

Backup & recovery DRP, HA & co

Adventure is just bad planning

Agenda

- Risk analysis
- DRP
- Back up
- High availability
- Journaling
- SWA

Analyse des risques

Ou pourquoi faire des backup
quand on a le système le plus
fiable au monde ?

Risk analysis

- Evaluer tous les risques de pannes, d'interruption, de problèmes...
 - ⇒Panne électrique
 - ⇒Panne hardware
 - ⇒Disque
 - ⇒Réseau
 - ⇒Mémoire...
 - ⇒Problème OS
 - ⇒Problème application
 - ⇒Erreur humaine...
 - ⇒Accident... incendie inondation explosion..

Risk response

- Estimer la probabilité de chaque risque.
- Prévoir les réponses spécifiques à chaque risque.
- Prévoir le délai de réponse pour chaque risque.
- Valoriser le risque (criticité)
- Valoriser le coût de la couverture

Business continuity

- **Capability** of a business to **withstand outages** and operate mission critical services normally and **without interruption** per a pre-defined **service level agreement**
 - Solution must address data, operational environment, applications, the application hosting environment, and the end user interface
 - Requires a collection of services, software, hardware, and procedures to be selected, described in a documented plan, implemented, and practiced regularly
- Includes both **Disaster Recovery (DR)** and **High Availability (HA)**
 - DR addresses the set of resources, plans, services and procedures to recover and resume mission critical applications at a remote site in the event of a disaster
 - HA defined as the ability to withstand all outages (planned, unplanned, and disasters) and to provide continuous processing for all mission critical applications

DRP

- Comment établir un DRP
- Timing
- Exemple (voir B&R guide)

DISASTER RECOVERY PLANNING

- La prudence est la mère de la porcelaine...
- Quelques règles de base...

Règle # 1:

- NE PAS DEVOIR S'EN SERVIR

- ⇒ Mais en disposer au cas où....
- ⇒ Et s'assurer qu'ils sont utilisables
- ⇒ Et qu'on a bien tout sur les backups...
- ⇒ Eviter « c'est la faute à pas de chance... »

Nous avons tous l'expérience de backup qui ont été bien utiles...
et de situations où des données ont été perdues ... mais pas de notre
faute...

Règle # 2:

- PREVOIR LE PIRE

- ⇒ Mais disposer de tous les éléments pour pouvoir
pallier facilement à une petite demande.

Règle # 3:

- DOCUMENTER

- ⇒ Un plan de sauvegarde est un document écrit.
- ⇒ Le document PAPIER doit être disponible...
- ⇒ Il doit pouvoir être mis en œuvre par une personne dont la seule compétence est de savoir lire...

Règle # 4:

- TESTER

- ⇒ Un plan de sauvegarde doit être testé et validé
- ⇒ Il y a peu de chance que tout soit bon du premier coup...
- ⇒ Tester à blanc... (le week-end)
(arrêt planifié et redémarrage...)
- ⇒ Tester en réel... (le week-end)
(arrêt non planifié et basculement sur le système BU pour une semaine...)

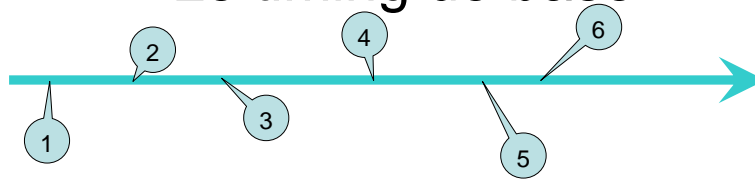
Règle # 5:

- RETESTER et MAINTENIR
 - ⇒ Un plan de sauvegarde doit être REGULIEREREMENT testé et validé
 - ⇒ Il y a peu de chance que rien n'ait changé depuis le dernier test...
 - ⇒ Promouvoir un responsable (désigner une victime)
 - ⇒ Mettre à jour la documentation sur papier !
 - ⇒ Tester à blanc...
 - ⇒ Tester en réel...
 - ⇒ EVALUATION PERMANENTE INDISPENSABLE

Référence

- Backup & recovery guide...
- <http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/topic/rzaj1/rzaj1.pdf>
- Un exemple de plan de sauvegarde et reprise...

Le timing de base



1. Dernière sauvegarde
2. Incident
3. Matériel disponible
4. Retour à la situation (1)
5. Retour à la situation en T(2)
6. Opérations normales

LE DELAI A PRENDRE EN COMPTE EST 2→6

Délai imprévisible

- Le temps écoulé entre la dernière sauvegarde et l'incident... aura une influence sur le temps nécessaire entre la restauration et la disponibilité du système
- → ADAPTER le Planning de sauvegarde... (fréquence des backups)

Délai de redémarrage

- Le temps écoulé entre l'incident et la remise en état du système est fonction du matériel disponible...
- → fonction du matériel
- → durée IPL
 - SMAPP (DSP/CHGRCYAP)
 - iASP

Délai de restauration

- Le temps écoulé entre le moment où le matériel est disponible et celui où la dernière sauvegarde est rechargée dépend du matériel de sauvegarde
- → ADAPTER les dispositifs de sauvegarde.
 - Tape (capacité et vitesse)
 - Réseau...

Délai de récupération

- Le temps écoulé entre le retour à la dernière sauvegarde et la situation au moment de l'incident
- → ADAPTER les procédures
 - Technique : journaling... Commitment control
 - Internes : conserver les documents de saisies.

Délai de redémarrage

- Le temps écoulé entre la récupération de la situation avant incident et la mise à disponibilité du système pour les utilisateurs.
- → ADAPTER les procédures de vérification
 - Validation (QUI donne le feu vert et Comment)
 - Basculement automatique

PLAN DE REPRISE APRES INCIDENT

- 1. OBJECTIFS

- ⇒ Minimiser les interruptions d'opérations.
- ⇒ Limiter les perturbations
- ⇒ Minimiser l'impact économique
- ⇒ Prévoir une méthode de travail de remplacement
- ⇒ Former le personnel aux procédures d'urgence
- ⇒ Garantir une remise en service rapide.

PLAN DE REPRISE APRES INCIDENT

- 2. PERSONNEL

- ⇒ Nom
- ⇒ Fonction
- ⇒ Spécialité
- ⇒ Adresse
- ⇒ Téléphone

Tenir compte de leur indisponibilité possible

PLAN DE REPRISE APRES INCIDENT

- 3. INVENTAIRE LOGICIELS

- ⇒ Nom
- ⇒ Description
- ⇒ Criticité
- ⇒ Dépendances (matériel...)
- ⇒ Fournisseur
- ⇒ Contact
- ⇒ Adresse
- ⇒ Téléphone...
- ⇒ Documentation applicative

PLAN DE REPRISE APRES INCIDENT

- 4. INVENTAIRE MATERIEL

- ⇒ Système...DSPHDWRSC...
- ⇒ Périphériques
 - ⇒ Consoles
 - ⇒ Modems , téléphones, lignes,
 - ⇒ Imprimantes
 - ⇒ Tapes
 - ⇒ Etc...
- ⇒ Références (Criticité, Fournisseur, type, modele s/n, contrat, etc...)

PLAN DE REPRISE APRES INCIDENT

- 5. BACKUPS

Fréquence et emplacement des

SAVE ENTIRE SYSTEM

SAVSYS

SAVSYSINF

SAVSECDTA

SAVE CONFIGURATION

SAVLIB NONSYS

SAVE CHANGE DATA

SAVE IFS

SAVE JRNRCV

SAVE HMC...

PC Console

PC spéciaux... (transmission, firewall, dns, antispam, antivirus, mail, ... etc.. Etc...)

PLAN DE REPRISE APRES INCIDENT

- 6. PROCEDURES

- INTERVENTION D'URGENCE

- Que faire en cas d'incident pour protéger les personnes et les données.

- OPERATIONS DE SAUVEGARDES

- Que faut il avoir prévu pour pouvoir redémarrer

- ACTIONS DE REPRISE

- Que faire pour redémarrer après un problème

PLAN DE REPRISE APRES INCIDENT

- 7. REDEMARRAGE
 - Check list pour site mobile
 - Check list pour site de secours
 - Check list pour site propre

PLAN DE REPRISE APRES INCIDENT

- 8. RESTAURATION DU SYSTEME
 - Micro Code → CD
 - SAVSYS → TAPE
 - SAVSECDTA → TAPE
 - SAVNONSYS → TAPE
 - BU JOURNALIER → TAPE
 - JRNRCV → TAPE
 - PROCEDURE & DOCUMENTATION
(BU&RECOVERY GUIDE)

PLAN DE REPRISE APRES INCIDENT

- REFERENCES
 - Ceci est un résumé
 - La documentation IBM est dispo sur www.iseries.ibm.com/infocenter donne des informations complémentaires pour établir ce plan de backup.
 - Un DRP doit être audité par un tiers et peut également être sous traité à des spécialistes.

RISK Analysis

- Que peut il bien m'arriver ?
- Cela n'arrive qu'aux autres...

RISQUES DIVERS

- Alimentation électrique
 - UPS, onduleur, groupe... et les utilisateurs...
 - Quid en cas de court circuit... ?
- Réseau
 - Doubler les lignes
 - Doubler les providers...
- 'Errare humanum est' ...
 - 'j'ai lancé la clotûre mensuelle... mais j'ai oublié une opération'
 - 'les factures sont sorties avec la TVA à 111%... '
 - 'J'ai supprimé par erreur une transaction... (avant-hier)'
 - 'J'ai supprimé par erreur une transaction... (de ce matin)'
 - 'J'ai supprimé les compteurs de stocks... (et les articles..)'
 - 'M.. C'était pas la prise du modem?'
 - Mount next tape (C G I ?)

RISQUES DIVERS

- Crash disque
 - Quid si 1 disque est en panne
 - Quid si 2 disques sont en panne
- Redundant Power
 - Doubler les alimentations
 - Circuits et Fusibles séparés
- Other HW
 - IOP
 - Faux contact sur une carte...
 - Double panne.

RISQUES DIVERS

- Application
 - Erreur de programme
 - Situation non prévue
 - Erreurs de données
- Erreur OS
 - DB
 - Application ne tourne pas
- Erreur opération
 - Disques full à 99,99% tout va bien (mais plus pour longtemps...)
 - Mauvaise réponse aux messages

RISQUES DIVERS

- INCENDIE
 - Dans la salle (alimentation grillée)
 - Papiers qui « traînent » sur un écran
 - Batterie d'un portable...
- INNONDATION
 - Fuite dans le système anti-incendie
 - Pompe en panne Salle en sous sol
 - Zones inondables
 - Fuites d'eau... ou condensation...
- Tremblement de terre, tempêtes, tornade...
- Mauvaise intention
 - Terrorisme, banditisme, vengeance, mauvais plaisant..
- Virus
 - Peu probable sur i5 mais...

BACKUP

- Q1. Que faut il sauver ?
- Q2. Quand ...?
 - » R1. TOUT.
 - » R2. Quand cela change.
- Are you saving the right Stuff

SAVE COMMANDS

- SAVSYS
 - Microcode (LIC)
 - QSYS
 - User profiles (SAVSECDTA)
 - Private authorities (SAVSECDTA)
 - Configuration objects (SAVCFG)

SAVE COMMANDS

- SAVSYSINF
 - System Reply List Entries
 - Certain System Values
 - Some System Values are Not Saved
 - Not Required for System Recovery
 - Service Attributes
 - Network Attributes
 - Environment Variables
 - PTFs for 5722SS1 and 5722999 Applied (TEMP or PERM) Since Last SAVSYS
 - All Group PTFs
 - All PTF Cover Letters
 - Loaded PTFs Copied into *SERVICE

SAVE COMMANDS

- SAV (IFS objects)
 - IBM Supplied directories
 - User Objects in IFS

!!! Vérifier les attributs des objets et des répertoires...

CHGATR /... ATR(*ALWSAV) VALUE(*YES)

SAVE COMMANDS

- SAVDLO (Folders)
 - IBM Supplied Folders
 - User Objects in « Shared Folders »
 - (think about migrate to IFS)
 - Distribution Objects (distribution queues, documents and file...)

SAVE COMMANDS

- SAVLIB *IBM
 - IBM Libraries
 - Q*
 - SAUF QGPL, QUSRSYS, QS36F
- SAVLIB *ALLUSR
 - QGPL, QUSRSYS, QS36F, #LIBRARY
 - All non Q* libraries
- SAVLIB *NONSYS
 - *IBM + *ALLUSR

SAVE COMMANDS

- SAVOBJ
- SAVCHGOBJ
- SAVLICPGM
- SAVSTG
- SAVS36F

- SAVRSTLIB SAVRSTOBJ

GO SAVE

- Option 21 : ENTIRE SYSTEM
 - SAVSYS
 - SAVLIB *NONSYS
 - SAVDLO
 - SAV

GO SAVE

- Option 22 : SYSTEM DATA
 - SAVSYS
 - SAV IBM Directories in IFS
 - SAVLIB *BM

GO SAVE

- Option 23 : USER DATA
 - SAVLIB *ALLUSER
 - SAVDLO
 - SAV User IFS Directories

Backing Up Domino Server Example

- Backing up directory for your Domino Server and the IBM-supplied directory:
 - 1. Ensure complete copy of server, by ending the server before the save:
 - ENDDOMSVR SERVER(server-name)
 - 2. Save Domino Server directory and system-supplied directory (substitute your directory name for /NOTES/DATA:
 - SAV DEV('QSYS.LIB/tape-device-name.DEVD')
 - OBJ('/NOTES/DATA/*')
 - ('/QIBM/UserData/Lotus/Notes/*'))
 - 3. Save library that contains customization information for your Domino servers: SAVLIB LIB(QUSRNOTES) DEV(tape-device-name)
- NOTE: If you use option 21 or option 23 from the Save menu regularly, you do not need to back up your Domino server separately.

Backing Up Windows Server

- Full Backup Saving /QFPNWSSTG or /dev/IASP/xxxx.udfs
 - NWSD for IXS/IXA Varied Off
- Saving Individual NT Server Objects Prior to V4R5
 - Copy Server Objects (Windows NT Command) to IFS Directory on AS/400
 - Objects Saved when Directory Saved
 - IBM's Tivoli Storage Manager (TSM)
 - Save to AS/400 Media using Window's NT Backup Product (Backup Exec)
- Saving /QNTC Directories Starting with V4R5
 - NWSD for IXS/IXA Varied On
 - Working TCP/IP Internal LAN Connection
 - Saves /QNTC Directories Associated with IXS/IXA

Backing Up Windows Server

- During Backup System Attempts to Save Directories in the /QNTC or /QFPNWSSTG Directory
 - If IXS/IXA Varied On, /QNTC Directories Saved
 - Requires Working TCP/IP Internal LAN Connection
 - If IXS/IXA Varied Off, /QFPNWSSTG Directories Saved
 - Individual Files and Directories Cannot be Restored From /QFPNWSSTG
- Time to Save /QFPNWSSTG SIGNIFICANTLY Less than Saving /QNTC
 - For Save Option 21 or 23 Vary Off NWSD
 - For Objects Changing Frequently
 - Place in One or Two Subdirectories in /QNTC
 - Save Changes with NWSD Varied ON

Backing Up Linux in a Partition

- Linux Data Stored in Two Ways
 - "Virtual Disks" (NWSSTG) Owned by iSeries
 - Real Disk Devices Owned by Linux
- Virtual Disks Backed Up Using the SAV Command
 - Stored in /QFPNWSSTG or /dev/IASPNAME/networkserver.udfs Directory
 - Linux Partition NWSD Must Be Varied Off
 - Restored with RST Command
 - Save Menu Option 21 (Entire System) Includes Linux
 - No Capability for File Level Save on iSeries

Backing Up Linux in a Partition

- Real Disk Devices Backed Up Using Linux Commands
 - Linux Writes to Virtual or Direct Attached Tape Devices
 - Requires Standard Linux Commands
 - Capability for File Level Save and Restore
- "Virtual" Disks Can Also be Backed Up to Virtual or Real Tape Devices with Standard Linux Commands

Backing Up AIX in a Partition *(New for V5R3)*

- AIX Data Stored in Two Ways
 - "Virtual Disks" (NWSSTG) Owned by i5/OS
 - Requires POWER5 Hardware
 - Requires AIX 5.3 Release
 - Real Disk Devices Owned by AIX
 - Requires Current AIX 5.2 Release
 - Backup Using IBM's Tivoli Storage Manager (TSM)
- Virtual Disks Backed Up Using the SAV Command
- Stored in /QFPNWSSTG or /dev/IASPNAME/networkserver.udfs Directory
- AIX Partition NWSD Must Be Varied Off
- Restored with RST Command
- Save Menu Option 21 (Entire System) Includes AIX
- No Capability for File Level Save on i5/OS

Backing Up Independent ASPs

- Independent ASP (Disk Pools 33-255) Used for Switched Disks & Clustering
 - Support for Libraries in IASPs in V5R2
 - Save/Restore Individual ASPs or Entire System with IASPs
 - ASPDEV Parameter on SAVxxx and RSTxxx Commands
- Independent ASPs Require Active State for Save
- Save-while-active Strategy for 24 X 7
- BRMS for IASPs Backup/Recovery Strategy
- Restricted State Save - Save Option 21 (Entire System)
 - Clustering Fail Over will Prevent Save of Data
 - Switches ASPs to Another System
- To Include Independent ASP Data - Save Option 21
 - End Cluster Resource Group
 - Ensure Independent ASPs are in an Active State

Backing Up Independent ASPs

- IASP Configuration Not Saved
 - Maintained on System and Can Be Recovered
- IASP Configuration Must be Created During System Recovery to Different System
- System Recovery to Different System Requires
 - Restore of System and User Data
 - May or May Not Include Independent ASP Data Depending on Save
 - IPL of System
 - Configuration of IASPs Using iSeries Navigator
 - Restore of IASP Data
- BRMS Guides Recovery of IASPs
 - *In V5R3 Can Recover an IASP with History from Another System*
 - *STRRCYBRM OPTION(*ASPDEV) ACTION(*RESTORE)*

Backing Up Logical Partitions

- Logical Partitioned Systems
 - Backup Each Partition - Multiple Tape Devices Required to Backup Concurrently
 - Recovering Primary Partition - All Partitions Ended
 - Recovery of Secondary Partition Initiated from Primary (Manual D-IPL)
 - Partition Configuration Maintained on System but Not Saved
- Recovery of Logical Partitioned Systems
 - After Restoring Licensed Internal Code, Partition and DASD Configuration Recovered or Recreated, and Operating System Restored, Secondary Partitions Can Recover Concurrently
 - Partition Configuration Can be Recovered on Same System but Must be Created on a Different System

Back Up Hardware Management Console (HMC)

- Required on i5 Hardware for Partitioned or CUoD Systems
- Backed Up Separately Outside of an Option 21 Save
- Backup Performed on HMC Console to DVD/RAM or FTP to Another Server – Can Be Scheduled
 - Backup Partition Profiles Prior to Installs and Upgrades
 - bkprofdata -m managedsysname -f deb.file
 - rstprofdata
 - Cannot Recover to System with Different Serial Number
 - DRCIndex and Serial Number Saved
- Disaster Recovery Backup (*New for HMC Version GA7*)
 - mksysplan -m managedsysame -f deb.sysplan
 - Deploysysplan Recalculates DRCIndex and Serial Number
 - Recover to Like Hardware
 - Equal to or Greater
 - Different Serial Number Allowed

STRATEGIE DE BACKUP

– SIMPLE :

- Vous disposez de la fenêtre suffisante (disponibilité du système pour des backups)
- Vous disposez du matériel ad hoc
 - » SAUVEZ TOUT LE SYSTEME CHAQUE JOUR
- Sinon
 - » SAUVEZ LE SYSTEME CHAQUE SEMAINE
 - » SAUVEZ les données chaque jour

OPERATIONAL ASSISTANT

- Go Backup
 - Daily Backup
 - Weekly Backup
 - Monthly Backup

STRATEGIE DE BACKUP

– MOYENNE :

- Vous disposez d'une fenêtre insuffisante (disponibilité du système pour des backups)
- Vous disposez du matériel ad hoc
 - SAUVEZ CHAQUE JOUR LES DONNEES MODIFIEES PAR SAVCHGOBJ
 - UTILISEZ LE JOURNALING
 - » Sauvegardez les receivers.(SAVOBJ ou SAVLIB)

STRATEGIE DE BACKUP

– COMPLEXE :

- Vous disposez d'une fenêtre insuffisante. Vous ne pouvez pas arrêter le système...
 - SAUVEZ CHAQUE JOUR LES DONNEES MODIFIEES PAR SAVCHGOBJ, SAVLIB, SAVOBJ
 - UTILISEZ LE JOURNALING
 - » Sauvegardez les receivers.(SAVOBJ ou SAVLIB)
 - UTILISEZ la fonction Save While Active
 - UTILISEZ plusieurs TAPE en parallèle pour diminuer le temps de backup (via BRMS)
 - UTILISEZ des Save Files ou des unités virtuelles

Backup Window

- Faster tape
- Parallel save
- Save file
- Virtual tape
- Data archiving
- Save Changed objects
- Second system
- Save while active
- Flash Copy

Parallel Save

- SAVLIB xx DEV(TAP01 TAP02)
 - Continues to TAP02 while rewinding TAP01
- Parallel save tasks
 - SBMJOB CMD(SAVLIB XX DEV(TAP01)
 - SBMJOB CMD(SAVLIB YY DEV(TAP02)
- Parallel save uses a media definition objects
- Media definition
 - Created with API QSRCRTMD
 - (BRMS do it for you.... recommended)

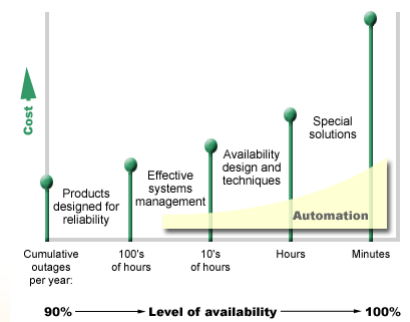
AVAILABILITY

– BASICS.

- Business continuity...
- Disaster Recovery
- High Availability
- Outages
- Backup Window
- Un/planned outage

DISPONIBILITE

– Fixer les objectifs



DISPONIBILITE

Disponibilité	Downtime/an
90%	36,5 jours
95%	18.25 jours
99%	3,65 jours
99.99%	50 minutes
99.999%	5 minutes

PREVENTION

Prevention

- Crash disk
 - DeviceParity
 - Mirrored Protection
 - Independent disk pools
 - Geographic Mirroring
 - Multipath disk units

Disk protection - Parity

- Raid 5
 - Parity data
 - Spread over 3 disks
 - Supports 1 disk failure.
 - 3 to 18 disk units
- Raid 6
 - Parity data
 - Spread over 4 to 18 disks
 - Supports 2 disk failures.
- Write cache and aux write cache IOA
 - No data loss
 - Not a failover
 - Data recovered when IOA replaced
- Hot Spare disk
 - Part of a raid array
 - Ready to replace a failed unit.
 - Automatic.
 - Reduce the time exposure to the risk of a second crash.

DISK Protection - mirroring

- Disk units
- Disk controllers
- I/O bus Unit
- I/O Adapter
- I/O Processors
- Bus
- Expansion towers
- HSL links

Disk Protection

- IASP or Independent Disk Pools
- The system continues if an iASP is missing

Disk Protection

- Geographic Mirroring
- Mirrors an iASP to a backup site.
- Requires
 - 5761 SS1 option 41
 - 5761 HAS

Disk Protection

- MultiPath
- The connection between system i and Storage server (DSXXXX) is redundant.

Plan power failure

- Power requirements
- Redundant Power supplies
- UPS
 - Connection between UPS and system
- Power generator

Haute disponibilité

- Requier un second système.
- Permet
 - DRP
 - Interventions planifiées
 - HW maintenance...
 - Upgrade software, ptf...
 - Backup

High Availability

- Application resilience (use clustering)
- Data resilience
 - Logical replication (use journaling)
 - Switchable device
 - Cross Site mirroring
 - Geographic Mirroring
 - Metro Mirror (PPRC)
 - Global Mirror

High Availability

- **CLUSTER**
 - Un groupe de système (ou partitions) qui peuvent partager des ressources
- **CLUSTER NODE**
 - Un système ou une partition membre d'un cluster
- **CLUSTER RESSOURCE GROUP**
 - Un objet i5/OS qui regroupe les ressources utilisées pour gérer les événements dans un environnement HA
- **DEVICE DOMAIN**
 - Regroupe les Systèmes d'un cluster qui partagent des ressources
- **CLUSTER ADMINISTRATIVE DOMAIN**

High Availability

- Switched disks
 - iASP contrôlé par un CRG qui peut être switché entre les nodes d'un cluster
- Switchable device
 - Independent disk pool
 - Network Server Host Adapter
 - Optical Device
 - Tape Device
 - Ethernet Line
 - Network Server

Independent disk pool

- iASP
 - Standalone (private to 1 system)
 - Switchable (between systems)
 - Number from 33 to 255
 - 'ASP 1 : System
 - 'ASP 2 → 32' User ASP
 - *SYSBAS : ASP 1 to 32
 - Disk pool group
 - 1 primary + n secondary disk pools.
 - Data independent but group is a whole

Independent disk pools

- Multiple databases
- Same library name in multiple instances
- 3 types of diskpools
 - UDFS
 - Primary
 - Secondary
- Some restrictions
 - JOBQ, SBSDB...
- HW requirement (ideally 1 IOA or IOP)

Independent disk pools

- SETASPGRP
- SAVxxx operations...
ASPDEV(*CURASPGRP or *SYSBAS)
 - Need setaspgrp BEFORE
 - Save Option 21 doesnot save ALL !!!!
- Initial ASPGRP in job description

Geographic Mirroring

- Mirroring of iASP between systems
- One is active (varied on) and useable
- The other iASP is varied off and not usable.
- The remote system is UP.
- Cluster (HASM) is used to switch

HIGH AVAILABILITY

Application Resilience

Combine with Data Resilience for complete solution

Fully transparent

- Full resilience with automatic restart & transparent failover
- Users repositioned to last committed transaction
- No data loss, no sign-on required, no perceived loss of server; only delay in response

Semi-transparent:

- Automatic application restart & recovery to last transaction boundary
- The resilient data & the application restart point match exactly

Semi-automatic:

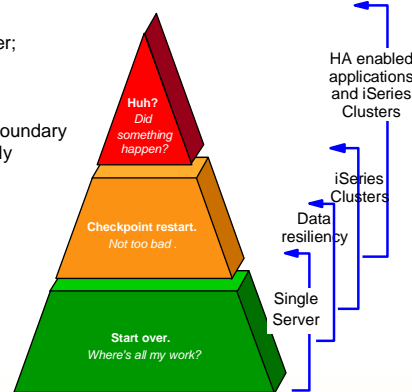
- Automatic application restart & recovery to some architected application "restart" point
- Normally consistent with state of data, but user may have to manually match application to position of data

Basic application failover:

- Automatic application restart after outage
- User manually repositions within application

No application recovery:

- Users manually restart application with resilient data
- User determines where to resume work



Data Resilience

Combine with Application Resilience for complete solution

• Logical Replication

Business partner software product

Second copy of data is generated logically identical to the first
Replication is done on object basis near real time

• Switchable Device

Switchable IASPs

Single copy of data is maintained
Data in IASP switched to backup system during outage

• Operating System Storage Management based Replication

Cross-Site Mirroring (XSM) with Geographic Mirroring

Second copy of data in IASP is generated logically identical to the first
Changes to production IASP replicated to second copy of IASP through another system

• Storage Server based Replication

PPRC used with iSeries Copy Services for Total Storage toolkit

Second copy of data is generated physically identical to the first
Total Storage peer to peer remote copy (PPRC) function combined with IASPs

PPRC used with SAN Load Source

Second copy of data is generated physically identical to the first
Total Storage peer to peer remote copy (PPRC) function combined with Boot from SAN

Applicability of Solution to Problem Set

Start to determine possible matches of technologies to specific needs

1. Initial analysis to **eliminate** technologies that do not fit
2. After initial analysis, perform detailed analysis of complete requirement sets against specific characteristics of each technology

Data Resilience Technologies

		Logical replication	Switched disk	XSM	PPRC with Copy Services toolkit	PPRC with SAN Load Source
Backup Window Reduction			n/a	n/a	n/a	n/a
Planned Maintenance						n/a
Recovery for disaster outage			n/a			
HA for unplanned outage						n/a
Workload Balancing						n/a

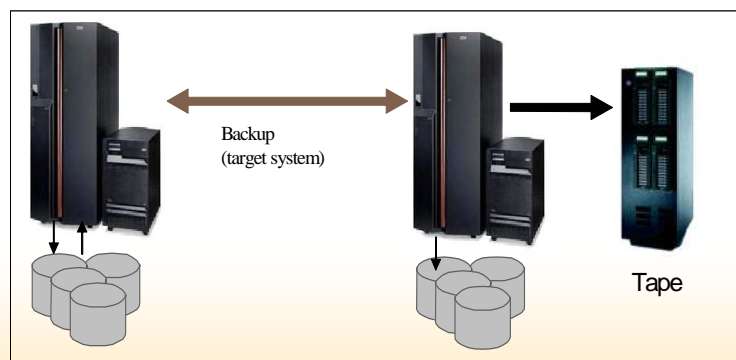
Data Resilience Technologies Detailed Attributes of Solutions

Data Resilience Technologies

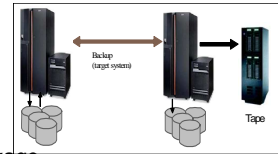
- **Logical Replication**
 - *Business partner software product*
- **Switchable Device**
 - *Switchable IASPs*
- **Operating System Storage Management based Replication**
 - *Cross-Site Mirroring (XSM) with Geographic Mirroring*
- **Storage Server based Replication**
 - *Total Storage PPRC used with iSeries Copy Services toolkit*
 - *Total Storage PPRC used with SAN Load Source*

Logical Replication

- Second copy of data is generated logically identical to first
- Replication done on object basis (file, member, data area, program, etc.) near real-time
- Normally done via a business partner software product



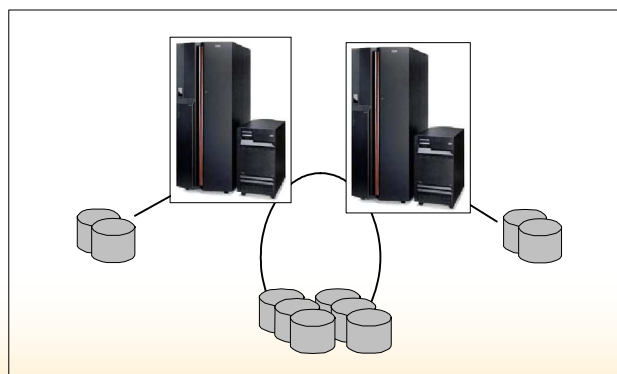
Logical Replication



- **Most widely deployed data resiliency topology for iSeries**
 - Typically deployed via an HA Business Partner solution package
 - **Replication done on object basis (file, data area, program, etc.) near real-time**
 - Done at the lowest unit of change for the object, e.g. record level for database files
 - Otherwise, done on entire object when change detected by replication software
 - OS/400 Remote Journaling provides efficient, reliable transport mechanism
- **Benefits:**
 - Rapid activation of production environment on backup server via role-swap operation
 - Replicated data can be concurrently accessed for backups or other read-only apps
 - Minimal recovery is needed when switching over to the backup copy
- **Considerations:**
 - Complexity of setup and maintenance
 - Modification of "live" copies of objects on backup server
 - Lag time between changes on source being available on backup server
 - Consistency between journaled and non-journaled objects

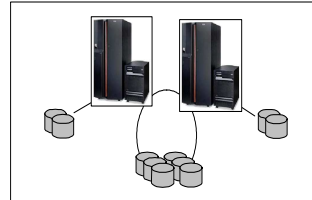
Switchable IASPs

- Single copy of data is maintained
- Data in Independent ASP (IASP) switched to backup system during outage



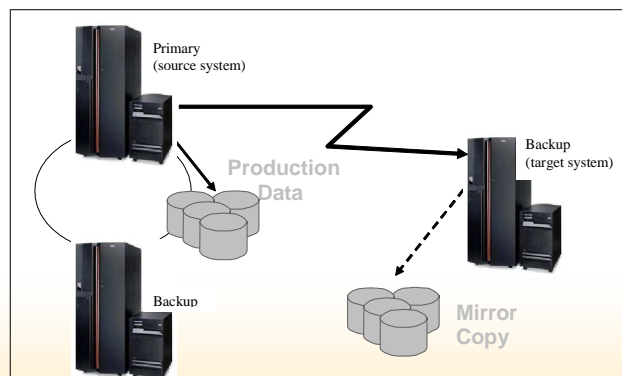
Switchable IASPs

- **Independent Auxiliary Storage Pools (IASPs)**
 - OS/400 Option 41 - High Availability Switchable Resources
 - Switch disks from one system to another
- **Benefits:**
 - Simplicity
 - Data is always current (no copy to synchronize)
 - No in-flight data to lose
 - Minimal performance overhead
 - Supports integrated environments (Windows, Linux) as well as i5OS
- **Considerations:**
 - Setup DASD configuration, data, and application structure
 - Single copy of data (mirroring recommended to protect data, reduce SPOFs)
 - No concurrent access from both hosts
 - HW restrictions (distance, conc maint)
 - DB restrictions on cross IASP relationships



Cross-Site Mirroring (XSM) with Geographic Mirroring

- Second copy of data in an IASP is generated logically identical to first
- Changes to production IASP replicated to second copy of IASP thru another system
- Operating system storage management based replication solution

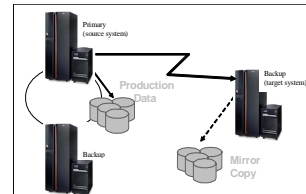


Cross-Site Mirroring (XSM) with Geographic Mirroring

- **Mirroring of IASP data via OS/400 storage management to a second server**
 - Included in Option 41 of OS/400 V5R3
 - Enables switching or automatic failover to mirrored copy of IASP

- **Benefits:**

- Same as switched device
- Two copies of IASP data
- Can be local or remote
- Ease of deployment and operation
- Supports integrated environments (Windows, Linux) as well as i5OS

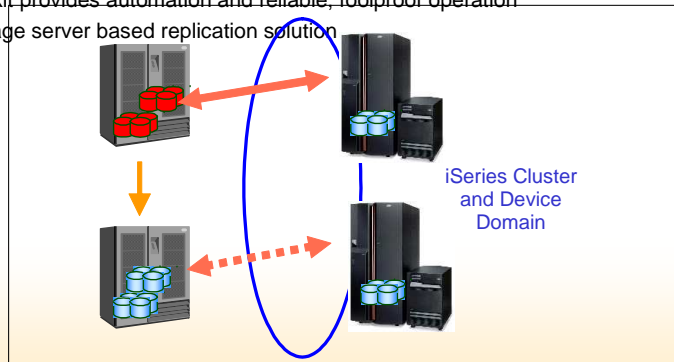


- **Considerations:**

- Performance impacts of synchronous operation, distance, bandwidth, latency
- Mirror copy cannot be concurrently accessed
- Impractical to detach mirrored copy to do backups to tape
- *Full data re-synchronization required for any persistent transmission interruption*
- Recommend at least three system configuration

Total Storage PPRC with iSeries Copy Services toolkit

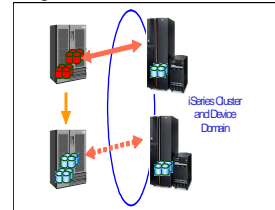
- Second copy of data is generated physically identical to the first
- Total Storage peer to peer remote copy (PPRC) function combined with IASP
- Toolkit provides automation and reliable, foolproof operation
- Storage server based replication solution



Total Storage PPRC with iSeries Copy Services toolkit

- **Replication of IASP data at storage controller level to second ESS or DS using PPRC**

- PPRC generates a second copy of the IASP on another Total Storage server
- Toolkit part of *iSeries Copy Services for IBM TotalStorage* offering
- Combines PPRC, IASP, and OS/400 cluster services for
- Coordinated switchover/failover



- **Benefits:**

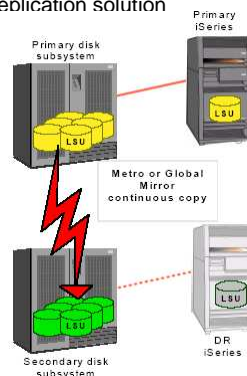
- Remote copy and coordinated switching without an IPL
- Can combine with FlashCopy for backup window reduction

- **Considerations:**

- Performance impacts of synchronous mode: distance, bandwidth, latency
- Mirror copy cannot be concurrently accessed
- Asynchronous mode requires IBM TotalStorage Global Mirror
- Requires tools and services to deploy

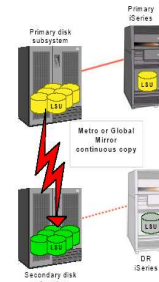
Total Storage PPRC with SAN Load Source

- Second copy of data is generated physically identical to the first
- Total Storage peer to peer remote copy (PPRC) function combined with Boot from SAN
- All data, include load source, is replicated to second external storage server
- Storage server based replication solution



Total Storage PPRC with SAN Load Source

- **Replication of data at storage controller level to second storage server using PPRC**
 - PPRC generates a second copy of **all** data on another Total Storage server
 - Combines PPRC and boot from SAN for disaster recovery
- **Benefits:**
 - Generates complete copy system for DR
 - Requires no changes to applications
- **Considerations:**
 - Fail over requires manual intervention and careful recovery
 - All changed data, including temporaries, are replicated
 - High transmission volumes between Total Storage serve
 - Only for DR (do not consider if need HA)
 - Performance and distance implications with synchronous mode
 - Asynchronous mode requires IBM TotalStorage Global Mirror



Journaling

Journaling

- Principe
 - Chaque accès au fichier est enregistré
- La définition se fait par un objet de type *JRN
- Les données sont enregistrées dans un *JRNRCV

Journaling

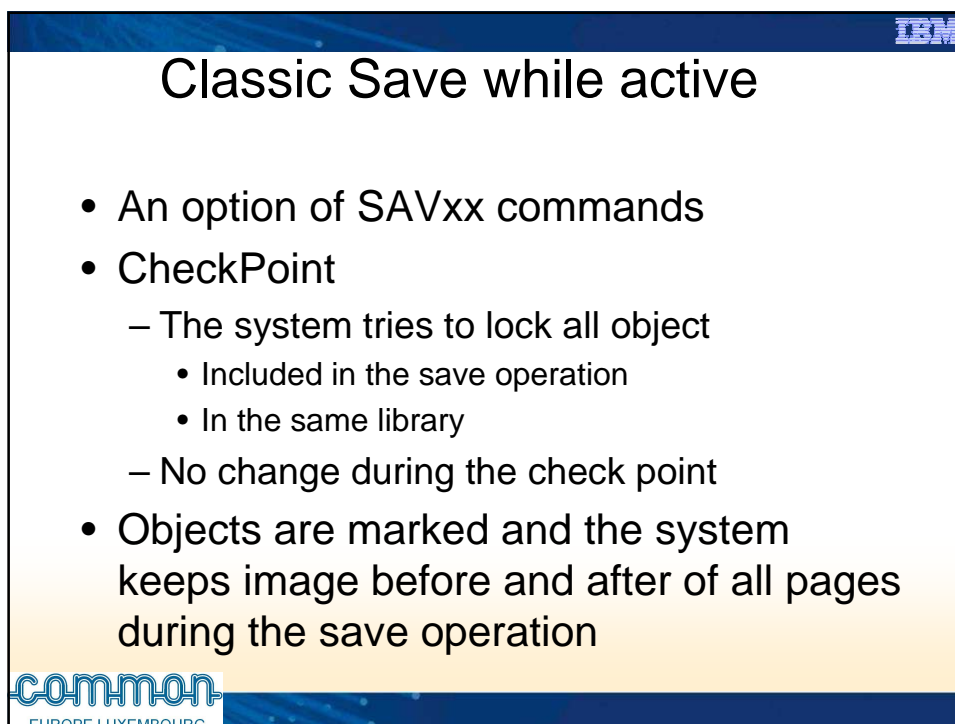
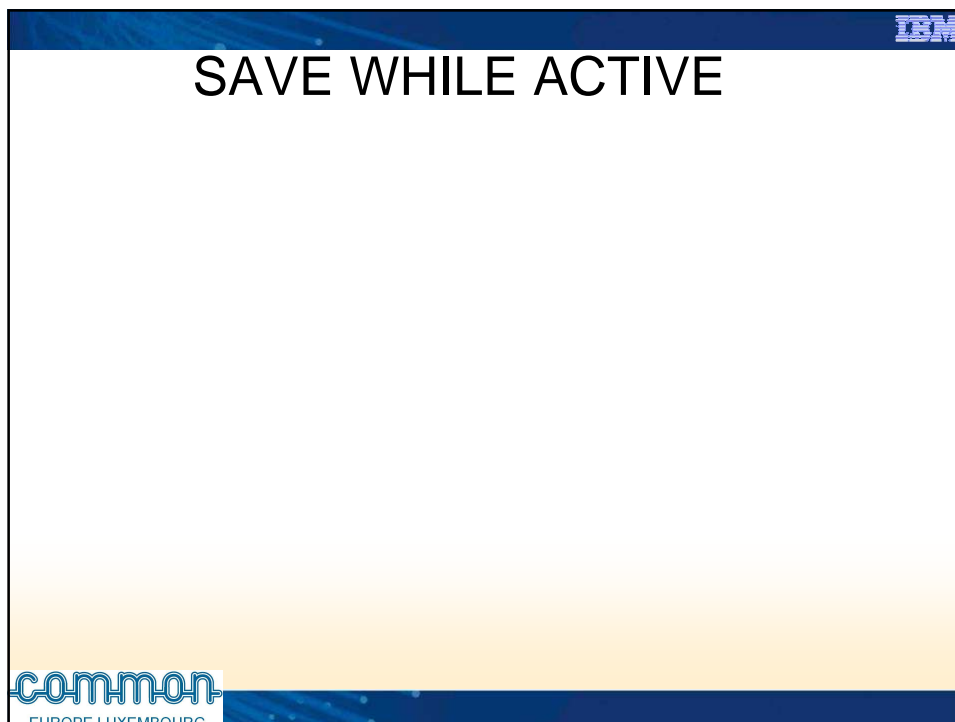
- Commandes
- CRTJRNRCV
 - Select ASP
- CRTJRN
 - Select ASP
 - Manage receiver, delete receiver
- STRJRNPF
 - IMAGES(*BEFORE *AFTER) OMJRNE(*OPNCLO)
- ENDJRNPF
- APYJRNCHG
- RMVJRNCHG
- DSPJRN
- SNDJRNE
- API (remote journal, receive journal entry, etc...)

Journaling

- Cleanup (manage receiver)
- SQL Database ... Table
- Commitment Control
 - STRCMTCTL
 - Commit / Rollback
- 2 phase commit

Audit

- Must create receivers and QAUDJRN journal.
- Controlled by system values
 - QAUDCTL (*OBJAUD *AUDLVL
 - QAUDLVL & QAUDLVL2
- Security Audit options
- Spoolfiles
- Object audit controlled by commands
 - CHGAUD
 - CHGOBJAUD



Ragged Save while active

- An option of SAVxx commands
- Need Journal and commitment control.
- If a CheckPoint cannot be reached
 - The object is flagged and saved
- The journal is saved after the objects.
- The save is « inconsistent »
- Consistency will be built at restore time if needed.

Virtual tape

Virtual Tape Support

- Key Advantages
 - Supported on all Save/Restore Commands and APIs (except SAVSTG)
 - Can Be Faster than Saving Directly to Tape
 - Similar Performance as Save Files
 - Best Performance in Separate ASP
 - Eliminates Save File Limitations
 - One Library Per Save File
 - SAVSYS Not Supported on Save File
 - Parallel Saves Not Supported on Save File
 - 1 TB Size Limitation on Save File
 - Eliminates Media Error Limitations
 - Saves Ending Due to Tape Device or Media Errors
 - Save-while-active Checkpoint Restriction
 - Once Checkpoint Reached Saves Can't be Restarted
 - Duplicate Saves to Media (DUPTAP or DUPMEDBRM)
 - When Tape Devices Available
 - At Your Convenience
 - Onsite and Offsite Storage
 - Keep Virtual Volumes on Systems as Needed
 - Keep Duplicated Volumes Offsite

Virtual Tape Support

- Considerations
 - Additional DASD Requirements
 - No Install from SAVSYS Virtual Volume
 - D-IPL Only from Media
 - May Not Be Faster
 - Tape Technology
 - System Configuration and Environment
 - Data Compaction Not Supported
 - Data Compression Support
 - DTACPR(*YES) Parameter on Save Commands
 - Default is *NO
 - SNA Low Data Compression
 - Significant Performance Impact

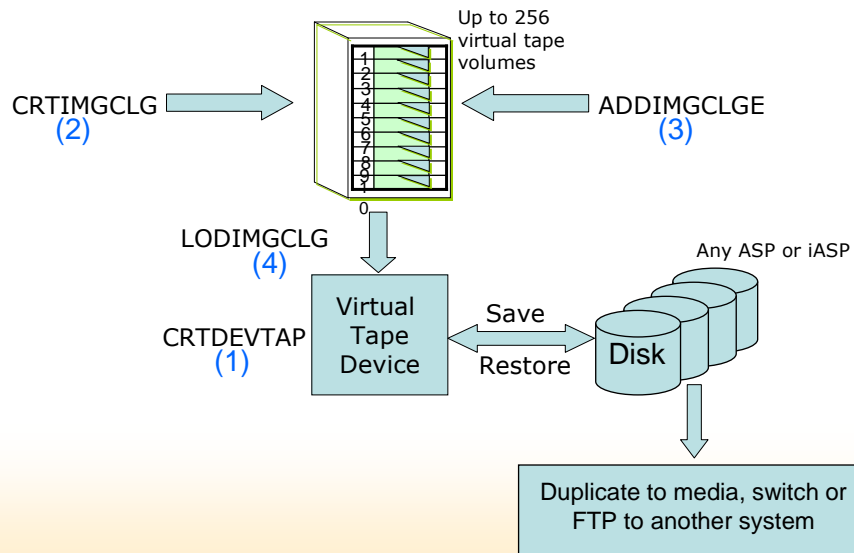
Virtual Tape Support

- Implementation of Virtual Tape
 - Included in Base i5 Operating System
 - Configures on RACL (Random Access Cartridge Loader) Tape Device
 - I/O to Disk instead of Tape Media
 - Behaves as Tape Library Mounting Specified Volumes
 - Up to 35 Virtual Tape Devices
 - Virtual Tape Volumes Support Multiple Optimum Block Sizes
 - Compatibility with Tape Devices
 - Existing Image Catalog Commands used for Virtual Optical
 - Tape Volume Management Interface with iSeries Navigator
 - User Interface is Green Screen or iSeries Navigator
 - Complete End User Interface and Tape Management with BRMS
- Virtual Volumes Stored as IFS Stream Files
 - FTP to Other Servers or Partitions
 - Considerations
 - Bandwidth
 - Management of Transmitted Files
 - Disaster Recovery

Virtual Tape Support

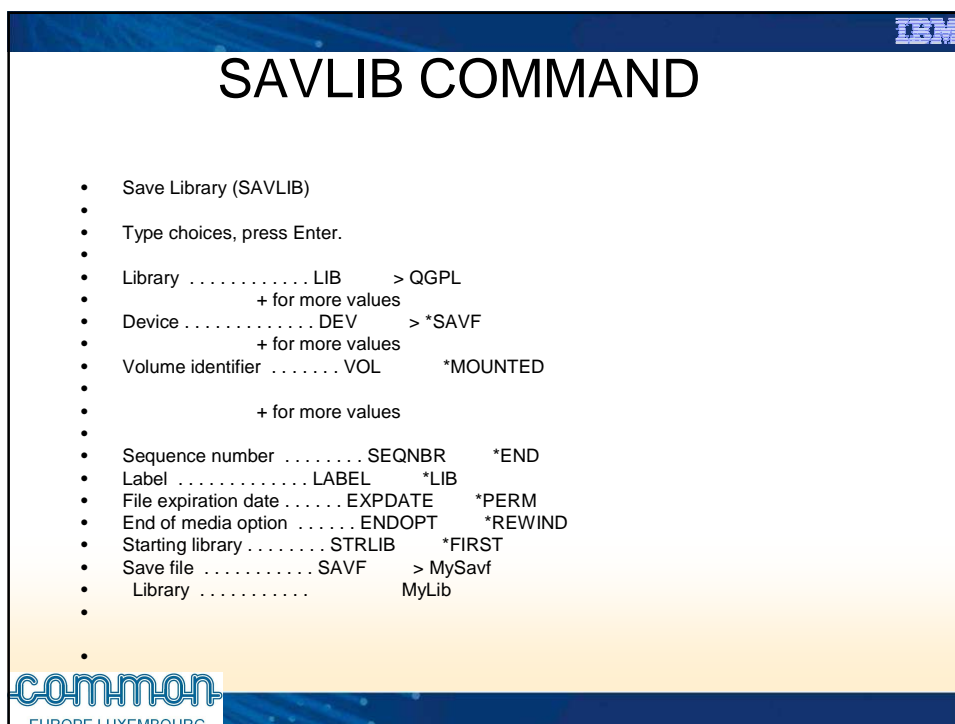
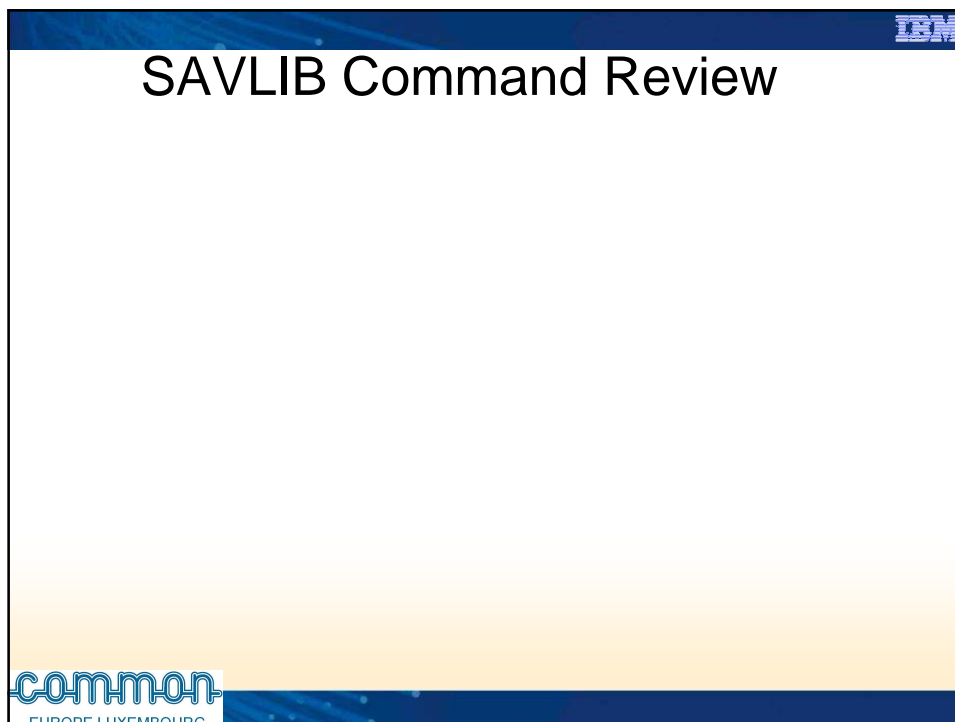
- Virtual Tape Devices with Guest Partitions (Linux, AIX)
 - Supported Using Virtual I/O
 - Virtual Tape Device Description
 - Configure with NO Volume Unload During Vary Off
 - Virtual Volume Mounting
 - Must Mount in Advance by i5/OS Partition


Overview and Implementation





Implementing Virtual Tape

1. Create Virtual Tape Devices
2. Create Image Catalog
3. Create Virtual Tape Image
4. Load Image Catalog into Virtual Device
5. Virtual Tape Storage Ready for Save/Restore






- Save Library (SAVLIB)
-
- Type choices, press Enter.
-
- Media definition MEDDFN
- Library *LIBL
- Optical file OPTFILE **
-
- Use optimum block USEOPTBLK *YES
-
- Additional Parameters
-
- Target release TGTRLS *CURRENT
- Update history UPDHST *YES
- Clear CLEAR *NONE
- Object pre-check PRECHK *NO
- Save active SAVACT *NO
-

- Save Library (SAVLIB)
-
- Type choices, press Enter.
-
- Save active wait time: SAVACTWAIT
- Object locks 120
- Pending record changes *LOCKWAIT
- Other pending changes *LOCKWAIT
- Save active message queue . . . SAVACTMSGQ *NONE
- Library *LIBL
- Save access paths ACCPTH *SYSVAL
- Save file data SAVFDTA *YES
- Spooled file data SPLFDTA *NONE
- Queue data QDTA *NONE
- Storage STG *KEEP
- Data compression DTACPR *DEV
- Data compaction COMPACT *DEV
- Libraries to omit OMITLIB *NONE
-
- + for more values
-



- Save Library (SAVLIB)
-
- Type choices, press Enter.
-
- Objects to omit: OMITOBJ
- Object
- Library *ALL
- Object type *ALL
- + for more values
- ASP device ASPDEV *
- Output OUTPUT *NONE
- File to receive output OUTFILE
- Library *LIBL
- Output member options: OUTMBR
- Member to receive output . . . *FIRST
- Replace or add records . . . *REPLACE
- Type of output information . . . INFTYPE *OBJ
- Command user space CMDUSRSPC
- Library *LIBL
-

Hardware review

- Tapes
 - Model
 - Capacity
 - Speed
- Tape Libraries

TAPE

- Internal (SAS)
 - 4mm DAT
 - 36/72GB
 - 80/160
 - Half high LTO4
 - 800GB/1.6TB

TAPE

- External
 - LTO3
 - LTO4
 - LTO4 Half High
 - SLR
 - DAT

