Hidden Gems of IBM i

Alison Butterill
WW IBM i Offering Manager

And the IBM i Team

Finding a “Hidden Gem”

- Every release = 100s of new functions
  - Some big
  - Some small
- How to know them all?

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Finding a “Hidden Gem”

- Every release = 100s of new functions
  - Some big
  - Some small
- How to know them all?
- All IBM users have favourites
- These are some of our…

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“Hidden Gems”

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Database – Constraints

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Constraints

- **Constraints** enforce the business rules defined by the data model

There are three types of constraints:

1. A ***unique constraint*** is a rule that forbids duplicate values in one or more columns within a table.
   Two forms:
   a) **Unique Key(s)** – a unique index is used
   b) **Primary Key** – a single column with a unique, non-NULL value (sometimes an Identity value is used)
2. A ***referential constraint*** is a logical rule about values in one or more columns in one or more tables
3. A ***check constraint*** sets restrictions on data added to a specific table

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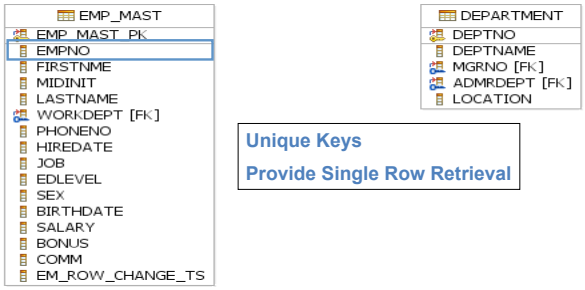
Constraints Enforce the Rules



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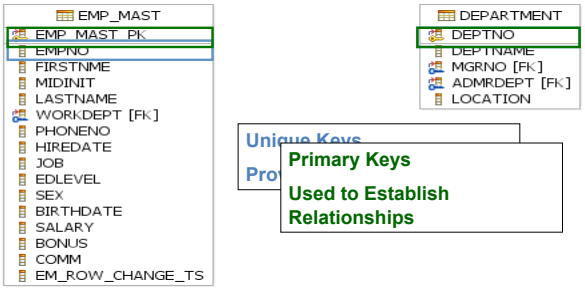
Constraints Enforce the Rules



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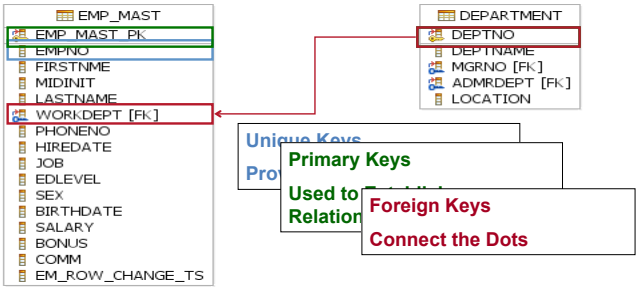
Constraints Enforce the Rules



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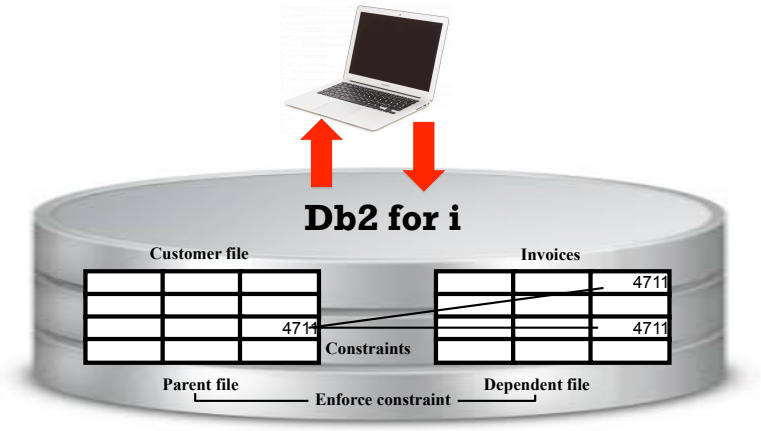
Referential Integrity



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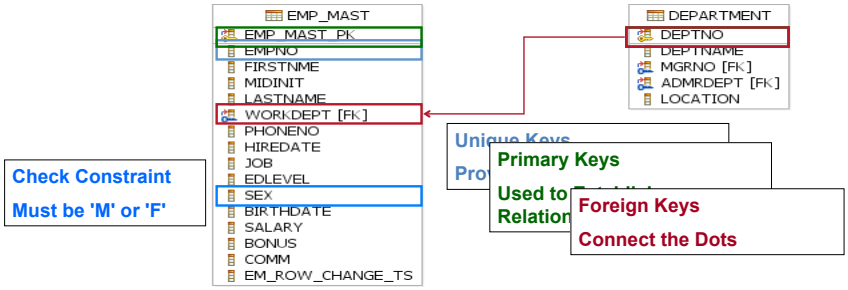
Constraints Enforce the Rules



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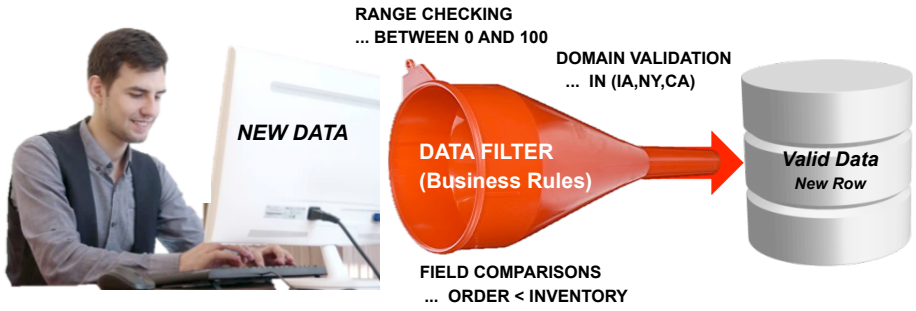
Check Constraints



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Access Client Solutions (ACS)

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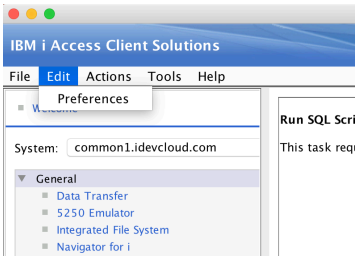
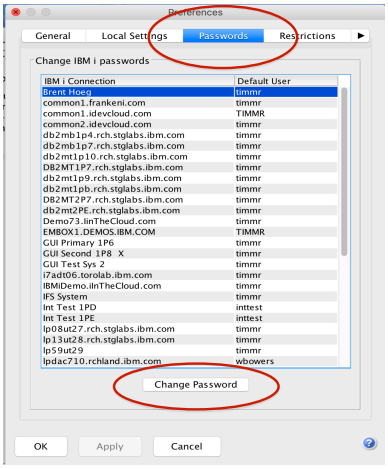
ACS – Passwords



- Select All or just the system you want to change



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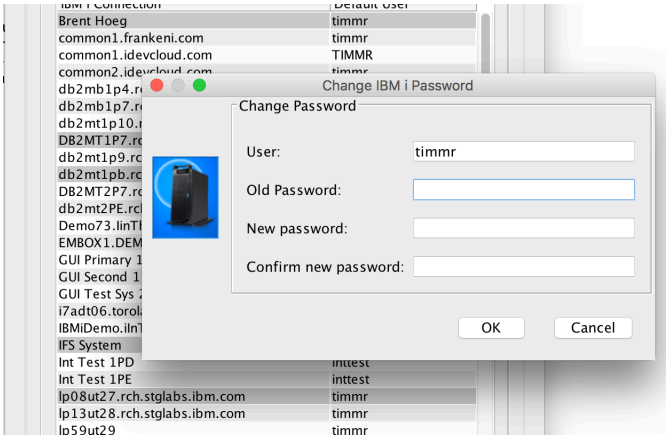
ACS – Passwords

- User and Password must be the same on all systems
- ACS then 'signon' to each selected system and update the User with the New Password



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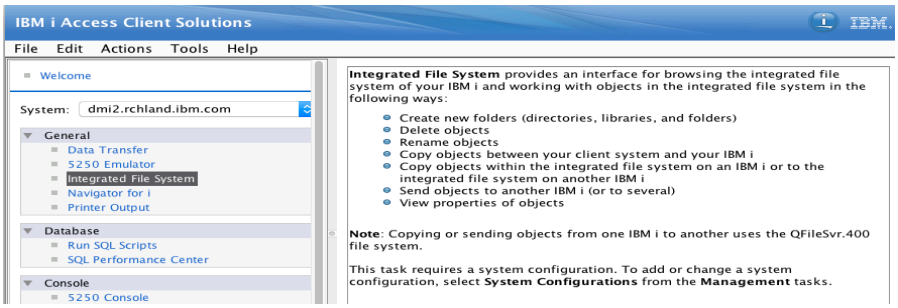
IBM i Access Client Solutions – Integrated File System



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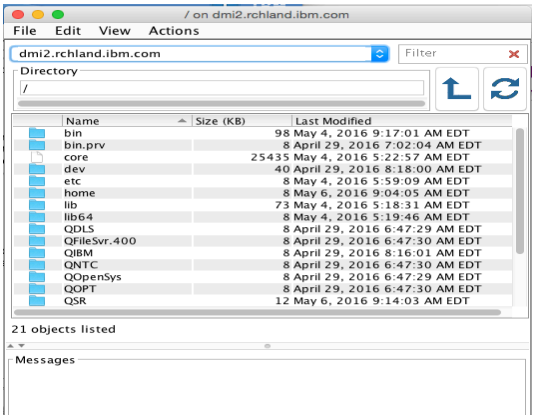
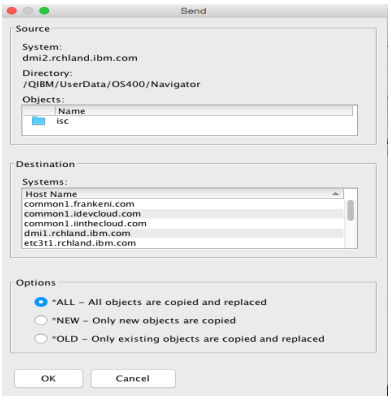
IBM i Access Client Solutions – Integrated File System





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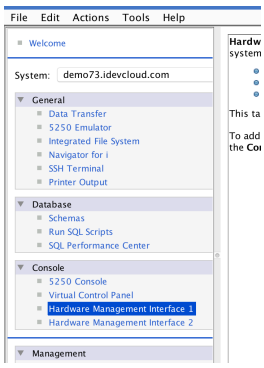
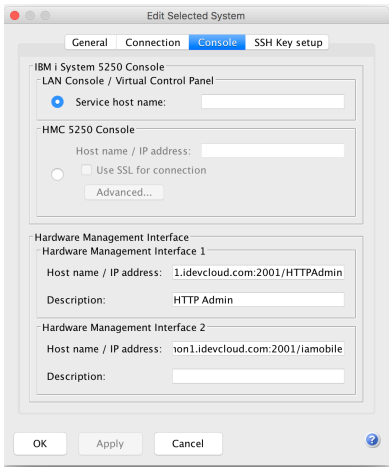
Fast pass to links…

- Easy way to register and access other important links.
  - Enter your favorite interface
  - Click for repeatable easy access.
  - Web Admin GUI
  - iAccess Mobile
  - Storage server
  - HMC
  - Web Query interface
  - Others…





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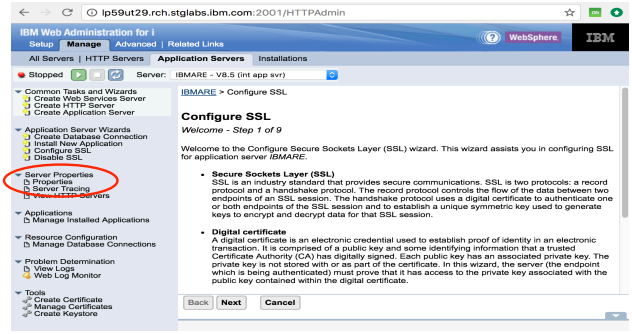
SSL/TLS Wizard

Web Admin GUI - http://hostname:2001/HTTPAdmin

- Configure either HTTP servers for SSL and Web Application Servers for SSL
- Updates the server configurations as well the necessary updates to DCM



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Implicit Remote Database Access

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Implicit Remote Database Access

- A local application can run SQL statements against a local database or a remote database.
- To specify a remote database, you can use a three-part name. A three-part name consists of the RDB name, schema/library name, and object name.
  -- SQL naming: <database-name>.<schema-name>.<object-name>
  -- System naming: <database-name>/<schema-name>/<object-name>

```
CL: ADDRDBDIRE RDB(X1423P2) RMTLOCNAME(X1423P2 *IP);

CREATE TABLE X1423P2.TOYSTORE.EMPLOYEE (EMPNO CHAR(6),
                        FIRSTNME CHAR(10),
                        LASTNAME CHAR(15));
INSERT INTO X1423P2.TOYSTORE.EMPLOYEE
  VALUES ('000002','Michael','Thompson');

SELECT * FROM X1423P2.TOYSTORE.EMPLOYEE;
```

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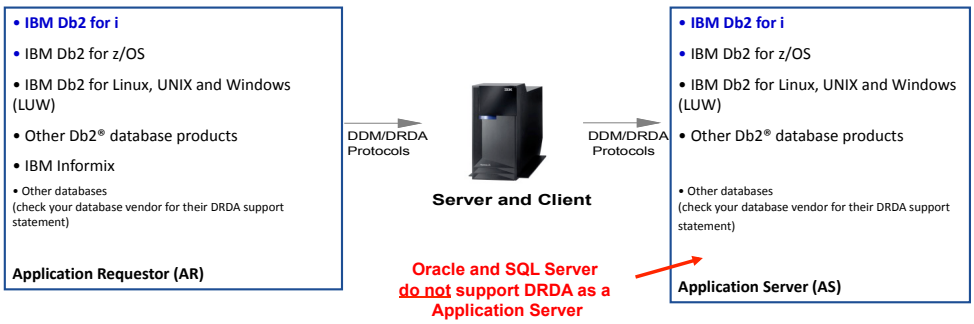
Implicit Remote Database Access



Article: Improve Your Data Center with Three-part Name Aliases
http://iprodeveloper.com/database/improve-your-data-center-three-part-name-aliases

Article: Achieve improved database interoperability with SQL and RDB aliases
http://www.ibm.com/developerworks/ibmi/library/i-improved-database-interoperability-sql-rdb/index.html

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Open Source

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Open Source to the Next Level

- New distribution mechanism: RPM's ('ibmi' platform)
- Package manager
  - Installs/manages OSS packages
- IBM-hosted public RPM repository

5733-OPS Program Offering

- Option 1 – Node.JS 0.x
- Option 2 - Python 3.4
- Option 3 – GCC / chroot
- Option 4 – Python 2.7
- Option 5 – Node.JS 4.x
- Option 6 – Git
- Option 7 – Tools
- Option 8 – Orion
- Option 9 – cloud-init
- Option 10 – Node.JS v6.x
- Option 11 – Nginx

https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/IBM%20i%20Technology%20Updates/page/Open%20Source%20RPM%27s

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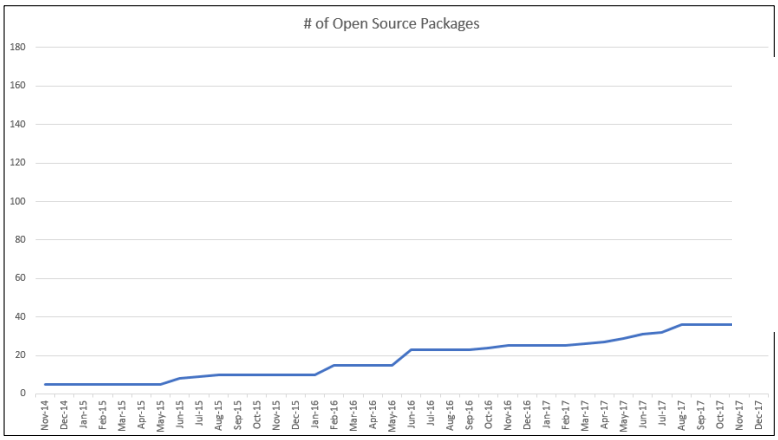
of Open Source Packages Delivered



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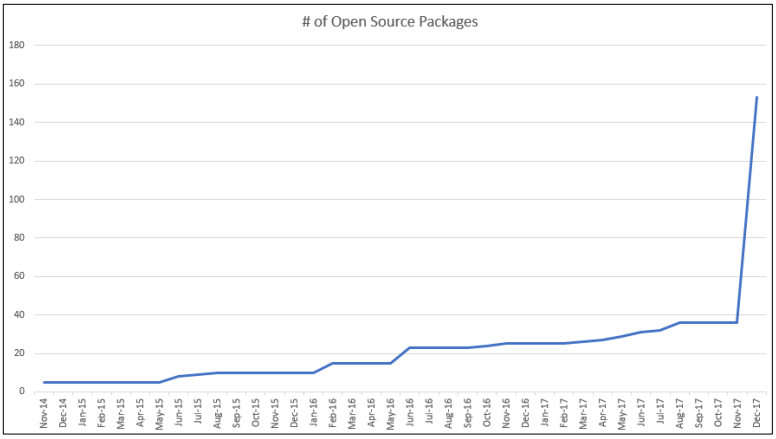
of Open Source Packages Delivered



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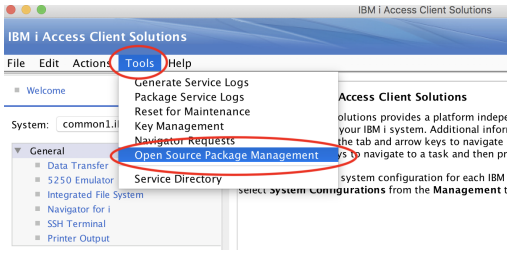
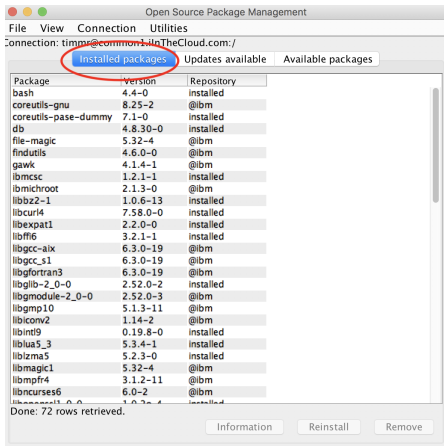
ACS Open Source Tooling – Manage RPMs





RPM management tooling.

- See RPMs installed in this location (chroot)
- See if updates to the installed packages are available
- View ALL available RPM packages

Licensing

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IBM i Solution Editions – Worldwide

- *In partnership with industry-leading ISVs*

- Complete, integrated solutions for mid-sized businesses
- Rapid deployment
- Simplified, flexible and highly secure infrastructure for core business applications
- Minimize risk
- Maximize ROI

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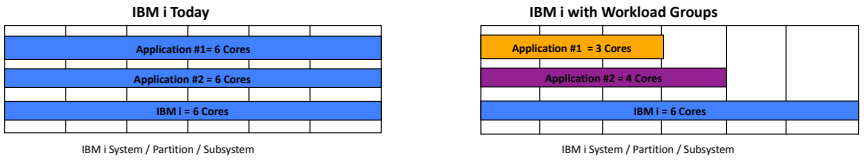
IBM i Workload Groups

- Enhanced Management & Licensing
- Workload Groups new capabilities to manage/license workloads on IBM i
  - Limit the number of cores that are used by specific applications within single system/partition/ subsystem
  - Limits placed at the whole processor-core level
  - Applications licensed for the number of capped cores
  - Can cap a single job or all jobs/threads in a subsystem



https://www.ibm.com/developerworks/mydeveloperworks/wikis/home?lang=en#/wiki/IBM%20i%20Technology%20Updates/page/IBM%20i%20workload%20groups

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Entitled System Support (ESS) Enhancements – Interim Keys

"Interim keys"
Available since: February 16, 2017

What are interim keys?
- Self-serve 40-day temporary keys for LPPs and OS features
- For emergencies stemming from ordering or licensing issues in a variety of situations
  - E.g. orders are pending or transfer of entitlements are pending in IBM records
- Also retrieve currently installed IBM i OS key - no customer number registration required

Interim keys…
- do not take the place of a customer purchasing temporary licensing (5733-ITL) if required for migrations, etc.
- are not issued for IBM i operating system entitlements (feature 5051, 5052, 5053)

Who can generate interim keys?
- Everyone: no customer number registration required

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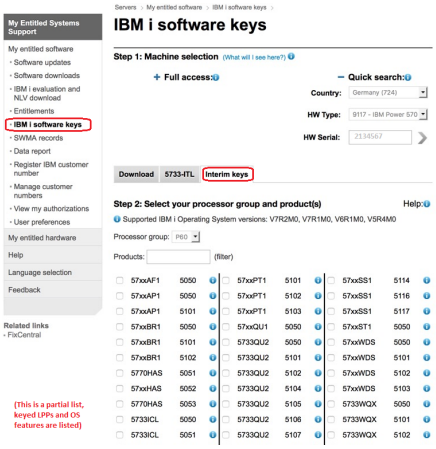
ESS Enhancements – Interim Keys

Interim Keys

Refer to:
http://www.ibm.com/servers/eserver/ess/ > IBM i Software Keys

Start Date
The start date is immediate: i.e., the 40 days begins when you acquire the keys from ESS



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ESS Enhancements – Interim Keys – Ts & Cs

The availability of interim keys for a hardware machine serial number is dependent on several conditions:

1. The machine type, hardware machine serial number must be valid and recognized by ESS
2. If the machine is licensed to IBM i OS, the machine must have at least one IBM i per processor license installed
3. The machine may not have…
   - an order for IBM i Temporary Licensing (5733-ITL) pending for activation, or
   - active 5733-ITL keys

   If the hardware machine serial has active 5733-ITL keys, no interim keys can be generated for products and product functions which cannot be ordered with 5733-ITL
4. The machine has not had two or more temporary keys within the last 12 months for the required product function
   - "Temporary keys" means a key with an expiration date and without entitlement, so e.g. could be keys acquired via 5733-ITL or interim keys
   - This limitation applies to a product function on a machine serial number across Version/Release/Mod levels. Example:
   - On a machine serial, I acquire:
     5761-JS1 5050 1st request: 40-day key
     5761-SS1 5112 1st request: 40-day key
     5770-SS1 5112 2nd request: 21-day key
     On this same serial, I can subsequently make a 2nd key request for 5761-JS1 and can acquire keys for other products/functions, e.g. 57xx-BR1, 57xx-PT1

If the machine meets the conditions as stated above, 40-day interim keys are generated initially, then 21-day interim key may be subsequently generated if needed Do not generate the additional 21-day temporary key until the 40-day key is close to expiration since the key expiration date is calculated at the time you acquire the key from ESS.

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Database Query/400 Discovery Tool

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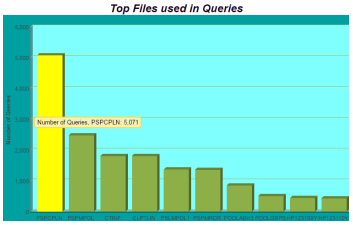
Query/400 Challenges

- They multiply like rabbits
- There is no easy way to know:
  - Who is running the most queries?
  - What queries are running the longest?
  - When was the query last changed?
  - If we change a file structure, which queries will break?
  - What queries are obsolete?
  - What files are being used the most in queries?
  - How many files have output into intermediate work/temp files?
- Antiquated tooling

D

Understand Your Queries: Query/400 Discovery Tool

- Included with Db2 Web Query EZ-Install
  - Or standalone version can be requested as well
- Interrogates Query/400 Definition Objects
  - Use as Impact Analysis tool
  - Use as first step in Query/400 modernization project (into Db2 Web Query)
- Creates output tables containing its findings:
  - Files being accessed
  - Fields in selection criteria or result sets
  - Join types used
  - Output types used
  - Chaining identifiers
- SQL Scripts and Reports provided to interrogate output tables



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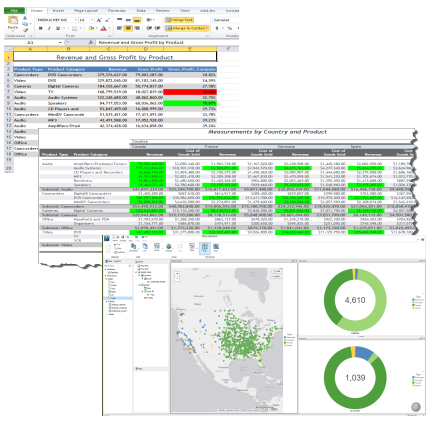
Designed Originally as a Tool to Build Modernization Strategy

- Identify candidates to be IMPORTED to Db2 Web Query
  - Low hanging fruit, highly used queries to get data into Excel, for example
- Identify candidates for deletion
  - Obsolete?
- Identify candidates that can be consolidated
  - Similar reports can be replaced with a single interactive Db2 Web Query Active or Drill down report
- Investigate others
  - Chained Queries – why? Is there a simpler way to do this with a real SQL tool? Probably



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Example: Modernizing a “Chained” Queries

- The idea of chaining a query is because you often needed to have a first pass at the data to create a temporary, or workfile, that has massaged that data in some way, but need a 2nd (or more) query that queries the tmp/wrk file to get your final result.
- A good example of that might be a classic “as a % of” column you want in a report, and to add further complication, a % of total within a subtotal or report break.
  - You first needed to create the totals within each subtotal grouping (query #1), and then store that in the temp/work file.
  - Query #2 would then calculate “as a % of” column against total revenue within that subtotal group

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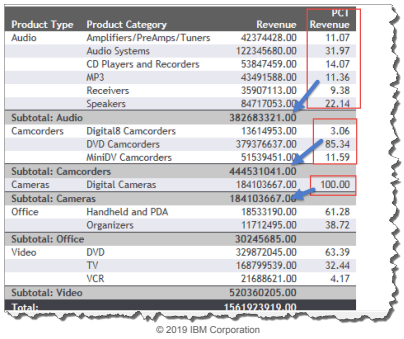
Re-do in Db2 Web Query to Eliminate Multiple Passes of Data

- While Db2 Web Query has a similar concept to “chaining” using what is called HOLD Files - WHY WOULD YOU WANT TO DO THAT?
- There are better options that do this with a single pass of the data



Product Type	Product Category	Revenue	PCT Revenue
Audio	Amplifiers/PreAmps/Tuners	42374428.00	11.07
	Audio Systems	122345680.00	31.97
	CD Players and Recorders	53847459.00	14.07
	MP3	43491588.00	11.36
	Receivers	35907113.00	9.38
	Speakers	84717053.00	22.14
Subtotal: Audio		382683321.00	
Camcorders	Digital8 Camcorders	13614953.00	3.06
	DVD Camcorders	379376637.00	85.34
	MiniDV Camcorders	51539451.00	11.59
Subtotal: Camcorders		444531041.00	
Cameras	Digital Cameras	184103667.00	100.00
Subtotal: Cameras		184103667.00	
Office	Handheld and PDA	18533190.00	61.28
	Organizers	11712495.00	38.72
Subtotal: Office		30245685.00	
Video	DVD	329872045.00	63.39
	TV	168799539.00	32.44
	VCR	21688621.00	4.17
Subtotal: Video		520360205.00	
Total:		1561923919.00	

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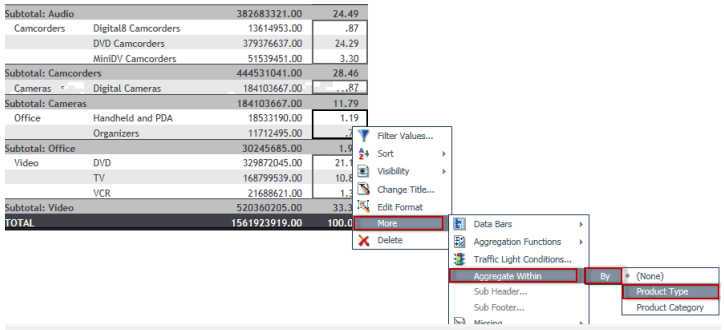
Re-do in Db2 Web Query to Eliminate Multiple Passes of Data

1. Either import first query in the chain or build the query from scratch and use AGGREGATE WITHIN function within Db2 Web Query report authoring tool



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Re-do in Db2 Web Query to Eliminate Multiple Passes of Data

2. Push the heavy lifting to Db2 for i with NEW 7.3 OLAP SQL Extensions
   - New SQL functions and constructs that can be leveraged in Db2 Web Query

```
SELECT PRODUCTTYPE, PRODUCTCATEGORY, SUM(LINETOTAL) AS Revenue,
  DEC(FLOAT(SUM(LINETOTAL)) * 100 /
  SUM(SUM(LINETOTAL)) OVER(PARTITION BY PRODUCTTYPE), 20,2) AS Pct_of_Product_Type_CAT_Total
  FROM  QWQCENT.INVENTORY T1 INNER JOIN QWQCENT.ORDERS T2
  ON T1.PRODUCTNUMBER = T2.PRODUCTNUMBER
  GROUP BY PRODUCTTYPE, PRODUCTCATEGORY
  ORDER BY PRODUCTTYPE, PRODUCTCATEGORY;
```

   - Build and test SQL Statement (probably using Run SQL Scripts in ACS)
   - Save the SQL either in a .SQL script file or create it in an SQL View
     - Build metadata over the SQL Statement in Db2 Web Query

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Systems Management - Watches

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Watches

- Watches can be use to automate the actions taken when the following occur:
  - Message
  - Licensed Internal Code Log (LIC Log)
  - Problem Activity Log Entry (PAL entry)

- Start Watch (STRWCH) command or API (QSCSWCH)
- End Watch (ENDWCH) command or API (QSCEWCH)
- Work with Watches (WRKWCH) command to display watches

- When the condition being watched occurs, your program gets control and you can take any action you want

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Watches

- Low Overhead
  - Watches are an exit program
  - Minimal overhead until the watched condition occurs

- Your program gets control to determine what action to take
- Your program runs *out-of-band*

- For message watches
  - Can watch for messages sent to any message queue, including
    - QSYSOPR, History Log
  - Can watch for messages sent to any job log
    - Can specify generic job name
    - Can specify *ALL to watch for a message to all job logs

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Set Server Subsystem Routing

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QSYS2.SET_SERVER_SBS_ROUTING() – Procedure

This procedure can be used to configure alternate subsystems by user and IBM i server name. This allows an IBM i administrator to relocate users into subsystems that are configured to meet user expectations or to protect overall system resources.

- Procedure QSYS2.SET_SERVER_SBS_ROUTING()

Procedure Parameters:

1. **Authorization Name**
   The user profile name
2. **Server Name**
   QZDASOINIT, QRWTSRVR, and many others or *ALL
3. **Alternate Subsystem Name**
   The name of the subsystem to use
4. **Allow Rollover (YES or NO)**
   If the alternate subsystem cannot be used, should the default subsystem be used or should the connect fail?

Authorization name can be:
- ü User name
- ü Group name
- ü Supplemental Group name

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Example…

- Construct a subsystem that will constrain the amount of system resources available to users who are known to execute ad hoc queries.

```
CL: CRTSBSD SBSD(QGPL/ADHOCSBS) POOLS((1 *BASE))
   TEXT('Ad hoc users SBS');

CL: CRTJOBQ QGPL/ADHOCJOBQ TEXT('Ad hoc users job queue');

CL: ADDJOBQE SBSD(QGPL/ADHOCSBS) JOBQ(QGPL/ADHOCJOBQ)
   MAXACT(100) SEQNBR(40);

CL: CRTCLS CLS(QGPL/ADHOCCLS) RUNPTY(55) TIMESLICE(100)
   TEXT('Ad hoc class');
-- Repeat the ADDPJE for each server name
CL: ADDPJE SBSD(QGPL/ADHOCSBS) PGM(QSYS/QZDASOINIT)
   JOBD(QGPL/QDFTSVR) CLS(QGPL/ADHOCCLS);

CL: STRSBS SBSD(QGPL/ADHOCSBS);

CL: CALL QSYS2.SET_SERVER_SBS_ROUTING(
   'JOEUSER', '*ALL', 'ADHOCSBS', 'NO');
```

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QSYS2.SERVER_SBS_ROUTING – View

- QSYS2.SERVER_SBS_ROUTING is used to access the alternative subsystem user configuration
- The configuration detail is stored within the ***USRPRF** objects
- **Authorization requirements** to change the configuration:
  *SECADM user special authority
  *OBJMGT and *USE to the target *USRPRF

```
SELECT * FROM QSYS2.SERVER_SBS_ROUTING;
```

AUTHORIZATION_NAME	QRWTSRVR_SUBSYSTEM	QZDASOINIT_SUBSYSTEM
JOEUSER	ADHOCSBS	ADHOCSBS

QRWTSRVR_ROLLOVER	QZDASOINIT_ROLLOVER	QZRCSRVS_ROLLOVER
NO	NO	NO

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Configurable Servers

www.ibm.com/support/knowledgecenter/ssw_ibm_i_73/rzajq/rzajqprocsetrouting.htm

Table 1. Servers and default subsystems

Server Description	Server Name	Default subsystem
Central server	QZSCSRVS	QUSRWRK
Database server	QZDASOINIT	QUSRWRK
Data queue server	QZHQSSRV	QUSRWRK
DDM	QRWTSRVR	QUSRWRK
DRDA	QRWTSRVR	QUSRWRK
File server	QPWFSERVSO	QSERVER
Network print server	QNPSERVS	QUSRWRK
Remote command server	QZRCSRVS	QUSRWRK

T

Grouping similar Navigator users

Manage ACS users

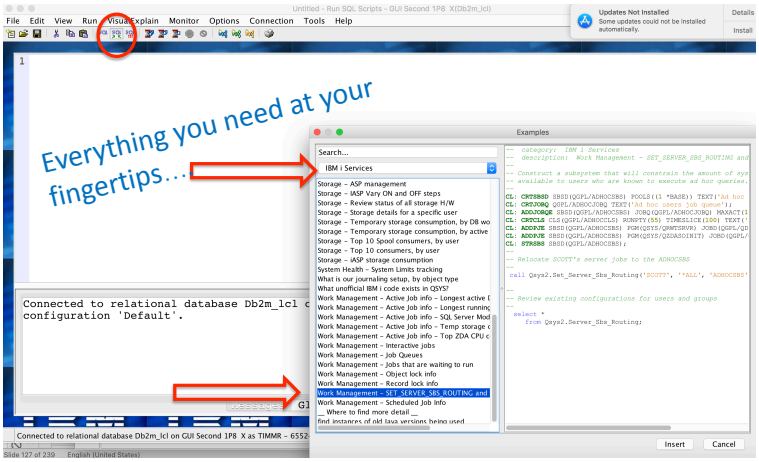
- Ø Avoid having all users run in QUSRWRK, with the same priority
- Ø Setup once and manage the Group Profile

```
-- Description: Reposition all Navigator users into a
--              controlled subsystem and do not allow
--              connections to fall-over into the default
--              subsystem (QUSRWRK or QSERVER) if the
--              INAVGRP subsystem cannot be used

CALL QSYS2.SET_SERVER_SBS_ROUTING(
          AUTHORIZATION_NAME => 'INAVGRP',
          SERVER_NAME        => '*ALL',
          SUBSYSTEM_NAME     => 'INAVSBS',
          ALLOW_ROLLOVER     => 'NO');
```

T

ACS Insert from examples



T

Db2 Web Query EZ-Install

D

Db2 Web Query EZ-Install

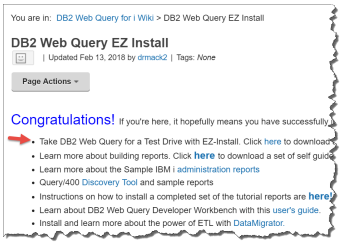
- Simplified Installation and time to value
  - EZ-Install Package
    - Includes Sample reports/dashboards that a Systems Admin might be interested in
    - Db2 Web Query audit reports/dashboards
    - Automated setup so you can immediately run with the over 14 chapters of self guided tutorials
      - And we also include the completed tutorial reports so you have over 50 sample reports/dashboards
    - Query/400 Discovery Tool
    - Must be at 7.1 or above

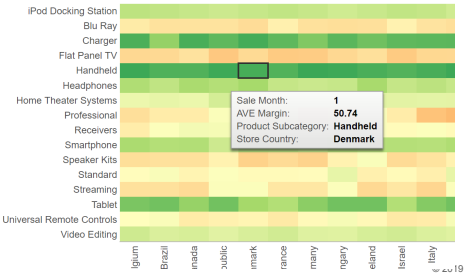
- To Request, send email to QU2@us.ibm.com
  - Include name, company name, and serial number where you plan to install

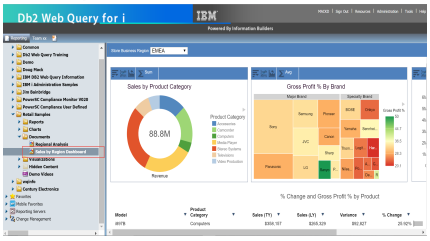
D

Take the EZ-Install Test Drive

- After completion, go to ibm.biz/db2wqezinstall
  - Test Drive what you now have
  - Learn how to build reports/dashboards
  - Run Query/400 Discovery Tool
  - Learn about Developer Workbench
  - Learn about DataMigrator
  - COMING: Learn about Data Dimension Table







A command line gem….

A

55

Analyze Command Performance (ANZCMDPFR)

- Simple utility that reports wall-clock time spent on the specified command and provides other performance-related information

```
                    Analyze Command Performance (ANZCMDPFR)

Type choices, press Enter.

Command  . . . . . . . . . . . .   wrkactjob
                                   ____________________________________
                                   ____________________________________
                                   ____________________________________
                                   ____________________________________
                                   ____________________________________
                                   ____________________________________
                                   ____________________________________
Command file . . . . . . . . . .   _____________      Name
  Library  . . . . . . . . . . .     *LIBL            Name, *LIBL, *CURLIB
Command member . . . . . . . . .   *FIRST           Name, *FIRST
Output . . . . . . . . . . . . .   *MSG             *MSG, *OUTFILE
```

A

Analyze Command Performance – CPCC711

- CPCC711 logged to the job log of the job that ran the ANZCMDPFR
  - Contains the detailed analysis information

```
                        Additional Message Information

Message ID . . . . . :   CPCC711
Date sent  . . . . . :   10/14/16      Time sent  . . . . . :   12:48:34

Message . . . . :   ANZCMDPFR command completed successfully.

Cause . . . . . :   The request to measure the performance of a single CL
  command or a set of CL commands has completed.
    Total Time Used . . . . . . . . . . . : 2.038
    Total CPU time Used . . . . . . . . . : .003
    Synchronous Database Reads  . . . . . : 0
    Synchronous Non Database Reads  . . . : 19
    Synchronous Database Writes . . . . . : 0
    Synchronous Non Database Writes . . . : 0
    Asynchronous Database Reads . . . . . : 0
    Asynchronous Non Database Reads . . . : 0
    Asynchronous Database Writes  . . . . : 0
                                                                      More...
Press Enter to continue.
```

A

Display Service Tools User IDs Without Going into SST

- Display Services Tools User ID
  - DSPSSTUSR
  - Will also show if the SST ID is linked to an IBM i user profile
    - Associating an SST User ID with an IBM i user profile is done in SST

```
                        Display Service Tools User IDs
                                                            System:   DMI1
Type options, press Enter.
  5=Display

Opt  DST/SST ID  Status     Linked      Description
 _   DMMAY       *ENABLED   DMMAY       DAWN MAY
 _   GIBBONS     *ENABLED               JOE GIBBONS
 _   QSECOFR     *ENABLED   QSECOFR     QSECOFR
 _   QSRV        *ENABLED               QSRV
 _   11111111    *ENABLED               11111111
 _   22222222    *ENABLED               22222222
```

A

Analyze Command Performance – For the database user

- Analyze database performance using ACS and RUNSQL

```
cl:CLRPOOL POOL(*JOB);
create table  qtemp.fooUser as (select * from qsys2.user_info) with no data;

cl:ANZCMDPFR CMD(runsql sql('insert into qtemp.fooUser select * from qsys2.user_info where
authorization_name = "SCOTTF" ') commit(*NONE)) OUTPUT(*OUTFILE) OUTFILE(QTEMP/
CMDPERF);

select clksec, cpusec, sdbrd, sndrd, sdbwr, sndwr, adbrd, andrd, adbwr, andwr from
QTEMP.CMDPERF;
```

CLKSEC	CPUSEC	SDBRD	SNDRD	SDBWR	SNDWR	ADBRD	ANDRD	ADBWR	ANDWR
9.156	0.125	0	4504	1	1	0	6	3	2

A

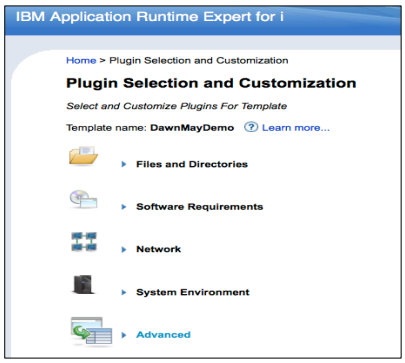
Systems Management – Administration Runtime Expert

T

Administration Runtime Expert – 5733-ARE

http://www-03.ibm.com/systems/power/software/i/are/index.html

- **Automated** tool to verify the physical condition and runtime attributes of:
  - Applications
  - Systems
  - Environments
- Ability to **fix detected problems**
  - Fix user profiles to known values
  - Fix authorities on files and directories
- Verify **multiple systems**
- **Schedule** verifications
  - Select system
  - Timeframe

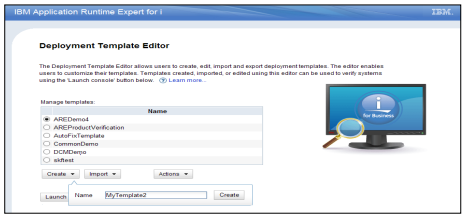


T

Administration Runtime Expert – Manage PTFs

http://www.ibmsystemsmag.com/Blogs/i-Can/September-2015/IBM-Application-Runtime-Expert-for-i--Managing-PTF/

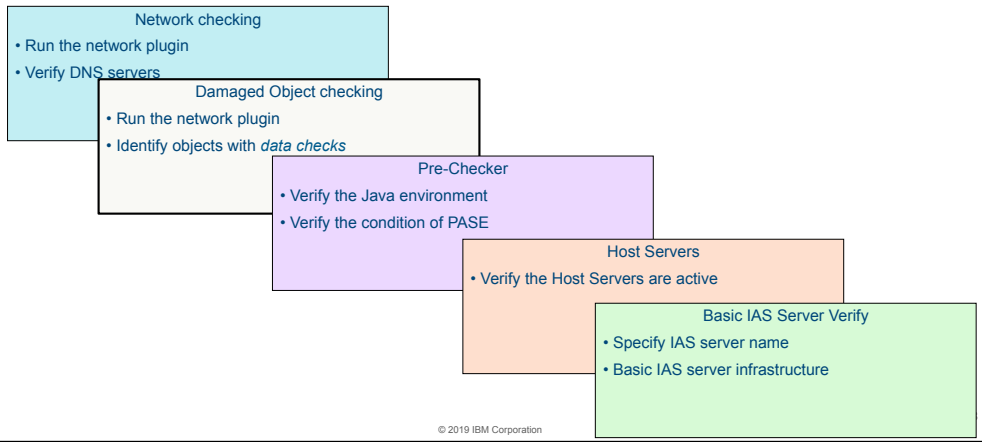
- Compare PTF levels across systems
- Compare PTF levels against IBM cloud
- Send PTF's from one system to another via *SAVF
- Load PTF's from image catalogs
- Scheduled PTF verifications
- Send an email when something is wrong
- Compare an endless number of other system attributes



T

Useful ARE utilities

IBM i includes a handful of ready made templates



T

Network Health Checker

- Simple utility to verify your network configuration

– STRQSH

```
/QIBM/ProdData/OS/OSGi/templates/bin/areVerify.sh -network


Summary report written to //network.summary
Detailed report written to //network.out

Running plugin Network Verifier                                    >
Retrieving local host name                                       o Start
time is Mon May 08 14:57:20 UTC 2017                         o Local host name
is dmi2.rchland.ibm.com                                  o End time is Mon May 08
14:57:20 UTC 2017                                  o Amount of time needed to retrieve
local host name was 0 seconds
```

http://ibmsystemsmag.blogs.com/i_can/2013/09/application-runtime-expert-network-health-checker.html

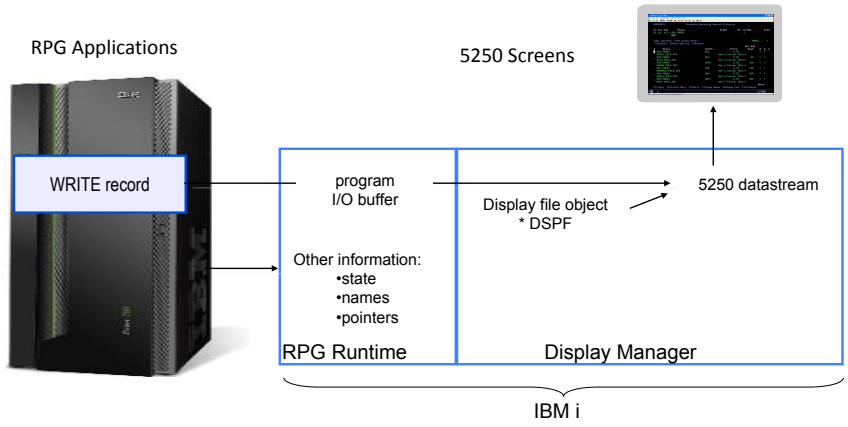
T

RPG Open Access

A

65

Rational Open Access: RPG Edition



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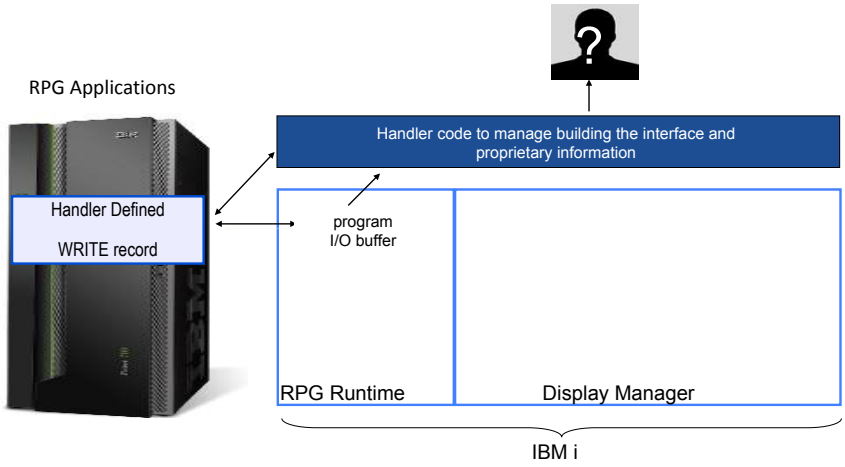
Rational Open Access: RPG Edition



A

Any RPG device type

- Any RPG device type can be defined as an Open Access file: DISK, PRINTER, or WORKSTN.
- The provider of the handling procedure can choose the RPG device-type that best fits the function that the handler provides.
- Examples
  - User interface: WORKSTN file
  - Creating an Excel document: PRINTER file
  - Accessing a Web service: keyed DISK file

A

The RPG coding to define an Open Access file

- The HANDLER keyword identifies the location of the handler. The handler can be a program or a procedure.

```
Fmyfile   cf   e   workstn  extdesc('MYLIB/MYFILE')
F                           handler('MYLIB/MYSRVPGM(hdlMyfile)')
F                           usropn
```

Other examples of the HANDLER keyword

- `handler('MYLIB/MYPGM')`
- `handler(charVariable)`
  - `where charVariable = 'MYLIB/MYPGM' or 'MYSRVPGM(proc)'`
- `handler(rpgPrototype)`
- `handler(procptrVariable)`

A

69

BRMS

A

70

BRMS Enterprise Function

- For environments where there are multiple sites running BRMS
- Centralized site in enterprise for collection of BRMS data
  - Direct network
  - Collection nodes

A

71

BRMS Enterprise Function

§ Central "Enterprise System" (HUB) pulls important information from systems (NODES) defined in its "Enterprise" network.
§ Automates tasks to assist in managing health of BRMS backup/recovery
  – May generate
    • specific notifications
    • verifications
    • other functions
§ Navigator for i GUI interface only
§ Enterprise Capability being added to Advanced Feature of BRMS

A

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System Limits

System Limits

Customer Requirements

- We need to be **proactive** and understand our posture against important system limits
- I want to be able to **recognize** trends and run-away situations
- We need to **understand** how spikes like month-end processing affect our consumption of operating system resources.

IBM i Innovation

- **Leverage** the integrated IBM i operating system to instrument the automated recognition of resource consumption
- Accommodate **different types** of consumption (Job, Object, ASP, and System)
- **Db2 for i** is the repository
- Define the **criteria** for which limits are worthy of tracking

Patent filed March/2013 "Integrated Limits Tracking, Trending, and Reporting"

System Limits

Added in IBM i 6.1

Customer Requirements

- We need to be **proactive** and understand our posture against important system limits
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- Define the **criteria** for which limits are worthy of tracking

Patent filed March/2013 "Integrated Limits Tracking, Trending, and Reporting"

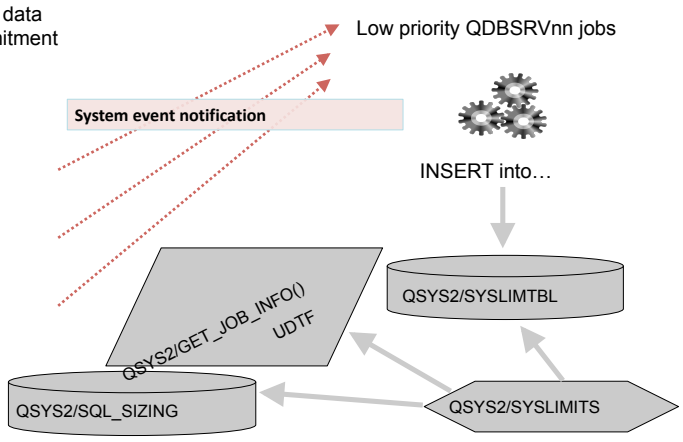
System Limits Architecture

User Job – Long running data purge running with commitment control

10,000th row deleted

110,000th row deleted

210,000th row deleted



System Limits – Where does the data reside

Object	Type	Purpose
QSYS2/SYSLIMTBL	*FILE SQL Table	System wide (including iASP) physical file repository for tracked System Limits. Designed to have the smallest storage footprint.
QSYS2/GET_JOB_INFO	User Defined Table Function	Accepts a job name as input and returns a single row of information about an active job.
QSYS2/SQL_SIZING	*FILE SQL Table	Table where architected limits are defined, including translated descriptions.
QSYS2/SYSLIMITS	*FILE SQL View	The external interface which joins detail from the preceding three resources.

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System Limits – Documentation

www.ibm.com/support/knowledgecenter/ssw_ibm_i_73/rzajq/rzajqserviceshealth.htm

Table 4. Work management limits

Limit description	Limit ID	Maximum	Floor	Increment
Maximum number of jobs	19000	970,000	1,000	400
Maximum number of spool files	19002	2,610,000	10,000	5,000
Maximum number of spooled files in each independent ASP	19003	10,000,000	10,000	5,000

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System Limits – Work Management

```
WITH TT(JOB_MAXIMUM)
 AS (SELECT CURRENT_NUMERIC_VALUE
      FROM QSYS2.SYSTEM_VALUE_INFO
      WHERE SYSTEM_VALUE_NAME = 'QMAXJOB')
SELECT LAST_CHANGE_TIMESTAMP AS INCREMENT_TIME, CURRENT_VALUE AS JOB_COUNT,
TT.JOB_MAXIMUM, DEC(DEC(CURRENT_VALUE,19,2) / DEC(TT.JOB_MAXIMUM,19,2) * 100,19,2)
AS PERCENT_CONSUMED
FROM QSYS2.SYSLIMITS, TT
WHERE LIMIT_ID = 19000 ORDER BY CURRENT_VALUE DESC
```

INCREMENT_TIME	JOB_COUNT	JOB_MAXIMUM	PERCENT_CONSUMED
2015-05-18 00:33:25.439414	71408	163520	43.66
2015-05-16 08:00:13.560947	71008	163520	43.42
2015-05-18 01:00:23.118807	70031	163520	42.82
2015-05-12 22:42:48.345298	69008	163520	42.20
2015-05-12 22:42:33.200108	68608	163520	41.95
2015-05-12 22:31:28.636105	68208	163520	41.71
2015-05-18 01:01:01.333811	68140	163520	41.67
2015-05-18 01:02:01.376725	65246	163520	39.90
2015-05-18 01:07:04.412267	54952	163520	33.60
2015-05-12 21:47:34.281314	49808	163520	30.45

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Deleting data while under Commitment Control

SELECT SIZING_NAME, CURRENT_VALUE FROM QSYS2.SYSLIMITS WHERE JOB_NAME = upper('297851/Q ... - Rchaptf3.rch.s...

SIZING_NAME	CURRENT_VALUE
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	10000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	10000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	110000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	110000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	210000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	210000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	310000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	310000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	410000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	410000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	510000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	510000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	610000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	610000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	710000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	710000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	810000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	810000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	910000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	910000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	810000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	710000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	610000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	510000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	410000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	310000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	210000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	110000
MAXIMUM NUMBER OF ROW CHANGE OPERATIONS IN A UNIT OF WORK	10000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	810000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	710000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	610000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	510000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	410000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	310000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	210000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	110000
MAXIMUM NUMBER OF ROWS LOCKED IN A UNIT OF WORK	10000

Floor

Increments reflect increasing number of deleted rows

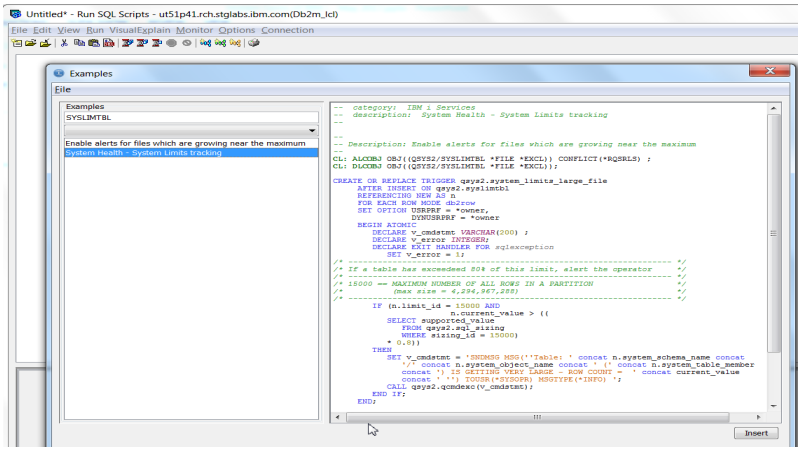
Note… we deleted 1 million rows, the high point is not recorded

Commit or Rollback releasing the locks

80

Protection automated with a Trigger

- Built into ACS
- Insert from Examples…



Integrated File System

Added in IBM i 7.2

Limit description	Limit ID	Maximum	Floor	Increment
Number of objects linked in a directory	18402	0	100,000	10,000
Maximum number of directories linked in a directory	18403	1,000,000	1,000	1,000
Maximum number of file system objects in *SYSBAS ASPs	18404	2,147,483,647	100,000	10,000
Maximum number of file system objects in an independent ASP	18405	2,147,483,647	100,000	10,000
Maximum number of document library objects in a folder	18406	65510	1,000	500
Number of document library objects in the system ASP	18407	0	100,000	10,000
Maximum number of document library objects in a user ASP	18408	1,000,000	100,000	10,000
Maximum number of bytes in a stream file	18409	1,099,511,627,776	16,777,216	1,048,576
Maximum number of bytes in a document	18410	2,147,483,647	16,777,216	1,048,576

Find the largest IFS files

SELECT LASTCHG, JOB_NAME, ASP_NUMBER, IFS_PATH_NAME, USER_NAME, CURRENT_VALUE FROM QSYS2.SYSLIMITS WHERE **LIMIT_ID = 18409** ORDER BY CURRENT_VALUE DESC;

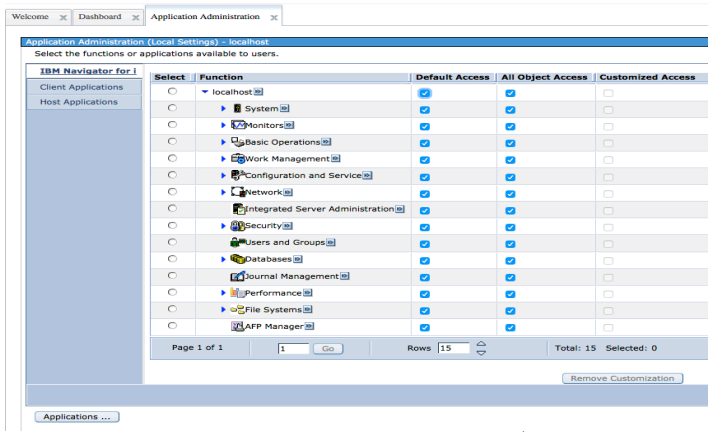
SELECT LASTCHG, JOB_NAME, ASP_NUMBER, IFS_PATH_NAME, USER_NAME, CURRENT_VALUE FROM QSYS2.S ... - Rchastca(Rchastca)

LASTCHG	JOB_NAME	ASP_NUMBER	IFS_PATH_NAME	USER_NAME	CURRENT_VALUE
2015-01-03 23:...	337465/VCPDTA/QJVACMDSRV	1	/orbtrc.18122014.0929.20.txt	VCPDTA	1099511535858
2015-01-03 23:...	337465/VCPDTA/QJVACMDSRV	1	/orbtrc.18122014.0929.20.txt	VCPDTA	1099510485672
2015-01-03 23:...	337465/VCPDTA/QJVACMDSRV	1	/orbtrc.18122014.0929.20.txt	VCPDTA	1099509435486
2015-01-03 23:...	337465/VCPDTA/QJVACMDSRV	1	/orbtrc.18122014.0929.20.txt	VCPDTA	1099508385300
2015-01-03 23:...	337465/VCPDTA/QJVACMDSRV	1	/orbtrc.18122014.0929.20.txt	VCPDTA	1099507335114
2015-02-26 15:...	407956/QACE/QP0ZSPWP	1	/QIBM/UserData/ACE/log/server.log	QACE	61870255
2015-02-27 12:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	49286416
2015-02-27 10:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	48237784
2015-02-27 08:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	47189088
2015-02-27 06:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	46140361
2015-02-27 04:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	45091718
2015-02-27 02:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	44042651
2015-02-27 00:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	42993987
2015-02-26 22:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	41945337
2015-02-26 20:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	40896606
2015-02-26 18:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	39848021
2015-02-26 16:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	38799357
2015-02-26 14:...	405803/QBRMS/Q1ACPDST	1	/tmp/brms/qbrms	QBRMS	37750700
2015-02-26 13:...	413714/QBRMS/QBRMSYNC	1	/tmp/brms/qbrms	QBRMS	36702048
2015-02-26 13:...	413707/HERBST/QPADEV09K6	1	/tmp/brms/flightrec	HERBST	22021074
2015-02-27 04:...	407982/EBANK/QJVACMDSRV	1	/ebank/logs/EBANK00052.log	EBANK	22020395
2015-02-27 00:...	407982/EBANK/QJVACMDSRV	1	/ebank/logs/EBANK00052.log	EBANK	20971806
2015-02-26 21:...	407982/EBANK/QJVACMDSRV	1	/ebank/logs/EBANK00052.log	EBANK	19923136
2015-02-26 18:...	407982/EBANK/QJVACMDSRV	1	/ebank/logs/EBANK00052.log	EBANK	18874543
2015-02-26 14:...	407982/EBANK/QJVACMDSRV	1	/ebank/logs/EBANK00052.log	EBANK	17825926

Navigator for i – Application Administration

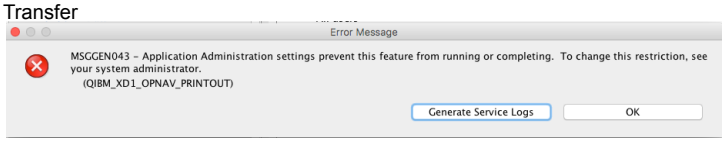
Application Administration for Navigator for i

Control who can access what tasks in Navigator for i



And … Application Administration applies to Access Client Solutions

- Access configured in Application Administration now applies for Access Client Solutions
  - Added in January 2017
- Application Administration for Navigator functions
  - Printer Output
  - Integrated File Systems
  - Database tasks (Run SQL Scripts and SQL Performance Center)
- Application Administration for Client Applications
  - 5250 emulator
  - Data Transfer

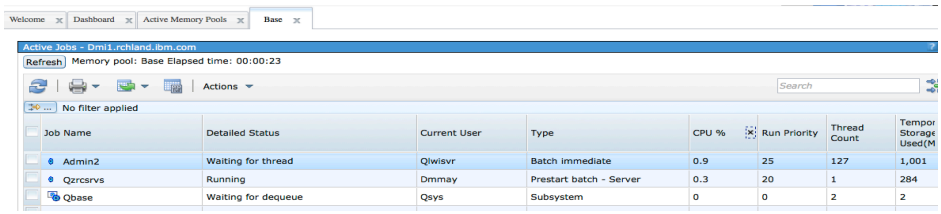


http://ibmsystemsmag.com/blogs/i-can/february-2017/application-administration-with-access-client-solu/

Systems Management – Jobs in Memory Pools

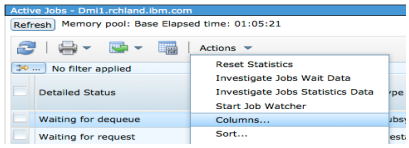
Display Jobs Running in a Memory Pool

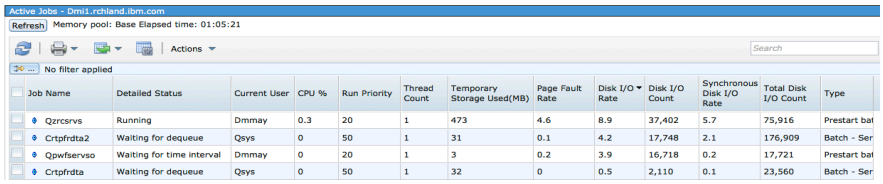
- Work Management [?] Active Memory Pools
- Select the desired memory pool and you can see the jobs running in that memory pool



Display Jobs Running in a Memory Pool… Customize Columns

- Customize columns to add/omit additional information
  - Customization is remembered

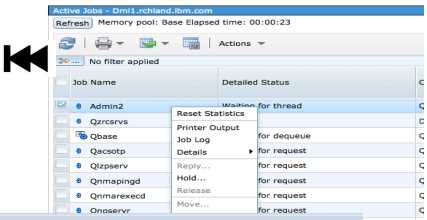


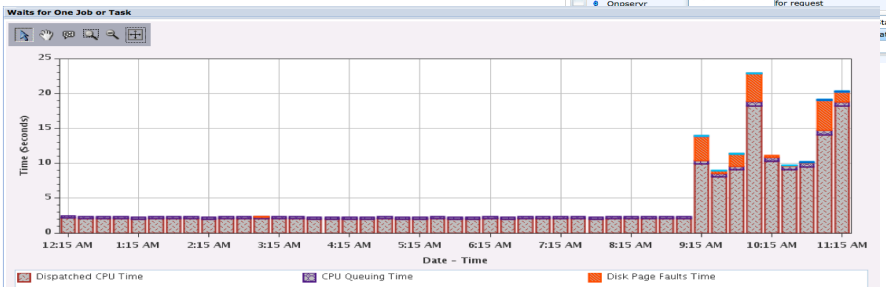


89

Look Backward in Time for a Job

- If you discover a job with a potential performance issue, you can easily launch the Performance Data Investigator to see what the job has been doing in the past





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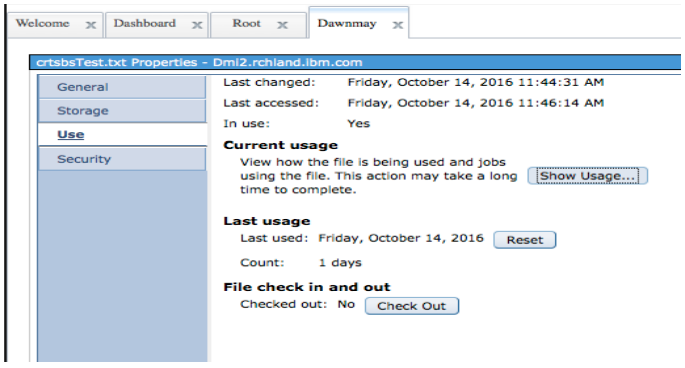
Systems Management – Holder of Files in IFS

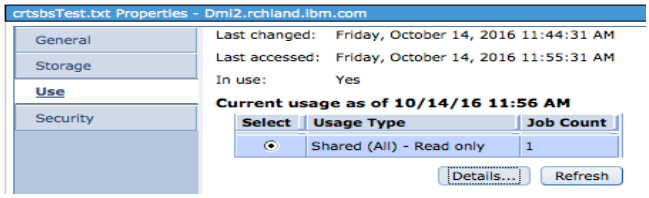
Display File Usage Information – find holders of files in the IFS

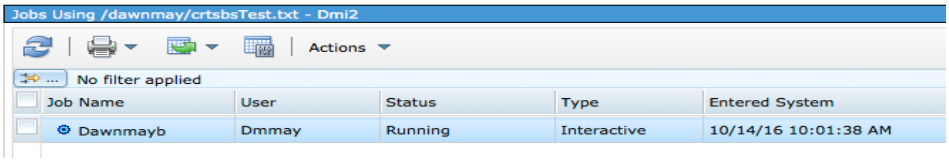
- Locate the file in the IFS, view Properties
  - Select Use tab, then click on the “Show Usage” button



Display File Usage Information – find holders of files in the IFS …

- Select the entry to review details which will display the job(s)



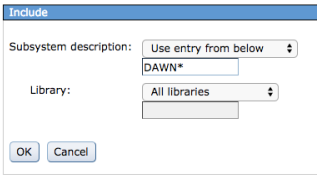


Systems Management – Configure Subsystems with Navigator for i

94

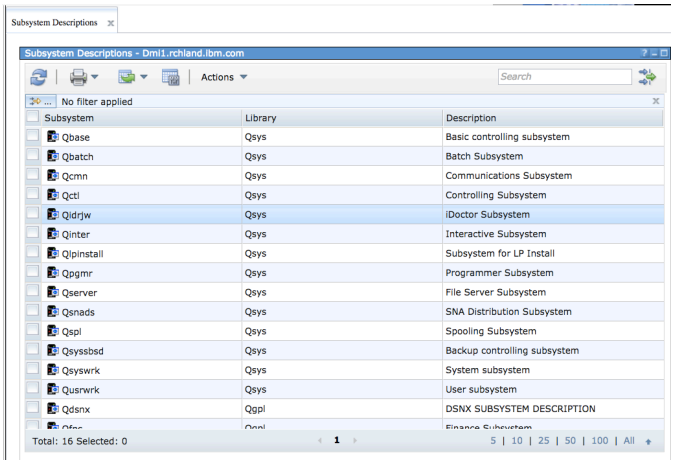
Subsystem Configuration with Navigator

- Subsystem configuration support was added to Navigator with the **December 2016** update
- Use **Actions -> include** to specify subsystem descriptions to display
  - Similar to WRKSBSD command prompt
- If you need your own class or job queue, you will still need to create those via the green screen
  - Or use the **Run Command** task within the **System** tasks to create those objects



http://www.ibmsystemsmag.com/Blogs/i-Can/March-2017/Subsystem-Management-with-Navigator-for-i/

95



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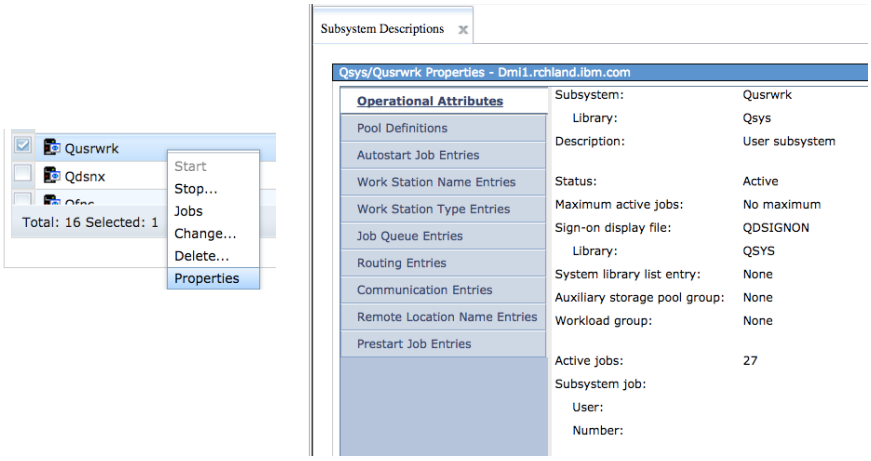
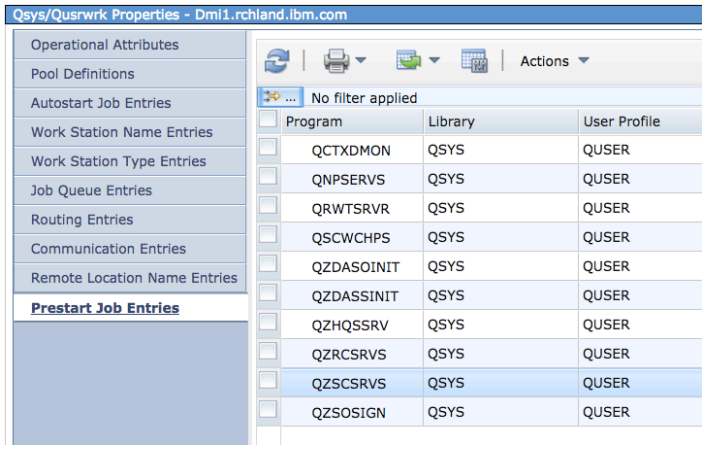


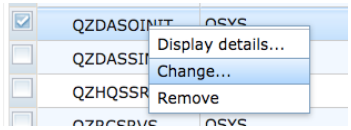
97

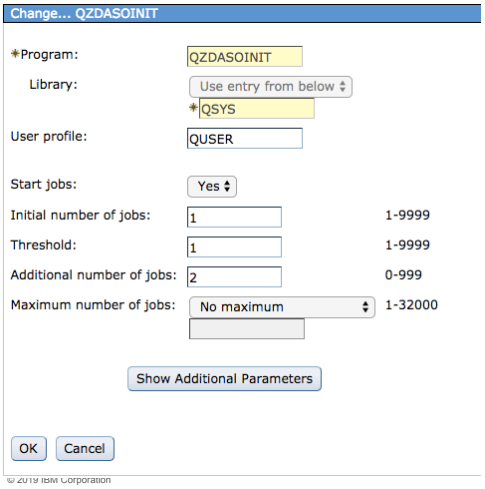
Prestart Job Entries via Navigator



98

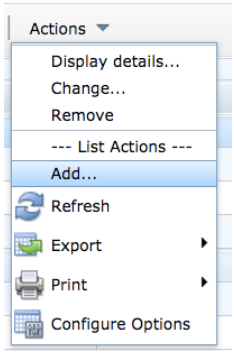
Changing a prestart job entry

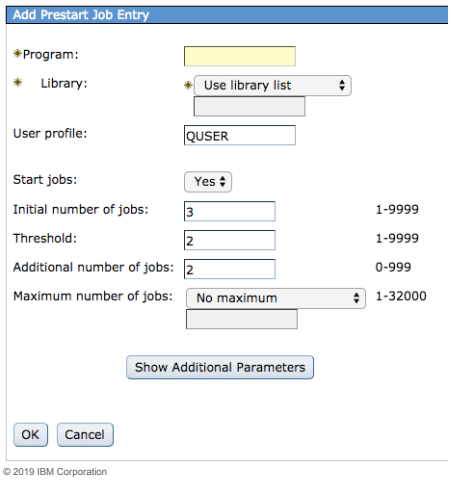




99

Adding a prestart job entry





100

Subsystem Configuration Options

- There are many ways to specify which subsystems jobs should run in
- Traditional work management
  - Routing entries, job queue entries, workstation entries, communications entries, prestart job entries, autostart job entries, etc…
- Server job configuration
  - Specify the subsystem for server jobs by IP address
    - Host servers, DDM/DRDA server
- Route requests based upon user profile (7.1 and later)
- Configure the subsystem for the HTTP server (7.1 and later)
- Configure the subsystem for the QSQSRVR jobs (introduced in V5R4)
- Configure the subsystem for the SSH jobs (introduced in V5R4)
- Configure the subsystem for the FTP and SMTP servers (introduced in V5R1)

101

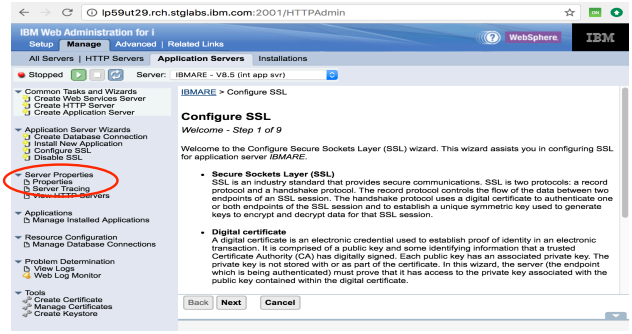
Systems Management – SSL/TLS Wizards

102

SSL/TLS Wizard

Web Admin GUI - http://hostname:2001/HTTPAdmin

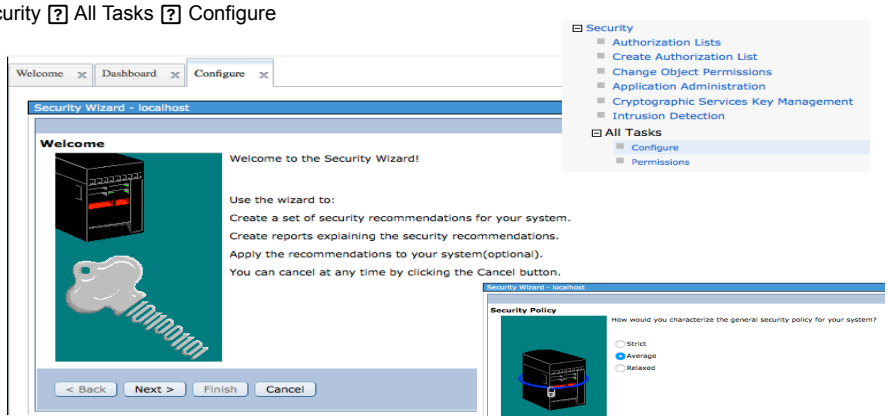
- Configure either HTTP servers for SSL and Web Application Servers for SSL
- Updates the server configurations as well the necessary updates to DCM



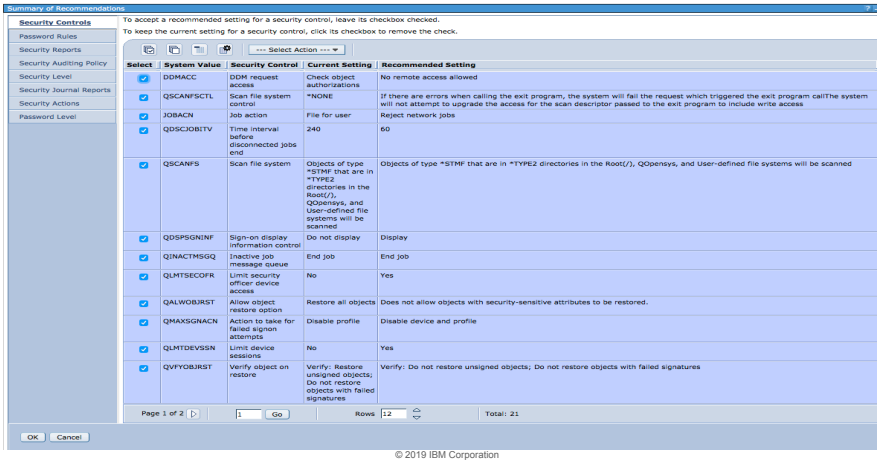
Systems Management – Security Wizard

Security Wizard

- Security ? All Tasks ? Configure

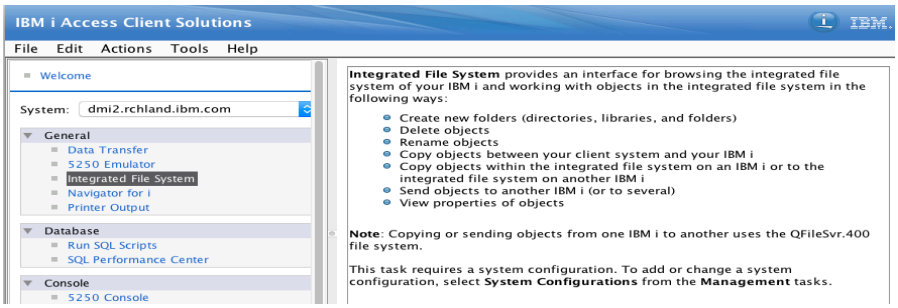


Security Wizard - Recommendations



Access Client Solutions – Integrated File System

IBM i Access Client Solutions – Integrated File System



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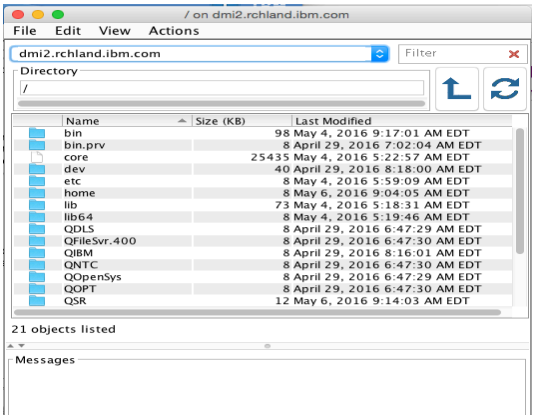
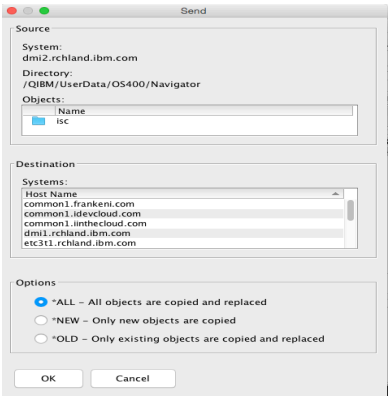




109

RPG “Sort Arrays”

110

Sorting a subset of an Array

- Allow dynamic sorting/resizing of arrays, %SUBARR
  - %SUBARR(array : start : length)
  - `sorta %subarr(myArray:4:10)`
  - sorts 10 elements of myArray starting at 4th

RPG: Sort and search a data structure array

- Sort a data structure array using one subfield as a key

```
// sort by name
SORTA info(*).name;

// sort by due date
SORTA info(*).dueDate;
```

- Search a data structure array using one subfield as a key

```
// search for a name
pos = %LOOKUP('Jack' : info(*).name);

// search for today's date
pos = %LOOKUP(%date() : info(*).dueDate);
```

Example: The "family" array

```
D child        ds             qualified template
D   name                25a   varying
D   age                  5i 0
D family       ds             qualified dim(5)
D   name                25a   varying
D   numChild             5i 0
D   child                      likeds(child) dim(10)
```

name	numChild	child	
		name	age
Smith	2	Sally	12
		Jimmy	2
Jones	3	Polly	9
		Andy	5
		Mary	11
Johnson	2	Paul	13
		Anne	10

Example: The "family" array

```
// sort the family array by age of first child
SORTA family(*).child(1).age;
```

name	numChild	child	
		name	age
Smith	2	Sally	12
		Jimmy	2
Jones	3	Polly	9
		Andy	5
		Mary	11
Johnson	2	Paul	13
		Anne	10

The "family" array sorted ascending by oldest child

```
// sort the family array by age of first child
SORTA family(*).child(1).age;
```

name	numChild	child	
		name	age
Johnson	2	Paul	13
		Anne	10
Smith	2	Sally	12
		Jimmy	2
Jones	3	Polly	9
		Andy	5
		Mary	11

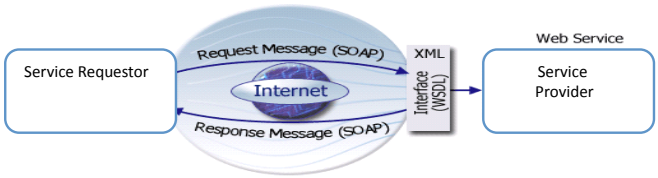
115

Consuming Web Services

116

Web Services Made Easy

- Software Application requiring some additional components
- Exposed Services; published and available
- Web Service = Self-Contained function with well-defined interfaces that provide functionality that is accessible over the Internet/Intranet
- Industry Standard Connection protocol
- SOAP or REST



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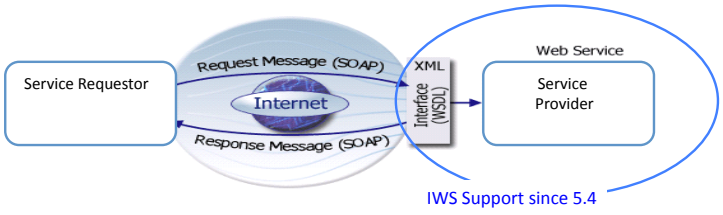

Web Services Made Easy

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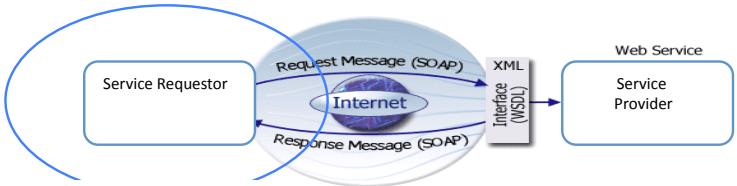


How to Make RPG call a Web Service?

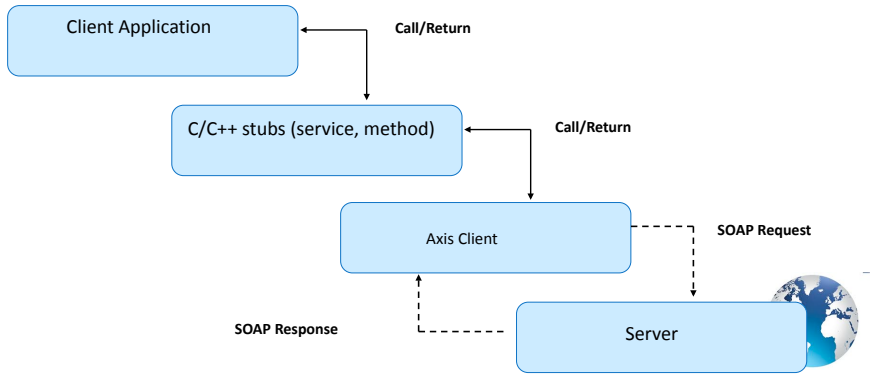
Solving the RPG Issue

- Provide an easier path for ILE RPG programs to consume a Web service
- Use WSDL2RPG tool
  - § Generate RPG stub code directly from a WSDL file
- Allow RPG programmers to decide whether or not they want to work with C stub code

Web Services Client for ILE

- *Old Way: Using the Apache Axis Client (for SOAP)*

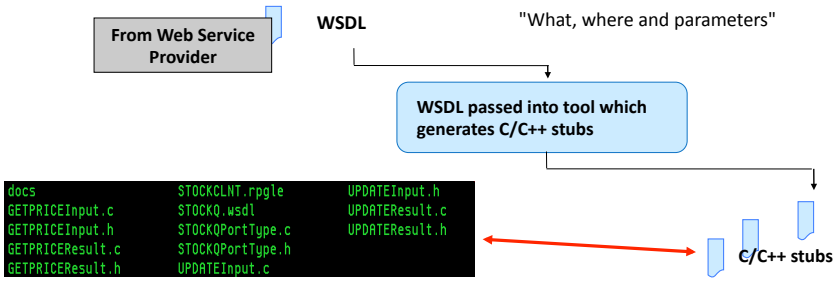
- Create the application that uses the stubs to invoke the Web service



Web Services Client for ILE

- *Stub Generation – Creating a Web Services Proxy*

- Developer generates stubs using:
  - –Java tools (wsdl2ws.jar)
  - –Qshell script - wsdl2ws.sh -lc STOCKQ.wsdl



RPG Client Application using StockQuote.c stub

- Business application can reference the "stubs" using procedure names

```
H DFTNAME(GETQUOTERP)

DgetStub          PR                *   ExtProc('get_StockQuote_stub')
D pEndpoint                         *   Value
*
DgetQuote         PR              4F    ExtProc('getQuote')
D pStockQuoteWS                     *   Value
D pStockName                        *   Value
*
DdestroyStub      PR                    ExtProc('destroy_StockQuote_stub')
D pStockQuoteWS                     *   Value
D StockQuoteWS    S                 *
D Endpoint        S              100A
D StockName       S               10A
D fQuoteDollars   S                4F
D QuoteDollars    S                6P 3
D Output          S               50A
C                   eval      Endpoint = 'http://cobolpv:9080' +
C                                        '/StockQuote/services' +
C                                        '/StockQuote' + X'00'
```

NOT ALL CODE SHOWN IN THIS EXAMPLE

WSDL2RPG Tool

- WSDL2RPG generates RPG stub code directly from WSDL files
  - C stub code no longer needs to be called by user
  - Pure ILE RPG solution at their disposal
- RPG Stub code is less error prone
  - Parameters are clearly defined as RPG data structures instead of pointers
  - No need to map RPG prototypes to C procedures names
  - Overly complex WSDL files can still cause problem
  - No more memory management issues
- RPG programmers can stay in RPG and avoid C altogether

Convert SQL to Spreadsheet

J

The problem

- Database content needs to be exported or integrated into other workflows using a popular spreadsheet format

J

CPYTOIMPF

- All-on-i solution
- Can be used with *COMMA for the FLDDLM parameter, generates a .csv-like file

J

The Solution I've Seen Many Times…

1. IBM i issues a remote command to a PC
   - Incoming Remote Command
   - STRPCO/STRPCCMD
2. That remote (PC) command runs IBM i Access Data Transfer
   - Downloads the table as desired format
3. Another remote (PC) command then sends the file to IBM i
   - Mapped network drive
4. IBM i processes the data
   - Includes in email, report, archiving, etc.

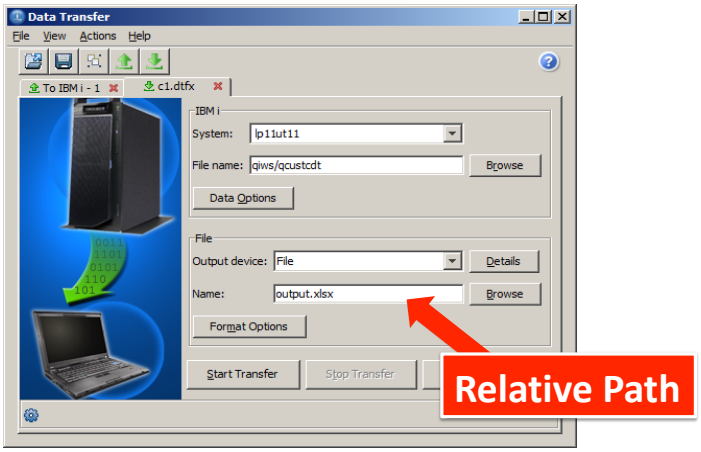
J

Hidden Gem solution #1

- IBM i Access Client Solutions (ACS)
- Relatively platform-agnostic
  - Runs anywhere that has Java

J

Creating a request to run on IBM i



J

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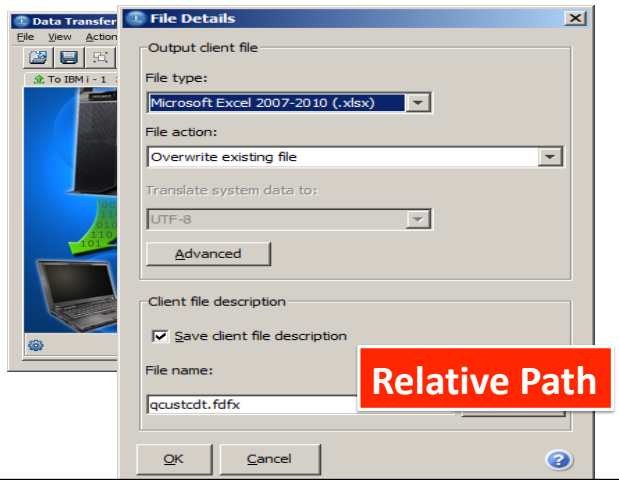
Creating a request to run on IBM i



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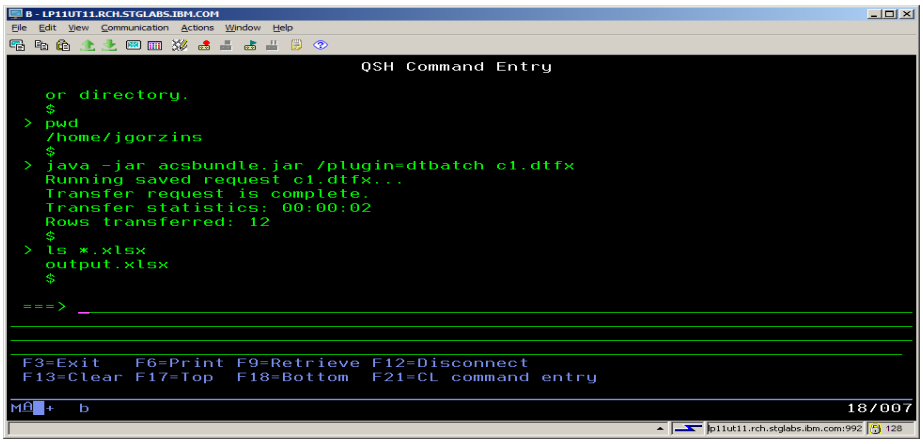
Creating a request to run on IBM i



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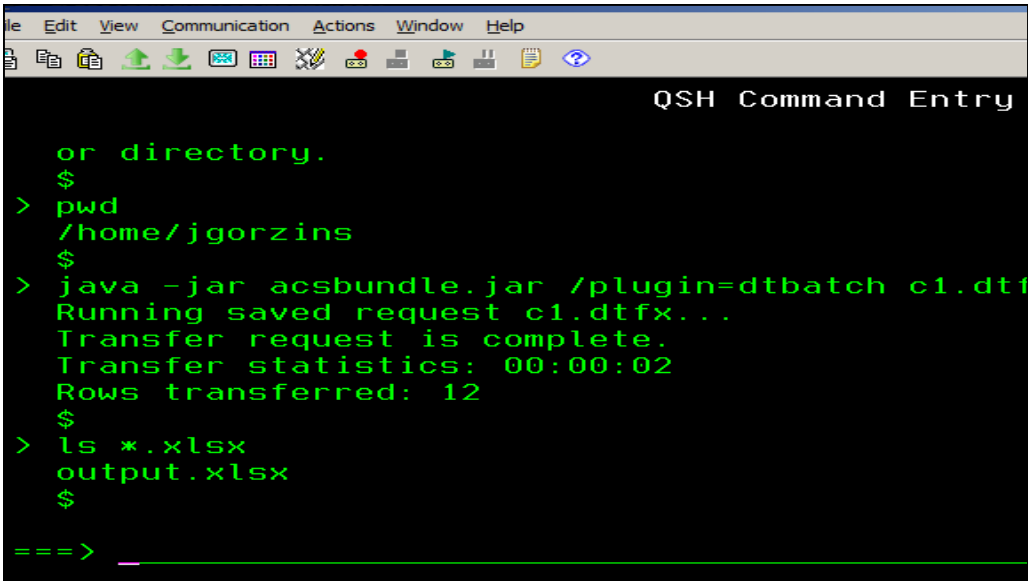

Automation and Command Line – CLDOWNLOAD

/PLUGIN=cldownload /system=<system>
[/userid=<userid>]
{/hostfile=<library/filename> | /sql="statement"}
{/clientfile=<path><filename>.<extension> | /display}

```
    /userid     - user id to use when connecting to the target system
    /hostfile   - Source library and file on the IBM i system for the download
                  e.g. /hostfile=QIWS/QCUSTCDT
    /sql        - specify an SQL statement
                  e.g. /sql="select CUSNUM,LSTNAM,INIT,ZIPCOD from QIWS/QCUSTCDT"
    /clientfile - Target file location for the download.
                  The format of this file will be determined by the specified
                  extension (for example, .csv .ods .xlsx .xlsx)
                  If the file extension is not specified or is of a type
                  not supported, the data will be formatted as a .csv file
    /display    - write the output to the terminal
```

J

Automation and Command Line – CLDOWNLOAD

```
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```

/hostfile
Choose a Db2 table

/sql
Give it your own

Automation and Command Line – CLDOWNLOAD

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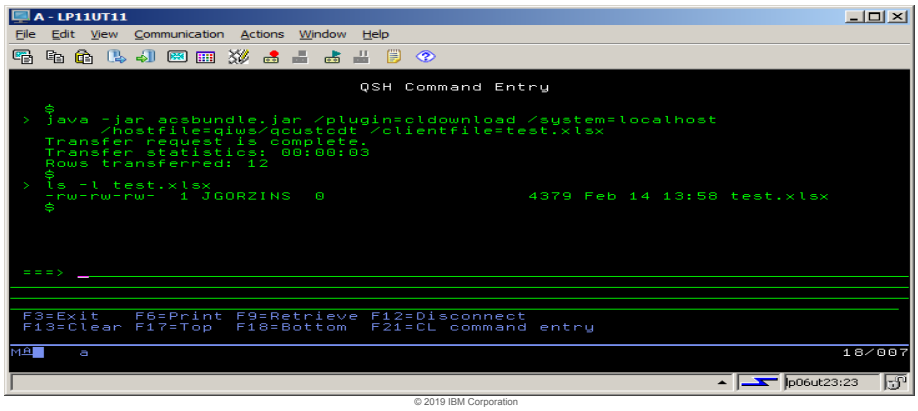
    /display    - write the output to the terminal
```

/clientfile
Output file (type is determined by extension)

Automation and Command Line – CLDOWNLOAD

- Shell command CLDownload example, on IBM i
- Note: no login needed!!



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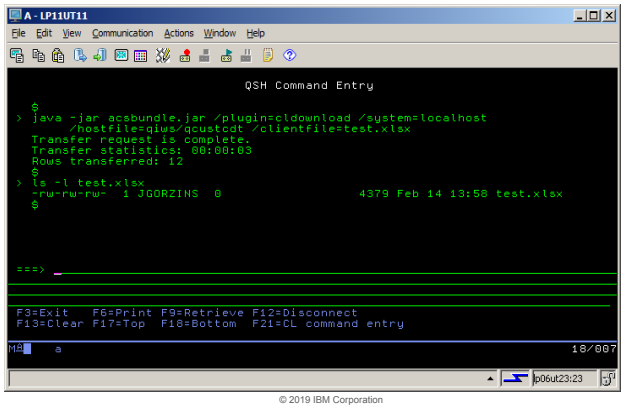


J

Open Source program to convert SQL Output to Excel

https://github.com/Club-Seiden/python-for-IBM-i-examples/tree/master/non-wheel/dbtoxlsx

```
usage: dbtoxlsx.py [-h] [-c C] [-l L] [-f [FNAMES [FNAMES ...]]] [-o O] [-b B] [-i I]

Example: python3 dbtoxlsx.py -c "select * From QSYS2.USER_INFO WHERE STATUS = '*ENABLED'" -o /home/test.xlsx

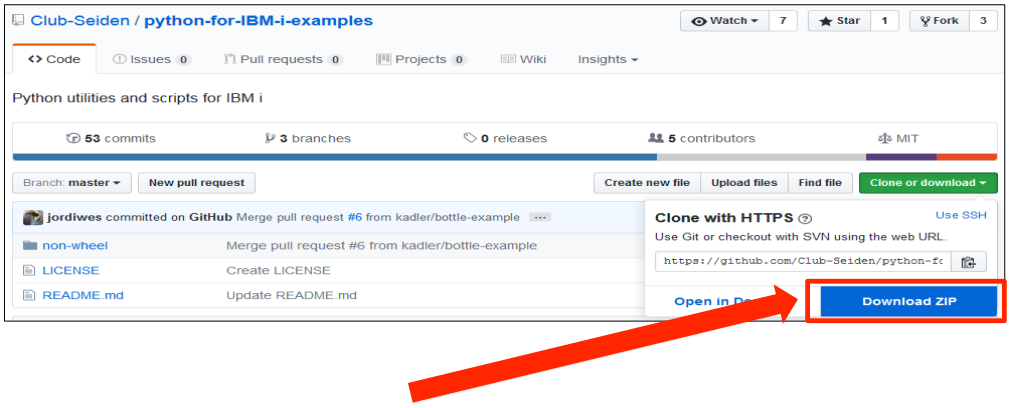
Implement SQL from IBM i command line and direct output to an Excel
spreadsheet.

Requires the latest ibm_db PTF:
https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/IBM%20i%20Technology%20Updates/page/Py
And xlsxwriter via command from SSH or qp2term:
pip3 install xlsxwriter

optional arguments:
  -h, --help            show this help message and exit
  -c C, --c C           SQL command to execute. If left empty you must specify
                        a library and source file to execute the default
                        command: Select * from <library>.<file>
  -l L, --l L           Name of the library that contains the database source
                        file(s) that you wish to query
  -f [FNAMES [FNAMES ...]], --f [FNAMES [FNAMES ...]]
                        One or more database source files
  -o O, --o O           Name of the excel file to contain the output
  -b B, --b B           Turn on bold for column headings
  -i I, --i I           Turn on italic for column headings
```

J

Installing by downloading .zip file



Installing with git

- From a shell (THIS IS A SINGLE COMMAND):

```
git -d http.sslVerify=false clone
https://github.com/Club-Seiden/python-for-IBM-i-examples/
```

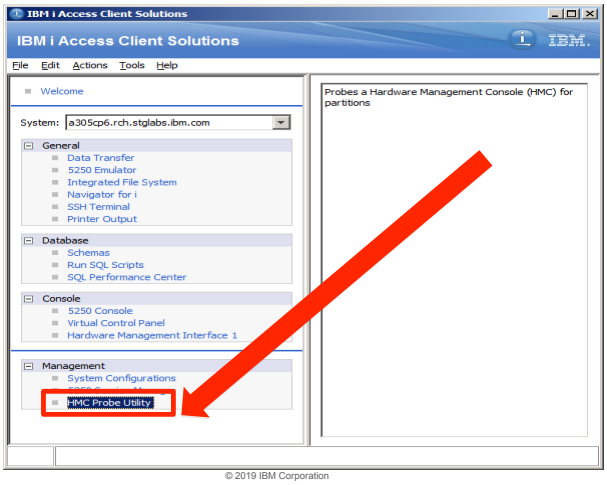

dbtoxlsx.py features

- Give it SQL or a table name
- Download multiple tables with a single command!
  - Resultant tables end up in multiple spreadsheets within a single workbook!
- Column headings can be bold or italicized

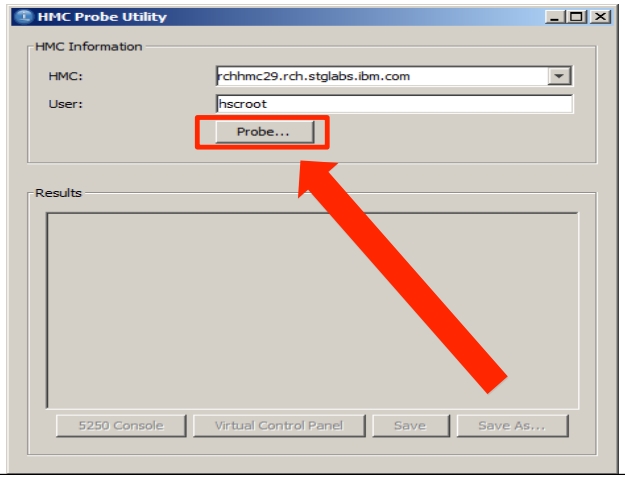
J

ACS HMC Probe Utility

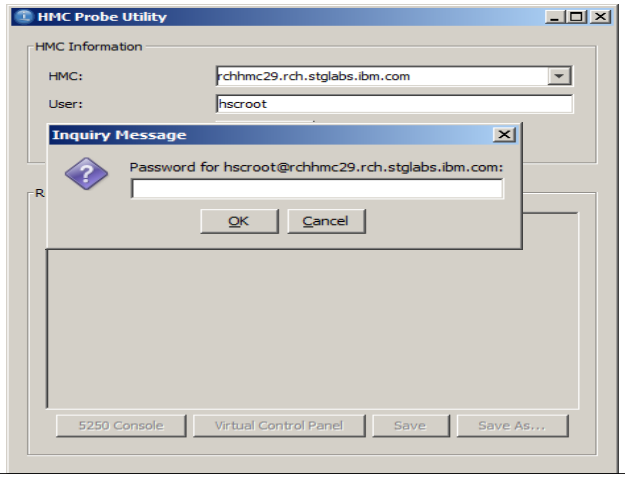
HMC Probe Utility



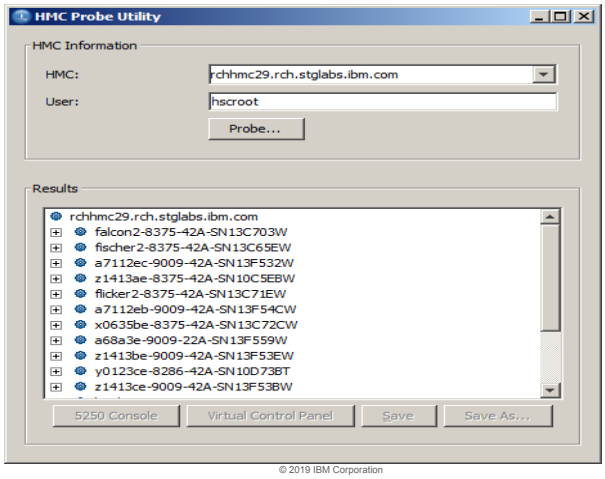
HMC Probe Utility



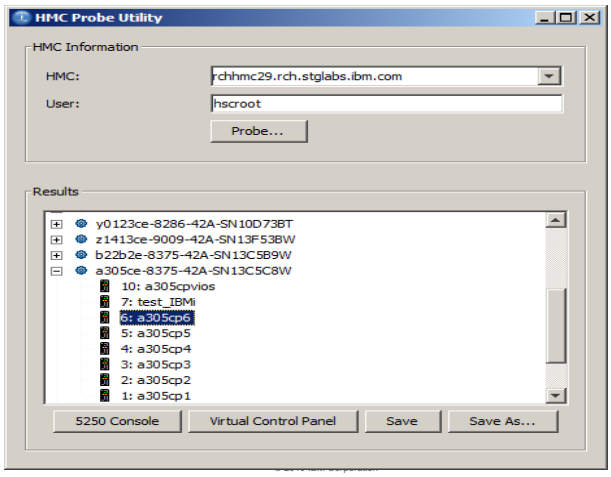
HMC Probe Utility



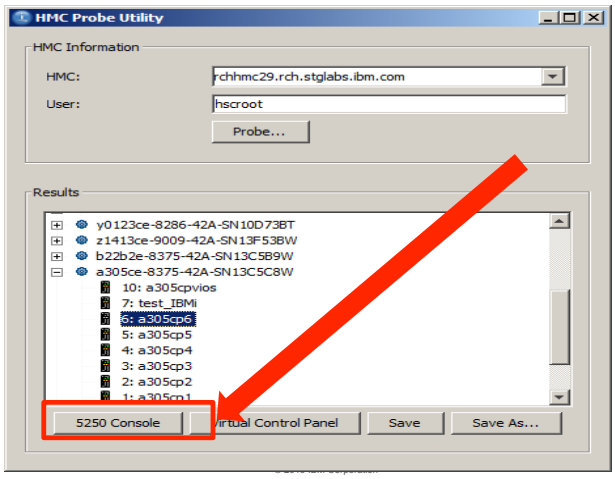
HMC Probe Utility



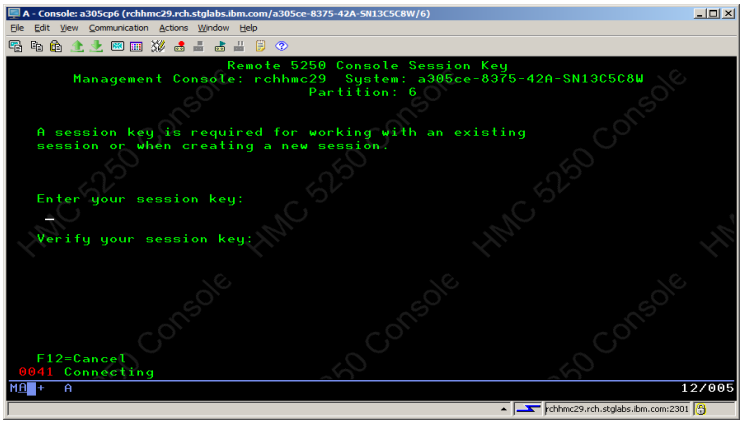
HMC Probe Utility



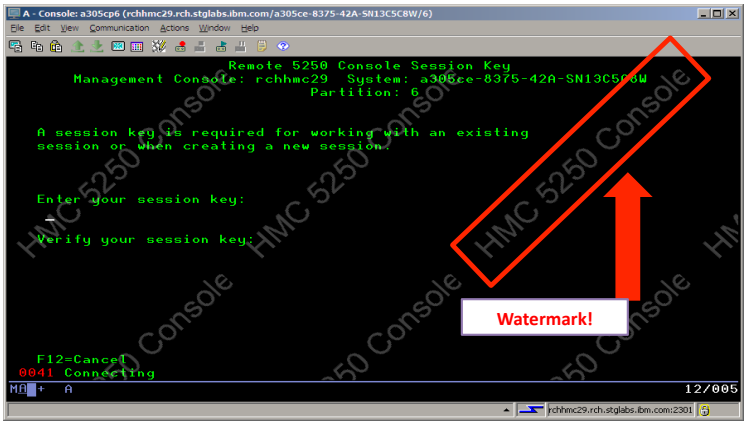
HMC Probe Utility



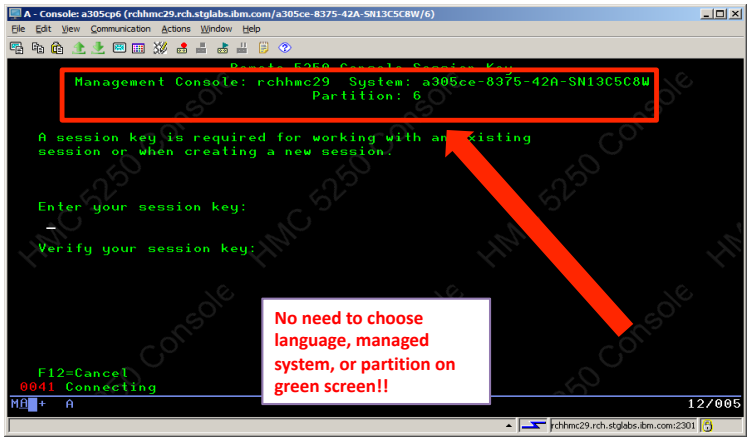
HMC Probe Utility



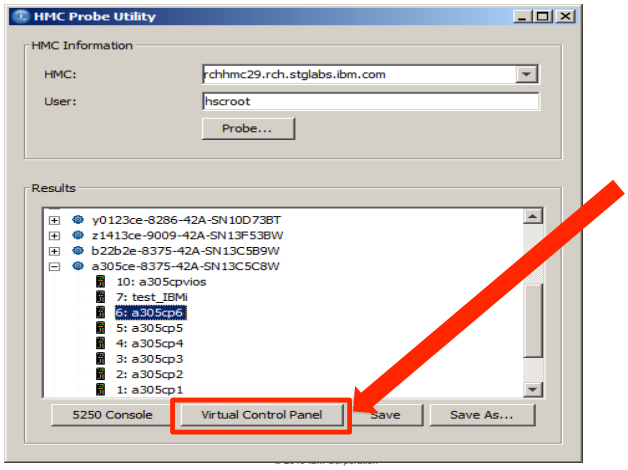
HMC Probe Utility



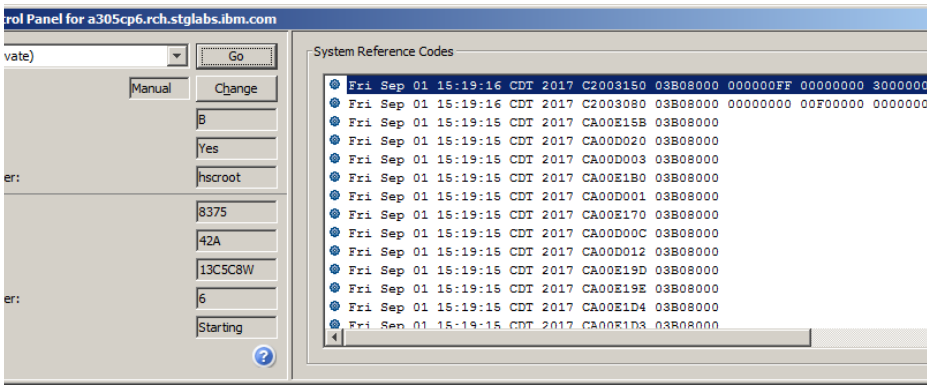
HMC Probe Utility



HMC Probe Utility



HMC Probe Utility



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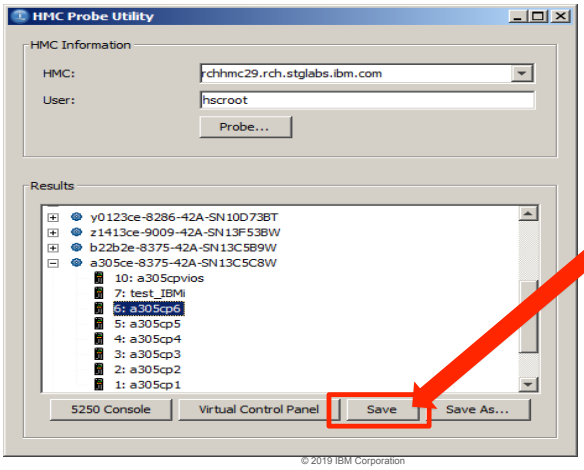

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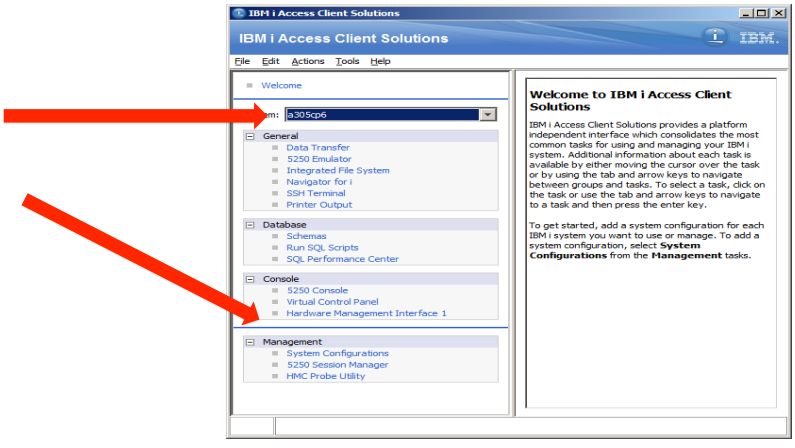

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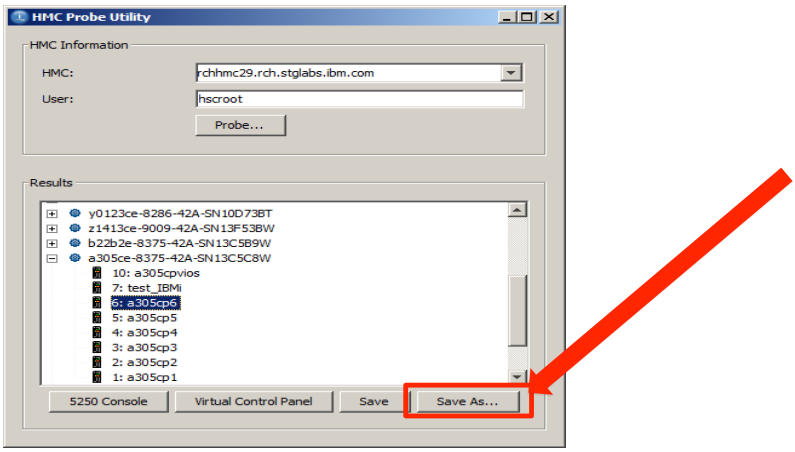

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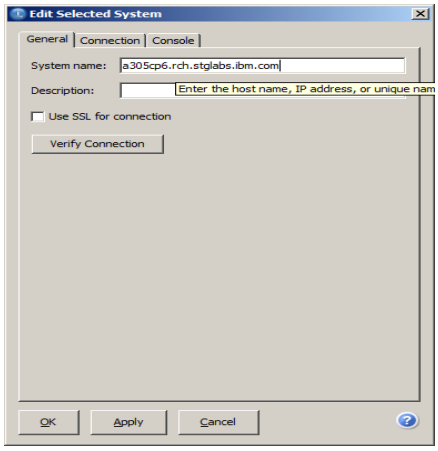

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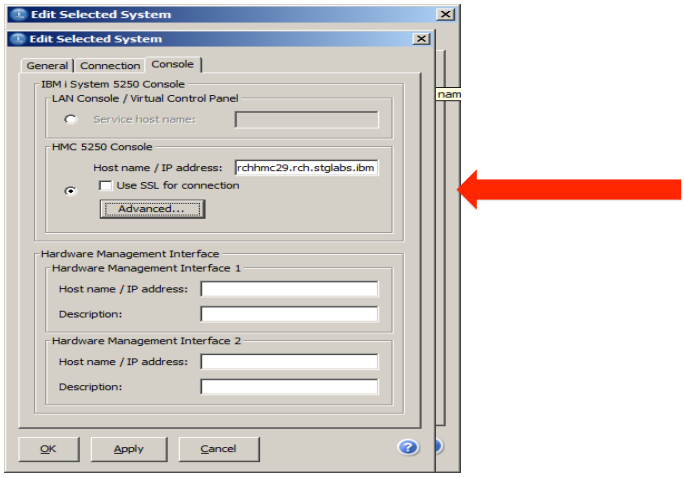

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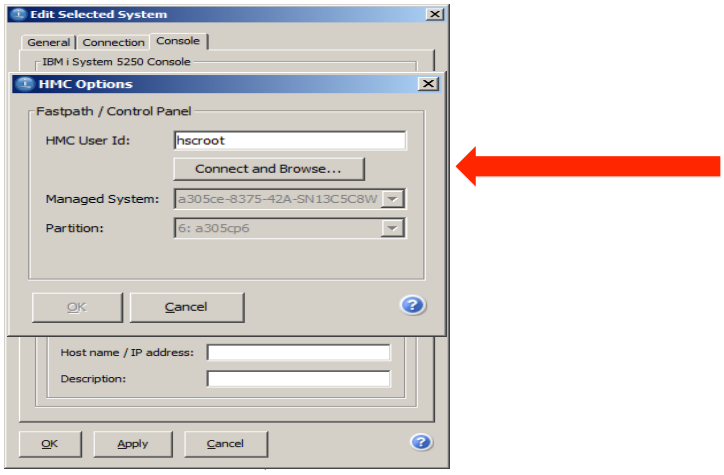
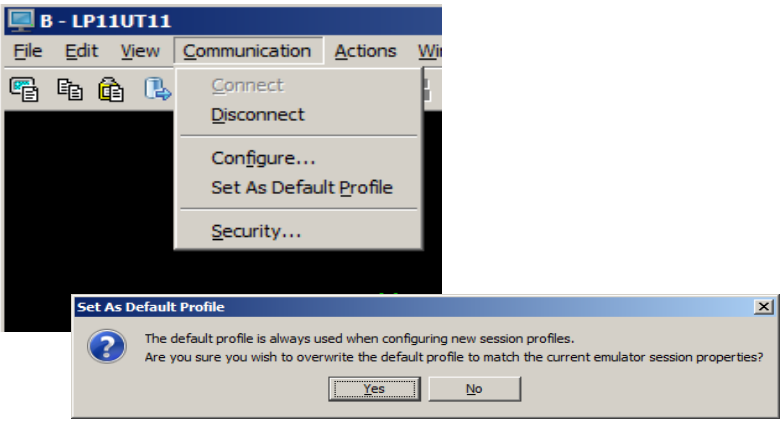


Access Client Solutions 5250: Save as Default Profile

J

ACS 5250: Save as Default Profile



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ACS 5250: Save as Default Profile

- Your current preferences will now be set as the default settings for all new 5250 sessions you create!
- This includes (but is not limited to)
  - Key mappings
  - Color mappings
  - Watermark settings
  - Screen history
  - SSL setting
  - Bypass signon
  - Screen Size (27x132)

J

rsync

J

rsync

- Synchronize files and directories between systems
- Cross-platform
- Various techniques for determining if file needs update

J

rsync

- Fast and versatile remote (and local) copying tool
- By default only transfers files whose modification times or sizes differ
- Uses a novel method to transfer only file deltas to speed up transfer
- Can be used to sync local directories or between a local and remote
- Can also be used as a remote transfer utility, ie. replace ftp or scp
- NOTE: To transfer remotely, you must have rsync installed on both systems
- https://rsync.samba.org/
- PTF is SI63268
  - 5733-OPS Option 7

J

rsync examples

```
# sync two folders, note the slash (important)
$ rsync -r src/ dst

# sync two folders and delete removed files
$ rsync -r --delete src/ dst

# sync local directory to remote directory
# this uses SSH to connect
$ rsync -r src/ user@system:dst
```

J

rsync options

- rsync is a powerful and somewhat complicated tool
- Lots of switches and options:
  - -r, recurse in to subdirectories
  - -l, copy symlinks as symlinks
  - -t, preserve modification times
  - -g and -o, preserve group and user ownership
  - -P, show progress while transferring
- Usually best to use -a (archive), equivalent to -rlptgoD
- Use --exclude to exclude files from the sync
- May want to use --delete if you want to remove deleted files on the destination
- Use -n, --dry-run to see what rsync would do without actually doing it

J

Incremental Backup

```
# create full backup from src to dst
$ rsync -a --delete src/ dst_full

# create Monday's incremental backup
$ rsync -a --delete --link-dest=dst_full src/ \
  dst_mon

# create Tuesday's incremental backup
$ rsync -a --delete --link-dest=dst_full src/ \
  dst_tue
```

J

Incremental Backup

```
$ find dst_full dst_mon dst_tue -type f
dst_full/myfile
dst_mon/myfile
dst_tue/myfile

ls -l dst_full/* dst_mon/* dst_tue/*
-rw-r--r-- 3 kadler 0 0 Apr 26 13:27 dst_full/myfile
-rw-r--r-- 3 kadler 0 0 Apr 26 13:27 dst_mon/myfile
-rw-r--r-- 3 kadler 0 0 Apr 26 13:27 dst_tue/myfile
```

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Browser-based Node.js debugging

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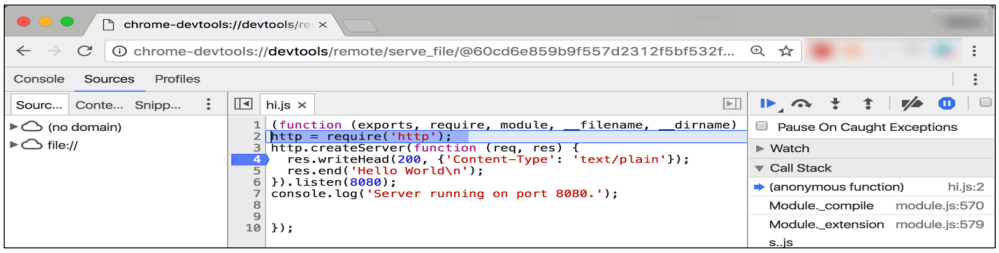
Debugging Node.js in a browser



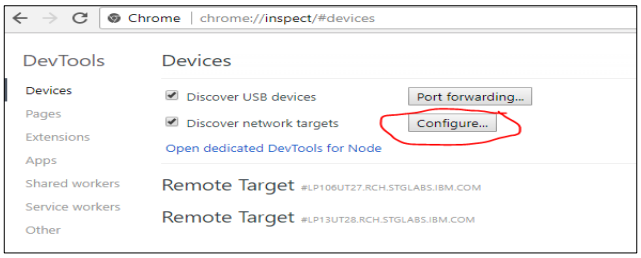
More debugging options: bit.ly/rs-debug-nodejs

J

Debugging Node.js in a browser

Visit `chrome://inspect` in chrome

Configure your hostname and port as a "network target" (port 9229 is default port)



J

Debugging Node.js in a browser

- $ node --inspect=0.0.0.0 hi.js
- Debugger listening on port 9229.

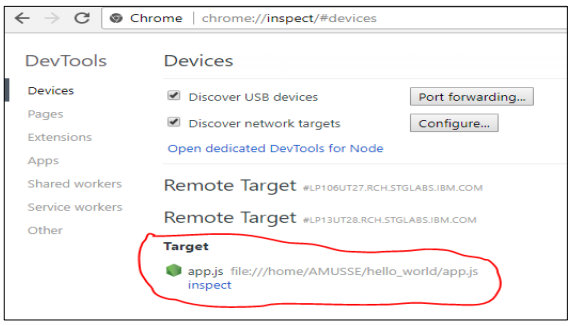
Start node with `--inspect`

NOTE: IP Address '0.0.0.0' is important!
Port will default to 9229 if not specified

J

Debugging Node.js in a browser

VOILA!! You will now see the remote target and can launch debug!



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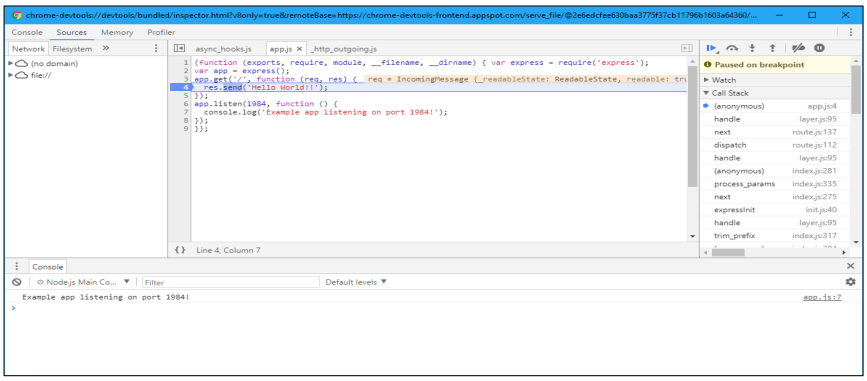


J

Database – Create or Replace Tables

S

Create OR REPLACE Table

Data Definition Language (DDL) SQL statements that support the optional 'OR REPLACE' clause:

- CREATE OR REPLACE ALIAS
- CREATE OR REPLACE FUNCTION
- CREATE OR REPLACE MASK
- CREATE OR REPLACE PERMISSION
- CREATE OR REPLACE PROCEDURE
- CREATE OR REPLACE SEQUENCE
- **CREATE OR REPLACE TABLE**
- CREATE OR REPLACE TRIGGER
- CREATE OR REPLACE VARIABLE
- CREATE OR REPLACE VIEW

Replacing a table:
- ü Data-Centric
- ü Dependent Views & MQTs preserved
- ü Triggers preserved
- ü RCAC controls preserved
- ü Auditing preserved
- ü Authorizations preserved
- ü Comments and Labels preserved
- ü Rows optionally deleted

Knowledge Center

http://www-01.ibm.com/support/knowledgecenter/ssw_ibm_i_72/db2/rbafzhctabl.htm?lang=en

Article for previous OR REPLACE statements

http://iprodeveloper.com/database/use-sql-create-or-replace-improve-db2-i-object-management

S

Create OR REPLACE Table

Drawbacks to using ALTER TABLE:
1) Complex to continually build the perfect set of changes
2) Change management products find it difficult to handle ALTER TABLE

Ø CREATE OR REPLACE TABLE allows users to manage the master table source.
Ø The attributes specified on the CREATE OR REPLACE TABLE will be compared to the existing attributes and the corresponding alters are performed.

Before

```
ALTER TABLE corpdata.employee

ALTER COLUMN firstnme
   SET DATA TYPE VARCHAR(20) NOT NULL

ALTER COLUMN lastname
   SET DATA TYPE VARCHAR(30) NOT NULL

ALTER COLUMN phoneno
  SET DATA TYPE VARCHAR(13)

ADD COLUMN level INT BEFORE edlevel
```

After

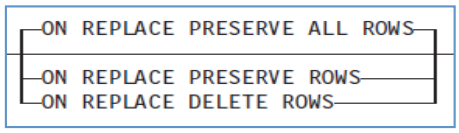
```
CREATE OR REPLACE TABLE corpdata.employee(
                empno CHAR(6) NOT NULL,
                firstnme VARCHAR(20) NOT NULL,
                midinit CHAR(1) NOT NULL,
                lastname VARCHAR(30) NOT NULL,
                workdept CHAR(3) DEFAULT NULL,
                phoneno VARCHAR(13) DEFAULT NULL,
 hiredate DATE DEFAULT NULL,
 job CHAR(8) DEFAULT NULL,
 level INT,
 edlevel SMALLINT NOT NULL,
 sex CHAR(1) DEFAULT NULL,
 birthdate DATE DEFAULT NULL,
 salary DECIMAL(9, 2) DEFAULT NULL,
 bonus DECIMAL(9, 2) DEFAULT NULL,
 comm DECIMAL(9, 2) DEFAULT NULL,
                PRIMARY KEY( empno ) )
```

S

Create OR REPLACE Table

Db2 for i implements table replacement using the necessary set of ALTER operations. If alter doesn't support the action, neither will create or replace table.

Usage Question: **Do you want to preserve the data?**



PRESERVE ALL ROWS (default)
- Rows are always preserved
- Columns can be dropped or altered

PRESERVE ROWS
- Rows are preserved, unless a range is eliminated from a partitioned table
- If a specified range or partition name matches, the partition is preserved
- Columns can be dropped or altered

DELETE ROWS
- All rows are deleted
- No delete triggers are fired

S

Create OR REPLACE Table

What about **CREATE TABLE AS or CREATE TABLE LIKE**?

```
CREATE OR REPLACE TABLE EMPLOYEE AS
(SELECT * FROM MASTER_TABLES.EMPLOYEE)
WITH NO DATA
INCLUDING IDENTITY COLUMN ATTRIBUTES
INCLUDING COLUMN DEFAULTS
INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES
INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES
ON REPLACE PRESERVE ROWS
```

Using CREATE TABLE AS
- Copy-options can be used to retain columns and attributes
- Constraints are not included
- Must use WITH NO DATA

```
CREATE OR REPLACE TABLE EMPLOYEE LIKE MASTER_TABLES.EMPLOYEE
INCLUDING IDENTITY COLUMN ATTRIBUTES
INCLUDING COLUMN DEFAULTS
INCLUDING IMPLICITLY HIDDEN COLUMN ATTRIBUTES
INCLUDING ROW CHANGE TIMESTAMP COLUMN ATTRIBUTES
ON REPLACE PRESERVE ROWS
```

Using CREATE TABLE LIKE
- Copy-options can be used to retain columns and attributes
- Constraints are not included

S

Create OR REPLACE Table

How does dependency management work?

```
CREATE OR REPLACE TABLE DEMO_IT (
      FRST CHAR(6) CCSID 37 NOT NULL,
                  SCND INTEGER,
      THRD VARCHAR(10)
)

CREATE OR REPLACE VIEW VIEW_IT AS
  SELECT * FROM DEMO_IT
CREATE INDEX INDEX_IT ON DEMO_IT(THRD);

CREATE OR REPLACE TABLE DEMO_IT (
 FIRST_NAME  FOR COLUMN FRST CLOB(1K) NOT NULL,
             SECOND_NAME FOR COLUMN SCND BIGINT DEFAULT -1,
 THIRD_NAME  FOR COLUMN THRD VARCHAR(1000)
)
```

Dependent object management:
- Column names (SQL names), data types and attribute changes are reflected in dependent objects
- System column names (field names) cannot be changed
- If Db2 for i cannot gain exclusive access to all the dependent objects, the operation will fail with SQL0913
- If the change is incompatible, the operation will fail

VIEW_IT field definitions before & after the replacing the table

```
Field Level Information
                Data          Field  Buffer
Field           Type         Length  Length
FRST            CHAR              6       6
  Default value . . . . . . . . . . . . . :
  Coded Character Set Identifier . . . . . :
SCND            BINARY           18   0     8
  Allows the null value . . . . . . . . . :
THRD            CHAR           1000    1002
  Variable length field . . . . . . . . . :
```

```
Field Level Information
                Data          Field  Buffer      Buffer
Field           Type         Length  Length      Position
FRST            CLOB           1024      32             1
  Allocated Length . . . . . . . . . . . :
  Default value . . . . . . . . . . . . . :
  Coded Character Set Identifier . . . . . :
SCND            BINARY           18   0     8         33
  Allows the null value . . . . . . . . . :
THRD            CHAR           1000    1002          41
  Variable length field . . . . . . . . . :
```

S

Create OR REPLACE Table

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VIEW_IT before the CREATE OR REPLACE of DEMO_IT

```
Field Level Information
            Data         Field  Buffer    Buffer         Field    Column
 Field      Type         Length  Length  Position        Usage    Heading
 FRST       CHAR              6       6         1        Both     FRST
   Default value . . . . . . . . . . . . :  None
   Coded Character Set Identifier  . . . . :    37
 SCND       BINARY         9  0         4         7        Both     SCND
   Allows the null value
 THRD       CHAR             10        12        11        Both     THRD
   Variable length field
   Allows the null value
   Coded Character Set Identifier  . . . . . :    37
```

VIEW_IT after the CREATE OR REPLACE of DEMO_IT

```
Field Level Information
            Data         Field  Buffer    Buffer         Field    Column
 Field      Type         Length  Length  Position        Usage    Heading
 FRST       CLOB           1024      32         1        Both     FRST
   Allocated Length . . . . . . . . . . :       0
   Default value . . . . . . . . . . . . :  None
   Coded Character Set Identifier  . . . . :    37
 SCND       BINARY        18  0        8        33        Both     SCND
   Allows the null value
 THRD       CHAR          1000      1002        41        Both     THRD
   Variable length field
   Allows the null value
   Coded Character Set Identifier  . . . . . :    37
```


Create OR REPLACE Table

Generating DDL for existing tables will normally produce separate statements for the table and its constraints.

Use the GENERATE_SQL() procedure to produce master table source.

```
CALL qsys2.generate_sql (
'EMPLOYEE',
'TOYSTORE_MINNESOTA_1',
'TABLE',
CREATE_OR_REPLACE_OPTION =>'1',
CONSTRAINT_OPTION =>'2')
```

```
CREATE OR REPLACE TABLE TOYSTORE_MINNESOTA_1.EMPLOYEE (
EMPNO CHAR(6) CCSID 37 NOT NULL ,
FIRSTNME VARCHAR(12) CCSID 37 NOT NULL ,
MIDINIT CHAR(1) CCSID 37 NOT NULL ,
LASTNAME VARCHAR(15) CCSID 37 NOT NULL ,
WORKDEPT CHAR(3) CCSID 37 DEFAULT NULL ,
PHONENO CHAR(4) CCSID 37 DEFAULT NULL ,
HIREDATE DATE DEFAULT NULL ,
JOB CHAR(8) CCSID 37 DEFAULT NULL ,
EDLEVEL SMALLINT NOT NULL ,
SEX CHAR(1) CCSID 37 DEFAULT NULL ,
BIRTHDATE DATE DEFAULT NULL ,
SALARY DECIMAL(9, 2) DEFAULT NULL ,
BONUS DECIMAL(9, 2) DEFAULT NULL ,
COMM DECIMAL(9, 2) DEFAULT NULL ,
CONSTRAINT TOYSTORE_MINNESOTA_1.Q_TOYST00001_EMPLOYEE_EMPNO_00001 PRIMARY KEY(
EMPNO ) ,
CONSTRAINT TOYSTORE_MINNESOTA_1.RED
FOREIGN KEY( WORKDEPT )
REFERENCES TOYSTORE_MINNESOTA_1.DEPARTMENT ( DEPTNO )
ON DELETE SET NULL
ON UPDATE NO ACTION ,
CONSTRAINT TOYSTORE_MINNESOTA_1.NUMBER
CHECK( PHONENO >= '0000' AND PHONENO <= '9999' ) )
```

Constraints

S

Managing Database Changes in Production

Fair Lock Option

Challenge: Frequent DML activity blocks DDL request

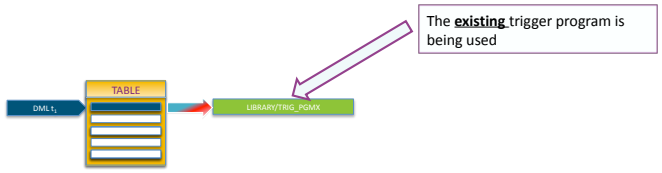
Response: **PREVENT_ADDITIONAL_CONFLICTING_LOCKS** QAQQINI control

Benefit: Improved ability to transform data model in production

Support: Applies to ALTER TABLE (Add, Alter or Drop Column), CREATE TRIGGER, LOCK TABLE, & RENAME TABLE

Fair Lock Option

Challenge: Seemingly impossible to make DDL changes in production
Response: **ALLOW_DDL_CHANGES_WHILE_OPEN** QAQQINI control
Benefit: Ability to deploy trigger changes without quiescing user activity
Support: Applies to CREATE TRIGGER, ALTER TRIGGER, DROP TRIGGER, COMMENT ON TRIGGER, and LABEL ON TRIGGER, ADDPFTRG, RMVPFTRG, and CHGPFTRG



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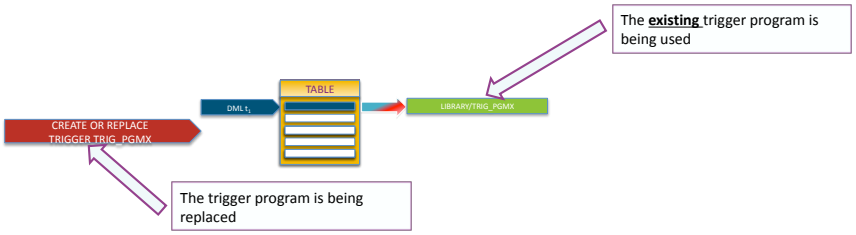

S

Fair Lock Option

Challenge: Seemingly impossible to make DDL changes in production
Response: **ALLOW_DDL_CHANGES_WHILE_OPEN** QAQQINI control
Benefit: Ability to deploy trigger changes without quiescing user activity
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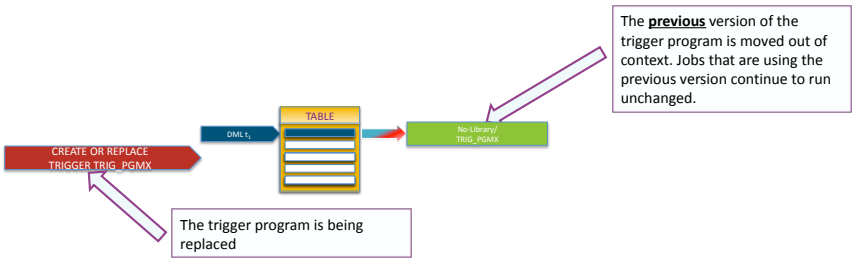

S

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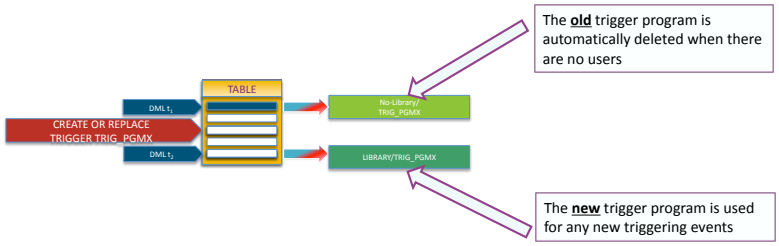


S

Fair Lock Option

- Using the QAQQINI (Query Options) control
  -- CHGQRYA
  -- OVERRIDE_QAQQINI

```
call qsys2.override_qaqqini(1, '', '');
call qsys2.override_qaqqini(2,
                    'ALLOW_DDL_CHANGES_WHILE_OPEN',
                    '*YES');

CREATE OR REPLACE TRIGGER toystore.new_hire
 AFTER INSERT ON toystore.employee
   FOR EACH ROW MODE DB2SQL
     UPDATE toystore.company_stats
       SET Number_of_employees = Number_of_employees + 1;
```

Article for Managing Trigger Programs in Production

http://ibmsystemsmag.com/blogs/i-can/august-2017/manage-trigger-programs-in-productions/

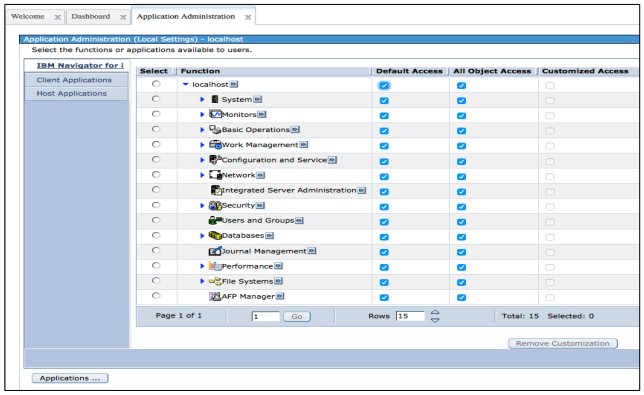
S

Navigator for i – Application Administration

192

Application Administration for Navigator for i

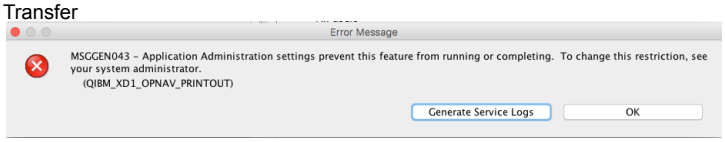
Control who can access what tasks in Navigator for i



T

And … Application Administration applies to Access Client Solutions

- Access configured in Application Administration now applies for Access Client Solutions
  - Added in January 2017
- Application Administration for Navigator functions
  - Printer Output
  - Integrated File Systems
  - Database tasks (Run SQL Scripts and SQL Performance Center)
- Application Administration for Client Applications
  - 5250 emulator
  - Data Transfer



http://ibmsystemsmag.com/blogs/i-can/february-2017/application-administration-with-access-client-solu/

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T

noxDB

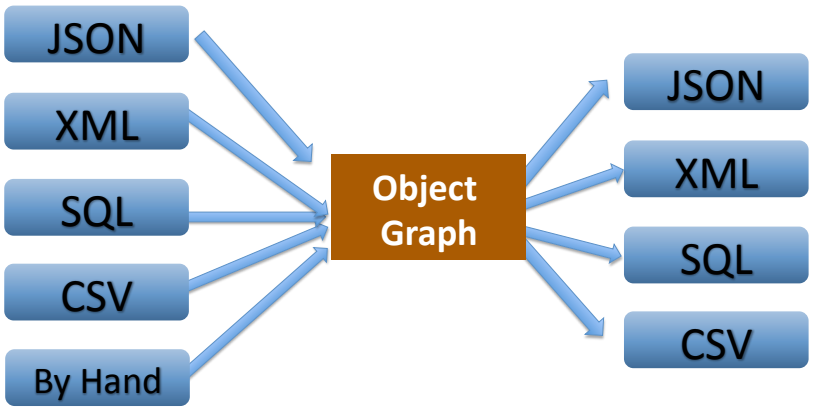
J

noxDB – Not Only XML

- opensource framework
- Work with
  - XML
  - JSON
  - SQL
- One single approach - From within RPG.
- https://github.com/NielsLiisberg/noxDB

J

RPG Data manipulation and transformation



J

Example

```
pJson = JSON_ParseString('[            -
  {a:"Hello",b:1,c:22.7},              -
  {a:"Yes\" you can",b:2,c:3.14}       -
]');

json_WriteJsonStmf(pJson: '/jsonxml/out1.json': 1208: *OFF);
json_WriteXmlStmf (pJson: '/jsonxml/out1.xml' : 1208: *OFF);
json_WriteCsvStmf (pJson: '/jsonxml/out1.csv' : 1208: *OFF :
  '{ decPoint:",",  delimiter:";",  headers:true}'
);

json_Close(pJson);
```

J

Example

```
pJson = Json_ParseFile ('/samples/json/simple.json');

if Json_Error(pJson) ;
   msg = Json_Message(pJson);
   Json_dump(pJson);
   Json_Close(pJson);
   return;
endif;

// Locate and return the value:
pNode = Json_Locate(pJson: '/price');
price = Json_GetNum(pNode);

// Or in one go:
price = Json_GetNum(pJson: '/price');
text  = Json_GetStr(pJson: '/text');

// Or in one go - with deafults if not found
id    = Json_GetNum(pJson: '/id'   : -1 );
text  = Json_GetStr(pJson: '/desc': 'N/A');
```

J

IBM i Community

A

IBM i Community

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http://www.ibmsystemsmag.com/Blogs/i-Can/

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A

IBM Rochester is Special

205

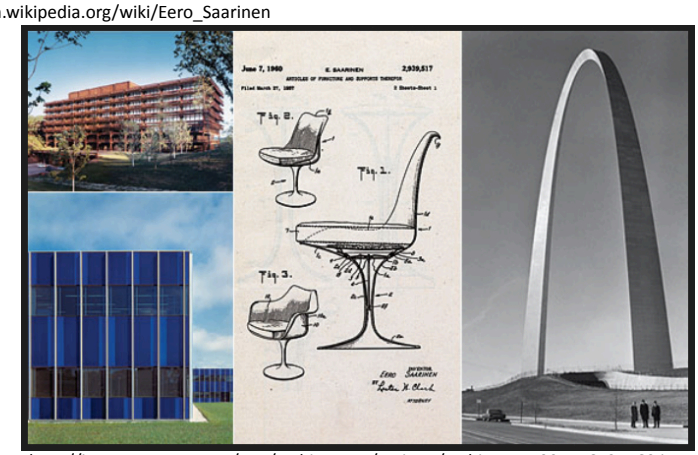
What do IBM Rochester, Minnesota, (home of IBM i)….

and St. Louis, Missouri …

have in COMMON ?

The same architect - Eero Saarinen

https://en.wikipedia.org/wiki/Eero_Saarinen



http://images.nymag.com/arts/architecture/reviews/architecture091116_2_560.jpg

Other Famous Works by Eero Saarinen

IBM Rochester's Architect

Eero Saarinen
https://en.wikipedia.org/wiki/Eero_Saarinen

Hidden Gems of IBM i

Alison Butterill
WW IBM i Offering Manager

And the IBM i Team

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