

Performance Monitoring with Performance Data Investigator

Erik Knudson
Senior Technical Consultant
erik.knudson@siriuscom.com

Agenda

- Options for performance monitoring and analysis
- What's new
- Pre-requisites and getting started
- Health Indicators
- Performance Investigator
- Monitors
- Documentation

Performance Monitoring Options

Lots of ways, old & new to review IBM i performance

- 5250 Performance Tools menu
- Commands (e.g., WRKSYSACT)
- IBM i Navigator monitors
- iDoctor and PEX analyzer
- PM/400
- HMC V8 hardware monitor
- PowerVP
- Job Watcher / Disk Watcher
- Navigator for i Performance Data Investigator

Getting Started

- At least V6R1 of IBM i
- Performance Collection needs to be active
- The HTTP *ADMIN server must be active
- Performance Tools are needed for some options
- Current PTF groups are recommended
 - HTTP
 - Java
 - Database
 - Performance Tools

Collection Services

- Collection Services is an IBM process that collects system and job level performance data
- IBM recommends running collection services whenever production is running
- System overhead is minimal
- Collects data at intervals, from every 15 seconds to hourly
- Data automatically expires (you may wish to copy some collections for long term analysis)
- Data is used for Performance Tools, PM/400, and Performance Data Investigator

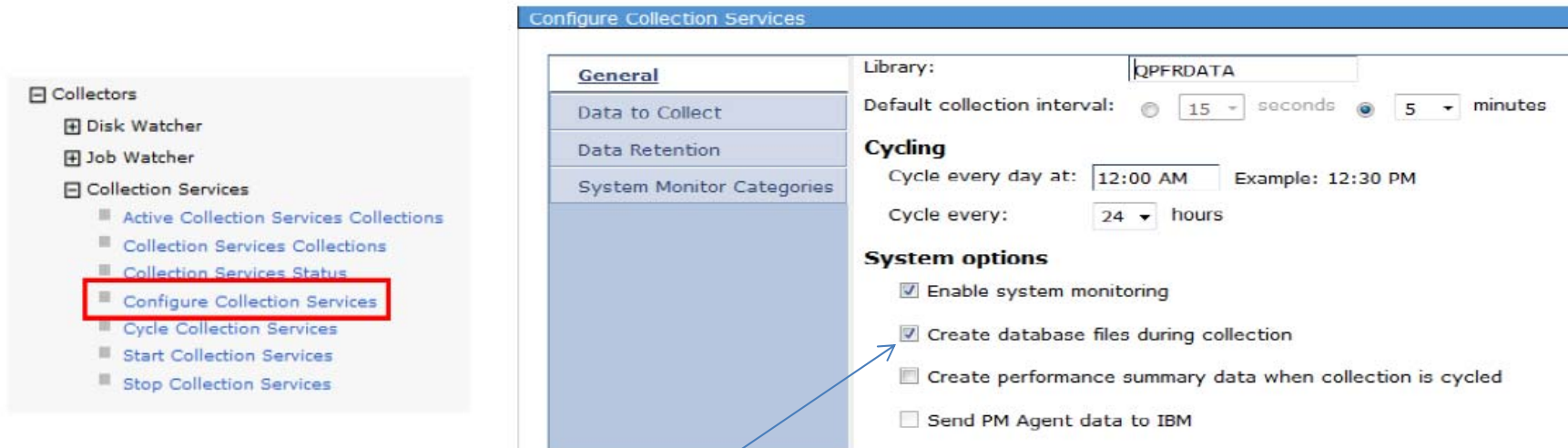
Collection Services Categories

- System Bus
- Memory Pools
- Hardware
- Subsystems
- CPU
- System Data
- Jobs
- Tasks and Threads
- Response Time
- APPN / SNA
- TCP/IP
- TCP/IP Details
- Extended Cache
- Domino
- Apache server
- LPAR details
- WebSphere
- Java VM
- Removable Storage*
- External Storage*
- System Internals*
- SQL**

*=new in 7.1

**=new in 7.2

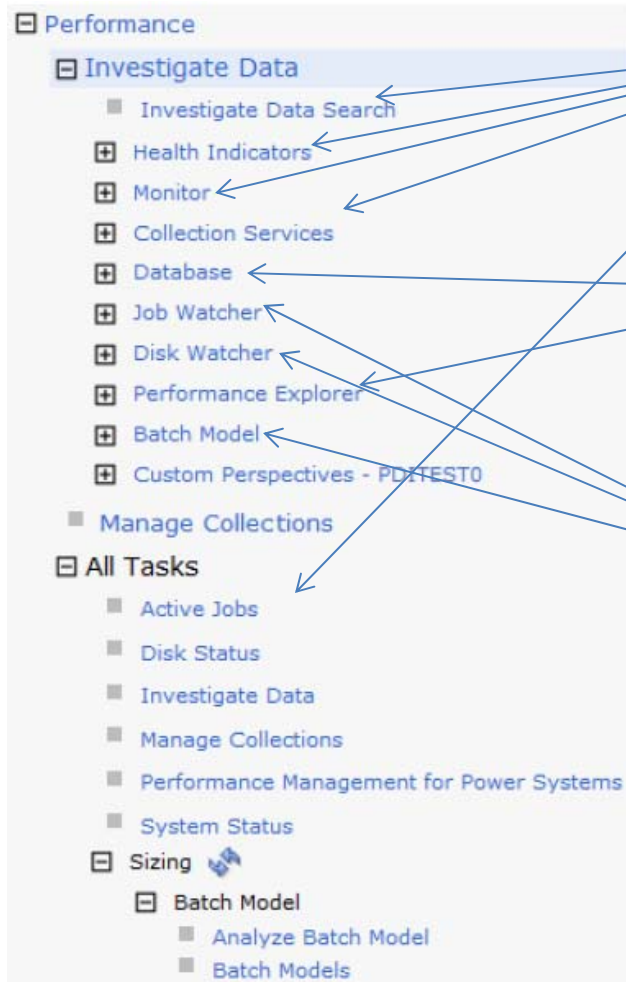
Activating Collection Options



Required for Performance Investigator

Command line equivalents include STRPFRCOL, CFGPFRCOL

Required software

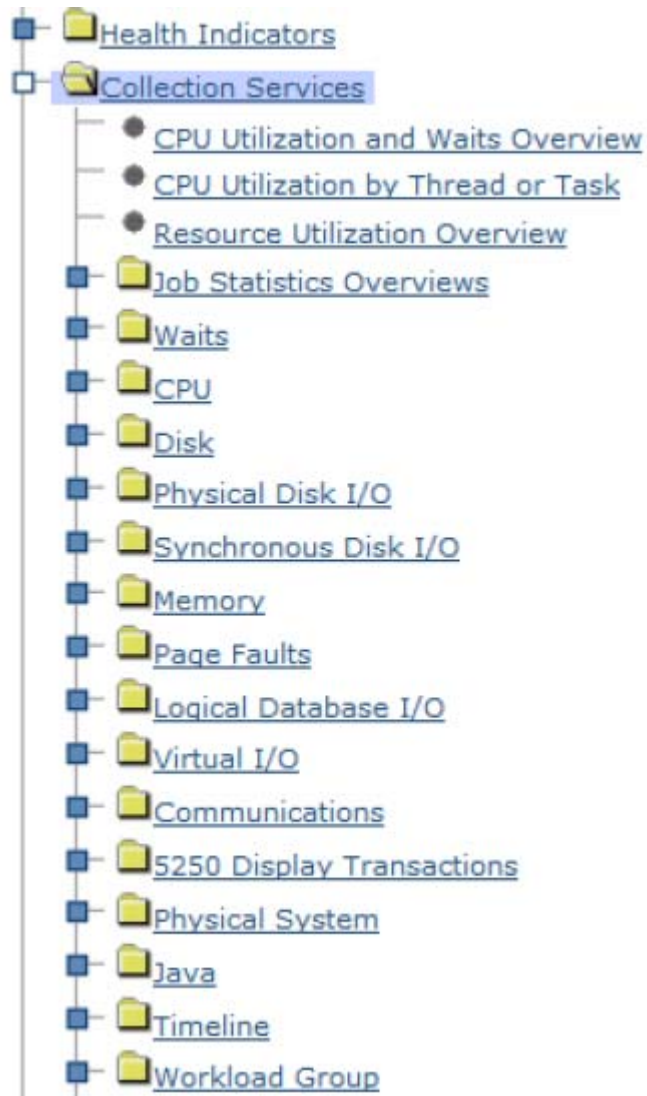


Base operating system

Performance Tools

Performance tools features

Included in Collection Services



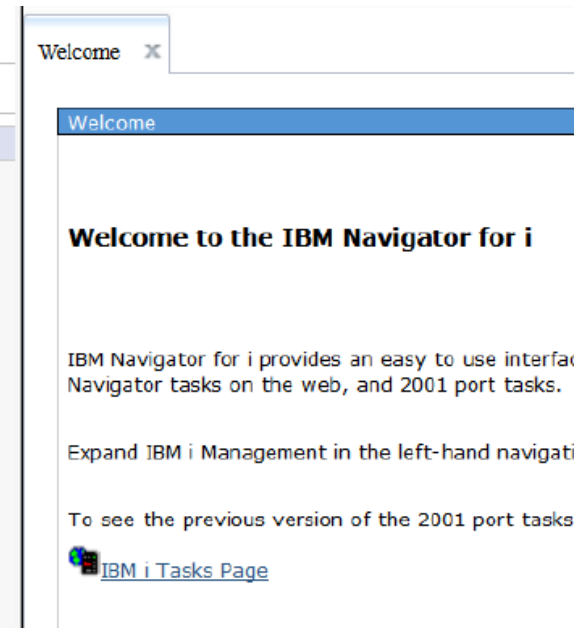
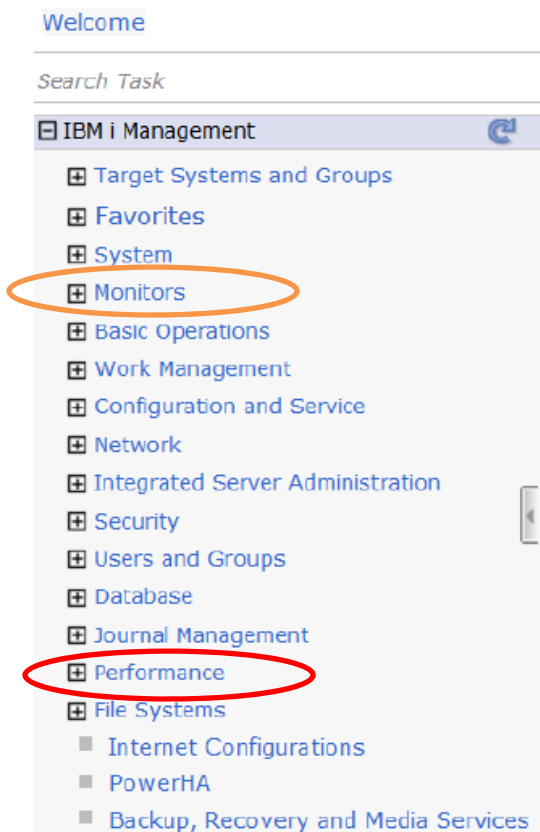
Base operating system includes many areas for analysis

Navigator for i

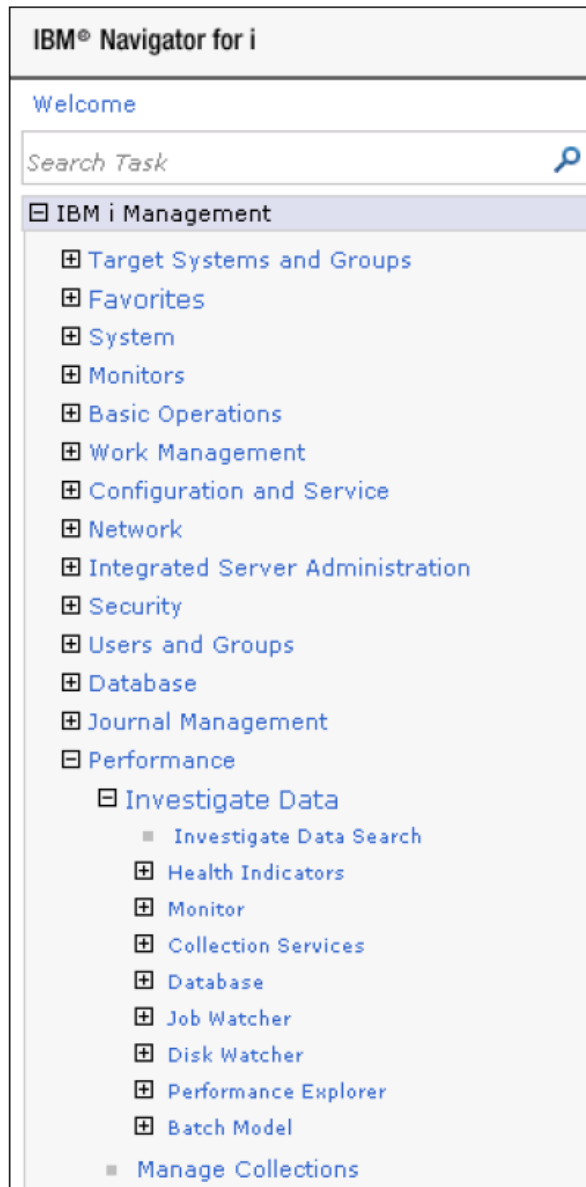
IBM Navigator for i is the web console for managing your system

- Navigator for i essentially replaced System i Navigator
- System i Navigator will not be updated past 7.1
- HTTP *ADMIN server must be running, STRTCPSVR SERVER (*HTTP) HTTPSVR (*ADMIN)
- Just point your browser at <http://IBMiIPAddress:2001>
- Traditional admin server tasks (DCM, HTTP management, etc.) are available too

Navigator for i Interface



Performance Data Investigator



Open Navigator for i, then expand “Performance” and “Investigate Data”

If users have access problems, add them to the QPMCCDATA and QPMCCFDN authority lists

Health Indicators

The “Health Indicators” section gives you a quick red/yellow/green light on performance

Expanding “Health Indicators” shows:



V7.2 only

Selecting data to view

Select an indicator to view, then a library with performance collections, and a collection (typically a day) to view, then “Display”

Perspectives

- Health Indicators
 - System Resources Health Indicators
 - CPU Health Indicators**
 - Disk Health Indicators
 - Memory Pools Health Indicators
 - Response Time Health Indicators
- Collection Services
- Database
- Disk Watcher
- Performance Explorer
- Custom Perspectives - EKNUDSON

Selection

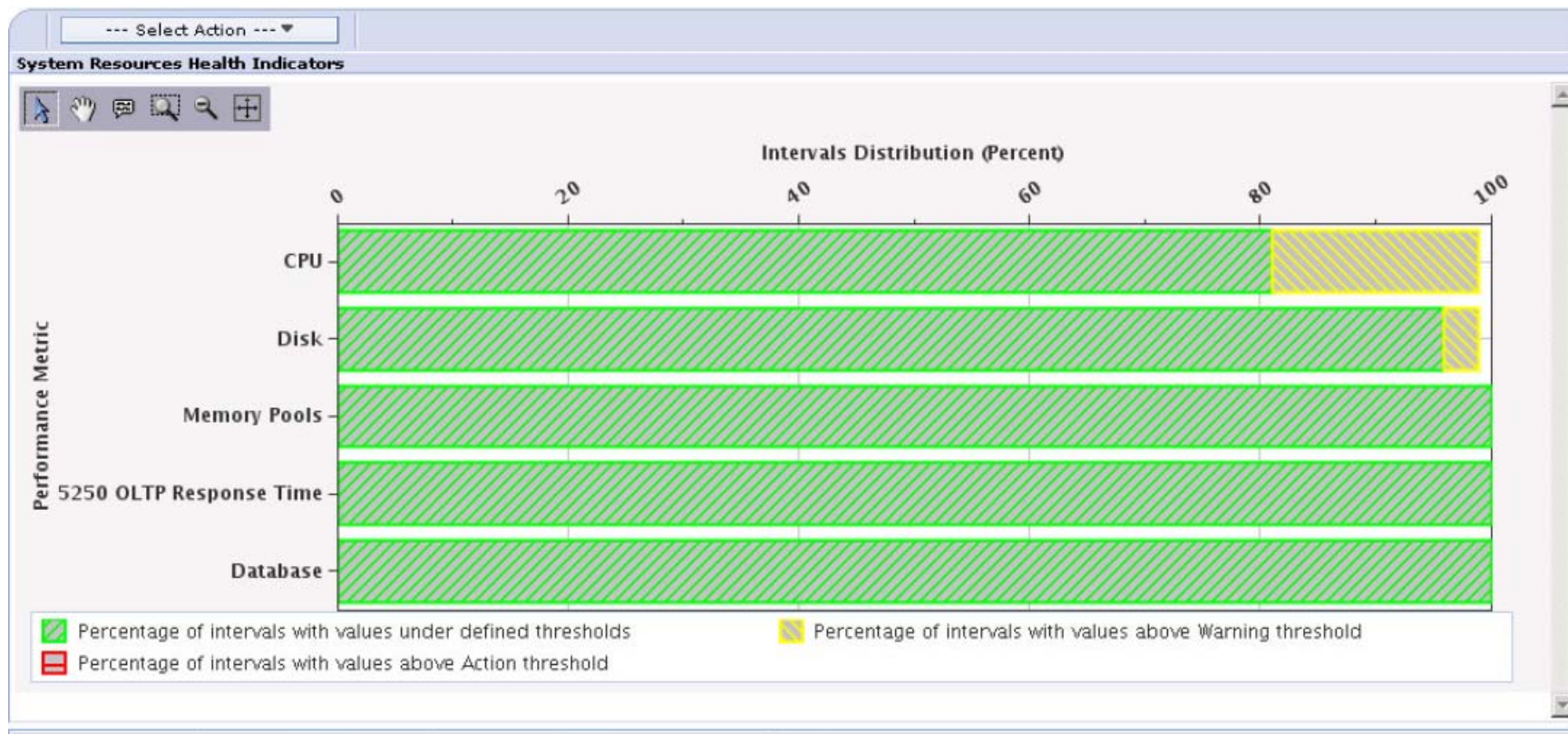
Name
CPU Health Indicators

Collection

Collection Library	Collection Name
SIRIUSPFM	Q099000114 (*CSFILE) - Apr 9, 2015 12:01:14 AM

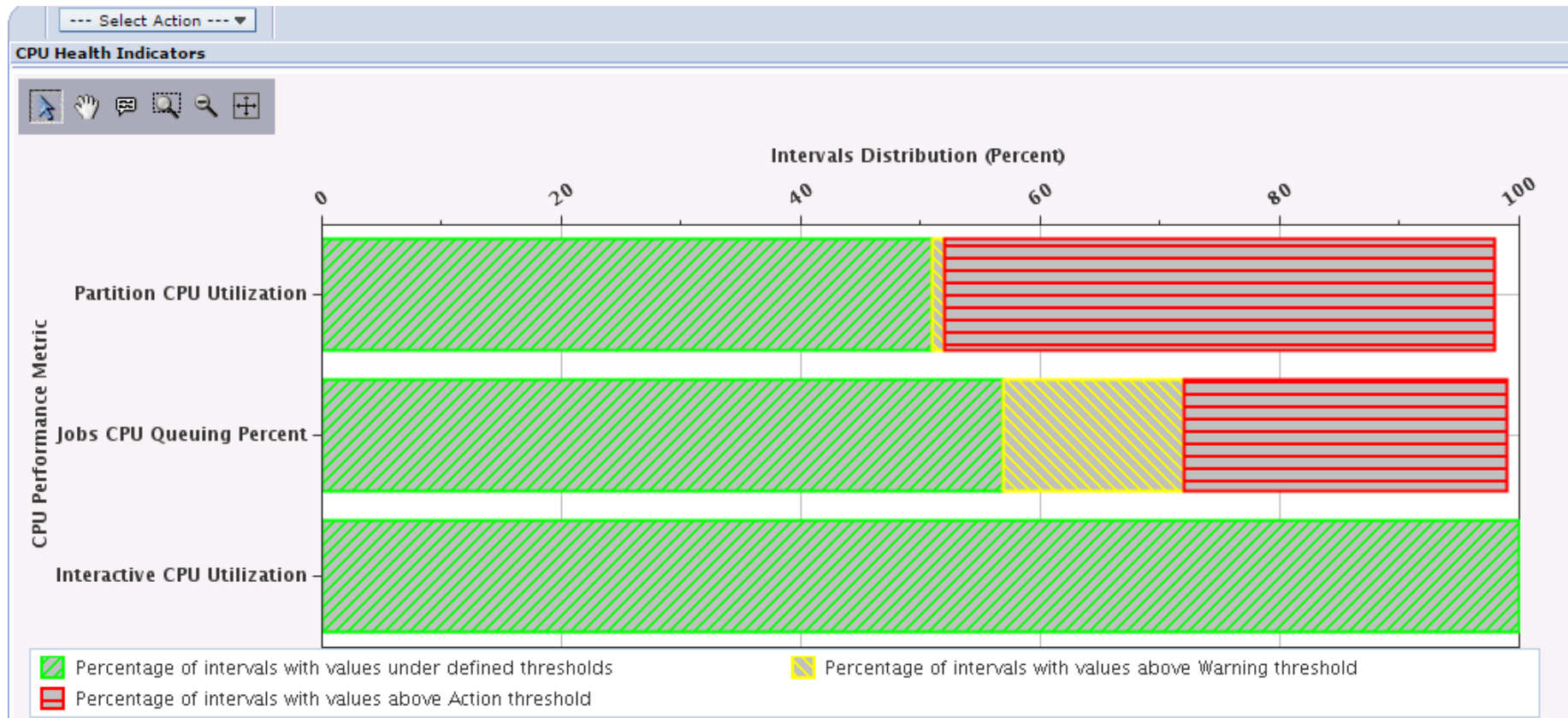
Display Search Options Close

Health Indicators



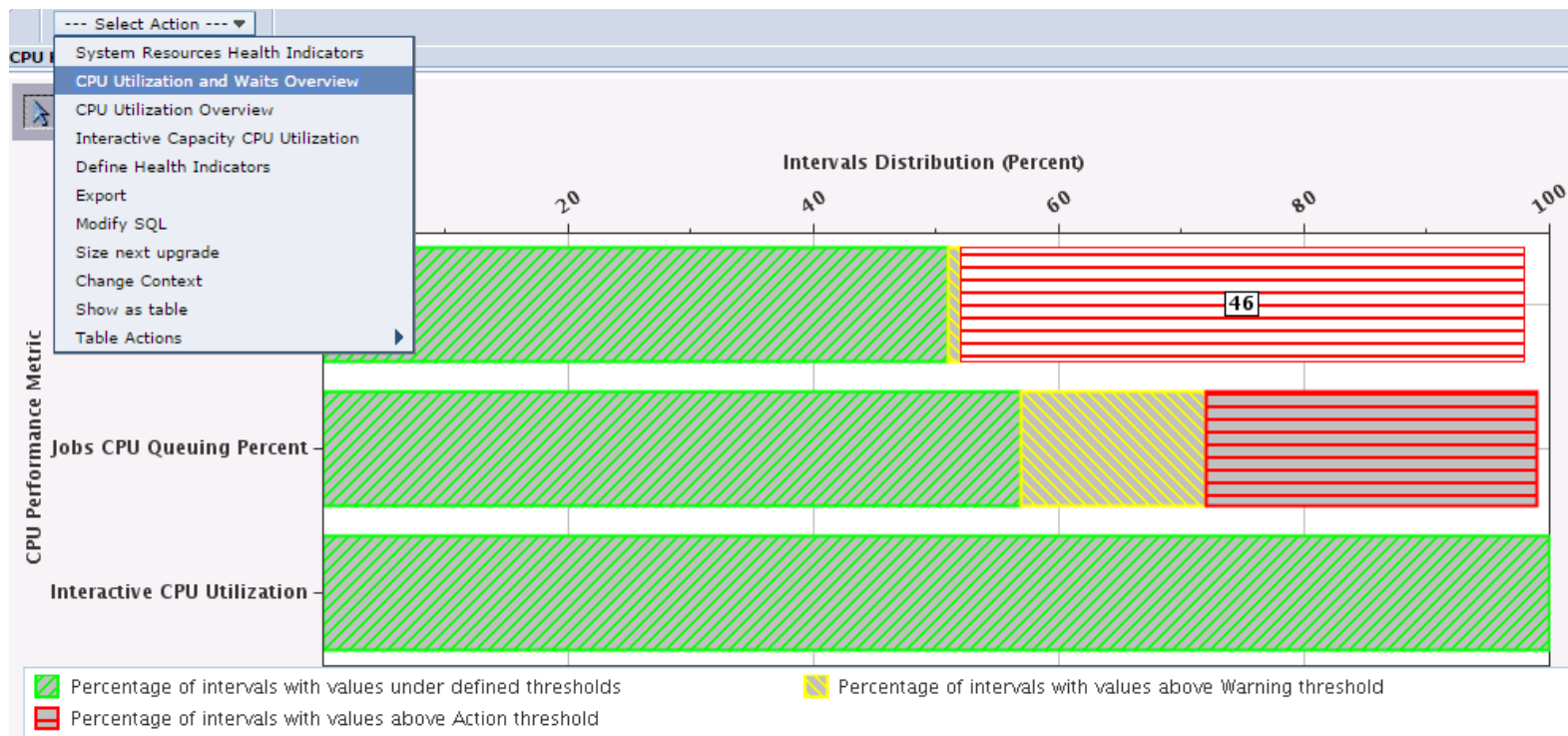
The bar shows green if all indicators were below thresholds. If some indicators exceeded “warning” or “action” thresholds in some intervals, the bar will show yellow or red for the percentage of intervals that exceeded thresholds

CPU Health view



For CPU, the default is to show yellow if CPU exceeded 85% and red if CPU exceeded 90% during an interval. If 10 jobs were queued waiting for CPU in an interval yellow is shown, 20 jobs queuing causes a display of red (these thresholds can be changed)

Drill down or up



The “Select Action” button allows options within the data, including showing related graphs for a selection, exporting the view, changing the red/yellow/green defaults, showing the underlying data, and even editing the SQL that creates this view

Collection Services search

New in 7.2, “Investigate Data Search” helps you find what tools and options are available to you



Investigate Data Search

disk Case Sensitive Whole Words Only
Found 121 results for 'disk'

Search In:

- Package Name Description Metrics
 Perspective View SQL

Show Columns:

- Metrics
 SQL

Package Name	Perspective	Description
Health Indicators	Disk Health Indicators	This chart shows Disk health in accordance to the defined threshold proportion of intervals where D thresholds.
Monitor	Disk Arm Utilization (Average)	Charts show the disk arm utilization monitored, as well as the metrics.

Other Performance tasks

- [-] Performance
 - Investigate Data
 - Manage Collections
- [-] All Tasks
 - Active Jobs
 - Disk Status
 - Manage Collections
 - Investigate Data
 - Performance Management for Power Systems
 - System Status

The most common 5250 screens used for viewing current performance are also available.

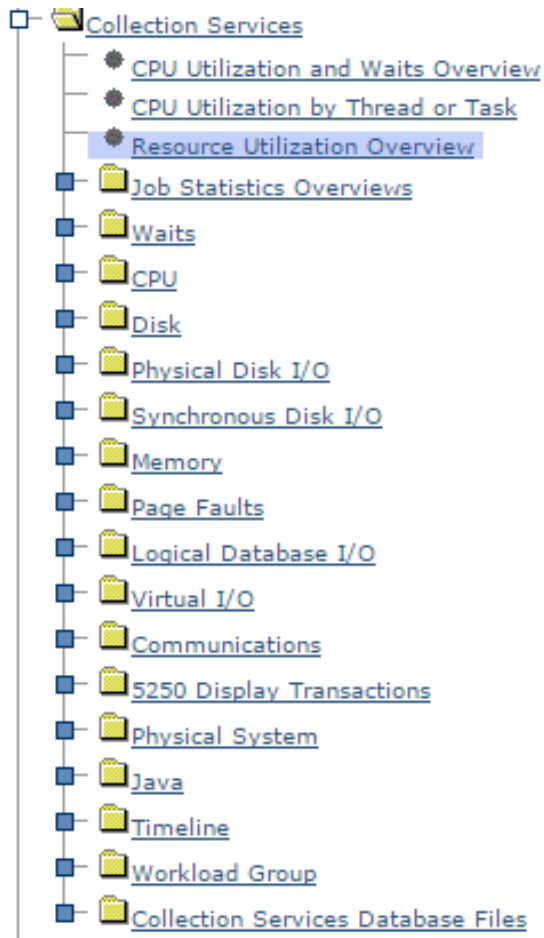
Disk Status - 172.22.51.164

Refresh Elapsed time: 00:07:23

Actions Filter

Unit	Type	Size (MB)	% Used	% Busy	I/O Requests	Request Size (KB)	Read Requests	Write Requests	Amount Read (KB)	Amount Written (KB)
No filter applied										
1	2145	76,355	37.2	0	1.5	32.6	0.7	0.8	36.3	29.4
2	2145	76,355	37.2	0	0	0	0	0	0	0
3	2145	76,355	37.2	0	1.8	32.9	0.6	1.2	36.1	31.3
4	2145	76,355	37.2	0	0	0	0	0	0	0
5	2145	76,355	37.2	1	1.6	35.7	0.6	1	38.3	34.1
6	2145	76,355	37.2	1	1.6	29.1	0.7	0.9	36.8	23.4

Collection Services options



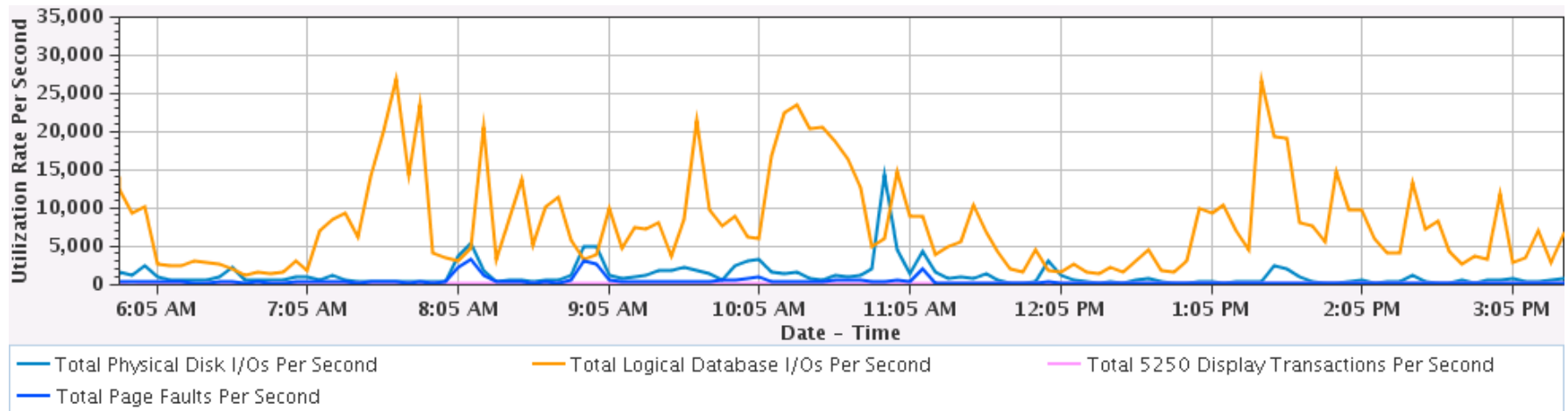
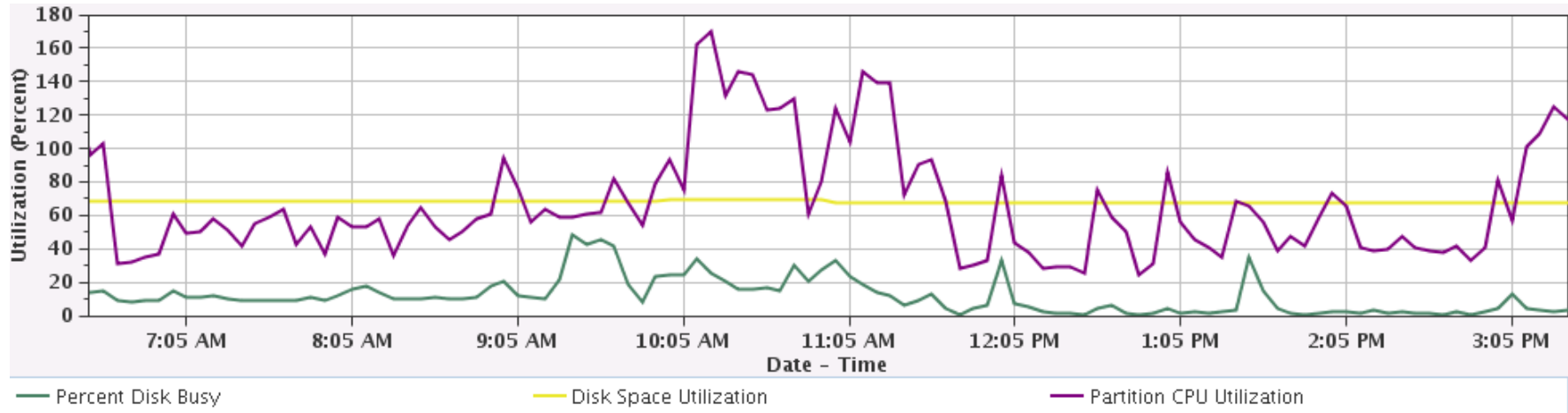
Expand the “Collection Services” folder to view the performance perspectives available.

Each subfolder can be opened to view the reports available for that type

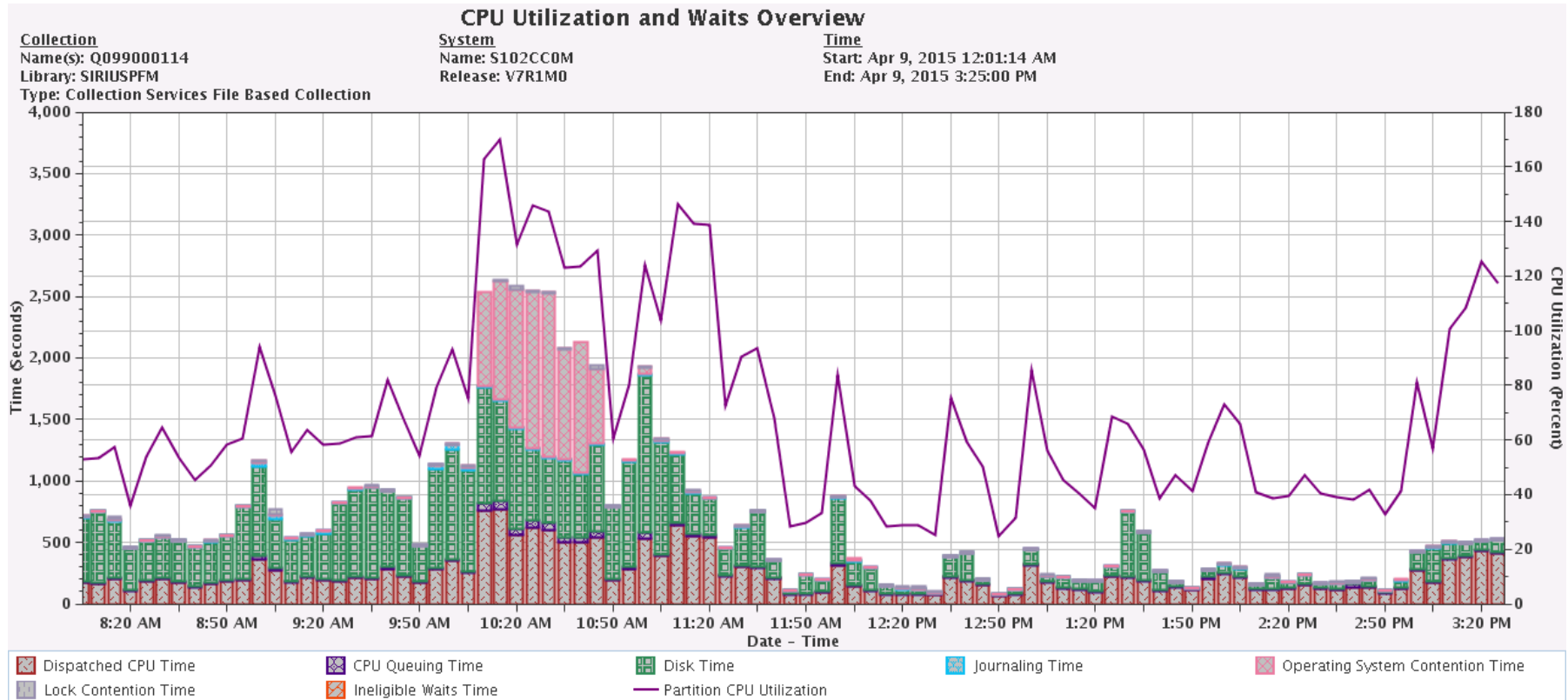
V7.2 adds storage allocation section to view temporary space usage

The Resource Utilization Overview can be a useful place to start

Resource Utilization

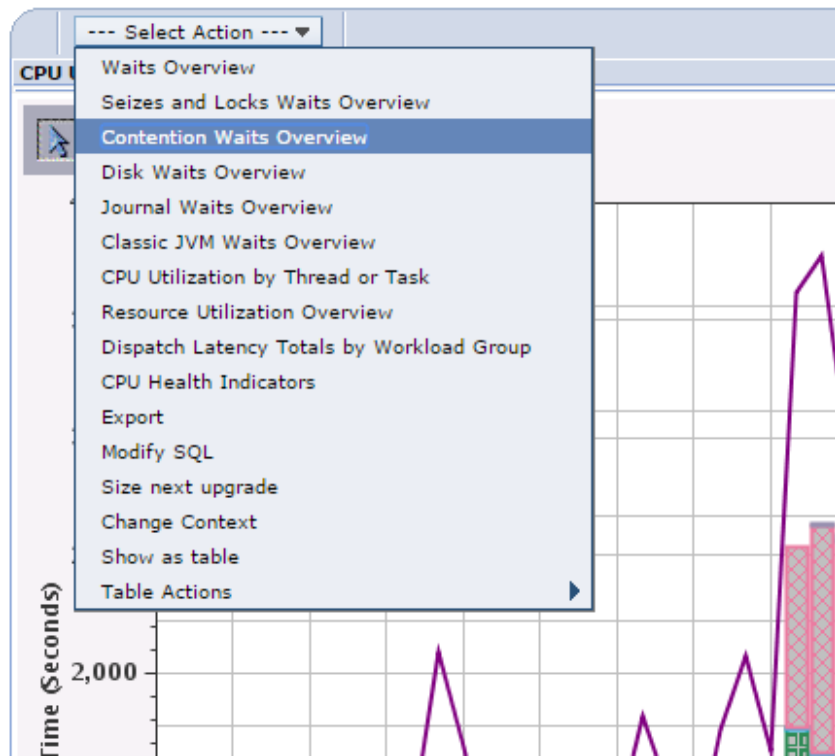


CPU Utilization and Waits



CPU Utilization and waits shows you at a high level how time was spent by jobs

Drill into CPU usage and waits

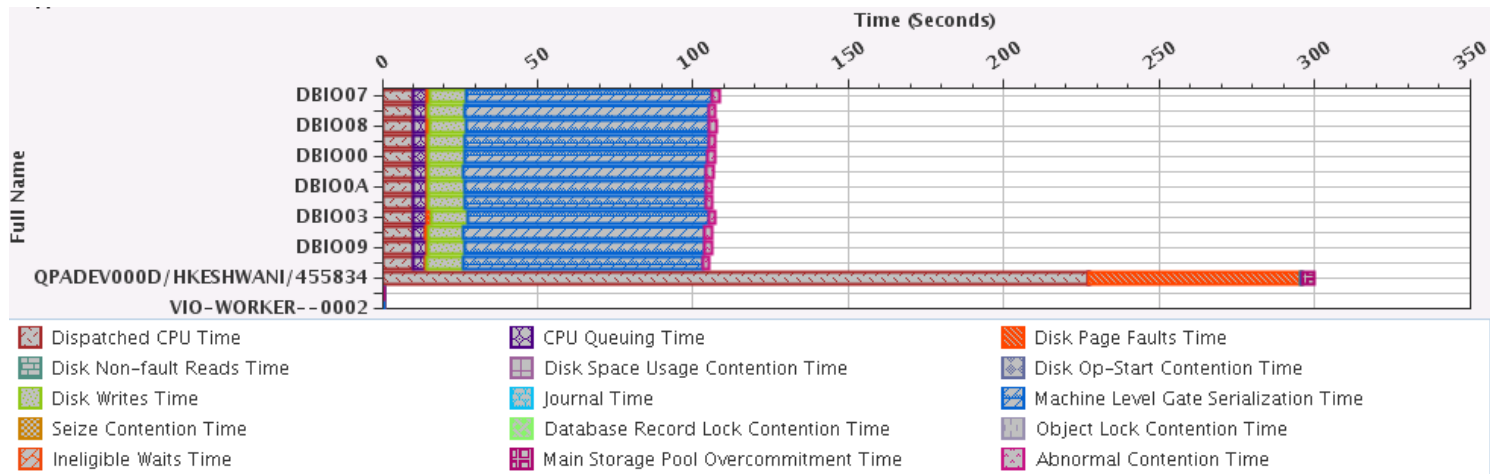
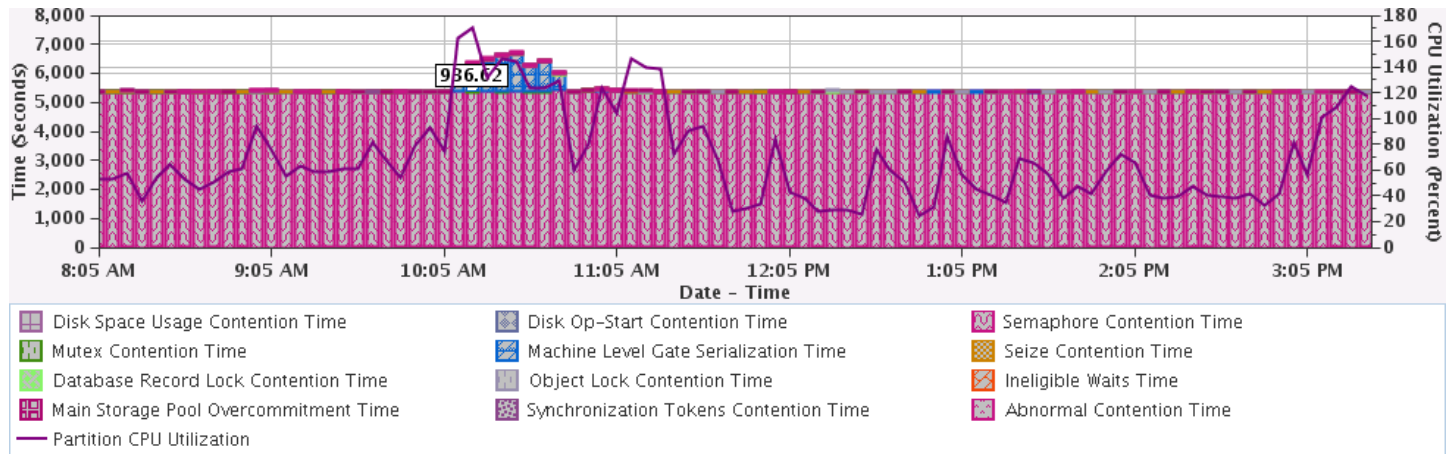


If you see waits or CPU utilization you want to look at in more detail, select to drill down

Waits are described at:

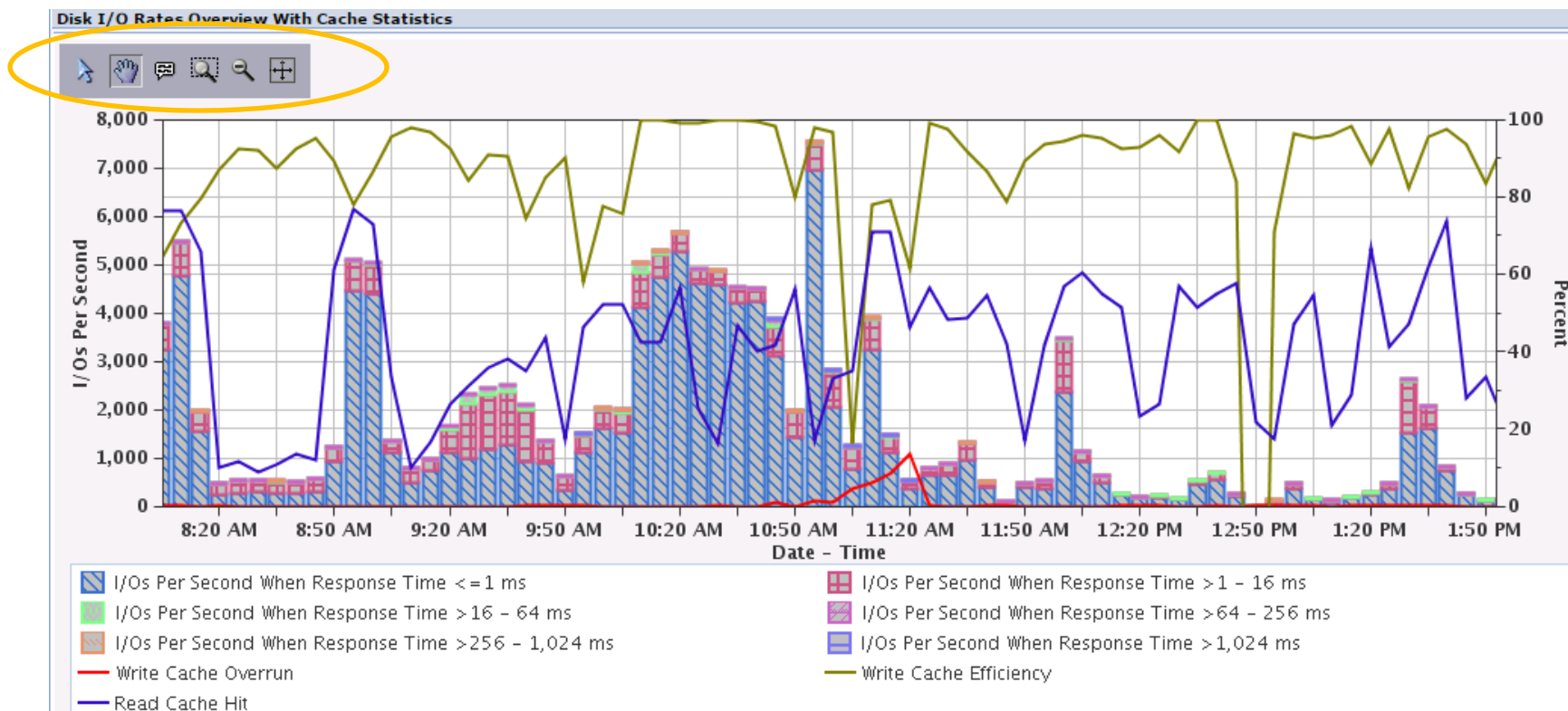
<http://www.ibm.com/developerworks/ibmi/library/i-ibmi-wait-accounting/>

Waits detail



Reporting options

The top left options allow you to: select data points and graph sections, pan the section of graph displayed, show tooltip help, and zoom the section of graph displayed



Graphs over time

Investigate Data - Performance Data Investigator

Selection

Name
Disk I/O Average Response Time Overview

Description
This chart shows disk average response time segmented by the amount of I/O time.

View List
Disk I/O Average Response Time Overview

Collection

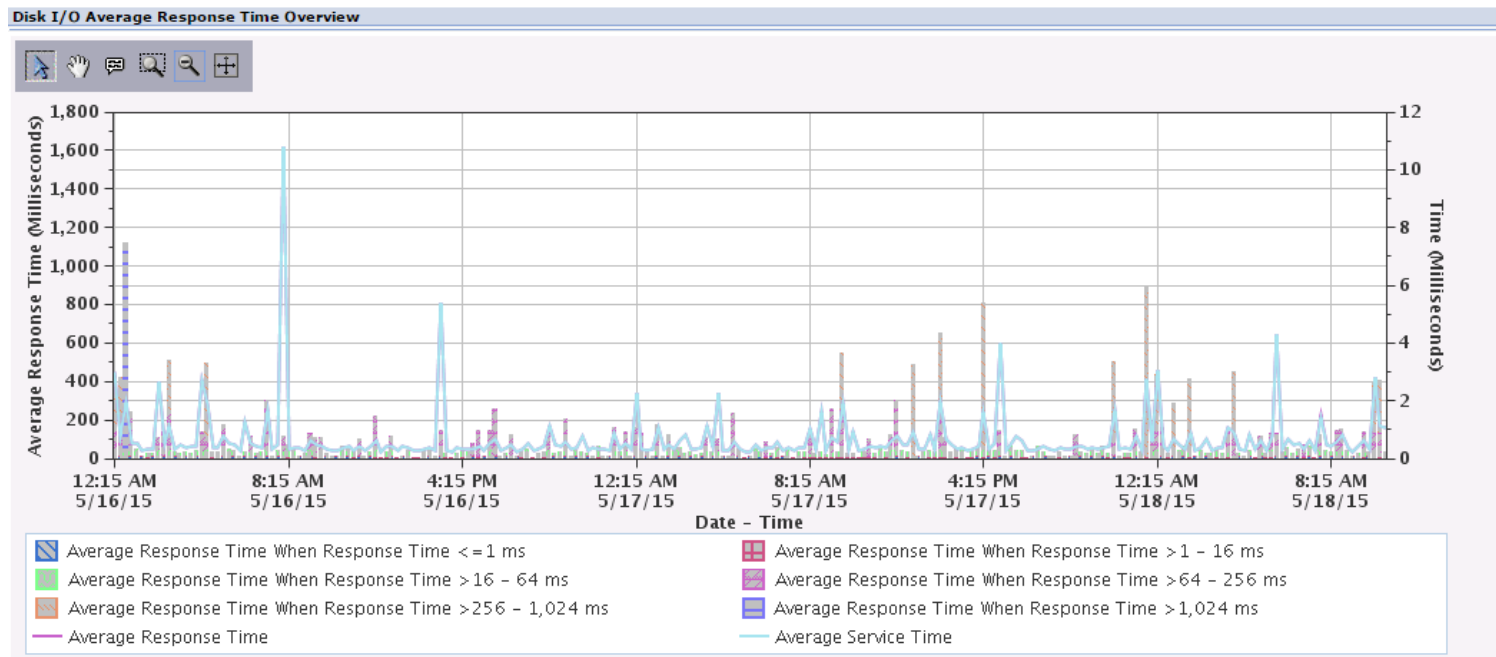
Collection Library: QPFRDATA
Collection Name: All

Buttons: Display, Search

Most Recent

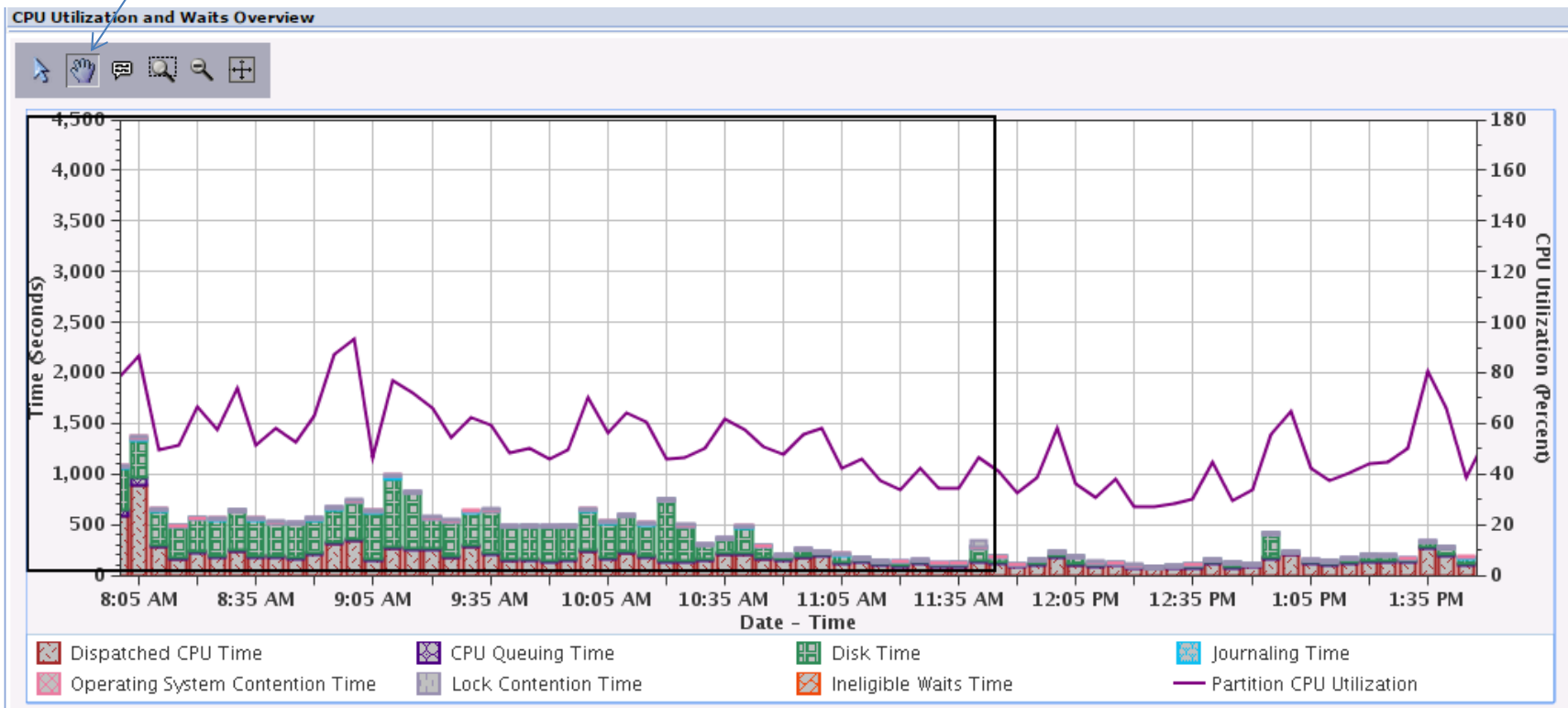
- All
- Q139000005 (*CSFILE) - May 19, 2015 12:00:06 AM
- Q138203150 (*CSFILE) - May 18, 2015 8:31:50 PM
- Q138000002 (*CSFILE) - May 18, 2015 12:00:02 AM
- Q137000002 (*CSFILE) - May 17, 2015 12:00:02 AM
- Q136000002 (*CSFILE) - May 16, 2015 12:00:02 AM

Libraries with no more than 5 collections available will also show an “All” option that allows you to see performance over the entire period



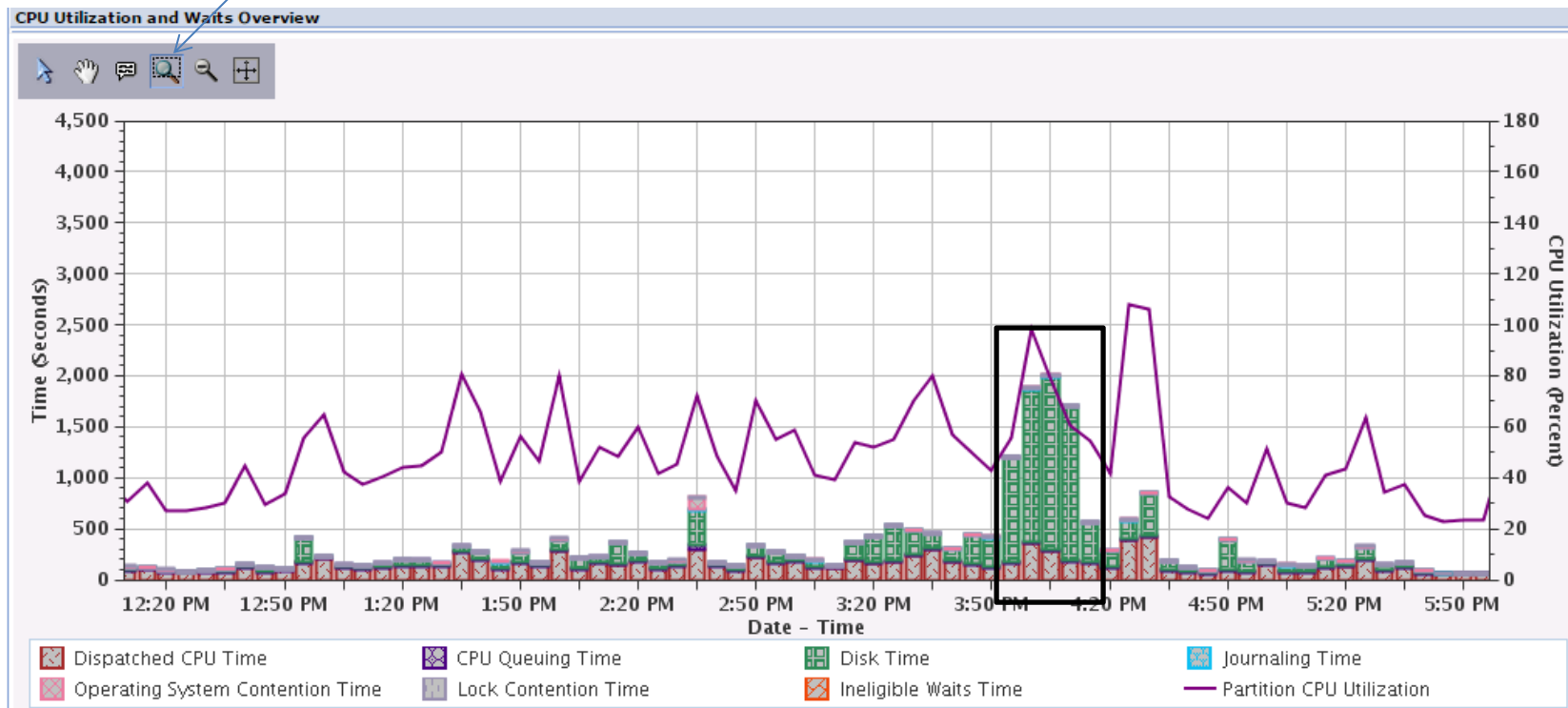
Pan

The “Pan” button lets you change the time or job window displayed



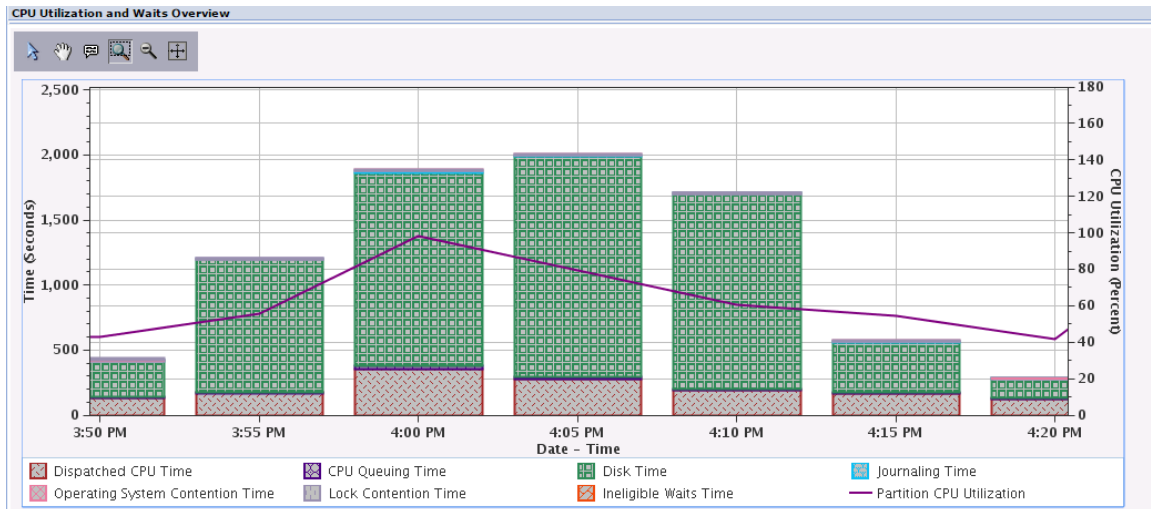
Zoom Region

“Zoom Region” lets you quickly focus on an area that appears to be of interest. Select “Zoom Region” and then select the area of the chart you want to display



Region and jobs involved

Zoomed into the region with unusual disk waits, then switched to view the jobs waiting on disk during an interval

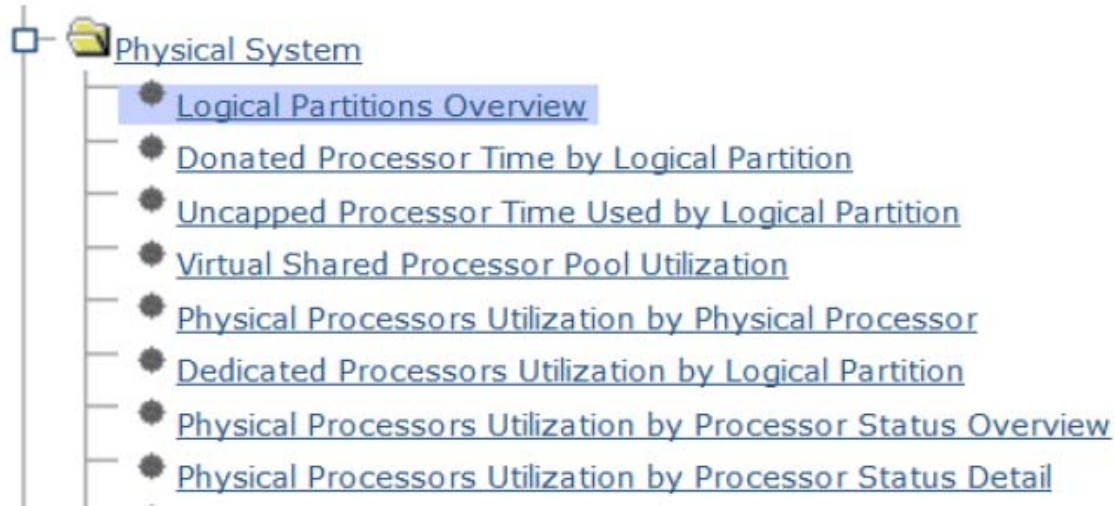


Show as table

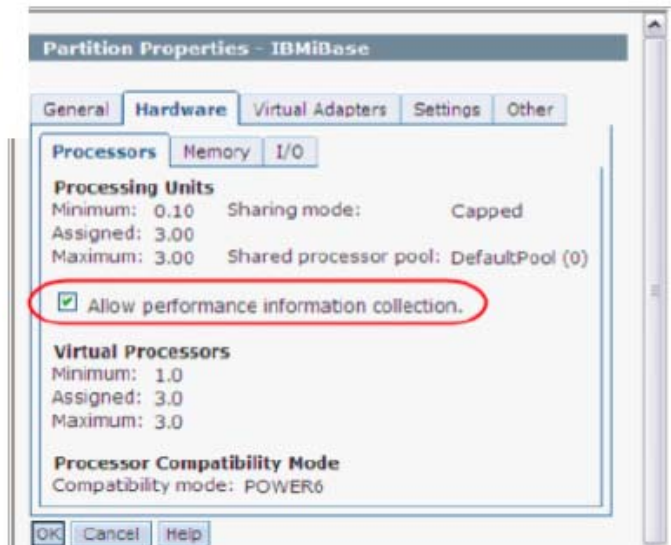
Charts can also be shown as tables instead, and the charts can be sorted, filtered, and columns de-selected

Select	Name	Job User	Job Number	Dispatched CPU Active Time (Seconds)	Dispatched CPU Waiting Time (Seconds)	Dispatched CPU Transferred Time (Seconds)	Dispatched CPU Time (Seconds)
<input type="checkbox"/>	US51		420551	25.16	34.78	0	
<input type="checkbox"/>	QPADEV004	KMILLIKAN	422734	21.58	30.25	0	
<input type="checkbox"/>	QZDASOINIT	QUSER	422653	9.73	12.05	0	
<input type="checkbox"/>	RISCA1	JMCDONALD	421076	9.16	12.79	0	
<input type="checkbox"/>	QPADEV0021	LCONNOLLEY	421141	8.22	8.83	0	
<input type="checkbox"/>	QPADEV001J	MROMERO	421079	8	12.28	0	

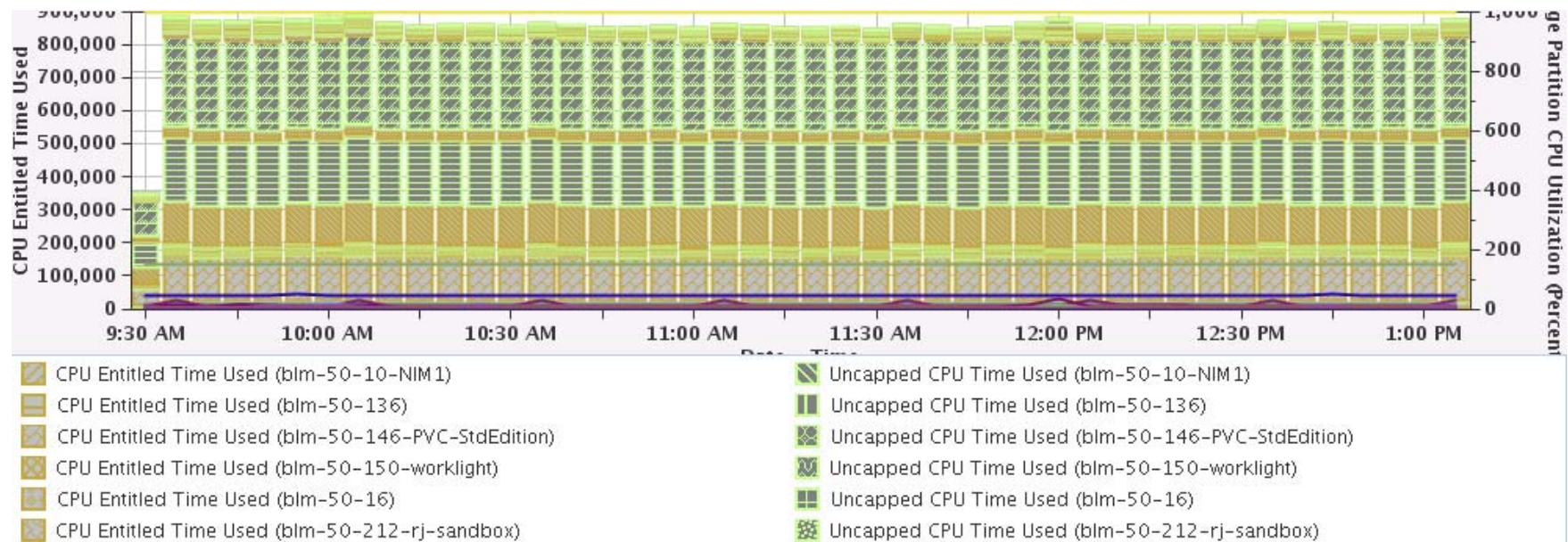
Physical system performance



HMC option to enable performance collection must be turned on for the IBM i partition to collect the data



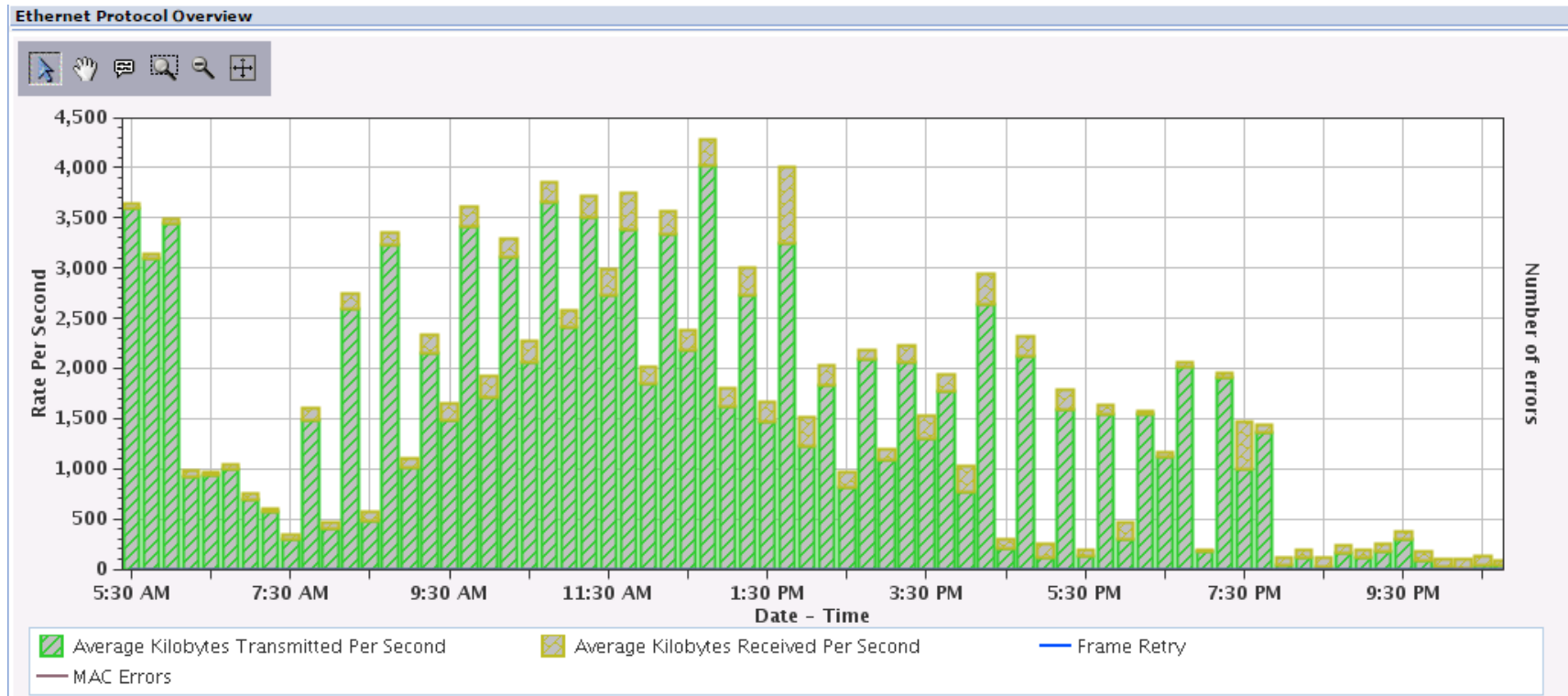
Physical performance perspective



The “Physical System” perspective allows you to see all processor utilization from all partitions (including AIX and VIOS), see how often partitions are “donating” CPU to other partitions, and view how resources at the bus level like 12X loops and PCIe cards are performing

(Our test/development system has 43 partitions so this chart is a little busy)

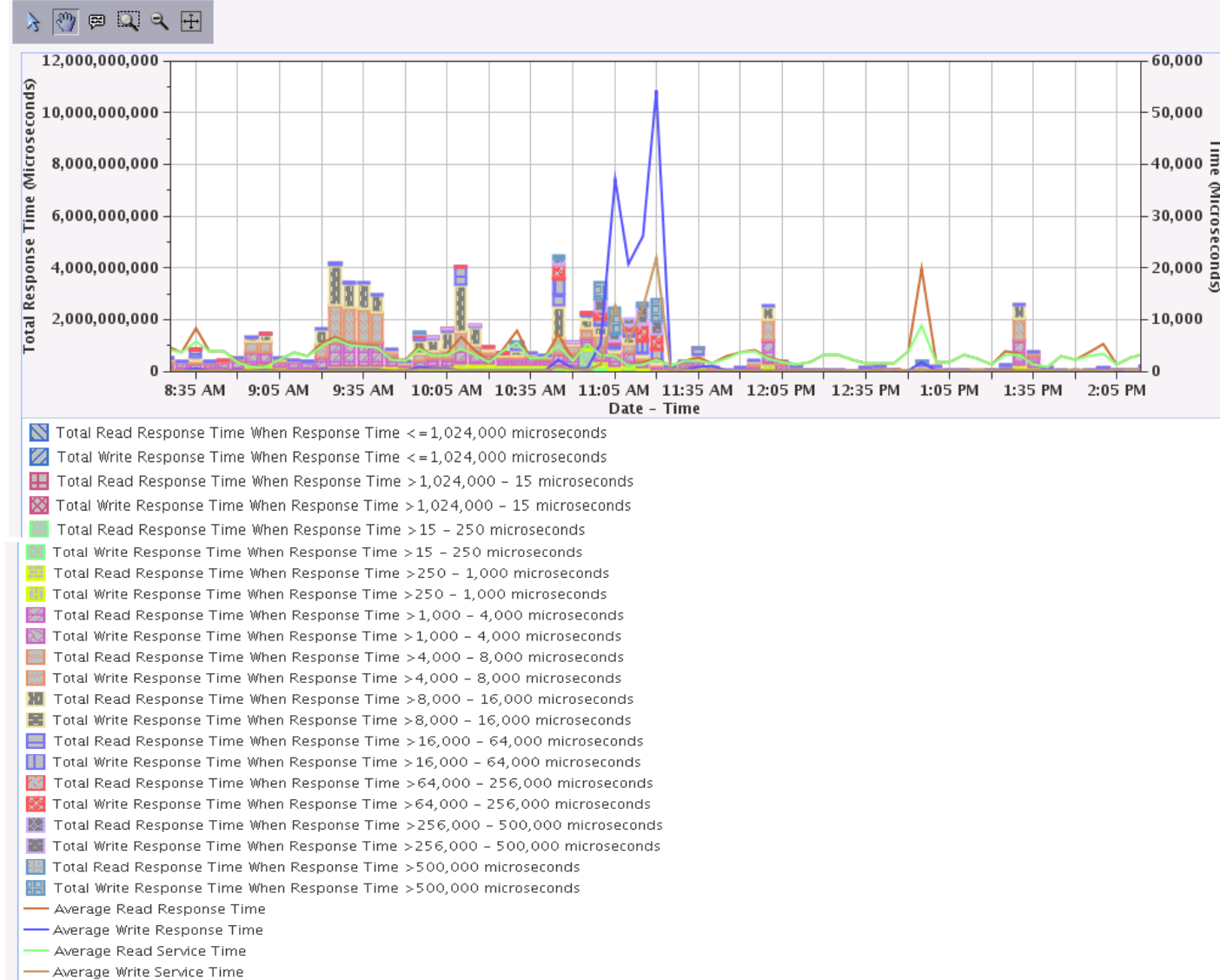
Ethernet performance



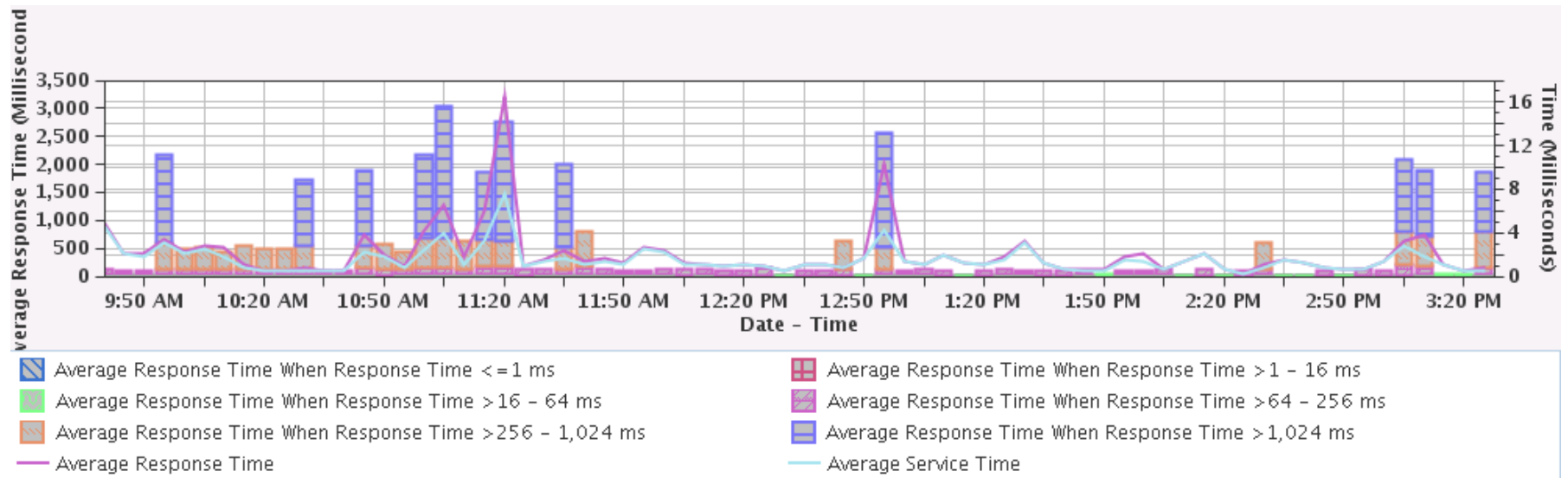
Communications – Ethernet shows how much data is sent and received, and how many errors and retries are observed

Disk response time

Disk I/O Total Response Time Overview - Detailed

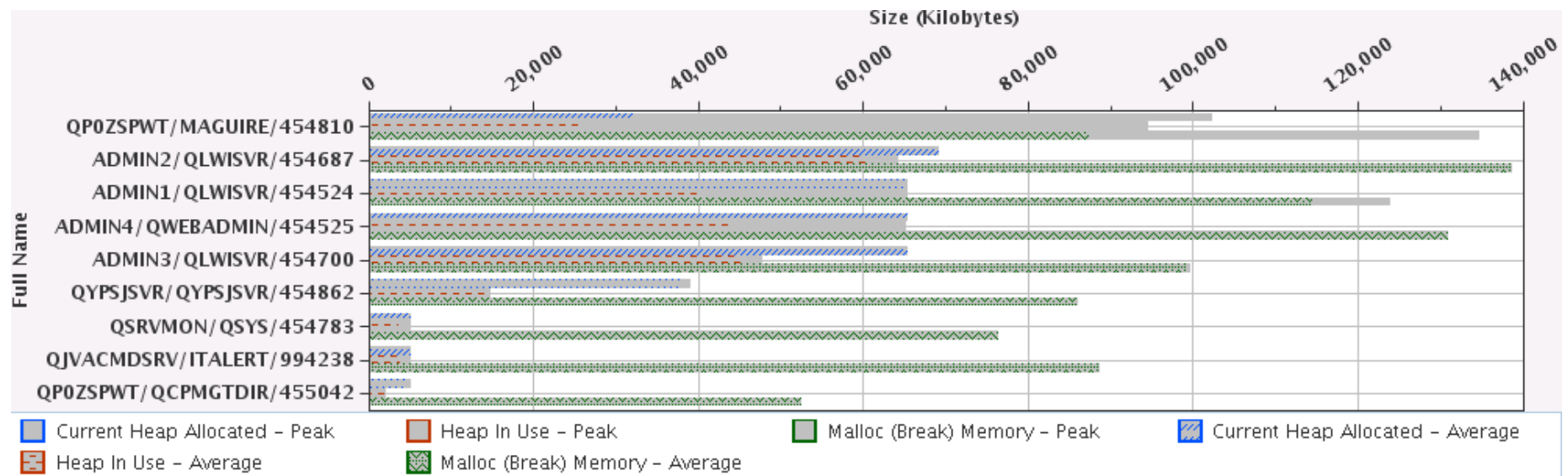


Disk average response time

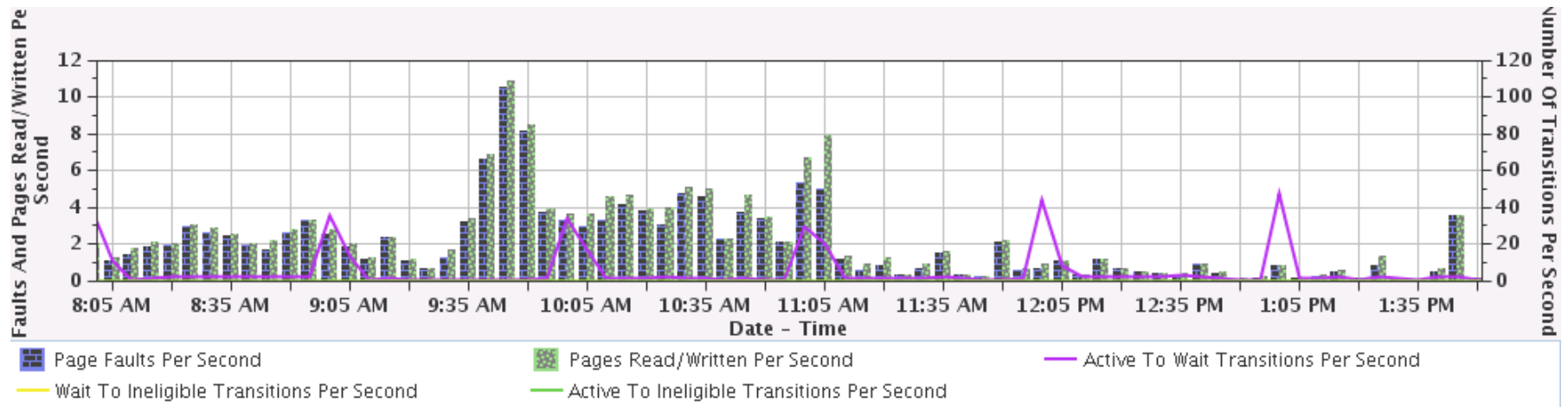


Disk response time may be the most critical factor in system performance. IBM rule of thumb is under 5 ms is good, 5-10 ms is average, over 10 ms needs review

Java

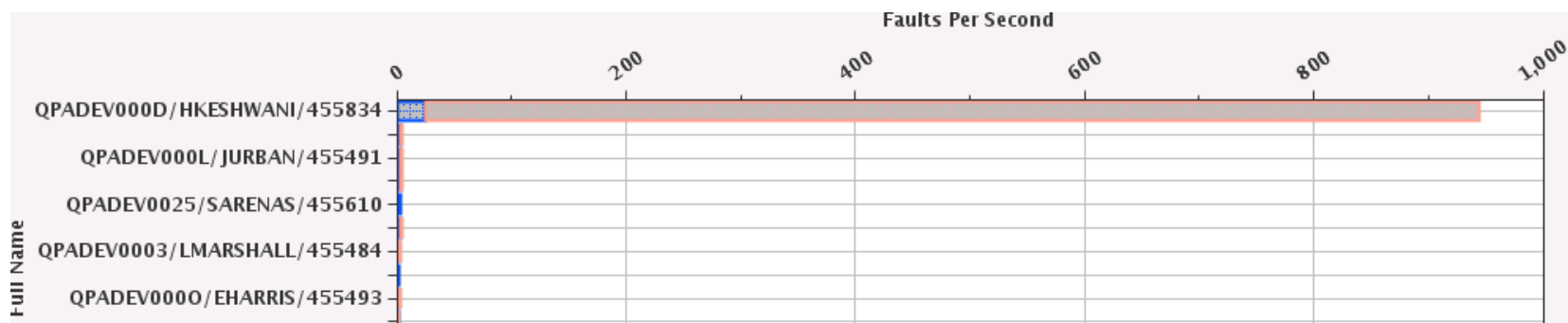
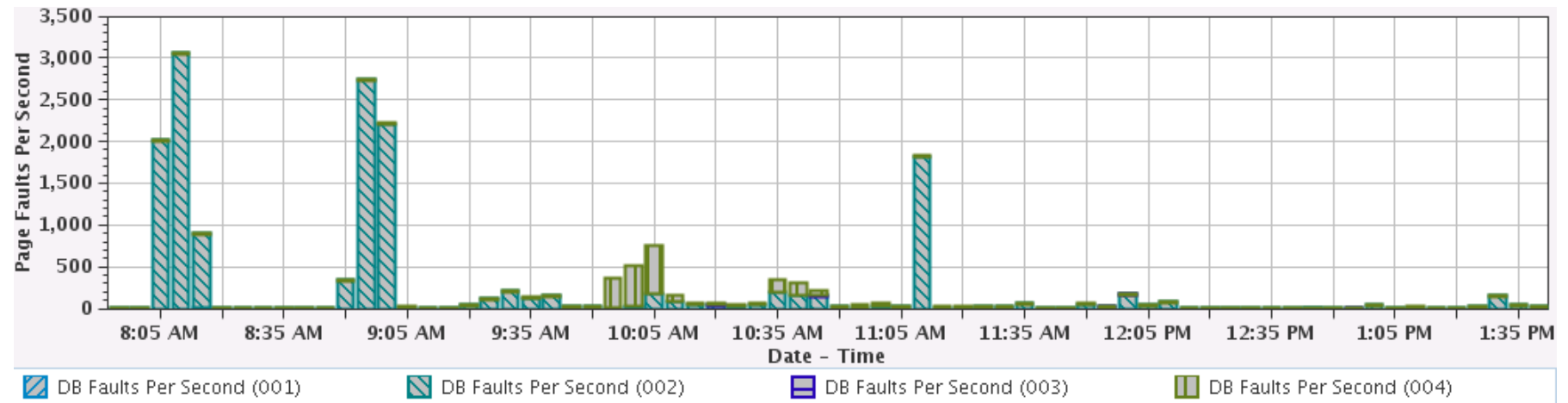


Memory



Can view all or one pool, this chart shows the machine pool (001) only. IBM's guideline on machine pool faulting is that it should typically be less than 10 faults per second

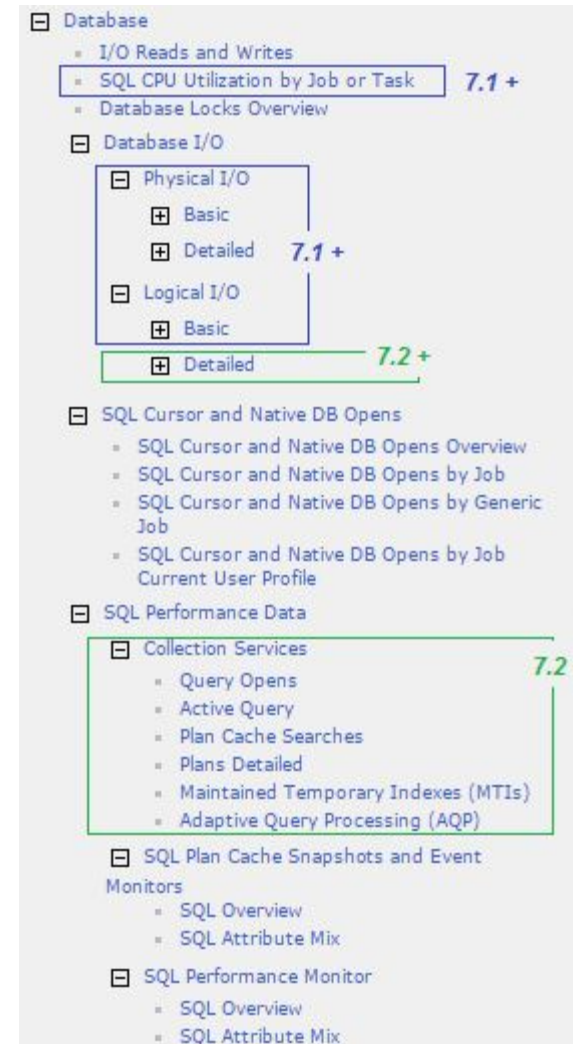
Memory faulting detail



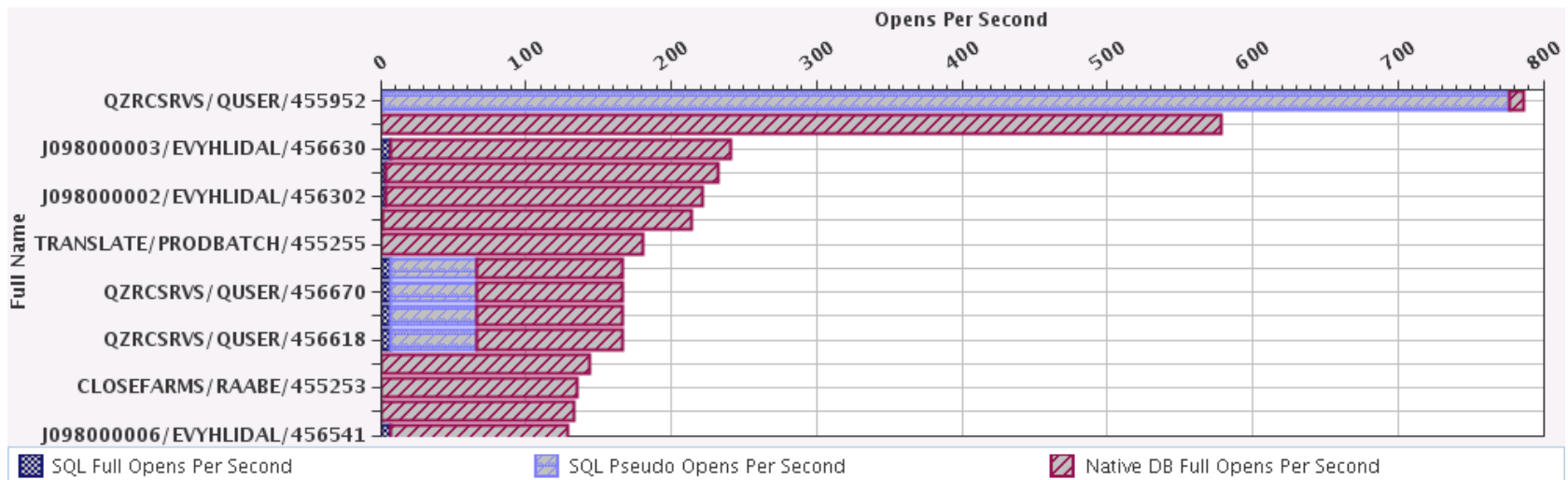
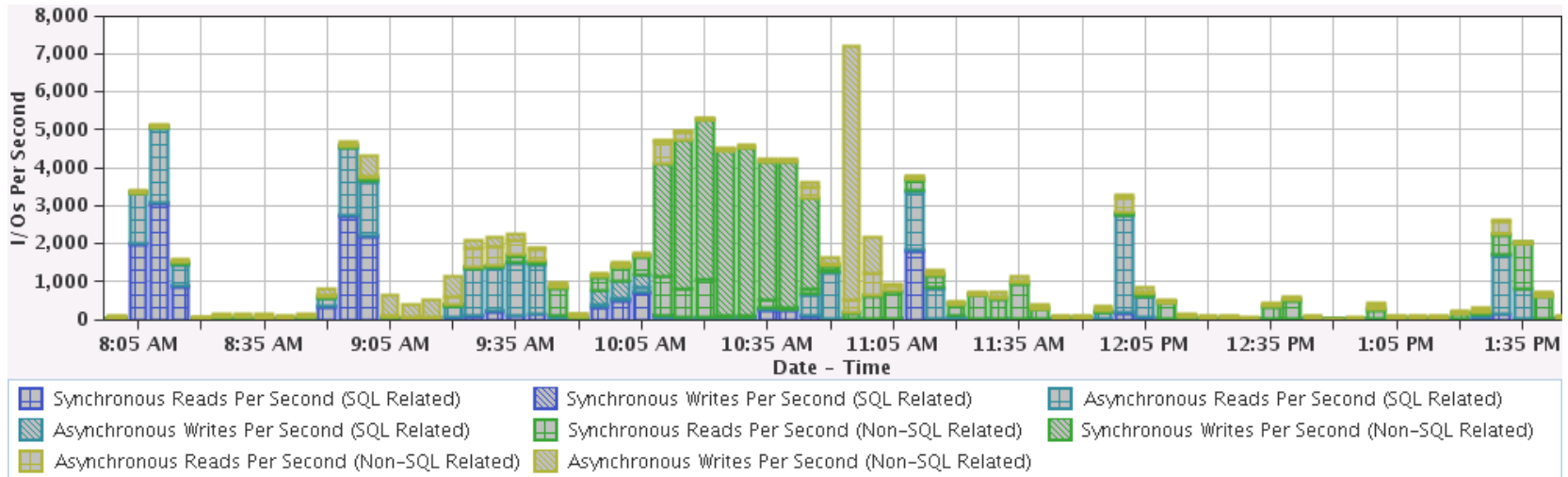
You can also view faulting for all pools, and then if a particular region has unusual faulting, select “Page faults by job or task” to drill down and find out what was causing the high faulting

Database perspective

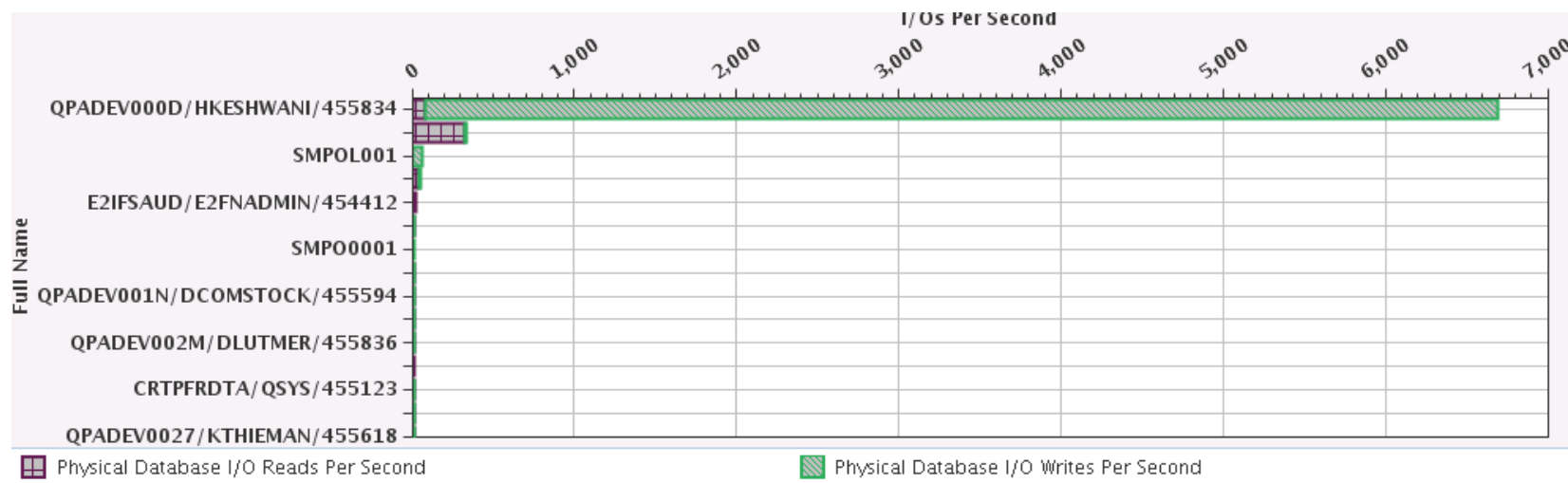
- Database performance review requires Performance Tools
- Database performance perspectives were enhanced greatly at both 7.1 and 7.2
- Current fix groups for Performance, Database, and HTTP are recommended



Database examples

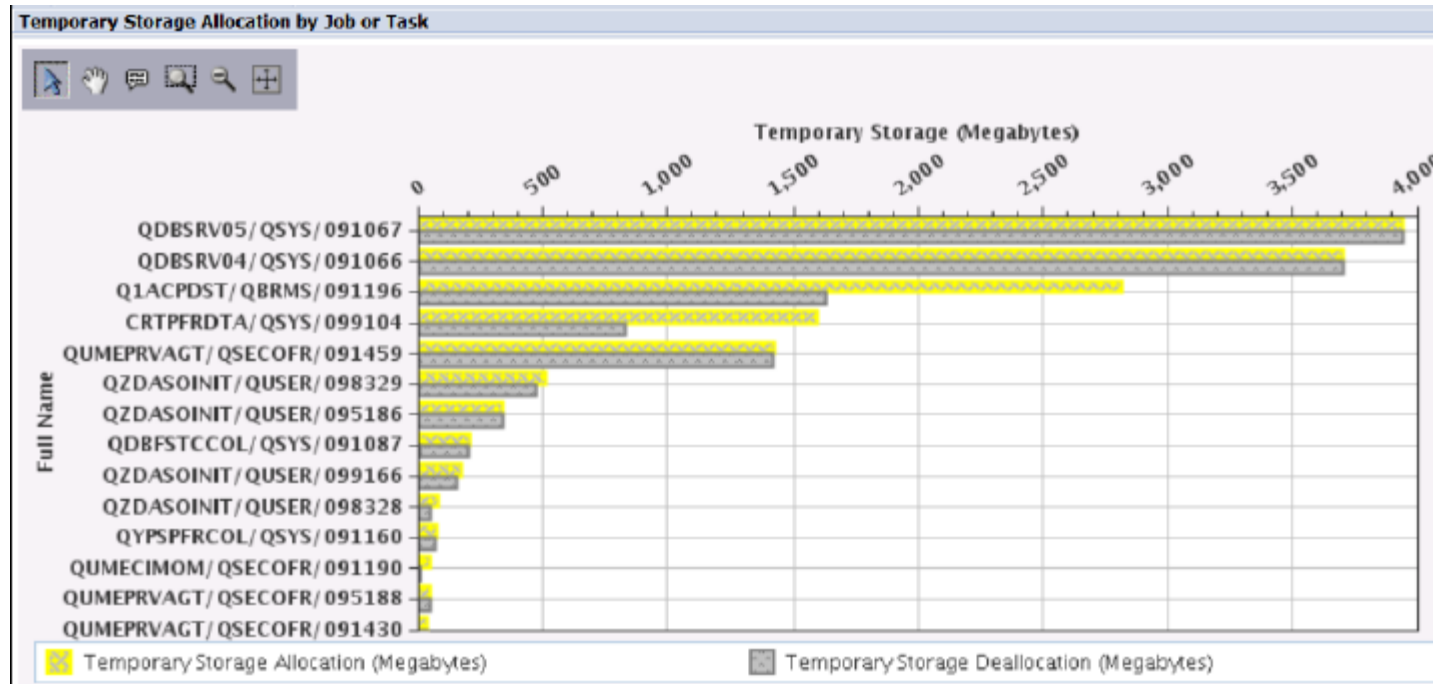


Database – drill down



Drilling down from Database I/O for a high I/O period into “Database I/O by Job or Task” finds that most of the high I/O is coming from a single job!

Storage Allocation



The Storage Allocation perspective was added with IBM i 7.2 and it allows you to see storage allocations/deallocations and temporary storage use. Views are available across the system and for specific jobs

Creating reports

- [-] Monitors
- [-] Basic Operations
- [-] Work Management
- [-] Configuration and Service
- [-] Network
- [-] Integrated Server Administration
- [-] Security
- [-] Users and Groups
- [-] Database
- [-] Journal Management
- [-] Performance
 - [-] Investigate Data
 - [-] Investigate Data Search
 - [-] Health Indicators
 - [-] System Resources Health Indicators
 - [-] CPU Health Indicators
 - [-] Disk Health Indicators
 - [-] Memory Pools Health Indicators
 - [-] Response Time Health Indicators
 - [-] Collection Services
 - [-] Database
 - [-] Disk Watcher
 - [-] Performance Explorer
 - [-] Custom Perspectives - EKNUDSON
 - [-] Manage Collections
- [-] All Tasks
 - [-] Active Jobs
 - [-] Disk Status
 - [-] Investigate Data Search
 - [-] Investigate Data
 - [-] Manage Collections
 - [-] Performance Management for Power Systems
 - [-] System Status
- [-] Collections
 - [-] Convert Collection
 - [-] Copy Collection
 - [-] Create Performance Data
 - [-] Delete Collection
 - [-] Restore Collection
 - [-] Save Collection
- [-] Performance Data Reports
 - [-] Add Definition
 - [-] Delete Definition
 - [-] New Based On
 - [-] Report Definitions

Report Definitions - 172.22.51.164

Add Performance Data Report Definition

Add Performance Data Report Definition

Name:

Description:

Perspectives

Select	Perspective	Package
<input type="checkbox"/>	None	

Collection

Collection:

Library:

Type:

Cover Page

Title:

Report definition name

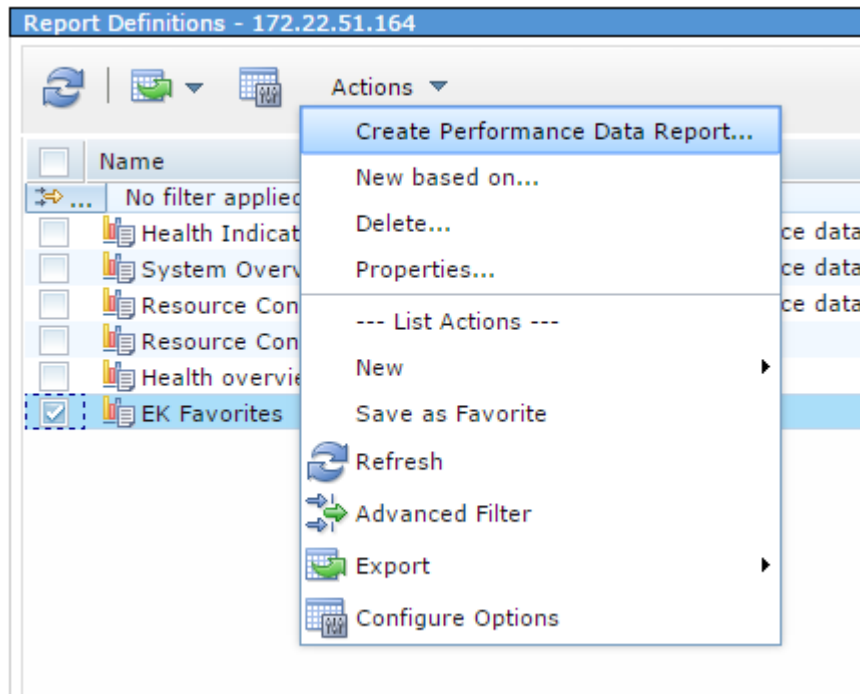
Date created

Perspectives

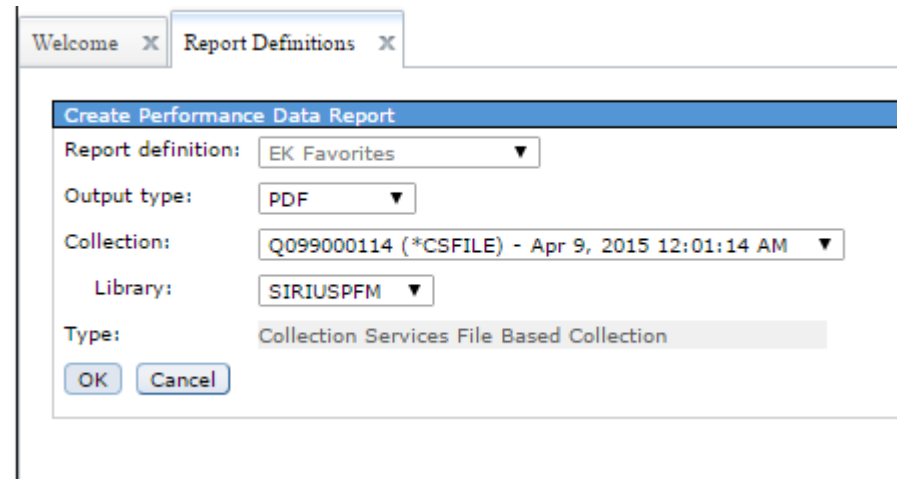
Collection name

Performance Investigator does not let you schedule reports, but you can run a set of pre-selected reports all at once

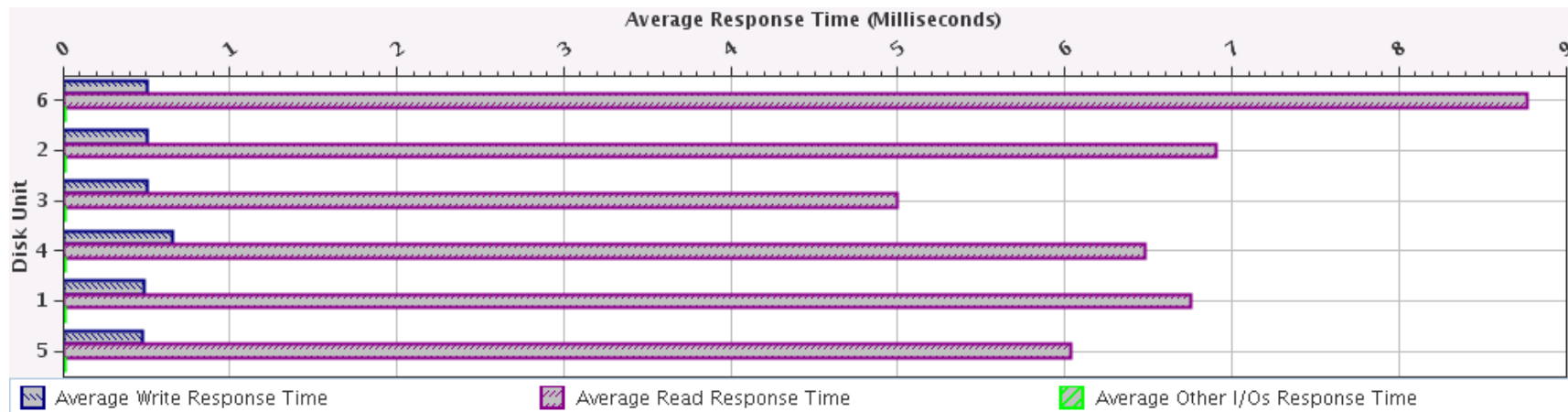
Creating reports



Add the reports you want to see (typically using “latest” collection) and then run with the “Create Performance Data Report” option



Disk Watcher



Disk Watcher (also requires Performance Tools) shows a number of more detailed reports on disk performance for individual drives or pools

Job Watcher

Job Watcher shows much more individual detail on job performance than collection services, including call stacks, SQL statements, and both lock object waited on and lock holder (requires Performance Tools)

Object waited on: logs :8E01C054
00000015 Pool: 2

Holding job or task: POFSYNC00N000 Interval timestamp: Sep 13, 2011 8:46:09 AM

Call Stack

Call Level	Program	Module	Procedure
1			qutde_block_trace
2			pReceiveBlock__9QuCounterFP11QuBaseTimerPvQ2_8TDQSEnum4EnumUIQ2_2Qu8WaitType
3			seizeConflict__21RmslSeizeControlBlockFP11RmslPlmpSRPP12RmslSRPEntP15RmslSeizeRec
4			obtainSeize__21RmslSeizeControlBlockFP11RmslPlmpSRPP12RmslSRPEntP18RmslPDCInform
5			rmslSeizeAddr__FR11RmslPlmpSRP
6			__ls__10P0dJournalFRC22P0dJournalPrimarySeize
7			seizeObjectsForJournalUpdate__FP18P0dGenericMiObjectP10P0dJournal
8			updateEntryWithJournaling__FR14P0dUpdateEntry
9			updateEntry__12P0dDirectoryFRP14P0dUpdateEntry
10			bsfhandlesyncrequest__FRIP11BsfSyncNode
11			bsfsynctask__FPUC

Batch Model

Batch model was introduced in IBM i 7.2, and requires a Performance Tools license

The purpose of this new function is to help analyze batch job performance characteristics as well as predict batch workload run times after changes are made to disk, processor, or workload volumes

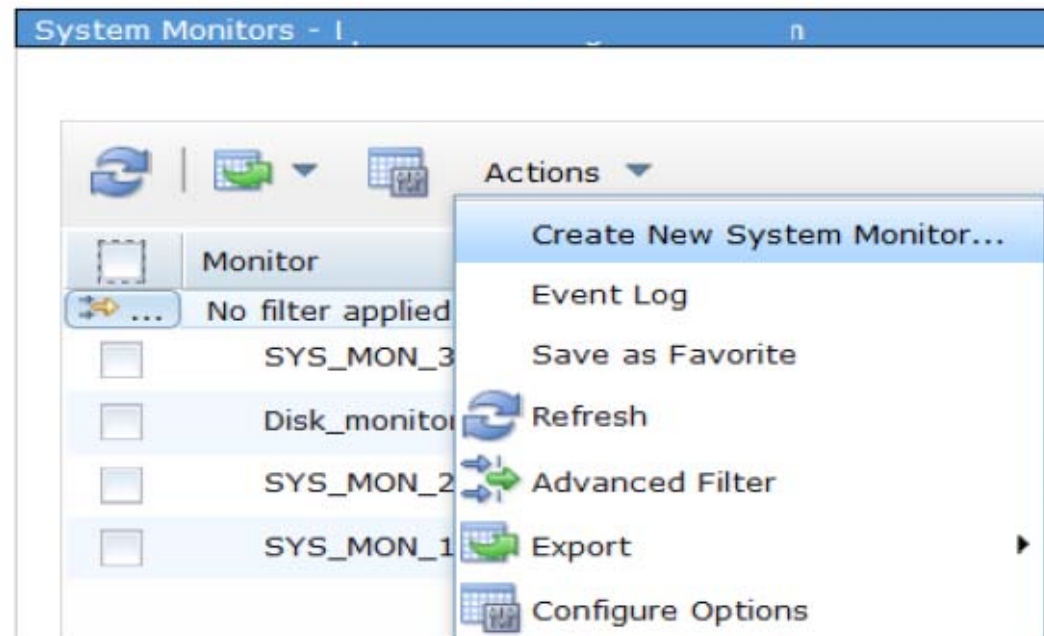
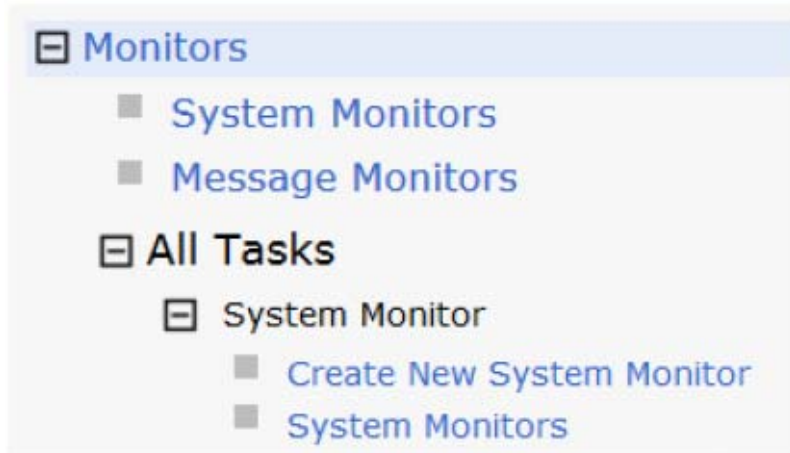
System Monitors

The Navigator for i interface at 7.2 adds support for both system and message monitors

- System monitor function is similar to the Operations Navigator monitor, but new monitors are available
- Specify what you want to monitor (e.g. CPU util.)
 - Enter a first threshold and the action to take
 - Enter a secondary threshold and an action to take
- Message queues including QSYSOPR can be monitored with an action specified

(New SNDSMTPEMM command works well in conjunction with monitors)

Creating a system monitor



Items that can be monitored

- System
 - Batch Logical Database I/O Rate
 - Communications Line Utilization (Average)
 - Communications Line Utilization (Maximum)
 - CPU Utilization (Average)
 - CPU Utilization (Interactive Jobs)
 - CPU Utilization (SQL)
 - CPU Utilization (Uncapped)
 - Disk Arm Utilization (Average)
 - Disk Arm Utilization (Maximum)
 - Disk Arm Utilization for Independent ASP (Average)
 - Disk Arm Utilization for Independent ASP (Maximum)
 - Disk Arm Utilization for System ASP (Average)
 - Disk Arm Utilization for System ASP (Maximum)
 - Disk Arm Utilization for User ASP (Average)
 - Disk Arm Utilization for User ASP (Maximum)
 - Disk Storage Utilization (Average)
 - Disk Storage Utilization (Maximum)
 - Disk Storage Utilization for Independent ASP (Average)
 - Disk Storage Utilization for Independent ASP (Maximum)
 - Disk Storage Utilization for System ASP (Average)
 - Disk Storage Utilization for System ASP (Maximum)
 - Disk Storage Utilization for User ASP (Average)
 - Disk Storage Utilization for User ASP (Maximum)
 - Interactive Response Time (Average)
 - Interactive Response Time (Maximum)
 - LAN Utilization (Average)
 - LAN Utilization (Maximum)
 - Machine Pool Faults Rate
 - Shared Processor Pool Utilization (Physical)
 - Shared Processor Pool Utilization (Virtual)
 - Spool File Creation Rate
 - Temporary Storage Utilization
 - Transaction Rate (Interactive)
 - User Pool Faults Rate (Average)
 - User Pool Faults Rate (Maximum)

Monitors have to be restarted after an IPL

Documentation

- Knowledge Center: http://www-01.ibm.com/support/knowledgecenter/ssw_ibm_i_72/rzahx/rzahxwebnavperformance.htm?lang=en
- IBM i Performance FAQ: http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?subtype=WH&infotype=SA&appname=STGE_PO_PO_USEN&htmlfid=POW03102USEN&attachment=POW03102USEN.PDF
- DeveloperWorks: <http://www.ibm.com/developerworks/ibmi/library/i-pdi/index.html>
- Performance Management on i: <http://www-03.ibm.com/systems/power/software/i/management/performance/index.html>
- “i Can” blog: <http://www.ibmssystemsmag.com/Blogs/i-Can/>
- Performance Capabilities Reference: http://www-03.ibm.com/systems/resources/systems_power_software_i_perfmgmt_pcrm_apr2014.pdf
- V6R1 performance redbook: <http://www.redbooks.ibm.com/redbooks/pdfs/sg247808.pdf>
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Thank You

Erik Knudson
Senior Technical Consultant