P0910115

Nortel Networks Symposium Call Center Server

Planning and Engineering Guide

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NORTEL NETWORKS

How the world shares ideas.

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Publication history

April 2000

Standard 2.0 of the *Nortel Networks Symposium Call Center Server Planning and Engineering Guide* for Release 3.0 is released. This version includes corrections to the sample performance characteristics.

April 2000

Standard 1.0 of the *Nortel Networks Symposium Call Center Server Planning and Engineering Guide* for Release 3.0 is released.

Contents

Chapter 1

Getting started

In this chapter

Overview

Welcome

Nortel Networks is pleased to announce the Symposium Call Center Server. The server is designed to provide a call center solution for varied and changing business requirements by offering a suite of applications that includes call processing and agent handling, management and reporting, networking, and third-party application interfaces.

Some advantages of the Symposium Call Center Server are

- complete call control and reporting
- application flexibility
- state-of-the art user interface
- industry standard, client-server architecture
- open interfaces: database, real time, host routing, and Meridian Link Services (MLS)
- comprehensive networking through public and private networks
- leveraged PBX switching reliability and client-server processing power

Introduction

The *Symposium Call Center Server Planning and Engineering Guide* provides information on how to manage the configuration of your Symposium Call Center Server.

For information on using or administering other tools and features of the Symposium Call Center Server, refer to the appropriate document. To find out which document you need, see “Related documents” on page 20.

This chapter describes the major components of the Symposium Call Center Server architecture. Each system type—Meridian 1 (M1) and DMS/MSL-100—is illustrated in the following sections. For M1 systems with the Network skill-based routing (NSBR) feature enabled, the major components in a Network Control Center (NCC) setup are illustrated.

Who should read this guide

This guide is for Symposium Call Center Server system designers and technical support staff members. It is also intended to be used by administrators who are responsible for day-to-day management of the Symposium Call Center Server configuration.

Network information

This guide contains references to the Symposium Call Center Server Network skill-based routing feature. However, this feature is not available for all switch types. For more information on networking, refer to the *Symposium Call Center Server Network Control Center Administrator's Guide* and other documents listed in "Related documents" on page 20.

Symposium Call Center Server components

The Symposium Call Center Server consists of three key components: switching equipment, server, and client. The telephony component is made up of the phonesets and the Meridian 1 or DMS/MSL-100 family of switches. The server component is comprised of the Symposium Call Center Server and network. The client software is installed on the supervisor workstations, and accesses the server over the customer's LAN.

Server component

The server component consists of these main elements:

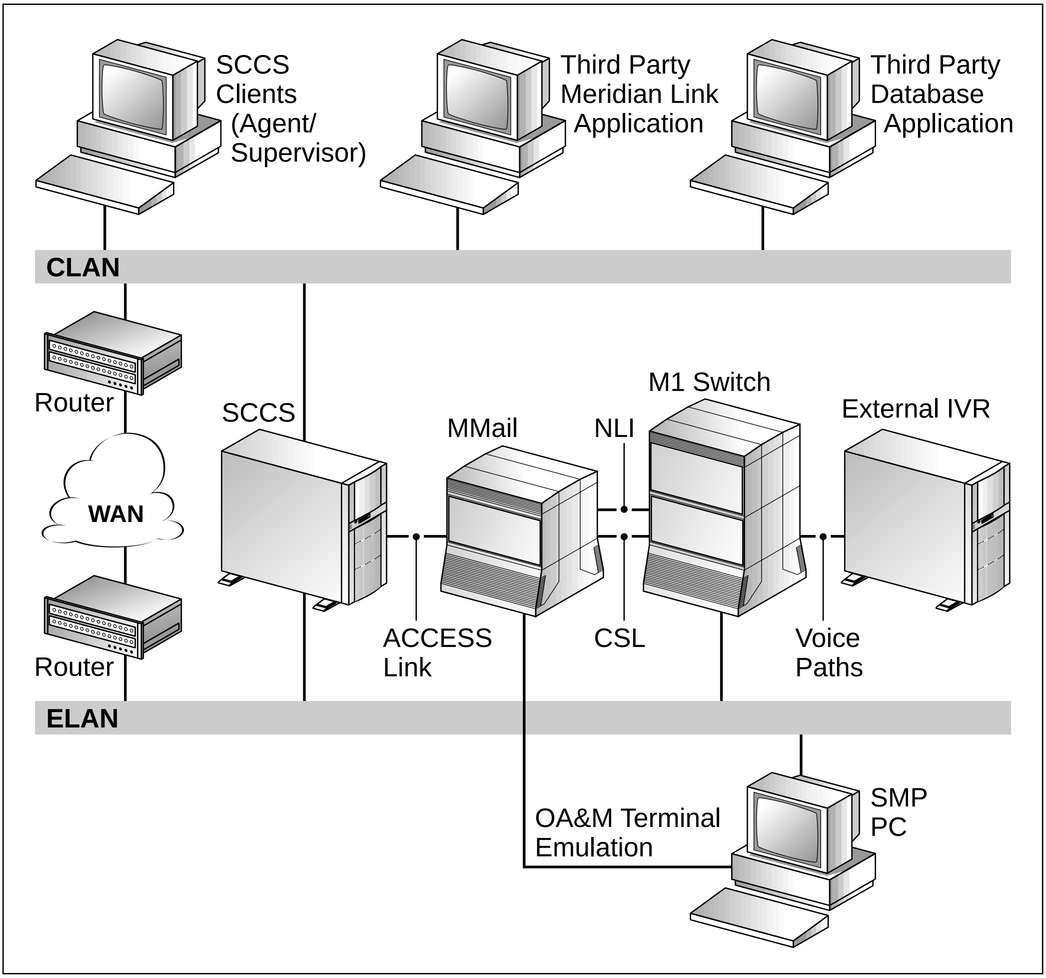
- a PC-based server operating under Windows NT
- an Embedded LAN (ELAN), which connects Nortel Networks equipment: the Meridian 1 (M1) or DMS/MSL-100 switch, the Symposium Call Center Server, and an optional Administration client PC running the System Management Interface (SMI) software. To preserve the bandwidth required for Nortel Networks equipment, no client PCs are allowed on the ELAN.
- Symposium Call Center Server base software to provide operations, administration, and management (OA&M) functions for the server
- the Symposium Call Center Server application, which runs on the server and is accessed and controlled by the Symposium Call Center Server client PCs. Symposium Call Center Server requires an M1 or a DMS/MSL-100 switch.
- pcANYWHERE32 on the server for remote support access

Client component

The client component consists of customer-supplied PCs, operating under Windows 95/98 or Windows NT. These client PCs are connected by the Customer LAN (CLAN).

Meridian 1 server architecture

The major components of the Symposium Call Center Server nodal architecture when connected to a Meridian 1 (M1) switch are shown in the following illustration.



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These components can be broken into processor-based and network-based components.

Processor-based components

- Symposium Call Center Server and client PCs
- third-party application platforms on the Customer LAN (CLAN)
- Meridian Mail
- M1 switch
- System Management Platform (SMP)
- Operations Administration and Maintenance (OA&M) terminals

Network-based components

- Embedded LAN (ELAN)
- Customer LAN (CLAN)
- Wide Area Network (WAN)
- Meridian Mail Access Link
- Command and Status Link (CSL)
- Network Loop Interface (NLI)
- voice and signaling channels for Meridian Mail ports
- trunks and lines associated with Symposium Call Center Server

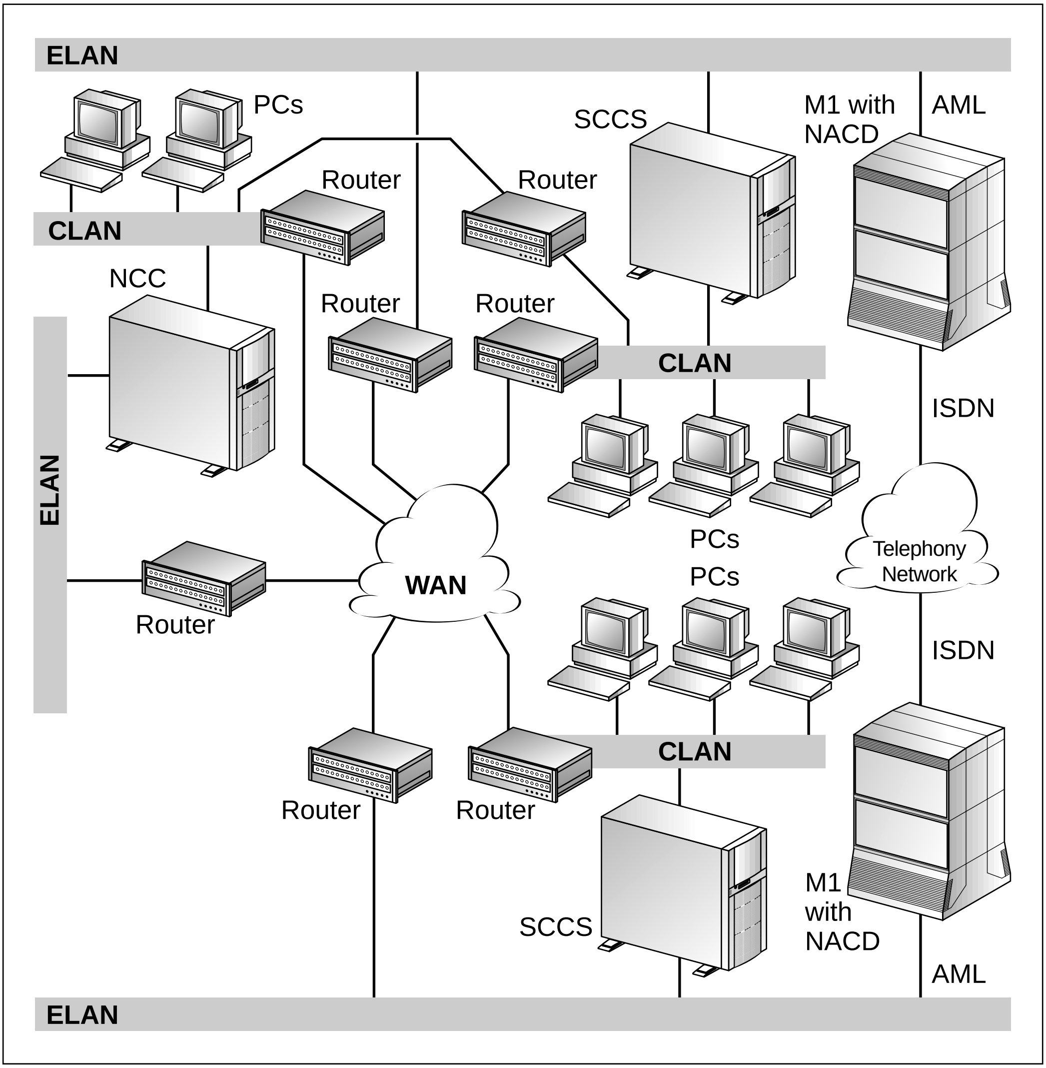
Symposium Call Center Server NCC architecture

Sites connected together in a Wide Area Network (WAN) require a central, non-call-processing computer to control the network This computer is known as the Network Control Centre (NCC). All Symposium Call Center Servers are connected to the NCC server. The NCC server can be located at the same site as one of the servers in the network. The NCC is described in detail in Chapter 6, “Engineering the NCC server.”

Notes:

- In Release 3.0, the networking of calls is supported for the M1 switch only.
- If the NCC is located at the same site as a Symposium Call Center Server, Nortel Networks recommends that an IP router be used. The router, as shown in the diagram, separates local traffic from networking traffic.

The major components of the Symposium Call Center Server Network Control Center (NCC) are shown in the following illustration.



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These components can be broken into processor-based and network-based components.

Processor-based components

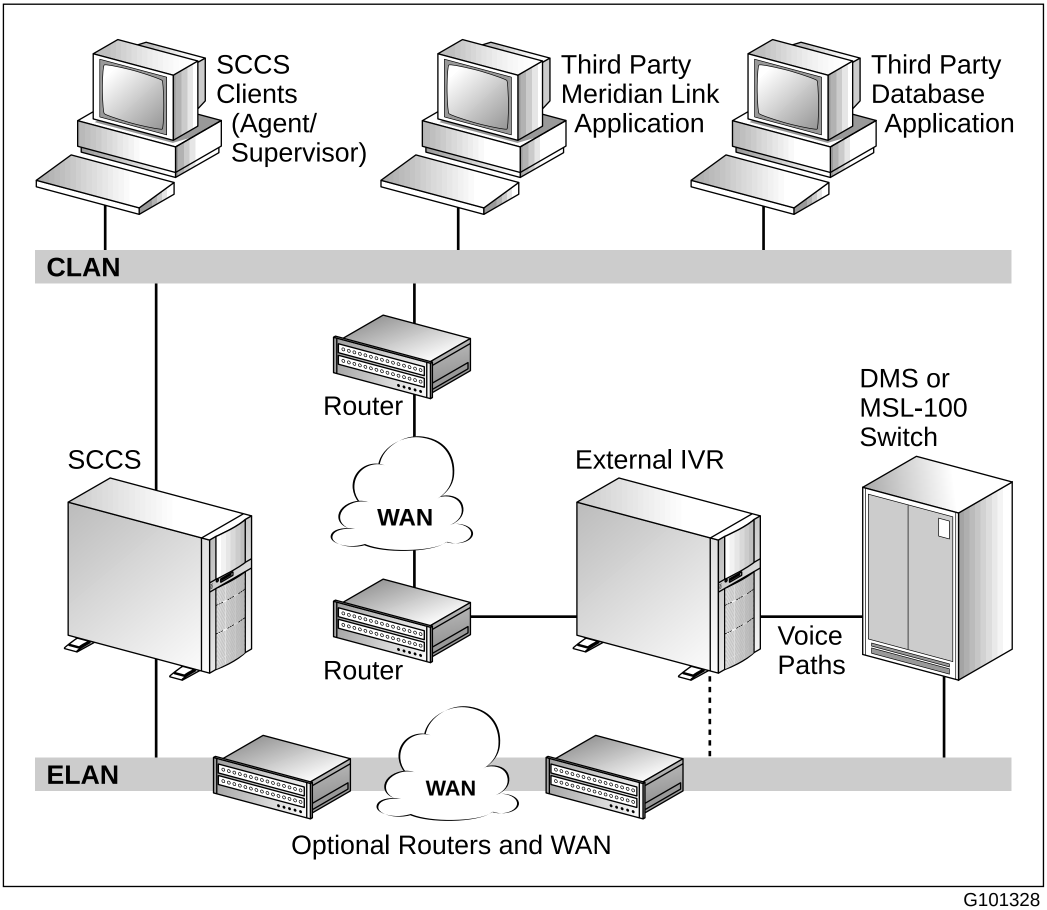
- Symposium Call Center Server and client PCs
- Meridian 1 switch (M1) with networked automatic call distribution (NACD) support

Network-based components

- ELAN
- CLAN
- WAN
- trunks and lines associated with Symposium Call Center Server

DMS/MSL-100 server architecture

The major components of the Symposium Call Center Server architecture when connected to a DMS/MSL-100 switch are shown in the following illustration.



Note: The external IVR system can be connected to either the ELAN (dotted line in the preceding diagram) or CLAN.

These components can be broken into processor-based and network-based components.

Processor-based components

- the Symposium Call Center Server and client PCs
- a subset of Meridian Link Services with DMS functionality only
- third-party application platforms on the Customer LAN (CLAN)
- the DMS switch

Network-based components

- Embedded LAN (ELAN)
- Customer LAN (CLAN)
- Wide Area Network (WAN)
- ICM link between Symposium Call Center Server and the DMS/MSL-100

Symposium Call Center Server hardware platforms

Platform types

The Symposium Call Center Server application is built upon the Meridian Application Server (MAS) hardware platform. Five platforms in two series (700 and 1000) are used: MAS 701t, MAS 702t, MAS 1000t, MAS 1001t, and MAS 1003t. The following table lists the available server hardware configurations:

#	Configuration	MAS base	CPU	Memory (Mbytes)	Disk (Gbytes)	Symbol	Tape	CD-ROM
1	1000t Base 256/10	1000t	P166	256	10	P166/256/10	4/8 GB DAT	4X
2	701t Base 256/10	701t	PP200	256	10	PP200/256/10	4/8 GB DAT	4X
3	701t Raid 256/10	701t	PP200	256	2 x 20	PP200/256/20	4/8 GB DAT	4X
4	1001t Base 256/18	1001t	PII300	256	18	PII300/256/18	16/32 GB SCSI	24X
5	1001t Raid 256/18	1001t	PII300	256	2 x 18	PII300/256/36	16/32 GB SCSI	24X
6	702t Base 256/12	702t	PII350	256	12	PII350/256/12	16/32 GB SCSI	24X
7	702t Raid 256/12	702t	PII350	256	2 x 12	PII350/256/24	16/32 GB SCSI	24X
8	702t Base 256/12	702t	PII450	256	12	PII450/256/12	16/32 GB SCSI	24X
9	702t Raid 256/12	702t	PII450	256	2 x 12	PII450/256/24	16/32 GB SCSI	24X

#	Configuration	MAS base	CPU	Memory (Mbytes)	Disk (Gbytes)	Symbol	Tape	CD-ROM
10	1003t Raid 256/22	1003t	2PIII500	256	2 x 22	2PIII500/256/44	16/32 GB SCSI	32X

Platforms supported for the Meridian 1 switch

The MAS platforms supported by a stand-alone server (that is, without the NSBR feature) are the 701t and 702t (Enhanced Configuration only), 1000t, 1001t, and 1003t. The MAS platforms supported by a Symposium Call Center Server with the optional NSBR feature enabled are the 701t and 702t (Enhanced Configuration only), 1001t, and 1003t. The MAS platforms supported by the NCC are the 1001t and 1003t.

Platforms supported for the DMS/MSL-100 switch

Currently, the DMS/MSL-100 only supports the 702t RAID configuration with 12 Gbytes of disk space (configuration 9) and the 1003t with 22 Gbytes of disk space (configuration 10).

Server CPU

The following table shows the processors used by the Symposium Call Center Server, and the performance of each processor relative to the Intel Pentium Pro 200:

Processor	Platform	PP200 Relative	iComp
P166 (Pentium, 166 MHz)	1000t	1.74	127
PP200 (Pentium Pro, 200 MHz)	701t	1.00	220
PII300 (Pentium II, 300 MHz)	1001t	0.66	332
PII350 (Pentium II, 350 MHz)	702t	0.57	386
PII450 (Pentium II, 450 MHz)	702t	0.46	483
2PIII500 (Dual Pentium III, 500 MHz)	1003t	0.23	966

Notes:

- iComp is an industry standard for CPU rating and evaluation. The numbers in this table are based on extrapolations using the iComp2.0 Index values.
- For optimum performance, CPU utilization should not exceed 50% for periods of 15 to 20 minutes. CPU utilization can exceed this limit by up to 100% for relatively short periods.

Server MTBF Ratings

Each Symposium Call Center Server has a different Mean Time Between Failures (MTBF) rating, which is based on the MTBF rating for each of its sub-components. The MTBF ratings for each server configuration are given for two different scenarios: MTBF for call processing, and MTBF for any failure.

MTBF for call processing (CP MTBF)

Only critical components that affect call processing are included. Components such as keyboards, monitors, and modems, are not included.

MTBF for any failure (Total MTBF)

All components in the platform are considered.

#	Configuration	CP MTBF (years)	Total MTBF (years)
1	1000t Base 256/10	1.18	0.65
2	701t Base 256/10	1.0	0.59
3	701t Raid 256/10	2.33	0.89
4	1001t Base 256/18	0.72	0.48
5	1001t Raid 256/18	2.42	0.92
6	702t Base 256/12 (PII350)	0.98	0.59
7	702t Raid 256/12 (PII350)	2.21	0.88
8	702t Base 256/12 (PII450)	0.98	0.59
9	702t Raid 256/12 (PII450)	2.21	0.88

#	Configuration	CP MTBF (years)	Total MTBF (years)
10	1003t Raid 256/22	3.57	1.04

Paging file

Windows NT uses a process called *demand paging* to exchange data between RAM and paging files. When Windows NT Server is installed, Setup creates a default virtual memory paging file, Pagefile.sys, and places this file on the boot partition where the operating system is installed. Under these circumstances and if "write debugging information to" option is selected from System Startup/ Recovery, the pagefile also allows Windows NT to create a crash dump file (Memory.dmp) in the case of a catastrophic failure (should a Kernel STOP error occur).

Note: This is not valid for systems converting from R1.x to R3.0, where the pagefile actually has to be moved off of the boot partion.

For Symposium Call Center Server Release 3.0, a default swapfile size of 268 Mbytes (256 + 12, where 256 is the number of Mbytes of physical RAM) is used. After Windows NT Server is installed, the settings for the pagefile should be changed accordingly. Both the minimum and maximum size should be set to 268 Mbytes. However, for a few very large configurations (in the case of some customers using the 1003t platform), this setting may not sufficient. In these cases, Nortel Networks recommends an increase of both the initial and the maximum size to 378 Mbytes.

Engineering methods

Introduction

You can use the following methods for estimating the requirements for a Symposium Call Center Server system:

- the CapTool method
- the detailed formulas method

CapTool method

The CapTool method provides an easy-to-use interface for inputting the parameters used to calculate system requirements. When all parameters are entered, CapTool can automatically identify the system requirements, including hardware platform, bandwidth, and disk space.

To use the CapTool method, see one of the following chapters:

- **M1 switch—**Chapter 3, “M1 Symposium Call Center Server and NCC requirements”
- **DMS/MSL-100 switch—**Chapter 4, “DMS/MSL-100 Symposium Call Center Server requirements”

Formulas method

The formulas method is similar to the CapTool method, but it is a manual calculation method. To use the formulas method, see Chapter 5, “Using the formula method.”

Note: Nortel Networks recommends that you use the CapTool method to verify all calculations obtained with this method.

What's new in Release 3.0

Introduction

The following sections list enhancements to the Symposium Call Center Server Release 3.0, and changes to the models in this guide.

New features in Symposium Call Center Server Release 3.0

- networking skill-based routing (Meridian 1 switch only)
- Symposium Event Interface
- DMS/MSL-100 features (such as call complexity models, external IVR, and so on)

Changes to platform requirements for Release 3.0

- 256 Mbytes of RAM is required on all platforms.
- The size of the Windows NT swap file must be at least 268 Mbytes.
- The Standard configurations of the 701t and 702t are no longer supported.
- Networking is not supported on the 1000t platform.
- Maximum CPU utilization is 50%.

Changes to switch requirements for Release 3.0

The Meridian 1 version of Symposium Call Center Server requires Meridian 1 Release 24 or 25.

Changes to the models

New models

- Meridian Link Services (now includes outbound calls, transferring and conferencing via MLS, as well as other CTI applications)
- new Inbound Call Complexity parameters (for example, queue to agent)
- Outbound Call Complexity

- transferring and conferencing via phonesets
- data extraction via ODBC interface
- Graphical Real-time Display
- WAN calculations (including consolidated reporting for networking)

Changes to existing models

- Peak call rates are used for CPU and LAN calculations (that is, call rate during the busiest hour).
- Calls per day are used for disk space calculations.

Resource usage impact analysis

- WAN bandwidth requirement is highly dependent upon the amount of network call-by-call (CBC) data being collected and the amount of consolidated reporting being executed at each node.
- Symposium Call Center Server CPU is highly correlated with the peak call rate, the number of RTD clients, screens per client, and refresh rate.
- For large sites, a 10 Mbps CLAN might not be sufficient, based on calculations from major contributors to CLAN utilization, namely RTD/RTI/GRTD, SEI, and MLS in certain scenarios (for example, outbound with predictive dialer).
- Network Control Center computations are based on network CBC data collection.
- Fewer restrictions apply to non-steady state activities (see Appendix E, “CPU utilization upper limits”).

Skills you need

Introduction

This section describes the skills and knowledge you need to use this guide effectively.

Nortel Networks product knowledge

Knowledge of, or experience with, the following Nortel Networks products is helpful in engineering the Symposium Call Center Server:

- Symposium Call Center Server
- Meridian 1 switch
- X11
- DMS-100 family of switches or the MSL-100 switch
- Meridian Mail

PC experience or knowledge

Knowledge of, or experience with, the following PC products and concepts is helpful when administering the Symposium Call Center Server:

- client/server architecture
- Microsoft Windows NT 4.0 Advanced Server
- Microsoft Windows 95, Windows 98, or Windows NT 4.0 Workstation
- Microsoft TCP/IP

Other experience or knowledge

Other types of experience or knowledge that might be useful include

- networking
- troubleshooting
- configuring Windows NT

- queuing theory (voice port calculations)

Related documents

Introduction

This section lists the documents in which you can find additional information related to the Symposium Call Center Server.

Symposium Call Center Server installation

The following documents contain procedures for installing the Symposium Call Center Server hardware and software.

If you need information about	Refer to
■ performing the initial hardware installation	*Nortel Networks Meridian Application Server Installation and Maintenance Guide* for your hardware platform
■ installing your server software	*Nortel Networks Symposium Call Center Server Software Installation and Upgrade Guide*
■ planning the network between the DMS switch and the WAN	*Nortel Networks Symposium Call Center Server DMS-100 ICM Router Guide* (NTP 297-2233-903) *Nortel Networks Symposium Call Center Server DMS Switch Guide*
■ installing the Network Control Center	*Nortel Networks Symposium Call Center Server Network Control Center Administrator's Guide*

Symposium Call Center Server setup

The following documents pertain to the setup and configuration of the Symposium Call Center Server and the Meridian 1 or DMS/MSL-100 family of switches.

If you need information about	Refer to
■ configuring the server	*Nortel Networks Symposium Call Center Server Setup Guide* and the *Symposium Call Center Server Administrator's Guide*
■ Meridian 1 switch configuration	*Nortel Networks Symposium Call Center Server and Meridian 1 Switch Guide*
■ DMS/MSL-100 switch configuration	*Nortel Networks Symposium Call Center Server DMS Switch Guide*

DMS switch documents

The following documents pertain to the administration of the DMS/MSL-100 switch.

If you need information about	Refer to
■ utilities used to manage and monitor the switch	*DMS Utilities Guide*
■ Ethernet Interface Unit (EIU) installation and configuration	*EIU Installation and Configuration Guide*

Symposium Call Center Server administration

The following documents pertain to the administration of the Symposium Call Center Server.

If you need information about	Refer to
■ the support and administration of the call center application that runs on client PCs connected to the server	*Nortel Networks Symposium Call Center Server Call Center Administrator's Guide*
■ setting up real-time displays ■ managing reports	*Nortel Networks Symposium Call Center Server Call Center Supervisor's Guide*
■ accessing the database ■ entity relationship diagram (ERD)	*Nortel Networks Symposium Call Center Server Historical Reporting and Data Dictionary*
■ creating and administering call center scripts	*Nortel Networks Symposium Call Center Server Scripting Guide*
■ support and administration of the network control center	*Nortel Networks Symposium Call Center Server Network Control Center Administrator's Guide*

Other documents

In addition to the Symposium Call Center Server documentation, the following sets of documents are supplied with a Symposium Call Center Server system, where applicable:

- Intel installation and user guide
- RAID controller guide (if installed)
- Ethernet and (if used) Token Ring network card guides
- modem guide

Note: If you have obtained Crystal Reports 6.0 or 7.0 to create customized reports, you also need the Crystal Reports documentation.

Chapter 2

Using the CapTool method

In this chapter

Overview

Introduction

This chapter describes how to install the Capacity Assessment Tool (CapTool) application from the supplied disks. It also describes how you can use CapTool to engineer a system.

For detailed information about the property pages, see one of the following chapters:

For	see
Meridian 1 systems	Chapter 3, “M1 Symposium Call Center Server and NCC requirements.”
DMS systems	Chapter 4, “DMS/MSL-100 Symposium Call Center Server requirements.”

Installing CapTool

Before you begin

Requirements

The following table shows the minimum hardware and software that you must have on your computer to install CapTool:

Minimum configuration	Recommended configuration
an Intel-compatible 80486 DX processor	Pentium processor
Microsoft Windows	
16 Mbytes of RAM	32 Mbytes of RAM
25 Mbytes of free disk space	35 Mbytes of free disk space
3.5-inch floppy drive	
a monitor capable of 640 x 480 display	

Note: During an upgrade, all of your Capacity Assessment files are retained.

Uninstall previous versions of CapTool

Before installing a new version of CapTool, follow these steps to uninstall the previous version.

1 From the Windows Start menu, choose Programs → CAPACITY TOOL → Uninstaller.

Result: The program prompts you to confirm that you want to remove the selected application.

2 Click Yes.

Result: The Remove Programs from Your Computer dialog box appears. When the Uninstall is complete, the message `Uninstall successfully completed` appears at the bottom of the dialog box.

3 Click OK.

To install CapTool

1. Insert the disk (found at the back of the *Symposium Call Center Server Planning and Engineering Guide*) containing the CapTool application into your floppy drive.
2. From the Windows Start menu, choose Run.
3. In the Open box, type **A:\Setup** (assuming your floppy drive is drive A).
4. Click OK to start the Setup Wizard.
5. Click Next.
6. If you want to change the installation directory, click Browse and select a different directory.
7. Click Next.
8. If desired, type a new name in the Program Folder field.
9. Click Next to complete the installation.

   Result: The installation program installs the files and adds a folder for the CapTool application to the Programs folder on your Start menu. When the installation is complete, it displays the message `Setup is complete.`
10. Click OK.

Understanding the CapTool application

Purpose of CapTool

The Capacity Assessment Tool (CapTool) helps you to plan for a new Symposium Call Center Server system, or to determine how proposed changes will affect an existing system. You can use CapTool to determine

- the hardware requirements of the server
- the data bandwidth requirements of the server
- the number of voice ports required by the server

CapTool does not specify capacity requirements of the Meridian 1 or DMS/MSL-100 switches. For such information, you must refer to the documentation that accompanies the respective switches.

Hardware requirements

CapTool selects the required hardware configuration (a combination of CPU, memory, and disk space) from a list of available hardware configurations.

Voice ports

The voice ports used by Symposium Call Center Server must be dedicated to the Symposium Call Center Server application. Symposium Call Center Server cannot share resources with other applications such as Meridian MAX.

You can use CapTool to determine the number of voice ports required for Give IVR, Collect Digits, and Give Controlled Broadcast sessions.

Bandwidth

The data communication bandwidth consists of the average required bandwidth for a Customer LAN (CLAN), Embedded LAN (ELAN), and Wide Area Network (WAN).

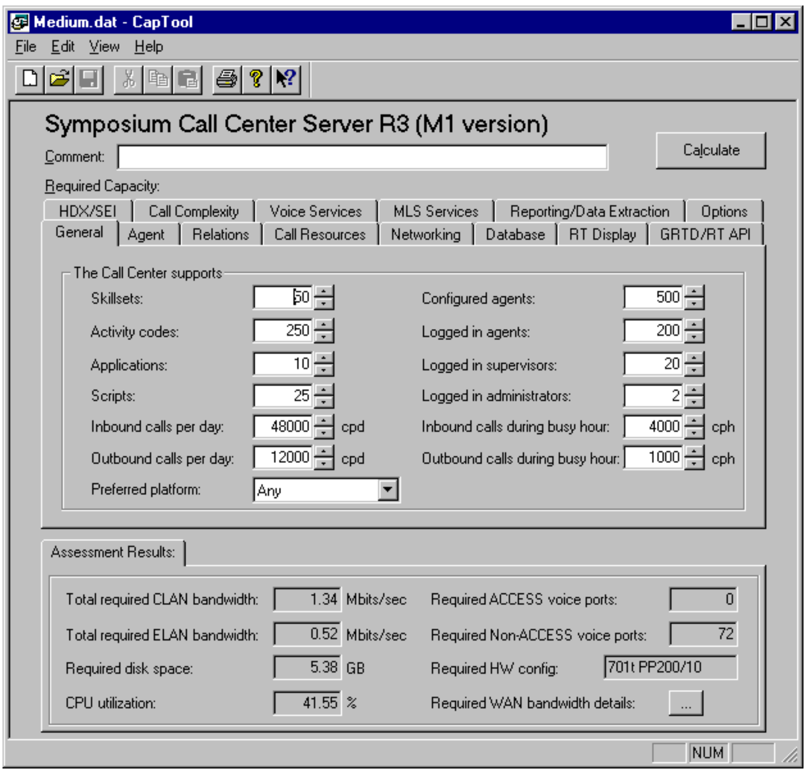
The results of the CapTool analysis describe the requirements of the Symposium Call Center Server *only.* You must adjust your configuration to accommodate anything else that your CLAN is used for beyond the Symposium Call Center Server.

Viewing CapTool windows

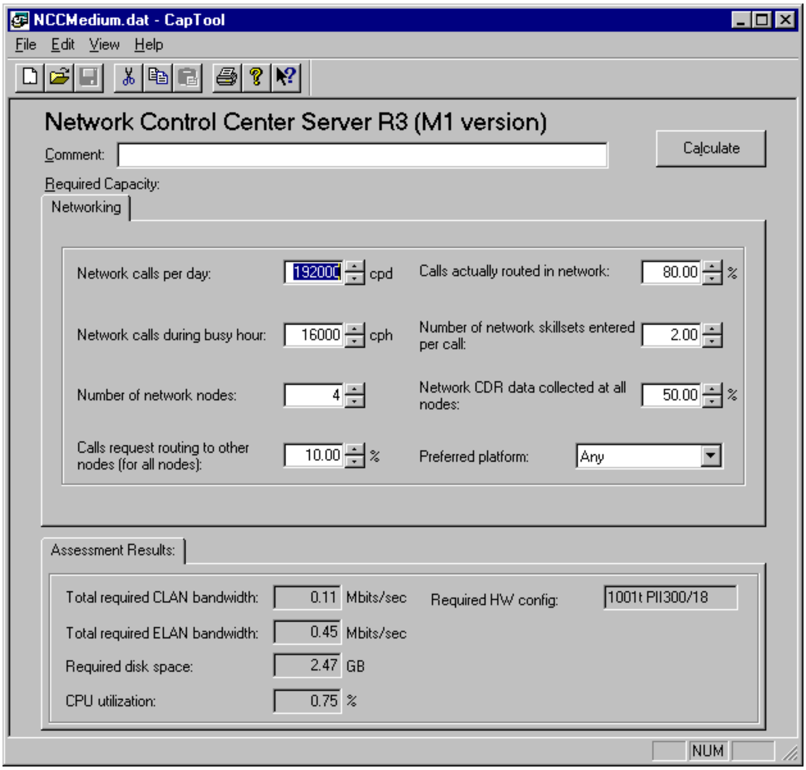
Introduction

This section describes the three sections of the main window of CapTool—the Comment area, the Property Pages area, and the Assessment Results area. The following illustrations show the CapTool main screens.

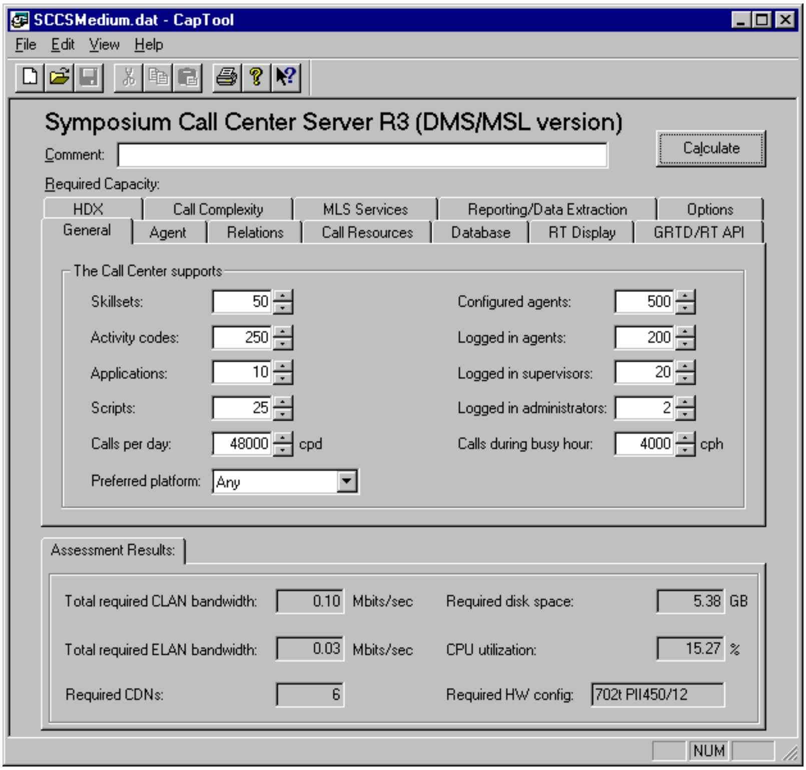
CapTool main window for the Meridian 1 switch



CapTool main window for the NCC



CapTool main window for a DMS/MSL-100 switch



Previewing CapTool's comment area

The top section of the CapTool window— the Comment area— contains a single-line text entry field in which you can enter a brief description (up to 60 characters) of the currently open file.

Previewing CapTool's property pages area

The middle section of the CapTool window is the property pages area. Each tab represents a property page. On each of these property pages, you enter values into the fields. Property pages include the following:

- General
- Agent
- Relations
- Call Resources
- Networking (M1 only)
- Database
- Real-time Display
- GRTD/Real-time API
- HDX/Event Interface
- Call Complexity
- Voice Services (M1 only)
- MLS Services
- Reporting
- Options

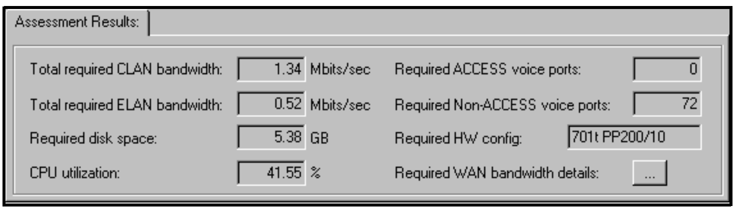
For a detailed description of these pages and the fields that they contain, see one of the following chapters:

For	see
Meridian 1 systems	Chapter 3, “M1 Symposium Call Center Server and NCC requirements.”
DMS systems	Chapter 4, “DMS/MSL-100 Symposium Call Center Server requirements.”

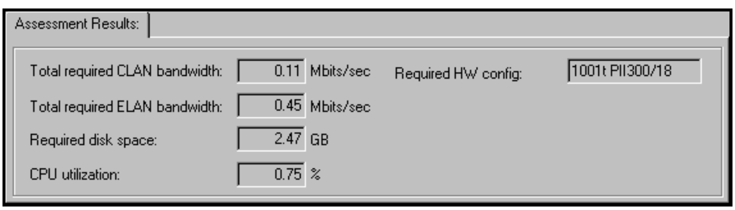
Previewing CapTool’s Assessment Results area

The bottom section of the CapTool window is the Assessment Results area. This area contains the results of the Capacity Assessment. For a detailed description of the fields contained in this area, see “Viewing assessment results” on page 39.

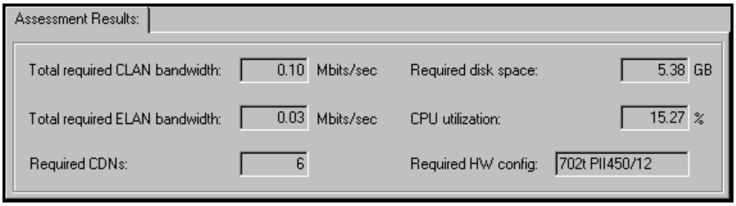
M1 Assessment Results



Network Control Center Assessment Results



DMS/MSL-100 Assessment Results



Working with CapTool files

Introduction

You can open an existing Capacity Assessment file, create a new Capacity Assessment file, save your changes to a Capacity Assessment file, or print a Capacity Assessment file.

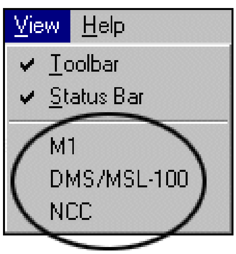
To open a file

When you open CapTool for the first time, the default Capacity Assessment file opens. You can work with this file, or you can open an existing one.

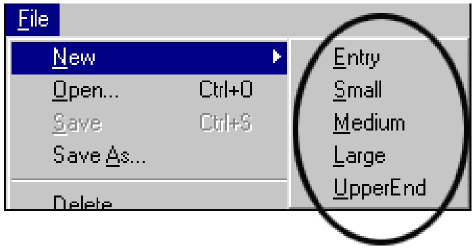
To open an existing Capacity Assessment file, choose File → Open.

To create a new file

1. Choose File → New.
2. Choose View and select the type of system you want to engineer (M1 server, DMS/MSL-100 server, or NCC).



3 Select a workload scenario (Entry, Small, Medium, Large, or UpperEnd).



Note: For a detailed description of workload scenario properties, see "Workload types" on page 281.

4 If prompted, click Yes to save changes to the file that is currently open, or No to close the file without saving changes.

Result: A new file opens using the default settings for the workload selected in step 3.

5 Choose File → Save As.

6 Type a file name in the File Name field.

7 Click Save.

To save a file

To save the Capacity Assessment file that you are currently working on, choose File → Save.

To preview a file

To preview the page layout of the report before you print it, choose File → Print Preview.

To print a file

To print the Capacity Assessment file that you are currently working on, choose File → Print.

Performing a capacity assessment

Introduction

Follow this procedure for each Symposium Call Center Server and NCC that you want to engineer.

To perform a capacity assessment

1 Start the application from the Start menu by choosing Programs→ Capacity Tool → Capacity Tool.

Result: The most recently used Capacity Assessment file opens.

2 If you want to use a different Capacity Assessment file, open or create it now (see “To open a file” on page 35, or “To create a new file” on page 35).

3 Enter values in the fields in the property pages. (For more information, see “Entering values in property pages,” below.)

4 Click Calculate.

Result: The program updates the Assessment Results area.

5 Save or print the results of the Capacity Assessment (see “To save a file” on page 36, or “To print a file” on page 36).

6 Choose File → Exit.

Entering values in property pages

Remember these points when entering field values:

- To display a property page, click the tab.
- Click the small triangle arrows (“thumb wheels”) beside fields to increase or decrease the values by one. Alternatively, highlight the existing value and enter a new value.
- When you click the Calculate button, CapTool analyzes the properties and then displays the results in the Assessment Results area at the bottom of the window.

- If you enter a value that exceeds the limit for a field, a system message appears and tells you the range of values you can enter.
- You can toggle quickly between different scenarios by selecting a recently used file from the File menu.
- The default values for the property pages are determined by the workload that you selected in step 3 on page 36. For a list of these values, see "Workload types" on page 281.

Viewing assessment results

Introduction

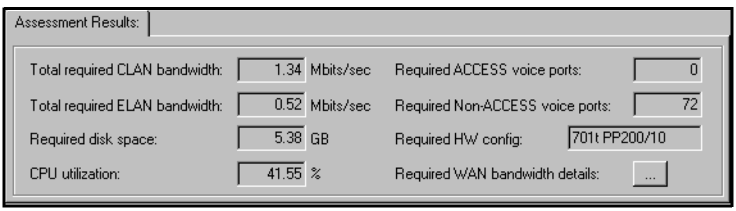
The Assessment Results area of the CapTool main screen displays the results of the capacity analysis, based on all of the values you entered into property pages. This analysis assesses values entered against LAN, performance requirements, and computer resources.

If any parameter value exceeds limits so that an analysis cannot be completed, then a system message appears. This message shows the parameter that must be adjusted so that the analysis can be completed. Whenever this message appears, you must reenter the new value for the parameter and click Calculate again.

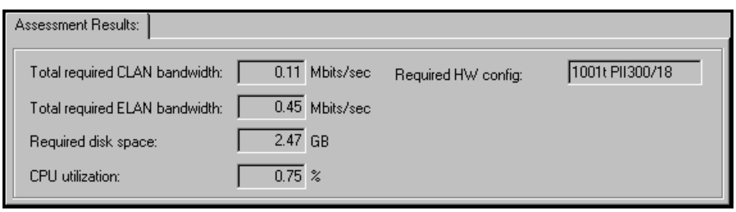
Assessment Results for a medium workload

The following illustration shows the Assessment Results area based on an analysis from a medium-sized call center. For information on each field, see "Description of Assessment Results fields" on page 40.

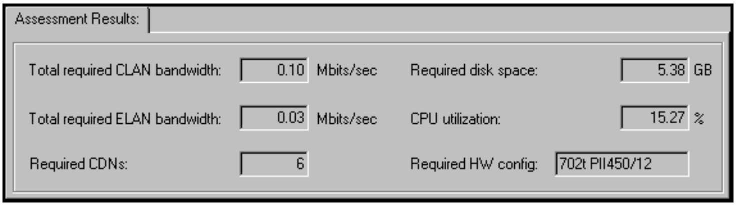
Assessment Results fields for M1 server analysis



Assessment Results area for NCC analysis



Assessment Results area for DMS/MSL-100 analysis



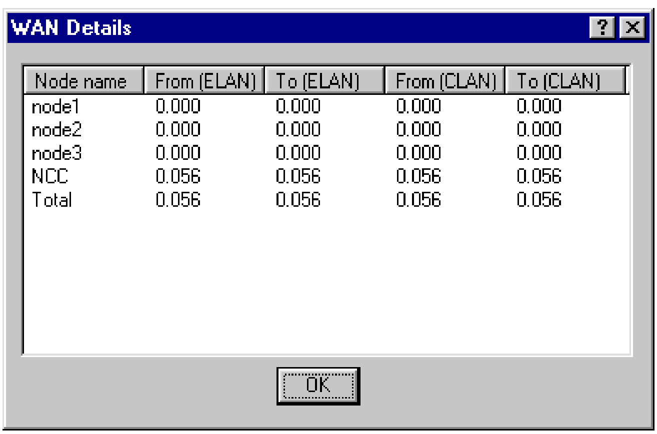
Description of Assessment Results fields

The following table provides descriptions for each field in the Assessment Results area. Values that appear in this area cannot be adjusted.

Field	Description
Total required CLAN bandwidth (Mbits/sec)	The total required bandwidth (expressed in megabits per second) of the Customer LAN (CLAN) section connected to the Symposium Call Center Server. **Note**: The results of the Capacity Assessment Tool analysis describe the requirements of the Symposium Call Center Server *only*. You must adjust your configuration to accommodate anything else that your CLAN is used for beyond the Symposium Call Center Server.
Total required ELAN bandwidth (Mbits/sec)	The total required bandwidth (expressed in megabits per second) of the Embedded LAN section connected to the Symposium Call Center Server.
Required disk space (Gbytes)	The disk space, expressed in Gbytes, required on the server to adequately handle all data communication requirements.
CPU utilization (%)	The percentage of central processor unit (CPU) usage required to process system data communication requirements. **Note:** This should be less than or equal to 50%.

Field	Description
Required ACCESS voice ports	(M1 only) The number of Meridian Mail voice ports required to be handled directly by the server using ACCESS link.
Required Non-ACCESS voice ports	(M1 only) The number of Meridian Mail voice ports required to be handled by the server without using ACCESS link.
Required CDNs	(DMS/MSL-100 only) The number of controlled directory numbers required by the system.
Required HW config	The minimum hardware configuration required to effectively process system data communication requirements.
Required WAN bandwidth details	(M1 only) Press this button to open the WAN details window shown at the end of this table.

To calculate the required WAN bandwidth, click Required WAN bandwidth details. Press this button to open the WAN details window, which displays each node on the network, and the ELAN and CLAN bandwidth requirements.



To calculate the required WAN bandwidth for the NCC server, you must calculate the traffic for every Symposium Call Center Server node connected to the NCC server. This means manually assessing traffic to and from the ELAN and CLAN for each node. The sum of these calculations then becomes the NCC bandwidth requirement.

Chapter 3

M1 Symposium Call Center Server and NCC requirements

In this chapter

Overview

Introduction

This chapter describes the fields displayed on the property pages for an M1 Symposium Call Center Server or NCC system.

Parameter

The Parameter column in the tables starting on page 48 indicates the corresponding parameter used in the formula method (see Chapter 5, “Using the formula method”).

Example

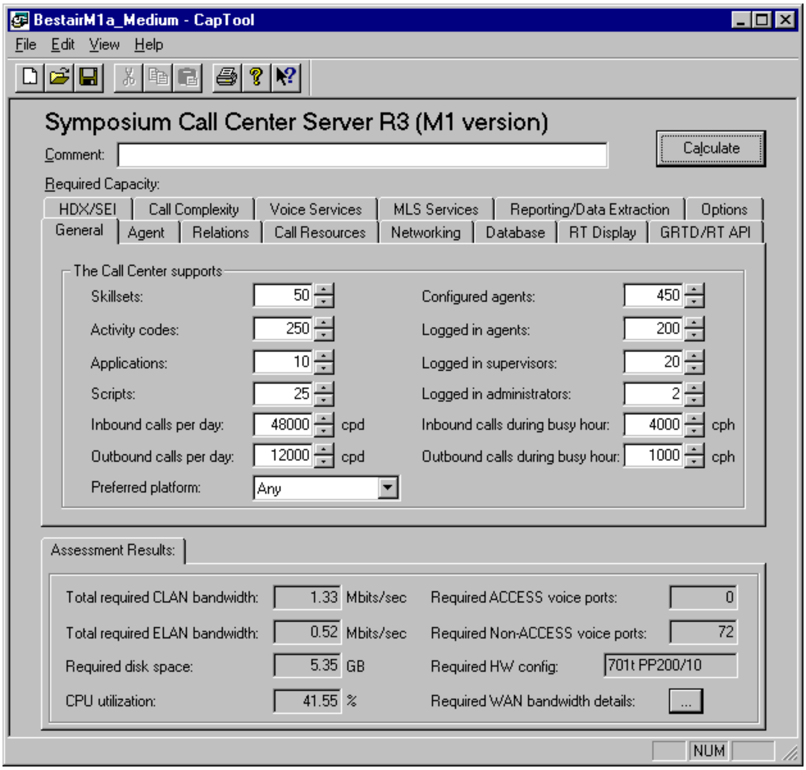
BestAir seat sale

Every July, BestAir Airline has a seat sale on certain flights. In the past, this event has dramatically increased the number of calls coming in to the call center. This July, BestAir plans to increase the number of agents in its call center from 450 to 550 to handle the extra calls.

The administrator of the call center can use the Capacity Assessment Tool to determine how these changes will affect the requirements of the call center system. BestAir might need to upgrade some equipment to handle the extra call traffic.

The following illustration shows the call center with the original 450 agents:

Original call center configured for 450 agents



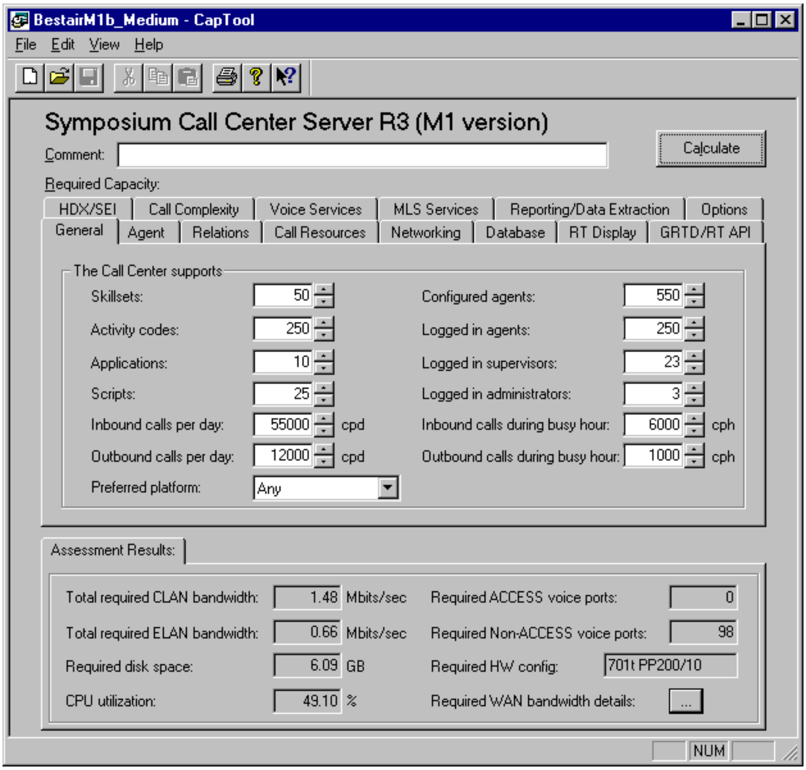
New call center configuration

The system administrator enters the proposed changes. This example increases

- the number of calls per hour and per day
- the number of agents logged on
- the total number of agents
- the number of supervisors and administrators logged on

The following illustration shows the BestAir call center after these changes are made:

New Call Center configured with an extra 100 agents



The Capacity Assessment Tool calculates the impact of the changes and shows them in the Assessment Results area in the lower part of each screen. Notice that the Assessment Results area shows an increase in

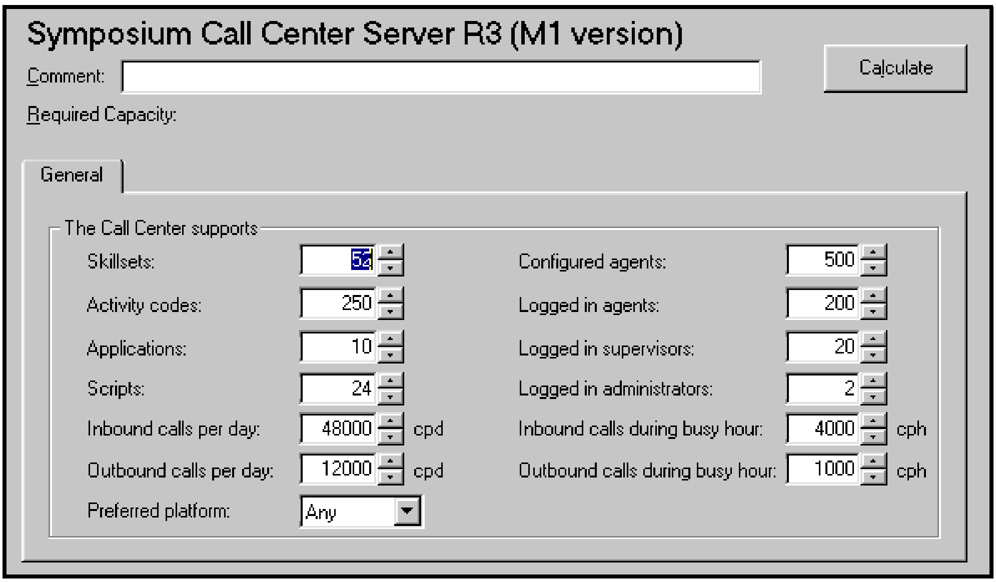
- ELAN and CLAN bandwidth requirements
- hard disk space requirements
- CPU utilization
- number of non-ACCESS voice ports required

However, the existing hardware configuration can support the additional load.

General

Introduction

The General page allows you to enter information about your call center size and workload. The following illustration shows the General property page for the M1 switch:



General page field descriptions

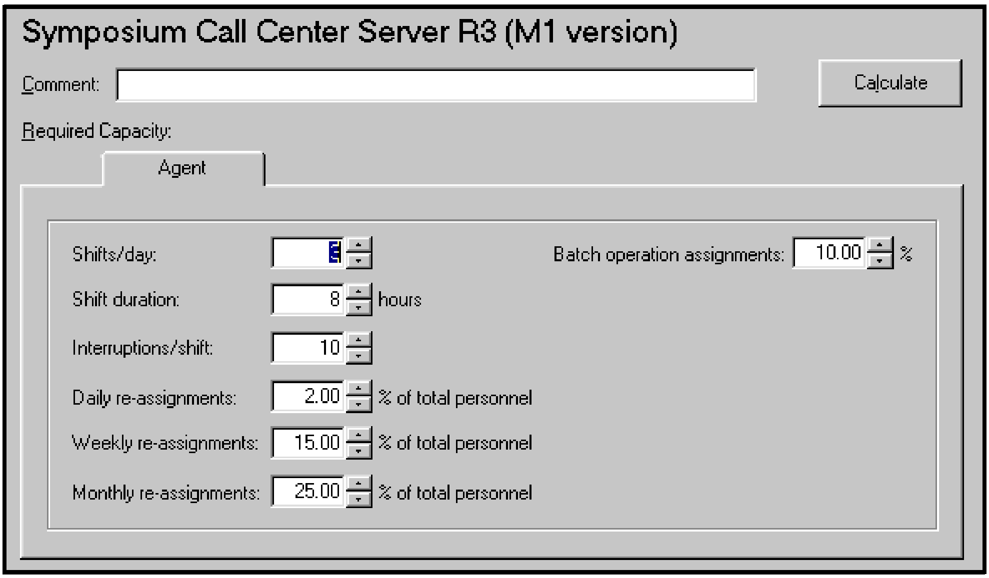
Field	Valid range	Description	Parameter
Skillsets	1–350 Default 50	The number of skillsets defined.	nSkillsets
Activity codes	0–5000 Default 250	The number of activity codes defined.	nActCodes
Applications	5–500 Default 10	The number of primary scripts (applications) defined.	nApplications

Field	Valid range	Description	Parameter
Scripts	1–1500 Default 25	The number of scripts defined.	nScripts
Configured agents	1–3000 Default 500	The total number of agents defined.	nTAgents
Logged in agents	0–1000 (dual CPU) 1–600 (other platforms) Default 200	The maximum number of agents logged in at any one time.	nAgents
Logged in supervisors	0–100 Default 20	The number of supervisors logged in.	nSupervisors
Logged in administrators	0–100 Default 2	The number of administrators logged in.	nAdministrators
Inbound calls per day (cpd)	0–600 000 Default 48 000	The expected average number of inbound calls per day.	24 * DailyCallRate
Inbound calls during busy hour (cph)	0–25 000 Default 4000	The expected average number of inbound calls originating locally during a busy hour.	PeakCallRate
Outbound calls per day (cpd)	0–600 000 Default 12 000	The expected average number of outbound calls per day.	24 * DailyOutCallRate
Outbound calls during busy hour (cph)	0–25 000 Default 1 000	The expected average number of outbound calls during a busy hour.	PeakOutCallRate
Preferred platform	Any	The user-selected platform that CapTool uses for the workload to make the assessment on.	Any

Agent

Introduction

The Agent page allows you to enter information about agent work shifts and work assignments. The following illustration shows the Agent property page for the M1 switch:



Agent field descriptions

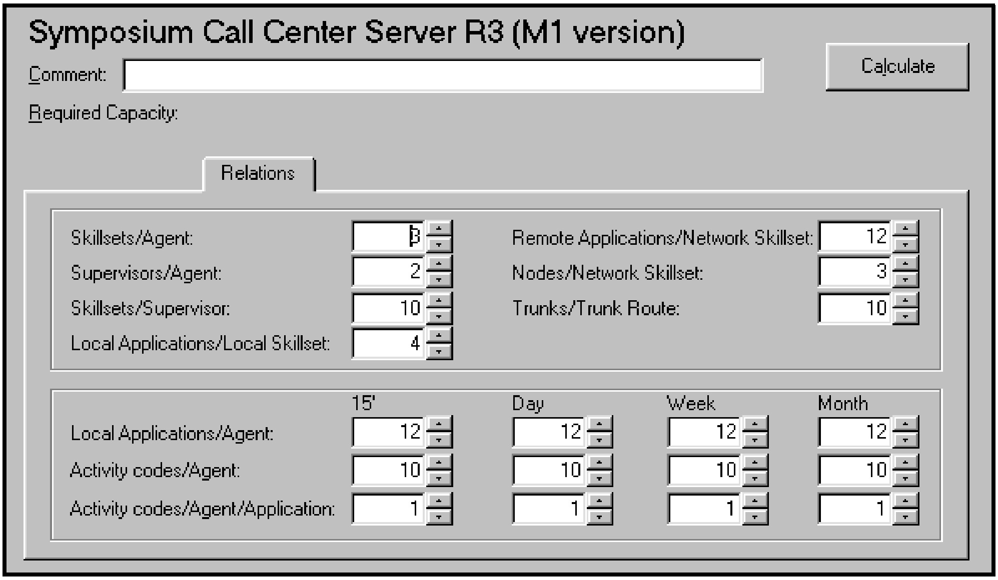
Field	Valid range	Description	Parameter
Shifts/day	0–100 Default 3	The number of agent shifts per day.	nShifts
Shift duration	0–100 Default 8	The number of hours per agent shift.	nShiftsHrs

Field	Valid range	Description	Parameter
Interruptions/ shift	0–100 Default 10	The number of agent interruptions, such as scheduled breaks, logon/logoff, and walkaway, per shift.	nIntPerShift
Daily re-assignments (%)	0–100 Default 2	The percentage of agent-supervisor and agent-skillset assignments that are changed daily.	pAgDaily Reassign
Weekly re-assignments (%)	0–100 Default 15	The percentage of agent-supervisor and agent-skillset assignments that are changed weekly.	pAgWeekly Reassign
Monthly re-assignments (%)	0–100 Default 25	The percentage of agent-supervisor and agent-skillset assignments that are changed monthly.	pAgMonthly Reassign
Batch operation assignments (%)	0–100 Default 10	The percentage of agents whose supervisor or skillset assignments are changed in batch operation (that is, with agent to skillset or agent to supervisor assignments.	pBatchAssign Factor

Relations

Introduction

The Relations page allows you to input values relating to relationships such as skillsets per agent and trunks per trunk route. The following illustration shows the Relations property page for the M1 switch:



Relations field descriptions

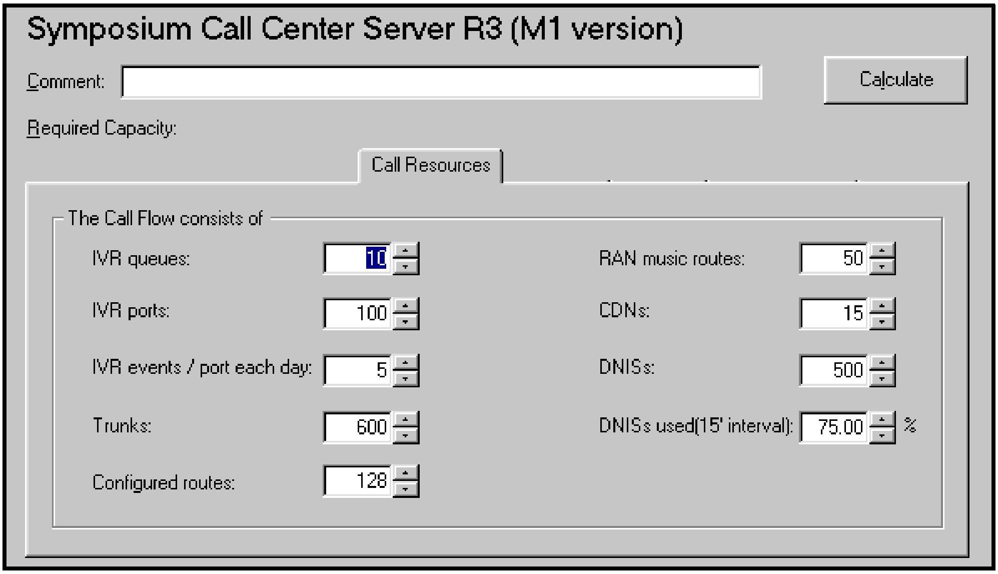
Field	Valid range	Description	Parameter
Skillsets/Agent	1–50 Default 3	The average number of skillsets served by an agent.	aSkill_Agent
Supervisors/ Agent	1–6 Default 2	The average number of supervisors to which an agent reports.	aSup_Agent
Skillsets/ Supervisor	1–350 Default 10	The average number of skillsets served by the supervisor’s agents.	aSkill_Supv

Field	Valid range	Description	Parameter
Local Applications/ Local Skillset	1–500 Default 4	The average number of local applications per local skillset.	aAppl_Skill
Remote Applications/ Network Skillset	1–500 Default 12	The average number of remote applications per network skillset per node.	aAppl_NetSkill
Nodes/Network Skillset	1–30 Default 3	The average number of nodes per network skillset.	aNodes_NetSkill
Trunks/Trunk Route	1–3000 Default 10	The average number of trunks per trunk route.	aTrunk_Routes
Local Applications/ Agent in 15', Day, Week, Month	1–500 Default 12	The average number of local applications handled by each agent for the specified period: interval (15 minutes), day, week, month.	aApplAgent Intv/ Day/Week/ Month
Activity codes/ Agent in 15', Day, Week, Month	0–5000 Default 1	The average number of unique activity codes entered per agent for the specified period: interval (15 minutes), day, week, month.	aActCode_Agent Intv/Day/Week/ Month
Activity codes/ Agent/ Application in 15', Day, Week, Month	0–5000 Default 10	The average number of unique activity codes entered per agent per local application for the specified period: interval (15 minutes), day, week, month.	aActCode_Agent _Appl Intv/Day/Week/ Month

Call Resources

Introduction

The Call Resources page allows you to enter information about usage of switch resources. The following illustration shows the Call Resources property page for the M1 switch:



Call Resources field descriptions

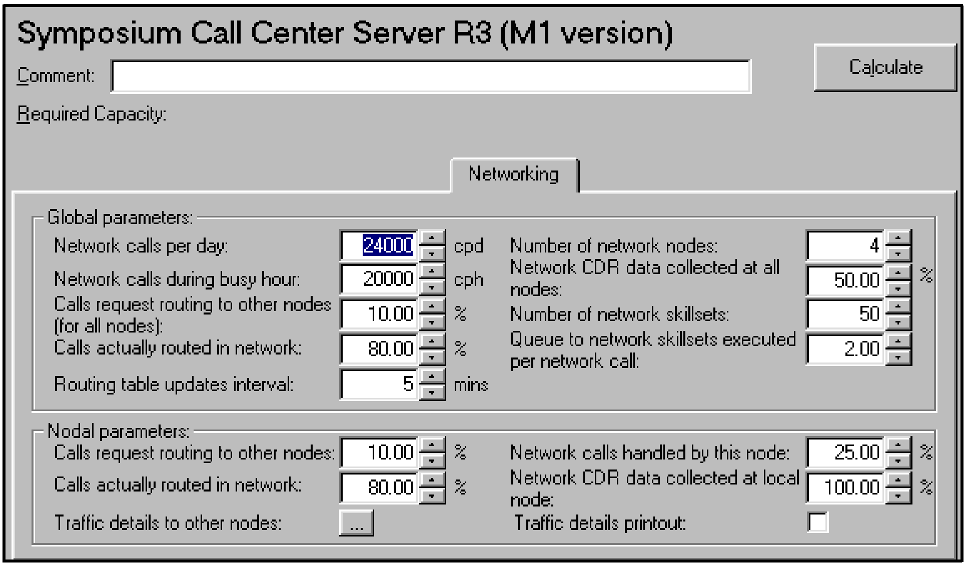
Field	Valid range	Description	Parameter
IVR queues	1–150 Default 10	The number of Interactive Voice Response (IVR) queues configured.	nIVRQ
IVR ports	1–500 Default 48	The number of Interactive Voice Response (IVR) ports configured.	nIVRPorts

Field	Valid range	Description	Parameter
IVR events/ port each day	1–999 Default 5	The number of Interactive Voice Response (IVR) events per port per day defined.	nIVRPortEvents
Trunks	1–3000 Default 300	The number of trunks in the system.	nTrunks
Configured routes	1–513 Default 128	The number of routes configured. This number cannot exceed 513.	nRoutes
RAN music routes	0–513 Default 50	The number of Recorded Announcement (RAN) or music routes configured.	nRMRoutes
CDNs	1–240 Default 15	The number of Controlled Directory Numbers (CDNs) in the system.	nCDN
DNISs	1–10 000 Default 500	The number of Dialed Number Identification Services (DNISs) defined in the system.	nDNIS
DNISs used (15' interval) (%)	0–100 Default 75	The percentage of Dialed Number Identification Services (DNISs) used during a single data collection interval.	nDNISInterval

Networking (Symposium Call Center Server)

Introduction

The Networking page allows you to input values relating to global and nodal networking parameters. This page also contains a button that allows entry of network traffic details to other nodes. The following illustrations show the Networking property page and the windows that are accessed from the button:



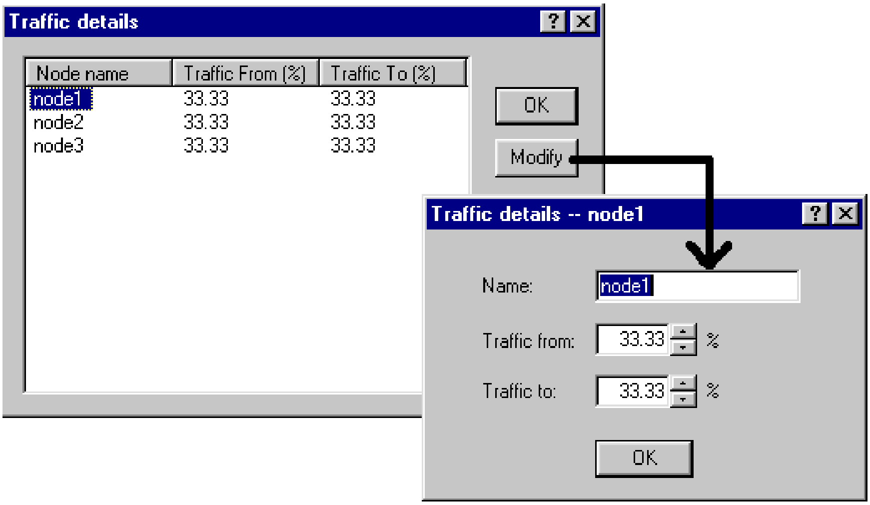
Networking field descriptions

Field	Valid range	Description	Parameters
Global parameters			
Network calls per day (cpd)	0–900 000 Default 24 000	The average number of calls coming in to the network during a day.	24 * DailyNetwork CallRate

Field	Valid range	Description	Parameters
Network calls during busy hour (cph)	0–375 000 Default 24 000	The average number of calls coming in to the network during a busy hour.	PeakNetwork CallRate
Calls request routing to other nodes (for all nodes)%	0–100 Default 10	The percentage of calls originating at all nodes in the network that are queued to a network skillset.	pNetOutNetw
Calls actually routed in network (%)	0–100 Default 80	The percentage of calls queued to network skillsets within the network that are actually routed to another node in the network.	pActual NetworkingNetw
Routing table updates interval (mins)	1–9999 Default 10	The frequency, in minutes, of routing table updates.	NCC_Period_ Min
Number of network nodes	1–30 Default 6	The number of nodes in the Symposium Call Center Server network, including the local node.	nNetNodes
Network CDR data collected at all nodes (%)	0–100 Default 100	The percentage of network Call Detail Reporting (CDR) data that is collected at all nodes in the network.	pCBCNetwork
Number of network skillsets	0–50 Default 50	The number of network skillsets that route a call to another Symposium Call Center Server site.	nNetSkillsets
Queue to network skillsets executed per network call	0–10 Default 2	The average number of skillset queues entered by a network call.	aQTNSPerNetw Call

Field	Valid range	Description	Parameters
Nodal parameters			
Calls request routing to other nodes (%)	0–100 Default 10	The percentage of calls originating at the local node that are queued to a network skillset.	pNetOut
Calls actually routed in network (%)	0–100 Default 80	The percentage of calls queued to network skillsets at the local node that are actually routed to another node in the network.	pActual Networking
Network calls handled by this node (%)	0–100 Default 17	The percentage of calls incoming network calls that are presented to agents on the local node.	pNetIn
Network CDR data collected at local node (%)	0–100 Default 100	The percentage of network Call Detail Reporting (CDR) data that is collected at the local node.	pCBCNetwork Node
Traffic details to other nodes ...	Button	Press this button to enter the traffic from this node to other nodes in the network. The traffic is assumed to be distributed equally by default.	
Traffic details printout	Check (Yes)/ Unchecked (No)	Check this box to generate traffic reports or remove the check mark to elect not to print reports.	

When you press Traffic details to other nodes, the Traffic details window appears. This window lists all the nodes on the network. Highlight a node and click Modify to adjust traffic values for that node.



To enter values in this screen, click the Modify button. The Traffic details input dialog box appears, allowing you to adjust values in the Traffic from and Traffic to areas relating to the specified node. For example, in the above illustration, node 1 is highlighted in the Traffic details window. When you click Modify, a dialog box for node 1 appears. In this dialog box, you can click the thumbwheels to increase or decrease values, or you can enter a new value into the field.

Description of Traffic details fields

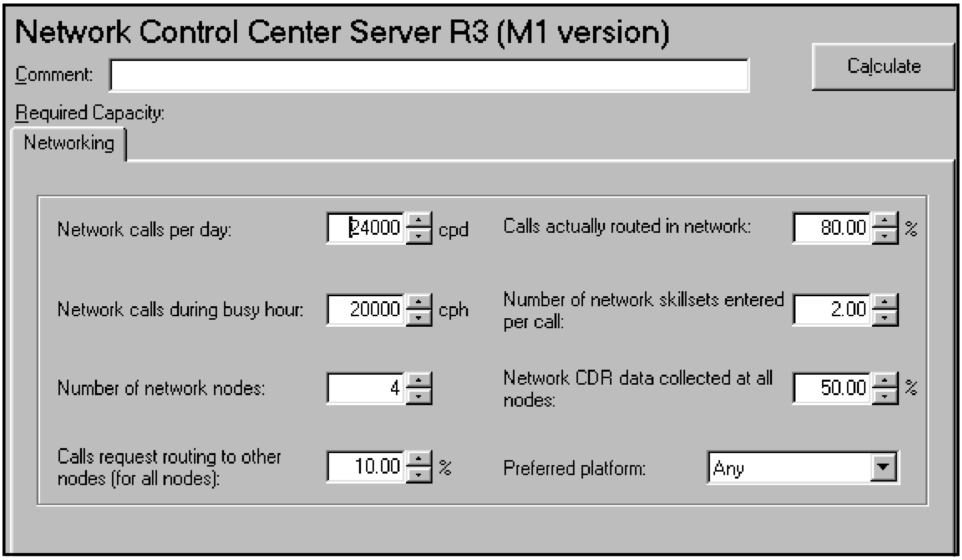
Field	Valid range	Description	Parameters
Name	Text	The name of the node.	
Traffic from (%)	0–100 Default 20	The percentage of networked calls originating at this node that are sent to the local node. **Note**: The total for all nodes must be approximately 100 percent.	pNetInOther Node

Field	Valid range	Description	Parameters
Traffic to (%)	0–100 Default 20	The percentage of networked calls originating at the local node that are sent to this node. **Note**: The total for all nodes must be approximately 100 percent.	pNetOutOther Node

Networking (NCC)

Introduction

The Networking page for NCC allows you to input networking parameters for all nodes on the network that the NCC server controls. The following illustration shows the Networking property page for the NCC server:



NCC Networking field descriptions

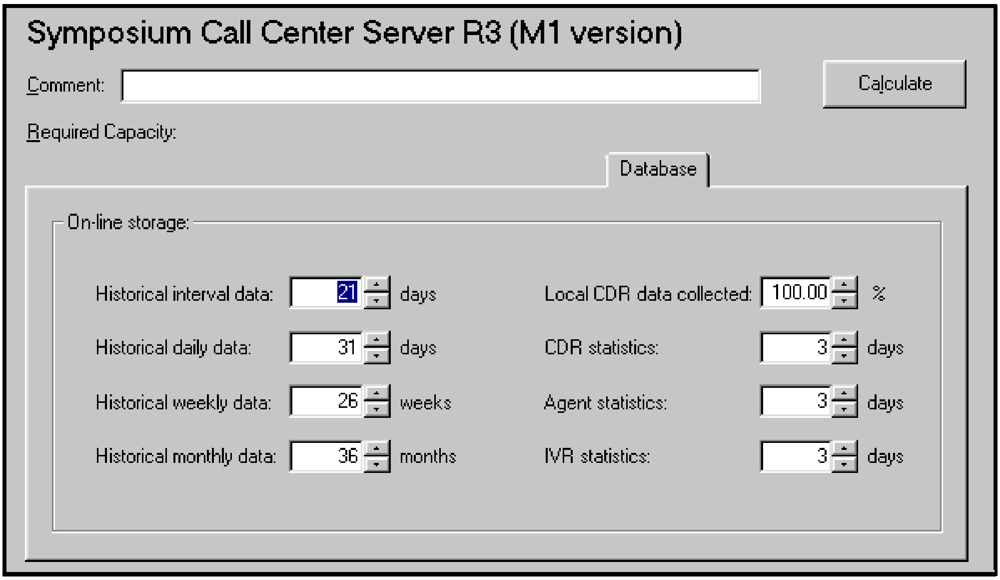
Field	Valid range	Description	Parameters
Network calls per day (cpd)	0–9 000 000 Default 24 000	The average number of calls entering the network during a day.	DailyNetwork CallRate
Network calls during busy hour (cph)	0–375 000 Default 24 000	The average number of calls entering the network during a busy hour.	PeakNetwork CallRate

Field	Valid range	Description	Parameters
Number of network nodes	1–30 Default 6	The number of network nodes including the local node in the Symposium Call Center Server network.	nNetNodes
Calls request routing to other nodes (for all nodes)%	0–100 Default 10	The percentage of calls originating at all nodes in the network that are queued to a network skillset.	pNetOutNetw
Calls actually routed in network (%)	0–100 Default 80	The percentage of calls queued to network skillsets within the network that are actually routed to another node in the network.	pActual NetworkingNetw
Number of network skillsets entered per call	0–50 Default 50	The number of network skillsets that route a call to another Symposium Call Center Server site.	aQTNSPerNetw Call
Network CDR data collected at all nodes (%)	0–100 Default 100	The percentage of network Call Detail Reporting (CDR) data that is collected at all nodes in the network.	pCBCNetwork
Preferred platform	Default Any	The platform chosen by the user to be the Network Control Center server (NCC only).	

Database

Introduction

The Database page allows you to input values used in calculating database storage requirements. The following illustration shows the Database property page for the M1 switch:



Database field descriptions

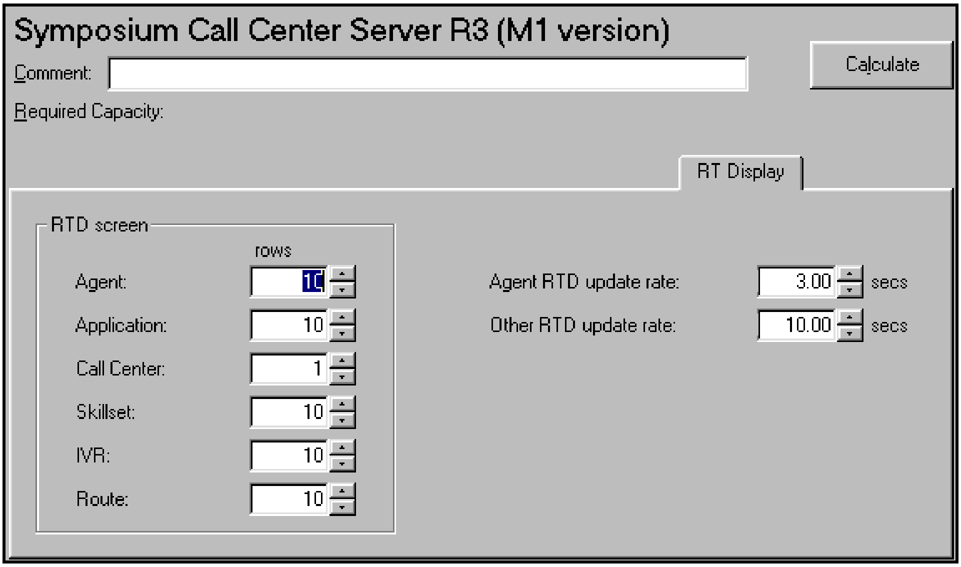
Field	Valid range	Description	Parameter
Historical interval data (days)	1–999 Default 21	The number of days that historical interval statistics are stored.	nDInterval
Historical daily data (days)	1–999 Default 31	The number of days that historical daily statistics are stored.	nDDay

Field	Valid range	Description	Parameter
Historical weekly data (weeks)	1–999 Default 26	The number of weeks that historical weekly statistics are stored.	nWWeek
Historical monthly data (months)	1–999 Default 36	The number of months that historical monthly statistics are stored.	nMMonth
Local CDR data collected (%)	0–100 Default 100	The percentage of Call Detail Reporting (CDR) data, also known as call-by-call data, that is collected at the local node.	pCBCNode
CDR statistics (days)	0–999 Default 3	The number of days that the call-by-call statistics are stored. A value of zero indicates that data is not collected.	nDCallByCall
Agent statistics (days)	1–999 Default 3	The number of days that Agent Event statistics are stored.	nDAgentStat
IVR statistics (days)	1–999 Default 3	The number of days that Interactive Voice Response (IVR) Event statistics are stored.	nDIVRStat

Real-time Display

Introduction

The Real-time Display page allows you to define resource requirements for real-time display screens. The following illustration shows the Real-time Display property page for the M1 switch:



Real-time Display field descriptions

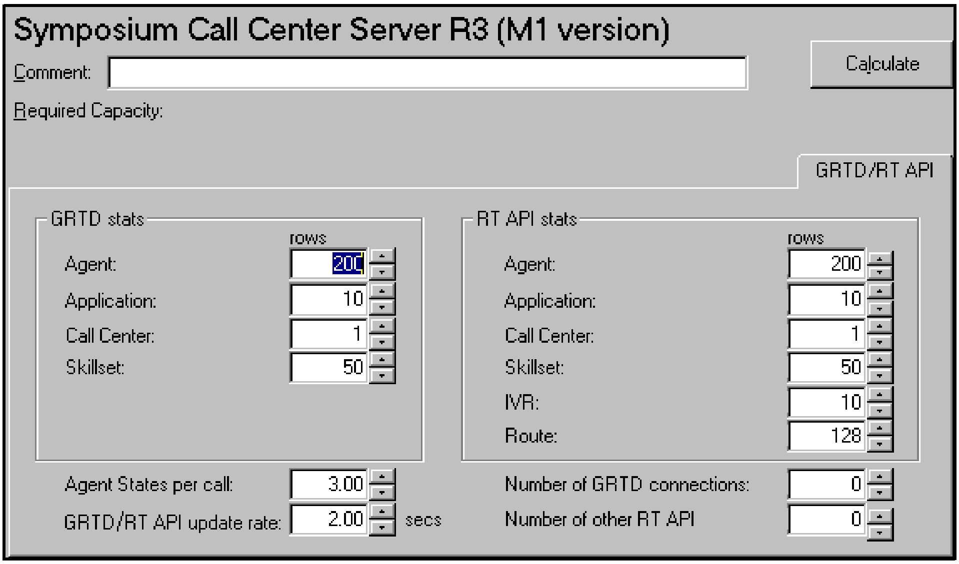
Field	Valid range	Description	Parameter
Agent	0–3000 Default 10	The number of rows displayed on each agent Real-time Display (RTD) screen.	nRTDAgRows
Application	0–5000 Default 10	The number of rows displayed on each application Real-time Display (RTD) screen.	nRTDAppRows

Field	Valid range	Description	Parameter
Call Center	0–1 Default 1	The number of rows displayed on the Call Center RTD screen.	nRTDCCRows
Skillset	0–350 Default 10	The number of rows displayed on each skillset RTD screen.	nRTDSkillRows
IVR	0–96 Default 10	The number of rows displayed on each IVR RTD screen.	nRTDIVRRows
Route	0–513 Default 10	The number of rows displayed on each route RTD screen.	nRTDRoute Rows
Agent RTD update rate (secs)	0.5–99 Default 3	The update rate of agent RTD screens.	AgScrUpdate Intvl
Other RTD update rate (secs)	2–99 Default 10	The update rate of other RTD screens (other than Agent display).	RTDScrUpdate Intvl

GRTD/Real-time API

Introduction

The GRTD/Real-time API page allows you to define resource requirements for graphical real-time display (GRTD) and the real-time application program interface (API). The following illustration shows the GRTD/Real-time API property page for the M1 switch:



GRTD/Real-time API field descriptions

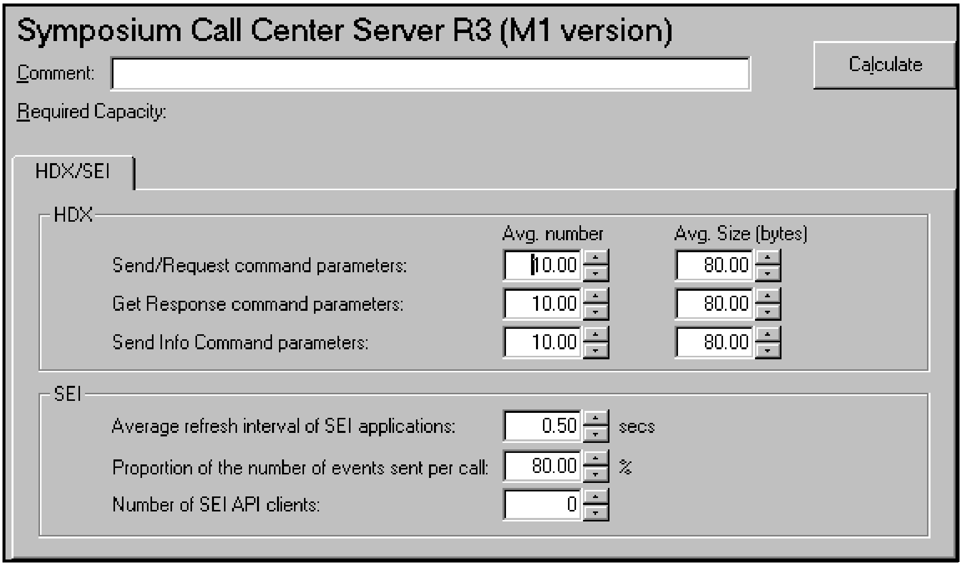
Field	Valid range	Description	Parameters
Agent (rows of GRTD/RT API stats)	0–3000 Default 200	The number of rows in the Agent GRTD and RT API statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDAgRows/ nRTIAgRows

Field	Valid range	Description	Parameters
Application (rows of GRTD/RT API stats)	0–500 Default 10	The number of rows in the GRTD and RT API Application statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDApp Rows/ nRTIAppRows
Call Center (rows of GRTD/RT API stats)	0–1 Default 1	The number of rows in the GRTD and RT API Call Center statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDCCRows/ nRTICCRows
Skillset (rows of GRTD/RT API stats)	0–350 Default 50	The number of rows in the GRTD and RT API Skillset statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDSkill Rows/ nRTISkillRows
IVR (rows of RT API stats)	0–96 Default 10	The number of rows in the RT API Interactive Voice Response (IVR) statistics.	nRTIIVRRows
Route (rows of RT API stats)	0–530 Default 128	The number of rows in the RT API Route statistics.	nRTIRouteRows
Agent States per call	0–99 Default 3	The average number of agent states per call.	aAgStatesCall
GRTD/RT API update rate (secs)	2–99 Default 2	The average update (refresh) interval in seconds of RT API applications.	RTIUpdateIntvl
Number of GRTD connections	0–100 Default 0	The number of GRTD connections to the system.	nGRTDClients
Number of other RT API connections	0–100 Default 0	The number of RT API clients expected to be connected to the system.	nRTIClients

HDX/SEI

Introduction

The HDX/SEI page allows you to define resource requirements for the Host Data Exchange (HDX) and Symposium Event Interface (SEI) interfaces. The following illustration shows the HDX/SEI property page for the M1 switch:



HDX/SEI field descriptions

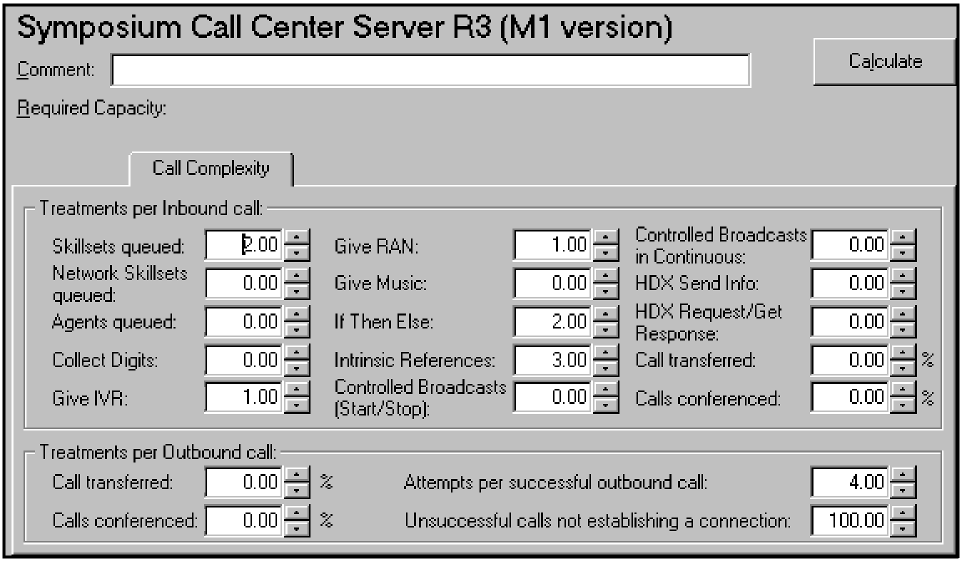
Field	Valid range	Description	Parameter
Average number of Send/Request command parameters	0–99 Default 10	The average number and average size of Send/Request instructions to be sent from the server PC to the client PC.	aDX_SndReq_ ParNum
Average size of Send/Request command parameters	0–999 Default 80		aDX_SndReq_ ParSize
Average number of Get Response command parameters	0–99 Default 10	The average number and average size of Get Response instructions to be sent from the server PC to the client PC.	aDX_GetResp_ ParNum
Average size of Get Response command parameters	0–999 Default 80		aDX_GetResp_ ParSize
Average number of Send Info Command parameters	0–99 Default 10	The average number and average size of Send Info instructions to be sent from the server PC to the client PC.	aDX_SndInfo_ ParNum
Average size of Send Info Command parameters	0–999 Default 80		aDX_SendInfo_ ParSize
Average refresh interval of SEI applications (secs)	0.5–5 Default 2	The average update interval of all Symposium Event Interface (SEI) applications.	aEIUpdateIntvl

Field	Valid range	Description	Parameter
Proportion of the number of events sent per call (%)	0–100 Default 10	The proportion, expressed as a percentage, of the total number of events sent per call as calculated with the formula “Actual events per call/ Total number of events available.”	pEventsCall
Number of SEI API clients	0–3 Default 1	The number of clients using the Symposium Event Interface (SEI) Application Program Interface (API).	nSEIClients

Call Complexity

Introduction

The Call Complexity page allows you to input values relating to the number of treatments given to inbound and outbound calls. The following illustration shows the Call Complexity property page for the M1 switch:



Call Complexity field descriptions

Field	Valid range	Description	Parameter
Treatments per inbound call			
Skillsets queued	0–99 Default 2	The average number of skillsets entered by an inbound call.	aQTSPerCall

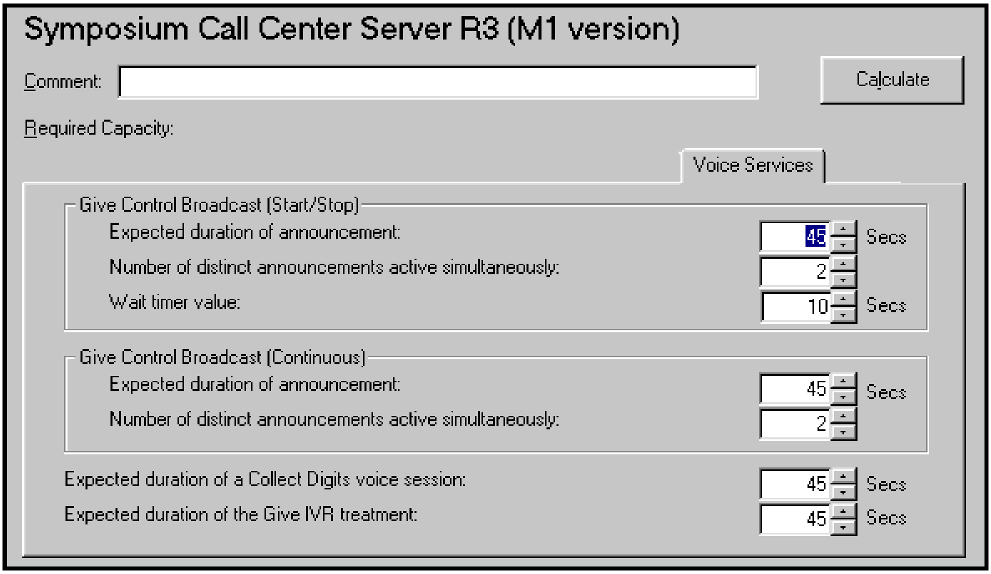
Field	Valid range	Description	Parameter
Network Skillsets queued	0–99 Default 0	The average number of network skillsets entered by an inbound call.	aQTNSPerNetw Call
Agents queued	0–99 Default 0	The average number of agent queues entered by an inbound call.	aQTAPerCall
Collect Digits	0–99 Default 0	The average number of collect digit requests per inbound call.	aVSCDGPerCall
Give IVR	0–99 Default 1	The average number of Give Interactive Voice Response (IVR) sessions per inbound call.	aGIVRPerCall
Give RAN	0–99 Default 1	The average number of Give Recorded Announcement (RAN) instances per inbound call.	aGRANPerCall
Give Music	0–99 Default 0	The average number of Give Music sessions per inbound call.	aGMUSPerCall
If Then Else	0–99 Default 2	The average number of “If Then Else” call treatments per inbound call.	aIFTHPerCall
Intrinsic References	0–99 Default 3	The average number of references to intrinsics per inbound call.	aINTRPerCall
Controlled Broadcasts (Start/Stop)	0–99 Default 0	The average number of controlled broadcast sessions in Start/Stop mode per inbound call.	aGCBPerCall
Controlled Broadcasts in Continuous	0–99 Default 0	The average number of controlled broadcast sessions in Continuous mode per inbound call.	aGCBCPerCall
HDX Send Info	0–99 Default 0	The average number of Host Data Exchange (HDX) Send Info treatments per inbound call.	aHDXSIPerCall

Field	Valid range	Description	Parameter
HDX Request/ Get Response	0–99 Default 0	The average number of HDX Request/ Get Response treatments per inbound call.	aHDXRGPerCall
Call transferred (%)	0–100 Default 0	The percentage of inbound calls that are transferred to another agent or Controlled Directory Number (CDN).	pTransferIn
Calls conferenced (%)	0–100 Default 0	The percentage of inbound calls that are conferenced with another agent or with a supervisor.	pConferencedIn
Treatments per Outbound call			
Call transferred (%)	0–100 Default 0	The percentage of outbound calls that are transferred to another agent or CDN.	pTransferOut
Call conferenced (%)	0–100 Default 0	The percentage of inbound calls that are conferenced with another agent or with a supervisor.	pConferenceOut
Attempts per successful outbound call	0–99 Default 4	The average number of call attempts per successful outbound call. **Note**: A successful call is defined as a call that reaches a live person.	aAttPerOutCall
Unsuccessful calls not establishing a connection	0–100 Default 100	The percentage of unsuccessful outbound calls that do not establish a Public Switch Telephone Network (PSTN).	pUCallsNCon

Voice Services

Introduction

The Voice Services page allows you to input values relating to the voice treatments given to calls. The following illustration shows the Voice Services property page for the M1 switch:



Voice Services field descriptions

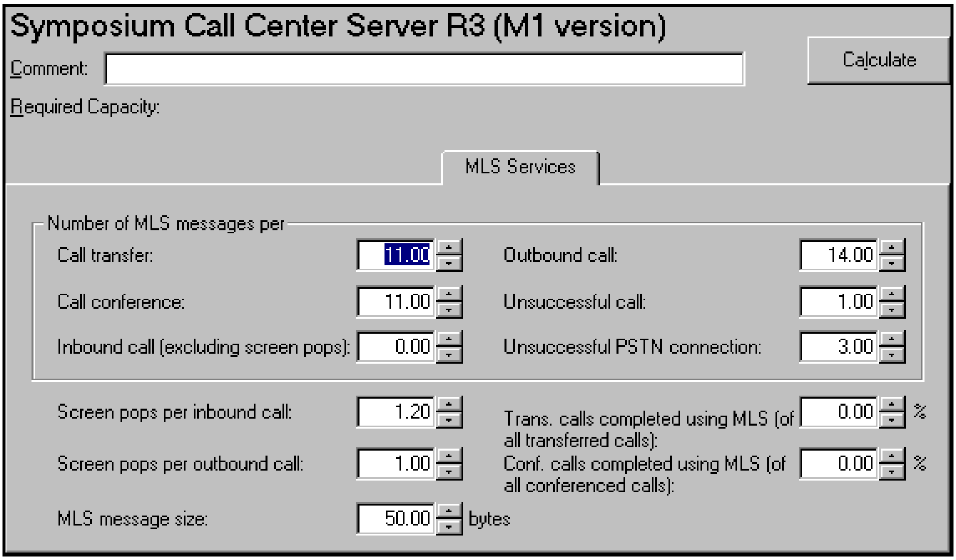
Field	Valid range	Description	Parameter
Give Control Broadcast (Start/Stop)			
Expected duration of announcement	1–999 Default 45	The expected duration in seconds of a Give Control Broadcast (GCB) announcement in Start/Stop mode.	nGCB_Duration

Field	Valid range	Description	Parameter
Number of distinct announcements active simultaneously	1–99 Default 2	The expected number of distinct GCB announcements played simultaneously in Start/Stop mode.	nGCB_ Simultaneous
Wait timer value	2–300 Default 10	The length in seconds of the Broadcast Port Wait Timer.	nGCB_WTimer
Give Control Broadcast (Continuous)			
Expected duration of announcement	1–999 Default 45	The expected duration in seconds of a GCB announcement in Continuous mode.	nGCBC_ Duration
Number of distinct announcements active simultaneously	1–99 Default 2	The expected number of distinct GCB announcements played simultaneously in Continuous mode.	nGCBC_ Simultaneous
Expected duration of a Collect Digits voice session	1–999 Default 45	The expected duration in seconds of a Collect Digits voice session.	nVSCDG_ Duration
Expected duration of the Give IVR treatment	1–999 Default 45	The expected duration in seconds of a Give IVR treatment.	nGIVR_ Duration

MLS Services

Introduction

The MLS page allows you to define resource requirements for MLS. The following illustration shows the MLS Services page for the M1 switch:



MLS field descriptions

Field	Valid range	Description	Parameter
Number of MLS messages per			
Call transfer	1–99 calls Default 11	The average number of MLS messages per call transfer.	aMMSGPerTx
Call conference	1–99 calls Default 11	The average number of MLS messages per call conference.	aMMSGPerConf

Field	Valid range	Description	Parameter
Inbound call (excluding screen pops)	0–99 calls Default 0	The average number of MLS messages per inbound call, excluding screen pops.	aMMSGPerCall
Outbound call	0–99 calls Default 14	The average number of MLS messages per outbound call, including screen pops.	aMMSGPerOut Call
Unsuccessful call	0–99 Default 0	The average number of MLS messages per PSTN connection resulting in an unsuccessful call attempt.	aMMSGPerN Con
Unsuccessful PSTN connection	0–99 Default 3	The average number of MLS messages per unsuccessful PSTN connection.	aMMSGPerCon UCall
Screen pops per inbound call	0–99 Default 1.2	The number of screen pops per inbound call.	aMSPPerCall
Screen pops per outbound call	0–99 Default 1	The number of screen pops per outbound call.	aMSPPerOutCall
MLS message size	1–999 Default 30	The average size of MLS messages in bytes. This figure does not include overhead.	aMMSG_Size
Trans. calls completed using MLS (of all transferred calls)	0–100 Default 0	The proportion of transferred calls completed by an MLS application such as Symposium Agent.	pTrnf_MLS
Conf. calls completed using MLS (of all conferenced calls)	0–100 Default 0	The proportion of conferenced calls completed by an MLS application such as Symposium Agent.	pConf_MLS

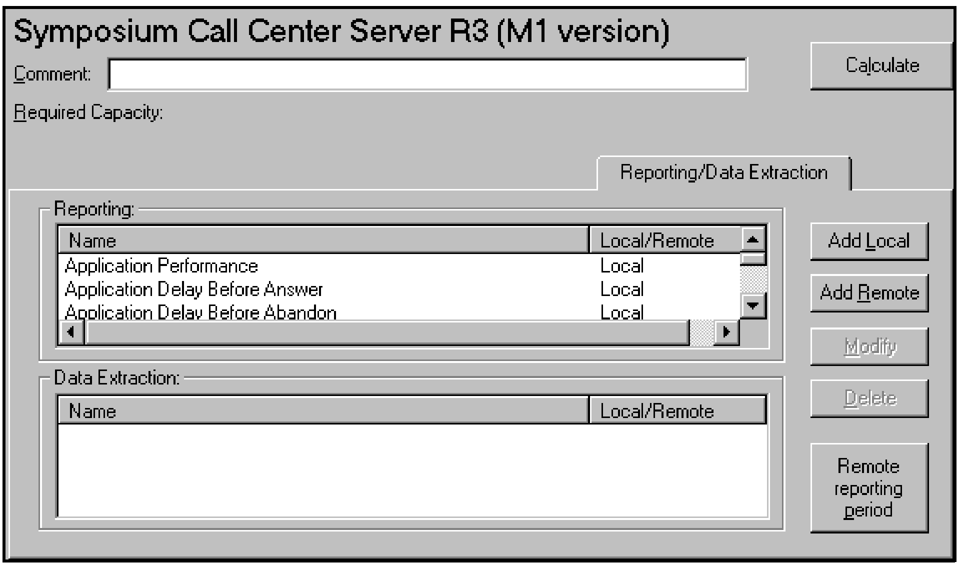
Reporting/Data Extraction

Introduction

The Reporting page allows you to specify the report generation and data extraction activities to be included in capacity calculations. Reports and data extractions are classified as

- local—if they are generated by local client PCs (that is, client PCs on the local segment of the CLAN) connected to the local server
- remote—if they are generated by local client PCs connected to a remote server or by remote client PCs (that is, client PCs on a remote segment of the CLAN) connected to the local server

The following illustration shows the Reporting/Data Extraction property page:



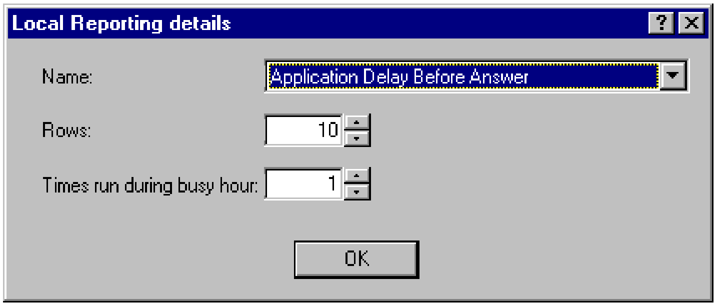
Reporting/Data Extraction field descriptions

Field	Valid range	Description
Reporting		
Name	Text	The name of the report. You can add a local or remote report based on hundreds of predefined reports.
Local/Remote	Local/ Remote	**Note:** Shows whether the server on which the report is generated is a local or remote server.
Data Extraction		
Name	Text	The name of the view from which data is to be extracted.
Local/Remote	Local/ Remote	Shows if the server from which the data is extracted is a local or remote server.

To add local reporting/data extraction activities

1. Click the Name bar or inside the list box for the report type that you want to add (Reporting or Data Extraction).
2. Click Add Local.
3. Select a report from the Name drop-down list.
4. Specify the number of rows (entries) in the report.

5 Specify the number of times per hour that the report is generated during the peak period.



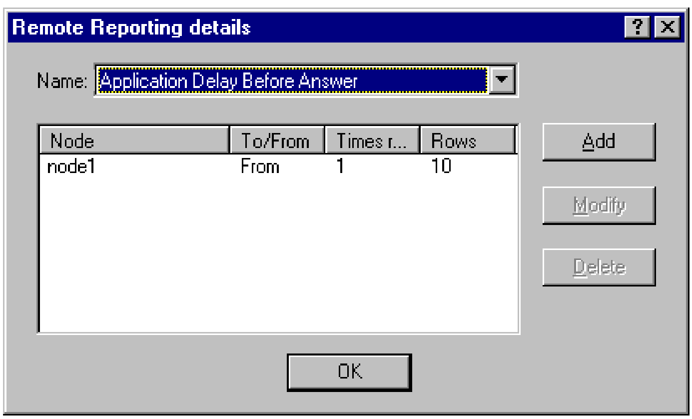
6 Click OK.

To add remote reporting/data extraction activities

1 Click the Name bar or inside the list box for the report type that you want to add (Reporting or Data Extraction).

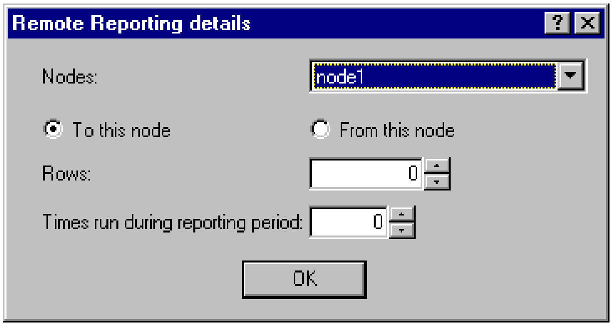
2 Click Add Remote.

3 Select a view from the Name drop-down list.



4 Click the Node column label.

5 Click Add.



6 In the Nodes box, select the server on which the report is to be generated, or from which the data is to be extracted.

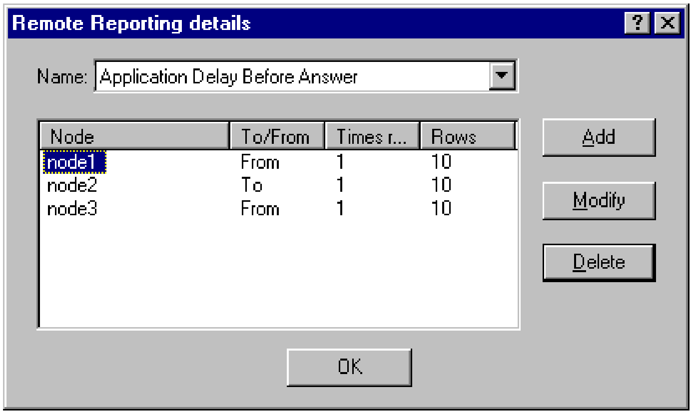
7 Select To this node if the report or data extraction activity runs on the remote node. Select From this node if the activity occurs on the local node.

8 In the Rows box, enter the number of rows to appear in the report. The number you enter appears in the Rows column.

9 In the Times run during reporting period box, enter the number of times the report should be run in a typical reporting period. (To define the reporting period, see “To change the reporting period for remote reporting and data extraction activities” on page 86.) The number you enter appears in the Times run column.

10 Click OK to exit.

Result: The details dialog box appears, showing all the nodes that you added.

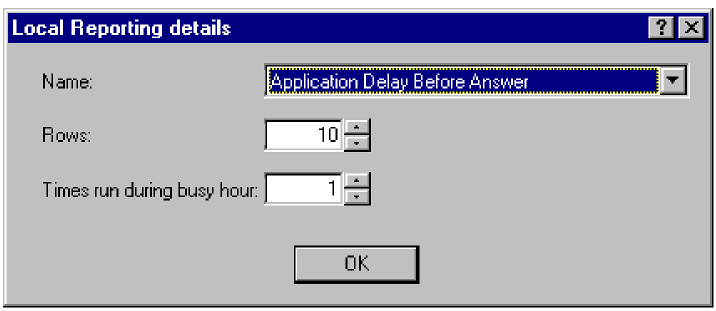


To change local reporting/data extraction activities

1 Select the report or data extraction you want to change.

2 Click Modify.

Result: The Local Reporting details or View/Data Extraction Details dialog box appears.



3 Make the desired changes.

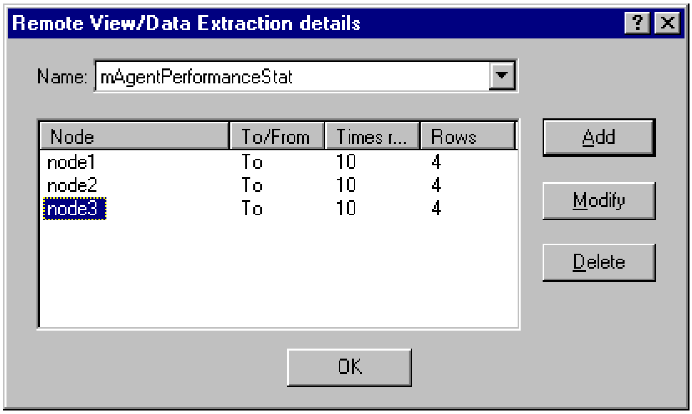
4 Click OK.

To change remote reporting/data extraction activities

1 Select the report or data extraction you want to change.

2 Click Modify.

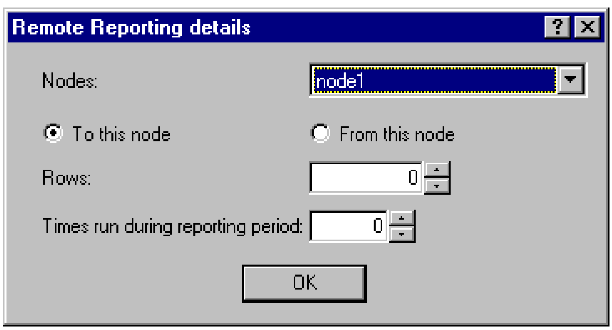
3 The Remote Reporting or View/Data Extraction details dialog box appears.



4 To add a node, follow these steps:

a. Click Add.

b. The Remote Reporting details dialog box appears.



c. In the Nodes box, select the server on which the report is to be generated, or from which the data is to be extracted.

d. Select To this node if the report or data extraction activity runs on the remote node. Select From this node if the activity occurs on the local node.

e. In the Rows box, enter the number of rows to appear in the report. The number you enter appears in the Rows column.

f. In the Times run during reporting period box, enter the number of times the report should be run in a typical reporting period. (To define the reporting period, see “To change the reporting period for remote reporting and data extraction activities” on page 86.) The number you enter appears in the Times run column.

g. Click OK to exit.

5 To change a node, follow these steps:

a. Select the node.

b. Click Modify.

Result: The Remote Reporting or View/Data Extraction dialog box appears.

c. Make the desired changes.

d. Click OK.

6 To delete a node, follow these steps.

a. Select the node.

b. Click Delete.

7 Click OK.

To delete reporting/data extraction activities

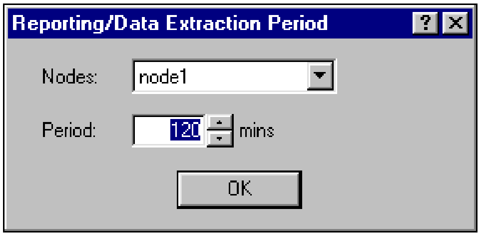
1 Select the report or data extraction you want to change.

2 Click Delete.

To change the reporting period for remote reporting and data extraction activities

1 Click Remote Reporting Period.

Result: The Reporting/Data Extraction Period dialog box appears.



2 In the Node box, select the node for which you want to define the data extraction period.

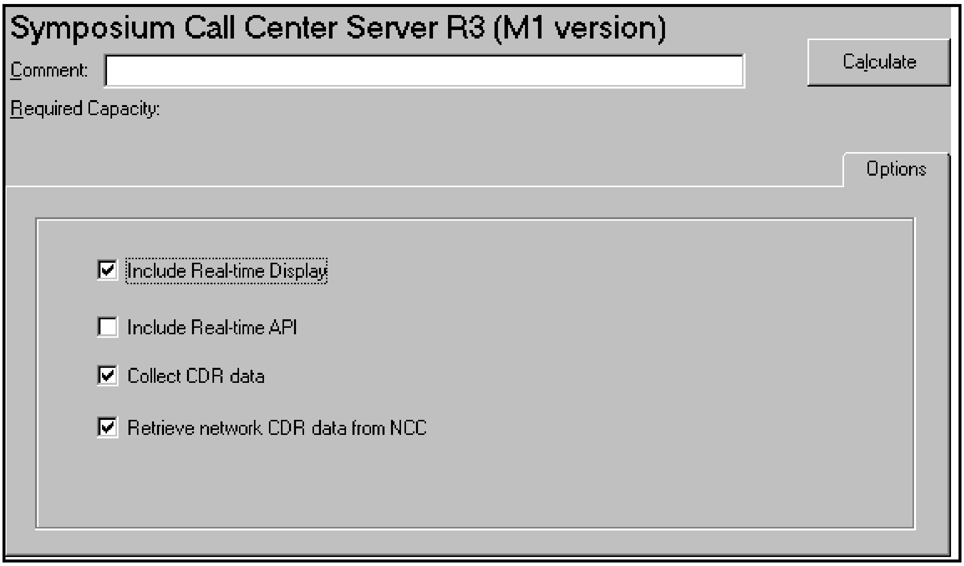
3 In the Period box, specify the period.

4 Click OK.

Options

Introduction

The Options page allows you to set preferences for calculations. The following illustration shows the Options page for the M1 switch:



Options field descriptions

Field	Valid range	Description
Include Real-time Display	Check box	Check or clear this box to include or exclude the capacity requirements of Real-time displays in calculations.
Include Real-time API	Check box	Check or clear this box to include or exclude the capacity requirements of the Real-time Application Program Interface in calculations.

Field	Valid range	Description
Collect CDR data	Check box	Check or clear this box to include or exclude the capacity requirements of the CallByCall database in calculations.
Retrieve network CDR data from NCC	Check box	Check or clear this box to include or exclude the capacity requirements for collecting call-by-call statistics for outbound network calls in calculations.

Chapter 4

DMS/MSL-100 Symposium Call Center Server requirements

In this chapter

Overview

Introduction

This chapter describes the fields displayed on the property pages for a DMS/MSL-100 system.

Parameter

The Parameter column in the tables starting on page 94 indicates the corresponding parameter used in the formula method (see Chapter 5, “Using the formula method”).

Example

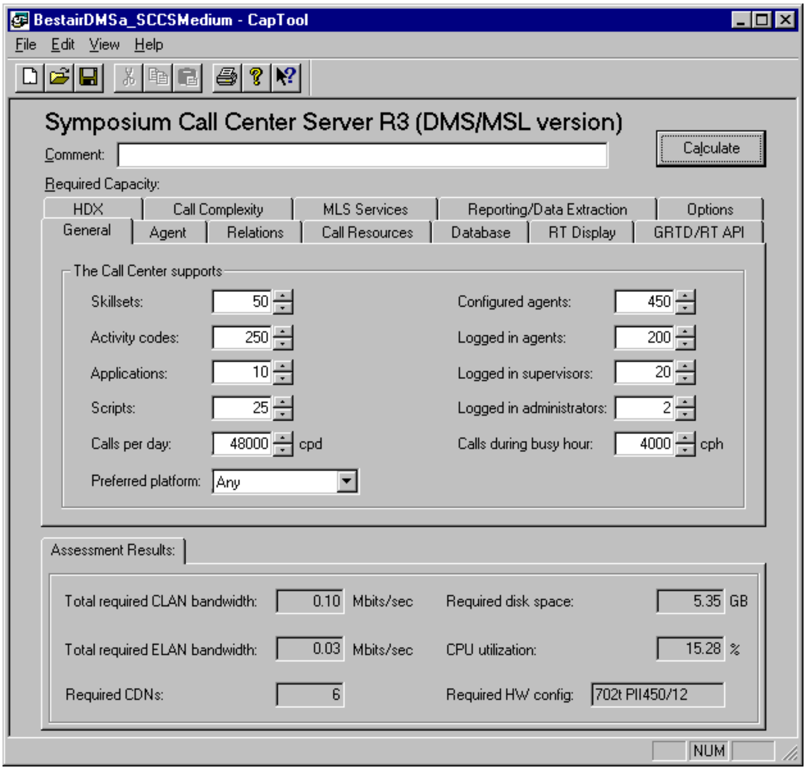
BestAir seat sale

Every July, BestAir Airline has a seat sale on certain flights. In the past, this event has dramatically increased the number of calls coming in to the call center. This July, BestAir plans to increase the number of agents in its call center from 450 to 550 to handle the extra calls.

The administrator of the call center can use the Capacity Assessment Tool to determine how these changes will affect the requirements of the call center system. BestAir might need to upgrade some equipment to handle the extra call traffic.

The following illustration shows the call center with the original 450 agents:

Original call center configured for 450 agents



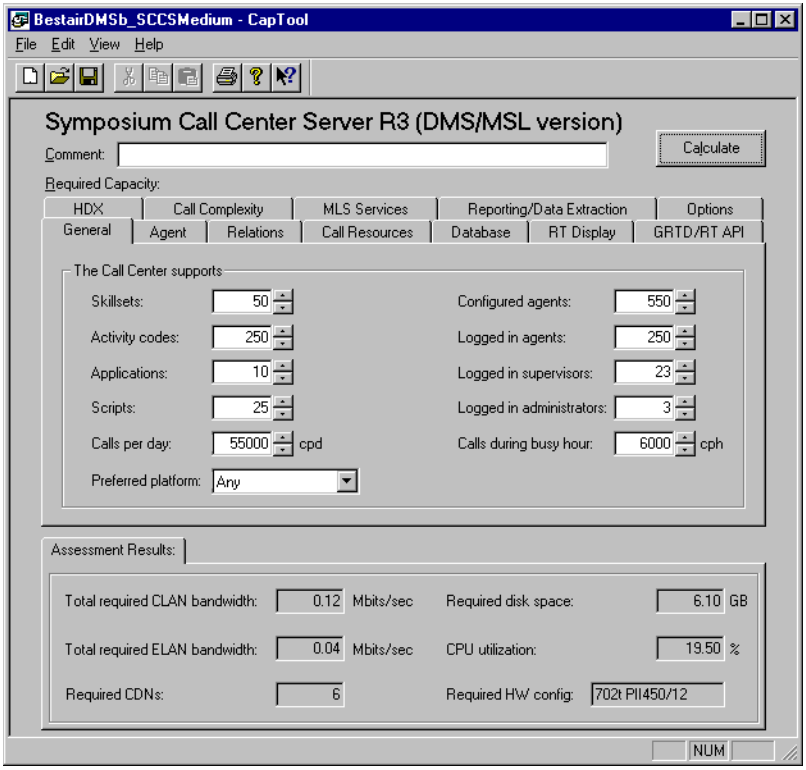
New call center configuration

The system administrator enters the proposed changes. This example increases

- the number of calls per hour and per day
- the number of agents logged on
- the total number of agents
- the number of supervisors and administrators logged on

The following illustration shows the BestAir call center after these changes are made:

New Call Center configured with an extra 100 agents



The Capacity Assessment Tool calculates the impact of the changes and shows them in the Assessment Results area in the lower part of each screen. Notice that the Assessment Results area shows an increase in

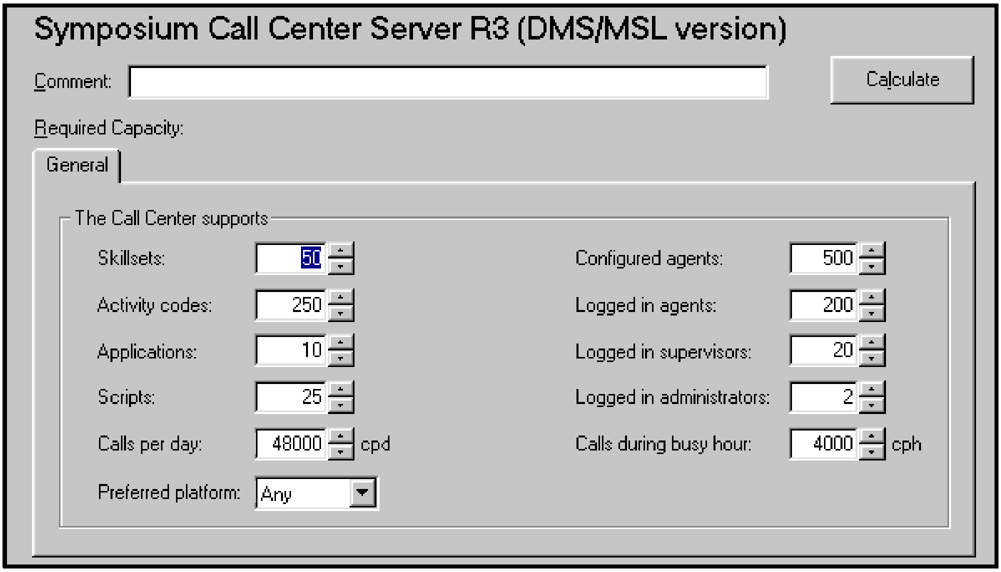
- ELAN and CLAN bandwidth requirements
- hard disk space requirements
- CPU utilization

However, the existing hardware configuration can support the additional load.

General

Introduction

The General page allows you to enter information about your call center size and workload. The following illustration shows the General property page for the DMS/MSL-100 switch:



General page field descriptions

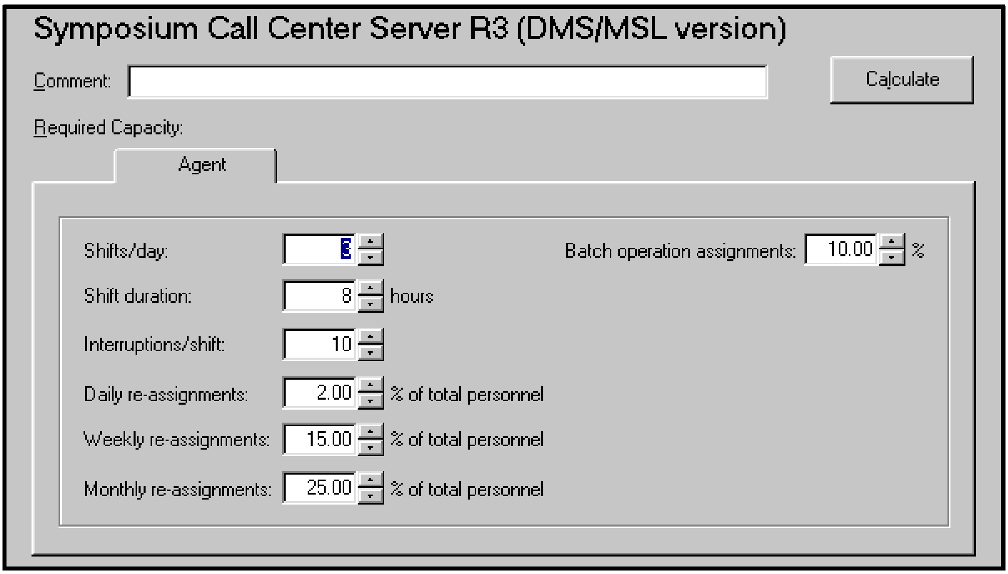
Field	Valid range	Description	Parameter
Skillsets	1–350 Default 50	The number of skillsets defined.	nSkillsets
Activity codes	0–1000 Default 250	The number of activity codes defined.	nActCodes

Field	Valid range	Description	Parameter
Applications	5–500 Default 10	The number of primary scripts (applications) defomed.	nApplications
Scripts	1–1500 Default 25	The number of scripts defined.	nScripts
Configured agents	1–3000 Default 500	The total number of agents defined.	nTAgents
Logged in agents	0–1000 (dual CPU) 1–600 (other platforms) Default 200	The maximum number of agents logged in at any one time.	nAgents
Logged in supervisors	0–100 Default 20	The number of supervisors logged in.	nSupervisors
Logged in administrators	0–100 Default 2	The number of administrators logged in.	nAdministrators
Calls per day (cpd)	0–600 000 Default 48 000	The expected average number of inbound calls per day.	0–600 000 Default 48 000
Calls during busy hour	0–25 000 Default 4000	The expected average number of inbound calls originating locally during a busy hour.	PeakCallRate
Preferred platform	Any	The user-selected platform that CapTool uses for the workload to make the assessment on.	Any

Agent

Introduction

The Agent page allows you to enter information about agent work shifts and work assignments. The following illustration shows the Agent property page for the DMS/MSL-100 switch:



Agent field descriptions

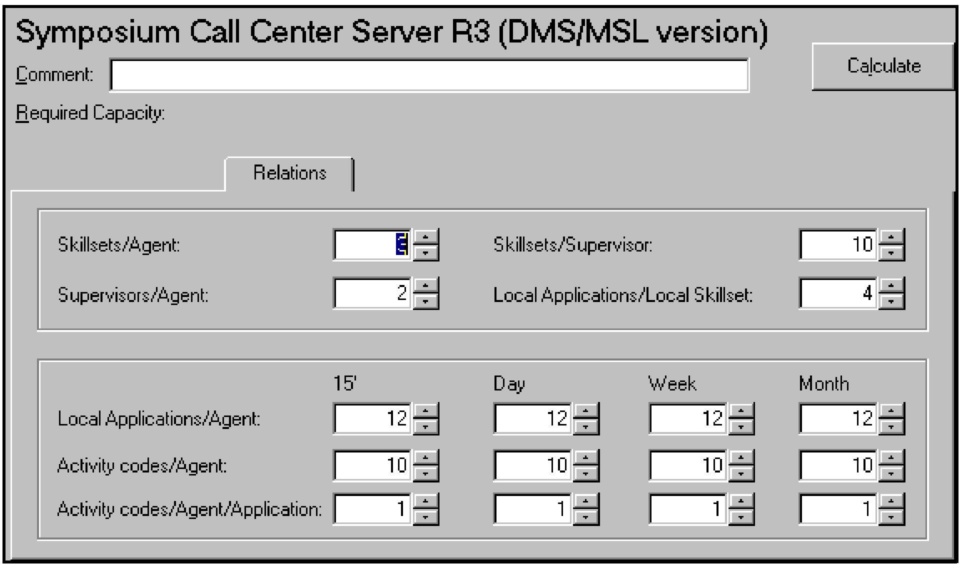
Field	Valid range	Description	Parameter
Shifts/day	0–100 Default 3	The number of agent shifts per day.	nShifts
Shift duration	0–100 Default 8	The number of hours per agent shift.	nShiftsHrs

Field	Valid range	Description	Parameter
Interruptions/ shift	0–100 Default 10	The number of agent interruptions, such as scheduled breaks, logon/logoff and walkaway, per shift.	nIntPerShift
Daily re-assignments (%)	0–100 Default 2	The percentage of agent-supervisor and agent-skillset assignments that are changed daily.	pAgDaily Reassign
Weekly re-assignments (%)	0–100 Default 15	The percentage of agent-supervisor and agent-skillset assignments that are changed weekly.	pAgWeekly Reassign
Monthly re-assignments (%)	0–100 Default 25	The percentage of agent-supervisor and agent-skillset assignments that are changed monthly.	pAgMonthly Reassign
Batch operation assignments (%)	0–100 Default 10	The percentage of agents whose supervisor or skillset assignments are changed in batch operation (that is, with agent to skillset or agent to supervisor assignments.	pBatchAssign Factor

Relations

Introduction

The Relations page allows you to input values relating to relationships such as skillsets per agent. The following illustration shows the Relations property page for the DMS/MSL-100 switch:



Relations field descriptions

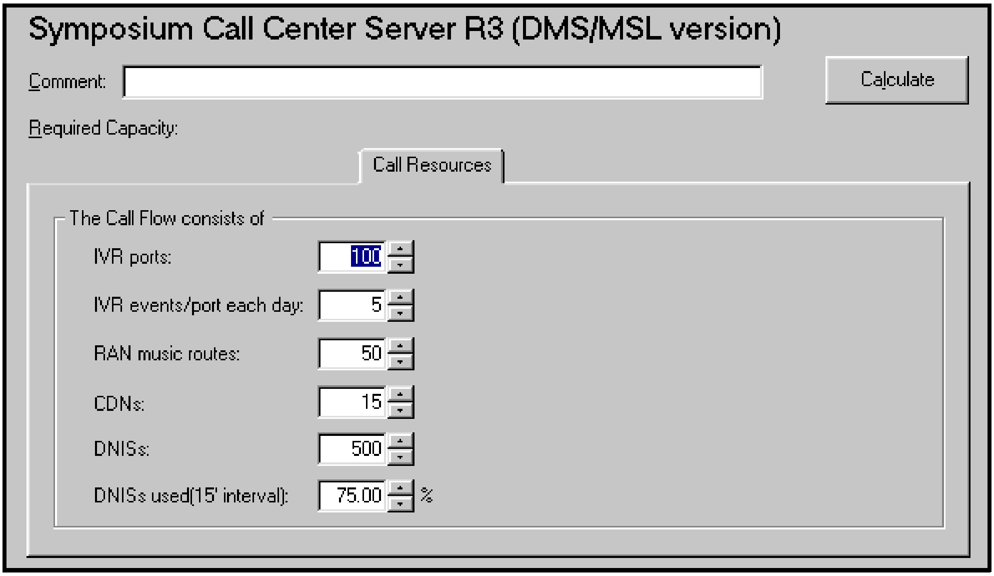
Field	Valid range	Description	Parameter
Skillsets/Agent	1–50 Default 3	The average number of skillsets served by an agent.	aSkill_Agent
Supervisors/Agent	1–6 Default 2	The average number of supervisors to which an agent reports.	aSup_Agent
Skillsets/Supervisor	1–350 Default 10	The average number of skillsets served by the supervisor's agents.	aSkill_Supv

Field	Valid range	Description	Parameter
Local Applications/ Local Skillset	1–500 Default 4	The average number of local applications per local skillset.	aAppl_Skill
Local Applications/ Agent in 15', Day, Week, Month	1–500 Default 12	The average number of local applications handled by each agent for the specified period: interval (15 minutes), day, week, month.	aApplAgent Intv/ Day/Week/ Month
Activity codes/ Agent in 15', Day, Week, Month	0–5000 Default 1	The average number of unique activity codes entered per agent for the specified period: interval (15 minutes), day, week, month.	aActCode_Agent Intv/Day/Week/ Month
Activity codes/ Agent/ Application in 15', Day, Week, Month	0–5000 Default 10	The average number of unique activity codes entered per agent per local application for the specified period: interval (15 minutes), day, week, month.	aActCode_Agent _Appl Intv/Day/Week/ Month

Call Resources

Introduction

The Call Resources page allows you to enter information about usage of switch resources. The following illustration shows the Call Resources property page for the DMS/MSL-100 switch:



Call Resources field descriptions

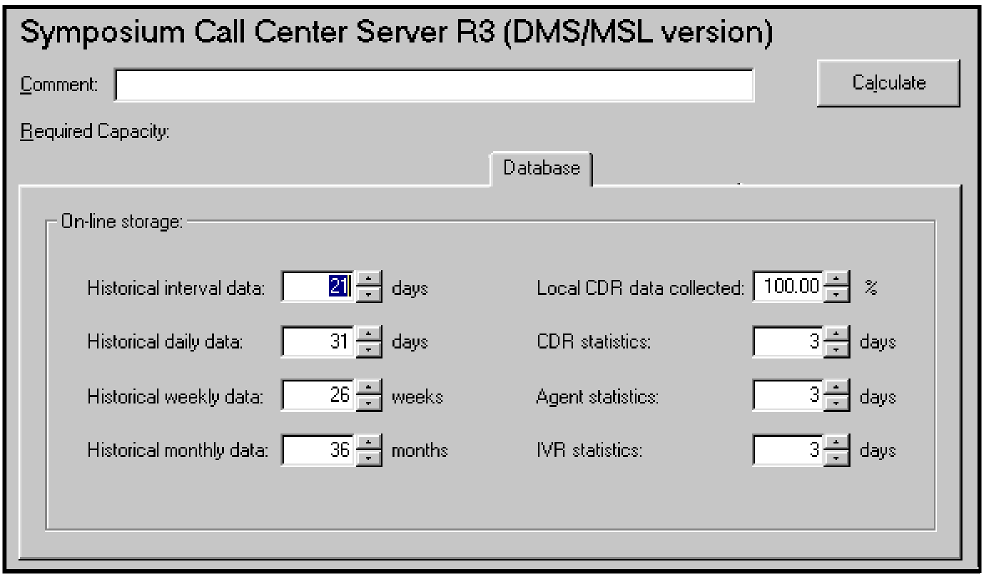
Field	Valid range	Description	Parameter
IVR ports	1–500 Default 48	The number of Interactive Voice Response (IVR) ports configured.	nIVRPorts
IVR events/ port each day	1–999 Default 5	The number of Interactive Voice Response (IVR) events per port per day defined.	nIVRPortEvents

Field	Valid range	Description	Parameter
RAN music routes	0–513 Default 50	The number of Recorded Announcement (RAN) or music routes configured.	nRMRoutes
CDNs	1–240 Default 15	The number of Controlled Directory Numbers (CDNs) in the system.	nCDN
DNISs	1–10 000 Default 500	The number of Dialed Number Identification Services (DNISs) defined in the system.	nDNIS
DNISs used (15' interval) (%)	0–100 Default 75	The percentage of Dialed Number Identification Services (DNISs) used during a single data collection interval.	nDNISInterval

Database

Introduction

The Database page allows you to input values used in calculating database storage requirements. The following illustration shows the Database property page for the DMS/MSL-100 switch:



Database field descriptions

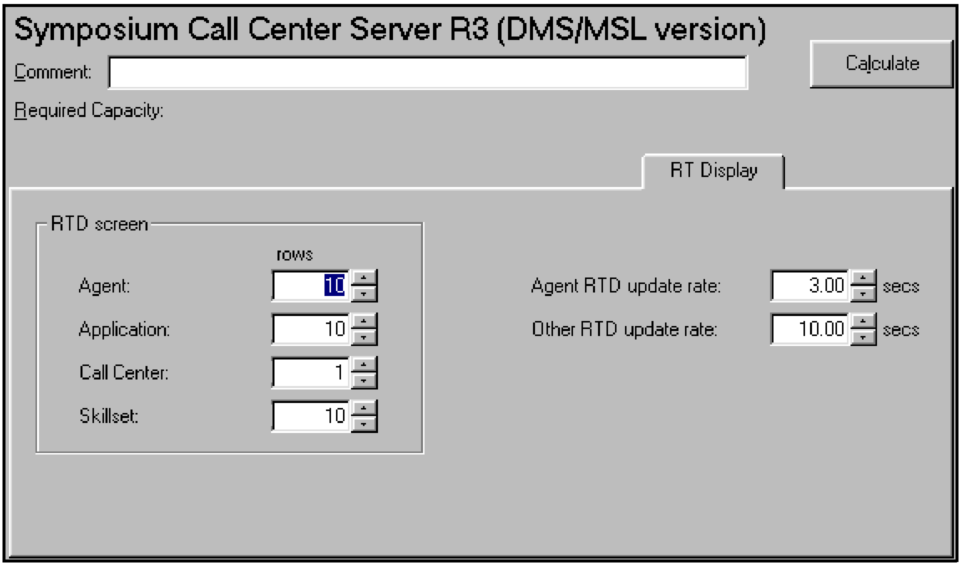
Field	Valid range	Description	Parameter
Historical interval data	1–999 Default 21	The number of days that historical interval statistics are stored.	nDInterval
Historical daily data	1–999 Default 31	The number of days that historical daily statistics are stored.	nDDay
Historical weekly data	1–999 Default 26	The number of weeks that historical weekly statistics are stored.	nWWeek

Field	Valid range	Description	Parameter
Historical monthly data	1–999 Default 36	The number of months that historical monthly statistics are stored.	nMMonth
Local CDR data collected	0–100 Default 100	The percentage of Call Detail Reporting (CDR) data, also known as call-by-call data, that is collected at the local node.	pCBCNode
CDR statistics	0–999 Default 3	The number of days that the call-by-call statistics are stored. A value of zero indicates that data is not collected.	nDCallByCall
Agent statistics	1–999 Default 3	The number of days that Agent Event statistics are stored.	nDAgentStat
IVR statistics	1–999 Default 3	The number of days that Interactive Voice Response (IVR) Event statistics are stored.	nDIVRStat

Real-time Display

Introduction

The Real-time Display page allows you to define resource requirements for real-time display screens. The following illustration shows the Real-time Display property page for the DMS/MSL-100 switch:



Real-time Display field descriptions

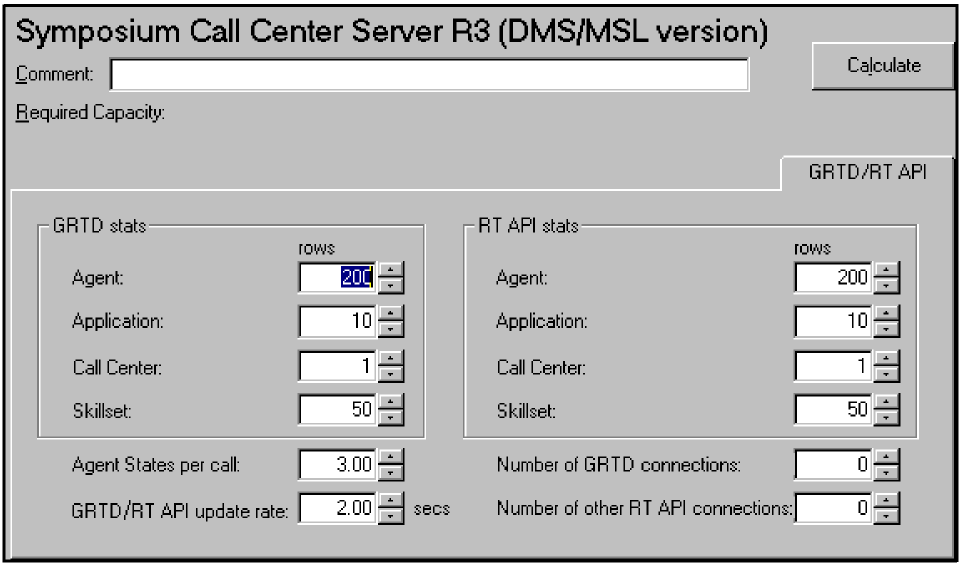
Field	Valid range	Description	Parameter
Agent	0–3000 Default 10	The number of rows displayed on each agent Real-time Display (RTD) screen.	nRTDAgRows
Application	0–5000 Default 10	The number of rows displayed on each application Real-time Display (RTD) screen.	nRTDAppRows

Field	Valid range	Description	Parameter
Call Center	0–1 Default 1	The number of rows displayed on the Call Center RTD screen.	nRTDCCRows
Skillset	0–350 Default 10	The number of rows displayed on each skillset RTD screen.	nRTDSkillRows
Agent RTD update rate (secs)	0.5–99 Default 3	The update rate of agent RTD screens.	AgScrUpdate Intvl
Other RTD update rate (secs)	2–99 Default 10	The update rate of other RTD screens (other than Agent display).	RTDScrUpdate Intvl

GRTD/Real-time API

Introduction

The GRTD/Real-time API page allows you to define resource requirements for graphical real-time display (GRTD) and the real-time application program interface (API). The following illustration shows the GRTD/Real-time API property page for the DMS/MSL-100 switch:



GRTD/Real-time API field descriptions

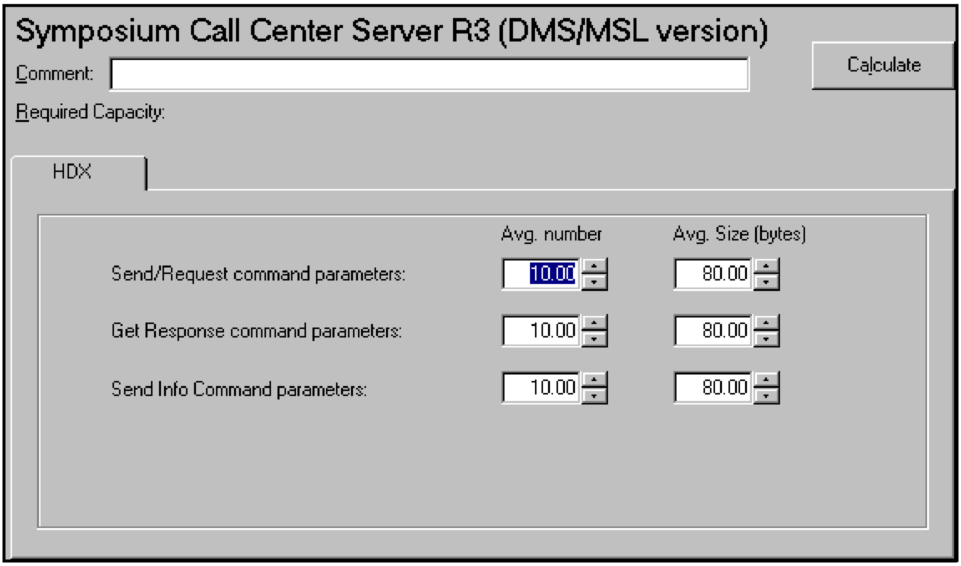
Field	Valid range	Description	Parameters
Agent (rows of GRTD/RT API stats)	0–3000 Default 200	The number of rows in the Agent GRTD and RT API statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDAgRows/ nRTIAgRows

Field	Valid range	Description	Parameters
Application (rows of GRTD/RT API stats)	0–500 Default 10	The number of rows in the GRTD and RT API Application statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDApp Rows/ nRTIAppRows
Call Center (rows of GRTD/RT API stats)	0–1 Default 1	The number of rows in the GRTD and RT API Call Center statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDCCRows/ nRTICCRows
Skillset (rows of GRTD/RT API stats)	0–350 Default 50	The number of rows in the GRTD and RT API Skillset statistics. **Note**: Row values are the same for GRTD and RT API sections.	nGRTDSkill Rows/ nRTISkillRows
Agent States per call	0–99 Default 3	The average number of agent states per call.	aAgStatesCall
GRTD/RT API update rate (secs)	2–99 Default 2	The average update (refresh) interval in seconds of RT API applications.	RTIUpdateIntvl
Number of GRTD connections	0–100 Default 0	The number of GRTD connections to the system.	nGRTDClients
Number of other RT API connections	0–100 Default 0	The number of RT API clients expected to be connected to the system.	nRTIClients

HDX

Introduction

The HDX page allows you to define resource requirements for the Host Data Exchange (HDX) interface. The following illustration shows the HDX property page for the DMS/MSL-100 switch:



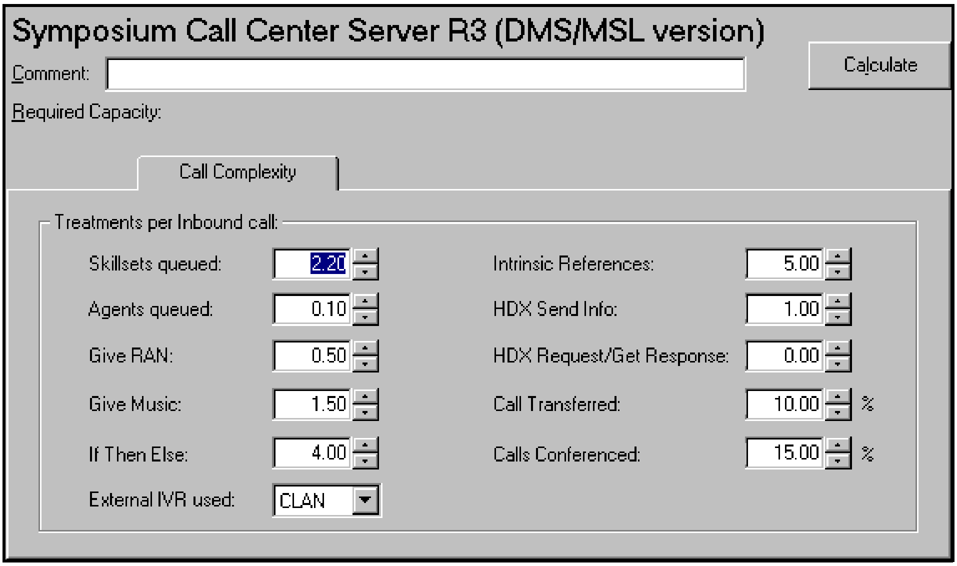
HDX field descriptions

Field	Valid range	Description	Parameter
Average number of Send/Request command parameters	0–99 Default 10	The average number and average size of Send/Request instructions to be sent from the server PC to the client PC.	aDX_SndReq_ParNum
Average size of Send/Request command parameters	0–999 Default 80	The average number and average size of Send/Request instructions to be sent from the server PC to the client PC.	aDX_SndReq_ParSize
Average number of Get Response command parameters	0–99 Default 10	The average number and average size of Get Response instructions to be sent from the server PC to the client PC.	aDX_GetResp_ParNum
Average size of Get Response command parameters	0–999 Default 80	The average number and average size of Get Response instructions to be sent from the server PC to the client PC.	aDX_GetResp_ParSize
Average number of Send Info Command parameters	0–99 Default 10	The average number and average size of Send Info instructions to be sent from the server PC to the client PC.	aDX_SndInfo_ParNum
Average size of Send Info Command parameters	0–999 Default 80	The average number and average size of Send Info instructions to be sent from the server PC to the client PC.	aDX_SendInfo_ParSize

Call Complexity

Introduction

The Call Complexity page allows you to input values relating to the number of treatments given to inbound calls. The following illustration shows the Call Complexity property page for the DMS/MSL-100 switch:



Call Complexity field descriptions

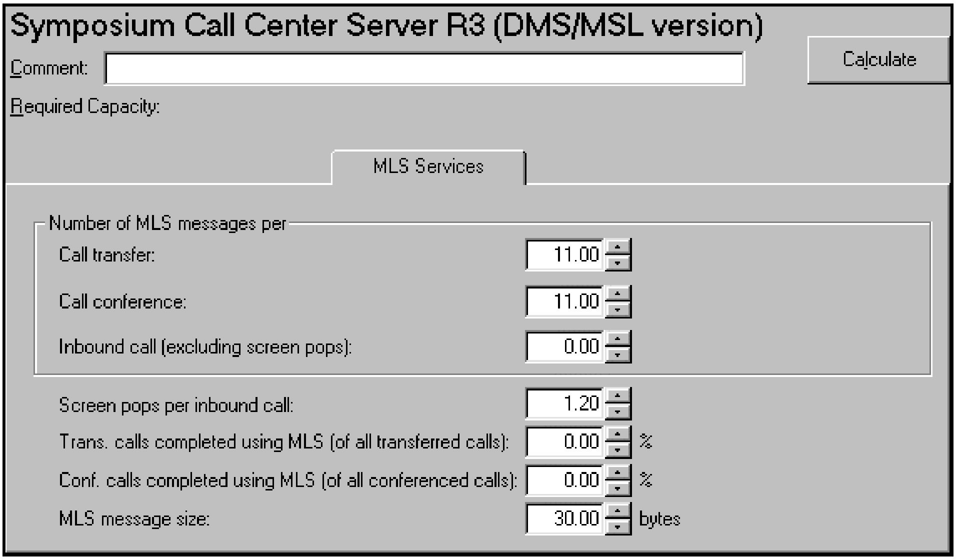
Field	Valid range	Description	Parameter
Skillsets queued	0–99 Default 2.2	The average number of skillsets entered by an inbound call.	aQTSPerCall
Agents queued	0–99 Default 0.1	The average number of agent queues entered by an inbound call.	aQTAPerCall

Field	Valid range	Description	Parameter
Give RAN	0–99 Default 0.5	The average number of Give Recorded Announcement (RAN) instances per inbound call.	aGRANPerCall
Give Music	0–99 Default 1.5	The average number of Give Music sessions per inbound call.	aGMUSPerCall
If Then Else	0–99 Default 4	The average number of “If Then Else” call treatments per inbound call.	aIFTHPerCall
External IVR used	None CLAN (Default) ELAN	A drop-down menu that indicates if the external Interactive Voice Response (IVR) system (if present) is connected to the CLAN or the ELAN. If None appears, then that means no IVR is present.	
Intrinsic References	0–99 Default 5	The average number of references to intrinsics per inbound call.	aINTRPerCall
HDX Send Info	0–99 Default 1	The average number of Host Data Exchange (HDX) Send Info treatments per inbound call.	aHDXSIPerCall
HDX Request/ Get Response	0–99 Default 0	The average number of HDX Request/ Get Response treatments per inbound call.	aHDXRGPerCall
Call transferred (%)	0–100 Default 10	The percentage of inbound calls that are transferred to another agent or Controlled Directory Number (CDN).	pTransferIn
Calls Conferenced (%)	0–100 Default 15	The percentage of inbound calls that are conferenced with another agent or with a supervisor.	pConferencedIn

MLS Services

Introduction

The MLS page allows you to define resource requirements for MLS. The following illustration shows the MLS Services page for the DMS/MSL-100 switch:



MLS field descriptions

Field	Valid range	Description	Parameter
Number of MLS messages per			
Call transfer	1–99 calls Default 11	The average number of MLS messages per call transfer.	aMMSGPerTx
Call conference	1–99 calls Default 11	The average number of MLS messages per call conference.	aMMSGPerConf

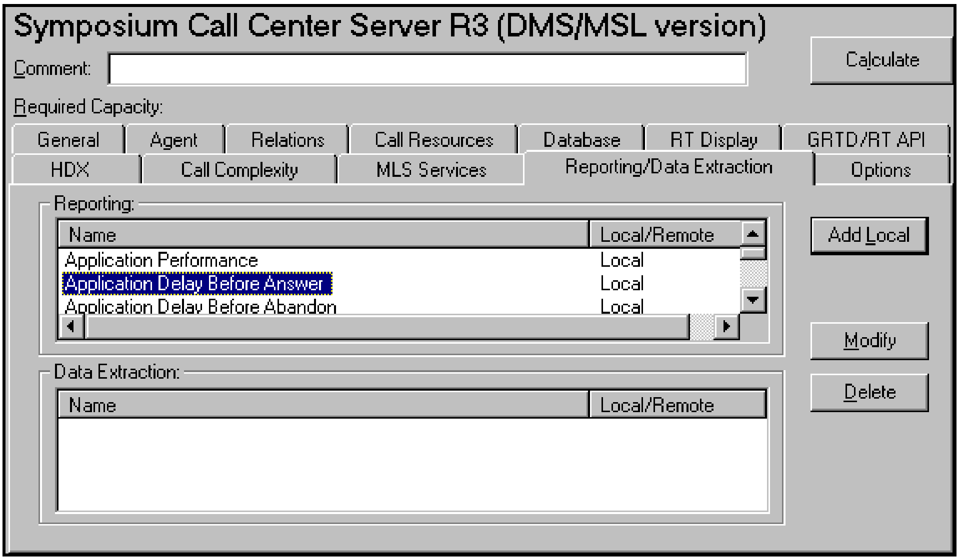
Field	Valid range	Description	Parameter
Inbound call (excluding screen pops)	0–99 calls Default 0	The average number of MLS messages per inbound call, excluding screen pops.	aMMSGPerCall
Screen pops per inbound call	0–99 Default 1.2	The number of screen pops per inbound call.	aMSPPerCall
Trans. calls completed using MLS (of all transferred calls)	0–100 Default 0	The proportion of transferred calls completed by an MLS application such as Symposium Agent.	pTrnf_MLS
Conf. calls completed using MLS (of all conferenced calls)	0–100 Default 0	The proportion of conferenced calls completed by an MLS application such as Symposium Agent.	pConf_MLS
MLS message size	1–999 Default 30	The average size of MLS messages in bytes. This figure does not include overhead.	aMMSG_Size

Reporting/Data Extraction

Introduction

The Reporting page allows you to specify the report generation and data extraction activities to be included in capacity calculations. For the DMS switch, all reports are generated locally (that is, by PCs connected to the local server).

The following illustration shows the Reporting/Data Extraction property page:



Reporting/Data Extraction field descriptions

Field	Valid range	Description
Reporting		
Name	Text	The name of the report. You can add a local or remote report based on hundreds of predefined reports.

Field	Valid range	Description
Local/Remote	Local/ Remote	Shows whether the server on which the report is generated is a local or remote server. **Note:** In this release, only local reporting is available.
Data Extraction		
Name	Text	The name of the view from which data is to be extracted.
Local/Remote	Local/ Remote	Shows if the server from which the data is extracted is a local or remote server. In this release, only local data extraction is available.

To add local reporting/data extraction activities

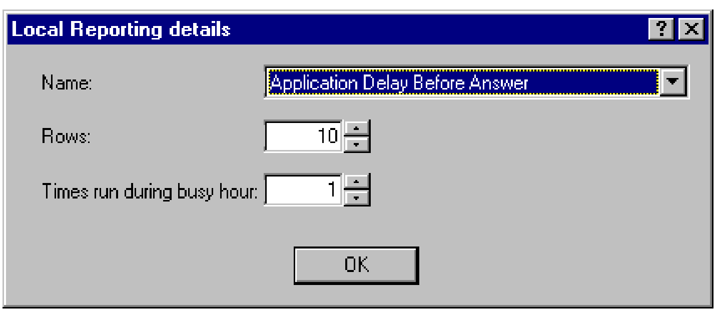
1 Click the Name bar or inside the list box for the report type that you want to add (Reporting or Data Extraction).

2 Click Add Local.

3 Select a report from the Name drop-down list.

4 Specify the number of rows (entries) in the report.

5 Specify the number of times per hour that the report is generated during the peak period.



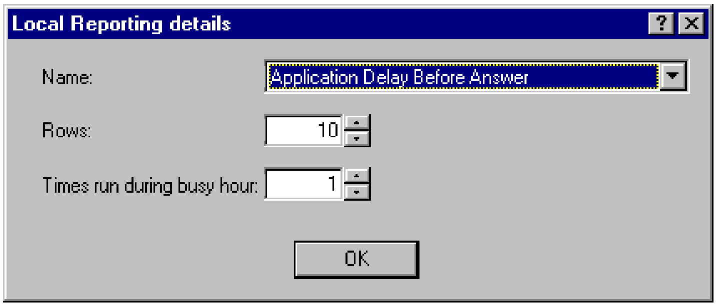
6 Click OK .

To change local reporting/data extraction activities

1 Select the report or data extraction you want to change.

2 Click Modify.

Result: The Local Reporting details or View/Data Extraction Details dialog box appears.



3 Make the desired changes.

4 Click OK.

To delete reporting/data extraction activities

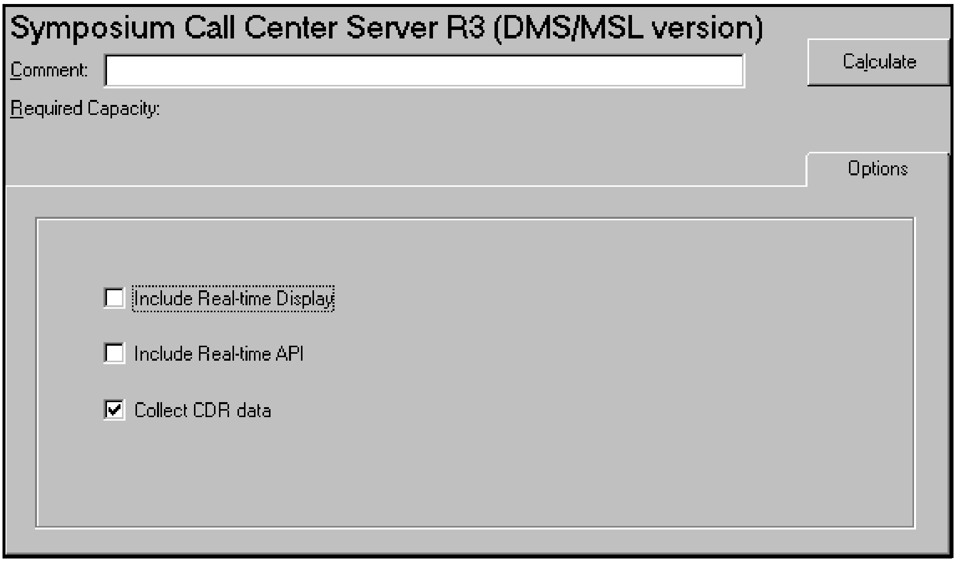
1 Select the report or data extraction you want to change.

2 Click Delete.

Options

Introduction

The Options page allows you to set preferences for calculations. The following illustration shows the Options page for the DMS/MSL-100 switch:



Options field descriptions

Field	Valid range	Description
Include Real-time Display	Check box	Check or clear this box to include or exclude the capacity requirements of Real-time displays in calculations.
Include Real-time API	Check box	Check or clear this box to include or exclude the capacity requirements of the Real-time Application Program Interface in calculations.

Field	Valid range	Description
Collect CDR data	Check box	Check or clear this box to include or exclude the capacity requirements of the CallByCall database in calculations.

Chapter 5

Using the formula method

In this chapter

Checklist for using the formula method

Meridian 1 switch

Step	✔
Record your workload parameters. See page 122.	
Determine the expected call rate for networking. See page 139.	
Calculate server disk utilization. See page 145.	
Calculate server CPU utilization. See page 152.	
Calculate ELAN utilization. See page 171.	
Calculate CLAN utilization. See page 195.	
Calculate online backup elapsed time. See page 230.	
Calculate WAN utilization. See page 215.	
If you are using Meridian Mail, determine the number of Meridian Mail voice ports required. Refer to Chapter 7, “Planning Meridian Mail requirements (M1 only).”	
If you are using the optional network skill-based routing feature, engineer the Network Control Center. Refer to Chapter 6, “Engineering the NCC server.”	

DMS/MSL-100 switch

Step	✔
Record your workload parameters. See page 122.	
Calculate server disk utilization. See page 145.	
Calculate server CPU utilization. See page 152.	
Calculate ELAN utilization. See page 183.	
Calculate CLAN utilization. See page 195.	
Calculate online backup elapsed time. See page 230.	
Calculate WAN utilization. See page 229.	

Record your workload parameters

Introduction

Record the parameters for your system under the parameter name in the Parameter column in the following table. Use these values for the parameter variables in all subsequent computations.

Note: Refer to "Call complexity" on page 290 for a description of the call complexity models used in this chapter.

Naming conventions for parameters

The following conventions are used for parameter names:

- Names starting with the letter "n" define a number, or a quantity of items; for example, nAgents defines the number of agents in the system.
- Names starting with letter "b" define a boolean; for example, bCollectCBC defines whether or not call-by-call (CBC) statistics are collected.
- Names starting with the letter "p" define a proportion which is usually expressed as a percentage (%). For example, pNetOut defines the proportion of outbound network calls.
- Names starting with the letter "a" define an average relation between one quantity and another. This value is not always equal to a simple quotient between the quantities.

  For example, aSkill_Agent defines an average number of skillsets served by an agent. This number is not equal to nSkillsets/nAgents but is based on the skillset/agent assignment pattern in a call center. If your call center has 100 agents and 100 skillsets, nSkillsets/nAgents is 1. If each agent serves an average of 10 skillsets, the value for aSkill_Agent is 10.
- Names that do not start with either "n," "p," or "a" are the names relating to call rate (CallRate) or to the quantities derived by computations. For example, CallByCall_RecsDay defines the number of records added to the CallbyCall table in a day. This number is derived by using a number of formulas from system parameters.

Workload parameters

In the following table, parameters are arranged by switch type. All parameters that apply to both switch types appear in the upper part of the table section. All parameters that apply only to the M1 or DMS/MSL-100 switch type appear at the end of each table section, where applicable.

Parameter	Description	Switch	Resource impact
Call rate			
PeakCallRate	The expected number of inbound calls originating locally during a busy hour (used for CPU utilization calculations).	Both	CPU, LAN, WAN
DailyCallRate	The expected daily average number of inbound calls per hour (used for disk space calculations). Default = 1/2 PeakCallRate.	Both	Disk Space
PeakOutCallRate	The expected number of outbound calls originating locally during a busy hour (used for CPU utilization calculations).	M1	CPU, LAN, WAN
DailyOutCallRate	The expected daily average number of outbound calls per hour (used for disk space calculations). Default = 1/2 PeakOutCallRate.	M1	Disk Space
PeakNetworkCallRate	The expected number of calls originating in the network during a busy hour (used for CPU utilization calculations). Default = PeakCallRate * nNetNodes.	M1	CPU, LAN, WAN
DailyNetworkCall Rate	The expected daily average number of calls per hour in the network (used for disk space calculations). Default = DailyCallRate * nNetNodes.	M1	Disk Space
General parameters			
nAgents	Number of agents logged on simultaneously.	Both	CPU, LAN, Disk Space

Parameter	Description	Switch	Resource impact
nTAgents	Total number of agents defined in the system.	Both	LAN, Disk Space
nSupervisors	Number of logged on supervisors. Defaults = 10% of the number of agents.	Both	CPU, LAN, Disk Space
nAdministrators	Number of logged on administrators.	Both	Disk Space
nScripts	Number of scripts defined in the system (previously called nTaskFlows). Typically, nScripts=nAgents/8.	Both	Disk Space
nApplications	Number of applications—the number of “exit” points from the Master_Script. The typical number of applications ranges from 5 in small systems to 200 in large ones. Number of applications is always less than or equal to the number of scripts: nApplications <= nScripts.	Both	CPU, LAN, Disk Space, WAN
nSkillsets	Number of skillsets defined. Maximum = 354 (including network skillsets and 4 system skillsets that are hidden from the user). Typically nSkillsets=nAgents/4.	Both	CPU, LAN, Disk Space,
nActCodes	Number of activity codes in a typical configuration. Typically, nActCodes = nSkillsets * 5. Maximum = 5000.	Both	Disk Space
bCollectCBC	Defines whether CBC statistics are collected.	Both	CPU, LAN, Disk Space,
bExternal_IVR	Defines whether or not an external IVR system is connected to the DMS/MSL-100 system.	DMS	CPU, LAN, Disk Space, WAN
Call resources			
nCDN	Number of CDNs in the system. Typically nCDN=nApplications*1.5 (see Chapter 9 for the DMS).	Both	CPU, LAN, Disk Space
nRMRoutes	Number of RAN or music routes included in nRoutes.	Both	CPU, LAN, Disk Space

Parameter	Description	Switch	Resource impact
nDNIS	Number of DNIS defined in the system.	Both	CPU, LAN, Disk Space
pDNISInterval	Proportion of DNISs used during a single data collection interval. Value depends on the system use. Defaults 75% for small systems and 60% for larger ones.	Both	Disk Space
nIVRQ	Number of IVR queues configured. Default = 10.	Both	CPU, LAN, Disk Space,
nRoutes	Number of routes configured. Default=128 for small systems (<200 agents) and 250 for larger ones (>500 agents).	M1	CPU, LAN, Disk Space
nTrunks	Number of trunks in the system. Usually the number of trunks is 1.5*nAgents (max=3000).	M1	CPU, LAN, Disk Space
nIVRPorts	Number of IVR ports. Typical value = 48 in small systems (M1) and 384 in the larger ones (DMS/MSL-100).	M1	CPU, LAN, Disk Space,
nIVRPortEvents	Number of IVR events per port per day (logon/logoff and so on). Typical value = 5 in smaller systems (less than 200 agents) and 20 in larger ones (greater than 500 agents).	M1	Disk Space
Relations (Typical range for relations is 1–15, workload dependent)			
aSkill_Agent	Average number of skillsets served by an agent.	Both	Disk Space
aSup_Agent	Average number of supervisors an agent reports to.	Both	Disk Space
aSkill_Supv	Average number of skillsets served by the supervisor’s agents.	Both	CPU, LAN
aAppl_Skill	Average number of local applications per local skillset.	Both	Disk Space

Parameter	Description	Switch	Resource impact
aAppl_Agent	Average number of local applications per agent. Can be derived as aAppl_Skill * aSkill_Agent as an upper bound.	Both	Disk Space
aAppl_NetSkill	Average number of remote applications per network skillset per node.	M1	Disk Space
aNodes_NetSkill	Average number of nodes per network skillset.	M1	Disk Space
aTrunk_Routes	Average number of trunks per trunk route.	M1	Disk Space
Interval relations			
aActCode_Agent_Intv	Average number of activity codes (not necessarily unique) entered per agent per interval.	Both	Disk Space
aAppl_Agent_Intv	Average number of unique activity codes entered per agent per local application per interval. Can be derived as aActCode_Agent_Intv / aAppl_Agent_Intv.	Both	Disk Space
Daily relations			
aActCode_Agent_Day	Average number of activity codes entered per agent per day (not necessarily unique).	Both	Disk Space
aAppl_Agent_Day	Average number of unique local applications per agent per day.	Both	Disk Space
aActCode_Agent_Appl_Day	Average number of unique activity codes entered per agent per local application per day.	Both	Disk Space
Weekly relations			
aActCode_Agent_Week	Average number of activity codes (not necessarily unique) entered per agent per week.	Both	Disk Space

Parameter	Description	Switch	Resource impact
aAppl_Agent_Week	Average number of unique local applications per agent per week.	Both	Disk Space
aActCode_Agent_ Appl_Week	Average number of unique activity codes entered per agent per local application per week.	Both	Disk Space
Monthly relations			
aActCode_Agent_ Month	Average number of activity codes (not necessarily unique) entered per agent per month.	Both	Disk Space
aAppl_Agent_Month	Average number of unique local applications per agent per month.	Both	Disk Space
aActCode_Agent_ Appl_Month	Average number of unique activity codes entered per agent per local application per month.	Both	Disk Space
Agent operations			
nShifts	Number of agent shifts per day. Default = 3.	Both	Disk Space, CPU
nShiftsHrs	Number of hours per agent shift. Default = 8.	Both	Disk Space, CPU
nIntPerShift	Number of agent interruptions per shift. The number of agent-related events depends on the number of interruptions (logon/logoff, walkaway, and so on). Default = 10.	Both	Disk Space, CPU
pAgDailyReassign	Proportion of agent-supervisor and agent-skillset assignments that are changed daily. Default = 2%.	Both	Disk Space
pAgWeeklyReassign	Proportion of agent-supervisor and agent-skillset assignments that are changed weekly. Default = 15%.	Both	Disk Space
pAgMonthlyReassign	Proportion of agent-supervisor and agent-skillset assignments that are changed monthly. Default = 25%.	Both	Disk Space

Parameter	Description	Switch	Resource impact
Networking (M1 only)			
Global networking parameters			
nNetNodes	Number of call processing nodes in the multinode Symposium Call Center Server network including the local node (max=30). **Note:** This does not include the NCC because the NCC does no call processing.	M1	CPU, LAN, Disk Space, WAN
pCBCNetwork	Proportion of network CBC data that is collected at all nodes in the network. Default = 100%.	M1	CPU, LAN, WAN
pNetOutNetw	Proportion of calls arriving at all nodes in the network that are queued to a network skillset. Default = 10%.	M1	CPU, LAN, WAN
pActualNetworkingNetw	Proportion of all calls queued to network skillsets within the network that are actually routed to another node in the network. Default = 80%.	M1	CPU, LAN, WAN
aQTNSPerNetwCall	Average number of network skillset queues entered per call. Default = 2. Maximum = 30/nNetwBestNodes.	M1	CPU, LAN, Disk Space, WAN
nNetSkillsets	Number of network skillsets (that is, skillsets existing on multiple sites in the network).	M1	Disk Space
NCC_Period_Min	Routing table update interval. Default = 5 minutes.	M1	WAN
nNetwBestNodes	Average number of nodes queued to for a QTNS command for all nodes in the network. (This is currently fixed at 3 and cannot be changed.)	M1	CPU, LAN, Disk Space, WAN

Parameter	Description	Switch	Resource impact
Nodal networking parameters			
pCBCNetworkNode	Proportion of network CBC data that is collected at the local node when it is a destination node. Default = pCBCNetwork.	M1	CPU, LAN, Disk Space, WAN
pNetOut	Proportion of calls arriving at the local node that are queued to a network skillset. Default = 10%.	M1	CPU, LAN, Disk Space, WAN
pNetOutOtherNode	Proportion of networked calls originating at this node that are routed to a particular other node in the network. The default is 100% * 1 / (nNetNodes –1). **Note:** Calculate this parameter for each node in the network to which this node routes calls.	M1	WAN
pActualNetworking	Proportion of all calls queued to network skillsets by this node that are actually routed to another node in the network. Default = 80%.	M1	CPU, LAN, WAN
pNetIn	Proportion of all incoming network calls that are presented to agents on the local node. Default = 100% * 1 / nNetNodes since all network calls are assumed to be distributed equally.	M1	CPU, LAN, Disk Space, WAN
pNetInOtherNode	Proportion of incoming networked calls originating at a particular node in the network. Default = 100% * 1 / (nNetNodes –1). **Note:** Calculate this parameter for each node in the network that routes calls to this node.	M1	WAN

Parameter	Description	Switch	Resource impact
aQTNSPerCall	Average number of network skillsets queues entered per network-out call. Default = 2. Maximum = 30 / nBestNodes.	M1	CPU, LAN, Disk Space, WAN
nBestNodes	Average number of nodes queued for a QTNS command executed at the local node. Default = 3. Max = min (20, nNetNnodes – 1).	M1	CPU, LAN, Disk Space, WAN
Database			
nDInterval	Number of days that the historical interval data are kept online.	Both	Disk Space
nDDay	Number of days that the historical daily data is kept online.	Both	Disk Space
nWWeek	Number of weeks that the historical weekly data is kept online.	Both	Disk Space
nMMonth	Number of months that the historical monthly data is kept online.	Both	Disk Space
nDCallbyCall	Number of days that the CBC event records is kept online (part of CBC database).	Both	Disk Space
pCBCNode	Proportion of local CBC data that is collected at the local node. Default=100%.	Both	Disk Space
nDAgentStat	Number of days that the agent event records are kept online.	Both	Disk Space
nDIVRStat	Number of days that IVR event records are kept online.	Both	Disk Space
nHrsBackup	Number of hours allowed for online backup.	Both	Disk Space
Data characteristics			
nRTFormulas	Number of real-time formulas defined.	Both	Disk Space
nRTColumns	Number of columns in real-time displays.	Both	Disk Space

Parameter	Description	Switch	Resource impact
nScriptVarsPerScripts	Number of script variables per script.	Both	Disk Space
aScriptTreeDepth	Average depth of script execution tree.	Both	Disk Space
pBatchAssignFactor	Proportion of elements (for example, agent skillsets or agent supervisors) assigned in agent to skillset or agent to supervisor assignments.	Both	Disk Space
nTelsetFields	Number of telset fields on the agent's phoneset display. Default = 11 fields x 4 types (44) for M1, 0 for DMS.	Both	Disk Space
Real-time displays			
AgScrUpdateIntvl	Weighted average of the update rate of all agent RTD screens. Minimum = 0.5 second. Typical value = 3 seconds.	Both	CPU, LAN
RTDScrUpdateIntvl	Weighted average of the update rate of other RTD screens (other than agent RTDs). Minimum = 2 seconds. Typical value = 3 seconds.	Both	CPU, LAN
nRTDAgRows	Number of rows per agent RTD screen (nAgents/nSupervisors).	Both	CPU, LAN
nRTDAppRows	Number of rows per application RTD screen. (This number is always nApplications.)	Both	CPU, LAN
nRTDCCRows	Number of rows per nodal RTD screen (1).	Both	CPU, LAN
nRTDSkillRows	Number of rows per skillset RTD screen, average number of skillsets per supervisor (aSkill_Supv).	Both	CPU, LAN
nRTDIVRRows	Number of rows per IVR RTD screen.	M1	CPU, LAN
nRTDRouteRows	Number of rows per route RTD screen.	M1	CPU, LAN

Parameter	Description	Switch	Resource impact
Real-time API			
RTIUpdateIntvl	Weighted average of the update (refresh) interval of all real-time API and Graphical Real-time Display applications. Minimum and typical values = 2 seconds.	Both	CPU, LAN
nRTIAgRows	Number of rows per RT API agent statistics (nAgents).	Both	CPU, LAN
nRTIAppRows	Number of rows per RT API application sStats (nApplications).	Both	CPU, LAN
nRTICCRows	Number of rows per RT API Nodal statistics (1).	Both	CPU, LAN
nRTISkillRows	Number of rows per RT API Skillset statistics (nSkillsets).	Both	CPU, LAN
aAgStatesCall	Average number of agent states per call.	Both	CPU, LAN
nRTIClients	Number of RTD API clients.	Both	CPU, LAN
nRTIIVRRows	Number of rows per RT API IVR statistics (nIVRQ).	M1	CPU, LAN
nRTIRouteRows	Number of rows per RT API Route statistics (nRoutes).	M1	CPU, LAN
Graphical Real-time Display			
GRTDUpdateIntvl	Weighted average of the update (refresh) interval of all GRTD applications (minimum and typical values are 2 seconds).	Both	CPU, LAN
nGRTDAgRows	Number of rows of agent statistics (nAgents).	Both	CPU, LAN
nGRTDAppRows	Number of rows of application statistics (nApplications).	Both	CPU, LAN
nGRTDCCRows	Number of rows of Nodal statistics (1).	Both	CPU, LAN
nGRTDSkillRows	Number of rows of skillset statistics (nSkillsets).	Both	CPU, LAN

Parameter	Description	Switch	Resource impact
aAgStatesCall	Average number of agent states per call.	Both	CPU, LAN
nGRTDClients	Number of GRTD clients.	Both	CPU, LAN
HDX (if present)			
aDX_SndReq_ParNum	Average number of Send Request command parameters.	Both	CPU, LAN
aDX_SndReq_ParSize	Average size of Send Request parameters.	Both	CPU, LAN
aDX_GetResp_ParNum	Average number of Get Response command parameters.	Both	CPU, LAN
aDX_GetResp_ParSize	Average size of Get Response parameters.	Both	CPU, LAN
aDX_SndInfo_ParNum	Average number of Send Info command parameters.	Both	CPU, LAN
aDX_SndInfo_ParSize	Average size of Send Info parameters.	Both	CPU, LAN
External IVR (if present)			
aExternal_IVR_Size	Average number of bytes in the external IVR caller entered data (CED) message sent to Symposium Call Center Server.	DMS	CPU, LAN
Event interface (M1 only, if present)			
aEIUpdateIntvl	Average update (refresh) interval of all Event Interface applications. Range = 1/2 second – 5 seconds. Default = 1/2 second.	M1	CPU, LAN
pEventsCall	Proportion of the number of events sent to client applications per call. Default = 80%. **Note:** The number of events sent to a client is application-specific.	M1	CPU, LAN
nSEIClients	Number of SEI API clients. Maximum = 3.	M1	CPU, LAN

Parameter	Description	Switch	Resource impact
Voice Services (M1 only)			
nGCB_Duration	Duration (in seconds) of a Give Controlled Broadcast in Start/Stop mode.	M1	Voice Ports
nGCBC_Duration	Duration (in seconds) of a Give Controlled Broadcast in Continuous mode.	M1	Voice Ports
nVSCDG_Duration	Duration (in seconds) of a Collect Digits voice session.	M1	Voice Ports
nGIVR_Duration	Duration of the Give IVR treatment.	M1	Voice Ports
nGCB_Simultaneous	Number of distinct Give Controlled Broadcast sessions played simultaneously in Start/Stop mode.	M1	Voice Ports
nGCBC_ Simultaneous	Number of distinct Give Controlled Broadcast played simultaneously in Continuous mode.	M1	Voice Ports
nGCB_WTimer	The length (in seconds) of the Broadcast Port Wait Timer.	M1	Voice Ports
Inbound call complexity model			
aQTSPerCall	Average number of skillset queues entered per inbound call.	Both	Disk Space, CPU
aQTAPerCall	Average number of agent queues entered per inbound call.	Both	Disk Space, CPU
aGRANPerCall	Average number of Give RAN treatments per inbound call (Never with GCB).	Both	CPU, LAN, Disk Space
aGMUSPerCall	Average number of Give Music treatments per inbound call.	Both	CPU, LAN, Disk Space
aIFTHPerCall	Average number of If Then Else treatments per inbound call.	Both	CPU

Parameter	Description	Switch	Resource impact
aINTRPerCall	Average number of Intrinsic References per inbound call (Expected Wait Time, Longest Idle Agent, Oldest Call, Position in Queue).	Both	CPU
aHDXSIPerCall	Average number of HDX Send Info treatments per inbound call (only if HDX is present). For example, `SEND INFO Provider_ID XXXX YYYY`	Both	CPU, LAN, Disk Space

aHDXRGPerCall	Average number of HDX Send Request/ Get Response treatments per inbound call (only if HDX is present). For example,
	`SEND REQUEST Provider_ID XXXX YYYY`
	`GET RESPONSE Provider_ID XXXX YYYY`
		Both	CPU, LAN, Disk Space

aMSPPerCall	Average number of screen pops per inbound call.	Both	CPU, LAN
aMMSGPerCall	Average number of MLS messages per inbound call (excluding screen pops).	Both	CPU, LAN
pTransferIn	Proportion of inbound calls that are transferred to another agent or DN.	Both	CPU, LAN
pConferenceIn	Proportion of inbound calls that are conferenced with another agent or supervisor.	Both	CPU, LAN

aGCBPerCall	Average number of controlled broadcasts in Start/Stop mode per inbound call. Never with Give RAN. For example,
	`Give Controlled Broadcast Announcement YYYY`
	`Play Prompt Voice Segment X`
		M1	CPU, LAN, Disk Space, Voice Ports

Parameter	Description	Switch	Resource impact

aGCBCPerCall	Average number of controlled broadcasts in Continuous mode per inbound call. For example,
	`Give Controlled Broadcast Announcement YYYY`
	`Play Prompt Voice Segment X continuous`
		M1	CPU, LAN, Disk Space, Voice Ports

aVSCDGPerCall	Average number of collect digit services per inbound call. 2 digits each time (including voice session and play prompt). For example,
	`Open Voice Session VVVV`
	`Play Prompt Voice Segment SSSS`
	`COLLECT 2  DIGITS INTO ZZZZ`
	`End Voice Session`
		M1	CPU, LAN, Disk Space, Voice Ports

aGIVRPerCall	Average number of Give IVR treatments per inbound call:
	`GIVE IVR NNNN`
	`With Treatment TTTT`
		M1	CPU, LAN, Disk Space, Voice Ports

pTransferOut	Proportion of inbound calls that are transferred to another agent or DN.	Both	CPU, LAN
pConferenceOut	Proportion of inbound calls that are conferenced with another agent or supervisor.	Both	CPU, LAN
Outbound call complexity model			
aAttPerOutCall	Average number of unsuccessful call attempts per successful outbound call. A successful outbound call is one that reaches a live person.	M1	CPU, LAN

Parameter	Description	Switch	Resource impact
pUCallsNCon	Proportion of unsuccessful calls not establishing a PSTN connection. **Note:** An unsuccessful call can result in either a PSTN connection that does not reach a live party (for example, one connecting to an answering machine) or in an unsuccessful PSTN connection (for example, one resulting in a busy tone). See “Outbound call models (M1 only)” on page 293 for more details.	M1	CPU, LAN
aMSPPerOutCall	Average number of screen pops per outbound call.	M1	CPU, LAN
aMMSGPerOutCall	Average number of MLS messages per outbound call (excluding screen pops).	M1	CPU, LAN
aMMSGPerConUCall	Average number of MLS messages per unsuccessful call that results in a successful PSTN connection.	M1	CPU, LAN
aMMSGPerNCon	Average number of MLS messages per unsuccessful call that results in an unsuccessful PSTN connection.	M1	CPU, LAN

Parameter	Description	Switch	Resource impact
Meridian Link Services, transfers and conferencing			
aMMSG_Size	Average MLS message size (in bytes, not including standard overhead of 88 bytes (78 for TCP/IP plus 10 for collisions due to the CSMA/CD Ethernet protocol) **Note:** Only a limited set of commands are supported for the DMS/MSL-100.	Both	LAN
pConf_MLS	Proportion of conferenced calls completed by an MLS application (for example, Symposium Agent).	M1	CPU, LAN
pTrnf_MLS	Proportion of transferred calls completed by an MLS application (for example, Symposium Agent).	M1	CPU, LAN
aMMSGPerTx	Average number of MLS messages per call transfer.	M1	CPU, LAN
aMMSGPerConf	Average number of MLS messages per call conference.	M1	CPU, LAN

Note: Inbound call complexity model parameters represent the number of executed statements, not the number of statements in the script.

Determine the expected call rate for network calls (M1 only)

Types of calls

When networking is available, five types of “calls” are recognized on Symposium Call Center Server. These five types are shown in the following table. The call costs are an intuitive description of costs associated with the calls. The formal costs are described in the relevant sections on CPU, memory, and disk impact.

Call/request type	Description	Call cost assumptions
Call: Local–Local	Calls originating locally, handled by local agents.	Described by the complexity of the Symposium Call Center Server local call model.
Call: Local–Network	Calls originating locally, handled by agents on other nodes. Calls are given all treatments that are part of the local call model before being sent to an agent on a remote node.	Equal to the complexity of the Symposium Call Center Server local call model *minus* the final connect to agent *plus* the cost of an agent request to the network node.
Call: Network – Local	Calls originating on other nodes, handled by local agents.	The cost of these calls is simply the cost of processing the agent request and handing the call to an agent. It is assumed that all call treatments are provided on the originating node of the call.
Request: Local – Network	An unsuccessful request for the network agent sent whenever a `Queue To Network Skillset` is executed. (All successful requests are included in Call: Local–Network.)	The cost of this request is significantly smaller than the cost of a call; it includes only sending a request and then canceling it.

Call/request type	Description	Call cost assumptions
Request: Network – Local	An unsuccessful request for the local agent received from a network node. (All successful requests are included in Call: Network – Local.)	The cost of this request is significantly smaller than the cost of a call, it includes only processing a request and the cancellation of a request.

Call rate computations

Each of the call types described above is associated with a different call rate. The following table shows the call rate computations for these call types. The rates for different call and request types are used throughout this document.

Call type	Parameter name	Call rate formula	Description
n/a	nwAccNetwPeakCall Rate	PeakNetworkCallRate * pNetOutNetw / 100 * pActualNetworkingNetw / 100	# calls handled at a different node then the originator (network calls)
n/a	nwReqNetwPeakCall Rate	aQTNSPerNetwCall * nNetwRequestsSent * PeakNetworkCallRate * pNetOutNetw / 100	# networking requests
n/a	nwRejNetwPeakCall Rate	nwReqNetwPeakCallRate – nwAccNetwPeakCallRate	# requests that are rejected/cancelled
Call: Local—Network	nwOAccPeakCallRate	PeakCallRate * pNetOut / 100 * pActualNetworking / 100	# local calls handled remotely (network out calls)
Call: Local—Local	LocalPeakCallRate	PeakCallRate – nwOAccPeakCallRate	# local calls handled locally
Call: Network—Local	nwIAccPeakCallRate	nwAccNetwPeakCallRate * pNetIn/100	# remote calls handled locally (network in calls)

Call type	Parameter name	Call rate formula	Description
n/a	nwOReqPeakCallRate	aQTNSPerCall * nRequestsSent * PeakCallRate * pNetOut / 100	# Outgoing networking requests
n/a	nwIReqPeakCallRate	nwReqNetwPeakCallRate * pNetIn / 100	# Incoming networking requests
Request: Local—Network	nwORejPeakCallRate	nwOReqPeakCallRate – nwOAccPeakCallRate	# outgoing requests that are rejected/ cancelled
Request: Network—Local	nwIRejPeakCallRate	nwIReqPeakCallRate – nwIAccPeakCallRate	# incoming requests that are rejected/ cancelled
n/a	AgentPeakCallRate	LocalPeakCallRate + nwIAccPeakCallRate	# calls handled by agents on the local node
n/a	nwAccNetwDailyCall Rate	DailyNetworkCallRate * pNetOutNetw / 100 * pActualNetworkingNetw / 100	# calls handled at a different node then the originator (network calls)
n/a	nwReqNetwDailyCall Rate	aQTNSPerNetwCall * nNetwRequestsSent * DailyNetworkCallRate * pNetOutNetw / 100	# networking requests
n/a	nwRejNetwDailyCall Rate	nwReqNetwDailyCallRate – nwAccNetwDailyCallRate	# requests that are rejected/cancelled
Call: Local—Network	nwOAccDailyCallRate	DailyCallRate * pNetOut / 100 * pActualNetworking / 100	# local calls handled remotely (network out calls)
Call: Local—Local	LocalDailyCallRate	DailyCallRate – nwOAccDailyCallRate	# local calls handled locally
Call: Network—Local	nwIAccDailyCallRate	nwAccNetwDailyCallRate * pNetIn / 100	# remote calls handled locally (network in calls)

Call type	Parameter name	Call rate formula	Description
n/a	nwOReqDailyCallRate	aQTNSPerCall * nRequestsSent * DailyCallRate * pNetOut / 100	# Outgoing networking requests
n/a	nwIReqDailyCallRate	nwReqNetwDailyCallRate * pNetIn/100	# Incoming networking requests
Request: Local—Network	nwORejDailyCallRate	nwOReqDailyCallRate **–** nwOAccDailyCallRate	# outgoing requests that are rejected/ cancelled
Request: Network—Local	nwIRejDailyCallRate	nwIReqDailyCallRate **–** nwIAccDailyCallRate	# incoming requests that are rejected/ cancelled
n/a	AgentDailyCallRate	LocalDailyCallRate + nwIAccDailyCallRate	# calls handled by agents on the local node

Some of these quantities are based on the number of requests that are sent whenever a call is queued to a network skillset. The number of requests is defined as

```
nRequestsSent = Min (nBestNodes, nNetNodes – 1)
```

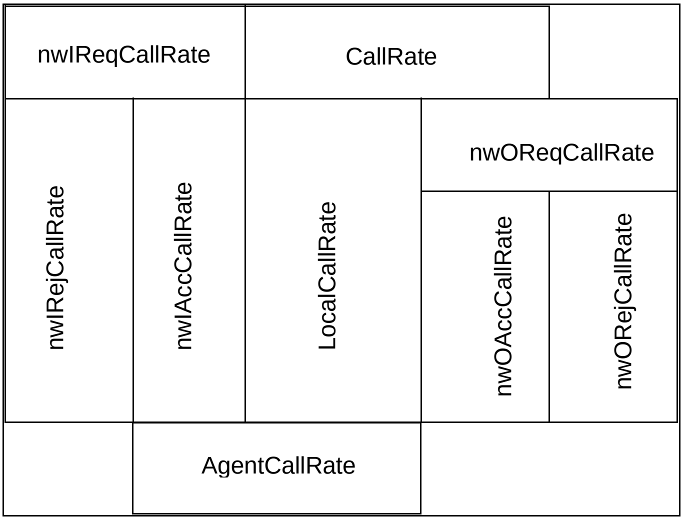
```
nNetwRequestsSent = Min (nNetwBestNodes, nNetNodes – 1)
```

Note: nBestNodes and nNetwBestNodes are fixed at 3.

The value of the rank table size is fixed at 3 (a design decision) and cannot be controlled by the user.

Relationship between call and request rates

The following illustration shows the relationship between different call and request rates defined above. These relationships apply to both peak and daily call rates:



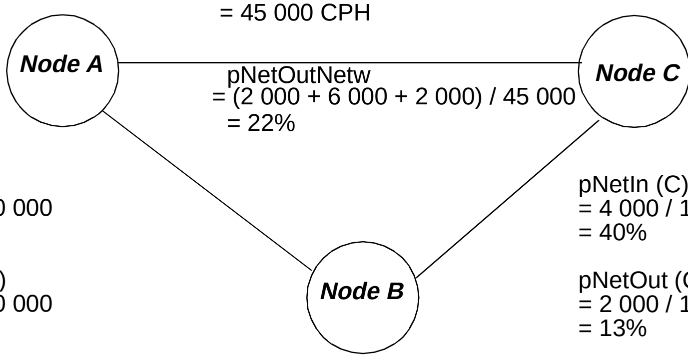
Networking parameters

The following illustration shows the relationship of the networking parameters in a network consisting of three nodes (A, B, C):

Node A:
Calls arriving at the node: 10 000
Calls networked in: 4 000
Calls networked out: 2 000

Node C:
Calls arriving at the node: 15 000
Calls networked in: 4 000
Calls networked out: 2 000

Network Call Rate
= 10 000 + 20 000 + 15 000
= 45 000 CPH



pNetOutNetw
= (2 000 + 6 000 + 2 000) / 45 000
= 22%

pNetIn (A)
= 4 000 / 10 000
= 40%

pNetOut (A)
= 2 000 / 10 000
= 20%

pNetInOtherNode (A from B)
= 50% (6 000) / 4 000
= 75%

pNetInOtherNode (A from C)
= 50% (2 000) / 4 000
= 25%

pNetOutOtherNode (default)
= 100% / (3 - 1)
= 50%

Node B:
Call arriving at the node: 20 000
Calls networked in: 2 000
Calls networked out: 6 000

pNetIn (B)
= 2 000 / 10 000
= 20%

pNetOut (B)
= 6 000 / 20 000
= 30%

pNetInOtherNode (B from A)
= 50% (2 000) / 2 000
= 50%

pNetInOtherNode (B from C)
= 50% (2 000) / 2 000
= 50%

pNetOutOtherNode (default)
= 100% / (3 - 1)
= 50%

pNetIn (C)
= 4 000 / 10 000
= 40%

pNetOut (C)
= 2 000 / 15 000
= 13%

pNetInOtherNode (C from A)
= 50% (2 000) / 4 000
= 25%

pNetInOtherNode (C from B)
= 50% (6 000) / 4 000
= 75%

pNetOutOtherNode (default)
= 100% / (3 - 1)
= 50%

Note: This example assumes that calls networked out from a particular node are evenly distributed to the other two nodes.

Calculate server disk utilization

Introduction

The total disk space requirements depend on

- the size of Symposium Call Center Server and MAS executable files
- Master and User database size
- the size of database tables, and the size of the largest table
- the disk space utilization factor

The database space (the largest portion of the disk space required) includes the space needed to store configuration tables, event tables, and interval tables. The formulas for computing the sizes of the individual Symposium Call Center Server tables, as well as the definition of the SizeOf() notation, are presented in Appendix B, "Database table sizes," on page 311.

The following sections provide formulas for calculating disk space requirements.

Configuration tables disk space

Configuration tables are "static" tables that contain the information related to the configuration. The information and the size of these tables do not change on a per call basis. The size of these tables depends on a number of global system parameters that are expected to be relatively constant after the initial system setup by the customer (for example, the total number of agents, and activity codes). Configurations table size computations use a number of additional parameters shown in the table in "Record your workload parameters" on page 122. The size of the configuration tables is computed as

```
ConfigTablesSizeKb = SizeOf(ConfigurationTables)
```

Event tables disk space

There are four event tables:

- CallByCall Statistics—The largest table of the four. If CBC recording is turned on, it is updated (that is, a record is added) several times per call depending on the complexity of the call.
- Agent Login Statistics—Updated every time an agent logs on or logs off.
- IVR Port statistics—Updated every time the status of the IVR port changes.
- Skillset State Statistics

Note: CBC statistics are stored in the CBC database. All other tables are stored in the Blue database.

```
CallByCallSizeKb = SizeOf(NIeCallByCallStatYYYYMMDD)
```

The size of the Agent Login Statistics table per day depends in the number of agent events per shift. The size is computed as

```
AgentLoginStatSizeKb = SizeOf(NIeAgentLoginStat)
```

The daily size of the IVR Port Statistics table depends on the number of IVR port events per day (login/logout) and is computed as

```
IVRPortStatSizeKb = SizeOf(NIeIVRPortLoginStat)
```

Interval, Daily, Weekly, and Monthly tables disk space

There are four types of historical statistics tables: interval, daily, weekly and monthly tables. These tables have similar structure but are updated based on different intervals and are kept online for different durations.

Interval tables

The interval-based records are generated every interval (such as every 15 minutes). The following formulas are used to estimate the total size of all interval records generated per day.

```
nIntervalsPerDay = nShifts * nShiftsHour * 4

IntervalStatDailySizeKb =
  nIntervalsPerDay * SizeOf(IntervalStatTables)
```

In addition to the interval statistics tables, there are also temporary interval tables that are used to hold the interval statistics data while the data is being collected. The size of these temporary tables is as

```
IntervalTempSizeKb = SizeOf(TempIntervalTables)
```

Daily tables

Daily records are generated every day. The following formulas are used to estimate the total size of all daily records generated per day.

```
DailyStatDailySizeKb = SizeOf(DailyStatTables)
```

Weekly tables

Weekly records are generated every week. The following formulas are used to estimate the total size of all weekly records generated per week.

```
WeeklyStatWeeklySizeKb = SizeOf(WeeklyStatTables)
```

Monthly tables

Monthly records are generated every month. The following formulas are used to estimate the total size of all monthly records generated per month.

```
MonthlyStatMonthlySizeKb = SizeOf(MonthlyStatTables)
```

Detailed computations

Symposium Call Center Server and MAS executable sizes as well as Master and User database sizes are estimated based on the designer input:

WINNT_Kb = 150,000

WINNT_Swap_files_Kb = 274,000

SCCS_files_Kb = 700,000

MAS_files_Kb = 103,000

Sybase_DB_Kb = 74,000

MAS_DB_Kb = 230,000

C_Drive_Space = 100,000 (for all platforms except 1003t)

C_Drive_Space = 2,048,000 (for 1003t only)

As per Sybase recommendations, there must be additional space equivalent to the size of 120 percent of the largest table for the database system to function properly. The largest tables (excluding the CallByCall statistics) are the historical statistics tables (interval, daily, weekly and monthly) and the event statistics tables. The largest table size is computed as

```
LargestTableSizeKb = MAX(
    SizeOf(NIi***Stat) * nIntervalsPerDay * nDInterval
    SizeOf(NId***Stat) * nDDay
    SizeOf(NIw***Stat) * nWWeek
    SizeOf(NIm***Stat) * nMMonth
    AgentLoginStatSizeKb
    IVRPortStatSizeKb
  )
```

where *** represents the different historical statistics table names.

The largest table overhead is 120 percent. All other overheads, as recommended by Sybase, are log files and temporary disk space overheads. Log files and temporary disk space for the Blue Database are 20 percent and 30 percent respectively. For the CBC database, these values are both 5 percent. In addition, the disk space utilization factor is set to 90 percent:

```
DB_Log_Overhead = 0.2 (20%)

DB_Temp_Overhead = 0.3 (30%)

CBC_Log_Overhead = 0.05 (5%)

CBC_Temp_Overhead = 0.05 (5%)

LargestTab_Overhead = 1.2 (120%)

Max_Disk_Utilization = 0.9 (90%)
```

The total disk space required is computed as

```
Overhead_SpaceKb =
  SUMOF(
    WINNT_Kb
    WINNT_Swap_files_Kb
    SCCS_files_Kb
    MAS_files_Kb
    MAS_DB_Kb
    Sybase_DB_Kb
    C_Drive_Space
  )
```

For a system with a 2-Gbyte hard drive

```
CBC_DB_SpaceKb = 6 Mbytes
```

For other systems

```
CBC_DB_SpaceKb =
  CallByCallSizeKb * (nDCallByCall + 1.5) *
  (1 + CBC_Log_Overhead + CBC_Temp_Overhead)
```

```
Blue_DB_SpaceKb =
  SUMOF(
    LargestTableSizeKb * LargestTab_Overhead
    ConfigTableSizeKb
    AgentLoginStatSizeKb * nDAgentStat
    IVRPortStatSizeKb * nDIVRStat
    IntervalStatDailySizeKb * (nDInterval + 2)
    IntervalTempSizeKb
    DailyStatDailySizeKb * (nDDay + 2)
    WeeklyStatWeeklySizeKb * (nWWeek + 2)
    MonthlyStatMonthlySizeKb * (nMMonth + 2)
  ) * (1 + DB_Log_Overhead + DB_Temp_Overhead)

TotalDiskSpaceRequiredMb =
  ((CBC_DB_SpaceKb + Blue_DB_SpaceKb) /
  Max_Disk_Utilization + Overhead_SpaceKb) / 1000
```

Backup size computations

In this section, the amount of data that is to be backed up for an online backup is estimated. This is required for estimating the impact of backups on the CPU utilization and for estimating the backup storage requirements.

```
CBCBackupSizeKb =
  CallByCallSizeKb * (nDCallByCall + 0.5)

BlueBackupSizeKb =
  SUMOF(
    ConfigTableSizeKb
    AgentLoginStatSizeKb * (nDAgentStat + 0.5)
    IVRPortStatSizeKb * (nDIVRStat + 0.5)
    IntervalStatDailySizeKb * (nDInterval + 0.5)
    IntervalTempSizeKb
    DailyStatDailySizeKb * nDDay
    WeeklyStatWeeklySizeKb * nWWeek
    MonthlyStatMonthlySizeKb * nMMonth
  )

TotalBackupSizeKb =
  SUMOF(
    CBCBackupSizeKb
    BlueBackupSizeKb
  )
```

Calculate server CPU utilization

Introduction

The total CPU utilization comprises the following primary components:

- base call processing
- inbound call services
- outbound call services (M1 only)
- database access
- real-time displays
- real-time API
- event interface
- interval reporting
- networking impact

Each of these components is described in the following sections.

Detailed CPU requirement computations

The total CPU requirement is derived by summing all the contributions to CPU utilization. That is, the total CPU utilization is calculated as

$$U_{Total} = \Sigma U_i$$

where

- U_i is a utilization component
- i is an index for each component

so that ΣU_i represents the sum of the CPU utilizations over all of the components listed in the following table.

The following table lists the utilization components:

Description	Utilization component (U_i)
Basic Call Processing	U_{BaseCP}
Queue To Skillset	U_{QTS}
Queue To Network Skillset	U_{QTNS}
Queue To Agent	U_{QTA}
Transfer inbound call	U_{TRN_IN}
Conference inbound call	U_{CNF_IN}
Transfer outbound call	U_{TRN_OUT}
Conference outbound call	U_{CNF_OUT}
Give Controlled Broadcast	U_{GCB}
Give Controlled Broadcast Continuous	U_{GCBC}
Collect Digits	U_{VSCDG}
Give IVR	U_{GIVR}
IVR	U_{IVR}
MLS Screen Pops for inbound calls	$U_{MLINK\_SP\_IN}$
MLS Screen Pops for outbound calls	$U_{MLINK\_SP\_OUT}$
MLS Applications for inbound calls	U_{MLINK_IN}
MLS Applications for outbound calls	U_{MLINK_OUT}
MLS Conference for inbound calls	$U_{MLINK\_CONF\_IN}$
MLS Transfer for inbound calls	$U_{MLINK\_TX\_IN}$
MLS Conference for outbound calls	$U_{MLINK\_CONF\_OUT}$
MLS Transfer for outbound calls	$U_{MLINK\_TX\_OUT}$

Description	Utilization component (U_i)
Host Data Exchange Send Info	U_{HDXSI}
Host Data Exchange Request/Get Data	U_{HDXRG}
If-Then-Else	U_{IFTH}
Intrinsics	U_{INTR}
Give RAN	U_{GRAN}
Give Music	U_{GMUS}
Blue Sybase	U_{BS}
CBC Sybase	U_{CBC}
Remote CBC Sybase	U_{RCBC}
Real-time Background	U_{BRT}
Real-time displays	U_{RTD}
Real-time API	U_{RTI}
Graphical Real-time Data	U_{GRTD}
Event Interface Background	U_{BEI}
Event Interface	U_{SEI}
Reporting	U_{REP}
Data Extraction	U_{DATA}
Networking Related	U_{NET}

Note: Utilization component is based on the PP200 CPU.

CPU measurements

The following table shows the CPU utilization for each component, based on the PP200 CPU. To change to a different processor, multiply the value by the PP200 relative factor as provided in “Server CPU” on page 12. For example, to map to a Pentium 166, multiply the values by 1.74.

Parameter	Value	Notes
U_{BG}	2.3 %	Overall background cpu (%) on PP200
BCC_Cost	0.037 CpuSec	Basic call (on local node for local call)
BCC_Netw_Cost	0.037 CpuSec	Basic call (on local node for outcall)
QTS_Cost	0.0059 CpuSec	Queue to Skillset
QTNS_Cost	0.0065 CpuSec	Queue to network skillset
QTA_Cost	0.0012 CpuSec	Queue to Agent
TRN_Cost	0.030 CpuSec	Transfer Call
CONF_Cost	0.030 CpuSec	Conference Call
GCB_Cost	0.070 CpuSec	Give controlled broadcast (Start/Stop)
GCBC_Cost	0.070 CpuSec	Give controlled Broadcast (Continuous)
VSCDG_Cost	0.121 CpuSec	Voice Session with Play Prompt and Collect Digits
GIVR_Cost	0.031 CpuSec	Give IVR
IVR_Cost	0.044 CpuSec	Process External IVR messages
IFTHEN_Cost	0.0014 CpuSec	If-Then-Else, the cost is small, close to that of INTR_Cost
INTR_Cost	0.0014 CpuSec	Intrinsic reference
GRAN_Cost	0.00065 CpuSec	Give RAN
GMUS_Cost	0.0024 CpuSec	Give Music

Parameter	**Value**	**Notes**
HDXSI_Cost	0.0012 CpuSec	Data Exchange—Send Information
HDXRG_Cost	0.0023 CpuSec	Data Exchange—Send Request / Get Response
MLINK_Msg_Cost	0.079 CpuSec	MLS Message
MSP_Cost	0.0052 CpuSec	MLS Screen Pop Cost
BCP_Insert_Cost	0.00048 CpuSec	Cost of a single bulk copy procedure (BCP) insert (Sybase)
Remote_BCP_Insert_Cost	0.00018 CpuSec	Cost of a single Remote BCP insert (Sybase)
Cons_Insert_Cost	0.0062 CpuSec	Cost of a single consolidation (Sybase)
RTDCell_Cost	0.00008 CpuSec	Cell update cost on RTD
RTICell_Cost	0.00008 CpuSec	Cell update cost on RTI per client
U_{BRT}	6.1%	Base RTD/RTI cpu (%) on PP200
BaseRow_Cost	0.099 ms	Base cost for a row selected
ColRow_Cost	0.012 ms	Cost per column per row selected
MultiRow_Cost	2.05 ms	Cost per row selected with >1 view
SEIEvent_Cost	0.0076 CpuSec	Event Monitoring cost on SEI
SEIMessage_Cost	0.0015 CpuSec	Notification Message cost on SEI
U_{BEI}	1.8 %	Base Event Interface cpu (%) on PP200
DBBackupDAT_cost	1104 CpuSec	Cost to perform an online database backup per Gbytes of data with a DAT drive
DBBackupMLR_cost	552 CpuSec	Cost to perform an online database backup per Gbytes of data with a MLR drive
IREJ_Cost	0.031 CpuSec	Network call rejected/cancelled locally. The cost of request and cancellation only.

Parameter	Value	Notes
IACC_Cost	0.076 CpuSec	Network call accepted locally. The cost of the messaging as well as the basic call processing on the local node.
OREJ_Cost	0.0078 CpuSec	Local request cancelled/rejected elsewhere. Cost of request and rejection only.
OACC_Cost	0.024 CpuSec	Local call accepted elsewhere. The cost of Basic Call (similar to BCC), as well as the cost of the accepted request.

The following sections contain the details of each utilization calculation. The total CPU utilization is summarized at the end. Examples are given in some of the subsections for clarification.

Background call processing

The background CPU is the amount of CPU resource that is used when no other utilization components are running. It is a measured quantity and has been measured to be U_{BG} = 2.3% on a 701t platform (PP200).

Base call processing

The base call processing CPU requirement is the amount of CPU resource required for the Symposium Call Center Server to answer untreated calls at the specified call rate. The base CPU resource requirements do not include

- disk access
- queueing to skillsets
- real-time display
- historical reporting

As such, these values bound from below Symposium Call Center Server performance (that is, server performance can never exceed these values).

The equation used for CPU contribution on the PP200 is

```
UBaseCP =
  U_BG + (BCC_Cost*LocalPeakCallRate + BCC_Netw_Cost *
  nwOAccPeakCallRate) / 3600
```

Inbound call services

Call treatment services are treatments given to calls dictated by the script. These include voice services, “Queue to Skillset,” as well as the Basic Call Cost described in the previous section.

Measurements are taken to quantify the CPU resources required for call treatment services. For example, the measurements are based on the CPU cost of executing a single treatment script operation whenever there are no agents available to service the call immediately.

The CPU requirement for these services all have the same calculation:

$$U_i = S_i * N_i * PeakCallRate / 3600$$

where S_i is the CPU cost which was measured in CPU seconds and N_i is the average number of treatments per call. The following table provides S_i and N_i values used in the formula.

i (service)	S_i (Cost)	N_i (Frequency)
QTS	QTS_Cost	aQTSPerCall
QTNS	QTNS_Cost	aQTNSPerCall * pNetOut
QTA	QTA_Cost	aQTAPerCall
GCB	GCB_Cost	aGCBPerCall
GCBC	GCBC_Cost	aGCBCPerCall
VSCDG	VSCDG_Cost	aVSCDGPerCall
GIVR	GIVR_Cost	aGIVRPerCall
IVR	IVR_Cost	1 (if external IVR); 0 (otherwise)

i (service)	S_i (Cost)	N_i (Frequency)
IFTH	IFTHEN_Cost	aIFTHPerCall
INTR	INTR_Cost	aINTRPerCall
GRAN	GRAN_Cost	aGRANPerCall
GMUS	GMUS_Cost	aGMUSPerCall
HDXSI	HDXSI_Cost	aHDXSIPerCall
HDXRG	HDXRG_Cost	aHDXRGPerCall
TRN_IN	TRN_Cost	pTransferIn/100 * (1 – pTrnf_MLS/100)
CNF_IN	CNF_Cost	pConferenceIn/100 * (1 – pConf_MLS/100)
MLINK_SP_IN	MSP_Cost	aMSPPerCall
MLINK_IN	MLINK_Msg_Cost	aMMSGPerCall
MLINK_CONF_IN	MLINK_Msg_Cost	aMMSGPerConf * pConferenceIn/100 * pConf_MLS/100
MLINK_TX_IN	MLINK_Msg_Cost	aMMSGPerTx * pTransferIn/100 * pTrnf_MLS/100

Example

What is the CPU cost of MLS screen pops for a call rate of 6000 calls per hour?

Solution

The general formula is $U_i = S_i * N_i * R/3600$
From the preceding table, S_i is 0.0055. From “Call complexity” on page 290, N_i is 1.2 for the M1.
Thus, U_{MSP} = 1.1%

Outbound call services (M1 only)

The CPU contribution due to outbound MLS applications is made up of three components:

- MLS messages due to successful outbound calls
- MLS messages due to attempts resulting in unsuccessful PSTN connections
- MLS messages due to attempts resulting in calls not connected

Recall that an outbound call is defined as a call that reaches a live party. An unsuccessful call could be either a PSTN connection not reaching a live person or a call that is not connected. Each of these events corresponds to a term in the bracketed sum in the MLINK_OUT row in the following table.

As in the inbound case, the CPU requirement for these contributions all have the same calculation:

$$\mathbf{U_o} = S_o * N_o * \mathtt{PeakOutCallRate} / 3600$$

where S_o is the CPU cost which was measured in CPU seconds and N_o is the average number of treatments per call. The following table provides S_o and N_o values used in the formula.

o (Service)	S_o (Cost)	N_o (Frequency)
TRN_OUT	TRN_Cost	pTransferOut / 100 * (1 – pTrnf_MLS / 100)
CNF_OUT	CNF_Cost	pConferenceOut / 100 * (1 – pConf_MLS / 100)
MLINK_OUT	MLINK_Msg_Cost	aMMSGPerOutCall + aAttPerOutCall * (1 – pUCallsNCon / 100) * aMMSGPerConUCall + aAttPerOutCall * pUCallsNCon/100 * aMMSGPerNCon
MLINK_SP_OUT	MSP_Cost	aMSPPerOutCall
MLINK_CONF_OUT	MLINK_Msg_Cost	aMMSGPerConf * pConferenceOut / 100 * pConf_MLS / 100

o (Service)	S_o (Cost)	N_o (Frequency)
MLINK_TX_OUT	MLINK_Msg_Cost	aMMSGPerTx * pTransferOut / 100 * pTrnf_MLS/100

Database operations

Database operational requirements describe the database access (insert) capabilities for the Symposium Call Center Server. The requirements are based on the amount and the type of data to be written in the database per unit of time. The following sections describe the computations to determine the disk access requirements. The computations are based on measurements performed on a non-RAID configuration with all disk drives having similar characteristics.

Disk insert rate is based on the number of table rows to be written into the database per unit of time. The rows of the event and interval tables are written using the Bulk Copy Procedure (BCP) method. The interval tables are then consolidated by the database. Experimental measurements performed on a MAS server (Pentium 100) determined the values for BCP_Insert_Cost and Cons_Insert_Cost in units of CPU-Seconds incurred per insert for BCP and Consolidations scaled to the PP200. These values are given in the table in “Detailed CPU requirement computations” on page 152.

Note: Bulk Copy Procedure (BCP) is a Sybase utility.

The following formulas are used to compute the rate of inserts (rows per second) required based on the system parameters.The formulas for the number of rows for the individual tables and the definition of the NumberOfRecords() notation are presented in Appendix B, “Database table sizes,” on page 311.

Number of records per day for event tables

To compute the number of records (rows) per day for the event tables, use this formula:

```
CallByCall_RecsDay =
  NumberOfRecords(NIeCallByCallStatYYYYMMDD)

AgentLoginStat_RecsDay =
  NumberOfRecords(NIeAgentLoginStat)

IVRPortStat_RecsDay =
  NumberOfRecords(NIeIVRPortLoginStat)
```

Number of records per day for interval tables

To compute the number of records (rows) per day for interval historical statistics tables, use this formula:

```
nIntervalsPerDay = nShifts * nShiftsHour * 4

IntervalStat_RecsDay =
  nIntervalsPerDay * NumberOfRecords(IntervalStatTables)
```

Note: Daily, Weekly, and Monthly tables are generated during the Nightly database maintenance operations.

Number of records per second

To compute the total number of records (rows) to be written into the database every second for the Blue and CBC databases, use this formula:

```
Blue_BCP_DiskInsertRate_InsertsSec =
  (IntervalStat_RecsDay + AgentLoginStat_RecsDay +
  IVRPortStat_RecsDay) / (3600 * nShifts * nShiftsHrs)

CBC_BCP_DiskInsertRate_InsertsSec =
  CallByCall_RecsDay * (PeakCallRate / DailyCallRate) /
  (3600 * 24)
```

The resulting CBC_BCP_DiskInsertRate_InsertsSec represents the number of inserts per second required to support the given call rate and workload. These records are written into the database using Sybase's BCP operation.

Number of consolidations per second

After the records are written into the database, some of the records must be consolidated, including all interval tables. This consolidation operation requires additional CPU resources. The following is the computation of the parameter Blue_Cons_DiskInsertRate_InsertsSec . This parameter refers to the number of consolidation per second required for each database, as in the following:

```
Blue_Cons_DiskInsertRate_InsertsSec =
  IntervalStat_RecsDay / (3600 * nShifts * nShiftsHrs)
```

Data manipulation

The CPU requirements of the Sybase SQL Server to support the insert rate as computed above, depend mainly on the number of disk inserts per second, and can be estimated as

U_{BS} **= Blue_SybaseTotalCPU%** =

```
  SUMOF (
     Blue_BCP_DiskInsertRate_InsertsSec * BCP_Insert_Cost
     Blue_Cons_DiskInsertRate_InsertsSec *
     Cons_Insert_Cost
  ) * 100%
```

U_{CBC} = `CBC_BCP_DiskInsertRate_InsertsSec * BCP_Insert_Cost * 100%`

U_{RCBC} = `CBC_RBCP_DiskInsertRate_InsertsSec * Remote_BCP_Insert_Cost * 100%`

where

- **CBC_RBCP_DiskInsertRate_InsertsSec** = NCBC_Records_PerNodePerHour / 3600
- and NCBC_Records_PerNodePerHour is defined in “Network CBC Traffic per Node on the CLAN (M1 only)” on page 213.

Data extraction

Symposium Call Center Server is supplied with a number of views for periodic and on-demand extraction of data from the database. These views are described in “Symposium Call Center Server database views” on page 364. The CPU requirements for data extraction depend on the complexity of the query, the number of rows selected and the number of columns selected from the views. A single data extraction can select data from multiple views at one time that are joined based on the rules defined in the entity relationship diagram (ERD). For more information, refer to the *Nortel Networks Symposium Call Center Server Historical Reporting and Data Dictionary.*

Single-view data extraction

For single-view data extractions, the impact is approximately linear with respect to the number of columns.

The following formulas describe the estimation of the impact of single-view data extraction in terms of the number of milliseconds of PP200 CPU required to extract the data. Before applying these formulas, you must know the number of rows to be extracted (DataRows):

DataRowCPU_msec = ViewColumns * ColRow_Cost + BaseRow_Cost

Multiple-view data extraction

For multiple-view data extractions the impact is dependent on the actual complexity of the data selection operation and on the state of the database at the time the report is generated. The DataRowCPU_msec is taken as MultiRow_Cost.

DataCPU_msec = DataRowCPU_msec * DataRows

To determine the impact of the data extraction, compute the DataCPU_msec for each data extraction run during the busy hour and multiply it by the number of times that the data extraction is expected to be executed:

TotalDailyDataCPU_msec =
SUMOF_ALL(
DataCPU_msec * ExtractionsPerBusyHour...for all data extractions
)

$\mathbf{U}_{DATA}$ = TotalExtractDataCPU_msec / (1000 * 3600)

The DataTotalCPU% value would be the percentage of CPU required for data extraction during the busy hour.

Real-time background

CPU requirements for real-time data can be broken into two functional groups: those for the real-time displays (RTD) and those for the Real-time API (RTI). The real-time displays refer to the RTDs on the client PCs. The API refers to the real-time data being sent to customer applications. If either one or both is operating, a background CPU cost is incurred. This cost has been derived from measurements and is given as U_{BRT} in “CPU measurements” on page 155. The governing equation is

$$\mathbf{U_{BRT}} = U_{BRT} \text{ if either RTD, RTI or GRTD is operating}$$
$$= 0 \text{ otherwise}$$

Real-time displays

The real-time display (RTD) load on the CPU depends on the number of clients, the number of screens displayed on the clients, the size of the screens, and the refresh rate. The equations used for CPU contribution due to the RTDs are

$$\mathbf{U_{RTD}} = U_{Client} * N_{Clients}$$

$$\mathbf{U_{Client}} = \Sigma U_{Screen}$$

$$\mathbf{U_{Screen}} = N_{Columns} * N_{Rows} * \text{RTDCell\_Cost} / I_{Screen}$$

where

- screen refers to one of the displays, such as Agents, Applications, or Skillsets.
- I_{Screen} is the requested refresh interval for a single screen (AgScrUpdateIntvl, RTDScrUpdateIntvl)
- N_{Rows} is the number of rows displayed on a single screen
- $N_{Columns}$ is the number of columns displayed on a single screen

  Note: The number of columns that come with the standard templates supplied with the product are given in “Real-time display traffic on the CLAN” on page 196.

- *RTDCell_Cost* is the CPU time in seconds required per displayed cell (CpuSec_Cell_Refresh). This value is given in “CPU measurements” on page 155.
- U_{Screen} is the CPU utilization per client per display type
- U_{Client} is the CPU utilization per client
- $N_{Clients}$ is the number of clients (same as number of supervisors)
- U_{RTD} is the total CPU utilization due to the RTDs

Real-time API

The equation used for CPU contribution due to the Real-time APIs (RTI) on the Pentium Pro 200 is

$$\mathbf{U_{RTI}} = \texttt{nRTIClients* RTICell\_Cost * } \Sigma(N_i / I_i)$$

where

- N_i is the number of cells sent for statistic i which is calculated as the number of rows multiplied by the number of columns sent for the statistic.
- RTICell_Cost is the CPU time in seconds required per cell sent (CpuSec_Cell_Refresh). This value appears in “CPU measurements” on page 155.
- I_i is the Refresh Interval for statistic i (RTIUpdateIntvl)

Graphical real-time data

The equation used for CPU contribution due to the graphical real-time data (GRTD) application on the Pentium Pro (PP) 200 is

$$\mathbf{U_{GRTD}} = \texttt{nGRTDClients* RTICell\_Cost * } \Sigma(N_i / I_i)$$

where

- N_i is the number of cells sent for statistic i which is calculated as the number of rows multiplied by the number of columns sent for the statistic.
- *RTICell_Cost* is the CPU time in seconds required per cell sent (CpuSec_Cell_Refresh). This value appears in the table.
- I_i is the refresh interval for statistic i (RTIUpdateIntvl)

Event Interface background

The background CPU due to the Event Interface operation is given as

```
UBEI = UBEI if SEI is operating
     = 0 otherwise
```

Event Interface

The equation used for CPU contribution due to the Event Interface on the Symposium Call Center Server system is

```
USEI =
  nSEIClients * (pEventsCall * SEIEvent_Cost * aNEvents/
  3600 + SEIMessage_Cost/aEIUpdateIntvl)
```

where

- SEIEvent_Cost is the CPU time in seconds required per event monitored This value appears in “CPU measurements” on page 155.
- SEIMessage_Cost is the CPU time in seconds required per message sent This value appears in “CPU measurements” on page 155.
- aNEvents is the average number of events that occur per hour =

```
SUMOF (
      BCC_CBC_Events * PeakCallRate
      (Local_BCC_CBC_Events + RecsPerCall) *
          LocalPeakCallRate
      (OACC_CBC_Events + RecsPerNWOutCall) *
          nwOAccPeakCallRate
      OREJ_CBC_Events * nwORejPeakCallRate
      (IACC_CBC_Events+ RecsPerNWInCall) *
          nwIAccPeakCallRate
      IREJ_CBC_Events * nwIRejPeakCallRate
   )
```

Note: For more information abour RecsPerCall, see Appendix B, “Database table sizes,” on page 311.

Reporting

Symposium Call Center Server is supplied with a number of predefined (standard) reports for periodic and on-demand reporting of various aspects of the Symposium Call Center Server operations. The CPU requirements of the reports depend on the following factors:

- the number of rows per report
- the number of columns per report
- the number of the database views that the report is based on
- the complexity of the operations on these views

It is important to also include CPU calculations for every consolidated report where the current node is one of the nodes selected in the report. For consolidated reports, the value “number of rows per report” should be the number of rows returned from the current node. The number of views and the number of columns for each of the standard reports is shown in Table 9 in Appendix C, “Symposium Call Center Server standard reports,” on page 331.

Predefined Symposium Call Center Server workloads do not include the description of the typical use of Symposium Call Center Server reporting. For analysis purposes, the reports listed in “Reports” on page 288 are assumed to be executed at the same time as CBC data collected.

Note: Each installation may have very different reporting requirements.

Interval reporting is done every 15 minutes. Based on this, the CPU load for the Interval reports can be determined.

The CPU impact depends on the number of views the report is based on. Some reports are based on a single database view (for example, report Summarized Application Performance is based on a single view). Others are based on the data from multiple views (for example Application Performance).

Single-view reports

For single-view reports the impact is approximately linear with respect to the number of columns.

The following formulas describe the estimation of the impact of single-view reports in terms of the number of milliseconds of PP200 CPU required to generate the report. Before applying these formulas, you must know the number of rows to be generated by the report (ReportRows):

```
ReportRowCPU_msec =
  ReportColumns * ColRow_Cost + BaseRow_Cost
```

Note: These formulas can also be used for single-view reports other than the standard reports. Single-view standard reports are identified with “1” in the “views” column in Table 9 in “List of standard reports” on page 333.

Multiple-view reports

For multiple-views report, the impact depends on the actual complexity of the data selection operation and on the state of the database at the time the report is generated. The ReportRowCPU_msec is taken as MultiRow_Cost.

```
ReportCPU_msec = ReportRowCPU_msec * ReportRows
```

For interval reports, the CPU utilization is

```
TotalReportIntervalCPU =
  SUMOF_ALL(
  ReportCPU_msec...for reports run each interval
  ) / (1000 * 15 * 60)
```

To determine the impact of the reporting, compute the ReportCPU_msec for each report generated during the busy hour and multiply it by the number of times the report is expected to be executed:

```
TotalReportDailyCPU =
  SUMOF_ALL(
  ReportCPU_msec * ReportsPerDay...for all other reports
  ) / (1000 * 3600)
```

U_{REP} = TotalReportDailyCPU + TotalReportIntervalCPU

Networking

The networking cost is primarily due to the network call processing. The cost includes the basic call processing portion and the processing of the successful request for incoming and outgoing calls (OACC_Cost and IACC_Cost) as well as the cost of processing of the rejected and cancelled requests (OREJ_Cost and IREJ_Cost). Other components (such as routing table updates) are minimal and need not be included in computations. The networking cost is, therefore, computed as

```
U_NET =
  SUMOF (
     IREJ_Cost * nwIRejPeakCallRate
     IACC_Cost * nwIAccPeakCallRate
     OREJ_Cost * nwORejPeakCallRate
     OACC_Cost * nwOAccPeakCallRate
  ) / 3600
```

Online database backup

The online database backup runs as a low priority background task. Although it consumes CPU resources, it does not impact the CPU time required by Symposium Call Center Server for call processing or reporting.

Calculate ELAN utilization (M1)

Introduction

The embedded LAN (ELAN) is an Ethernet link between the M1 switch and the Symposium Call Center Server. ELAN bandwith is 10 Mbps (TCPIP_Bandwidth_MBitsSec = 10).

ELAN traffice

The ELAN carries the following traffic:

- Call Processing AML (AML_Utilization)
- Networking Call Processing (NCP_Utilization)
- Network Control Center traffic (NCCUpd_Utilization)
- Meridian Link Services (MLink_Utilization)

If more than one Symposium Call Center Server system is on the same ELAN, then the ELAN utilization is the sum of the ELAN utilization for each system.

Note: NCC traffic can be routed over the CLAN. In this document, it is assumed NCC traffic is routed over the ELAN. Use detailed computations to determine the NCC traffic portion.

Maximum acceptable utilization

The utilization of the ELAN is dependent mainly on

- call rate
- call complexity
- frequency of MLS services

The maximum acceptable utilization of the ELAN depends on the amount of traffic on the LAN, the length of the cable, and on the size of the messages. The probability of collision of packets depends on these factors and affects the average delay within the network. Total utilization of ELAN should not exceed

45 percent (if the components are under 300 meters apart) or 30 percent (if the components are up to 3000 meters apart). For more information on utilization, refer to Appendix D, “Ethernet delay factors versus bandwidth utilization,” on page 345.

Detailed ELAN requirements computations

ELAN utilization is computed as

```
EmbeddedLan_Utilization =
  AML_Utilization + NCP_Utilization + NCCUpd_Utilization +
  MLink_Utilization
```

The utilization of the ELAN is not expected to be the performance bottleneck. Even in the case of the Upper End workload the ELAN utilization is under 6 percent.

The following sections describe the detailed computations for each of the components of the ELAN traffic.

Call processing traffic impact on ELAN

Call processing application module link (AML) provides the connection between M1 and the Symposium Call Center Server for call processing-related traffic over the ELAN.

AML cost for basic local calls

The following table shows number of bytes transferred for common AML services (that is, services that occur for every call) for basic calls handled by local agents. BCC_AMLBytes represents the amount of information that is transferred over the ELAN for these calls..

AML service	Bytes transferred	#Messages
Call Arrival	246	1
Give Ringback	243	2
Give Silence	243	2

AML service	Bytes transferred	#Messages
Route to...	559	3
Agent Answer	500	4
Call Disconnect	364	3
Total per Call—BCC_AMLBytes	2,155	
Total per Call—BCC_AMLMessages		15

Note: Bytes transferred includes the standard TCP-IP overhead of 88 bytes per message.

AML cost for basic outgoing accepted network calls

The following table shows number of bytes transferred for common AML services (that is, services that occur for every call) for basic calls originating on the local node that are handled by agents on other nodes. nwOAcc_AMLBytes represents the amount of information that is transferred over the ELAN for these calls.

AML service	Bytes transferred	#Messages
Call Arrival	246	1
Give Ringback	243	2
Give Silence	243	2
Route to...	559	3
Total per Call—nwOAcc_AMLBytes	1291	
Total per Call—nwOAcc_AMLMessages		8

Note: Bytes transferred includes the standard TCP-IP overhead of 88 bytes per message.

AML services for basic incoming accepted network calls

The following table shows number of bytes transferred for common AML services (that is, services that occur for every call) for basic calls originating on other nodes that are handled by local agents. nwIAcc_AMLBytes represents the amount of information that is transferred over the ELAN for these calls

AML service	Bytes transferred	#Messages
Call Arrival	246	1
Route to...	559	3
Agent Answer	500	4
Call Disconnect	364	3
Total per Call—nwIAcc_AMLBytes	1669	
Total per Call—nwIAcc_AMLMessages		11

Note: Bytes transferred includes the standard TCP-IP overhead of 88 bytes per message.

AML cost for call treatments

Symposium Call Center Server calls can also use a number of voice services that require communication to M1 via the ELAN (using the AML link). These services and the sizes of messages associated with them are shown in the following table:

AML service	Variable name	Bytes	Variable name	#Messages
Basic Call Serives	BCC_AMLBytes	2,155	BCC_AMLMessages	15
Give Controlled Broadcast (Start/Stop)	GCB_AMLBytes	673	GCB_AMLMessages	5
Give Controlled Broadcast (Continuous)	GCBC_AMLBytes	673	GCBC_AML Messages	5

AML service	Variable name	Bytes	Variable name	#Messages
Collect Digits Session (including play prompt)	VSCDG_AML Bytes	673	VSCDG_AML Messages	5
Give IVR Session	GIVR_AMLBytes	673	GIVR_AML Messages	5
Give RAN	GRAN_AML Bytes	359	GRAN_AML Messages	3
Give MUSIC	GMUSIC_AML Bytes	249	GMUSIC_AML Messages	2

Note: The sizes of GCBC, VSCDG and GIVR messages are assumed to be similar to the size of GCB messages.

The number of AML bytes and messages generated per call due to treatments is computed as

```
Treatments_AMLBytes =
  SUMOF(
     GCB_AMLBytes*aGCBPerCall
     GCBC_AMLBytes*aGCBCPerCall
     VSCDG_AMLBytes*aVSCDGPerCall
     GIVR_AMLBytes * aGIVRPerCall
     GRAN_AMLBytes * aGRANPerCall
     GMUSIC_AMLBytes * aGMUSICPerCall
  )

Treatments_AMLMessages =
  SUMOF(
     GCB_AMLMessages*aGCBPerCall
     GCBC_AMLMessages*aGCBCPerCall
     VSCDG_AMLMessages*aVSCDGPerCall
     GIVR_AMLMessages * aGIVRPerCall
     GRAN_AMLMessages * aGRANPerCall
     GMUSIC_AMLMessages * aGMUSICPerCall
  )
```

AML cost for transferring calls

The following table shows the size of number of bytes transferred when a call is transferred to another agent.

AML service	Bytes transferred	#Messages
Transfer Init	308	2
Call Answer	428	3
Call Disconnect	382	3
Trn_AMLBytes	1118	
Trn_AMLMessages		8

AML cost for conferencing calls

The following table shows the number of bytes transferred when a call is conferenced to another agent.

AML service	Bytes transferred	#Messages
Conference Init	297	2
Call Answer	704	5
Call Disconnect	525	4
Conf_AMLBytes	1526	
Conf_AMLMessages		11

Total AML cost

Total AML bytes and messages generated per various local and network calls are then calculated as follows. Note that there are no treatments associated with network incoming calls.

```
ELAN_BCC_Bytes = BCC_AMLBytes + Treatments_AMLBytes

ELAN_BCC_Messages =
  BCC_AMLMessages + Treatments_AMLMessages
```

```
ELAN_OACC_Bytes = nwOAcc_AMLBytes + Treatments_AMLBytes

ELAN_OACC_Messages =
  nwOAcc_AMLMessages + Treatments_AMLMessages

ELAN_IACC_Bytes = nwIAcc_AMLBytes

ELAN_IACC_Messages = nwIAcc_AMLMessages

ELAN_Tx_Bytes =
  Trn_AMLBytes * pTransferIn/100 * (1 – pTrnf_MLS/100)

ELAN_Cf_Bytes =
  Conf_AMLBytes * pConferenceIn/100 * (1 – pConf_MLS/100)

ELAN_Tx_Messages =
  Trn_AMLMessages * pTransferIn/100 * (1 – pTrnf_MLS/100)

ELAN_Cf_Messages =
  Conf_AMLMessages * pConferenceIn/100 *
  (1 – pConf_MLS/100)

ELAN_TxOut_Bytes =
  Trn_AMLBytes * pTransferOut/100 * (1 – pTrnf_MLS/100)

ELAN_CfOut_Bytes =
  Conf_AMLBytes * pConferenceOut/100 * (1 – pConf_MLS/100)

ELAN_TxOut_Messages =
  Trn_AMLMessages * pTransferOut/100 * (1 – pTrnf_MLS/100)

ELAN_CfOut_Messages =
  Conf_AMLMessages * pConferenceOut/100 *
  (1 – pConf_MLS/100)
```

The average size of a message is computed as

```
ELAN_CallMessageSize =
  SUMOF(
    (ELAN_BCC_Bytes / ELAN_BCC_Messages) *
        (LocalPeakCallRate + PeakOutCallRate)
    (ELAN_OACC_Bytes / ELAN_OACC_Messages) *
        nwOAccPeakCallRate
    (ELAN_IACC_Bytes / ELAN_IACC_Messages) *
        nwIAccPeakCallRate
```

```
         (ELAN_Tx_Bytes / ELAN_Tx_Messages) *
            AgentPeakCallRate
        (ELAN_Cf_Bytes / ELAN_Cf_Messages) *
            AgentPeakCallRate
        (ELAN_TxOut_Bytes / ELAN_TxOut_Messages) *
            PeakOutCallRate
        (ELAN_CfOut_Bytes / ELAN_CfOut_Messages) *
            PeakOutCallRate)
    ) / (PeakCallRate + nwIAccPeakCallRate +
            PeakOutCallRate)
```

The total contribution to the AML bandwidth is computed as

```
  AML_BW_Required_MbitsSec =
    ((SUMOF(
      ELAN_BCC_Bytes * (LocalPeakCallRate +
          PeakOutCallRate)
      ELAN_OACC_Bytes * nwOAccPeakCallRate
      ELAN_IACC_Bytes * nwIAccPeakCallRate
      ELAN_Tx_Bytes * AgentPeakCallRate
      ELAN_Cf_Bytes * AgentPeakCallRate
      ELAN_TxOut_Bytes * PeakOutCallRate
      ELAN_CfOut_Bytes * AgentPeakCallRate
    ) /3600)*8)/1000000
```

Finally, the AML link utilization can be calculated as

```
  AML_Utilization =
    100% * AML_BW_Required_MbitsSec /
    TCPIP_Bandwidth_MbitsSec
```

MLS traffic on the ELAN

Meridian Link Services (MLS) provides the connection between M1 or DMS/MSL-100 and the third-party applications. MLS traffic is combined with Symposium Call Center Server traffic en route from the switch to the third-party application. The MLS traffic uses the ELAN between the switch and the Symposium Call Center Server and then the CLAN between the Symposium Call Center Server and the third-party devices.

MLS traffic can be subdivided into traffic resulting from inbound calls and the traffic resulting from outbound calls.

Inbound call traffic

Inbound MLS traffic is dependent on the number of MLS messages associated with each inbound call (including screen pops) and the MLS messages due to transferring and conferencing inbound calls. The total bandwidth requirement for MLS inbound traffic can be expressed as

```
MLinkIn_BW_Required_MbitsSec =
  SUM OF (
    aMMSGPerCall
    aMSPPerCall
    aMMSGPerTx * pTransferIn/100 * pTrnf_MLS/100
    aMMSGPerConf * pConferenceIn/100 * pConf_MLS/100
  ) * PeakCallRate * (aMMSG_Size + 88) * 8 / (3600 *
  1000000)
```

The inbound MLS utilization is defined as

```
MLinkIn_Utilization =
  100% * MLinkIn_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Outbound call traffic

For the outbound call contribution, the ELAN traffic is made up by MLS messages for successful calls (including screen pops), unsuccessful connected calls and unconnected calls, as well as MLS messages. The total bandwidth requirement for MLS outbound traffic can be expressed as

```
MLinkOut_BW_Required_MbitsSec=
  SUM OF(
    aMMSGPerOutCall
    aMSPPerOutCall
    aMMSGPerConUCall * aAttPerOutCall *
        (1 – pUCallsNCon / 100)
    aMMSGPerNCon * aAttPerOutCall * pUCallsNCon / 100
    aMMSGPerTx * pTransferOut/100 * pTrnf_MLS/100
    aMMSGPerConf * pConferenceOut/100 * pConf_MLS/100
  ) * PeakOutCallRate * (aMMSG_Size + 88) * 8 /
  (3600 * 1000000)
```

The outbound MLS utilization is defined as

```
MLinkOut_Utilization =
  100% * MLinkOut_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Network agent requests impact on the ELAN (M1 only)

Networked Symposium Call Center Server results in Embedded LAN (ELAN) traffic used for communicating the network agent requests between the different Symposium Call Center Server nodes. Network Call Processing (NCP) traffic consists of messages sent by the Symposium Call Center Server nodes in a network to request a remote agent to service an incoming call. The messages associated with sending and canceling these requests, as well as receiving responses and agent reservations, are shown in the following table:

Message	Variable name	Message size
Network Agent Request	NARequest	199
Network Agent Response	NAResponse	403
Network Agent Reserved	NAReserved	403
Network Agent Cancelled Request	NACancRequest	199

Note: Message sizes include the standard TCP-IP overhead of 88 bytes plus Toolkit protocol overhead of 55 bytes, yielding a total of 143 bytes of total overhead.

Three basic functions are associated with network agent requests:

- requesting an agent
- receiving a reservation
- cancelling a request

These basic operations are associated with four type of requests: successful and canceled requests on the local and on the network node.

Bytes transferred for each type of request

The amounts of information related to these four types of requests are summarized in the following table:

Name	Bytes transferred per request	Notes
nwAcc_Bytes	NARequest + NAResponse + NAReserved	Successful request for an agent on local node.
nwRej_Bytes	NARequest + NAResponse + NAReserved + NACancRequest	Cancellation of the request for an agent on the local node. Assume that an agent has already been reserved.
nwAccFrom_Bytes (out calls)	NARequest	Bytes sent for the successful request for an agent on another node.
nwAccTo_Bytes (in calls)	NAResponse + NAReserved	Bytes received for the successful request for an agent on another node.
nwRejFrom_Bytes (out calls)	NARequest + NACancRequest	Bytes sent for the unsuccessful request for an agent on another node.
nwRejTo_Bytes (in calls)	NAResponse + NAReserved	Bytes received for the unsuccessful request for an agent on another node.

The amount of traffic depends on the rate of the requests. The total amount of NCP traffic is therefore computed as

```
NCP_BW_Required_MbitsSec =
  SUMOF(
     nwIAccPeakCallRate * nwAcc_Bytes
     nwIRejPeakCallRate * nwRej_Bytes
     nwOAccPeakCallRate * nwAcc_Bytes
     nwORejPeakCallRate * nwRej_Bytes
  ) * 8 / (3600 * 1000000)

NCP_Utilization =
  100% * NCP_BW_Required_MbitsSec / TCPIP_Bandwidth
```

Networking NCC updates impact on the ELAN

Network Control Center (NCC) updates traffic consists of periodic broadcasting of the routing tables by NCC nodes. The assumption is made that these updates occur once every NCC_Period_Min (currently this value is 5 minutes). The impact of such updates is expected to be negligible. Therefore, NCCUpd_Utilization = 0.

Calculate ELAN utilization (DMS/MSL-100)

Introduction

The embedded LAN (ELAN) is an Ethernet link between the DMS/MSL-100 switch and the Symposium Call Center Server. The Intelligent Call Management (ICM) link is considered as part of the ELAN.

ELAN bandwith is 10 Mbps (TCPIP_Bandwidth_MBitsSec = 10).

ELAN traffic

The ELAN carries the following traffic:

- Call Processing ICM (ICM_Utilization)
- External IVR (IVR_Utilization)
- Meridian Link Services (MLink_Utilization)

Note: IVR caller entered data (CED) can use either ELAN or CLAN.

Maximum acceptable utilization

The utilization of the ELAN is dependent mainly on

- call rate
- call complexity
- frequency of MLS services

The maximum acceptable utilization of the ELAN depends on the amount of traffic on the LAN, the length of the cable, and on the size of the messages. The probability of collision of packets depends on these factors and affects the average delay within the network. Total utilization of ELAN should not exceed 45 percent (if the components are under 300 meters apart) or 30 percent (if the components are up to 3000 meters apart). For more information on utilization, refer to Appendix D, “Ethernet delay factors versus bandwidth utilization,” on page 345.

Detailed ELAN requirements computations

ELAN utilization is computed as

```
EmbeddedLan_Utilization =
  ICM_Utilization + IVR_Utilization + MLink_Utilization
```

The utilization of the ELAN is not expected to be the performance bottleneck. Even in the case of the Upper End workload the ELAN utilization is under 6 percent.

The following sections describe the detailed computations for each of the components of the ELAN traffic.

Call processing traffic impact on the ELAN

The call processing traffic is broken into two components: the traffic from the Symposium Call Center Server to the DMS/MSL-100 (inbound) and the traffic from the DMS/MSL-100 to the Symposium Call Center Server (outbound). LAN utilization for this traffic is computed as

```
ICM_Utilization =
    Inbound_ICM_Utilization + Outbound_ICM_Utilization
```

Traffic from the server to the switch for common ICM services

Call Processing Intelligent Call Manager (ICM) provides the connection between the DMS/MSL-100 and the Symposium Call Center Server for Call Processing related traffic over the ELAN. The common ICM services (that is, the ones that occur for every call) for basic calls are shown in the following table:

ICM service	Variable name	Bytes transferred
Give Treatment(Ringback)	GRNG_ICMBytes	128
Route Call	RCall_ICMBytes	130
Total per Call	BCC_In_ICMBytes	258

Note: Bytes transferred includes standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

BCC_ICMBytes represents the amount of information that is transferred over the ELAN for every basic Symposium Call Center Server call.

Traffic from the server to the switch for voice services

Symposium Call Center Server calls may also use a number of voice services that require communication to the DMS/MSL-100 via the ELAN (using the ICM link). These services and the sizes of messages associated with them are shown in the following table:

ICM service	Variablename	Bytes transferred
Give Treatment(Ringback)	GRNG_ICMBytes	128
Give Treatment(RAN)	GRAN_ICMBytes	128
Give Treatment(Music)	GMUS_ICMBytes	128

Note: Bytes transferred includes standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

Traffic from the server to the switch generated due to treatments

The number of ICM bytes and messages generated per call due to treatments is computed as

```
Treatments_In_ICMBytes =
  SUMOF(
     GRAN_ICMBytes * aGRANPerCall
     GMUS_ICMBytes * aGMUSPerCall
  )
```

Total ICM bytes generated per various calls are then calculated as

```
ELAN_In_ICMBytes =
  BCC_In_ICMBytes + Treatments_In_ICMBytes
```

The average size of an inbound message is computed as

```
ELAN_ICM_In_MessageSize =
  SUMOF(
     GRNG_ICMBytes * 1
     RCall_ICMBytes * 1
     GRAN_ICMBytes * aGRANPerCall
     GMUS_ICMBytes * aGMUSPerCall
  ) / (2 + aGRANPerCall + aGMUSPerCall)
```

The total contribution to the ICM bandwidth is computed as

```
ICM_In_BW_Required_MbitsSec =
  ELAN_In_ICMBytes * PeakCallRate /3600*8/1000000
```

Finally, the inbound ICM link utilization can be calculated as

```
Inbound_ICM_Utilization =
  100% * ICM_In_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MbitsSec
```

Traffic from the switch to the server for basic calls

The messages sent from the DMS/MSL-100 to Symposium Call Center Server for basic calls (that is, the ones that occur for every call) are shown in the following table:

ICM message	Bytes transferred	#Messages
Call Queued (Arrival)	152	1
Give Treatment(Ringback) Response	112	1
Route Call Response	112	1
Call Released (CDN)	140	1
Call Answered (Agent)	158	1
Call Released (Agent)	140	1
Set Action (Agent)	106	1
Total per Call—BCC_Out_ICMBytes	920	

ICM message	Bytes transferred	#Messages
Total per Call—BCC_Out_ICMMessages		7

Note: Bytes transferred includes standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

BCC_Out_ICMBytes represents the amount of information that is sent from the ICM Ethernet Interface Unit (EIU) to the Symposium Call Center Server over the ELAN for every basic Symposium Call Center Server call.

Traffic from the switch to the server for other services

Symposium Call Center Server calls may also use a number of services that require communication to the DMS/MSL-100 across the ELAN using the ICM link. The response messages sent for each service message and their sizes are shown in the following table:

Treatment type	Response messages	Bytes transferred	Variable name	#Messages
Ringback	Response	112	GRNG_Out_ICM Bytes	1
RAN	Response, Treatment Complete	224	GRAN_Out_ICM Bytes	2
Music	Response	112	GMUS_Out_ICM Bytes	1

Note: Bytes transferred includes standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

Traffic from the switch to the server for transferred calls

Calls can also be transferred to another agent by the agent who receives the call. The additional messages sent from the DMS/MSL-100 to Symposium Call Center Server for each call transferred and their sizes are shown in the following table:

ICM message	Bytes transferred	#Messages
Consult Init	128	1
Call Offered (New DN)	156	1
Call Answered (New DN)	158	1
Call Transferred (New DN)	132	1
Call Released (New DN)	140	1
Agent Not Ready (New DN)	106	1
Agent Ready (New DN)	106	1
Total per Call—TRN_Out_ICMBytes	926	
Total per Call—TRN_Out_ICMMessages		7

Note: Bytes transferred includes standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

Traffic from the switch to the server for conferenced calls

Calls may also be conferenced with another agent by the agent who receives the call. The additional messages sent from the DMS/MSL-100 to Symposium Call Center Server for each call conferenced and their sizes are shown in the following table:

ICM message	Bytes transferred	#Messages
Consult Init	128	1
Call Offered (New DN)	156	1

ICM message	Bytes transferred	#Messages
Call Answered (New DN)	158	1
Call Conferenced (New DN)	144	1
Call Conferenced (Agent)	144	1
Call Released (New DN)	140	1
Agent Not Ready (New DN)	106	1
Agent Ready (New DN)	106	1
Total per Call—Conf_Out_ICMBytes	1082	
Total per Call—Conf_Out_ICMMessages		8

Note: Bytes transferred includes standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

Traffic from the switch to the server generated due to treatments

The number of ICM bytes generated per call due to treatments is computed as

```
Treatments_Out_ICMBytes =
  SUMOF(
    GRAN_Out_ICMBytes * aGRANPerCall
    GMUS_Out_ICMBytes * aGMUSPerCall
    TRN_Out_ICMBytes * pTransferIn/100
        * ( 1 - pTrnf_MLS/100)
    Conf_Out_ICMBytes * pConferenceIn/100
        * ( 1 - pConf_MLS/100)
  )
```

Total ICM bytes generated per various calls are then calculated as

```
ELAN_Out_ICMBytes =
  BCC_Out_ICMBytes + Treatments_Out_ICMBytes
```

The average size of an outbound message is computed as

```
ELAN_ICM_Out_MessageSize =
  (BCC_Out_ICMBytes + Treatments_Out_ICMBytes) /
  SUMOF(
     BCC_Out_ICMMessages
     GRAN_Out_ICMMessages * aGRANPerCall
     GMUS_Out_ICMMessages * aGMUSPerCall
     TRN_Out_ICMMessages * pTransferIn/100
         * ( 1 - pTrnf_MLS/100)
     Conf_Out_ICMMessages * pConferenceIn/100
         * ( 1 - pConf_MLS/100)
     )
```

The total contribution to the ICM bandwidth is computed as

```
ICM_Out_BW_Required_MbitsSec =
  ELAN_Out_ICMBytes * PeakCallRate / 3600 * 8 /1000000
```

Finally, the outbound ICM link utilization can be calculated as

```
Outbound_ICM_Utilization =
  100% * ICM_Out_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MbitsSec
```

MLS traffic on the ELAN

Meridian Link Services (MLS) provides the connection between M1 or DMS/MSL-100 and the third-party applications. MLS traffic is combined with Symposium Call Center Server traffic en route from the switch to the third-party application. The MLS traffic uses the ELAN between the switch and the Symposium Call Center Server and then the CLAN between the Symposium Call Center Server and the third-party devices.

MLS traffic can be subdivided into traffic resulting from inbound calls and the traffic resulting from outbound calls.

Inbound call traffic

Inbound MLS traffic is dependent on the number of MLS messages associated with each inbound call (including screen pops) and the MLS messages due to transferring and conferencing inbound calls. The total bandwidth requirement for MLS inbound traffic can be expressed as

```
MLinkIn_BW_Required_MbitsSec =
  SUM OF (
    aMMSGPerCall
    aMSPPerCall
    aMMSGPerTx * pTransferIn/100 * pTrnf_MLS/100
    aMMSGPerConf * pConferenceIn/100 * pConf_MLS/100
  ) * PeakCallRate * (aMMSG_Size + 88) * 8 / (3600 *
    1000000)
```

The inbound MLS utilization is defined as

```
MLinkIn_Utilization =
  100% * MLinkIn_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Outbound call traffic

For the outbound call contribution, the ELAN traffic is made up by MLS messages for successful calls (including screen pops), unsuccessful connected calls and unconnected calls, as well as MLS messages. The total bandwidth requirement for MLS outbound traffic can be expressed as

```
MLinkOut_BW_Required_MbitsSec=
  SUM OF(
    aMMSGPerOutCall
    aMSPPerOutCall
    aMMSGPerConUCall * aAttPerOutCall *
        (1 - pUCallsNCon / 100)
    aMMSGPerNCon * aAttPerOutCall * pUCallsNCon / 100
    aMMSGPerTx * pTransferOut/100 * pTrnf_MLS/100
    aMMSGPerConf * pConferenceOut/100 * pConf_MLS/100
  ) * PeakOutCallRate * (aMMSG_Size + 88) * 8 /
    (3600 * 1000000)
```

The outbound MLS utilization is defined as

```
MLinkOut_Utilization =
  100% * MLinkOut_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

External IVR traffic impact on the ELAN

Most traffic related to Integrated Voice Response (IVR) on the ELAN is sent to the Symposium Call Center Server from the DMS/MSL-100 as a result of actions taken by the IVR system. It is assumed that this traffic is identical for all IVR systems.

Cost of IVR messages

The messages described in the following table are sent from the DMS/MSL-100 to the Symposium Call Center Server for each call handled by the IVR system. There is also the possibility of the IVR caller-entered data (CED) message being sent from the IVR system to the Symposium Call Center Server directly over the ELAN. This depends on whether the IVR system is connected to the ELAN or the CLAN.

ICM service	Bytes transferred	#Messages
Call Offered	156	1
Call Answered	158	1
Consult Init	128	1
Transfer Complete	112	1
Call Released	140	1
Total per Call—DMS_IVRBytes	694	
Total per Call—DMS_IVRMessages		5

Note: Bytes transferred include standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

The messages defined in this table show only the messages sent from ICM to Symposium Call Center Server. The table does not include any messages from ICM that are sent to the IVR system via the MLS interface.

The average size of an IVR outbound message is computed as

```
ELAN_IVR_Out_MessageSize =
  DMS_IVRBytes / 5
```

The total contribution to the ICM bandwidth is computed as

```
IVR_BW_Required_MbitsSec =
  (((DMS_IVRBytes * PeakCallRate) /3600)*8)/1000000
```

Cost of caller-entered data (CED) messages

The CED messages are sent directly between the external IVR system and Symposium Call Center Server. It is assumed that this traffic is identical for all IVR systems. The messages described in the following table are sent between the IVR system and the Symposium Call Center Server for each call arrival.

IVR service	Bytes transferred	#Messages
Caller Entered Data Overhead	115	1
Caller Entered Data Response	101	1
Total per Call—CED_IVR_OH_Bytes	216	
Total per Call—CED_IVRMessages		2

Note: Bytes transferred include standard TCP-IP overhead of 88 (78 + 10 for collisions) bytes per message.

Total IVR bytes generated per call is then calculated as

```
CED_IVR_Bytes =
  CED_IVR_OH_Bytes + aExternal_IVR_Size
```

The total contribution to the ICM bandwidth is

```
CED_BW_Required_MbitsSec =
  (((CED_IVR_Bytes * PeakCallRate)/3600)*8)/1000000
```

If the external IVR is on ELAN then

```
ELAN_CED_BW_Required_MbitsSec = CED_BW_Required_MbitsSec
```

else

```
ELAN_CED_BW_Required_MbitsSec = 0
```

Finally, the IVR link utilization can be calculated as

```
IVR_Utilization =
  100% * (IVR_BW_Required_MbitsSec +
  ELAN_CED_BW_Required_MbitsSec)/TCPIP_Bandwidth_MbitsSec
```

DMS/MSL-100 external IVR fast transfer impact

If the IVR system is using the MLS capability of the Symposium Call Center Server system to transfer the call from the IVR voice port to the Symposium Call Center Server CDN, then this additional traffic must be included in ELAN and CLAN computations. For more information, refer to "MLS traffic on the ELAN" on page 178 and "MLS traffic impact on the CLAN" on page 206.

Calculate CLAN utilization

Introduction

The Customer LAN (CLAN) is an Ethernet or a Token Ring link between the Symposium Call Center Server and the Symposium Call Center Server clients. Customer LAN (CLAN) bandwith is 10 Mbps.

CLAN traffic

CLAN traffic consists of the following elements:

- real-time display (RTDisp_Utilization)
- real-time data API (RTI_Utilization)
- Event Interface (SEI_Utilization)
- MLS (MLink_Utilization)
- Host Data Exchange (HDX_Utilization)
- reporting-related traffic (Reporting_Utilization)
- network CBC traffic to the NCC (NCBC_Utilization)
- non-Symposium Call Center Server customer traffic

Notes:

- IVR caller entered data (CED) can use either CLAN or ELAN.
- If the NCC and nodal server share the same CLAN, then the traffic contributions from both must be totalled to derive the total CLAN impact on bandwidth. It is recommended that an IP router be used to separate the traffic on the ELAN and CLAN.

Maximum acceptable utilization

The maximum acceptable utilization of the CLAN is identical to the ELAN. For more information, refer to Appendix D, “Ethernet delay factors versus bandwidth utilization,” on page 345.

Detailed CLAN requirements computations

```
CustomerLan_Utilization =
  SUMOF(
    RTDisp_Utilization
    RTI_Utilization
    GRTD_Utilization
    SEI_Utilization
    MLink_Utilization
    HDX_Utilization
    CLAN_IVR_Utilization
    Data_Extraction_Utilization
    Reporting_Utilization
    NCBC_Utilization
  )
```

The maximum acceptable utilization of the CLAN depends on the amount of traffic on the LAN, the length of the wire, and the size of the messages. The probability of collision of packets depends on these factors and affects the average delay within the network. Total utilization of the CLAN should not exceed 45 percent (if the components are under 300 meters apart) or 30 percent (if the components are 3000 meters apart). For more information, see Appendix D, “Ethernet delay factors versus bandwidth utilization,” on page 345.

Real-time display traffic on the CLAN

Real-time display traffic provides the communications between the Symposium Call Center Server and the Symposium Call Center Server Client workstations over the CLAN (or WAN in the networked Symposium Call Center Server environment). This traffic consists of messages related to the supervisor real-time display screens. This traffic depends on

- the amount of update information
- the frequency of updates for each screen
- the number of screens
- the number of supervisors

Other CLAN traffic, such as agent Operation, Administration, and Management (OA&M) information, constitutes a negligible portion of the total amount of traffic on the CLAN. The following computations assume the standard TCP/IP overhead of 88 bytes per message and a toolkit overhead of 55 bytes per message for a total of 143 bytes of overhead per message.

The computations are based on the bandwith required for each supervisor screen. The amount of information per screen depends on the number of rows and the size of each row.

Note: A supervisor can have a maximum of four RTD screens open at a time.

Row size

The following table shows row size for each of the standard real-time displays.

RTD screens	Record_Size—No networking (bytes)	Record_Size—Networking (bytes)
Agent Statistics Screen	51	51
Application Statistics Screen	48	72
Nodal Screen	24	36
Skillset Statistics Screen	48	60
IVR Statistics (M1 only)	36	36
Route Statistics (M1 only)	12	12

Notice the different record sizes for networking compared to no networking: when there is no networking, fewer fields are shown. Also, IVR and Route statistics are only available for the M1 switch type.

Rows per screen

The number of Rows per screen is determined by the supervisor. Usually this number corresponds to the number of agents reporting to the supervisor (for the Agent screen), and the number of applications per supervisor for the Applications screen. The number of rows per screen is defined in the following parameters: nRTDAgRows, nRTDAppRows, nRTDCCRows and nRTDSkillRows.

The screen update interval specifies how often the screen information is transferred from Symposium Call Center Server to the supervisor workstation. The interval is determined by the supervisor. This interval is defined in AgScrUpdateIntvl and RTDScrUpdateIntvl. AgScrUpdateIntvl defines the interval for agent screen and RTDScrUpdateIntvl defines the interval for all other screens.

The RTD bandwidth required is computed as

```
RTDisp_Screen_BW_Required_MbitsSec=
  (nSupervisors * (nScreenRows * ScreenRowBytes + 143)
    * 8) / RTDScrUpdateIntvl /1000000
```

where nScreenRows is one of nRTDAgRows, nRTDAppRows, nRTDCCRows or nRTDSkillRows, depending on the screen; ScreenRowBytes is determined from the preceding table, and RTDScrUpdateIntvl is defined by AgScrUpdateIntvl for agent screen and RTDScrUpdateIntvl for all other screens.

If an agent screen contains all of the columns as suggested in “Row size” on page 197, then the formula above should be used. If the agent screen does not contain the Time In State column, then the updates need not be sent every time, but only whenever the state of the agent changes.

The following formula computes the average number of agent state changes per screen update interval:

```
AgentStateChange_Update=
  AgScrUpdateIntv * (2 * nIntPerShift/nShiftHrs +
  aAgStatesCall * ((AgentPeakCallRate + nwIRejPeakCallRate
  + PeakOutCallRate) / nAgents)) / 3600
```

This formula assumes that the agent changes its state twice for every interruption during the shift (for example, Ready/NotReady), twice for every call handled and the calls are distributed evenly between the agents. The probability that an agent will change his or her state during the screen update interval is computed as

```
AgentStateChange_Prob = MIN(1,AgentStateChange_Update)
```

The bandwith required for the agent screen is then computed as

```
Agent_Screen_BW_Required_MbitsSec=
  (nSupervisors * (nScreenRows * ScreenRowBytes + 143)
  * 8) * AgentStateChange_Prob / (AgScrUpdateIntv
  *1000000)
```

The total bandwidth required for all real-time display screens is computed using the following:

```
RTDisp_BW_Required_MbitsSec=
  SUMOF_ALL(RTDisp_Screen_BW_Required_MbitsSec)
          ... (for all screens)
```

```
RTDisp_Utilization =
  100% *RTDisp_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Each screen update is transferred as a single message over the network. Therefore the message rate per second depends on the number of supervisors, on the number of RTD screens per supervisor, and on the real-time display refresh interval. The number of screens per supervisor is four. Therefore, the number of messages transferred per second can be estimated as

```
RTDisp_MessagesPerSecond=
  (nSupervisors * 4) / RTDScrUpdateIntvl
```

The average size of message can be computed as

```
RTDisp_AvgBytesPerMessage =
  (RTDisp_BW_Required_MbitsSec / 8) /
  RTDisp_MessagesPerSecond
```

Real-time Data API traffic on the CLAN

The real-time API (RTI) sends real-time data over the CLAN for the use of customer applications. The calculations used to derive the LAN utilization due to the RTI traffic are similar to the real-time display bandwidth calculations. As with RTD traffic, RTI traffic also consists of messages related to the agent time in state data. However, the smallest update interval possible is two seconds.

Agents, therefore, must change state every two seconds and as a result all rows are updated every refresh interval. This simplifies the calculations since the mean number of agent state changes per update interval does not have to be accounted for.

Note: The following computations assume the standard TCP/IP overhead of 88 bytes per message and a toolkit overhead of 55 bytes per message for a total of 143 bytes of overhead per message.

The number of statistics sent, the corresponding number of columns, the update interval, and the size of the row in bytes is shown in the following table:

Real-time API screens	Record_Size—No networking (bytes)	Record_Size—Networking (bytes)
Agent Statistics Screen	51	51
Application Statistics Screen	48	72
Nodal Screen	24	36
Skillset Statistics Screen	48	60
IVR Statistics (M1 only)	36	36
Route Statistics (M1 only)	12	12

Record sizes for networking are different than for no networking in that fewer fields are shown when there is no networking. Also, IVR and Route statistics are only available for the M1 switch type.

The number of rows per RTI screen is defined in the following parameters: nRTIAgRows, nRTIAppRows, nRTICCRows, nRTISkillRows, nRTIRouteRows and nRTIIVRRows.

The Real-time API (RTI) traffic per is calculated then as

```
RTI_BW_Required_MbitsSec =
  (nRecords*Record_Size+143) * 8 / Update_Interval /
  1000000 * nRTIClients
```

where the summation is taken over all RTI screens.

The LAN utilization due to the RTI is then calculated as

```
RTI_Utilization =
  100% *RTI_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Each RTI screen update is transferred as a single message over the network. Therefore the message rate per second depends on the number of RTI screens and the RTI refresh interval. The number of RTI screens is six. Therefore, the number of messages transferred per second can be estimated as

```
RTI_MessagesPerSecond=
  6 / RTIUpdateIntvl
```

The average size of message can be computed as

```
RTI_AvgBytesPerMessage =
  (RTI_BW_Required_MbitsSec / 8) / RTI_MessagesPerSecond
```

Graphical Real-time Display data traffic on the CLAN

The Graphical Real-time Display (GRTD) application sends real-time data over the CLAN for the use of customer applications. The calculations used to derive the LAN utilization due to the GRTD traffic are similar to the Real-time Display (RTD) bandwidth calculations. As with RTD traffic, GRTD traffic also consists of messages relating to the agent time in state data. However, the smallest update interval possible is two seconds. Agents therefore change state every two seconds with the result that all rows are updated every refresh interval. This simplifies the calculations since the mean number of agent state changes per update interval does not have to be accounted for. The following computations assume the standard TCP/IP overhead of 88 bytes per message and a toolkit overhead of 55 bytes per message for a total of 143 bytes of overhead per message.

The following table shows the number of statistics sent, the corresponding number of columns, the update interval and the size of the row in bytes, for each standard real-time display:

Real-time screens	Record_Size—No networking (bytes)	Record_Size—Networking (bytes)
Agent Statistics Screen	51	51
Application Statistics Screen	48	72
Nodal Screen	24	36
Skillset Statistics Screen	48	60

Record sizes for networking differ from no networking in that fewer fields are shown when there is no networking.

The number of rows per GRTD screen is defined in the following parameters: nGRTDAgRows, nGRTDAppRows, nGRTCCRows and nGRTDSkillRows.

The Graphical Real-time Display traffic is calculated as

```
GRTD_BW_Required_MbitsSec =
  (nRecords*Record_Size+143)*8/Update_Interval/1000000 *
  nGRTDClients
```

where the summation is taken over all GRTD screens.

The LAN utilization due to the GRTD data is then calculated as

```
GRTD_Utilization =
  100% * GRTD_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Each GRTD screen update is transferred as a single message over the network. Therefore the message rate per second depends on the number of GRTD screens and the GRTD refresh interval. The number of messages transferred per second can be estimated as

```
GRTD_MessagesPerSecond=
  4 / GRTDUpdateIntvl
```

The average size of message can be computed as

```
GRTD_AvgBytesPerMessage =
  (GRTD_BW_Required_MbitsSec / 8) / GRTD_MessagesPerSecond
```

Event Interface traffic on the CLAN (M1 only)

The Symposium Event Interface (SEI) feature provides the connection between third-party applications on the Customer LAN (CLAN) and Symposium Call Center Server event handlers. SEI is used by third-party applications to receive notification messages when call processing events are recognized by Symposium Call Center Server. The sending of notification messages from SEI to the third-party applications is done on a periodic basis. This period can range from one half to five seconds and is set for each time an application registers for notification with SEI. Each third-party application receives notification for the events that they choose and that are recorded in the CBC database. The application can receive notification for all or a subset of all possible events.

```
SEI_BASE = 200 bytes

SEI_Event_Size = 550 bytes

SEI_NotificationsPerSecondPerClient =
  SUMOF (
     (BCC_CBC_Events + RecsPerCall) * PeakCallRate
     (OACC_CBC_Events + RecsPerNWOutCall) *
         nwOAccPeakCallRate
     OREJ_CBC_Events * nwORejPeakCallRate
     (IACC_CBC_Events + RecsPerNWInCall) *
         nwIAccPeakCallRate
     IREJ_CBC_Events * nwIRejPeakCallRate
     ) / 3600 * pEventsCall
```

Note: For more information about RecsPerCall, see Appendix B, "Database table sizes," on page 311..

```
SEI_NotificationsPerMessage =
  SEI_NotificationsPerSecondPerClient * EIUpdateIntvl

SEI_MessageSize =
  SEI_Base + SEI_NotificationsPerMessage * SEI_Event_Size
```

```
SEI_MessagesPerSecond =
  1 / EIUpdateIntvl * nSEIClients
```

The bandwidth required by the SEI feature, based on the assumption of 40 percent overhead, is computed as

```
SEI_BW_Required_MbitsSec =
  88+ SEI_MessageSize * 8 * SEI_MessagesPerSecond / 1000000

SEI_Utilization =
  100% * SEI_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Host Data Exchange traffic on the CLAN

The Host Data Exchange (HDX) feature provides the connection between Symposium Call Center Server and the third-party applications on the CLAN. HDX is used to exchange the information during the execution of a script whenever Send Request, Get Response, and Send Info script instructions are used. HDX is not used for any of the predefined workloads (see “Workload types” on page 281) and scripts.

All HDX script commands may have up to 10 parameters, and each parameter may be up to 256 bytes. The actual number of parameters and the parameter sizes are determined by the application. Each HDX command also contains a 20 byte provider ID field.

There are two basic DX applications: the Send Request/Get Response pair and Send Info. The amount of information transferred per application is computed as

```
DX_ReqResp_Bytes =
  aDX_SndReq_ParNum * aDX_SndReq_ParSize +
  aDX_GetResp_ParNum * aDX_GetResp_ParSize + 2 * 20 + 2 *
  88

Max_DX_ReqResp_Bytes = 1816

DX_GetInfo_Bytes =
  aDX_SndInfo_ParNum * aDX_SndInfo_ParSize + 20 + 88

Max_DX_SendInfo_Bytes = 908
```

The proportion of calls that use the Send Request/Get Response pair is defined as aHDXRGPerCall. The proportion of calls that use Send Info is defined as aHDXSIPerCall. See “Record your workload parameters” on page 122 for definitions. These proportions are determined from the customer traffic projections. The bandwidth required by the DX feature, based on the assumption of 20 percent overhead, is computed as

```
DX_BW_Required_MbitsSec =
  SUMOF(
    aHDXRGPerCall * DX_ReqResp_Bytes
    aHDXSIPerCall * DX_SendInfo_Bytes
  ) * (LocalPeakCallRate + nwIAccPeakCallRate) * 1.2* 8 /
  (3600 * 1000000)

HDX_Utilization =
  100% * DX_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

The following table shows the worst case HDX utilization, computed using the formulas above for the given rates:

DX application rate per hour	Request/ Response	SendInfo	Request/Response and SendInfo
1000	0.0%	0.0%	0.1%
5000	0.2%	0.1%	0.4%
10 000	0.5%	0.2%	0.7%
15 000	0.7%	0.4%	1.1%
20 000	1.0%	0.5%	1.5%
25 000	1.2%	0.6%	1.8%

The number of messages transferred per second by the HDX feature can be estimated as

```
HDX_MessagesPerSecond =
  SUMOF(
     aHDXRGPerCall * DX_RG_Messages
     aHDXSIPerCall * DX_SI_Messages
  ) * (LocalPeakCallRate + nwIAccPeakCallRate) / 3600
```

The average size of message can be computed as

```
HDX_AvgBytesPerMessage =
  (DX_BW_Required_MbitsSec / 8) / HDX_MessagesPerSecond
```

MLS traffic impact on the CLAN

MLS traffic impact on the CLAN is identical to the MLS traffic analysis made for the ELAN. See “MLS traffic on the ELAN” on page 178 for detailed computations.

External IVR traffic (DMS/MSL-100)

The external IVR system can be connected to either the ELAN or CLAN. If it is connected to the CLAN, all IVR caller-entered data traffic transferred between the server and IVR system travels over the CLAN. The traffic is assumed to be identical for all IVR systems. Link utilization due to call-entered data traffic is calculated in “Cost of caller-entered data (CED) messages” on page 193.

If the external IVR system is connected to the CLAN, then

```
CLAN_CED_BW_Required_MbitsSec = CED_BW_Required_MbitsSec
```

else

```
CLAN_IVR_BW_Required_MbitsSec = 0
```

Finally, the IVR link utilization can be calculated as

```
CLAN_IVR_Utilization =
  100% * CLAN_CED_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MbitsSec
```

Data extraction traffic on the CLAN

Symposium Call Center Server data extraction results in the transfer of data between the Symposium Call Center Server and a customer server over the CLAN. The amount of information transferred depends on

- the number of rows
- the amount of information per row
- the frequency of invocation of the data extraction process

The estimate of the LAN impact of the data extraction function depends on the approximate size of each extraction (DataRows) and the number of extractions per hour (ExtractsPerHour) which must be known in advance. The amount of information per row for each of the views (DataRowBytes) is shown in Appendix B, "Database table sizes," on page 311.

CLAN traffic for each data extraction is computed based on 40 percent protocol overhead as follows for each report:

```
DataTraffic_Mbits =
  DataRows * DataRowBytes * 8 * ExtractsPerHour * 1.4 /
  1000000
```

Total bandwidth required for Symposium Call Center Server reporting is computed as

```
Data_BW_Required_MbitsSec =
  SUMOF_ALL (DataTraffic_Mbits) / 3600
```
...for all data extractions

```
Data_Extraction_Utilization =
  Data_BW_Required_MbitsSec / TCPIP_Bandwidth_MBitsSec *
  100%
```

Reporting traffic on the CLAN

Symposium Call Center Server reporting results in transfer of report data between the Symposium Call Center Server and the client over the CLAN. The amount of information transferred depends on the size of report (number of rows), the amount of information per row, and the frequency of invocation of the report.

The amount of information can be calculated using the following formula:

```
Reporting_Utilization =
  SUMOF(
     Local__Historical_Reporting_BW_Required_MbitsSec
     Local__CBC_Reporting_BW_Required_MbitsSec
     Cons_Reporting_BW_Required_MbitsSec
     Cons_CBC_Reporting_BW_Required_MbitsSec
  ) / TCPIP_Bandwidth_MBitsSec * 100%
```

Local historical reporting traffic

Local reporting traffic consists of configuration, historical statistics, and call detail reporting reports extracted from the local Symposium Call Center Server system on the same CLAN. The estimate of the LAN impact of the reporting function depends on the approximate size of each report (ReportRows) and the number of reports per hour (ReportsPerHour), which must be known in advance. The amount of information per row for each of the standard reports (ReportRowBytes) is shown in Appendix C, "List of standard reports".

Note: For reports other than the standard reports, the number of bytes per row can be determined by using the **sp_help** <table_name> sybase command for the tables that the report is based on. This determines the size of each column in the report. Once the individual column sizes are obtained, the size of the row is computed as the sum of the sizes of columns.

CLAN traffic for each report is computed based on 40 percent protocol overhead as follows for each report:

```
ReportTraffic_Mbits =
  ReportRows * ReportRowBytes * 8 * ReportsPerHour * 1.4 /
  1000000
```

Total bandwidth required for Symposium Call Center Server reporting is computed as

```
Local_Historical_Reporting_BW_Required_MbitsSec =
  SUMOF_ALL (ReportTraffic_Mbits) / 3600
```

Local cbc reporting traffic

It is assumed that all data collected is reported on once. As such, the amount of CBC data sent to the client PC every hour from the local node is equal to the amount of data collected at the local node. The amount of CBC data collected per day is CallByCallSizeKb, described in "Event tables disk space" on page 146. Assuming a 40 percent protocol overhead, the amount of information retrieved per hour is computed as

```
Nodal_CBC_Reporting_Data =
  CallByCallSizeKb / 24

Local_CBC_Reporting_BW_Required_MbitsSec =
  Nodal_CBC_Reporting_Data * 8 * 1.4 / (3600 * 1000)
```

Consolidated historical statistics reporting traffic (M1 only)

Consolidated Historical Statistics reports can be generated from any PC in the network which can connect to the NCC server. For each consolidated report, the user can select the set of nodes the report will be based on. As such, the CLAN of both the current node and the selected nodes will be affected.

```
Cons_Reporting_BW_Required_MbitsSec =
  SUMOF(
    Client_Cons_Reporting_BW_Required_MbitsSec
    Node_Cons_Reporting_BW_Required_MbitsSec
  )
```

Reports generated by a client PC on the CLAN (M1 only)

Clients can connect to the NCC from any CLAN and request a consolidated report on network activity. Consolidated reports combine data from multiple nodes in the network. The estimate of the LAN impact of the function depends on

- the number of nodes that are selected (NumberOfNodes)
- the approximate size of each report (ReportRowsPerNode)
- the number of reports per hour (ReportsPerHour)

This information must be known in advance. The amount of information per row for each of the standard reports (ReportRowBytes) is shown in Appendix C, "Symposium Call Center Server standard reports," on page 331.

CLAN traffic for each report is computed-based on 40 percent protocol overhead for each report as

```
Client_Cons_ReportTraffic_Mbits =
  ReportRowsPerNode * NumberOfNodes * ReportRowBytes * 8 *
  ReportsPerHour * 1.4 / 1000000
```

Total bandwidth required for Symposium Call Center Server reporting is computed as

```
Client_Cons_Reporting_BW_Required_MbitsSec =
  SUMOF_ALL (Client_Cons_ReportTraffic_Mbits) / 3600
```
...for all reports

Reports selected from any node (M1 only)

If the PC from which the report is generated is at a different site, then the local CLAN is used whenever any consolidated report selects data from the local node. The estimate of the LAN impact of the reporting function depends on the approximate size of each report (ReportRowsPerNode) for this node and the number of reports per hour (ReportsPerHour) for this node which must be known in advance. The amount of information per row for each of the standard reports (ReportRowBytes) is shown in Appendix C.

CLAN traffic for each report is computed based on 40 percent protocol overhead as follows for each report:

```
Node_Cons_ReportTraffic_Mbits =
  ReportRowsPerNode * ReportRowBytes * 8 * ReportsPerHour
  * 1.4 / 1000000
```

Total bandwidth required for Symposium Call Center Server reporting is computed as

```
Node_Cons_Reporting_BW_Required_MbitsSec =
  SUMOF_ALL (Node_Cons_ReportTraffic_Mbits) / 3600
```
...for all reports

Consolidated CBC reporting traffic (M1 only)

Clients connected to the NCC can request a consolidated CBC report on network activity. For each report, customers can specify a single node on which the report is based. It is recommended that the client PC that generates the report is on the same CLAN as the node that the report is based on; however, this is not assumed in the following calculations.

```
Cons_CBC_Reporting_BW_Required_MbitsSec =
  SUMOF(
    Client_Cons_CBC_Reporting_BW_Required_MbitsSec
    Node_Cons_CBC_Reporting_BW_Required_MbitsSec
  )
```

Report selected from local node (M1 only)

It is assumed that all data collected is reported on once. As such, the amount of CBC data sent to the client PC every hour from the local node is equal to the amount of data collected at the local node. Reporting on local data is accounted for in “Local CBC Reporting Traffic” on page 209. To determine the amount of bandwidth required for network CBC data retrieved from the NCC, assume a 40 percent protocol overhead, and compute as follows:

```
Node_Cons_CBC_Reporting_Data =
  SUMOF (
    IREJ_CBC_Events * nwORejPeakCallRate
    IACC_CBC_Events * nwOAccPeakCallRate
  ) * NetCBCRecSize

Node_Cons_CBC_Reporting_BW_Required_MbitsSec =
  Node_Cons_CBC_RNCC_Data * 8 * 1.4 / (3600 * 1000)
```

Reports generated by a client PC on the CLAN (M1 only): Method 1

The consolidated network CBC report is limited to one hour of data for any single invocation of the report. But an end user can run multiple reports for different nodes. For the purpose of engineering enough LAN capacity, it is assumed that the amount of CBC data retrieved for any particular report is equal to the amount of network CBC data that is collected at the NCC and the source node for all network out calls that originate at the node selected in the report. Therefore the amount of information that can be retrieved per hour for a single node is computed as

```
CBC_Cons_ReportTraffic_Mbits =
  SUMOF(
     NetwCBC_NCC_Data
     Node_Cons_CBC_Reporting_Data
  )        ...for each node
```

where

```
NetwCBC_NCC_Data =
  SUMOF(
     IREJ_CBC_Events * nwOReqPeakCallRate
     IACC_CBC_Events * nwOAccPeakCallRate
  )
```

where the values for IREJ_CBC_Events, IACC_CBC_Events, nwOReqPeakCallRate and nwOAccPeakCallRate are for the node selected in the report (not necessarily the current node).

The amount of local CBC data collected at the node selected is the value Node_Cons_CBC_Reporting_Data for the node selected in the report (not necessarily the current node).

Note: Since the reporting of local CBC data is already accounted for in section "Local CBC Reporting Traffic" on page 209, it is important that the reporting of this data is not accounted for twice unless it is actually extracted twice in different reports.

With a 40 percent protocol overhead, the total amount of information retreived is computed as follows, where the value for CBC_Cons_ReportTraffic_Mbits is for the node selected in the report (not necessarily the current node):

```
Client_Cons_CBC_Reporting_BW_Required_MbitsSec =
  SUMOF_ALL (CBC_Cons_ReportTraffic_Mbits) / 3600 * 1.4
     ...for all reports
```

Reports generated by a client PC on the CLAN (M1 only): Method 2

The amount of data due to network CBC consolidated reporting can be estimated using the method in “Report selected from local node (M1 only)” on page 211. The estimate of the LAN impact of the reporting function depends on the approximate size of each report (ReportRows) and the number of reports per hour (ReportsPerHour), which must be known in advance. The amount of information per row (ReportRowBytes) for each of the standard reports is shown in Appendix C, “Symposium Call Center Server standard reports,” on page 331.

CLAN traffic for each report is computed based on 40 percent protocol overhead, as follows for each report:

```
Client_Cons_CBC_Reporting_BW_Required_MbitsSec =
  SUMOF_ALL (ReportTraffic_Mbits) / 3600
```

...for all reports

Network CBC traffic per node on the CLAN (M1 only)

When processing a networked call that originates on another node, a server records events associated with the call in the local CBC database. These events are also reported to the NCC. The events associated with successful as well as with rejected and cancelled network calls are sent to NCC. The following formula describes the number of events reported to the NCC per hour:

```
NCBC_Records_PerNodePerHour =
  SUMOF (
     IACC_CBC_Events * nwIAccPeakCallRate
     IREJ_CBC_Events * nwIRejPeakCallRate
  ) * pCBCNetworkNode/100
```

It is assumed that the size of each record is the size of a record in the CBC database, namely the NIeNetCallByCallStatYYYYMMDD event table (NetCbcRecSize), which can be obtained from Table 2 in Appendix B, “Database table sizes,” on page 311. Therefore, the amount of information sent per hour, assuming 30 percent protocol overhead, is computed as

```
NCBC_Traffic_KbHr =
  NCBC_Records_PerNodePerHour * NetCbcRecSize * 1.3

NCBC_BW_Required_MbitsSec =
  (NCBC_Traffic_KbHr / 1000) * 8 / 3600

NCBC_Utilization =
  100% * NCBC_BW_Required_MbitsSec /
  TCPIP_Bandwidth_MBitsSec
```

Calculate WAN requirements (M1)

Introduction

A Wide Area Network (WAN) can be used to provide communication between multiple nodes in the networked Symposium Call Center Server environment.

WAN traffic

The Wide Area Network (WAN) is used to carry the following types of data:

- networking call processing-related traffic between the servers
- network call events recording traffic between the servers and NCC
- Network Control Center (NCC) routing table update traffic between the NCC and the individual servers
- CBC and consolidated reporting traffic between the client PCs and the NCC or servers

To analyze network call processing (NCP) traffic, all activity during the peak busy hour of incoming calls is considered. To analyze reporting traffic, the period of highest reporting activity is considered. These two times are usually mutually exclusive. Customers are advised not to run their large reporting activities during the peak busy hour.

To engineer sufficient WAN capacity to handle system needs, the WAN must be engineered to handle both the NCP traffic and reporting traffic during the busiest periods. In the following WAN bandwidth calculations, reporting information for the busiest network reporting time period must be used.

Dedicating the WAN network

In addition, it is preferable that the WAN network is dedicated to Symposium Call Center Server call processing, although this is not always possible for all system configuration. In a shared WAN environment, it is possible that not even the network administrators have enough control over the network traffic to prevent a large file transfer from impacting other traffic and guaranteeing that latency time requirements are met. In an uncontrolled environment it is difficult to engineer a system to meet specified performance constraints.

Timeouts

The primary factors that determine the maximum acceptable latency time of the NCP messages are the timeouts defined in the networking code. The timeout set for NCP traffic is 10 seconds. This includes the time to send a message from one node to another and receive a response. (Responses are not received for every message but this case can be ignored). The largest NCP messages are approximately 400 bytes including TCP/IP and Media Access Control (MAC) overhead, as shown in "Bytes transferred for each type of request" on page 181. As such, it has been concluded that the maximum acceptable latency time to transmit a single message from node to node through the ELAN over a WAN connection is four seconds.

WAN traffic between local node and another node

Traffic between any two nodes consists of the Network Call Processing (NCP) traffic described in "Network Agent Requests Impact on the ELAN (M1 only)" on page 180. The WAN traffic between the local node and some other particular node in the network is the proportion of that traffic to the total NCP traffic that is sent between the pair of nodes.

For many customers, the NCC is located at the same site as one or more of the nodes in the network. If this is the case, a WAN connection is not needed between the two CLANs, but it is recommended that the CLANs be separated by a router.

To compute the WAN bandwidth between a remote node and a node located at the same site as the NCC, add the WAN bandwidth requirements between the remote node and the local node and between the remote node and the NCC for both the ELAN and CLAN.

WAN traffic from local node on ELAN

The traffic on the WAN between the ELANs of two nodes consists of network call processing traffic. The total WAN bandwidth required from the node is computed as

```
N2NE_BW_From =
  SUMOF(
     nwIAccPeakCallRate * nwAccTo_Bytes *
         pNetInOtherNode/100
     nwIRejPeakCallRate * nwRejTo_Bytes *
         pNetInOtherNode/100
     nwOAccPeakCallRate * nwAccFrom_Bytes *
         pNetOutOtherNode/100
     nwORejPeakCallRate * nwRejFrom_Bytes *
         pNetOutOtherNode/100
  ) * 8 * 1.3 / (3600 * 1000000)
```

If N2NE_BW_From > 0 or N2NE_BW_To > 0

```
N2NE_BW_Required_From_MbitsSec =
  Max(0.056, 2 * (N2NE_BW_From + 0.2 * N2NE_BW_To))
```

Else

```
N2NE_BW_Required_From_MbitsSec = 0
```

This is the amount of traffic that a circuit from the ELAN on the local node to the ELAN on the other node must be able to handle.

WAN traffic to local node on ELAN

The traffic on the WAN between the ELANs of two nodes consists of network call processing traffic. The total WAN bandwidth required from the node is computed as

```
N2NE_BW_To =
  SUMOF(
    nwIAccPeakCallRate * nwAccFrom_Bytes *
        pNetInOtherNode/100
    nwIRejPeakCallRate * nwRejFrom_Bytes *
        pNetInOtherNode/100
    nwOAccPeakCallRate * nwAccTo_Bytes *
        pNetOutOtherNode/100
    nwORejPeakCallRate * nwRejTo_Bytes *
        pNetOutOtherNode/100
  ) * 8 * 1.3 / (3600 * 1000000)
```

If N2NE_BW_To > 0 or N2NE_BW_From > 0

```
N2NE_BW_Required_To_MbitsSec =
  Max(0.056, 2 * (N2NE_BW_To + 0.2 * N2NE_BW_From))
```

Else

```
2NE_BW_Required_To_MbitsSec = 0
```

This is the amount of traffic that a circuit to the ELAN on the local node from the ELAN on the other node must be able to handle.

WAN traffic from local node on CLAN

The traffic on the WAN between the CLANs of two nodes may consist of both consolidated historical statistics reporting traffic and consolidated network CBC reporting traffic. This section is concerned only with the traffic to a particular node rather than all other nodes.

For every historical report, CBC report or data extraction selected from this node, the amount of information per row for each of the standard reports (ReportRowBytes) is shown in “List of standard reports” on page 333.

Traffic is computed for each report that is from this node for a client on the other node based on 40 percent protocol overhead as

```
CONS_Traffic_Node_Mbits =
  DataRowsPerNode * DataRowBytes * 8 * #_Times_Run * 1.4 /
  1000000
```

Total bandwidth required for Symposium Call Center Server consolidated reporting is computed as

```
CONS_Data_From_BW_Required_Mbits =
  SUMOF_ALL (CONS_Traffic_Node_Mbits)
```

...for all reports from node

Computing the required capacity

The required WAN capacity is based on the maximum allowable duration for running all of the reports included in Appendix C, "List of standard reports," on page 333. The duration value represents the maximum allowable amount of time to execute this set of reports/data extractions.

```
Duration_Sec = min(3600; Maximum_duration_in_hours * 3600)

CONS_Data_From_BW_Required_MbitsSec =
  Cons_Data_From_BW_Required_Mbits / Duration_Sec
```

If CONS_Data_From_BW_Required_MbitsSec > 0 or CONS_Data_To_BW_Required_MbitsSec > 0

```
N2NC_BW_Required_From_MbitsSec =
  Max(0.056, 2 * (CONS_Data_From_BW_Required_MbitsSec +
        0.2 * CONS_Data_To_BW_Required_MbitsSec))
```

Else

```
N2NC_BW_Required_From_MbitsSec = 0
```

WAN traffic to local node on CLAN

The traffic on the WAN between the CLANs of two nodes can consist of both consolidated historical statistics reporting traffic and consolidated network CBC reporting traffic. This section is concerned only with the traffic from a particular node rather then all other nodes.

For reporting traffic for historical statistics, consolidated historical statistics, CBC statistics, or for data extraction traffic generated by a client PC on the CLAN, see the amount of information per row for each of the standard reports (ReportRowBytes) in "List of standard reports" on page 333.

Traffic is computed for each report that is from this node for a client on the other node, based on 40 percent protocol overhead as

```
CONS_Traffic_Node_Mbits =
  DataRowsPerNode * DataRowBytes * 8 * #_Times_Run * 1.4 /
  1000000
```

Total bandwidth required for Symposium Call Center Server consolidated reporting is computed as

```
CONS_Data_To_BW_Required_Mbits =
  SUMOF_ALL (CONS_Traffic_Node_Mbits)
```

...for all reports from node

Computing the required capacity

The required WAN capacity is based on the maximum allowable duration for running all of the reports included in the above section. The duration value represents the maximum allowable amount of time to execute this set of reports and data extractions.

```
Duration_Sec = min(3600; Maximum_duration_in_hours * 3600)

CONS_Data_To_BW_Required_MbitsSec =
  Cons_Data_To_BW_Required_Mbits / Duration_Sec
```

if CONS_Data_To_BW_Required_MbitsSec > 0 or CONS_Data_From_BW_Required_MbitsSec > 0

```
N2NC_BW_Required_To_MbitsSec =
  Max(0.056, 2 * (CONS_Data_To_BW_Required_MbitsSec +
  0.2 * CONS_Data_From_BW_Required_MbitsSec))
```

Else

```
N2NC_BW_Required_To_MbitsSec = 0
```

This is the amount of traffic that a circuit to the CLAN on the local node from the CLAN on the other node must be able to handle.

WAN traffic between local node and NCC

An NCC node receives the network call recording events from all local nodes and sends the event records whenever they are requested by local nodes generating CBC reports. This traffic per node is NCBC_BW_Requried_MbitsSec, described in “Network CBC Traffic per Node on the CLAN (M1 only)” on page 213.

WAN traffic from NCC on ELAN

The traffic on the WAN between the ELANs of the NCC and the node consists of updates to the routing tables and remote applications table. These tables are only updated at configuration time and periodically thereafter. The following table describes what tables are involved in this process and what data is propagated when a particular item is changed.

Object changed	Tables involved	Data propagated	Sent to
Network Skillset (Added/ Modified/Deleted)	NINCCNetworkSkillset	Affected rows	All Nodes
Routing Information (Added/Modified/Deleted)	NINCCRanking	Affected rows for each skillset for each source node	Source Node
Site (Added/Modified/ Deleted)	NINCCSite	Affected rows	All Nodes
Application (Added/ Deleted at any site)	NINCCRemote Application	Entire Table	All Nodes
Network/Local CBC collection (Modified at any site)	NINCCRemote Application	Entire Table	All Nodes

The objects that are considered to result in the majority of traffic are those that affect the NINCCRemoteApplication table. As such, only the propagation of the NINCCRemoteApplication table is considered in the following analysis:

Propagation_Data_Mbits = SizeOf(NINCCRemoteApplication)*8 / 1000

Propagation_Data_MbitsSec = Propagation_Data_Mbits * 1.3 / (60*NCC_Period_Min)

NCCE_BW_Required_From_MbitsSec = Max(0.056, 2 * Propagation_Data_MbitsSec)

This is the amount of traffic that a circuit from ELAN on the NCC to the ELAN on the local node must be able to handle.

WAN traffic to NCC on ELAN

The only traffic that is sent from the local node to the NCC through the ELAN is TCP/IP protocol overhead. This is assumed to be 20 percent of the traffic from the NCC and is set to the minimum of 56 kbps.

NCCE_BW_Required_To_MbitsSec = Max(0.056, 0.4 * Propagation_Data_MbitsSec)

This is the amount of traffic that a circuit to the ELAN on the NCC from the ELAN on the local node must be able to handle.

WAN traffic from NCC on CLAN

The traffic on the WAN between the CLANs from the NCC to the node may consist of consolidated CBC reporting traffic. For the purpose of engineering enough WAN capacity, it is assumed that an individual on the CLAN of the current node runs a consolidated network CBC report such that all network CBC data collected at the NCC is reported on once. If this is not the case, then the WAN connection required capacity must be at least 56 kbps.

The bandwidth required to transmit this data is computed as NCBC_BW_Required_MbitsSec based on 30 percent protocol overhead for Bulk Copy Procedure (BCP). As such, the reporting traffic is computed based on 40 percent protocol overhead as if Network CBC data is retrieved from the NCC

```
BW_From_MbitsSec =
    NCBC_BW_Required_MbitsSec * 1.4 / 1.3
```

else

```
BW_From_MbitsSec = 0
```

```
NCPC_BW_Required_From_MbitsSec =
  Max(0.056, 2 * BW_From_MbitsSec + 0.4 *
  Total_NCC_BW_Required_MbitsSec)
```

This is the amount of traffic that a circuit from the NCC to the local node must be able to handle.

WAN traffic to NCC on CLAN

The traffic on the WAN between the CLANs from the node to the NCC consists of CBC traffic plus any data for consolidated reporting performed by a client PC on the CLAN of the NCC.

Collection of network CBC data

The WAN bandwidth required to transmit the CBC data is computed based on the total amount of CBC traffic that is sent to the NCC every hour. Based on 30 percent protocol overhead for BCP, the total WAN bandwidth required from the node is computed as

```
NCBC_Records_PerHour =
  SUMOF (
    IACC_CBC_Events * nwAccNetwPeakCallRate
    IREJ_CBC_Events * nwRejNetwPeakCallRate
  ) * pCBCNetwork
```

It is assumed that the size of each record is the size of a record in the CBC database, namely the NIeNetCallByCallStatYYYYMMDD event table (NetCbcRecSize), which can be obtained from “Computing the number of rows per table” on page 326. Therefore, the amount of information sent per hour, assuming 30 percent protocol overhead, is computed as

```
Total_NCBC_Traffic_KbHr =
  NCBC_Records_PerHour * NetCbcRecSize * 1.3
```

```
Total_NCBC_BW_Required_MbitsSec =
  (Total_NCBC_Traffic_KbHr / 1000) * 8 / 3600
```

Every historical report, CBC report, or data extraction selected from this node generates reporting traffic. This reporting traffic can consist of both consolidated historical statistics reporting traffic and consolidated network CBC reporting traffic.

For consolidated historical statistics reporting traffic, the amount of information per row for each of the standard reports (ReportRowBytes) is shown in Appendix C, “Symposium Call Center Server standard reports,” on page 331.

Traffic is computed for each report that is from this node for a client on the NCC based on 40 percent protocol overhead as

```
NCC_Cons_Traffic_Mbits =
  DataRowsPerNode * DataRowBytes * 8 * #_Times_Run * 1.4 /
  1000000
```

Total bandwidth required for Symposium Call Center Server consolidated reporting is computed as

```
NCC_Cons_Data_BW_Required_Mbits =
  SUMOF_ALL (NCC_Cons_Traffic_Mbits)
```

...for all reports from node

Computing the required capacity

The required WAN capacity is based on the maximum allowable duration for running all of the reports included in “List of standard reports” on page 333. The duration value represents the maximum allowable amount of time to execute this set of reports or data extractions.

```
Duration_Sec = min(3600; Maximum_duration_in_hours * 3600)

Total_NCC_BW_Required_MbitsSec =
  NCC_Cons_Data_BW_Required_Mbits / Duration_Sec +
  Total_NCBC_BW_Required_MbitsSec

NCPC_BW_Required_To_MbitsSec =
  Max(0.056, 2* (Total_NCC_BW_Required_MbitsSec + 0.2 *
  BW_From_MbitsSec))
```

This is the amount of traffic that a circuit to the CLAN on the NCC from the CLAN on the local node must be able to handle.

Sample analysis of network CBC data collection capacity requirements

Since nwAccNetwPeakCallRate and nwRejNetwPeakCallRate are a function of the NetworkPeakCallRate, the bandwidth required is dependent on the number of nodes in the network and the proportion of network CBC data that is collected. The collection of network CBC data can be disabled on an application basis at each node giving the administrator control over the amount of data collected (pCBCNetwork). The following tables demonstrates how the required bandwidth for a single node depends on the number of nodes in the network and the proportion of CBC data collected.

CLAN WAN bandwidth required to NCC in kbps per node to support network CBC data collection with 10 percent of calls networked

	pCBCNetwork				
# Nodes in network	**20%**	**40%**	**60%**	**80%**	**100%**
2	2.8	5.5	8.3	11	14
3	6.2	12	19	24	30

# Nodes in network	pCBCNetwork				
	20%	40%	60%	80%	100%
4	11	22	34	44	56
5	14	28	42	56	70
6	17	34	50	68	84
10	28	56	84	112	140
20	56	112	N/A	N/A	N/A
30	84	N/A	N/A	N/A	N/A

Note: This table assumes a daily call rate of 10 000 CPH and a value of 10 percent for pNetOut for each node.

CLAN WAN bandwidth required to NCC in kbps per node to support network CBC data collection with 50 percent of calls networked

# Nodes in network	pCBCNetwork				
	20%	40%	60%	80%	100%
2	14	28	41	56	70
3	31	60	95	N/A	N/A
4	55	110	N/A	N/A	N/A
5	70	140	N/A	N/A	N/A
6	84	N/A	N/A	N/A	N/A
10	140	N/A	N/A	N/A	N/A
20	N/A	N/A	N/A	N/A	N/A
30	N/A	N/A	N/A	N/A	N/A

Note: This table assumes a daily call rate of 10 000 CPH and a value of 50 percent for pNetOut for each node.

Since the maximum allowable amount of network CBC data that can be collected is limited to 10 000 calls per hour, for all nodes the value of pCBCNetwork must decrease as the number of nodes in the network is increased.

WAN traffic at local node

At every local node "hub" some of the ELAN and CLAN networking-related traffic is routed to other nodes via a WAN. The ELAN traffic routed over the WAN consists of remote agent requests and responses described in "Network Agent Requests Impact on the ELAN (M1 only)" on page 180. The CLAN traffic consists of the network calls event information that is recorded on the NCC described in "Network CBC Traffic per Node on the CLAN (M1 only)" on page 213, and reporting traffic described in "Reporting traffic on the CLAN" on page 207.

If there is a router on each LAN then the total WAN bandwidth that the router connected to the ELAN must be able to handle is computed as

```
WAN_ELAN_MbitsSec =
  N2NE_BW_Required_From_MbitsSec +
  N2NE_BW_Required_To_MbitsSec +
  NCCE_BW_Required_From_MbitsSec +
  NCCE_BW_Required_To_MbitsSec
```

If there is a router on each LAN then the total WAN bandwidth that the router connected to the CLAN must be able to handle is computed as

```
WAN_CLAN_MbitsSec =
  N2NC_BW_Required_From_MbitsSec +
  N2NC_BW_Required_To_MbitsSec +
  NCPC_BW_Required_From_MbitsSec +
  NCPC_BW_Required_To_MbitsSec
```

If there is a single router on both LANs, then the total WAN bandwidth that the router must be able to handle is computed as

```
WAN_LAN_MbitsSec =
  WAN_ELAN_MbitsSec + WAN_CLAN_MbitsSec
```

Calculate WAN requirements (DMS/MSL-100)

Introduction

The WAN is used to carry the ELAN and CLAN traffic between the customer site and the carrier site (usually the telephone company site). Discussion of the WAN connecting a DMS/MSL-100 switch is beyond the scope of this manual. For more information, refer to the *DMS-100 ICM Router Guide*.

WAN traffic for ELAN

The total amount of ELAN traffic on the WAN can be calculated as

```
DMS_ELAN_WAN_Required_MbitsSec =
  MAX(0.056, SUMOF(
     MLinkIn_BW_Required_MbitsSec
     ICM_In_BW_Required_MbitsSec
     ICM_Out_BW_Required_MbitsSec
     IVR_BW_Required_MbitsSec
  ))
```

This is the amount of traffic that the WAN and router must be able to handle.

WAN traffic for CLAN

The total amount of CLAN traffic on the WAN can be calculated as

```
DMS_CLAN_WAN_Required_MbitsSec =
  MAX(0.056, SUMOF(
     CLAN_IVR_BW_Required_MbitsSec
  ))
```

This is the amount of traffic that the WAN and router must be able to handle.

Online database backup elapsed time

Introduction

The online database backup runs as a low priority background task and does not impact the CPU time required by Symposium Call Center Server for call processing or reporting. The CPU time required by Symposium Call Center Server does impact the elapsed time of the online database backup. Since the database backup can use only the unused portion of the CPU, the busier the system the longer the backup takes.

Calculating online backup elasped time

The elapsed time of the online database backup can be computed as

`Available_CPU` =
`100% - U`$_{Total}$

`DB_CPU_Cost` =
`DBBackupDAT_cost` (if a Seagate DAT tape drive is used)
`DBBackupMLR_cost` (if a Tandberg MLR tape drive is used)

`BackupElpasedTime_Hours` =
`TotalBackupSizeKb / 1,000,000 * DB_CPU_Cost * 1.5`
`/ (3600 * Available_CPU/100%)`

Note: TotalBackupSizeKb is obtained in "Backup size computations" on page 151.

Chapter 6

Engineering the NCC server

In this chapter

Overview

Introduction

This chapter presents the performance characteristics of the Symposium Call Center Server Network Control Center (NCC) server and describes the CPU, memory, disk, ELAN, CLAN, and WAN resources required for the NCC.

NCC server hardware platforms

Introduction

The following table shows the currently available Symposium Call Center Server Network Control Center (NCC) server configurations:

#	Configuration	MAS base	CPU	Memory (Mbytes)	Disk (Gbytes)	Symbol	Tape	CD-ROM
1	1001t Base 256/18	1001t	PII300	256	18	PII399/256/18	16/32 GB SCSI	24X
2	1001t Raid 256/18	1001t	PII300	256	2 x 36	PII300/256/36	16/32 GB SCSI	24X
3	1003t Raid 256/22	1003t	PIII500	256	2 x 22	2PPIII500/256/44	16/32 GB SCSI	32X

Note: For RAID disk systems, actual usable disk space is half the total physical disk capacity.

NCC server performance parameters

Introduction

The Network Control Center (NCC) performance parameters used for the Symposium Call Center Server NCC Server can be found in “Record your workload parameters” on page 122. The common parameters for the NCC have the same values as those given in “Common parameters” on page 285, except for Historical Data. The NCC does not maintain historical statistics, although the nDCallbyCall parameter is used. The NCC does not support real-time displays, agent operations or voice services.

Call load

The NCC is a service provider to all Symposium Call Center Server network nodes. It does not perform any call processing directly. However, the resource load for the NCC server is a function of the total network call rate to the Symposium Call Center Server network. A large portion of the NCC load is due to the receiving (recording) and sending (reporting) of call-by-call (CBC) records to and from the individual network nodes. The resource limits on the NCC server may thus limit the individual networked call rates per site, which in turn limits the overall call rate per site.

The call load on the NCC server is proportional to the number of events generated by network calls from occurrences of acceptances and rejections at the destination nodes. See “Network Agent Requests Impact on the ELAN (M1 only)” on page 180 for the definitions of call types.

Resource usage

The major contributor to resource usage on the NCC is the rate of CBC records being sent by the network nodes to the NCC. This is a function of the number of Queue to Network Skillsets (QTNS) applied per call and whether or not the collection of network CBC data has been enabled for the original application that handled the call at the source node. An example of this is given in “WAN traffic from NCC on CLAN” on page 247. The mean number of QTNS’s per call is given by aQTNSPerNetwCall and is the average number of QTNSs per call over all calls.

NCC server performance summary

Resource usage on the NCC is a function of CBC recording and reporting, routing table updates, and the number of network nodes. Since the amount of network CBC data that can be collected at the NCC is limited to 10 000 calls per hour (CPH), the NCC performance is not affected significantly by the number of nodes in the network.

The following sections detail the CPU, memory, LAN, and disk space requirements of the Symposium Call Center Server NCC server. The CPU and memory requirements are estimated based on performance test measurements. The disk space and LAN requirements are estimated based on the size of the database tables and the number of messages passed between the Symposium Call Center Server components during normal operation.

NCC server CPU requirements

Introduction

The total NCC server CPU utilization is comprised of the following components:

- background CPU
- call event recording
- call event reporting
- routing table operations

Each of these components are described in the following sections.

NCC workload CPU scenario requirements

The capacity of the NCC server depends on the amount of network CBC data being collected, the rate at which routing table updates are distributed to the nodes, and the amount of reporting done by the client systems. A detailed analysis of the network call center operation capacity can be derived using the computations that appear in the following sections.

Most processing done by the NCC tends to be bursty in nature. Either there is network CBC data being loaded into the database or the data is being extracted for reporting purposes. The average CPU utilization of the NCC is expected to remain below the engineering point of 50% although there can be short periods where the CPU utilization exceeds this. The limiting factor for running reports is normally the bandwidth of the WAN and LAN connections to the NCC.

NCC detailed CPU requirements computations

The total CPU requirement given is derived by summing all the contributions to CPU utilization. The same notation is used to represent the individual CPU utilization components as given in "Detailed CPU requirement computations" on page 152:

$$\mathtt{NCC\_U}_{\mathtt{Total}} = \Sigma U_i$$

The utilization components used for the NCC CPU requirements are given in the following table:

NCC CPU utilization components

Description	Utilization component (U_i) (% of CPU)
Background CPU (BG)	U_{BG}
NCC CBC Event Recording	U_{NER}
NCC Event Reporting	U_{NERP}
Routing Table Operations (RTO)	U_{RTO}

The CPU requirements are based on measurements taken during performance testing. These measurements are summarized in the following table for the Pentium Pro 200 (PP200) processor:

CPU measurements summary (based on PP200)

Parameter	Value	Units	Notes
U_{BG}	0.01	% (=1%)	Overall background CPU (%) on PP200
NBCP_RInsert_Cost	0.00043	CpuSec	Cost of a single BCP remote insert (Sybase)
NCC_Retrieve_Cost	0.00039	CpuSec	Cost for a row selected

In the following sections, details of each utilization calculation is given, followed by the total CPU utilization summary.

NCC background CPU

The background CPU is the amount of CPU resource that is used when no other utilization components are running. Background CPU is a measured quantity.

NCC call event recording CPU

Events associated with the processing of networked calls at the destination node are recorded at the destination and then sent periodically to the NCC. The NCC inserts these records into the NCC CBC database. The CPU cost of doing this depends on the number of records that have to be inserted per unit of time.

NCBC_BCP_RecordsPerHour is the number of records generated in the NCC CBC database in an hour. This number depends on the call rate and the proportion of network incoming and outgoing calls.

```
NCBC_BCP_RecordsPerHour =
  SUMOF(
     IACC_CBC_Events * nwAccNetwPeakCallRate
     IREJ_CBC_Events * nwRejNetwPeakCallRate
  )* pCBCNetwork/100
```

Each node inserts these records into the NCC CBC database using remote bulk copy procedure (BCP). The CPU cost of doing this depends on the number of records that have to be inserted per unit of time. The BCP disk insert rate is a function of the number of CBC records sent per hour.

```
NCBC_BCP_DiskInsertRate_InsertsSec =
  NCBC_BCP_RecordsPerHour/3600
```

The CPU cost for the event recording is stated as

```
NCBC_ER_CPU% =
  NCBC_BCP_DiskInsertRate_InsertsSec * NBCP_RInsert_Cost
  * 100%
```

U_{NER} = NCBC_ER_CPU%

NCC call event reporting CPU

Reports can be requested by clients throughout the network. CBC data recorded at the destination are stored at the NCC and must be accessed by each client to generate reports. It is assumed that the number of records retrieved from the NCC for reporting is roughly equivalent to the number of records sent to the NCC. The rate of CBC records sent to the NCC per hour is derived in the previous section “NCC call event recording CPU” on page 238 and is NCBC_BCP_Records_PerHour. The rate of CBC record retrieval then is

```
NCBC_Retrieve_RecordsPerSec =
  NCBC_BCP_Records_PerHour/3600
```

The CPU cost for retrieving CBC records for reporting is

```
NCBC_RetrieveCPU% =
  NCBC_Retrieve_RecordsPerSec * NCC_Retrieve_Cost * 100%
```

U_{NERP} = NCBC_RetrieveCPU%

NCC routing table operations CPU

NCC routing tables are configured for each node at the NCC. The routing tables are then propagated to each respective node. The configuration itself is expected to have a negligible impact on the CPU. These tables are also sent to each of their respective nodes if any of the configuration parameters have changed. The sending is done on a periodic basis and the CPU cost incurred from this activity is considered to be negligible, as in the following formula:

U_{RTO} = 0%

Impact of online database backup

The online database backup runs as a low priority background task. Although it consumes CPU resources, it does not impact the CPU time required by the NCC for CBC record processing or routing table processing.

NCC server memory requirements

Introduction

Standard Symposium Call Center Server system configurations currently come with 256 Mbytes of RAM. In these systems, performance on the Symposium Call Center Server is limited by the CPU and not by the memory. However, present memory configurations are adequate for the NCC server.

NCC server disk space requirements

Introduction

The disk space required for the NCC consists primarily of the network CBC database. Since there is no call processing, the size of the database is static.

NCC detailed disk requirements

The calculations to derive the disk size requirements are identical to those for the Symposium Call Center Server since the database structures are identical. However, the table sizes are different. For the calculations, refer to “Calculate server disk utilization” on page 145.

NCC configuration tables disk space

The determination of the NCC configuration table sizes is identical to “Configuration Tables Disk Space” on page 145, except that most values are zero, with the exception of nNetNodes, nNetSkillsets, and the predefined constants that are documented in Table 8.

NCC Interval, Daily, Weekly, and Monthly tables disk space

All of these tables are empty since none of these statistics are recorded at the NCC. When using the Symposium Call Center Server model, set all of the historical data parameters to zero.

NCC event tables disk space

The Agent Login, IVR Port, and Call-by-Call statistics tables contain no records.

The Network Call-by-Call Statistics table contains all of the incall network call events for all calls that originate at a source node with the call detailed reporting option enabled for the application that initially processes the call.

Note: There is one Network Call-by-Call Statistics table for each day of CBC records.

The size of a Network CBC database record (NetwCBCRecSize) in kbytes is the row size of table NIeNetCallByCallStatYYYYMMDD. For more information, refer to “Symposium Call Center Server database table sizes” on page 312. The size of the NIeNetCallByCallStatYYYYMMDD event table in the NCC is a function of the call rate, proportion of network calls, and data retention period.

```
NCallByCallSizeKb =
  SizeOf(NIeNetCallByCallStatYYYYMMDD)
```

NCC total disk space requirements

Calculations for the total disk space requirements for the NCC is similar to those for the Symposium Call Center Server given in “Detailed computations” on page 148. The overhead is the same for the sizes of the Windows NT, MAS, and Symposium Call Center Server executables as well as the Master and User databases. The only differences is in the Blue (system) database where there are only configuration tables. Some of the overheads for log files and temporary disk space are modified for the NCC. The differences in the calculations are given below:

```
NDB_Log_Overhead = 0.2 (20%)

NDB_Temp_Overhead = 0.3 (30%)

NCBC_Log_Overhead = 0.05 (5%)

NCBC_Temp_Overhead = 0.3 (30%)

NCBC_DB_SpaceKb =
  NCallByCallSizeKb * (nDCallbyCall + 1.5) *
  (1 + NCBC_Log_Overhead + NCBC_Temp_Overhead)

NBlue_DB_SpaceKb = 2097152

NTotalDiskSpaceRequiredMb =
  ((NCBC_DB_SpaceKb + NBlue_DB_SpaceKb) /
  Max_Disk_Utilization + Overhead_SpaceKb) / 1000
```

NCC ELAN requirements

Introduction

Embedded LAN (ELAN) traffic associated with the Network Control Center (NCC) consists primarily of NCC traffic (NCCUpd_Utilization). This traffic consists of periodic broadcasting of the routing tables by the NCC nodes. These updates occur once every NCC_Period_Min minutes. For a single node, this traffic is insignificant, as shown in “Calculate ELAN utilization (M1)” on page 171. For a multinode network, the traffic is still considered to be insignificant compared to the capacity of the ELAN.

The following routing tables are propagated from the NCC:

- NINCCSite—changes only
- NINCCRanking—changes only
- NINCCNetworkSkillset—changes only
- NINCCRemoteApplication—entire table

NCC CLAN requirements

Introduction

The NCC Customer LAN (CLAN) primarily carries traffic for CBC recording and reporting.

NCC CLAN detailed requirements

The traffic on the CLAN consists of CBC event data and consolidated CBC reporting traffic. The NCC ELAN utilization is calculated as

```
NCC_CLan_Utilization =
  NCC_NCBC_Utilization + NCBC_Reporting_Utilization
```

The following sections describe the detailed computations for each component.

CBC CLAN requirements

When processing a networked call that originates on another node, the server records events associated with this call in the local CBC database. These events are also reported to the NCC. The events associated with successful, as well as with rejected and cancelled network calls, are sent to the NCC. The number of records generated in NCC CBC database in an hour is calculated as

```
NCBC_BCP_RecordsPerHour
```

Assuming 30% protocol overhead for bulk copy procedure (BCP), the required bandwidth for the NCC CLAN is

```
NCC_NCBC_BW_Required_MbitsSec =
  NCBC_BCP_RecordsPerHour * NetwCBCRecSize * 1.3 / 1000 *
  8 / 3600
```

Note: NetwCBCRecSize is the record size of the NIeNetCallByCallStatYYYYMMDD table documented in “Symposium Call Center Server database table sizes” on page 312.

The utilization component for the NCC CLAN then is

```
NCC_NCBC_Utilization =
  NCC_NCBC_BW_Required_MbitsSec / TCPIP_Bandwidth
```

Consolidated reporting traffic

It is assumed that all clients connected to the NCC reside on the CLAN of the local node. As such, the running of consolidated reports does not affect the CLAN of the NCC unless the NCC CLAN and the CLAN of the local node are constructed such that all traffic flows across both LANs.

NCC CBC reporting traffic

Clients connected to the NCC can request a CBC report on network activity. For each report run, the user must specify which node the report is based on. It is assumed that all data collected is reported on once. As such, it is assumed that the amount of information retrieved from the local nodes for network CBC reporting is roughly equivalent to the amount of information sent to the NCC due to reporting activities on the local node. With a 40-percent protocol overhead for reporting, the amount of information retrieved per hour is computed as

```
NCBC_Reporting_BW_Required_MbitsSec =
  NCBC_BCP_RecordsPerHour * NetwCBCRecSize * 1.4 / 1000 *
  8 / 3600
```

The utilization component for the NCC CLAN then is

```
NCC_Reporting_Utilization =
  NCBC_Reporting_BW_Required_MbitsSec / TCPIP_Bandwidth
```

NCC server and WAN traffic

Introduction

An NCC node receives the network call recording events from local nodes and sends the events records whenever they are requested by local nodes generating CBC reports. This traffic is described in “CBC CLAN requirements” on page 244 as *NCC_NCBC_BW_Requried_MbitsSec*.

WAN traffic from NCC on ELAN

The only traffic from the NCC ELAN is the updating of the routing tables. As such, the ELAN WAN traffic for each server is computed as

```
EWAN_BW_From_NCC_MbitsSec = NCC_BW_Required_From_MbitsSec
```

This is the amount of traffic that a router on an NCC ELAN must be able to handle. To analyze the required bandwidth for each individual circuit between the different nodes and the NCC, see “WAN Traffic between Local Node and NCC” on page 221.

WAN traffic to NCC on ELAN

The only traffic to the NCC ELAN is the protocol overhead for the updating of the routing tables. The ELAN WAN traffic for each server is computed as

```
EWAN_BW_To_NCC_MbitsSec = NCC_BW_Required_To_MbitsSec
```

This is the amount of traffic that a router on an NCC ELAN must be able to handle. To analyze the required bandwidth for each individual circuit between the different nodes and the NCC, see “WAN Traffic between Local Node and NCC” on page 221.

WAN traffic from NCC on CLAN

The only traffic from the NCC CLAN is the network CBC reporting traffic. CLAN WAN traffic for each server is computed as

```
CWAN_BW_From_NCC_MbitsSec =
  NCPC_BW_Required_From_MbitsSec
```

This is the amount of traffic that a router on an NCC CLAN must be able to handle. To analyze the required bandwidth for each individual circuit between the different nodes and the NCC, see "WAN Traffic between Local Node and NCC" on page 221.

WAN traffic to NCC on CLAN

The only traffic to the NCC CLAN is the network CBC event data. CLAN WAN traffic for each server is computed as

```
CWAN_BW_To_NCC_MbitsSec = NCPC_BW_Required_To_MbitsSec
```

This is the amount of traffic that a router on an NCC CLAN must be able to handle. To analyze the required bandwidth for each individual circuit between the different nodes and the NCC, see "WAN Traffic between Local Node and NCC" on page 221.

Total WAN traffic at NCC

If there is a router on each LAN, then the total WAN bandwidth required by the router connected to the ELAN or CLAN is the same as above. If there is a single router on both LANs, then the total WAN bandwidth that the router must be able to handle is computed as

```
NCC_WAN_MbitsSec =
  EWAN_BW_From_NCC_MbitsSec + EWAN_BW_To_NCC_MbitsSec +
  CWAN_BW_From_NCC_MbitsSec + CWAN_BW_To_NCC_MbitsSec
```

Online database backup elapsed time calculation

Introduction

The online database backup runs as a low priority background task and does not impact the CPU time required by Symposium Call Center Server for call processing or reporting. The CPU time required by Symposium Call Center Server does impact the elapsed time of the online database backup. Since the database backup can only use the unused portion of the CPU, the busier the system the longer the backup takes. The elapsed time of the online database backup can be computed as

NCC_Available_CPU =
100% - NCC_U$_{Total}$ (from section "NCC detailed CPU requirements computations" on page 236)

NCC_Database_Size_MB =
sizeof(NIeNetCallbyCallStatYYYMMDD) / 1024

NCC_DB_CPU_Cost = DBBackupMLR_cost

NCC_BackupElpasedTime_Hours =
NCC_Database_Size_MB / 1000 * NCC_DB_CPU_Cost * 1.5 / (3600 * NCC_Available_CPU/100)

Chapter 7

Planning Meridian Mail requirements (M1 only)

In this chapter

Meridian Mail platforms

Introduction

Meridian Mail, Release 8 or higher must be used with Symposium Call Center Server. The following table shows the four Meridian Mail platforms, the numbers of ports available on each of these platforms, and the increments for port additions.

Meridian Mail platform	Ports	Port increments	Approx. maximum CCS	Maximum port requests at 1 min MHT	Maximum port requests at 30 sec MHT
Card Opt	2–12	2 ports	247	412	824
EC 11	4–48	4 or 8 ports	1342	2237	4474
Modular Opt/Modular Opt GP	4–64	4 or 8 ports	1858	3097	6194
Modular EC	4–96	4 ports	2912	4853	9706

Notes:

- 1 CCS is 100 call-seconds. 36 CCS is the equivalent of 1 erlang and is the amount of traffic one port can handle if it is busy all the time.
- MHT is not to be confused with call rate. A single call can create more than one port request.

Meridian Mail ports requirements

Introduction

This chapter provides information for determining the number of voice ports required to accommodate Meridian Mail on a Symposium Call Center Server system.

To calculate ports requirements

The number of voice ports required depends on

- the rate of port requests
- the duration of voice session
- the Grade of Service

Grade of Service (GOS) refers to the probability that requests will be delayed by more than a certain number of seconds. For Meridian Mail, the standard GOS used is 5 percent probability that the calls will be delayed for more than 6 seconds, and 95 percent of the calls will incur a delay of less than 6 seconds.

The computation of voice port requirements for Give Controlled Broadcasts (GBC) in Start/Stop mode include the computation of port request rate based on Broadcast Port Wait timer, Poisson request arrival rate, and the maximum number of calls per port (=50). Once the port request rate is computed, the Erlang C computations are applied.

The computations of voice port requirements for Give Controlled Broadcasts in Continuous (GCBC) mode are based on Erlang B and the maximum number of calls per port (=50).

Total number of ports required is computed as

```
TotalVoicePorts =
  nGIVR_Ports + nVSCDG_Ports + nGCB_Ports + nGCBC_Ports
```

Total number of ports required by the Symposium Call Center Server controlled voice processing (control is maintained over the ACCESS link) is based on the ports required for GCB, GCBC and collect digits voice session (VSCDG) services:

```
TotalSVPVoicePorts =
  nVSCDG_Ports + nGCB_Ports + nGCBC_Ports
```

Note that TotalSVPVoicePorts cannot exceed the number of ports supported by a single ACCESS link (96 ports).

For the predefined workloads with the Symposium Voice Processing (SVP) call model (see “Workload types” on page 281), the number of voice ports required is 36 (for 1000 CPH), 90 (for 5000 CPH), and 154 (for 10 000 CPH). Detailed computations appear in the following sections.

Note: Voice ports cannot be shared on either the M1 or DMS/MSL-100 switches.

Installation grounding (M1 only)

To avoid damage that could occur to the Symposium Call Center Server, the switch, or Meridian Mail as a result of poor grounding, electro-optical isolators should be installed for use on the RS-232 ACCESS cable. Use this type of isolator to ensure that no surges occur during electrical disturbances.

GIVR_Ports computations

The number of voice ports required for Give IVR (GIVR) voice service depends on the rate of GIVR requests and the duration of the GIVR treatment. The formula for determining the rate of GIVR services is

```
GIVR_Rate = PeakCallRate * aGIVRPerCall
```

In the following table, use the nearest values for IVR rate and duration (GIVR_Rate and nGIVR_Duration) to determine the number of ports required, as

```
nGIVR_Ports = ports from the following table
```

Number of ports required for GIVR and VSCDG voice services

GIVR_Rate VSCDG_Rate	nGIVR_Duration or nVSCDG_Duration (Seconds)			
	15	**30**	**45**	**60**
250	4	5	7	8
500	5	8	11	13
1000	8	13	18	23
2000	13	23	32	41
3000	18	32	45	59
4000	23	41	59	76
5000	28	50	72	93
6000	32	59	84	110
7000	37	67	97	127
8000	41	76	110	144
9000	45	84	123	161
10 000	50	93	136	178

VSCDG_Ports computations

The number of voice ports required for collect digits voice session (VSCDG) depends on the rate and duration of VSCDG requests. To determine the rate of VSCDG services, use the following formula:

```
VSCDG_Rate = PeakCallRate * aVSCDGPerCall
```

In the preceding table, use the nearest values for VSCDG rate and duration (VSCDG_Rate and nVSCDG_Duration) to determine the number of ports required, as in the following formula:

```
nVSCDG_Ports = ports from the preceding table
```

For the predefined workloads (see “Workload types” on page 281), the number of required voice ports for VSCDG is 18 for 1000 CPH, 72 for 5000 CPH, and 136 for 10 000 CPH.

GCB_Ports computations

The number of voice ports required for Give Controlled Broadcast (Start/Stop) voice sessions depends on

- the rate of GCB requests
- the duration of the GCB announcements
- the average number of distinct continuous broadcast announcements executed at a time
- the length of the broadcast port wait timer

The following estimations assume that the distinct start/stop broadcasts are used equally. To determine the rate of GCB services

```
GCBC_Rate =
  PeakCallRate * aGCBPerCall / nGCB_Simultaneous
```

The following table shows the numbers of ports required for service rates from 500 to 6000 requests per hour and Broadcast port timer values from 0 to 20 seconds. In the table on page 253, use the nearest values for GCB rate and duration (GCB_Rate and nGCB_Duration) to determine the number of ports required:

```
nGCB_Ports =
  nGCB_Simultaneous * (ports from the following table)
```

For the predefined workloads (see “Workload types” on page 281), the number of required voice ports for GCB is 18 for all call rates greater than 1000 CPH.

Number of ports required for Give Controlled Broadcast Start/Stop

	Announcement duration (seconds)			
nGCB_WTimer	**30**	**60**	**90**	**120**
Rate = 500 GCB Per Hour				
0	8	13	18	23
2	8	13	18	23
4	8	13	18	23
6	8	13	18	23
8	8	12	17	21
10	7	11	14	18
12	6	9	12	15
14	5	8	11	14
16	5	8	10	12
18	5	7	9	11
20	4	7	9	11
Rate = 1000 GCB per hour				
0	13	23	32	41
2	13	23	32	41
4	12	21	29	37
6	9	15	21	27
8	8	12	17	21
10	7	11	14	18
12	6	9	12	15

	Announcement duration (seconds)			
nGCB_WTimer	**30**	**60**	**90**	**120**
14	5	8	11	14
16	5	8	10	12
18	5	7	9	11
20	4	7	9	11
Rate = 2000 GCB per hour				
0	23	41	59	76
2	21	37	53	69
4	12	21	29	37
6	9	15	21	27
8	8	12	17	21
10	7	11	14	18
12	6	9	12	15
14	5	8	11	14
16	5	8	10	12
18	5	7	9	11
20	4	7	9	11
Rate = 4000 GCB per hour				
0	41	76	110	144
2	21	37	53	69
4	12	21	29	37
6	9	15	21	27

	Announcement duration (seconds)			
nGCB_WTimer	**30**	**60**	**90**	**120**
8	8	12	17	21
10	7	11	14	18
12	6	9	12	15
14	5	8	11	14
16	5	8	10	12
18	5	7	9	11
20	4	7	9	11
Rate = 6000 GCB per hour				
0	59	110	161	212
2	21	37	53	69
4	12	21	29	37
6	9	15	21	27
8	8	12	17	21
10	7	11	14	18
12	6	9	12	15
14	5	8	11	14
16	5	8	10	12
18	5	7	9	11
20	4	7	9	11

GCBC_Ports computations

The number of voice mail ports required for Give Controlled Broadcast (Continuous) voice sessions depends on

- the rate of GCBC requests
- the duration of the GCBC announcements
- the average number of distinct continuous broadcast announcements executed at a time

The following estimations assume that the distinct continuous broadcasts are used equally. To determine the rate of GCBC services

```
GCBC_Rate =
  PeakCallRate * aGCBCPerCall / nGCBC_Simultaneous
```

In the following table, use the nearest values for GCBC rate and duration (GCBC_Rate and nGCBC_Duration) to determine the number of ports required:

```
nGCBC_Ports =
  nGCBC_Simultaneous * (ports from following table)
```

For the predefined workloads (see “Workload types” on page 281), the number of required voice ports for GCBC is 0.

Number of ports required for Give Controlled Broadcast Continuous

Rate (calls per hour)	nGCBC_Duration (Seconds)			
	30	**60**	**90**	**120**
250	1	1	1	1
500	1	1	1	1
1000	1	1	1	1
2000	1	1	2	2
3000	1	2	2	3

Rate (calls per hour)	nGCBC_Duration (Seconds)			
	30	60	90	120
4000	1	2	3	3
5000	1	2	3	4
6000	2	3	4	5
7000	2	3	4	5
8000	2	3	5	6
9000	2	4	5	7
10 000	2	4	6	8

CSL link

The command and status link (CSL) facilitates communication between M1 and Meridian Mail. This link is only utilized when voice services are required for a call. The bandwidth of the CSL link is 9.6 kbps. The maximum utilization of CSL link is 70 percent. Maximum CSL call rate is estimated to be 56 523 Calls/Hour if all calls require voice service. The following table shows the utilization of the CSL link based on workload and the call rate.

CSL utilization per workload

Call rate	CSL utilization per workload (%)
1000	1.2%
5000	6.2%
10 000	12.4%
15 000	18.6%
20 000	24.8%
25 000	31.0%

Note: Maximum utilization is 70 percent.

The following describes the computation if CSL link capacity as well as the maximum rate of CSL related calls (Voice) it can support. Using the computations below, the Maximum CSL call rate is estimated to be 56 523 calls per hour.

The following table shows the variables and their values used in the CSL link calculations. For further details, see Appendix F, “Symposium Call Center Server detailed calculations.”

CSL services (Sizes include overhead)

Variable	Definition	Value
CSL_Bandwidth_KBitsSec	CSL Link Bandwidth (kbps)	9.6
CSL_Max_Utilization	CSL Link Maximum Utilization	0.7 (70%)
nGCB_Simultaneous	Average # simultaneous calls per port on GCB	(See “Common parameters” on page 285)

```
CSL_BW_Required_KbitsSec =
  (((PeakCallRate)/
  nGCB_Simultaneous)*CSL_Bytes_PerSession*AvgGCBCall*8)/
  1000)/3600

CSL_Utilization =
  100% * CSL_BW_Required_KbitsSec / CSL_Bandwidth_KBitsSec

Max_CSL_Sessions_PerHour =
  (CSL_Bandwidth*CSL_Max_Utilization*1000*3600)/
  (CSL_Bytes_PerSession*8)
```

NLI link

The network loop interface (NLI) link facilitates the voice path between M1 and Meridian Mail. It is used only for calls requiring IVR service. The number of the voice ports needed for this link must be calculated according to the number of voice sessions required by the Symposium Call Center Server, namely Voice_Services, which is the rate of voice services per hour that is determined from the Symposium Call Center Server applications.

MLS requirements

Introduction

The ACCESS link is used for communications between Symposium Call Center Server and Meridian Mail. It is required for all Meridian Mail-based voice processing. The following table shows the utilization of the ACCESS link based on workload and the call rate. The recommended ACCESS link speed is 19.2 kbps.

Call rate	ACCESS utilization (%)
1000	2.0%
5000	9.8%
10000	19.6%
15000	29.3%
20000	39.1%
25000	48.9%

ACCESS link

Symposium Call Center Server can support a single ACCESS link that is used by the Symposium Call Center Server software to control voice processing on Meridian Mail voice ports. Voice services, such as Give Controlled Broadcast Open/Close Voice Session, are examples of controlled voice processing. A single ACCESS link supports up to 96 voice ports. This might limit Symposium Call Center Server performance by limiting the rate of calls that require Symposium Call Center Server control of voice processing.

Symposium Call Center Server voice services that do not require local voice port control (such as Give IVR) do not result in the ACCESS link usage and, therefore, are not subject to the 96 ports limitation. Additional voice ports might be required, however, to support these services.

Note: For the predefined workloads with SVP call model (see “Workload types” on page 281), it is estimated that Symposium Call Center Server requires 64 to 96 voice ports or more, depending on the call rate. See the detailed computations of ports in “Planning Meridian Mail requirements (M1 only)” on page 249.

Chapter 8

Planning M1 switch requirements

In this chapter

Meridian 1 switch requirements

Supported software loads

You must use Meridian 1 (M1) release 24 or 25 in conjunction with Symposium Call Center Server Release 3.0.

Maximum achievable call rates

To determine the maximum achievable call rates for different M1 models, you must sum up all the contributions resulting from both the call complexity and the MLS commands issued by CTI applications. You must also add any other applications that may be communicating over the ELAN with the M1. You can achieve this by calculating the total Equivalent Basic Call (EBC) value for all incoming traffic. For more information, refer to your switch documentation.

Administration PC

An administration PC can be attached to the ELAN. This PC can only be used for general M1 and Symposium Call Center Server-related administration (such as SMI) and not for bandwidth-intensive applications such as historical reports or real-time displays.

M1 Networked ACD

The usage of Networked ACD (NACD) is transparent to Symposium Call Center Server. The call rates used in Symposium Call Center Server engineering are the total calls arriving to Symposium Call Center Server from the local M1, either directly or from M1 Networked ACD.

M1 ISDN

The Integrated Services Digital Network (ISDN) circuits to the Public Switched Telephone Network (PSTN) must be provisioned to handle the network call traffic to and from each M1 switch. It is assumed that these circuits are provisioned in a similar manner to that of M1 NACD.

Chapter 9

Planning DMS/MSL-100 switch requirements

In this chapter

Overview

Supported software loads

The DMS or MSL-100 with CCM10, CCM11, or CCM12 (Call Center Modules) software loads must be used in conjunction with Symposium Call Center Server Release 3.0. Refer to the DMS/MSL-100 engineering guidelines to properly configure the DMS/MSL-100.

Number of servers supported

A single DMS/MSL-100 can support up to 16 Symposium Call Center Server systems. Each Symposium Call Center Server system must be engineered independently of each other, but the DMS/MSL-100 must be engineered as a shared resource.

Requirement analysis

To analyze the impact from one or more Symposium Call Center Server systems on the DMS/MSL-100 switch, you must first calculate the workload on each of the Symposium Call Center Servers. You can then derive the resulting workload that is generated against the DMS/MSL-100 switch from each Symposium Call Center Server.

In CCM10 and CCM11, there are only 128 ICM/SCAI buffers to processing incoming/outgoing messages. Based on the details of a particular call processing scenario, the number of ICM/SCAI buffers may limit the maximum call rate that can be achieved. The details of the number of messages sent from and received by the server are discussed in "Call processing traffic impact on the ELAN" on page 184 and "External IVR traffic impact on the ELAN" on page 192. These sections do not include messages sent to and received from the switch by another server, such as external IVR fast transfer commands. DMS engineering organizations should be contacted to verify that the DMS can support any particular call processing scenario including Symposium Call Center Server.

Impact of MLS support

MLS traffic

Symposium Call Center Server supports a third-party Computer Telephony Integration (CTI) interface. For every CTI command sent to Symposium Call Center Server per call, a corresponding command is sent to the DMS/MSL-100. To analyze this activity, you must analyze the activity of each application that sends CTI commands to Symposium Call Center Server. The only MLS messages supported on the DMS/MSL-100 are

- initiate transfer
- complete transfer
- login
- logout
- ready
- not ready

For performance modeling purposes, only the transfer operations are considered, since the overall contribution due to number of agent interruptions per shift (that is, logon/logoff, ready/not ready) is expected to be insignificant when compared with the above events. If the IVR system is using the MLS capability of the Symposium Call Center Server server to transfer the call from the IVR voice port to the server CDN, then this additional traffic should be included in the MLS traffic when you calculate

- CPU requirements (see “Calculate server CPU utilization” on page 152
- MLS traffic on the ELAN (see “MLS traffic on the ELAN” on page 178)
- and MLS traffic on the CLAN (see “MLS traffic impact on the CLAN” on page 206)

Audio routes

Audio route requirements

Symposium Call Center Server can use up to 512 preconfigured audio routes. The audio routes are classified as either music routes or RAN routes depending on whether the last give treatment command in the audio route is Give Music or Give RAN respectively. The DMS/MSL-100 must have the capability to assign an audio route to every call waiting for an agent. Symposium Call Center Server supports up to 3000 waiting calls.

Number of CDNs required

CDNs

The calls arriving at any Symposium Call Center Server DN are held in a series of CDNs. Each CDN holds up to 511 calls. Symposium Call Center Server Release 3.0 only supports 1000 active agents, with active calls and 3000 waiting calls. Therefore, the maximum number of waiting calls must be less than 3000. For 3000 waiting calls, you require six CDNs. Therefore, the maximum number of CDNs required is six.

Chapter 10

Other guidelines

In this chapter

Symposium Call Center Server client

Client hardware configuration

To avoid performance and reliability problems, the minimum recommended Symposium Call Center Server client hardware configuration consists of an Intel Pentium 90 MHz PC with the following hardware features:

- 32 Mbytes of RAM for Windows 95, Windows 98 (64 Mbytes of RAM for Windows NT 4.0)
- hard disk drive with 1 Gbyte available
- one 3.5 inch 1.44 Mbyte floppy disk drive
- 4 speed (or higher) CD ROM
- one Ethernet Network Interface Card (NIC) or one Token Ring NIC
- parallel printer port
- serial port (16550 UART)
- VGA color monitor
- Windows compatible mouse

Notes:

- A Pentium 90 with 32 Mbytes of RAM might be sufficient for small sites managing a small number of objects (less than 100) at once and generate simple reports. A faster system is recommended for managing large numbers of objects (greater than 1000) and generating large reports.
- The generation of large call-by-call (CBC) reports can require up to 1 Gbyte of free disk space and can take up to two hours to produce with a Pentium 90 processor. A system with a Pentium II or III processor with at least 64 Mbytes of RAM is highly recommended for anyone trying to generate large CBC reports.

Client software configuration

Operating system

The Symposium Call Center Server client PC uses Windows 95, Windows 98, or the Windows NT 4.0 operating system. The Windows 95, Windows 98 and Windows NT 4.0 operating systems require at least 16 Mbytes of RAM and at least an additional 100 Mbytes of free disk space for swap files. Windows 95, Windows 98, and Windows NT require 130 Mbytes, 170 Mbytes, and 130 Mbytes respectively of hard disk space for the operating system software, depending on which options are selected at installation.

Note: Report generation on a Windows NT client system can be significantly improved with 64 Mbytes of RAM instead of 32 Mbytes.

SMI Workbench

The Symposium Call Center Server Client PC employs the System Management Interface (SMI) Workbench. The client software requires 130 Mbytes of hard disk space and an additional 10 Mbytes of disk space on the hard drive where the operating system is installed. An optional set of Network Control Center (NCC) report templates require 150 Mbytes of disk space. They can be used only when the client system is connected to an NCC server.

Virtual memory

Nortel Networks strongly recomments that the Windows 95 or Windows 98 operating systems manage the virtual memory resources of the PC. This prevents memory problems caused by insufficient disk space for swapping. It is recommended that there be at least 100 Mbytes of free disk on the drive where the swapfile is located at run time.

Temporary files

The creation of reports can create large temporary files in the operating system's default temporary ("temp") directory. Reports from the Call Detail Reporting feature can create temporary files of one Gbytes or more, depending on the circumstances. It is important that a client system with enough capacity is used to generate whatever report is being run. See "Client hardware configuration" on page 274.

Routers

Introduction

A router is required for networked Symposium Call Center Servers to isolate CLAN and ELAN traffic. The router ensures that traffic bound for one LAN does not appear on the other.

Configuring routers

Customers must ensure that ELAN traffic never traverses a CLAN and CLAN traffic never traverses an ELAN. This restriction applies to a networked environment as well as a non-networked (nodal) environment.

A router can also route traffic between the Symposium Call Center Server nodes. In addition, a router is required for remote administrator logons. Any router that supports IP routing and is capable of handling the traffic required can be used.

A set of routers might also be required to support configurations where the DMS/MSL-100 and Symposium Call Center Server are in separate physical locations. A set of routers with a wide-area network connection can provide a connection between the customer's Symposium Call Center Server system and the DMS/MSL-100. Any router that supports IP routing and is capable of handling the ELAN traffic can be used.

Configuring IVR

M1 external IVR system

Refer to the engineering guidelines for the external IVR system to properly configure the external IVR system and the M1. External IVR can be used as a replacement for Meridian Mail, specifically for non-controlled Give IVR commands.

DMS/MSL-100 external IVR system

Refer to engineering guidelines for the external IVR system to properly configure the external IVR system and the DMS/MSL-100. The external IVR system must use DMS/MSL-100 ACD queues and must always be used as a “front-end” to the Symposium Call Center Server. Because of limited CTI support in Release 3, IVR systems requiring the ability to execute CTI commands can only use the following commands: *login, logout, ready, not ready, initiate transfer,* and *complete transfer.*

Note: The last two pertain to digital transfer.

Appendix A

Sample performance characteristics

In this appendix

Overview

Introduction

This appendix provides the following performance characteristics for sample workloads, call complexities, and call volumes:

- server disk space utilization
- server CPU utilization
- ELAN utilization
- CLAN utilization
- NCC disk space utilization
- NCC CLAN utilization

Workload types

Introduction

This section describes the characteristics of the workloads used in the examples in this appendix. The examples use five types of workloads:

- entry
- small
- medium
- large
- upper end

Characteristics of the workload types

Parameter	Entry	Small	Medium	Large	UprEnd
General parameters					
Number of agents logged on simultaneously	20	100	200	500	1500
Number of agents defined in the system	60	300	500	1000	3000
Number of phonesets	70	350	700	1700	3000
Number of supervisors logged on	2	10	20	50	100
Number of administrators logged on	1	1	1	2	2
Number of scripts	10	50	100	200	500
Number of applications (that is, exit points from the Master_Script)	5	25	50	100	250
Number of skillsets	5	25	50	125	200
Number of activity codes	25	125	250	625	1250

Parameter	Entry	Small	Medium	Large	UprEnd
Call resources parameters					
Number of IVR queues	5	10	20	30	50
Number of IVR ports	10	50	100	250	750
Number of IVR events per port per day (logon/logoff)	5	5	5	10	10
Number of routes	128	128	128	250	250
Number of trunks (M1)	60	300	600	1500	3000
Number of CDNs	8	8	15	75	240
Number of RAN and music routes	30	40	50	100	250
Number of DNISs (M1)	50	100	500	1000	5000
Number of DNISs (DMS)	50	100	200	500	1000
Proportion of DNIS used during a single data collection interval	75%	75%	75%	75%	60%
Relations parameters					
Average number of skillsets served by an agent	3	3	3	3	3
Average number of skillsets served by a supervisor’s agents	5	5	10	10	15
Average number of supervisors an agent reports to	1	2	2	3	3
Average number of local applications per skillset	1	2	4	4	4
Average number of remote applications per network skillset per node (M1)	1	4	12	16	24

Parameter	Entry	Small	Medium	Large	UprEnd
Average number of nodes per network skillset (M1)	1	2	3	4	6
Average number of trunks per trunk route (M1)	2	5	10	20	30
Average number of activity codes (not necessarily unique) entered per agent per interval/day/week/month	5	10	10	15	15
Average number of applications that route calls to an particular agent during a interval/day/week/month	3	6	12	12	12
Average number of activity codes entered by an agent for calls that were routed by a particular application during an interval/day/week/month	Average number of activity codes entered per agent / Average number of applications that route calls to a particular agent				
Networking parameters (M1 only)					
Global networking parameters					
Number of call processing nodes in the network (including local node)	1	2	4	6	30
Proportion of CBC data collected at all nodes in the network	100%	100%	50%	40%	10%
Number of network skillsets	5	25	50	50	50
Proportion of all calls in the network that are queued to a network skillset	10%	10%	10%	10%	10%
Nodal networking parameters					
Proportion of all incoming network calls that are presented to agents at the local node	100%	50%	25%	17%	3%

Parameter	Entry	Small	Medium	Large	UprEnd
Proportion of incoming networked calls originating at a particular node in the network	100%	100%	33%	20%	3%
Proportion of calls arriving at the local node that are queued to a network skillset	10%	10%	10%	10%	10%
Proportion of networked calls originating at this node that are routed to a particular other node in the network	100%	100%	33%	20%	3%
Real-time displays					
Number of rows per agent RTD	10	10	10	10	15
Number of rows per application RTD	5	5	10	50	200
Number of rows per nodal RTD	1	1	1	1	1
Number of rows per skillset RTD	5	5	10	10	15
Number of rows per IVR RTD (M1)	10	10	10	10	10
Number of rows per route RTD (M1)	128	128	128	250	250
Real-time API					
Number of rows of agent statistics	20	100	200	500	1500
Number of rows of application statistics	5	5	10	50	200
Number of rows of nodal statistics	1	1	1	1	1
Number of rows of skillset statistics	5	25	50	125	200
Number of rows of IVR statistics (M1)	10	10	10	10	10

Parameter	Entry	Small	Medium	Large	UprEnd
Number of rows of route statistics (M1)	128	128	128	250	250

Note: These workloads do not include descriptions of typical use of Symposium Call Center Server data extraction. Each installation can have very different requirements.

Common parameters

The following parameters are assumed to have the same value for all workload scenarios:

Parameter	Value
Real-time displays/Real-time API parameters	
Weighted average update rate of all agent RTD screens, in seconds	3
Weighted average update rate for all other RTD screens (except agent RTDs), in seconds	10
Weighted average update interval for all real-time API and GRTD applications, in seconds	2
Average number of agent states per call	3
Number of RTD API clients	0
Number of GRTD clients	0
Event interface parameters (M1 only)	
Average update interval of all Event Interface applications.	0.5
Proportion of number of events sent to client applications per call	80%
Number of SEI API clients	0
Historical data parameters	

Parameter	Value
Number of days historical interval data is stored online	21
Number of days historical daily data is stored online	31
Number of weeks historical weekly data is stored online	26
Number of months historical monthly data is stored online	36
Number of days call-by-call data is stored online	3
Number of days agent event records are stored online	3
Number of days IVR event records are stored online	3
Proportion of local CBC data that is collected at the local node	100%
Agent operations parameters	
Number of agent shifts per day	3
Number of hours per agent shift	8
Number of agent interruptions per shift	10
Proportion of agent-supervisor and agent-skillset assignments that are changed daily	2%
Proportion of agent-supervisor and agent-skillset assignments that are changed weekly	15%
Proportion of agent-supervisor and agent-skillset assignments that are changed monthly	25%
Data characteristics parameters	
Number of RTD formulas defined	50
Number of columns in RTDs	50
Number of script variables per script	10
Average depth of script execution tree	10

Parameter	Value
Proportion of elements assigned in agent to skillset or agent to supervisor assignments	10%
HDX	
Average number of Send/Request command parameters	10
Average size of Send/Request command parameters	80
Average number of Get Response parameters	10
Average size of Get Response parameters	80
Average number of Send Info command parameters	10
Average size of Send Info parameters	80
External IVR	
Average number of bytes in caller-entered data sent to the server	20
MLS	
Average number of MLink messages per call transfer	11
Average number of MLink messages per call conference	11
Average MLink message size (in bytes, not including standard overhead of 88 bytes)	50
Proportion of conferenced calls completed by an MLS application	0%
Proportion of conferenced calls completed by an MLS application	0%
Networking (M1 only)	
Proportion of network CBC data that is collected at the local node when it is a destination node	100%
Proportion of all calls queued to network skillsets by this node that are actually routed to another node	80%

Parameter	Value
Proportion of all calls queued to network skillsets within the network that are actually routed to another node	80%
Average number of network skillset queues entered per network call	2
Routing table update interval	5
Voice services (M1 only)	
Duration (in seconds) of a Give Controlled Broadcast session in Start/Stop mode	45
Duration (in seconds) of a Give Controlled Broadcast session in Continuous mode	45
Duration (in seconds) of a Collect Digits voice session	45
Duration (in seconds) of a Give IVR session	45
Number of distinct Give Controlled Broadcast sessions played simultaneously in Start/Stop mode	2
Number of distinct Give Controlled Broadcast sessions played simultaneously in Continuous mode	2
The length (in seconds) of the Broadcast Port Wait Timer	10

Reports

For the workload scenarios, it is assumed that the following reports are used:

Interval reports

- Application Performance
- Application Delay Before Answer
- Application Delay Before Abandon
- Skillset Performance

Daily reports

- Application Performance
- Application Delay Before Answer
- Application Delay Before Abandon
- Application Call Treatment
- Activity Code By Application
- Application By Activity Code
- Skillset Performance
- Agent Performance
- Agent Performance by Supervisor
- Agent DN Performance
- Agent Average Calls Per Hour
- Estimated Revenue By Agent
- Trunk Performance (M1 Only)
- Route Performance (M1 Only)
- IVR Queue Statistics (M1 Only)
- IVR Port Statistics (M1 Only)
- DNIS Statistics
- CDN Statistics
- Music/RAN Route Statistics

Call complexity

Introduction

Symposium Call Center Server call processing resource requirements (CPU, memory, and so on) vary depending on the complexity of the call and the call rate. Call complexity is defined as the number of each type of service used by the call. Over time, the average number of each type of service per call can be used to estimate the expected resource consumption.

For example, if a typical call in the system is queued to two skillsets then the expected resource cost per call is two times the resource cost of queueing a call to one skillset provided that the costs are a linear function of call rate.

This section describes the call complexity models used for the examples in this appendix.

Basic call

To estimate the resource consumption for different call rates, it is necessary to define the cost of a basic call. A basic call is processed by the following script commands:

```
Give Ringback
Queue to Skillset
Quit
```

where an agent is available. The cost of a basic call is the resources consumed during processing of this call.

Inbound call models

Meridian 1 call models

The following call complexity models apply to the Meridian 1 switch:

- **SVP** (Symposium Voice Processing)—This call model includes basic call, queuing to two skillsets and applying voice services controlled by the

Symposium Call Center Server (Controlled Broadcast and Collect Digits Voice Session).

- **MVP** (Meridian Voice Processing)—This call model includes basic call, queuing to two skillsets and applying voice services controlled by the M1 (Give RAN instead of Controlled Broadcast and Give IVR instead of Collect Digits Voice Session).

DMS/MSL-100 call models

The following call complexity models apply to the DMS/MSL-100 switches:

- **Simple** (Regular Symposium customer)—In this call model, the customer uses a DMS or MSL-100 switch with an external IVR system. Each call is given IVR treatment and then routed to an agent with a particular skillset.
- **Complex** (Busy Symposium customer)—In this call model, the customer uses a DMS or MSL-100 switch with an external IVR system. Each call is given IVR treatment followed by multiple RAN/music treatments while waiting for an agent.

Number and types of services per call

The following table shows the average number and types of services assumed for calls in each model:

	M1		**DMS/MSL-100**	
Parameter	**SVP**	**MVP**	**Simple**	**Complex**
Basic Call	1	1	1	1
Average number of skillset queues entered per inbound call	2	2	1	2.2
Average number of agent queues entered per inbound call	0	0	0	0.1
Average number of controlled broadcasts in Start/Stop mode per inbound call. Never with Give RAN	1	0	N/A	N/A
Average number of controlled broadcasts in Continuous mode per inbound call	0	0	N/A	N/A

	M1		DMS/MSL-100	
Parameter	**SVP**	**MVP**	**Simple**	**Complex**
Average number of collect digit services per inbound call. 2 digits each time (including voice session and play prompt)	1	0	N/A	N/A
Average number of Give IVR treatments per inbound call	0	1	N/A	N/A
Average number of Give RAN treatments per inbound call (Never with GCB)	0	1	0	0.5
Average number of Give Music treatments per inbound call	0	0	0	1.5
Average number of HDX Send Info treatments per inbound call (Only if HDX is present)	0	0	1	1
Average number of HDX Request/Get Response treatments per inbound call (Only if HDX is present)	0	0	0	0
Average number of Intrinsic References per inbound call (Expected Wait Time, Longest Idle Agent, Oldest Call, Position in Queue)	3	3	2	5
Average number of If Then Else treatments per inbound call	2	2	2	4
Proportion of inbound calls that are transferred to another agent or DN	0%	0%	0%	10%
Proportion of inbound calls that are conferenced with another agent or supervisor	0%	0%	0%	15%
Proportion of conferenced calls completed by an MLS application (such as, Symposium Agent)	0%	0%	0%	0%

	M1		DMS/MSL-100	
Parameter	**SVP**	**MVP**	**Simple**	**Complex**
Is an external IVR system is connected to the DMS/MSL-100 system?	N/A	N/A	Yes	Yes
Average number of screen pops per inbound call	1.2	1.2	1.2	1.2
Average number of MLink messages per inbound call (excluding screen pops)	0	0	0	6
Are call-by-call statistics collected?	Yes	Yes	Yes	Yes
Average number of network skillset queues entered per call	2	2	N/A	N/A
Proportion of calls arriving at the local node that are queued to a network skillset	10%	10%	N/A	N/A

Outbound call models (M1 only)

For the purposes of the Symposium Call Center Server performance evaluation, two typical local outbound call models are defined. These models apply to calls that originate from the local node. Unlike the inbound case, the outbound models are only available for the M1, because of the limited Meridian Link Services Manager (MLSM) features for the DMS switch.

Note: The only MLINK messages supported on the DMS are *initiate transfer, complete transfer, login*, *logout*, *ready,* and *not ready*).

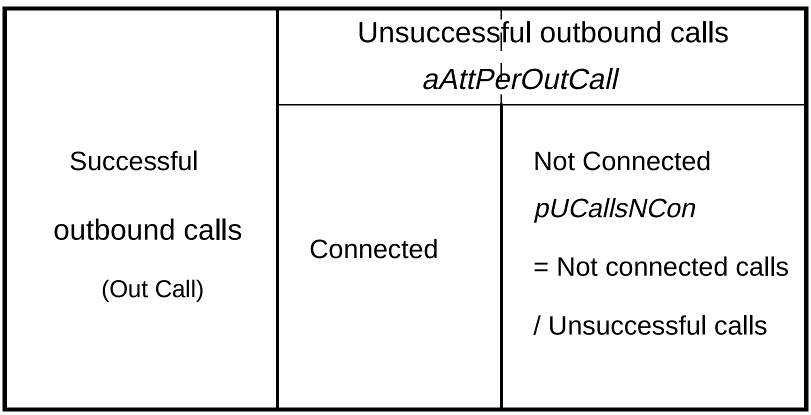
Outbound call results

Each outbound call attempt might have one of the results listed in the following table:

Event	Result	Example
outbound call	successful	call reaching a live party

Event	Result	Example
PSTN connection established	unsuccessful	call reaching an answering machine
PSTN connection not established	unsuccessful	call receiving a busy signal or unanswered call

The parameter aAttPerOutCall represents the average number of unsuccessful call attempts for each outbound call (that is a caller contacting a live party), whereas the variable pUCallsNCon denotes the proportion of unsuccessful call attempts not establishing a PSTN connection. These relationships are indicated in the following illustration.



Example

If aAttPerOutCall = 4, then to generate an outbound rate of 5000 CPH, it would be necessary to have a total of 25 000 call attempts (5000 successful and 20 000 unsuccessful) predictive dialing call attempts; if pUCallsNCon = 50 percent for the same example, then for every five call attempts, one is a successful outbound call, two are unsuccessful PSTN connections, and the remaining two are successful PSTN connections that do not reach a person, such as calls connecting to an answering machine.

Predictive dialing

The Predictive Dialing (PD) call model requires the existence of an autodialer that can place a high number of phone calls and then only transfer to the agent those calls that reach a live voice. Digital signal processing (DSP) capabilities enable this type of application to perform the necessary call progress analysis on outbound calls. Using predictive dialing, therefore, eliminates agent time wasted in calls made to busy or otherwise unavailable parties.

CTI Application

The CTI Application (CTI) call model assumes that the agents themselves have a desktop application to place outbound calls. In this case, no calls are monitored by the autodialer on behalf of the agent. This application performs third party call control for agents to place the outbound calls via the TAPI Service Provider software. The above mentioned parameters also apply to this case; however, aMMSGPerOutCall (the average number of MLINK messages per outbound call) is different, since the call is not being transferred from the autodialer to the agent, as in the predictive dialing application. In addition, aMMSGPerConUCall (the average number of MLINK messages per PSTN connection resulting in an unsuccessful call) can also be different from the above case, since the DSP could be smart enough to detect an answering machine before the call gets connected, whereas the CTI application may not have that capability.

Call types

The call types used for outbound performance evaluation are formally defined by providing the expected number of various call services per call type. These numbers are summarized in the following table:

	Symposium Call Center Server–M1	
Parameter	**Predictive dialing**	**CTI application**
Basic Call	1	1
pTransferOut	0%	0%
pConferenceOut	0%	0%
aAttPerOutCall	4	4

Parameter	Symposium Call Center Server–M1	
	Predictive dialing	CTI application
pUCallsNCon	100%	50%
aMSPPerOutCall	1	1
aMMSGPerOutCall	14	8
aMMSGPerConUCall	0	8
aMMSGPerNCon	3	2

Server disk space utilization

Introduction

Server disk space utilization is dependent on

- workload type
- call rate

Disk space required

Call rate (CPH) Peak/Daily	Disk space required (Gbytes) Entry	Small	Medium	Large	UpperEnd
1000/500	3	4	5	11	29
5000/2500	4	4	6	12	30
10 000/5000	6	6	6	13	32
15 000//7500	8	8	8	14	33
20 000/10 000	10	10	10	14	34
25 000/12 500	13	13	13	15	35

Server CPU utilization

Introduction

Server CPU utilization is dependent on

- call complexity model
- call rate
- number of agents

System performance limits for the M1 switch

The following table shows processor requirements for the M1 switch:

		SVP Call Model		MVP Call Model	
Processor	**MHT (Minutes)**	**Agents**	**PeakCallRate (CPH)**	**Agents**	**PeakCallRate (CPH)**
P166	2	75	2250	125	3750
	3	100	2000	150	3000
	4	100	1500	175	2625
PP200	2	125	3750	250	7500
	3	175	3500	275	5500
	4	225	3375	325	4875
PII300	2	225	6750	375	11 250
	3	275	5500	425	8500
	4	325	4875	450	6750

		SVP Call Model		MVP Call Model	
Processor	MHT (Minutes)	Agents	PeakCallRate (CPH)	Agents	PeakCallRate (CPH)
PII350	2	250	7500	425	12 750
	3	325	6500	475	9500
	4	375	5625	525	7875
PII450	2	325	9750	500	15 000
	3	400	8000	575	11 500
	4	475	7125	625	9375
2PIII500	2	625	18 750	900	27 000
	3	750	15 000	975	19 500
	4	850	12 750	1050	15 750

System performance limits for the DMS/MSL-100 switch

The following table shows processor requirements for the DMS and MSL-100 switch:

		Simple Call Model		Complex Call Model	
Processor	MHT (Minutes)	Agents	PeakCallRate (CPH)	Agents	PeakCallRate (CPH)
PII450	2	500	15 000	400	12 000
	3	575	11 500	475	9500
	4	625	9375	550	8250

		Simple Call Model		Complex Call Model	
Processor	**MHT (Minutes)**	**Agents**	**PeakCallRate (CPH)**	**Agents**	**PeakCallRate (CPH)**
2PIII500	2	900	27 000	725	21 750
	3	1000	20 000	850	17 000
	4	1050	17 750	925	13 875

ELAN utilization

Introduction

ELAN utilization is dependent on

- workload
- call rate

ELAN traffic

Embedded LAN (ELAN) bandwidth is 10 Mbps. The ELAN carries the following traffic:

- call processing AML
- call processing ICM
- external IVR traffic

  Note: IVR caller entered data (CED) can use either ELAN or CLAN.
- networking call processing traffic
- Network Control Center traffic
- Meridian Link traffic

If more than one Symposium Call Center Server system is on the same ELAN, then the ELAN utilization is the sum of the ELAN utilization for each system.

Notes:

- For the Meridian 1 switch, ELAN utilization should not exceed 10 percent.
- NCC traffic can be routed over the CLAN. The examples assume that NCC traffic is routed over the ELAN.

Meridian 1 switch

The following table shows ELAN utilization for the M1 switch:

	ELAN Utilization per workload				
Call rate (CPH)	**Entry**	**Small**	**Medium**	**Large**	**UpperEnd**
1000	0.1%	0.1%	0.1%	0.1%	0.1%
5000	0.4%	0.4%	0.5%	0.5%	0.5%
10 000	0.7%	0.9%	1.1%	1.1%	1.1%
15 000	1.1%	1.3%	1.6%	1.6%	1.6%
20 000	1.5%	1.7%	2.1%	2.1%	2.1%
25 000	1.9%	2.1%	2.7%	2.7%	2.7%

Note: This table is based on the MVP complex call model. However, ELAN utilization does not differ significantly based on call model.

DMS/MSL-100 switch

The following table shows ELAN utilization for the DMS and MSL-100 switches:

	ELAN utilization per workload				
Call rate	**Entry**	**Small**	**Medium**	**Large**	**UpperEnd**
1000	0.1%	0.1%	0.1%	0.1%	0.1%
5000	0.3%	0.3%	0.3%	0.3%	0.3%
10000	0.6%	0.6%	0.6%	0.6%	0.6%
15000	0.9%	0.9%	0.9%	0.9%	0.9%
20000	1.2%	1.2%	1.2%	1.2%	1.2%
25000	1.5%	1.5%	1.5%	1.5%	1.5%

Note: This table is based on the complex call model. However, ELAN utilization does not differ significantly based on call model.

Networking ELAN utilization (M1 only)

If you are using the optional NSBR feature, additional ELAN bandwidth is required for network call processing. The following table indicates the ELAN utilization required for different call volumes:

	NCP ELAN utilization per workload (%)				
Call Rate (CPH)	Entry	Small	Medium	Large	UpperEnd
1000	0.0%	0.0%	0.0%	0.0%	0.0%
5000	0.0%	0.0%	0.2%	0.2%	0.2%
10 000	0.0%	0.1%	0.3%	0.3%	0.3%
15 000	0.0%	0.1%	0.5%	0.5%	0.5%
20 000	0.0%	0.2%	0.6%	0.6%	0.6%
25 000	0.0%	0.2%	0.8%	0.8%	0.8%

CLAN utilization

Introduction

CLAN utilization is dependent on

- workload
- call rate

CLAN traffic

Customer LAN (CLAN) bandwidth is 10 Mbps. CLAN traffic consists of

- real-time display traffic
- real-time data API traffic
- Symposium Event Interface traffic
- MLS traffic
- Host Data Exchange traffic
- reporting-related traffic
- non-Symposium Call Center Server customer traffic (not included)

IVR caller entered data (CED) can use either CLAN or ELAN.

Note: CLAN utilization should not exceed 30 percent.

Meridian 1 switch

The following table shows CLAN utilization for the M1 switch:

	CLAN utilization per workload (%)				
Call rate	Entry	Small	Medium	Large	UpperEnd
1000	0.1%	0.4%	0.8%	3.0%	15.8%
5000	0.3%	0.6%	1.0%	3.3%	16.1%
10 000	0.6%	0.9%	1.3%	3.5%	16.3%
15 000	0.9%	1.2%	1.6%	3.8%	16.6%
20 000	1.1%	1.4%	1.9%	4.1%	16.9%
25 000	1.4%	1.7%	2.1%	4.4%	17.2%

Notes:

- Utilization is identical for the SVP and MVP call models.
- The Symposium Call Center Server utilization of the CLAN can be as high as 9 percent for the system with 500 agents (Large Workload). Care must be taken to ensure that the CLAN has enough spare capacity to accommodate Symposium Call Center Server-related traffic as well as customer traffic.

CLAN utilization for real-time display traffic

Real-time Display LAN requirements per workload

Call rate (CPH)	Entry	Small	Medium	Large	UpperEnd
1000	0.1%	0.3%	0.6%	2.7%	15%
5000	0.1%	0.3%	0.6%	2.7%	15%
10 000	0.1%	0.3%	0.6%	2.7%	15%
15 000	0.1%	0.3%	0.6%	2.7%	15%
20 000	0.1%	0.3%	0.6%	2.7%	15%
25 000	0.1%	0.3%	0.6%	2.7%	15%

CLAN utilization for real-time API traffic (MVP call model)

Real-time Data API CLAN requirements per workload

Call rate (CPH)	Entry	Small	Medium	Large	UpperEnd
1000	0.2%	0.4%	0.7%	1.6%	4.3%
5000	0.2%	0.4%	0.7%	1.6%	4.3%
10 000	0.2%	0.4%	0.7%	1.6%	4.3%
15 000	0.2%	0.4%	0.7%	1.6%	4.3%
20 000	0.2%	0.4%	0.7%	1.6%	4.3%
25 000	0.2%	0.4%	0.7%	1.6%	4.3%

CLAN utilization for Graphical Real-time Display traffic (MVP call model)

	GRTD CLAN requirements per workload				
Call rate	Entry	Small	Medium	Large	UpperEnd
1000	0.1%	0.3%	0.6%	1.5%	4.1%
5000	0.1%	0.3%	0.6%	1.5%	4.1%
10 000	0.1%	0.3%	0.6%	1.5%	4.1%
15 000	0.1%	0.3%	0.6%	1.5%	4.1%
20 000	0.1%	0.3%	0.6%	1.5%	4.1%
25 000	0.1%	0.3%	0.6%	1.5%	4.1%

NCC disk space requirements

Introduction

NCC disk space utilization is dependent upon

- network-out call rate
- number of nodes

Disk space requirements

The following table shows disk space requirements for networks with different numbers of nodes. The table assumes that

- The peak network-out call rate for each node is constant at 10 000 calls per hour (CPH).
- The total number of calls per day (CPD) for each node is 120 000 calls.
- Two queue to network skillsets commands are executed per call.
- Ten percent of calls are networked out.

Number of nodes	Disk space required (Gbytes)
2	4.7
4	6.4
6	7.6
10	9.8
20	9.8
30	9.8

Note: The NCC can collect network call-by-call data for a maximum of 10 000 network-out calls per hour. (The network can support more than 10 000 network-out calls per hour, but network call-by-call data is only collected for the first 10 000.)

NCC CLAN utilization

NCC CLAN workload scenarios requirements

The summary of CLAN utilization is shown in the following table. External load is taken as Call Rate per network node. It is assumed that all nodes in the network have identical workloads of 10 000 CPH and 10 percent of calls networked out.

Number of nodes	CLAN utilization
2	0.14%
4	0.58%
6	0.87%
10	1.5%
20	1.5%
30	1.5%

Appendix B

Database table sizes

In this appendix

Symposium Call Center Server database table sizes

Introduction

The following tables list Symposium Call Center Server database tables along with corresponding record sizes and the formulas used to compute the numbers of records per table. The record sizes are obtained using the Sybase *sp_estspace* utility for 10 000 000 rows for each table.

Event table sizes

Number of call-by-call events per call

Events associated with each call may be recorded in the call-by-call (CBC) database when CBC recording is turned on for a corresponding application. The number of events associated with each call service is required to calculate the size of the CBC database. One record is generated for each event. The following table gives the number of events associated with each call service:

Table 1 Number of call-by-call events per call for each service

Service	Variable name	# CBC events
Basic Call Processing[a]	BCC_CBC_Events	5
Basic Local Call Processing[b]	Local_BCC_CBC_Events	5
Queue To Skillset	QTS_CBC_Events	2
Queue To Network Skillset[c]	QTNS_CBC_Events	2
Queue To Agent	QTA_CBC_Events	2
Give Controlled Broadcast (Start/Stop)[d]	GCB_CBC_Events	7
Give Controlled Broadcast (Continuous)[e]	GCBC_CBC_Events	7
Voice Session Collect Digits[f]	VSCDG_CBC_Events	9

Table 1 Number of call-by-call events per call for each service

Service	Variable name	# CBC events
Give IVR[g]	GIVR_CBC_Events	7
Give RAN	GRAN_CBC_Events	2
Give MUSIC	GMUS_CBC_Events	2
Give Overflow	GOFL_CBC_Events	1
Give Busy	GBSY_CBC_Events	1
Give Route To	GRT_CBC_Events	1
Give Silence	GSil_CBC_Events	1
Disconnect	Disc_CBC_Events	1
Hdx Send Info	HDXSI_CBC_Events	1
Hdx Request/Get Response	HDXRG_CBC_Events	2
Outbound PSTN Connection[h]	OutConn_CBC_Events	2
Call Entered Data (External IVR)	CED_CBC_Events	1
Call Transfer (External IVR)[i]	IVR_CBC_Events	6
Transfer Call[j]	TRAN_CBC_Events	6
Conference Call[k]	CONF_CBC_Events	7
Network call rejected/cancelled locally[l]	IREJ_CBC_Events	2
Network call accepted locally[m]	IACC_CBC_Events	6
Local request rejected/cancelled elsewhere[n]	OREJ_CBC_Events	2
Local call accepted elsewhere (events due to local portion of processing, plus due to acceptance of call on other node that reported locally)[o]	OACC_CBC_Events	3

a. Includes 1 Call Arrival (2 events), 1 RingBack, 1 Interflow, 1 Call Handed Off

b. Includes 2 Queue to Skillset, 1 Present to Agent, 1 Call Answered, 1 Call Released

c. Includes 1 Call Enqueued, 1 Call Dequeued.

d. Includes 1 Give Broadcast, 1 IVR Call Enqueued, 1 IVR Call Session Begin, 1 IVR Port in Use, 1 IVR Call Session Interrupted, 1 IVR Port Free, 1 Give Broadcast Completed

e. Same as 4 above.

f. Includes 1 Play Prompt, 1 IVR Call Enqueued, 1 IVR Call Session Begin, 1 IVR Port in Use, 1 Digit Collection, 1 Digit Collection Ended, 1 IVR Call Session End, 1 IVR Port Free, 1 Play Prompt Ended

g. Includes 1 Give IVR, 1 IVR Call Enqueued, 1 IVR Call Session Begin, 1 IVR Port in Use, 1 IVR Call Session End, 1 IVR Port Free, 1 Call Returned from IVR

h. For a successful outbound call, the 2 events are: DN incall answer and DN incall release, whereas for an unsuccessful call resulting in a PSTN connection, the 2 events are: DN outcall initiated and DN outcall release.

i. Includes 1 Consult Init, 1 Call Arrival (2 events), 1 Call Answered, 1 Call Transferred, 1 Local Call Released.

j. Includes 1 Consult Init, 1 Call Arrival (2 events), 1 Call Answered, 1 Call Transferred, 1 Local Call Released.

k. Includes 1 Consult Init, 1 Call Arrival (2 events), 1 Call Answered, 2 Call Conferenced, 1 Call Released

l. Includes 1 Call Enqueued, 1 Call Dequeued

m. Includes 1 Call Enqueued, 1 Network InCall Arrived, 1 Call Dequeued, 1 Call Presented to Agent, 1 Call Answered, 1 Call Released

n. Includes 1 Call Enqueued, 1 Call Dequeued; This is in addition to the events documented in footnote 1 and 2 or 14

o. Includes 1 Local Call Networked Out, 1 Call Answered, 1 Call Released; This is in addition to basic call processing as documented in footnote 1

Event table sizes

Table 2 Symposium Call Center Server event tables

Table name	Row size ANSI (KB)	Number of rows computations
NIeAgentLoginStat	0.098	nAgents*(2*nIntPerShift+2)*nShifts
NIeSkillsetStateStat	0.014	0
NIeIVRPortLoginStat	0.071	nIVRPortEvents*nIVRPorts
NIeCallByCallStatYYYYMMDD	0.141	RecordsPerHour * 24
NIeNetCallByCallStatYYYYMMDD	0.149	NCCRecordsPerHour * 24

The computations above use parameters RecsPerCall, RecsPerNWInCall, RecsPerNWOutCall, nNetwCallsSDMEvents and NRequests. RecsPerCall is the average number of records recorded in the CBC database for each local Symposium Call Center Server call due to various call services. RecsPerNWOutCall is the average number of records recorded in the CBC database for each Symposium Call Center Server network out call due to various call services. RecsPerNWInCall is the average number of records recorded in the CBC database for each Symposium Call Center Server network in call due to various call services. RecsPerOutCall is the average number of records recorded in the Call By Call database for each Symposium Call Center Server call due to various outbound call services. These numbers depend on the call complexity and are determined as follows:

```
RecsPerNWOutCall =
  SUMOF(
     aQTSPerCall*QTS_CBC_Events
     aQTNSPerCall*pNetOut*QTNS_CBC_Events
     aQTAPerCall*QTA_CBC_Events
     aGCBPerCall*GCB_CBC_Events
     aGCBCPerCall*GCBC_CBC_Events
     aVSCDGPerCall*VSCDG_CBC_Events
```

```
    aGIVRPerCall*GIVR_CBC_Events
    aGRANPerCall*GRAN_CBC_Events
    aGMUSPerCall*GMUS_CBC_Events
    aHDXSIPerCall*HDXSI_CBC_Events
    aHDXRGPerCall*HDXRG_CBC_Events
  )
```

```
RecsPerNWInCall =
  SUMOF(
    pTransferIn/100*TRAN_CBC_Events
    pConferenceIn/100*CONF_CBC_Events
  )
```

```
RecsPerCall =
  SUMOF(
    RecsPerNWOutCall
    RecsPerNWInCall
  )
```

```
RecsPerOutCall =
  SUMOF{
    [1 + aAttPerOutCall * (1 - pUCallsNCon/100)] *
        OutConn_CBC_Events
    pTransferOut/100 * TRAN_CBC_Events
    pConferenceOut/100 * CONF_CBC_Events
  }
```

RecordsPerHour is the number of records generated in the CBC database in an hour. This number depends on the call rate and the proportion of network incoming and outgoing calls, as in the following formula:

```
RecordsPerHour =
  SUMOF (
    BCC_CBC_Events * DailyCallRate
    (Local_BCC_CBC_Events + RecsPerCall) *
        LocalDailyCallRate
    (CED_CBC_Events + IVR_CBC_Events ) * DailyCallRate
        (if External IVR)
    (OACC_CBC_Events + RecsPerNWOutCall) *
        nwOAccDailyCallRate
```

```
    OREJ_CBC_Events * nwORejDailyCallRate
    (IACC_CBC_Events + RecsPerNWInCall) *
        nwIAccDailyCallRate
    IREJ_CBC_Events * nwIRejDailyCallRate
    RecsPerOutCall * DailyOutCallRate
  ) * pCBCNode/100
```

NCCRecordsPerHour is the number of records generated in NCC CBC database in an hour. This number depends on the call rate and the proportion of network incoming and outgoing calls.

```
NCCRecordsPerHour =
  SUMOF(
    IACC_CBC_Events * nwAccNetwDailyCallRate
    IREJ_CBC_Events * nwRejNetwDailyCallRate
  ) * pCBCNetwork/100
```

The computations below use parameters CallsPerInterval and CallsPerDay. These parameters represent the average number of calls processed by the Symposium Call Center Server during a single interval (assuming steady call arrival) and during a single day respectively, and are computed as follows:

```
CallsPerInterval = DailyCallRate / 4

CallsPerDay = DailyCallRate * 24.
```

Table 3 Symposium Call Center Server interval stat tables (number of records per interval)

Table name	Row size ANSI (KB)	Number of rows computations
NIiActivityCodeStat	0.066	aActCode_Agent_Appl_Intv * aAppl_Agent * nAgents
NIiAgentByAppStat	0.050	min(CallsPerInterval, nAgents * aAppl_Agent)
NIiAgentBySkillsetStat	0.056	min(CallsPerInterval, nAgents * aSkill_Agent)
NIiAgentPerfStat	0.212	nAgents
NIiAppStat	0.369	nApplications
NIiCDNStat	0.032	min(CallsPerInterval, nCDN)
NIiDNISStat	0.074	min(CallsPerInterval, nDNIS * pDNISInterval / 100)

Table 3 Symposium Call Center Server interval stat tables (number of records per interval)

Table name	Row size ANSI (KB)	Number of rows computations
NIiIVRPortStat	0.057	nIVRPorts
NIiIVRStat	0.047	min(CallsPerInterval, nIVRQ)
NIiNetworkInCallStat	0.057	min(NetInCallsPerInterval, nApplications * (nNetNodes - 1))
NIiNetworkOutStat	0.053	min(NetOutCallsPerInterval, nApplications * (nNetNodes - 1))
NIiRANMusicRoute Stat	0.018	min(CallsPerInterval, nRMRRoutes)
NIiRouteStat	0.021	min(CallsPerInterval, nRoutes)
NIiSkillsetStat	0.055	min(CallsPerInterval, nSkillsets * aAppl_Skill + nNetSkillsets * aAppl_NetSkill * aNodes_NetSkill)
NIiTrunkStat	0.033	min(CallsPerInterval, nTrunks * aTrunk_Routes)

Table 4 Symposium Call Center Server temp interval stat tables (number of records per interval)

Table name	Row size ANSI (KB)	Number of rows computations
NItActivityCodeStat	0.064	aActCode_Agent_Appl_Intv * aAppl_Agent * nAgents
NItAgentByAppStat	0.049	min(CallsPerInterval, nAgents * aAppl_Agent)
NItAgentBySkillsetStat	0.055	min(CallsPerInterval, nAgents * aSkill_Agent)
NItAgentPerfStat	0.205	nAgents
NItAppStat	0.366	nApplications
NItCDNStat	0.032	min(CallsPerInterval, nCDN)
NItDNISStat	0.073	min(CallsPerInterval, nDNIS)
NItIVRPortStat	0.056	nIVRPorts
NItIVRStat	0.047	min(CallsPerInterval, nIVRQ)
NItNetworkInCallStat	0.056	min(NetInCallsPerInterval, nApplications * (nNetNodes - 1))

Table 4 Symposium Call Center Server temp interval stat tables (number of records per interval)

Table name	Row size ANSI (KB)	Number of rows computations
NItNetworkOutStat	0.052	min(NetOutCallsPerInterval, nApplications * (nNetNodes - 1))
NItRANMusicRoute Stat	0.017	min(CallsPerInterval, nRMRRoutes)
NItRouteStat	0.021	min(CallsPerInterval, nRoutes)
NItSkillsetStat	0.054	min(CallsPerInterval, nSkillsets * aAppl_Skill + nNetSkillsets * aAppl_NetSkill * aNodes_NetSkill)
NItTrunkStat	0.033	min(CallsPerInterval, nTrunks * aTrunk_Routes)

Table 5 Symposium Call Center Server Daily stat tables (number of records per day)

Table name	Row size ANSI (KB)	Number of rows computations
NIdActivityCodeStat	0.066	aActCode_Agent_Appl_Day * aAppl_Agent * min(nTAgents, nShifts * nAgents) * (1+pAgDailyReassign/100)
NIdAgentByAppStat	0.052	min[CallsPerDay, min(nTAgents, nShifts*nAgents) * aAppl_Agent * (1+ pAgDailyReassign/100)]
NIdAgentBySkillsetStat	0.060	min[CallsPerDay, min(nTAgents, nShifts*nAgents) * aSkill_Agent * (1+ pAgDailyReassign/100)]
NIdAgentPerfStat	0.288	min(nTAgents, nShifts*nAgents) * (1+ pAgDailyReassign/100)
NIdAppStat	0.657	nApplications
NIdCDNStat	0.042	nCDN
NIdDNISStat	0.099	min(CallsPerDay, nDNIS)
NIdIVRPortStat	0.063	nIVRPorts
NIdIVRStat	0.067	nIVRQ

Table 5 Symposium Call Center Server Daily stat tables (number of records per day)

Table name	Row size ANSI (KB)	Number of rows computations
NIdNetworkInCallStat	0.067	min(CallsPerDay, nApplications * (nNetNodes - 1))
NIdNetworkOutStat	0.059	min(CallsPerDay, nApplications * (nNetNodes - 1))
NIdRANMusicRoute Stat	0.020	nRMRRoutes
NIdRouteStat	0.027	nRoutes
NIdSkillsetStat	0.069	min(CallsPerDay, nSkillsets * aAppl_Skill + nNetSkillsets * aAppl_NetSkill * aNodes_NetSkill)
NIdTrunkStat	0.039	min(CallsPerDay, nTrunks * aTrunk_Routes)

Table 6 Symposium Call Center Server weekly stat tables (number of records per week)

Table Name	Row size ANSI (KB)	Number of Rows computations
NIwActivityCodeStat	0.066	aActCode_Agent_Appl_Week * aAppl_Agent * nTAgents * (1+pAgWeeklyReassign/100)
NIwAgentByAppStat	0.052	nTAgents * aAppl_Agent * (1+ pAgWeeklyReassign/100)
NIwAgentBySkillsetStat	0.060	nTAgents * aSkill_Agent * (1+ pAgWeeklyReassign/100)
NIwAgentPerfStat	0.288	nTAgents * 1+ pAgWeeklyReassign/100)
NIwAppStat	0.657	nApplications
NIwCDNStat	0.042	nCDN
NIwDNISStat	0.099	min(CallsPerDay*7, nDNIS)
NIwIVRPortStat	0.063	nIVRPorts
NIwIVRStat	0.067	nIVRQ
NIwNetworkInCallStat	0.067	nApplications * (nNetNodes - 1)

Table 6 Symposium Call Center Server weekly stat tables (number of records per week)

Table Name	Row size ANSI (KB)	Number of Rows computations
NIwNetworkOutStat	0.059	nApplications * (nNetNodes - 1)
NIwRANMusicRoute Stat	0.020	nRMRRoutes
NIwRouteStat	0.027	nRoutes
NIwSkillsetStat	0.069	nSkillsets * aAppl_Skill + nNetSkillsets * aAppl_NetSkill * aNodes_NetSkill
NIwTrunkStat	0.039	nTrunks * aTrunk_Routes

Table 7 Symposium Call Center Server monthly stat tables (number of records per month)

Table name	Row size ANSI (KB)	Number of rows computations
NImActivityCodeStat	0.066	aActCode_Agent_Appl_Month * aAppl_Agent * nTAgents * (1+pAgMonthlyReassign/100)
NImAgentByAppStat	0.052	nTAgents * aAppl_Agent * (1+ pAgMonthlyReassign/100)
NImAgentBySkillsetStat	0.060	nTAgents * aSkill_Agent * (1+ pAgMonthlyReassign/100)
NImAgentPerfStat	0.288	nTAgents * (1+ pAgMonthlyReassign/100)
NImAppStat	0.657	nApplications
NImCDNStat	0.042	nCDN
NImDNISStat	0.099	nDNIS
NImIVRPortStat	0.063	nIVRPorts
NImIVRStat	0.067	nIVRQ
NImNetworkInCallStat	0.067	nApplications * (nNetNodes - 1)

Table 7 Symposium Call Center Server monthly stat tables (number of records per month)

Table name	Row size ANSI (KB)	Number of rows computations
NImNetworkOutStat	0.059	nApplications * (nNetNodes - 1)
NImRANMusicRouteStat	0.020	nRMRRoutes
NImRouteStat	0.027	nRoutes
NImSkillsetStat	0.069	nSkillsets * aAppl_Skill + nNetSkillsets * aAppl_NetSkill * aNodes_NetSkill
NImTrunkStat	0.039	nTrunks * aTrunk_Routes

Table 8 Symposium Call Center Server configuration tables

Table name	Row size ANSI (KB)	Number of rows computations
NIActivityCode	0.092	nActCodes
NIAgentByTaskFlow	0.038	nAgents * nScripts
NIAgentByTaskFlowVariable	0.027	nAgents * nScripts * nTFVarsPerTF
NIApplication	0.048	nApplications
NIApplicationByTaskFlow	0.016	nApplications * nScripts
NICDN	0.076	nCDN
NIDBSpaceAllocated	0.046	100
NIDBSpaceUsed	0.024	200
NIDNIS	0.096	nDNIS
NIEnums	0.068	308
NIHDCConfig	0.033	200
NIHDMConfig	0.037	100
NIHDMStatus	0.035	100
NIHDSpaceAllocated	0.016	100
NIID	1.265	13
NIIVRPort	0.117	nIVRPorts
NIIVRQueue	0.075	nIVRQ
NINCCConfig	0.035	nCustomers

Table 8 Symposium Call Center Server configuration tables

Table name	Row size ANSI (KB)	Number of rows computations
NINCCNetworkSkillset	0.105	nNetSkillsets
NINCCNetworkSkillsetBySite	0.022	nNetSkillsets * nNetNodes
NINCCRanking	0.030	nNetNodes * (nNetNodes-1) * nNetSkillsets
NINCCRankingAssign	0.128	nNetNodes * nNetSkillsets * pBatchAssignFactor/100
NINCCRankingAssignData	0.018	(nNetNodes * nNetSkillsets * pBatchAssignFactor/100) * (nNetNodes * nNetSkillsets * 20)
NINCCRemoteApplication	0.044	nApplications * nNetNodes
NINCCSite	0.158	nNetNodes
NINetworkConfig	0.044	1
NINetworkSkillset	0.105	nNetSkillsets
NINetworkSkillsetStatus	0.020	nNetSkillsets
NIParameter	0.068	12
NIRanking	0.030	(nNetNodes-1) * nNetSkillsets
NIRDCConfig	0.041	nCustomers
NIRealTimeColumn	0.062	nRTColumns
NIRealTimeFormula	0.229	nRTFormulas
NIRealTimeTemplate	0.045	7
NIRemoteApplication	0.044	nApplications * nNetNodes
NIRoute	0.071	nRoutes + nRMRoutes
NISchema	0.140	1
NISDPConfig	0.018	1
NISite	0.165	nNetNodes
NISkillset	0.150	nSkillsets
NISkillsetAssign	0.125	nTAgents * aSkill_Agent * pBatchAssignFactor/100 / 100
NISkillsetAssignData	0.030	nTAgents * aSkill_Agent * pBatchAssignFactor/100

Table 8 Symposium Call Center Server configuration tables

Table name	Row size ANSI (KB)	Number of rows computations
NISkillsetByAgent	0.033	nTAgents * aSkill_Agent * 1.5
NISkillsetByTaskFlow	0.016	(nSkillsets * nScripts) / aAppl_Skill
NISkillsetByTaskFlowVariable	0.016	(nSkillsets * nScripts/aAppl_Skill) * nTFVarsPerTF
NIStatsTableName	0.050	60
NIStorageConfig	0.031	30
NISupervisorAgent	0.087	nTAgents * aSup_Agent
NITargetSwitchComm	0.052	nNetNodes
NITaskFlow[a]	11.884	nScripts (avg. 10K)
NITaskFlowTree	0.016	nScripts * aTFTreeDepth
NITaskFlowVariable	0.179	nScripts * nTFVarsPerTF
NITaskFlowVariableByTaskFlow	0.016	nScripts * nTFVarsPerTF
NITaskFlowVariableValue	0.266	nScripts * nTFVarsPerTF * pBatchAssignFactor/100
NITelsetField	0.043	nCustomers * nTelsetFields
NITerminal	0.072	(nAgents + nSupervisors) * 1.2
NITFFile	109.43	nScripts (avg. 100K)
NIThreshold	0.027	(nDNIS+nIVRQ+nRoutes+nSkillsets+nApplications+nNetSkillsets) * 0.1
NIThresholdTemplate	0.051	nDNIS+nIVRQ+nRoutes+nSkillsets+nApplications+nNetSkillsets
NItRefScript	0.023	20
NIUser	0.149	nTAgents+(nSupervisors+nAdministrators) * nShifts
NIUserAssign	0.125	(nAgents+nSupervisors+nAdministrators) * pBatchAssignFactor/100
NIUserAssignData	0.042	(nAgents+nSupervisors+nAdministrators) * pBatchAssignFactor/100
NIUserTemplate	0.055	nTAgents+(nSupervisors+nAdministrators) * nShifts

a. Assumes the script file takes 3K of space

Computing the number of rows per table

Introduction

The above tables can be used to compute the number of records for an individual Symposium Call Center Server table or for a group of tables. To determine the number of rows per individual table, use the number of rows computations as specified in Table 2 though to Table 8. For example, the number of records per day in the NIdSkillsetStat table is computed as nSkillsets*aAppl_Skill from Table 5, “Symposium Call Center Server Daily stat tables (number of records per day).”

Throughout the document the notation NumberOfRecords(<table_name>) is used to specify the number of records in the appropriate Symposium Call Center Server table as specified above. For example, NumberOfRecords(NIdSkillsetStat)=nSkillsets * aAppl_Skill from Table 5, “Symposium Call Center Server Daily stat tables (number of records per day).”

To simplify notation, the following parameters are used:

- *NumberOfRecords(<group_of_tables>)*—specifies the number of records for a group of tables. The number of records in a group of tables is the sum of the number of records of the individual tables. The groups of tables recognized as follows:
- *EventTables*—described in Table 2
- *IntervalStatTables*—described in Table 3
- *TempIntervalTables*—described in Table 4
- *DailyStatTables*—described in Table 5
- *WeeklyStatTables*—described in Table 6
- *MonthlyStatTables*—described in Table 7
- *ConfigurationTables*—described in Table 8

For example, NumberOfRecords(EventTables) represents the number of records in the Symposium Call Center Server event tables generated per day and is computed in the following formula:

```
NumberOfRecords(EventTables) =
  SUMOF(
    NumberOfRecords(NIeAgentLoginStat)
    NumberOfRecords(NIeIVRPortLoginStat)
    NumberOfRecords(NIeCallByCallStatYYYYMMDD)
  )

= SUMOF(
    nAgents*(2*nIntPerShift+2)*nShifts
    4*nSkillsets
    nIVRPortEvents*nIVRPorts
    (RecsPerCall+RecsPerNWCall*pNetOut)*DailyCallRate*24
  )
```

Computing the table size

Introduction

The above tables can be used to compute the size (in kbytes) for an individual Symposium Call Center Server table or for a group of tables. To determine the size per individual table, use the row size as specified in Table 2 though to Table 8, multiplied by the appropriate number of records:

```
SizeOf(<table>) = NumberOfRecords(<table>)*<RowSize>
```

For example, the daily size of the NIdSkillsetStat is computed as NumberOfRecords(NIdSkillsetStat)*0.039 from Table 5.

Throughout the document, the notation SizeOf(<table_name>) is used to specify the size of the appropriate Symposium Call Center Server table as specified above. For example,

```
SizeOf(NIdSkillsetStat)=
  NumberOfRecords(NIdSkillsetStat)*0.039=
  nSkillsets*aAppl_Skill*0.039
```

from Table 5.

Note: The Configuration Tables and the Temporary Interval Stat Tables (Table 8 and Table 4) have the size of at least 32K[1]. Therefore, the computations for these tables are

```
MAX(32,NumberOfRecords(<table>)*<RowSize>)
```

To simplify notation, the parameter SizeOf(<group_of_tables>) is used to specify the size for a group of tables. The size of a group of tables is the sum of the sizes of the individual tables. The groups of tables recognized is the same as the ones described in “Computing the number of rows per table” on page 326.

1. The minimal size of all tables is 32K; however, the computations for tables other than the Configuration Tables and the Temp Interval Tables represent the size of a portion of the table (daily, weekly, monthly, and so on) and the total size for each of these tables (once the portions are added up) is very unlikely to be less than 32K.

For example, *SizeOf(EventTables)* represents the size of the Symposium Call Center Server event tables in kbytes generated per day and is computed as

```
SizeOf(EventTables)
  = SUMOF(
     SizeOf(NIeAgentLoginStat)
     SizeOf(NIeSkillsetStateStat)
     SizeOf(NIeIVRPortLoginStat)
     SizeOf(NIeCallByCallStatYYYYMMDD)
     SizeOf(NIeNetwCallByCallStatYYYYMMDD)
  )

= SUMOF(
     0.094 * NumberOfRecords(NIeAgentLoginStat)
     0.014 * NumberOfRecords(NIeSkillsetStateStat)
     0.071 * NumberOfRecords(NIeIVRPortLoginStat)
     0.141 * NumberOfRecords(NIeCallByCallStatYYYYMMDD)
     0.145 *
         NumberOfRecords(NIeNetwCallByCallStatYYYYMMDD)
  )

= SUMOF(
     0.094 * nAgents*(2*nIntPerShift+2)*nShifts
     0.014 * 0
     0.071 * nIVRPortEvents*nIVRPorts
     0.141 * RecordsPerHour*nShifts*nShiftsHrs
```

Appendix C

Symposium Call Center Server standard reports

In this appendix

Overview

Introduction

Symposium Call Center Server has a number of standard reports, known as "canned" reports, supplied as a part of the system. Table 9 shows the number of columns, the number of bytes per row as well as the number of views that each report is based on. This information can be used in the computation of LAN and CPU reporting impact.

List of standard reports

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Configuration Reports						
Historical and Real Time Statistics Properties	17	17	1	15	15	1
Supervisor Properties	614	16	2	582	15	2
Agent Properties	792	24	2	771	22	2
Telephone Display Properties	164	4	1	N/A		
CDN Properties	120	3	1	120	3	1
Activity Code Properties	62	2	1	62	2	1
Route Properties	152	6	2	N/A		
DNIS Properties	66	3	1	66	3	1
IVR Queue and Port Properties	450	20	3	N/A		
Application Properties	65	4	2	65	4	2
Application Script Properties	60	2	1	60	2	1
Application Template Properties	157	8	2	157	8	2
Skillset Properties	380	15	1	348	14	1
Formula Properties	492	4	1	492	4	1
Real Time Template Properties	338	9	3	338	9	3
Agent Supervisor Assignment	670	13	2	670	13	2
Agent Skillset Assignment	492	9	1	492	9	1
Agent Skillset Properties	347	9	3	315	8	3
Agent By Supervisor Properties	305	8	1	305	8	1
Agent Position ID	198	8	2	166	7	1
Script Variable Properties	667	9	2	667	9	2
Database View Definitions	91	4	1	91	4	1
Script Variable By Script	380	6	1	380	6	1

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Skillset Routing	67	6	3	N/A		
Site and Application (NCC)	69	5	1	N/A		
Site and Applicaion	69	5	1	N/A		
Skillset Routing (NCC)	93	5	2	N/A		
Table Routing Assignment (NCC)	330	8	2	N/A		
User Access Privilege	380	16	1	380	16	1
Interval Historical Reports						
Agent Performance	287	57	1	257	47	1
Agent Performance by Supervisor	253	10	1	387	45	1
Agent DN Performance	337	24	1	325	20	1
Agent Short Calls	359	39	1	357	38	1
Agent By Skillset Performance	199	11	1	195	10	1
Activity Code by Agent	221	9	1	221	9	1
Agent By Application Performance	193	9	1	189	8	1
Agent Network/Agent NACD Activity	171	11	1	N/A		
Agent Transferred/Conferenced Activity	205	30	1	201	29	1
Agent by Activity Code	253	10	1	253	10	1
Application Performance	61	12	1	61	12	1
Application Delay Before Answer	177	70	1	177	70	1
Application Delay Before Abandon	173	69	1	173	69	1
Application Call Treatment	77	17	1	77	17	1
Application by Skillset	103	14	1	103	14	1
Activity Code By Application	253	10	1	253	10	1
Application By Activity Code	257	11	1	257	11	1
Trunk Performance	65	11	1	N/A		
Route Performance	51	10	1	N/A		
IVR Queue Statistics	68	13	1	N/A		

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
IVR Port Statistics	98	12	1	N/A		
DNIS Statistics	113	21	1	109	19	1
CDN Statistics	57	8	1	59	9	1
Music/RAN Route Statistics	49	6	1	49	6	1
Skillset by Application	103	14	1	103	14	1
Skillset Performance	99	13	1	99	13	1
Daily Historical Reports						
Agent Performance	361	57	1	316	46	1
Agent Performance Calls Answered Top 5	248	9	1	445	45	1
Agent Performance Calls Answered Bottom 5	461	49	1	445	45	1
Agent Performance by Supervisor	469	51	1	445	45	1
Agent DN Performance	356	23	1	340	19	1
Agent DN Performance Calls Answered Top 5	356	23	1	340	19	1
Agent DN Performance Calls Answered Bott 5	356	23	1	340	19	1
Agent by Activity Code	248	9	1	248	9	1
Agent Short Calls	416	38	1	412	37	1
Agent Average Calls Per Hour	180	12	1	172	10	1
Agent Average Calls Per Hour Top 5	180	12	1	172	10	1
Agent Average Calls Per Hour Bottom 5	180	12	1	172	10	1
Estimated Revenue Per Agent	218	8	1	218	8	1
Agent By Skillset Performance	198	10	1	194	9	1
Activity Code by Agent	216	8	1	216	8	1
Agent By Application Performance	195	9	1	191	8	1
Agent Network/Agent NACD Activity	172	10	1	N/A		

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Agent Transferred/Conferenced Activity	248	29	1	244	28	1
Application Performance	66	11	1	66	11	1
Application Delay Before Answer	298	69	1	298	69	1
Application Delay Before Abandon	296	68	1	296	68	1
Application Call Treatment	95	17	1	95	17	1
Application by Skillset	107	14	1	107	14	1
Activity Code By Application	104	6	1	104	6	1
Application By Activity Code	252	10	1	252	10	1
Trunk Performance	71	11	1	N/A		
Route Performance	50	6	1	N/A		
IVR Queue Statistics	77	12	1	N/A		
IVR Port Statistics	129	12	1	N/A		
DNIS Statistics	130	20	1	122	18	1
CDN Statistics	60	7	1	64	8	1
Music/RAN Route Statistics	46	5	1	46	5	1
Skillset by Application	107	14	1	107	14	1
Skillset Performance	98	12	1	98	12	1
Weekly Historical Reports						
Agent Performance	361	57	1	316	46	1
Agent Performance Calls Answered Top 5	248	9	1	445	45	1
Agent Performance Calls Answered Bottom 5	461	49	1	445	45	1
Agent Performance by Supervisor	469	51	1	445	45	1
Agent DN Performance	356	23	1	340	19	1
Agent DN Performance Calls Answered Top 5	356	23	1	340	19	1

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Agent DN Performance Calls Answered Bott 5	356	23	1	340	19	1
Agent by Activity Code	248	9	1	248	9	1
Agent Short Calls	416	38	1	412	37	1
Agent Average Calls Per Hour	180	12	1	172	10	1
Agent Average Calls Per Hour Top 5	180	12	1	172	10	1
Agent Average Calls Per Hour Bottom 5	180	12	1	172	10	1
Estimated Revenue Per Agent	218	8	1	218	8	1
Agent By Skillset Performance	198	10	1	194	9	1
Activity Code by Agent	216	8	1	216	8	1
Agent By Application Performance	195	9	1	191	8	1
Agent Network/Agent NACD Activity	172	10	1	N/A		
Agent Transferred/Conferenced Activity	248	29	1	244	28	1
Application Performance	66	11	1	66	11	1
Application Delay Before Answer	298	69	1	298	69	1
Application Delay Before Abandon	296	68	1	296	68	1
Application Call Treatment	95	17	1	95	17	1
Application by Skillset	107	14	1	107	14	1
Activity Code By Application	104	6	1	104	6	1
Application By Activity Code	252	10	1	252	10	1
Trunk Performance	71	11	1	N/A		
Route Performance	50	6	1	N/A		
IVR Queue Statistics	77	12	1	N/A		
IVR Port Statistics	129	12	1	N/A		
DNIS Statistics	130	20	1	122	18	1
CDN Statistics	60	7	1	64	8	1

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Music/RAN Route Statistics	46	5	1	46	5	1
Skillset by Application	107	14	1	107	14	1
Skillset Performance	98	12	1	98	12	1
Monthly Historical Reports						
Agent Performance	361	57	1	316	46	1
Agent Performance Calls Answered Top 5	248	9	1	445	45	1
Agent Performance Calls Answered Bottom 5	461	49	1	445	45	1
Agent Performance by Supervisor	469	51	1	445	45	1
Agent DN Performance	356	23	1	340	19	1
Agent DN Performance Calls Answered Top 5	356	23	1	340	19	1
Agent DN Performance Calls Answered Bott 5	356	23	1	340	19	1
Agent by Activity Code	248	9	1	248	9	1
Agent Short Calls	416	38	1	412	37	1
Agent Average Calls Per Hour	180	12	1	172	10	1
Agent Average Calls Per Hour Top 5	180	12	1	172	10	1
Agent Average Calls Per Hour Bottom 5	180	12	1	172	10	1
Estimated Revenue Per Agent	218	8	1	218	8	1
Agent By Skillset Performance	198	10	1	194	9	1
Activity Code by Agent	216	8	1	216	8	1
Agent By Application Performance	195	9	1	191	8	1
Agent Network/Agent NACD Activity	172	10	1	N/A		
Agent Transferred/Conferenced Activity	248	29	1	244	28	1
Application Performance	66	11	1	66	11	1

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Application Delay Before Answer	298	69	1	298	69	1
Application Delay Before Abandon	296	68	1	296	68	1
Application Call Treatment	95	17	1	95	17	1
Application by Skillset	107	14	1	107	14	1
Activity Code By Application	104	6	1	104	6	1
Application By Activity Code	252	10	1	252	10	1
Trunk Performance	71	11	1	N/A		
Route Performance	50	6	1	N/A		
IVR Queue Statistics	77	12	1	N/A		
IVR Port Statistics	129	12	1	N/A		
DNIS Statistics	130	20	1	122	18	1
CDN Statistics	60	7	1	64	8	1
Music/RAN Route Statistics	46	5	1	46	5	1
Skillset by Application	107	14	1	107	14	1
Skillset Performance	98	12	1	98	12	1
Nodal Interval Consolidated Historical Reports						
Nodal Cons Application Performance	50	8	1	N/A		
Nodal Cons Application Delay Before Answer	177	70	1	N/A		
Nodal Cons Application Delay Before Abandon	173	69	1	N/A		
Nodal Daily Consolidated Historical Reports						
Nodal Cons Application Performance	62	9	1	N/A		
Nodal Cons Application Delay Before Answer	298	69	1	N/A		
Nodal Cons Application Delay Before Abandon	296	68	1	N/A		

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Nodal Weekly Consolidated Historical Reports						
Nodal Cons Application Performance	62	9	1	N/A		
Nodal Cons Application Delay Before Answer	298	69	1	N/A		
Nodal Cons Application Delay Before Abandon	296	68	1	N/A		
Nodal Monthly Consolidated Historical Reports						
Nodal Cons Application Performance	62	9	1	N/A		
Nodal Cons Application Delay Before Answer	298	69	1	N/A		
Nodal Cons Application Delay Before Abandon	296	68	1	N/A		
Network Interval Historical Reports						
Network Incoming Calls	34	2	1	N/A		
Network Outgoing Calls	105	8	1	N/A		
Network Skillset Performance	135	16	1	N/A		
Network Application Performance	73	15	1	N/A		
Network Route Performance	53	8	1	N/A		
Network DNIS Performance	117	23	1	N/A		
Network Daily Historical Reports						
Network Incoming Calls	113	17	1	N/A		
Network Outgoing Calls	111	8	1	N/A		
Network Skillset Performance	136	15	1	N/A		
Network Application Performance	80	14	1	N/A		
Network Route Performance	54	7	1	N/A		
Network DNIS Statistics	138	22	1	N/A		
Network Weekly Historical Reports						
Network Incoming Calls	113	17	1	N/A		

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Network Outgoing Calls	111	8	1	N/A		
Network Skillset Performance	136	15	1	N/A		
Network Application Performance	80	14	1	N/A		
Network Route Performance	54	7	1	N/A		
Network DNIS Performance	138	22	1	N/A		
Network Monthly Historical Reports						
Network Incoming Calls	113	17	1	N/A		
Network Outgoing Calls	111	8	1	N/A		
Network Skillset Performance	136	15	1	N/A		
Network Application Performance	80	14	1	N/A		
Network Route Performance	54	7	1	N/A		
Network DNIS Performance	138	22	1	N/A		
Network Consolidated Interval Historical Reports						
Network Consolidated Incoming Calls	103	17	1	N/A		
Network Consolidated Outgoing Calls	105	8	1	N/A		
Network Consolidated Skillset Performance	97	13	1	N/A		
Network Consolidated Application Performance	73	15	1	N/A		
Network Consolidated Route Performance	53	8	1	N/A		
Network Consolidated DNIS Statistics	117	23	1	N/A		
Network Consolidated Daily Historical Reports						
Network Consolidated Incoming Calls	113	17	1	N/A		
Network Consolidated Outgoing Calls	111	8	1	N/A		
Network Consolidated Skillset Performance	98	12	1	N/A		

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Network Consolidated Application Performance	80	14	1	N/A		
Network Consolidated Route Performance	54	7	1	N/A		
Network Consolidated DNIS Statistics	138	22	1	N/A		
Network Consolidated Weekly Historical Reports						
Network Consolidated Incoming Calls	113	17	1	N/A		
Network Consolidated Outgoing Calls	111	8	1	N/A		
Network Consolidated Skillset Performance	98	12	1	N/A		
Network Consolidated Application Performance	80	14	1	N/A		
Network Consolidated Route Performance	54	7	1	N/A		
Network Consolidated DNIS Statistics	138	22	1	N/A		
Network Consolidated Monthly Historical Reports						
Network Consolidated Incoming Calls	113	17	1	N/A		
Network Consolidated Outgoing Calls	111	8	1	N/A		
Network Consolidated Skillset Performance	98	12	1	N/A		
Network Consolidated Application Performance	80	14	1	N/A		
Network Consolidated Route Performance	54	7	1	N/A		
Network Consolidated DNIS Statistics	138	22	1	N/A		

Table 9 Symposium Call Center Server standard reports

Title	M1			DMS/MSL-100		
	Bytes per row	Columns	Views	Bytes per row	Columns	Views
Other Reports						
Agent Login/Logout	220	11	1	220	11	1
IVR Port First Login/Last Logout	82	6	1	82	6	1
Call By Call Statistics	314	12	1	318	13	1
Network Call By Call Statistics	318	13	1	N/A		

Appendix D

Ethernet delay factors versus bandwidth utilization

In this appendix

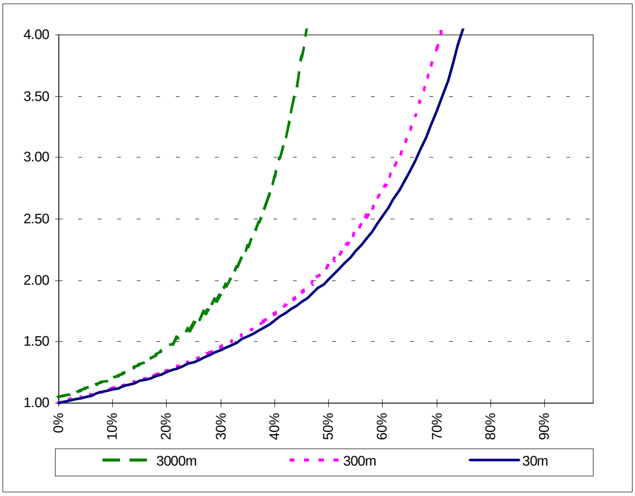
Ethernet delay factors versus utilization

Introduction

Figure 1 shows the relationship between the average delay factor and the LAN utilization for different wire lengths. For example, for a system located in a single room (wire length between components is under 30 meters), the delay factor will be 2 whenever the LAN utilization is 50 percent. That is, it takes the data packet twice as long to travel between the components as it would on an “idle” system. The delay factor X effectively reduces the LAN bandwidth by the factor of X. For example, for a delay factor of 2, the effective bandwidth of the Ethernet LAN would be 5 Mbits/Sec instead of 10 Mbits/Sec. Figure 1 shows the performance characteristics for Ethernet. Token Ring has similar performance characteristics for utilizations below 60 to 70 percent.

You must take care to plan CLAN and ELAN traffic so that the delay factor is never greater than 2. Use Figure 1 to determine the maximum allowable utilization given the distance between Symposium Call Center Server components. For example, if the distance between the Symposium Call Center Server components is expected to be 3000 meters, then the Private LAN utilization should not exceed 30 percent. If all of the Symposium Call Center Server components are placed in the same building and the wire length does not exceed 300 meters, then the maximum ELAN utilization can be as high as 45 percent. CLAN utilization is estimated based on the maximum distance between Symposium Call Center Server components as well as your own components.

Figure 1 Ethernet delay factors versus utilization percent



In the computations in this section, the total TCP/IP bandwidth, parameter *TCPIP_Bandwidth_MbitsSec*, has the value of 10.

Using the time delay factor formula

Introduction

The graphs shown in Figure 1 were produced using a formula for the average time delay factor of a packet traveling across a LAN using the CSMA/CD (better known as Ethernet) access method. The formula for average packet delay time was programmed in MathCAD (version 3.1) to produce those graphs and is given here as

$$Delay = \frac{\rho \cdot \left[\frac{mb^2}{m^2} + (4e+2)a + 5a^2 + 4e(2e-1)a^2\right]}{2 \cdot (1 - \rho(1 + (2e+1) \cdot a))} + \left(1 + 2ea + \frac{a}{2}\right) - \frac{(1 - e^{-2a\rho}) \cdot \left[\left(\frac{2}{\rho} + 2 \cdot \frac{a}{e}\right) - 6a\right]}{2 \cdot [(Fpe^{-\rho a - 1} - 1) + e^{-2\rho a}]}$$

Note: The derivation of this formula can be found in *Telecommunication Networks* by Mischa Schwartz, Addison-Wesley, 1987.

The formula varies with the utilization ratio (given as ‘rho’ in the above equation), which is a value between zero and one representing the proportion of bandwidth utilized on the Ethernet. This value changes depending on the number of client workstation nodes operating with one Ethernet LAN making transaction requests to any other node. A single utilization value is used for simplicity and is assumed to be known using a LAN traffic performance measurement. The value ‘m’ is the average packet time (that is, the average packet length in bits divided by the LAN bit signaling rate), and ‘e’ is the value 2.7182 (natural logarithm base).

The value of ‘Delay’ above is an average delay factor that an average packet of time ‘m’ is transacted across the LAN. For example, the value of ‘Delay’ is 1 for no delay, such that the packet delay time is equal to the packet propagation time, and 2 if the delay time is double the packet propagation time. In this formula, the following assumptions are made:

$$Fp = \frac{1}{1+\rho} \qquad mb = \sqrt{2}m \qquad a = \frac{t}{m}$$

The function ‘Fp’ is derived from the packet size distribution. An assumption is made that the packet sizes are exponentially distributed which leads to the formulation that ‘Fp’ varies with the bandwidth utilization as above. Here ‘mb’ is the standard deviation of the average packet time ‘m’ which is also in seconds. The value for ‘mb’ above also follows from the exponential assumption.

The quantity ‘a’ given above is a parameter, which establishes the throughput limit for CSMA/CD. This parameter has no unit and is the ratio of the maximum end-to-end propagation delay time ‘t’ divided by the average packet time ‘m’, both in seconds. A value for ‘a’ that exceeds a limit (about 0.01) implies that the packet collision resolution of CSMA/CD is becoming more difficult and will cause longer packet throughput delays particularly with small packets.

The average packet time ‘m’ is determined as the average packet size in bits (at the hardware or ‘wire’ level) divided by the LAN signaling time. For example, a packet of 100 bytes would be approximately packaged at 10 bits/byte and signaled at 10 Mbps for a 10Base-T LAN with a packet time of 100 micro-seconds.

The maximum end-to-end propagation delay time ‘t’ is determined as the maximum physical wire length of two nodes divided by the speed of light. For example, if the maximum wire length is 300 m, the end-to-end propagation delay time is 1 micro-second.

The consequence of this LAN design choice would be that a=0.01, causing the packet throughput to be limited at a bandwidth utilization of 94 percent. This design also means that the average packet will be delayed by a factor of 2 at a bandwidth utilization of 50 percent (see Figure 2). This choice is still good, however, for longer wire lengths (up to 3000 metres) and smaller packet sizes. Beyond 3000 metres, the throughput limit with an Ethernet LAN is reduced, and longer transaction delays can be expected.

Appendix E

CPU utilization upper limits

In this appendix

Overview

Introduction

This appendix presents the rationale for using 50 percent as the upper limit on CPU utilization for the configurations with 256 Mbytes of RAM.

Bottlenecks and reserve capacity

Upper limit for CPU utilization

Typically, 70 percent is chosen as the upper limit value for CPU utilization for the following reasons:

- minimizing the times when the CPU is the bottleneck
- ensuring that there is enough reserve CPU capacity to handle burstiness and unexpected loading

However, 50 percent utilization is used here for the following reasons:

- designer trace tools (which can take a considerable amount of CPU resources)
- ad-hoc activities, such as validating large scripts, can consume a significant amount of CPU resources for an extended amount of time. Ad-hoc activities include
  - activation of the master script
  - validation of a large script
  - supervisor reassignments
  - skillset reassignments
  - generation of large reports
  - extraction of large amounts of data from the database
  - simultaneous login or logout of a large number of agents

Defaulted calls during ad hoc activities

If you experience an unacceptable proportion of defaulted calls during the running of any adhoc activity during a busy period (the number of calls received per hour is higher then the daily average), reschedule the activity. For example, you can reschedule the ad-hoc activity to run during a period when the system is not as busy. It is also recommended that scripts be activated one at a time during a busy period and that the activation cascading functionality (the ability to activate all scripts by just activating the master) only be used after a major upgrade.

Reserve capacity

As for “burstiness” and unexpected loading, a good rule of thumb is to have 25 to 30 percent of capacity in reserve.

Minimizing CPU bottlenecks

Standard queueing equation

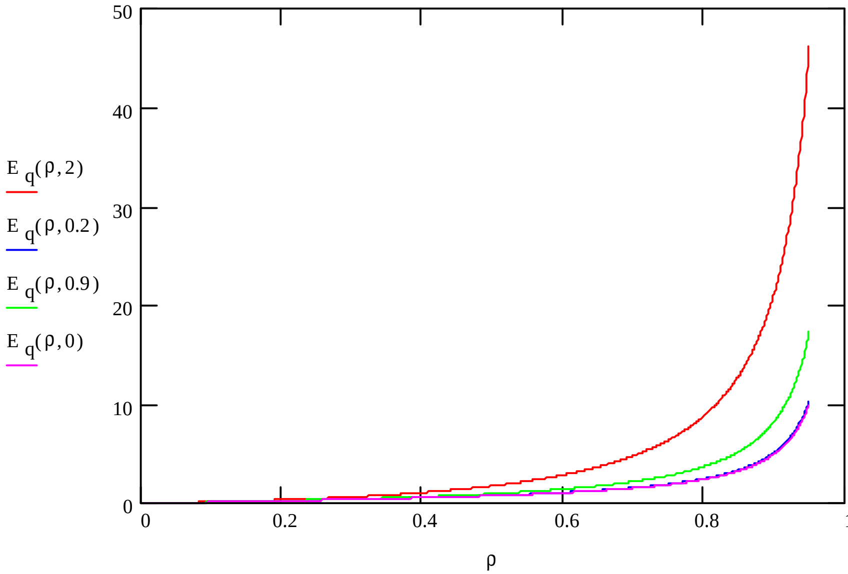
All tasks requesting CPU resources queue for service. The standard queueing equation used for determining the average number of tasks in the queue is the Khintchine and Polloczek result for the M/G/1 queue. This equation states that the expected number in the queue is a function of the server utilization and the coefficient of variation (COV) of the service time. (The COV is the ratio of the standard deviation to the mean). More explicitly:

$$E_q(\rho, R) := \rho + \frac{\rho^2}{2\cdot(1-\rho)}\cdot\left(1+R^2\right)$$

where ρ is the server (CPU) utilization and R is the COV of the service time (CPU task time). Although in reality, tasks have different priorities, the equation still gives a good approximation to the number of tasks waiting for the CPU.

A plot of this curve for different values of R is shown in Figure 2.

Figure 2 Number of waiting tasks versus CPU utilization



As shown, there is a sharp bend in the curve at 80 to 90 percent depending on the COV. Operating in this part of the curve is not recommended since the system is highly sensitive to load fluctuations. A slight increase in load results in a disproportionately large increase in mean queue size possibly resulting in buffer overflow and unacceptably long response times. What is desirable is to operate in the flatter part of the curve which is much less sensitive to load fluctuations keeping mean buffer sizes relatively constant. 70 percent is a safe upper bound for this region. However, 50 percent allows for a larger margin of safety.

Non-steady state activities

Introduction

A number of non-steady state processes can have a significant impact on the steady state call processing activity of the server. To minimize the impact of these functions on call processing, the use of these functions has been restricted. A number of recommendations are also made on how and when these functions should be used. Nortel Networks recommends against running two or more large non-steady state activities concurrently.

Non-steady state process

The major non-steady state processes and their restrictions are as follows:

- activation of the Master_Script
  - It is recommended that the master script should not be activated during a busy period.
  - If the master script is activated under load, all primary and secondary scripts should be activated first.
  - The master script can be activated such that all primary and secondary scripts are also activated if the server is not performing call processing.
- validation of large scripts

  It is recommended that the master script or any large script should not be validated during a busy period.
- supervisor reassignments

  The size of a supervisor reassignment has been restricted to 1000 entries. It is recommended that multiple supervisor reassignments not be run concurrently.
- skillset reassignments

  The size of a skillset reassignment has been restricted to 1000 entries where the number of skillsets times the number of agents involved is less then 5000. It is recommended that multiple skillset reassignments not be run concurrently.

- generation of large reports

  There are no restrictions on report generation but it is recommended that large reports are generated one after the other rather than concurrently.

- extraction of large amounts of data from the database

  There are no restrictions on data extraction but it is recommended that large data extractions are generated one after the other rather than concurrently.

- en-mass login and logout of agents

  There are no restrictions on agent logon/logoff but it is recommended that this activity be spread over a 5 to 15 minute period and not be during the peak busy hour.

Appendix F

Symposium Call Center Server detailed calculations

In this appendix

Overview

Introduction

This appendix supplies supplementary information required for the documentation of the detailed calculations presented throughout this document.

CSL calculations

Introduction

Table 10 shows the high runner Command and Status Link (CSL) for example, setting up and taking down an IVR session, services along with the total sizes of the messages[1] associated with them. *Voice_Services* is the rate of voice services per hour. This value can be computed by determining the proportion of calls that require voice services.

Table 10 CSL services (sizes include overhead)

Command and status link service	Variable name	Size (Bytes)
Setup Session	CSLSetupBytes	82
Release Session	CSLReleaseBytes	25
Total Session	CSL_Bytes_PerSession	107

1. The sizes include the Overhead of 7 bytes per message.

Access link calculations

Introduction

Table 11 shows ACCESS services related to the scripts shown above along with the total sizes of the messages[1] associated with them. It is assumed that the number of digits collected is 9, the length of DN is 12 digits and the number of voice segments played is 10. The following are parameter definitions:

VoiceMenuIVR is the proportion of voice menu calls (*ACC_VoiceMenuServices*)

pControlledIVR is the proportion of the regular controlled Voice calls (*ACC_ControlledServices*).

Table 11 ACCESS services (sizes include overhead)

ACCESS Session Services	Size to MMail	Size from MMail	#used in controlled voice call services	#used in voice menu services
Call Setup (Voice Menu and Regular)	42	201	1	1
Play Segments	79	37	1	2
Collect Digits	7	15	0	9
Call Disconnect (Voice Menu)	27	75	0	1
ACCESS bytes per call (max(to_MMail, from_MMail))			238	485

1. The sizes include the overhead and ACK per message.

Appendix G

Symposium Call Center Server database views

In this appendix

Symposium Call Center Server database views

Introduction

Symposium Call Center Server has a number of database views supplied as a part of the system. You can extract data from the database through these views. Table 12 shows the number of columns and the number of bytes per row for each view. You can use this information to help calculate the LAN and CPU reporting impact.

Table 12 Symposium Call Center Server views

View	M1		DMS/MSL-100	
	Bytes per row	Columns	Bytes per row	Columns
Configuration views				
AccessRights	383	19	383	19
ActivityCode	62	2	62	2
Agent	671	23	650	21
Application	43	5	43	5
ApplicationByScript	594	10	594	10
ApplicationTemplate	92	4	92	4
ApplicationThresholdTemplate	126	6	126	6
CDN	201	5	201	5
CodeToMessageMap	114	3	114	3
DNIS	70	4	70	4
DNISThresholdTemplate	38	3	38	3
Formula	576	6	576	6
HistoricalStatCollection	18	18	16	16
HistoricalStatDuration	100	11	100	11
HistoricalStatStorage	92	4	92	4
IVRPort	198	8	198	8

Table 12 Symposium Call Center Server views

View	M1		DMS/MSL-100	
	Bytes per row	Columns	Bytes per row	Columns
IVRQueue	126	6	N/A	
IVRThreholdTemplate	130	7	130	7
NCCConfig	12	3	N/A	
NCCNetworkSkillset	165	6	N/A	
NCCRanking	104	7	N/A	
NCCRemoteApplication	73	6	N/A	
NCCSite	229	7	N/A	
NetworkConfig	30	1	N/A	
NetworkRankingAssignment	349	12	N/A	
NetworkSkillsetStatus	68	5	N/A	
NetworkThresholdTemplate	122	5	N/A	
PhoneSetDisplay	164	4	N/A	
Ranking	104	7	N/A	
RealTimeColumn	124	7	124	7
RealTimeStatCollection	90	17	88	15
RealTimeTemplate	198	5	198	5
RemoteApplication	73	6	N/A	
Route	119	5	38	3
RouteThresholdTemplate	126	6	126	6
ScheduledSkillsetAssignment	520	13	520	13
ScheduledSupervisorAssignment	486	11	486	11
Script	469	9	469	9
ScriptVariableProperties	477	6	477	6
ScriptVariables	380	6	380	6
Site	264	10	N/A	
Skillset	395	20	363	19
SkillsetByAgent	101	4	101	4
SkillsetByAssignment	520	13	520	13

Table 12 Symposium Call Center Server views

View	M1		DMS/MSL-100	
	Bytes per row	Columns	Bytes per row	Columns
SkillsetThresholdTemplate	134	8	134	8
SummaryThresholdTemplate	126	6	126	6
Supervisor	619	16	587	15
SupervisorAgentAssignment	321	9	321	9
SupervisorByAssignment	486	11	486	11
SwitchPort	229	7	N/A	
TargetSwitchComm	76	6	N/A	
UserTemplate	126	10	120	8
UserThresholdTemplate	46	5	46	5
Views	91	4	91	4
Event Statistics Views				
eAgentLoginStat	220	11	220	11
eCallByCallStatYYYYMMDD	314	12	318	13
eIVRPortLoginStat	82	6	N/A	
eNetCallByCallStatYYYYMMDD	318	13	N/A	
Interval Statistics Views				
iActivityCodeStat	307	14	307	14
iAgentByApplicationStat	247	13	243	12
iAgentBySkillsetStat	253	15	249	14
iAgentPerformanceStat	513	68	487	60
iApplicationStat	443	174	435	171
iCDNStat	91	10	93	11
iDNISStat	151	25	147	23
iIVRPortStat	162	15	162	15
iIVRStat	108	18	108	18
iNetworkInCallStat	179	23	N/A	
iNetworkOutStat	175	21	N/A	

Table 12 Symposium Call Center Server views

View	M1		DMS/MSL-100	
	Bytes per row	Columns	Bytes per row	Columns
iNetworkSkillsetStat	145	20	N/A	
iRANMusicRouteStat	83	8	83	8
iRouteStat	87	10	N/A	
iSkillsetStat	147	21	147	21
iTrunkStat	99	13	N/A	
Daily Statistics Views				
dActivityCodeStat	307	14	307	14
dAgentByApplicationStat	249	13	245	12
dAgentBySkillsetStat	257	15	253	14
dAgentPerformanceStat	587	68	555	60
dApplicationStat	739	174	727	171
dCDNStat	99	10	103	11
dDNISStat	177	25	169	23
dIVRPortStat	168	15	168	15
dIVRStat	128	18	128	18
dNetworkInCallStat	189	23	N/A	
dNetworkOutStat	181	21	N/A	
dNetworkSkillsetStat	145	20	N/A	
dRANMusicRouteStat	85	8	85	8
dRouteStat	93	10	N/A	
dSkillsetStat	161	21	161	21
dTrunkStat	105	13	N/A	
Weekly Statistics Views				
wActivityCodeStat	307	14	307	14
wAgentByApplicationStat	249	13	245	12
wAgentBySkillsetStat	257	15	253	14
wAgentPerformanceStat	587	68	555	60

Table 12 Symposium Call Center Server views

View	M1		DMS/MSL-100	
	Bytes per row	Columns	Bytes per row	Columns
wApplicationStat	739	174	727	171
wCDNStat	99	10	103	11
wDNISStat	177	25	169	23
wIVRPortStat	168	15	168	15
wIVRStat	128	18	128	18
wNetworkInCallStat	189	23	N/A	
wNetworkOutStat	181	21	N/A	
wNetworkSkillsetStat	145	20	N/A	
wRANMusicRouteStat	85	8	85	8
wRouteStat	93	10	N/A	
wSkillsetStat	161	21	161	21
wTrunkStat	105	13	N/A	
Monthly Statistics Views				
mActivityCodeStat	307	14	307	14
mAgentByApplicationStat	249	13	245	12
mAgentBySkillsetStat	257	15	253	14
mAgentPerformanceStat	587	68	555	60
mApplicationStat	739	174	727	171
mCDNStat	99	10	103	11
mDNISStat	177	25	169	23
mIVRPortStat	168	15	168	15
mIVRStat	128	18	128	18
mNetworkInCallStat	189	23	N/A	
mNetworkOutStat	181	21	N/A	

Table 12 Symposium Call Center Server views

View	M1		DMS/MSL-100	
	Bytes per row	Columns	Bytes per row	Columns
mNetworkSkillsetStat	145	20	N/A	
mRANMusicRouteStat	85	8	85	8
mRouteStat	93	10	N/A	
mSkillsetStat	161	21	161	21
mTrunkStat	105	13	N/A	

Appendix H

Abbreviations and acronyms

In this appendix

Abbreviations and acronyms

Abbreviation/ acronym	Expanded name
ACD	Automatic Call Distribution
AML	Application Module Link
API	Application Program Interface
BCP	Bulk Copy Procedure
CBC	Call by Call
CCS	Call Center Seconds
CDN	Controlled Directory Number
CDR	Call Detail Reporting
CED	Caller Entered Data
CLAN	Customer Local Area Network
CPD	Calls Per Day
CPH	Calls Per Hour
CP MTBT	Mean Time Between Failures for Call Processing
CPU	Central Processing Unit
CSL	Command and Status Link
CSMA/CD	Carrier Sense Multiple Access/Collision Detection
CTI	Computer Telephony Interface
DAT	Digital Audio Tape
DMS	Digital Multiplexor Switch

Abbreviation/ acronym	**Expanded name**
DN	Directory Number
DNIS	Dialed Number Identification Service
DSP	Digital Signal Processing
DX	Data Exchange
EBC	Equivalent Basic Call
EI	Event Interface (Symposium Event Interface)
EIU	Ethernet Interface Unit
ELAN	Embedded Local Area Network
ERD	Entity Relationship Diagram
GCB	Give Controlled Broadcast
GCBC	Give Controlled Broadcast Continuous
GIVR	Give Interactive Voice Response
GOS	Grade of Service
GRTD	Graphical Real-time Display
HDC	Historical Data Collector
HDX	Host Data Exchange
ICCM	Integrated Call Center Manager
ICM	Intelligent Call Management
IP	Internet Protocol
ISDN	Integrated Services Digital Network
IVR	Interactive Voice Response

Abbreviation/ acronym	Expanded name
M1	Meridian 1
MAC	Media Access Control
MAS	Meridian Application Server
MB	Megabyte
Mbps	Megabits per second
MHT	Mean Holding Time
Mhz	Megahertz
MLINK	Meridian Link
MLS	Meridian Link Services
MLSM	Meridian Link Services Manager
MTBF	Mean Time Between Failures
MVP	Meridian Voice Processing
NACD	Network Automatic Call Distribution
NCBC	Network Call by Call
NCC	Network Control Center
NCP	Network Call Processing
NIC	Network Interface Card
NLI	Network Loop Interface
OA&M	Operation, Administration and Maintenance
ODBC	Open Database Connectivity
PBX	Private Branch Exchange

Abbreviation/ acronym	Expanded name
PD	Predictive Dialing
PP200	Pentium Pro 200
PSTN	Public Switch Telephone Network
QTNS	Queue To Network Skillset
RAM	Random Access Memory
RAN	Recorded Announcement
RAID	Redundant Array of Independent Disks
RTD	Real-time Display
RT API	Real-time Application Program Interface
RTI	Same as RT API.
SCSI	Small Computer System Interface
SEI	Symposium Event Interface (Event Interface)
SMI	System Management Interface
SMP	System Management Platform
SQL	Structured Query Language
SVP	Symposium Voice Processing
TAPI	Telephony Application Program Interface
TCP/IP	Transport Control Protocol/Internet Protocol
TN	Terminal Number
UART	Universal Asynchronous Receiver Transmittal
VSCDG	Collect Digit Voice Session

Abbreviation/ acronym	Expanded name
WAN	Wide Area Network

Glossary

A

accelerator key

A key on a phoneset that an agent can use to place a call quickly. When an agent presses an accelerator key, the system places the call to the configured number associated with the key. For example, if an agent presses the Emergency key, the system places a call to the agent's supervisor.

access class

A collection of access levels that defines the actions a member of the access class can perform within the system. For example, a member of the Administrator access class might be given a collection of Read/Write access levels.

access level

A level of access or permission given to a particular user for a particular application or function. For example, a user might be given View Only access to historical reports.

ACCESS link

A communication channel between the Symposium Call Center Server and Meridian Mail.

ACCESS voice port

A Meridian Mail voice port that is controlled by the ACCESS link.

ACD call

See Automatic call distribution call.

ACD-DN

See Automatic call distribution directory number.

ACD group

See Automatic call distribution group.

ACD routing table

See Automatic call distribution routing table.

ACD subgroup

See Automatic call distribution subgroup.

acquired resource

A resource configured on the switch that is under the control of the Symposium Call Center Server. Resources must be configured with matching values on both the switch and the Symposium Call Center Server.

activated script

A script that is processing calls or is ready to process calls. Before you can activate a script, you must first validate it.

activity code

A number that an agent enters on his or her phoneset during a call. Activity codes provide a way of tracking the time agents spend on various types of incoming calls. They are also known as Line of Business (LOB) codes. For example, the activity code 720 might be used to track sales calls. Agents can then enter 720 on their phonesets during sales calls, and this information can be generated in an Activity Code report.

administrator

A user who is responsible for maintaining the Symposium Call Center Server.

agent

A user who is responsible for handling customer calls.

agent login ID

A unique identification number assigned to a particular agent. The agent uses this number when logging in. The agent ID is not associated with any particular phoneset.

agent to skillset assignment

A matrix that, when you run it, sets the priority of one or more agents for a skillset. Agent to skillset assignments can be scheduled.

agent to supervisor assignment

A definition that, when you run it, assigns one or more agents to specific supervisors. Agent to supervisor assignments can be scheduled.

application

1. A logical entity that represents a Symposium Call Center Server script for reporting purposes. The master script and each primary script have an associated application. The application has the same name as the script it represents. 2. A program that runs on a computer.

application program interface

A set of routines, protocols, and tools that programmers use to develop software applications. APIs simplify the development process by providing commonly used programming procedures.

associated supervisor

A supervisor who is available for an agent if the agent's reporting supervisor is unavailable. *See also* reporting supervisor.

Automatic call distribution call

A call to an ACD-DN. ACD calls are distributed to agents in an ACD group based on the ACD routing table on the switch.

Automatic call distribution directory number

Primary and supplementary DNs associated with an ACD group. Calls made to these DNs are distributed to agents belonging to the group, based on the ACD routing table on the switch.

Automatic call distribution group

An entity defined on the switch for the purpose of call distribution. When a customer dials an ACD group, the call is routed to any agent who is a member of that group.

Automatic call distribution routing table

A table configured on the switch that contains a list of ACD-DNs used to define routes for incoming calls. This ensures that incoming calls not processed by Symposium Call Center Server will be queued to ACD groups and handled by available agents.

Automatic call distribution subgroup

An entity defined on the switch to assign supervisory responsibilities. Each subgroup has one supervisor phoneset and a number of agent phonesets associated with it. Agents can log on to any phoneset within their ACD subgroup. The supervisor must log on to the supervisor phoneset to monitor his or her assigned agents.

C

call age

The amount of time a call was waiting in the system before being answered by an agent.

call destination

The site to which an outgoing network call is sent. *See also* call source.

call intrinsic

A script element that stores call-related information assigned when a call enters the Symposium Call Center Server. *See also* intrinsic, skillset intrinsic, time intrinsic, and traffic intrinsic.

call presentation class

A collection of preferences that determines how calls are presented to an agent. A call presentation class specifies whether a break time between calls is allowed, whether calls can be presented to an agent whose secondary DN is active, whether an agent can put DN calls on hold for incoming ACD calls, and whether an agent phoneset displays that the agent is reserved for a network call.

call priority

A numerical value assigned in a script that defines the relative importance of a call. If two calls are in the queue when an agent becomes available, and one call is queued with a higher priority than the other, the agent receives the higher priority call first. *See also* skillset priority.

call source

The site from which an incoming network call originates. *See also* call destination.

call treatment

A script element that enables you to provide handling to a call while it is waiting to be answered by a call center agent. For example, a caller can hear a recorded announcement or music while waiting for an agent.

call variable

A script variable that applies to a specific call. A call variable follows the call through the system and is passed from one script to another with the call. *See also* global variable, script variable.

Calling Line Identification

This is an optional service that identifies the telephone number of the caller. This information can then be used to route the call to the appropriate agent or skillset. The CLID can also be displayed on an agent's phoneset.

CDN

See controlled directory number.

CLAN

See Customer local area network.

CLID

See Calling Line Identification.

client

The part of Symposium Call Center Server that runs on a personal computer or workstation and relies on the server to perform some operations. *See also* server.

command

A building block used with expressions, variables, and intrinsics to create scripts. Commands perform distinct functions, such as routing a call to a specific destination, playing music to a caller, or disconnecting a caller.

controlled directory number

A special directory number that allows calls arriving at the switch to be queued when the CDN is controlled by an application such as Symposium Call Center Server. When a call arrives at this number, the switch notifies the application and waits for routing instructions, which are performed by scripts in Symposium Call Center Server.

Customer local area network

The LAN to which your corporate services and resources connect. The Symposium Call Center Server and client both connect to the CLAN. Third-party applications that interface with the server also connect to this LAN.

D

DBMS

Database Management System

deactivated script

A script that does not process any new calls. If a script is in use when it is deactivated, calls continue to be processed by the script until they are completed.

default activity code

The activity code that is assigned to a call if an agent does not enter an activity code manually, or when an agent presses the activity code button twice on his or her phoneset. Each skillset has a defined default activity code.

default skillset

The skillset to which calls are queued if they have not been queued to a skillset or a specific agent by the end of a script.

desktop user

A configured user who can log on to the Symposium Call Center Server from a client PC.

destination site

The site to which an outgoing network call is sent. *See also* source site.

DHCP

See dynamic host configuration protocol.

Dial-Up Networking

See Remote Access Services.

Dialed Number Identification Service

An optional service that allows Symposium Call Center Server to identify the phone number dialed by the incoming caller. An agent can receive calls from customers calling in on different DNISs and, if the DNIS is displayed on the phoneset, can prepare a response according to the DNIS.

Digital Multiplex Switch

A Nortel Networks switch for the central office market.

directory number

The number that identifies a phoneset on a switch. The directory number (DN) can be a local extension (local DN), a public network telephone number, or an automatic call distribution directory number (ACD-DN).

directory number call

A call that is presented to the DN key on an agent’s phoneset.

display threshold

A threshold used in real-time displays to highlight a value below or above the normal range.

DMS

Digital Multiplex Switch.

DN

See directory number.

DN call

See directory number call.

DNIS

See Dialed Number Identification Service.

dongle

The attachment plugged into the parallel port of a DMS/MSL-100 server that authenticates the serial number required at the time of server installation.

dynamic host configuration protocol

A protocol for dynamically assigning IP addresses to devices on a network.

dynamic link library

A library of executable functions or data that can be used by a Windows application. Typically, a DLL provides one or more particular functions and a program accesses the functions by creating either a static or dynamic link to the DLL. A DLL can be used by several applications at the same time.

E

ELAN

See embedded local area network.

embedded local area network

A dedicated Ethernet TCP/IP LAN that connects the Symposium Call Center Server and the switch.

Emergency key

A key on an agent’s phoneset that, when pressed by an agent, automatically calls his or her supervisor to notify the supervisor of a problem with a caller.

event

1. An occurrence or action on the Symposium Call Center Server, such as the sending or receiving of a message, the opening or closing of an application, or the reporting of an error. Some events are for information only, while others can indicate a problem. Events are categorized by severity: information, minor, major, and critical. 2. An action generated by a script command, such as queuing a call to a skillset or playing music.

expression

A building block used in scripts to test for conditions, perform calculations, or compare values within scripts. *See also* logical expression, mathematical expression, and Redundant Array of Inexpensive Disks.

F

filter timer

The length of time after the system unsuccessfully attempts to route calls to a destination site, before that site is filtered out of a routing table.

first-level threshold

The value that represents the lowest value of the normal range for a statistic in a threshold class. The system tracks how often the value for the statistic falls below this value.

G

global settings

Settings that apply to all skillsets or IVR ACD-DNs that are configured on your system.

global variable

A variable that contains values that can be used by any script on the system. The value of a global variable can only be changed in the Script Variable Properties sheet. It cannot be changed in a script. *See also* call variable, script variable.

I

ICM

See Intelligent Call Manager.

Incalls key

The key on an agent phoneset to which incoming ACD and Symposium Call Center Server calls are presented.

Intelligent Call Manager

A high capacity call center TCP/IP interface to the switch that enables the exchange of messages between the switch and a remote host computer.

Interactive voice response

An application that allows telephone callers to interact with a host computer using prerecorded messages and prompts.

Interactive voice response ACD-DN

A directory number that routes a caller to a specific IVR application. An IVR ACD-DN must be acquired for non-integrated IVR systems.

Interactive voice response event

A voice port login or logout. An IVR event is pegged in the database when a call acquires or de-acquires a voice port.

Internet Protocol address

An identifier for a computer or device on a TCP/IP network. Networks use the TCP/IP protocol to route messages based on the IP address of the destination. For customers using NSBR, site IP addresses must be unique and correct. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be 0 to 255. For example, 1.160.10.240 could be an IP address.

intrinsic

A word or phrase used in a script to gain access to system information about skillsets, agents, time, and call traffic that can then be used in formulas and decision-making statements. *See also* call intrinsic, skillset intrinsic, time intrinsic, and traffic intrinsic.

IP address

See Internet Protocol address.

IVR

See Interactive voice response.

IVR ACD-DN

See Interactive voice response ACD-DN.

IVR event

See Interactive voice response event.

IVR port

See voice port.

L

LAN

See Local area network.

Line of Business code
See activity code.

LOB code
See activity code.

Local area network
A computer network that spans a relatively small area. Most LANs connect workstations and personal computers and are confined to a single building or group of buildings.

local call
A call that originates at the local site. *See also* network call.

local skillset
A skillset that can be used at the local site only. *See also* network skillset, skillset.

logical expression
A symbol used in scripts to test for different conditions. Logical expressions are AND, OR, and NOT. *See also* mathematical expression, Redundant Array of Inexpensive Disks.

M

M1
Meridian 1 switch

master script
The first script executed when a call arrives at the Symposium Call Center Server. A default master script is provided with Symposium Call Center Server, but it can be customized by an authorized user. It can be deactivated but not deleted. *See also* network script, primary script, script, secondary script.

mathematical expression
An expression used in scripts to add, subtract, multiply, and divide values. Mathematical expressions are addition (+), subtraction (-), division (/), and multiplication (*). *See also* logical expression, Redundant Array of Inexpensive Disks.

Meridian Link Services

A communications facility that provides an interface between the switch and a third-party host application.

Meridian Mail

A Nortel Networks product that provides voice messaging and other voice and fax services.

Meridian MAX

A Nortel Networks product that provides call processing based on ACD routing.

MLS

See Meridian Link Services.

MM

See Meridian Mail.

music route

A resource installed on the switch that provides music to callers while they wait for an agent.

N

NACD call

A call that arrives at the server from a network ACD-DN.

NCC

See Network Control Center.

network call

A call that originates at another site in the network. *See also* local call.

Network Control Center

The server on a Symposium Call Center Server system where NSBR is configured and where communication between servers is managed.

network script

The script that is executed to handle error conditions for Symposium Call Center Server calls forwarded from one site to another, for customers using NSBR. The network script is a system-defined script provided with Symposium Call Center Server, but it can be customized by an authorized user. It can be deactivated but not deleted. *See also* master script, primary script ,script, secondary script.

Network Skill-Based Routing

An optional feature with Symposium Call Center Server that provides skill-based routing to multiple networked sites.

network skillset

A skillset that is common to every site on the network. Network skillsets must be created at the Network Control Center (NCC).

night mode

A skillset state in which the server does not queue incoming calls to the skillset, and in which all queued calls are given night treatment. A skillset goes into night mode automatically when the last agent logs off, or the administrator can put it into night mode manually. *See also* out-of-service mode, transition mode.

NPA

See Number Plan Area.

NSBR

See Network Skill-Based Routing.

Number Plan Area

Area code

O

object linking and embedding

A compound document standard that enables you to create objects with one application and then link or embed them in a second application.

ODBC

See Open Database Connectivity.

OEM

Original equipment manufacturer

OLE

See object linking and embedding.

Open Database Connectivity

A Microsoft-defined database application program interface (API) standard.

out-of-service mode

A skillset state in which the skillset does not take calls. A skillset is out of service if there are no agents logged on or if the supervisor puts the skillset into out-of-service mode manually. *See also* night mode, transition mode.

out-of-service skillset

A skillset that is not taking any new calls. While a skillset is out of service, incoming calls cannot be queued to the skillset. *See also* local skillset, network skillset, skillset.

P

PBX

See private branch exchange.

pegging

The action of incrementing statistical counters to track and report on system events.

pegging threshold

A threshold used to define a cut-off value for statistics such as short call and service level. Pegging thresholds are used in reports.

PEP

See Performance Enhancement Package.

Performance Enhancement Package

A Symposium Call Center Server supplementary software application that enhances the functionality of previously released software by improving performance, adding functionality, or correcting a problem discovered since the original release.

personal directory number

A DN on which an agent can be reached directly, usually for private calls.

phoneset

The physical device, connected to the switch, to which calls are presented. Each agent and supervisor must have a phoneset.

phoneset display

The display area on an agent's phoneset where information about incoming calls can be communicated.

Position ID

1. A unique identifier for a phoneset, used by the switch to route calls to the phoneset. 2. Referred to as Telephony/Port Address in Symposium Call Center Server.

primary ACD-DN

A directory number that callers can dial to reach an ACD group.

primary script

A script that is executed or referenced by the master script. A primary script can route calls to skillsets, or it can transfer routing control to a secondary script. *See also* master script, network script, script, secondary script.

private branch exchange

A telephone switch, typically used by a business to service its internal telephone needs. A PBX usually offers more advanced features than are generally available on the public network.

R

RAN

recorded announcement

RAN route
See recorded announcement route.

RAS
See Remote Access Services.

recorded announcement route
A resource installed on the switch that offers a recorded announcement to callers.

Redundant Array of Inexpensive Disks
A category of disk drives that employs two or more drives in combination for fault tolerance and performance.

relational expression
An expression used in scripts to test for different conditions. Relational expressions are less than (<), greater than (>), less than or equal to (< =), greater than or equal to (> =), and not equal to (< >). *See also* logical expression, mathematical expression.

Remote Access Services
A feature built into Windows NT and Windows 95 that enables users to log on to an NT-based LAN using a modem, X.25 connection, or WAN link. This feature is also known as Dial-Up Networking.

reporting supervisor
The supervisor who has primary responsibility for an agent. When an agent presses the Emergency key on the phoneset, the emergency call is presented to the agent's reporting supervisor. *See also* associated supervisor.

round robin routing table
A routing table that queues the first call to the first three sites in the routing table, then the second three sites, then the third three sites, and so on, until an agent is reserved at one of the sites. *See also* sequential routing table.

route
A group of trunks. Each trunk carries either incoming or outgoing calls to the switch. *See also* music route, RAN route.

routing table

A table that defines how calls are routed to the sites on the network. *See also* round robin routing table, sequential routing table.

S

sample script

A script that is installed with the Symposium Call Center Server client. Sample scripts are stored as text files in a special folder on the client. The contents of these scripts can be imported or copied into user scripts to create scripts for typical call center scenarios.

SCM

See Service Control Manager.

script

A set of instructions that relates to a particular type of call, caller, or set of conditions, such as time of day or day of week. *See also* master script, network script, primary script, secondary script.

script variable

See variable.

second-level threshold

The value used in display thresholds that represents the highest value of the normal range for a given statistic.

secondary directory number

A DN defined on the agent's phoneset as a Centrex line for incoming and outgoing non-ACD calls.

secondary script

Any script (other than a master, network, or primary script) that is referenced from a primary script or any other secondary script. There is no pegging of statistics for actions occurring during a secondary script. *See also* master script, network script, primary script, script.

sequential routing table

A routing table method that always queues a call to the first three active sites in the routing table. *See also* round robin routing table.

server

A computer or device on a network that manages network resources. Examples of servers include file servers, print servers, network servers, and database servers. The Symposium Call Center Server is used to configure the operations of the call center. *See also* client.

service

A process that adheres to a Windows NT structure and requirements. A service provides system functionality.

Service Control Manager

A Windows NT process that manages the different services on the PC.

service level

The percentage of incoming calls answered within a configured number of seconds.

service level threshold

A parameter that defines the number of seconds within which incoming calls should be answered.

Simple Network Management Protocol

A set of protocols for managing complex networks. SNMP works by sending messages, called protocol data units (PDUs), to different parts of a network and then analyzing the responses.

site

1. A system using Symposium Call Center Server that can be accessed using SMI. 2. A system using Symposium Call Center Server and participating in Network Skill-Based Routing.

skillset

A group of capabilities or knowledge required to answer a specific type of call. *See also* local skillset, network skillset.

skillset intrinsic

A script element that inserts information about a skillset in a script. Skillset intrinsics return values such as skillsets, integers, and agent IDs. These values are then used in queuing commands. *See also* call intrinsic, intrinsic, time intrinsic, and traffic intrinsic.

skillset priority

An attribute of a skillset assignment that determines the order in which calls from different skillsets are presented to an agent. When an agent becomes available, calls might be waiting for several of the skillsets to which the agent belongs. The server presents the call queued for the skillset for which the agent has the highest priority.

source site

The site from which an incoming network call originates. *See also* destination site.

standby

In skillset assignments, a property that grants an agent membership in a skillset, but makes the agent inactive for that skillset.

supervisor

A user who manages a group of agents. *See also* associated supervisor and reporting supervisor.

supplementary ACD-DN

A DN associated with a primary DN. Any calls to the supplementary DN are automatically routed to the primary DN. A supplementary DN can be a toll-free (1-800) number, for example.

switch

The hardware that receives incoming calls and routes them to their destination.

switch resource

A device that is configured on the switch. For example, a CDN is configured on the switch, and then is used as a resource with Symposium Call Center Server. *See also* acquired resource.

Symposium Call Center Server call

A call to a CDN that is controlled by the Symposium Call Center Server. The call is presented to the Incalls key on an agent's phoneset.

system-defined scripts

The Master_Script and the Network_Script (if NSBR is enabled). These scripts This script can be customized or deactivated by a user, but cannot be deleted. These scripts are This script is the first scripts executed for every local or network call arriving at the call center.

T

target site

See destination site.

TCP/IP

See Transport Control Protocol/Internet Protocol.

telephony

The science of translating sound into electrical signals, transmitting them, and then converting them back to sound. The term is used frequently to refer to computer hardware and software that perform functions traditionally performed by telephone equipment.

threshold

A value for a statistic at which system handling of the statistic changes.

threshold class

A set of options that specifies how statistics are treated in reports and real-time displays. *See also* display threshold, pegging threshold.

time intrinsic

A script element that stores information about system time, including time of day, day of week, and week of year. *See also* call intrinsic, intrinsic, skillset intrinsic, and traffic intrinsic.

Token Ring

A PC network protocol developed by IBM. A Token Ring network is a type of computer network in which all the computers are arranged schematically in a circle.

traffic intrinsic

An intrinsic that inserts information about system-level traffic in a script. *See also* call intrinsic, intrinsic, skillset intrinsic, and time intrinsic.

transition mode

A skillset state in which the server presents already queued calls to a skillset. New calls queued to the skillset are given out-of-service treatment. *See also* night mode, out-of-service mode.

Transport Control Protocol/Internet Protocol

The communication protocol used to connect devices on the Internet. TCP/IP is the standard protocol for transmitting data over networks.

treatment

See also call treatment.

trunk

A communications link between a PBX and the public central office, or between PBXs. Various trunk types provide services such as Direct Inward Dialing (DID trunks), ISDN, and Central Office connectivity.

U

user-created script

A script that is created by an authorized user on the Symposium Call Center Server system. Primary and secondary scripts are user-created scripts.

user-defined script

A script that is modified by an authorized user on the Symposium Call Center Server system.

utility

A program that performs a specific task, usually related to managing system resources. Operating systems contain a number of utilities for managing disk drives, printers, and other devices.

V

validation

The process of checking a script to ensure that all the syntax and semantics are correct. A script must be validated before it can be activated.

variable

A placeholder for values calculated within a script, such as CLID. Variables are defined in the Script Variable Properties sheet and can be used in multiple scripts to determine treatment and routing of calls entering the Symposium Call Center Server.

voice port

A connection from a telephony port on the switch to a port on the IVR system.

W

WAN

See also Wide area network.

Wide area network

A computer network that spans a relatively large geographical area. Typically, a WAN consists of two or more local area networks (LANs). The largest WAN in existence is the Internet.

workload scenarios

Sets of configuration values defined for typical patterns of system operations. Five typical workload scenarios (entry, small, medium, large, and upper end) are used in the Capacity Assessment Tool for capacity analysis for the Symposium Call Center Server.

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Reader Response Form

Nortel Networks Symposium Call Center Server
Planning and Engineering Guide
Product release 3.0
P0910115

Tell us about yourself:

Name: ____________________

Company: ____________________

Address: ____________________

____

Occupation: ____________________ **Phone:** ____________________

1. What is your level of experience with this product?

   ☐ New user ☐ Intermediate ☐ Experienced ☐ Programmer

2. How do you use this book?

   ☐ Learning ☐ Procedural ☐ Reference ☐ Problem solving

3. Did this book meet your needs?

   ☐ Yes ☐ No

   If you answered No to this question, please answer the following questions.

4. What chapters, sections, or procedures did you find hard to understand?

   ____

   ____

   ____

5. What information (if any) was missing from this book?

   ____

   ____

   ____

6. How could we improve this book?

   ____

   ____

   ____

Please return your comments by fax to (416) 597-7104, or mail your comments to
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How the world shares ideas.

Reader Response Form

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