

REAL-TIME PERFORMANCE MANAGEMENT FOR THE ENTERPRISE

RtPM



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IT MONITOR IN ACTION



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Sr. Manufacturing Systems Engineer

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Systems Administrator

AGENDA

- Introduction
- Software Evaluation
- Basic Steps of Implementation
- Examples
- Results
- Future Plans



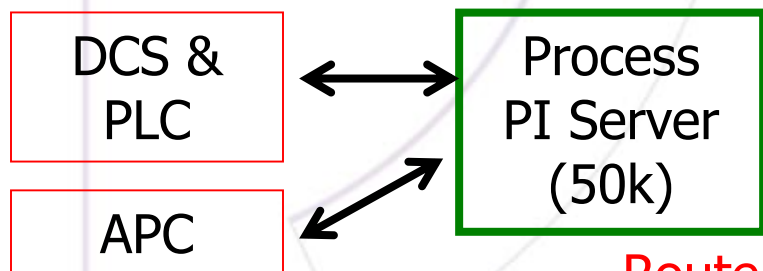
INTRODUCTION

- Carolyn Przybylski (sha-BILL-skee)
 - Started with Cytec in 1987; Process Engineer -> Production Engineer -> Process Control Engineer -> Sr. Manufacturing Systems Engineer
 - PI Systems Manager (6 years)
- Chris Gaffney
 - Started with Cytec in 1996 as Systems Administrator
 - MCSE (MS Certified Systems Engineer)
 - CCNA (Cisco Certified Network Associate)
 - IT Monitor Systems Manager
- Cytec Industries – Fortier Plant
 - New Orleans, LA
 - Chemical Manufacturing plant -
 - Continuous Processes (24/7/365)
 - 440+ Cytec employees & 150+ contractors onsite

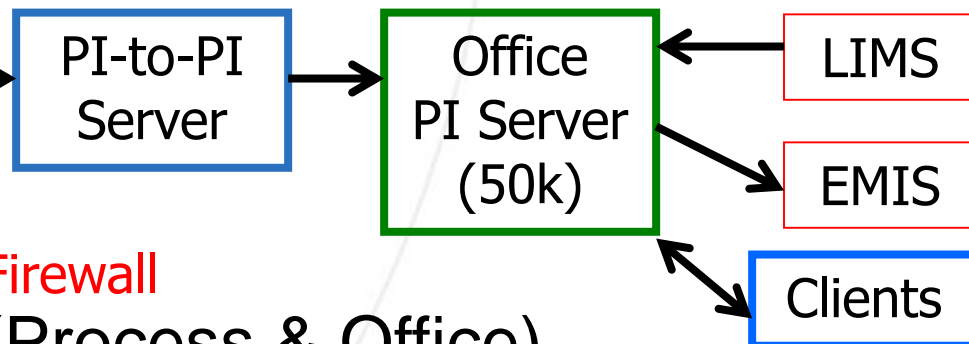


PI SYSTEM LAYOUT

PROCESS NETWORK



OFFICE NETWORK



Routers/Firewall

- Separate Networks (Process & Office)
- Two 50K tag servers with PI-to-PI interface
- Interfaces:
 - 6 DCS (GSE D/3 & Yokogawa)
 - 20+ PLC (Square D, Allen Bradley)
 - 2 Advanced Process Control (APC) Systems
 - Laboratory Mgmt System (LIMS)
 - Environmental Mgmt System (EMIS)

NETWORK LAYOUT

PROCESS NETWORK

- 5 Windows servers
- 30+ Cisco switches
- 1 Unix
- 6 VMS servers
- 19 PC/workstations

OFFICE NETWORK

- 40+ Windows servers
- 80+ Cisco switches
- 400+ PCs

Routers/Firewall



Method to Monitor Network

- Using What's Up Gold (WUG) to alert when servers and critical applications went down (react quickly)
- WUG log files & server Event logs provided some valuable information, but strictly reactive
- In order to be Pro-active, needed a method to capture and view history as well as see current trends to:
 - identify & troubleshoot problems before shutdowns occurred
 - justify infrastructure upgrades
 - perform capacity planning



Software Evaluation:

- BMC Software – BMC Patrol
- Concord - eHealth
- HP – OpenView
- IP Switch – WhatsUp Gold
- OSI – IT Monitor
- Disclaimer: The functionality and cost of these software packages may have changed since 4Q2002 when we performed our evaluation



Software Evaluation: AREAS OF COMPARISON

Evaluated each software in the areas of:

- **Functionality**
 - Historical recording capability
 - Data manipulation/configuration
 - Custom Graphic & Trend creation
(ease & flexibility)
- **Training required (system mgmt & client use)**
- **Cost (software purchase & implementation time)**



Software Evaluation: FUNCTIONALITY

- Except for WUG, all met the minimum functionality requirements.
- WUG, BMC Patrol, eHealth, & OpenView had auto-discovery feature for initial graphic creation
- IT Monitor had highest flexibility in data manipulation & configuration (ex/comp filters, scan frequency, calc tags, etc.)
- Since each software met our basic functionality requirements (except WUG), the decision would be heavily based on areas of training & cost



Software Evaluation: TRAINING REQUIRED

- Full training required for all of the software packages except IT Monitor
- No additional training was needed for IT Monitor
 - Extensive experience with:
 - creating PI tags, graphics and reports for existing 2 PI servers
 - PI server configuration and software installs
 - PI Interface Configuration Utility (ICU) & wizards for PI-SNMP & PI-PerfMon very intuitive
 - **This was a BIG plus for IT Monitor since additional costs are not incurred for training or vendor assistance**



Software Evaluation: COST

- Software costs ranged from K\$50 to over K\$100
- On the low end was IT Monitor: cost was based on number of nodes (servers/switches) and tags (data streams) and included six interfaces for all nodes
- On the high end was OpenView: cost based on size of historical database in addition to number of nodes
- BMC Patrol & eHealth were in the middle range
- Cost higher for BMC Patrol, eHealth, & OpenView due to individual agent purchase required for EACH node



Software Evaluation: AND THE WINNER IS...

- We were leaning towards IT Monitor due to the training issue and lower cost, but we decided to write our own software package instead
- OSI offered a discount we couldn't refuse but our salesman made us promise not to tell anyone
- But seriously folks: IT Monitor was the best fit for us on the basis of functionality, training, and cost

Just Kidding!

oops!



Software Evaluation: INTANGIBLES

- IT Monitor server is not as “critical” as our process data historians
 - We can tolerate brief outages of the IT Monitor server
 - Therefore, the IT Monitor server can be used as a real-time test server for PI server application installs and upgrades before applying to our process data PI servers
- IT Monitor does not require an agent to run on the monitored nodes
 - Agents could possibly increase server overhead
 - Would not have to spend time installing another application or service on server nodes



IMPLEMENTATION STEPS

- Determine tag naming convention
 - Very difficult since many more parameters available than for process data
 - still struggling with this
- Build tags and displays for all servers
 - CPU, Disk, Memory, uptime, processes, ping
 - Started with wizards for tag definitions
 - Downloaded templates from OSI's website for some tag definitions and graphics, then customized/created new displays as needed
- Started same process for switches



EXAMPLES

SERVER GRAPHIC MENU




		CPU	MEM	DISK(S)	PING			CPU	MEM	DISK(S)	PING
PI Servers						Domain Controllers					
PI01	Office Side PI	■	■	■	■	DC01	Primary DC	■	■	■	■
PI02	Process Side PI	■	■	■	■	DC02	Backup DC	■	■	■	■
PI03	PI-to-PI	■	■	■	■	DC03	Backup DC	■	■	■	■
PI04	Acid Yokogawa Interface	■	■	■	■	File/Print/App/Backup Servers					
PI05	IT Monitor	■	■	■	■	BAK01	Network Backups	■	■	■	■
PI06	PLC Interfaces	■	■	■	■	BK01	AS / DHCP	■	■	■	■
APC Servers						FP01	File / App	■	■	■	■
ANAPC	Acrylo APC	■	■	■	■	FP02	File / App	■	■	■	■
SFAPC	Acid APC	■	■	■	■	FP03	Print / DHCP	■	■	■	■
Application Servers						SQL Servers					
ACS01	TACTACT / RADIUS	■	■	■	■	SQL01	IMS (lab)	■	■	■	■
APP01	CCure	■	■	■	■	SQL02	Icon / Payroll / Web Apps	■	■	■	■
APP02	DNS & FTP	■	■	■	■	SQL03	Prism2000 & Plantware	■	■	■	■
BJS	Batch Job	■	■	■	■	DMS Servers					
ELEC	Electrical	■	■	■	■	DMS01	Document Management	■	■	■	■
IIS01	Intranet	■	■	■	■	DMS02	Document Management	■	■	■	■
MGT01	Management	■	■	■	■	DMS03	Document Management	■	■	■	■
PDOC01	Process Doctor	■	■	■	■	DMS04	Document Management	■	■	■	■
SAFER	Safer Weather Data	■	■	■	■	Virtual Machine Host Servers					
TS01	Fortier Terminal	■	■	■	■	VMH01	Virtual Machine Host	■	■	■	■
SVR07	Mtc Apps	■	■	■	■	VMH02	Virtual Machine Host	■	■	■	■
LEGEND:		NORMAL	WARNING	ALARM	BAD VALUE	VMH03	Virtual Machine Host	■	■	■	■

EXAMPLES

Menu

SQL01 SERVER STATUS

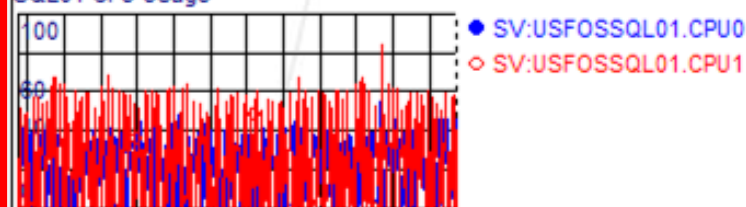
CPU, Disk and Memory

Volume C:	479 Free Mb	% Processor Time (10m avg):	13.32
Used Space:		# of Processes:	51
Disk Read Time %:	0.00	Memory Available Mb:	258
Disk Write Time %:	0.87	Pages per sec:	14
Volume E:	9736 Free Mb	System Uptime (Days):	16
Used Space:		CPU Usage (%)	
Disk Read Time %:	0.54	CPU0	46.82
Disk Write Time %:	0.00	CPU1	42.12
Volume F:	63976 Free Mb		
Used Space:			
Disk Read Time %:	0.00		
Disk Write Time %:	100.00		

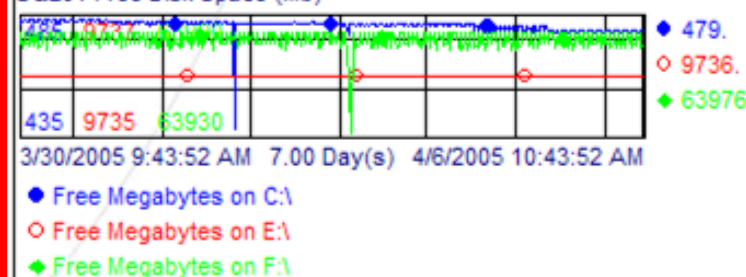
Additional Server Information

Full Name:	USFOSSQL01	IP Address:	164.84.116.13
Building Location:	Admin Data Center	Rack Location:	RCK4
Operating System:	Server 2000	Redundant Server:	none
Function:	Falcon, Payroll, Webboard and other applications		

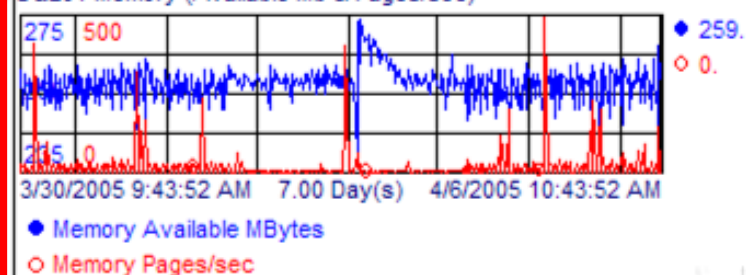
SQL01 CPU Usage



SQL01 Free Disk Space (Mb)



SQL01 Memory (Available Mb & Pages/sec)



EXAMPLES

Menu

PI02 SYSTEM OVERVIEW

PI Services

Archive Subsystem

Out-of-Order Events/Sec 0
Events Cascade/Sec 0
Archived Events/Sec 302
Time to Archive Shift (hours) 44

Base Subsystem

Point Count 10394
Module Count 7
Total Data Streams 10401

Snapshot Subsystem

Out-of-Order Snapshots/Sec 0
Snapshot Events/Sec 368
Queued Events/Sec 302

Network Manager

Total Connections 44
Total Messages Sent/Sec 46

Update Manager




Pending Events 3423
Consumer Count 19
New Events/sec 367

PI Server PING Status

PI01 
PI02 
PI03 

Hardware

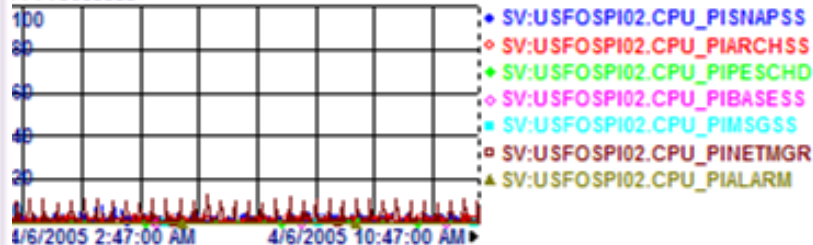
PI Server CPU, Disk and Memory

Volume C: (OS) 12423 Free Mb
Used Space: 
Disk Read Time %: 0.00
Disk Write Time %: 0.18
% Processor Time (10m avg): 3.73
of Processes: 57
Memory Available Mb: 1317
Pages per sec: 0
System Uptime (Days): 79
Volume D: (Apps) 16381 Free Mb
Used Space: 
Disk Read Time %: 0.00
Disk Write Time %: 0.15
CPU Usage (%)
CPU0: 2.54
CPU1: 1.27
Volume E: (Archives) 122453 Free Mb
Used Space: 
Disk Read Time %: 0.00
Disk Write Time %: 0.04

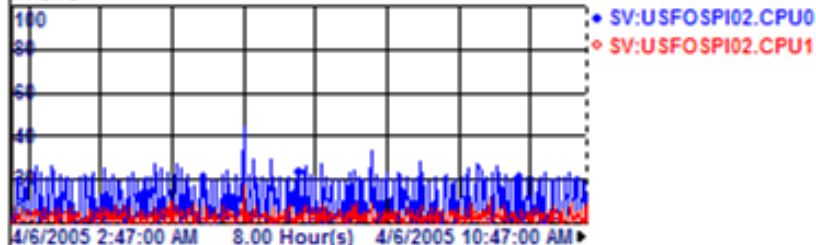
Network Port

Bytes Sent/Sec 14936 Bytes Received/Sec 11580

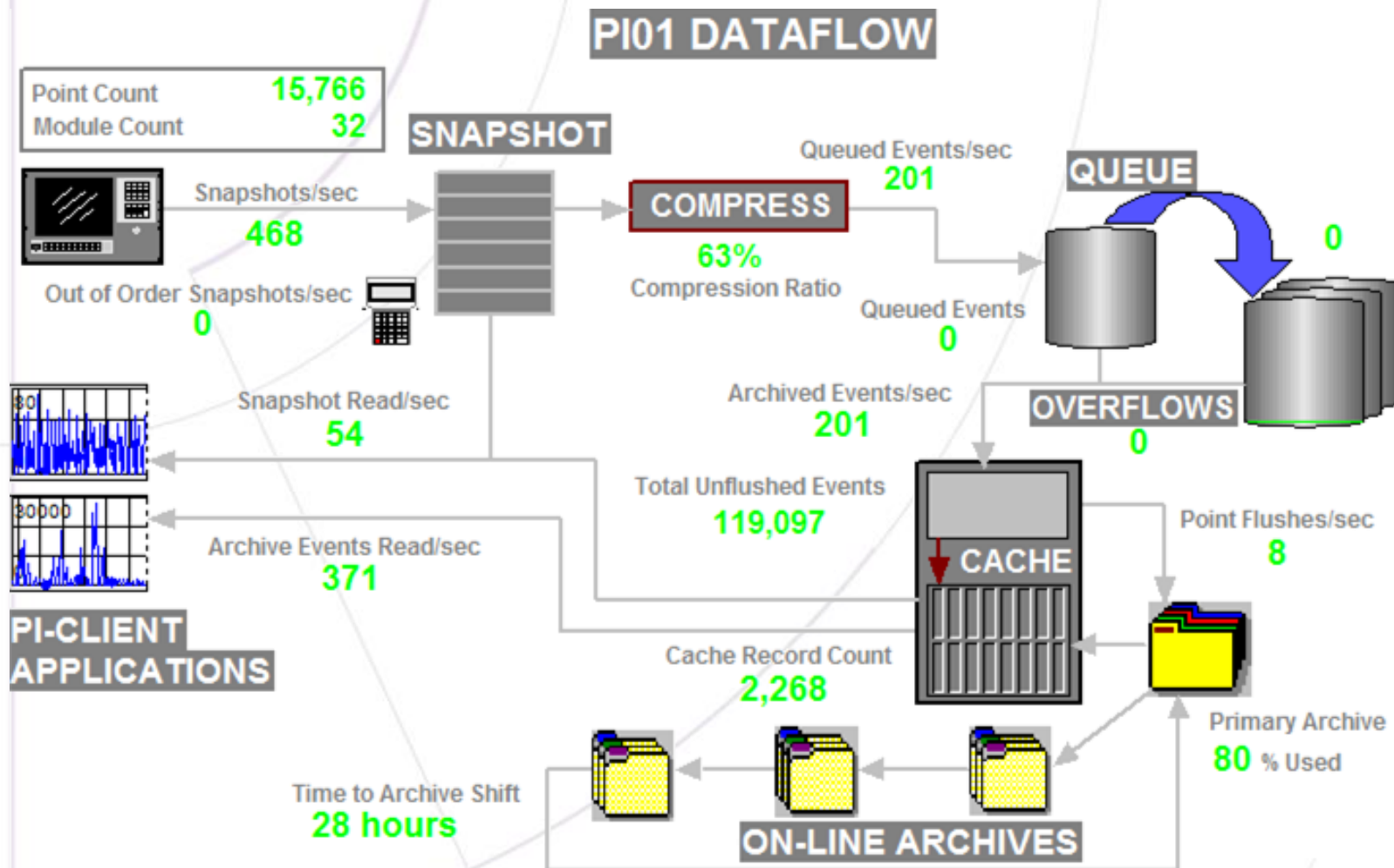
PI Processes



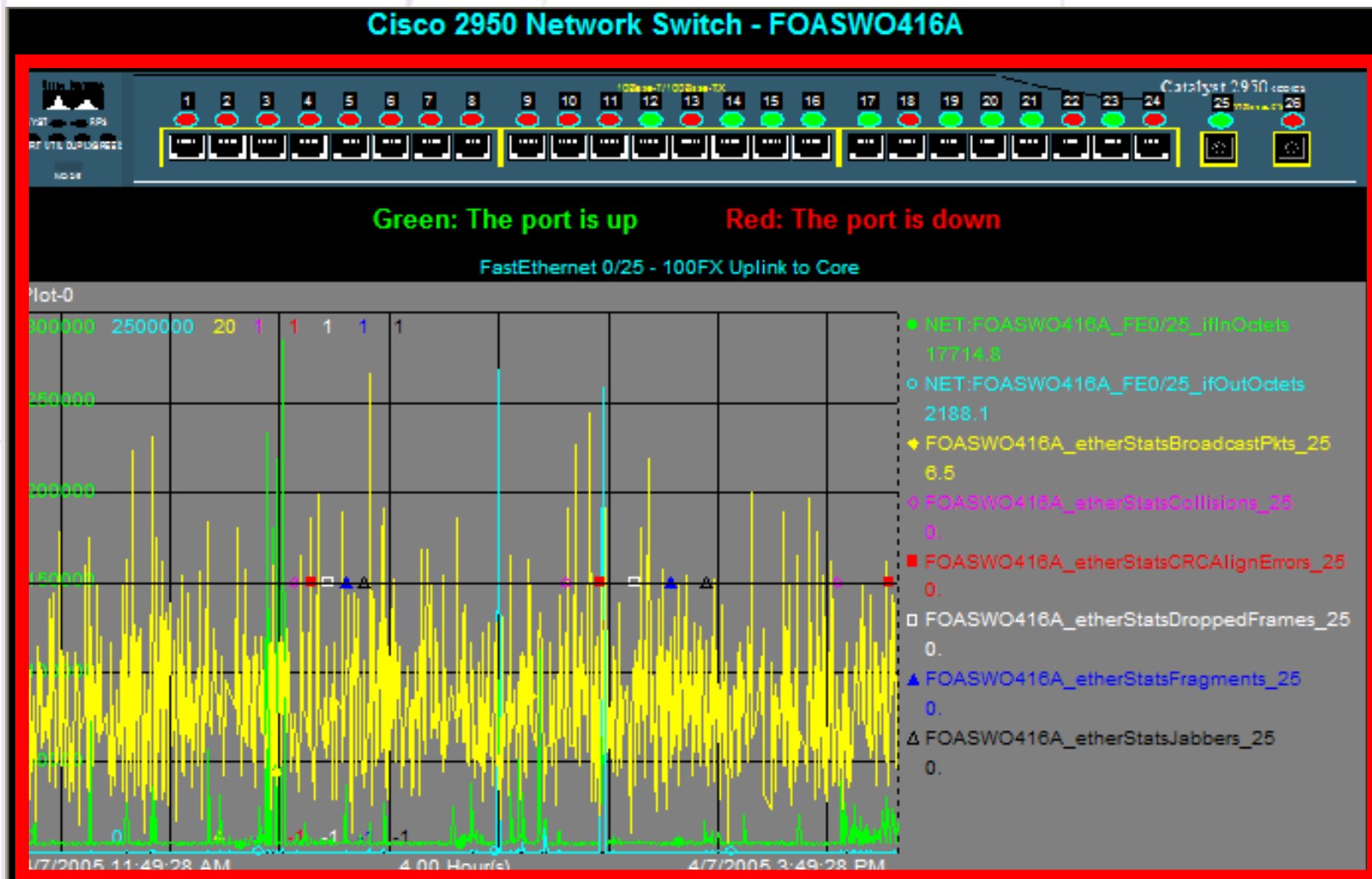
PI CPU



EXAMPLES

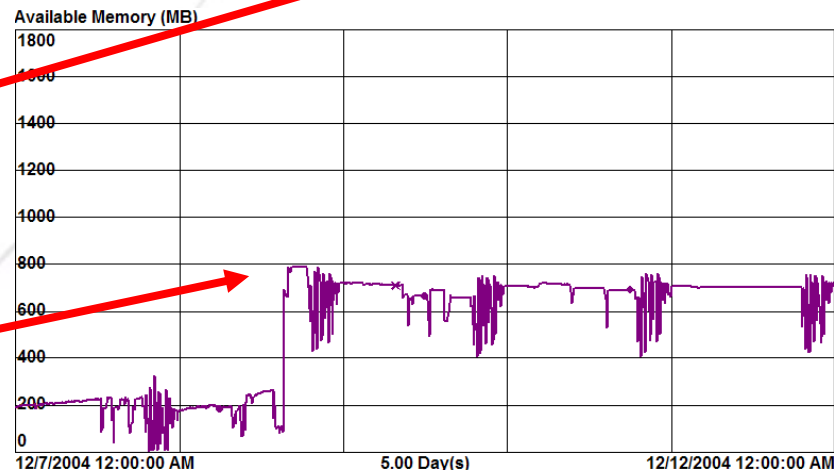


EXAMPLES



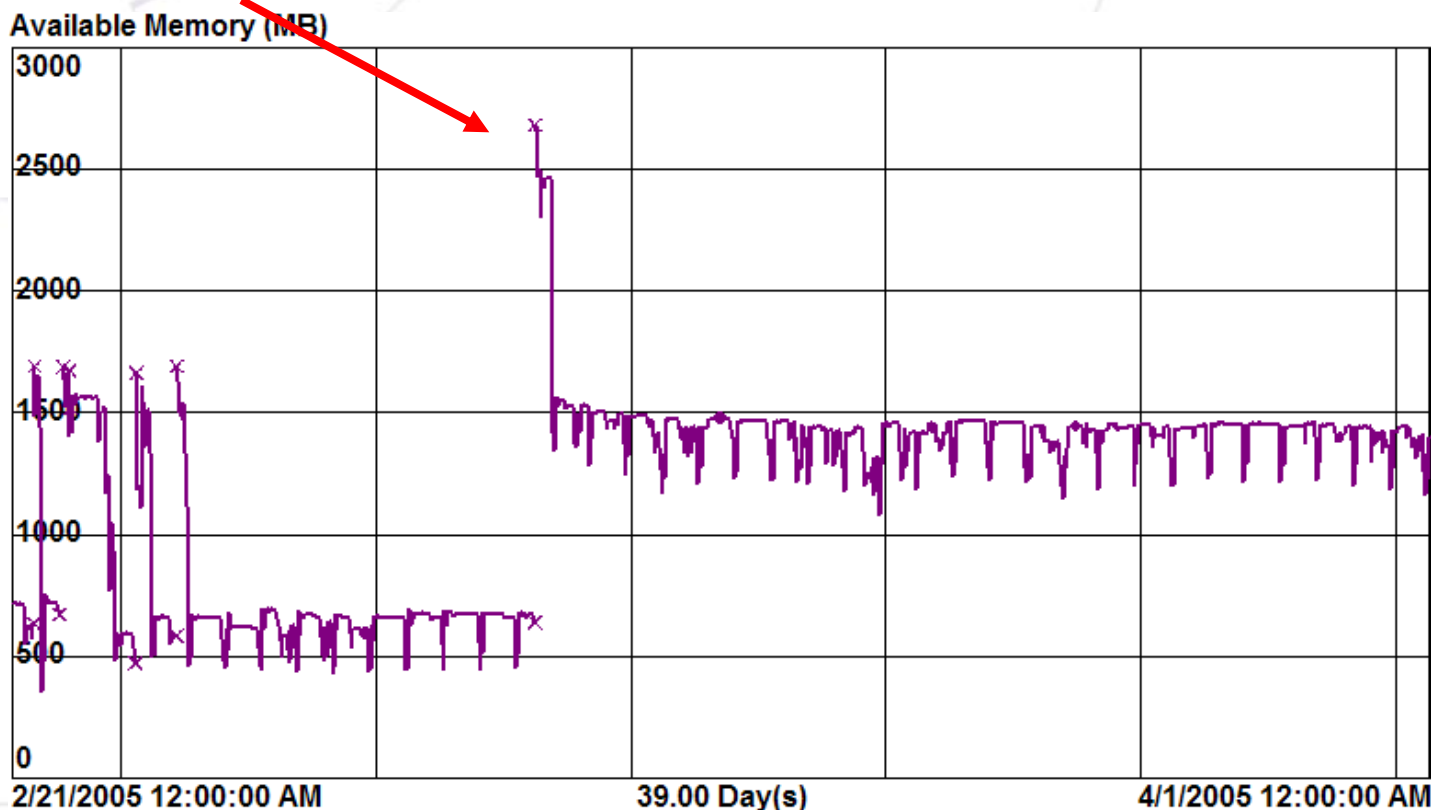
RESULTS – CASE 1A

- SQL Server running several apps (Valve tuning, PI-PB, weather data I/F)
- Periodic crashes occurring without clues to why in event log
- Upon reboots, server had plenty of memory until next run of nightly reports
- SQL reports grabbing all available memory and not letting go
- Limited the amount of memory available to SQL so that it would be available for other apps



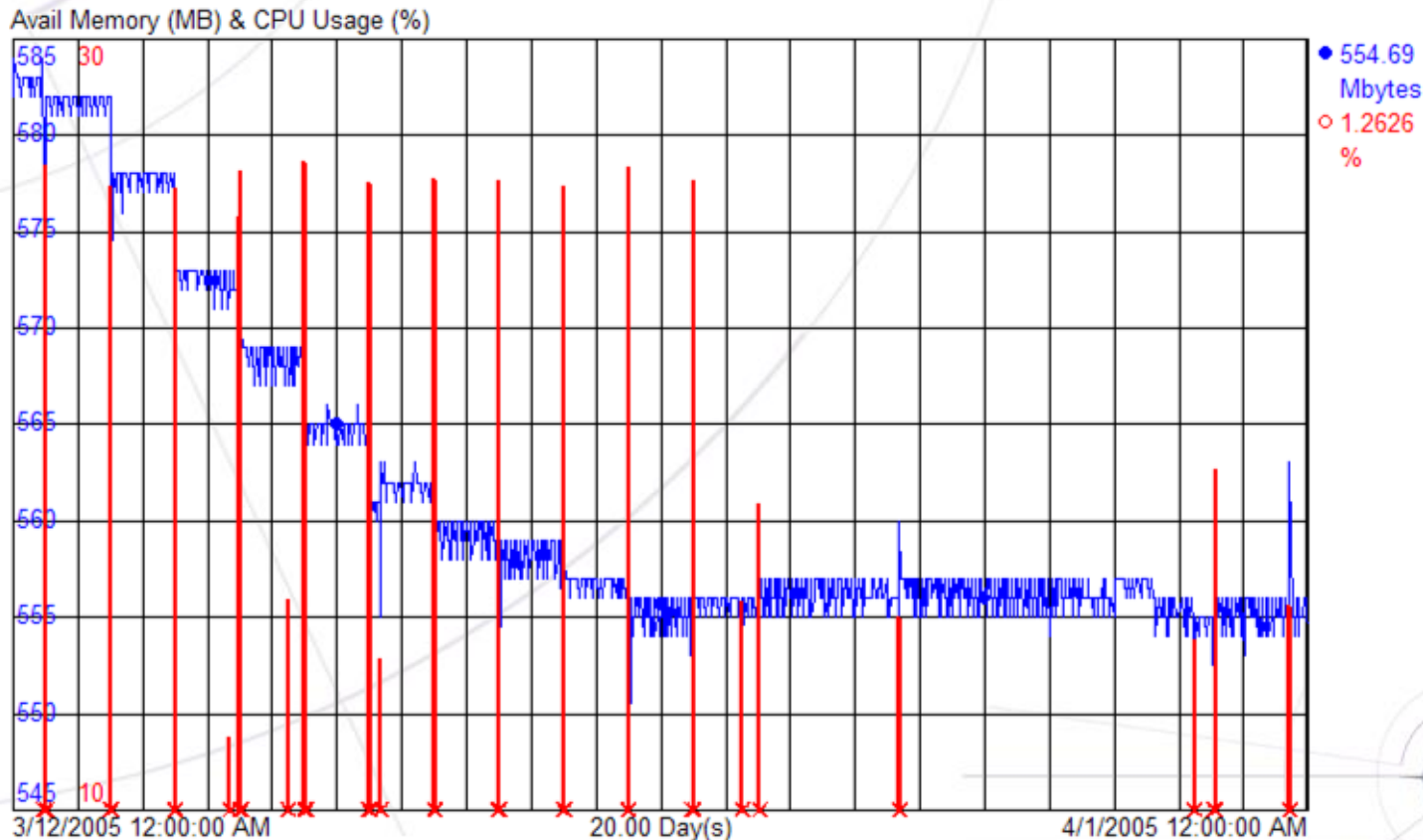
RESULTS – CASE 1B

- Still experiencing server crashes after limiting available memory for SQL
- Documented results justified addition of more server memory, even though we already had 2 GB
- Added 1GB memory to server; no more problems



RESULTS – CASE 2

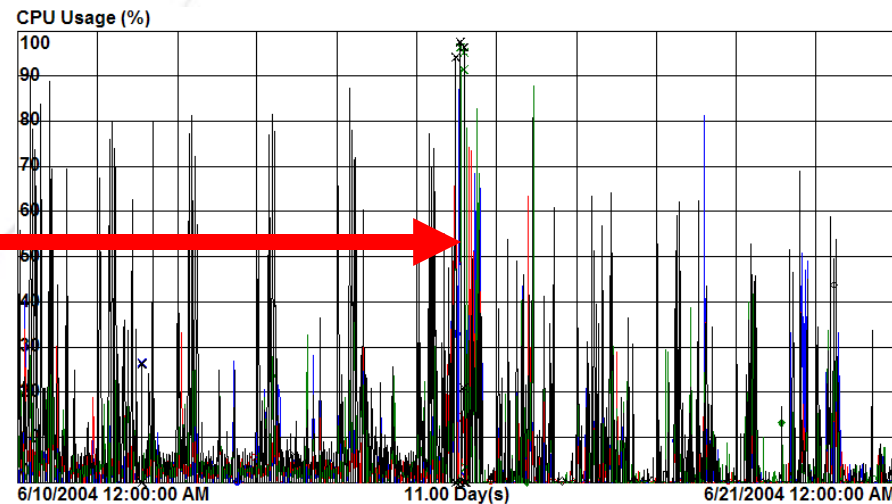
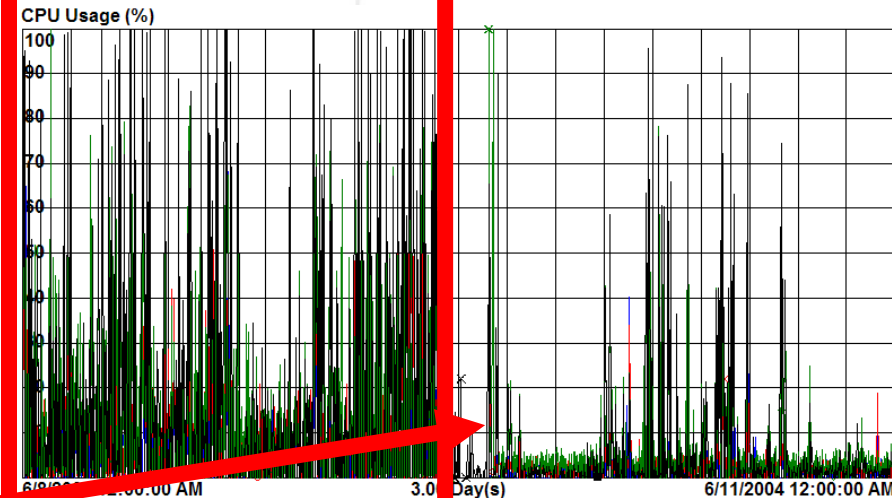
- Discovered slow memory leak on a Server 2000 machine that had step change drops when CPU spiked each day
- Happening on other servers, but not all – only Server 2000 OS
- Problem due to AV scans on Server 2000 machines
- Changed AV scan settings to fix memory leaks



RESULTS – CASE 3

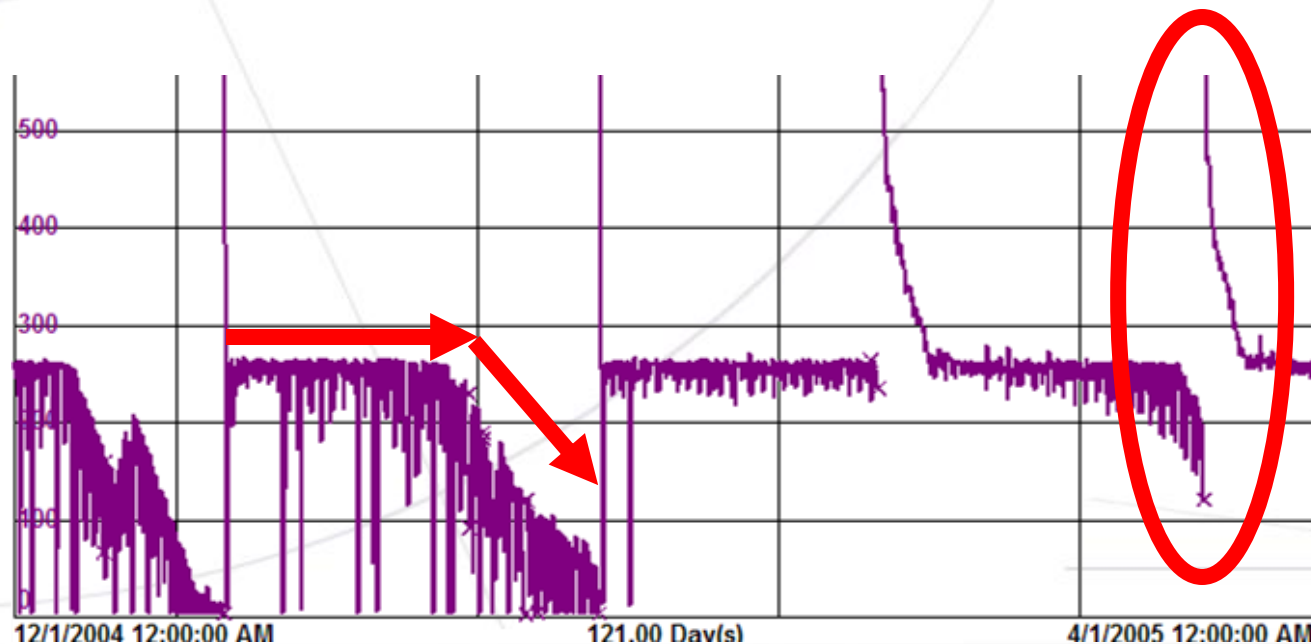
- PI server

- Performance problems
 - morning reports maxing out CPUs
 - taking up to 10 minutes to run one particularly large report
- Justified new server using same PI UDS 3.3 (3.4 with multi-threading not available, yet)
 - Reduced CPU usage
 - same report runs in 30 seconds
- Upgraded to PI UDS 3.4 with multi-threading:
 - same report now runs in 4 seconds
 - spread spikes out during peak usage periods
 - Impact most likely larger if done without hardware upgrade



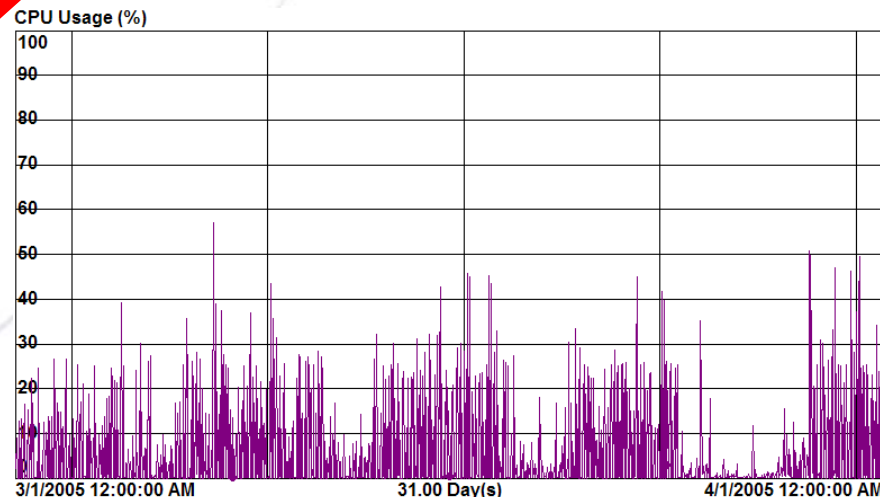
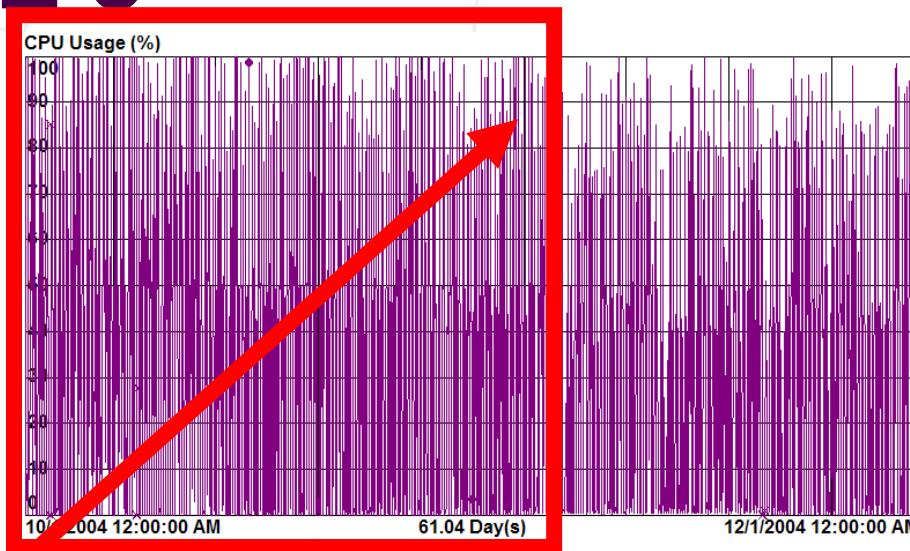
RESULTS – CASE 4

- Experiencing server crashes on another server
- Memory stable for a while, then suddenly starts dropping
- Until root cause can be found, performing controlled/scheduled reboots at start of drop rather than waiting for crash
- Next step: create memory tags for individual processes to determine which process having problems



RESULTS – CASE 5

- Shipment Scheduling application server
 - Performance problems: very slow response over several months
 - Trends showed very high CPU usage
 - Increased memory from 500MB to 1GB; slight CPU improvement, but still high
 - Able to show that hardware was impacting performance & justified purchase of new server
 - Big improvement



RESULTS - Summary

- Server “dashboard” graphic
 - invaluable tool used every day to highlight problems before serious consequences
 - since it is easy to modify, it is kept up to date as servers added, deleted & changed
- All of the data viewed was available with Windows Performance Monitor in real-time, but...
- IT Monitor allowed easy view of historical data over long periods
 - key to finding SLOW memory leaks that are hard to see in short term
 - able to modify trends quickly & easily and to group items together on trends on the fly
 - key to discovering problems in a timely manner



RESULTS - Summary

- Troubleshooting

- SQL reports grabbing all available memory and not letting go
- Server 2000 memory leaks upon AV scans
- Perform scheduled reboots per trend data to avoid crashes

- Upgrade Justification

- New Shipment Scheduling application server
- New PI server

- Capacity Planning

- Raid Sets: Purchases based on disk usage monitoring
- Server Consolidation
 - Previously had multiple under-utilized servers
 - Used IT Monitor to look at required resources and determine how much server consolidation was possible
 - **Server consolidation project: annual savings of K\$25**



FUTURE PLANS – Short Term

- Implement IT Monitor on all switches and routers
 - Individual graphics for each
 - Overview/dashboard graphic similar to server dashboard
- Implement PI-ModuleDB with PI-PB3 for faster graphical review
- Use SNMP interface to monitor Frame Relay (WAN)



FUTURE PLANS – Long Term

- Use SNMP interface to monitor:
 - SNMP enabled UPS units & PLCs
 - Wireless Network
 - Firewall/VPN
 - Existing Intrusion Prevention System
 - Performance of application specific processes (SQL, IIS, DMS) similar to existing monitoring of PI processes
- Use NetFlow interface for Layer 3 network application & security analysis
- Threshold exception notification/alerting?



QUESTIONS / COMMENTS?

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**Thank you for your time and
interest!**

