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Common Europe Luxembourg
Introducing IBM eServer i5 & 

Best Practices : Backup & Recovery
by Eddy Pasteger

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About this presentation

Objectives

- Review of ways to save/restore information from/to an iSeries server, even well-know ones

Warning

- This presentation is built on functionalities available starting i5/OS V5R3



Best Practices : Backup & Recovery

Agenda

- Chapter 1. Introduction
- Chapter 2. Back to Basics
 - The essentials for save/restore
- Chapter 3. Advanced Techniques
 - Techniques to reduce backup window and/or system unavailability
 - Techniques to improve recovery point
- Chapter 4. Recovery & Recovery Tests
 - Tips to avoid another disaster during recovery ...
- Chapter 5. Specific Applications
 - Or how to save/restore Lotus Domino, IXS/IXA, LPARed Linux, WebSphere MQ
- Chapter 6. More Good Stuff ...
 - Some functionalities and products
 - Discussion beyond the scope of this presentation ...

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Backup & Recovery

Chapter 1. Introduction

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Introduction

What is a "Backup" ?

- Backup is the activity of copying information so that it will be preserved "in case of"

Why "Backup" ?

- To be able to recover !

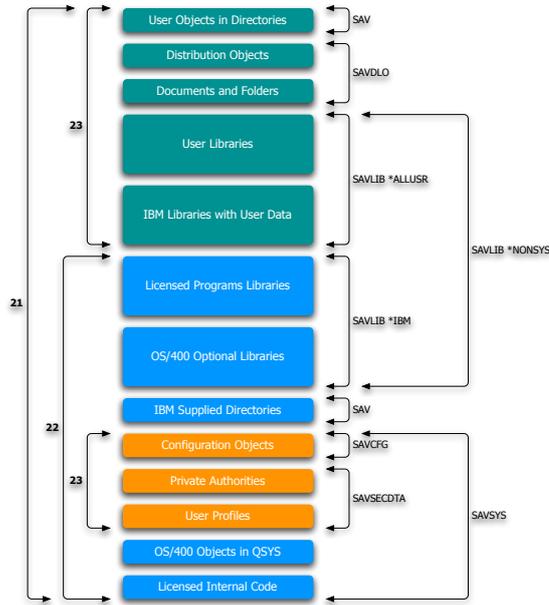
Why "Recover" ?

- Because "errare humanum est"
 - Because machines are made by human beings
 - Because of catastrophes
 - Because of malice
- And especially ... because of everything you don't think about !

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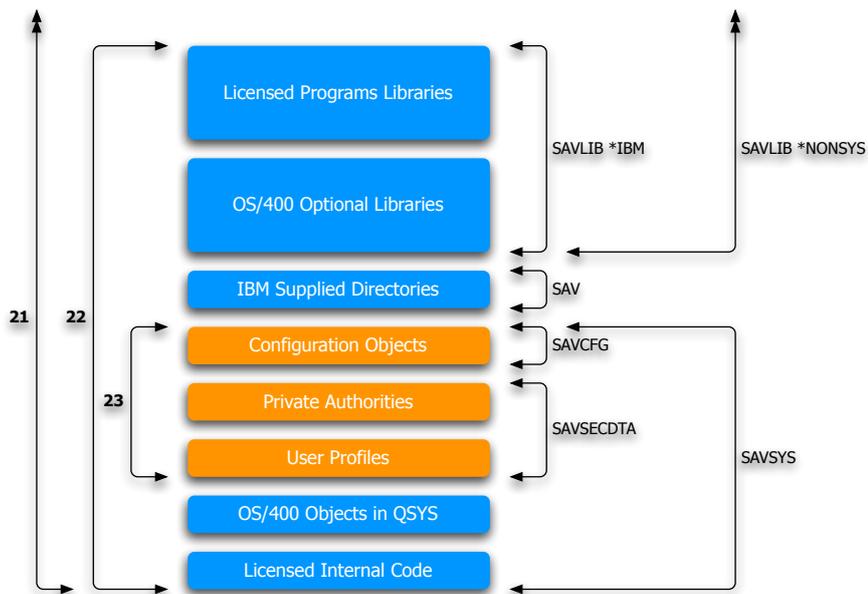
Back to Basics

The Right Stuff to Save ...



Back to Basics

Saving System Information ...



Back to Basics

SAVSYS

- The "SAVe SYStem" command ...
 - Saves the Licensed Internal Code
 - Saves the disk configuration
 - Saves the base of the Operating System (objects in QSYS)
- ... in a format compatible with the installation of the iSeries
- It does not save any object on any other library
 - Beware of objects insanely created into QSYS !
- In addition, it saves
 - The security (see also SAVSECDTA)
 - The configuration (see also SAVCFG)
- Restrictions :
 - All subsystems must be inactive
- Tip for "geeks"
 - History information for data area QSYS/QSAVSYS ...
- Restore commands :
 - NONE : the system's base must be installed !
 - RSTUSRPRF to restore the SAVSECDTA part
 - RSTCFG to restore the SAVCFG part

Licensed Programs Libraries

OS/400 Optional Libraries

IBM Supplied Directories

Configuration Objects

Private Authorities

User Profiles

OS/400 Objects in QSYS

Licensed Internal Code

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SAVSECDTA

- The "SAVe SECurity DaTA" command ...
 - Saves User profiles
 - Saves Group profiles
 - Saves Private authorities
 - Saves Authorization lists
 - Saves Authority holders
- Does not require a system in a restricted state
- Restrictions :
 - Changes to USRPRF made while SAVSECDTA run may or may not be reflected on media
 - Concurrent runnings of SAVSECDTA are not allowed
- Tips for "geeks"
 - History information for data area QSYS/QSAVUSRPRF ...
- Restore commands :
 - RSTUSRPRF

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OS/400 Optional Libraries

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SAVCFG

- The "SAVE ConFIguration" command ...
 - Saves line descriptions
 - Saves controller descriptions
 - Saves device descriptions
 - Saves mode descriptions
 - Saves class-of-service descriptions
 - Saves network server descriptions
 - Saves configuration lists
 - Saves validation lists
 - Saves hardware resources data (SMR)
- Restrictions
 - System resources management (SMR) are not saved if command WRKHDWPRD is running !
- Tip for "geeks"
 - History information for data area QSYS/QSAVCFG ...
- Restore commands :
 - RSTCFG

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SAVCFG

- SAVCFG does not saves "ALL" configuration ... (some myths) :
 - DHCP configuration (located into IFS)
 - Directory Server (LDAP) (located into library QDIRSRV and into IFS)
 - Domino server configuration (located elsewhere ... ;-) !)
 - DNS configuration (located into IFS)
 - HTTP server configuration (located into IFS)
 - Management Central configuration (located into library QUSRSYS)
 - NTP configuration (located into IFS)
 - SMTP configuration (located into library QUSRSYS)
 - SNADS configuration (located into library QUSRSYS)
 - TCP/IP configuration (located into library QUSRSYS)
 - WebSphere MQ configuration (located elsewhere ... ;-) !)
- ... etcaetera ...
- LOT (not "ALL") of configuration information is located :
 - Into library QUSRSYS
 - Into /QIBM/UserData directory
 - Into /QIBM/QOpenSys/UserData directory

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OS/400 Objects in QSYS

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SAVLIB LIB(*IBM)

- Saves system libraries
 - All libraries whose name begins by letter "Q", except :
 - QDOC, QDOCxxxx, QDSNX
 - QGPL, QGPL38
 - QMGTC, QMGTC2, QMPGDATA, QMPGPROC
 - QPFRDATA,
 - QRECOVERY, QRCL, QRCLxxxx, QRCYxxxx, QRPLxxxx (*)
 - QSPL, QSPLxxxx, QSRV (*)
 - QSYS, QSYSxxxx, QSYS2, QSYS2xxxx
 - QSRVAGT
 - QS36F
 - QTEMP (*)
 - QUSER38, QUSRADSM, QUSRBRM, QUSRDIRCL, QUSRDIRDB, QUSRIDS, QUSRNOTES, QUSROND, QUSRPYSVR, QUSRPOSGS, QUSRPOSSA, QUSRRDARS, QUSRVI
 - QUSRSYS, QUSRVxRyMx
 - Beware of the "Q"
- Restore commands :
 - RSTLIB, RSTOBJ



Licensed Programs Libraries

OS/400 Optional Libraries

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Configuration Objects

Private Authorities

User Profiles

OS/400 Objects in QSYS

Licensed Internal Code

(*) These libraries contains temporary information. They are not saved nor restored !

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Back to Basics

SAVLICPGM

- The "SAVe LICensed ProGraM" command ...
 - Save a copy of all the objects that make up a licensed program
- ... in a format compatible with the installation processes
- Restore commands :
 - RSTLICPGM



Licensed Programs Libraries

OS/400 Optional Libraries

IBM Supplied Directories

Configuration Objects

Private Authorities

User Profiles

OS/400 Objects in QSYS

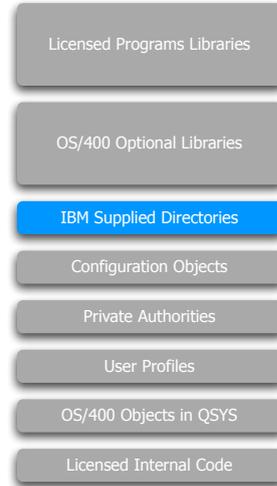
Licensed Internal Code

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Back to Basics

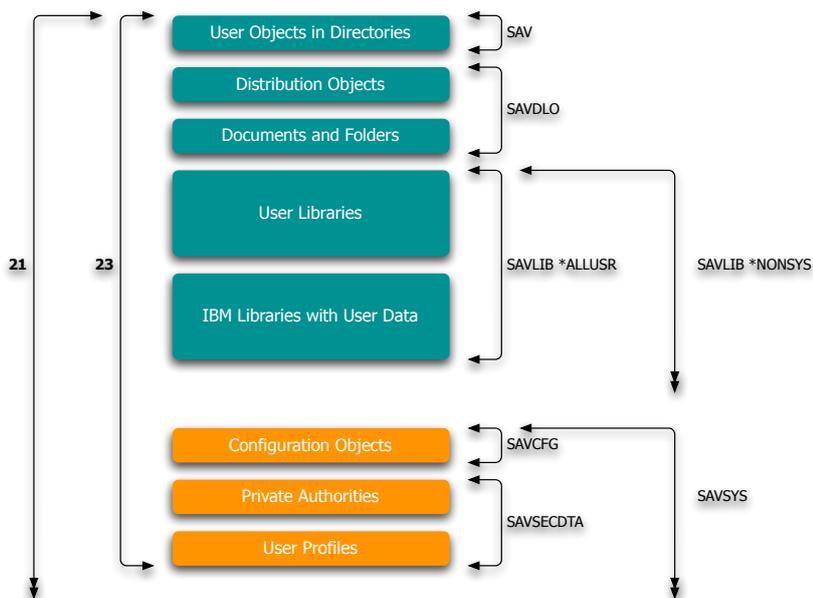
SAV

- IBM products or parts of IBM products located into IFS directories :
 - /QIBM/ProdData
 - /QOpenSys/QIBM/ProdData
- Warning: user parts of these IBM products are located into other IFS directories :
 - /QIBM/UserData
 - /QOpenSys/QIBM/UserData
- Restore commands :
 - RST

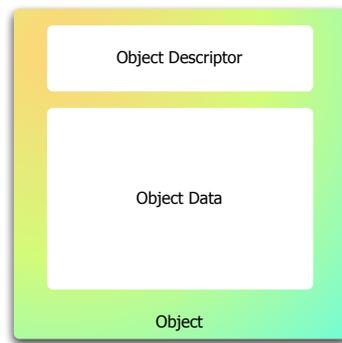


Back to Basics

Saving User Information ...



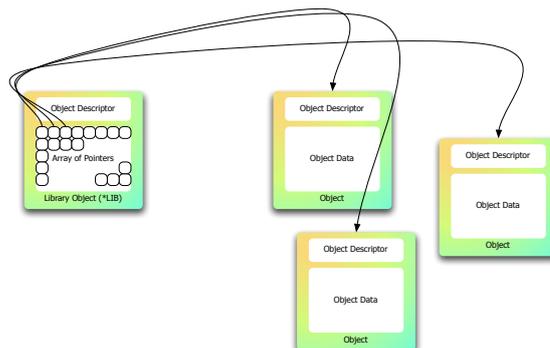
Back to Basics



About Libraries and objects ...

- Understand what an object is
 - Object descriptor : common part of all object
 - Object data : specific part depending on object structure

Back to Basics



About Libraries and objects ...

- Understand what a library is ...
 - Object descriptor : describes the library as any other object
 - Object data : array of pointers used to collect objects

Back to Basics

SAVLIB LIB(*ALLUSR)

- Saves user libraries
 - All libraries whose name does NOT begins by letter "Q" apart from :
 - QDOC, QDOCxxxx
 - QRECOVERY, QRCL, QRCLxxxx, QRCYxxxx, QRPLxxxx (*)
 - QSPL, QSPLxxxx, QSRV (*)
 - QSYS, QSYSxxxx, QSYS2, QSYS2xxxx
 - QTEMP (*)
 - Especially (but not exhaustive)
 - QGPL, QUSRSYS
 - QUSRxxxx
 - Beware of the "Q" !
- BUT, saves also
 - A file, labeled QFILE, containing a list of saved libraries
 - Used by equivalent restore function
- Restore commands
 - RSTLIB, RSTOBJ

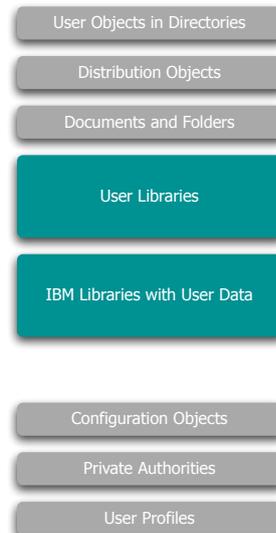


(*) These libraries contains temporary information. They are not saved nor restored !

Back to Basics

SAVLIB

- The "SAVe LIBrary" command ...
 - Saves the library object
 - Saves all the objects within that library
- LIB (...)
 - *ALLUSR
 - *IBM
 - *NONSYS
 - Library names
- OMITLIB (...)
 - Library names
- OMITOBJ (...)
 - Object names
- Restore commands
 - RSTLIB, RSTOBJ



(*) These libraries contains temporary information. They are not saved nor restored !

Back to Basics

SAVOBJ

- The "SAVE OBJECT" command ...
 - Saves objects
- LIB (...)
 - *ALLUSR
 - *IBM
 - *NONSYS
 - Library names
- OMITOBJ (...)
 - Object names
- OMITLIB (...)
 - Library names



User Objects in Directories

Distribution Objects

Documents and Folders

User Libraries

IBM Libraries with User Data

Configuration Objects

Private Authorities

User Profiles

(*) These libraries contains temporary information. They are not saved nor restored !

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About Document Library Objects

- What are DLOs ?
 - Hierarchical structure composed of "folders" and "documents"
 - Introduced mainly to support obsolete applications such OV/400, WAF/400, ...
- How DLOs are stored ?
 - DLOs stored in the system ASP : into library QDOC
 - DLOs stored in user ASPs : into library QDOCxxxx
 - Plus ... a set of indexes located into QUSRSYS
 - Files QAOSxxxx
- How DLOs are accessed ?
 - Via native DLO commands and menus
 - Via DLO APIs
 - Via the IFS (Integrated File System)
 - Since V3R1, via a file system named "QDLS" (Document Library Service)
- Warning
 - Accesses are limited to the only users registered into SDD (System Distribution Directory)

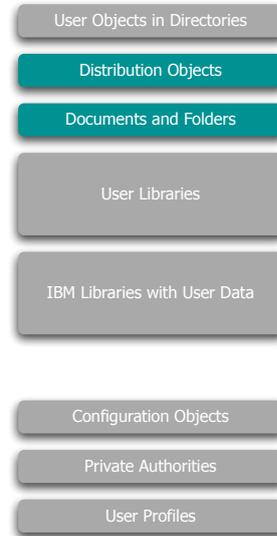


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SAVDLO

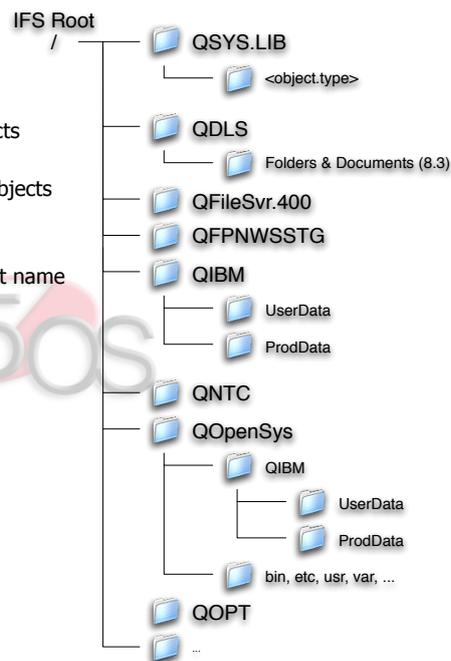
- The "SAVE Document Library Objects" command ...
 - Saves folders and documents of the document library service (DLS)
 - Saves distribution objects
- Restore Commands
 - RSTDLO



Back to Basics

About Integrated File System

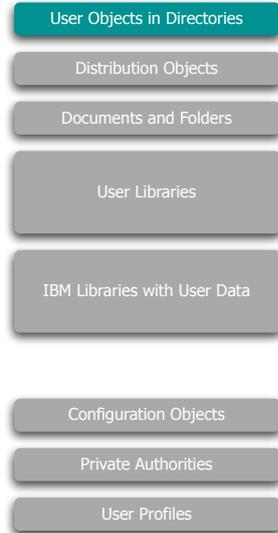
- Understand what IFS is ...
 - Directory
 - An object used to collect/locate other objects
 - Link
 - A named connection between directories/objects
 - Hard link vs. symbolic link
 - Path Name
 - Sequence of directory names plus an object name
 - Stream File
 - A randomly accessible sequence of bytes
 - Open Standards : ISO 10646
 - *TYPE1 = UCS2 Level 1 (aka. UNICODE)
 - *TYPE2 = UTF-16
 - Extended Attributes
 - .SUBJECT
 - .TYPE
 - .CODEPAGE



Back to Basics

SAV

- The "SAVE" command ...
 - Saves a specific object
 - Saves a directory or subdirectory
 - Saves an entire file system
 - Saves objects that meet search values
- Restore commands :
 - RST



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SAV

- What about QSYS.LIB
 - Native objects can be saved thru SAV, but restrictions applies
- You CAN :
 - Save a library :
 - SAV ... /QSYS.LIB/<library_name>.LIB
 - Save all objects within a library :
 - SAV ... /QSYS.LIB/<library_name>.LIB/*
 - Save objects of a specific type within a library :
 - SAV ... /QSYS.LIB/<library_name>.LIB/*.<object_type>
 - Save a specific objects within a library :
 - SAV ... /QSYS.LIB/<library_name>.LIB/<object_name>.<object_type>
 - ...

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SAV

- What about QSYS.LIB
 - Native objects can be saved thru SAV, but restrictions applies
- You CANNOT :
 - Save some type of "system" objects (e.g. *USRPRF)
 - Save QSYS itself, nor QSYSxxxx
 - Save QDOC, nor QDOCxxxx
 - Save QRECOVERY, nor QRCYxxxx
 - Save QRPLOBJ, nor QRPLxxxx
 - Save QSPL, nor QSPLxxxx
 - Save QSRV
 - Save QTEMP
 - Save changed objects
 - Save while active
- Recommendation
 - Prefer SAVLIB/SAVOBJ command to save native objects



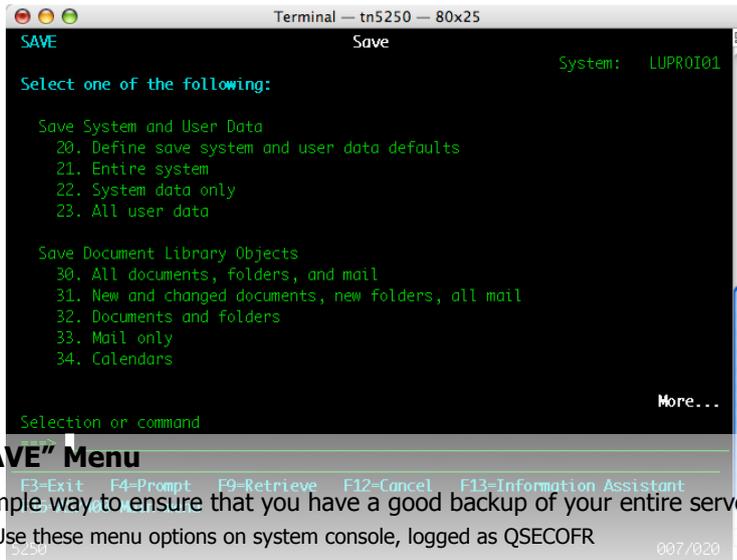
Back to Basics

SAV

- What about QDLS
 - DLOs can be saved thru SAV, but restrictions applies
- The OBJ and SUBTREE must be one of the following
 - OBJ('/QDLS/... path .../<folder_name>') SUBTREE(*ALL)
 - OBJ('/QDLS/... path .../<document_name>') SUBTREE(*OBJ)
- Other restrictions
 - Save changed objects
 - Save while active
- Recommendation
 - Prefer SAVDLO command to save DLOs



Back to Basics

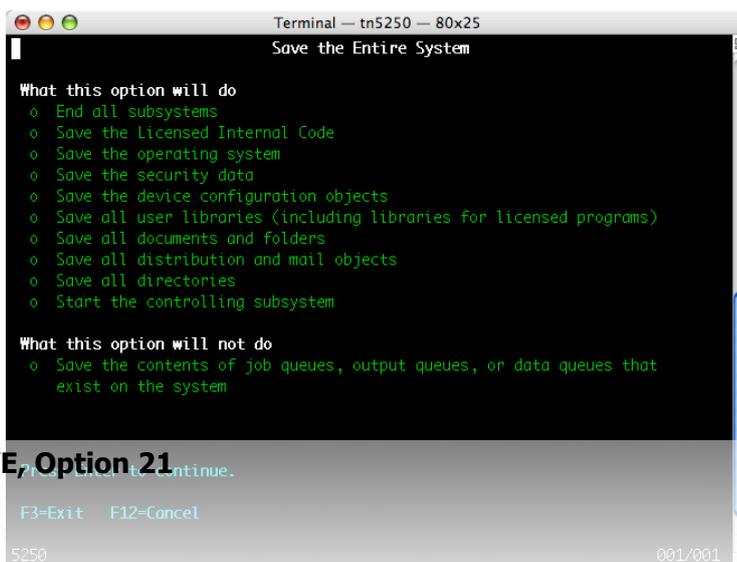


```
Terminal — tn5250 — 80x25
SAVE                                     Save                               System: LUPR0101
Select one of the following:
Save System and User Data
 20. Define save system and user data defaults
 21. Entire system
 22. System data only
 23. All user data
Save Document Library Objects
 30. All documents, folders, and mail
 31. New and changed documents, new folders, all mail
 32. Documents and folders
 33. Mail only
 34. Calendars
More...
Selection or command
F3=Exit  F4=Prompt  F9=Retrieve  F12=Cancel  F13=Information Assistant
5250                                         007/020
```

The "SAVE" Menu

- A simple way to ensure that you have a good backup of your entire server
 - Use these menu options on system console, logged as QSECOFR

Back to Basics



```
Terminal — tn5250 — 80x25
Save the Entire System
What this option will do
o End all subsystems
o Save the Licensed Internal Code
o Save the operating system
o Save the security data
o Save the device configuration objects
o Save all user libraries (including libraries for licensed programs)
o Save all documents and folders
o Save all distribution and mail objects
o Save all directories
o Start the controlling subsystem
What this option will not do
o Save the contents of job queues, output queues, or data queues that
  exist on the system
7/10/01 12:00:00 Continue.
F3=Exit  F12=Cancel
5250                                         001/001
```

GO SAVE, Option 21

Back to Basics

GO SAVE, Option 21 : Save Entire System

- Program QSYS/QMNSAVE :
 - ENDSBS SBS(*ALL) OPTION(*IMMED)
 - CHGMSGQ MSGQ(QSYSOPR) DLVRY(*BREAK or *NOTIFY)
 - SAVSYS
 - SAVLIB LIB(*NONSYS) ACCPTH(*YES)
 - SAVDLO DLO(*ALL) SAVFLR(*ANY)
 - SAV DEV('/QSYS.LIB/<tape_device_name>.DEV'D) OBJ ((/*) ('/QSYS.LIB' *OMIT) + ('/QDLS' *OMIT))UPDHST (*YES)
 - STRSBS SBSD(<controlling_subsystem>)
- CL Program source can be retrieved !
 - RTVCLSRC ...



Back to Basics

```
Terminal — tn5250 — 80x25
Save System Data Only

What this option will do
  o End all subsystems
  o Save the Licensed Internal Code
  o Save the operating system
  o Save the security data
  o Save the device configuration objects
  o Save all IBM-supplied libraries
  o Save all IBM-supplied directories
  o Start the controlling subsystem

What this option will not do
  o Save user libraries or IBM-supplied libraries that contain user data
  o Save user directories or IBM-supplied directories that contain user data
  o Save documents, folders, or mail objects
  o Save the contents of job queues, output queues, or data queues that exist on the system

Bottom
Please enter a response.
F3=Exit  F12=Cancel
5250 001/001
```

Go SAVE, Option 22

Back to Basics

GO SAVE, Option 22 : Save System Data Only

- Program QSYS/QSRSAVI :
 - ENDSBS SBS(*ALL) OPTION(*IMMED)
 - CHGMSGQ MSGQ(QSYSOPR) DLVRY(*BREAK or *NOTIFY)
 - SAVSYS
 - SAVLIB LIB(*IBM) ACCPTH(*YES)
 - SAV DEV('/QSYS.LIB/<tape_device_name>.DEVD') OBJ (('QIBM/ProdData') + ('QOpenSys/QIBM/ProdData')) UPDHST (*YES)
 - STRSBS SBSD(<controlling_subsystem>)
- CL Program source can be retrieved !
 - RTVCLSRC ...



Back to Basics

A screenshot of a terminal window titled 'Terminal - tn5250 - 80x25'. The terminal displays a dialog box titled 'Save All User Data'. The dialog box contains two sections: 'What this option will do' and 'What this option will not do'. The 'What this option will do' section lists: 'End all subsystems', 'Save the security data', 'Save the device configuration objects', 'Save all user libraries and IBM-supplied libraries that contain user data', 'Save all documents and folders', 'Save all distribution and mail objects', 'Save all user directories and IBM-supplied directories that contain user data', and 'Start the controlling subsystem'. The 'What this option will not do' section lists: 'Save the Licensed Internal Code', 'Save the operating system', 'Save all IBM-supplied libraries', and 'Save all IBM-supplied directories'. At the bottom of the dialog box, it says 'More...' and 'F3=Exit F12=Cancel'. The terminal prompt shows '5250' and '001/001'.

GO SAVE, Option 23

Back to Basics

GO SAVE, Option 23 : Save All User Data

- Program QSYS/QSRSAVU :
 - ENDSBS SBS(*ALL) OPTION(*IMMED)
 - CHGMSGQ MSGQ(QSYSOPR) DLVRY(*BREAK or *NOTIFY)
 - SAVSECDTA
 - SAVCFG
 - SAVLIB LIB(*ALLUSR) ACCPTH(*YES)
 - SAVDLO(*ALL) FLR(*ANY)
 - SAV DEV('/QSYS.LIB/<tape_device_name>.DEV'D) OBJ (('/*') + ('/QSYS.LIB' *OMIT) ('/QDLS' *OMIT) ('/QIBM/ProdData' *OMIT) + ('/QOpenSys/QIBM/ProdData' *OMIT)) UPDHST (*YES) +
 - STRSBS SBSD(<controlling_subsystem>)
- CL Program source can be retrieved !
 - RTVCLSRC ...

Back to Basics

```
Terminal - tn5250 - 80x25
Define Save System and User Data Defaults

Type choices, press Enter.

Devices . . . . . AP02      Names
_____
_____

Prompt for commands . . . . . N      Y=Yes, N=No

Check for active files . . . . . N      Y=Yes, N=No

Message queue delivery . . . . . *NOTIFY  *BREAK, *NOTIFY

Start time . . . . . *CURRENT  *CURRENT, time

Vary off network servers . . . . . *ALL      *ALL, *NONE, *WINDOWSNT *GUEST

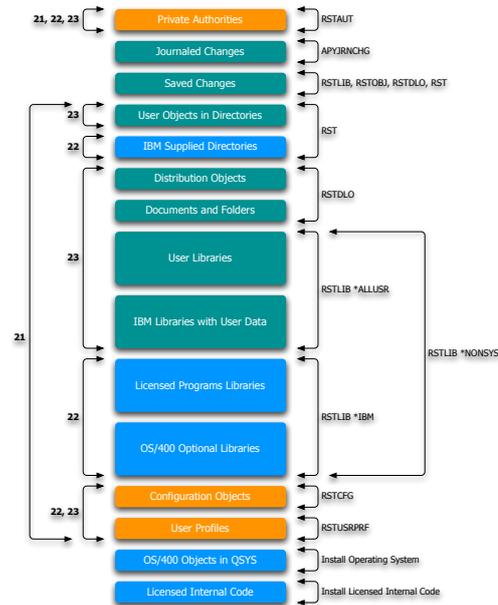
System . . . . . Y      Y=Yes, N=No
More...
```

GO SAVE, Option 20

- Used to fix parameter defaults for options 21, 22, 23

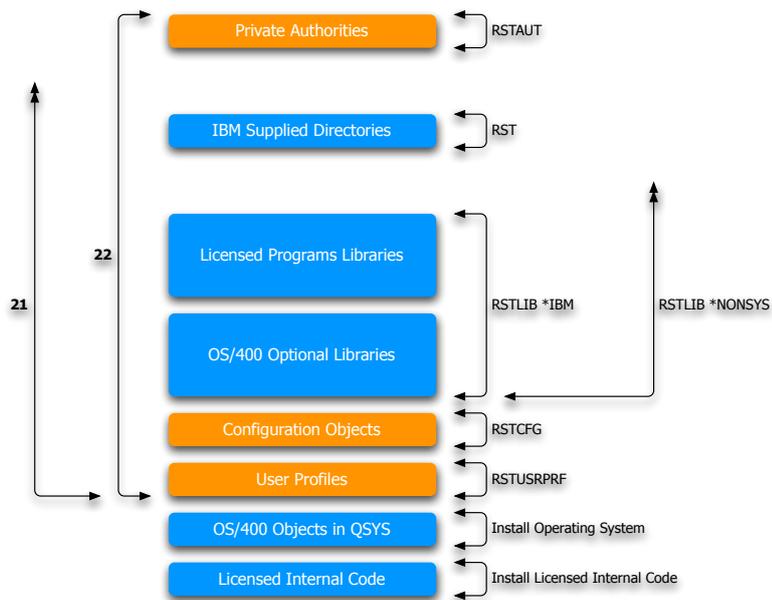
Back to Basics

The Right Stuff to Restore ...



Back to Basics

Restore System Information ...



Back to Basics

Recover the Licensed Internal Code

- How ?
 - Perform a manual D-Side IPL to mini-DST
 - Use "Install Licensed Internal Code" menu
 - Restore LIC
 - Install LIC and initialize the system
 - Install LIC and recover configuration
 - Install LIC and restore disk unit data
 - Install LIC and upgrade LSU
 - IPL on the installed LIC
 - Setup disk configuration
 - Start parity protection
 - Configure ASPs
 - Start mirrored protection



- BE CAREFUL -- UNDERSTAND WHAT YOU ARE DOING !



Back to Basics

Recover the Operating System

- How ?
 - Perform a manual B-Side IPL to DST
 - Use "Install Operating System" menu
 - Select and confirm installation an language
 - Select the right installation options
 - Complete or abbreviated installation
 - Select the right restore options
 - System information
 - Edit descriptions
 - Message reply list
 - Job descriptions
 - Subsystem descriptions
 - Define or change the system at IPL



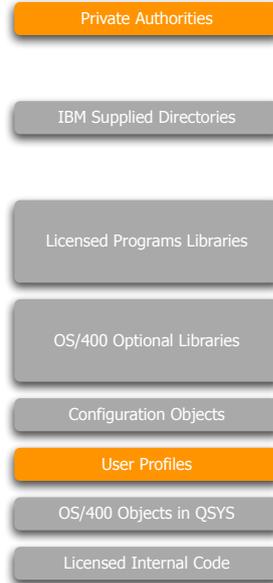
- BE CAREFUL -- UNDERSTAND WHAT YOU ARE DOING !



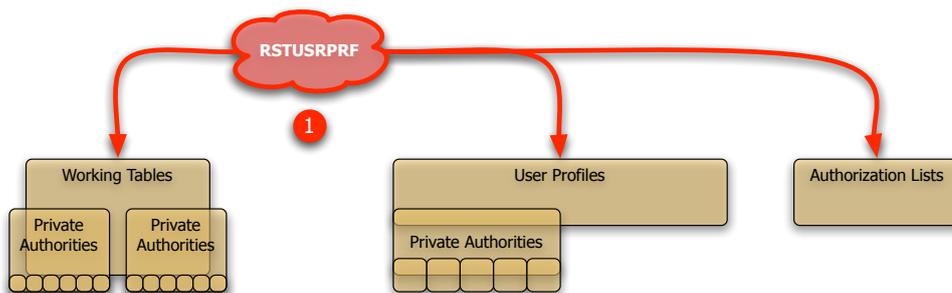
Back to Basics

Recover Security Information

- Security information consist of
 - User and group profiles
 - Authorization lists
 - Authority holders
 - Authority information stored with the objects
 - Owner and owner authority
 - Primary group and primary group authority
 - Public authority
 - Private authorities
- On tape : look for label QFILEUPR
- RSTUSRPRF USRPRF(*ALL) DEV(...)
SEQNBR(...) ENDOPT(*LEAVE) ALWOBJDIF(*ALL)
- IT IS ESSENTIAL THAT YOU RESTORE SECURITY INFORMATION IN THE CORRECT SEQUENCE !



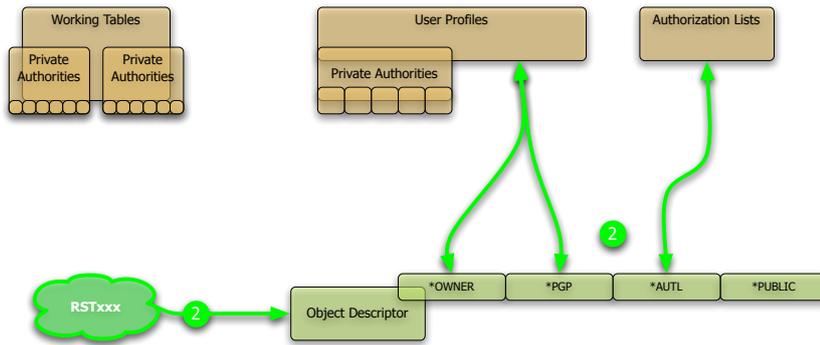
Back to Basics



Step ONE

- Restore user and group profiles
- Restore private authorities working tables
- Restore authorization lists and authority holders
- DO NOT IPL THE SYSTEM
 - Coz' IPL will clear working tables
 - RSTUSRPRF SECDTA(*PVTAUT)

Back to Basics



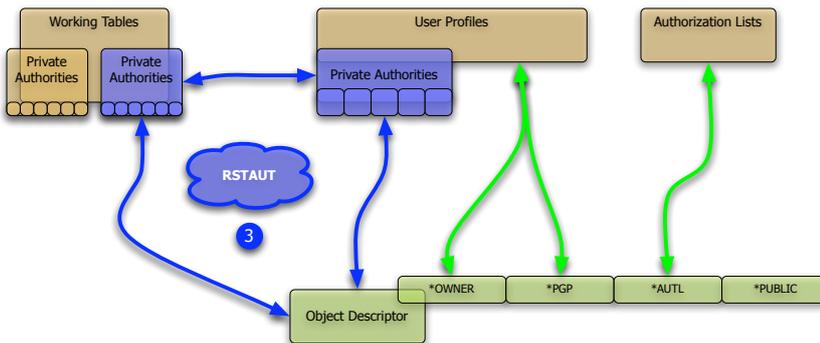
Step TWO

- Restore "native" objects (libraries and objects)
- Restore DLS objects
- Restore IFS objects

- How the system re-establish ownership ?
- How the system re-establish primary group ?
- How the system re-establish authorization list ?

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Back to Basics



Step THREE

- Restore private authorities

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Recover the Configuration Objects

- You can restore :
 - All configuration objects
 - A group of configuration objects by generic name
 - Specific type of configuration objects
 - System resource management information (SRM)
- On tape : look for label QFILEIOC
- RSTCFG OBJ(*ALL) DEV(...) OBJTYPE(*ALL) SRM(*NONE) SEQNBR(...) ENDOPT(*LEAVE) ALWOBJDIF(*ALL)

Private Authorities

IBM Supplied Directories

Licensed Programs Libraries

OS/400 Optional Libraries

Configuration Objects

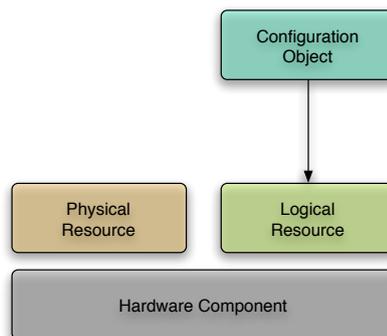
User Profiles

OS/400 Objects in QSYS

Licensed Internal Code

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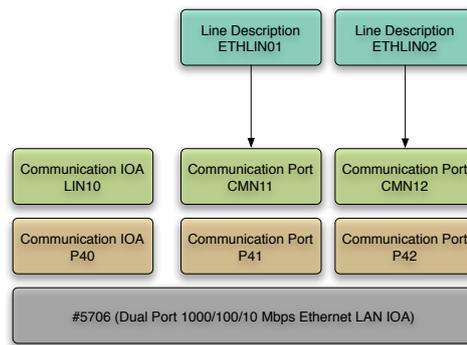


Understand Configuration

- Hardware component
 - The card itself (IOP or IOA)
- Physical resource
- Logical resource
- Configuration object
 - Line description, controller description, device description
 - LAN, WAN, LWS, TAP, TAPMLB, OPT, OPTMLB

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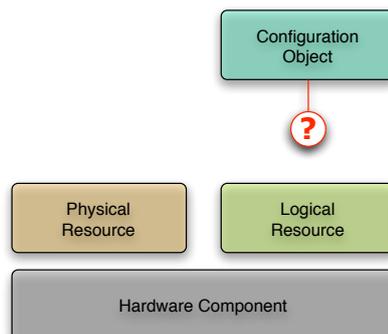


Understand Configuration by Example

- The adapter card is a #5706
- The physical resource name are P40/P41/P42
 - But we don't care about that
- The logical resource name are LIN10 for the IOA and CMN11/CMN12 for the ports
 - WRKHDWRSC TYPE(*CMN | *LWS | *STG)
- The configuration objects are two ethernet LAN line descriptions
 - CRTLINETH LIND(ETHLINxx) RSRCTYPE(CMNxx) ...

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Back to Basics



Understand Hardware Remapping

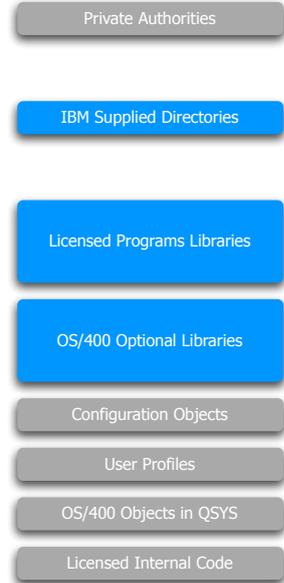
- When restoring configuration object to another system ...
 - Logical Hardware resource names are created during LIC installation
 - Hardware resource name contained within restored configuration same as it was at save time
 - They will not match !
- Action to make every configuration object using the right hardware resource
 - Individually, using resource management commands
 - Command WRKHDWPRD will help !

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Back to Basics

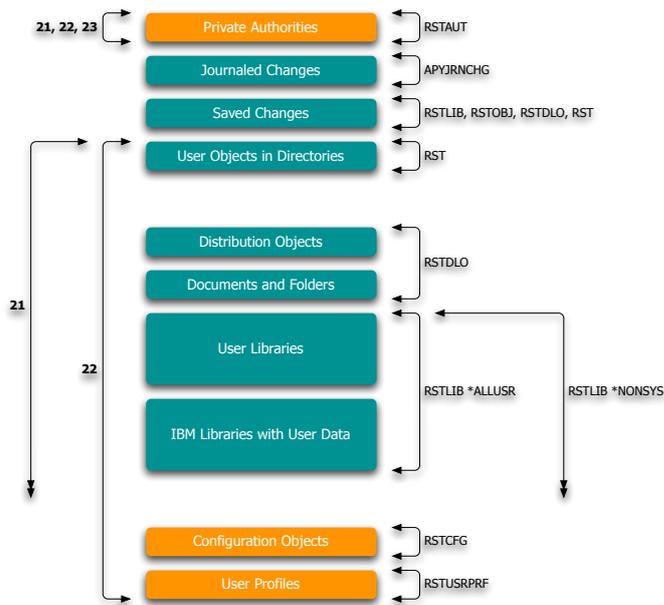
Recover the Other System Stuff

- Other system data to recover are located into
 - Libraries
 - IFS Directories
- Refer to "Restore User Information" ...



Back to Basics

Restore User Information ...



Back to Basics

Recover Libraries and Objects

- Restore multiple libraries
 - RSTLIB LIB(*NONSYS | *IBM | *ALLUSR) ...
 - RSTLIB LIB(<generic_library_name>) ...
 - RSTLIB LIB(<single_library_name>) ...
- Restore objects
 - RSTOBJ OBJ(...) TYPE(...)
- Formats are "compatible"
 - SAVLIB Multiple and RSTLIB Multiple
 - SAVLIB Multiple and RSTLIB Generic/List/Single
 - SAVLIB and RSTOBJ Generic/List/Single
- Remember
 - SEQ(...) ENDOPT(*LEAVE) ALWOBJDIF(*ALL)



Private Authorities

Journalled Changes

Saved Changes

User Objects in Directories

Distribution Objects

Documents and Folders

User Libraries

IBM Libraries with User Data

Configuration Objects

User Profiles

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Back to Basics

Recover Libraries and Objects

- The right restore sequence for libraries
 - QSYS2
 - QGPL
 - QUSRSYS
 - Other libraries
- The right restore sequence for objects
 - Library object
 - Journals
 - Physical files
 - Other journaled objects
 - Logical files
 - Journal receivers
- RSTLIB command is "aware" (at single library level)
 - It "knows" the right restore sequence (within a single library)



Private Authorities

Journalled Changes

Saved Changes

User Objects in Directories

Distribution Objects

Documents and Folders

User Libraries

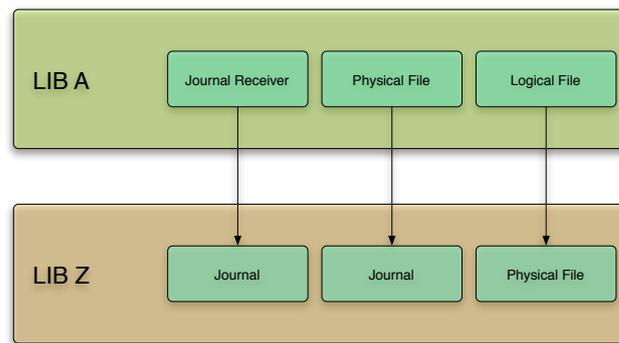
IBM Libraries with User Data

Configuration Objects

User Profiles

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Back to Basics



Restoring Libraries and Objects

- RSTLIB command is far less "aware" when restoring multiple libraries
 - RSTLIB LIB(*NONSYS | *IBM | *ALLUSR)
 - Libraries are restored by EBCDIC alphabetical order
 - Since V5R3 : QSYS2, QGPL and QUSRSYS are processed first
- This can be source of problems that need additional action
 - Journal receivers before journal object ... the journal receiver directory must be rebuilt
 - Physical files before journal object ... the files will no longer be journaled
 - Logical files before depending-on physical files ... these files will not be restored

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Back to Basics

Restoring Libraries and Objects : Geeks Corner

- About access paths
 - At save time : ACCPTH (*SYSVAL | *YES | *NO)
 - Access path description is always saved
 - Access path data may/may not be saved
 - Access path whose data is not saved must be rebuilt
 - Long running process, consuming lot of CPU and I/Os
 - EDTRBDAP
 - ALWAYS SAVE ACCESS PATHS DATA
- About referential constraints
 - Referential constraints are stored, saved and restored with the dependent files
 - PAY ATTENTION when restoring files that already exists on the system
 - Existing constraints are kept, the saved copies are not restored
- About triggers
 - Triggers definitions are stored, saved and restored with the dependent files
 - Make difference between trigger definition and trigger program
 - PAY ATTENTION when restoring files that already exists on the system
 - Existing triggers are kept, the saved copies are not restored

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Back to Basics

Recover the Document Library Objects

- RSTDLO DLO(*ALL) FLR(*ANY)
SEQ(...) ENDOPT(*LEAVE) ALWOBJDIF(*ALL)
→ Old stuff, no comment ...



Private Authorities

Journalled Changes

Saved Changes

User Objects in Directories

Distribution Objects

Documents and Folders

User Libraries

IBM Libraries with User Data

Configuration Objects

User Profiles

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Back to Basics

Recover the Objects in Directories

- The RST command restores a copy of one or more objects that can be used in the integrated file system
- Notes :
 - Objects CAN be restored to another directory path
 - Objects CANNOT be restored to another file system
- Reminder ... File Systems :
 - Root
 - QDLS
 - QFileSvr.400
 - QOpenSys
 - QOPT
 - QSYS.LIB



Private Authorities

Journalled Changes

Saved Changes

User Objects in Directories

Distribution Objects

Documents and Folders

User Libraries

IBM Libraries with User Data

Configuration Objects

User Profiles

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Back to Basics

Recover Additional Information

- Differential or incremental backups
 - RSTLIB, RSTOBJ, RSTDLO, RST
- Other single backups
 - RSTLIB, RSTOBJ, RSTDLO, RST
- Changes contained into journal receivers
 - Refer to "Advanced Techniques"



Private Authorities

Journalled Changes

Saved Changes

User Objects in Directories

Distribution Objects

Documents and Folders

User Libraries

IBM Libraries with User Data

Configuration Objects

User Profiles

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Back to Basics

Recover Private Authorities

- Refer to section "Recover Security Information"
- RSTAUT can be run in a non-restricted state
 - Runs multi-processed
 - Process multiple working table at the same time
 - Save up to 30% time
 - Subsystem QSYSWRK must be started
 - Coz' multiple prestared jobs runs here
- Warning : side effects ...
 - Locks !
 - Only one RSTAUT can be run on a system at a time
 - Do NOT cancel any of the prestared jobs in QSYSWRK
 - Doing so will cancel the entire RSTAUT command
- Important things to keep in mind
 - Restoring authorities is the last thing to do before doing IPL
 - RSTAUT can be a long running command
 - Depending on the number of private authorities

Private Authorities

Journalled Changes

Saved Changes

User Objects in Directories

Distribution Objects

Documents and Folders

User Libraries

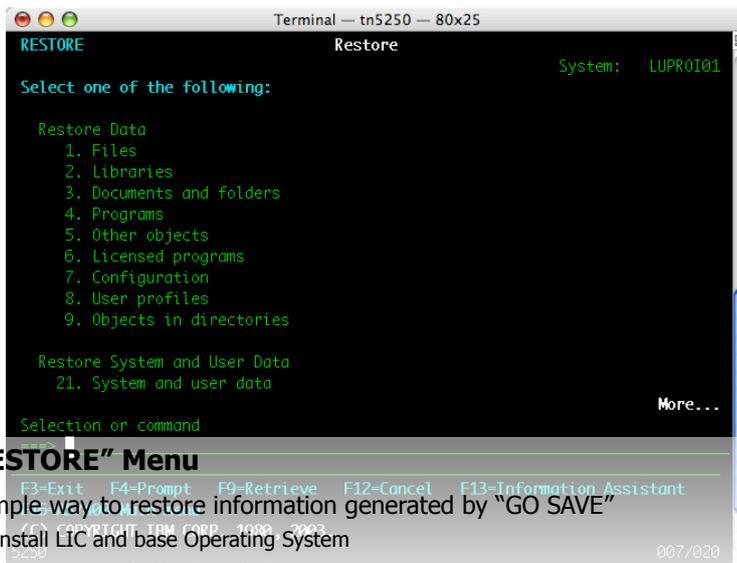
IBM Libraries with User Data

Configuration Objects

User Profiles

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Back to Basics

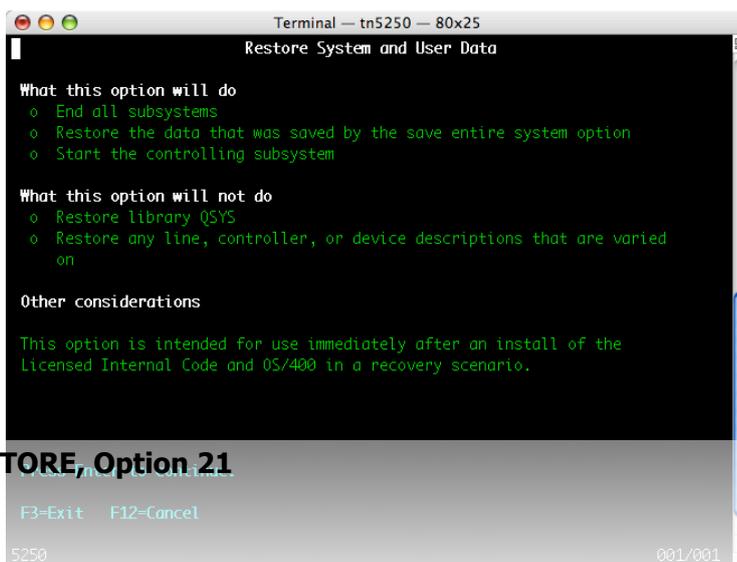


```
Terminal — tn5250 — 80x25
RESTORE                                Restore                                System: LUPR0101
Select one of the following:
Restore Data
 1. Files
 2. Libraries
 3. Documents and folders
 4. Programs
 5. Other objects
 6. Licensed programs
 7. Configuration
 8. User profiles
 9. Objects in directories
Restore System and User Data
21. System and user data
More...
Selection or command
F3=Exit  F4=Prompt  F9=Retrieve  F12=Cancel  F13=Information Assistant
(C) COPYRIGHT IBM CORP. 1989, 2003
5250                                         007/020
```

The "RESTORE" Menu

- A simple way to restore information generated by "GO SAVE"
 - Install LIC and base Operating System
 - Create a tape device description
 - GO RESTORE !

Back to Basics



```
Terminal — tn5250 — 80x25
Restore System and User Data
What this option will do
  o End all subsystems
  o Restore the data that was saved by the save entire system option
  o Start the controlling subsystem
What this option will not do
  o Restore library QSYS
  o Restore any line, controller, or device descriptions that are varied
  on
Other considerations
This option is intended for use immediately after an install of the
Licensed Internal Code and OS/400 in a recovery scenario.
F3=Exit  F12=Cancel
5250                                         001/001
```

GO RESTORE, Option 21

Back to Basics

GO RESTORE, Option 21 : Restore System and User Data

- Program QSYS/QMNRSTE :
 - ENDSBS SBS(*ALL) OPTION(*IMMED)
 - RSTUSRPRF USRPRF(*ALL)
 - RSTCFG OBJ(*ALL)
 - RSTLIB LIB(*NONSYS)
 - RSTDLO DLO(*ALL) SAVFLR(*ANY)
 - RST DEV('/QSYS.LIB/<tape_device_name>.DEV'D) OBJ ((/'*) ('/QSYS.LIB' *OMIT) + ('/QDLS' *OMIT))
 - RSTAUT
 - STRSBS SBSD(<controlling_subsystem>)
- CL Program source can be retrieved !
 - RTVCLSRC ...



Back to Basics

```
Terminal — tn5250 — 80x25
Restore System Data Only

What this option will do
  o End all subsystems
  o Restore the data that was saved by the save system data only option
  o Start the controlling subsystem

What this option will not do
  o Restore library QSYS, user libraries, or user directories
  o Restore any line, controller, or device descriptions that are varied
    on

Other considerations

This option is intended for use immediately after an install of the
Licensed Internal Code and OS/400 in a recovery scenario.

F3=Exit  F12=Cancel

5250                                001/001
```

GO RESTORE, Option 22

Back to Basics

GO RESTORE, Option 22 : Restore System Data Only

- Program QSYS/QSRRSTI :
 - ENDSBS SBS(*ALL) OPTION(*IMMED)
 - RSTUSRPRF USRPRF(*ALL)
 - RSTCFG OBJ(*ALL)
 - RSTLIB LIB(*IBM)
 - RST DEV('/QSYS.LIB/<tape_device_name>.DEV'D) OBJ (('QIBM/ProdData' + ('QOpenSys/QIBM/ProdData'))
 - STRSBS SBSD(<controlling_subsystem>)
- CL Program source can be retrieved !
 - RTVCLSRC ...



Back to Basics

A terminal window titled 'Terminal - tn5250 - 80x25' showing the help text for the 'Restore All User Data' option. The text is displayed in green on a black background. At the bottom of the terminal, it shows '5250' on the left and '001/001' on the right.

```
Terminal - tn5250 - 80x25
Restore All User Data

What this option will do
  o End all subsystems
  o Restore the data that was saved by the save all user data option
  o Start the controlling subsystem

What this option will not do
  o Restore library QSYS, other IBM-supplied libraries, or IBM-supplied
    directories
  o Restore any line, controller, or device descriptions that are varied
    on

Other considerations

This option is intended for use immediately after you have restored all
system data in a recovery scenario.

F3=Exit  F12=Cancel

5250                                001/001
```

GO RESTORE, Option 23

Back to Basics

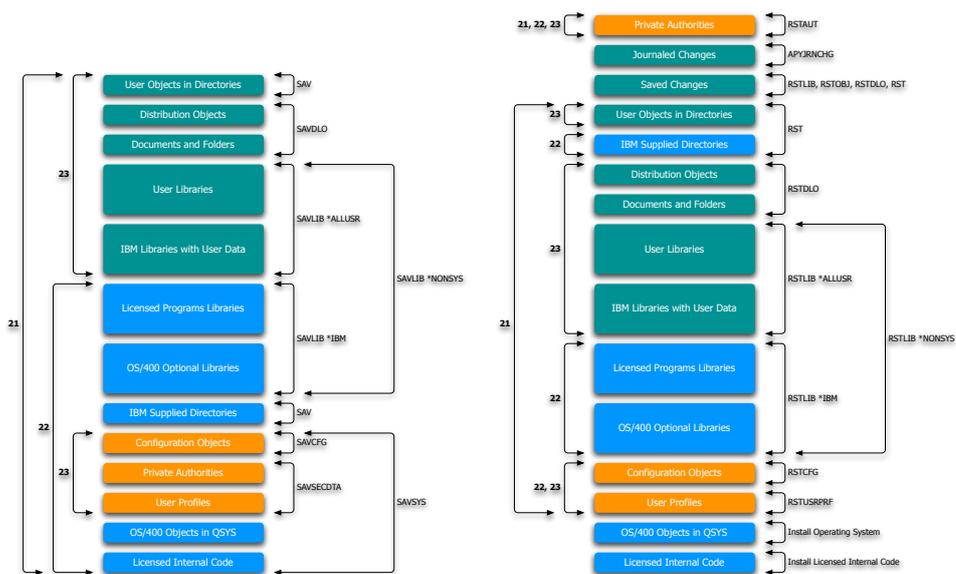
GO RESTORE, Option 23 : Restore All User Data

- Program QSYS/QSRRSTU :
 - ENDSBS SBS(*ALL) OPTION(*IMMED)
 - RSTUSRPRF USRPRF(*ALL)
 - RSTCFG OBJ(*ALL)
 - RSTLIB LIB(*ALLUSR)
 - RSTDLO DLO(*ALL) SAVFLR(*ANY)
 - RST DEV('/QSYS.LIB/<tape_device_name>.DEVD') OBJ (('/*') ('/QSYS.LIB' *OMIT) + ('/QDLS' *OMIT) ('/QIBM/ProdData' *OMIT) ('/QOpenSys/QIBM/ProdData' *OMIT))
 - RSTAUT
 - STRSBS SBSD(<controlling_subsystem>)
- CL Program source can be retrieved !
 - RTVCLSRC ...



Back to Basics

The Big Picture (G325-6328)



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Backup & Recovery

Chapter 3. Advanced Techniques

iSeries. mySeries.

Advanced Techniques

Improve your recovery point

- Let's make journalling help us

Reduce your backup window

- Understand "Speed"
- Incremental and Differential Backups
- Save-While-Active (SWA) backups
- Concurrent and Parallel backups



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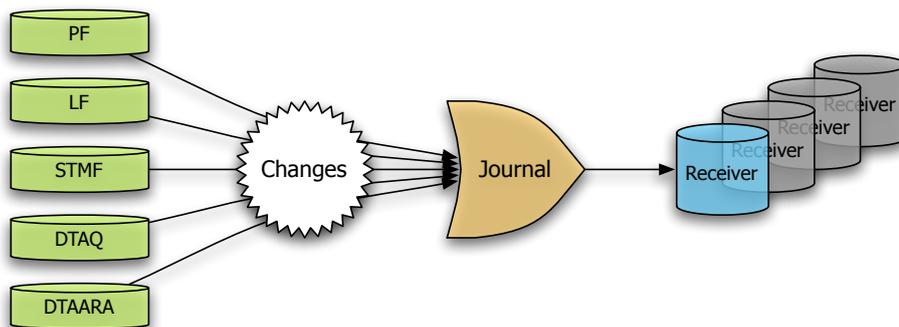
Backup & Recovery

Chapter 3. Advanced Techniques

Improve your Recovery Point

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Advanced Techniques

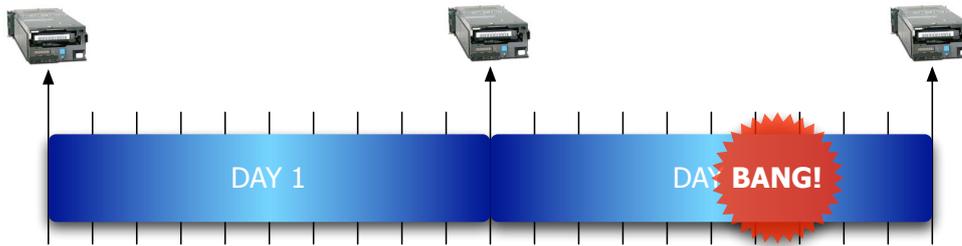


Improve your recovery point with journaling

- Journal and journal receivers are objects used to collect changes performed on objects
 - Completely secure : entries can only be added, not removed
 - Enhances security by providing an audit trail
 - Basis for data replication

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Advanced Techniques



Improve your recovery point with journaling

- Journal receivers can be detached and saved on a regular basis
- In case of disaster, use journal to recover
 - Restore most recent save
 - Restore, if necessary, journal and receivers
 - Use APYJRNCHG command to "replay" the entries

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Backup & Recovery

Chapter 3. Advanced Techniques

Understand "Speed"

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Advanced Techniques

Overview of factors influencing save performance

- Tape device type
- Connection speed
- Interface type (IOA)
- System design (IOP/IOA)
- Save workload type
- Storage configuration and performance
- CPU type and number

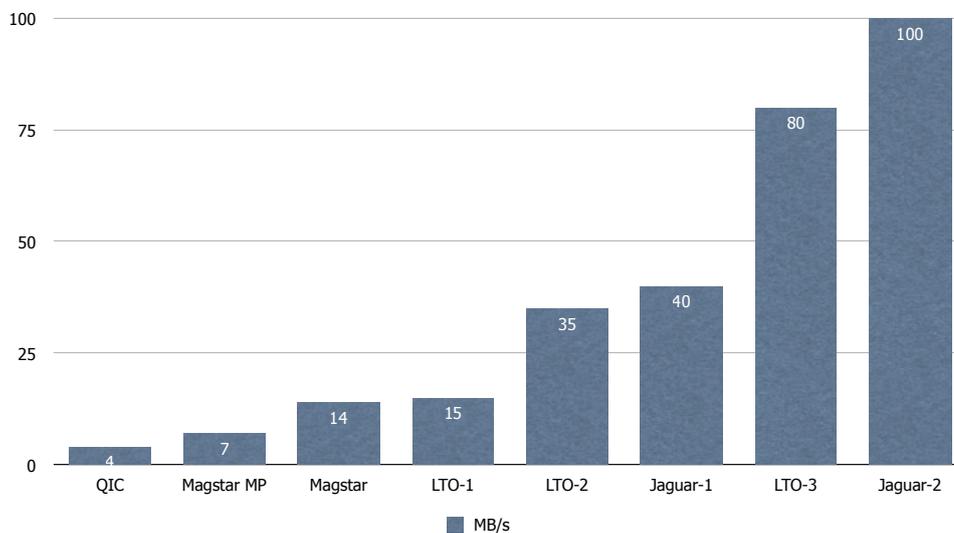
▪ = GB/h saved or restored



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Advanced Techniques

Tape Drive Capabilities

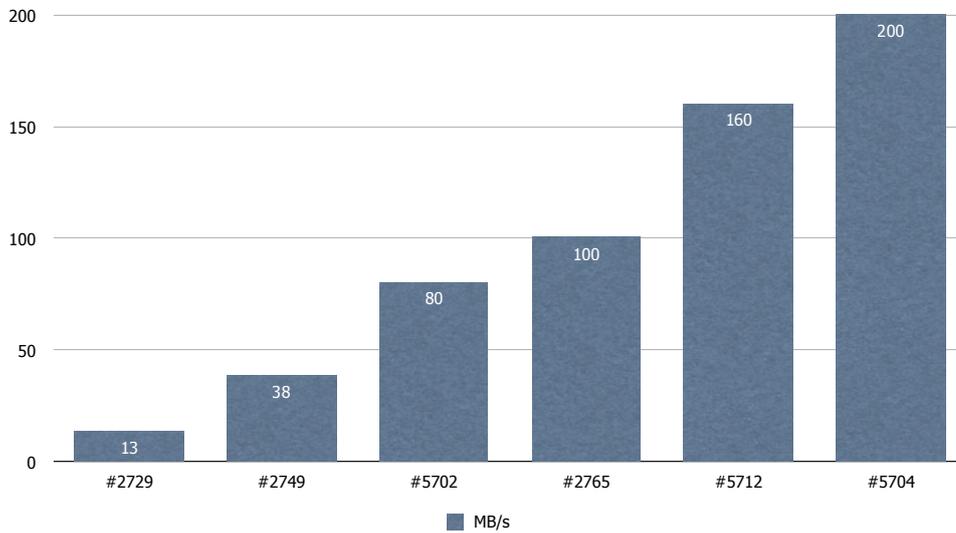


Source : iSeries System Handbook GA19-5486

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Advanced Techniques

Tape IOA Capabilities

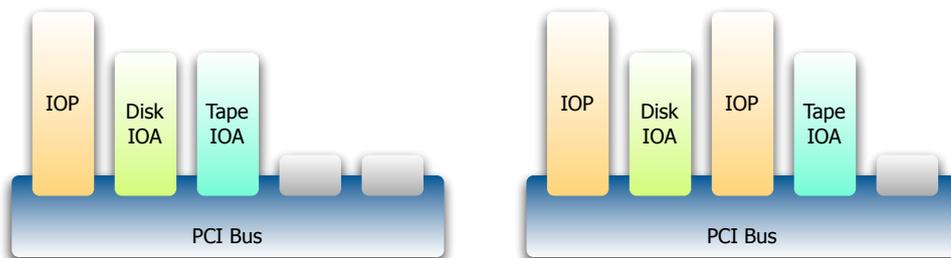


Source : iSeries System Handbook GA19-5486

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Advanced Techniques

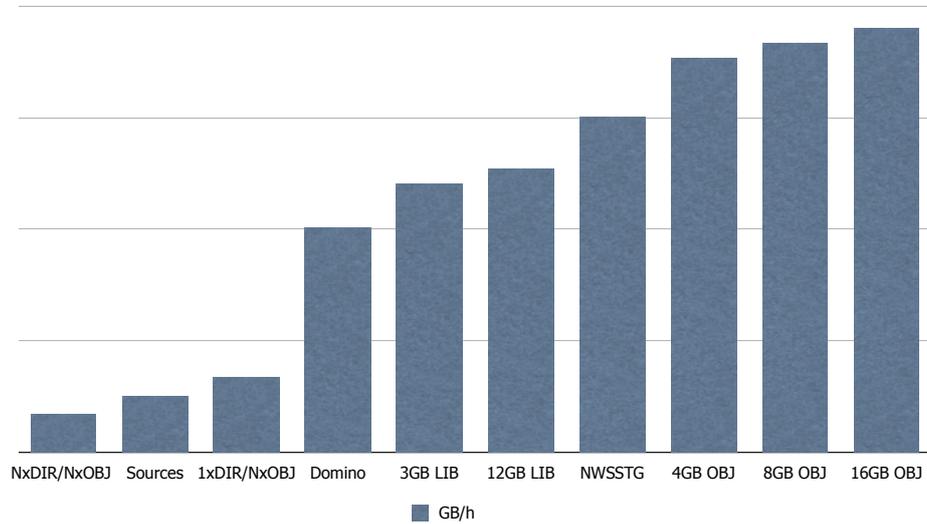
Influence of System Design



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Advanced Techniques

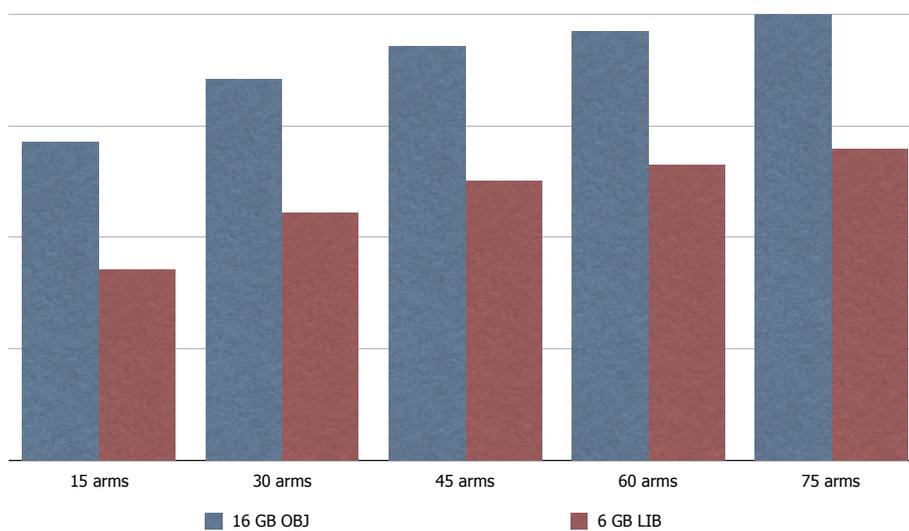
Influence of workload



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Advanced Techniques

Quantity of DASD arms impact



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Advanced Techniques

Tape Performance Planning

- When will a faster tape help ?
 - When current tape(s) are running at maximum speed
- How to maximize tape save/restore performance ?
 - Use fastest SCSI or FC adapters when necessary
 - Use multiple tape drive when you've max'ed a single drive
 - Have an adequate number of disk arms to provide maximum tape save/restore performance
 - Stay on top of PTFs (free save/restore performance boost via PTFs)
- When a faster tape unit won't help ?
 - Type of save/restore workload is slow
 - Server performance is constrained by disk, CPU or memory

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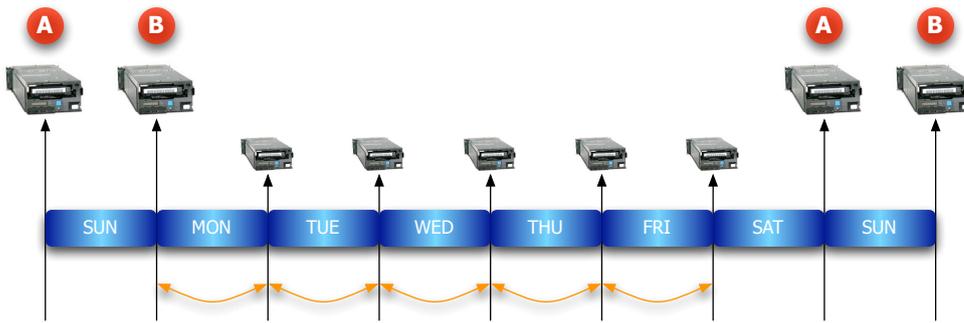


Backup & Recovery

Chapter 3. Advanced Techniques
Incremental and Differential Backups

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Advanced Techniques

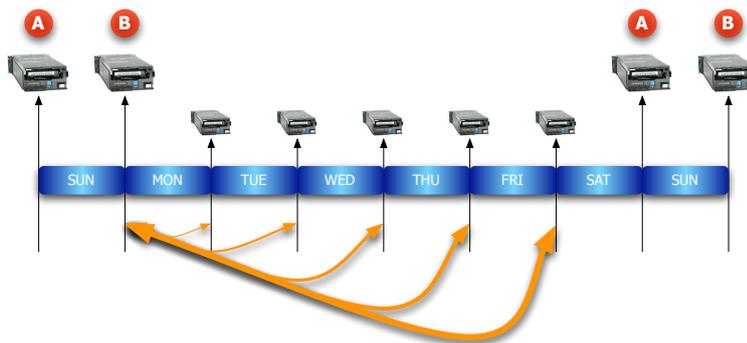


Incremental Backups

- On weekly basis ... save the entire system
- On daily basis ... save only objects which changed that day
- Advantage
 - Fastest daily save operations
- Drawback :
 - Need a rigorous tape inventory management (BRMS will help)
 - Long and complex to restore (BRMS will help)

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Advanced Techniques



Differential Backups

- On weekly basis ... save the entire system
- On daily basis ... save only objects which changed since last complete backup
- Advantage
 - Faster daily save operations
 - Little less complex to manage than "pure" incremental backups
- Drawback :
 - Need a rigorous tape inventory management (BRMS will help)
 - Complex to restore (BRMS will help)

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Advanced Techniques

Incremental and Differential Backups

- How to do?

- SAVCHGOBJ ...
OBJJRN(*YES | *NO)
REFDATE(<date> | *SAVLIB)
REFTIME(<time>)
UPDHST (*YES | *NO)
- SAV ...
CHGPERIOD(<start_date> <start_time> <end_date> <end_time>)
UPDHST (*YES | *NO)
- Restoring thru regular restore commands !

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Backup & Recovery

Chapter 3. Advanced Techniques
Save-While-Active Backups

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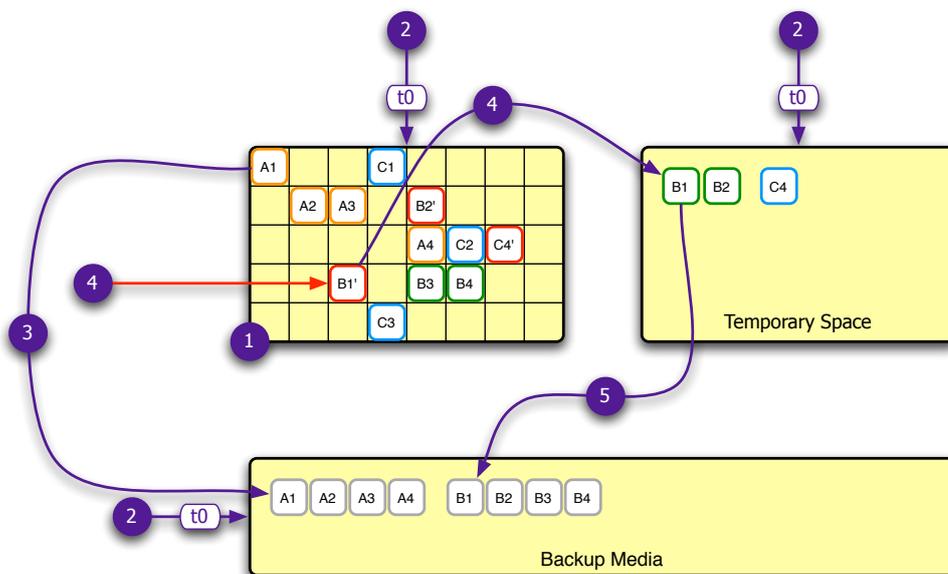
What is Save-While-Active ?

- An integrated i5/OS utility for save window reduction
 - No additional software or hardware required
 - Meanwhile, BRMS will help (MONSWABRM)
- Provides a virtual point in time copy on libraries and/or individual objects
 - Allows granular restores as needed
- Also known as "SWA"



Advanced Techniques

Understand SWA



Advanced Techniques

SWA-Enabled Commands

Command	Location	Function
SAVLIB	i5/OS	Save Library
SAVOBJ	i5/OS	Save Object
SAVCHGOBJ	i5/OS	Save Changed Objects
SAVDLO	i5/OS	Save Document Library Objects
SAV	i5/OS	Save
SAVRSTLIB	ObjectConnect	Save/Restore Library
SAVRSTOBJ	ObjectConnect	Save/Restore Object
SAVRSTCHG	ObjectConnect	Save/Restore Changed Objects
SAVRSTDLO	ObjectConnect	Save/Restore Document Library Objects
SAVRST	ObjectConnect	Save/Restore

Advanced Techniques

SWA Command Parameters

- SWA synchronization level (SAVACT)
 - Values for native objects : *NO | *SYNCLIB | *LIB | *SYNC | *YES
 - Values for IFS objects : *NO | *SYNC | *YES
- SWA Wait Time (SAVACTWAIT)
 - Object locks : <number_of_seconds> | *NOMAX
 - Commit pending record changes : *LOCKWAIT | *NOCMTBDY | *NOMAX
 - Commit pending object changes : *LOCKWAIT | *NOMAX
- Save Active Message Queue (SAVACTMSGQ)
 - Specify a message queue to receive checkpoint notification(s)

Advanced Techniques

SWA Locking Considerations

Object Type	SAVACT(*NO)	Save-While-Active	
		Establish Checkpoint	After Checkpoint
Most Objects	*SHRNUP	*SHRNUP	None
Configuration Objects	None	N/A	N/A
Data Area	*SHRNUP	*SHRRD	None
Database Members	*SHRNUP	*SHRRD	None
Document	*SHRNUP	*SHRRD	None
Folder	*SHRRD	*SHRRD	None
Job Queue	*SHRRD	*SHRRD	None
Journal	*SHRRD	*SHRRD	None
Journal Receiver	*SHRRD	*SHRRD	*SHRRD
Library Object (while library or inside objects are saved)	*SHRUPD	*SHRUPD	*SHRRD
Output Queue	*SHRRD	*SHRRD	None
SRM Objects	*SHRNUP	N/A	N/A
Security Data	*SHRRD	N/A	N/A
Objects with STG(*FREE)	*EXCL	N/A	N/A
Objects in Directories (IFS)	Share w/ Readers	Share w/ Readers	Shares w/ R/W
Objects in QNTC	These objects are not synchronized. All locks are released at checkpoint.		

Advanced Techniques

SWA Resources Considerations

- SWA and CPU
 - As a guideline, allow only 30% of CPU for workload running in the background
- SWA and Main Storage
 - Additional pages are required in the *MACHINE pool
 - Consider adding a minimum of 16MB to the machine pool
 - Monitor *MACHINE pool activity, adjust as needed
 - Separate SWA from other workload workload
 - Consider a separate memory pool with a minimum of 16MB
 - Monitor that pool activity
- SWA and Auxiliary Storage
 - As a guideline, disks should be less than 30% busy before adding SWA activity

Advanced Techniques

SWA Restrictions

- You cannot use SWA in the following situations
 - All subsystem are ended
 - When deleting/freeing storage as part of operation
 - SAVxxx ... STG(*DELETE | *FREE)
- You should not use SWA in the following situations
 - When the server is very busy
 - When there is little disk storage available
 - When PTFs are loaded, applied or removed



Advanced Techniques

SWA Methodologies

- Save-outage time reduction (RECOMMENDED)
 - End applications that makes changes to the objects you are saving
 - Start the SWA command and ask the system a checkpoint message
 - Wait for the checkpoint message
 - Once the checkpoint is established
 - The effective save operation begins
 - You can restart the application
 - Unavailability reduced from hours to minutes
 - Data consistency is guaranteed



Advanced Techniques

SWA Methodologies

- Save-outage time elimination (1)
 - Do not end applications that makes changes to the objects you are saving
 - Start the SWA command with SAVACTWAIT(*LOCKWAIT)

 - Objects with a lock conflict will not be saved
 - Checkpoint processing will failed if jobs remains with uncommitted transactions
 - Consistency is achieved at save time
 - NO CONSISTENCY GUARANTEED WITHOUT COMMITMENT CONTROL !

- Save-ourtage time elimination (2)
 - Do not end applications that makes changes to the objects you are saving
 - Start the SWA command with SAVACTWAIT(*NOCMTBDY)

 - Objects with a lock conflict will not be saved
 - Objects will be saved, even with commit-pending transactions
 - Consistency will be achieved if object ever restored
 - Journal receivers will be needed to recover !

 - Aka "Ragged" Save-While-Active
 - BRMS will greatly help handling this !

Advanced Techniques

About "Ragged" SWA

- Restore operations
 - Restore Journal Receivers
 - Restore Journals
 - Restore Files
 - Restore ...

- Objects contains partial transaction information
 - Existence of partial transaction and related journal receiver
 - Files with partial transactions cannot be opened

- Recovery after restore
 - Forward recovery : APYJRNCHG
 - Need for the receiver with the transaction complete
 - Backward recovery : RMVJRNCHG
 - Need for the receiver that includes the start of the transaction
 - Heroic recovery : CHGJRNOBJ PTLTNS(*ALWUSE)
 - Object is made available AS-IS
 - Will you accept the consequences ?

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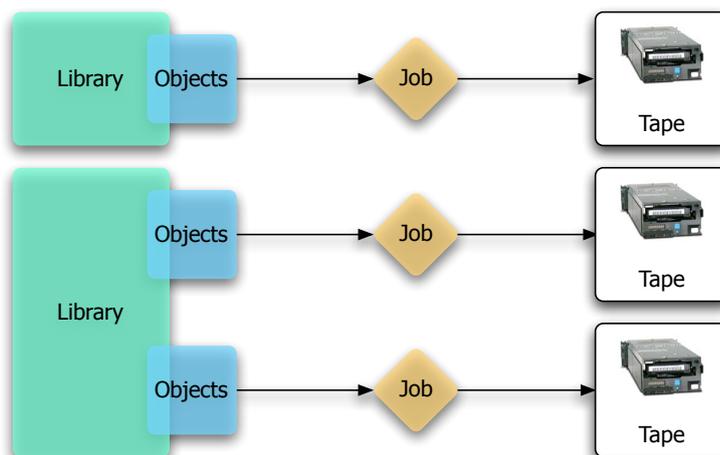
Backup & Recovery

Chapter 3. Advanced Techniques

Concurrent and Parallel Backup

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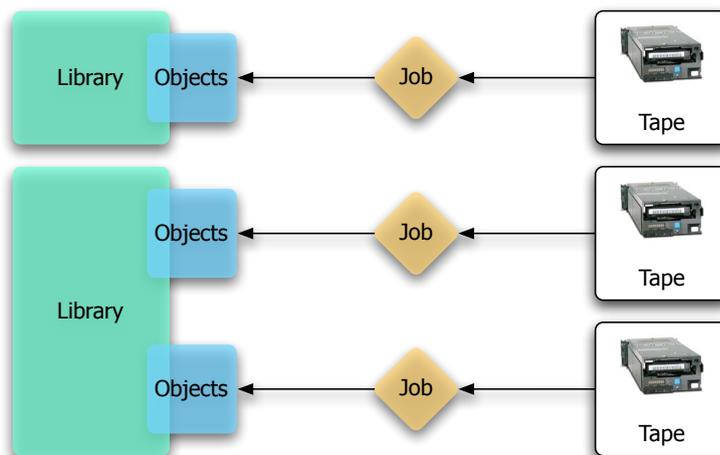


Concurrent Saves

- Different libraries can be saved concurrently
 - Only one SAVLIB per library
- Different objects within a library can be saved concurrently

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Advanced Techniques

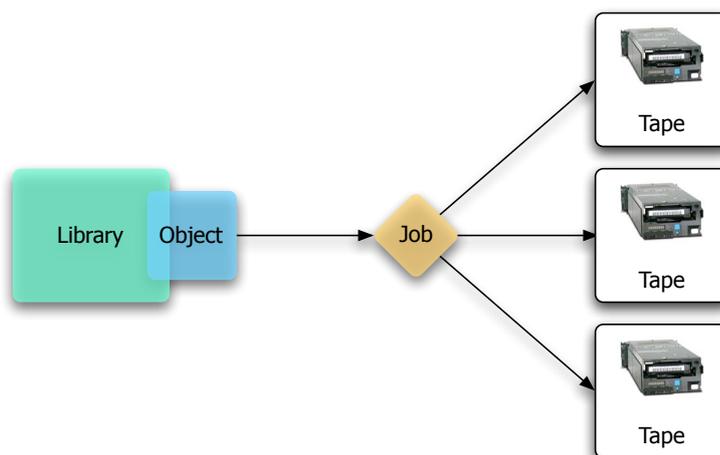


Concurrent Restores

- Different libraries can be restored concurrently
 - Only one RSTLIB per library
- Different objects in a library can be restored concurrently

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Advanced Techniques

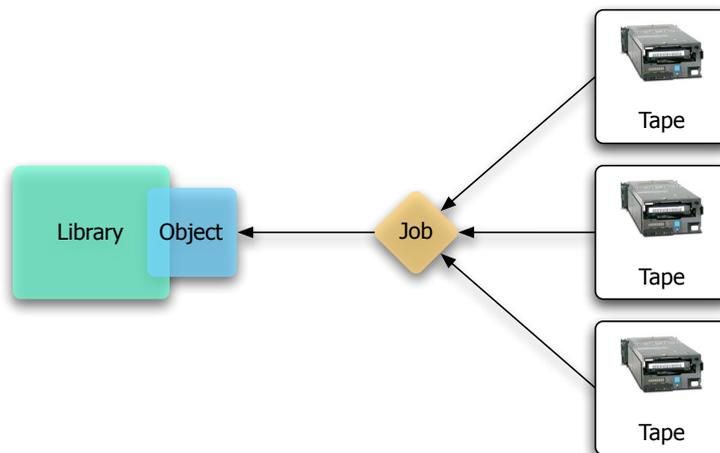


Parallel Save

- Simultaneous save of objects parts on multiple tapes
- Use via API (Art) or via BRMS (Science)

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Advanced Techniques



Parallel Restore

- Simultaneous restore of objects parts on multiple tapes
 - An equal number of tape device is needed to restore
- Use via API (Art) or via BRMS (Science)

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Backup & Recovery

Chapter 4. About Recovery and Recovery Tests

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About Recovery and Recovery Tests

The Golden Rules for Backup/Recovery

- Anything that has not been backed up cannot be recovered
- Anything that has not been backup up offsite will not survive a disaster
- Any backup that has not been tested with a recovery is not a backup
- Back it up or give it up !



About Recovery and Recovery Tests

Prevent disasters before test !

- Plan for recovery test
 - Passwords
 - Software Keys
 - Print important information
 - Recovery procedures
 - System information
- Manage your tapes
 - Ensure tapes are labeled or catalogued with unique volumes IDs
 - BRMS ...
 - Prevent overwriting tapes with active data
 - BRMS ...
 - Have at least TWO sets
 - Remember that media errors happens !
 - Use error reports to remove bad tapes from inventory
 - BRMS
 - DST/SST
 - Do NOT IGNORE tape problems



About Recovery and Recovery Tests

Prevent disasters before test !

- Ensure critical data is completely backed up !
 - Completely back up library QUSRSYS
 - #1 recovery problem today !
 - Objects starting with "Q" in QUSRSYS contains critical recovery data
- To save everything in QUSRSYS :
 - End all subsystems
 - End subsystems QSNADS, QSYSWRK, QSERVER
 - End TCP/IP
 - End Management Central
 - Use SAVE menu option 21 or 23
 - Use save-while-active feature



About Recovery and Recovery Tests

Prevent disasters before test !

- ALWAYS save access paths
 - Default on SAVE menu options 21, 22, 23 is '*YES'
 - Default on BRMS is '*YES'
 - Prior to V5R3 ...
 - Default for saving access paths on save commands is '*NO'
 - Starting V5R3 ...
 - Default for saving access paths on save commands is '*SYSVAL'
 - New system value QSAVACCPATH :
 - '1' = Save access paths (default)
 - '2' = Do not save access paths
 - '*YES' and '*NO' are still valid options
- Keep backup/recovery PTF group current
 - Check via WRKPTFGRP
 - V5R2M0 = SF99085
 - V5R3M0 = SF99185



About Recovery and Recovery Tests

Prevent disasters during test !

- Understand "alternate installation device" requirements
 - ...
- During install/restore
 - Unknown system : install LIC with option 2
 - Pre-configured system : install LIC with option 3
- Set system values for a quiet recovery
 - QALWOBJRST must be '*ALL'
 - QJOBMSGQFL must be '*PRTWRAP'
 - QTIME
 - QTIMZON
 - QVFOBJRST must be '1'
- Security-sensitive system value changes must be allowed
 - DST option
 - Default is to allow changes
 - If disallowed, must update in DST to allow changes during recovery !



About Recovery and Recovery Tests

Prevent disasters during test !

- Recovering to a different system (different serial number)
 - Must specify ALWOBJDIF(*ALL) on all RSTxxx commands
 - Must specify SRM(*NONE) on the RSTCFG command
- Security issues during recovery
 - After RSTUSRPRF, unsure of the QSECOFR password ?!
 - Change QSECOFR password before signing off
 - Know other user IDs needed for test
- Authorization lists securing objects in QSYS ?
 - Association lost because QSYS is restored prior to user profiles



About Recovery and Recovery Tests

Prevent disasters during test !

- Need only critical application restored ?
 - You must restore QSYS2, QGPL, and QUSRSYS
 - Starting V5R2, QSYS2 is part of '*ALLUSR'
 - Starting V5R3, SAVLIB/RSTLIB *NONSYS/*ALLUSR saves/restores QSYS2, QGPL and QUSRSYS first
- If you use journaling ...
 - The libraries containing the journals must be restored before journaled files
- About logical and physical files ...
 - You must restore all physical based-on files before you can restore the logical files
 - RSTLIB *NONSYS/*ALLUSR processes libraries by alphabetical order
 - CPF3204 - Cannot find object needed for file ... in ...
 - RSTOBJ OBJ(*ALL) SAVLIB(...) DEV(...) SEQ(...) OBJTYPE(*FILE) OPTION(*NEW) MBROPT(*ALL) ALWOBJDIF(*ALL)

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Backup & Recovery

Chapter 5. Specific Applications

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Specific Applications - General

Lots of applications typically runs on iSeries

- Dynamic Host Configuration Protocol (DHCP)
- Domain Name Server (DNS)
- Integrated xSeries Servers (*)
- Lotus Domino (*)
- Web Server (Apache)
- WebSphere Application Server
- WebSphere MQ (*)
- ...



Specific Applications - General

The right questions to ask yourself ...

- Do I understand the product implementation ?
 - Identify all application components
 - Which part is to save on which basis ?
- Do I understand how the product works ?
 - How to start the product ?
 - How to properly stop the product ?
- Which level of availability is needed ?
 - Offline backup ?
 - Save-While-Active ?



Specific Applications - Lotus Domino

Understand Domino implementation on the iSeries

- The QNOTES user profile
 - Intended for integration with underlying security mechanisms
- The QNOTES, QUSRNOTES and QNOTESxxxx libraries
 - QNOTES
 - Native objects such as programs (*PGM) or service programs (*SRVPGM)
 - QUSRNOTES
 - Configuration objects such as subsystem descriptions (*SBSD)
 - All data queues (*DTAQ) and job queues (*JOBQ) used by the servers
 - Status of the servers ... stored in user spaces (*USRSPC)
 - QNOTESxxxx
 - Objects related to optional components
- The QDOMINOvrmlib libraries
 - Same as QNOTES for latest multi-versions of the product

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Specific Applications - Lotus Domino

Understand Domino implementation on the iSeries

- Integrated file system components
 - Base domino program files
 - /QIBM/ProdData/LOTUS/NOTES
 - /QIBM/ProdData/LOTUS/NOTES/DOMINOxxx
 - User-written and/or third-party program files
 - /QIBM/UserData/LOTUS/NOTES
 - The Domino plug-in for iSeries Navigator
 - /QIBM/ProdData/GUIplugin/LOTUS.DOMINO
 - Domino data directories
 - Defaults to /Domino/<server_name>/Data
 - This structure can be used as-is or you can use your own !

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Specific Applications - Lotus Domino

Domino Backup Strategy

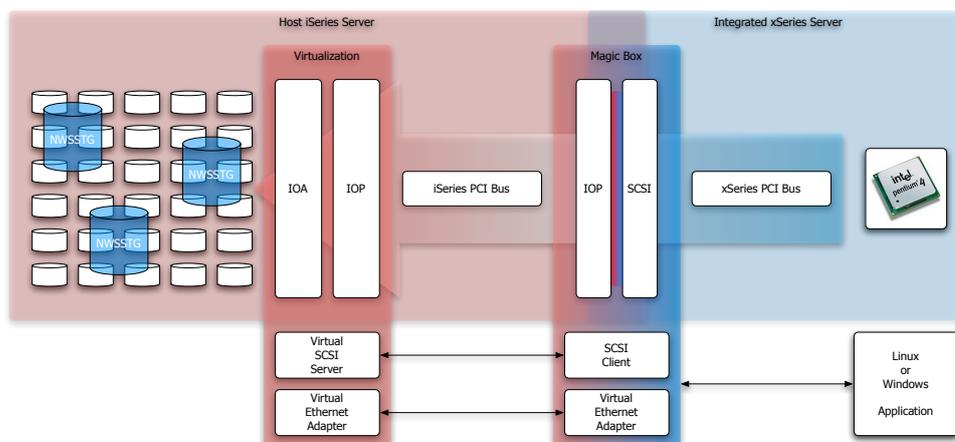
- Using operating system commands
 - Active Domino servers keeps lots of locks on its objects
 - Domino servers must be completely stopped to ensure complete backup
- YES, but my backup window is not large enough !
 - Consider use of a faster tape
 - Consider save files
 - Disk-to-disk operation faster than disk-to-tape
 - SAVSAVFDTA once Domino servers are restarted
 - Consider save-while-active
 - Domino servers are restarted once checkpoint is reached
 - Backup window reduced to a few minutes
 - Consider BRMS
 - Simplify usage of save-while-active
 - True online backup for .NSF files based on transaction logs (cf. journaling)
 - Consider Domino Cluster
 - Domino is "ClusterProven"

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Specific Applications - IXA/IXS

Things to know about integrated xSeries servers ...



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Specific Applications - IXA/IXS

Backup & Recovery of an integrated xSeries server

- 1a. Saving disk images
 - SAVCFG : Saves NWSD and LIND
 - SAVLIB LIB(QUSRSYS) : Saves TCP/IP configuration
 - SAV DEV(...) OBJ('/QFPNWSSTG/...') : Saves the Network Server Storage objects (NWSSTG)
- 1b. Recovering using disk images
 - RSTCFG
 - Recovers NWSD and LIND
 - RSTLIB LIB(QUSRSYS)
 - Recovers TCP/IP configuration
 - RST DEV(...) OBJ('/QFPNWSSTG/...')
 - Recovers Network Server Storage objects (NWSSTG)
 - WRKNWSSTG ... and verify links between NWSD and NWSSTG

Specific Applications - IXA/IXS

Backup & Recovery of an integrated xSeries server

- Notes
 - QFPNWSSTG contents a subdirectory per disk image, including :
 - One or multiple huge stream files containing disk data
 - A little control file (index + checksum)
 - About save
 - Integrated xSeries server must be inactive
 - Save-while-active is not allowed
 - Journalling is not allowed
 - About restore
 - Recovers only whole disks, not individual objects
 - Excellent for disaster recovery strategies
 - Poor to recover a single error

Specific Applications - IXA/IXS

Backup & Recovery of an integrated xSeries server

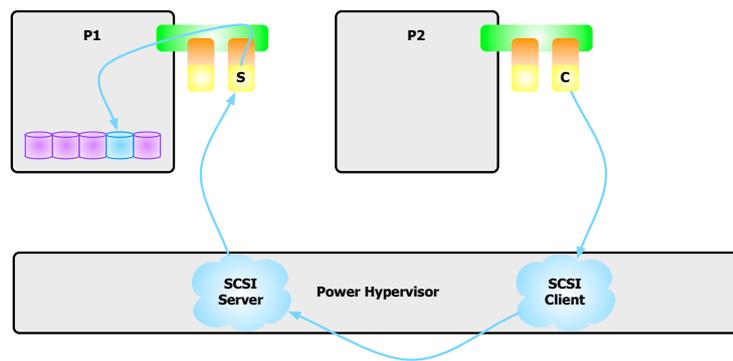
- 2. Via file system QNTC
 - i5/OS acts as a Windows client thru virtual point-to-point connection
 - NetServer must be properly configured
 - A user must be dedicated to save/restore operations
 - Cannot be QSECOFR
 - Must have same password under i5/OS and Windows
 - Must have access to all saved objects under Windows
 - Create source physical file QUSRSYS/QAZLCSAVL
 - SAV DEV(...) OBJ('/QNTC/<server_name>/<share_name>/<path>')
 - One member per integrated server to specify Windows share to process
- Notes
 - Not everything
 - Use in conjunction with disk image backups
 - Poor performance due to i5/OS-to-Windows-to-i5/OS client/server interactions
 - Object level backup which can be used for small volumes
 - Objects are saved using i5/OS formats

Specific Applications - IXA/IXS

Backup & Recovery of an integrated xSeries server

- 3. Via third-party Windows backup/recovery software
 - Using virtual SCSI controller to access i5/OS tape device
 - Tape device must be varied off under i5/OS
 - AS400DEV Windows command to lock/unlock resource
 - Using a locally attached tape device
- Notes
 - Third-party windows backup/recovery software often experience problems with virtual SCSI
 - Objects are saved using specific application format

Specific Applications - LPARed Linux



Things to know about LPARed Linux servers ...

- Running natively on i5, Linux I/Os can be
 - DIRECT, using dedicated adapters
 - VIRTUALIZED, using hypervisor SCSI Client/Server features
- When virtual I/Os are used, an i5/OS partition is used as host for the Linux storage
 - Implemented as an IXA/IXS, without hardware
 - Network Server Description (NWS D) and attached Network Server Storages (NWSSTG)

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Specific Applications - WebSphere MQ

Understand WebSphere MQ implementation on the iSeries

- The QMQM and QMQMADM user profile
 - Intended for integration with underlying security mechanisms
- The QMQM and QMxxxxxxx libraries
 - QMQM
 - Native objects such as programs (*PGM) or service programs (*SRVPGM)
 - QMxxxxxxx
 - Objects related to a queue manager instance
 - WARNING : those libraries are not considered by SAVLIB LIB(*ALLUSR) !

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Specific Applications - WebSphere MQ

Understand WebSphere MQ implementation on the iSeries

- Integrated file system components
 - Product Part
 - /QIBM/ProdData/mqm
 - User part
 - /QIBM/UserData/mqm
 - /QIBM/UserData/mqm/qmgrs/<Queue_Manager_Name>
 - /QIBM/UserData/mqm/qmgrs/<Queue_Manager_Name>/QMOMCHKPT
 - /QIBM/UserData/mqm/qmgrs/<Queue_Manager_Name>/qmanager/QMOMBJCAT



Specific Applications - WebSphere MQ

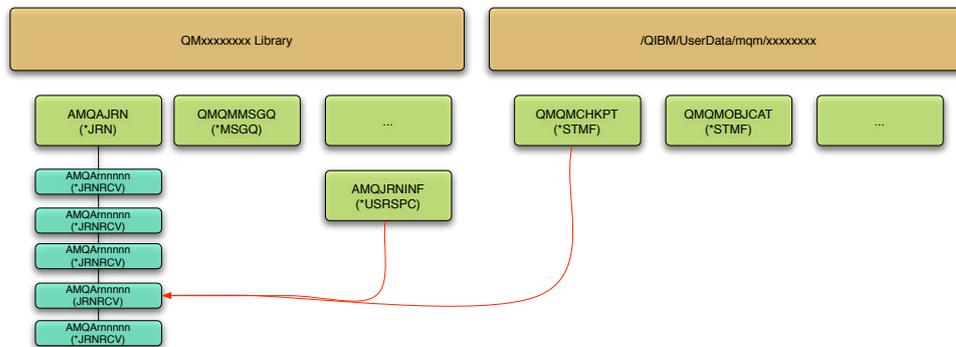
Understand WebSphere MQ implementation on the iSeries

- WebSphere MQ for iSeries journal usage
 - Persistent update to message queues happen in two stages
 - Updates are first written in a journal
 - Afterwards, the persistent queue file is updated
 - So, the journal receivers can be more up-to-date than the queue files
 - Concept of "checkpoint"
 - What is a "checkpoint" ?
 - Point in time is when information in journal is the same than information in queue
 - The most recent point of consistency from an application perspective
 - When "checkpoints" are generated ?
 - At application startup
 - After a certain number of transactions are logged
 - On demand ... via RCDMQMIMG command
 - At (proper) application shutdown
 - When a "checkpoint" is generated ...
 - A message is sent to QMxxxxxx/QMOMMSGQ
 - This message indicates the first journal receiver needed for recovery



Specific Applications - WebSphere MQ

Understand WebSphere MQ implementation on the iSeries



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Specific Applications - WebSphere MQ

Understand WebSphere MQ implementation on the iSeries

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Backup & Recovery

Chapter 6. More Good Stuff ...

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More Good Stuff

Operational Assistant Backup (aka. OA Backup)

- Key features
 - Basic backup utility
 - Handles backup, not recovery
 - Help to save
 - Security data, configuration, libraries, folders and directories
 - Three simple backup policies to handle
 - Daily, weekly and monthly strategies
 - Tape sets and rotations
 - Two backup list for libraries and folders
 - Complete or differential backups
 - Two customizable exit points available
 - Before and after backup processing
 - Generate simple reports
 - Integrates with operating system scheduler
 - WRKJOBSCDE
- Available as a standard option (at no additional charge) with OS/400 and i5/OS
 - GO BACKUP

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More Good Stuff

ObjectConnect

- ObjectConnect is a set of CL commands for moving objects between iSeries servers
 - Simply and efficiently !
 - SAVRSTxxx ... RMTLOCNAME(<target_system_name>)
 - Available as a standard option (at no additional charge) with OS/400 and i5/OS
 - 5722-SS1, Option 22
- Requirement
 - High speed connection using one of these protocols
 - SNA/APPC with APPN
 - AnyNet (SNA over TCP/IP)
 - OptiConnect



More Good Stuff

Backup, Recovery & Media Services for the iSeries (aka. BRMS)

- Key features
 - Control backups
 - Enabler for backup strategies
 - Great with media libraries
 - Great to deal with advanced B&R techniques
 - Parallel save/restore
 - Save-While-Active
 - Ragged Save-While-Active
 - Unattended restricted-state backups
 - Guides recovery at all levels
 - Recovery reports & procedures
 - Automated recovery
 - Classifies, tracks and protects tape media
 - Media inventory
 - Move policies
 - Single-system or multi-system environment
 - Shared inventory
 - Common definitions and policies



More Good Stuff

Backup, Recovery & Media Services for the iSeries (aka. BRMS)

- Licensed Program Product
 - Product 5722-BR1, three chargeable parts :
 - Base product
 - Network feature (multi-system environments)
 - Advanced feature (HSM)
 - Requires chargeable 5722-SS1 option 18 : "Media and Storage Extensions"
 - Runs on all i5, iSeries and AS/400
 - Supports all i5, iSeries and AS/400 tape devices and tape media
 - Significant step beyond OA Backup



More Good Stuff

We may also discuss about ...

- How to handle S/R operations with independent ASPs (IASPs) ...
- How can a third-party real-time replication software can help with S/R ...
- How can SAN infrastructures improve S/R operations ...



Questions & Answers

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Logical Partitions on the IBM Power5

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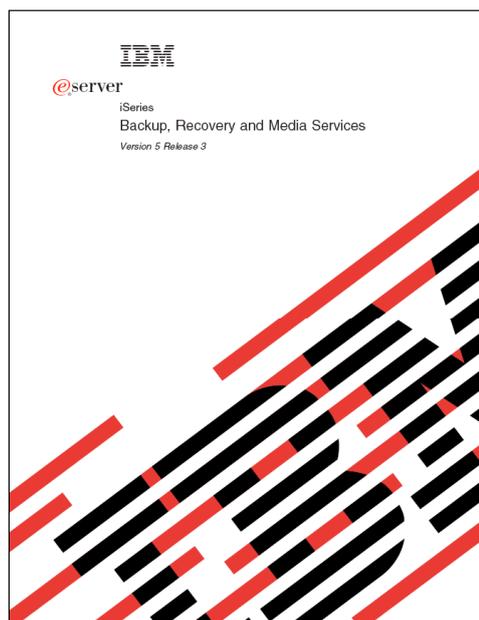
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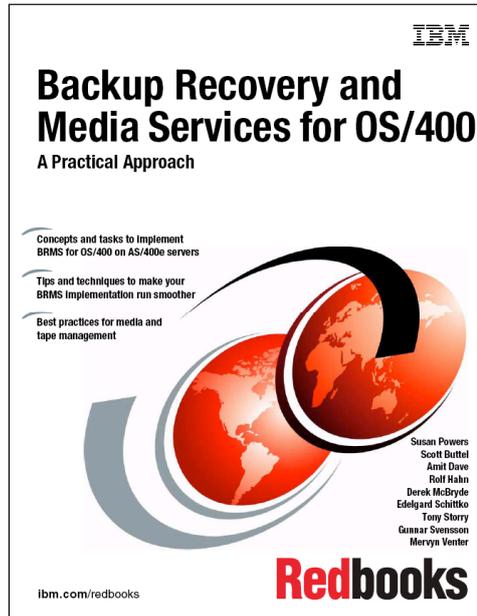
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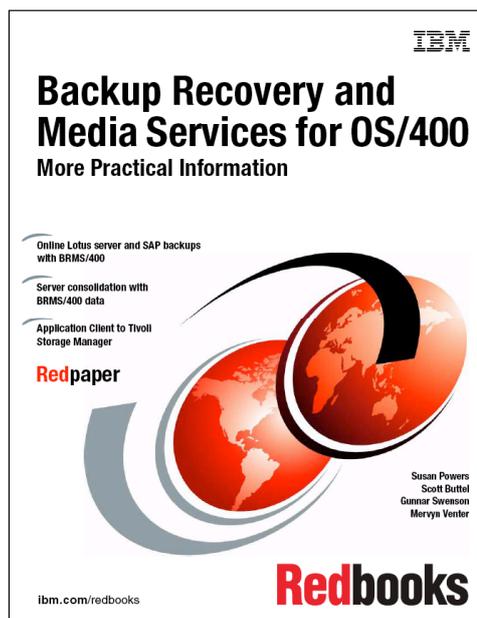
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Thank You!

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