Université IBM i 2018

16 et 17 mai

IBM Client Center Paris

S05 – Introduction to Performance Data Investigator

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Agenda

- Why PDI?
- Using PDI (and Tips)
- Suggested starting points
- PDI Navigation and Features
- Introduction to performance analysis using PDI
- References

Why PDI?

- IBM i does a fantastic job of collecting **a lot** of useful performance metrics.
  - *A lot.*
  - *–A LOT…*
  - –A LOT!

Jobs
CPU
I/O
Storage
Memory
Database
Java
Workload Groups
SQL
5250 Transactions
Communications
Waits

Why PDI?

- Now, you could write your own SQL over the database files produced to get the data you need…..

- Or…..you could let PDI do the hard work for you…..

```
SELECT
      QSY.INTNUM,
      QSY.CSDTETIM AS CSDTETIM,
      MAX(PCTSYSCPU) AS PCTSYSCPU,
      SUM(TIME01) * .000001 AS WBSEC01,
      SUM(TIME02) * .000001 AS WBSEC02,
      SUM(TIME05 + TIME06 + TIME07 + TIME08 + TIME09 + TIME10) * .000001 AS WB050607080910,
      SUM(TIME11) * .000001 AS WBSEC11,
      SUM(TIME14 + TIME15 + TIME19 + TIME32) * .000001 AS WB14151932,
      SUM(TIME16 + TIME17) * .000001 AS WB1617,
      SUM(TIME18) * .000001 AS WBSEC18,
      100 AS PCT100,
      DTETIM AS DTETIM,
      DTECEN AS DTECEN
FROM
      (
            SELECT
                  DTECEN || DTETIM AS CSDTETIM,
                  DOUBLE(JWTM01) AS TIME01,
                  DOUBLE(JWTM02) AS TIME02,
```

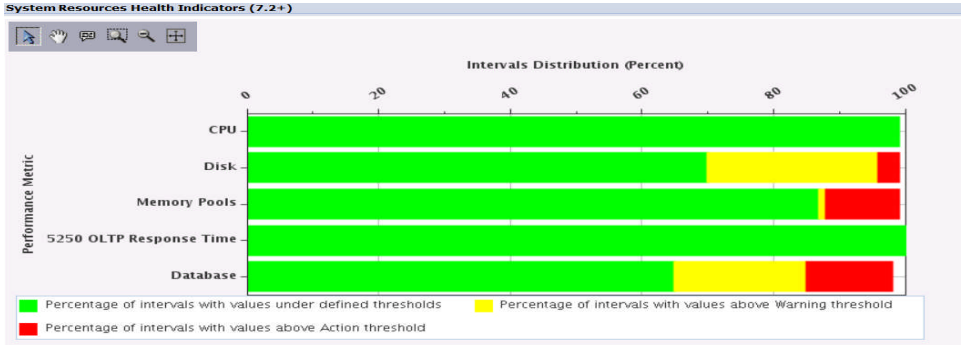
Why PDI?

- You could pour through raw performance data reports to spot problem areas…….

Opt	Date	Time	-Transaction- Count	Rsp	-CPU Util-- Tot	Int	Bch	Int Feat Util	--High-- Dsk	Unit	Pool Mch	Fault Usr	ID	Excp Util
_	07/31	05:15	2595	.06	8	3	5	2	3	0022	4	59	02	0
_	07/31	05:30	2925	.04	4	1	3	1	1	0022	5	9	04	0
_	07/31	05:45	2447	.05	4	1	3	1	1	0022	4	11	04	0
_	07/31	06:00	2173	.06	8	1	7	1	2	0004	6	18	02	0
_	07/31	06:15	2551	.06	14	1	13	1	4	0004	4	75	02	0
_	07/31	06:30	2529	.05	6	1	5	1	1	0022	6	7	04	0
_	07/31	06:45	3558	.05	13	5	8	3	2	0021	10	10	02	0
_	07/31	07:00	2968	.06	8	3	5	3	1	0003	3	15	04	0
_	07/31	07:15	4341	.11	36	4	32	3	4	0020	4	60	02	0
_	07/31	07:30	3378	.07	70	7	63	4	4	0022	3	23	02	0

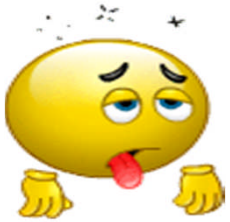
More...

- Or…..you could let PDI give you clues…….

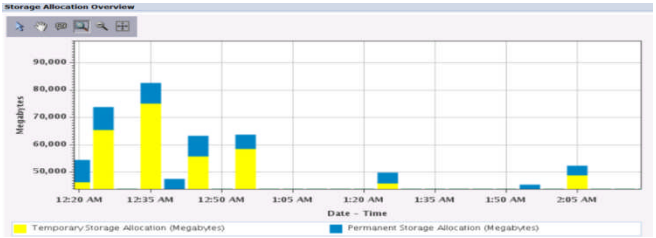


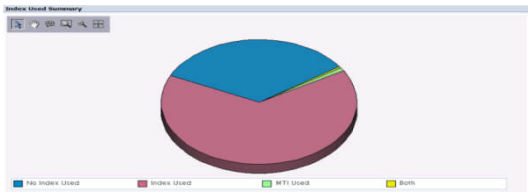
Why PDI?

- You could busy yourself figuring out complex data, putting it in spreadsheets, creating your own charts, producing reports, etc…(not to mention keeping up with new metrics!)



- Or, you could simplify…..and let PDI do all the hard work……

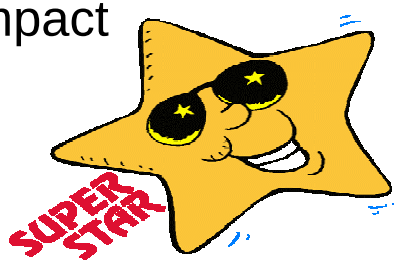




Why PDI?

- You could simply choose to ignore performance data…..

- Or, you could become a superstar and use PDI to proactively monitor your system to ward off potential issues before they impact productivity……



Why PDI?

- Integrated.
- Easy to use.
- Simplifies analysis.

i PDI, do you????

Let's get started using PDI……..

PDI is found in IBM Navigator for i

- IBM Navigator for i is the strategic console for managing IBM i
  - Has much of the function as System i Navigator **+ more**
    - But with a browser user interface
  - Integrated
    - Part of Base Operating System (SS1 Option 3)
  - Simply point your browser to http://systemname:2001

IBM Navigator for i – Browser support

Latest versions of:

- Mozilla Firefox
- Google Chrome
- Apple Safari
- Microsoft Edge

Note: Internet Explorer no longer supported

For additional browser information, refer to:

https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/IBM%20i%20Technology%20Updates/page/Browser%20tips

Browser Support tips (1 of 2)

Unexpected results could be browser related. Example problems are….

- Hung charts
- Empty tables

- Clear your browser cache after installing the PTFs
  - Then close/restart browser

- Review your browser security settings to allow pop-up exceptions
  - For details see the following web page: https://www.ibm.com/developerworks/mydeveloperworks/wikis/home?lang=en#/wiki/IBM%20i%20Technology%20Updates/page/Browser%20Tips

- In 7.2, a warning will appear if using unsupported browser:

Browser Support tips (2 of 2)

- Close unneeded tabs in Navigator session
  - Tasks in tabs consume resources and may cause performance degradation if too many are open

- Do ***not*** use PF-5 to Refresh a panel, instead use Refresh button found on Navigator panels

Pre-requisites for Navigator (1 of 2)

Everything is included on the V6R1 and later IBM i operating system!

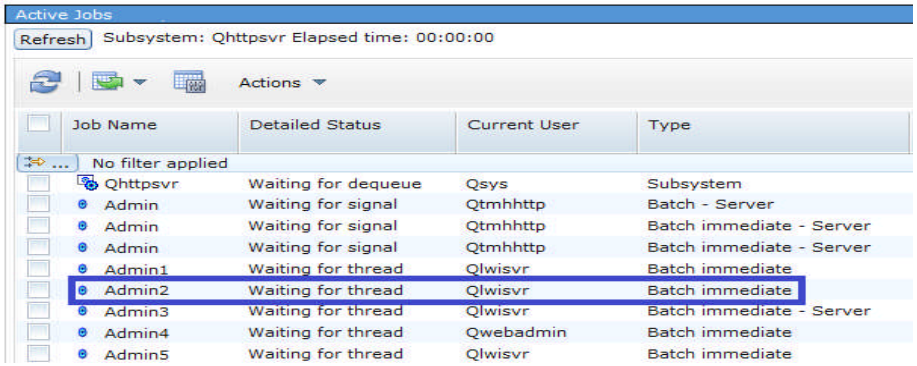
✓ Product install requirements:

	IBM i 7.3	IBM i 7.2	IBM i 7.1	IBM i 6.1
HTTP Server	5770DG1	5770DG1	5770DG1	5761DG1
- JDK	5770JV1	5770JV1	5770JV132 bit	5761JV1 option 8
Java ** Note new requirement for 64-bit JDK (Spring 2016) - JSE	5770JV1 option 15 (Java SE 7 64-bit) *- not Java SE 8 at this time*	5761JV1 option 12 (Java SE 6 64-bit) or 5761JV1 option 15 (Java SE 7 64-bit)		
- IBM Toolbox for Java		5770SS1 option 3	5770SS1 option 3	5761JC1
Performance Tools group	5770PT1	5770PT1	5770PT1	5761PT1
Database				
Host Servers	5770SS1 option 12	5770SS1 option 12	5770SS1 option 12	5761SS1 option 12
Qshell	5770SS1 option 30	5770SS1 option 30	5770SS1 option 30	5761SS1 option 30
PASE (Portable App Solutions Env)	5760SS1 option 33	5760SS1 option 33	5770SS1 option 33	5761SS1 option 33
Domain Name System	5770SS1 option 31	5770SS1 option 31	5770SS1 option 31	
Digital Certificate Manager	5770SS1 option 34	5770SS1 option 34	5770SS1 option 34	

Pre-requisites for Navigator (2 of 2)

✓ Ensure the HTTP Admin server is running (Qhttpsvr subsystem) :

Navigator runs in Admin2 server job



(STRTCPSVR SERVER(*HTTP) HTTPSVR(*ADMIN))

✓ Recent HTTP Group PTF

- PTFs for all components in Navigator are packaged and delivered as part of the HTTP PTF Groups.
- In addition there are a number of other groups that are needed to ensure that all parts of the navigator interface function properly.

Navigator related Group PTFs

- Fixes and major enhancements to **Navigator for i** are available in:
  - IBM i **7.3**
    - HTTP Server group - SF99722
    - Java group - SF99725
    - Database group - SF99703
    - Performance Tools group - SF99723
  - IBM i **7.2**
    - HTTP Server group - SF99713
    - Java group - SF99716
    - Database group - SF99702
    - Performance Tools group - SF99714
  - IBM i **7.1**
    - HTTP Server group - SF99368
    - Java group - SF99572
    - Database group - SF99701
    - Performance Tools group - SF99145

Navigator Enhancements are often taken back to previous releases via PTFs

Tips for Best Performance for Navigator

Note: Navigator will not run fast on a system that is already slow!

- ✓ Ensure no bad DNS entries on the system
  - http://www-912.ibm.com/s_dir/slkbase.nsf/1ac66549a21402188625680b0002037e/b9e677063f24f859862575ee006b1881
- ✓ Use Application Runtime Expert to validate your environment
  - http://www.ibm.com/developerworks/ibmi/library/i-applicationruntime/index.html
  - **Network health checker** can be run from QShell:
    `/QIBM/ProdData/OS/OSGi/templates/bin/areVerify.sh –network`

    http://ibmsystemsmag.blogs.com/i_can/2013/09/application-runtime-expert-network-health-checker.html
- ✓ Use the Web Performance Advisor to validate your Web Performance
  - http://pic.dhe.ibm.com/infocenter/iseries/v7r1m0/topic/rzaie/rzaieconwebperfadvisor.htm
- ✓ Keep current on Group PTFs

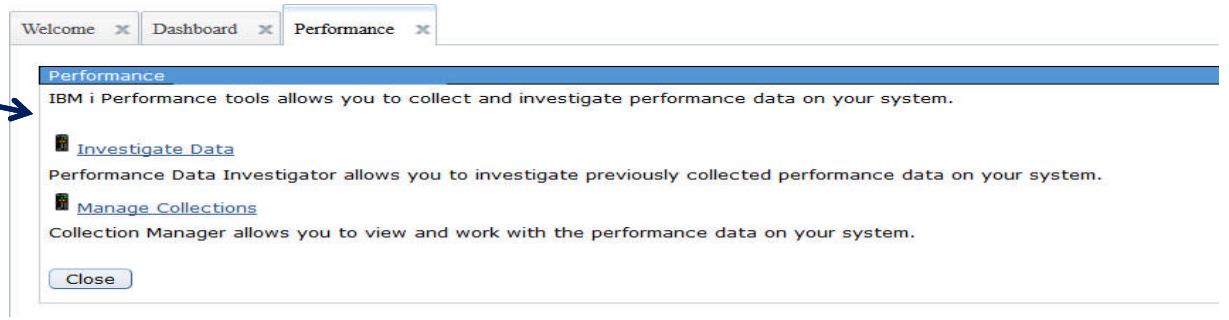
IBM Navigator for i

- IBM Navigator for i is the Web console for managing IBM i
  - Has much of the function as System i Navigator
    - but with a browser user interface
  - Simply point your browser to http://systemname:2001

Note: After the release of the **December 2016 HTTP Group PTF** the 2001 port is no longer redirecting to port 2005 by default. Instead 2001 will now only redirect to the **non-secure 2004 port.**

Performance Tasks

- "**Performance**" is a major function in Navigator
  - Investigate Data = *"Performance Data Investigator"*
  - Manage Collections
  - And much more!



Packaging: Performance Tools Licensed Program Product

7.2 7.3

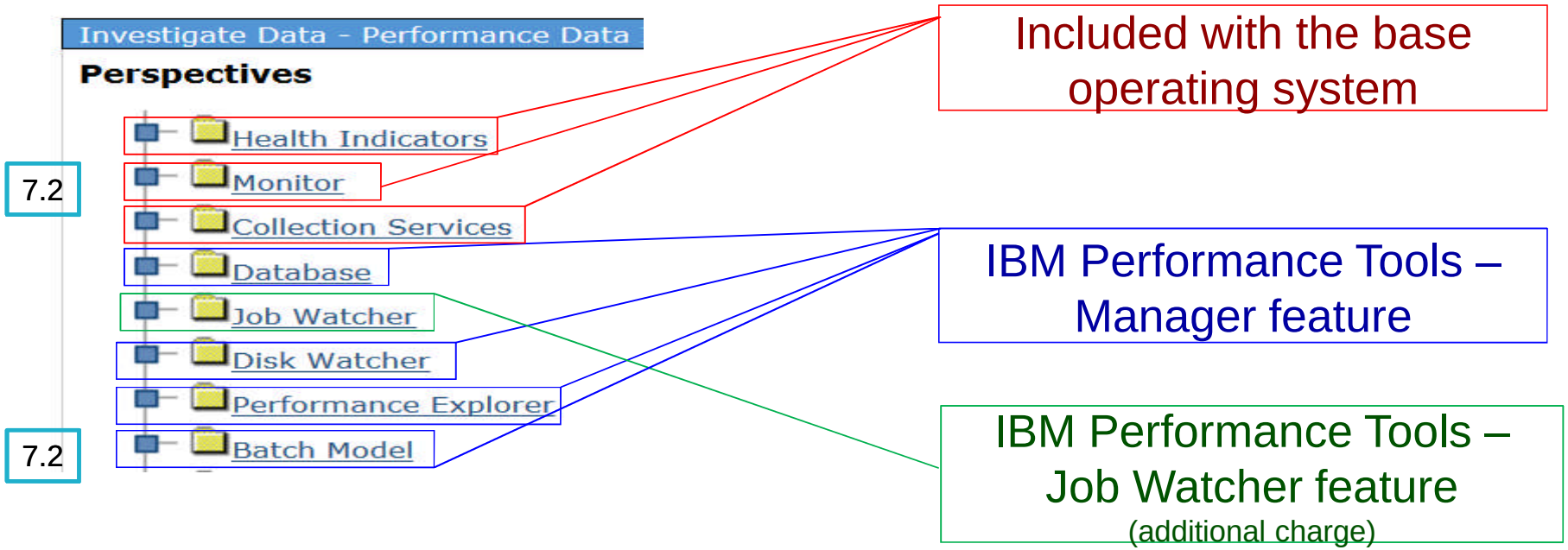
- IBM i for Collection Services, Health Indicators, Monitors, Graph History

- Performance Tools Licensed Program Product
  (5770PT1 for 7.1, 7.2, 7.3)

  - **Performance Tools - Manager Feature (option 1)** 7.2
    - Disk Watcher, Performance Explorer, Database, Batch Model
  - Performance Tools - Agent Feature
  - **Performance Tools - Job Watcher (option 3)**
    - Job Watcher

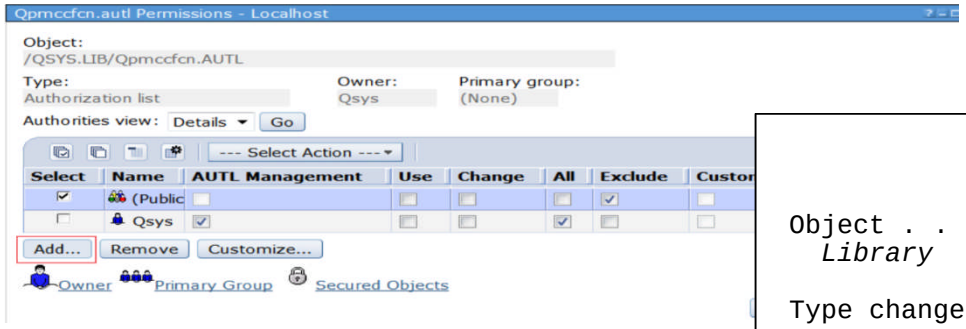
Product ID	Product Option	Release	Description
5770PT1	0000	V7R3M0	IBM Performance Tools for i - Base
5770PT1	0001	V7R3M0	Performance Tools - Manager Feature
5770PT1	0002	V7R3M0	Performance Tools - Agent Feature
5770PT1	0003	V7R3M0	Performance Tools - Job Watcher

Packaging view in PDI - 7.2 & 7.3



Prerequisites: Authority

- Users need to be authorized to use the Investigate Data and Manage Collections performance tasks
- Include users on the **QPMCCDATA and QPMCCFCN** authorization lists
  - *Can be done via GUI or green screen*




```
                              Edit Authorization List

 Object . . . . . :   QPMCCDATA        Owner  . . . . QSYS
   Library  . . . . :     QSYS          Primary group  . *NONE

 Type changes to current authorities, press Enter.

                Object    List
 User          Authority  Mgt
 *PUBLIC       *EXCLUDE
 QSYS          *ALL        X
 PDI01         *USE
 PDI02         *USE
 PDI03         *USE
More...
```

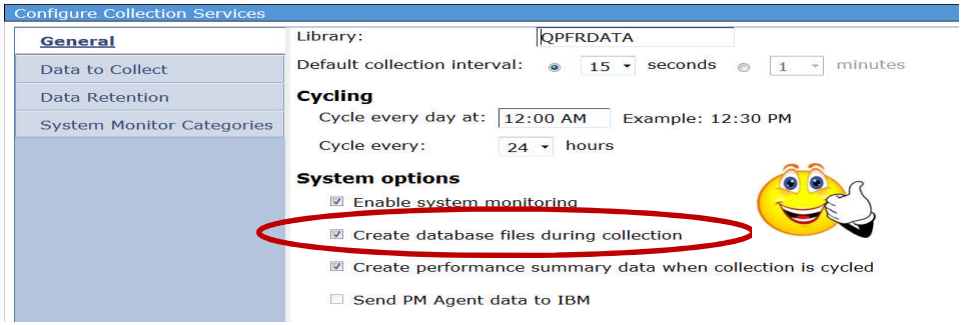
Prerequisites: Create Database Files

- **PDI requires data in the Collection Services DB2 files**
  - The default is to create the database files during performance data collection
  - If you have turned this off, you will not be able to view performance data with PDI until the data is created in the files
  - Recommended to leave this setting at the default

Command interface:

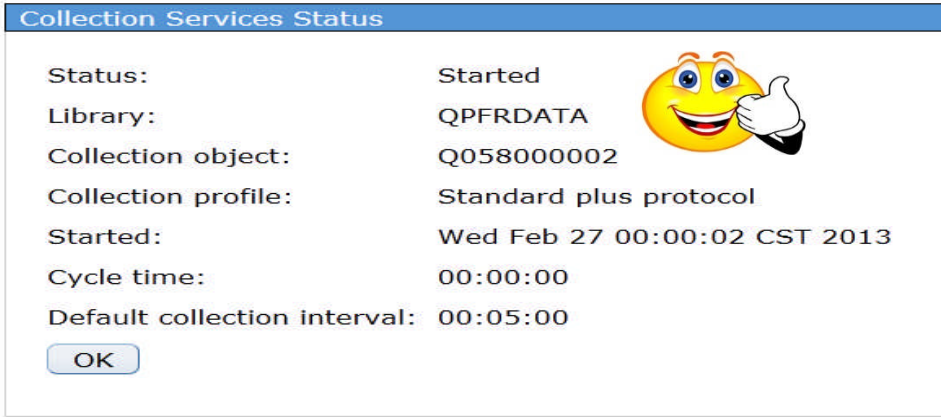
The “Create Database files” option for the performance collection should be *YES

`CFGPFRCOL` command - `CRTDBF(*YES)`

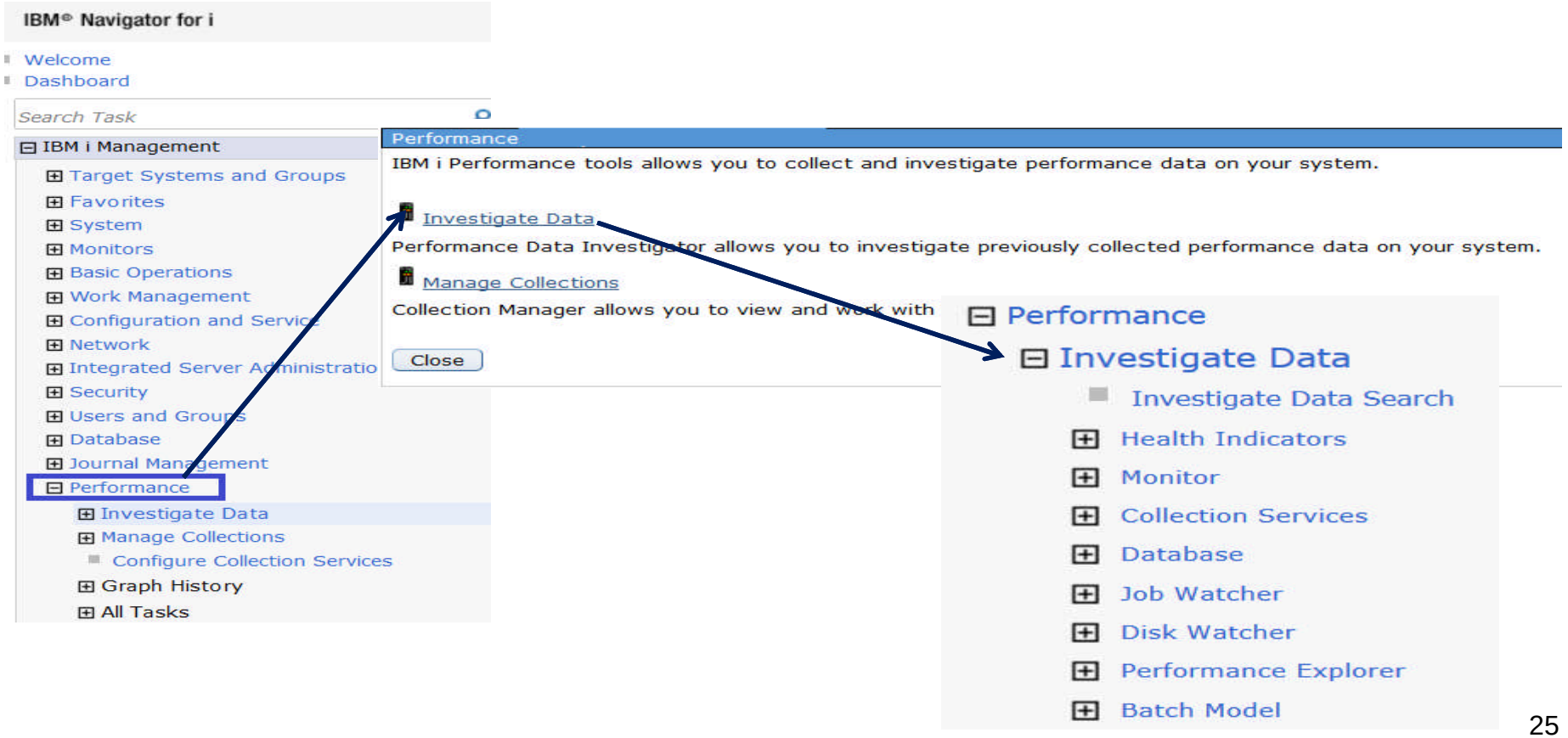


Prerequisites: Verify Collection Services is Active

- Collection Services is the foundation for many performance tasks
  - Make sure Collection Services is active (Started by default)



Investigate Data – Navigation Example



Investigate Data Terminology

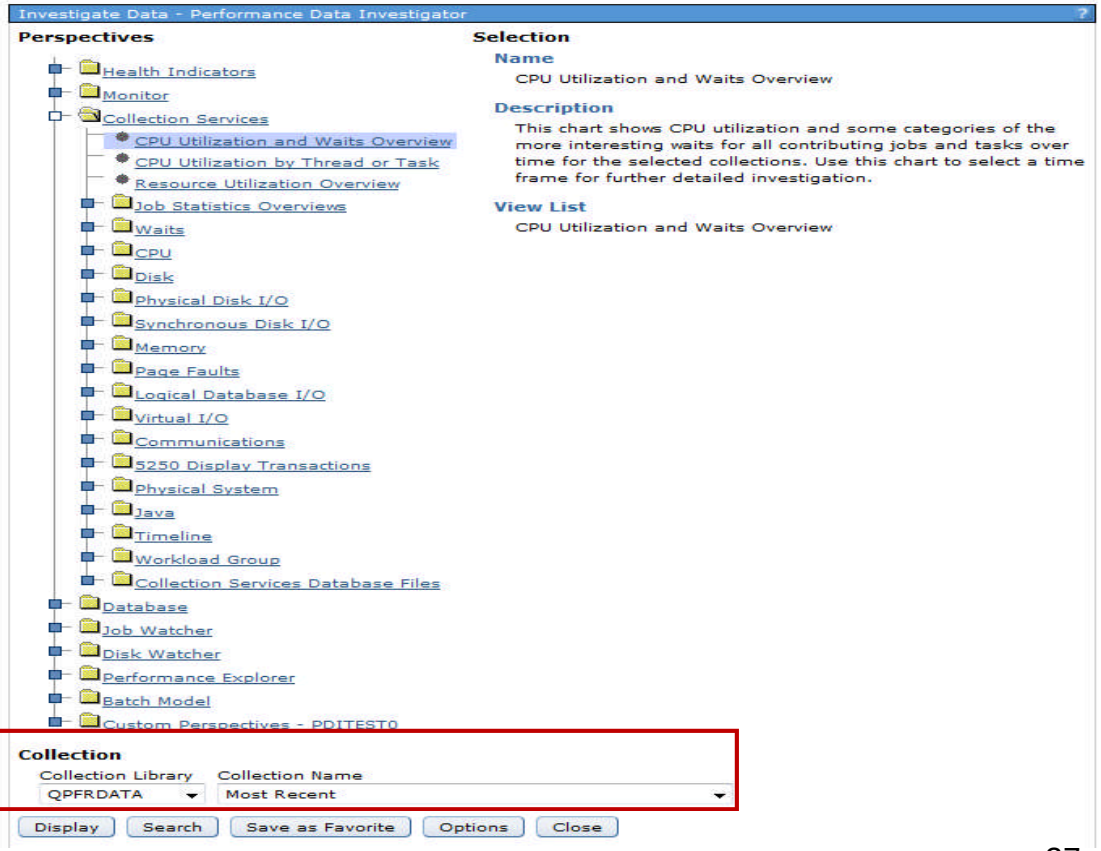
Perspectives are a logical grouping of similar or related views that benefit from being rendered side-by-side for reference or context.

Content Package is a set of perspectives that share a commonality (major theme).

Investigate Data – Select Collection

The Collection boxes allow you to specify which collection you want to work with.

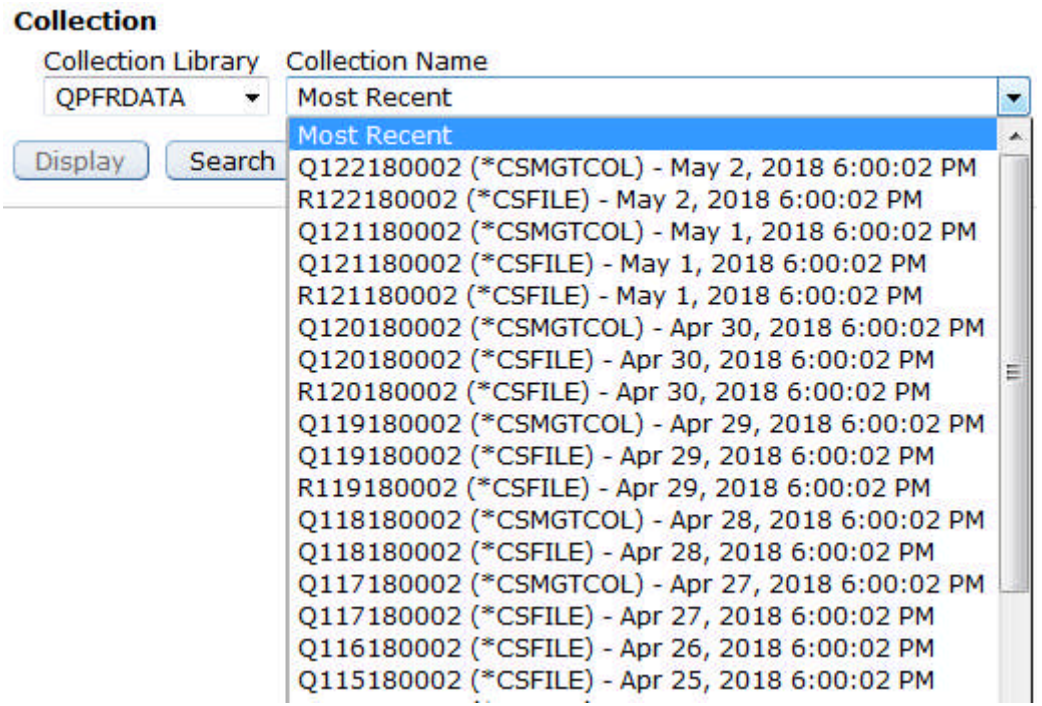
Only collections valid for the type of chart you select will be displayed.



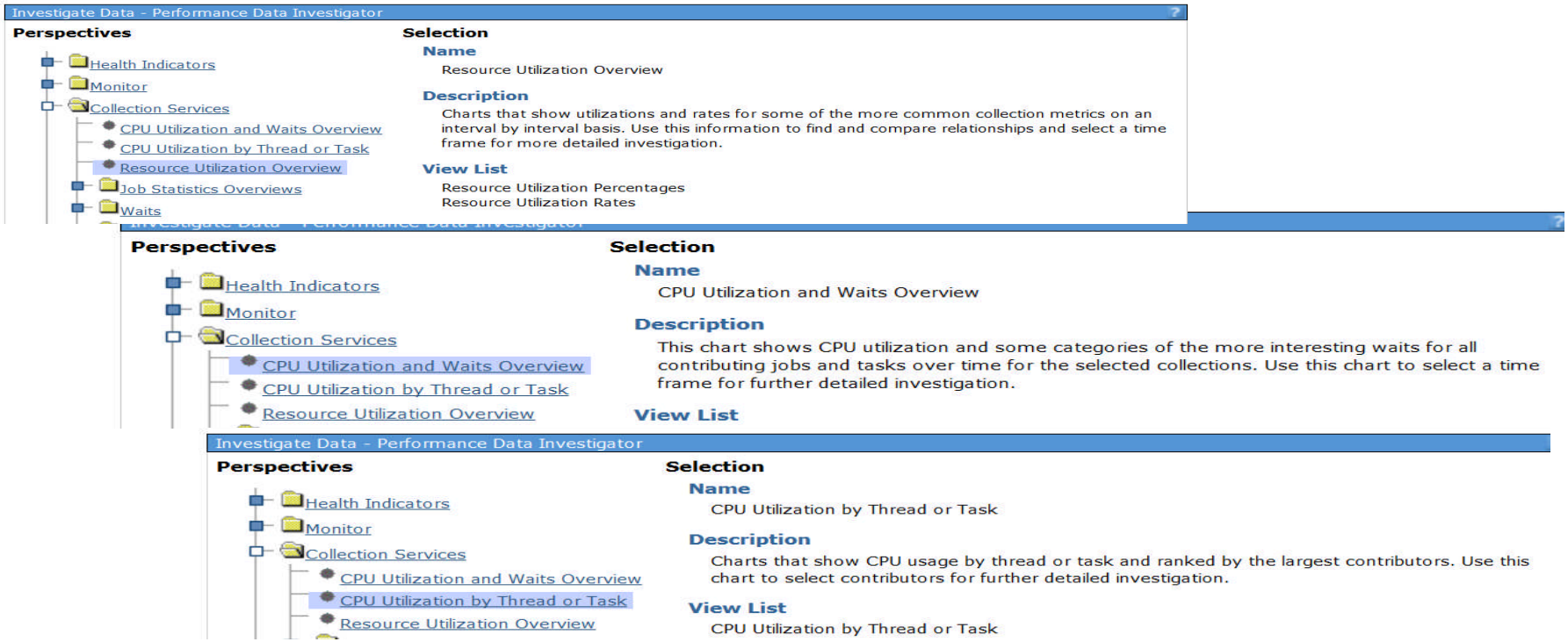
Selecting a Collection

- Collections have the date and time to help you identify the one you are interested in

- Note Q* and R* collections
  - R* collections are ***new*** in 7.2
    - System monitor data

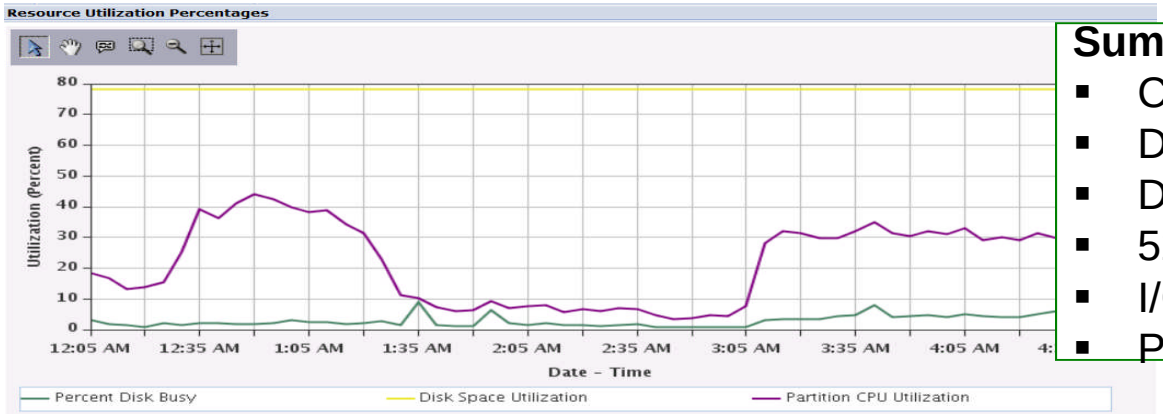


Suggested Starting Points



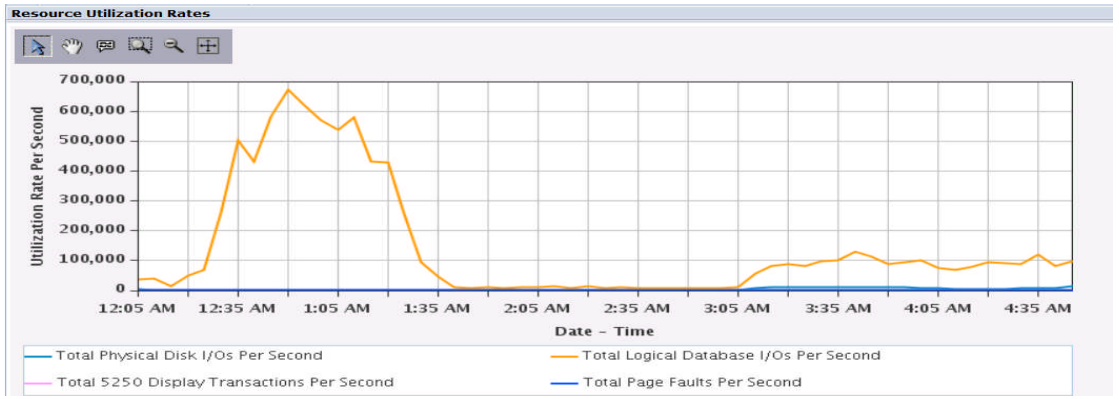
Starting points can depend on goal (monitoring versus problem determination…)

Resource Utilization Overview

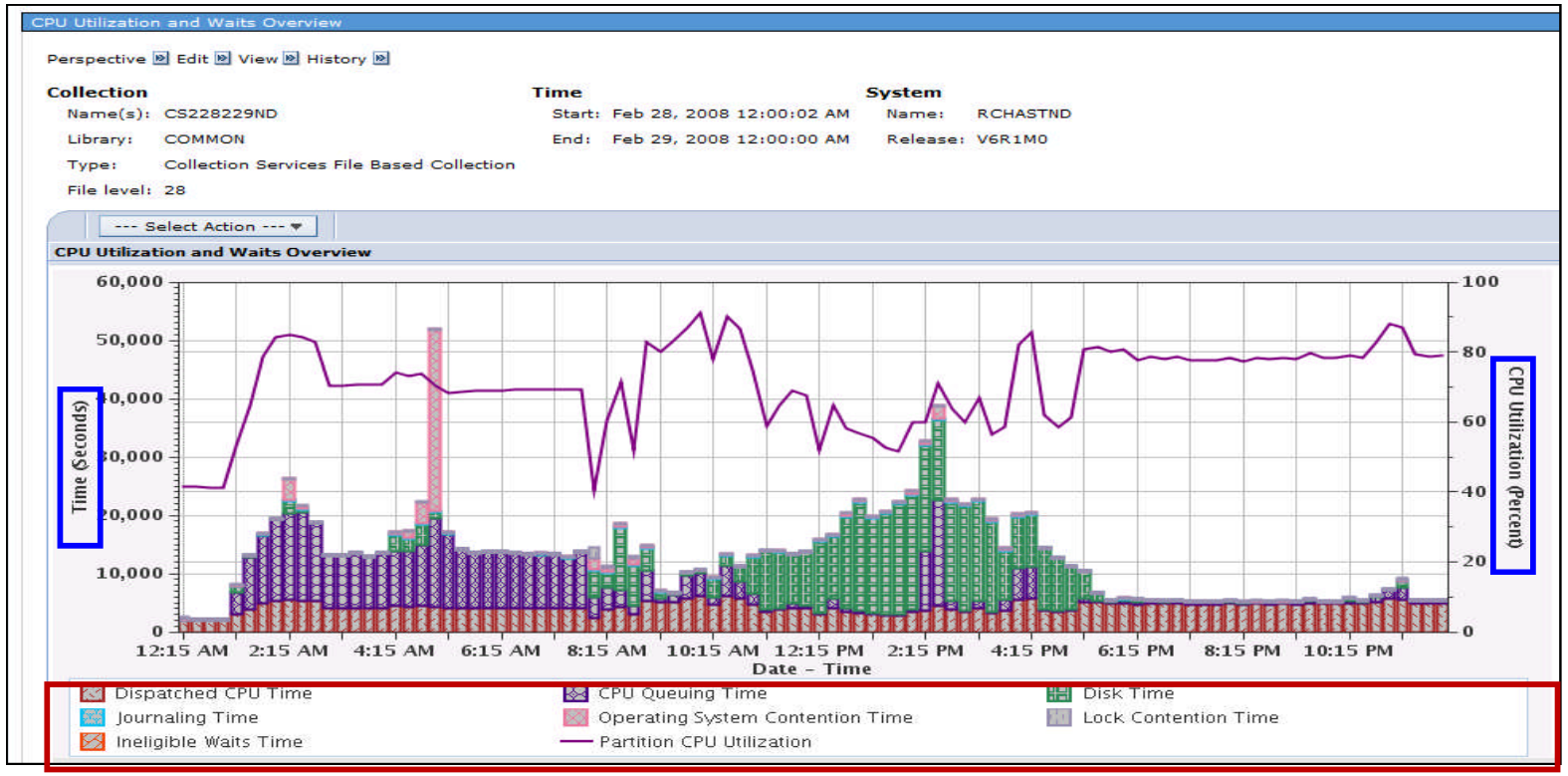


Summary for general overall health:

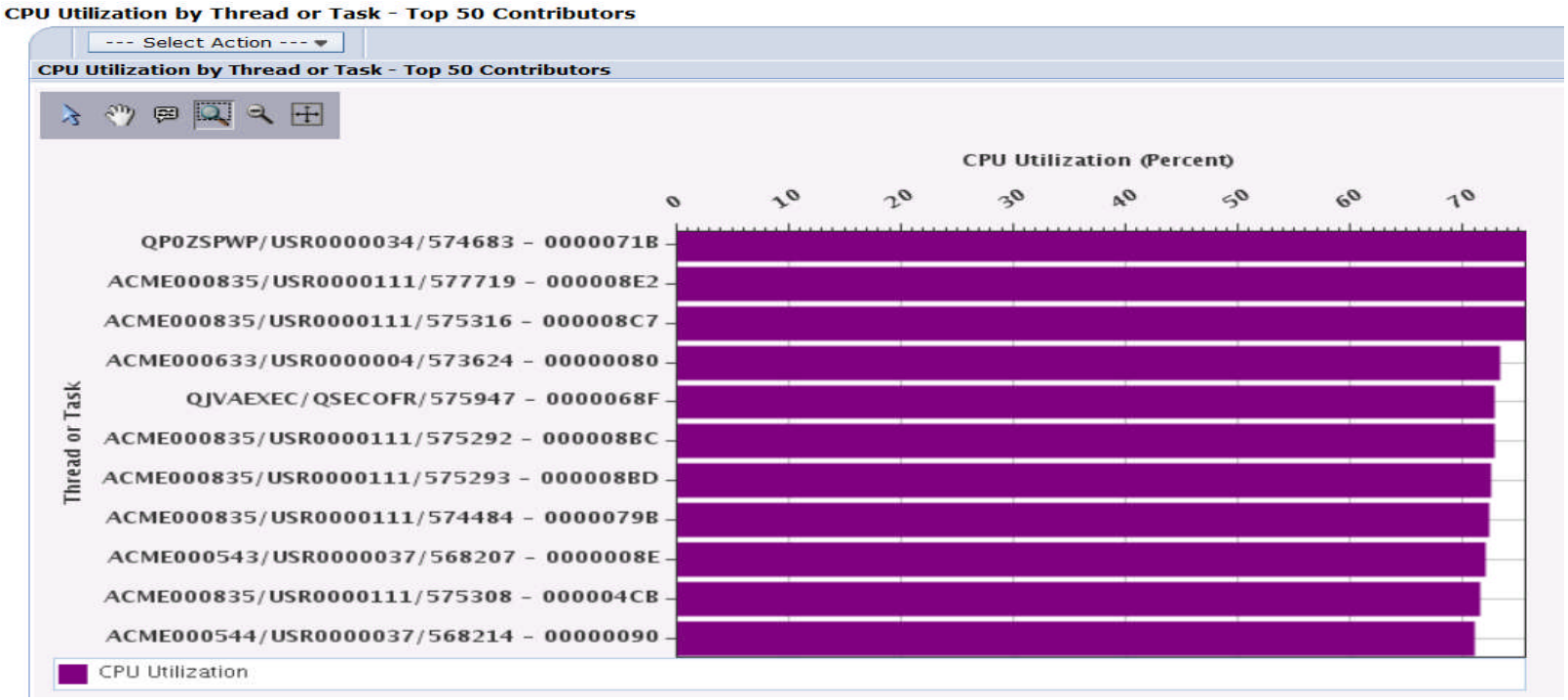
- CPU Utilization
- Disk Space Utilization
- Disk Busy
- 5250 Transactions per second
- I/Os per Second (logical and physical)
- Page Faults per second



CPU Utilization and Waits Overview

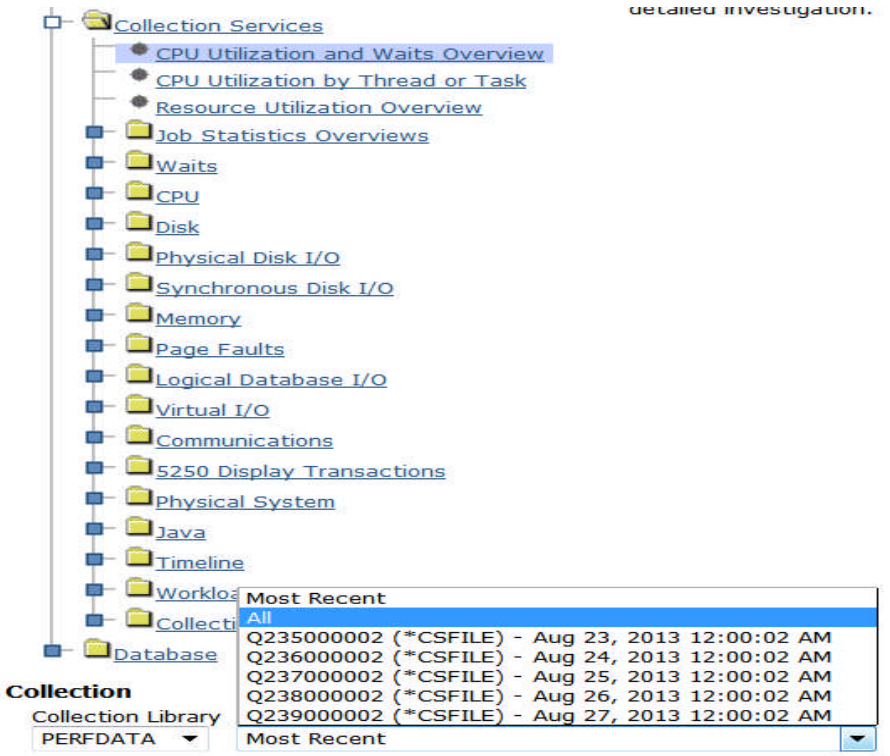


CPU Utilization by Thread or Task



Graphing Multiple Collections

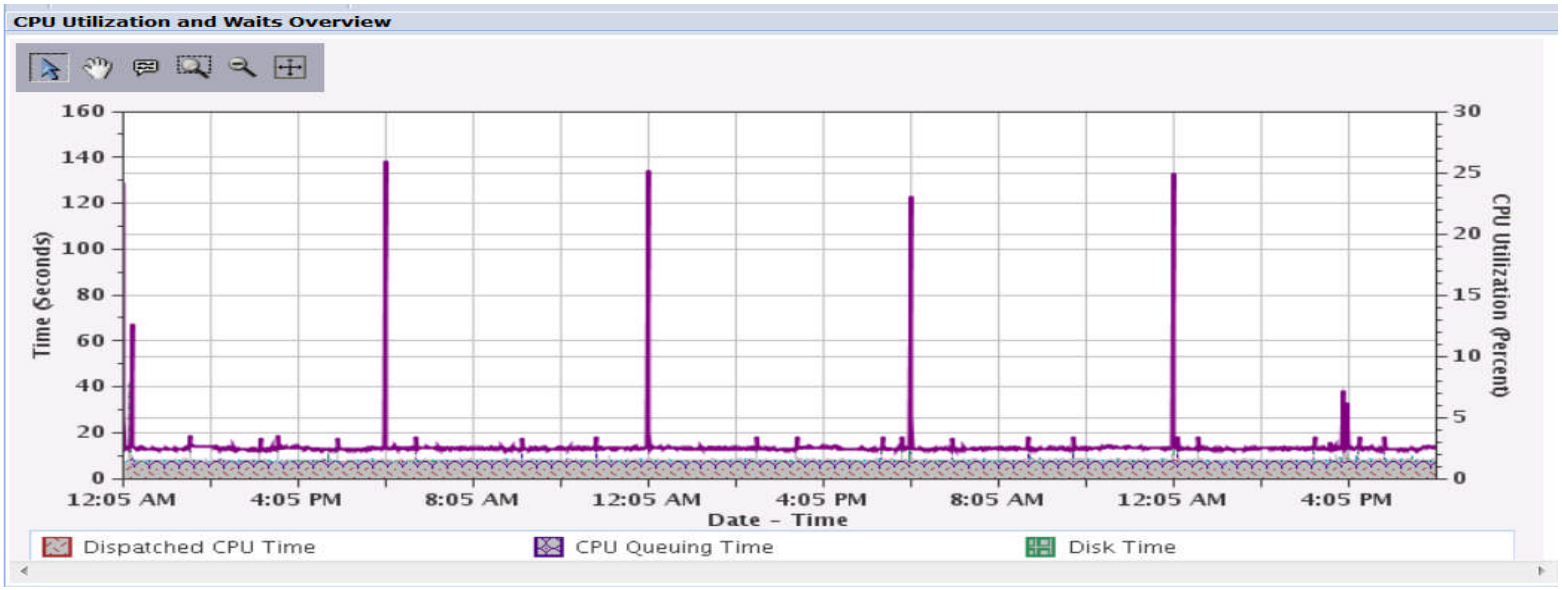
- If your collection library has **5 or fewer** collections, an **All** option is available to display all the collections in one graph
- It will take longer to display the graph
  - Multiple collections means larger queries!
- **Hint**: when the graph appears, you need to use the “reset zoom” tool to display all the data.



Graphing Multiple Collections

This example shows five days of (fairly uninteresting) Collection Services data

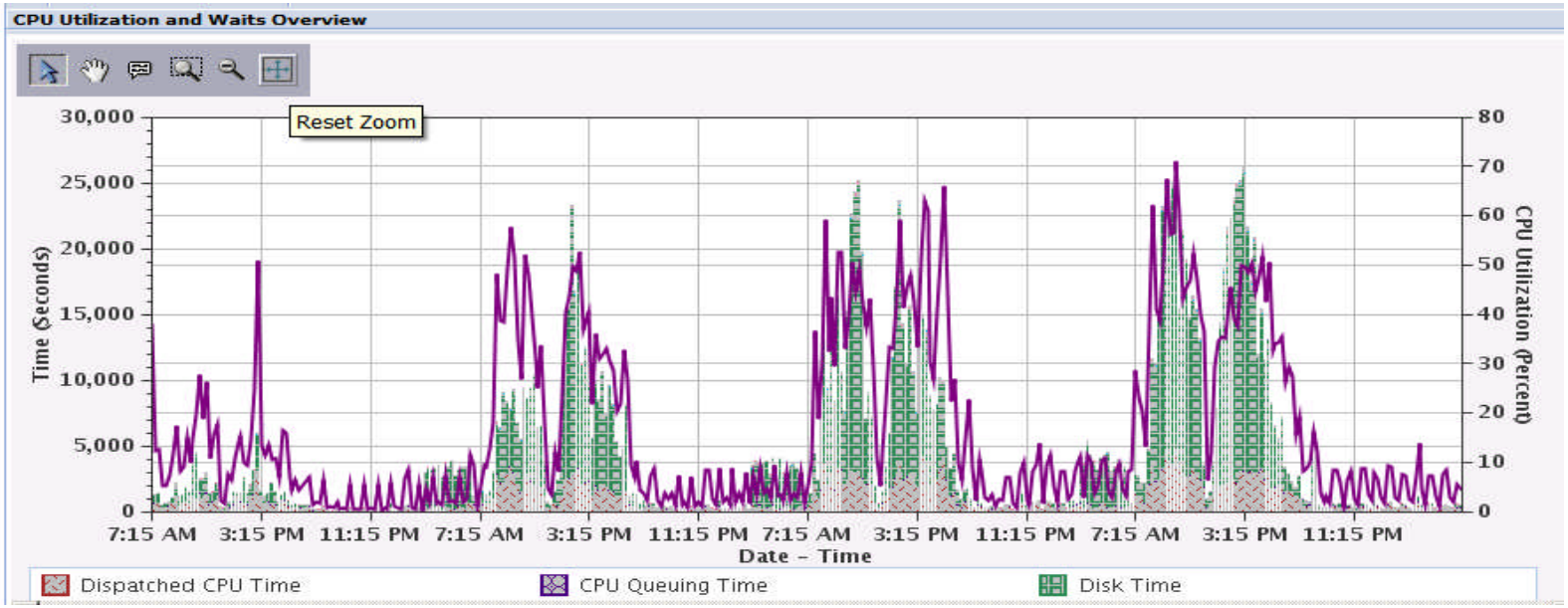
- *Do you know what ran each day at midnight?*



A More Interesting Example…

4 days of more interesting performance data.

Observe the pattern…



View Collection and System Details

Toggle on/off the detailed information regarding the collection or the system from which the collection originated

Show/hide Context

Show/hide System Information

Collection

Name(s): Q016000149
Library: PMR17037
Type: Collection Services File Based Collection
File level: 36

Time

Start: Jan 16, 2013 12:01:49 AM
End: Jan 17, 2013 12:01:57 AM

System

Name: ROCHMN
Release: V7R1M0

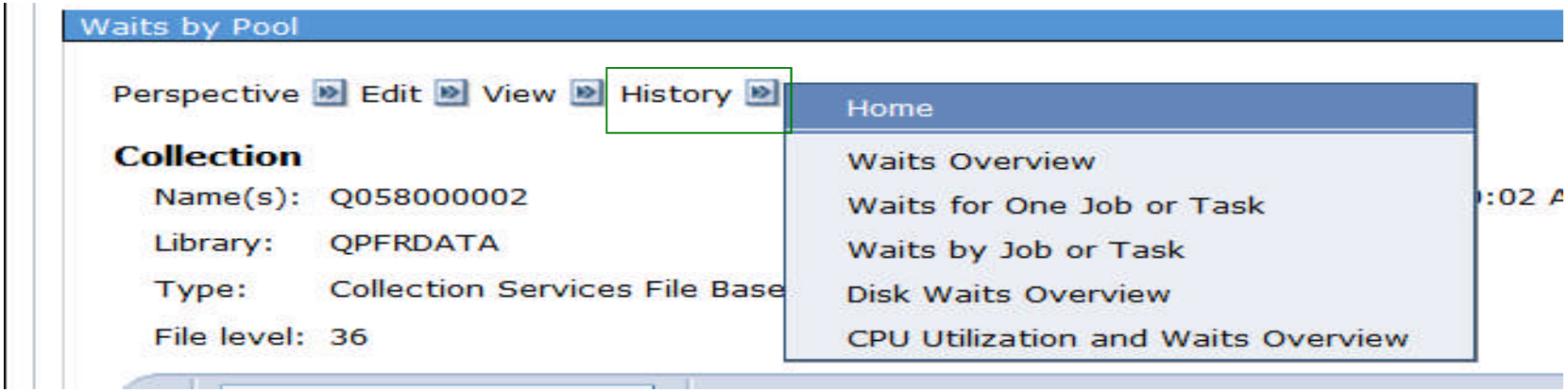
System Information

Name:	ROCHMN	Total Processors:	16	Interactive Threshold:	100%
Release:	V7R1M0	Processors / Cores Active:	10	System ASP Capacity	4,680 GB
Type:	9117	Available Processors:	6	Hypervisor Memory:	9,728 MB
Model:	MMA	Virtual Processors:	10	Primary Partition:	0
Serial Number:	10-3709C	Installed Processor Count:	12	Partition ID:	15
Processor Feature Code:	7380	Processor Units (allocated to partition):	3.05	Partition Count:	15
Processor Feature:	7380	Processor Sharing/Capped:	Yes / No	Partition Memory:	100 GB
Generated On:	ROCHMN	QPFRADJ System Value:	3		

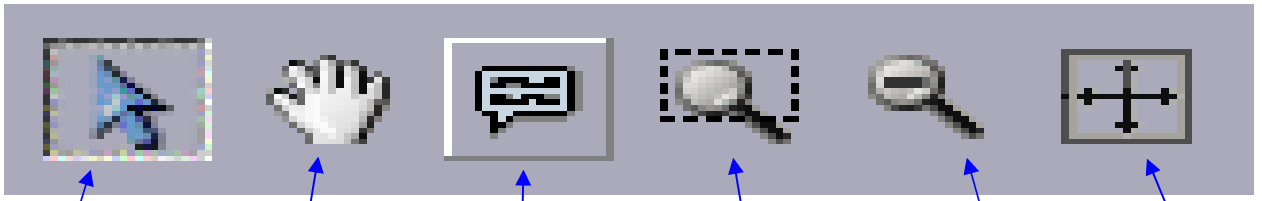
Provides quick access to system information from Collection Services QAPMCONF file for the Collection being viewed

Navigation History

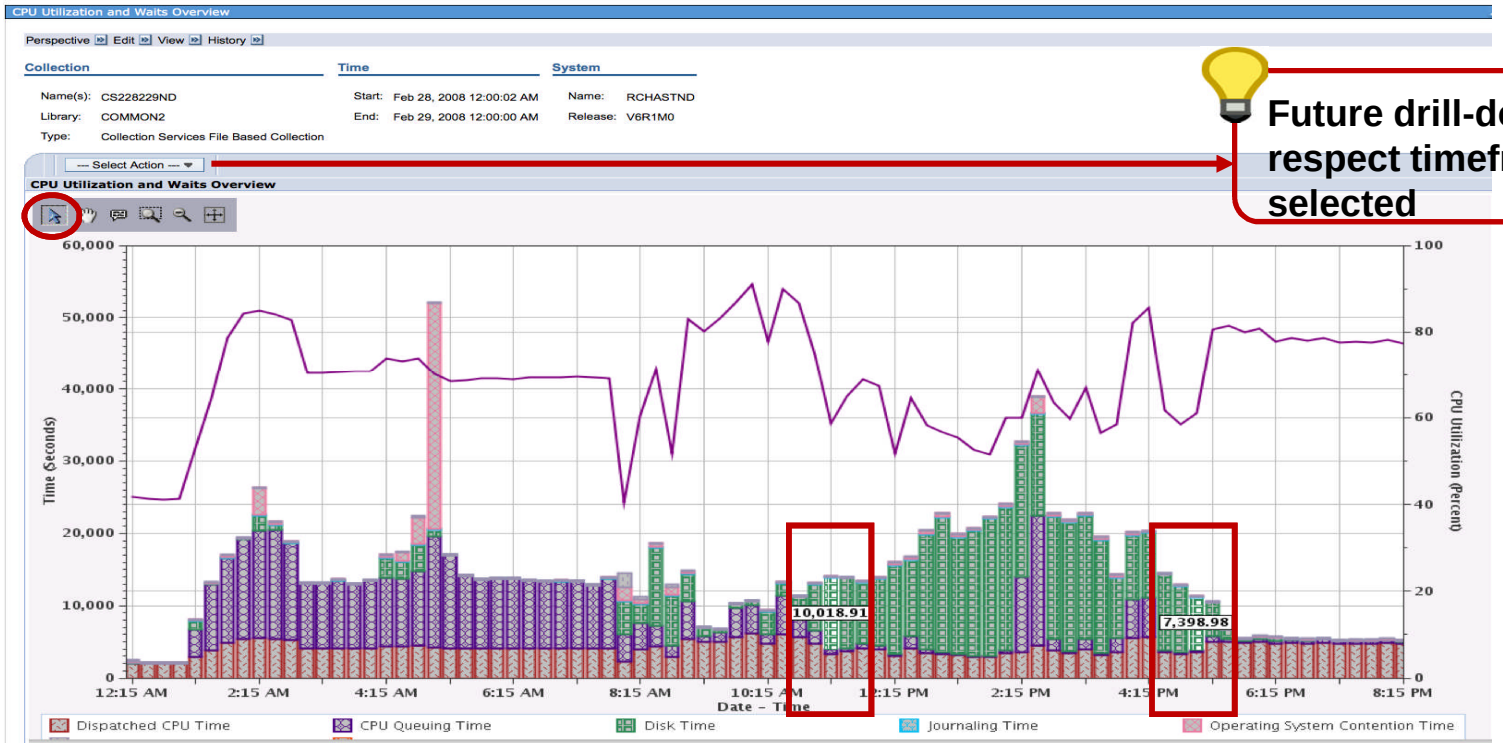
- Keeps track of where you have visited, easy to “back-track”
- Quick way to get back to “Home” (main navigation tree)



Tools to Interact with the Charts



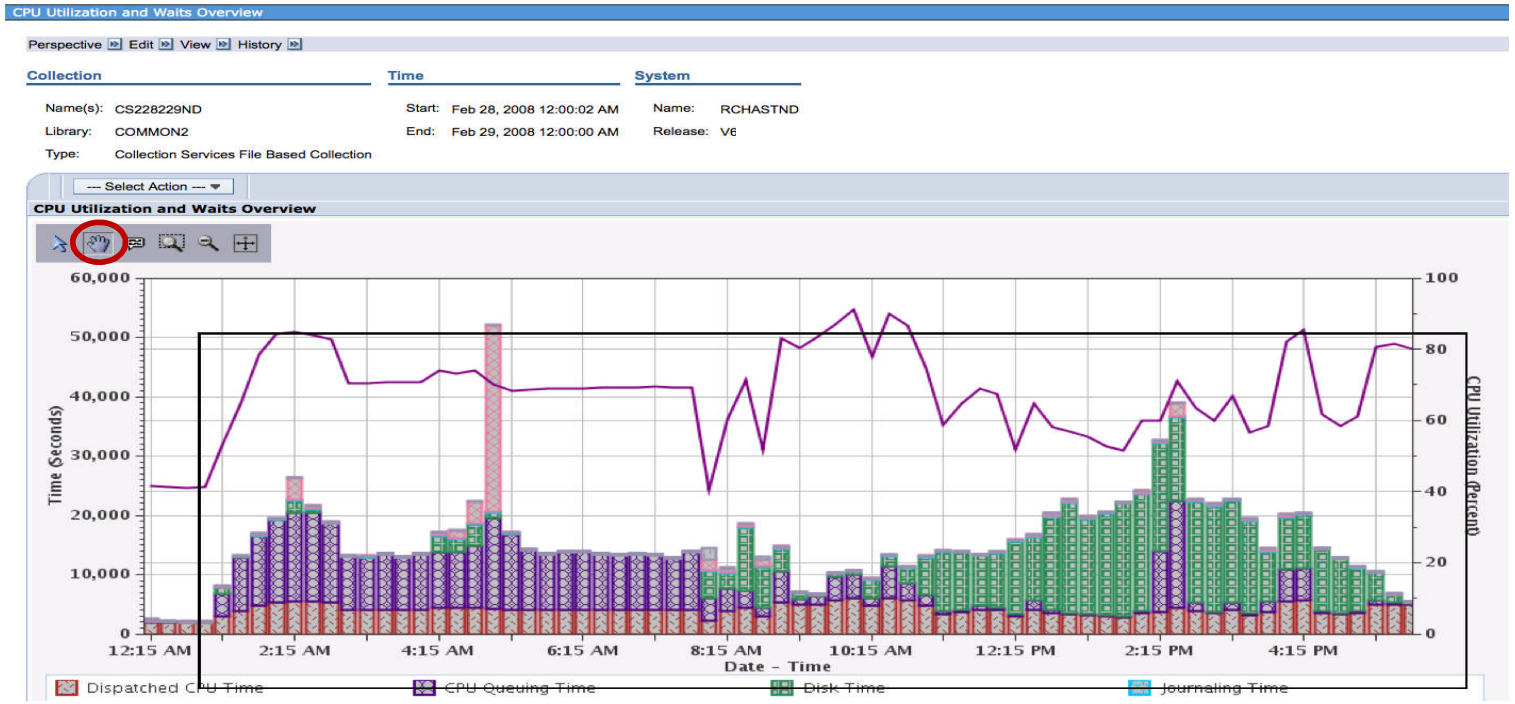
Selection



Future drill-downs will respect timeframe selected

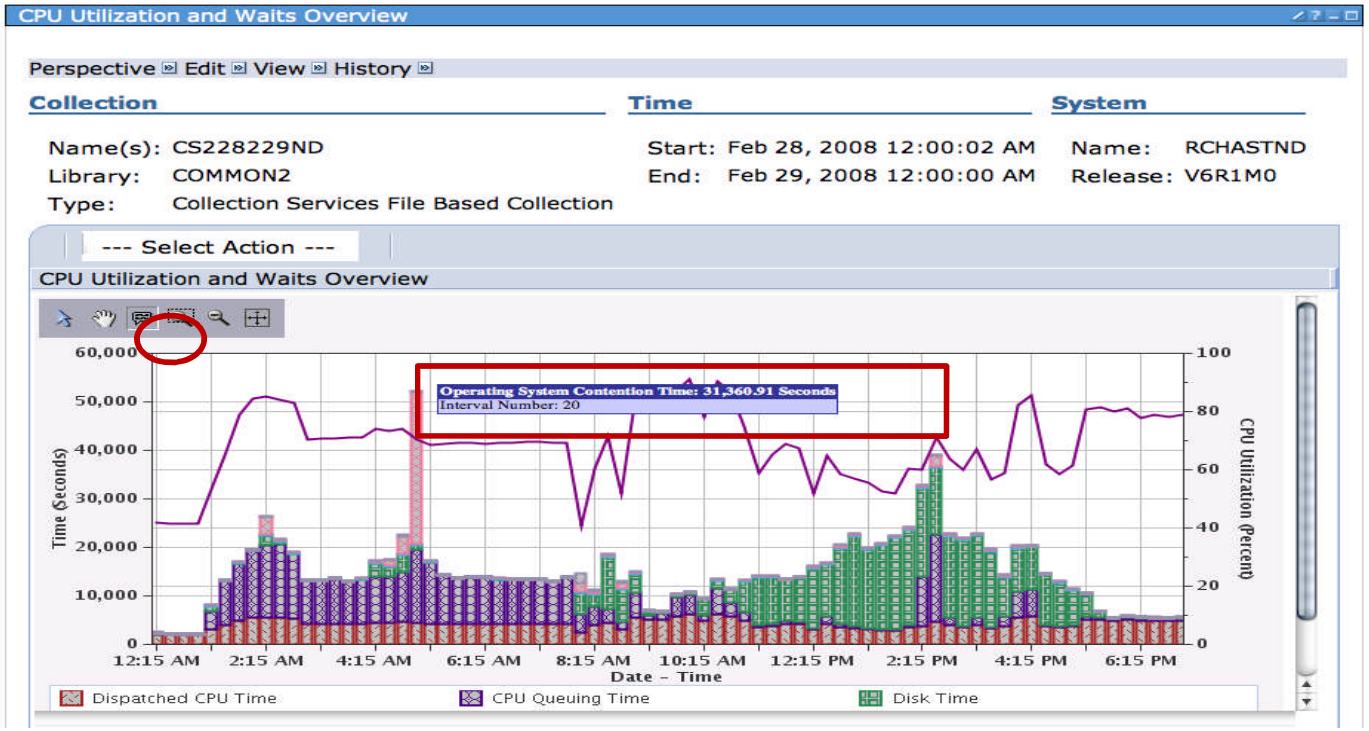
Use to select data point(s).

Pan



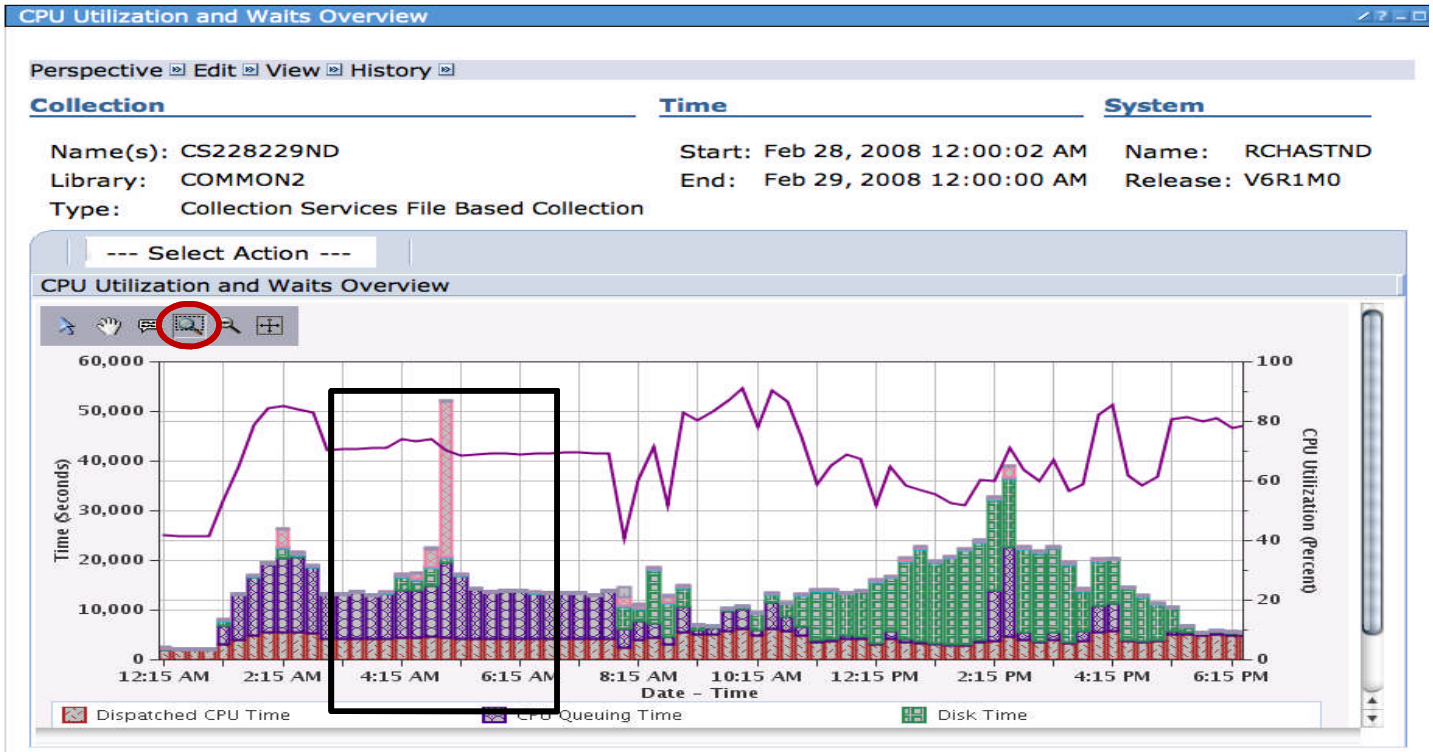
Use to shift chart right or left, up or down.

Tool Tips



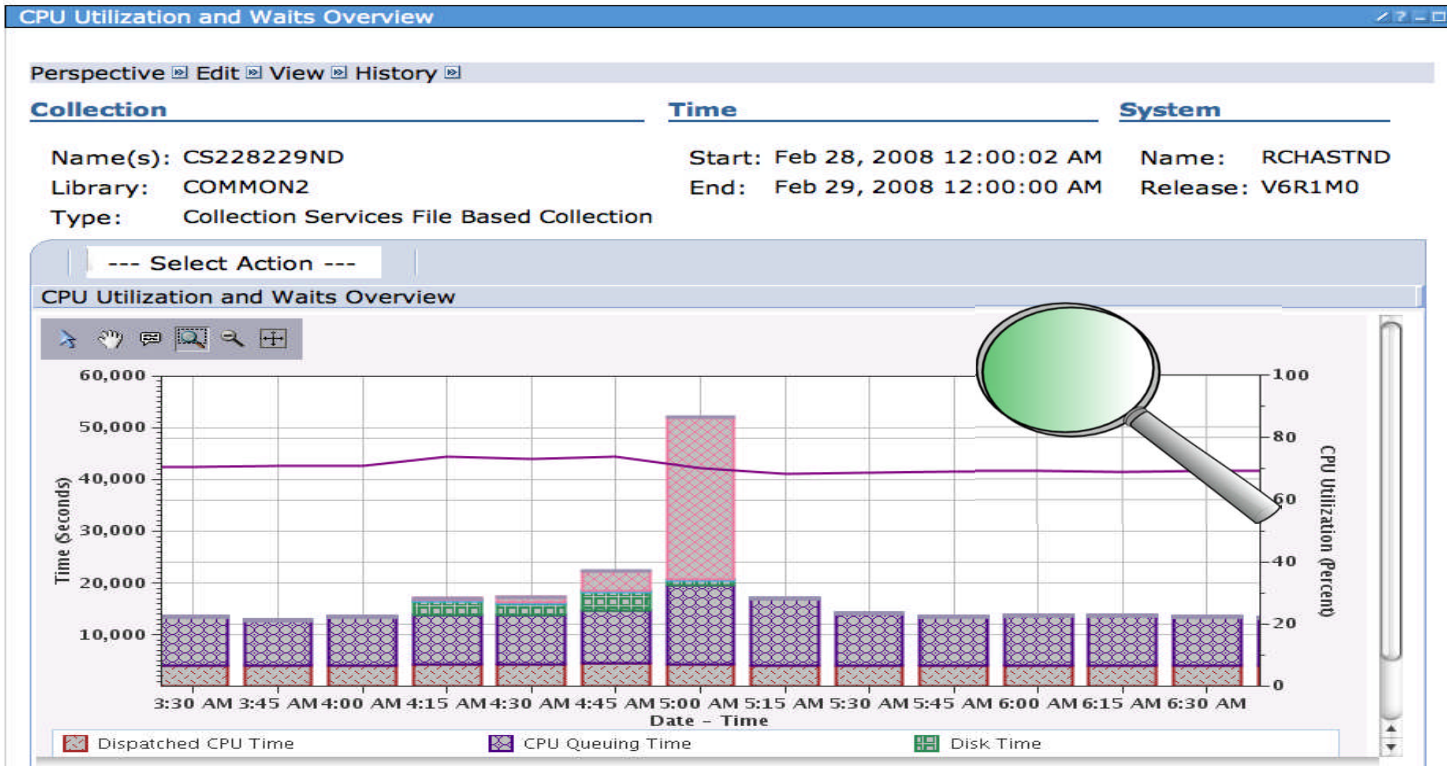
Use to see metric details for interval.

Zoom Region

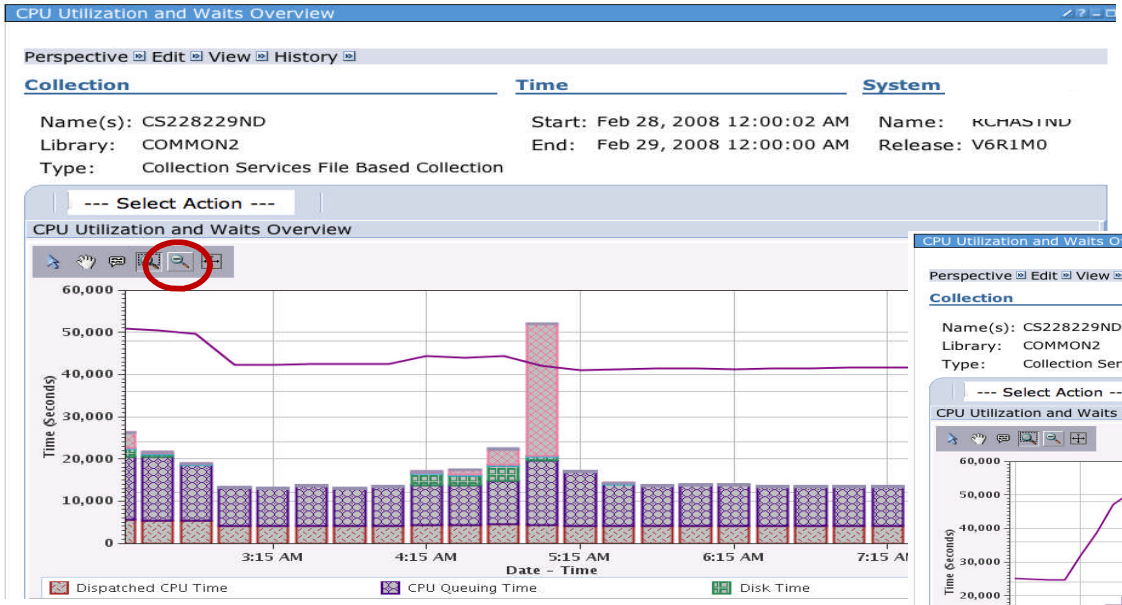


Use to zoom in on a range of data.

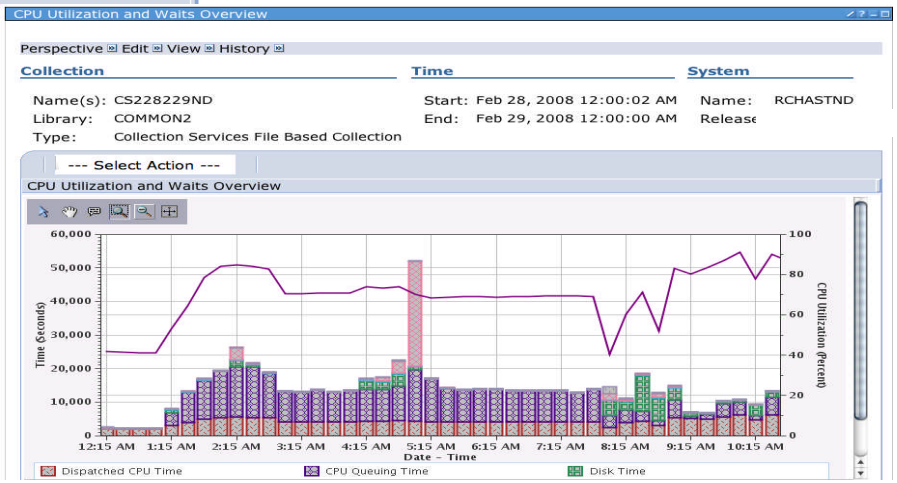
Zoom Region Results



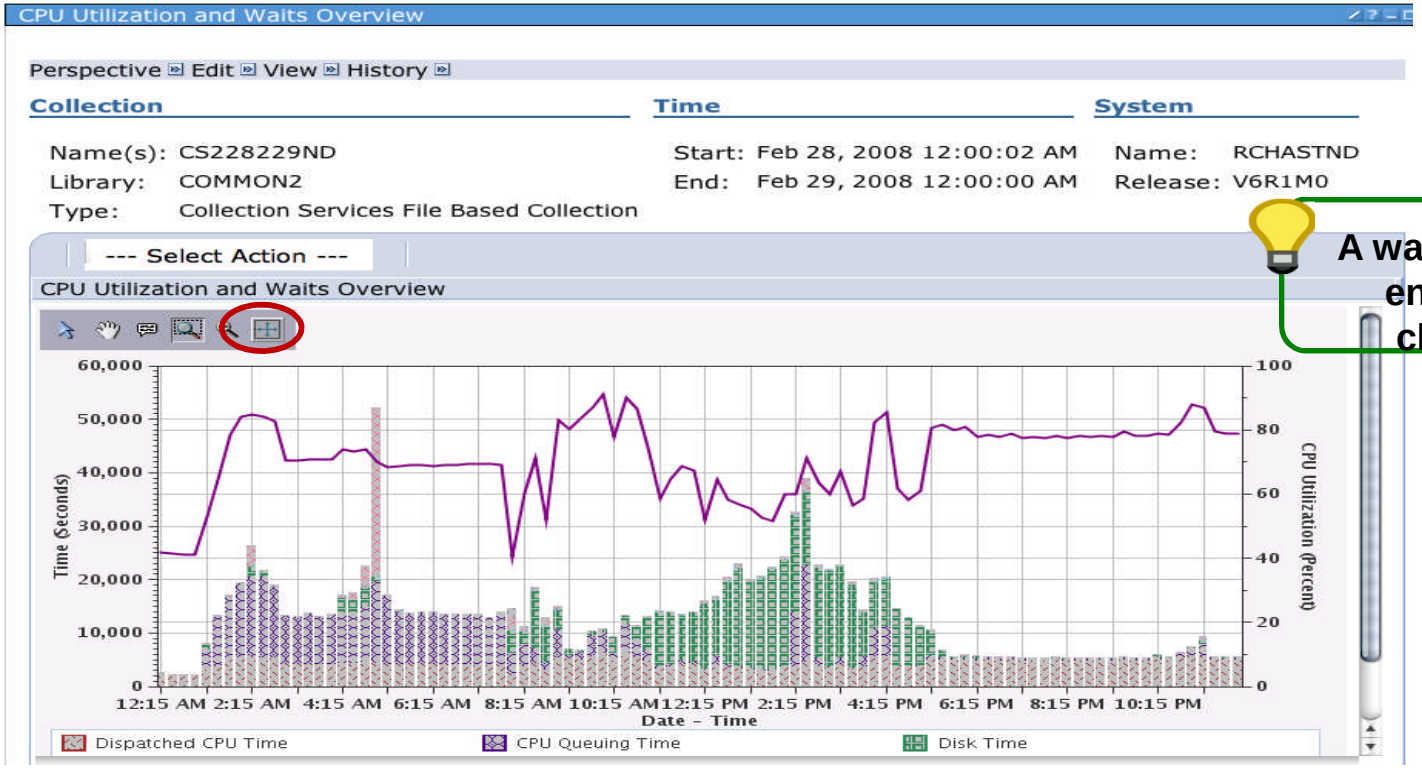
Zoom Out



Zoom out expands the graph each time it is clicked

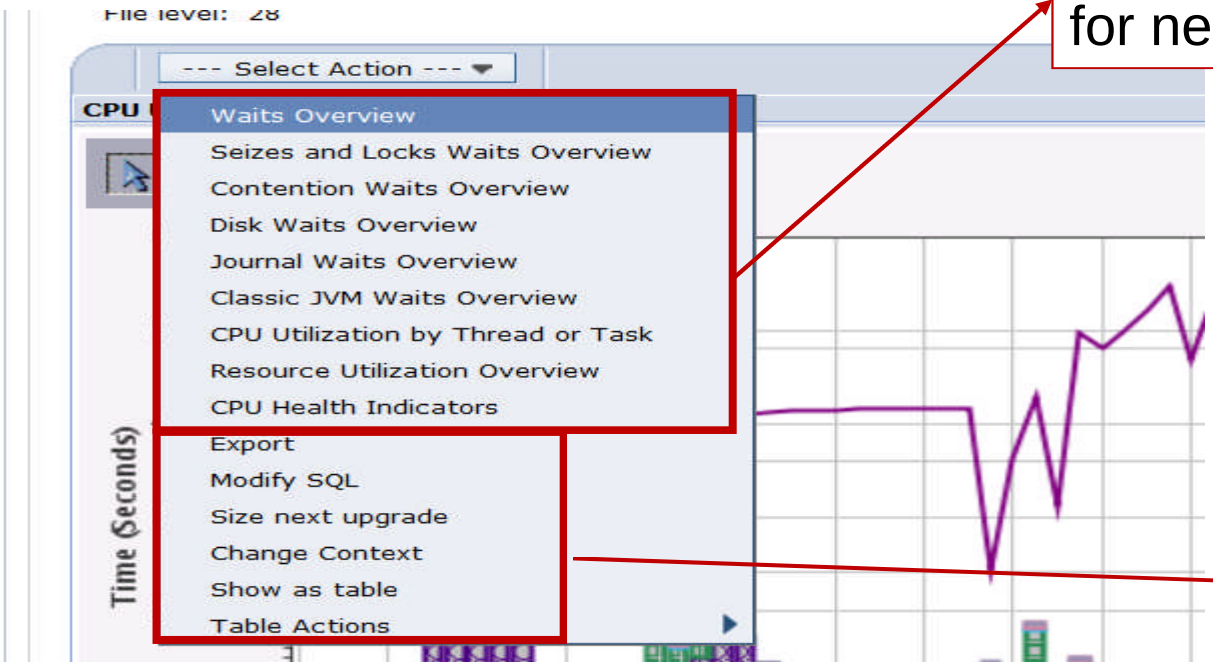


Full Zoom Out



A way to quickly view entire collection characteristics

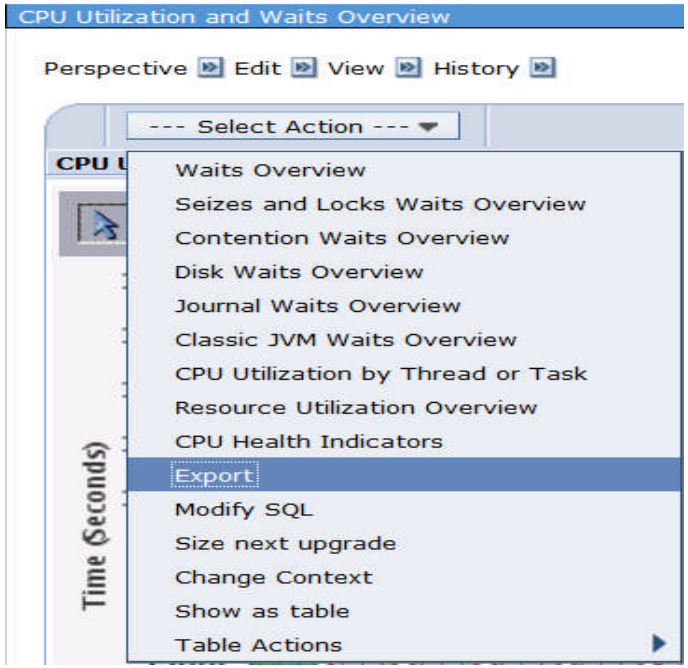
Drill-down

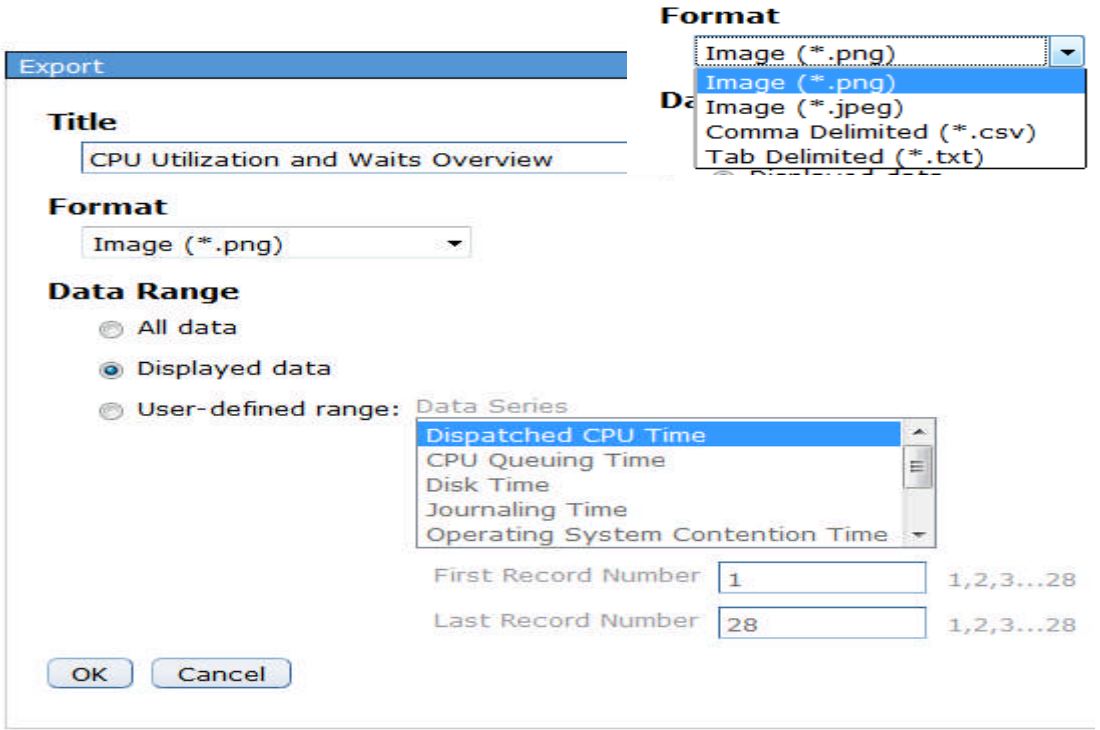


Suggested graph options for next step in analysis

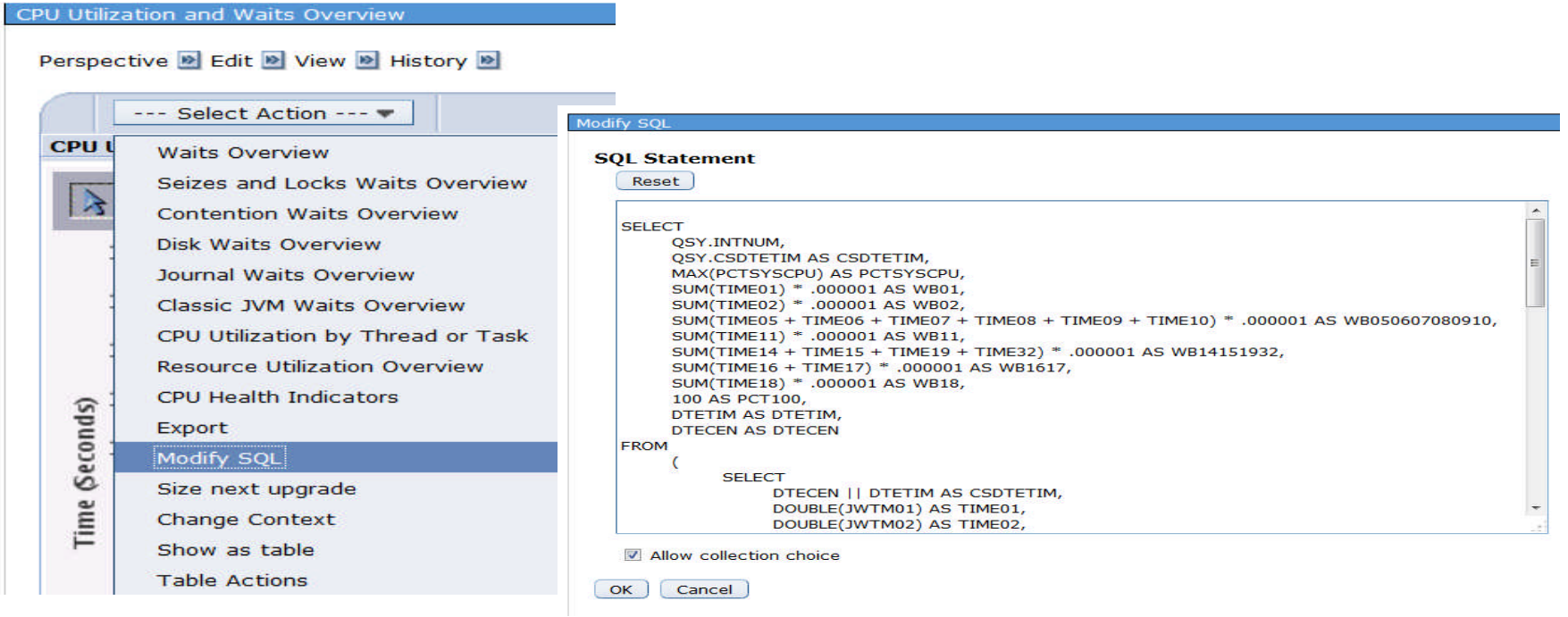
Other options to work with data or refine graphs

Export - *.png, *.jpeg, *.csv, *.txt

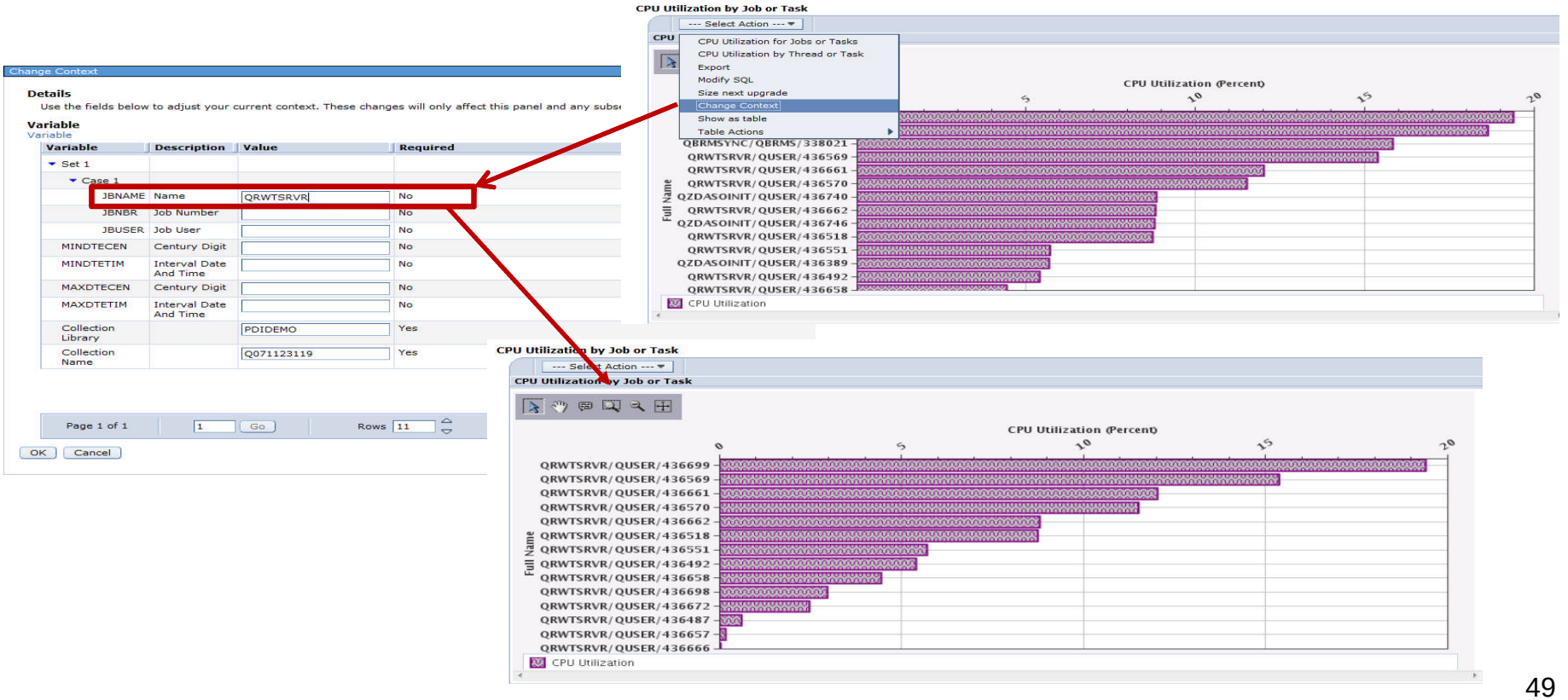




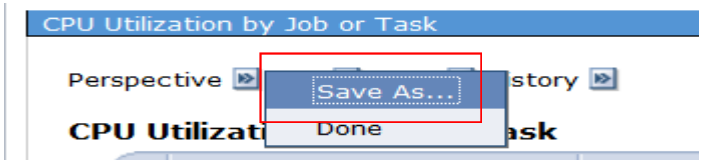
Modify SQL – customize the queries



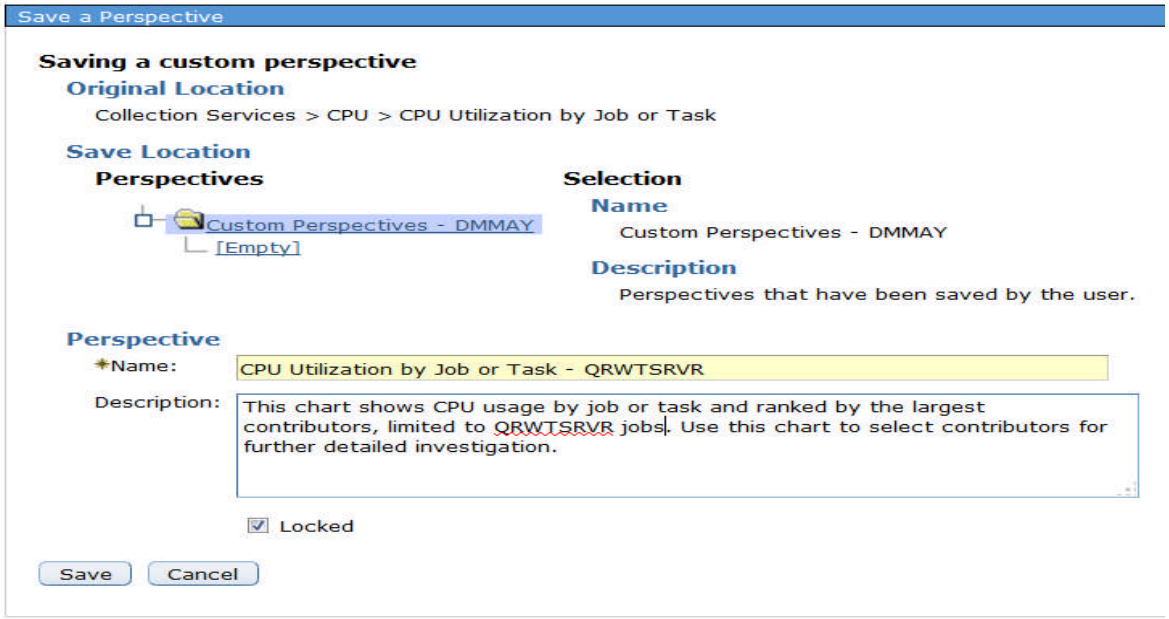
Change Context



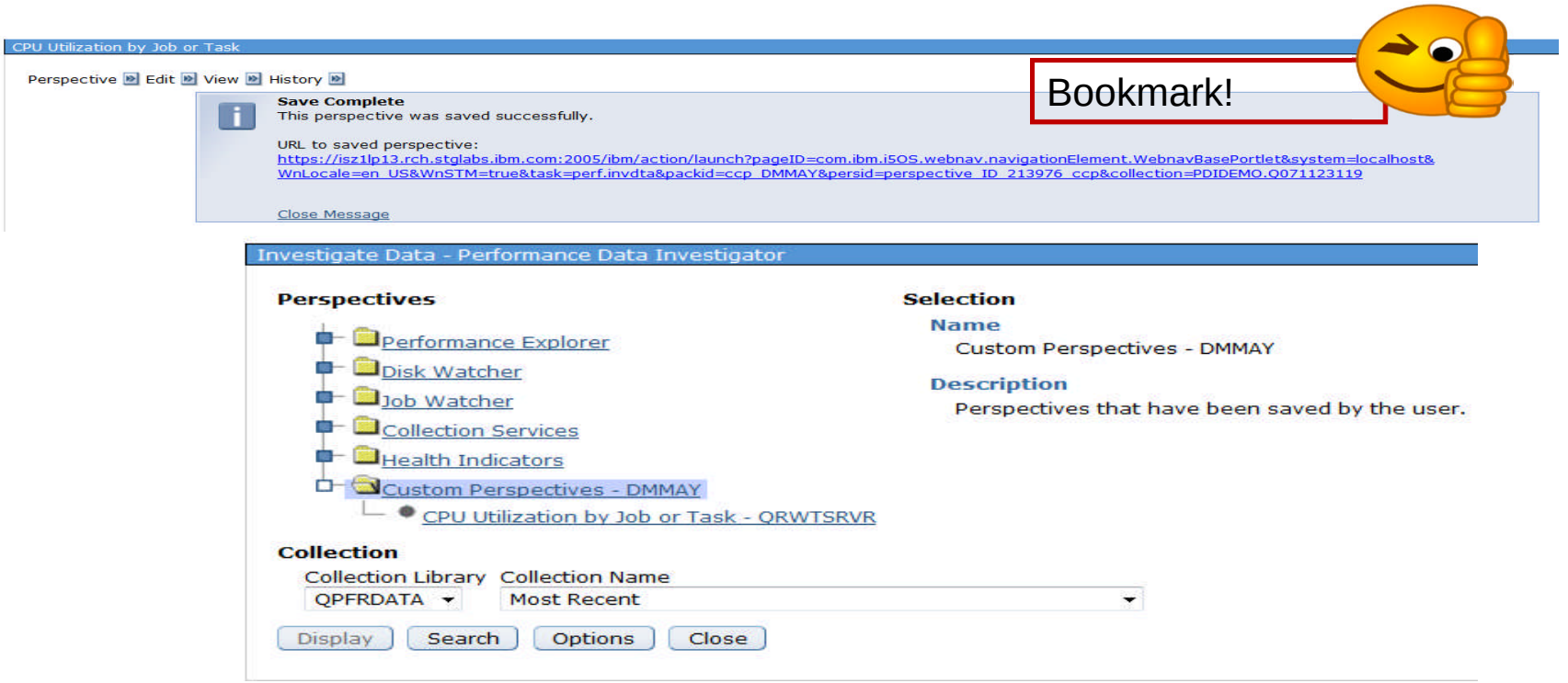
Perspective → Save As



When a table or chart is modified, you can save that table or chart for your own custom perspective using "**Save As...**"



Perspective → Save As



Show as Table

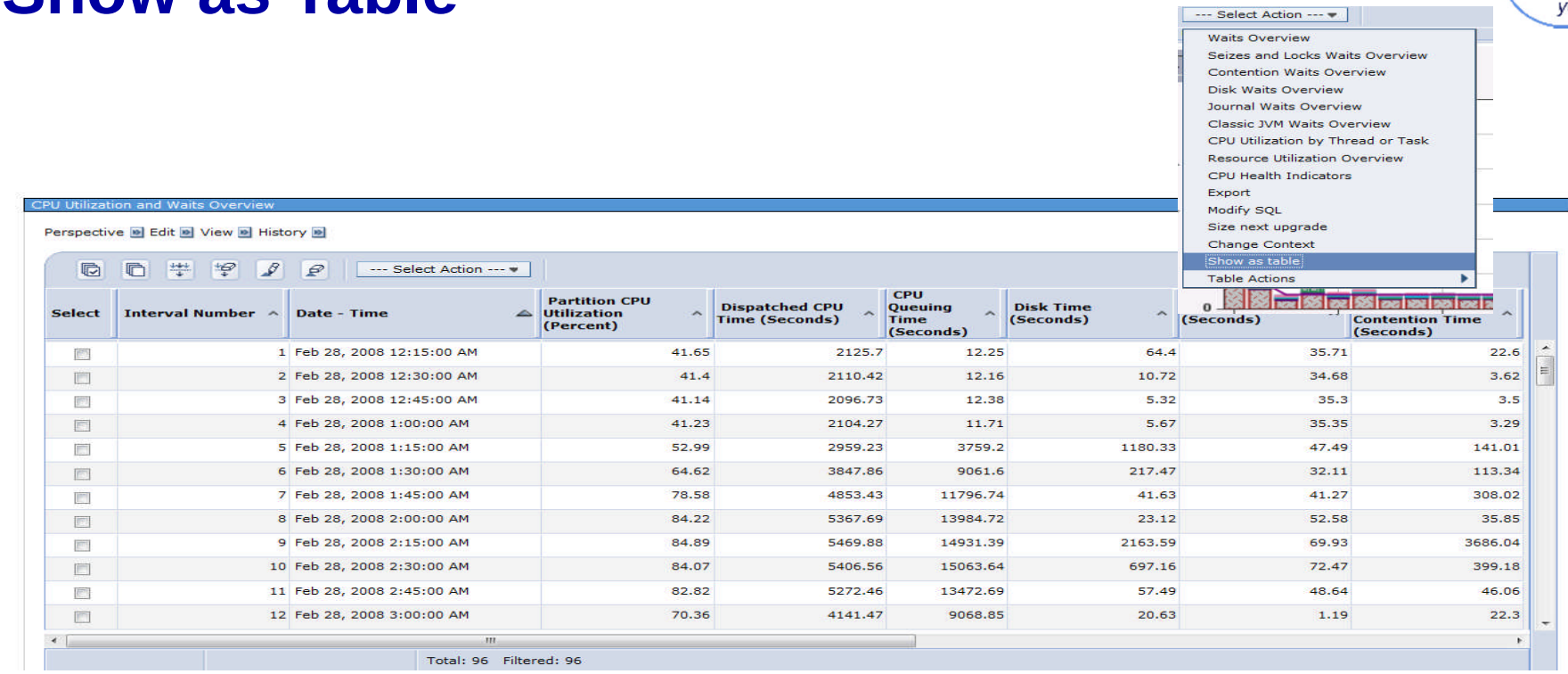
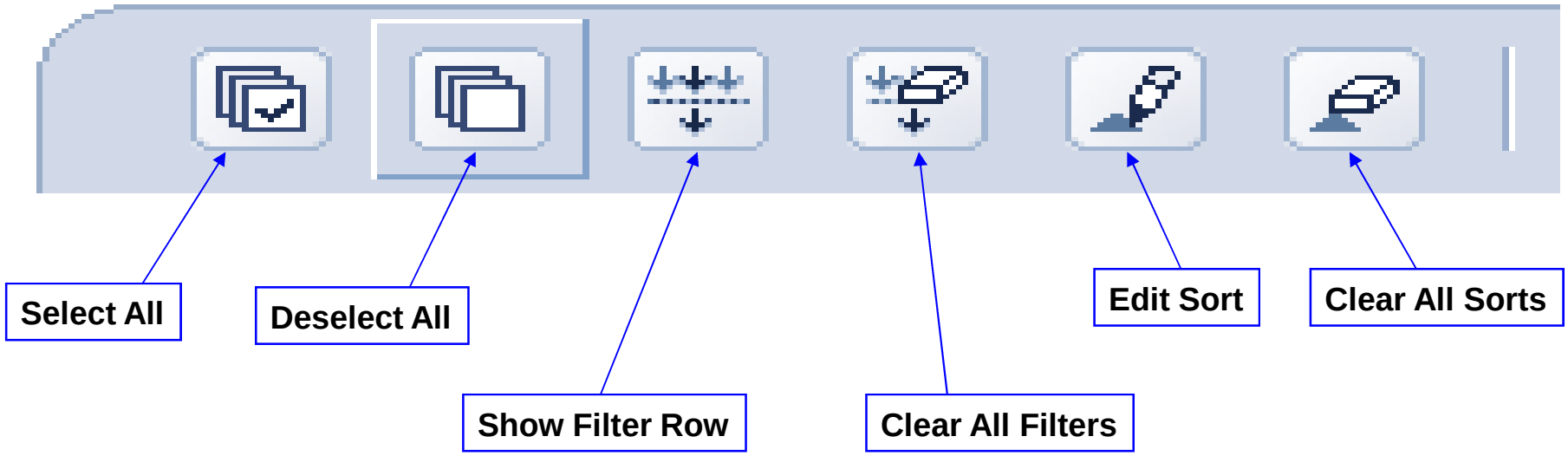
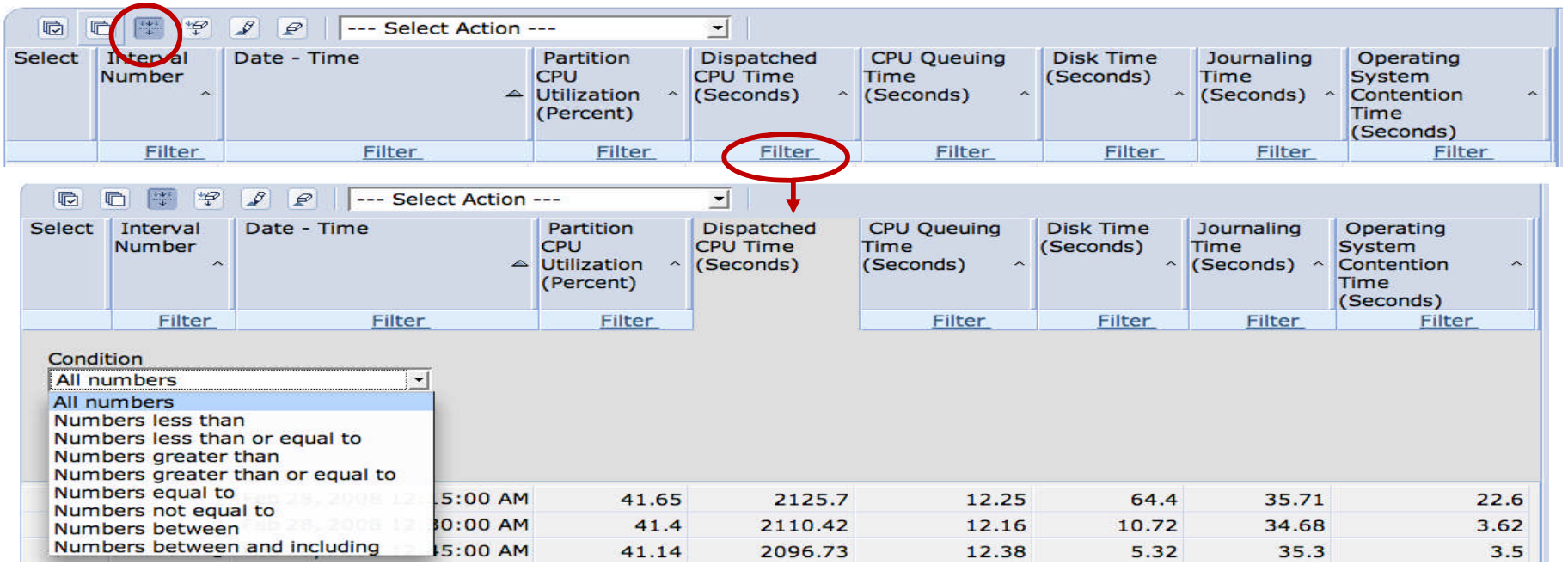


Table Features

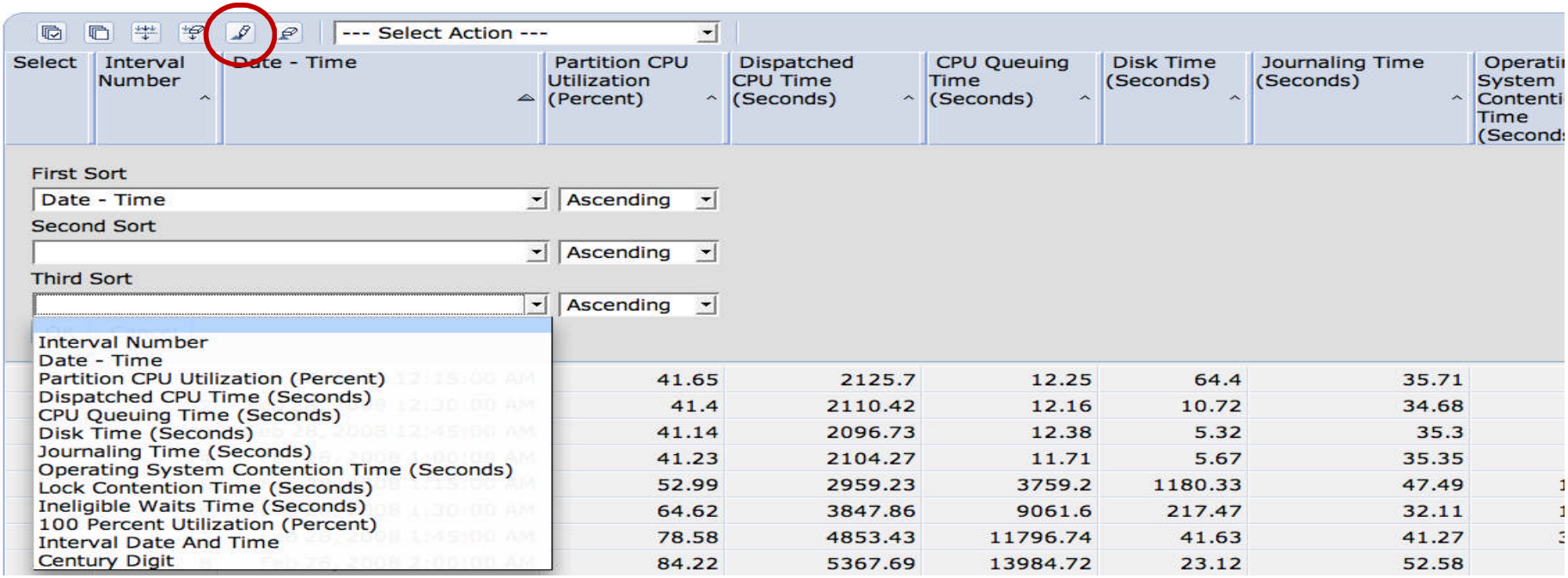


Filtering

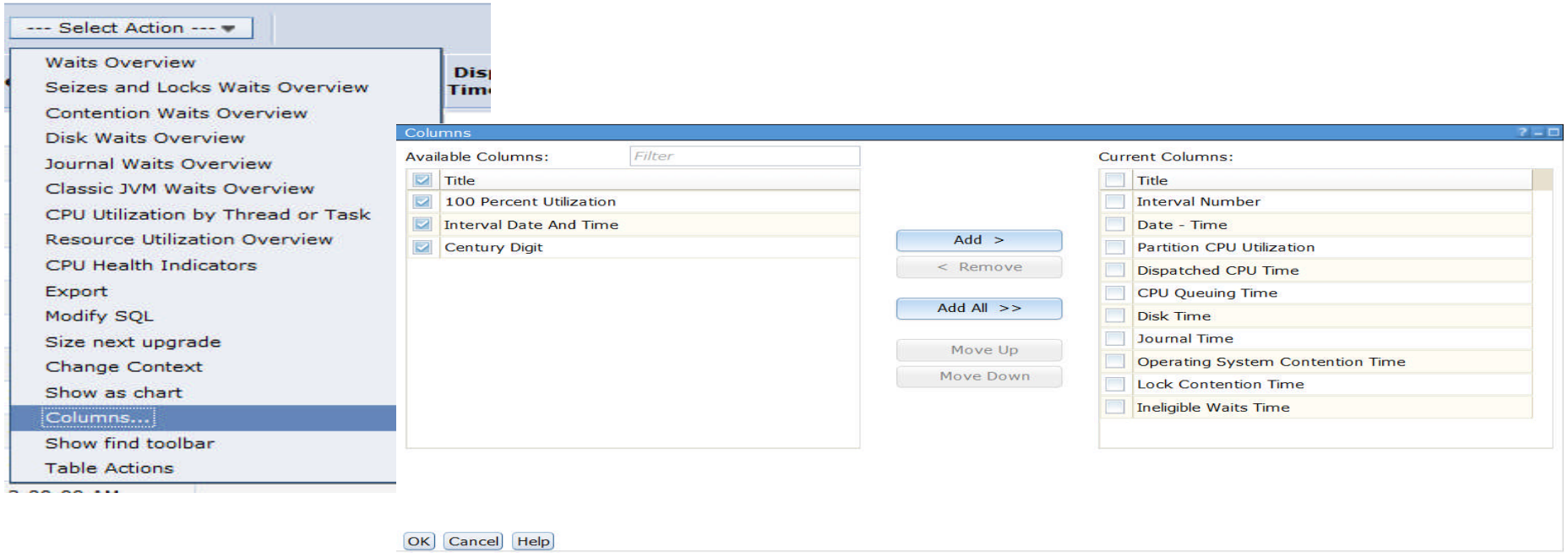
Show Filter Row



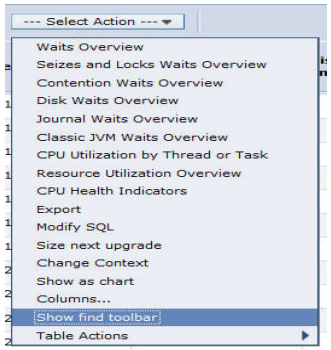
Sorting

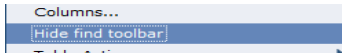

--- Select Action ---
Select
Interval Number
Date - Time
Partition CPU Utilization (Percent)
Dispatched CPU Time (Seconds)
CPU Queuing Time (Seconds)
Disk Time (Seconds)
Journaling Time (Seconds)
First Sort
Date - Time
Ascending
Second Sort
Ascending
Third Sort
Ascending
Interval Number
Date - Time
Partition CPU Utilization (Percent)
Dispatched CPU Time (Seconds)
CPU Queuing Time (Seconds)
Disk Time (Seconds)
Journaling Time (Seconds)
Operating System Contention Time (Seconds)
Lock Contention Time (Seconds)
Ineligible Waits Time (Seconds)
100 Percent Utilization (Percent)
Interval Date And Time
Century Digit
41.65 2125.7 12.25 64.4 35.71
41.4 2110.42 12.16 10.72 34.68
41.14 2096.73 12.38 5.32 35.3
41.23 2104.27 11.71 5.67 35.35
52.99 2959.23 3759.2 1180.33 47.49
64.62 3847.86 9061.6 217.47 32.11
78.58 4853.43 11796.74 41.63 41.27
84.22 5367.69 13984.72 23.12 52.58

Columns....


--- Select Action ---
Waits Overview
Seizes and Locks Waits Overview
Contention Waits Overview
Disk Waits Overview
Journal Waits Overview
Classic JVM Waits Overview
CPU Utilization by Thread or Task
Resource Utilization Overview
CPU Health Indicators
Export
Modify SQL
Size next upgrade
Change Context
Show as chart
Columns...
Show find toolbar
Table Actions
Columns
Available Columns:
Filter
Title
100 Percent Utilization
Interval Date And Time
Century Digit
Add >
< Remove
Add All >>
Move Up
Move Down
Current Columns:
Title
Interval Number
Date - Time
Partition CPU Utilization
Dispatched CPU Time
CPU Queuing Time
Disk Time
Journal Time
Operating System Contention Time
Lock Contention Time
Ineligible Waits Time
OK
Cancel
Help

Show find toolbar / Hide find toolbar & Search the table





Waits by Job Current User Profile

Perspective | Edit | View | History

Search for: stacyb | Condition: Contains | Column: All columns | Direction: Down

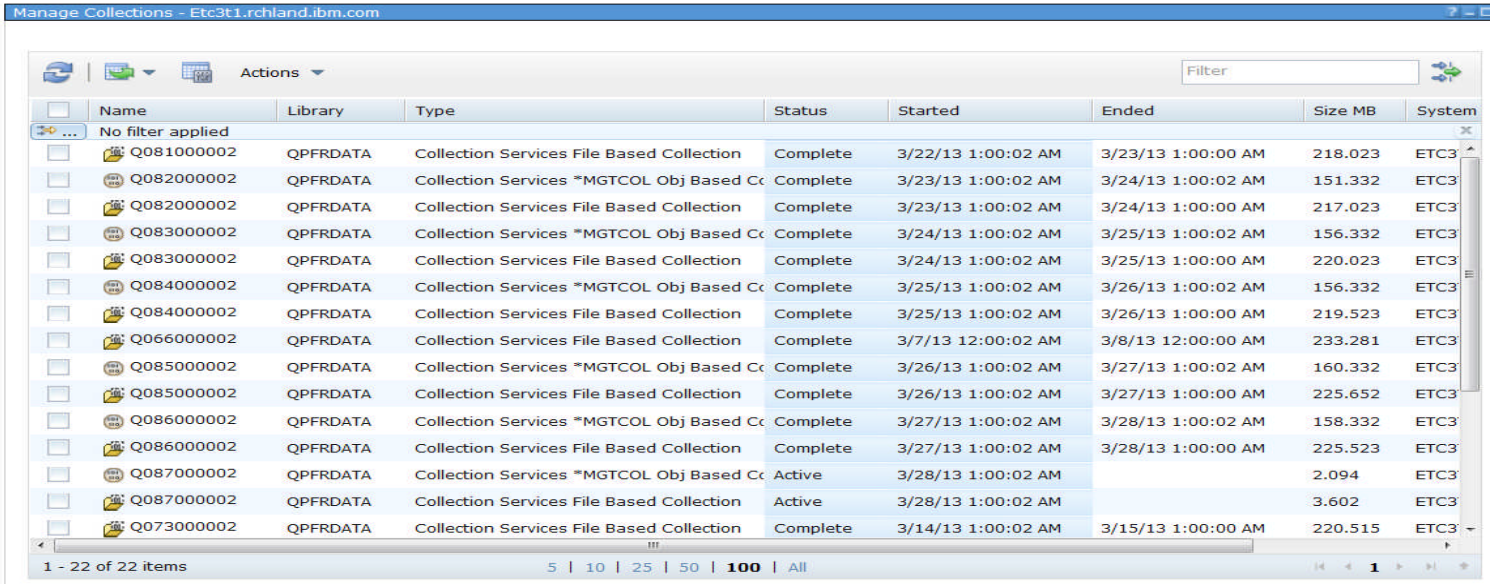
Find | Match case

--- Select Action ---

Select	Current User	Dispatched CPU Active Time (Seconds)	Dispatched CPU Waiting Time (Seconds)	Dispatched CPU Transferred Time (Seconds)	Dispatched CPU Time (Seconds)
☐	QEJBSVR	343.26	297.91	0	641.17
☐	WEAVE	312.5	239.11	0	551.61
☐	QSYS	48.97	41.96	0	90.94
☐	QLWISVR	41.47	45.95	0	87.42
☐	QBRMS	32.67	25.78	0	58.45
☐	QSECOFR	23.31	21.57	0	44.88
☐	QPM400	20	15.75	0	35.75
☐	QTCP	8.47	7.8	0	16.27
☐	HOSTPUB	3.37	3.64	0	7.02
☐	QTMHHTTP	1.66	2.52	0	4.17
☐	QWEBADMIN	1.52	2.26	0	3.78
☐	QYPSJSVR	1.47	2.21	0	3.68
☐	QDIRSRV	0.86	1.17	0	2.03
☐	QIJS	0.55	0.43	0	0.98
☐	QUSER	0.43	0.35	0	0.77
☐	DRLEWIS	0.21	0.16	0	0.37
☐	QSVMSS	0.15	0.13	0	0.28
☐	GIBBONS	0.05	0.04	0	0.09
☐	STACYB	0.04	0.03	0	0.08

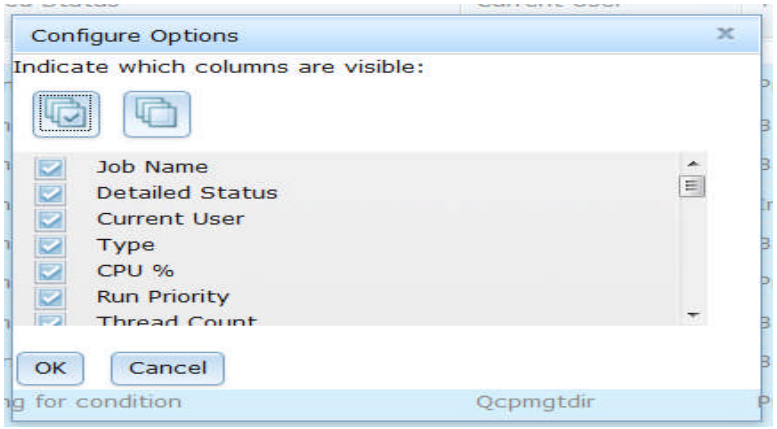
New Table Support

- Improved table support (7.2 and PTF'ed back to 6.1)
  - Collection manager and PDI Reports use the new table support
  - "Show as table" still uses the old table support

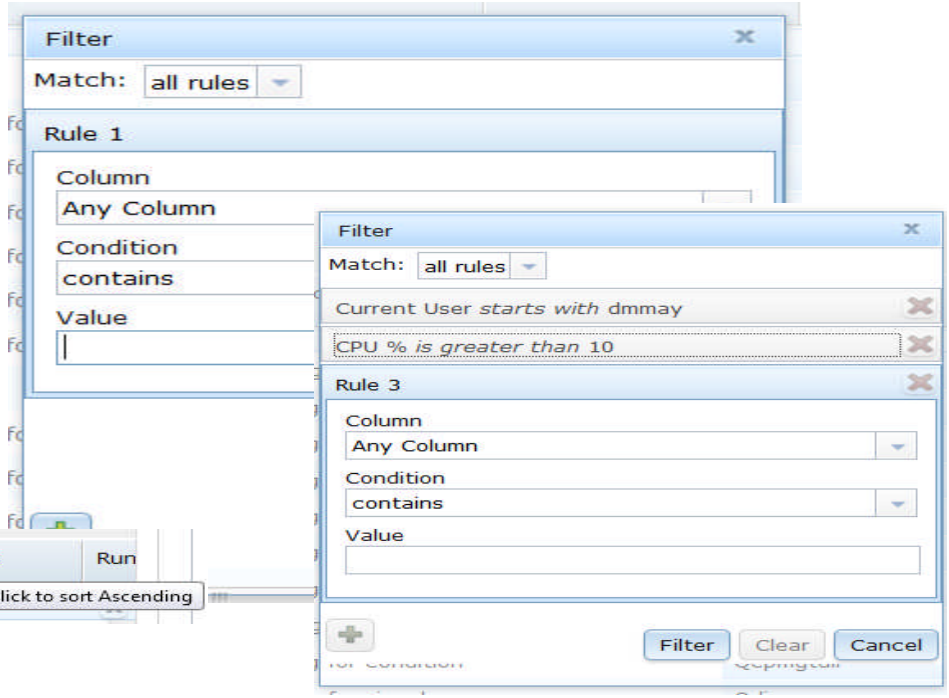


New Table Support – Same Features, New UI

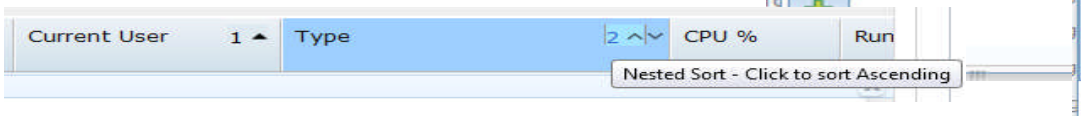
Configure Options for Columns



Filter column data



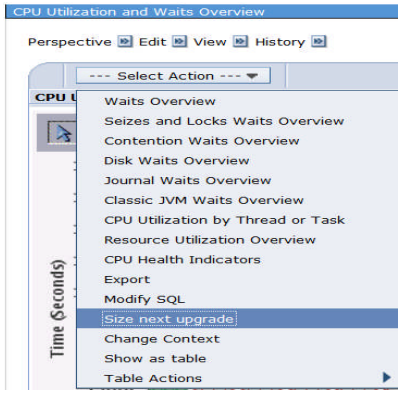
Sort Columns

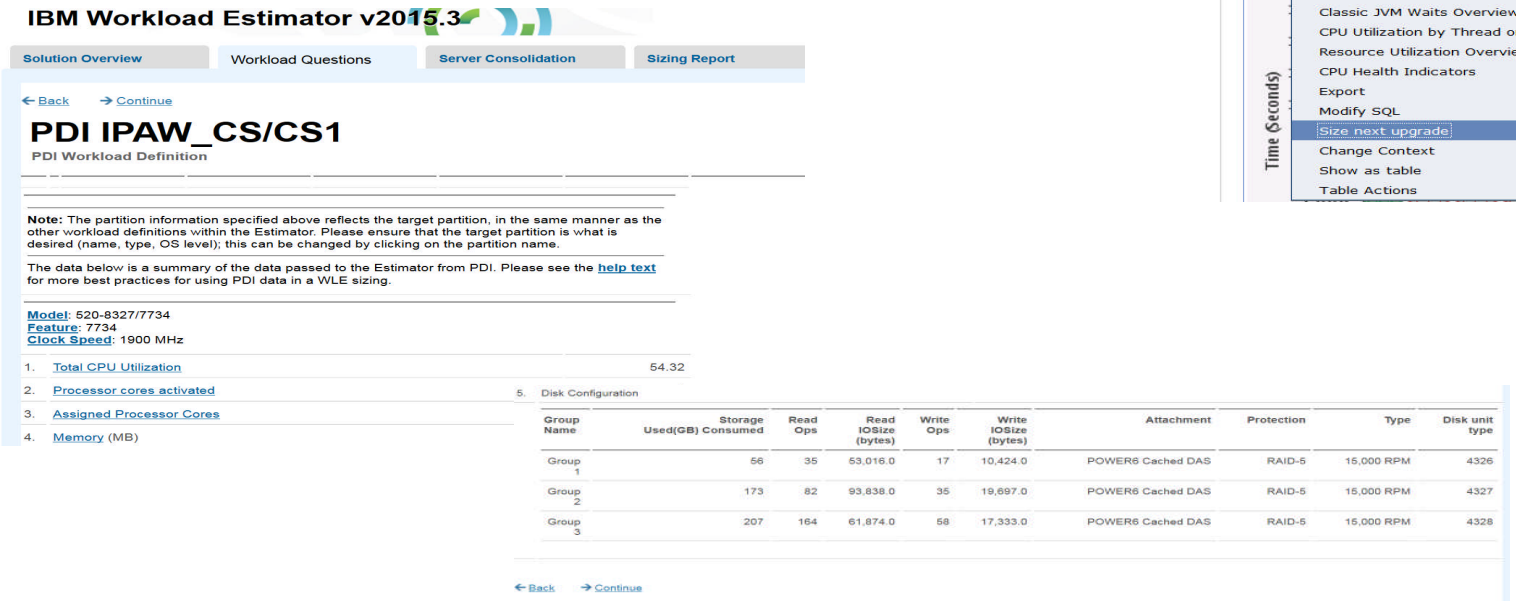


Size Next Upgrade

Takes the measured data from Collection Services and inputs it directly to the IBM Workload Estimator (WLE)

Intended for a one-time sizing activity





Investigate Data Search

"Investigate Data Search" added in 7.2

Investigate Data Search

Storage

Type at least 3 non-empty characters

Case Sensitive Whole Words Only

Search In:

Package Name Description Metrics

Perspective View SQL

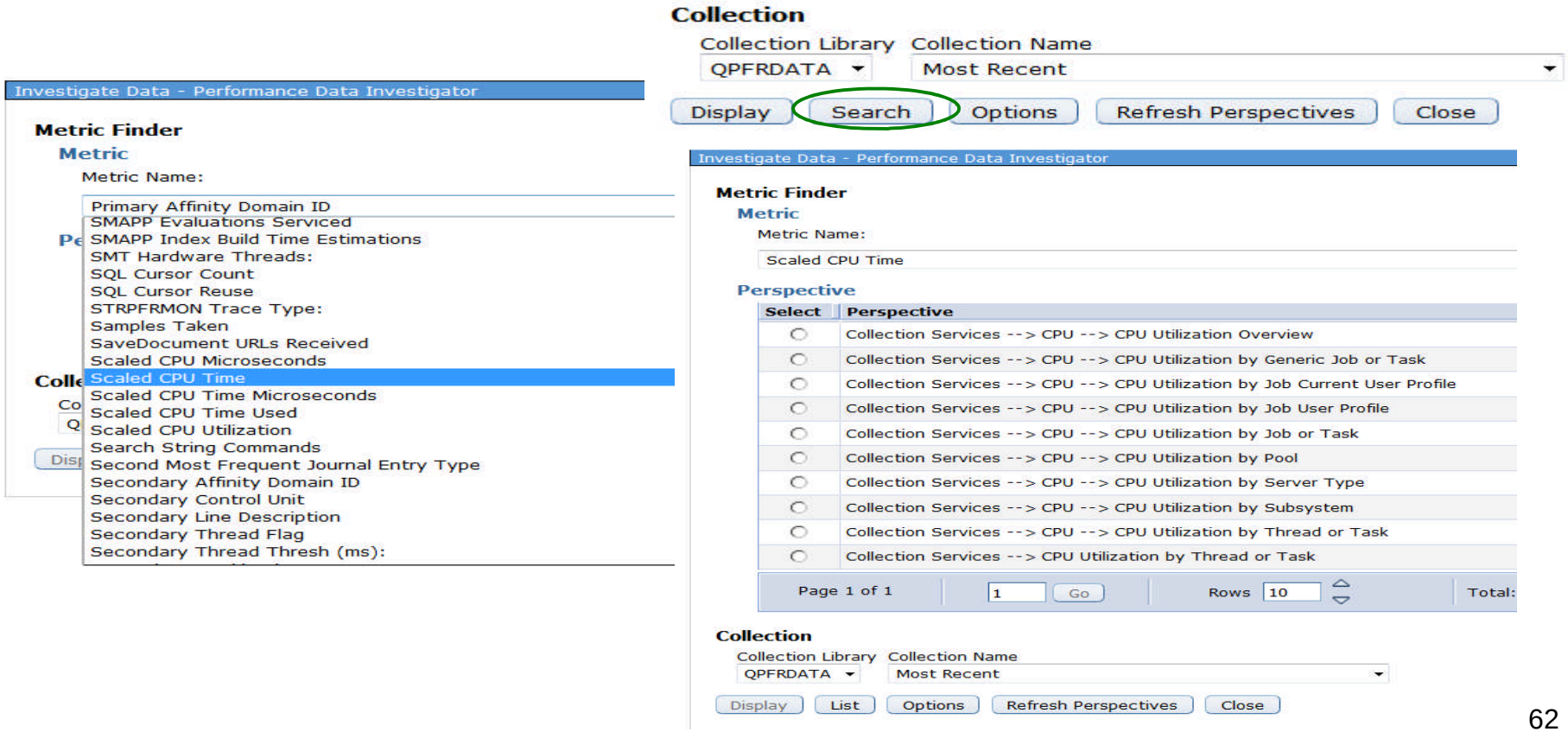
Show Columns:

Metrics

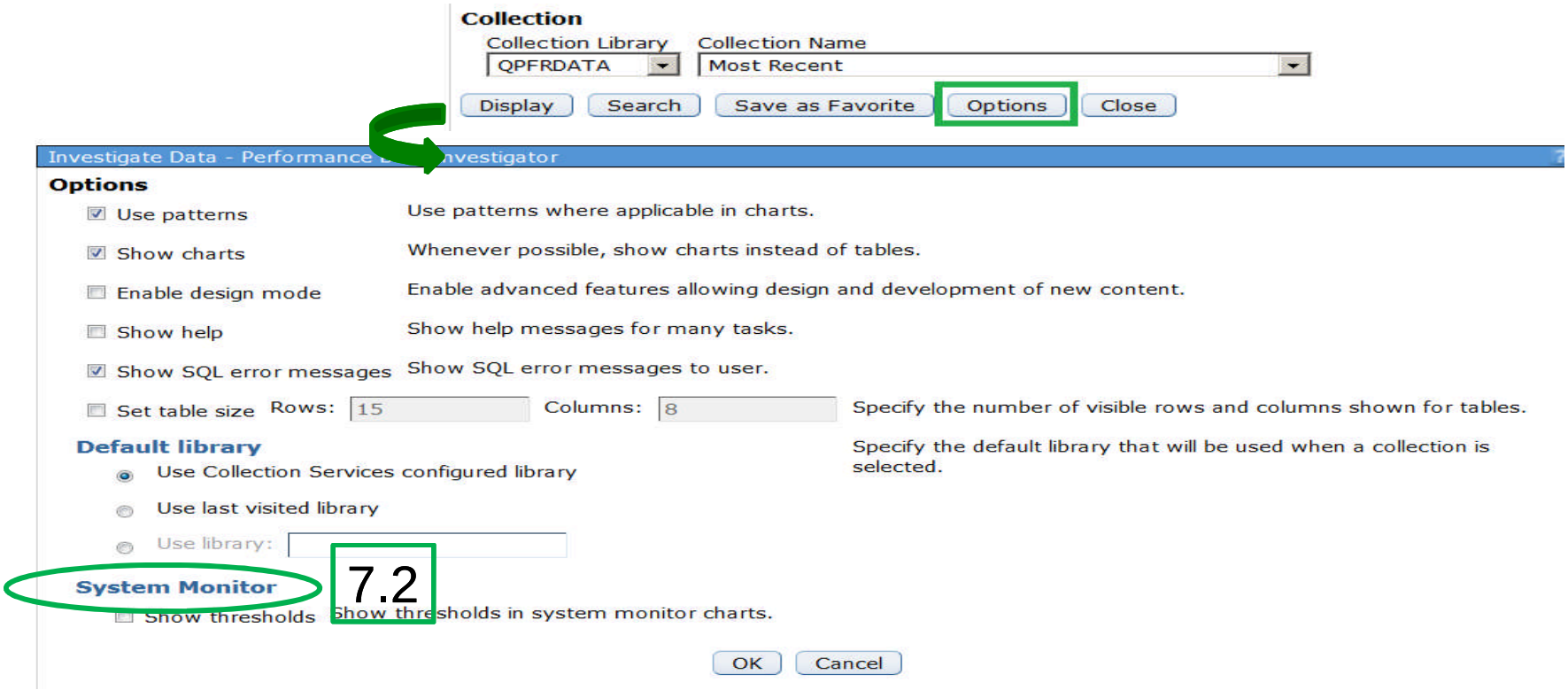
SQL

Package Name	Perspective	Description	View
Collection Services	Storage Allocation/Deallocation by Thread or Task	This chart shows allocation and deallocation of the temporary and permanent storage, net frames requested by thread or task. Use this chart to select a thread or task for viewing its storage statistics over time.	Storage Allocation/Deallocation by Thread or Task Sorted by Allocation
Collection Services	Storage Allocation/Deallocation Overview	This chart shows allocation and deallocation of the temporary and permanent storage for all contributors over time for the selected collections. Use this chart to select a time frame for further detailed investigation.	Storage Allocation/Deallocation Overview
Monitor	Disk Storage Utilization (Average)	Charts show the disk storage utilization (average) metric of the performance data monitored, as well as the metric breakdown details by ASP.	Disk Storage Utilization (Average)

Metric Finder

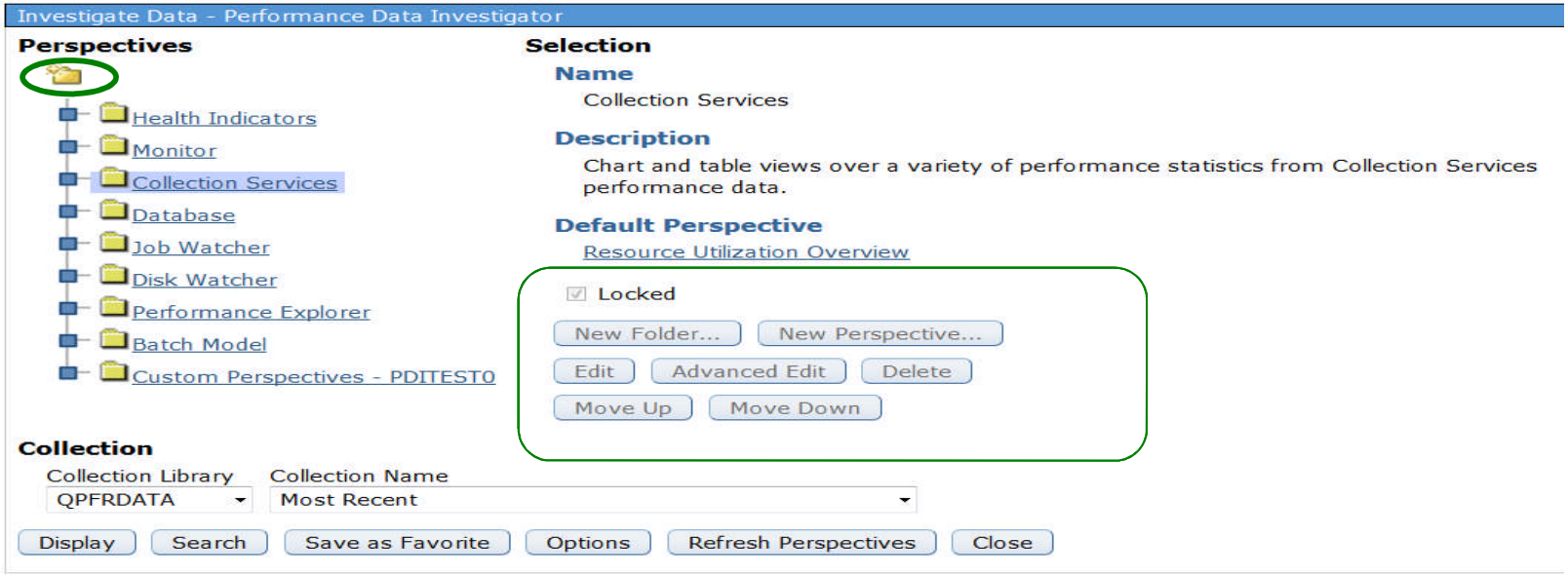


Options


Collection
Collection Library
QPFRDATA
Collection Name
Most Recent
Display
Search
Save as Favorite
Options
Close
Investigate Data - Performance
Options
Use patterns
Use patterns where applicable in charts.
Show charts
Whenever possible, show charts instead of tables.
Enable design mode
Enable advanced features allowing design and development of new content.
Show help
Show help messages for many tasks.
Show SQL error messages
Show SQL error messages to user.
Set table size
Rows: 15
Columns: 8
Specify the number of visible rows and columns shown for tables.
Default library
Specify the default library that will be used when a collection is selected.
Use Collection Services configured library
Use last visited library
Use library:
System Monitor
7.2
Show thresholds
Show thresholds in system monitor charts.
OK
Cancel

Design Mode

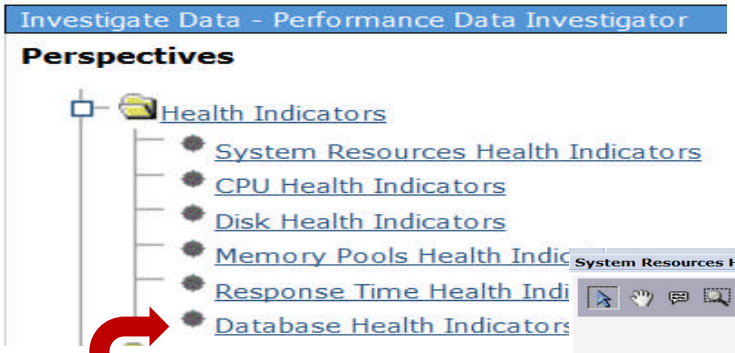
Once you “Enable Design Mode” - additional options become available to create and edit your own charts and tables.



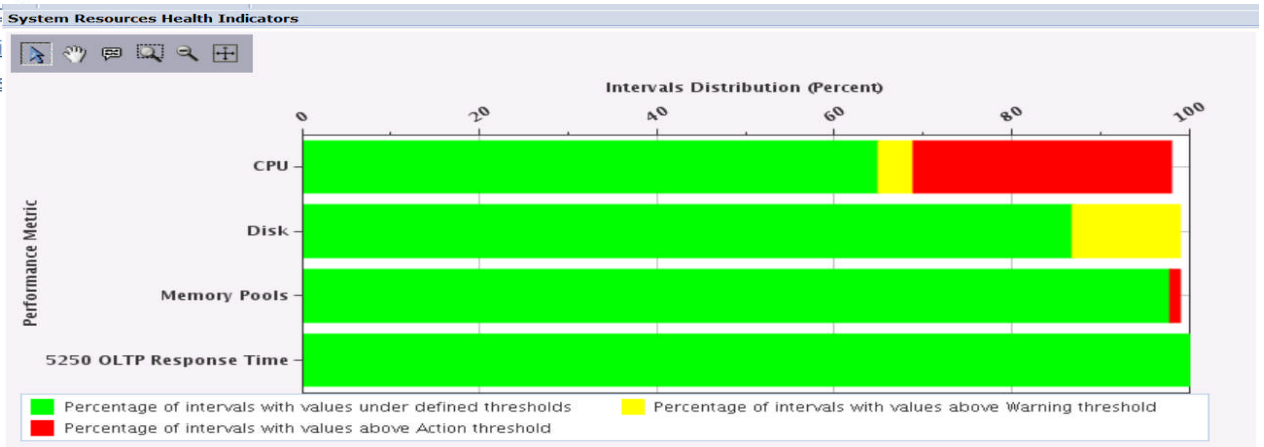
http://ibmsystemsmag.blogs.com/i_can/2011/08/customizing-a-perspective-in-pdi.html

Health Indicators

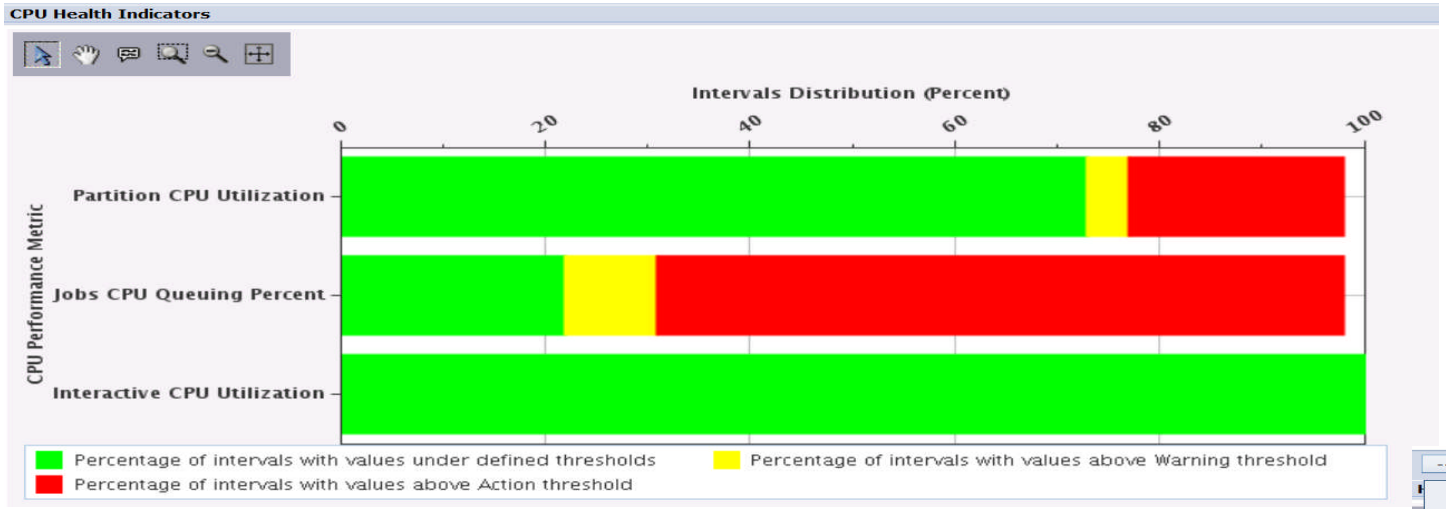
System Resource Health Indicators



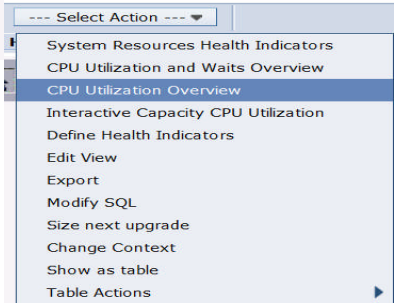
Database Health Indicators are new in 7.2



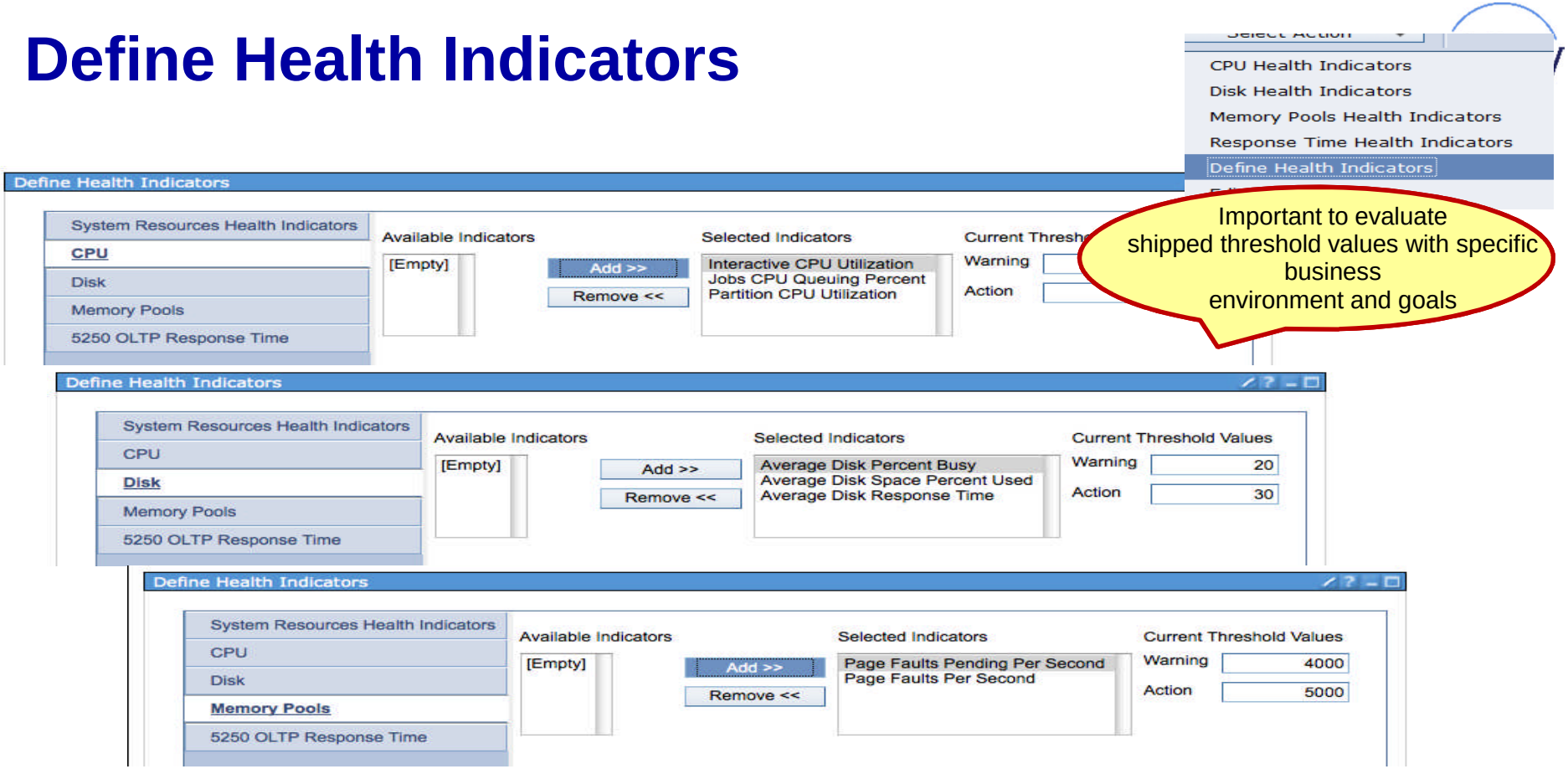
CPU Health Indicators



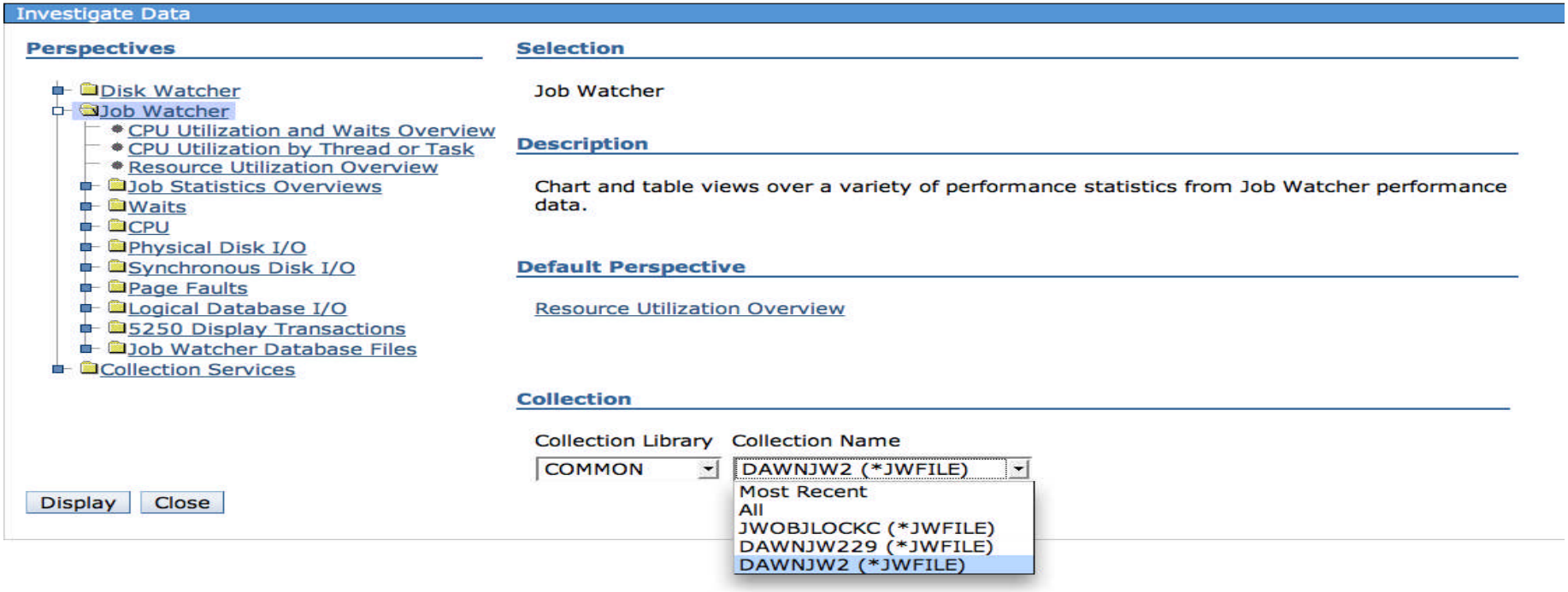
Drill-downs available →



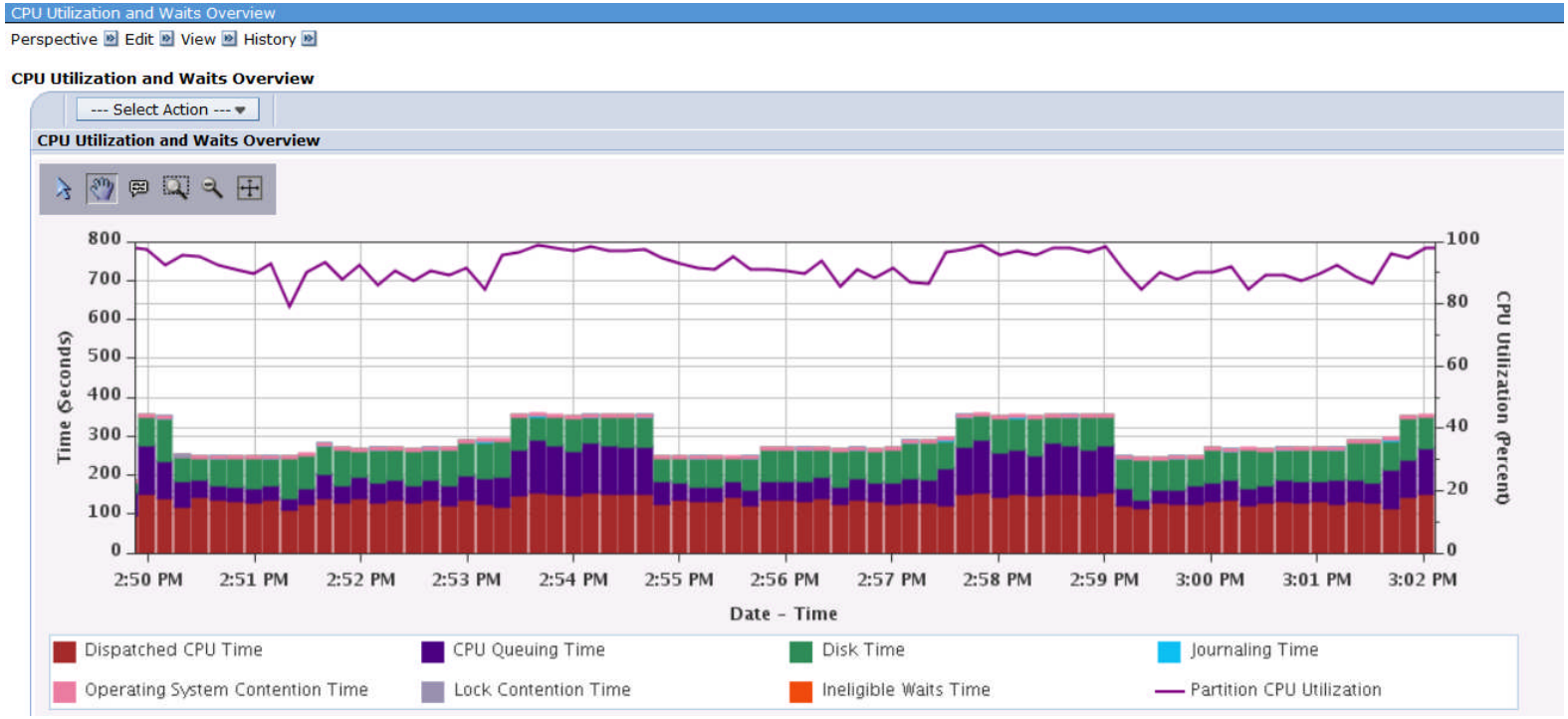
Define Health Indicators



Job Watcher

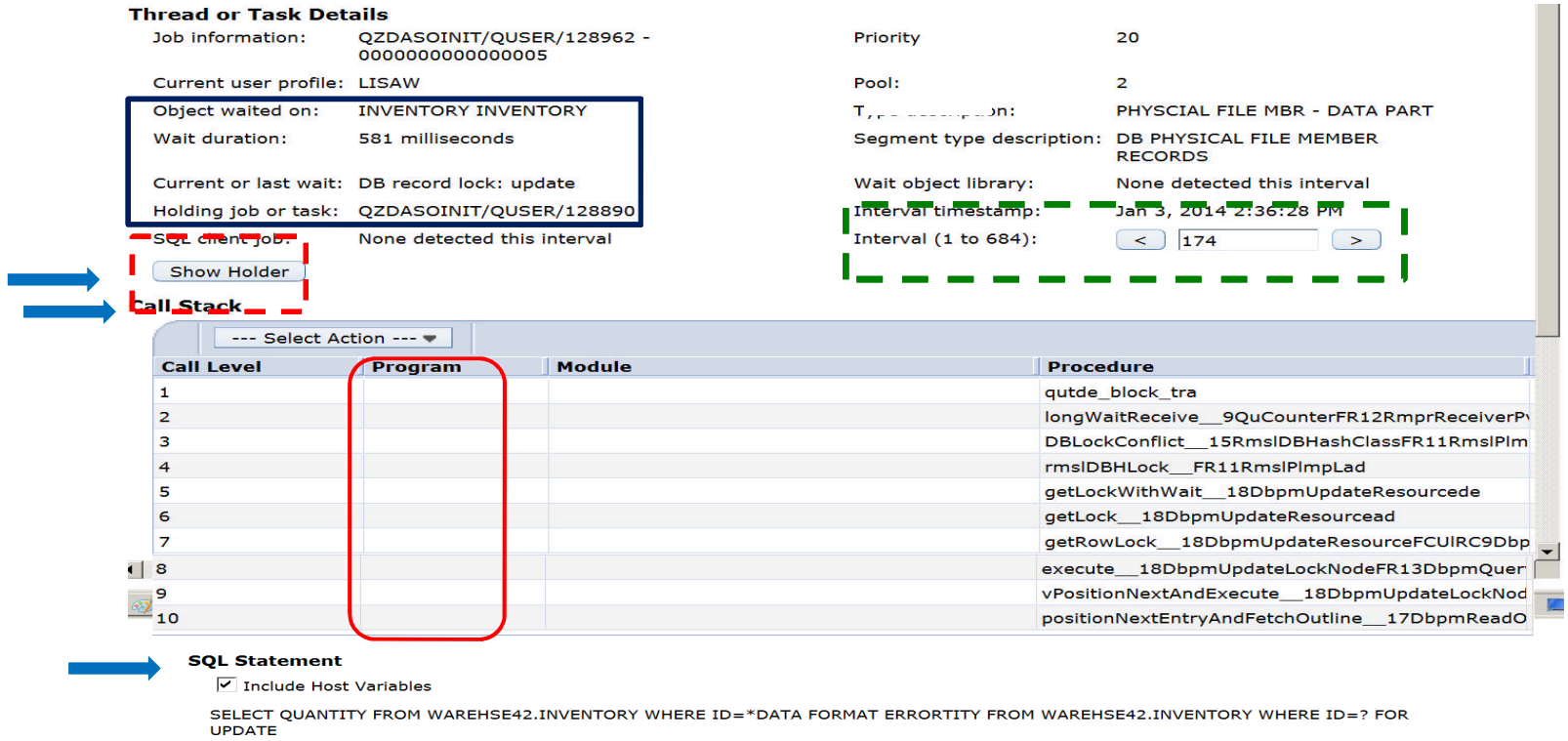

Investigate Data
Perspectives
Disk Watcher
Job Watcher
CPU Utilization and Waits Overview
CPU Utilization by Thread or Task
Resource Utilization Overview
Job Statistics Overviews
Waits
CPU
Physical Disk I/O
Synchronous Disk I/O
Page Faults
Logical Database I/O
5250 Display Transactions
Job Watcher Database Files
Collection Services
Selection
Job Watcher
Description
Chart and table views over a variety of performance statistics from Job Watcher performance data.
Default Perspective
Resource Utilization Overview
Collection
Collection Library
Collection Name
COMMON
DAWNJW2 (*JWFILE)
Most Recent
All
JWOBJLOCKC (*JWFILE)
DAWNJW229 (*JWFILE)
DAWNJW2 (*JWFILE)
Display
Close

Job Watcher - CPU Utilization and Waits Overview



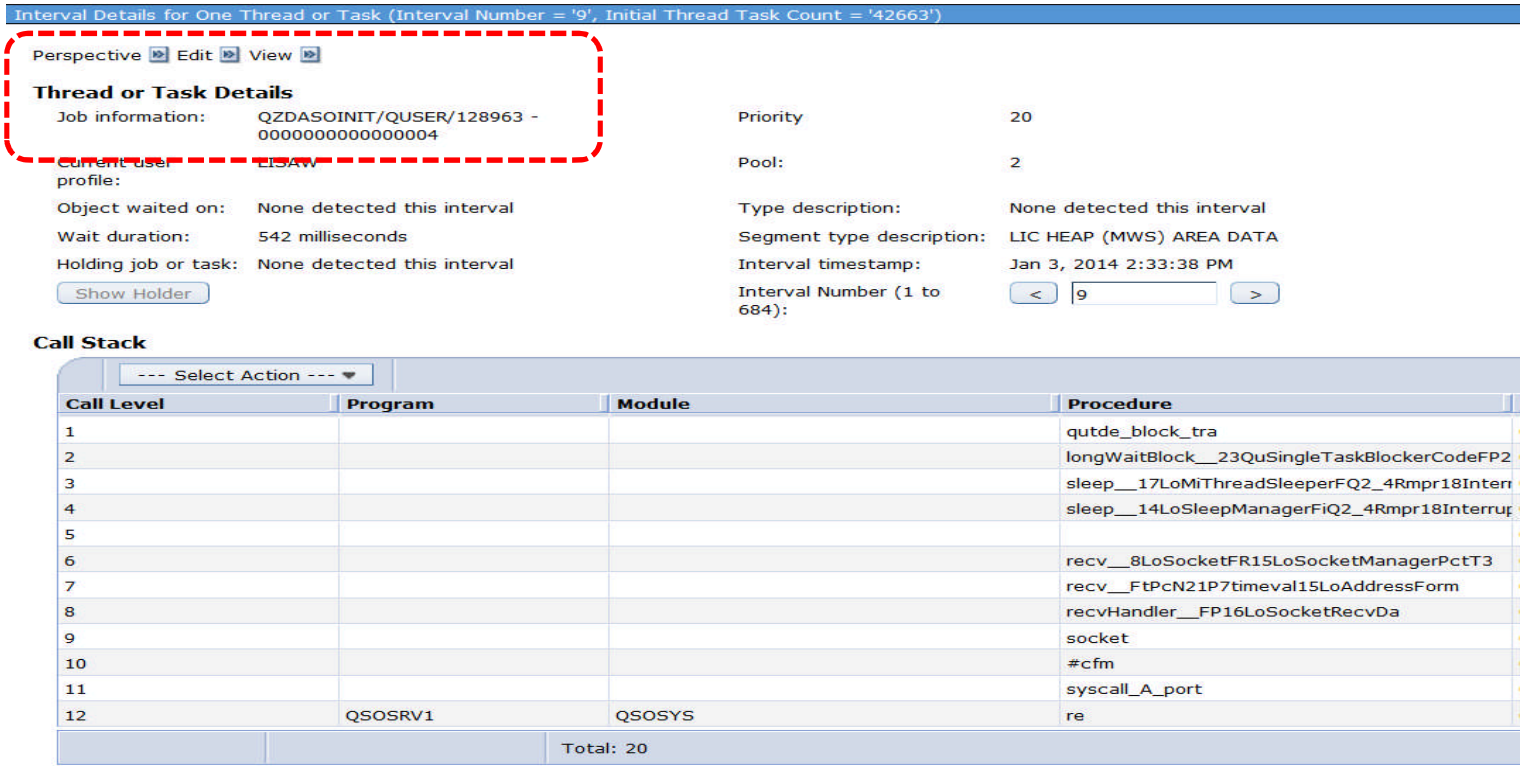
Job Watcher – Interval Details

- Object level information, holder information, call stacks, sql statement (if applicable)
- Can move to the next interval or specify an interval number

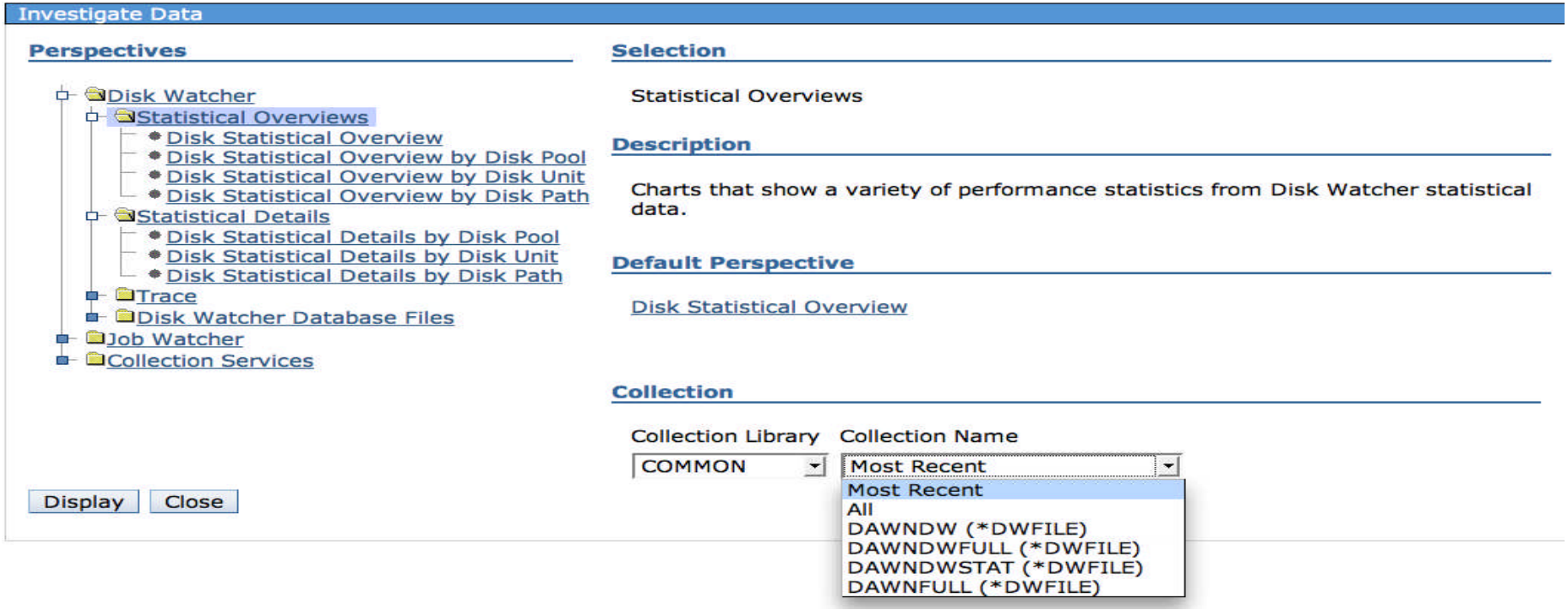


Job Watcher – Show Holder

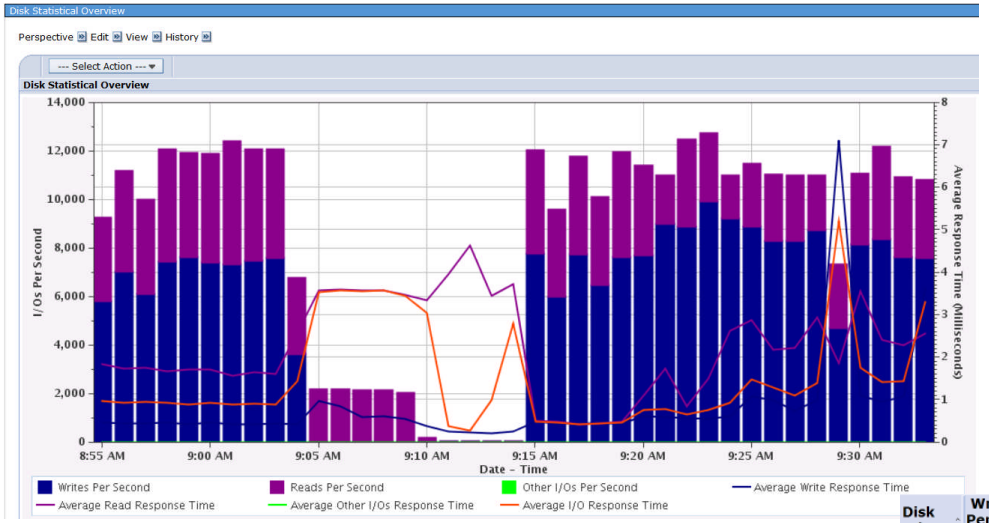
- When clicking the “Show Holder” button, the holding job or task info will be displayed.



Disk Watcher



Disk Watcher – Statistical Overviews



Disk Statistical Details
by Disk Unit →

Disk Unit	Writes Per Second	Total Writes Time (Microseconds)	Total Writes	Average Write Response Time (Milliseconds)	Reads Per Second	Total Reads Time (Microseconds)	Total Reads
20	80.56	175950662	185018	0.95	49.71	282724690	11415
17	89.22	191215563	204939	0.93	40.68	264619450	9343
13	81.02	179679328	186452	0.96	48.84	274793662	11239
19	80.7	167715597	185126	0.91	49.57	284330764	11371
23	82.14	171587291	188592	0.91	49.25	282287097	11308
14	81.32	174688160	186611	0.94	48.63	271365018	11160
18	86.36	183961541	198247	0.93	43.92	263163367	10082
24	77.6	166812672	178266	0.94	53.79	280611909	12356
21	86.23	182932893	198541	0.92	44.63	263267334	10277
15	75.49	169810668	173437	0.98	53.44	264217243	12279
22	83.29	182276882	191257	0.95	47.69	241121731	10950
16	81.63	168328084	186885	0.9	48.91	248662038	11198
5	75.44	169945071	173097	0.98	52.43	232447562	12029
12	81.86	177664449	187639	0.95	47.6	211450426	10910
6	74.9	161260837	171746	0.94	52.59	221205441	12058

Disk Watcher – Trace Data

I/O Counts by IOP, I/O Type, Pool, Object, Object Type, Module, Procedure

Perspective Edit View History

--- Select Action ---

Select	Total I/Os	IOP Name	I/O Type	Pool Number	Object Name	Object Type	Object Subtype	Module Name
☐	1401057	CMB01	SRd	3	CUSTO0000	0B	90	#dbbring
☐	564279	CMB01	SRd	2	DAILY000(	0B	90	DbpmDspAcc
☐	251838	CMB01	SFt	3	CUSTO0000	0B	90	DbDsCursor
☐	142494	CMB01	SFt	3	CUSTO0000	0B	90	stringHighUse
☐	110125	CMB01	SRd	3	DAILY000(	0B	9	
☐	107883	CMB01	SWt	3	Q04079N0	0B	9	
☐	107111	CMB01	SWt	3	Q04079N0	0B	9	
☐	106897	CMB01	SWt	3	Q04079N0	0B	9	
☐	106614	CMB01	SWt	3	Q04079N0	0B	9	
☐	106074	CMB01	SWt	3	Q04079N0	0B	9	
☐	89348	CMB01	SWt	3	Q04079N0	0B	9	
☐	89031	CMB01	SWt	3	Q04079N0	0B	9	
☐	88506	CMB01	SWt	3	Q04079N0	0B	9	
☐	88149	CMB01	SWt	3	Q04079N0	0B	9	
☐	87653	CMB01	SWt	3	Q04079N0	0B	9	
☐	86029	CMB01	SWt	3	Q04079N0	0B	9	
☐	85626	CMB01	SWt	3	Q04079N0	0B	9	
☐	85401	CMB01	SWt	3	Q04079N0	0B	9	

Total I/O Counts - what object the I/O is for, along with the module and procedure that did the I/O on that object.

Total Page Faults

Page Faults by IOP, Job, I/O Type, Pool, Object, Module, Procedure

Perspective Edit View History

--- Select Action ---

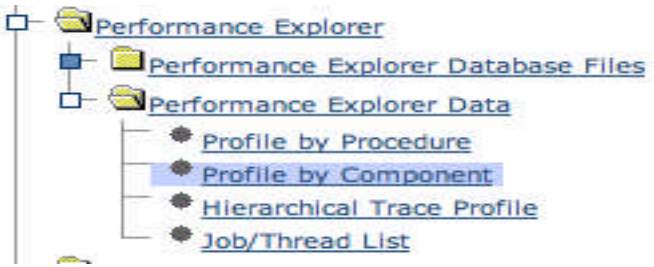
Select	Total Page Faults	IOP Name	Qualified Job Name or Task Name	I/O Type	Pool Number	Object Name	Object Type	Object Sub
☐	5978	CMB01	USRJOB002AEDGE 045406	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5937	CMB01	USRJOB001AEDGE 045405	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5871	CMB01	USRJOB005AEDGE 045409	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5870	CMB01	USRJOB004AEDGE 045408	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5800	CMB01	USRJOB003AEDGE 045407	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5755	CMB01	USRJOB010BEDGE 045414	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5691	CMB01	USRJOB009BEDGE 045413	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5629	CMB01	USRJOB008BEDGE 045412	SFt	3	CUSTO00001CUSTO00001	0B	90
☐	5623	CMB01	USRJOB007BEDGE 045411	SFt	3	CUSTO00001CUSTO00001	0B	90

I/O type

- **SFt = Segment address range fault**
- **SRd = Segment address range read**
- **SWt = Segment address range write**

External Object Types: http://pic.dhe.ibm.com/infocenter/iseries/v7r1m0/topic/rbam6/rbam6objecttypes.htm

Performance Explorer



Profile by Component

--- Select Action ---

Select		Total	Component	Procedure Name	Hit Count
☐	▾	Total			683(100%)
☐	▸		SLIC Common Functions		335 (49.05%)
☐	▾		SLIC Database		118 (17.28%)
☐				#dbrsqmn.#dbrsqmn	85(12.45%)
☐				sExecute__42VariableLengt	6(0.88%)
☐				sExecute__14HashOperatic	3(0.44%)
☐				sExecute__17PackedDivide	2(0.29%)
☐				sSad__19VariableLengthFie	2(0.29%)
☐				vPositionNextAndExecute_	2(0.29%)

Profile by Procedure

Perspective Edit View History

--- Select Action ---

Program Name	Module Name	Procedure Name	Component	Hit Count
CFTSMPI		#cftsmpi	SLIC Common Functions	332(48.61%)
STRHU		do_copyMemoryLarge	SLIC String Functions	94(13.76%)
DBRSQMN		#dbrsqmn	SLIC Database	85(12.45%)
CUSTOMER CUSTOMER		#DBXFMP2	MI Other	45(6.59%)
READER	READER	READER	MI Other	27(3.95%)
DBPM2010		sExecute__42VariableLen	SLIC Database	6(0.88%)
SMMUTLH		trimRangeForRead__14Sn	SLIC Storage Management	6(0.88%)
HvString		HvString	SLIC Hypervisor	4(0.59%)
SMMSSUBH		findStealablePage__20Sm	SLIC Storage Management	4(0.59%)
QDBGETM	QDBGETM	QDBGETM	XPF Database Other	4(0.59%)

Performance Data Reports

"Executive" Reports

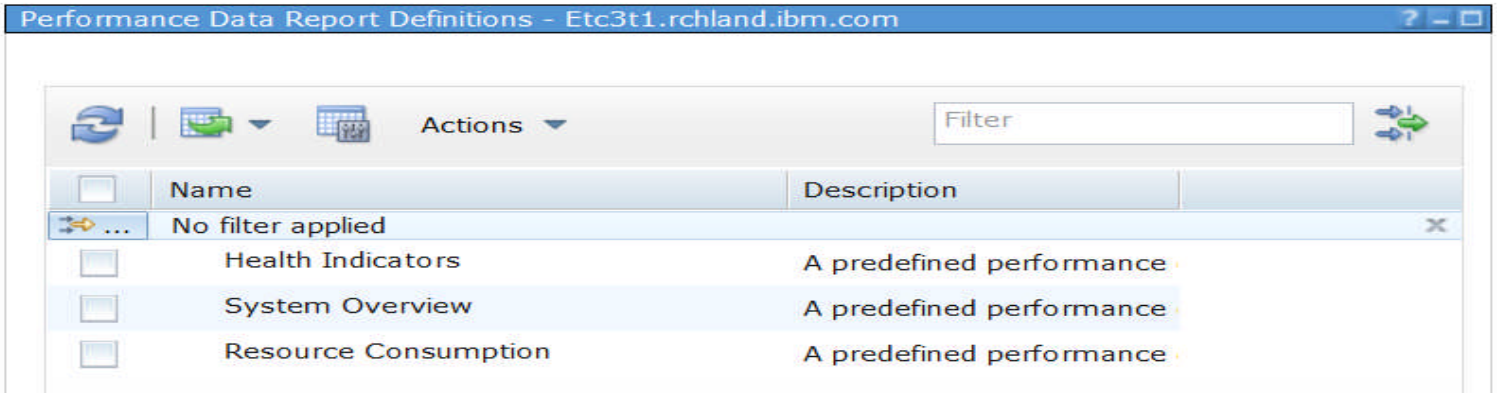
- Create a group of printed or online graphs of performance perspectives.
- Generate a PDF or zip file containing the requested graphs for the collection
- Use for weekly reports

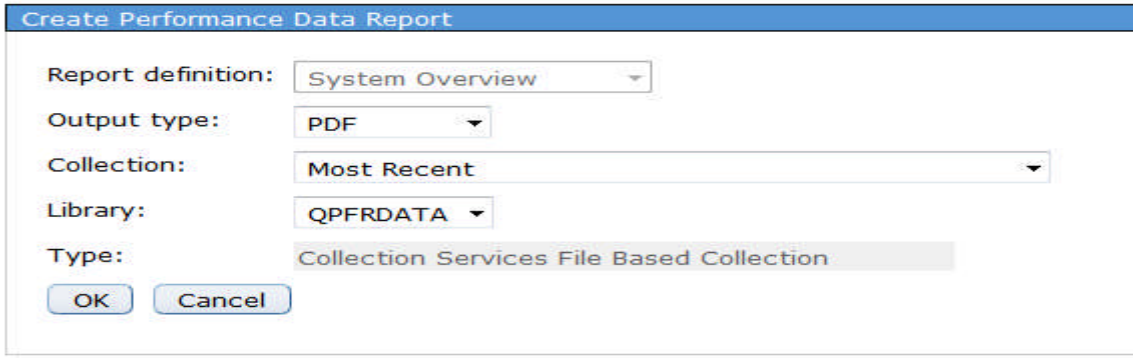
Start here with Reports ->

Performance Data Report Definitions

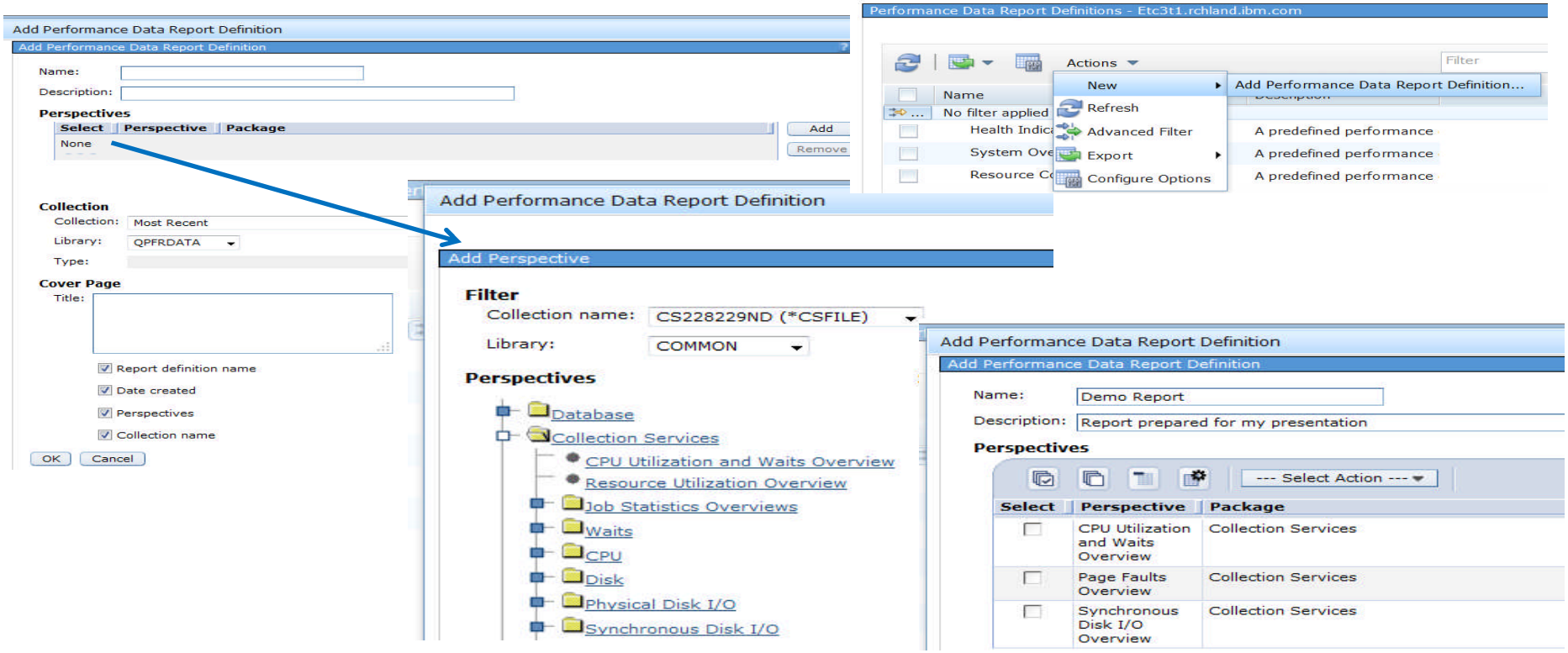
http://www.ibmsystemsmag.com/Blogs/i-Can/Archive/performance-reports-with-the-performance-data-inve/

Report Definitions

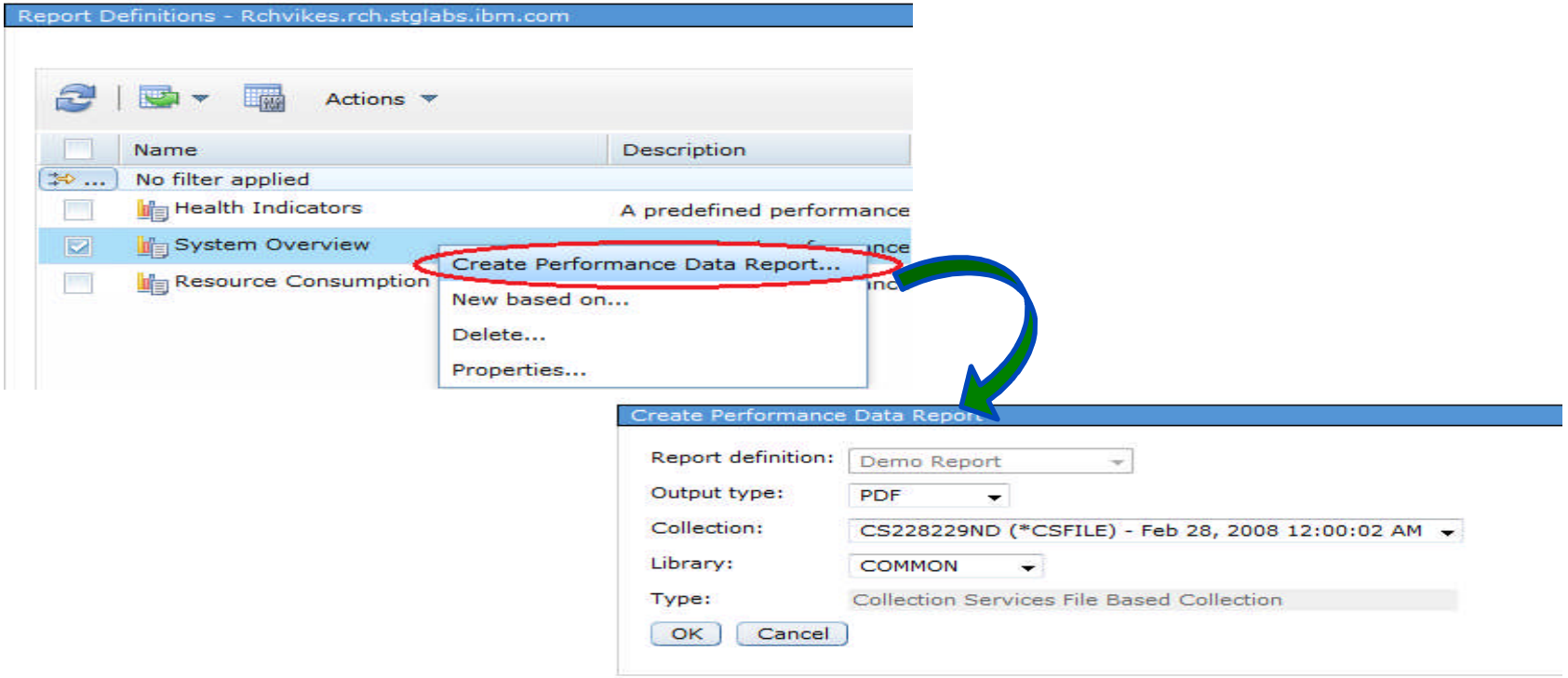




Create your own Report Definition



Create Performance Data Report



Resulting Report (PDF example)

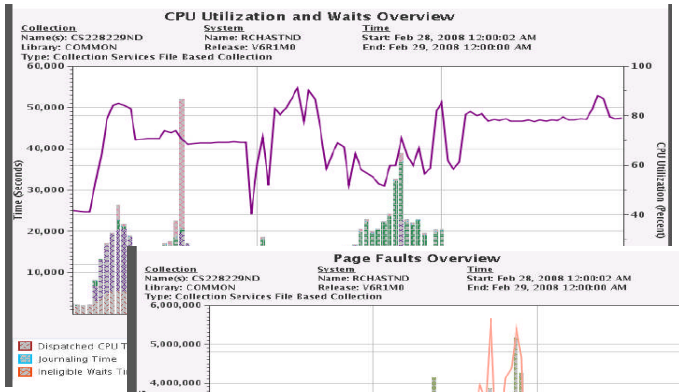
Feb 28, 2013 10:03:43 AM

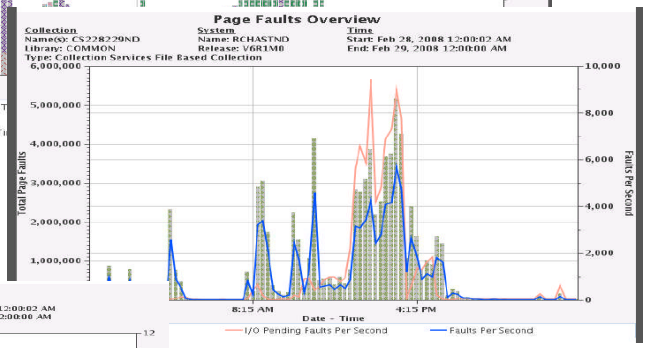
Performance data report definition:
Demo Report

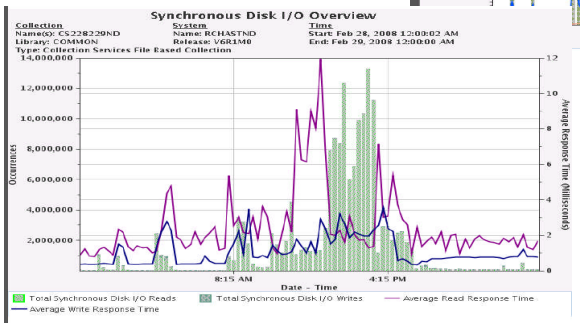
Report title:
Example Report based upon COMMON performance collection

Perspectives included in report:
CPU Utilization and Waits Overview
Page Faults Overview
Synchronous Disk I/O Overview

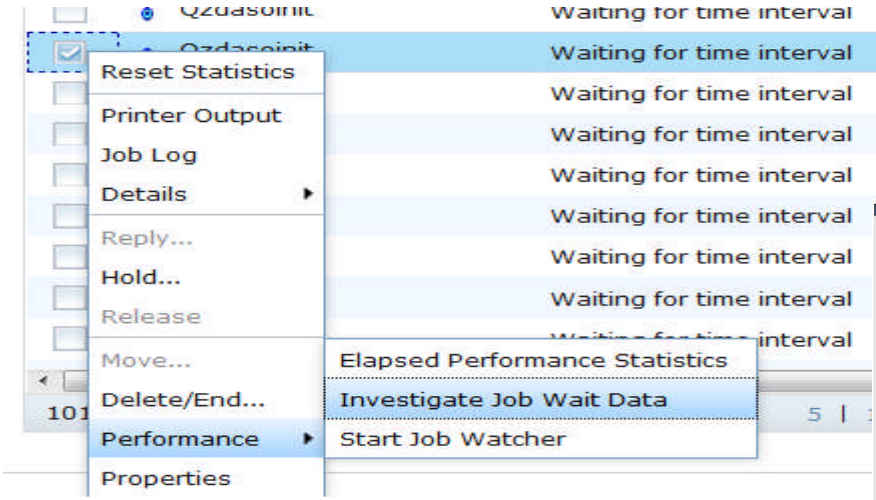
Library/Collection used for report:
Common/Cs228229nd





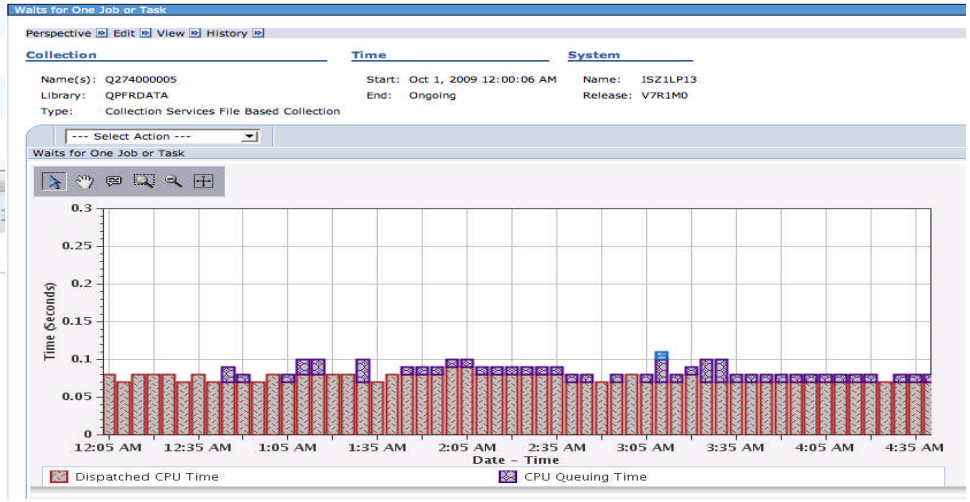


Integration with Active Jobs

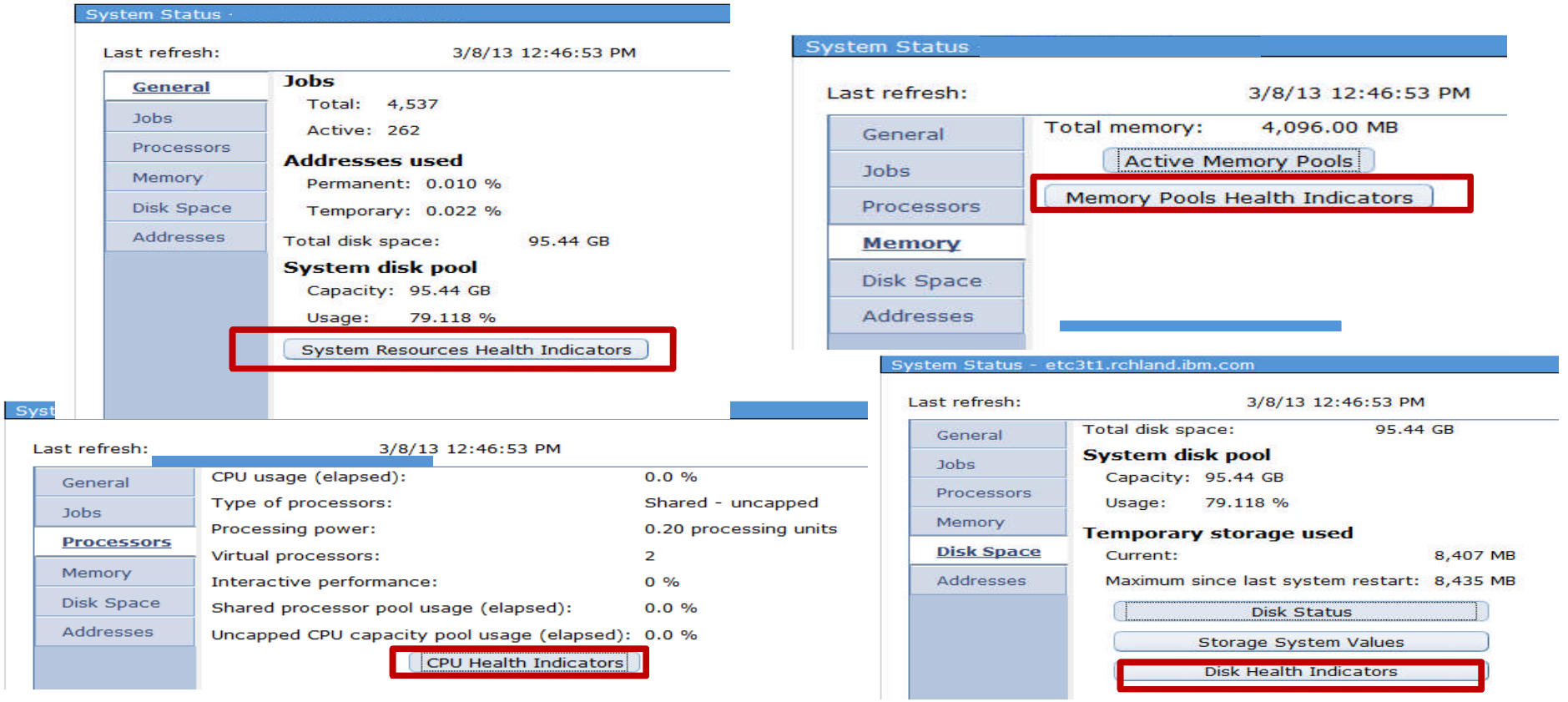


Active jobs – what's happening ***right now***

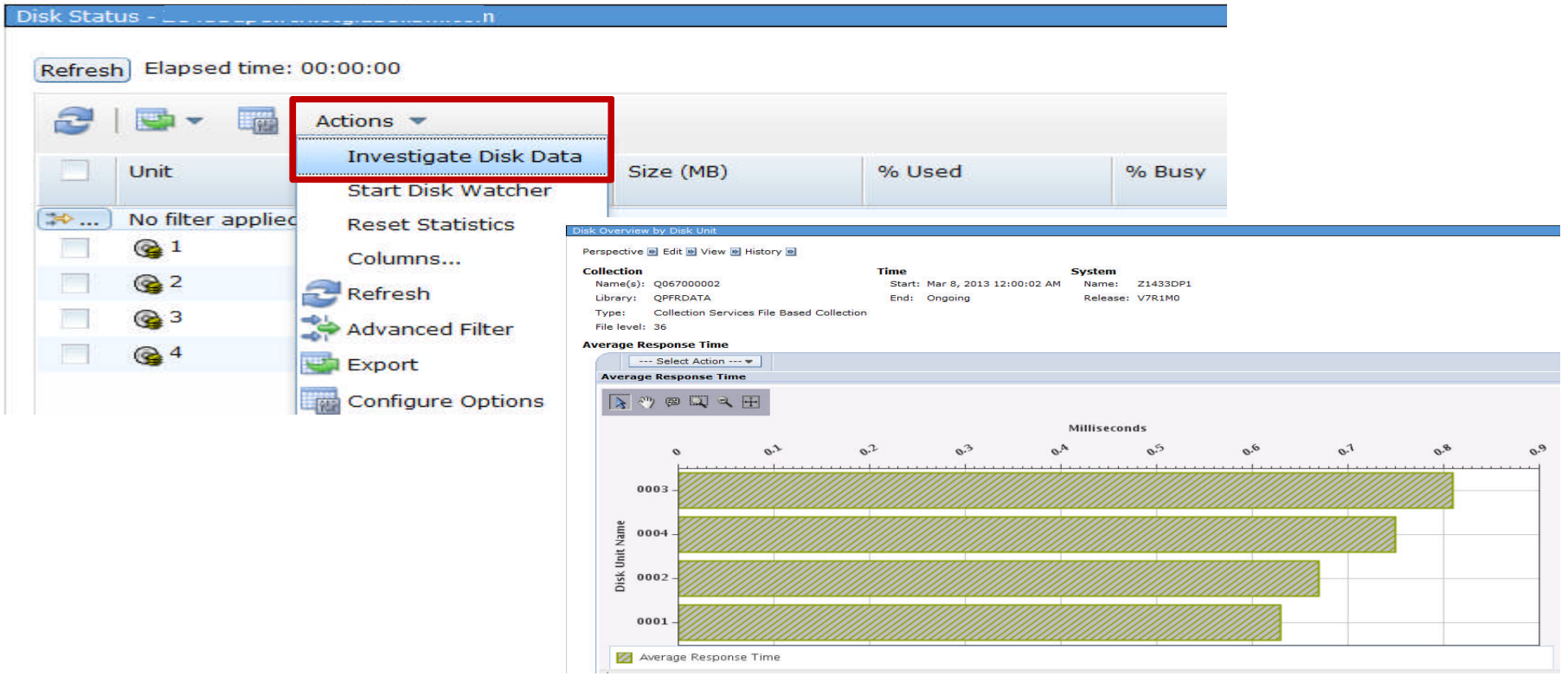
Collection Services data →Job wait data – what happened *up to now*



Integration with System Status



Integration with Disk Status



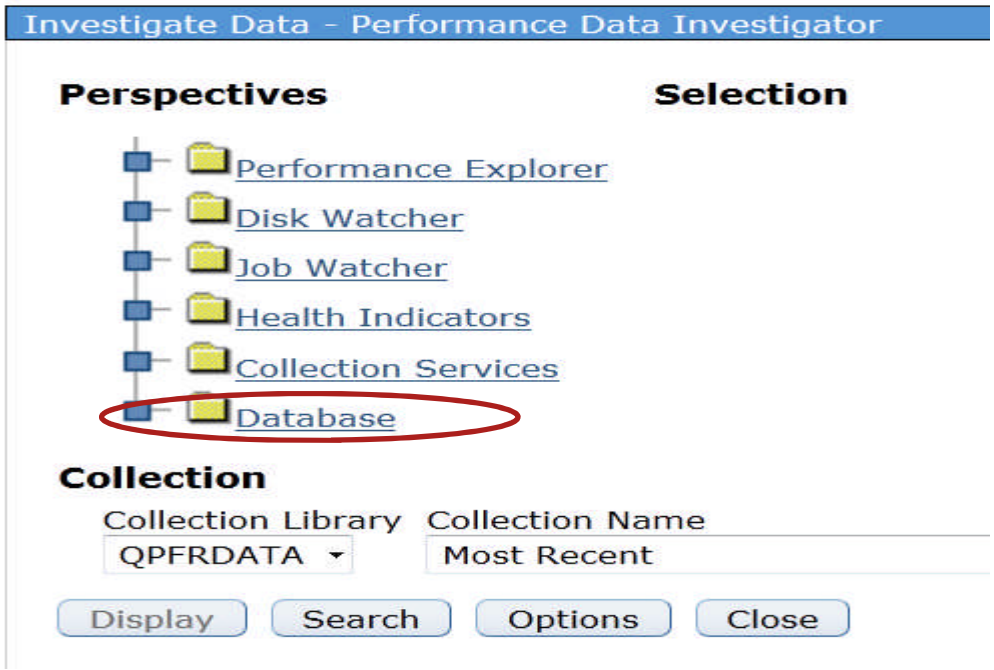
Investigate Data
Database

- ✓ Requires 2015 PTF groups, including the database group
- ✓ Must have the Performance Tools LPP **Manager** feature installed
- ✓ Available on IBM i 6.1 and 7.1 with PTFs
  - Included with IBM i 7.2/7.3

Integration with Database

- Leverage the capabilities of PDI with valuable data gathered from database
- PDI charting of
  - SQL Plan Cache Snapshots
  - SQL Performance Monitor files
- Collection Services collection of job-level SQL metrics
- Visual charts and/or tables in PDI that are focused on database related metrics
- Navigation between database and performance tasks

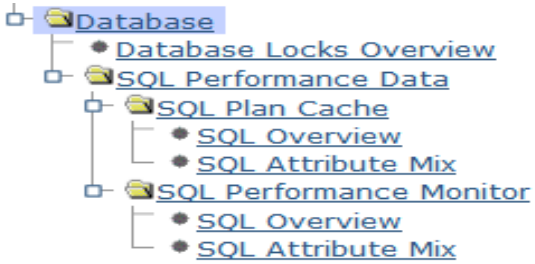
Database Perspectives



Integration with Database – package overview

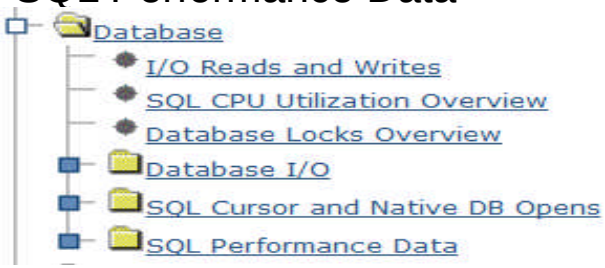
Database Package for 6.1

- Database Locks Overview
- SQL Performance Data
  - SQL Plan Cache Snapshots and Event Monitors
  - SQL Performance Monitor



Database Package for 7.1+

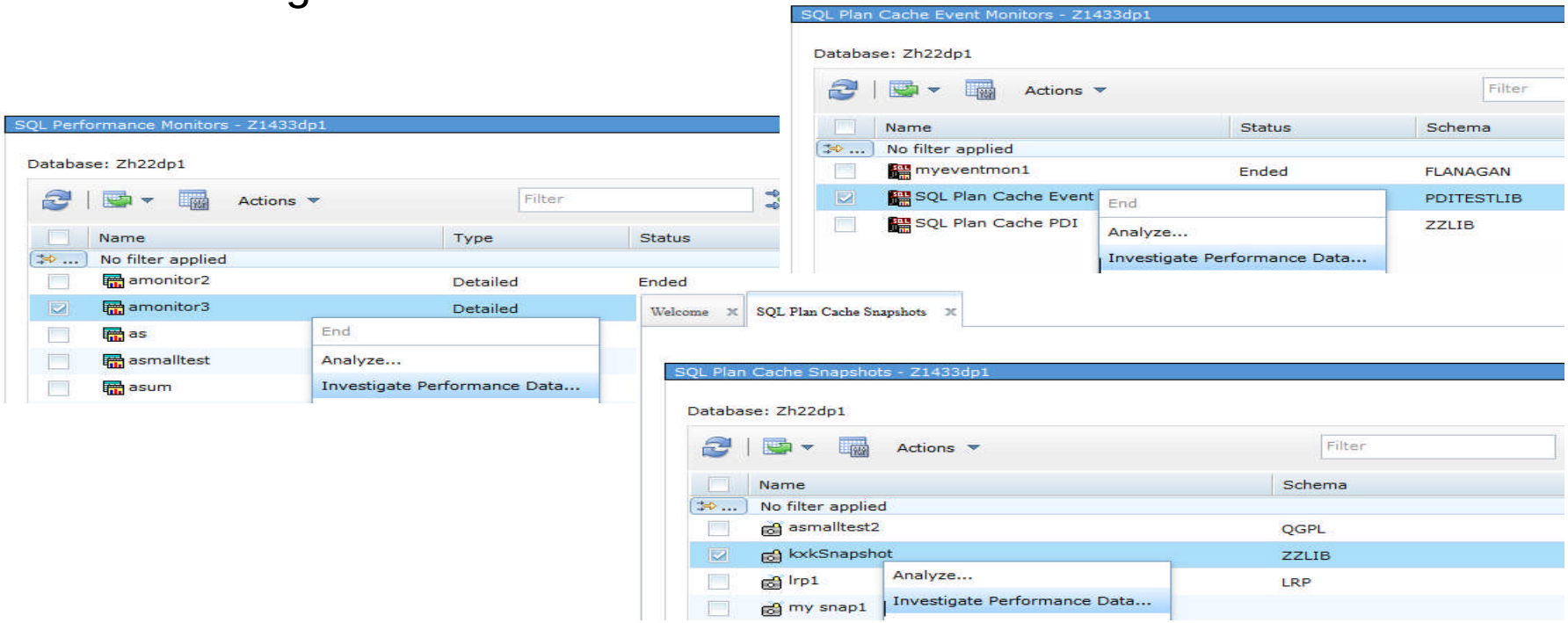
- I/O Reads and Writes
- SQL CPU Utilization Overview
- Database Locks Overview
- Database I/O
  - Utilizes Job Level SQL Metrics
- SQL Cursor and Native DB Opens
- SQL Performance Data



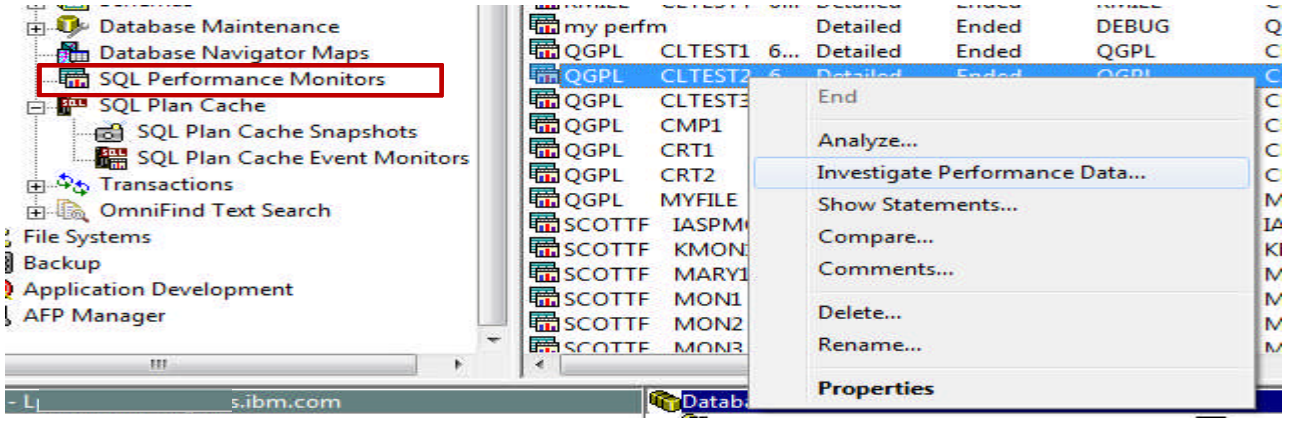
Monitors

Integration with Database

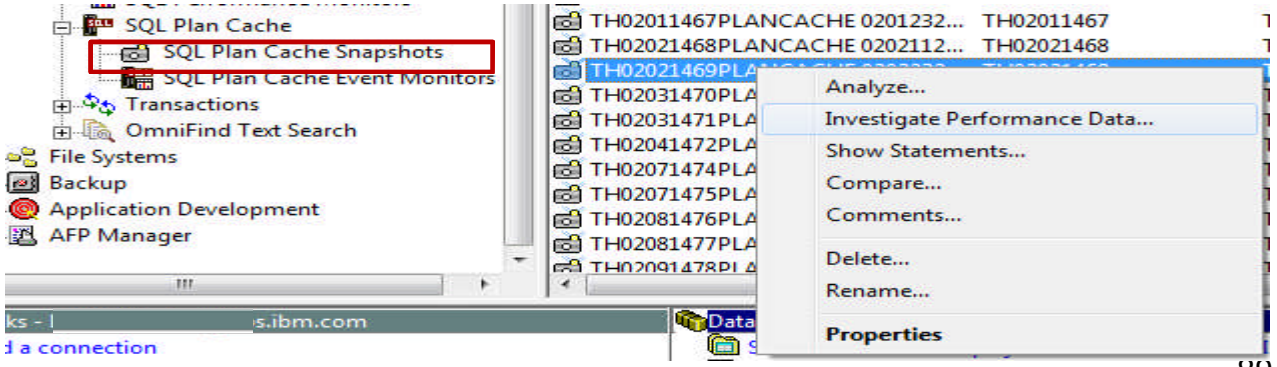
Launch “Investigate Performance Data” from various Database tasks



Launch PDI from System i Navigator client



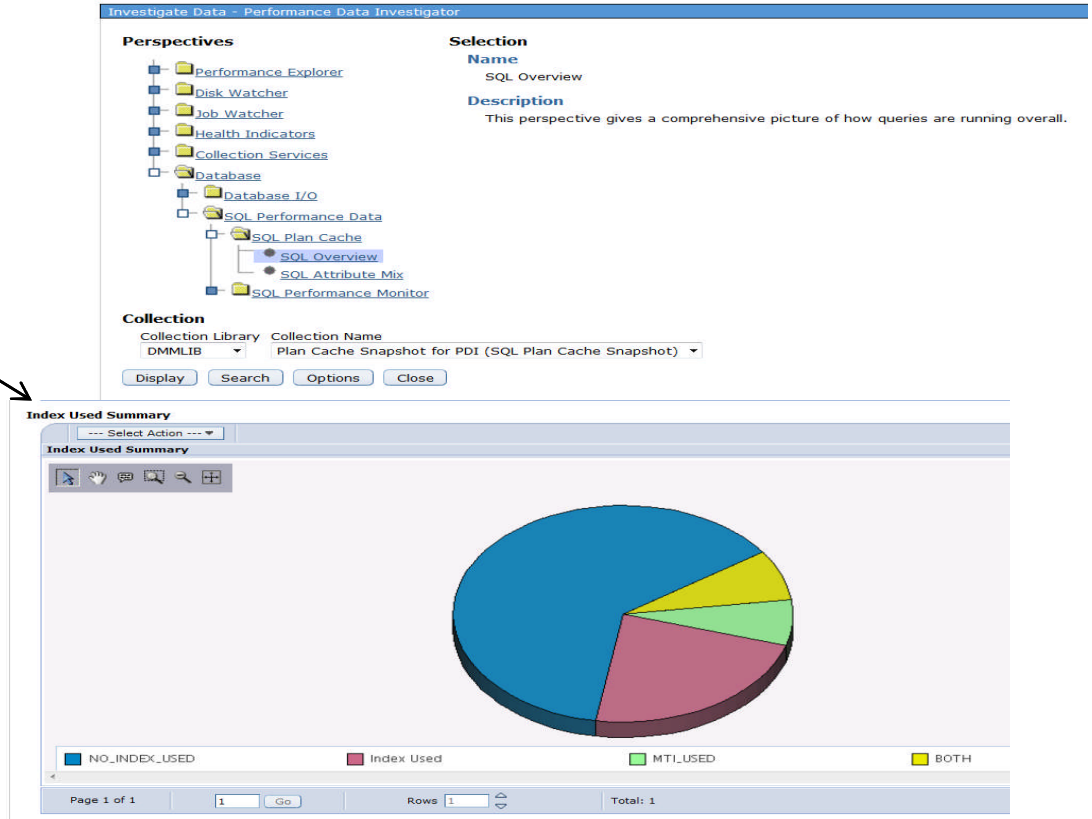
7.1



SQL Overview

Several graphs:

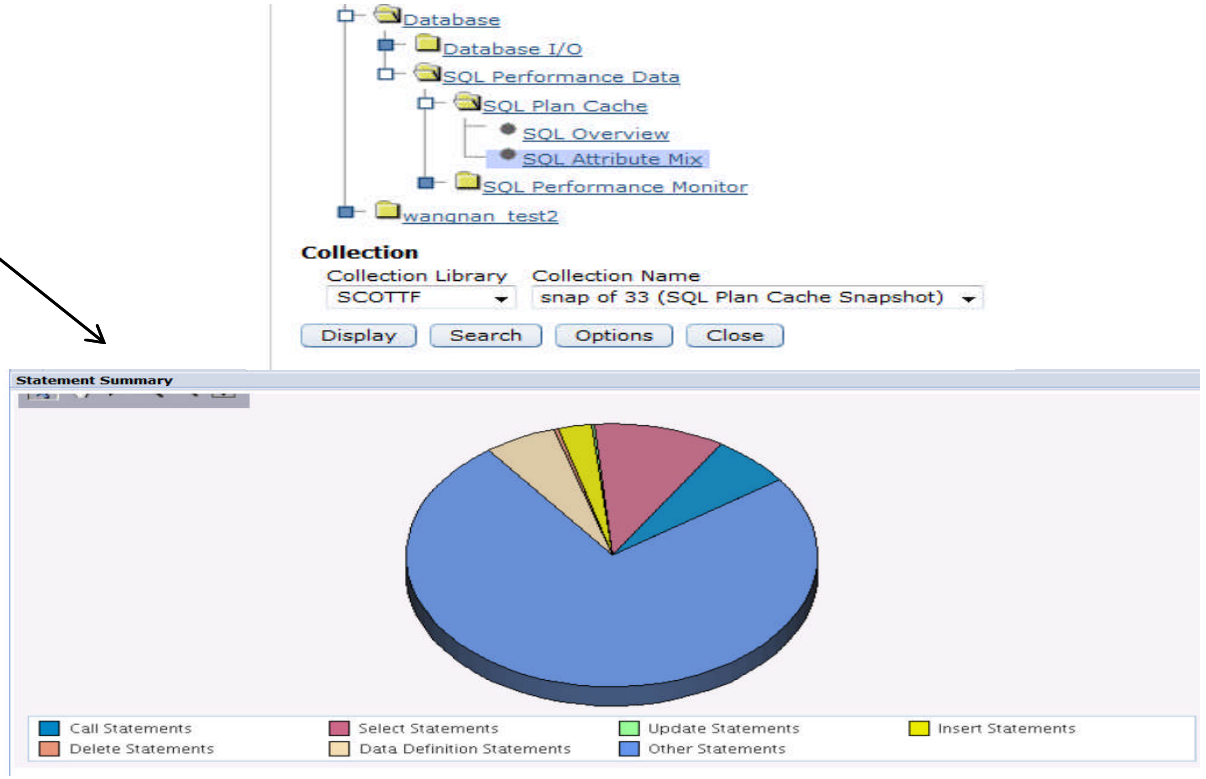
- Query time summary
- Open summary
- Open type summary
- Statement usage summary
- Index used summary
- Index create summary
- Index advised
- Statistics advised
- MQT use
- Access plan use
- Parallel degree usage



SQL Attribute Mix

Several graphs:

- Statement summary
- Statement type summary
- Isolation level summary
- Allow copy data summary
- Sort sequence summary
- Close cursor summary
- Naming summary
- Optimization goal
- Blocking summary



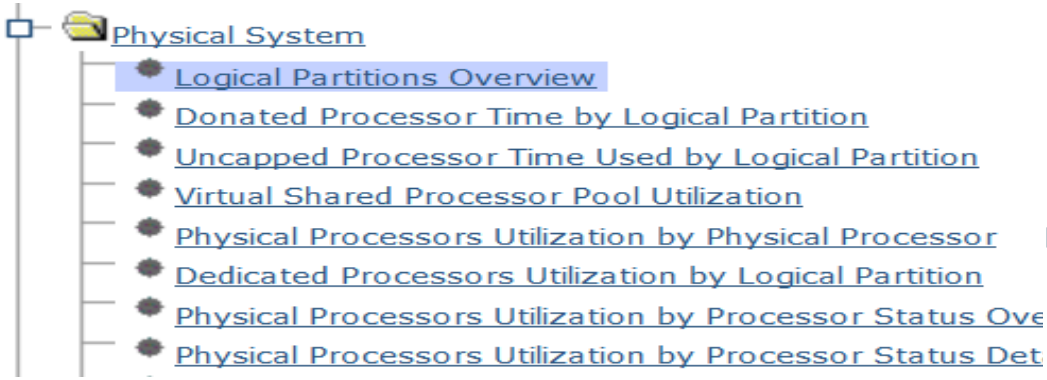
Investigate Data

PDI Fan Club Favorites

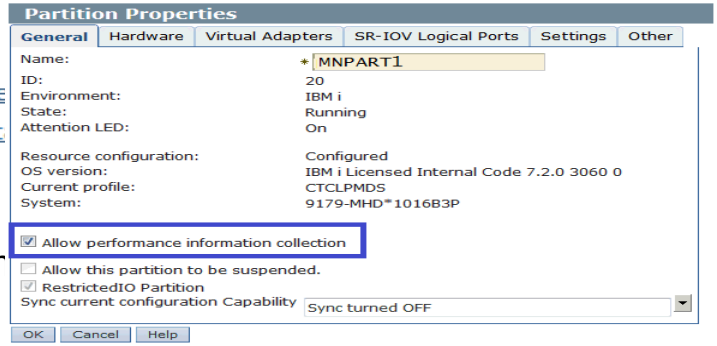
(some not available on 6.1 & 7.1)

Physical System Charts – Frame view of Performance

Collection Services has the ability to collect certain high-level cross-partition processor performance metrics for all logical partitions on the same single physical server *regardless of operating system*. This is available on Power 6 and above servers. When this data is available, it can be viewed via several perspectives found under "Physical System".

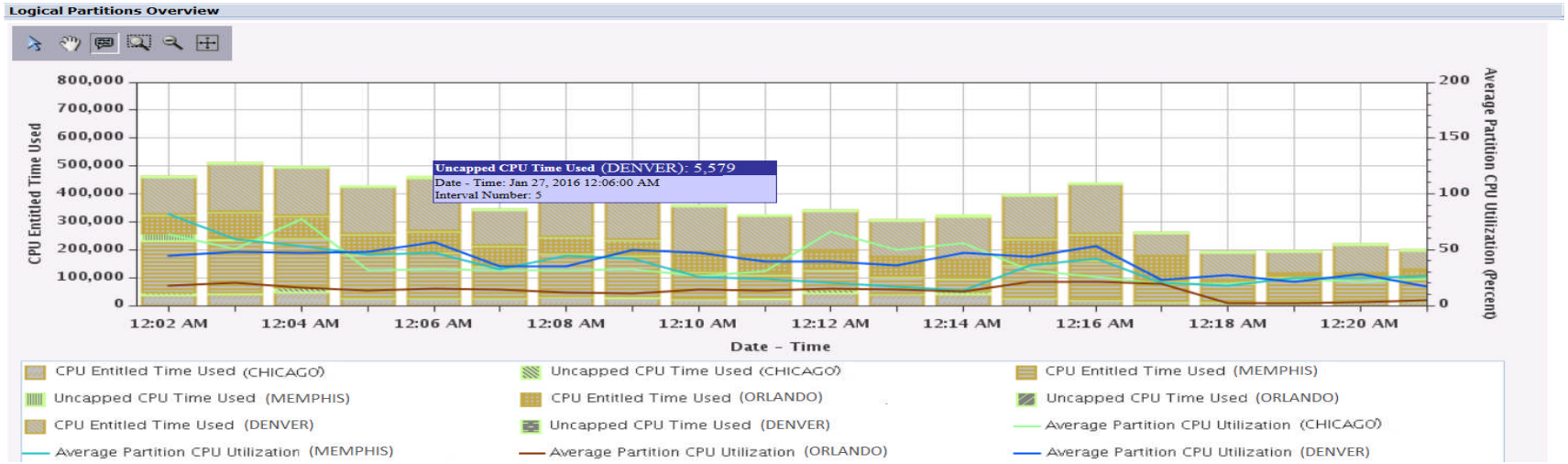


HMC option to enable performance collection must be turned on for the IBM i partition to collect the data →



http://ibmsystemsmag.blogs.com/i_can/2009/10/i-can-display-cpu-utilization-for-all-partitions.html

Logical Partitions Overview

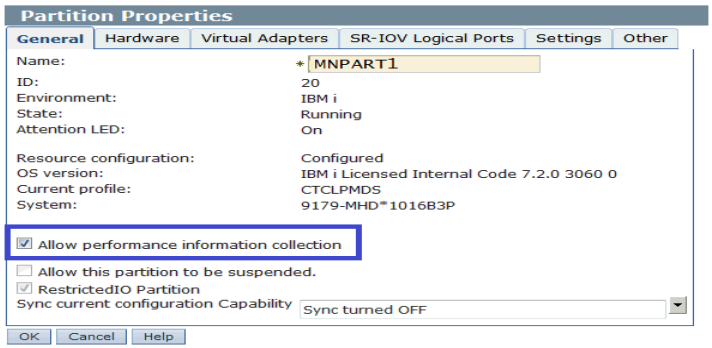


- 4 IBM partitions on system - all running IBM i (shared/uncapped)
- On a single chart, we can see:
  - Average CPU utilization for each partition
  - CPU Entitled Time Used
  - Uncapped CPU Time Used
  - Leverage tooltips and Table data

Logical Partition Operating System	Virtual Processors	Current Processing Capacity	Current Configured Memory	Average Partition CPU Utilization (Percent)	CPU Entitled Time Used	Uncapped CPU Time Used	Donated Processor Time
i5/OS	2	1	36864	63.4	37431	9440	0
i5/OS	6	4	77824	81.67	185079	24971	0
i5/OS	6	5	55296	17.44	70026	205	0
i5/OS	5	4	116736	44.31	133502	1352	0
i5/OS	2	1	36864	50.45	39497	6295	0
i5/OS	6	4	77824	59.62	188516	7904	0
i5/OS	6	5	55296	20.5	96609	355	0
i5/OS	5	4	116736	47.66	170108	1665	0

12X Bus Utilization

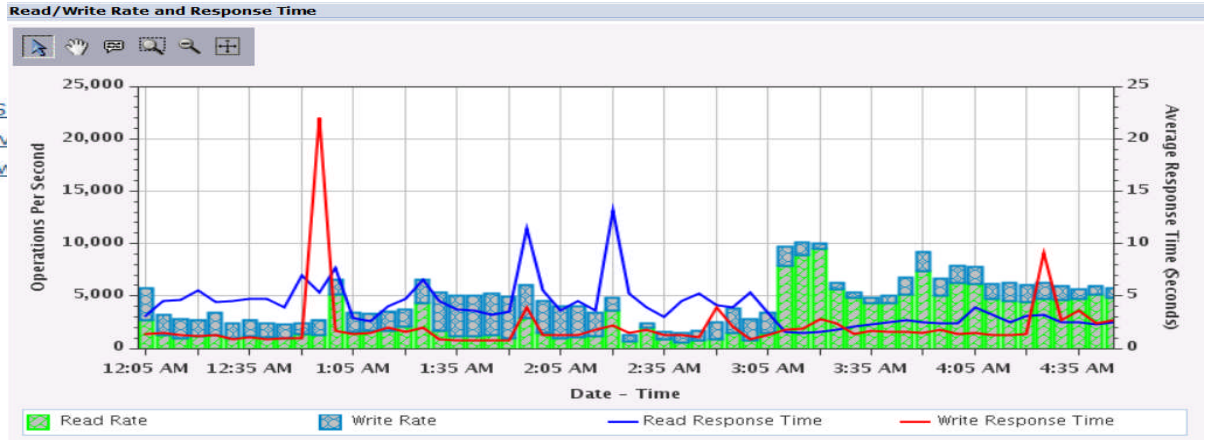
- (Spring 2014) PDI now has integrated charts that show views of how resources at the **bus level** like 12X loops and PCIe cards are performing



Collection Services - Disk Reads and Writes Detail

One perspective with several key charts, such as:

- Read and Write response times and rates
- Disk hardware information



Performance Data Investigator IBM I Model DSS

--- Select Action ---

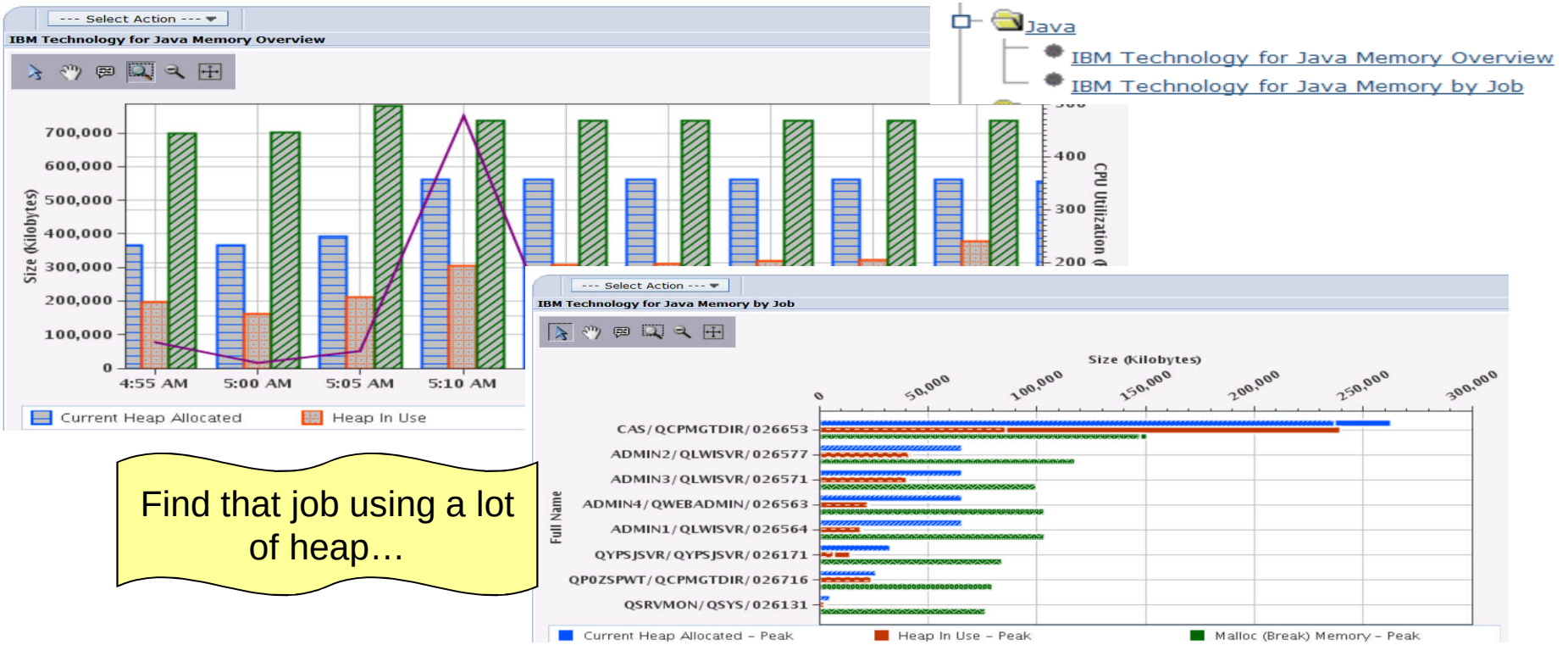
Select	Serial	SmfModel	ServerType	LogicalCapacity (GB)	LunCount	MeasureDateTime
	Internal	433A	i	2837	11	2016/10/12 00:05:00
	Internal	433A	i	2837	11	2016/10/12 00:10:00
	Internal	433A	i	2837	11	2016/10/12 00:15:00
	Internal	433A	i	2837	11	2016/10/12 00:20:00
	Internal	433A	i	2837	11	2016/10/12 00:25:00

Installed Disk Hardware

--- Select Action ---

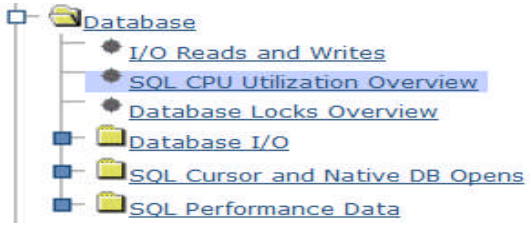
Select	ASP Number	Disk Unit Type	Feature Code	RAID Type	Unit Count	ASP Capacity (GB)	Disk Used	Average Unit Size
	1	15K SAS HDD	N/A	RAID-5	11	2837.4	54.21	257.9

Collection Services - Java Perspectives

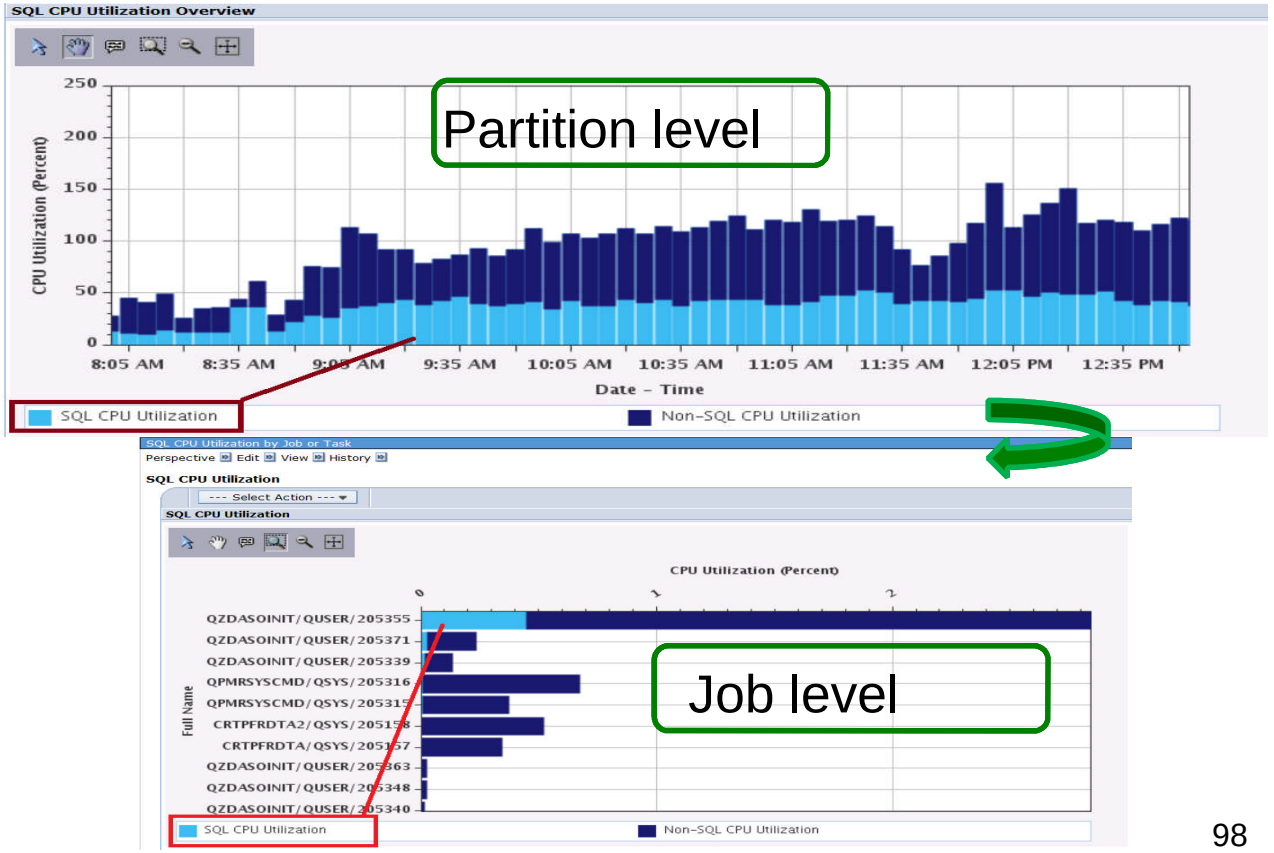


Find that job using a lot of heap…

Database - SQL CPU Utilization Overview

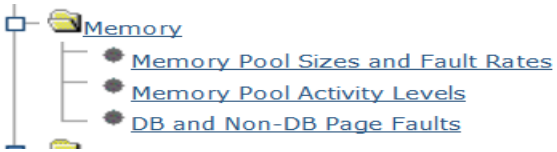


Allows you to see how much of your CPU utilization is due to SQL work

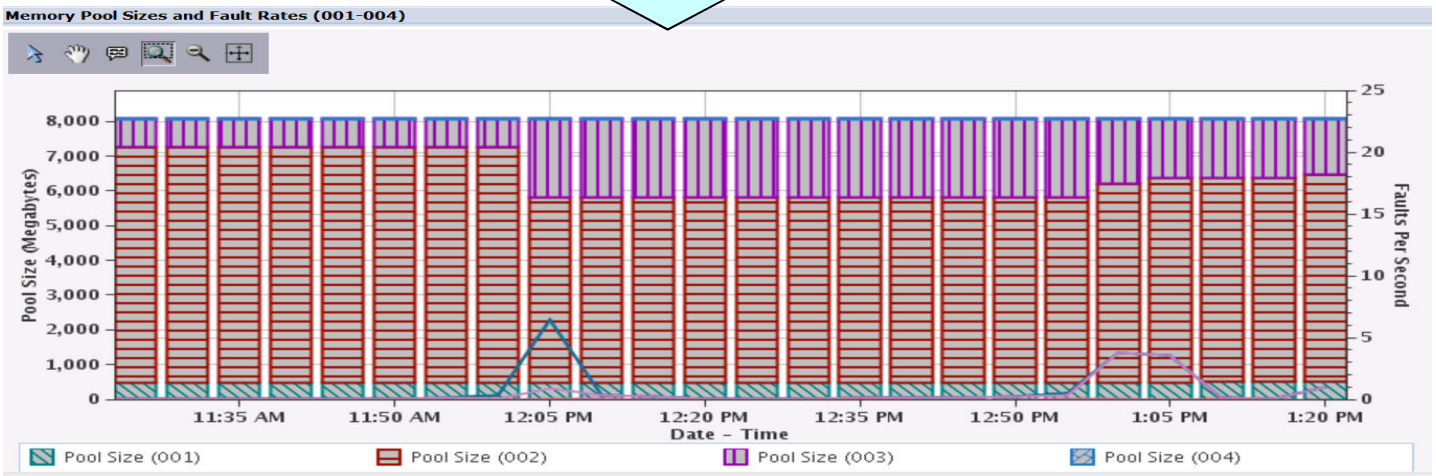


Collection Services - Memory

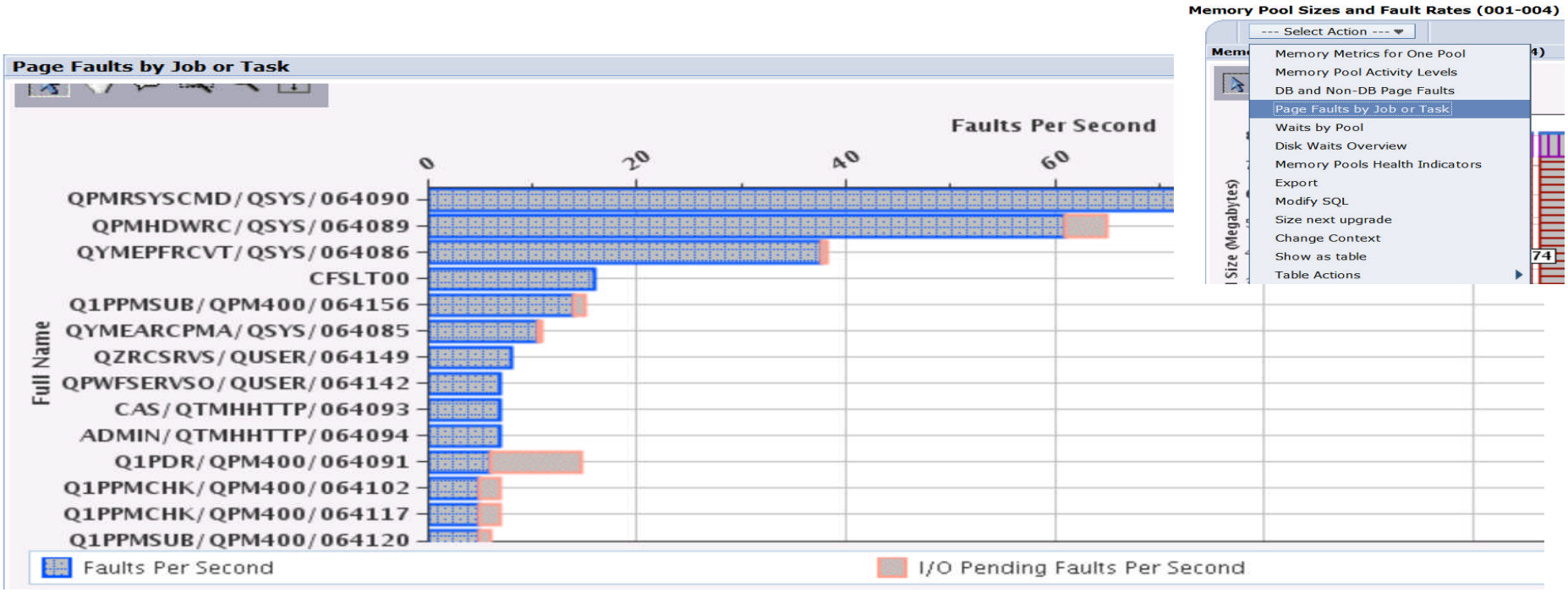
Pool size changes over time in a graphical view!



Note the change in pool sizes.
QPFRADJ is on.



Collection Services - Memory → Drilldown



Collection Services - Storage Allocation Perspectives

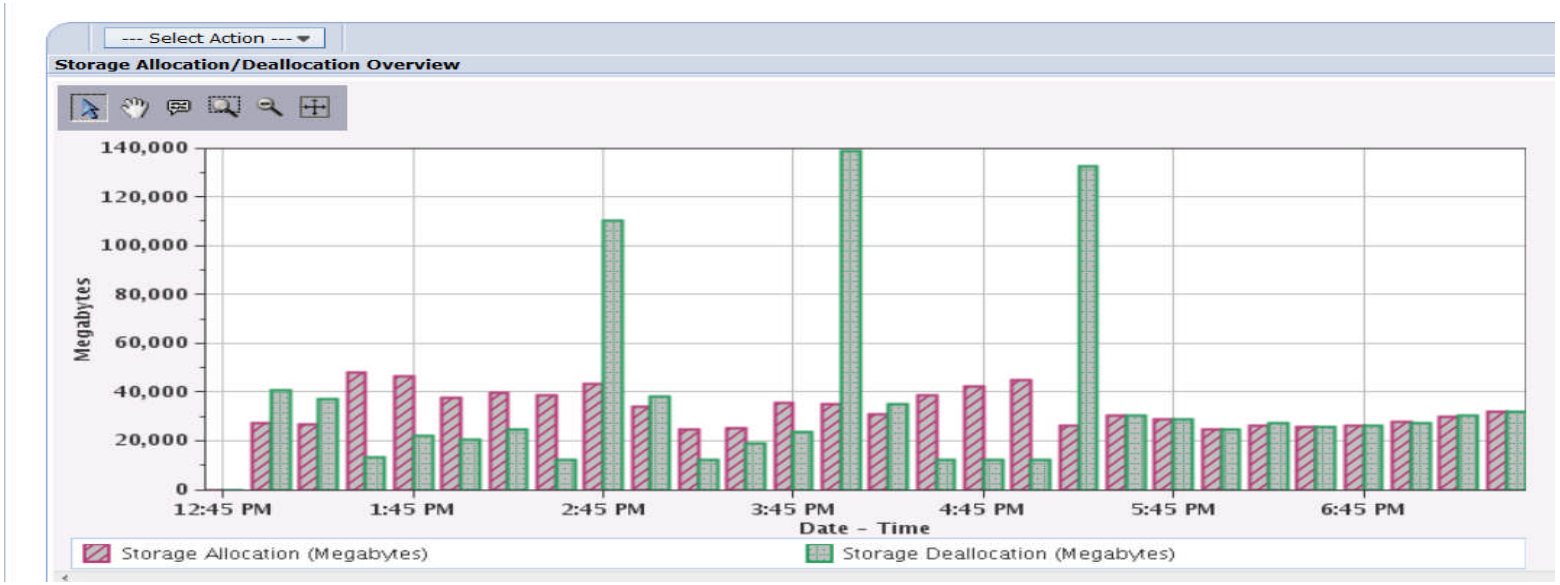
Selection

Name

Storage Allocation/Deallocation Overview

Description

This chart shows allocation and deallocation of the temporary and permanent storage for all contributors over time for the selected collections. Use this chart to select a time frame for further detailed investigation.



Collection Services - Storage Allocation by Thread or Task

Selection

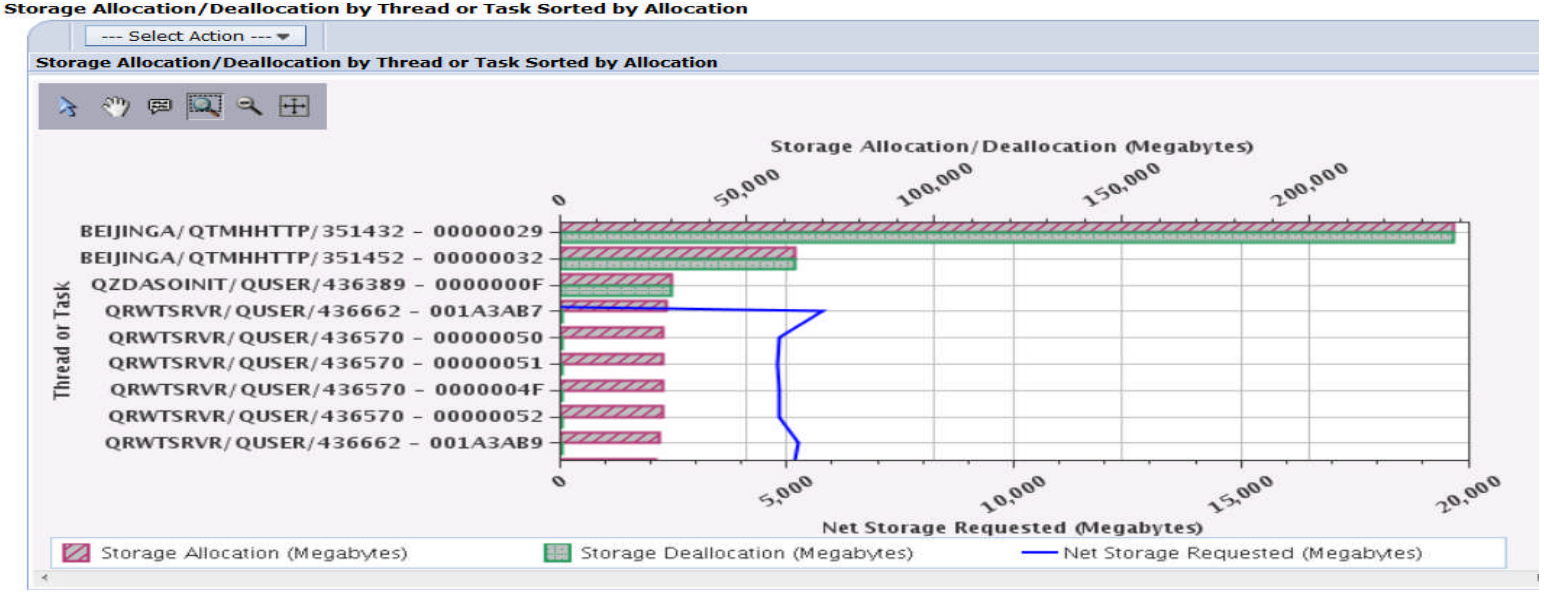
Name

Storage Allocation/Deallocation by Thread or Task

Description

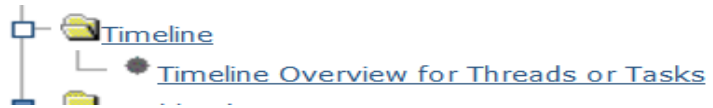
This chart shows allocation and deallocation of the temporary and permanent storage, net frames requested by thread or task. Use this chart to select a thread or task for viewing its storage statistics over time.

Storage Allocation/Deallocation by Thread or Task Sorted by Allocation



Collection Services - Timeline Perspective

- The timeline bars on the chart represent the elapsed time of threads or tasks
  - Dispatched CPU Time
  - CPU Queuing Time
  - Other Waits Time



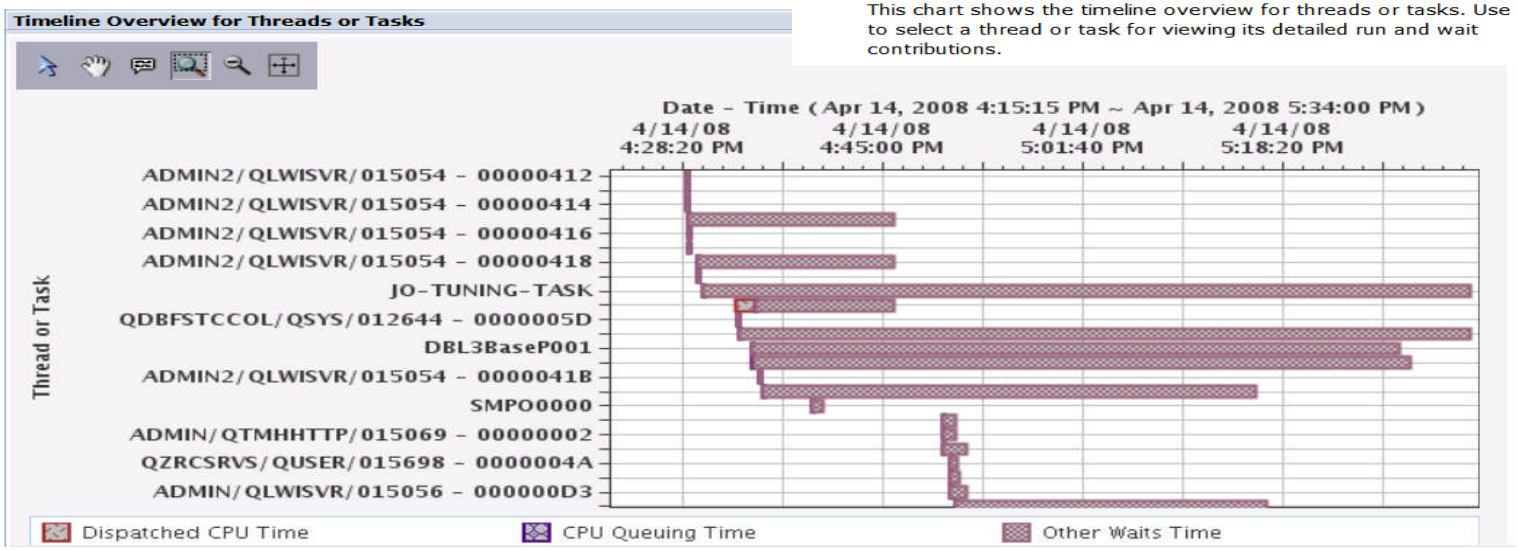
Selection

Name

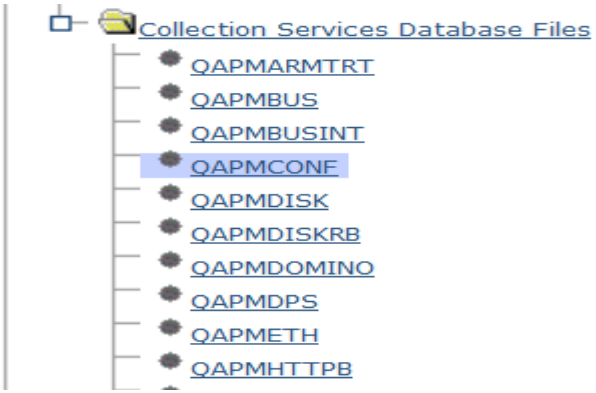
Timeline Overview for Threads or Tasks

Description

This chart shows the timeline overview for threads or tasks. Use this chart to select a thread or task for viewing its detailed run and wait contributions.



Collection Services Database Files…QAPMCONF



QAPMCONF

Perspective » Edit » View » History »

Collection
Name(s): Q067000002
Library: QPFRDATA
Type: Collection Services File Based Collection
File level: 36

Time
Start: Mar 8, 2013 12:00:02 AM
End: Ongoing

System
Name: ETC3T1
Release: V7R1M0

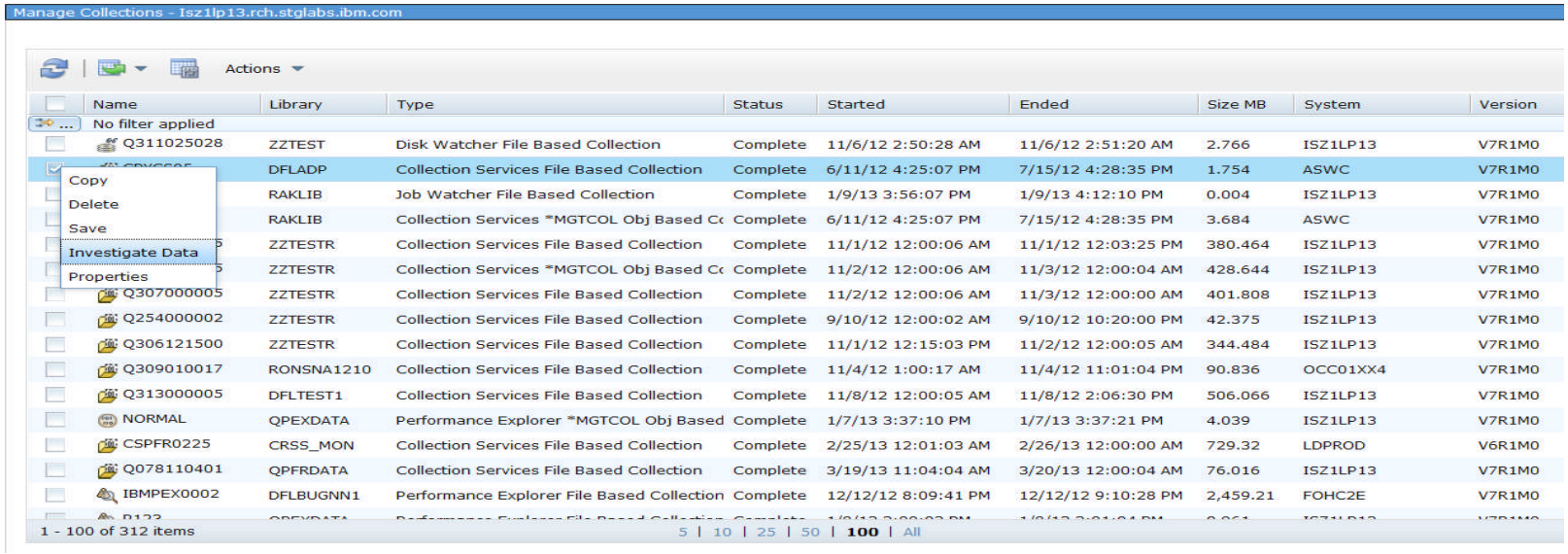
QAPMCONF Panel View

Library Name:	QPFRDATA	Processor Firmware Time:	No
Member Name:	Q067000002	Task Threshold Value (ms):	1,000
Start Time:	Mar 8, 2013 12:00:02 AM	Secondary Thread Thresh (ms):	1,000
Model Number:	61X	Disk Response Time Boundary 1 (us):	15
System Type:	7998	Disk Response Time Boundary 2 (us):	250
Partition Memory (KB):	4194304	Disk Response Time Boundary 3 (us):	1,000
Comm Data Collected:	Y	Disk Response Time Boundary 4 (us):	4,000
Machine Serial Number:	10-065FA	Disk Response Time Boundary 5 (us):	8,000
Response Time Boundary 1 (ms):	1000	Disk Response Time Boundary 6 (us):	16,000
Response Time Boundary 2 (ms):	2000	Disk Response Time Boundary 7 (us):	64,000
Response Time Boundary 3 (ms):	4000	Disk Response Time Boundary 8 (us):	256,000
Response Time Boundary 4 (ms):	8000	Disk Response Time Boundary 9 (us):	500,000
System ASP Capacity (KB):	93,206,752	Disk Response Time Boundary 10 (us):	1,024,000
Checksum Protection On:	N	Hypervisor Memory (MB):	640
Virtual Processors:	2	SMT Hardware Threads:	0
Installed Processors:	4	Time Interval (minutes):	5
Remote Response Boundary 1 (ms):	-	Interactive Limit (%):	100.00
Remote Response Boundary 2 (ms):	-	Time Interval (seconds):	300
Remote Response Boundary 3 (ms):	-	Interactive Threshold (%):	100.00
System ASP Capacity (KB):	93,206,752	Processor Multi-tasking Capability:	System Controlled
Perm 16MB Addr Remaining:	274,848,547,584	Output File System:	ETC3T1
Temp 16MB Addr Remaining	274,814,995,200	Partition Count:	3
Disk Resp Time Boundary 1 (ms):	1	Processor Folding Support:	No
Disk Resp Time Boundary 2 (ms):	16	Partition ID:	2
Disk Resp Time Boundary 3 (ms):	64	Primary Partition ID:	0
Disk Resp Time Boundary 4 (ms):	256	Processor Units:	0.2
Disk Resp Time Boundary 5 (ms):	1,024	System Version:	7
Collection Data:	Consistent with *SYS	System Release:	1.0
Collect Internal Data:	N	System Name:	ETC3T1
*CSMGTCOL Collection Library:	QPFRDATA	Performance Monitor Select Job:	
*CSMGTCOL Collection Name:	Q067000002	Shared Processor Pool:	Yes
Database Consistency:		Partition Sharing Capped:	Uncapped
Database Limit (% of CPU):	100.0	Variable Processor Speed Capability:	1
		QPFRADJ System Value:	2

Key Information about your system

Manage Collections

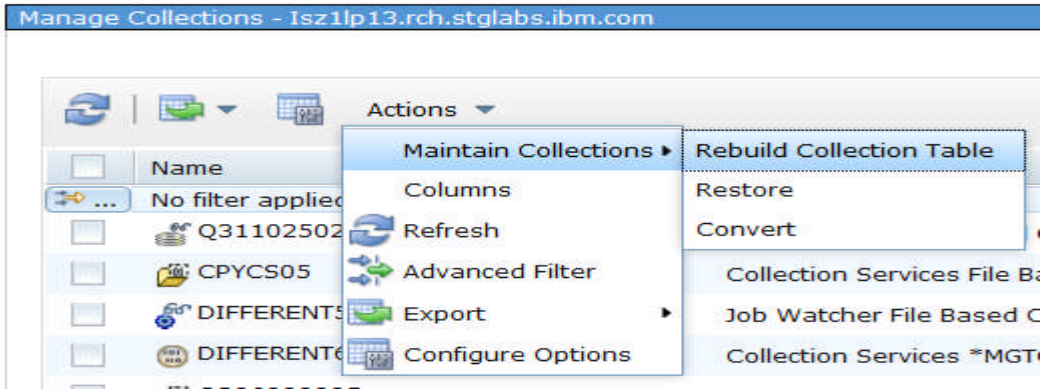
- The Manager Collections tasks allows you to see and manage all of your performance data from one central location
- Various tasks can be launched from the **Manage Collections** task, including the Performance Data Investigator



Manage Collections

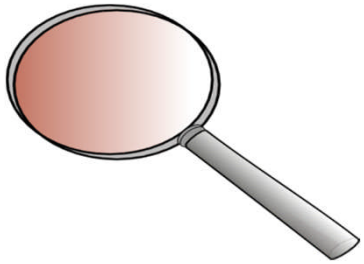
- If you restore performance data without using the Restore Performance Collection interface (or RSTPFRCOL), collections may not display in the Manage Collections view.

- The “Rebuild Collection Table” option will rebuild the meta-data used for the Manage Collections task and then your



Performance Data – Analysis

Performance Diagnostics with the Performance Data Investigator



Analyzing Performance Data Using PDI

- Now that you know all that PDI can do….
  - How do you really use it to analyze performance data?
  - There are no specific steps – it all depends upon what you see in the performance data
  - If you look at your performance data on a regular basis, you will learn your “normal” pattern which makes it easier to identify something unusual
  - Experience is the best teacher!

Analyzing Performance Data Using PDI

- Start by asking questions:
  - What was the symptom of the problem?
  - Who reported the problem
  - What time did it occur?
  - How long did it last?

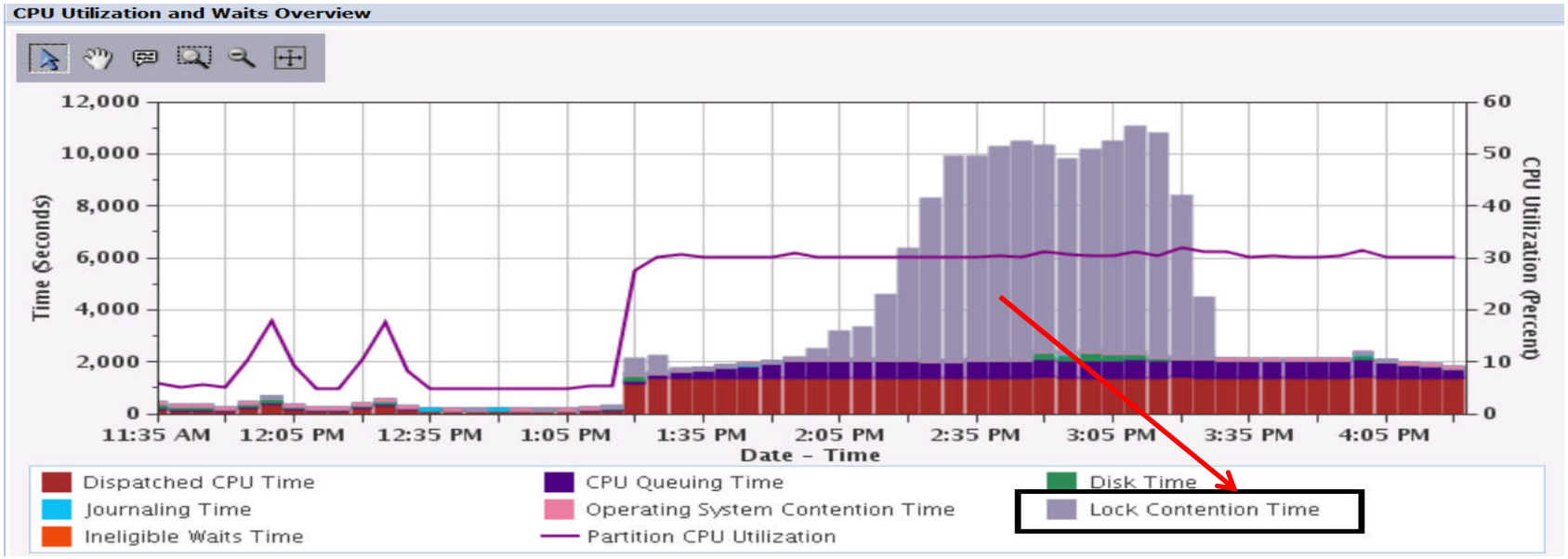
  - Have there been any recent **changes**?
    - New or changed workload?
    - Any application changes?
    - Any recent hardware configuration changes?

  - What was the **scope**?
    - Did it impact the entire system?
    - Did it impact some subset of work?
      - Specific users?
      - Specific applications?

CPU Utilization and Waits Overview

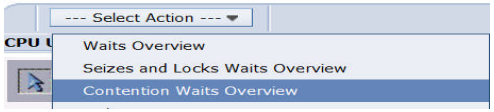
CPU Utilization and Waits Overview is an excellent starting place. Look for *interesting* points

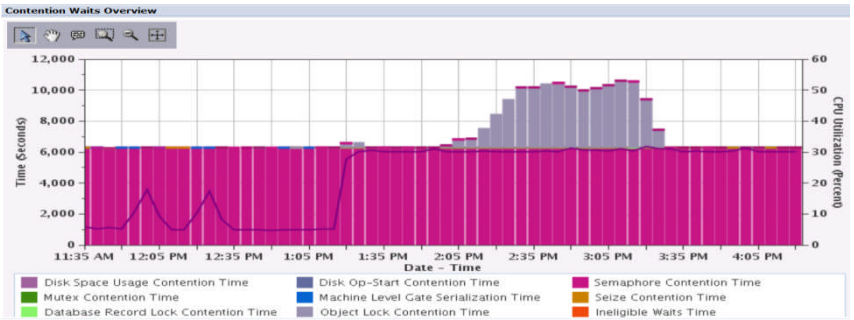
Next steps will depend upon the answer to the prior questions, along with what you see.



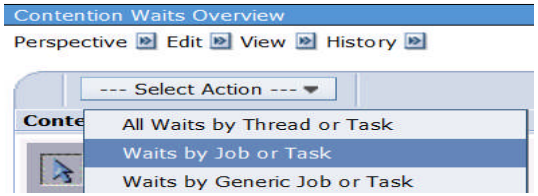
Using PDI, you can learn how to navigate through your data

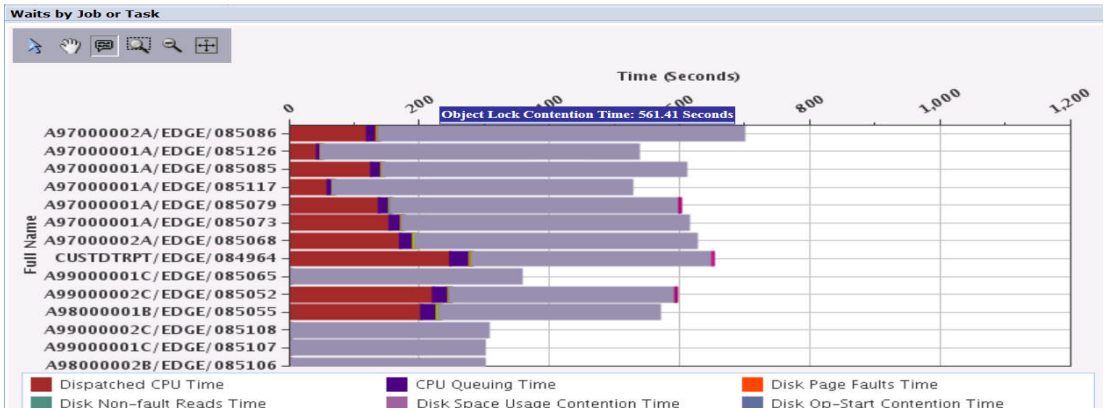
Take a closer look at what type of contention waits are occurring:





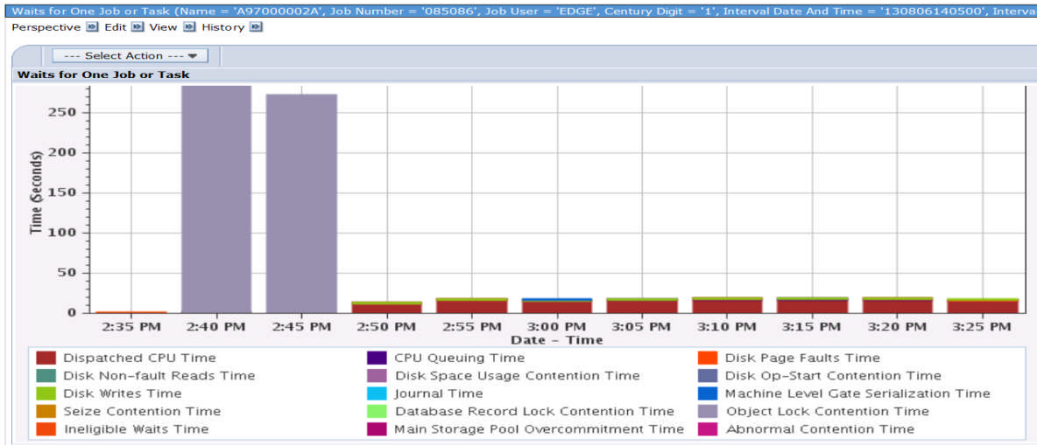
Which jobs/threads/tasks are affected by the wait time?





Drill-down based upon what you see

- Next, it may be interesting to see if the object lock wait time for a specific job occurred over several intervals, or just a few. Using select interactor , click on a job of interest, then select Waits for One Job or Task.



You may not be able to solve all performance problems with Collection Services data. However, you likely will gain valuable clues. Job Watcher is a good next step for this issue.

Recommendations

- If you are not using PDI, give it a try!

Remember, all partitions IBM i 6.1 and later can access the majority of the charts shown in this presentation – without installing/purchasing anything additional!!

- Stay current on PTFs
- Become familiar with your system's performance "signature" – it will make it easier to spot changes
- Keep baseline performance data
- See you at "i Can Find Your Performance Bottlenecks" session!

References

IBM i Performance FAQ a MUST read!

October 2017 update *(watch for a Spring 2018 soon!):*

https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=POW03102USEN

IBM Power Systems Performance

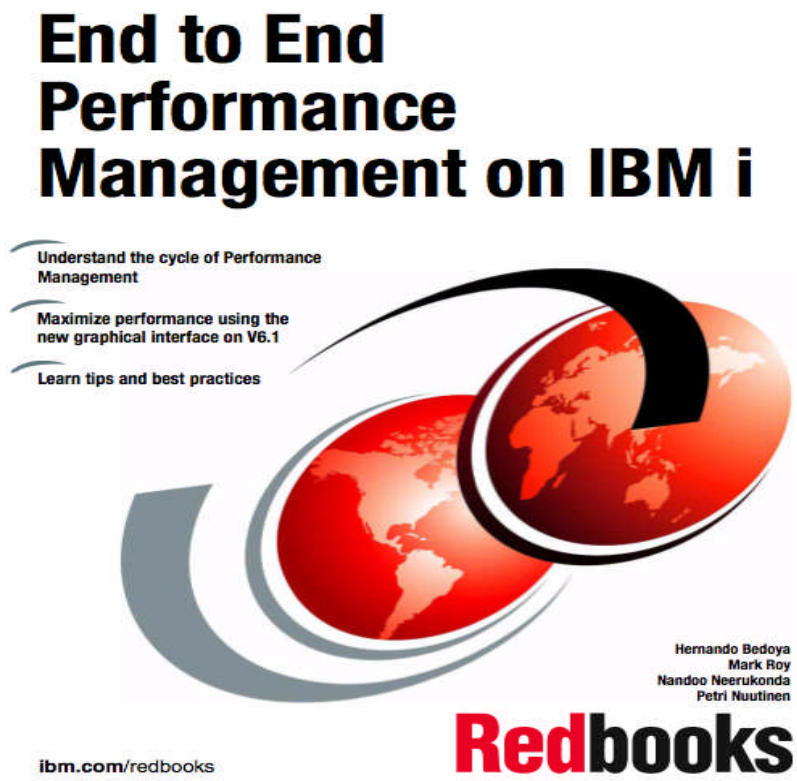
IBM i on Power - Performance FAQ

October 9, 2017

IBM i Web Sites with Performance Information

- IBM Knowledge Center:
  - 7.2 Performance
  - 7.3 Performance
- IBM i Performance Management:
  i Performance Management
- developerWorks:
  - IBM i Performance Tools: developerWorks Performance Tools
  - IBM i Performance Data Investigator: developerWorks PDI
- IBM iDoctor for IBM i: iDoctor
- IBM i Wait Accounting information:
  - Job Waits Whitepaper
  - KnowledgeCenter: The basics of Wait Accounting
  - developerWorks: IBM i Wait Accounting

A Redbooks publication!



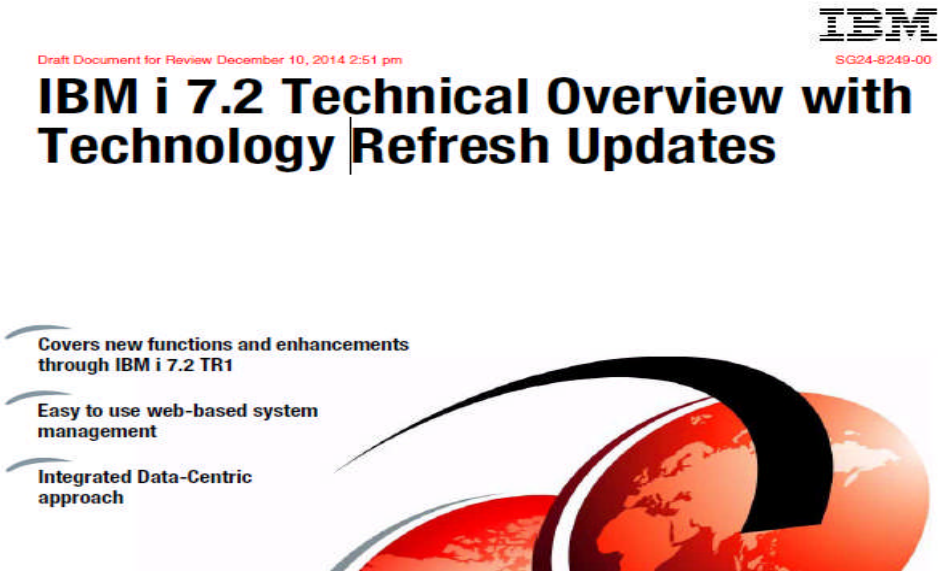
http://www.redbooks.ibm.com/redbooks/pdfs/sg247808.pdf

IBM i 7.2 Technology Refresh Updates

Covers the 7.2 content through Technology Refresh 1

Section 2.8 – Performance

Section 8.6.7 – Job level SQL stats in Collection Services



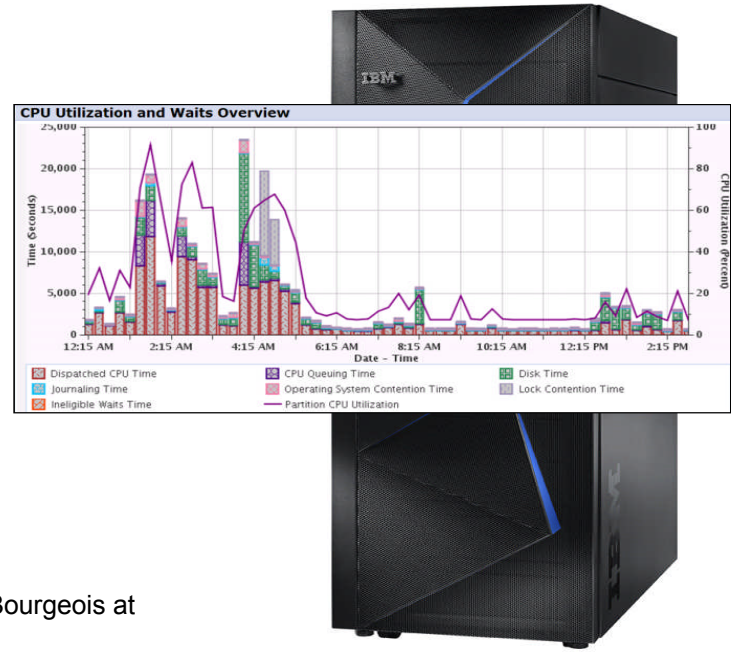
IBM i Performance Analysis Workshop

Learn the science and art of performance analysis, methodology and problem solving

Managing and analyzing the data can be quite complex. During this workshop, the IBM Systems Lab Services IBM i team will share useful techniques for analyzing performance data on key IBM i resources, and will cover strategies for solving performance problems. It will aid in building a future foundation of performance methodology you can apply in your environment.

Overview:

- Topics covered include:
  - Key performance analysis concepts
  - Performance tools
  - Performance data collectors (Collection Services, Job Watcher, Disk Watcher, and Performance Explorer)
  - Wait accounting
- Core methodology and analysis of:
  - Locks
  - Memory
  - I/O subsystem
  - CPU
- Concept reinforcement through case studies and lab exercises
- Discussions on theory, problem solving, prevention and best practices



Workshop details:

- Intermediate IBM i skill level
- 3-4 day workshop, public or private (on-site)
  - For general public workshop availability and enrollment: IBM i Performance Analysis Workshop
  - For public workshop availability and enrollment in France, please contact Philippe Bourgeois at pbourgeois@fr.ibm.com or Françoise Laurens at f_laurens@fr.ibm.com
  - For additional information, including private workshops, please contact Eric Barsness at ericbar@us.ibm.com or Stacy Benfield at stacylb@us.ibm.com, members of Systems Lab Services

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And finally…..

Thank you

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