Enterprise Server Performance Analysis & Capacity Planning in High Volume Batch and On- Line Environments

UNITE Technology Conference

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Session MCP4064

Guy Bonney

MGS INC

Computer Business Solutions

MGS, Inc.

- Software Engineering, Product Development & Professional Services firm founded in 1986
- We provide products and services to solve business problems:
  - **Software Engineering Services**
  - **Professional Services**
    - **Management Support Services**
    - **Consulting and Technical Services**
    - **Application Development Services**
    - **Training Services**
  - **Product Development**

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MGS Areas of Expertise

- Principals average over 25 years industry experience
- Junior staff - minimum 5 years experience
- 60% of experience is Unisys ClearPath NX/A Series
- Remainder is PC, Windows™, UNIX, C, Delphi, VB, LAN/WAN...

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MGS Software Products

- File Manager for ClearPath MCP/A Series (FMA)
- SightLine™ Performance Analyzer
- SightLine Capacity Manager
- SightLine Workload Analyzer
- HVFAX High Volume Facsimile Delivery System
- Proof of Correctness System (PCS)

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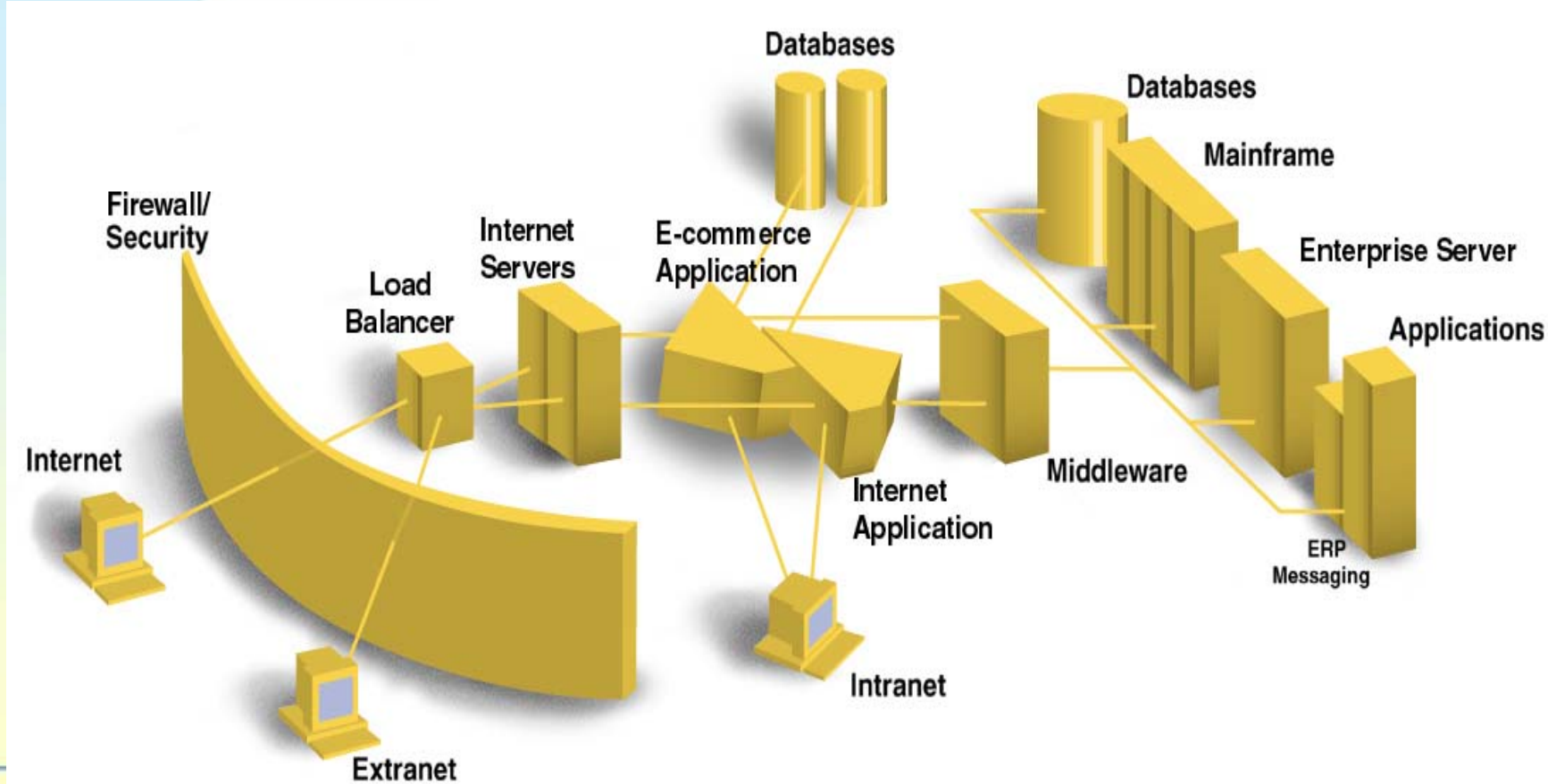
Complex Service Delivery Environment



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IT Performance/Capacity Issues

- Business Issues
- Information Technology Management Issues
- Technical Issues

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Business Issues

- Change
  - Growth
    - Evolutionary
      - New clients, new products, higher volumes
    - Revolutionary
      - Buy a new division / product line
      - Merger
      - Business exchange / partner collaboration
      - On Line customer service
      - On Line payment processing or store front
  - Decline
    - Lose business (cost reduction)
    - Change business focus / direction
    - Get bought or merged

Business Growth

- Growth in most organizations requires Information Technology services to change
- Growth is not possible without reliable IT service delivery and good performance
- Even without business growth IT must enhance offerings and offer new services

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IT Management Issues

- Where is the business going?
- What technologies are now available?
- What new & improved functionality do we need to support the business?
- What service levels are needed for effective business function?
- What capacity is required to deliver the services needed?
- What budget is available to procure necessary resources?

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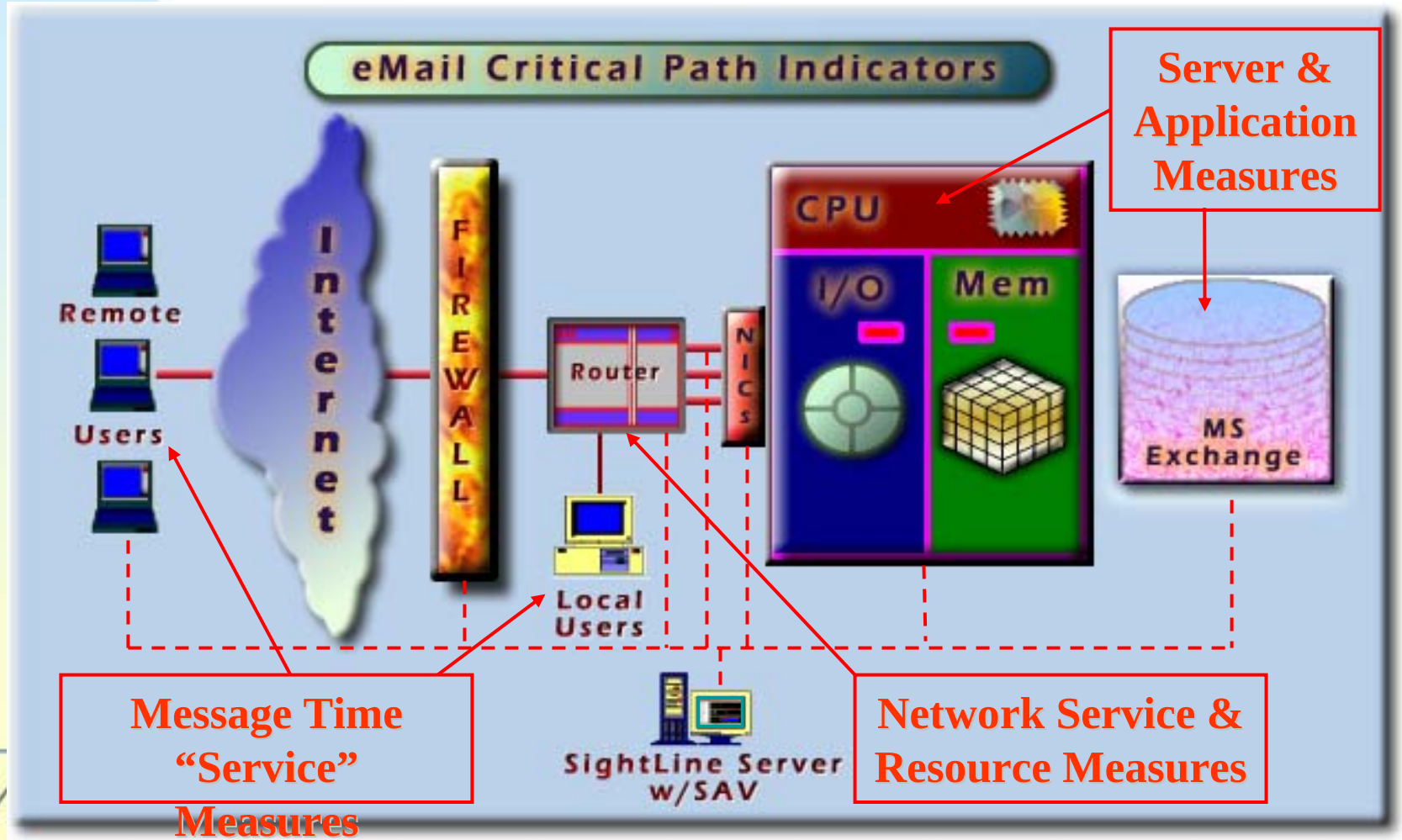
Technical Issues

- What resources are available for service delivery?
- How do we define the business workloads?
- What service levels are we delivering?
- How do we measure services and service levels?
- How should we report on performance and capacity issues?
- How do we do performance analysis?
- How do we do capacity planning?
- What tools are available?

What is Performance?

- Meeting Expectations.
- Complete Processing a Unit of Work in the Expected Time.
  - On-line transactions - Response Time
  - Batch runs - Elapsed time/Deadlines
  - “On-Line Batch” - Elapsed (Response) time
  - Delivering the email – Response Time

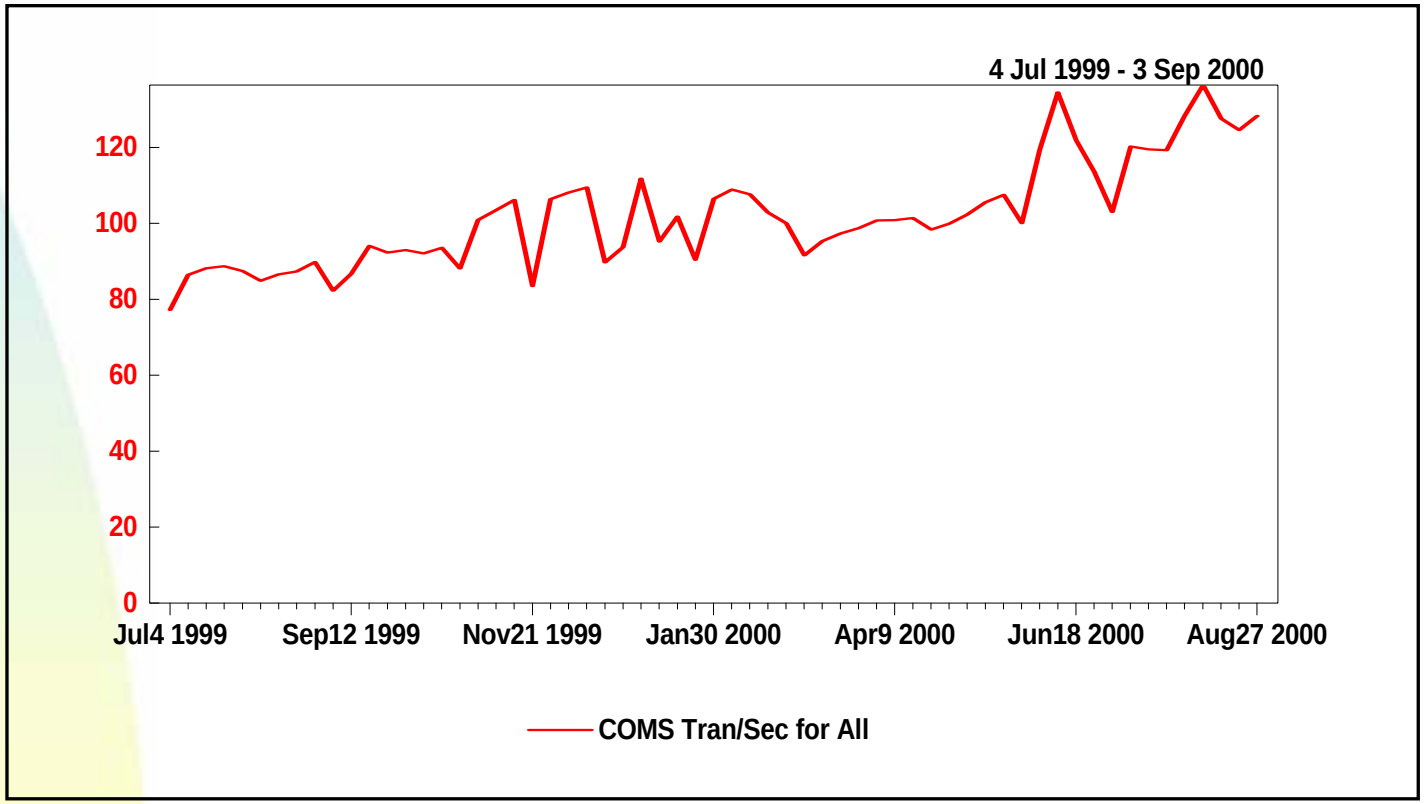
Monitoring the Critical Path



What is a Workload?

- Aggregate set of units of work to be processed
- Everything that must be accomplished to deliver a set of results to a requester

Workload Example



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What is Capacity?

- Simply the capability to process defined amounts of work in a specified period of time
- Measured in terms of units of work “processed”: MIPS, RPM, TPC-C transactions, MFLOPS, etc.

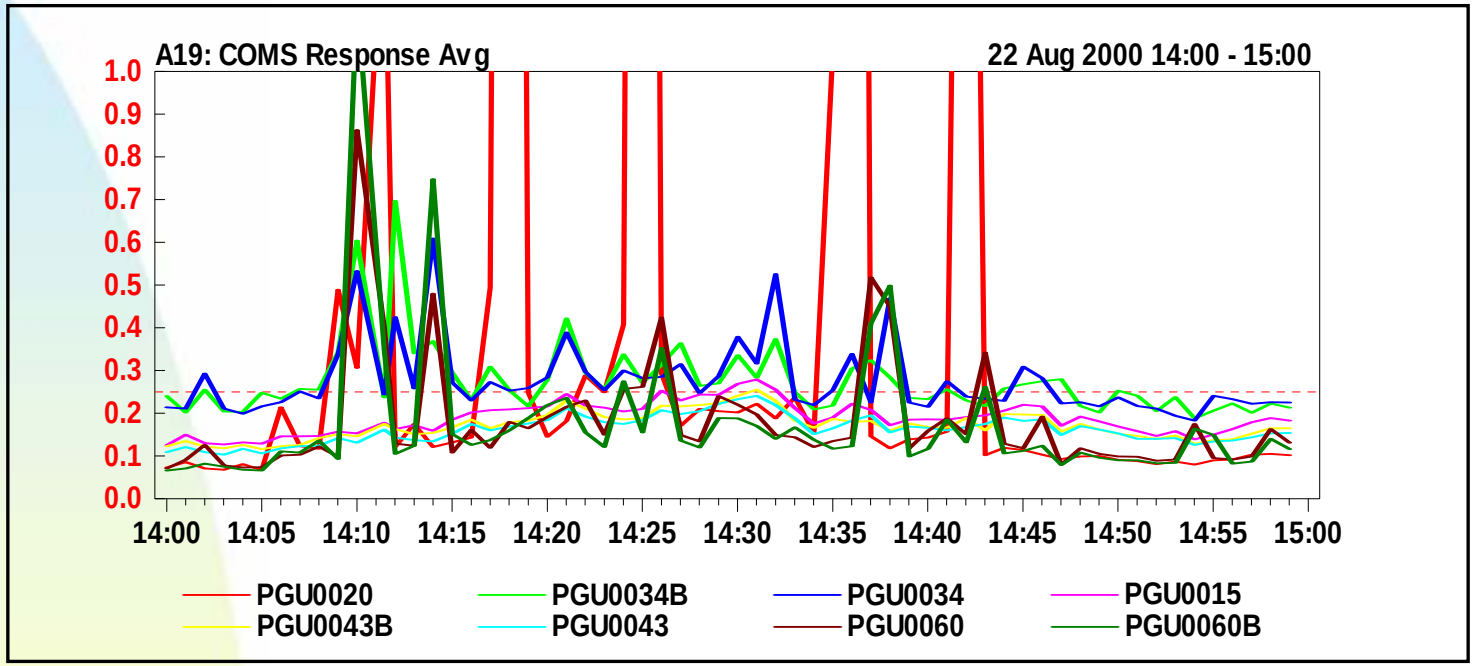
Performance vs. Capacity

- Capacity is the ability to process work
- Performance is the measure of workload processing effectiveness
- Performance and Capacity must be considered together as they are related

Performance Analysis Objectives

- Recognize performance anomalies (response time or service time issues)
- Detect bottlenecks (measure queuing and busy time)
- Determine cause of inadequate performance
- AVAILABILITY IS ASSUMED!

On-Line Response Time
Time Series Analysis



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Batch Cycle Analysis

TaskName	Mix#	CPUSecs	IOSecs	Memory	IOCount	PrintLns	Elapsed	StartTime	StopTime
(SFB)SFB/REPTAL0002	2004	1.6	1.3	9949	60	8	7.9	4/30/97 3:44	4/30/97 3:44
(SFB)SFB/REPACL0024	2018	111.3	93.5	15531	162324	4683	244.5	4/30/97 3:44	4/30/97 3:48
(SFB)SFB/REPACA0704	2152	56.1	25.6	16515	92726	85	71.2	4/30/97 3:52	4/30/97 3:53
(SFB)SFB/REPACA0706	2190	32.6	24.6	18091	135537	4835	52.6	4/30/97 3:53	4/30/97 3:54
(SFB)SFB/REPACA0760	2213	739.7	1916.3	19021	177340	156	2298.2	4/30/97 3:54	4/30/97 4:33
(SFB)SFB/REPAHA0760	2898	5.9	17.1	17566	1546	90	30	4/30/97 4:33	4/30/97 4:34
(SFB)SFB/REPEEA0002	2935	630.5	1274.7	21858	217908	744	2295.8	4/30/97 4:34	4/30/97 5:12
(SFB)SFB/REPAHL0033	3632	4.2	11.5	16134	3535	1120	26.2	4/30/97 5:13	4/30/97 5:13
(SFB)SFB/REPAHL0010	3648	26.8	92.3	14795	12989	1211	188.8	4/30/97 5:14	4/30/97 5:17
(SFB)SFB/REPCHA0612	3752	250	477.5	21567	53228	2057	921.4	4/30/97 5:19	4/30/97 5:35
(SFB)SFB/REPCCA0612	4032	1245	1786.9	22968	206670	9313	2696.4	4/30/97 5:35	4/30/97 6:20
TOTALS		3103.7	Secs.				8833	Secs.	
							2.45	Hours	

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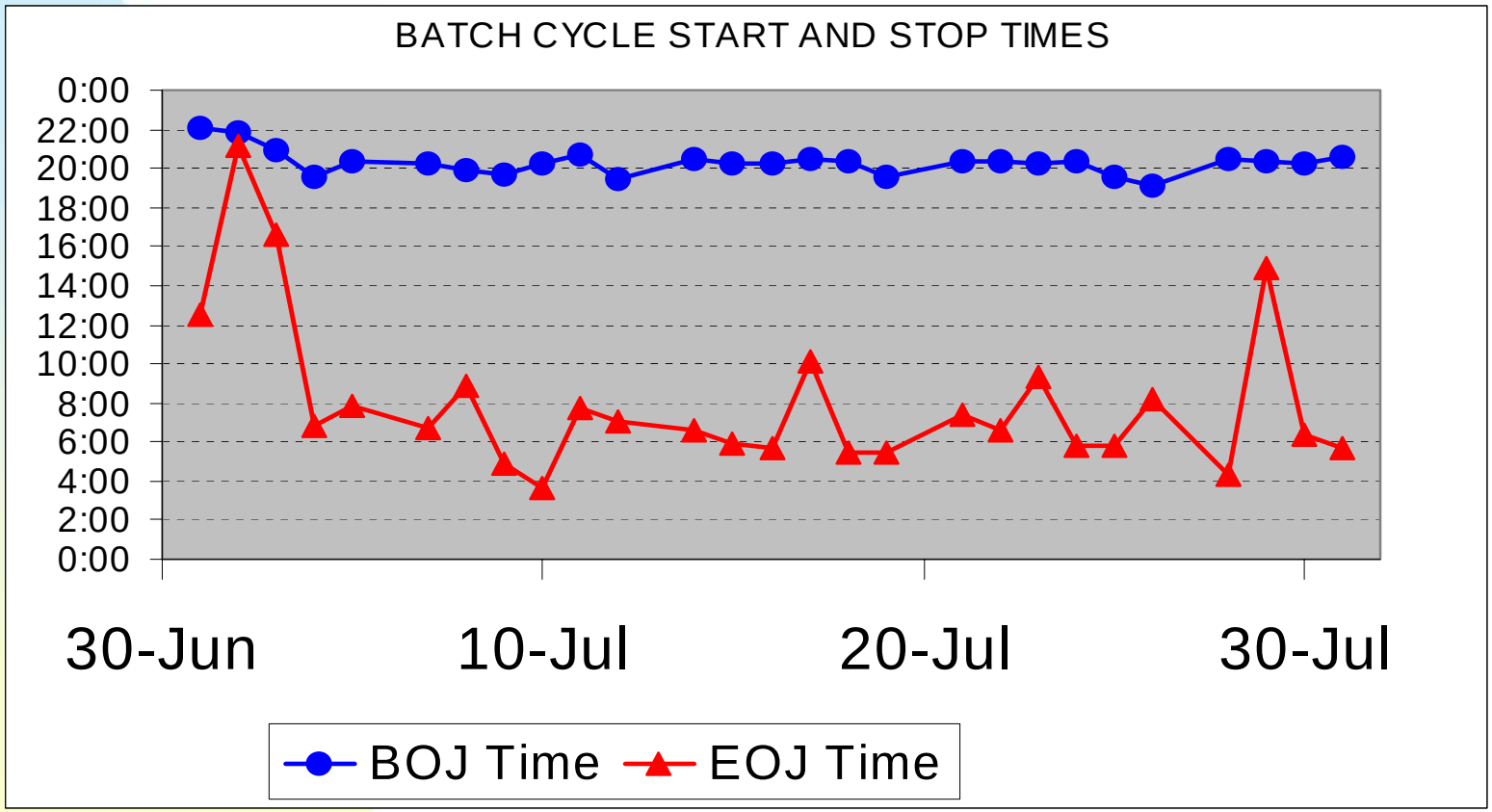
Deadline Graphic Analysis



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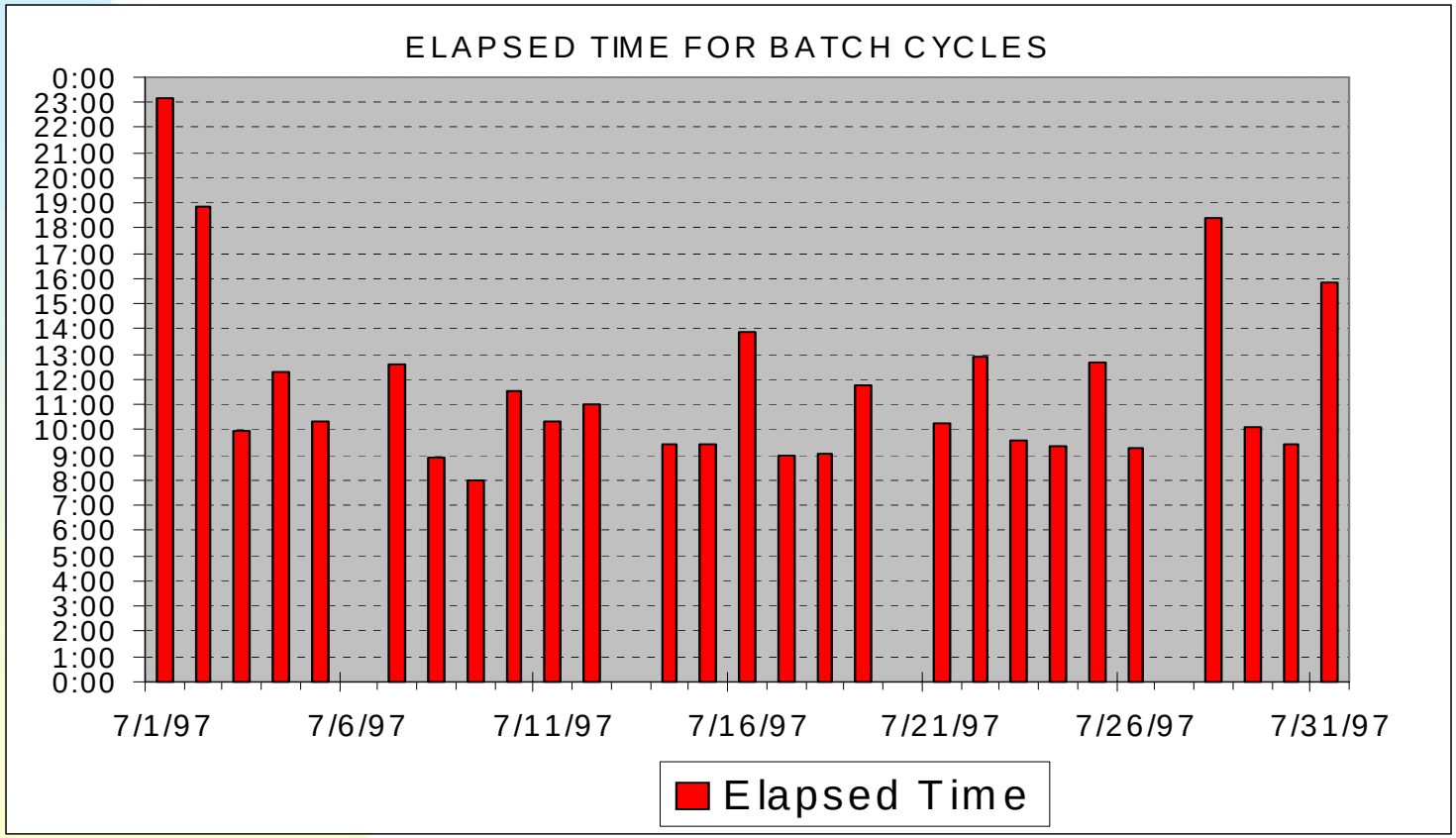
Batch Cycle Trend Analysis



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Program Run Exception Analysis

Report Date: 8/11/97 — MC0181 Exception Report for July 1997 Processing (30% > Avg. Elapsed Time) — Page 1

Name	Task Number	CPU Secs	IO Secs	ReadyQ Secs	Elapsed Secs	Disk IO Cnt	Tape IO Cnt	Print Lines	BOJ Date	BOJ Time	EOJ Date	EOJ Time
MC0181	9461	5,058	902	1,152	13,893	1,065,431	4,113,762	13	7/2/97	0:56:44	7/2/97	4:48:17
MC0181	6502	5,287	854	832	16,002	987,808	4,092,475	13	7/3/97	0:36:29	7/3/97	5:03:11
MC0181	2565	5,010	1,215	184	15,796	963,257	4,081,849	13	7/5/97	22:07:06	7/6/97	2:30:21
MC0181	4232	5,367	115	278	13,571	997,660	8	13	7/29/97	22:54:21	7/30/97	2:40:33
				July 97 AVG =	10,258							

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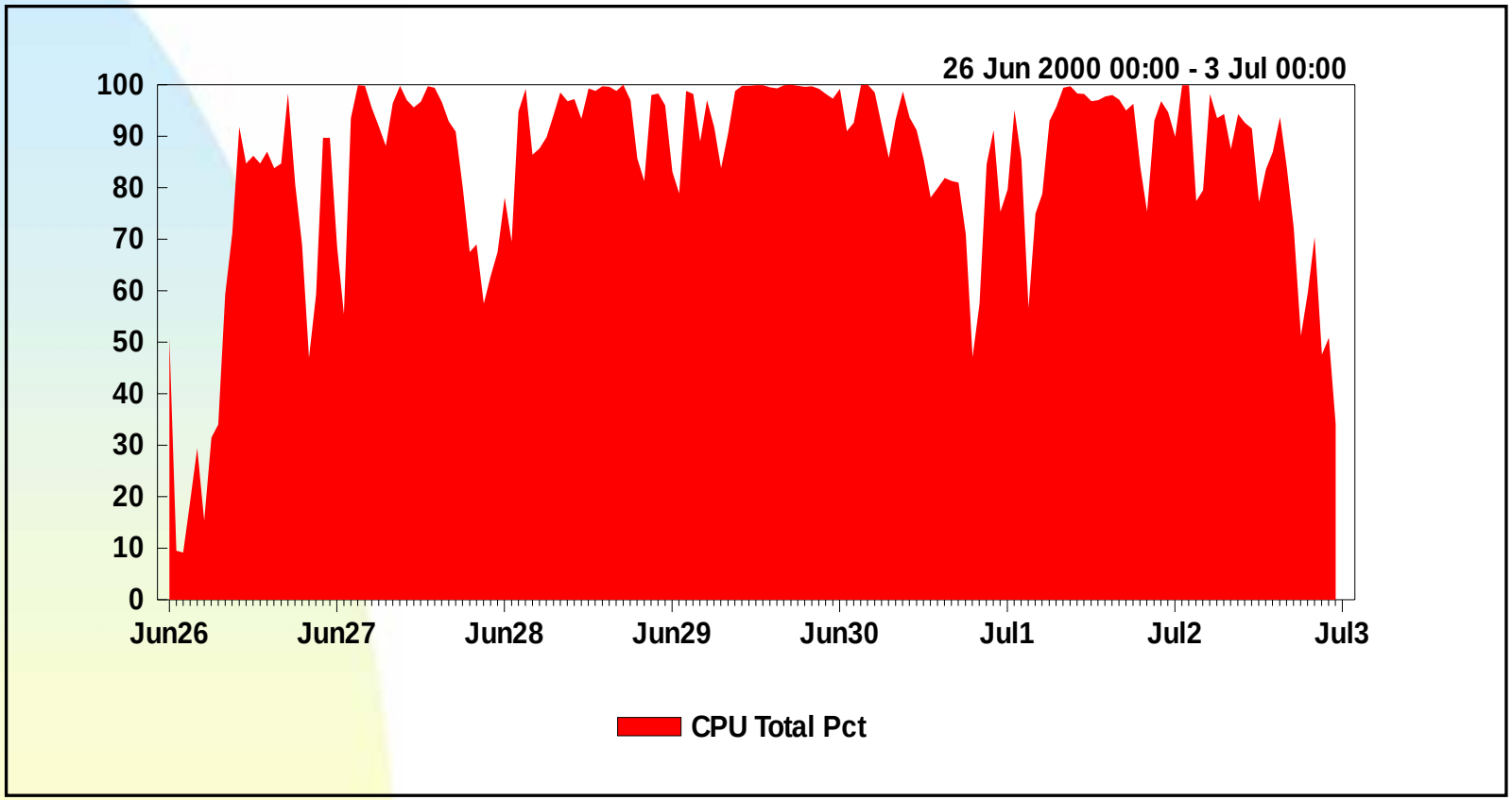
Analyze Components

- Review utilization, queuing and throughput rates for key components:
  - CPU
  - Memory
  - I/O Subsystems

CPU Analysis



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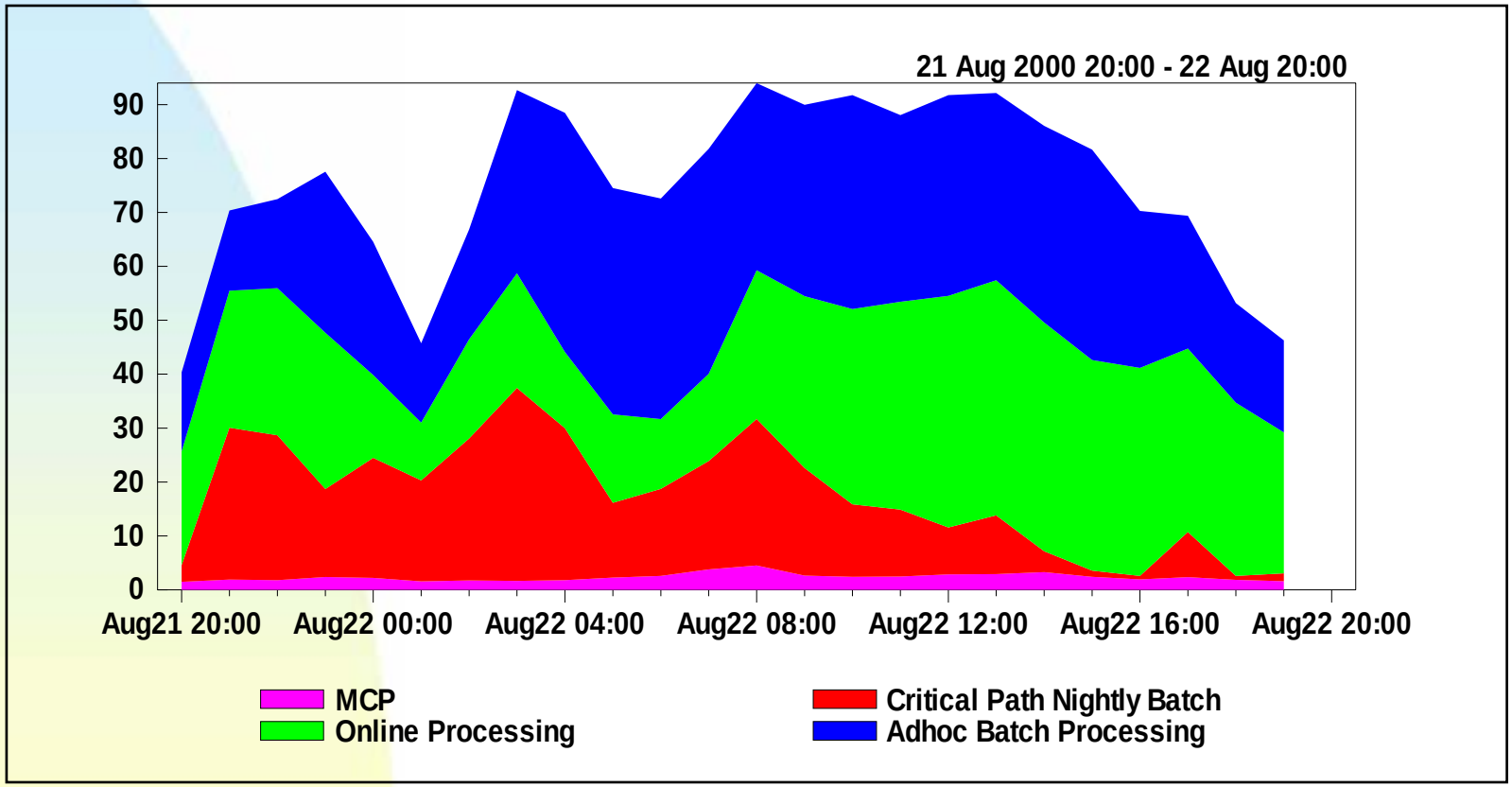
Workload CPU Distribution



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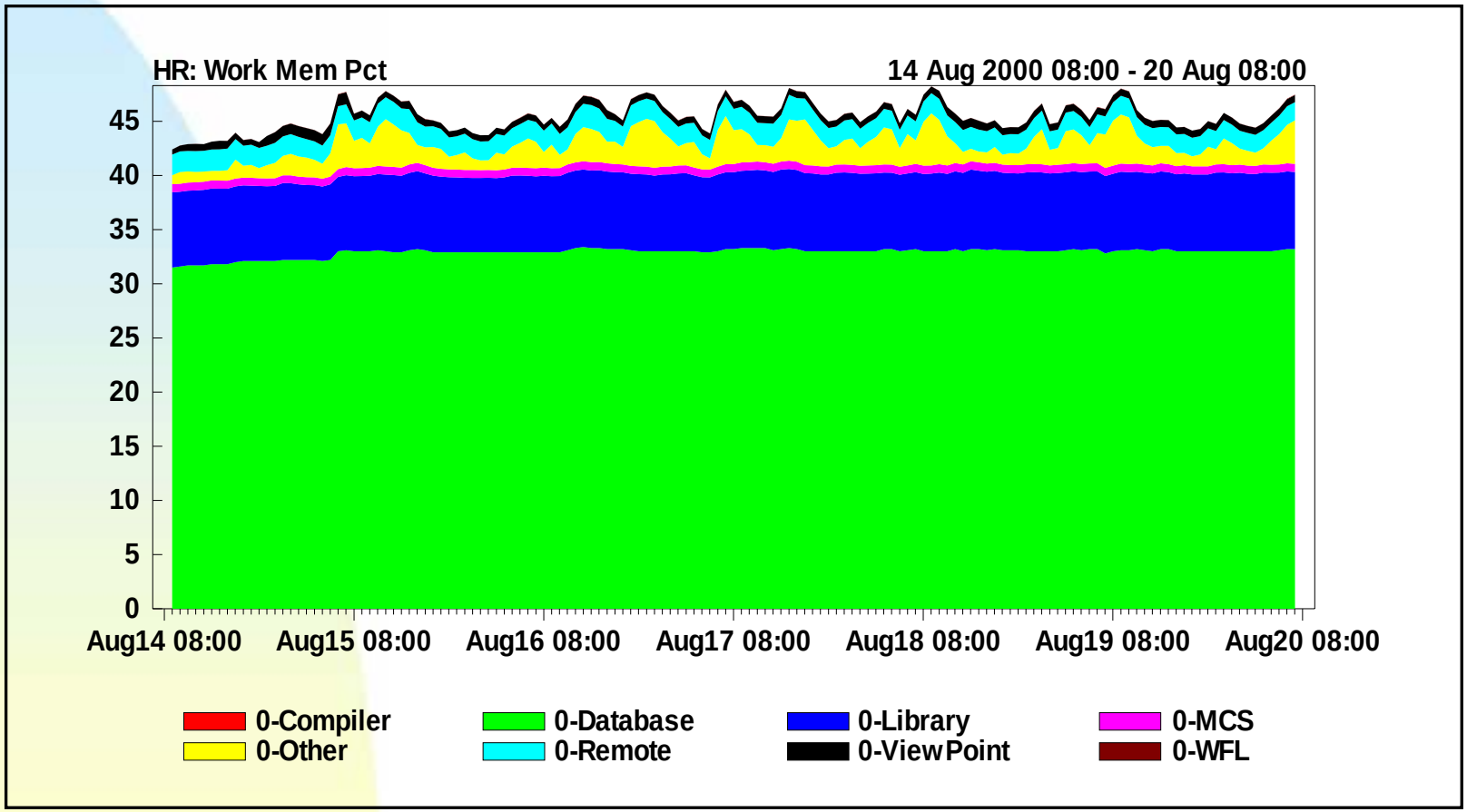
Memory Analysis



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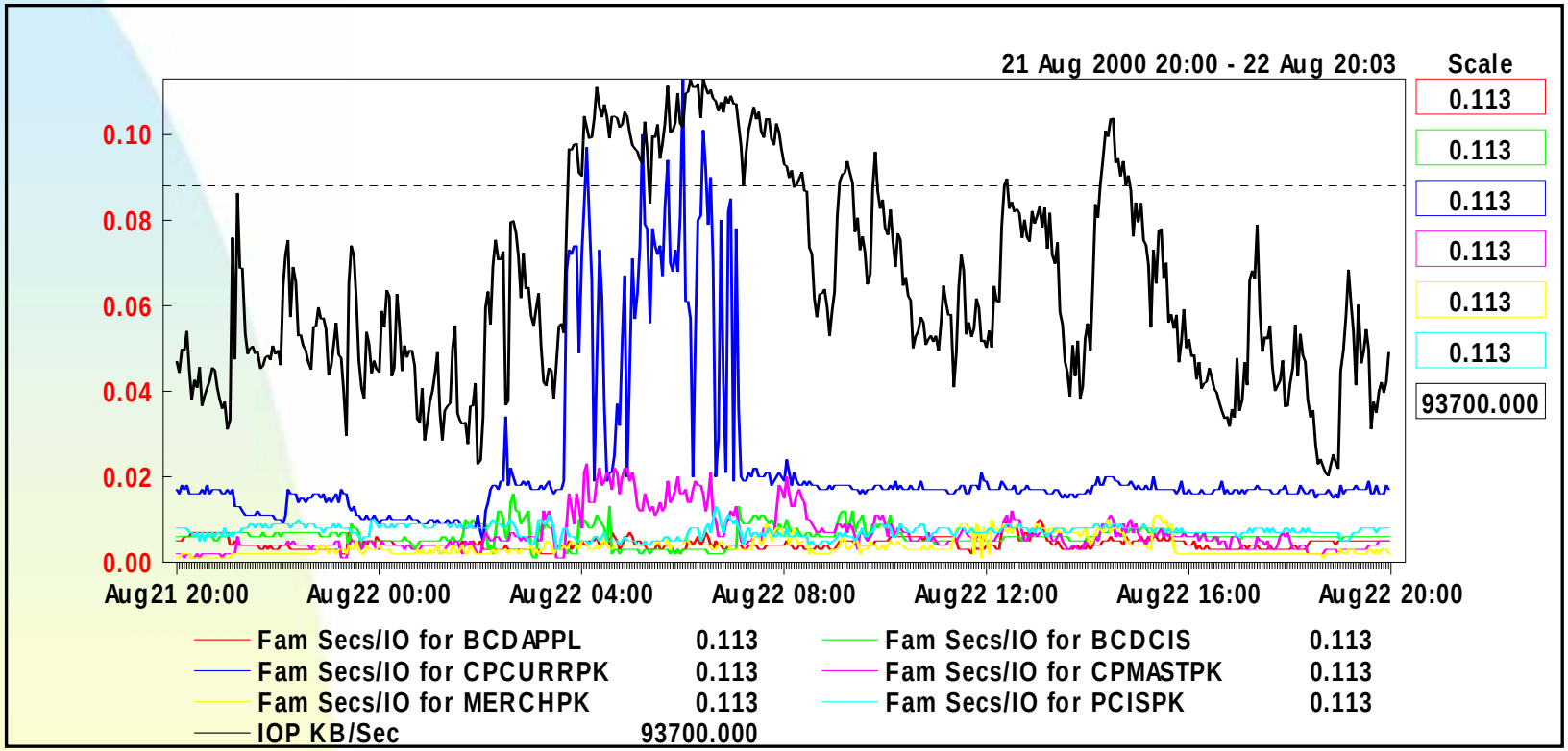
I/O Anomaly



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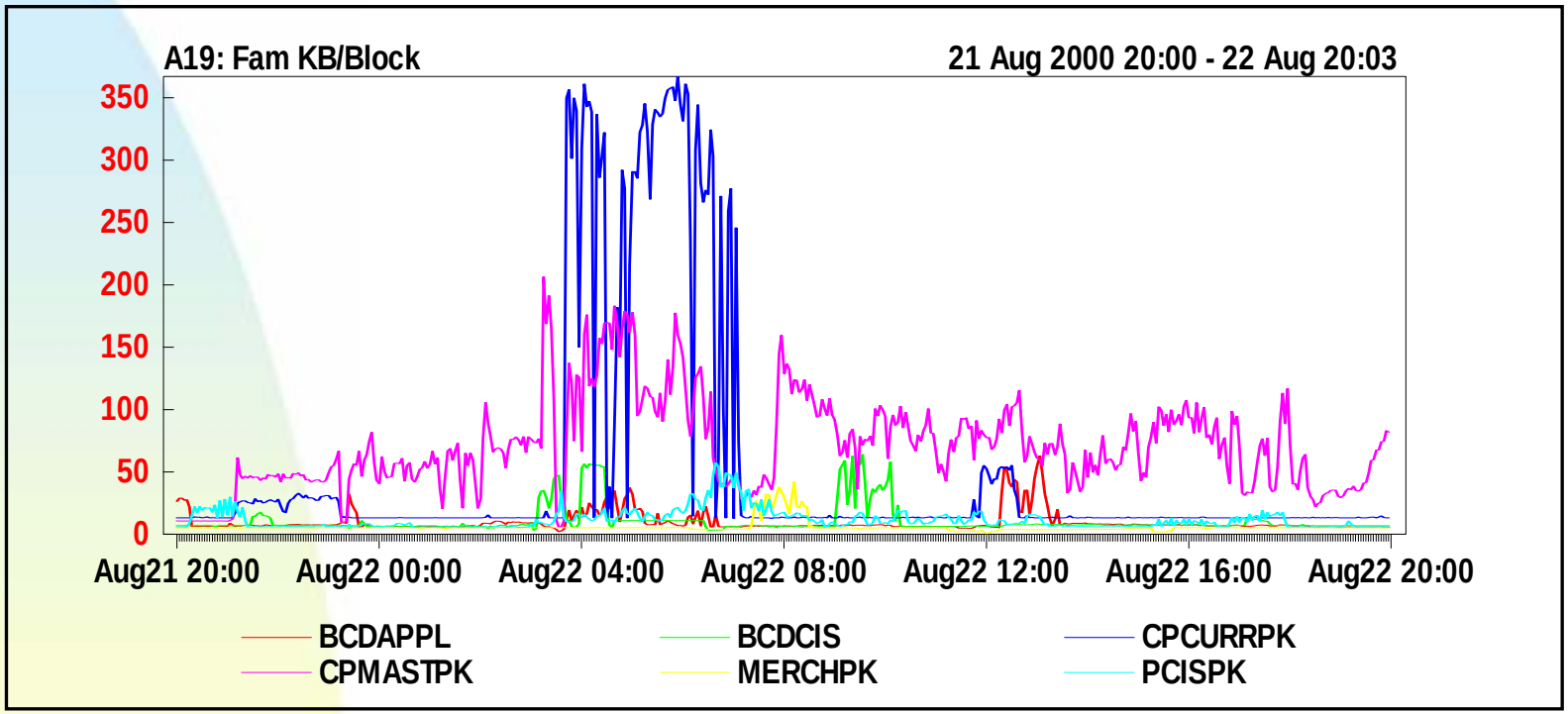
I/O Block Sizes



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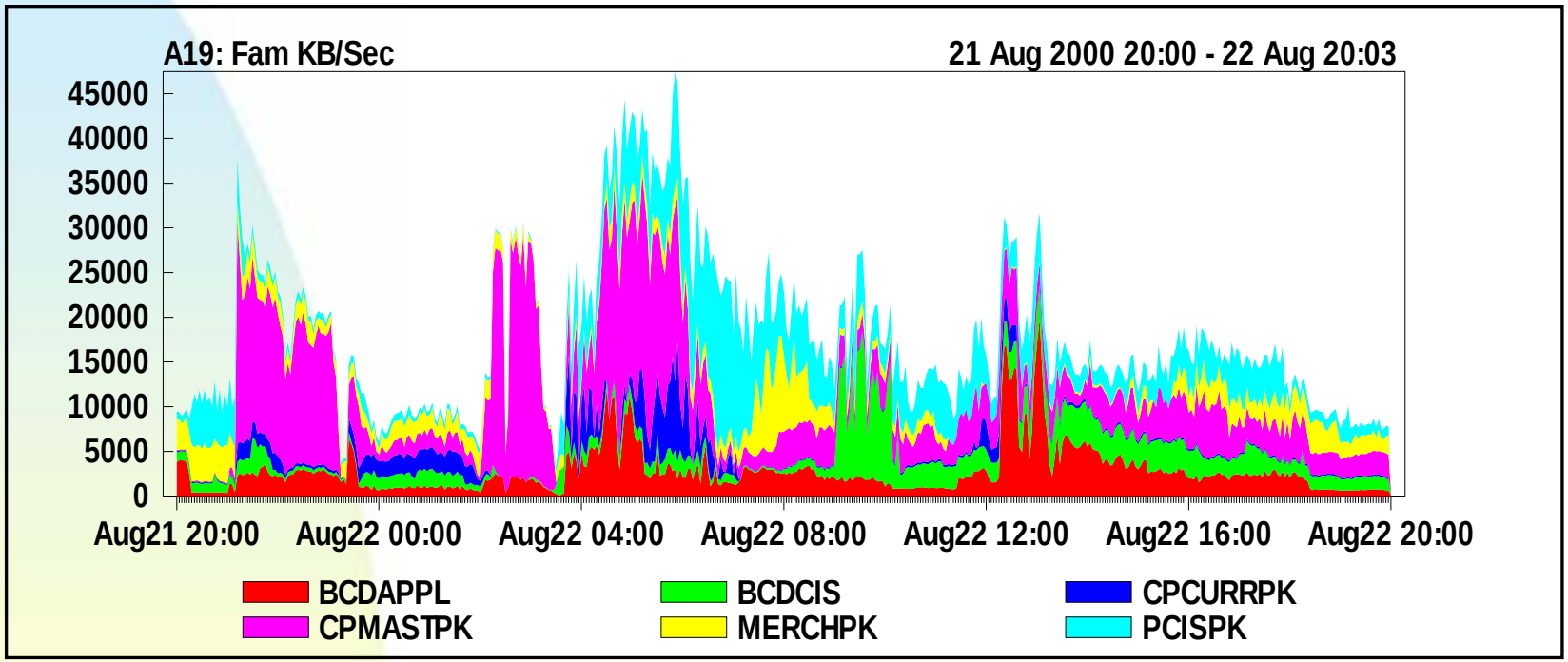
Disk I/O Transfer Rate



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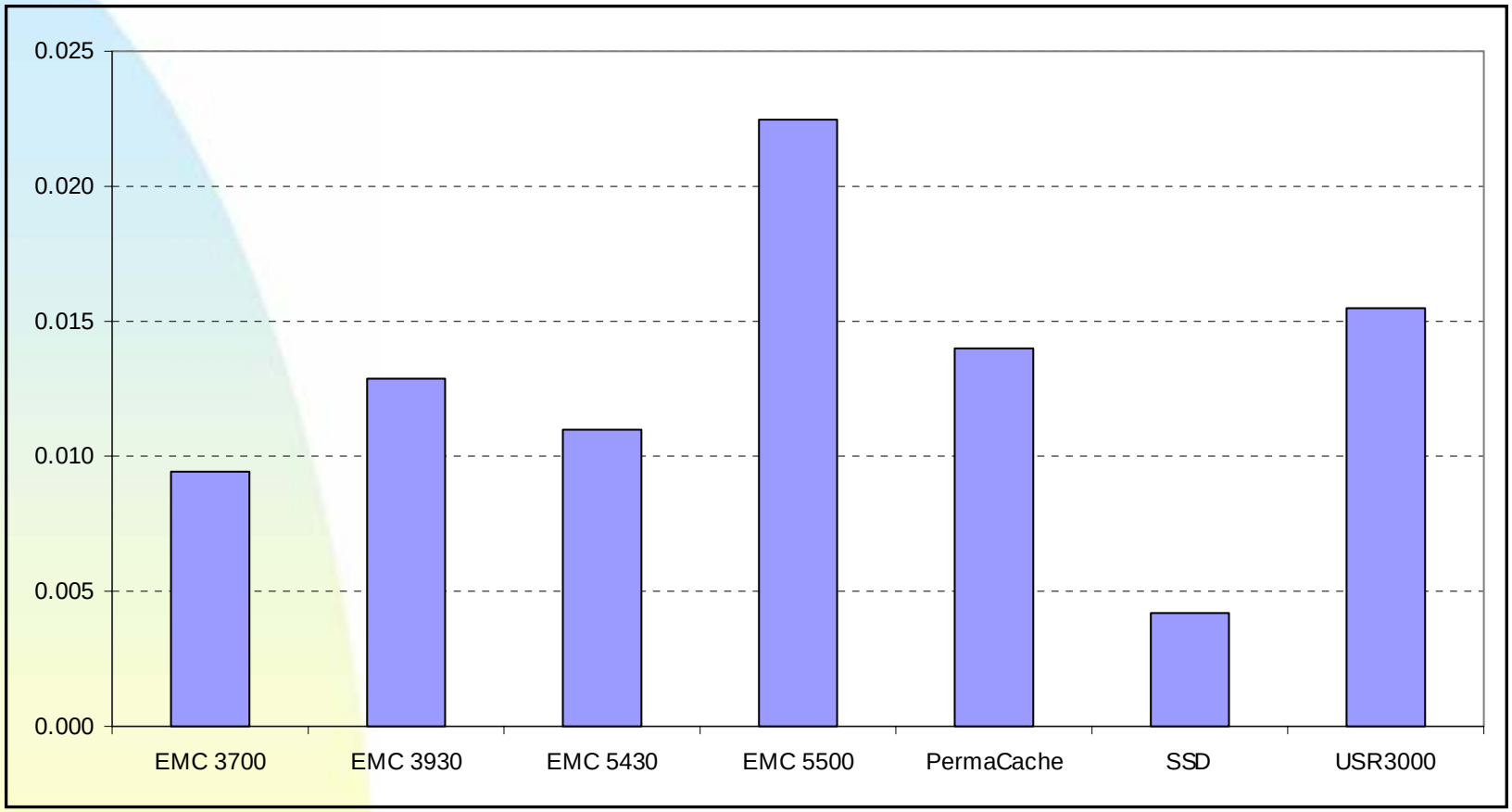
Disk Service by Type



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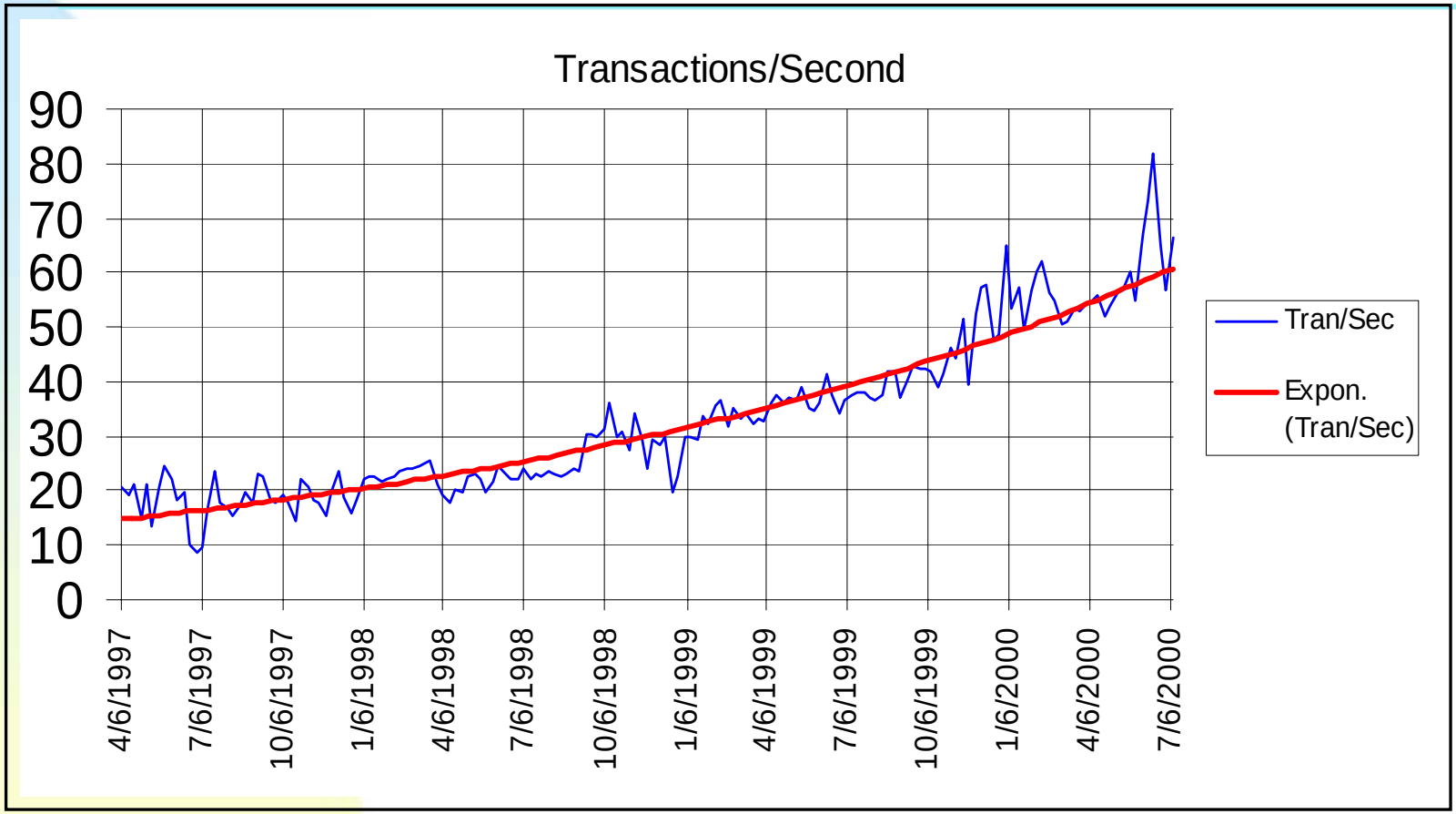
Capacity Planning Objectives

- Determine resources needed to support projected workload
- Verify desired performance / service levels can be met
- Define explicit list of questions to answer to avoid wasted effort

Capacity Planning Levels

- Simple Projection
  - Make Rule Of Thumb (ROT) assumptions for CPU, I/O and memory loading to stay within “safe bounds”
  - Use operational analysis techniques to estimate
  - Must understand component limits
  - Need monitor and analysis tools to validate
- Model Projection
  - Define processing types to be analyzed
  - Define time periods for modeling

On Line Workload Growth



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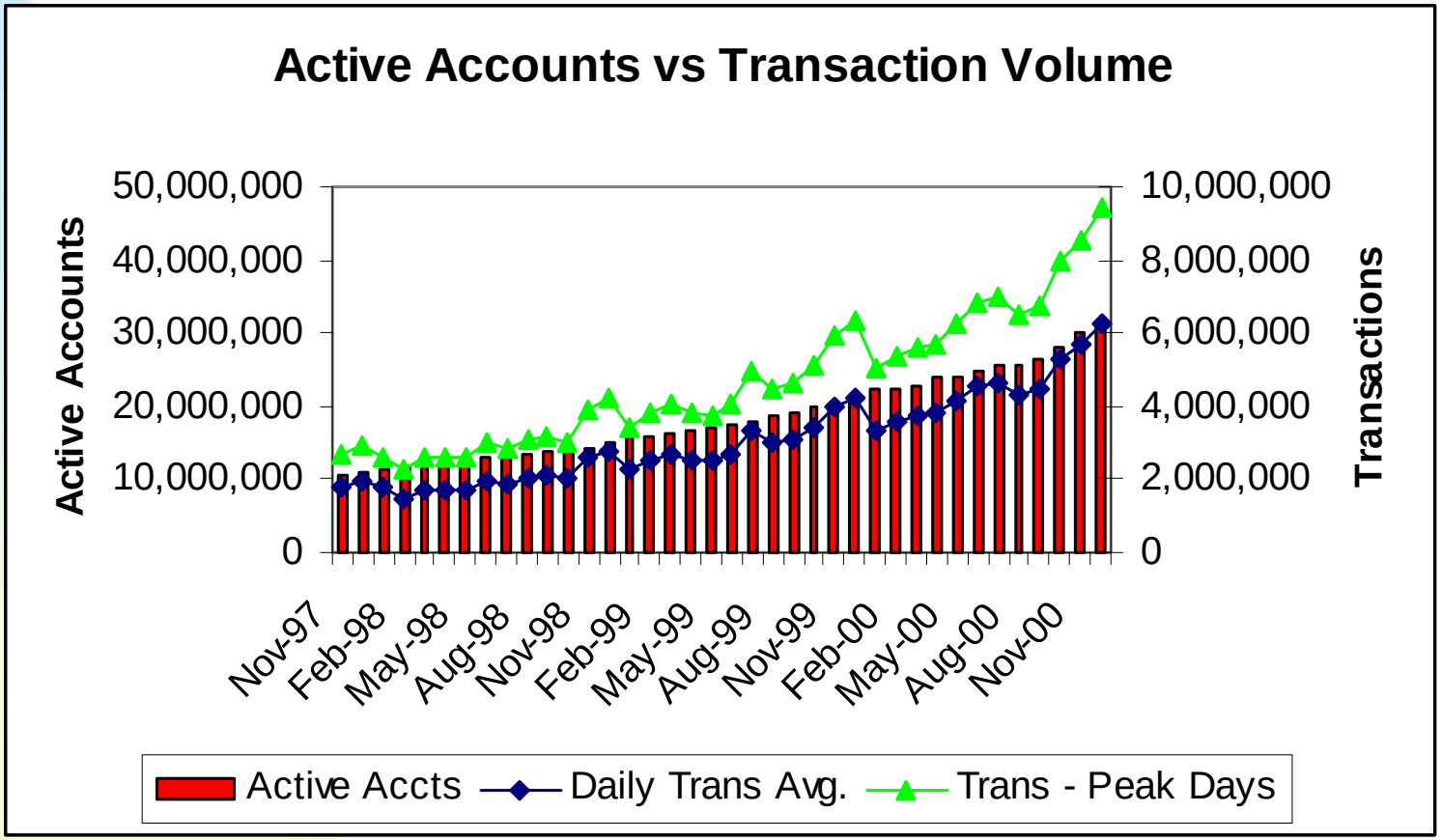
Batch Workload Growth



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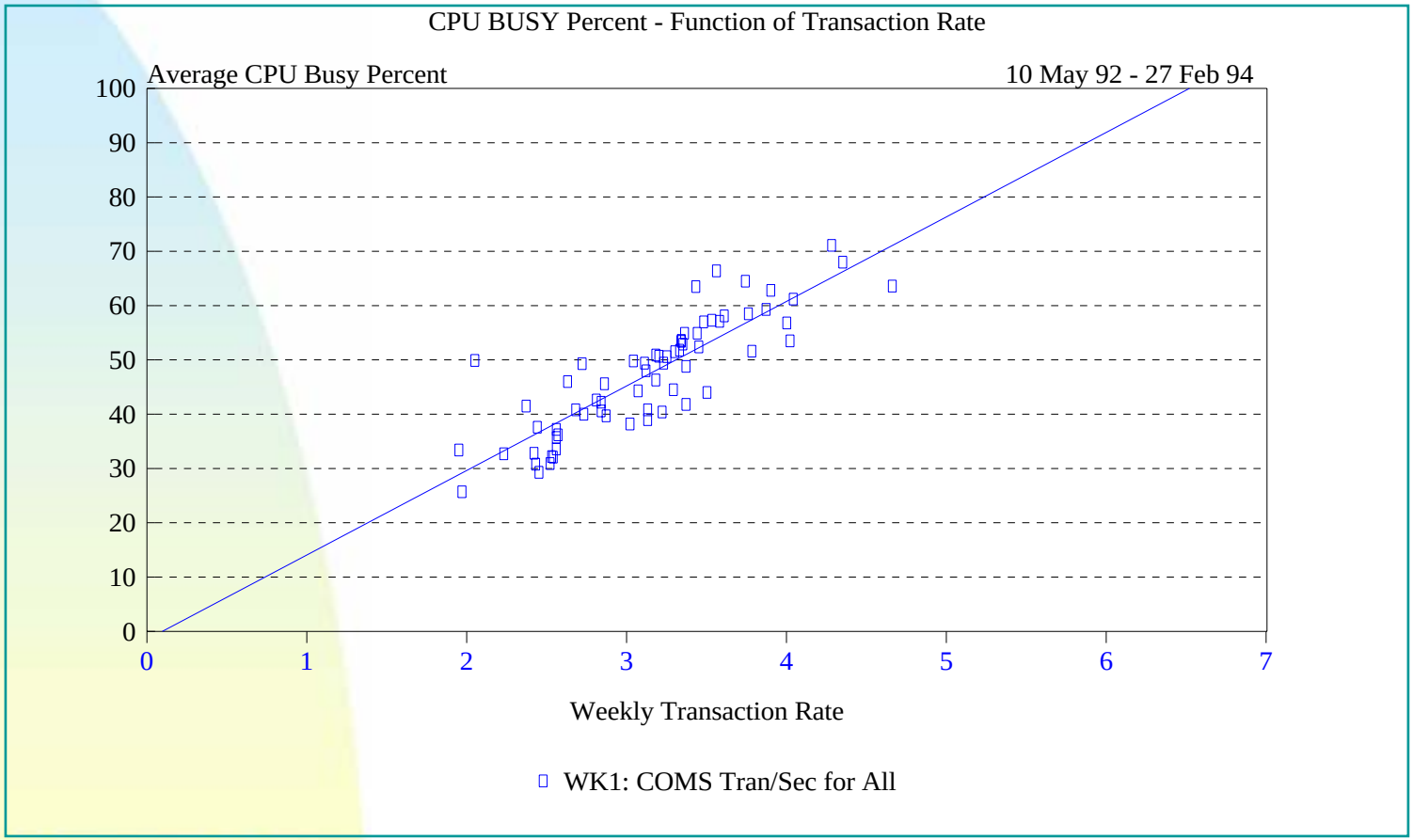
CPU Usage vs Transactions



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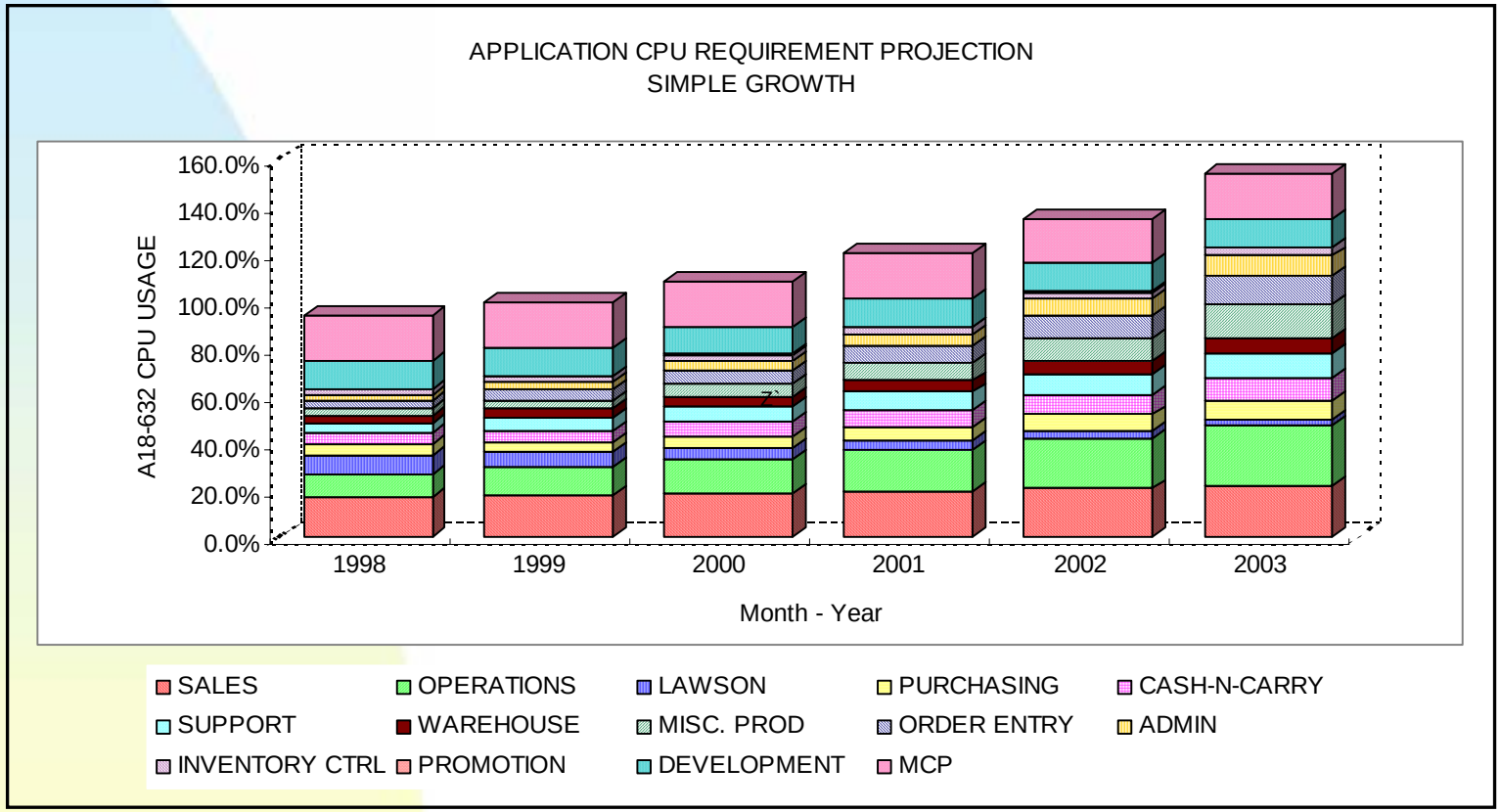
CPU Workload Capacity Projection



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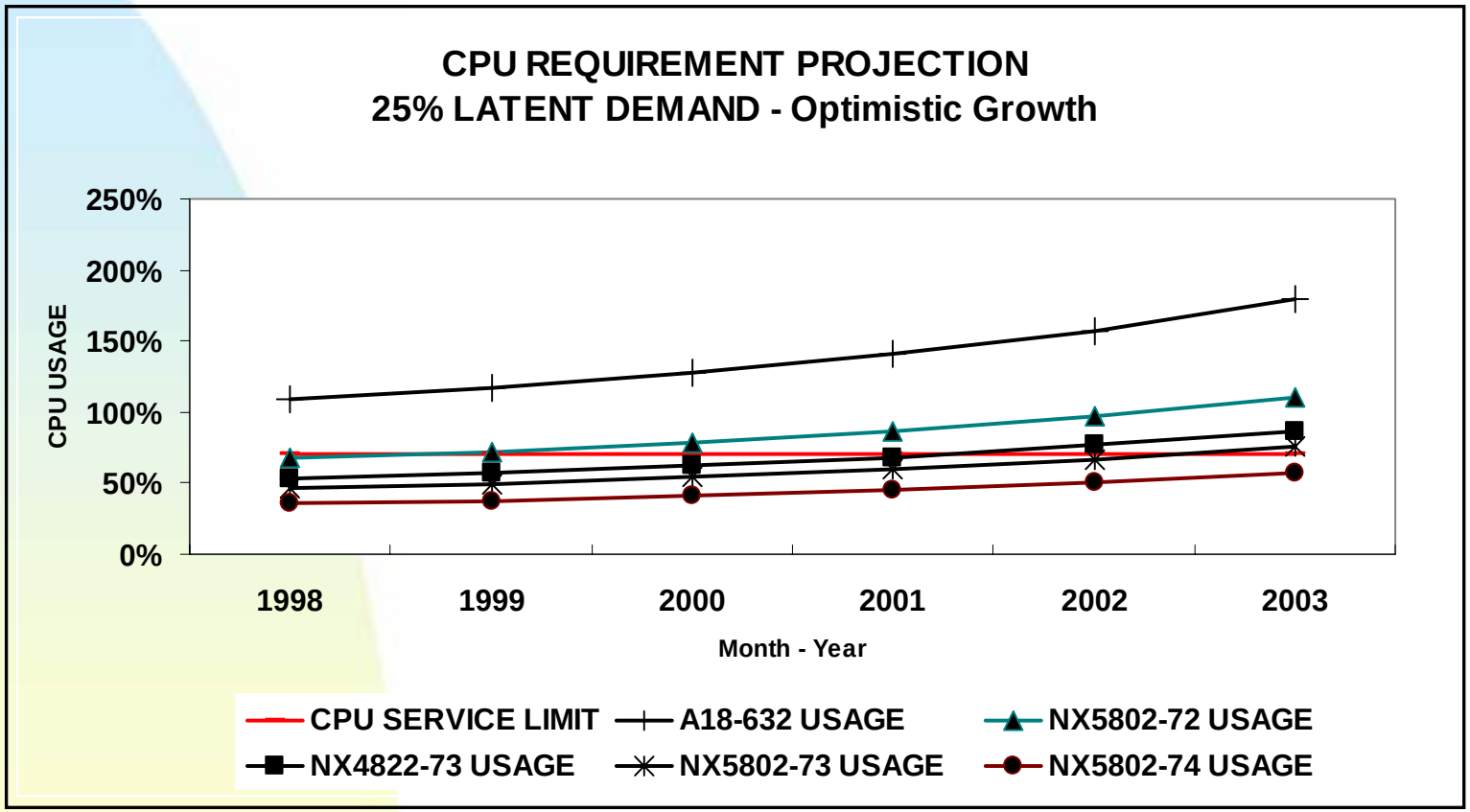
CPU Capacity Projection



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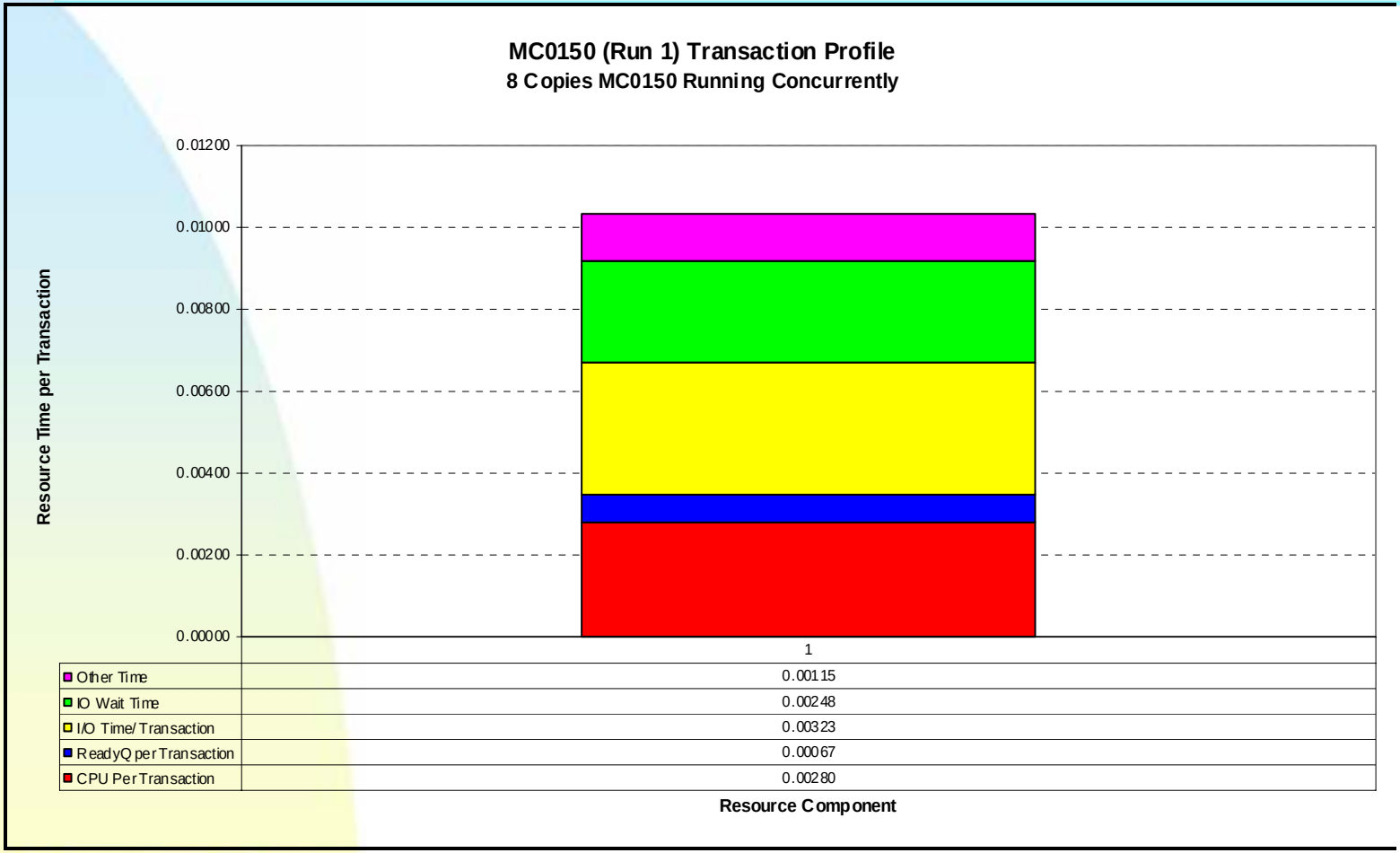
Capacity Models

- Characterize the workloads (CPU, memory, I/O, Delays)
- Define the hardware configuration
- Execute the model using current measured data
- Validate against actual measurement
- Change the model workload levels – rerun
- Change the model parameters (HW/SW spec) and rerun
- Analyze and report results

A Workload Profile



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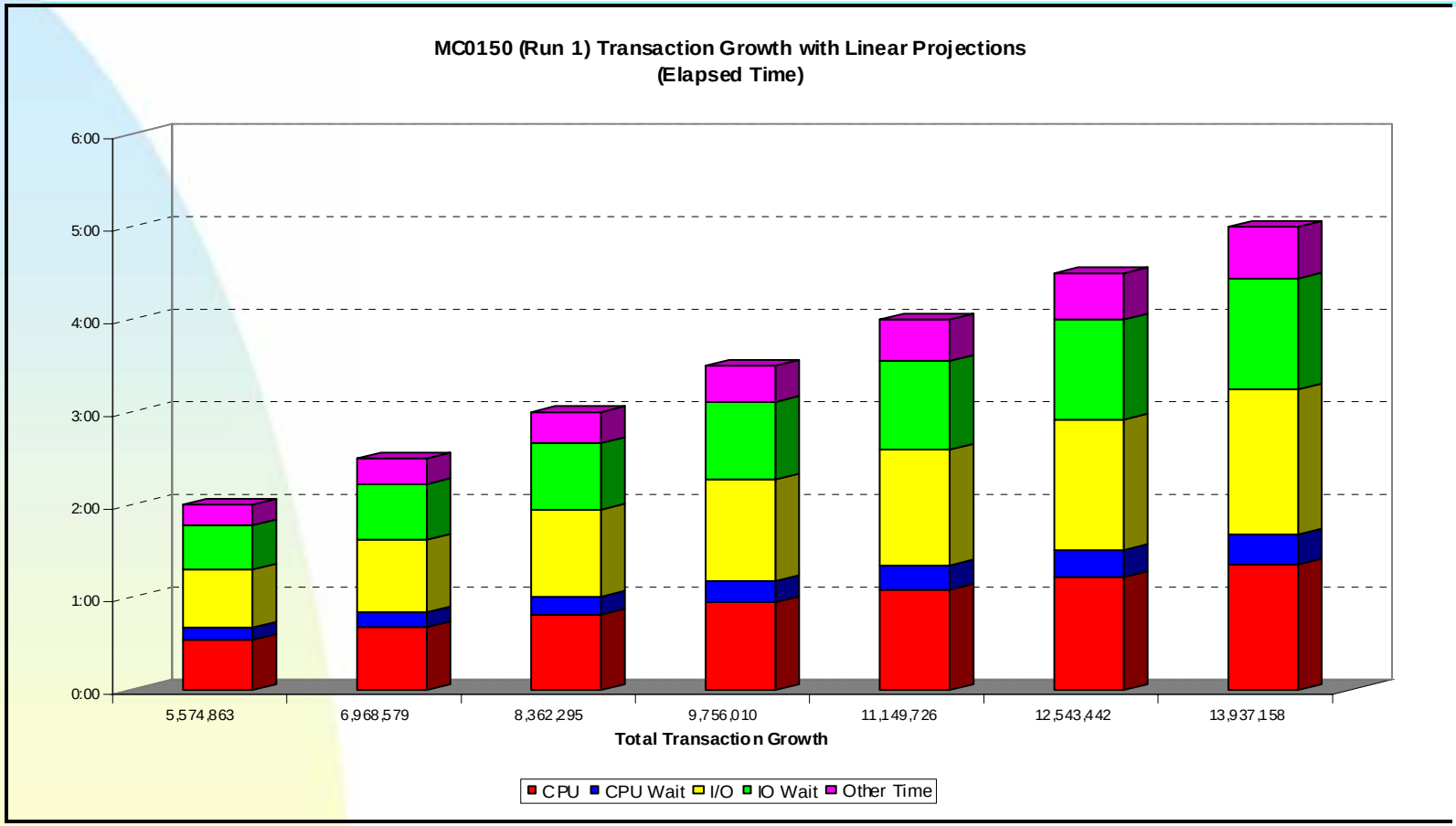
Linear Projection from Model



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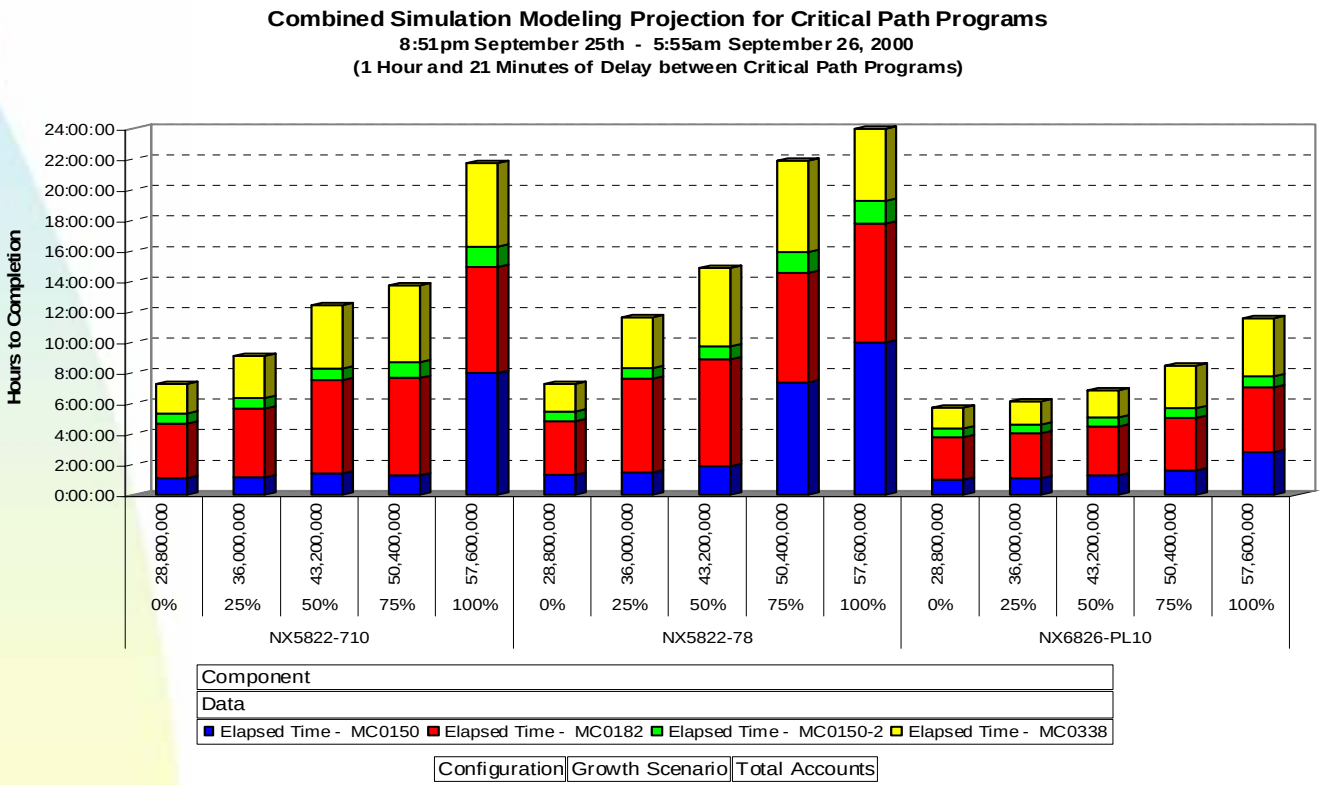
Batch Model Results



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Batch Cycle Table

	CPU Secs	ReadyQ Secs	Other Delay	Elapse IO Sec
Pre-Batch Prep	5100	1083	0	11757
Critical Nightly Batch	10563	2425	614	16993
Post Nightly Batch	17920	1777	2928	26556
Totals	33583	5286	3541	55305

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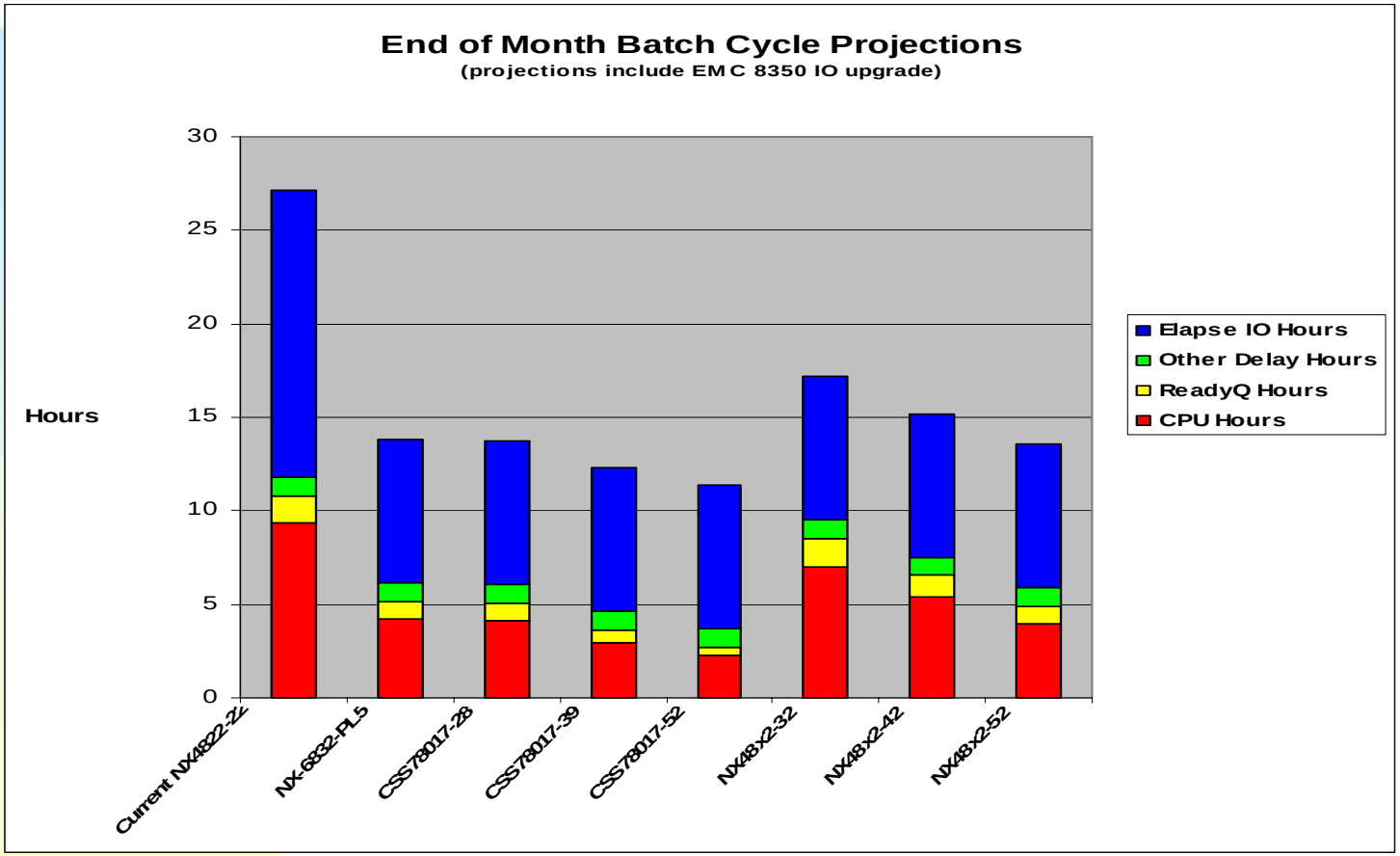
Batch Cycle Model



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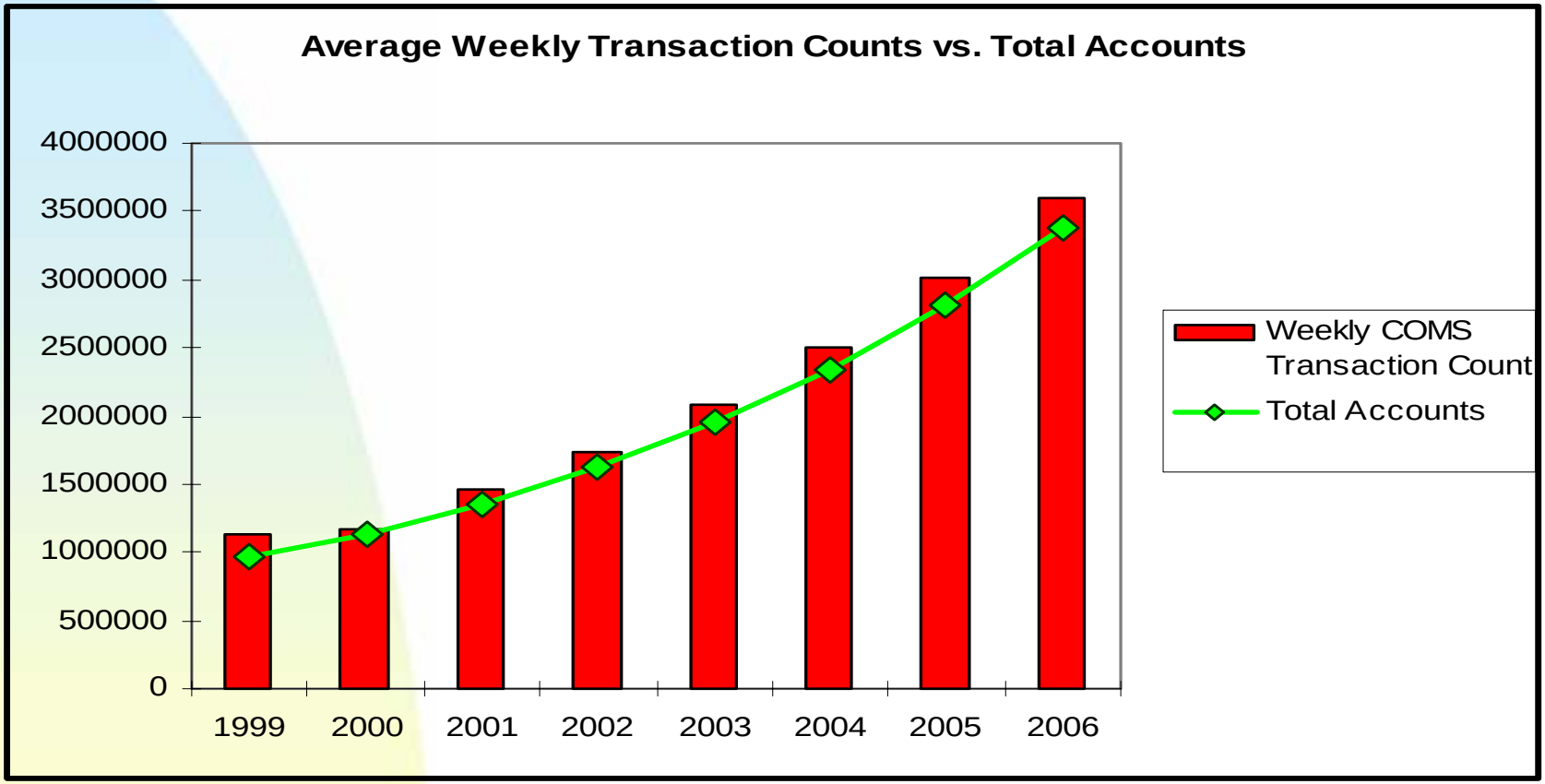
On-Line Workload Projection



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Workload Projection

Consolidated Workloads Peak Composite (based on NX6832-PL5):

	Dec-02	Dec-03	Dec-04	Dec-05	Dec-06	Dec-07
Sys-1 User Growth Rate	20%	28%	28%	11%	11%	11%
Sys-2 User Growth Rate	20%	10%	10%	10%	10%	10%
Sys-3 User Growth Rate	20%	15%	15%	11%	11%	11%

	Aug-02	**Dec-02**	**Dec-03**	**Dec-04**	**Dec-05**	**Dec-06**	**Dec-07**
CPU MCP %	**5.0**	5.0	5.0	5.0	5.0	5.0	5.0
Sys-1 CPU User %	**41.0**	49.2	63.0	80.6	89.5	99.3	110.2
Sys-2 CPU User %	**12.3**	14.8	16.2	17.9	19.6	21.6	23.8
Sys-3 CPU User %	**11.5**	13.8	15.9	18.3	20.3	22.5	25.0
Total	**69.8**	**82.8**	**100.1**	**121.7**	**134.4**	**148.4**	**164.0**

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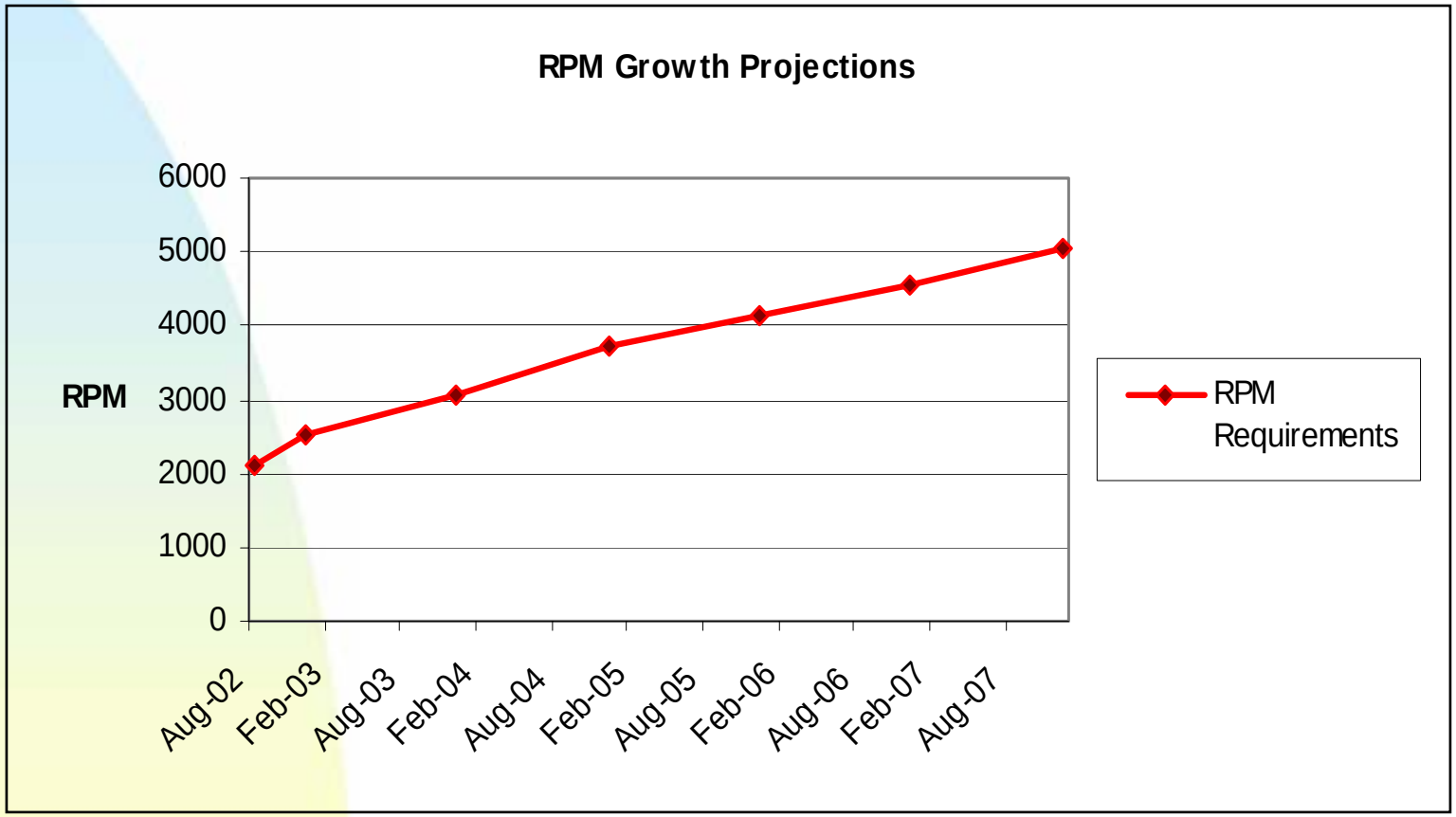
RPM Growth Projection



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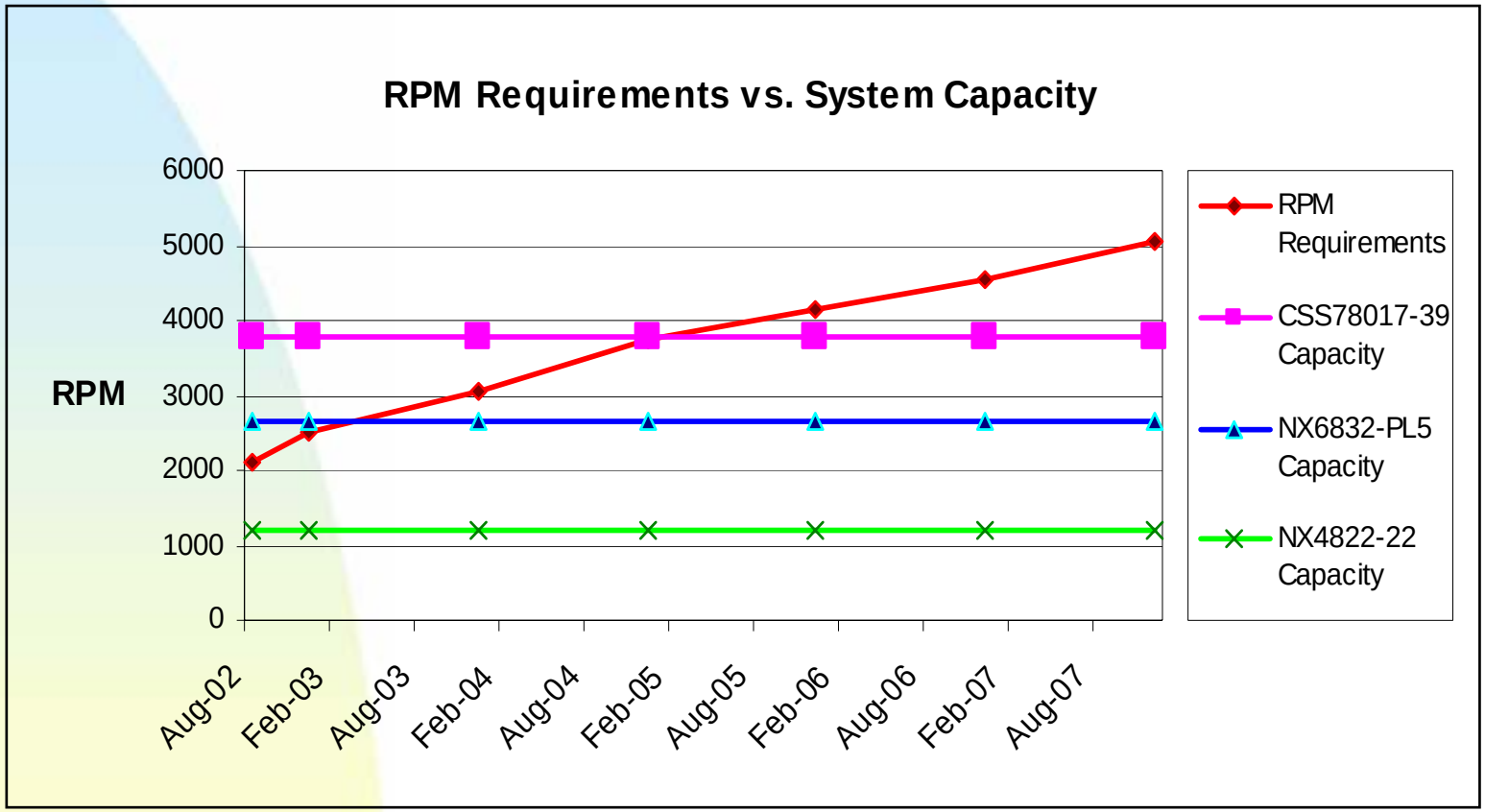
RPM vs Capacity



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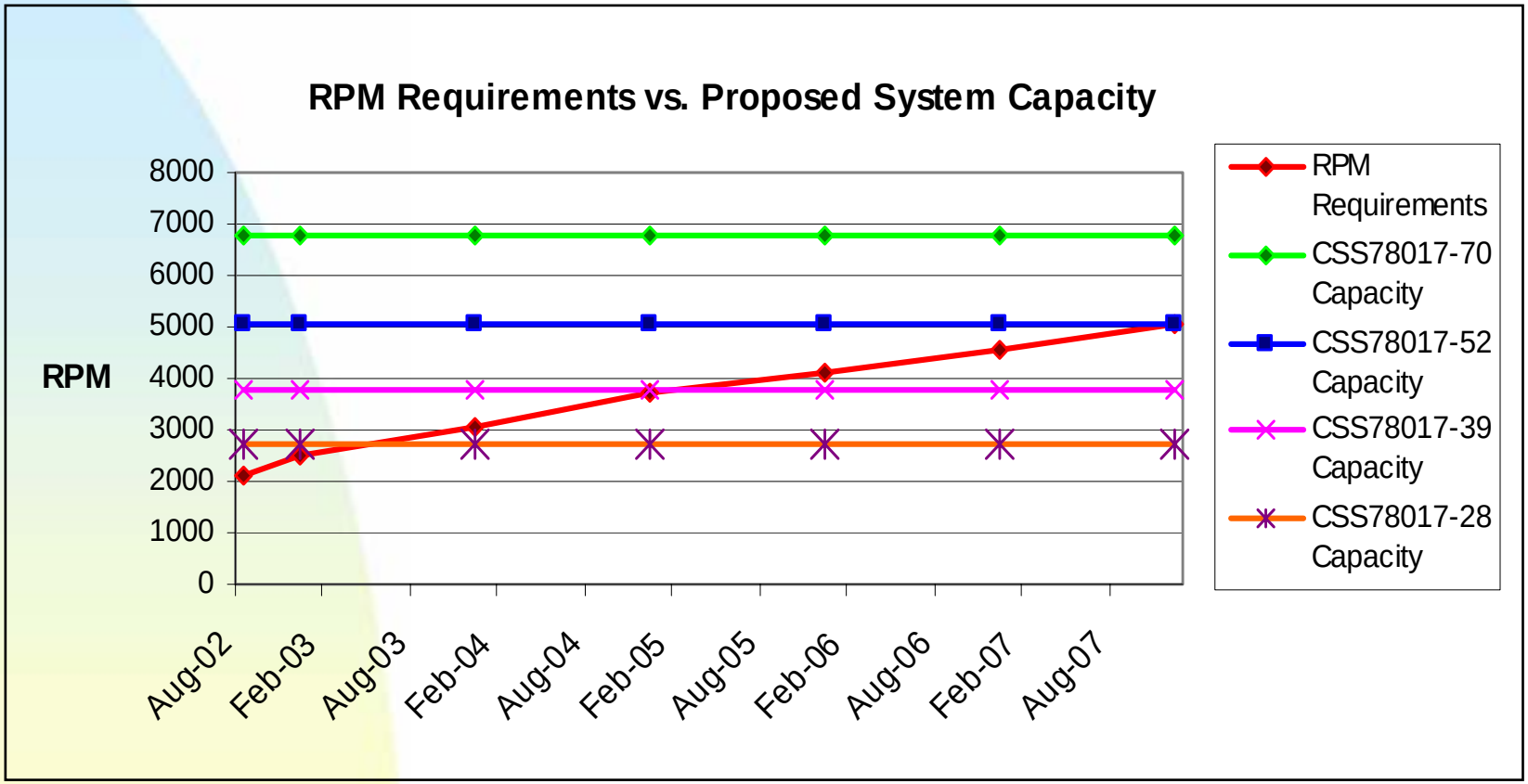
RPM Capacity Plan



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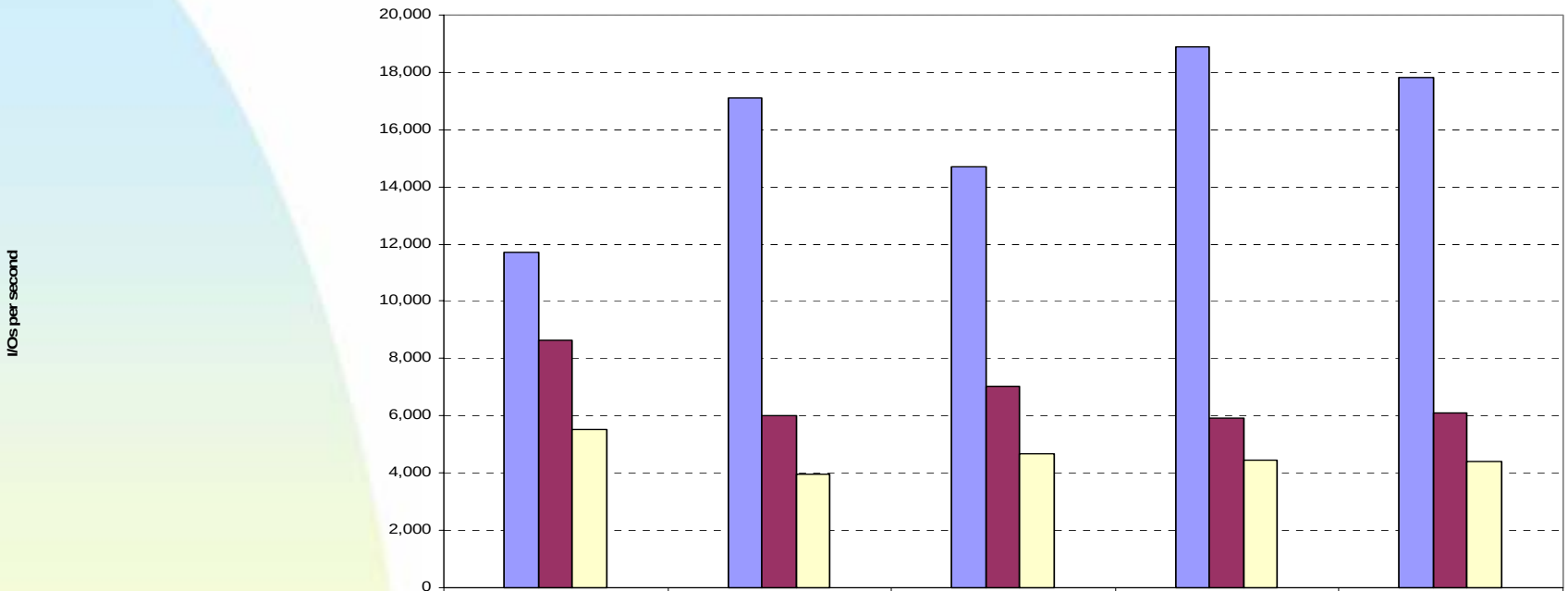
IO Capacity

IO Bandpass Growth Considerations for an NX6836-PLA
Actual Capital One and Theoretical I/O Levels
Theoretical Capacity I/O Projections Based on Actual IO Blocksize and Estimated I/O Bandpass



	GUI	MC0150-1	MC0182	MC0102	MC0338
NX6836-PLA I/O BandPass Million Bytes/Sec (Est)	101,351,250	102,945,107	103,762,817	111,834,557	108,997,543
Actual Avg IO Block in Bytes	11,700	17,100	14,700	18,900	17,800
Theoretical I/Os per Second	8,663	6,020	7,059	5,917	6,123
Actual Capital One IOs per Second Observed	5,515	3,947	4,695	4,447	4,425
Estimated % IORate Grow th over Observed Rates	57%	53%	50%	33%	38%

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The Resulting Plan

- Install Libra Model 180 at capacity level CSS78017-39 offering 3800 RPM useable Now.
- Purchase Capacity-on-Demand increments as needed in 2004
- Upgrade to CSS78017-52 (5000 RPM useable) in 2005 if growth projections hold into mid 2004.

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In Conclusion

- IT Service Delivery has become increasingly complex with the distribution of processing to multiple networked platforms.
- Fortunately, tools to monitor and manage performance and service delivery of the entire IT infrastructure in real time are now available.
- Integrated support for capacity projection and modeling is increasingly important to avoid service level degradation

Questions?

Thank you for your attention.

Are there any questions?

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DownLoad Available

- This presentation, complete with the speakers notes and annotations will be available on the MGS, Inc web site (www.mgsinc.com) for anonymous download by September 30, 2003.

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Contact Information

- MGS, Inc. is the software engineering organization that builds the ViewPoint and SightLine products for A Series, ClearPath and ClearPath Plus (MCP).
- MGS is a distributor of the SightLine products built by FORTEL Inc.
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