UNITE 2007

Managing Metered Systems: Best Practices in Planning and Managing Your Metered Platform

Session MCP/OS 4028

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MGS, Inc.

- Software Engineering, Product Development & Professional Services firm founded in 1986
- We solve business problems:
  - Products: SightLine for MCP, CheckOut, MGS Web Services, Deliver, C.A.T.T. , SecureCATT, and others
  - Professional Services
    - IT Management Planning
    - Capacity Planning and Management
    - Consulting and Technical Services including Performance Management and Hardware-Software-Network Integration
    - Application Development Services including Java/J2EE development and platform rehosting
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  - Software Engineering Services on ClearPath MCP, Windows, and UNIX platforms.

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- SightLine Product Suite
  - SightLine Expert Advisor/Vision (EA/V)
  - SightLine for ClearPath OS2200 Systems
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  - SightLine for UNIX Systems
    - HP-UX
    - Sun Solaris
    - IBM AIX
    - Tru64
    - Linux
  - SightLine for OpenVMS Systems
  - SightLine for Stratus VOS
- Torch for ClearPath OS2200
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Best Practices

- The most effective and efficient way of achieving a desired result

- The method which delivers a desired outcome with fewest problems or unexpected complications

- The most reliable and least costly way of getting things done.

- Best practices often evolve to fit changing conditions.

- New "best practices" are always being discovered.

IT Best Practices

- ITIL Service Delivery standards offer best practices and processes for:
  - Capacity management
  - Availability management
  - Financial management for IT services
  - Service level management
  - IT service continuity management
- This session concentrates on capacity management and touches on service level management

Metering Concepts

- Metered Systems ease the task of maintaining service levels – typically capacity installed is 10 to 100 times more then needed.

- CPU service level reserve is built in.

- CPU strategic reserve is also available but must be planned for (and purchased).

- Some Capacity Management challenges are eased but new ones are available.

- Capacity Planning is still required.

Metering Concepts

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

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
  - Capacity Baseline is relative to that purchased.

- **Capacity consumption can be decomposed to**
  - USER
  - OS
  - Individual Workload

Sizing Best Practice

- **Establish baseline values**
  - Performance
  - Capacity usage
  - Workload volume
- **Track historical data**
- **Perform trend analysis**
  - Capacity usage
  - Workload volume
  - Performance
- **Provide for Performance:**
  - Keep capacity at safe level
  - Project performance using operational analysis techniques
  - Model for best results

How to Plan for Metered Systems

- How to Plan for transition to a metered system?
  - Measure current resource utilization
  - Project capacity requirements
  - Determine best solution
    - Base-plus-usage (utility billed)
    - Pre-Paid (phone card)
  - Migration Considerations
    - IO infrastructure
    - Release levels

How to Plan for Metered Systems

- Use SightLine Capacity Manager, Torch, or other similar product to measure current resource utilization
  - Average weekly/monthly CPU %
    - Workload level for growth estimates
  - IO utilization
    - Average weekly/monthly IO rates (IO/Sec)
    - Throughput (KB/Sec)
    - Service level (Sec/IO)
    - Space utilization
  - Memory utilization
    - Total capacity
    - Total percent in use
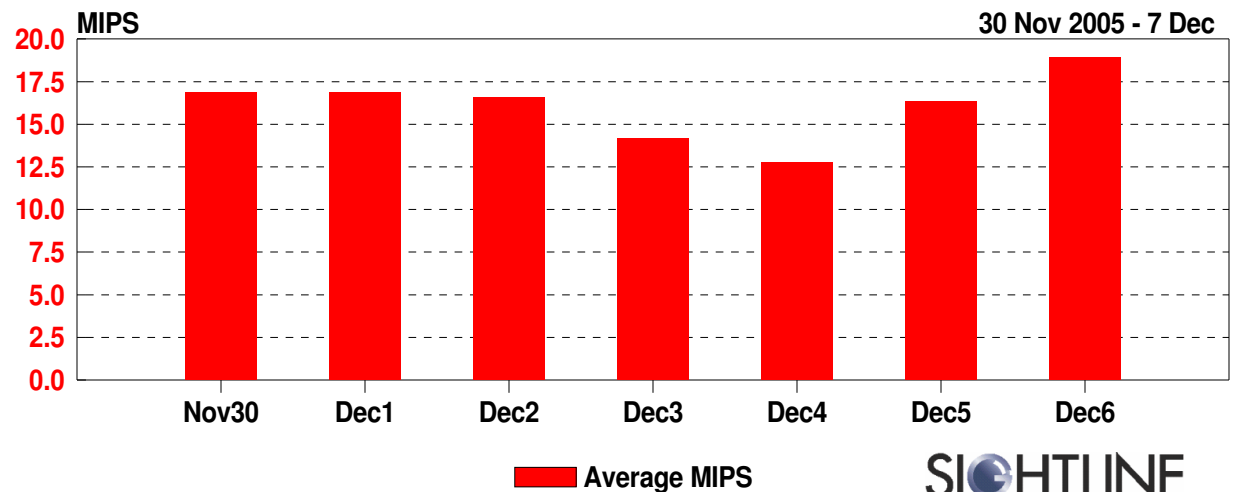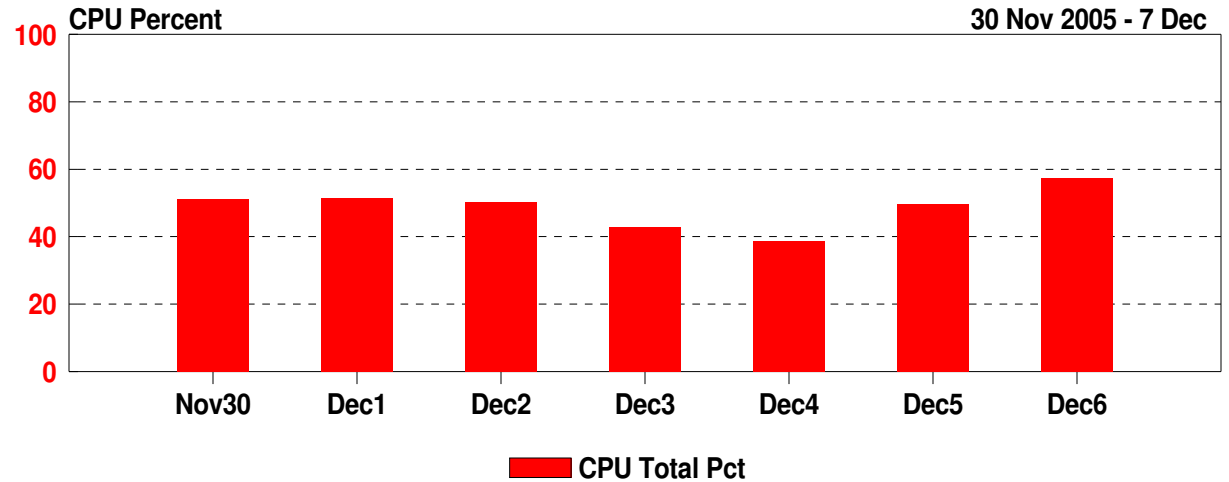 - Pay attention to peaks (particularly I/O).

How to Plan for Metered Systems

- **Convert average weekly/monthly CPU % to capacity metric**
  - Rating from current system
    - On MCP systems, convert RPM to MIPS by dividing by 24.3
  - Calculate MIPS needed
    - Average weekly/monthly CPU% * MIPS rating
    - Can use weekly if week-to-week variations do not occur
    - Add standard deviation to average
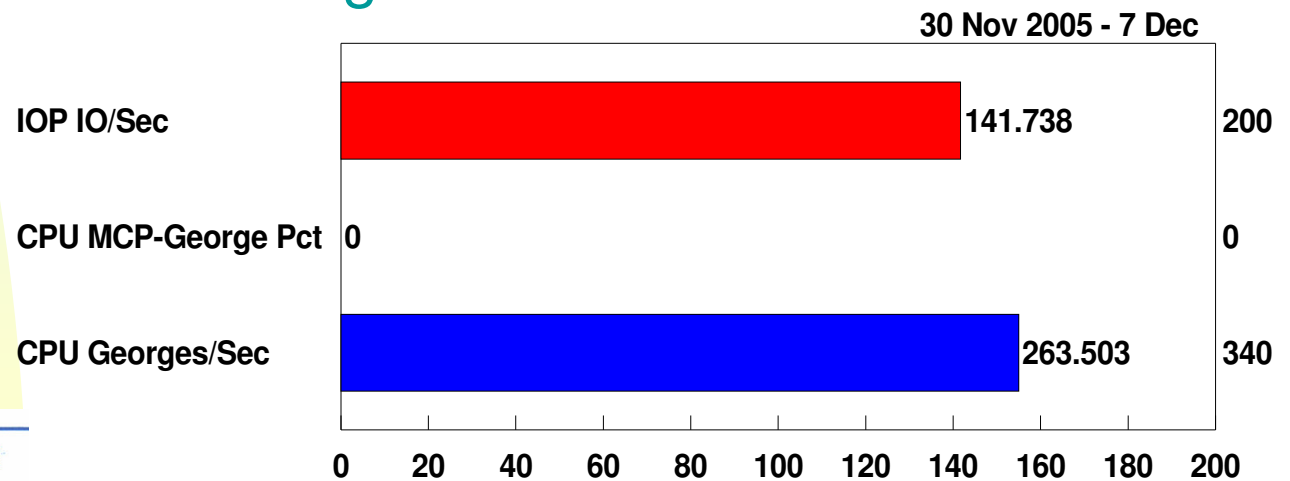
How to Plan for Metered Systems

CPU User Defined RPM

800

CPU Percent   **30 Nov 2005 - 7 Dec**

Chart axis values: 100, 80, 60, 40, 20, 0

Bar values (approx): Nov30 ~51, Dec1 ~52, Dec2 ~50, Dec3 ~43, Dec4 ~39, Dec5 ~50, Dec6 ~58

X-axis: Nov30, Dec1, Dec2, Dec3, Dec4, Dec5, Dec6

Legend: ■ CPU Total Pct

Average MIPS = ("CPU Total Pct"/100)*"CPU User Defined RPM"/24.3

Average MIPS 16.08

MIPS   **30 Nov 2005 - 7 Dec**

Chart axis values: 20.0, 17.5, 15.0, 12.5, 10.0, 7.5, 5.0, 2.5, 0.0

Bar values (approx): Nov30 ~16.8, Dec1 ~16.8, Dec2 ~16.6, Dec3 ~14.2, Dec4 ~12.8, Dec5 ~16.3, Dec6 ~18.8

X-axis: Nov30, Dec1, Dec2, Dec3, Dec4, Dec5, Dec6

Legend: ■ Average MIPS

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How to Plan for Metered Systems

- Average of 16.08 MIPS
- No TCP on newer Libra platforms
- Additional CPU overhead for:
  - MCP Answer-IO Finish
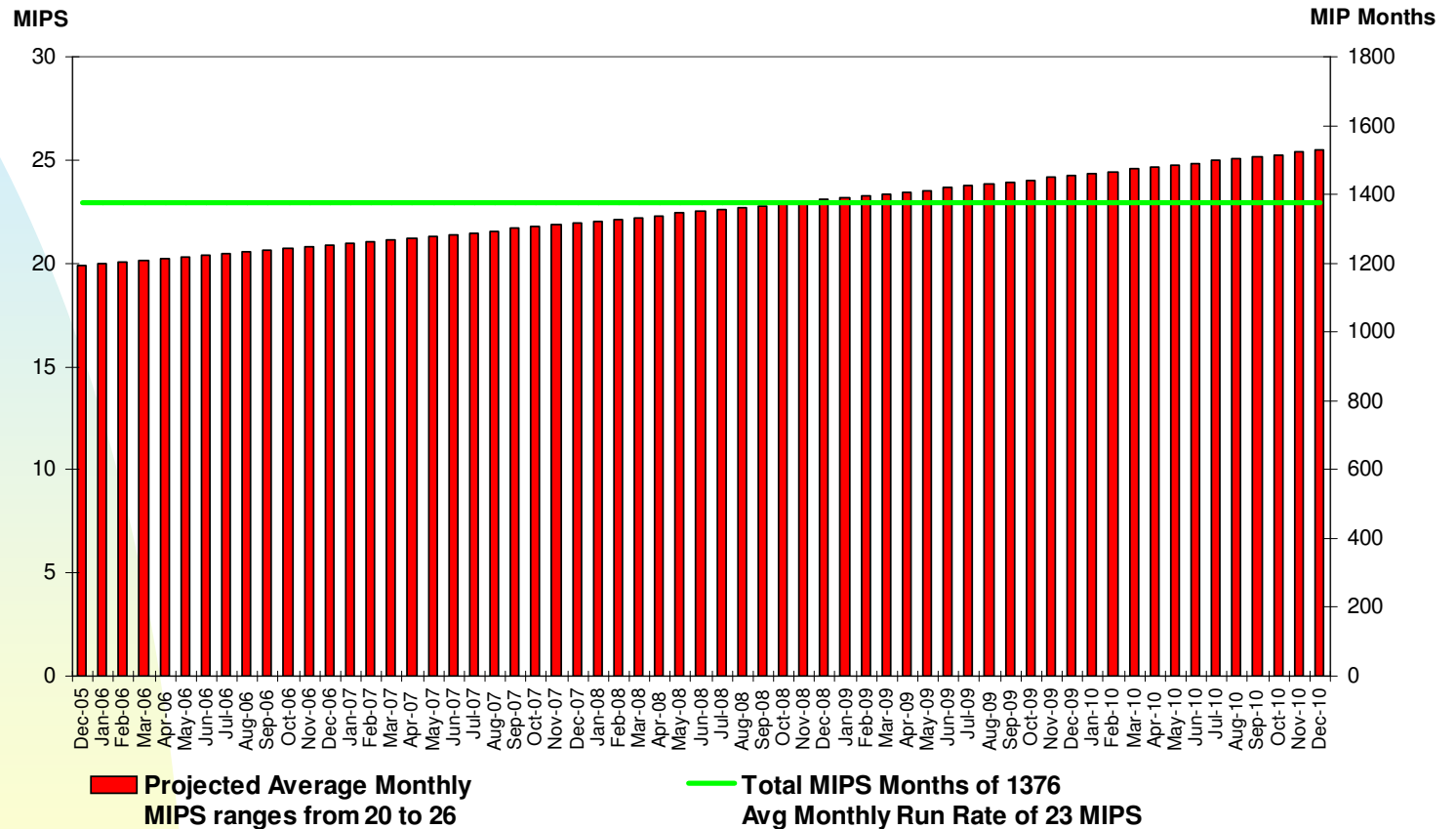 - MCP George
- Correlation with IO/Sec and Georges/Sec

30 Nov 2005 - 7 Dec

IOP IO/Sec	141.738	200
CPU MCP-George Pct	0	0
CPU Georges/Sec	263.503	340

0   20   40   60   80   100   120   140   160   180   200

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How to Plan for Metered Systems

- Total projected MIPS for metered system

16.08	Current Average MIPS
0.40	Standard Deviation
2.27	MCP Answer-IO Finish MIPS
1.10	MCP Georges MIPS
19.85	Total projected MIPS

- Apply growth estimates
- Create multi-year forecast in Excel or similar tool

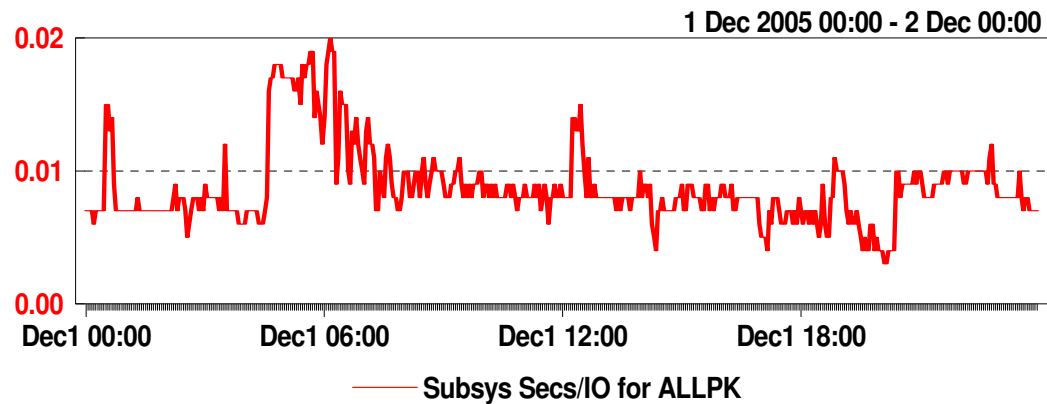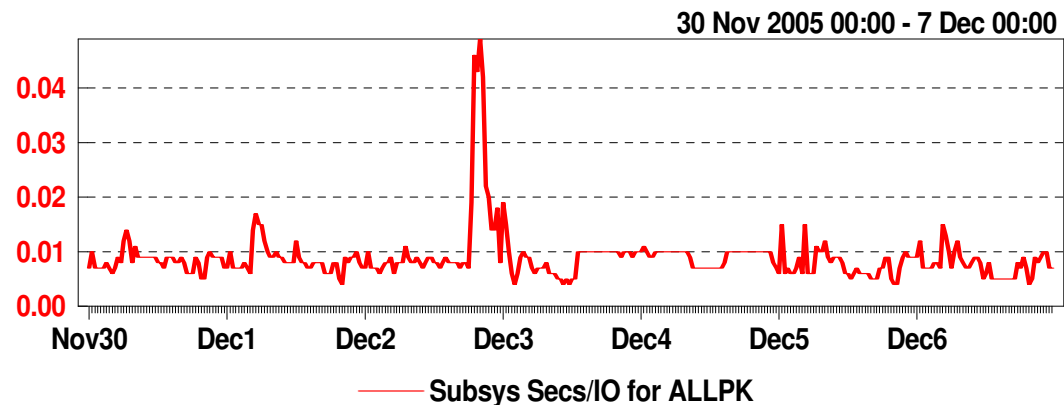# How to Plan for Metered Systems
Capacity Usage Projection

Projected Average Monthly MIPS ranges from 20 to 26

Total MIPS Months of 1376 Avg Monthly Run Rate of 23 MIPS

How to Plan for Metered Systems

- Base-plus-usage considerations
  - Can be better for systems with
    - Little growth or
    - Full chargeback to users or
    - Operating expense accounting
  - Lose monthly MIPS under minimum purchase (use 'em or lose 'em)
  - Want to under buy to avoid monthly loss
- Pre-paid considerations
  - Better for systems where variation in capacity needs is expected
  - Have entire license term to consume capacity purchase (no loss till end)
  - If growth exceeds estimates - buy more MIPS
  - If growth falls below estimates – have 2 months to use excess at the end of contract
- Pre-paid recommended for the MCP example due to anticipated growth

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How to Plan for Metered Systems

- Processor contention reduced

- IO bottlenecks?

30 Nov 2005 00:00 - 7 Dec 00:00

Subsys Secs/IO for ALLPK

1 Dec 2005 00:00 - 2 Dec 00:00

Subsys Secs/IO for ALLPK
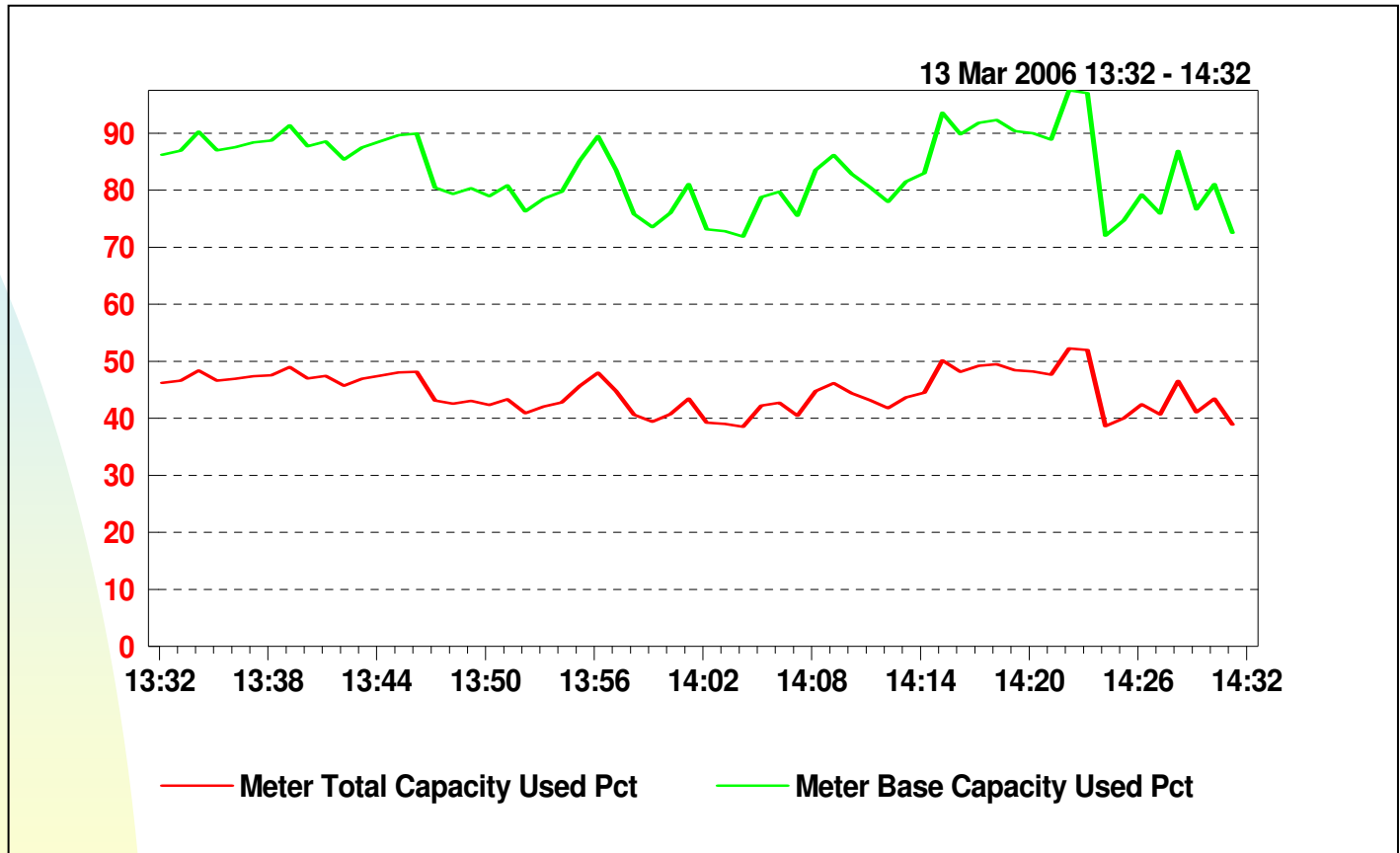
18

How to Plan for Metered Systems

- Other considerations:
  - Memory Requirements
  - Disk Space
  - When migrating having both systems on the same release level if possible
  - Create a migration plan
  - Test the migration plan

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Managing Metering Best Practices

- Monitor purchased capacity used:
  - Manage MIPS consumed above baseline
- Decompose workload capacity usage
  - Identify wasted MIPS
- Track and trend system capacity usage (not just CPU usage)
- Monitor/alert unusual capacity usage
- Validate Unisys reports
- Monitor and trend service levels
- Compare trends in: Service Levels, Capacity used, and Workload volume
- Report capacity status and projection regularly
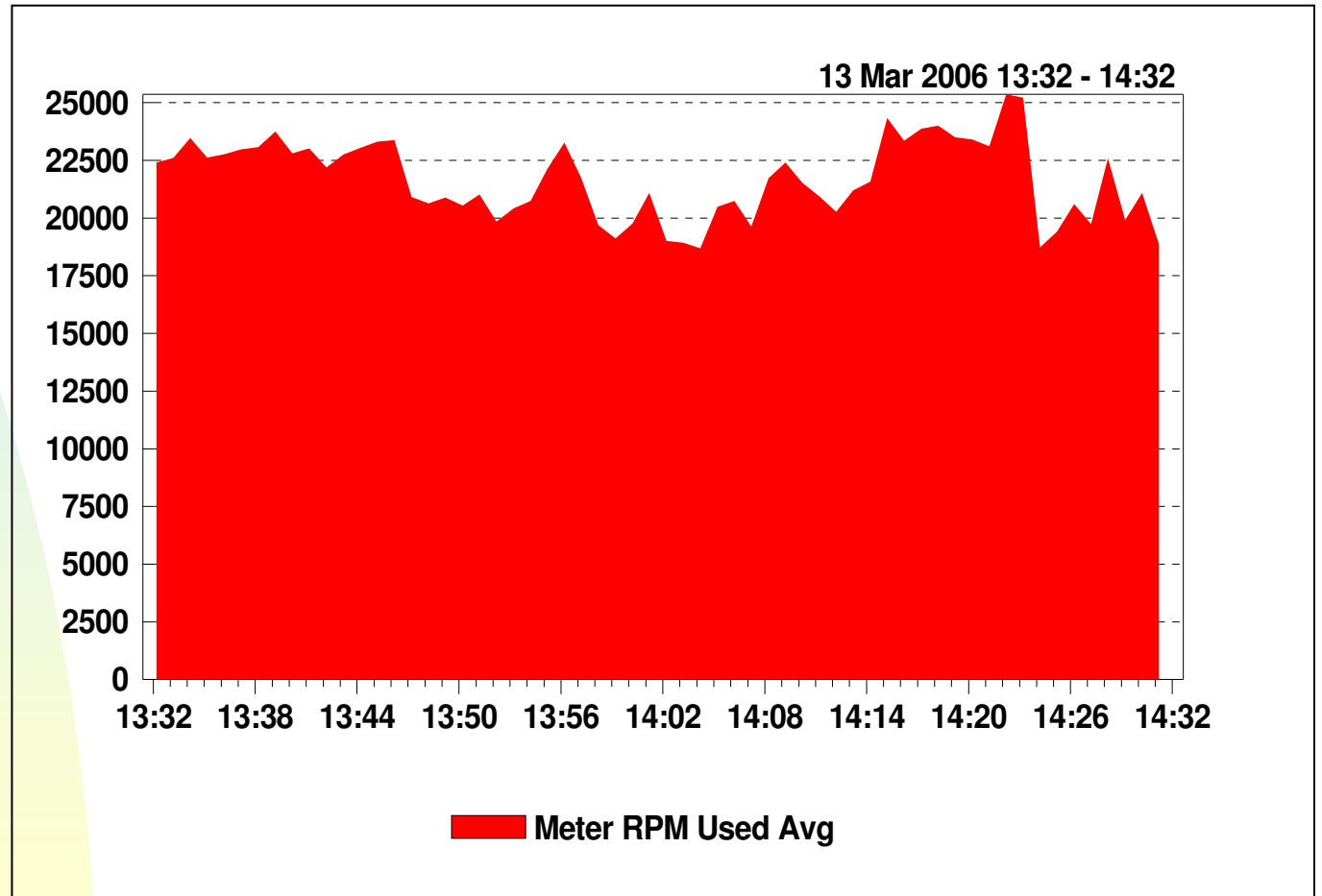- Objective: deliver service, manage cost and mitigate risk

Managing Metering
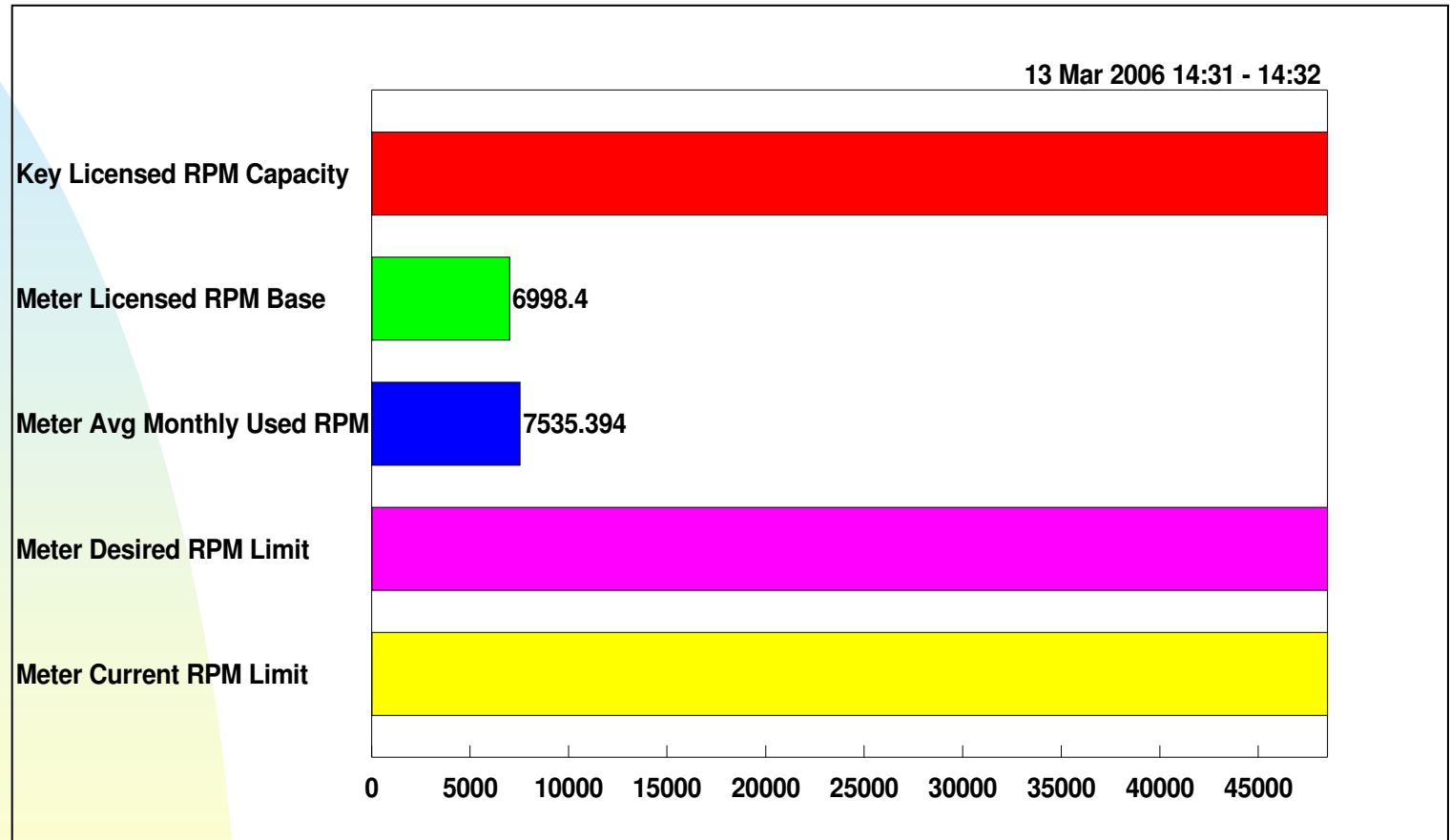## SightLine Capacity Monitoring

13 Mar 2006 13:32 - 14:32

— Meter Total Capacity Used Pct   — Meter Base Capacity Used Pct

Managing Metering
Metering RPM Delivery

13 Mar 2006 13:32 - 14:32

Meter RPM Used Avg

Managing Metering
Meter Limits and Usage

13 Mar 2006 14:31 - 14:32

Key Licensed RPM Capacity

Meter Licensed RPM Base — 6998.4

Meter Avg Monthly Used RPM — 7535.394

Meter Desired RPM Limit

Meter Current RPM Limit

0   5000   10000   15000   20000   25000   30000   35000   40000   45000

Managing Metering
Meter Key Status

13 Mar 2006 13:32 - 14:32

Meter Key Image MIPS*Months	13772.466	32100
Meter Key Image Capacity Used Pct	42.904	100
Meter Key Image Elapsed Months	17.066	30
Meter Key Licensed Months		30

0   5000   10000   15000   20000   25000   30000
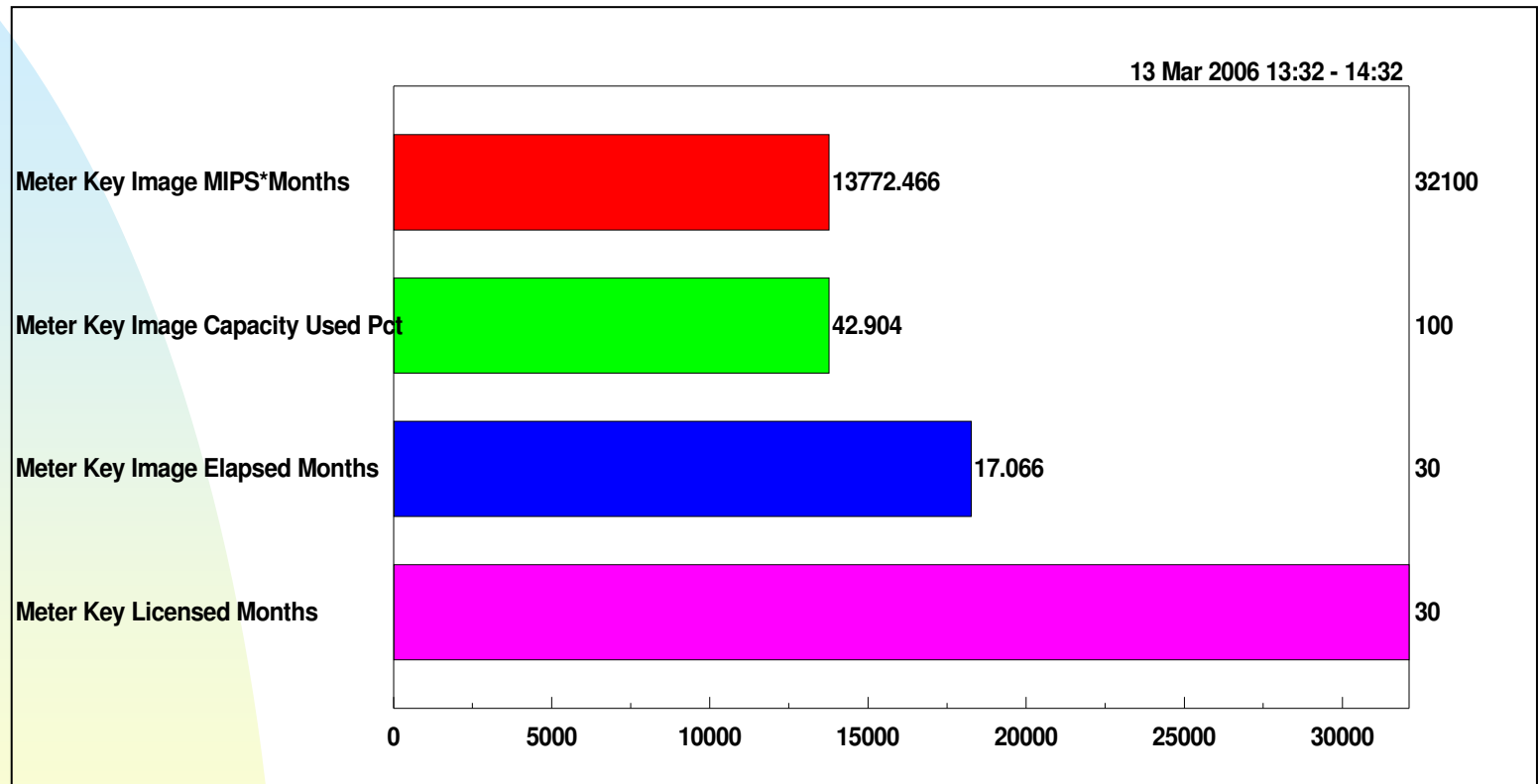
Managing Metering
Workload Capacity as % of Total Available

Work Capacity Used Pct　　　　　　　　　　　　　**13 Mar 2006 13:32 - 14:32**

Legend:
- 1-BL
- 1-FTP
- 1-DATACOMM
- 1-SYSTEM
- 1-RDB
- 1-SINGLEPO
- 1-SYSMONITOR
- 1-VIEWPOINT
- 1-OTHER
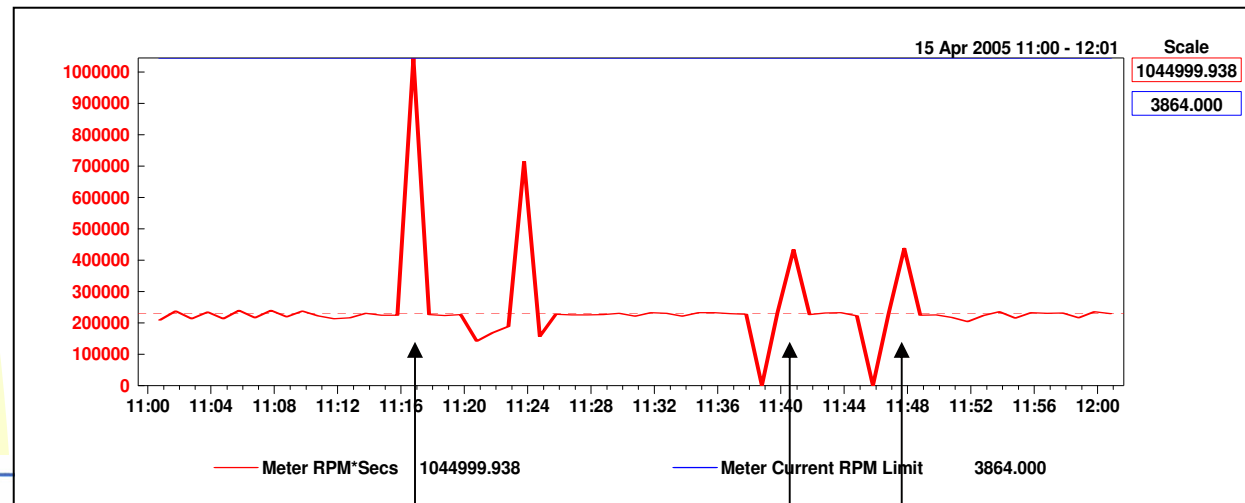
25
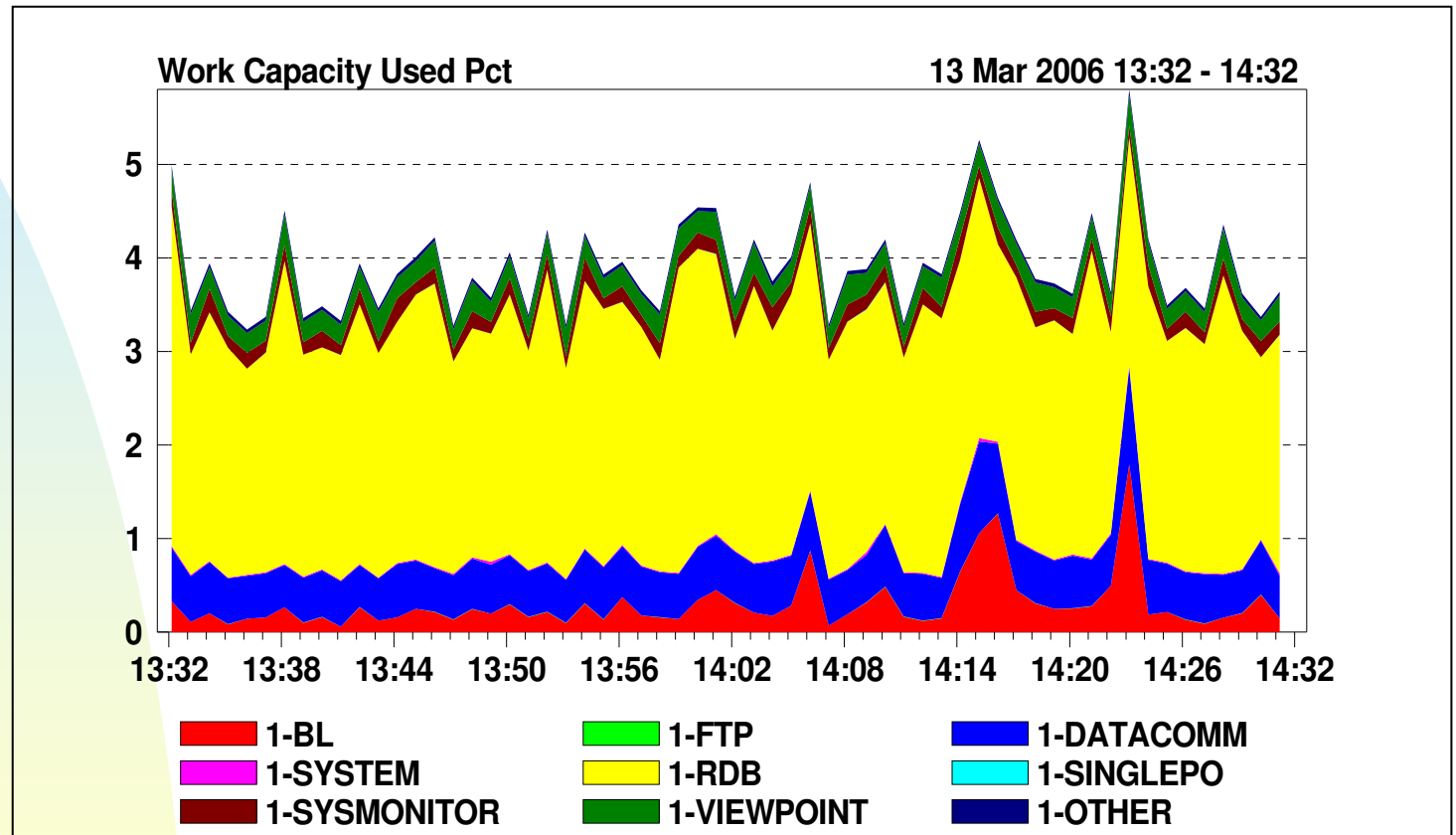
Managing Metering
Workload Capacity as % Purchased
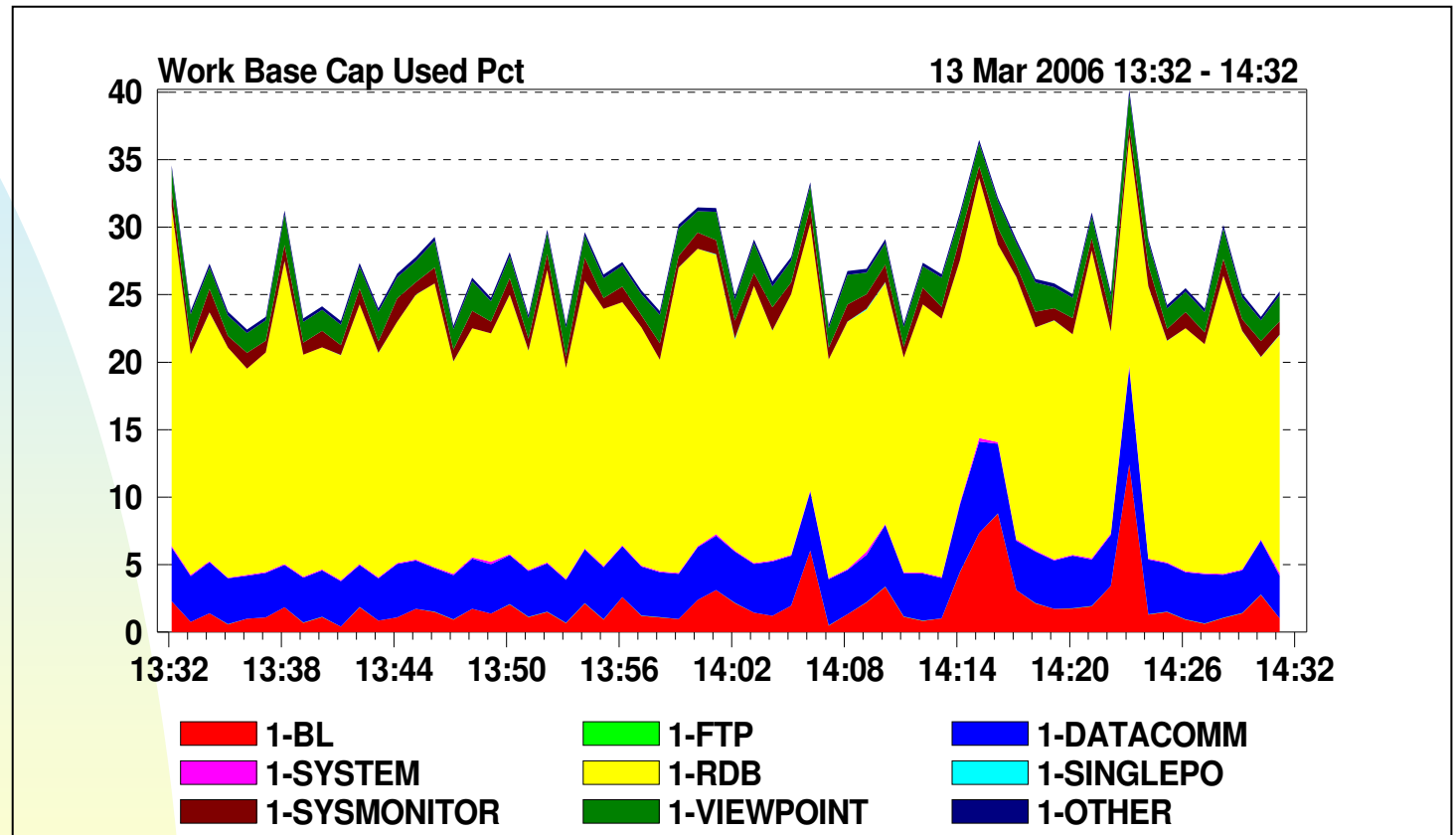
Managing Metering
Problem Detection

- Example of a problem value
  - Governor at 3,864
  - Sampling at 60 seconds
  - Max possible RPM*Seconds is 231,840 per sample period
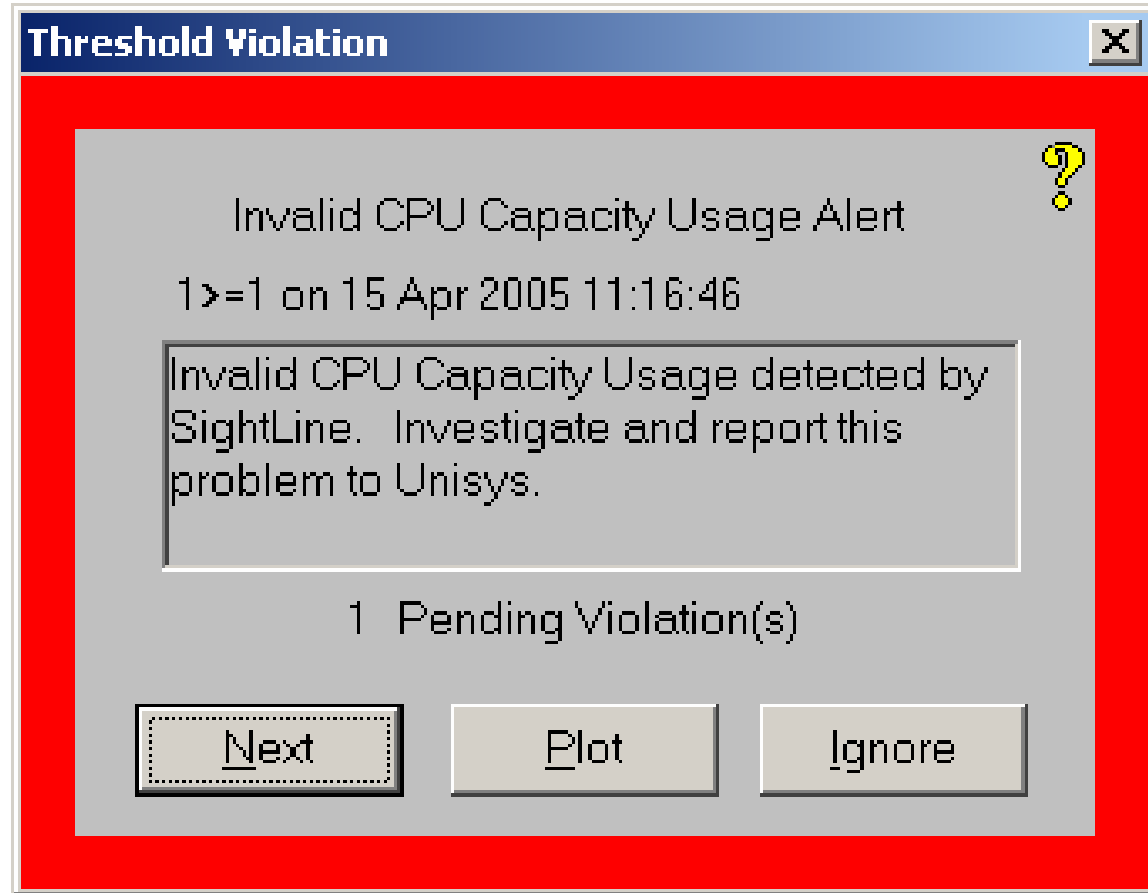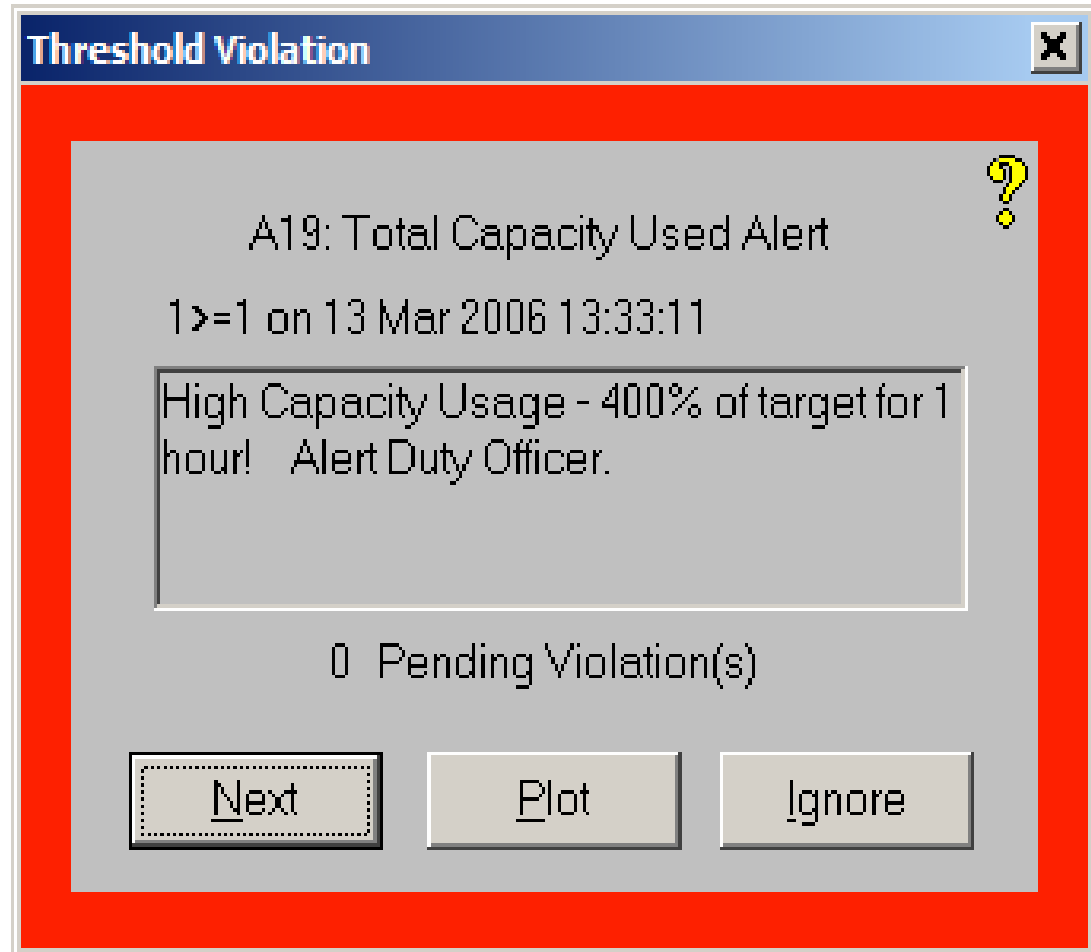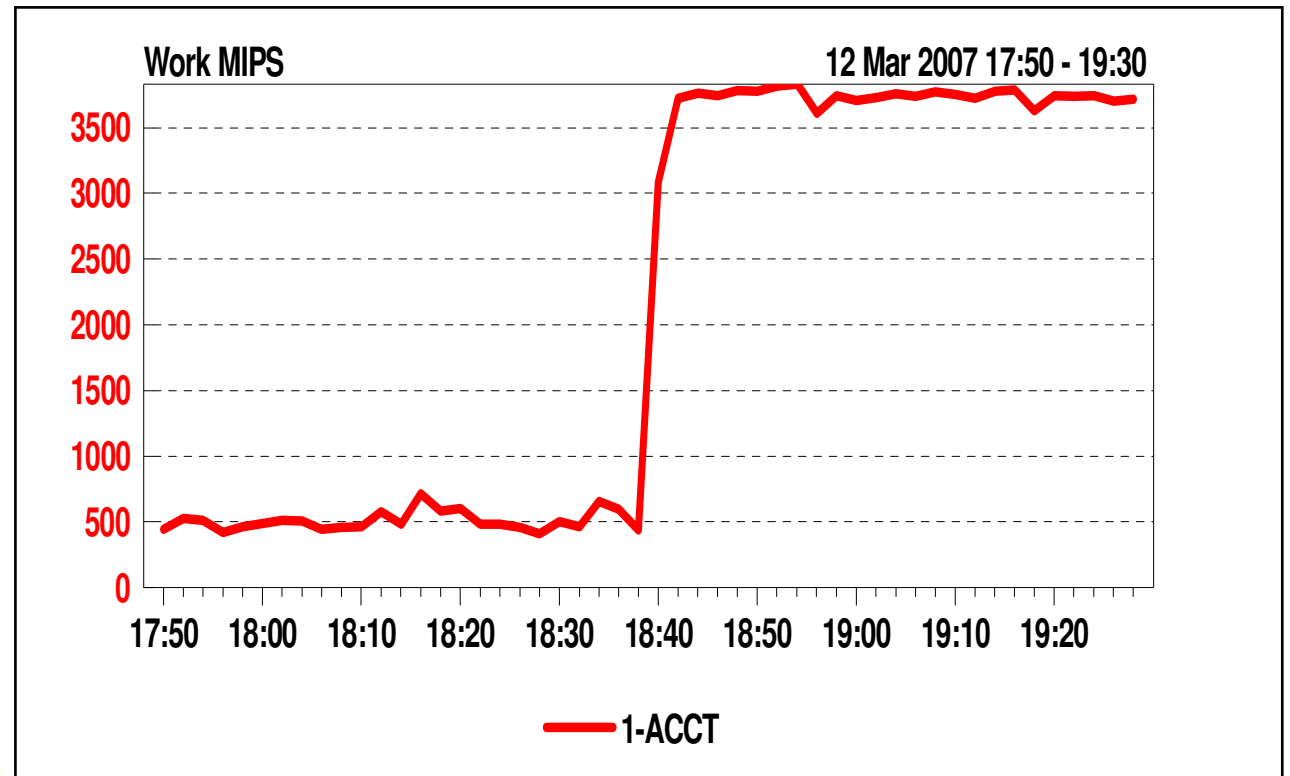 - System recorded over 1,000,000

15 Apr 2005 11:00 - 12:01

Scale
1044999.938
3864.000

Meter RPM*Secs   1044999.938   Meter Current RPM Limit   3864.000

Problem   Normal

Managing Metering
Problem Alerting

Threshold Violation

Invalid CPU Capacity Usage Alert

1>=1 on 15 Apr 2005 11:16:46

Invalid CPU Capacity Usage detected by SightLine. Investigate and report this problem to Unisys.

1 Pending Violation(s)

[Next]   [Plot]   [Ignore]

Managing Metering
Problem Alerting

Threshold Violation

A19: Total Capacity Used Alert

1>=1 on 13 Mar 2006 13:33:11

High Capacity Usage - 400% of target for 1 hour!   Alert Duty Officer.

0 Pending Violation(s)

[Next]   [Plot]   [Ignore]

Managing Metering
Excessive Workload Capacity Usage

Work MIPS   **12 Mar 2007 17:50 - 19:30**

1-ACCT

Managing Metering
Excessive Workload Usage Alarm

Threshold Violation

Excess Workload Capacity Usage Alert

1>=1 on 13 Mar 2006 14:23:11

Excess Capacity Usage by WorkLoad
1-ACCT used more that 3 times normal
usage

0 Pending Violation(s)

[Next] [Plot] [Ignore]

Managing Metering
Capacity Usage Projection

MIPS / **MIP Months**

Legend:
- **Projected Average Monthly MIPS ranges from 199 to 397** (red)
- **Total MIPS Months of 16843 — Avg Monthly Run Rate of 277 MIPS** (green)

Managing Metering
Capacity Usage Plan

Planned Cumulative Capacity Usage

Y-axis: MIPS Months (0 to 18000)

Legend: ■ Projected Cumulative Capacity Used ◆ Annual Capacity Usage Plan
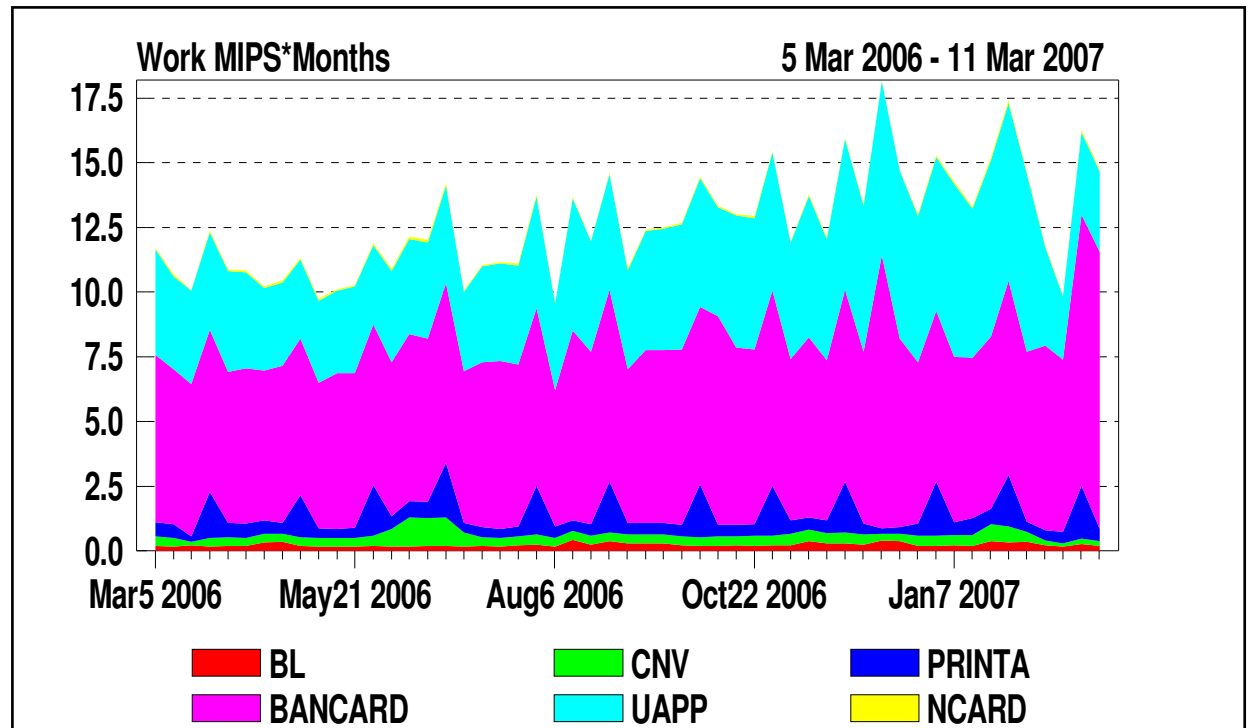
Managing Metering
Confirm Monthly Reports

```
13 Total Used 2,742,504,602 RPM sec 1,058 RPM
14 --> Metered 1,043 RPM month (standard)
15 ==> 43 MIPS month (standard) ID=072000ABE3F94530001
```


1 Mar 2006 - 1 Mar 2007

Legend: ■ Meter MCP MIPS*Months ■ Meter User MIPS*Months
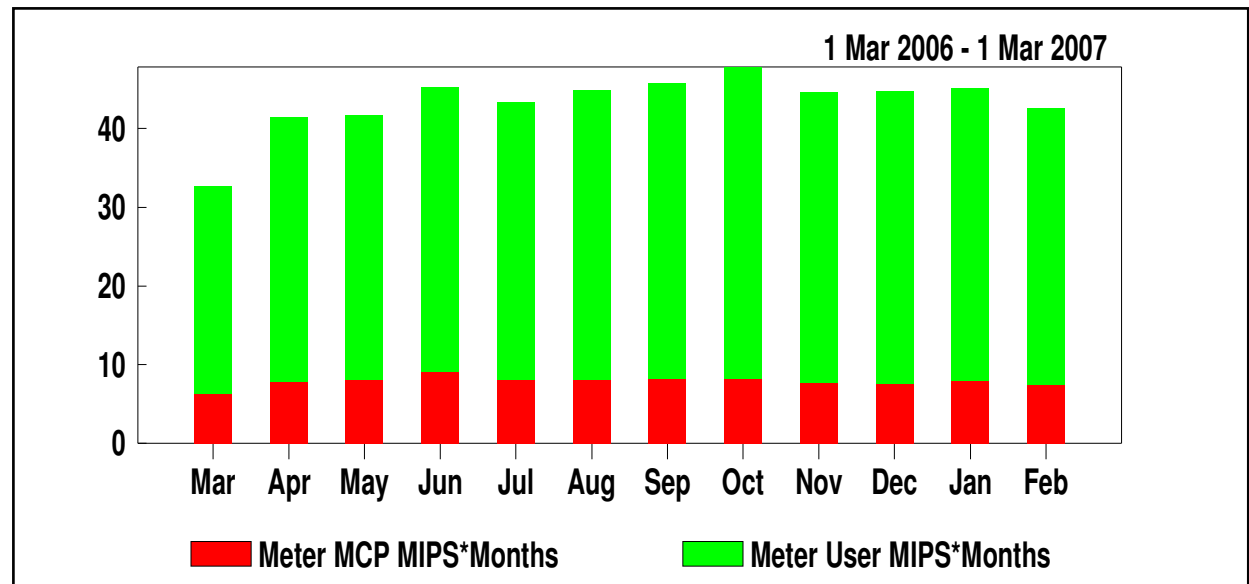
Managing Metering
Monitor Consumption Creep

Work MIPS*Months   5 Mar 2006 - 11 Mar 2007

Legend:
- **BL** (red)
- **CNV** (green)
- **PRINTA** (blue)
- **BANCARD** (magenta)
- **UAPP** (cyan)
- **NCARD** (yellow)

Managing Metering
Real Trend Analysis

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Managing Metering
Real Trend Projection

MIPS*Months Projection

$y = 18.504x + 440.21$
$R^2 = 0.9996$
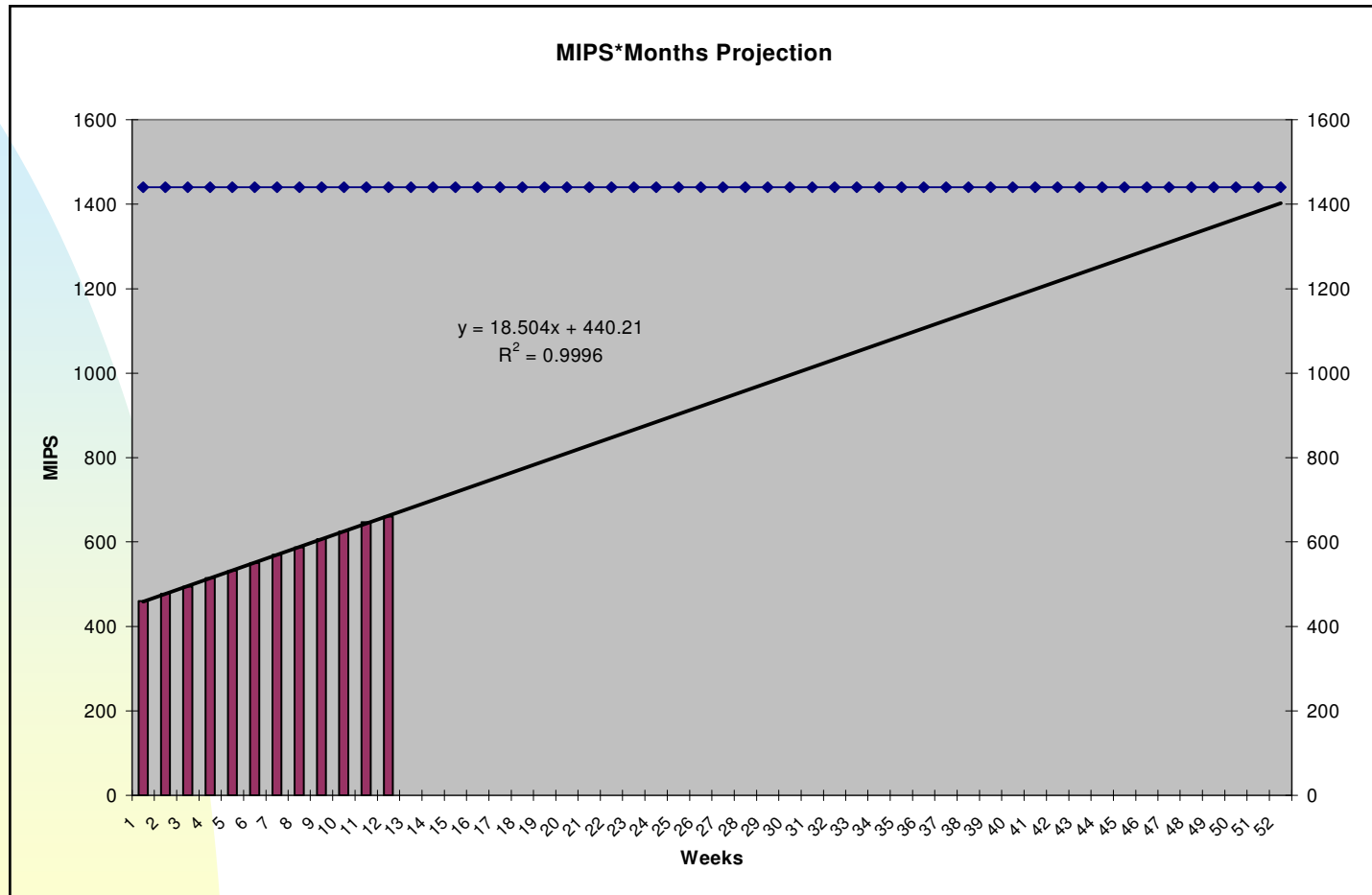
Managing Metering
Governor Considerations

- Setting the Governor to the level of Run Rate or Baseline defeats the value of a metered platform.

- Start with the CPUs unconstrained and stay there if possible.

- Consider running fewer CPUs at higher rates (study the actual capacity burn versus performance for key workloads).

- Set the Governor as high as feasible without blowing the capacity consumption "plan" (you do have a plan, right?).

- If used, recommend Governor setting at least twice the Run Rate or Baseline for a production system.

- Exception for development systems – set the Governor to constrain unnecessary consumption.

- Capacity Management never ends.

Monitoring OS2200 Metering

- Metering statistics are included in the SightLine Power Agent's MSB/System Log Interface Agent

- Type 551 log records

OS2200 Metering Metrics

If MSB_Utilization = on, the following metrics are reported:

CoD Booting Recs
CoD Meter Key Reg Recs
CoD Non-Meter Key Reg Recs
CoD Up IP Recs
CoD Down IP Recs
CoD Desired MIPS Chgd Recs
CoD MIPS Metering Recs
CoD Meter Prof Key Reg Recs

CoD Meter DR Key Reg Recs
CoD Meter DR Key Exp Recs
CoD Meter Prof Key Exp Recs
CoD Suspect Data Recs
CoD System Stop Recs
Other Part Key Recs
CoD Meter DR Key Reg Recs
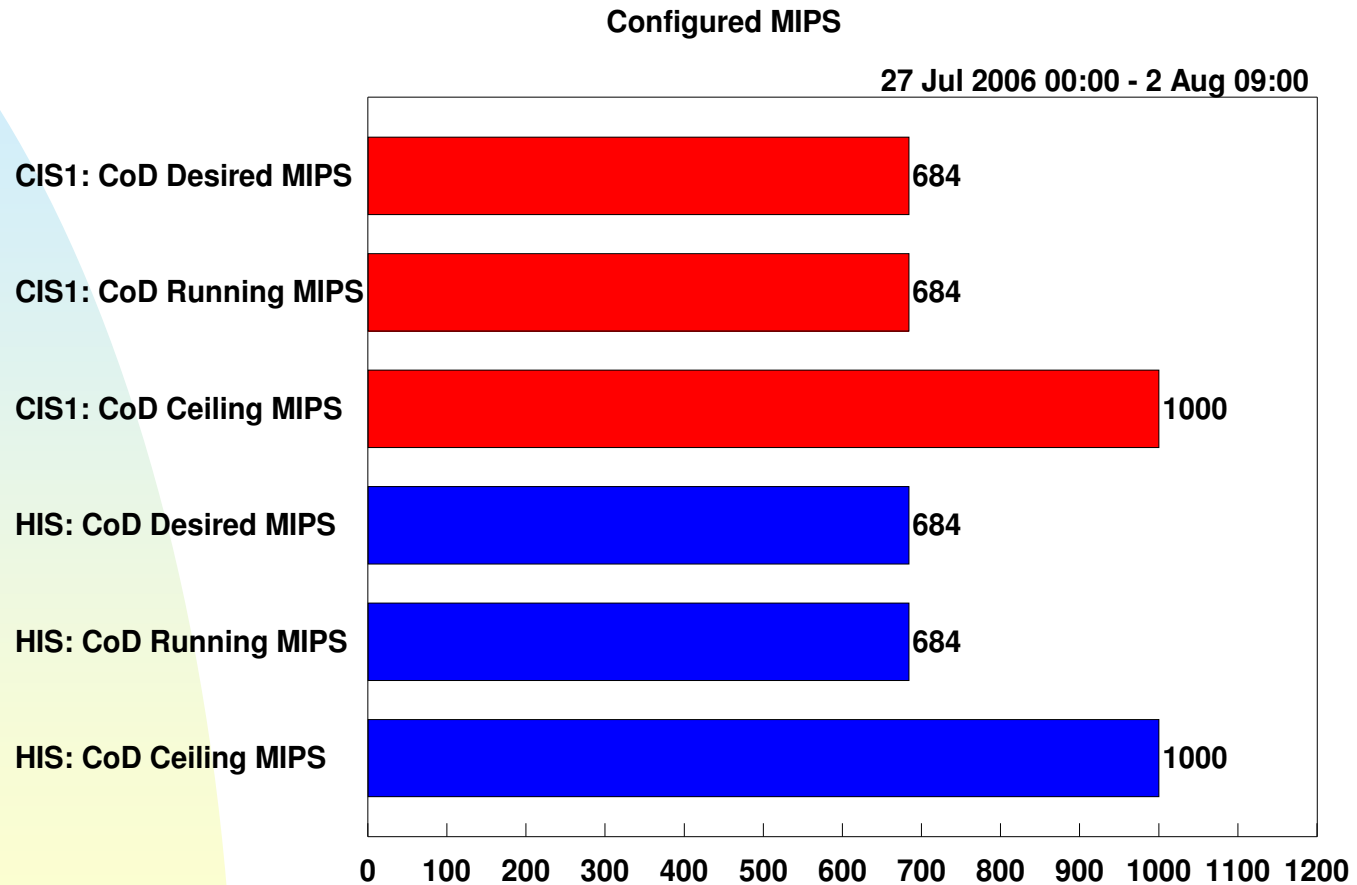
OS2200 Metering Metrics

If MSB_MIPS_Metered_Perf = on, the following metrics
are reported:

COD Desired MIPS   CoD MIPS Used/Sec
CoD Period % Elapsed   CoD % Desired MIPS
CoD Period % Baseline Used   CoD % Running MIPS
CoD Period MIPS-Months Total   CoD % Ceiling MIPS
CoD Running MIPS   CoD % Baseline MIPS
CoD Baseline MIPS   CoD Period Days
                                          CoD Period % Elapsed

OS2200 Metering Metrics
Configuration Information

Configured MIPS

27 Jul 2006 00:00 - 2 Aug 09:00

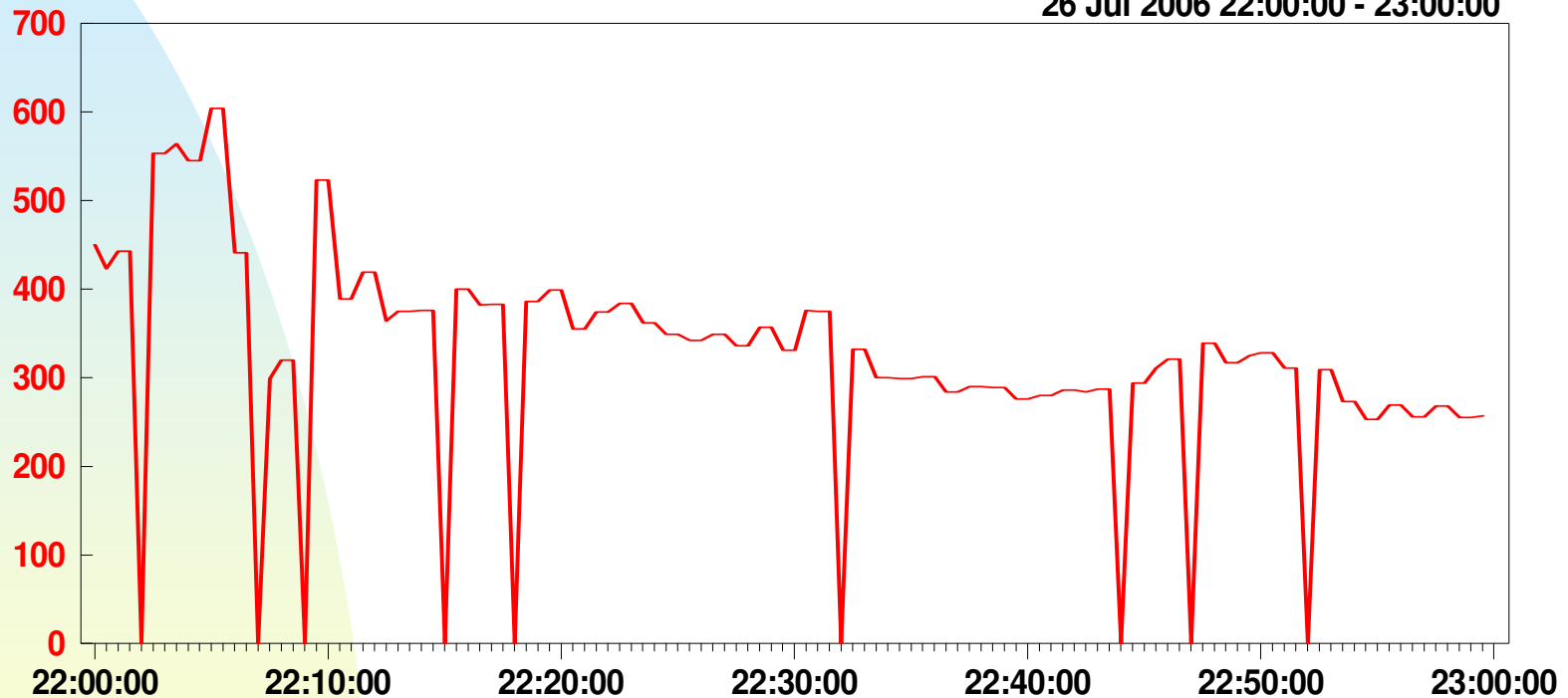| Metric	Value
CIS1: CoD Desired MIPS	684
CIS1: CoD Running MIPS	684
CIS1: CoD Ceiling MIPS	1000
HIS: CoD Desired MIPS	684
HIS: CoD Running MIPS	684
HIS: CoD Ceiling MIPS	1000

0 100 200 300 400 500 600 700 800 900 1000 1100 1200

OS2200 Metering Metrics
CoD MIPS Used/Sec

Real Time MIPS Usage

26 Jul 2006 22:00:00 - 23:00:00

CIS: CoD MIPS Used/Sec

OS2200 Metering Metrics
Estimated MIPS Usage

- Calc MIPS per Second

  "CoD Running MIPS" * ("IP Util Total"/100)

- Calc MIPS per Month
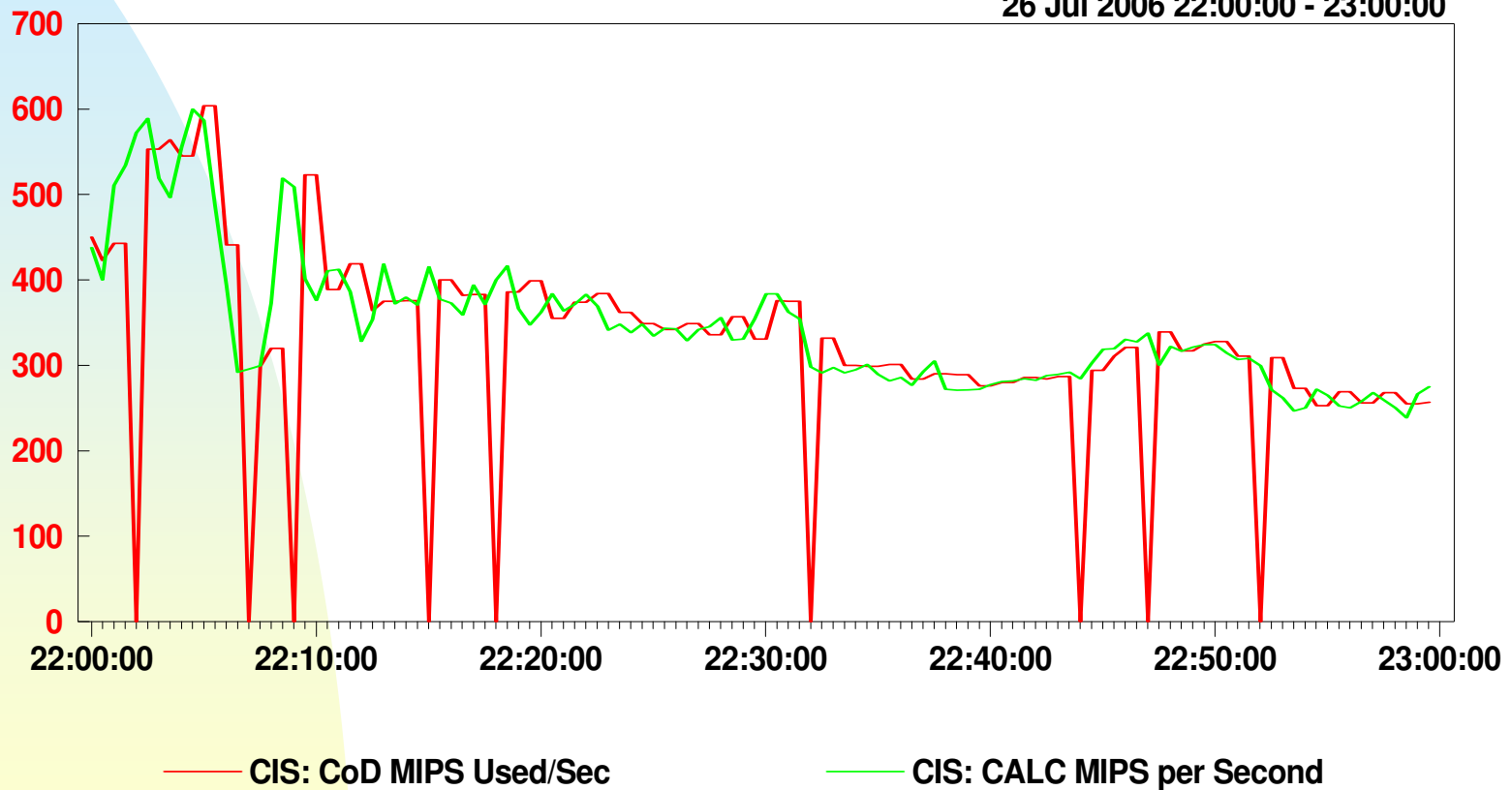
  ("Calc Mips per Sec" * "Elapsed Time")/2629800

  Note: 2,629,800 MIPS Seconds = 1 MIP Month
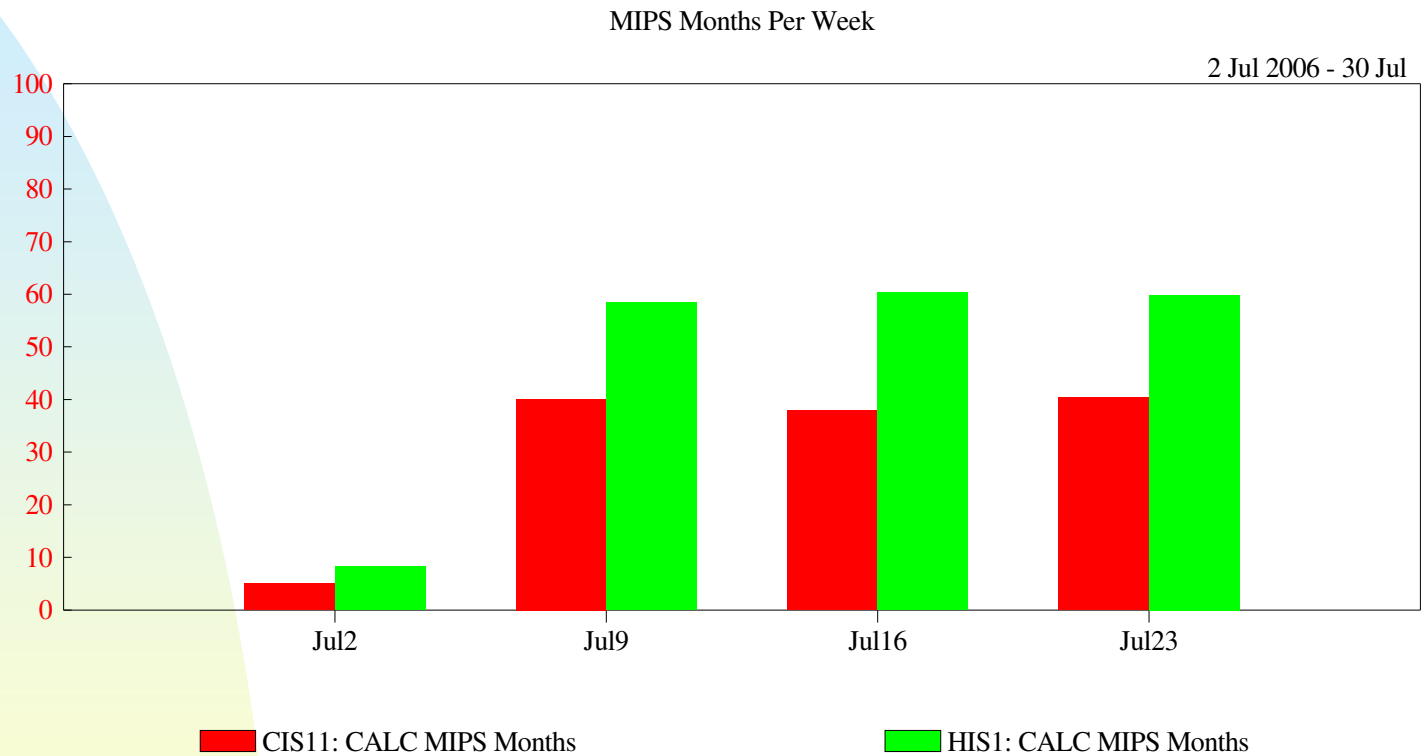
OS2200 Metering Metrics
Estimated MIPS Usage

Real Time MIPS Usage
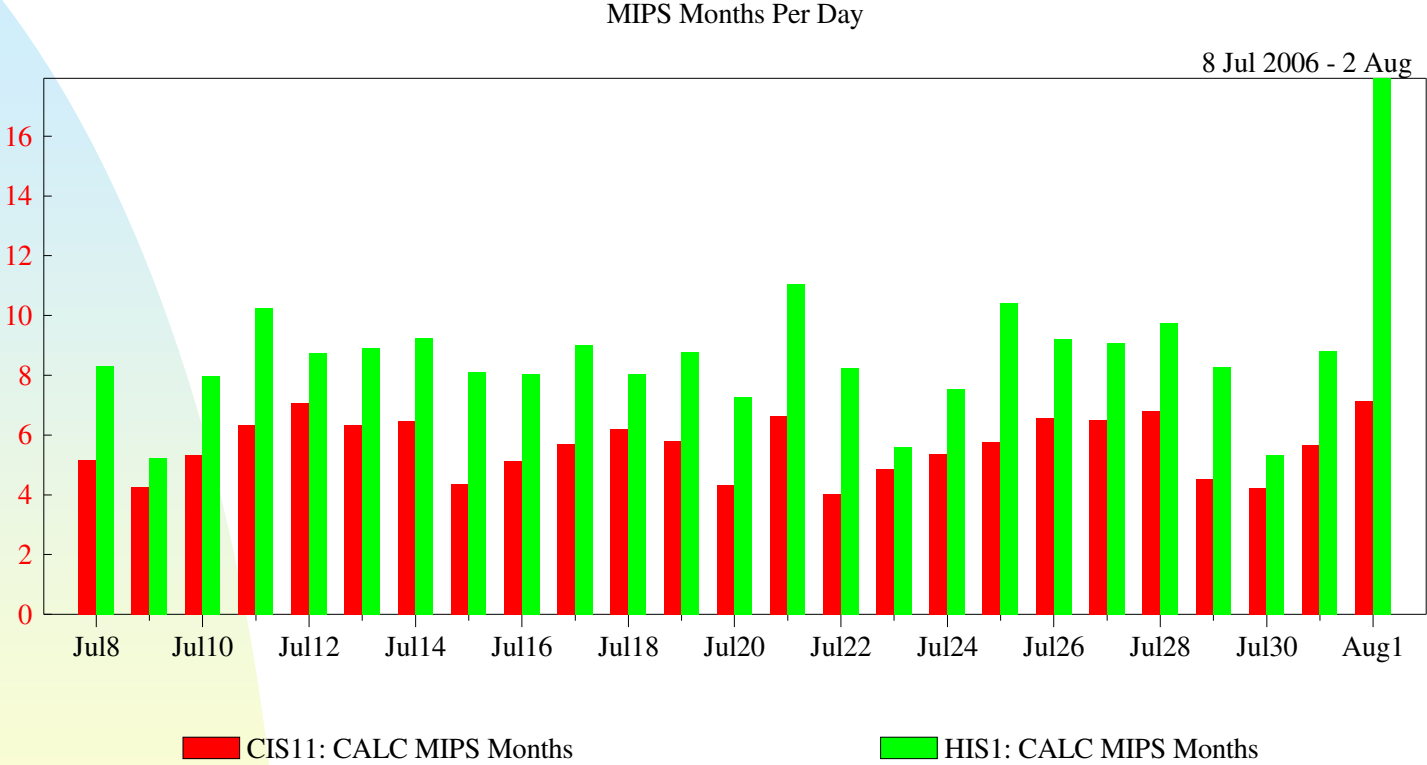
26 Jul 2006 22:00:00 - 23:00:00

CIS: CoD MIPS Used/Sec   CIS: CALC MIPS per Second

OS2200 Metering Metrics
Estimated MIPS Usage

MIPS Months Per Week

2 Jul 2006 - 30 Jul

CIS11: CALC MIPS Months   HIS1: CALC MIPS Months

OS2200 Metering Metrics
Estimated MIPS Usage

MIPS Months Per Day

8 Jul 2006 - 2 Aug

Legend:
- CIS11: CALC MIPS Months
- HIS1: CALC MIPS Months

OS2200 Metering Metrics
Estimated MIPS Usage

Heritage MIP Months

1 Aug 2006 - 2 Aug

HIS1: Batch MIPS Months	10.184
HIS1: Deadline MIPS Months	0
HIS1: Demand MIPS Months	0.01
HIS1: ILES MIPS Months	0.001
HIS1: Real Time MIPS Months	0.7
HIS1: TIP MIPS Months	2.789
HIS1: CMS MIPS Months	0.336
HIS1: UDS MIPS Months	0
HIS1: Exec MIPS Months	3.904

0   2   4   6   8   10   12   14   16

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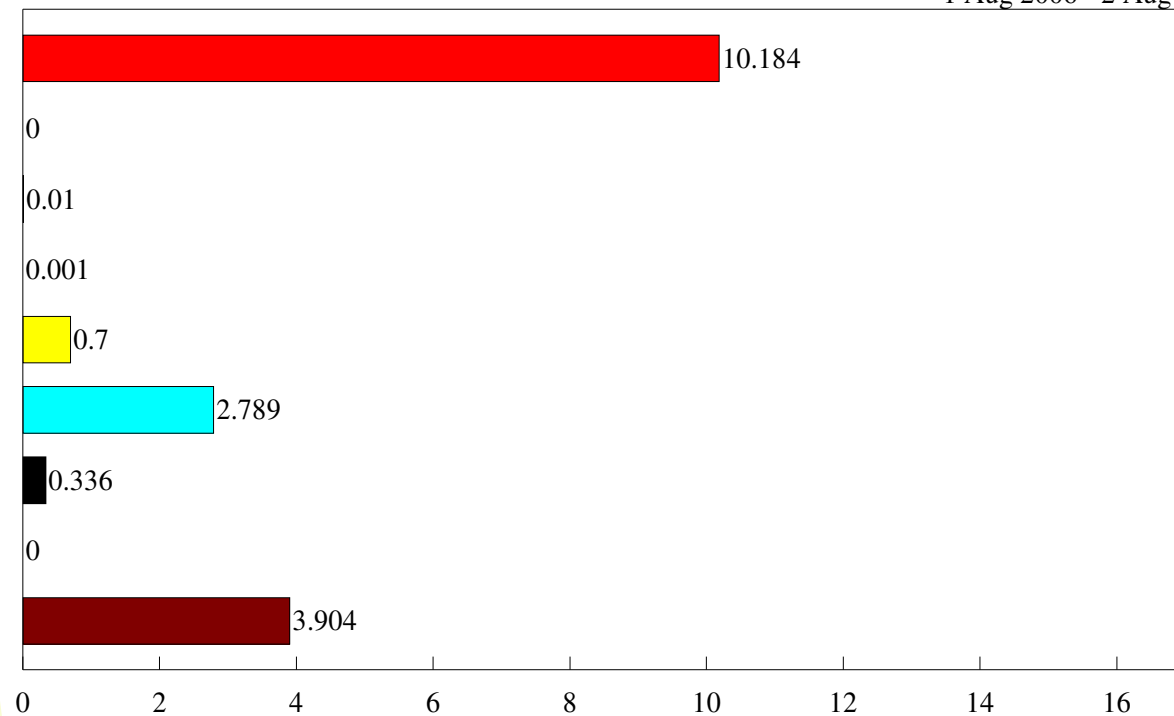
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SightLine for ClearPath OS2200
7R4 Power Agent Update

- Introduction of OLTP Interface Agent

- Support of SILAS log file

- Support of 67GB+ Disk Master Bit Table in CP-OS-2200 11.1

- Support of TFC Maintenance log entries in CP-OS-2200 11.1

- Support of version 3 of the MIPS metering log entry in CP-OS-2200 11.1

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SightLine for ClearPath MCP
6.4 Metering Agent Update

- Improved Sampling – using new call with lower CPU overhead

- New excessive consumption analysis and alarms

- Libra 5x5/6xx COD updates
  - Memory COD Keys
  - I/O COD Keys
  - Java Processor Keys

- Libra 6xx support

- Reduced overall CPU footprint

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SightLine Summary
Pre-emptive Performance & Capacity Management

- **Real-Time Resource monitoring**
  - Continuously monitors performance of business-critical HW and SW components
  - Immediately detects and reports performance problems & bottlenecks

- **In-depth Analysis**
  - Provides extensive analysis and problem diagnostic features and capabilities
  - Offers Trend analysis for future projections

- **Capacity Planning**
  - Enables determination of long-term capacity requirements to minimize costs & maximize value.

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Additional Questions?

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Managing Metered Systems: Best Practices in Planning and Managing Your Metered Platform

(presentation available at www.mgsinc.com/download.html)