DMS-100 Capacity Planner

The DMS SuperNode processor portfolio allows customers to choose the capacity level that meets their service needs.

The power of the DMS SuperNode-like any computing platform-must constantly be enhanced to support new applications and allow it to serve new markets. The evolving public network-with advanced services such as Advanced Intelligent Networking (AIN) and ISDN-will place increased demands on every switching system. This document examines the effects of these advanced services on DMS-100 systems and projects capacity requirements for eight model offices.

The Evolution of the DMS SuperNode System

The DMS SuperNode is in a unique position to deliver the advanced services of the future. Today, the DMS SuperNode offers the largest menu of telephony and data services in the industry. A range of technology and process enhancements are now taking these services beyond their traditional networks-into cable plants, fiber-optic networks, and wireless environments. In addition, the DMS SuperNode will support true, multivendor AIN for fast custom development of new services and network-wide deployment and management. Some of these enhancements have an effect on processor and memory usage:

Product Computing-Module Loads (PCLs)	After BCS36, Northern Telecom will begin delivering Product Computing-Module Loads (PCLs) instead of BCS releases or Universal Software Loads (USLs). Each PCL contains all the generally available software for a particular switch application in a particular market. There's no need to re-load software to activate a generally-available feature, because all features are already present in the switch.
New Call-Processing Platform	In 1995, Northern Telecom will introduce a new call-processing software platform-Generic Services Framework (GSF)-for most future advanced services, including AIN 0.2 and National ISDN-2 and beyond. The new platform will allow an accelerated development cycle as short as three to six months.
Two Types of PCLs	Beginning in 1995, DMS-100 customers in North American markets will be able to choose between two types of PCLs-"A" loads with GSF-based advanced services, and "B" loads that support all current services and future services not based on GSF. The first "A" load will be released with the North American software development stream NA004 (3Q95).
Layered Software	Software layering-partitioning the switch software into relatively independent components with well-defined interfaces to other components-will allow network providers to keep pace with the speed-to-market requirements of an increasingly competitive arena.

PCLs-because they contain all generally available software-may increase memory requirements over traditional custom loads. The amount of this increase varies according to the volume of software currently deployed. The difference in memory requirements between traditional and new loads will be greatest for offices that have limited feature deployment. Offices using feature-rich USLs today will not see much change when moving to PCLs.

The GSF call-processing platform typically has a 12-15-MB "start-up" effect on memory requirements-plus memory requirements directly proportional to service deployment. There is no incremental realtime demand associated with loading GSF software. Realtime effect is directly related to the volume of GSF-based services deployed.

Software layering partitions the switch software into relatively independent components with well-defined, easily managed interfaces among components. This restructure speeds development but has virtually no impact on either memory or realtime requirements.

Summary of Capacity Planning

The following table summarizes the projected upgrade requirements for eight model offices using LEC PCLs for DMS-100/200 switches-10K lines, 20K lines, 30K lines, and 50K lines with high or low penetration of centrex services. Furthermore, projections are shown for model offices taking "A" loads or "B" loads. Results for actual offices will vary.

These projections were generated with the July 1994 MEMCALC and REAL::TIME 7.0 tools. The NA releases refer to the release by which the upgrade should be made. A shaded box indicates that the PCL will not be available from that particular NA release. For example, the first "A" load will be available with NA004. There will be no LEC "B" load (for US DMS-100/200) or CDN "B" load (for Canadian DMS-100/200) released in NA005.

Lines	Centrex	Loads	NA001	NA002	NA003	NA004	NA005	NA006
10,000	Low	B						
		A				50 MixMem		
	High	B						
		A				50 MixMem		
20,000	Low	B						
		A				50 MixMem		
	High	B						50 MixMem
		A				50 MixMem		
30,000	Low	B						50 MixMem
		A				50 MixMem		
	High	B				50 MixMem		
		A				50 MixMem		
50,000	Low	B						50 MixMem
		A				50 MixMem		
	High	B	Series 60					
		A				Series 60		

50 MixMem refers to the Series 50 with Mixed Memory feature.

The network is thus evolving towards a higher-capacity system with a larger portfolio of advanced revenue-generating features. During this transition, Northern Telecom is working to ensure a cost-effective network upgrade that meets the service needs of our customers.

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1.0 Current Processor Portfolio

Today's network provider is demanding increasingly complex and diverse services. And to fully realize revenue from these services, the provider must be able to respond quickly to a rapidly changing market.

The key to success is a system with power and versatility, one that can grow without replacing the original investment. Northern Telecom's DMS SuperNode system meets the demands of this new high-capacity, high-service network.

Northern Telecom's processor portfolio currently includes the Series 20 through Series 60 options, with Series 70 scheduled for NA004 (1995).

The Series 50/60 BRISC processor-with up to 3.3 times the realtime capacity of the Series 20 and a memory capacity of up to 400 MB-can easily handle the majority of the North American market.

The Series 70-scheduled for availability with NA004 (1995)-uses a 88110-based CPU and burst-mode memory addressing to deliver 5.5 times the realtime capacity of the Series 20. The Series 70 uses 96 MB memory cards and, when equipped with SLMIII, will support growth up to 640 MB of memory.

The Series 70 will be a premium processor option for high-end offices with demanding feature needs, such as a large Centrex office with high penetration of advanced services.

Northern Telecom joins its customers in anticipating continued growth in both lines and high-demand services, and is already developing a next-phase processing option. The new option will be available in advance of the service needs that will drive its deployment.

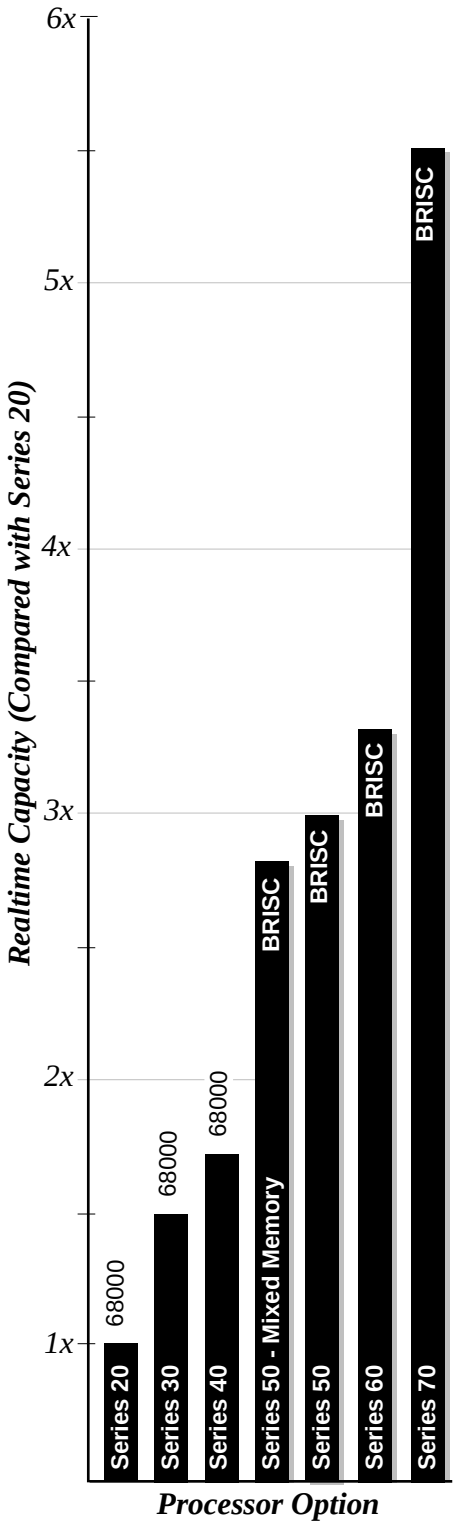


Figure 1. Realtime Capacities

Non-BRISC Processors (Series 20 through 40)

The Series 20 through 40 processors use Motorola's 680x0 microprocessor technology. Non-BRISC processors can use only 24-MB cards, and cannot take advantage of some advanced features like burst-mode memory addressing.

BRISC Processors (Series 50 through 70)

These processor options use BRISC technology, specifically designed for telecommunications switching applications. With RISC and the additional innovations of BRISC, the core processor of the DMS switching system accesses, processes, and transmits information more quickly and efficiently.

The **Series 50** has a realtime capacity of 3.0 times the Series 20. In addition to the increased processing capacity enabled by BRISC technology, the Series 50 includes other breakthroughs in processing power:

- **Dual-Bus Architecture**, which allows code and data to be retrieved simultaneously, without one operation affecting the other
- **Intelligent Prefetcher**, which anticipates processor demands and fetches code even before it is requested
- **Data and Code Cache Memory**, which stores frequently used or likely-to-be-used information for quick, convenient retrieval
- **Main Memory Manager**, which organizes and expedites transactions with the switch's main memory, when necessary

The Series 50 uses 24-MB memory cards only. The Mixed Memory feature-scheduled for introduction with NA004-will allow the Series 50 to support a mix of 24-MB cards and the newer 96-MB cards. Such a Series 50 has a maximum memory capacity of 320 MB, with a processor capacity of 2.7 times the Series 20.

The **Series 60** uses the same processor circuit packs as the Series 50, but uses only 96-MB memory cards. This allows a maximum of 400 MB of usable memory and a realtime capacity of 3.3 times the Series 20. This additional capacity is made possible through "burst mode" memory addressing, a protocol that improves processing time by locating and retrieving more parcels of data within one computer clock cycle. The result is a 10-13% real-time improvement over the Series 50 BRISC processor when fully loaded.

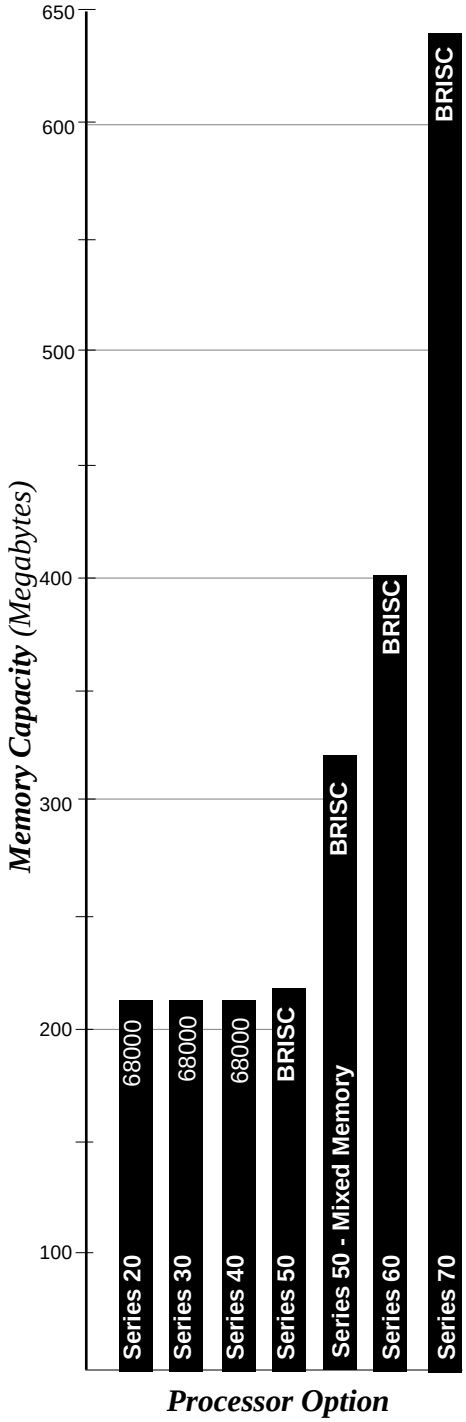


Figure 2. Memory Capacities

The **Series 70**-with a realtime capacity of 5.5 times the Series 20-uses a unique circuit pack with a 88110-based CPU. The Series 70 protects the customer's investment in memory by supporting current 96-MB cards.

Upgrading to BRISC Processors

Series 50-based DMS SuperNode systems are converted to the Series 60 through a "synch-compatible" upgrade procedure that replaces the 24-MB memory cards with 96-MB memory cards, without any service disruption to established calls.

DMS SuperNode Processor Series

Processor Series	Processor Type	Realtime Capacity (Compared to Series 20)	Accepts 24MB Memory Cards	Accepts 96MB Memory Cards
Series 20	680x0	1.0	■	□
Series 30	680x0	1.5	■	
Series 40	680x0	1.8	■	
Series 50	BRISC	3.0	■	
Series 50 Mixed Memory	BRISC	2.7	■	■
Series 60	BRISC	3.3		■
Series 70	BRISC	5.5		■

DMS SuperNode SE Only

Processor hardware must be changed when the Series 20, 30, or 40 processor is converted to a Series 50 or higher. These changes require a procedure based on a standard software upgrade that simultaneously converts the system from a non-BRISC to a BRISC software- and processor-based system. Figure 3 shows complete upgrade paths, including software.

Upgrading from Series 60 to Series 70 is straightforward, requiring only the exchange of the processor circuit packs and associated RTIF paddle boards, and the licensing of Series 70 software in the PCL. Existing 96-MB memory cards are compatible with the Series 70 processor and can remain in place.

DMS SuperNode Upgrades

	Series 20	Series 30	Series 40	Series 50	Series 60	Series 70
Processor	NT9X13BC	NT9X13GA	NT9X13HB	NT9X10AA	NT9X10AA	NT9X10BA
Paddleboard	NT9X26AB	NT9X26AB	NT9X26AB	NT9X26Dx*	NT9X26Dx*	NT9X26EA
Memory	NT9X14DB	NT9X14DB	NT9X14DB	NT9X14DB	NT9X14EA	NT9X14EA
Software	NTX960AD	NTXD17AA	NTXD18AA	NTXD25AA	NTXD26AA	TBD
				NT9X12AD	NT9X12AD	NT9X12AD
				SLM II	SLM II	SLM II or III *

DMS SuperNode SE Upgrade

	Series 20	Series 60
Processor	NT9X13MB	NT9X10AA
Paddleboard	NT9X26AB	NT9X26DB
Memory	NT9X14EA	NT9X14EA
Software	NTXD88AA	NTXC40AA

Figure 3. Upgrade to BRISC Processing

***** *Earlier vintage Series 50 processors may require an upgrade to: NT9X26DB (the current standard, compatible with Series 50 and Series 60)-or to NT9X26DC (required for mixed memory, and also compatible with the Series 60).*

** SLM III required for Series 70 applications with more than 400MB memory*

2.0 Future Capacity Projections

FUTURE CAPACITY PROJECTIONS - MEMORY

Memory Requirements-Standardized Software Loads

After BCS36, Northern Telecom will begin delivering software loads through a series of Product Computing-Module Loads (PCLs). Each of these loads will contain all generally available software for a particular switch application and market segment. There are several advantages to the PCL generic-load concept:

- **Rapid Feature Deployment**-There is no need to re-load software to obtain a generally available feature because all features are already resident in the PCL.
- **Standardization**-All sites can potentially deploy the same features, enabling the provider to market and deploy features across a network confident that the required software is present in all the switches.
- **Minimum Office Activity**-With PCLs, there are no re-loads to support unexpected feature growth.
- **Less Complex Ordering and Provisioning**-The simplified commercial structure of PCLs equate directly to administrative savings for the network operator.

There are incremental growth steps in memory requirements as software delivery methods migrate from custom loads to Universal Software Loads (USLs) to Product Computing-Module Loads (PCLs).

PCLs will require more memory than a BCS36 universal software load-the amount dependent on the feature-richness of the USL. The effect is largest in offices with limited feature deployment. Projected system memory demands are summarized in Figure 4.

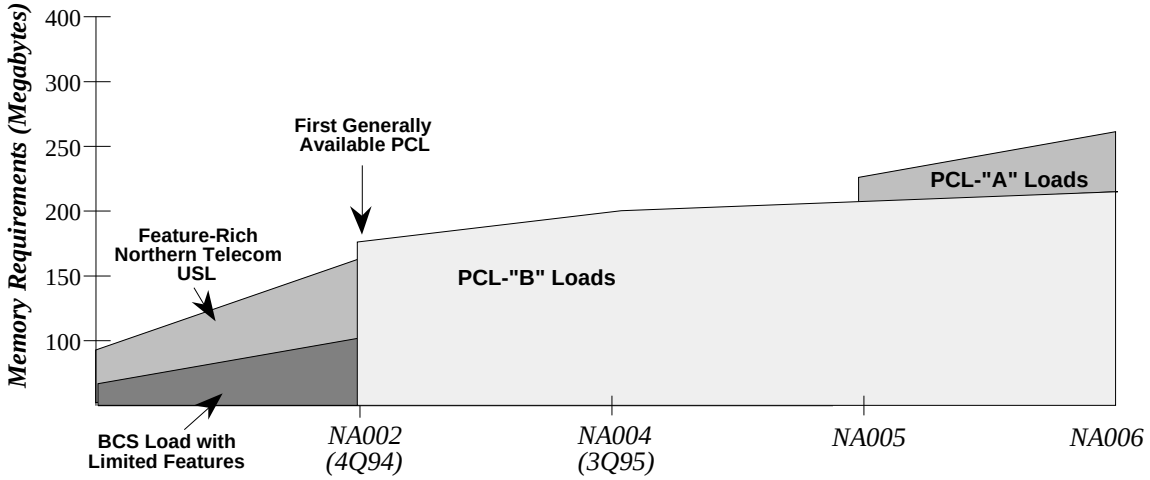


Figure 4. Growth in Memory Requirements
Typical Model Office-20,000 Lines, Low Centrex Penetration

Memory Requirements - Advanced Services

The first advanced services on the GSF call-processing platform will be generally available with NA004 A-Stream loads. The memory impact associated with deploying advanced services falls into two categories: a "getting started" requirement and an effect directly proportional to service penetration. The July 1994 version of the MEMCALC tool lets the user project this memory requirement for each office, beginning with NA005 releases. Memory projections for NA004 A-Stream offices will be handled individually, using NA005 projections as a guideline.

Memory Requirements - New Features and System Enhancements

The July 1994 version of the MEMCALC tool provides detailed calculations for NA001 memory requirements based on the content of the selected PCL and office-specific parameters. In addition to the NA001 detailed view, the tool also projects memory requirements through NA007 to support network providers' long-range planning activities. The tool accounts for planned new developments, such as new services and system enhancements.

FUTURE CAPACITY PROJECTIONS-REALTIME

The DMS SuperNode system can easily handle the additional realtime requirements brought about by software restructuring. Software layering has virtually no impact on realtime requirements. The Generic Services Framework (GSF) call-processing platform itself has no impact on realtime. The major factor affecting processor requirements is the deployment of GSF-based advanced services and the penetration of those services.

In the initial stages of advanced-services deployment, only 10% to 20% of all lines on a switch are expected to use GSF-based advanced services. The remainder of the lines may remain on the current architecture. The REAL::TIME 7.0 tool enables the user to project this realtime impact for each office through NA006.

GROWTH IN SAMPLE OFFICES

REAL::TIME and MEMCALC tools were run on eight model offices using aggressive feature penetration and growth assumptions to generate examples of memory and realtime growth through NA006. Of course, actual results calculated by the MEMCALC and REAL::TIME tools will be different for each office. However, these models can provide a high-level view of capacity growth. The table below shows the assumptions that were used in performing these model calculations.

Growth

4% termination growth per year across all line types
16% CLASS, with growth to 26% in NA006
CCS7 50% in BCS35 with incremental growth to 90% in NA006
2% AIN in NA001, with growth to 10% in NA006
1% ISDN in NA001 with linear growth to 10% in NA006

Calling Rates

2.00 BHCA per line for POTS/RES
3.00 BHCA per line for MDC
4.00 BHCA per line for ISDN

Percent Centrex Penetration

Low Centrex is defined as 10% of total lines
High Centrex is defined as 60% of total lines

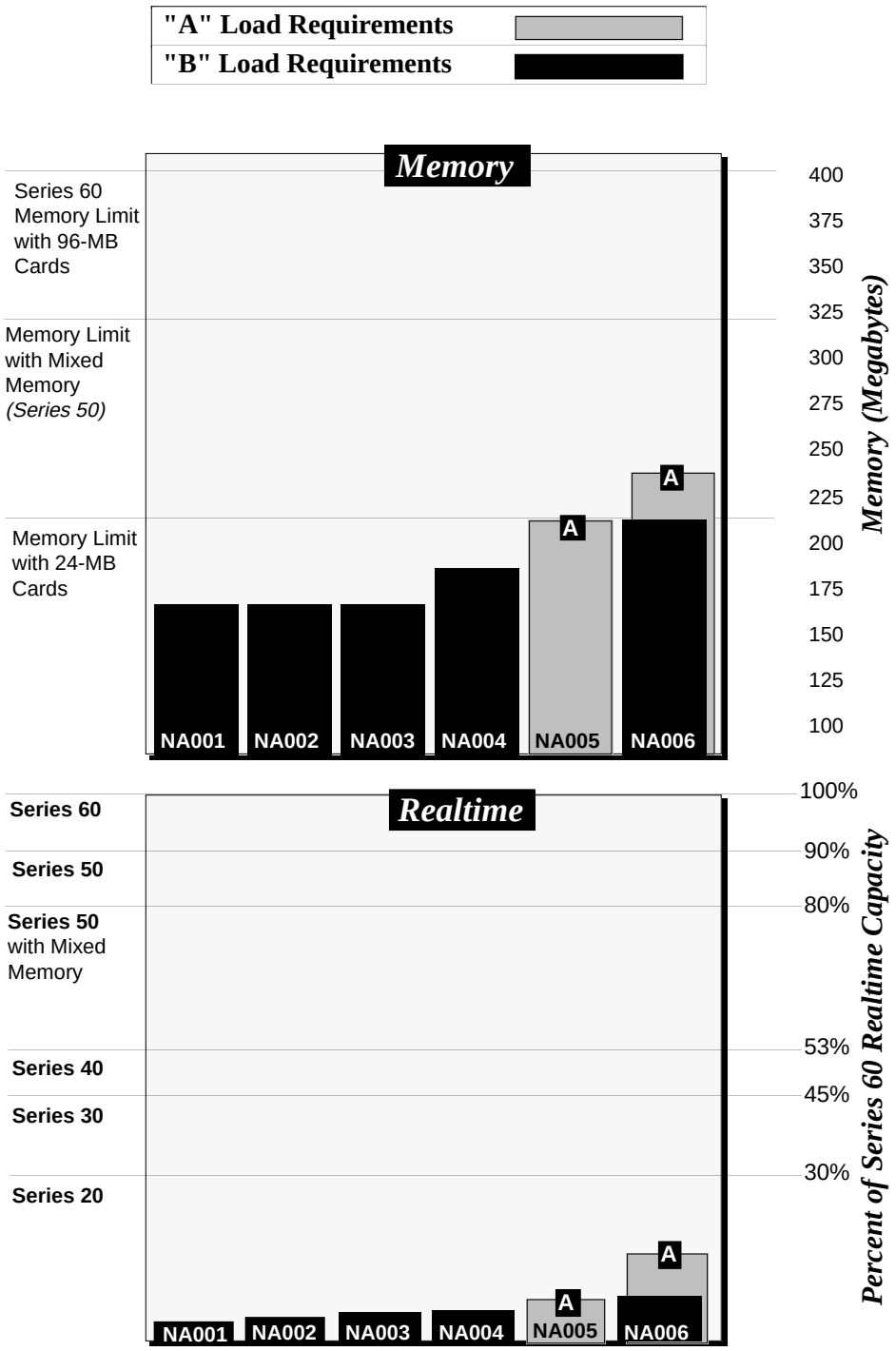
- 10% Multiple Appearance Directory Number (MADN) penetration
- 10% Meridian Business Set lines

Percentage of Lines Expected to Use GSF-Based Advanced Services (AIN 0.2, National ISDN-2)

Release	POTS	ISDN	RES	MDC
NA005	5%	50%	5%	10%
NA006	10%	100%	10%	25%

MODEL 1

GROWTH PROJECTIONS FOR A SAMPLE OFFICE
10,000 Lines, Low Centrex Penetration

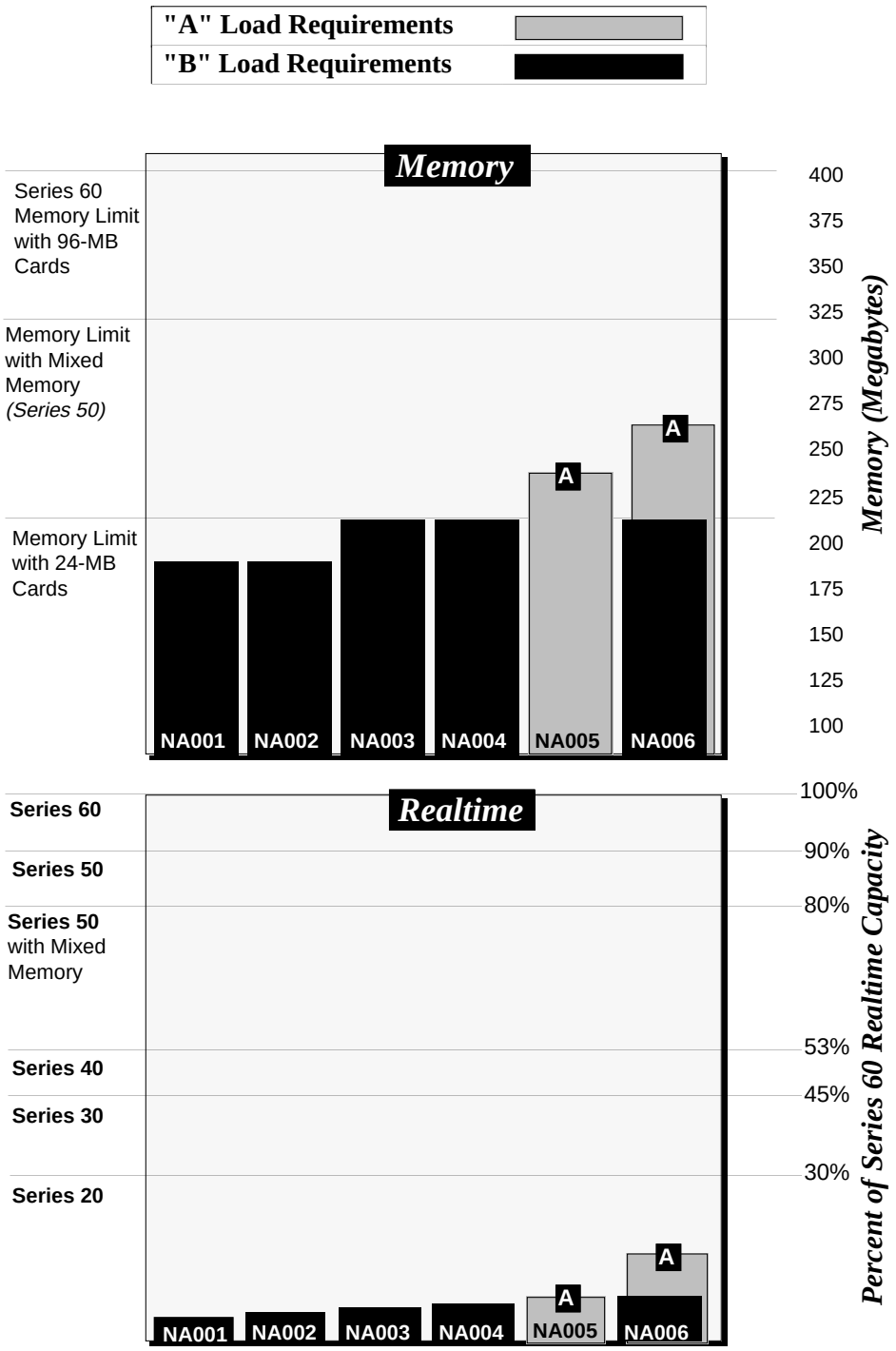


MODEL

2

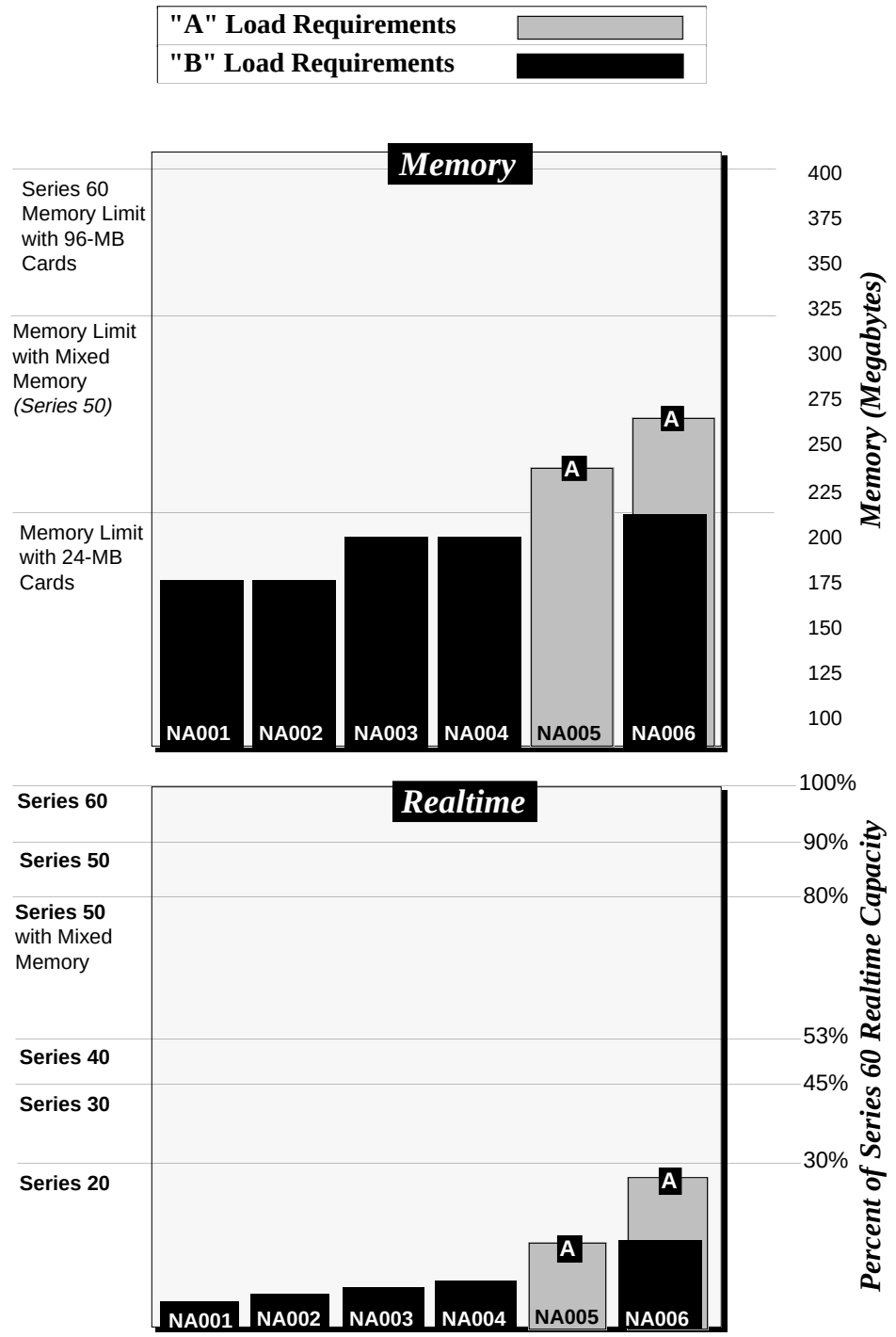
GROWTH PROJECTIONS FOR A SAMPLE OFFICE

10,000 Lines, High Centrex Penetration



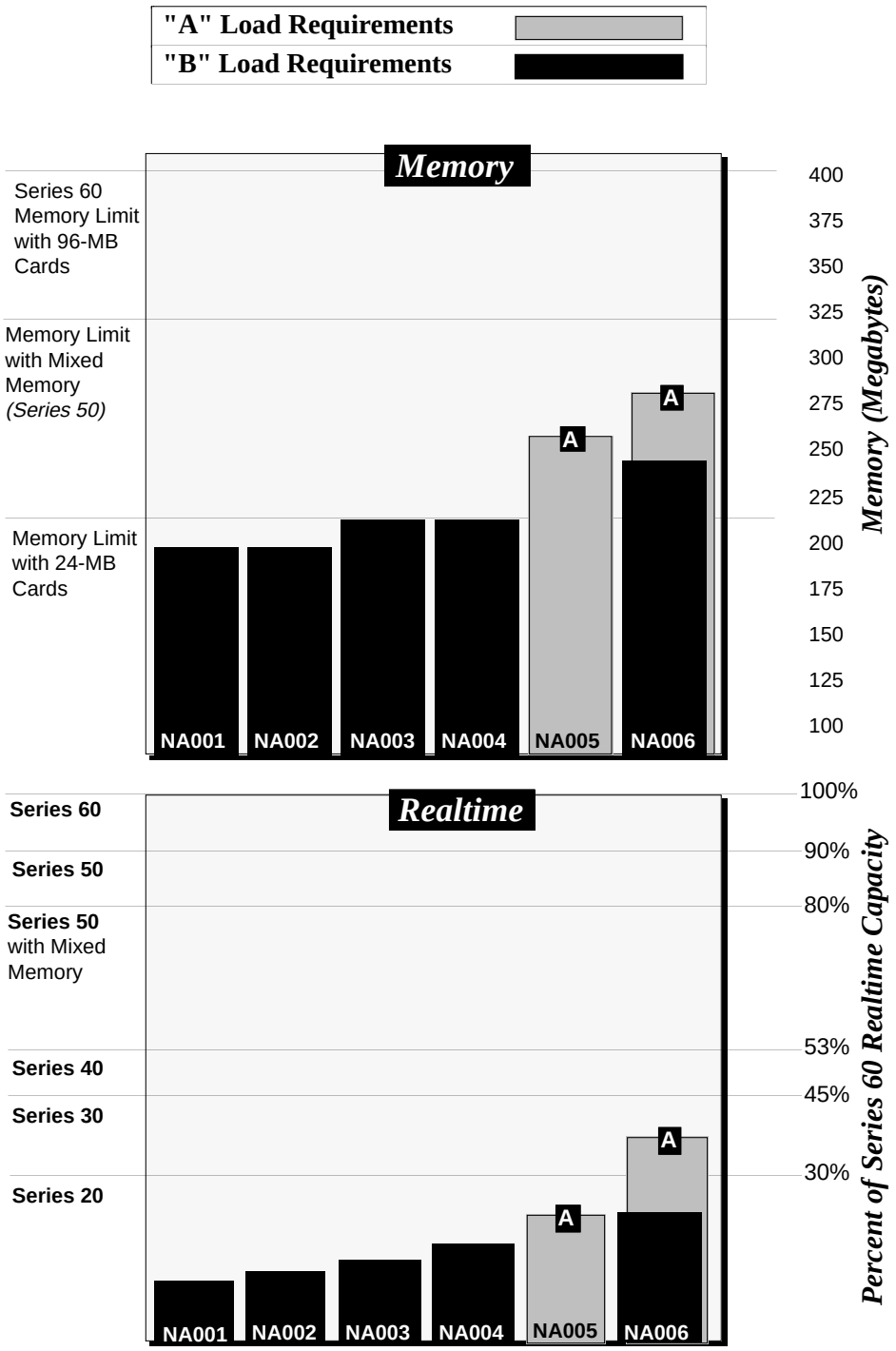
MODEL **3**

GROWTH PROJECTIONS FOR A SAMPLE OFFICE
20,000 Lines, Low Centrex Penetration



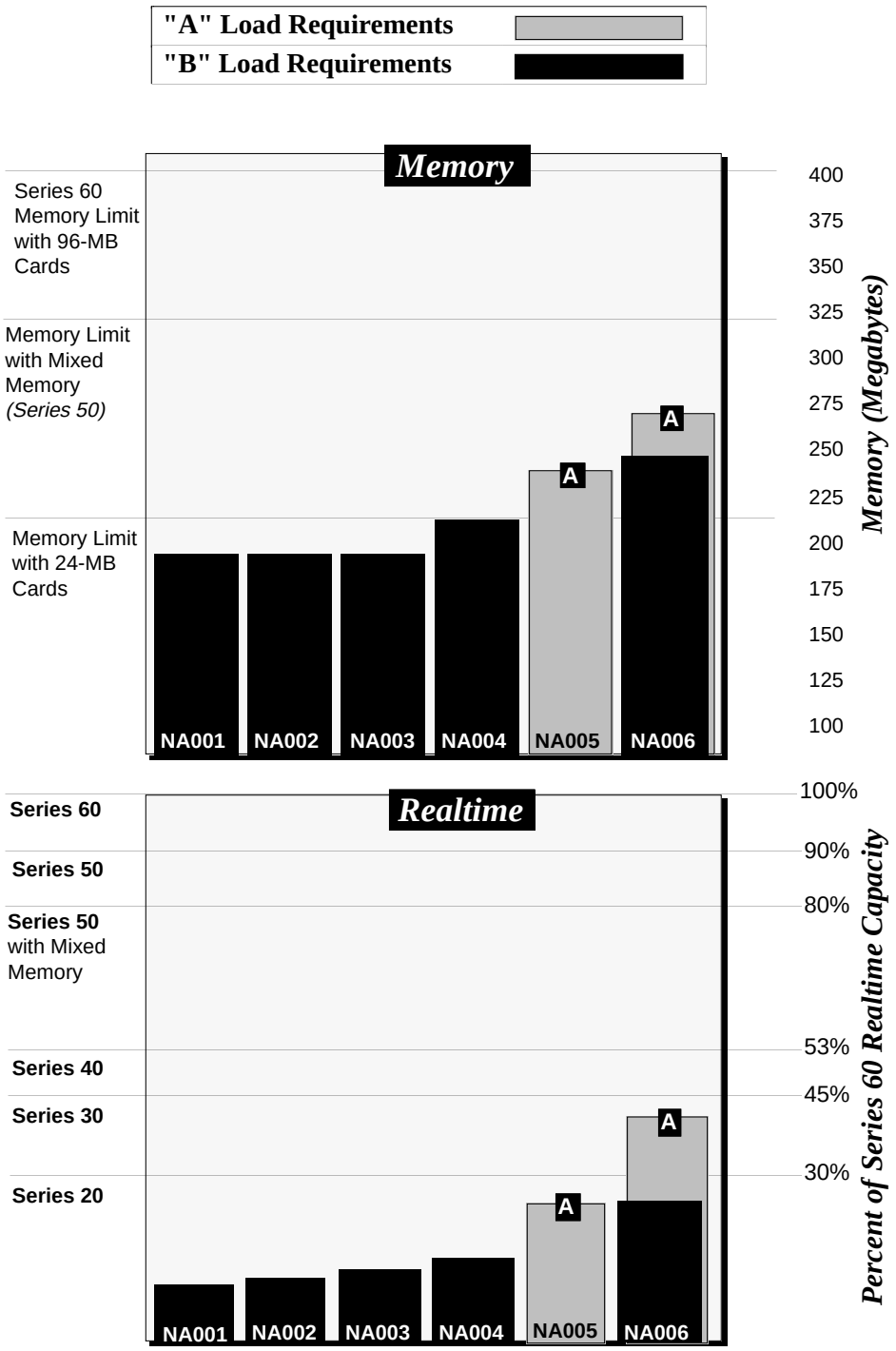
MODEL 4

GROWTH PROJECTIONS FOR A SAMPLE OFFICE
20,000 Lines, High Centrex Penetration



MODEL 5

GROWTH PROJECTIONS FOR A SAMPLE OFFICE
30,000 Lines, Low Centrex Penetration

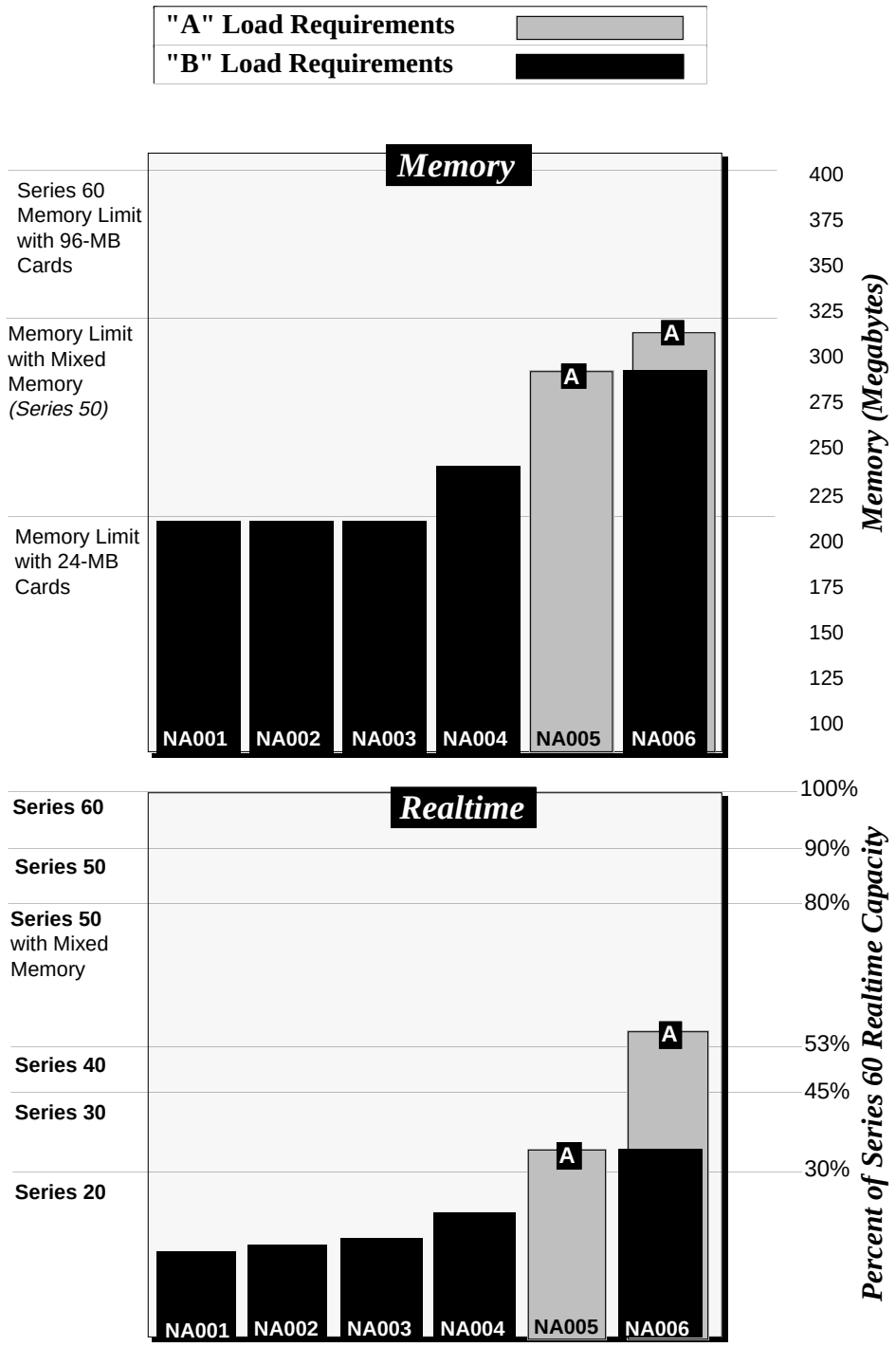


MODEL

6

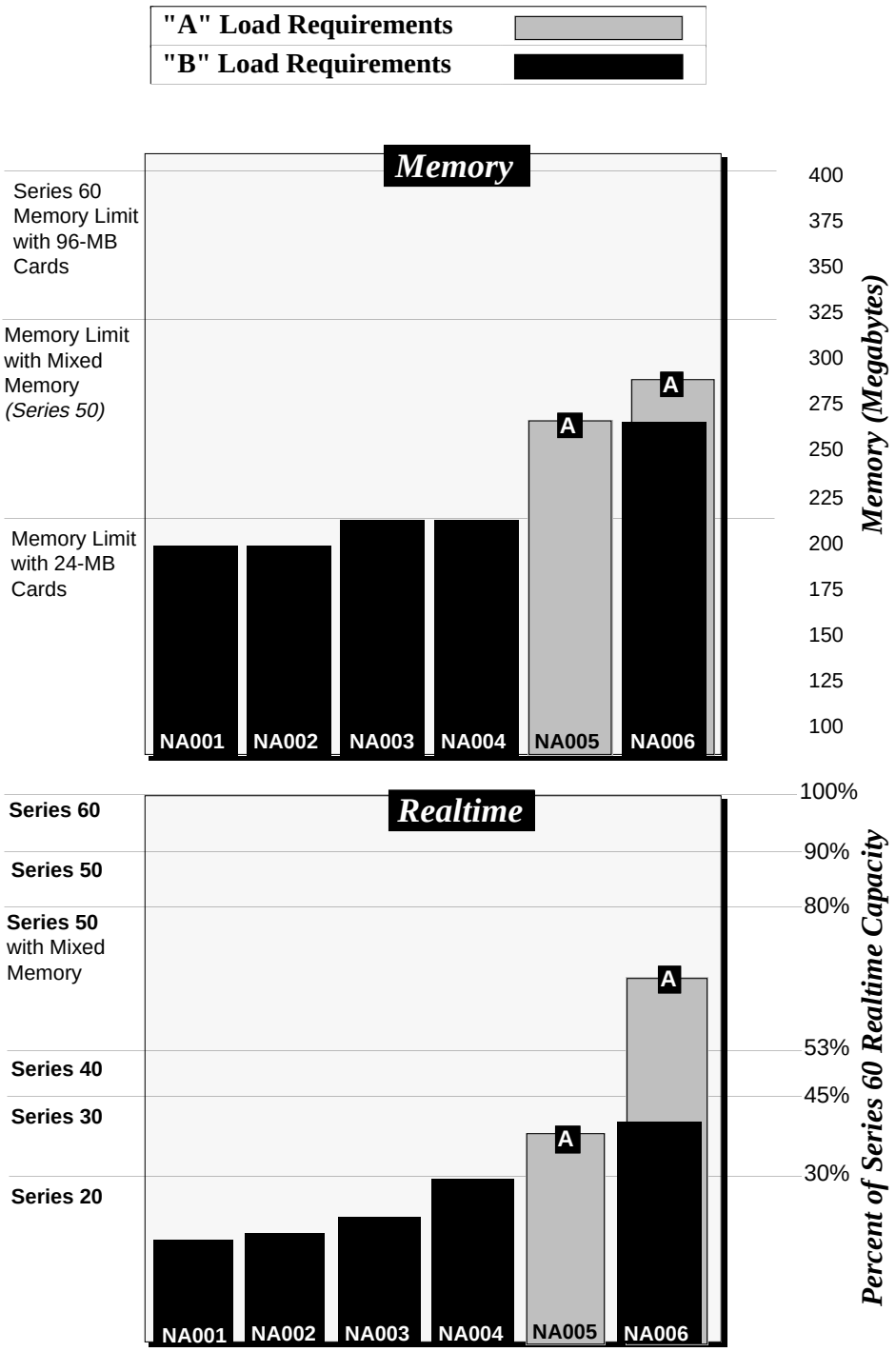
GROWTH PROJECTIONS FOR A SAMPLE OFFICE

30,000 Lines, High Centrex Penetration



MODEL 7

GROWTH PROJECTIONS FOR A SAMPLE OFFICE
50,000 Lines, Low Centrex Penetration

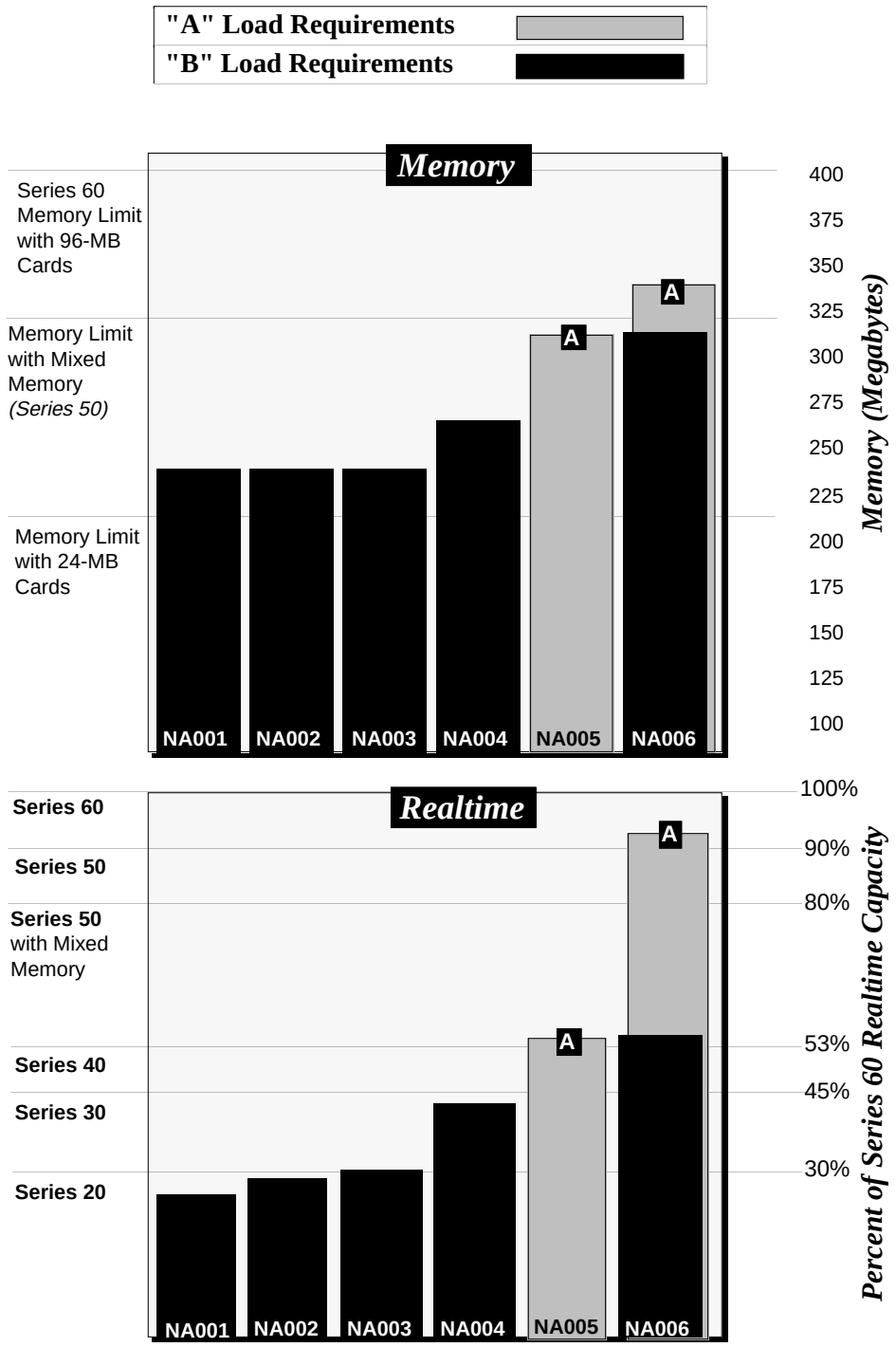


MODEL

8

GROWTH PROJECTIONS FOR A SAMPLE OFFICE

50,000 Lines, High Centrex Penetration



3.0 Managing Capacity Growth

Northern Telecom recommends standardization on the BRISC processor for the installed base. In order to support migration, our sales teams will be working closely with their customers to implement the most cost-effective upgrade plan that will prepare them for the deployment of GSF-based advanced services. It is also recommended that all initials be provisioned with Series 60s to best accommodate future growth.

For customers that may not need to deploy GSF-based services in the near future, there are other considerations that make a BRISC upgrade attractive. Customers that standardize on BRISC-enhancing consistency and capacity across the entire network-will see considerable administrative savings. In addition, the incremental capacity will provide the flexibility to meet revenue opportunities quickly.

MIXED MEMORY

Mixed Memory for BRISC processors will be introduced with NA004. Mixed Memory allows a BRISC processor to accept specific mixes of 24-MB and 96-MB memory packs. This means that existing 24-MB memory packs can be reused in the same switch, extending the addressable memory of the switch while deferring an upgrade to a Series 60. Before the introduction of Mixed Memory, the Series 50 processor is limited to using 24-MB cards.

The ability to mix and match memory packs allows network providers to extend the life of existing 24MB circuit packs and grow their capacity in stages.

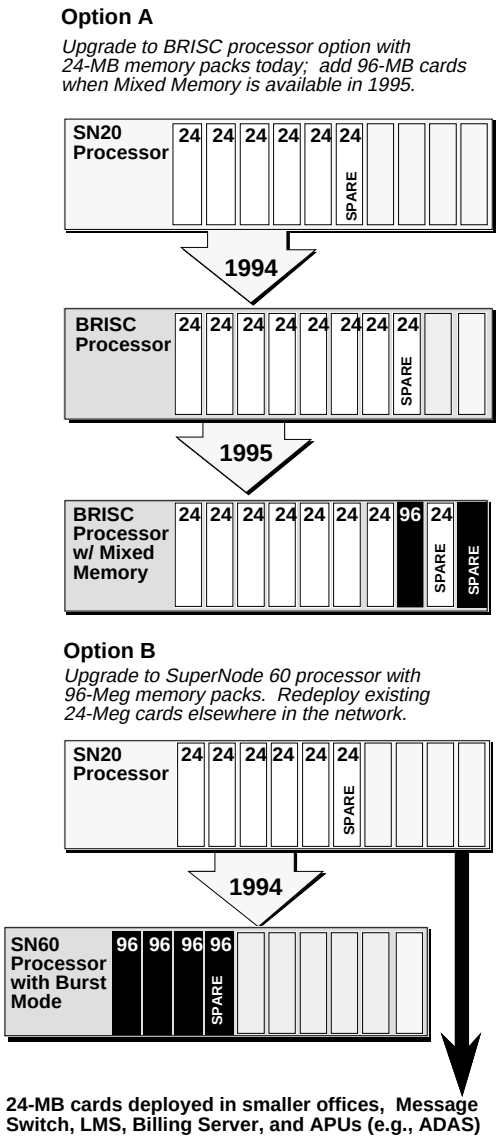


Figure 5. Mixed Memory
An Upgrade Option

As memory requirements grow, the customer adds 96-MB memory packs to support growth up to 320 MB. Beyond this point, the processor grows as a Series 60 processor, using 96-MB memory cards only and supplying “burst mode memory” for an additional performance enhancement.”

It is recommended that Series 60 be deployed now in sites that are expected to move to "A" loads in the future. This activity will make 24-MB cards available for redeployment elsewhere in the network, for example, in smaller offices.

REDEPLOYING 24-MB CARDS

To support new services on an advanced applications DMS platform-the Generic Services Framework-the DMS SuperNode Message Switch (MS) and the Link Peripheral Processor Local Message Switch (LMS) will require a memory upgrade for software delivered after 1994. The 24-MB memory cards can be reused, thereby protecting prior hardware investments. The table below demonstrates that there are ample redeployment opportunities in an average 200-office network.

Redeploying 24-MB Cards in a 200-Office Network

Number 24 MB Cards for Redeployment	50 sites x 12=**600**	70 sites x 12=**840**	100 sites x 12=**1200**
Opportunities			
Message Switch	200 sites x 2=**400**	200 sites x 2=**400**	200 sites x 2=**400**
LMS (LPP)	80 sites x 2=**160**	80 sites x 2=**160**	80 sites x 2=**160**
PCL Accommodation	150 sites x 4=**600**	130 sites x 4=**520**	100 sites x 4=**400**
Fill 24-MB Offices to Capacity	150 sites x 4=**600**	130 sites x 4=**520**	100 sites x 4=**400**

Assumes LPP deployed in 40% of offices
Average memory per site = 120 MB

For More Information

The following *Product / Service Information (PSI)* publications provide additional information about processor options and DMS Switching Evolution programs:

Feature Planning Guide: 3Q94-A Planning Perspective for Creating Tomorrow's Network 50004.11/06-94 Issue 12, June 1994

Introduction to the New North American Product Structure 50104.16/06-94 Issue 1

Series 60-A Powerful New Option in BRISC Processing 50084.16/05-94 Issue 1

To receive any of the above-listed publications, call the Sales and Marketing Information Center at 1-800-NORTHERN and request the document by number. The following user publications provide technical information related to realtime and memory provisioning:

DMS-100F Memory Administration Provisioning -SEB 88-01-002
REAL::TIME Version 7.0 Users Guide
BRISC Engineering Philosophy - SEB 91-11-003

For these technical user publications, contact your organization's documentation coordinator.

For more information about DMS Switching Evolution, Product Compute-Module Loads (PCLs), and processor options, contact your Northern Telecom representative.

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