UNITE 2005 - Minneapolis

Introduction to MCP Metering

Michael S. Recant
MGS, Inc.

Session: MCP4035
Room: Nicollet D1
9:15 am – 10:15 am
Tuesday, October 18, 2005

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Rev 1

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 Consulting Services
    - Performance/Capacity Services
    - Application Services
  - Product Development
    - Performance/Capacity Monitoring
    - Web Services
    - Java/J2EE Performance

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Metering Concepts

- **What is Metering?**
  - A new way to buy computer capacity
  - Traditional: buy enough capacity for "peak" processing periods
  - Metering: buy enough capacity for "average" processing and pay for any overage
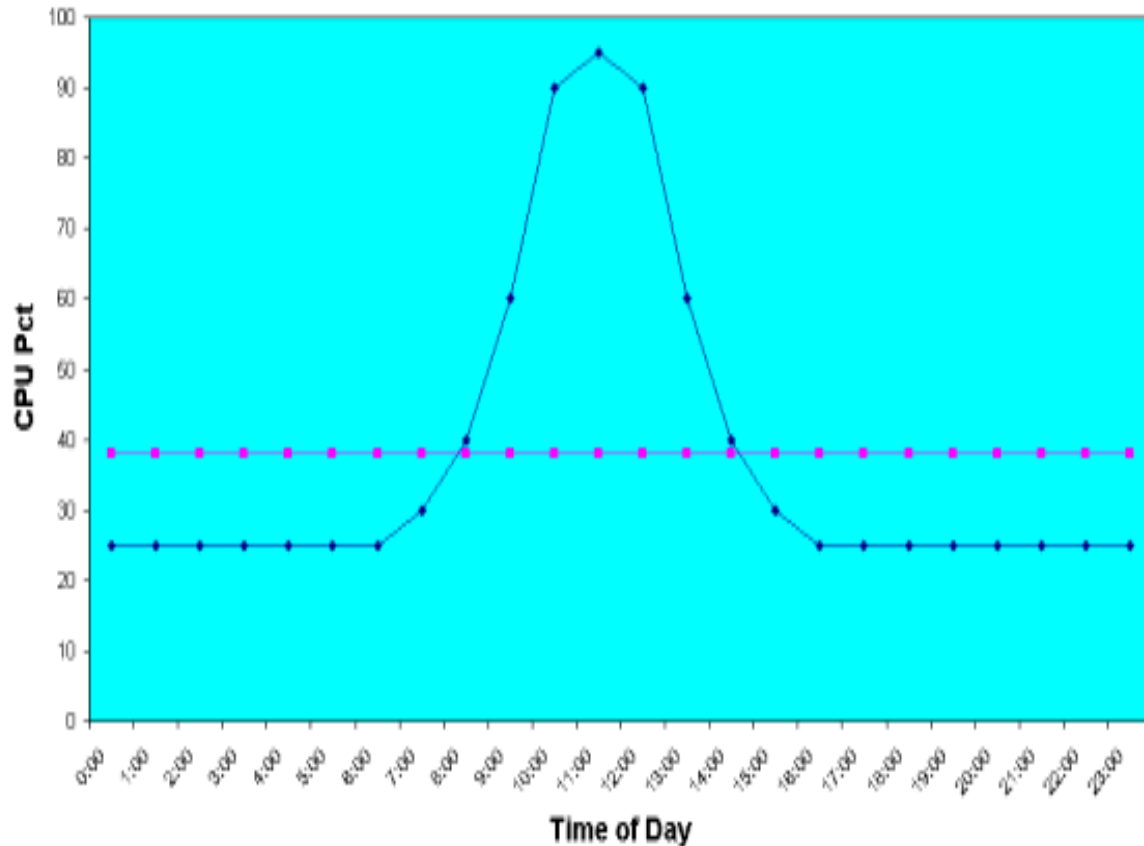 - Not a technology change, rather an accounting change

Metering Concepts

Processor Utilization

Traditional Purchase ⟶

Metering Purchase ⟶

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Average CPU 37.9%   **Peak CPU 95%**

Metering Concepts

- How does Metering work?
  - Hardware is purchased at a minimal cost
  - Hardware is capable of maximum speed
  - Unisys now licenses Capacity, not software
  - You license only the "average" capacity you actually expect to use

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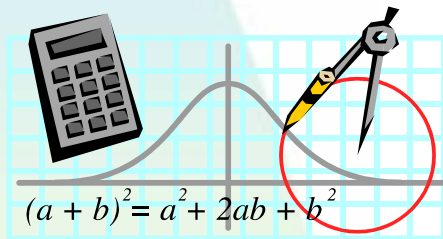
Metering Concepts

- The new way to license capacity
  - All mainframe software is available on the system
  - Processor speed (RPM) is user selected based on need and can be changed at any time
  - MCP Tracks capacity usage for everything run on the machine
  - MCP reports usage monthly to Unisys
  - Unit of capacity is the RPM-Second or the MIP-Month
  - Customer commits to pay for overages

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Metering Concepts

- ## MCP Tracking of Capacity
  - Periodic system sampling
  - Reads current system RPM setting
  - Calculates total CPU seconds used in the sample period
  - Multiplies RPM times CPU seconds and adds result to a monthly RPM-Second counter
  - Calculation adjusted for multiple CPUs, weighted to discount higher numbered CPUs

$(a + b)^2 = a^2 + 2ab + b^2$

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Metering Concepts

Sample RPM-Second Calculation:

- Processor Count   = 3
- System RPM   = 4,900
- Total CPU Seconds
  used in 1 minute   = 140

3 CPU Weight Table =

36%	33%	31%

RPM-Seconds =
    (60 * 4,900 * .36) +
    (60 * 4,900 * .33) +
    (20 * 4,900 * .31)
               = 233,240

Metering Concepts

- MCP Reporting of Capacity
  - MCP automatically generates monthly reports
  - Customer specifies the day of the month the report is issued
  - Report generated at 00:00 UTC
  - Report is e-mailed to a distribution list (includes Unisys)
  - Copy of the report is save on the Halt/Load unit (text file)

Metering Concepts

- **MCP control of capacity**
  - Implemented using the KEY mechanism
  - Metering Key specifies:
    - Maximum number of CPUs
    - Maximum Power Level of CPUs
    - Maximum total system RPM
    - Baseline RPM (Base-plus-usage)
    - Metering paradigm
      - Base-plus-usage
      - Pre-paid Performance

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Metering Concepts

- **Base-plus-usage**
  - Utility Concept
  - Customer pre-pays for an "average" or baseline monthly usage
  - Baseline is expressed as an RPM
  - Customer billed monthly for overages

Metering Concepts

- **Base-plus-usage**
  - Establish a monthly reporting period
  - Establish a baseline (average) monthly capacity usage
  - Baseline is expressed as an RPM
  - MCP tracks RPM-Seconds used in the reporting period
  - End of month:
    - MCP subtracts Baseline*PeriodSecs from actual used RPM-Secs
    - Positive result indicates an overage
    - Report is e-mailed to Unisys
    - Customer billed for overage

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Metering Concepts

- **Pre-paid Performance**
  - Phone card concept
  - Customer pre-pays an "average" capacity usage over the lifetime of the system
  - Capacity expressed as the average MIPS over a period of months
  - Customer can use the MIPS-Months as quickly or as slowly as he wants
  - When all MIPS-Months are consumed, more must be licensed from Unisys to continue use of the system

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Metering Concepts

- **Pre-paid Performance**
  - Establish a run rate (average) for the lifetime of the system
  - Run rate expressed as MIPS (24.3 RPM/MIP)
  - Establish the key lifetime in months
  - MCP accrues the MIPS-Months (RPM-Seconds) over the Key lifetime
  - Accrued MIPS-Months reported to Unisys monthly via e-mail
  - When licensed MIPS-Months are exceeded, more must be licensed
  - 2 month window to use excess at end

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Metering Technology

- Built on the Capacity on Demand (CoD) capability to change processor speed

- Supported on the Libra 590/595 and equivalent models

- Limited metering CERs for the Libra 180/185

- Same hardware for metered and non-metered Libra 500 systems

Buy Now!

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Metering Technology

- Controlled through the "KEY" mechanism

- IK command is used to install the metering key

- The key defines the system's max RPM and baseline RPM

- The MCP attempts to maintain target RPM even if IPs are DOWNed

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Metering Technology

- Default is for system to run at the "max" RPM
- Governor
  - Allows the customer to request to artificially lower the system's "max" RPM to a "requested" RPM
  - Actual RPM may be lower than requested RPM (granularity)
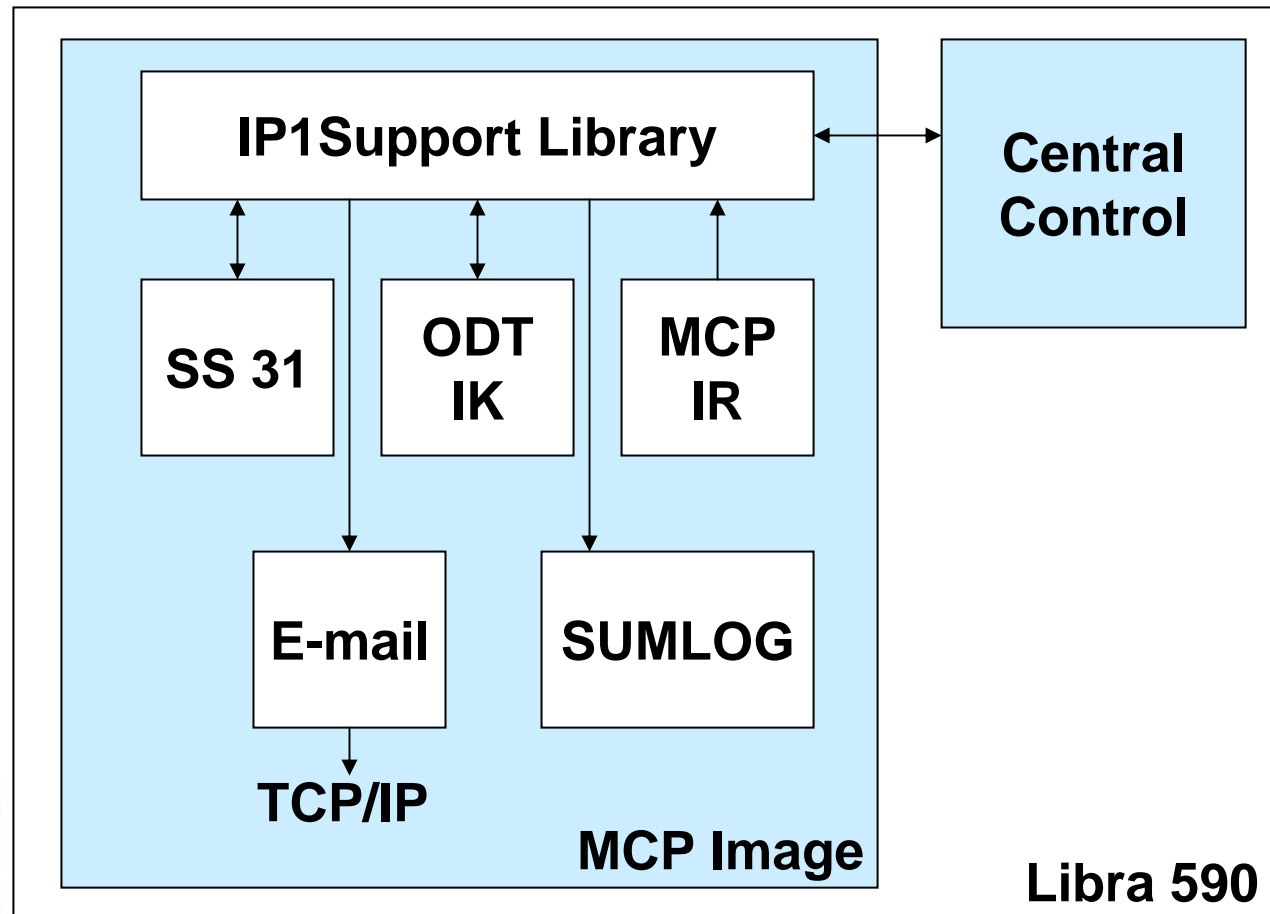 - RPM-Seconds calculated based on the actual Governor RPM setting

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SLOW

Metering Technology

- **Major Components**
  - MCP IP1Support Library
    - Central place for metering related functionality
  - IK command
    - Used to install keys, show Unisys report data
    - Set/adjust Governor (RPM)
  - Systemstatus 31
    - Software access to key/metering info
    - Except for 2 fields, changes only hourly
  - Metering Log records
    - Hourly reports and other events
    - Same format as Systemstatus 31
  - Central Control
    - Repository of keys, metering status, etc
    - Originally 6-7 Second delay in accessing, fixed in an IC

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Metering Technology

- Major Metering Components

Diagram components:
- IP1Support Library
- Central Control
- SS 31
- ODT IK
- MCP IR
- E-mail
- SUMLOG
- TCP/IP
- MCP Image
- Libra 590

Metering Technology

- **Reporting**
  - Manual report can be initiated at any time
  - End of period report automatically initiated by MCP
  - Text Saved on Halt/Load unit
  - Report e-mailed to Unisys

- **Report information also placed in system log**

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Metering Technology

- **Reporting**

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Sample Monthly Metering Report Information

Report Type:		Monthly	
Interval:		Mar 01, 2005 at 00:00:30 to	
		Apr 01, 2005 at 00:00:15	
Key	<key id>	Actual utilization	Avg Workload
	time	2,678,390 seconds	
Image	8@57R		20455 RPM
	Total Used	54,785,238,439 RPM Sec	
	Metered	20,833 RPM month	
		857 MIPS month	

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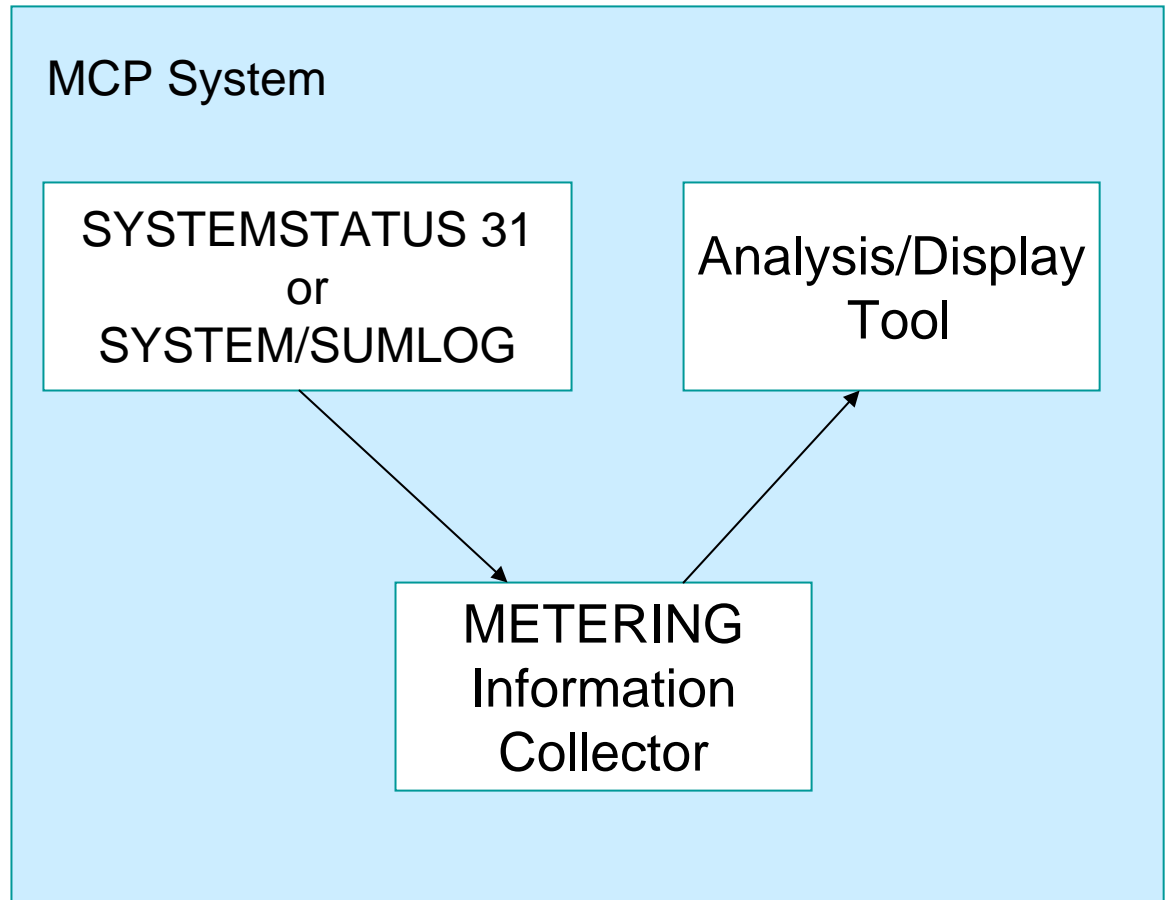**Computer Business Solutions**

Metering Technology

- **Central Processor Accounting**
  - "Effective" (or traditional) processor time tracks elapsed time a program spends using the CPU
  - Changing RPM changes the amount of work done by 1 second of "effective" CPU time
  - MCP now also tracks "normalized" processor time
  - CPU time is normalized to a standard (PL-57)
  - "Normalized" processor time is available through Systemstatus 25 and in the SYSTEM/SUMLOG
  - "Normalized" processor time is provided for Processor, Init Pbit and Other Pbit CPU times

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Collecting Metering Statistics

- Monitor the state of the current processor license Key (CoD or Metering)
- Monitor the MCP metering system
- Cannot monitor MCPvm processor license keys

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Collecting Metering Statistics

MCP System

SYSTEMSTATUS 31 or SYSTEM/SUMLOG		Analysis/Display Tool
	METERING Information Collector	

Collecting Metering Statistics

- **CoD Information**
  - **Contents of current Key/Image**
    - Key expiration date
    - Key Function (CoD, metering)
    - Type (permanent, temporary, disaster)
    - CPU Performance Level
    - Max number of CPUs
    - Redundant/NonRedundant
    - Licensed RPM
    - Time left on temporary/disaster keys
    - Time left to expiration

  - **IP1Support statistics**

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Collecting Metering Statistics

- **Metering Information**
  - Metering image attributes
    - Image Ordinal
    - Partition Type
    - Licensed Base RPM
    - Governor Settings
      - Desired RPM Limit
      - Actual RPM Limit
  - Track Three levels of Statistics
    - Current Sample
    - Current Billing Period
    - Key Lifetime Information

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Collecting Metering Statistics

- **Current Sample**
  - RPM*Seconds
  - Average RPM used
  - Percent base capacity used
  - Percent total capacity used

Collecting Metering Statistics

■ Current Billing Period
  - Period length in days
  - Period elapsed percent
  - Key active percent
  - Image active percent
  - Percent base capacity used
  - Percent total capacity used

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Collecting Metering Statistics

- **Key Lifetime Information**
  - Key elapsed months
  - Key Image elapsed months
  - Licensed months
    (requires manually defined pre-paid info)
  - Image accrued MIPS*Months
  - Percent total capacity used
    (requires manually defined pre-paid info)

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Analyzing Metering Statistics

- **Goals of Metering data analysis**
  - Unisys focus is a monthly billing report
  - Metering data can be reframed for monitoring of capacity consumption
  - Monitor at three levels:
    - Sample period
    - Current Unisys billing period
    - Key Lifetime
  - Elements tracked at each level
    - Interval elapsed
    - Raw capacity units used to date
    - Percentage of total capacity used
    - Percentage of "baseline" capacity used (including when greater than 100%)

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Analyzing Metering Statistics

- **"Capacity" versus "Utilization"**
  - "Utilization" measures are relative to the capacity on the floor
  - "Capacity" measures are hardware independent
  - Unisys metering information allows "Capacity" usage to now be monitored
  - The processor "Capacity" can even be pro-rated to the workload level.

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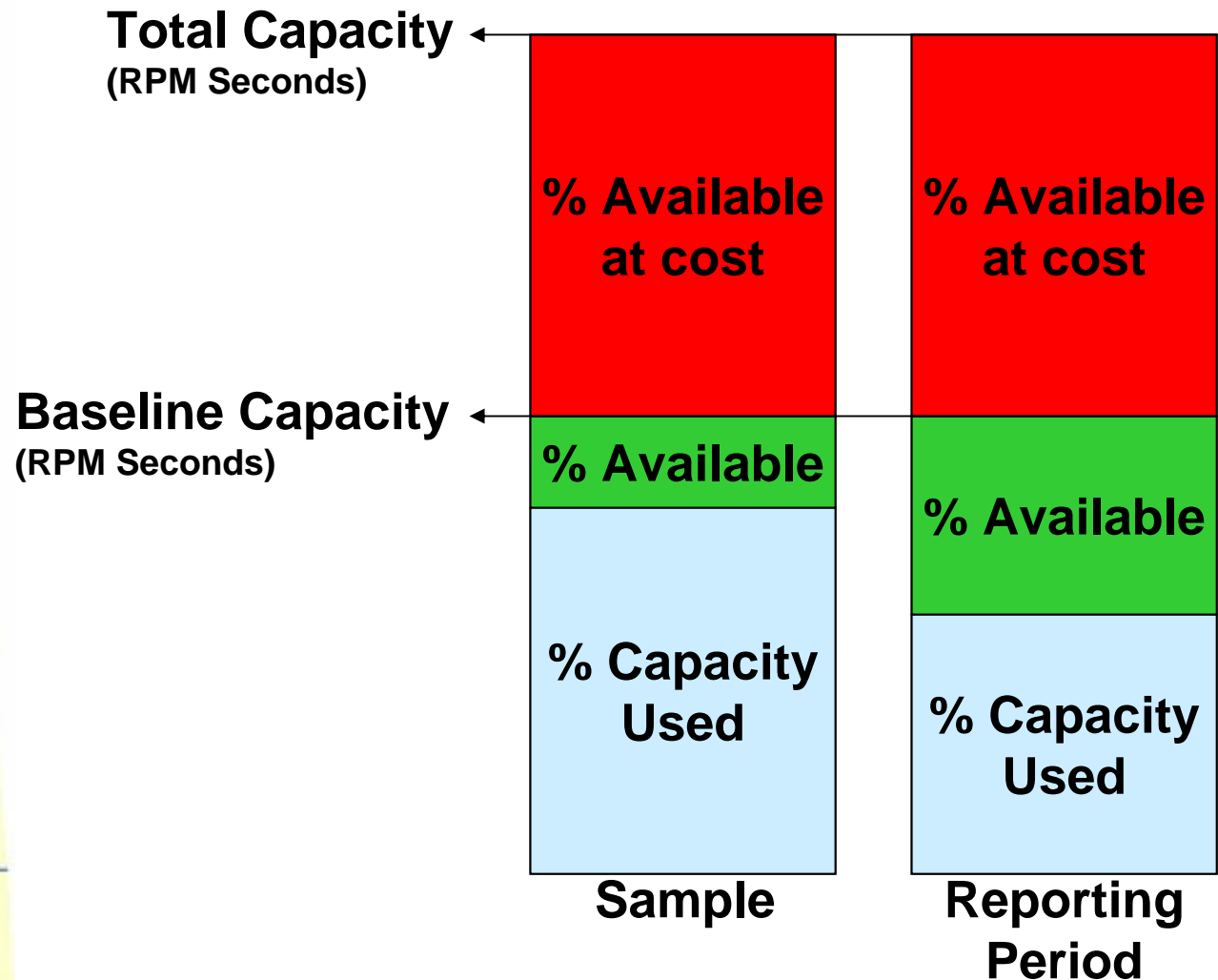**Computer Business Solutions**

Analyzing Metering Statistics

- **"Capacity Baseline"**
  - Both "Base-plus-usage" and "Pre-paid" models have a "baseline"
  - "Baseline" is simply your "expected" capacity consumption level
  - Goal is to, on the average, stay within your "baseline"

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Analyzing Metering Statistics

- **"Capacity Baseline"**
  - Base-plus-usage metering has a monthly "baseline" in RPM
    (defined in metering key)
  - Pre-paid Performance metering has a monthly "run rate" in MIPS
    (not defined in metering key)
  - Treats both of these as a logical "baseline" for capacity consumption
  - Capacity consumption is reported as a percentage of this "baseline"
  - The reported percentage can be either smaller or greater than 100%
  - Pre-paid "run rate" and license term must be manually entered

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Analyzing Metering Statistics

Total Capacity
(RPM Seconds)

Baseline Capacity
(RPM Seconds)

Sample	Reporting Period
% Available at cost	**% Available at cost**
% Available	**% Available**
% Capacity Used	**% Capacity Used**

Sample

Reporting Period

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Analyzing Metering Statistics
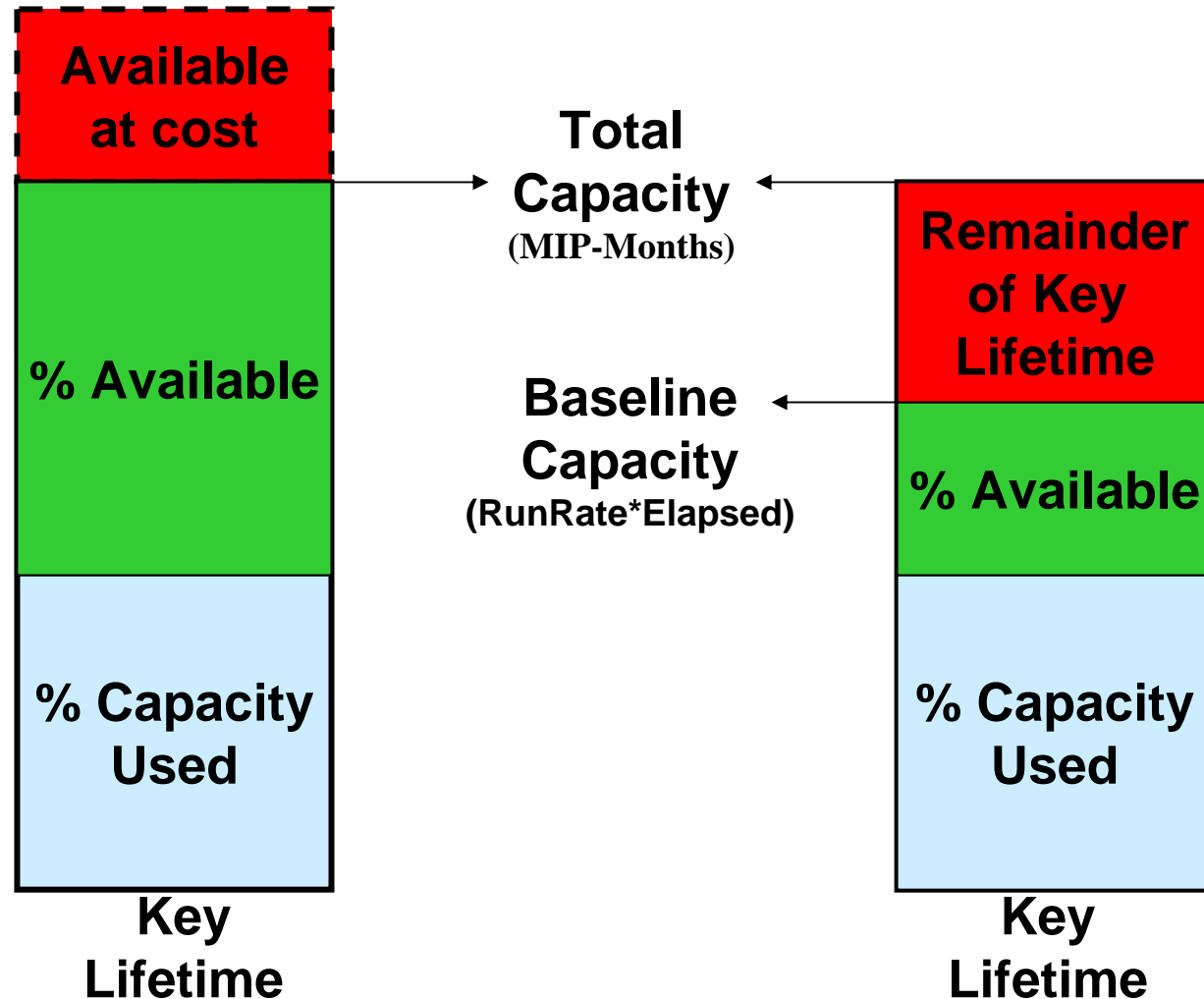
Analyzing Metering Statistics

- **You Can Decompose Capacity Consumption**
  - Unisys metering monitors only total system CPU usage
  - Analysis allows capacity consumption to be pro-rated:
    - USER
    - MCP
    - Individual workload

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Using Metering Statistics

- Why monitor metering data?
  - Minimize RPM-Seconds above baseline
  - Identify wasted RPM-Seconds
  - Track system capacity usage (not just CPU usage)
  - Validate Unisys reports

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Using Metering Statistics

Processor Utilization

Average CPU use above Baseline is extra cost!

Baseline →

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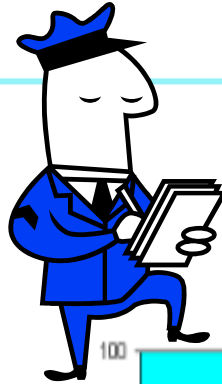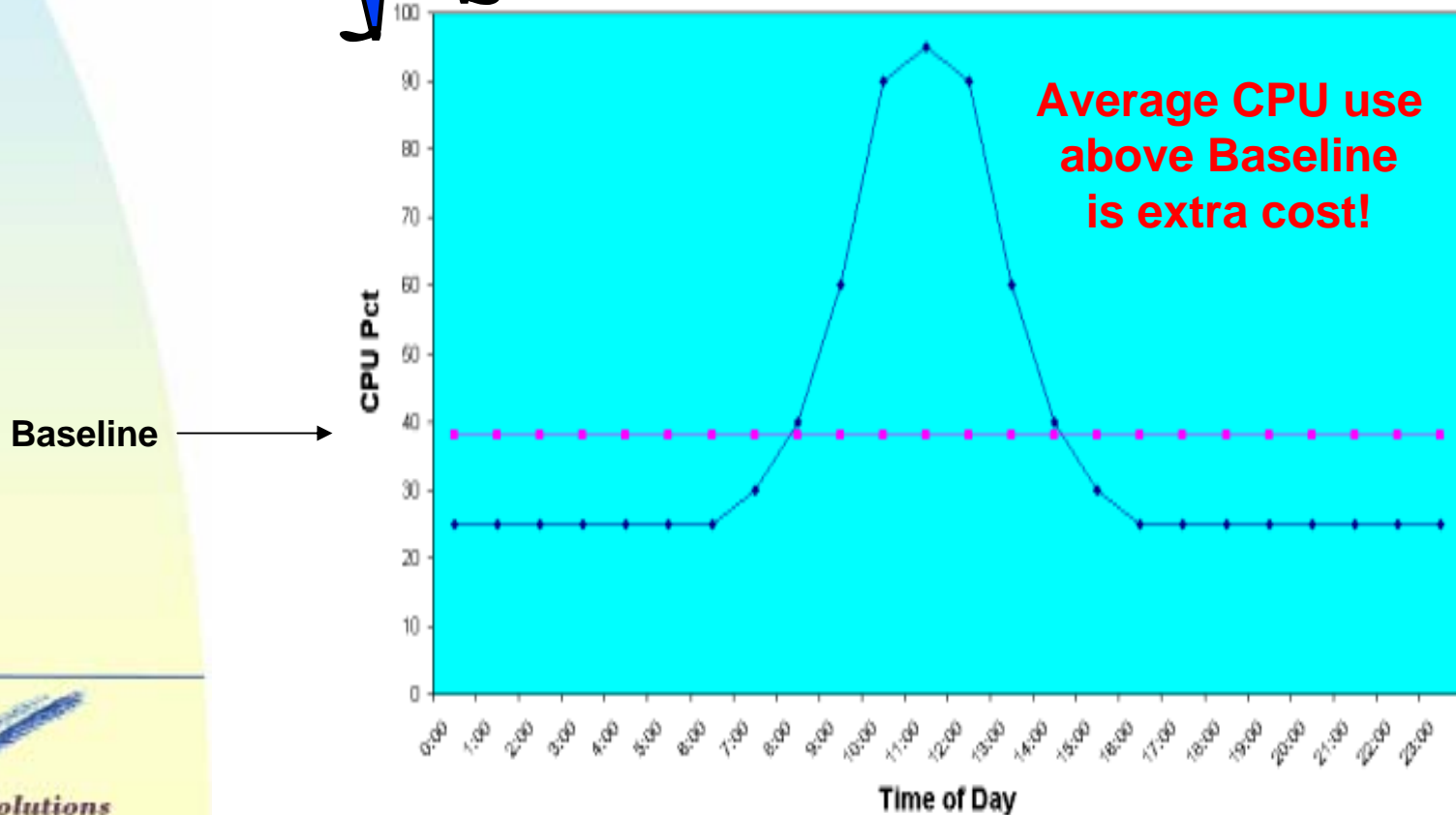
Using Metering Statistics

- **Example of a problem value**
  - Governor at 3,864
  - Sampling at 60 seconds
  - Max possible RPM*Seconds is 231,840 per sample period
  - Systemstatus 31 shows > 1,000,000

Problem   Normal
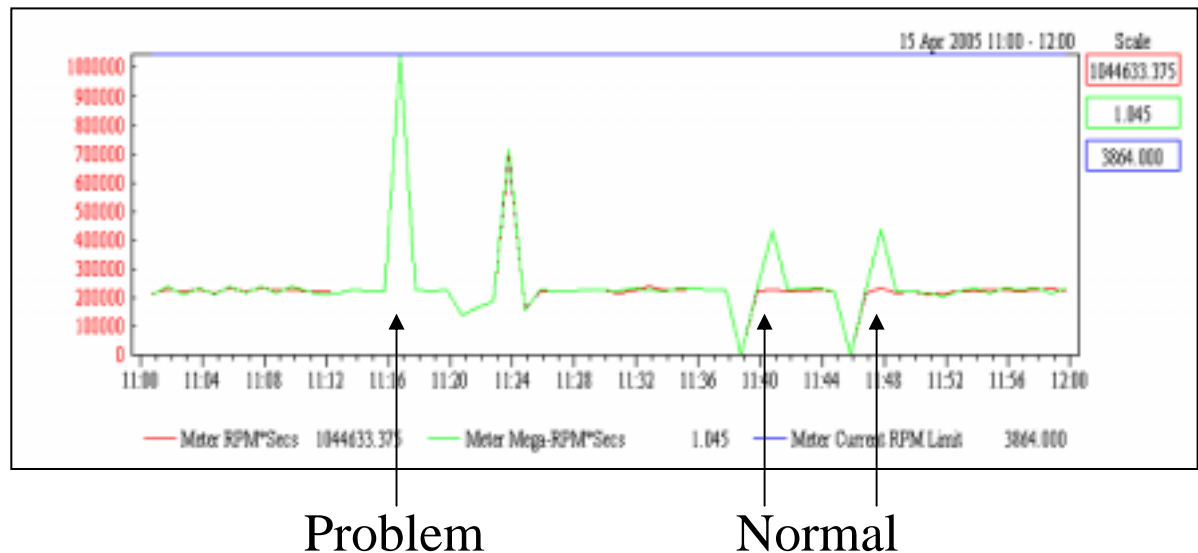
Metering Impact

- Example of a non-Metering to Metering migration
- High Volume on-line and batch workload (>1.5M tran/hour)
- NX6836-PL10 (~31,230 RPM) at maximum capacity
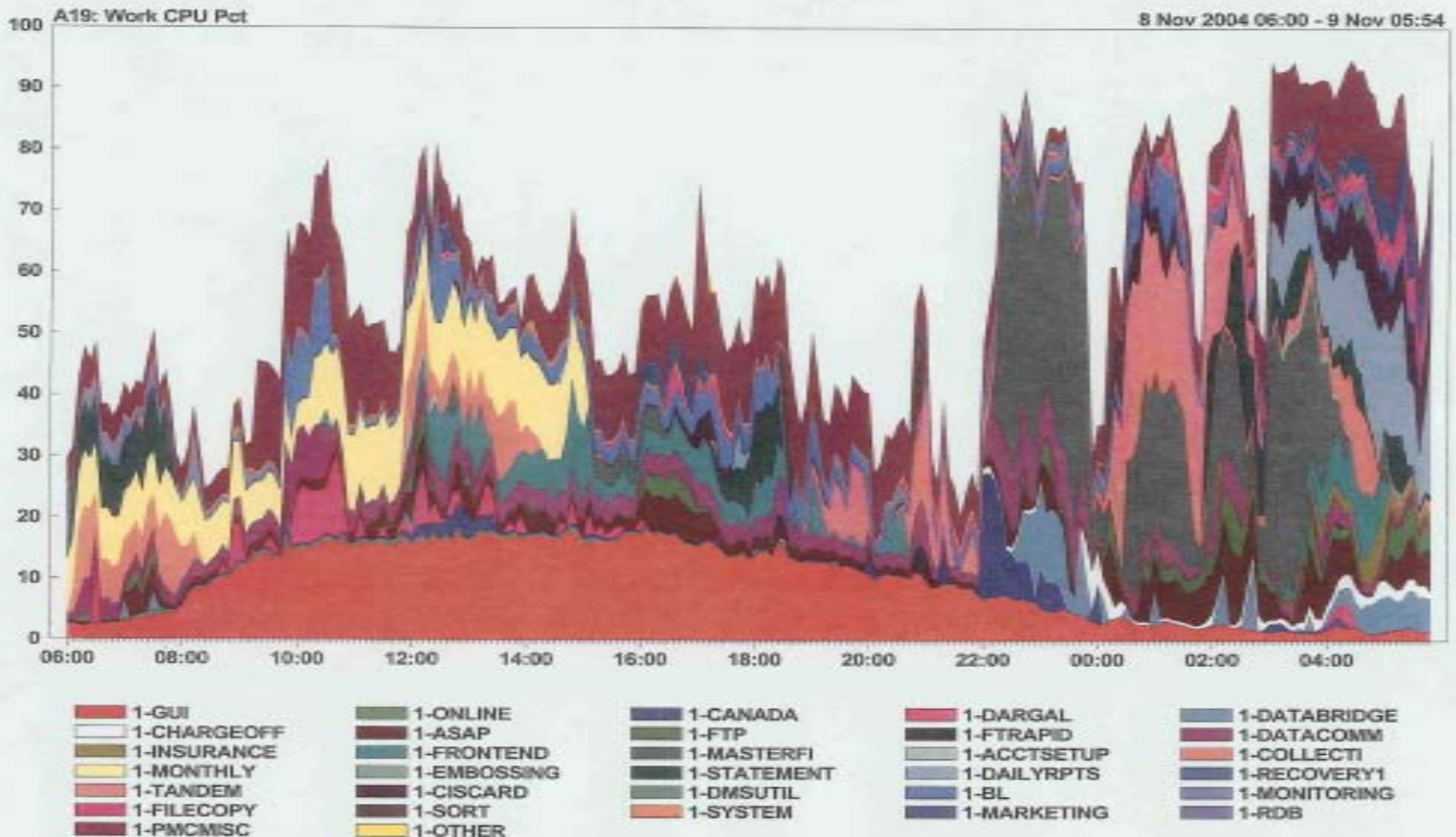- Moved to Libra 590 Pre-Paid (32,343 RPM Limit) about 4% faster based on RPM ratings

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Metering Impact – NX6836

System Workload Statistics

A19: Work CPU Pct   1 Nov 2004 06:00 - 2 Nov 05:54
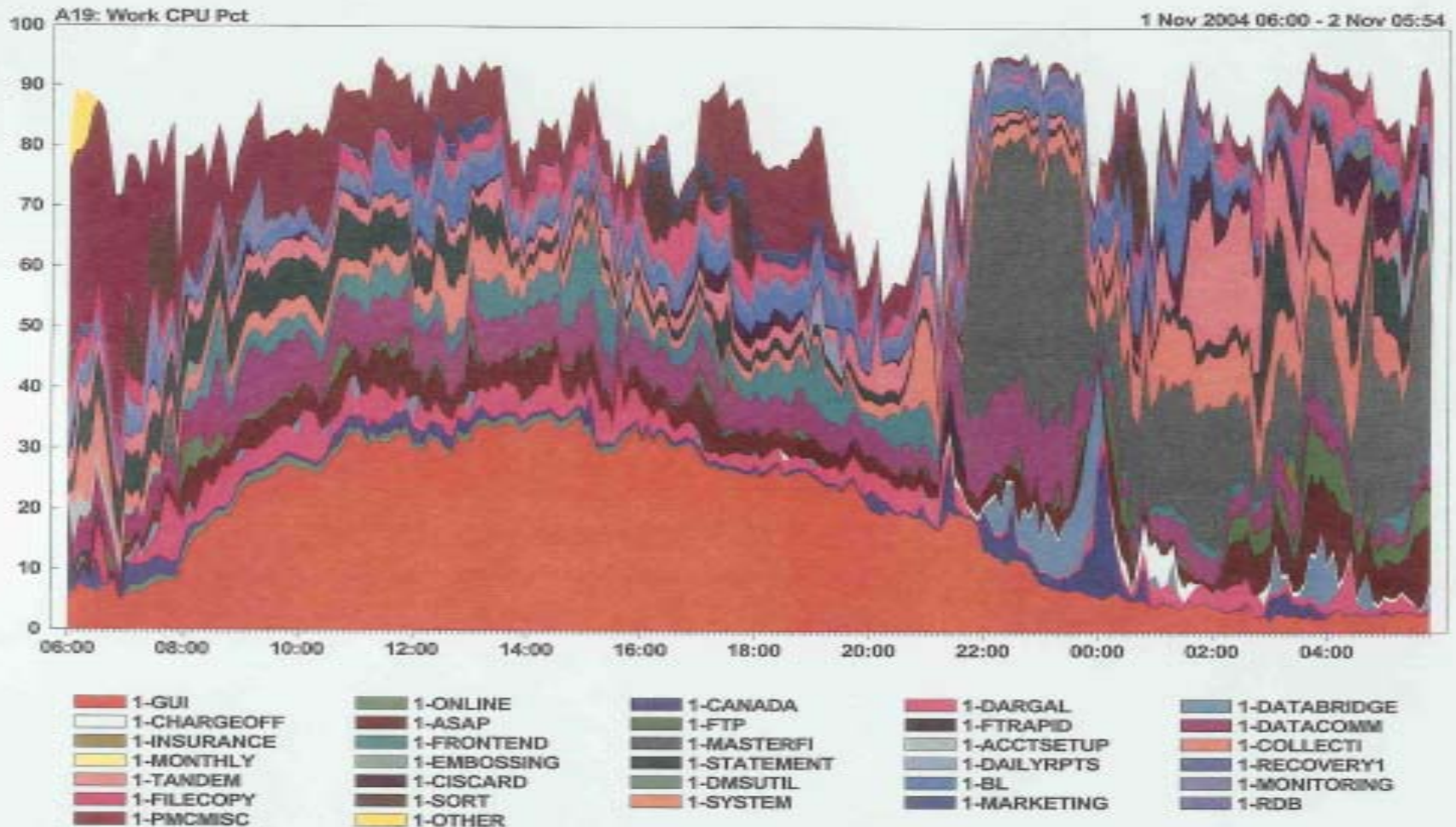
Metering Impact – Libra 590

Metering Impact - Results

- Dramatic decrease in CPU usage with significant improvement in performance
- Probable contributing factors (NX6830 vs Libra 580/590):
  - Improved internal CPU and buss architecture
  - Improved memory access
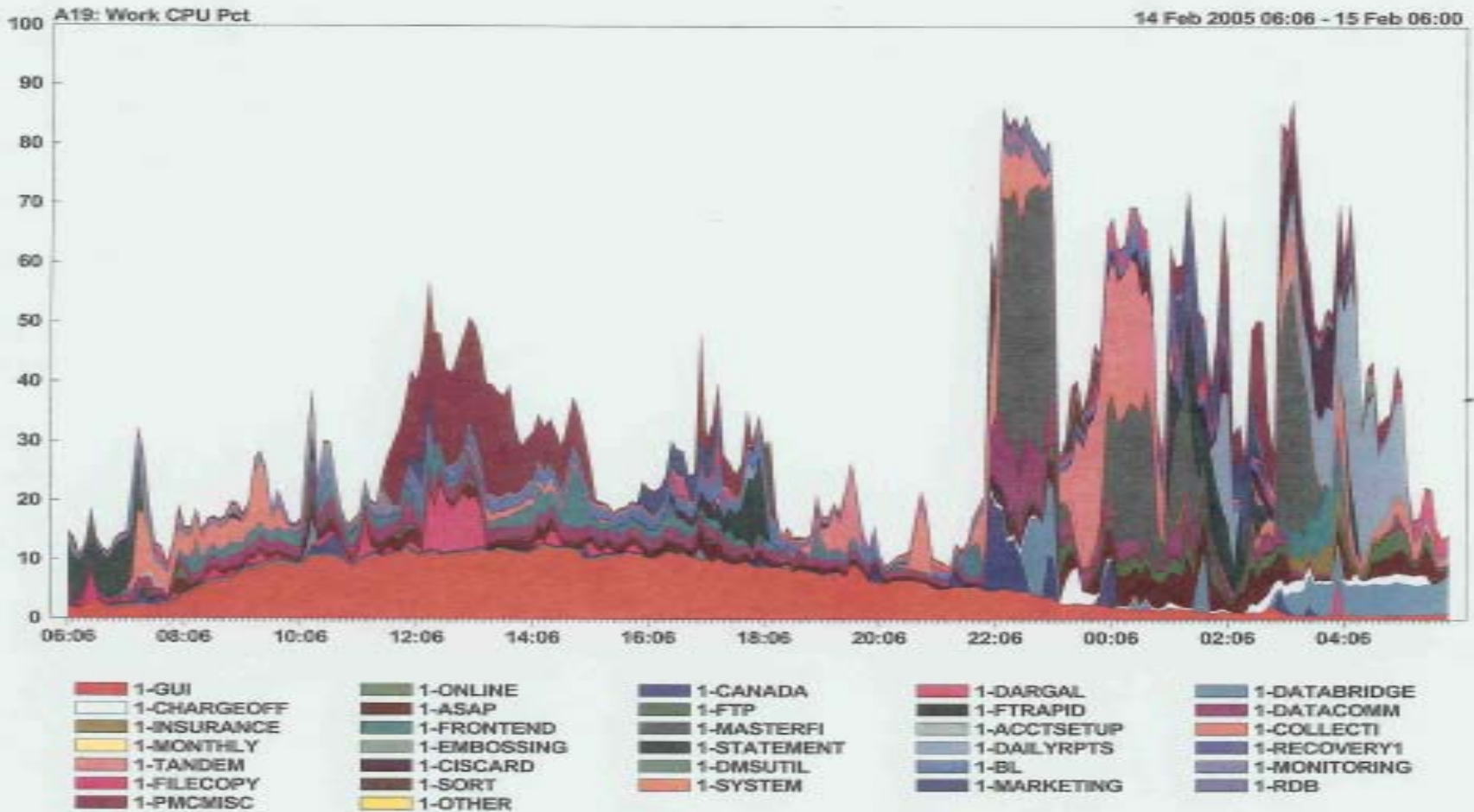 - Improved I/O architecture with more I/O channels and much higher bandpass

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Metering Impact – Governed

Metering Impact - Ungoverned

System Workload Statistics

Metering Impact - Results

- Workload performance observations:
  - On-Line run at 32,343 RPM limit and batch run at 48,503 RPM limit
  - On-Line and batch run at 48,503 RPM limit
- Generally lower CPU utilization
- Higher performance/throughput
- Higher RPM-Secs used at higher RPM limit

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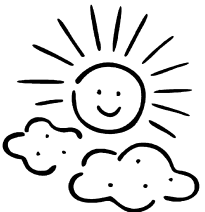
Additional Questions?

Michael S. Recant,

VP Software Development

MGS, Inc.
10901 Trade Road, Suite B
Richmond, VA 23236

Voice: (804)379-0230
Fax: (804)379-1299
Email: Mike.Recant@mgsinc.com
Web: www.mgsinc.com
(presentation is available on web site)

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