Engineering and Capacity Rules

For Windows NT Server using the Symposium™ TAPI Service Provider for Meridian 1 Release 2.1

Engineering and Capacity Rules
For Windows NT using the
Symposium TAPI Service Provider
for Meridian 1 Release 2

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Notice

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Abstract

Purpose:

The purpose of this Final Engineering and Capacity Rules is to describe the Capacity, Performance and Configurations of a Windows NT TAPI Server using the Symposium TAPI Service Provider for Meridian 1.

This document is divided into the following sections:

Chapter 1:, "Introduction," provides an overview of the Symposium TAPI Service Provider and this document.

Chapter 2:, "Installation Rules," overviews the hardware and software installation rules.

Chapter 3:, "Engineering Rules" provides information on the Engineering rules and Capacity guidelines.

A Table of Contents and Index are provided to assist in locating desired information.

Failed to adhere the Engineering and Capacity rules guidelines may result in following:

- Slow response from client side applications.
- Mismatch between physical phone states and TAPI client application.

- *Revision History*

This is the first release of the *Engineering and Capacity Rules for Windows NT Server using the Symposium TAPI Service Provider for Meridian 1 Release 2*. Whenever the Symposium TAPI Service Provider software is reissued or revised, updates of this guide will summarize the new capabilities.

History

Issue #	***Date***	***Additions and changes***
Issue 04	October 1998	Added Table for Testing Results Added changes for Nortel's PLM
Issue 05	April 1999	Updated for Release 2.1
Issue 06	October 1999	Updated for information on LAN/WAN statistics and impact.

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Section 1: Introduction

Overview

The Symposium TAPI Service Provider for Meridian 1 is a multifunctional TAPI 2.x-compliant service provider that marries the Microsoft TAPI 2.0 and 2.1 Application Programming Interfaces (APIs) to the Meridian 1. In combination with Microsoft TAPI 2.0 software, the Service Provider allows applications running on Windows NT 4.0 servers to monitor and control Meridian 1 telephones. In combination with Microsoft TAPI 2.1 software, the Service Provider allows applications running on Windows NT servers or Windows NT workstation, Windows 95 or Windows 98 clients to monitor and control Meridian 1 telephones. Together these products allow the telephony capabilities of the Meridian 1 to be easily and very cost effectively integrated with Windows-based business applications.

The Service Provider delivers comprehensive support of Meridian Link Release 5 call processing features. Included are Meridian Call Center agent functions such as login, ready/not-ready, and agent DN control, along with support for FastTransfer for predictive dialing applications, and applications-based routing to allow TAPI applications to route calls based on network information such as ANI, DNIS, etc. Additionally, the Symposium TAPI Service Provider for Meridian 1 provides advanced integration with IVR systems and multi-site networking capabilities. The *Symposium TAPI Service Provider for Meridian 1 Network Manager's Guide* contains additional product information and installation procedures and may be obtained from the Nortel web page, www.nortel.com/bap, under the BAP library section.

- When coupled with application software, the Symposium TAPI Service Provider for Meridian 1 can enable the automatic display of information on a user's PC based on Automatic Number Identification (ANI) or Calling Line Identification (CLID) and Dialed Number Identification (DNIS)
- coordinated voice and data transfers or conferences
- intelligent dialing such as predictive or preview dialing
- screen based telephony that allows users easy access to telephone functions directly on their workstation.
- intelligent call routing based on caller information provided via the PSTN or information resident in the customer database (Meridian Link configurations)
- The *IVR/Networking option* adds the ability for IVR systems to pass information about callers' interests to any TAPI application when calls are transferred from IVR ports
- passing call specific data with a call when it is transferred to users on other Meridian 1 systems – for example, to coordinated voice and data transfers or conferences across a network of Meridian 1's

Section 2: Installation Rules

Hardware Installation Rules

The minimum hardware level of the server PC is as follows:

- A Pentium 200 MHz PC, EISA or ISA Bus
- 3.5 Disk Drive
- CD ROM
- 64 Megabytes of RAM
- 10 Megabytes of free disk space for SP, support tools and database (Microsoft TAPI SW is already present on NT server)
- Ethernet card (dedicated LAN to Meridian 1)
- LAN card (for client PC LAN connection)
- Mouse
- VGA or SVGA Display (800 X 600 pixels)

Software Installation Rules

The Windows NT TAPI SP is designed to be hardware independent. Therefore, all that is required is a system that runs the Windows NT Server operating system.

A minimum release of 4.0 is required for the NT server with a minimum of Service Pack 4 installed.

Other server activity has the potential to effect TAPI performance. Although Microsoft is not requiring a dedicated TAPI server, large, time critical applications may warrant this.

Windows NT Server Engineering

The user must provide an Intel Pentium server running Windows NT 4.0 Server software.

Note: According to Microsoft, Windows NT Server user licenses required for file and printing usersneed not be purchased for each TAPI user.

The Windows NT 4.0 server must be configured as a Primary Domain Controller on the user's network. The Windows NT server may be shared by other applications, but the combined processing requirements must be taken into account.

The table below provides general server requirements for typical applications:

Table 1 General Server Requirements

Lines	CPU	Memory
1 - 400	Single 200Mhz Pentium	64 Meg
401 - 800	Dual 200Mhz Pentium	96 Meg
801 - 1000	Quad 200Mhz Pentium	128 Meg

Note: This is to support all of the clients with ONE TAPI Server running only telephony services

Section 3: Detailed Windows NT Server Engineering Rules

Hardware Engineering Rules and Capacity Guidelines

Performance Overview

The Windows NT TAPI Server performance engineering needs to take into account the following considerations:

- **CPU Performance - The percentage of CPU the TAPI Server and Symposium TAPI Service Provider use**
- **Memory - The amount of memory the TAPI Server and Symposium TAPI Service Provider require**
- **Clients – Line - The number of lines the TAPI Server is "monitoring"**
- **Calls per hour - The number of calls that the TAPI server and Symposium TAPI Service Provider need to handle**

Software Engineering Rules and Capacity Guidelines

Number of Lines - Clients

The Symposium TAPI Service Provider is designed to handle up to 1000 lines opened at a time. Using these guidelines, there can be 1000 clients that can attach via Remote Service Provider (RSP) to the server.

Note: Microsoft has stated this is a reasonable number to achieve.

Number of Calls

The Symposium TAPI Server is targeted to be able to handle 16,000 calls per hour. This includes the following:

- call setup
- talk/hold time
- call tear down

Configurations

Overview

The Nortel TAPI Server has objects that are “static” (Configuration parameter, Lines, Addresses, etc.) and others that are “dynamic” (Calls, Work Items, Requests, etc.). Since memory is allocated and freed for dynamic objects, this section assumes a “worst case” scenario based on the following:

- each line has a 3 party conference established (3 Call Objects)
- each line has an outstanding Request
- each Request has an associated Work Object
- each line has an unsolicited switch message (1 Work Object per message)

These assumptions utilize the following definitions:

- A 3-party conference call is used because it is the most often used form of conference call.
- A Request Object is created dynamically by the Service Provider to send a request to the Meridian Link switch software to process the operation requested by the Work Object.
- A Work Object is also created dynamically to process any operation such as MAKECALL, ANSWERCALL, DROPCALL, and so on. After the Work Object is created it is put into the work queue for processing by a separate work thread.
- A Line Object is a static data structure used by Symposium TAPI Service Provider to hold important information about line characteristics.
- An Address Object is also a static data structure used by the Service Provider to keep features and address state information about the address. Each Address Object is associated with only one Line Object. A line can contain a maximum of two addresses

Memory

Overhead

The amount of memory needed for the "base" objects that are created plus the code size.

Objects = 3 Kbytes
Code Size =5710 Kbytes

5713 Kbytes = 5.7 Megabytes (which is rounded up to 6 Mbytes in the "Total Memory" portion later in this section)

Static Objects

The amount of memory for each client/line.

- Each Line Object = 3 Kbytes
- Each Address Object = 1 Kbytes

Assume two addresses per line, bringing the required memory total to 5 Kbytes per line

- Each Line and 2 Addresses = 5 Kbytes
- Times number of Lines 1000 =

5000 Kbytes = 5.0 Megabytes for Static Objects

Dynamic Objects

The amount of memory needed for objects created to track calls and process TAPI requests.

- Each Work Object = 3 Kbytes
- Each Request Object = 1 Kbytes
- Each Call Object = 4 Kbytes

Formula

Total Dynamic Memory for single line 3 party established conference =
(Number of parties x size of Call Object) +size of Request Object +
size of Work Object + size of Work Object

Total Dynamic Memory for single line 3 party established conference =
(3 x 4 Kbytes) + (1 Kbytes) + (3 Kbytes) + (3 Kbytes) = 19Kbytes

Total Dynamic Memory = Number of Lines x 19 Kbytes;

The "worst" case used in this example (assuming 1000 lines) is as follows:

.

Total Dynamic Memory (1000 Lines) = 1000 x 19 = 19000Kbytes = 19 Mbytes

Total Memory

Memory used by the TAPI Service Provider

6 Mbytes	Overhead
6 Mbytes	Static Objects
19 Mbytes	Dynamic Objects

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31 Mbytes

Assuming Microsoft TAPI takes at least the same amount of space,
2 is the "fudge" factor for Microsoft TAPI.

The Operating System requires 32 Mbytes or 32000 Kbytes.

Formula

(((Static Objects + Dynamic Objects) x Lines) x "fudge" factor) + Overhead + Operating System = Total Memory

which is:
(((5 Kbytes + 19 Kbytes) x Lines) x 2) + 6000 Kbytes + 32000 Kbytes = Total Memory Kbytes

which is:
(24 Kbytes x Lines x 2) + 38000 Kbytes = Total Memory Kbytes

which is:
(48 Kbytes x Lines) + 38000 Kbytes = Total Memory Kbytes

which is:
0.048 (Lines) + 38 Mbytes = Total Memory Mbytes

Therefore the "worst" case for 1000 lines is (0.048 x 1000) + 38 = 48 + 38 = **86 Mbytes of Total Memory**

CPU

The CPU utilization is directly related to the call volume and the number of clients attached to the server.

Nortel lab measurements show that at 7200 calls/hour, the TAPI Server and Symposium TAPI Service Provider collectively consume about 65% of the available CPU capacity of a single 200 MHz Pentium Pro. Of that, the Symposium TAPI Service Provider application takes 9%, which means that each call consumes about .009 % of the capacity of a 200 MHz Pentium. This places the rated capacity of a Windows NT Server at about 9000 calls per hour, assuming a CPU load of 80% .

The CPU capacity expected to be consumed by a TAPI Server and the Symposium TAPI Service Provider can then be calculated by multiplying the number of busy hour calls by .00009 for this particular processor. However, CPU capacity has not proven to be linear in multiple processor configurations. Some measured CPU capacities are offered in Table 2.

Note: The table below consists of results of a server running only TAPISRV telephony services.

Table 2 Current Measurements

Num Lines	Incoming Calls /hr (3sec/call)	Incoming Calls /hr (10 sec/call)	Incoming Calls / hr (30sec/call)	Memory Consumption (TAPISRV)	CPU Utilization (TAPISRV)	Minimum PC Requirement
100	2000	600	200	42.8 MB	< 12.8%	Single 200 MHz Pentium with 64 Meg
200	4000	1200	400	47.6 MB	< 12.8%	Single 200 MHz Pentium with 64 Meg
300	6000	1800	600	50.5 MB	18.6% - 20. 0%	Single 200 MHz Pentium with 64 Meg
400	8000	2400	800	57.2 MB	20.0% - 27.5%	Dual 200 MHz Pentium with 96 Meg
500	10,000	3000	1000	62.0 MB	27.5% - 30.7%	Dual 200 MHz Pentium with 96 Meg
600	12,000	3600	1200	64.8 MB	30.7% - 34.9%	Dual 200 MHz Pentium with 96 Meg
700	14,000	4200	1400	71.6 MB	34.9% - 38.0%	Dual 200 MHz Pentium with 96 Meg
800	16,000	4800	1600	76.4 MB	38.0% - > 39.2%	Quad 200 MHz Pentium with 128Meg
900	18,000	5400	1800	81.2 MB		Quad 200 MHz Pentium with 128Meg
1000	20,000	6000	2000	86.0 MB		Quad 200 MHz Pentium with 128Meg

LAN/WAN Statistics

Meridian 1 Link Messages

The network traffic on LAN/WAN due to link messages is directly proportional to the number of lines monitored and number of calls appearing in the switch on these lines. During the life of the call, normal operations performed include MAKECALL, ANSWER, HOLD, UNHOLD and DROP. The following table shows the number of bytes send and received in performing these operations.

Operation	Messages Sent and Received	Total number of bytes sent and received
Making Call	Send (MAKECALL) + Received (OFFHOOK + PROGRESS + ACTIVE + PROGRESS)	(29 + 36 +43 + 48 + 47 = 203)
Answering Call	Received(RINGING) + Send(ANSWER) + Received(OFFHOOK + ACTIVE + ANSWER RESPONSE)	(48 + 18 + 36 + 48 + 27 = 177)
Hold Call	Send(HOLD) + Received (ONHOLD + PROGRESS)	(18 + 48 + 43 = 109)
Unhold Call	Send(UNHOLD) + Received (RETRIEVE + ACTIVE + PROGRESS)	(18 + 48 + 48 + 43 = 157)
Releasing(Drop) Call	Send(RELEASE) + Received (ONHOOK + DISCONNECT + RELEASE RESPONSE)	(18 + 36 + 36 + 27 = 117)

For calculating the load on a LAN/WAN assume that every inbound call appearing in the call center does ANSWER, HOLD, UNHOLD and DROP operations. Also assume the rate at which inbound calls appear in the call center is Y calls/hr. The load on LAN/WAN may then be calculated using following formula:

Load on LAN/WAN = ((Answering Call + Hold + Unhold + Releasing Call) * Y) Bytes/hr

For example, If there are 10,000 calls/hr , then:

Load on LAN/WAN = (177 + 109 + 157 + 117) * 10,000 = 5.6 MB/hr

Call Data Networking Messages between TAPI Servers

The network traffic load on a LAN/WAN due to call data networking messages is a function of the number of TAPI servers involved in networking, and the call rate with call data appearing. If there are

- X number of TAPI Server's configured to broadcast to Y number of TAPI Servers, and
- Z number of calls/hr appear on all of the X number of TAPI servers with a payload of call data size equal to N bytes, then
- The total load of traffic on LAN/WAN can be calculated using following formula:.

  Load on LAN/WAN = X * Y * (Z * N) Bytes/hr

For example if you have X = 5 (number of TAPI servers broadcasting), Y = 10 (number of TAPI servers receiving), and Z= 10,000 (Call/hr with call data) and N=512(Call data size in bytes) then

Load on LAN/WAN = 5 * 10 * 10,000 * 512 = 256 MB/hr

In the "worst case" scenario, where X (=Y) number of TAPI servers broadcast to each of the other TAPI servers in the network, and there are Z number of calls/hr appearing with N bytes of call data size, the total load of traffic on LAN/WAN would be:

Load on LAN/WAN = X * (X – 1) * (Z * N) Bytes/hr

For example if you have X = 10 (number of TAPI servers broadcasting), (X-1) (number of TAPI servers receiving), Z= 10,000 (Call/hr with call data), and N=512(Call data size in bytes) then

Load on LAN/WAN = 10 * (10 –1) * 10,000 * 512 = 460.8 MB/hr

The following table summarizes the LAN/WAN overhead due to call data networking.

Number of TAPI Server Broadcasting (X)	Number of TAPI Server Receiving broadcast call data (Y)	Incoming Call /hr on each broadcasting TAPI Server (Z)	Size of Call Data appearing with every call (N bytes)	LAN/WAN Network Overhead = X*Y*Z*N
5	10	1000	256	12.8 MB/hr
10	10	2000	256	51.2 MB/hr
20	30	4000	256	614.4 MB/hr
5	10	8000	512	204.8 MB/hr
10	10	10000	512	512 MB/hr
20	30	12000	512	3686.4 MB/hr

The above calculation and statistics of LAN/WAN overhead may be used by Network Administrator for providing necessary bandwidth for Network Traffic of Call Data Networking.

Broadcasting to all other TAPI Server machines in the network is seen as an overhead on network as well as on performance of TAPI Service provider. The Symposium TAPI SP for Meridian 1 Release 2.2 addresses this issue.

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