Collection Services
Your First Line of Defense for Performance

Dawn May - dmmay@us.ibm.com

Power is performance redefined

Deliver services faster, with higher quality
and superior economics

Agenda

- **Collection Services and collector function**
  - Collection Services overview
  - Collector overview
  - Tips for collector configuration
  - Special considerations
- **Create Performance Data and database files**
  - Basics of CRTPFRDTA
  - Overview of performance database files
  - Summary of new metrics in IBM i 6.1 and 7.1

Collection Services Overview

What is Collection Services?

- **IBM i function that collects system performance data on a time interval basis**

- **Collects data from many system resources including:**
  - Hardware (CEC, IOPs, Controllers, Devices)
  - Licensed Internal Code (LIC)
  - Operating System
  - User / IBM applications (middleware)

- **Automated - 24/7 operation**
  - Performance data always available
  - Low system overhead

- **Collects / reports data at regular intervals from 15 seconds to 1 hour**
- **Release independent data design**

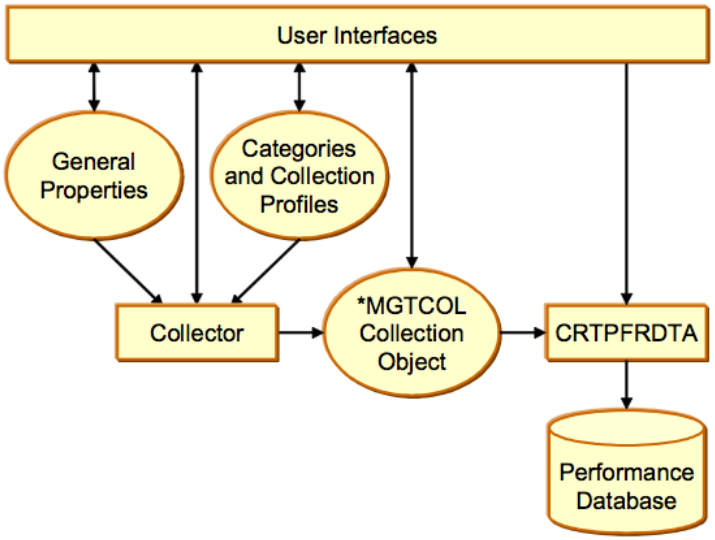
What is Time Interval (sample) Data?

- **Based on "Counters"**
  - Metrics (counters) instrumented by a function (database, storage management)
  - Counter incremented each time function does "*something*"
    - Number of opens, synchronous reads, synchronous writes, etc...
  - Counters wrap but are never reset
- **Value of counter is captured at specific time intervals**
- **Usually reported as a delta value for time interval**
  - Delta = $Value_{Time2}$ - $Value_{Time1}$

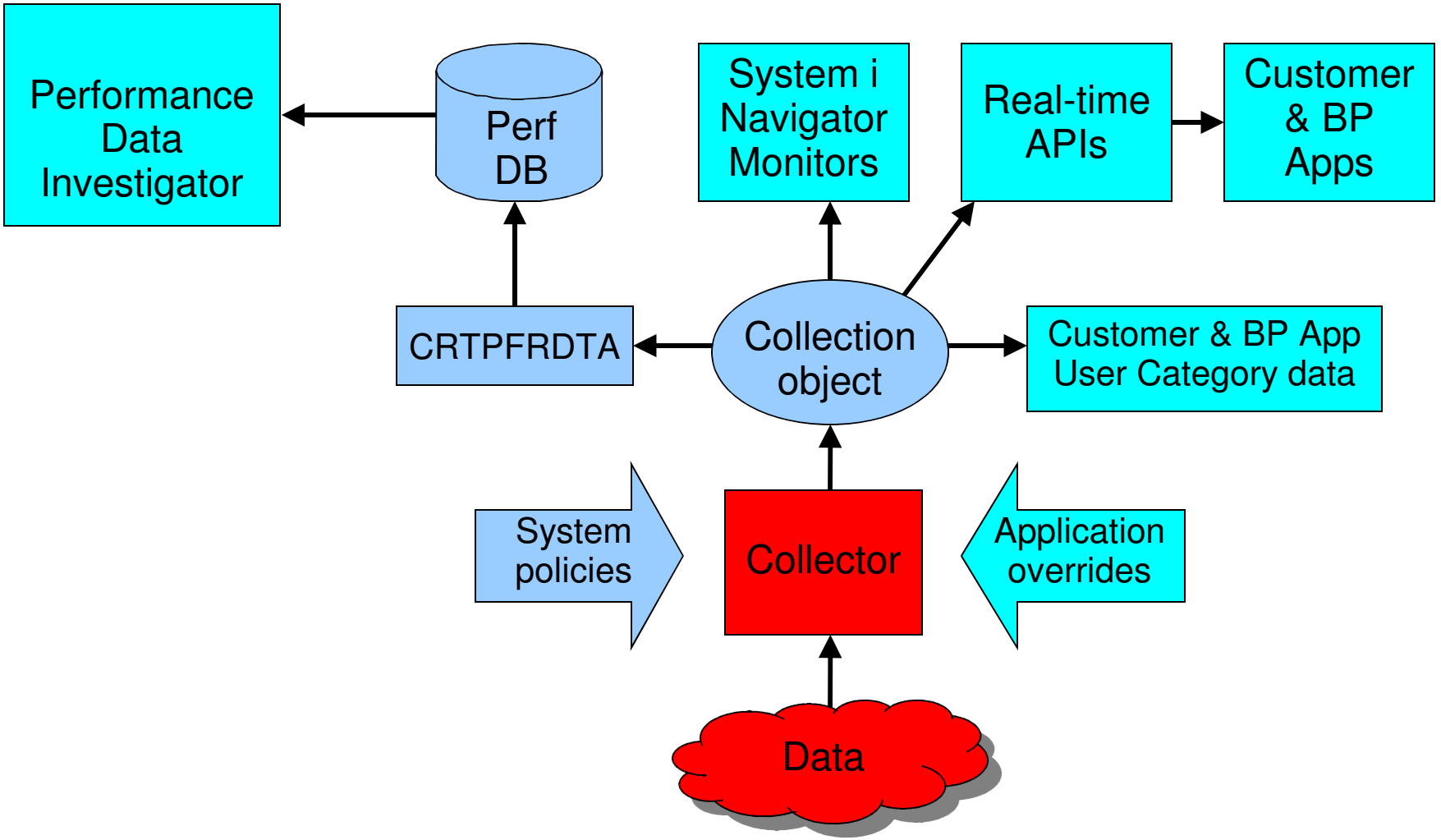
Why Collect Sample Data?

- **Low overhead monitoring of system activity**
  - How much of a resource is being consumed
  - By whom / when
  - Relationships between monitored data
- **Problem analysis - indicators of what to look at**
  - Identify job
    - Using too much CPU, too much time waiting, high I/O counts...
  - Disk contention
- **Trending**
  - When will the system run out of: CPU, disk, ...
- **Capacity planning**

Collector Function



Collection Services – Collector overview



Collector categories

- System Bus
- Storage Pool and Pool Tuning
- Hardware Configuration
- Subsystem
- System CPU
- System level data
- Job MI
- Job OS
- Disk Storage
- IOP
- Local Response Time
- Communication (Base, station, SAP)
- ARM
- APPN
- SNA
- SNADS Transaction
- TCP/IP Base
- TCP/IP Interface
- Integrated xSeries Server (IxS)
- Extended Adaptive Cache
- User-defined Transactions
- Domino
- HTTP Server (Powered by Apache)
- Data Port Services
- LPAR
- WAS
- JVM
- Removable Storage *New in 7.1
- External Storage *New in 7.1
- System Internal Data *New in 7.1

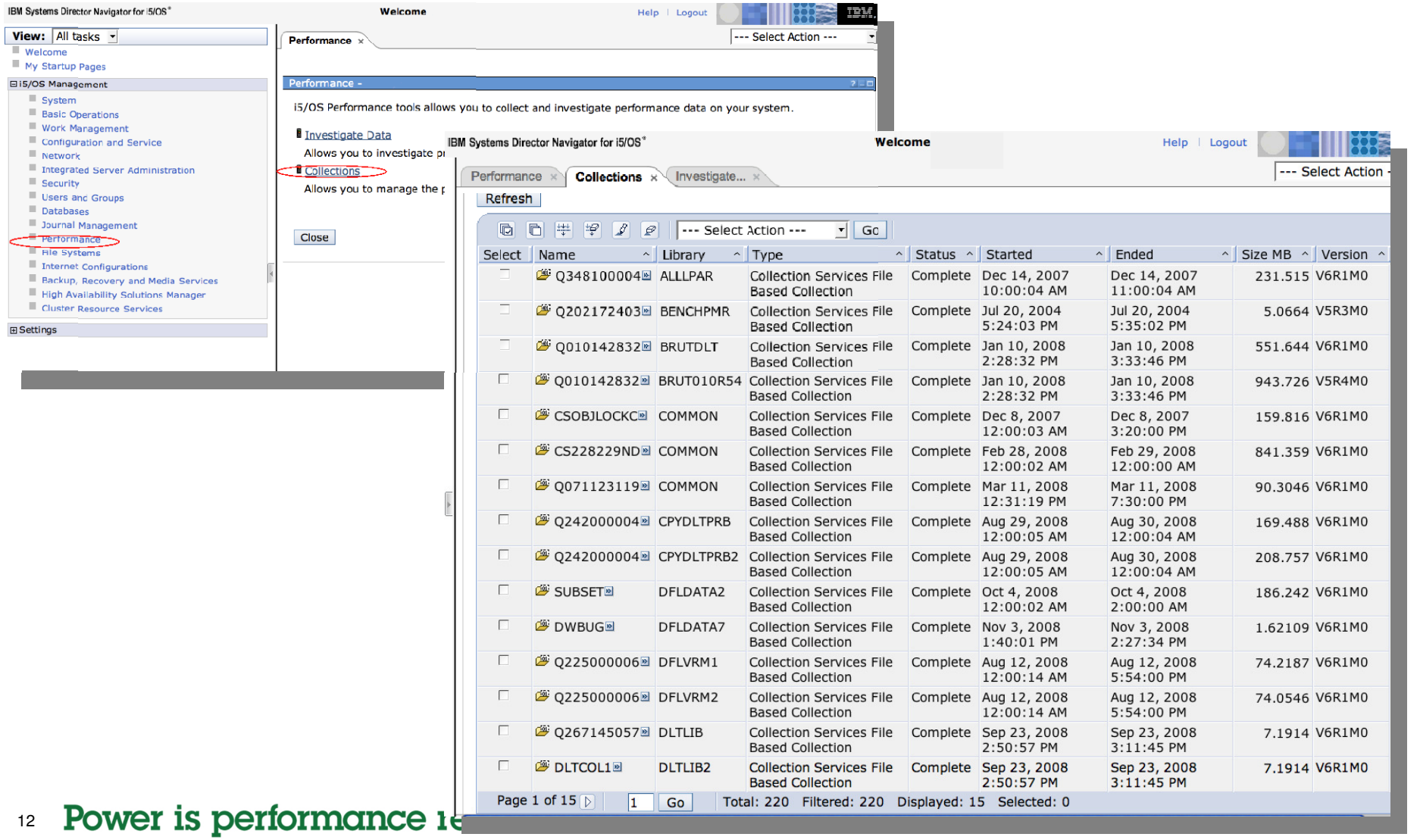
How is collector started?

- **On by default beginning in 6.1**
- **Other system functions**
  - System i Navigator system monitors
  - Performance Collector APIs used by applications
    - http://publib.boulder.ibm.com/infocenter/iseries/v7r1m0/topic/apis/perf1.htm
- **Manually**

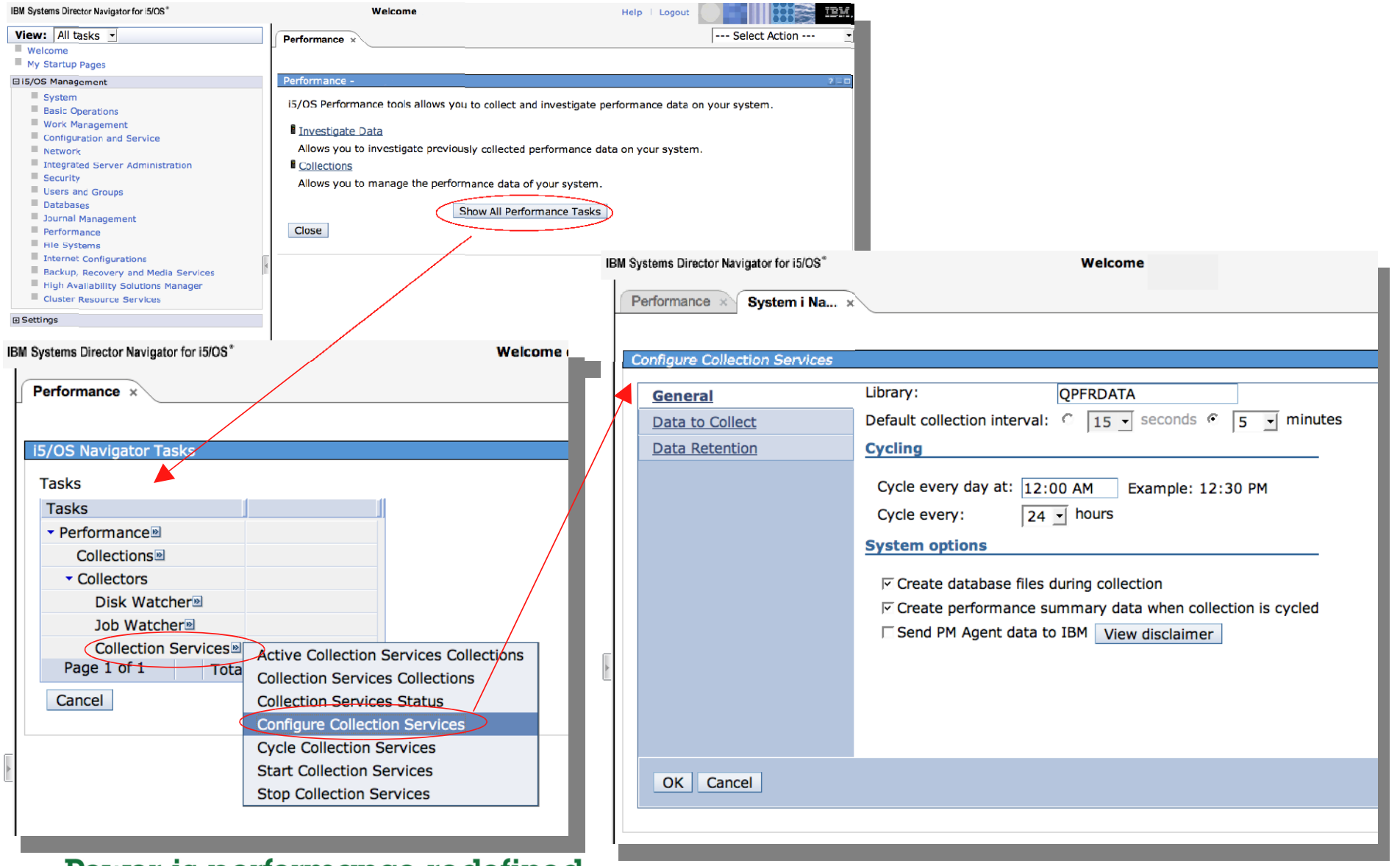
Manually Managing the Collector

- **There are many ways to start the collector and manage the data that it collects**
  - IBM Systems Director Navigator for i
  - System i Navigator
    - Need to install the “Configuration and Service” component on your client
  - Performance Tools Menu
    - Option 2 on GO PERFORM or STRPFRT
  - APIs
    - http://publib.boulder.ibm.com/infocenter/iseries/v6r1m0/topic/apis/perfmgmt_colsvc.htm
  - Commands
    - **STRPFRCOL** – Start Performance Collection
    - **ENDPFRCOL** – End Performance Collection
    - **CFGPFRCOL** – Configure Performance Collection
    - **CHKPFRCOL** – Check Performance Collection

Managing Collection Services in IBM Systems Director Navigator for i



Configuring Collection Services



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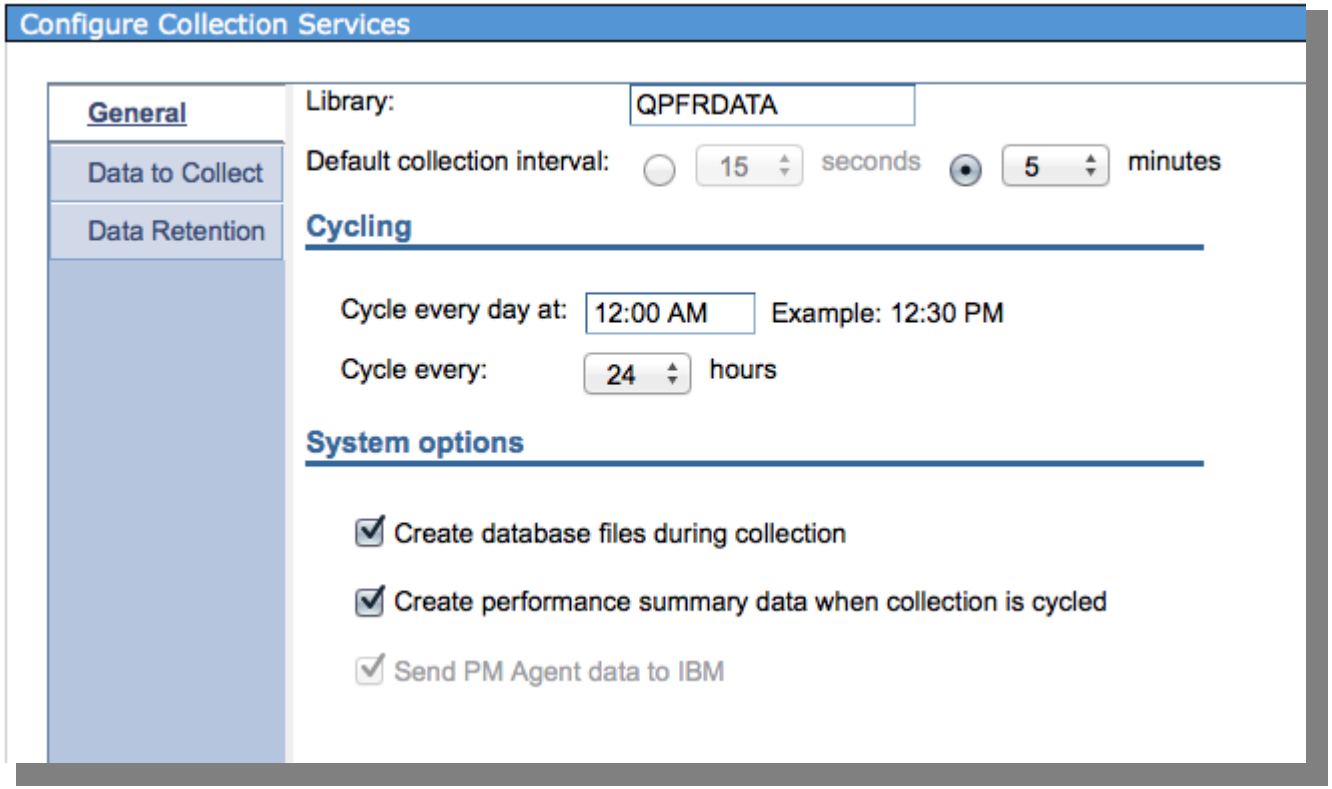
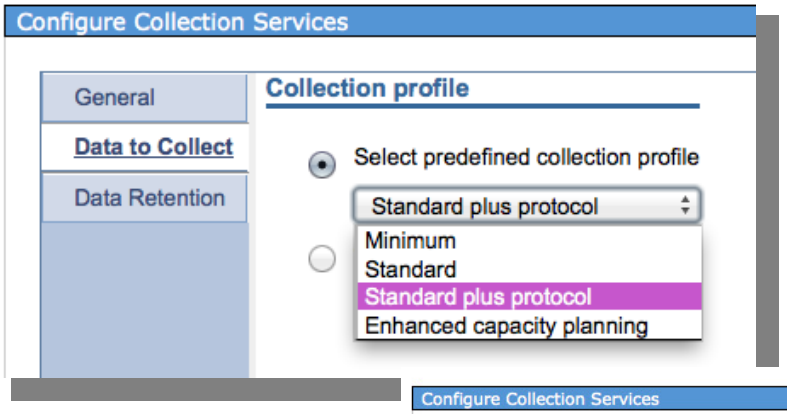
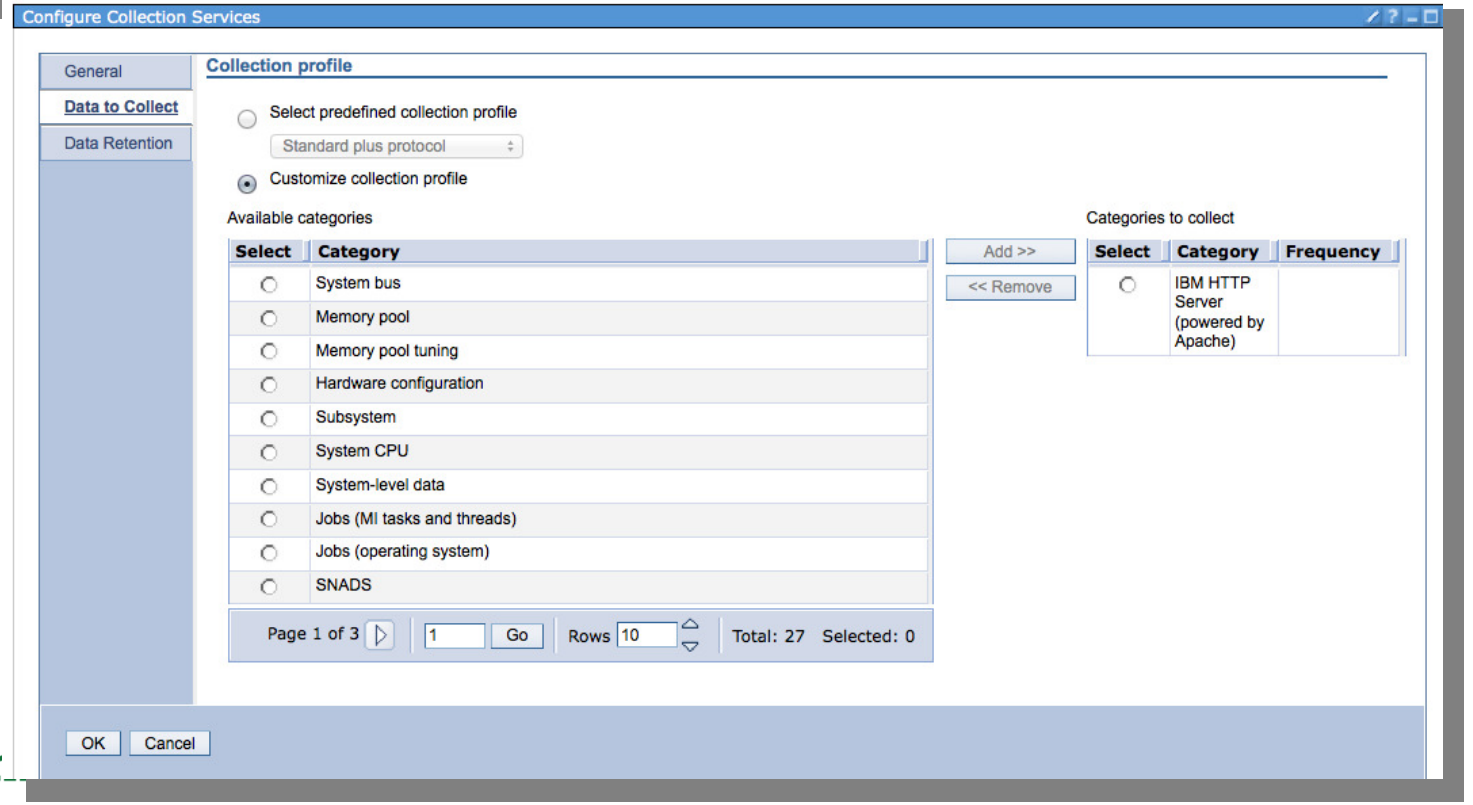
Configure Collection Services – General

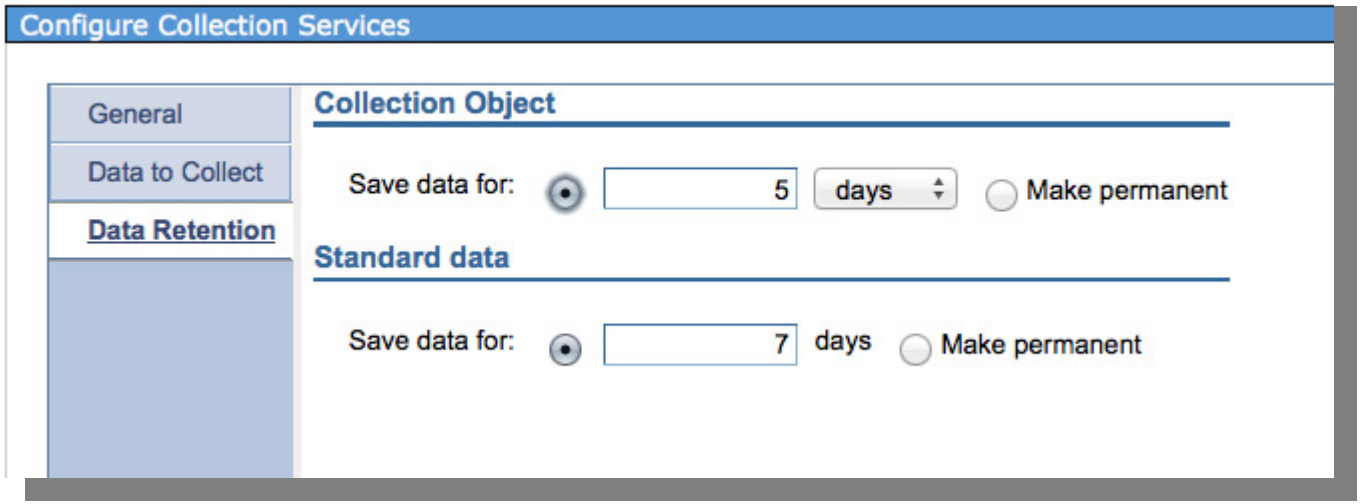


Configure Collection Services – Data to Collect

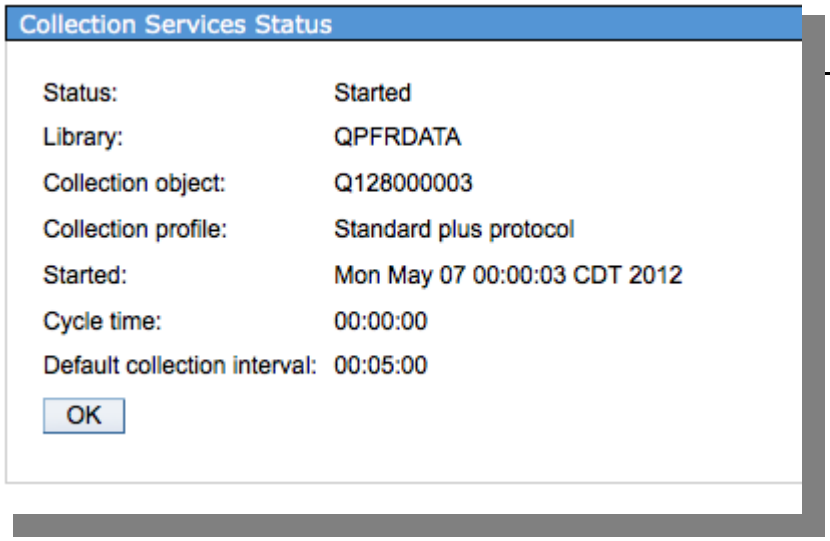




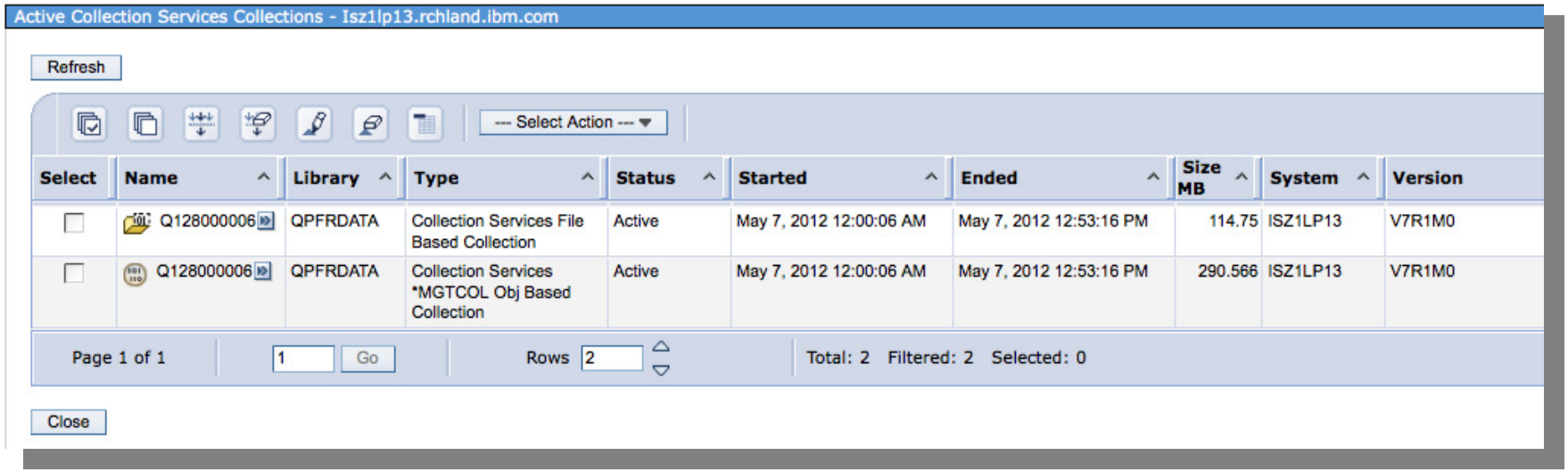
Configure Collection Services – Data Retention



Collection Services Status



Active Collection Services Collections



What will you see on your system?

```
                                Work with Active Jobs
                                                              09/09/05  13:08:46
CPU %:      .0     Elapsed time:   00:00:00     Active jobs:   176

Type options, press Enter.
  2=Change   3=Hold   4=End   5=Work with   6=Release   7=Display message
  8=Work with spooled files   13=Disconnect ...

Opt  Subsystem/Job  User        Type  CPU %  Function         Status
__   QSPL           QSYS        SBS      .0                   DEQW
__   QSYSWRK        QSYS        SBS      .0                   DEQW
__     CRTPFRDTA    QSYS        BCH      .0  CMD-CRTPFRDTA    DEQW
__     QCPMGTSVR    QCPMGTDIR   BCH      .0  PGM-QDIRSTRJVA   JVAW
__     QCSTCTCASD   QSYS        BCI      .0  PGM-QCSTCTEXEC   SELW
__     QTVTELNET    QTCP        BCH      .0                   TIMW
__     QYPSJSVR     QYPSJSVR    BCH      .0  PGM-QYPSJSVR     SIGW
__     QYPSPFRCOL   QSYS        BCH      .0  PGM-QYPSPFRCOL   DEQW
__     QYUSALRMD    QSYS        BCI      .0  PGM-QCSTCTEXEC   SELW
                                                              More...
Parameters or command
===>
F3=Exit   F5=Refresh       F7=Find      F10=Restart statistics
F11=Display elapsed data   F12=Cancel   F23=More options   F24=More keys
```

Create Performance Data job

Collector job

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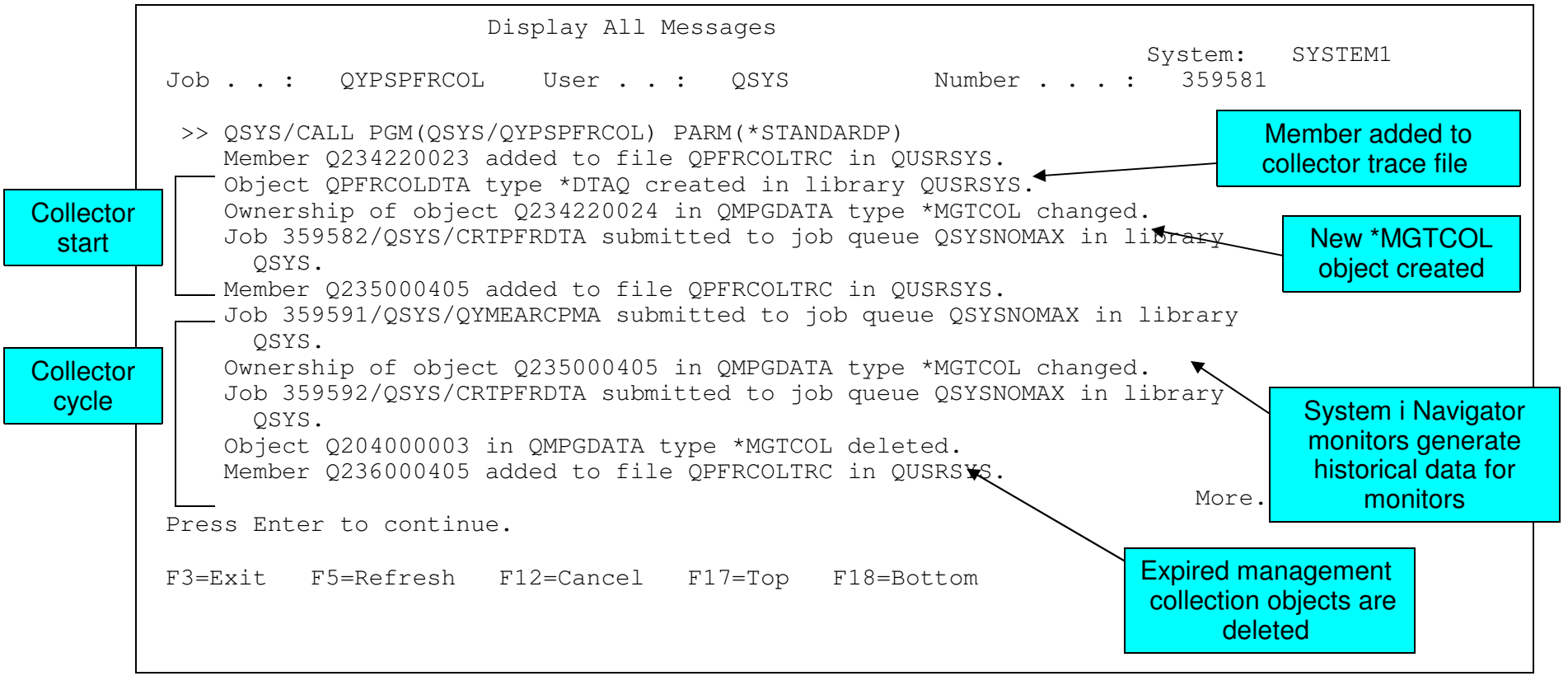
What will you see on your system? (cont)



Configuration Tips

Default settings (PM Agent Considerations)

```
                     Configure Perf Collection (CFGPFRCOL)

 Type choices, press Enter.

 Default interval . . . . . .   15.00          *SAME, .25, .50, 1.0, 5.0...
6.1 Collection library . . . . .   QPFRDATA      Name, *SAME      Used to be QMGPDATA
 Default collection profile . . .   *STANDARDP    *SAME, *MINIMUM, *STANDARD...
 Cycle time . . . . . .   000000          Time, *SAME
 Cycle interval . . . . . .   24              *SAME, 1-24 hours
 Collection retention period:
   Number of units  . . . . . .   00024         *SAME, 1-720, *PERM
   Unit of time . . . . . .   *HOURS          *HOURS, *DAYS
 Create database files  . . . . .   *YES         *SAME, *YES, *NO
 Create performance summary . . .   *NO          *SAME, *YES, *NO
6.1 Change PM Agent library  . . . .   *SAME        *SAME, *YES, *NO   Obsolete in 6.1

                            Additional Parameters

6.1 Standard data retention (days)     0000000010    Number, *SAME, *PERM

                                                                    Bottom
 F3=Exit    F4=Prompt    F5=Refresh    F12=Cancel    F13=How to use this display
 F24=More keys
```

Suggestions for production systems

- **Keep *MGTCOL objects**
  - Set retention period to at least a week
- **Choose Interval (e.g. 300 sec)**
  - Amount of data you can afford to keep
  - Remember < 300 sec requires *CUSTOM for I/O categories
- **Use *STANDARDP profile**
- **Set cycle time if business needs dictate a more optimum time**
- **Consider requirements for database files**
  - Most customers create QAPM* files concurrently with running collector
  - Can add CPU, memory, and disk contention to overloaded systems

When benchmarking

- **Confirm / change configuration**
- **Start / stabilize workload**
- **Start or cycle collector**
  - New *MGTCOL object
  - No point in saving data that is not part of measurement
  - Changed Library takes effect only for new objects

When benchmarking (cont)

- **Check system clock - plan run duration**
  - say you want 20 minutes of data (four 5 min intervals)
  - five samples are necessary (initial sample plus 4 intervals)
  - clock time is 12:02
  - you need to run past 12:25
- **End or cycle collection**
- **CRTPFRDTA**
  - from 12:05 to 12:25
  - 12:05 is initial sample
  - 12:10 is interval 1
  - 12:25 is interval 4

Special Considerations

Considerations – data impacts

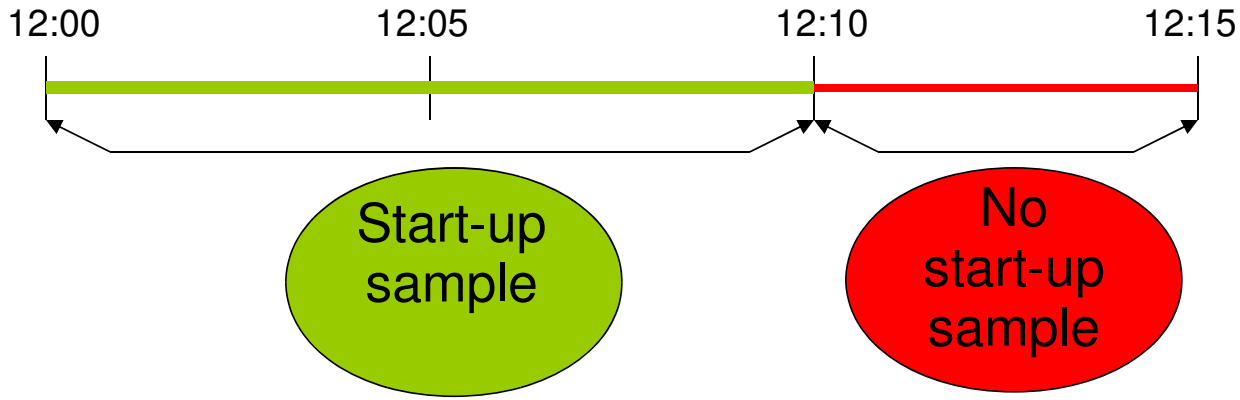
- Busy system x Short interval = a lot of data
- *JOBMI and *JOBOS categories are most likely to generate lots of data
- System i Navigator monitors are often used with short interval
- Collector manages *MGTCOL objects (attribute *PFR only)
- However, with automatic CRTPFRDTA - watch for database files growth due to size or number of members

Collection Services Data Management

- Collection Services will automatically expire data – but you should keep important collections for comparison
  - Past seven to ten days
    - Keeping the management collection objects is more important than the DB2 files
  - Key time periods & events, such as end-of-month or end-of-year processing, baseline prior to installing a new release
  - Back up key Collection Services data as you would business data
- Copy collection management objects to a separate library to prevent them from being automatically expired
- Review your Collection Services collection interval
  - Default is 15 minutes
  - Smaller intervals == more data
- Review your Collection Services cycle interval
  - Default is once daily at midnight
  - Select a time that will have minimal impact on critical business functions

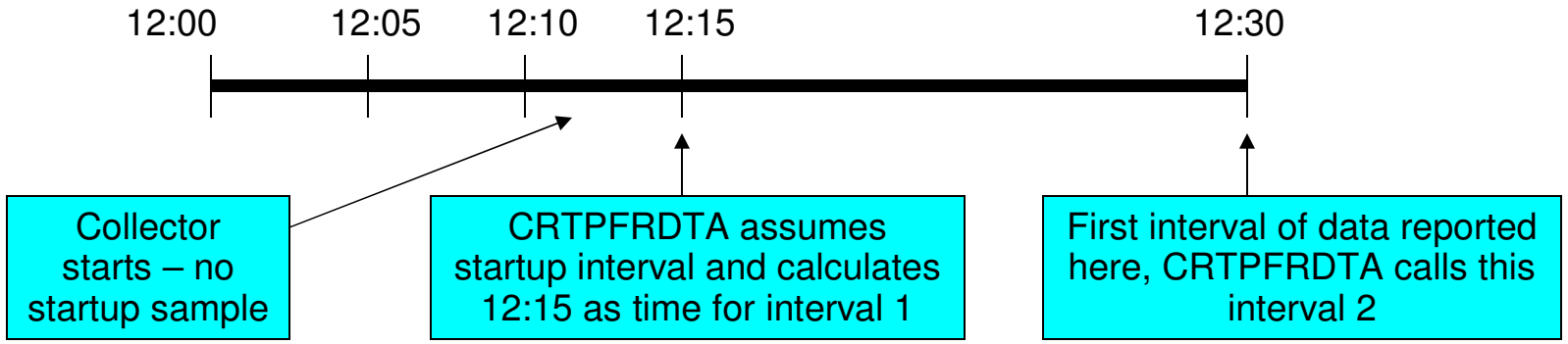
Considerations – time factors

- **Collector sample interval time is based on system clock boundaries**
  - Predictable samples
  - Ability to correlate data across systems or partitions
- **Startup sample happens only if > 1/3 of interval remains until next sample time**
  - Example: with 15 min configured interval…



Considerations – Why is DB interval 1 often missing?

- **CRTPFRDTA also uses clock intervals**
  - First calculated interval time after start time becomes interval number 1
  - Assumes there will be an initial (startup) interval



- **Recall that categories are independent and are collected at different intervals - some files may be affected while others are not**

Basics of CRTPFRDTA

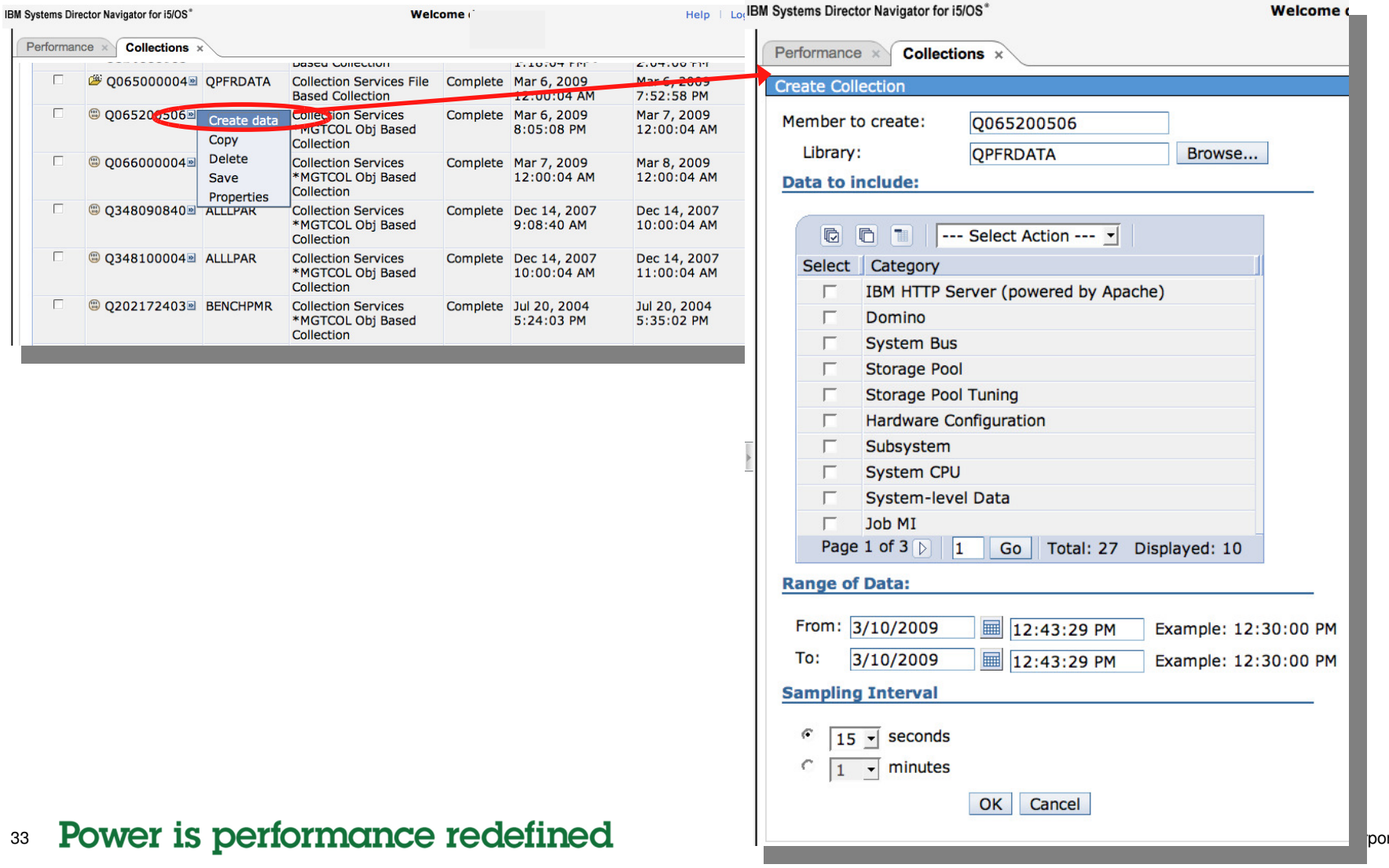
CRTPFRDTA – what is it?

- **Command to export data from a *MGTCOL object to performance database files**
- **Has special provisions to work with active collection object and wait for data**
- **Also a batch job submitted by and running with the collector**

CRTPFRDTA command

```
                    Create Performance Data (CRTPFRDTA)

Type choices, press Enter.

From collection  . . . . . .     _____________   Name, *ACTIVE
  Library  . . . . . . . . . .    QPFRDATA       Name
To member  . . . . . . . . . .   *FROMMGTCOL     Name, *FROMMGTCOL
To library . . . . . . . . . .   *FROMMGTCOL     Name, *FROMMGTCOL
Text 'description' . . . . . .   *SAME                                 _____________

Categories to process  . . . . .  *FROMMGTCOL   Name, *FROMMGTCOL, *APPN...
              + for more values _       __

Time interval (in minutes) . . .  *FROMMGTCOL   *FROMMGTCOL, 0.25, 0.5, 1...
Starting date and time:
  Starting date  . . . . . .     *FROMMGTCOL   Date, *FROMMGTCOL
  Starting time  . . . . . .      _________    Time
Ending date and time:
  Ending date  . . . . . .       *FROMMGTCOL   Date, *FROMMGTCOL, *ACTIVE
  Ending time  . . . . . .        _________    Time
```

Creating database files from Systems Director Navigator for i



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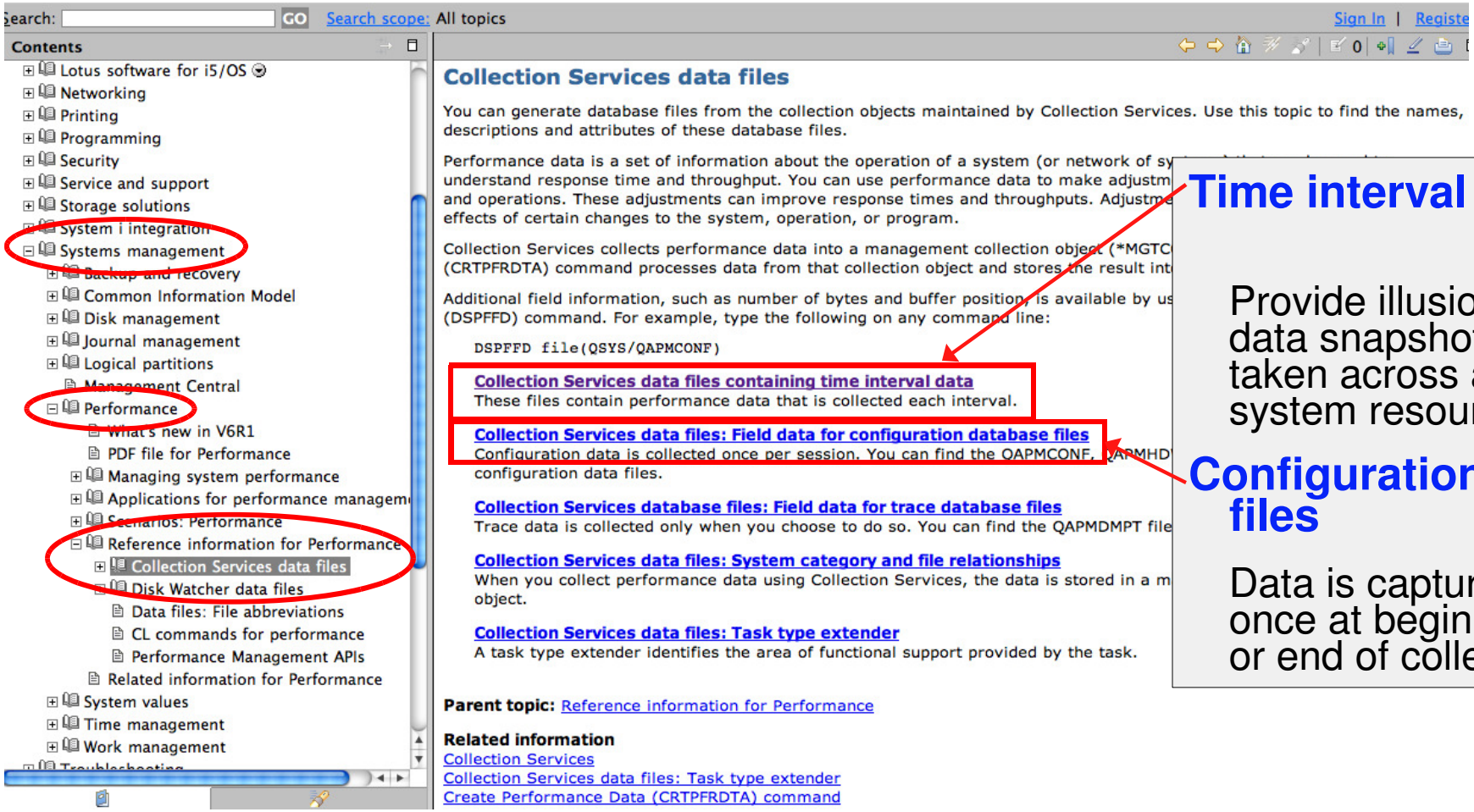
Overview of Performance Database Files

Performance files - basics

- **All files created by CRTPFRDTA begin with QAPM**
- **A performance collection exists as a member of the same name in every database file for which data was collected**
- **QAPMCONF is the control file to identify collections**
- **Much of the data is presented in performance reports. But not all of it!**

Types of files – where to find info

http://publib.boulder.ibm.com/eserver/ibmi.html



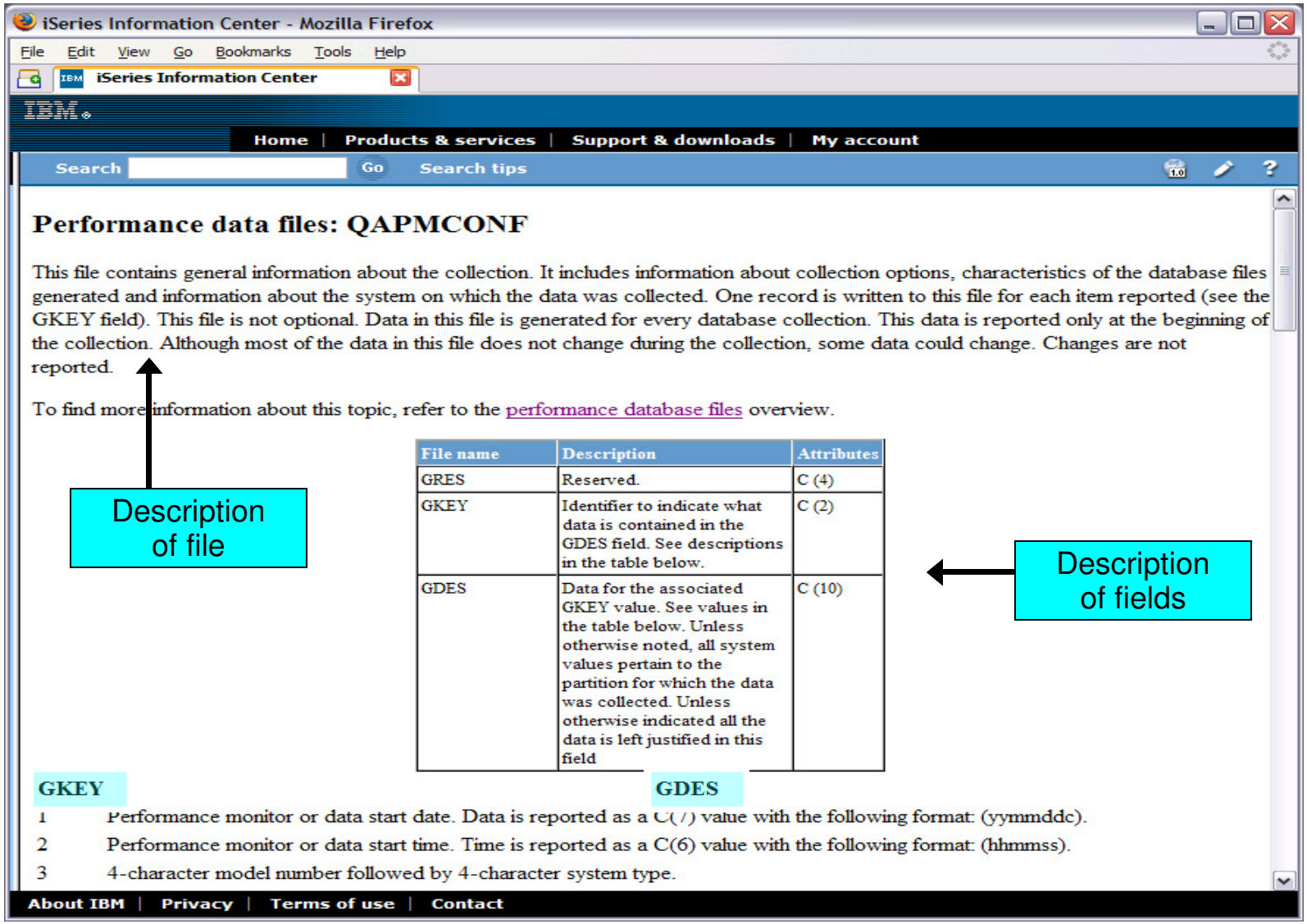
Time interval files

Provide illusion of data snapshot taken across all system resources

Configuration files

Data is captured once at beginning or end of collection

QAPMCONF - Configuration at start of collection



QAPMCONF - DSPPFM

```
File . . . . . :   QAPMCONF           Library  . . . . :   QMPGDATA
Member . . . . . :   Q255000002       Record . . . . . :   1
Control  . . . . .                    Column . . . . . :   1
Find . . . . . .
* . . .  + . . . .  . 1 . .  . . + .                                    *...+....1....+.
40404040 40C6027F 40404040 40404040                                   *    F"                    *
40404040 40F1F0F5 F0F9F1F2 F1404040                                   *    10509121               *
40404040 40F2F0F0 F0F0F0F2 40404040                                   *    2000002                *
40404040 40F340F8 F2F0F9F4 F0F64040                                   *    3 8209406              *
40404040 40F4F0F0 F1F5F3F6 F0F0F0F0                                   *    40015360000            *
40404040 40F5E840 40404040 40404040                                   *    5Y                     *
40404040 40F6F1F0 60F3E8D9 F4D44040                                   *    610-3YR4M              *
40404040 40F7F0F0 F0F0F0F0 F1F0F0F0                                   *    70000001000            *
40404040 40F8F0F0 F0F0F0F0 F2F0F0F0                                   *    80000002000            *
40404040 40F9F0F0 F0F0F0F0 F4F0F0F0                                   *    90000004000            *
40404040 F1F0F0F0 F0F0F0F0 F8F0F0F0                                   *    100000008000           *
40404040 F1F1F0F2 F5F7F0F6 F4F9F6F0                                   *    110257064960           *
40404040 F2F10000 00000F52 80004040                                   *    21êØ                 *
40404040 F1F2D540 40404040 40404040                                   *    12N                    *
40404040 F1F3003F 40404040 40404040                                   *    13                   *
40404040 C6C3F2F4 F2C54040 40404040                                   *    FC24BE                 *
40404040 C6D7F2F4 F3F84040 40404040                                   *    FP2438                 *
40404040 C6C9F1F5 F2F74040 40404040                                   *    FI1527                 *
                                                                                                  More...

F3=Exit    F12=Cancel    F19=Left    F20=Right    F24=More keys
```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QAPMCONF – interesting data

GKEY

S	System name
OS	Output file system (where CRTPFRDTA was run)
CL	Collection Library
CN	Collection Name (The name of the management collection object)
PN	Partition identifier
PP	Primary partition
PU	Processor units allocated to the partition
13	Number of virtual processors assigned to the partition
SP	Shared processor/pool attributes
IT	Interactive threshold
DM	On demand memory information
DP	On demand processor information
HM	Hypervisor memory

Time interval files - generalities

- **Common header (snapshot view)**
  - **Interval number** - consistent across files
  - **Interval date/time** – mostly same across files, but:
    - I/O data has the date/time it was obtained from each resource
    - When jobs end or lines vary off it is the time of the event
  - **Interval seconds** - time between last interval and current
    - Usually consistent but subject to same date/time considerations
    - For new jobs or varied on lines will be time since that event
- **Understanding file contents and generating queries to format & sort data for your specific situations can be a powerful tool**
- **Easy way to view a file directly:**

```
RUNQRY *NONE ((QPFRDATA/QAPMxxxxx *LAST))
```

Collection Services Enhancements in 6.1

- **Started at IPL - not dependent on PM Agent**
- **Collection configuration not changed by PM Agent**
- **DB file creation is default (if configured off – honored)**
- **Expiration of DB file collections are managed by CS**
- **Expired collections are deleted only if they exist in the configured collection library**
- **Summary data in the performance database**
- **Additional metrics**

Collection Services Enhancements in 6.1.1

- **12X Bus Metrics**
  - New file – QAPMBUSINT
- **External storage metrics for DS6K and DS8K**
  - LUN/Volume metrics
    - New file – QAPMXSTGB
    - “Black box” approach – one large data field
    - iDoctor will initially be needed to analyze this disk data

Collection Services Enhancements in 7.1

- **Additional data categories**
  - Removable storage – data collection for tape devices
    - New file - QAPMTAPE
  - External storage – for the collection of non-standard data associated with external storage subsystems.
    - New file - QAPMXSTGD
  - System internal – internal system data for use by the IBM support center
    - New file - QAPMSYSINT
- **Reduced collection and reporting of short lifespan threads and tasks**
  - Data reported cumulatively rather than individually
- **Data collection for jobs that have done save or restore operations**
  - New file - QAPMJOBS

Collection Services Enhancements in 7.1, continued

- **Active Memory Sharing**
  - Power 6 with firmware level xx340_075 or later
  - New file – QAPMSHRMP
- **Additional Disk metrics in QAPMDISK**
- **Energy Management Data**
  - QAPMSYSTEM will report energy management settings
- **IPv6 support**
- **Resource affinity metrics in QAPMJOBMI**
- **Improved accounting for server tasks, SMT mode, and virtualization**
  - Additional metrics in QAPMJOBMI and QAPMSYSTEM

Collection Services Enhancements in 7.1, continued

- **Lock counts on a thread basis in QAPMJOBMI**
  - Seizes held by the thread
  - Process scoped locks held by the thread
  - Thread scoped locks held by the thread
  - Process scoped database record locks held by the thread
  - Thread scoped database record locks held by the thread
- **More granular disk response time groups – new file QAPMDISKRB**
  - QAPMDISK file will continue to have the pre-7.1 response time groups
  - Increase the number of group definitions
  - Time will be in microseconds instead of milliseconds
  - Separate read and write times now in separate groups

Performance Database Files: What's New in 6.1 and 7.1?

QAPMBUSINT – data for internal system buses
New in 7.1

Field Name	Description	Attribute
BUNBR	Bus number	B(9,0)
BUTYPE	Bus type	B(4,0)
BUDFMT	Bus data format	C(4)
BUATTR1	Bus attribute 1	B(4,0)
BUPKTSND	Packets sent	B(18,0)
BUPKTRCV	Packets received	B(18,0)
BUBYTESND	Bytes sent	B(18,0)
BUBYTERCV	Bytes received	B(18,0)
BUMAXRATE	Maximum byte rate	B(18,0)

QAPMDISK – 6.1

Field Name	Description	Attribute
DSSECT	Disk unit sector size.	B(4,0)
DSIOARN	Disk storage adapter (IOA) resource name.	C(15)
DSSRLN	Disk unit serial number.	C(15)

QAPMDISK – 7.1

Field Name	Description	Attribute
DSPTROP	Path total read operations	B (18,0)
DSPTWOP	Path total write operations	B 18,0)
DSWWNN	World wide node name. A unique identifier representing the external storage subsystem the disk belongs to. This will be null for non-external disks.	BC (8)

QAPMDISKRB – disk time groups for read and write operations New in 7.1

Field Name	Description	Attribute
DSDRN	Device resource name	C (10)
DSRBKCTRx	Disk read operations in disk response time bucket x	B (9,0)
DSRBKRTRx	Disk response time in disk read response time bucket x	B (18,0)
DSRBKSTRx	Disk service time in disk read response time bucket x	B (18,0)
	repeated with x = 1 to 11	
DSRBKCTWx	Disk write operations in disk response time bucket x	B (9,0)
DSRBKRTWx	Disk response time in disk write response time bucket x	B(18,0)
DSRBKSTWx	Disk service time in disk write response time bucket x	B (18,0)
	repeated with x = 1 to 11	

QAPMJOBMI – 6.1, p1

Field Name	Description	Attribute
JBPGRQ	Page frames requested. Number of new page frames required by thread to satisfy page fault, read or clear operation.	B(9,0)
JBPGRL	Page frames released. Number of page frames explicitly released by thread.	B(9,0)
JBMSLR	File system symbolic link reads. This count includes the following file systems: Root (/), QOpenSys, and user-defined file systems.	B(9,0)
JBMDYR	File system directory reads. This count includes the following file systems: Root (/), QOpenSys, and user-defined file systems.	B(9,0)
JBMLCH	File system directory lookup cache hits. This count includes the following file systems: Root (/), QOpenSys, and user-defined file systems.	B(9,0)
JBMLCM	File system lookup cache misses. This count includes the following file systems: Root (/), QOpenSys, and user-defined file systems.	B(9,0)
JBMOPN	File system opens. This count includes the following file systems: Root (/), QOpenSys, and user-defined file systems.	B(9,0)
JBMNDC	File system non-directory creates. Count of create operations for non-directory objects such as files or symbolic links. This count includes the following file systems: Root (/), QOpenSys, and user-defined file systems.	B(9,0)
JBMNDD	File system non-directory deletes. Count of delete operations for non-directory objects such as files or symbolic links. This count includes the following file systems: Root (/), QOpenSys, and user-defined file systems.	B(9,0)

QAPMJOBMI – 6.1, p2

Field Name	Description	Attribute
JBSCPU	Thread scaled interval CPU time used charged. The amount of scaled processing time (in microseconds) charged to this thread. The ratio of JBSCPU to JBCPU shows the current processor speed in relation to nominal process speed.	B(18,0)
JBSTCPU	Job scaled interval CPU time charged. Thread scaled interval CPU time charged (in microseconds) totaled for all threads of the job within the interval.	B(18,0)
JBJVMF	JVM started. Indicates if this process has ever started a JVM. ' ' = unknown / not defined '0' = No '1' = Yes '2' = JVM was active at time of sample **Note**: This field is provided for primary threads only.	C(1)

QAPMJOBMI – 6.1, p3

Field Name	Description	Attribute
JBJVMT	JVM Type If JBJVMF is set to something other than x “00”, it indicates the type of JVM that was started. x‘00‘ = unknown / not defined x‘01’ = IBM Technology for Java - 32 Bit x‘02’ = IBM Technology for Java - 64 Bit x‘99’ = Classic JVM **Note**: This field is provided for primary threads only.	H(1)
JBPASE	i5/OS® PASE run time – Indicates if an i5/OS PASE runtime was active in the thread at the time this data was sampled. ‘ ‘ = unknown / not defined ‘0’ = No ‘1’ = Yes	C(1)
JBJTHDT	JVM thread type. For secondary threads within a process that has a JVM active, this field may be used to identify the type or function of the thread. Values other than those defined are reserved. Values supported by the IBM Technology for Java VM are: –x’00’ = Thread not assigned –x’1E’ - x’3B’ = GC Thread –x’1E’ - x’3B’ = GC Thread –x’3C’ - x’59’ = Finalization Thread –x’5A’ - x’77’ = JIT Thread –x’78’ - x‘95’ = JVM Internal Thread	H(1)

QAPMJOBMI – 7.1, p1

Field Name	Description	Attribute
JBNFHN	An identifier of a resource affinity domain this software thread or task is associated with	H(2)
JBNFLVL	Resource affinity level	H(1)
JBNFGRP	An identifier of a resource affinity group or resource affinity domain	H(4)
JBNFHNC	Local dispatch time. Amount of CPU time used by the thread on the resource affinity domain this thread is associated with.	B (18,0)
JBNFFNC	Non-local dispatch time. Amount of CPU time used by the thread on resource affinity domains other than the one this thread is associated with, but within the same group.	B (18,0)
JBNFHNP	Local page frames. Number of 4K page frames allocated for this thread during this interval from the resource affinity domain this thread is associated with.	B (9,0)
JBNFFNP	Non-local page frames. Number of 4K page frames allocated for this thread during this interval from resource affinity domains other than the one this thread is associated with, but within the same group.	B(18,0)
JBTNAME	Thread name.	C (16)
JBSLTCNT	Short lifespan entry count.	B (9,0)
JBSACPU	Accumulated job scaled CPU time.	B (18,0)
JBINDCPU	Thread unscaled CPU time used.	B (18,0)
JBSINDCPU	Thread scaled CPU time used.	B (18,0)
JBCPUWC	Processor elapsed time.	B (18,0)

QAPMJOBMI – 7.1, p2

Field Name	Description	Attribute
JBSEIZECNT	Seize count.	B (9,0)
JBPSLCKCNT	Process scoped lock count.	B (9,0)
JBTSLCKCNT	Thread scoped lock count	B (9,0)
JBPSRCDLCK	Process scoped database record lock count	B (9,0)
JBRSRCDLCK	Thread scoped database record lock count	B (9,0)
TBNFOGDT	Off-group dispatch time. Amount of CPU time used by the thread in a resource affinity group other than the one this thread is associated	B (18,0)
JBNFOGMA	Off-group page frames. Number of 4K page frames allocated for this thread during this interval from a resource affinity group other than the	B (9,0)

QAPMJOBSR – data for jobs that have performed save or restore operations - new in 7.1

Field Name	Description	Attribute
JSTYPE	Record/operation type. IFS save, IFS restore, library save, library restore.	C (1)
JSOPSSTR	Operations started	B (9,0)
JSGRPSTR	Groups started	B (9,0)
JSGRPEPRC	Groups preprocessed	B (9,0)
JSGCHKRDY	Groups checkpoint ready	B (9,0)
JSGCHKISSU	Groups checkpoint issued	B (9,0)
JSGCHKCMP	Groups checkpoint complete	B (9,0)
JSGIOISSU	Groups I/O issued	B (9,0)
JSGIOCMP	Groups I/O complete	B (9,0)
JSGRLSRDY	Groups release ready	B (9,0)
JSGOUTRDY	Groups output ready	B (9,0)
JSGRPCMP	Groups complete	B (9,0)
JSCNTSTR	Container starts	B (9,0)
JSCNTEND	Container ends	B (9,0)
JSIORQST	The number of I/O requests started	B (9,0)
JSIORESP	The number of I/O requests completed	B (9,0)
JSLDRQST	Internal object requests	B (9,0)
JSLDRESP	Internal object responses	B (9,0)
JSCHKRQST	Checkpoint requests	B (9,0)
JSCHKRESP	Checkpoint responses	B (9,0)
JSOPSCMP	Operations completed	B (9,0)
JSOPSTRM	Operations terminated	B (9,0)
JSOBJSUCC	The number of objects successfully saved or restored	B (9,0)
JSOBJFAIL	The number of objects not successfully saved or restored	B (9,0)

32 Wait Buckets as Defined at 6.1 (QAPMJOBWT/ QAPMJOBWTD/QAPMJOBWTG)

- Time dispatched on a CPU
- CPU queuing
- Reserved
- Other waits
- Disk page faults
- Disk non fault reads
- Disk space usage contention
- Disk op-start contention
- Disk writes
- Disk other
- Journaling
- Semaphore contention
- Mutex contention
- Machine level gate serialization
- Seize contention
- Database record lock contention

- Object lock contention
- Ineligible waits
- Main storage pool overcommitment
- Classic Java user including locks
- Classic Java JVM
- Classic Java other
- Socket accepts (idle)
- Socket transmits
- Socket receives
- Socket other
- IFS
- PASE
- Data queue receives
- Idle / waiting for work
- Synchronization Token contention
- Abnormal contention

QAPMJVM – New in 6.1, p1

Field Name	Description	Attribute
JVTYPE	Job type. 0: IBM Technology for Java - 32 Bit 1: IBM Technology for Java - 64 Bit	C (1)
JVVRSN	JVM version (UTF-16 CCSID 1200).	G (10)
JVPID	Process identifier.	B (9,0)
JVPOLICY	Garbage collection policy (UTF-16 CCSID 1200).	G (15)
JVHEAPC	Current heap allocated. Current amount of heap storage allocated for this JVM in kilobytes.	B (18,0)
JVHEAPU	Heap in use. Amount of allocated heap actually being used in kilobytes.	B (18,0)
JVMLCMEM	Malloc memory size in kilobytes.	B (18,0)
JVINTMEM	Internal memory size in kilobytes.	B (18,0)

QAPMJVM – New in 6.1, p2

Field Name	Description	Attribute
JVJITMEM	JIT memory size in kilobytes.	B (18,0)
JVSCLMEM	Shared class size in kilobytes.	B (18,0)
JVGCCNBR	Last garbage collection cycle number.	B (9,0)
JVGCCTME	Last garbage collection cycle time. Clock time spent performing garbage collection tasks during the last garbage collection cycle in milliseconds.	B (18,0)
JVGCITME	Interval garbage collection time. Clock time spent performing garbage collection tasks during this collection interval in milliseconds.	B (18,0)
JVGCTTME	Total garbage collection time. The total amount of clock time spent performing garbage collection by all tasks since the JVM started.	B (18,0)

QAPMSHRMP – data generated when a partition is defined to use Active Memory Sharing - new in 7.1

Field Name	Description	Attribute
SMPOOLID	Shared memory pool identifier	B (5,0)
SMWEIGHT	Memory weight	B (3,0)
SMREALUSE	Physical real memory used	B (18,0)
SMACCDLY	Real memory access delays	B (18,0)
SMACCWAIT	Real memory access wait time	B (18,0)
SMENTIOC	Entitled memory capacity for I/O	B (18,0)
SMMINIOC	Minimum entitled memory capacity for I/O	B (18,0)
SMOPTIOC	Optimal entitled memory capacity for I/O	B (18,0)
SMIOCUSE	Current I/O memory capacity in use	B (18,0)
SMIOCMAX	Maximum I/O memory capacity used	B (18,0)
SMIOMDLY	I/O memory mapping delays	B (18,0)
MPACCDLY	Pool real memory access delays	B (18,0)
MPACCWAIT	Pool real memory access wait time	B (18,0)
MPPHYMEM	Pool physical memory	B (18,0)
MPLOGMEM	Pool logical memory	B (18,0)
MPENTIOC	Pool entitled memory	B (18,0)
MPIOCUSE	Pool entitled memory in use	B (18,0)

QAPMSYSTEM – 6.1, p1

Field Name	Description	Attribute
SYVPID	SYVPID Virtual shared pool ID. This is the identifier of the partition's current virtual shared processor pool.	B (4,0)
SYVPCAP	Virtual shared pool entitled capacity. The entitled capacity of the partition's current virtual shared processor pool (in units of 1/100 of a physical processor).	B (9,0)
SYPPLU	Physical shared pool CPU time used. Total amount of CPU time (in milliseconds) used within the physical shared processor pool by all partitions that share the pool. Set to zero if physical shared pool is not used or the data is not available.	B (18,0)
SYPPLA	Physical shared pool CPU time available. Total amount of CPU time (in milliseconds) available within the physical shared processor pool. This value is determined based on the number of physical processors that are allocated to the pool. Set to zero if physical shared pool is not used or the data is not available. Note that this field will reflect CPU time donated by the dedicated partitions associated with the pool, if these partitions were configured to donate the unused CPU cycles to the pool.	B (18,0)
SYPTHV	Hypervisor CPU time. Amount of CPU time (in milliseconds) used by hypervisor for its internal needs. This time is included in SYSPTU.	B (18,0)
SYPTINT	Interrupt CPU time. Amount of CPU time (in milliseconds) used by operating system for interrupt processing. This time is included in SYSPTU.	B (18,0)

QAPMSYSTEM – 6.1, p2

Field Name	Description	Attribute
SYPTWS	Waittask time. Amount of CPU time (in milliseconds) used by waittask in SMT mode. This time is not included in SYSPTU.	B (18,0)
SYPTDN	Donated CPU time. Amount of CPU time (in milliseconds) donated by this partition to the physical shared processor pool. This time is only reported for dedicated partitions configured to donate their unused CPU cycles to physical shared pool.	B (18,0)
SYSSPTU	Scaled CPU time used (milliseconds). On some system models, the processors may operate at different speeds at different times, depending on power consumption or operating temperature. Ratio of SYSSPTU to SYSPTU shows the current processor speed in relation to nominal processor speed.	B (18,0)
SYUCAPF	Partition uncapped flag. Indicates if the partition capacity is uncapped: ‘ ‘ = unknown '0'= Partition capacity is capped or this partition does not share physical processors. '1' = Partition capacity is uncapped.	C (1)
SYDONF	Partition donation flag. Indicates if the partition supports donation of unused processing time to the physical shared processor pool: ‘ ‘ = unknown '0' = Partition does not support donation of processing time. '1' = Partition supports donation of processing time.	C (1)

QAPMSYSTEM – 7.1

Field Name	Description	Attribute
SYPTWAIT	Virtual Processor thread wait event time	B (18,0)
SYPTREADY	Virtual Processor thread wait ready time	B (18,0)
SYPTLATEN	Virtual Processor thread dispatch latency	B (18,0)
SYPTACT	Virtual Processor thread active time	B (18,0)
SYPTIDLE	Virtual Processor thread idle time	B (18,0)
SYPTINTR	Virtual Processor thread interrupt time	B (18,0)
SYFRMCPU	Processor firmware time used (in microseconds)	B (18,0)
SYFRMSCPU	Processor scaled firmware time used (in microseconds)	B (18,0)
SYPFOLDSW	Processor folding switch state	C (1)
SYPFOLDST	Processor folding state	C (1)
SYEMMAJCDE	Energy management major code	C (1)
SYEMMINCDE	Energy management minor code	C (1)
SYEMATTR	Energy management attributes	C (1)
SYEMPWRLMT	Energy management power draw limit in watts	B (9,1)

QAPMTAPE – tape device data - new in 7.1

Field Name	Description	Attribute
TPDRN	Tape device resource name	C (10)
TPTYPE	Tape device type	C (4)
TPMDLN	Model number	C (4)
TPIOPRN	IOP resource name	C (10)
TPIOARN	Storage adapter (IOA) resource name	C (10)
TPRDS	Number of reads	B (18,0)
TPWRTS	Number of writes	B (18,0)
TPBRD	Bytes read	B (18,0)
TPBWRT	Bytes written	B (18,0)
TPWREQ	Time spent waiting for a request from the client	B (18,0)
TPWRESP	Time spent waiting for a response from the drive	B (18,0)
TPSFMCMD	Space by file mark commands	B (18,0)
TPFLMRKSPC	File marks spaced	B (18,0)
TPSBCMD	Space blocked commands	B (18,0)
TPBLCKSPC	Blocks spaced	B (18,0)
TPWFMCMD	Write file mark commands	B (18,0)
TPFLMRKWRT	File marks written	B (18,0)
TPSEODCMD	Space to EOD commands	B (18,0)
TPWBCMD	Write buffer commands	B (18,0)
TPRESERVES	Reserve commands	B (18,0)
TPRELEASES	Release commands	B (18,0)
TPREWINDS	Rewind commands	B (18,0)
TPUNLOADS	Unload commands	B (18,0)
TPSTPOSCMD	Set tape position commands	B (18,0)
TPRDPOSCMD	Read tape position commands	B (18,0)

QAPMCONF – 6.1

Field Name	Description
UP	Partition usage counts. This record is present on systems supporting 5761-SS1 feature 5052 (user entitlement key). One metric will be returned as a 4 byte binary value: Usage count – the number of named users that are enabled in this partition.
US	System usage counts. This record is present on systems supporting 5761-SS1 feature 5052 (user entitlement key). Two metrics will be returned as 4 byte binary values: • Usage Limit – the number of named users allowed. This limit is system based not partition based. Accurate reporting depends on license key information that must be entered by the customer on the reporting partition. • Usage count – the number of named users that are enabled in the system. This value is system based not partition based.
XP	PM Agent data obtained. Indicates if this collection was processed for PM Agent data requirements. Applies to the originating system only. This is a 1 byte character field with a value of 1. This record will not be present unless PM Agent data was obtained.
XS	Summary data created. Indicates if summary data was created with this collection. This is a 1 byte character field with a value of 1. This record will not be present unless summary data was created.

Extra slides

Files of interest

JOB data files

- **QAPMJOBMI**
  - Data maintained by machine for all tasks and threads (only contains data for those items that used CPU)
    - CPU, transitions, Physical I/Os, faults, overflows, thread, journal, IFS, SSL, storage, current user, …
- **QAPMJOBOS**
  - Data maintained by i5/OS (data for every job each interval)
    - Job attributes, transactions, Logical I/Os, print stats, connection info, comm, IFS, submitter, server, …
- **QAPMJOBL**
  - Logical view combining the two
- **QAPMJSUM**
  - Selected QAPMJOBL data summarized by type of job

Job data tips

- **JBSTSF - status flag (started / terminated)**
- **JBSVIF - job uses interactive feature**
- **JBPGA, JBPGD - temporary storage usage**
- **JBCUSR - current user**
- **CPU and other job accounting metrics include data from query SMP (DBL03xxxx) tasks**

Job query example

```
OVRDBF FILE(QAPMJOBL) TOFILE(QMPGDATA/QAPMJOBL) MBR(*LAST)

SELECT JBSSYS, sum(JBCPU), sum(JBDBR+JBNDB+JBWRT) as Disk_IO
   FROM QAPMJOBL
   GROUP BY JBSSYS ORDER BY 2 desc
```

Subsystem	SUM (JBCPU)	DISK_IO
QSYSWRK	442,043.056	144,475
	105,967.872	36,993
QUSRWRK	43,040.840	3,570
BLDTESTSS	5,724.256	0
BLDSHIPSS	5,145.352	3
V2CTG456SS	5,001.688	7
ARAUJOSS	4,580.896	3
QCTL	1,439.888	2,892
QSERVER	9.320	0
QCMN	9.120	0

System tasks (no subsystem)

Job query example

```
OVRDBF FILE(QAPMJOBL) TOFILE(QMPGDATA/QAPMJOBL) MBR(*LAST)

SELECT JBNAME, JBNBR, sum(JBPGA-JBPGD) as Storage
  FROM QAPMJOBL
  GROUP BY JBNAME, JBNBR ORDER BY 3 desc
```

Job name	Job number	Storage
QYPSJSVR	361781	3,577,743
QYPSPFRCOL	361711	1,117,704
QCPMGTSVR	361784	834,159
CRTPFRDTA	361833	415,136
QSYSWRK	361632	412,177
QDIRSRV	361757	302,288
QSQSRVR	361817	293,025

Wait bucket files (collected with JOBMI data)

Provide data to show conditions and time that a job is waiting. A "bucket" is a category or collection of related wait conditions (a.k.a. block points). This support was designed to be flexible.

- **QAPMJOBWT**
  - Counts and clock times for each bucket
  - Current wait: time waiting and bucket to be used when wait is satisfied
- **QAPMJOBWTD**
  - Description for each bucket in unicode
- **QAPMJOBWTG**
  - Wait information for jobs/threads/tasks that did not use CPU in the data collection interval

Wait bucket tips

- **Bucket time can be greater than interval time**
- **First bucket is dispatched wall clock time**
  - Dedicated partitions: can equal CPU time (without query task time add-ins). But, see last point
  - Shared processor partitions: includes time waiting for processor
  - Dispatch times reflect number of logical processors (SMT / HMT : 2 logical processors per virtual processor)

QAPMJOBWTD Unicode

Job default tends to be CCSID 65535

```
RUNQRY *NONE ((QMPGDATA/QAPMJOBWTD *LAST))
```

Interval date time	Century digit	Description sequence number	Number of buckets	Wait bucket number	Wait bucket description
050912000415	1	1	16	1	ê Á Ë Á Ê Î Á À
050912000415	1	1	16	2	ä & í É Í Á Í Ñ > Å
050912000415	1	1	16	3	ê Á Ë Á Ê Î Á À
050912000415	1	1	16	4	| È Ç Á Ê Ï / Ñ È Ë
050912000415	1	1	16	5	à ë à ø / Å Á Ã / Í % È Ë
050912000415	1	1	16	6	à ë à ? È Ç Á Ê
050912000415	1	1	16	7	ë ? Ä , Á È
050912000415	1	1	16	8	ñ À % Á Ï / Ñ È Ñ > Å Ã ? Ê Ï ? Ê
050912000415	1	1	16	9	ë Á Ñ : Á
050912000415	1	1	16	10	| Â ¦ Á Ä È % ? Ä ,
050912000415	1	1	16	11	ê Á Ä ? Ê À % ? Ä ,
050912000415	1	1	16	12	å / È Á
050912000415	1	1	16	13	¢ / Î /
050912000415	1	1	16	14	¢ ? Í Ê > / %
050912000415	1	1	16	15	(Í È Á Ì / > À ë Á _ / ø Ç ? Ê Á
050912000415	1	1	16	16	ê Á Ë Á Ê Î Á À

CHGJOB CCSID(37) or your language CCSID!

Interval date time	Century digit	Description sequence number	Number of buckets	Wait bucket number	Wait bucket description
050912000415	1	1	16	1	Reserved
050912000415	1	1	16	2	CPU queuing
050912000415	1	1	16	3	Reserved
050912000415	1	1	16	4	Other waits
050912000415	1	1	16	5	DASD (page faults)
050912000415	1	1	16	6	DASD (other)
050912000415	1	1	16	7	Socket
050912000415	1	1	16	8	Idle / waiting for work
050912000415	1	1	16	9	Seize
050912000415	1	1	16	10	Object lock
050912000415	1	1	16	11	Record lock
050912000415	1	1	16	12	Gate
050912000415	1	1	16	13	Java
050912000415	1	1	16	14	Journal
050912000415	1	1	16	15	Mutex and Semaphore
050912000415	1	1	16	16	Reserved

System data files

- **QAPMSYSTEM**
  - system summary
    - All needed CPU utilization data now located here
    - Exception, journal, microcode data
    - Summary/peaks from other files
- **QAPMPOOLB**
  - storage pool stats
- **QAPMBUS**
  - system (SPD/PCI) bus data
- **QAPMAPPN / QAPMSNA**
  - wealth of information if still using SNA & APPN - see infoCenter

CPU utilization

- **With dynamic LPAR, CUoD, and uncapped partitions, traditional methodologies for calculating utilization break down**
- **Several new QAPMSYSTEM metrics (views) of available CPU**
- **For more info:**

http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/info/rzahx/rzahxcalculation.htm

http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/index.htm?info/rzahx/rzahxperfdatafiles1.htm

Data Port Services – QAPMDPS

Data port services is Licensed Internal Code (LIC) that supports the transfer of large volumes of data between a source system and one of *N* specified (switchable) target systems in a System i cluster.

- **Remote IASP mirroring**
  - Data for every remote IP address data is mirrored to
    - Asynchronous / synchronous mode
    - Messages, acknowledgments, failures
    - Message bytes sent / received
    - Round trip time
    - Retry & reroute counts
  - Understand mirroring activity or failures
  - Sync mode impact on I/O response time

Disk data - QAPMDISK

- **Source of all Disk unit info**
- **Managed by IOP**
  - Busy time, service time, response time, and queue time are based on statistical samples – not reported directly
  - Service time does not include time between system & IOP
- **Not managed by IOP**
  - Busy time, service time, response time, and queue time are based on measured data – reported via traditional metrics
  - Service time measurement is higher in system

User transaction data - QAPMUSRTNS

- **One record is created for each type of transaction that occurs for a given job during the interval**
- **System metrics include:**
  - Number of transactions, total transaction CPU
- **User data supported:**
  - Up to 16 user-provided counters
- **Additional info for using this support**
  - http://publib.boulder.ibm.com/infocenter/iseries/v7r1m0/topic/apis/perfmgmt_colsvc3.htm

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