IBM Power Systems

IBM i™ High Availability Options
2008 PUG – Charring Cross Hotel, London

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RAS - Reliability, Availability and Serviceability

Hardware Service

- Automatic Failure Notification
- Concurrent maintenance
- Predictive Failure Analysis & Reporting
- HMC (Hdw Maint Console)

Power Subsystem

- Redundant power supplies
- Dual line cords
- Redundant cooling fans
- Dedicated UPS Monitoring Interface
- Concurrent maintenance

Memory – CPU

- Error detection & correction
- Memory scrubbing
- Array repair at IPL using redundant array bits
- CPU Gard, CPU Sparing and Capacity on Demand
- "Chip kill" technology
- Redundant bit steering

Disk Subsystem

- RAID 5/6 protection
- Disk Mirroring protection
- SAN Multipath
- ESS/DS redundant cache
- Concurrent maintenance
- Add disk concurrently
- Move data concurrently
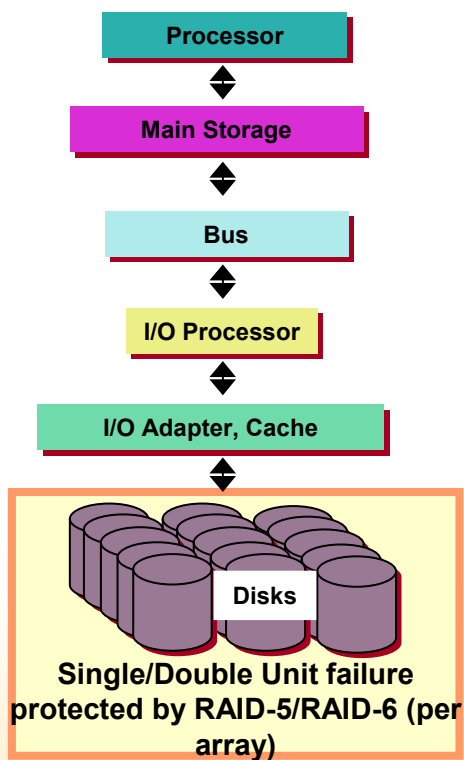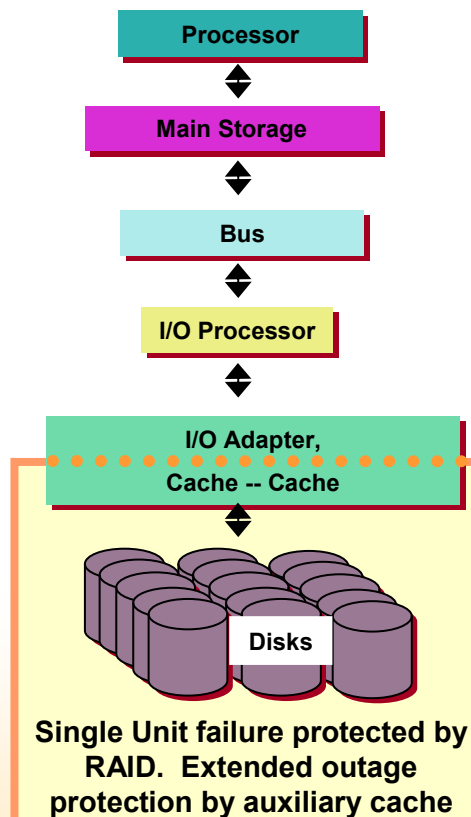- i5/OS Automatic Failure Notification

I/O Subsystem

- Hot pluggable PCI cards
- Concurrent maintenance
- Dynamic hardware resource reallocation
- Redundant HSL loops
- IOP reset
- Virtual IP, route fault tolerance, load balancing
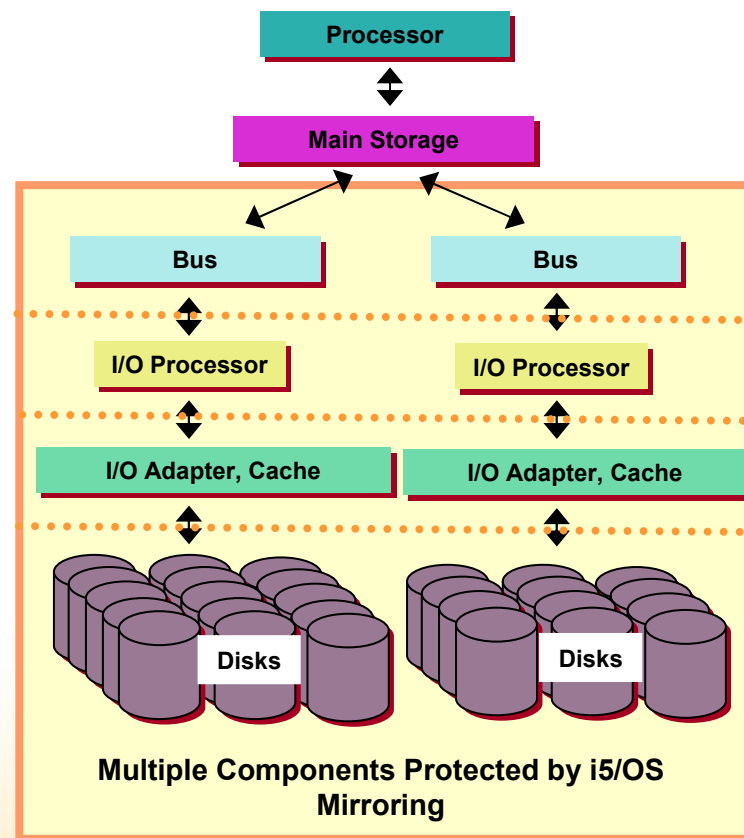
Disk Protection Options

RAID-5 / RAID-6

Processor

Main Storage

Bus

I/O Processor

I/O Adapter, Cache

Disks

Single/Double Unit failure protected by RAID-5/RAID-6 (per array)

Write cache protection for 5738/2780/2757 controllers

Processor

Main Storage

Bus

I/O Processor

I/O Adapter, Cache -- Cache

Disks

Single Unit failure protected by RAID. Extended outage protection by auxiliary cache

Mirroring

Processor

Main Storage

Bus   Bus

I/O Processor   I/O Processor

I/O Adapter, Cache   I/O Adapter, Cache

Disks   Disks

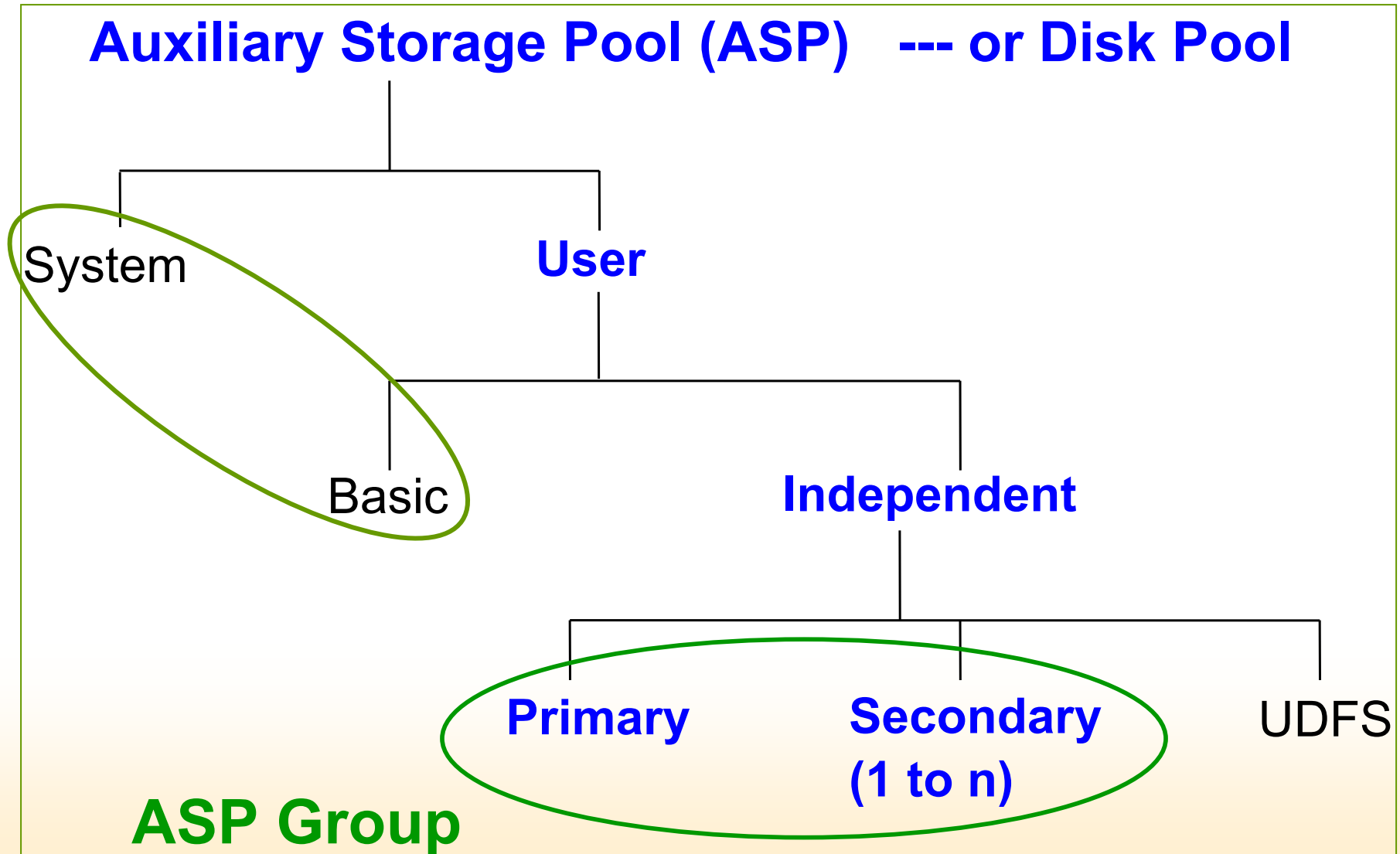**Multiple Components Protected by i5/OS Mirroring**

If not mirroring disk controllers, aux write cache makes sense

What is an Independent ASP (IASP)

- **An IASP is a set of DASD units which contain a collection of user objects and the necessary system data (storage management directories, object ownership and authorization information) such that the IASP can be taken offline or brought online independent of system activity on other ASPs.**

- **Can be made available and made unavailable to the server without restarting the system.**

- **Identified by device name.**

- **Overflow not allowed.**

- **Can be switched between systems in a clustered environment**

- **Each ASP group has a separate namespace and database**
  - –They do not overlap

- **VRYCFG or WRKCFGSTS used to independently bring online or take offline**
  - –**VRYCFG <aspname> *DEV *ON** to vary on
  - –**WRKCFGSTS *DEV *ASP** to view current status

IASP Terminology

Auxiliary Storage Pool (ASP) --- or Disk Pool

System

User

Basic

Independent

Primary   **Secondary (1 to n)**   UDFS

ASP Group

Types of ASPs

- **Basic ASP**
  - **ASP numbers 2-32**
  - **Linked to system ASP**
  - **Cannot be independently varied on or off**
  - **Will overflow into system ASP**
  - **Primarily used to isolate journal receivers from the data in the system ASP**

- **Independent ASP**
  - **Can be independently varied on and off**
  - **Can be switchable between systems**
  - **Identified by ASP number (33 – 255) and also by device description**
  - **Three types of IASP**
    - **UDFS**
    - **Primary**
    - **Secondary**

Types of Independent Auxiliary Storage Pools

- **UDFS IASP**
  - **Can only contain IFS objects**
 - **Slightly faster vary on time than a Primary IASP**

- **Primary IASP**
  - **Can contain IFS and library objects**
  - **Accessed via SETASPGRP**
  - **May have 0 or more secondary IASPs grouped with it**

- **Secondary IASP**
  - **Can contain IFS and library objects**
  - **Grouped with one Primary IASP**
  - **Varied on and off with the Primary IASP**
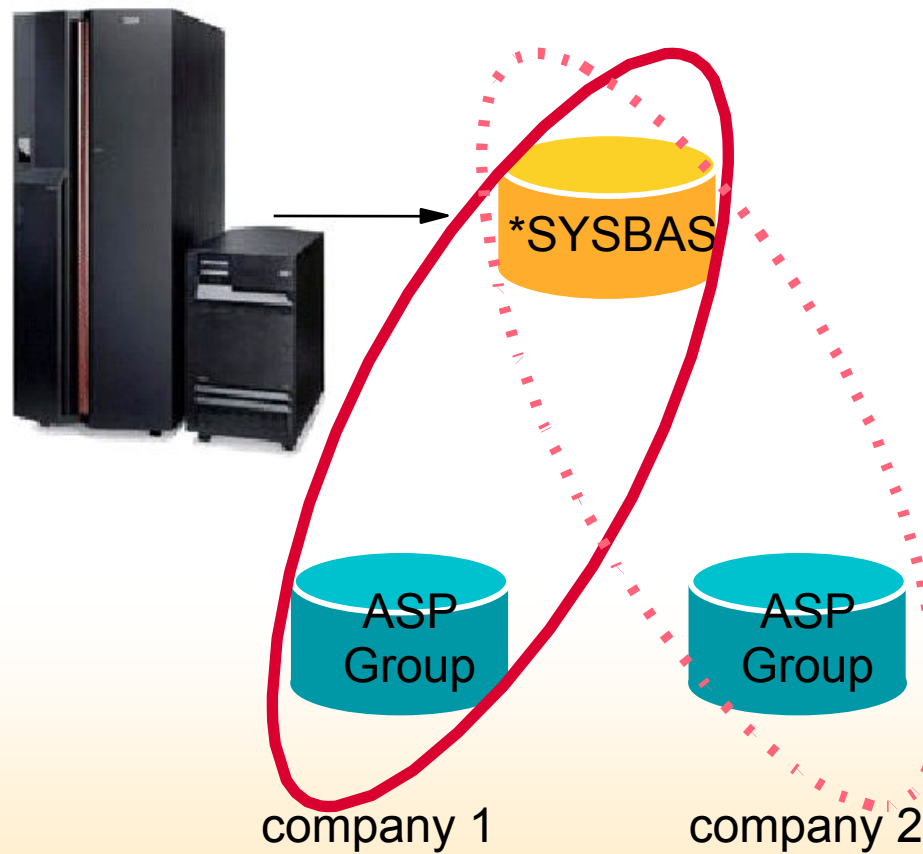 - **Used to isolate journal receivers from the data (similar to a Basic ASP)**
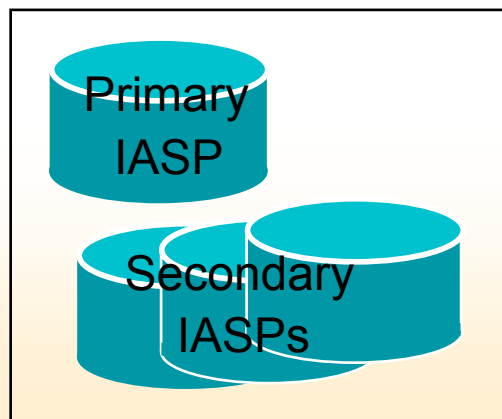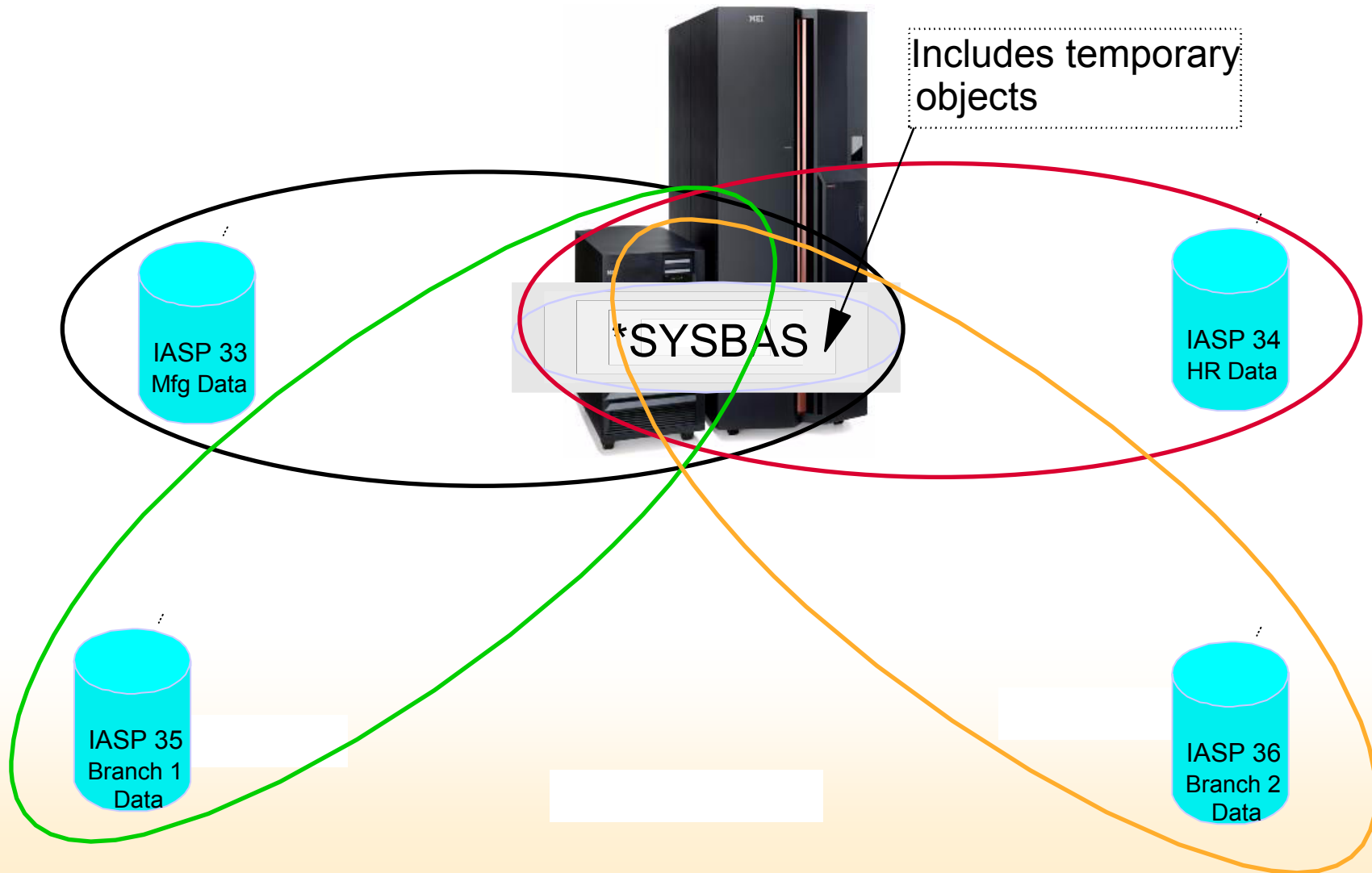
Library name space

*SYSBAS

Sys ASP

user ASPs

ASP Group

Primary IASP

Secondary IASPs
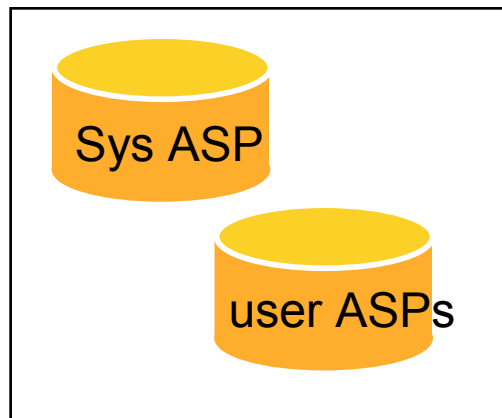
IASPs can be grouped together into an ASP group. *SYSBAS and an ASP group together becomes the "library name space"

*SYSBAS

ASP Group

ASP Group

company 1

company 2

Multiple Databases = Multiple Name Spaces

Includes temporary objects

*SYSBAS

IASP 33
Mfg Data

IASP 34
HR Data

IASP 35
Branch 1
Data

IASP 36
Branch 2
Data

IASP Object Types

Supported

*ALRTBL +	*FTR	*PGM +
*BLKSF	*GSS	*PNLGRP
*BNDDIR	*IGCDCT	*PSFCFG
*CHTFMT	*JOBD +	*QMFORM
*CHRSF	*JRN	*QMQRY
*CLD	*JRNRCV	*QRYDFN
*CLS +	*LIB +	*SBSD +
*CMD	*LOCALE	*SCHIDX
*CRQD	*MEDDFN	*SPADCT
*CSI	*MENU	*SQLPKG
*DIR	*MGTCOL	*SQLUDT
*DSTMF	*MODULE	*SRVPGM
*DTAARA	*MSGF	*STMF
*DTADCT	*MSGQ +	*SVRSTG
*DTAQ	*NODGRP	*SYMLNK
*FCT	*NODL	*TBL
*FIFO	*OUTQ	*USRIDX
*FILE +	*OVL	*USRQ
*FNTRSC	*PAGDFN	*USRSPC
*FNTTBL	*PAGSEG	*VLDL
*FORMDF	*PDG	*WSCST

NOT Supported

|	
*AUTHLR	*JOBQ
*AUTL	*JOBSCD
*CFGL	*LIND
*CNNL	*MODD
*COSD	*M36
*CRG	*M36CFG
*CSPMAP	*NTBD
*CSPTBL	*NWID
*CTLD	*NWSD
*DDIR	*PRDAVL
*DEVD	*PRDDFN
*DOC	*PRDLOD
*EDTD	*RCT
*EXITRG	*SOCKET
*FLR	*SSND
*IGCSRT	*S36
*IGCTBL	*USRPRF
*IPXD	

Virtual Tape

Announced Feb 06

– Integrated with i5/OS - V5R4 onwards

– Similar performance as save/restore to/from a save file

– Eliminates save file limitations
  • Single library only
  • No savsys capability
  • No parallel support
  • Size limitations

– Virtual tape volumes managed:
  • Using existing Image Catalog commands (used for virtual optical)
  • Using iSeries Navigator GUI

– Virtual tape volumes stored as IFS stream files
  • Can be FTP'ed to other systems and partitions
 • Can be duplicated to real tape devices (DUPTAP)

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
  • Significant Performance Impact if S/W compression used

Server

Virtual tape (on disk)

Physical Tape
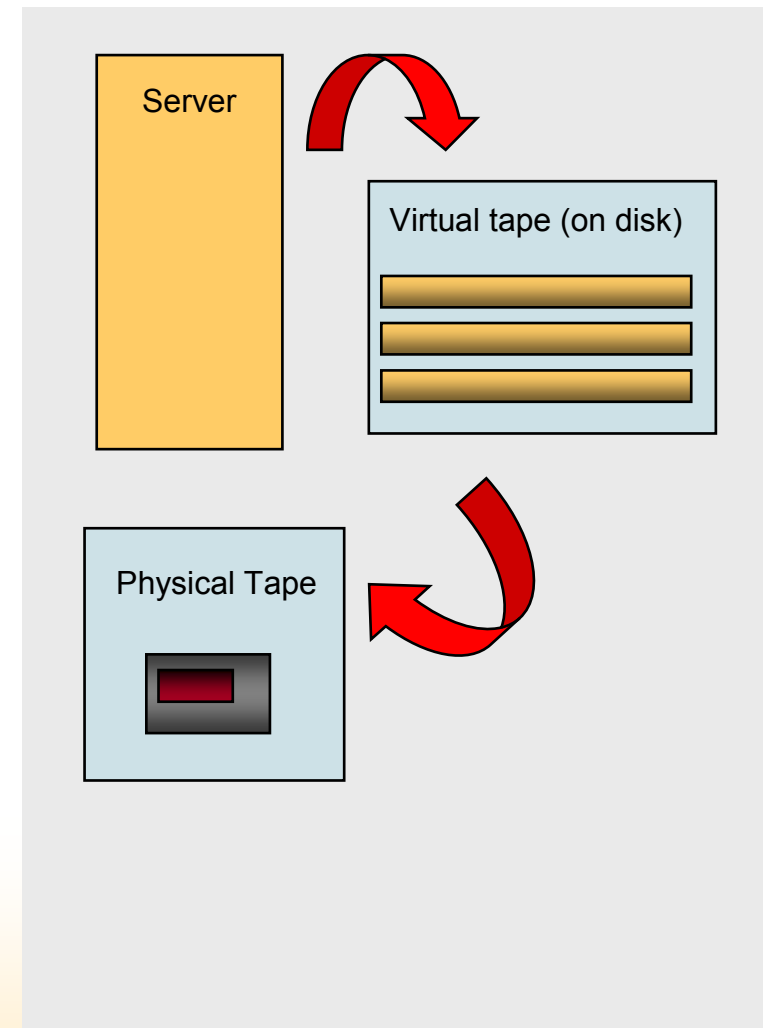
New with V5R4: Virtual Tape

Image catalog
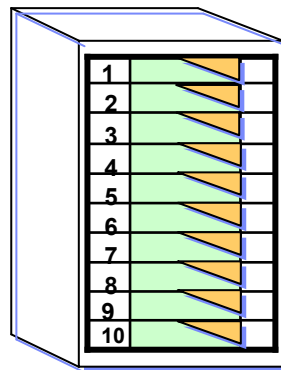
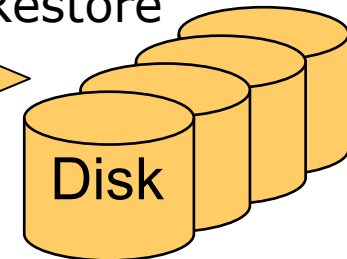Up to 256
virtual tape
volumes

LODIMGCLG

Virtual
Tape
Device

Save/Restore

Disk

Any ASP or iASP
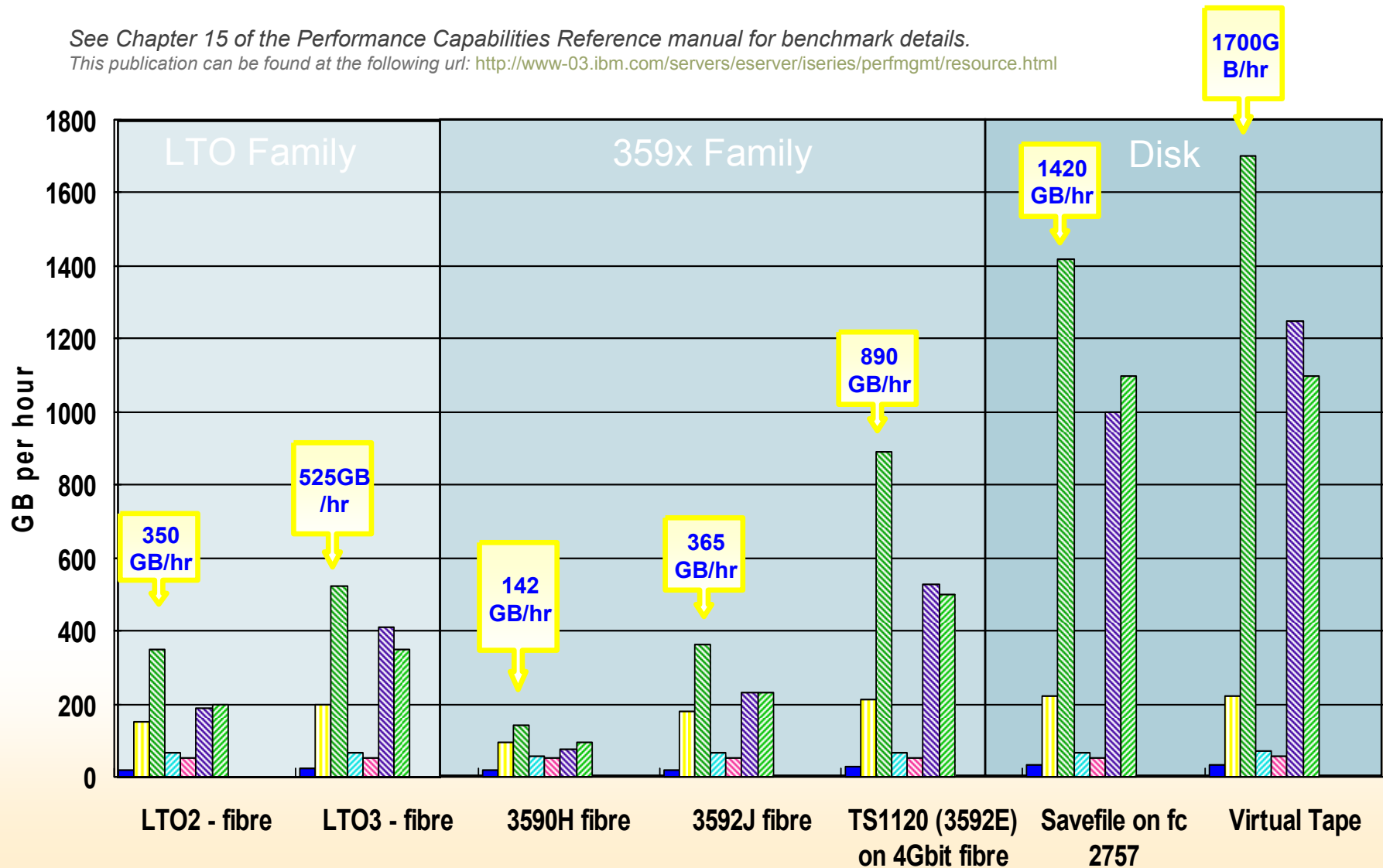
# Save/Restore Performance Benchmarks

IBM DataMirror iCluster®

- **IBM i5/OS <u>logical replication</u> product**
  - Software based solution
  - Optimized for near continuous data recoverability
  - Can provided unlimited geographic dispersion
  - Selectable object replication for lower bandwidth

- **IBM DataMirror iCluster**
  - Asynchronous data replication for disaster recovery
  - Can be adapted for high availability operations
  - Backup copy available for tape backups & data access
  - Active-Active replication with iBalance

- **IBM DataMirror iCluster SMB**
  - Near continuous data recoverability for SMB customers
  - Backup copy available for tape backups & data access

- **Benefits**
  - Software based HA/DR solution from IBM
  - SMB customers looking for basic data recoverability
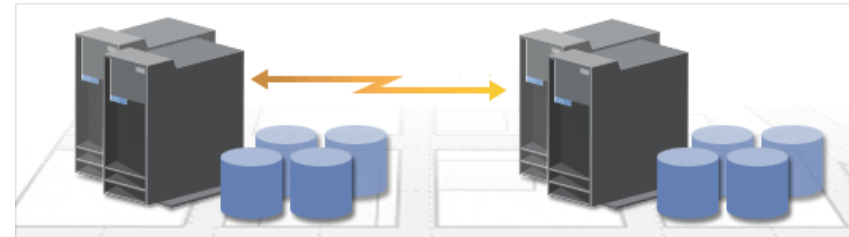
Supported Releases
  - IBM i V6R1, V5R4,V5R3

- **Product Number**
  - 5733-ICL
  - 5733-ICS

Prerequisites
  - IBM i Option 12, Host Servers
  - IBM TCP/IP Connectivity Utilities

IBM iCluster for i Enhancements

- **IBM i product for disaster recovery**
  - **Software based logical replication solution**

- **iCluster offering simplification**
  - **One product top to bottom**
  - **iCluster SMB withdrawn Dec 31**
  - **Price reduced/aligned with PowerHA**

- **iCluster 5.2**
  - **Usability & performance enhancements**
    - **Faster switching and startup**
    - **Sync check consolidation and automation**
  - **Now uses System License Keys**
  - **PTFs generated and installed with i**

- **Benefits**
  - **IBM product with IBM support**
  - **Scalable from small enterprises to large**
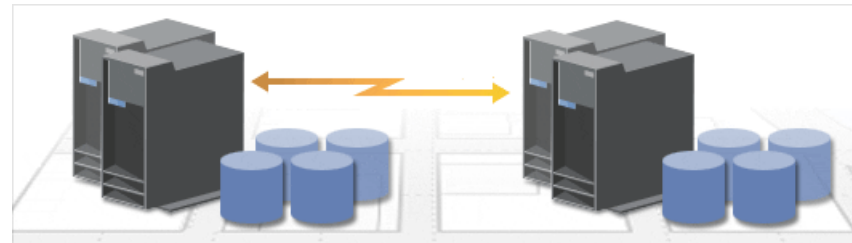
Announce:	Oct 7
GA:	Nov 14

PowerHA for i

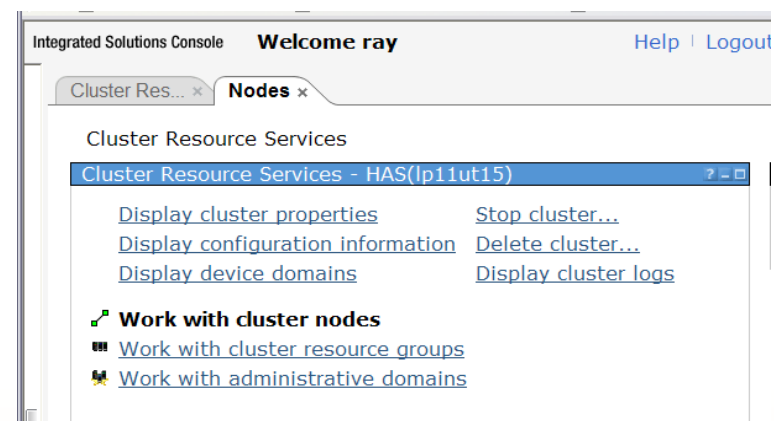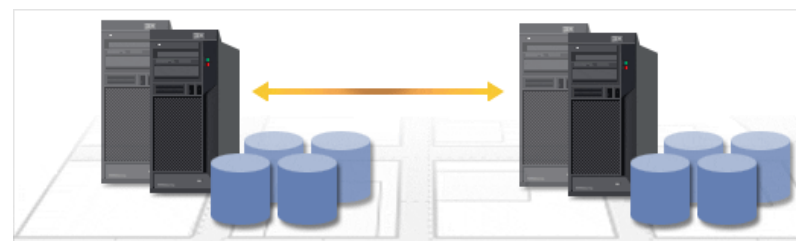- **IBM <u>storage based</u> clustering product**
  - Can enable near continuous application service
  - Minimize impact from planned & unplanned outages
  - Simple Web-based management

- **IBM® i and SAN based mirroring**
  - IASP data synchronously replicated for Cross Site Mirroring
  - Geographic Mirroring – IBM i synchronous mirroring
  - Metro Mirror - DS8000™ synchronous mirroring
  - Global Mirror - DS8000 asynchronous mirroring

- **IBM i Cluster Management**
  - Enables automatic or manual failover
  - Keeps systems in sync
  - Establishes a heartbeat between the systems
  - Backup recovery operations via Flash Copy

- **Benefits**
  - Hardware based HA/DR solution from IBM
  - Solution requiring minimal day to day administration
  - Trusted on demand role swap operations
  - Many commercial applications IASP enabled
  - Estimate over 500 IASP solutions deployed

Integrated Solutions Console   **Welcome ray**   Help | Logout

Cluster Res... ×   **Nodes** ×

Cluster Resource Services

Cluster Resource Services - HAS(lp11ut15)

Display cluster properties   Stop cluster...
Display configuration information   Delete cluster...
Display device domains   Display cluster logs

Work with cluster nodes
Work with cluster resource groups
Work with administrative domains

Supported Release
   V6R1

Prerequisites
   HA Switchable Resources (option 41)

Product Structure

PowerHA for i			
5761-HAS	Solution-Based	Task-Based	Commands

Cluster Management User Interfaces

XSM

Opt 41

Geographic Mirroring

Switchable Devices & Disk

Source/Target Side Tracking

Metro Mirror

Global Mirror

Flash Copy

SAN Solutions (DS6000/8000)

Switchable Resources

IBM i

IASP infrastructure   CRG infrastructure

Admin Domain infrastructure

Clustering Technology

IBM and System i SAN Focus

Continuous, consistent IBM investment

2008

- 4GB Smart IOA Dual Port (IOPless)
- IPL from Tape via SAN
- Tagged Command Queuing
- Header Strip Merge
- 4 Gb Fiber
- Advanced 'DS on iSeries' education
- SAN on iSeries Redbook - 3
- BRMS support for FlashCopy environment
- Boot from San (2847 IOA)
- CLI - Command Line Interface
- Additional i5/OS LUN sizes for increased flexibility
- SAN on iSeries Redbook - 2
- i5/OS Multipath fiber
- 2Gb fiber
- iSeries Copy Services for IBM TotalStorage (a.k.a. Toolkit)
- Disk Magic and OS/400 Performance Tools coordination
- Enhance ESS cache algorithms for iSeries
- SAN on iSeries Redbook - 1
- 1 Gb Fiber

…and more to come….
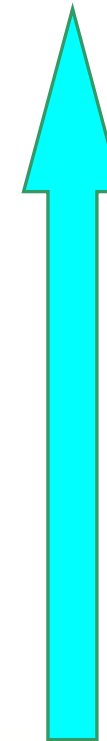
2001

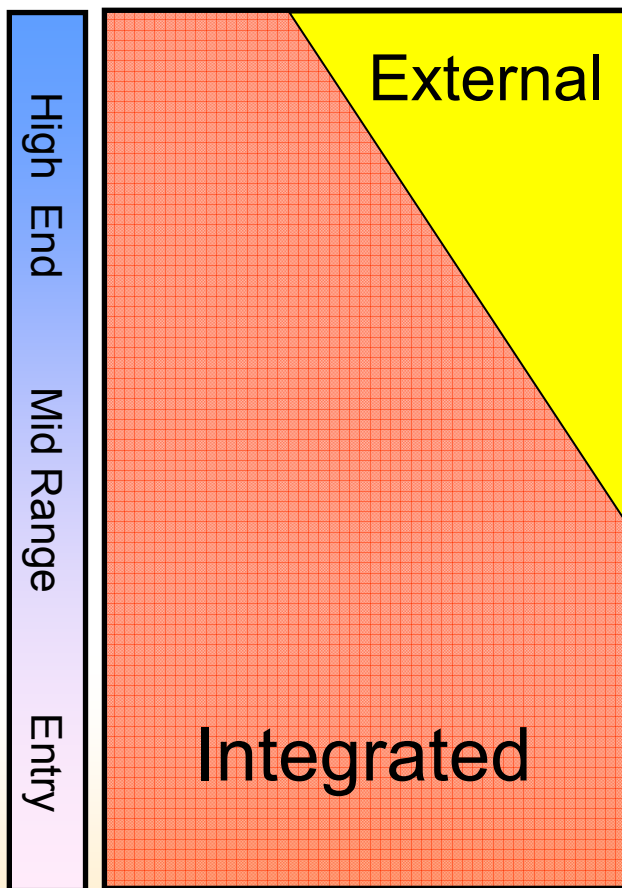# IBM i Storage Directions
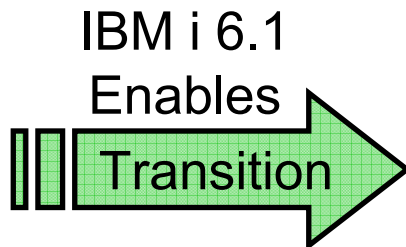
Historically

POWER6 and beyond

Integrated plus High End External Storage

Complementary Options

High End

Mid Range

Entry

External

Integrated

IBM i 6.1
Enables
Transition

High End

Mid Range

Entry

External

Integrated
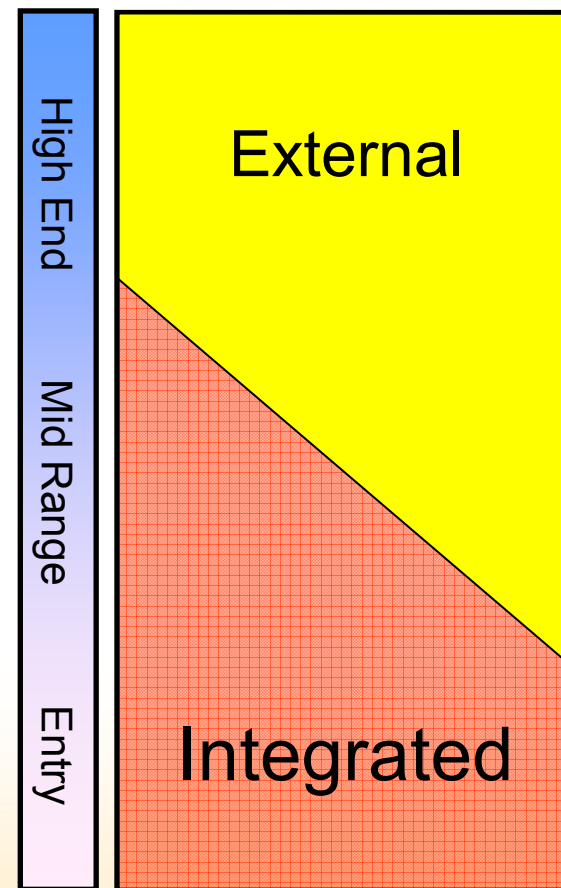
Flexible SAN Options on POWER6 via Fibre

- **DS8000 Enterprise Storage Solution**
  - Supported on #5749, #5774 new dual port Smart-IOA card and earlier FC card generations

- **DS6000 Midrange to Enterprise Storage Solution**
  - Not supported on #5749, #5774 new dual port Smart-IOA card, earlier FC card generations provide support.

- **DS4000/5000 Midrange Storage Solution**
  - Supported via VIOS running on POWER6 System i and JS12/JS22 Blades at V6R1

SAN Enhancements

- **New Fibre Channel Adapters**
  - **4Gbit, IOPless, Dual Port Adapters**
    - **Improve performance**
    - **Increase capacity with up to 64 LUNs per port (8-fold increase in density!!)**
    - **Enhance flexibility with support for disk & tape attachment**
    - **Add support for booting off tape**
  - **IBM i V6R1, POWER6 systems, and DS8000**

- **Support for IBM's Midrange Storage Solution**
  - **DS4700, DS4800 and DS5000 supported by VIOS with IBM i virtual partitions**

Greatly Enhanced SAN Disk Performance for IBM i

DS8300 Application

Response Time (Seconds) vs Throughput (TPM)

Legend: DS8300 IOP, DS8300 IOPless

CPU

Loop/bus

IOP

IOA

SAN
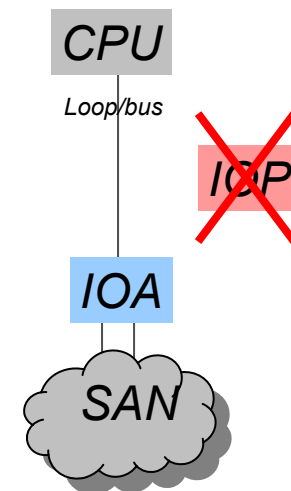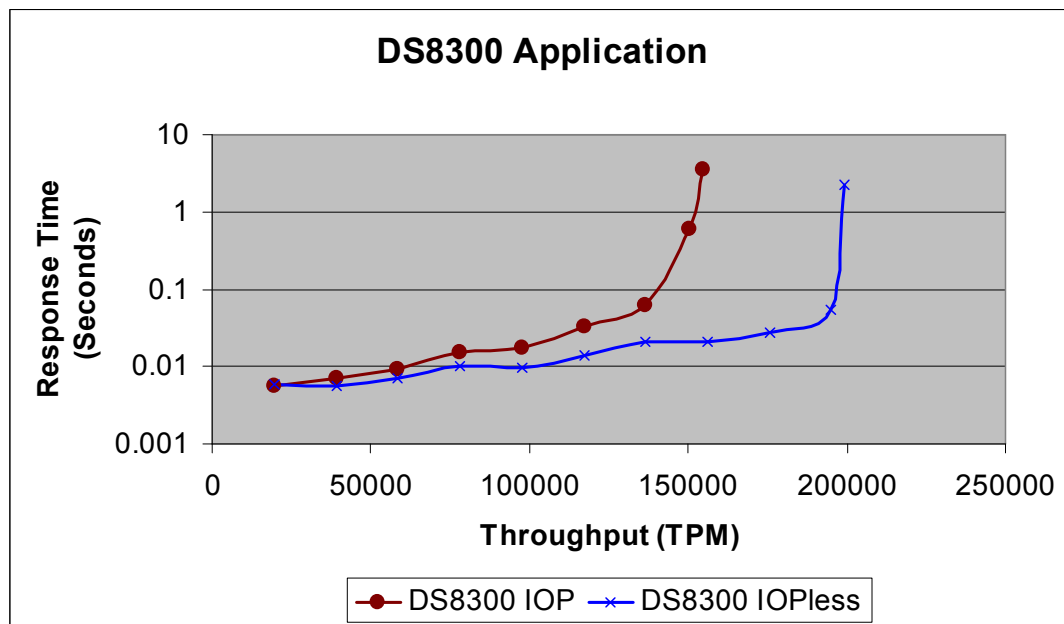
- Configuration the same except the Fibre Channel cards.
- 8 IOP-IOA pairs replaced by 4 smart IOAs.
- Smart IOA performance wins.

for Business

Current SAN implementation

- **Multipath IOP/IOA combination connection to external storage**
- **This just a graphic and does represent an actual config**

POWER6 and V6R1 SAN implementation

- **Multipath Smart IOA combination connection to external storage**
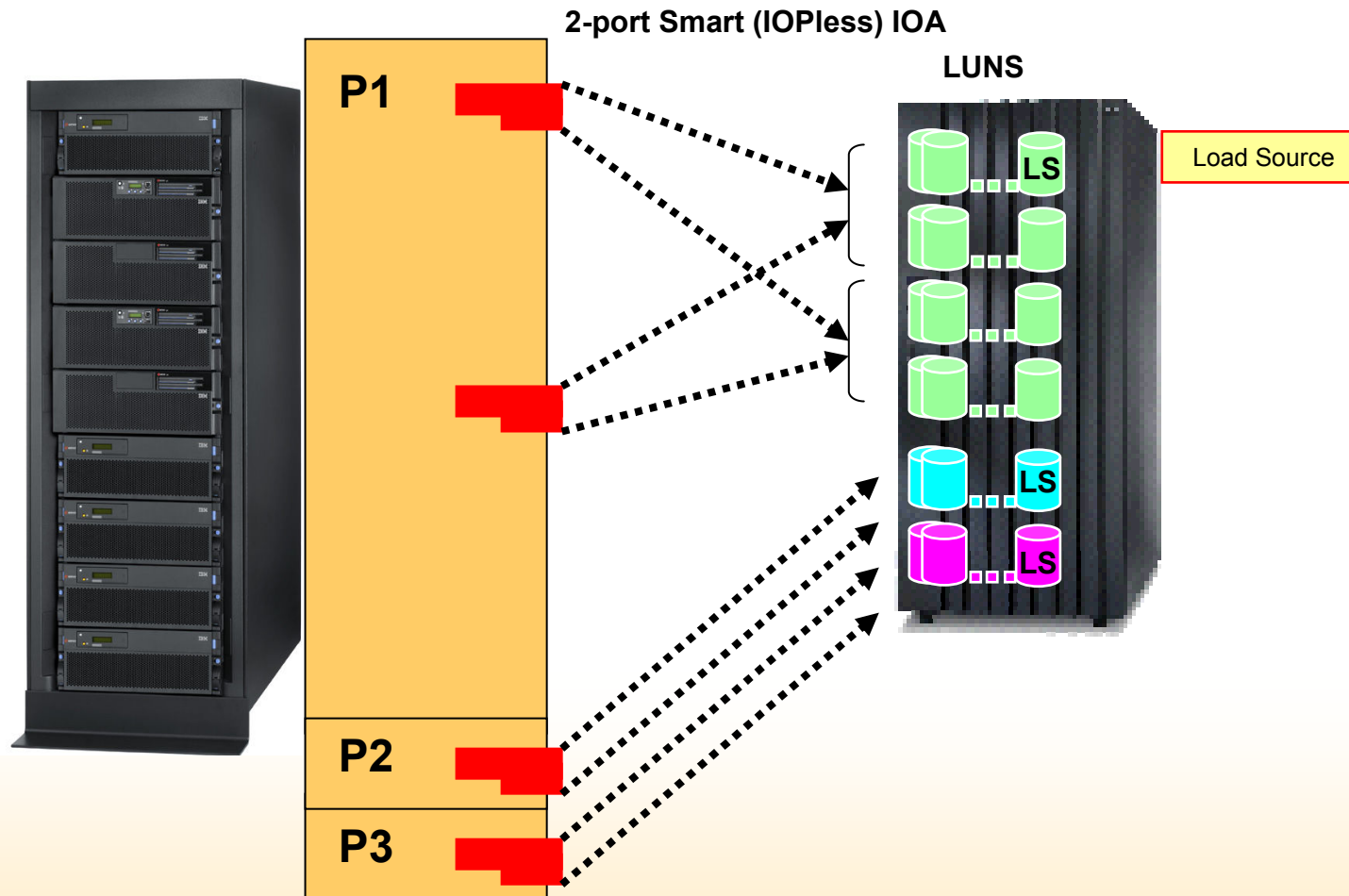
2-port Smart (IOPless) IOA

LUNS

P1

P2

P3

LS

LS

LS

Load Source

VIOS Storage Connectivity Big Picture
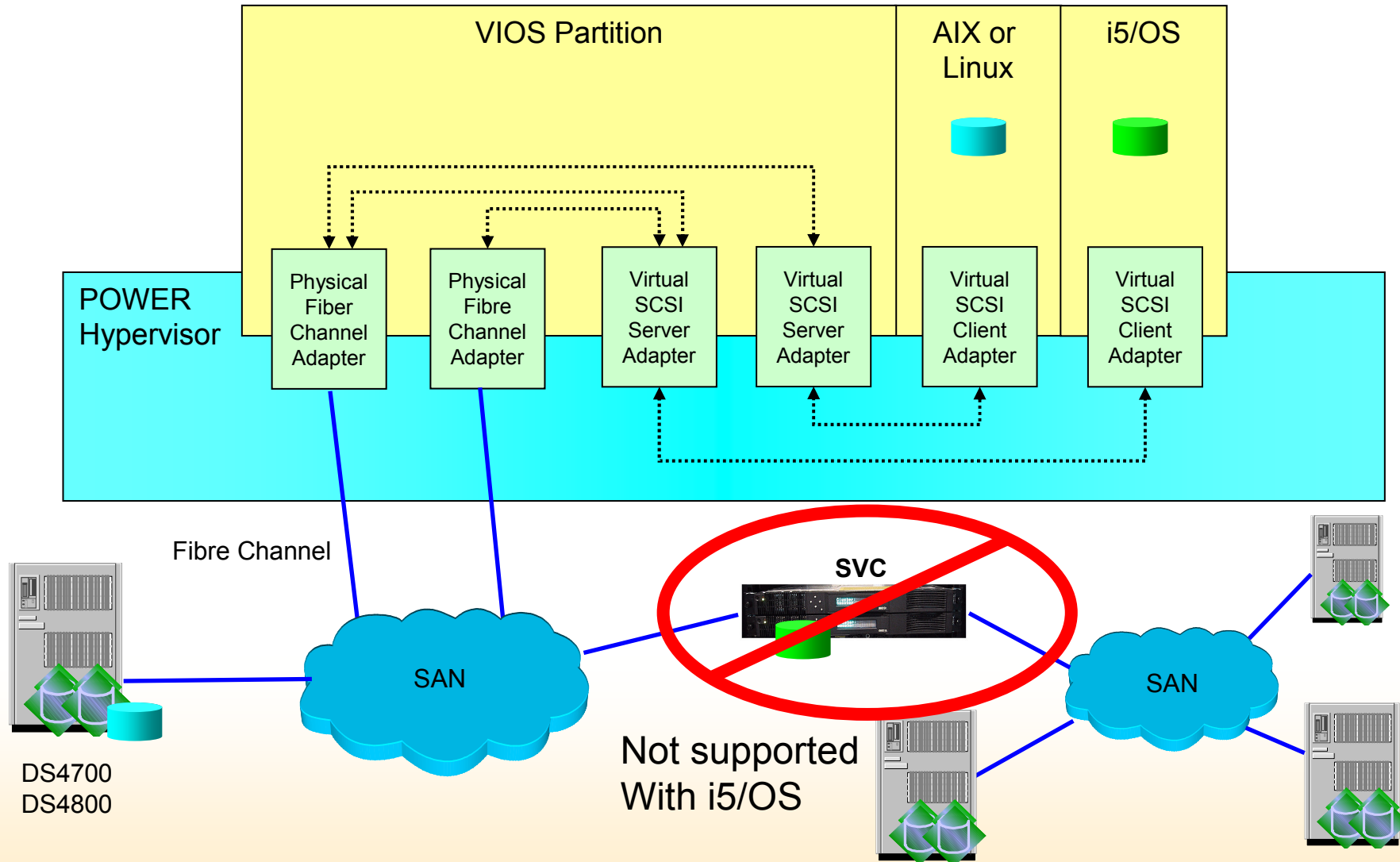
Assess System i Availability Technologies

RTO

Highest Availability for planned and unplanned outages

Availability Level

Base Availability

Multi-Server Solutions

Full Application Resiliency

IASP Replication Clusters (XSM and SAN)

Logical Replication & Clusters

Switched IASP Clusters

AIX, Linux, Intel Domino, VoIP Clusters

i5/OS Clusters

Partial Application Resiliency

Independent IASPs

Basic SAN Copy Services

i5/OS Disk Mirroring

Save while active

Journaling

SAN Multipath

Virtual tape

Hot site

Protect Access Path

High speed Multi-tape

LPAR On Demand

RAID-5+ RAID-6

BRMS

Power5 Redundancy

RAID-5

Off-site Storage

Concurrent Maint.

Single Server Solutions

Backups

Phone Home

Data Currency

RPO
No data Loss

IBM i Data Resiliency Positioning

Logical replication

OS based replication

Storage based replication

IBM HA/DR data replication options
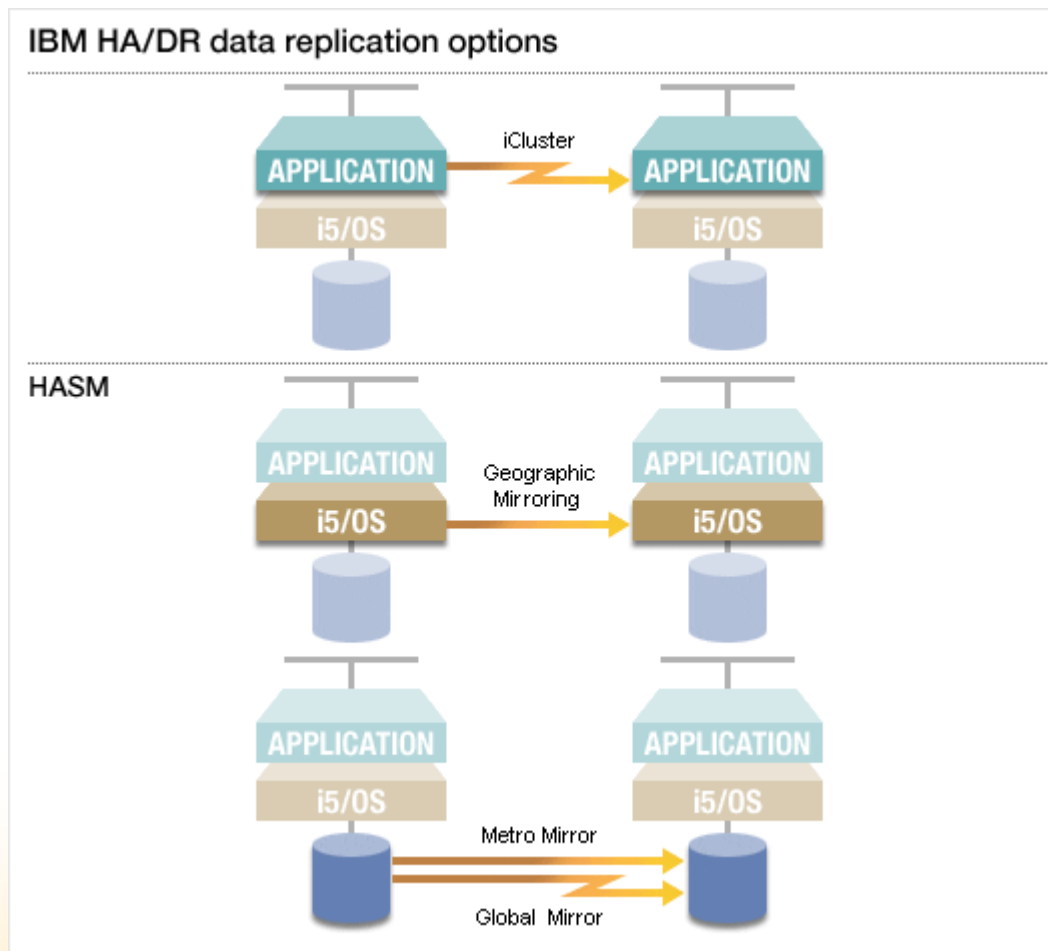
Asynchronous
Journal based replication
Over TCP/IP
Disk subsystem agnostic

Synchronous
IBM i based replication
Over TCP/IP
Disk subsystem agnostic

Synchronous or Asynchronous
Storage-based replication
Over Fiber Channel or FCIP
DS8000,DS6000™

IBM i5/OS Multi System Data Resiliency

Switchable IASP Clusters

- Strategic building block for IBM i5/OS High Availability and Disaster Recovery solutions
- Utilizes i5/OS® Cluster Resources for automation and application interface

Switched Disk Cluster

- Switched Disk
- Storage agnostic
- Single copy of data
- HA (Local only)

Geographic Mirroring Cluster

Geographic Mirroring

- Geographic Mirroring
- Storage agnostic
- HA and DR

Metro Mirror/Global Mirror Cluster

FlashCopy   *Metro Mirror*

- Metro Mirror
- Global Mirror
- Flash Copy
- HA and DR

Cross Site Mirroring

Logical Replication

iCluster

- iCluster
- Storage agnostic
- HA and DR
- Concurrent access
- Supports i5/OS Cluster

Basic San Copy Services

FlashCopy   *Global Mirror*

- Global Mirror
- Boot From SAN
- DR/Tape Backup

System i Availability Strategy - IASPs

LSU **SysBas**

HA. iSeries or LPAR
(iASP varied off)

HSL

iSeries
Cluster &
Device
Domain

Switchable
Tower

LSU **SysBas**

Prod. iSeries or LPAR
(iASP varied on)

Switched
Disk

System i Availability Strategy - IASPs

HSL

Tower

LSU **SysBas**

Prod. iSeries or LPAR (iASP varied on)

iSeries Cluster & Device Domain

Cross Site Mirroring
(Geographic Mirroring)

TCP/IP LAN Cluster- Comm.

HSL

Tower

DR iSeries or LPAR (iASP' varied off)

LSU **SysBas**

System i Availability Strategy - IASPs

System i Availability Strategy - IASPs

LSU

SysBas

**HA. iSeries or LPAR
(iASP varied off)**

HSL

**Switchable
Tower**

LSU

SysBas

**Prod. iSeries or LPAR
(iASP varied on)**

**iSeries
Cluster &
Device
Domain**

Combining
functions

**TCP/IP LAN
Cluster- Comm.**

HSL

Tower

**DR iSeries or LPAR
(iASP' varied off)**

LSU
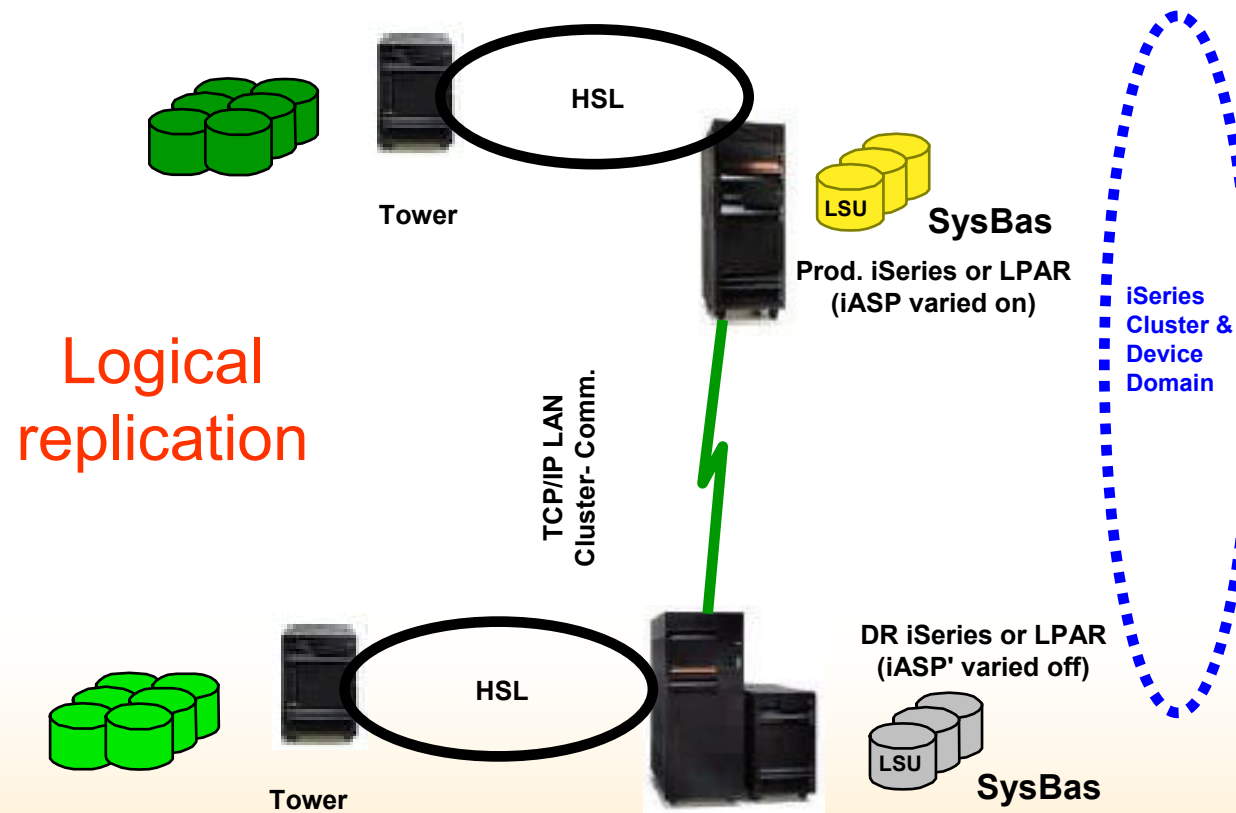
SysBas
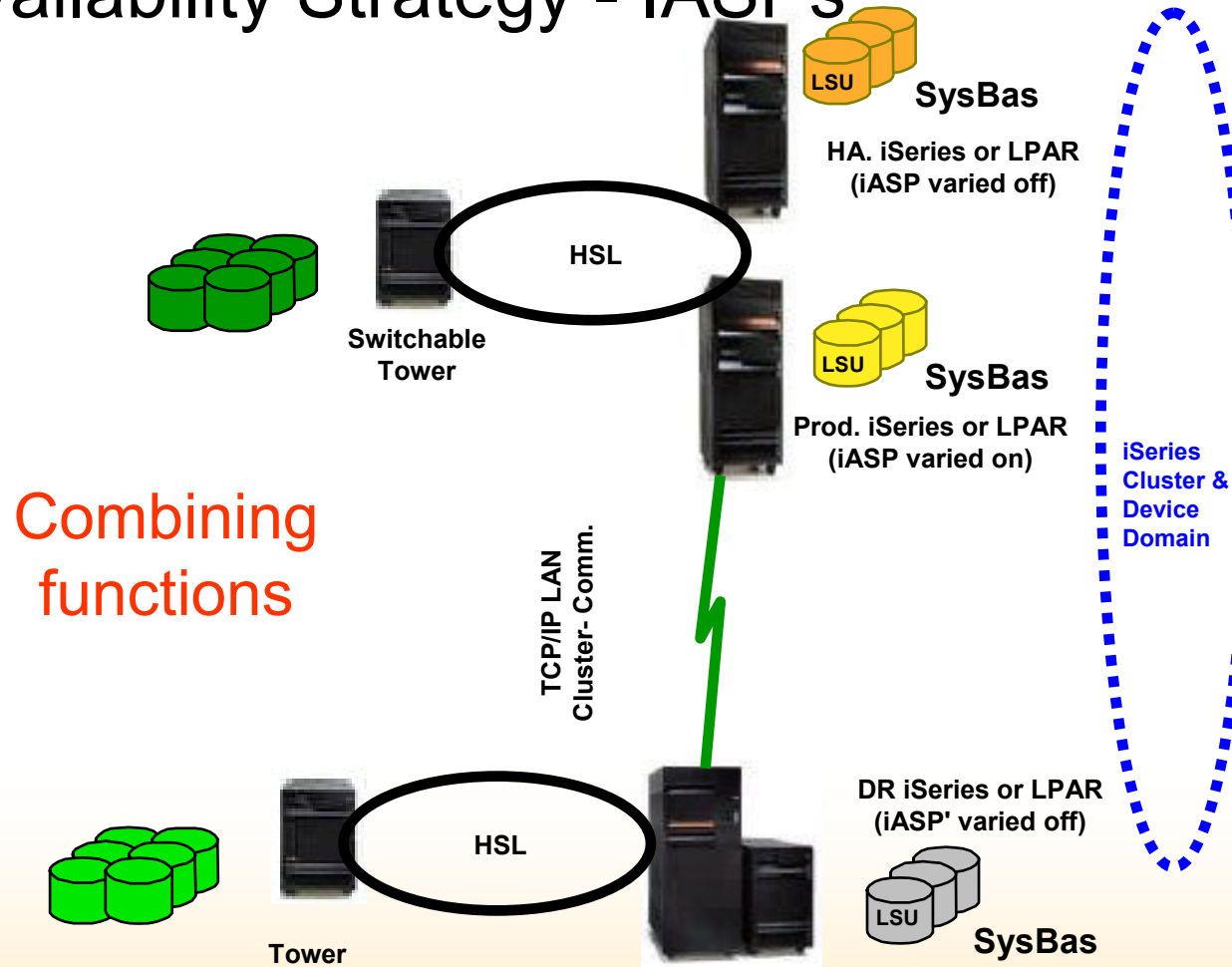
Data and Disaster Center Availability with Metro or Global Mirror (with Copy Services Toolkit)

Production
ESS or DS

IASP

Fibre

HSL

LSU
SysBas

HA. iSeries or LPAR
(iASP varied off)

Switchable
Tower

LSU
SysBas

Prod. iSeries or LPAR
(iASP varied on)

iSeries
Cluster &
Device
Domain

Cross Site Mirroring
(External Disk)

Fibre Channel

Metro or Global Mirror

TCP/IP LAN
Cluster- Comm.

IASP'
(sync.)

Fibre

HSL

DR iSeries or LPAR
(iASP' varied off)

LSU
SysBas

Tower

D/R
ESS or DS
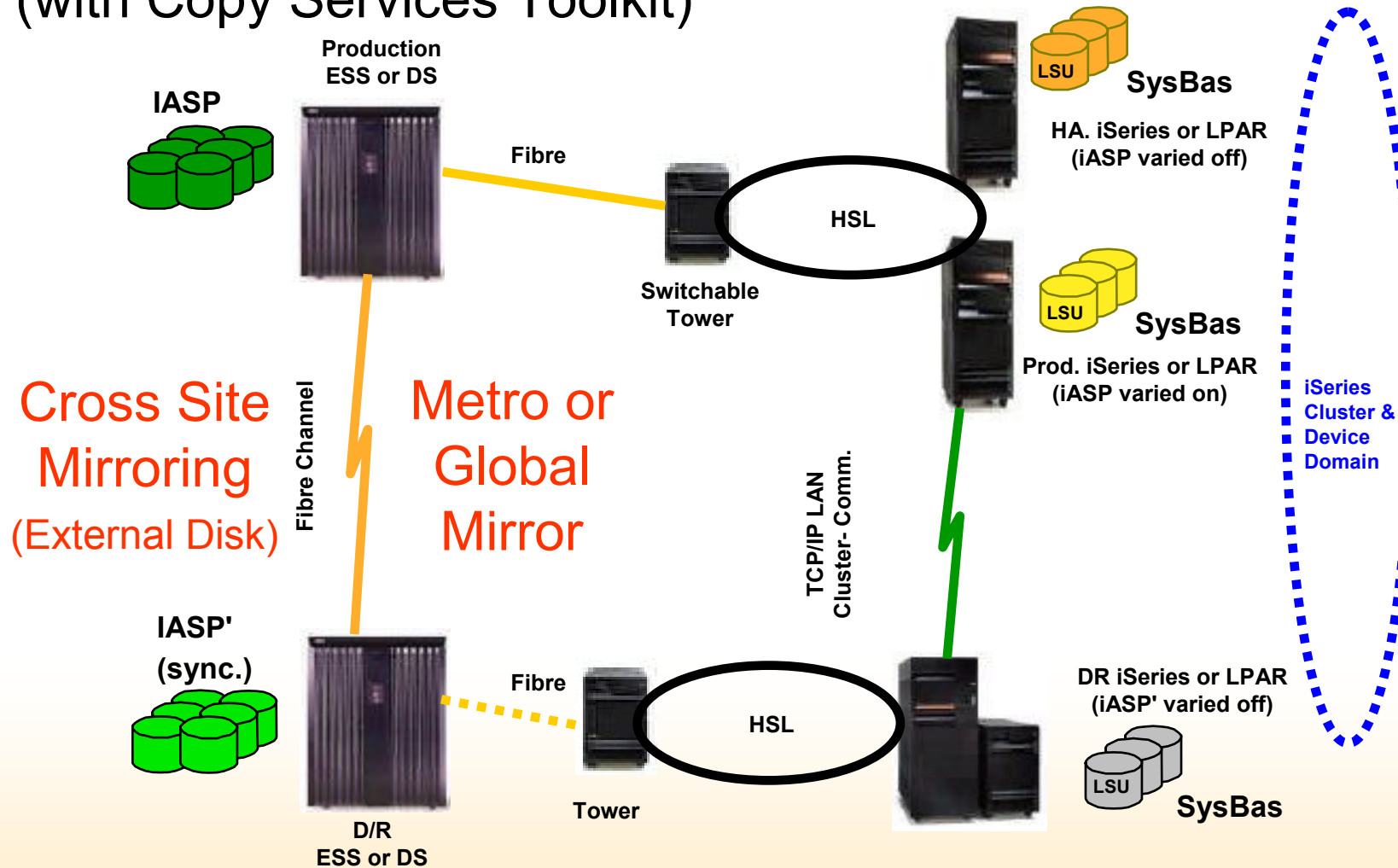
IBM i Business Resiliency Choices
Features, Benefits and Considerations

Feature	Benefit	Products	Considerations
Storage-Based	✓ Replication of all data written to disk ✓ Virtually unlimited geographic distance when using asynchronous ✓ Generally implemented for DR and HA (synchronous) ✓ Can be cluster controlled ✓ Synchronous (Metro Mirror only) or asynchronous network transmission (Global Mirror only) ✓ No manual management of replicated objects required ✓ FlashCopy means second copy of data can be used for fast backups, development, testing, etc. ✓ Order of changes is preserved via DS8000 and Metro Mirror ✓ Resolution of out of synch conditions (objects or data) is under control of DS8000	IBM Metro Mirror IBM Global Mirror IBM FlashCopy® *Can be used alone or with IASPs & Toolkit* *Note: used with IBM TotalStorage® DS8000*	¨ Network Bandwidth (all data and objects are replicated to second system) ¨ Only supported via external SAN storage ¨ No concurrent access to second copy of data ¨ IF not using IASPs, system IPL required for switching to backup copy ¨ Additional disk for Consistency Groups (Global Mirror only)
Operating System-Based	✓ Page replication controlled by operating system ✓ Ordering of changes is preserved by the operating system ✓ No manual management of replicated objects required ✓ Synchronous network data transmission ✓ Is cluster controlled ✓ Supports external or internal storage ✓ Only vary on of IASP is required for switching to backup system ✓ Resolution of out of synch conditions (objects or data) is under control of i5/OS ✓ Generally implemented for HA	Independent Auxiliary Storage Pools (IASP) Cross Site Mirroring (XSM) High Availability Solutions Manager (HASM) (implemented with XSM and IASP) (V6R1 only)	¨ Network Bandwidth (all data and objects in an IASP are replicated to the second system) ¨ Distance limitations ¨ No concurrent access to second copy of data ¨ Prior to V5R4 no source side tracking ¨ Requires IASP implementation
Logical Replication	✓ Selective data/object replication may reduce network overhead ✓ Virtually unlimited geographic distance ✓ Concurrent access to second data copy (for backups, read only access, etc.) ✓ No special hardware configuration requirements ✓ Choice of synchronous or asynchronous network transmission of data (synchronous only with remote journaling) ✓ Generally implemented for DR and HA ✓ Can be cluster controlled ✓ Can be used alone or with other HA technology choices ✓ Supports external or internal storage ✓ No IPLs required for switching. When used in conjunction with IASP—vary on of IASP is required ✓ Ordering of changes controlled by HA ISV software interfaces	IBM: IBM DataMirror iCluster Maximum Availability: *www.maximumavailability.com* Trader's: *http://www.quick-edd.com/uk/index_uk.htm* Vision Solutions: *http://www.visionsolutions.com*	¨ Possible apply lags on target system for changes in high volume environments ¨ Management to ensure all new objects are replicated ¨ Bandwidth has to be sufficient for replicated objects and data , and to ensure no data send lag ¨ Resolution of out of synch conditions (data or objects) is not under control of i5/OS

IBM i V6R1 Quiesce Function

- **Enables database suspend for any ASP**

- **Use for offline backup**

- **Especially valuable for IASP backup operations**
  - –Detach IASP in Geographic Mirror or FlashCopy

- **Backup will still be considered 'abnormal' but much friendlier**

- **Works best with applications running commitment control**

- **Applications without commitment control may be OK but TEST**

Detach
Remote ASP

System ASP

Flush Memory

Pinned Pages
remain

Main Store

FlashCopy

Independent ASP
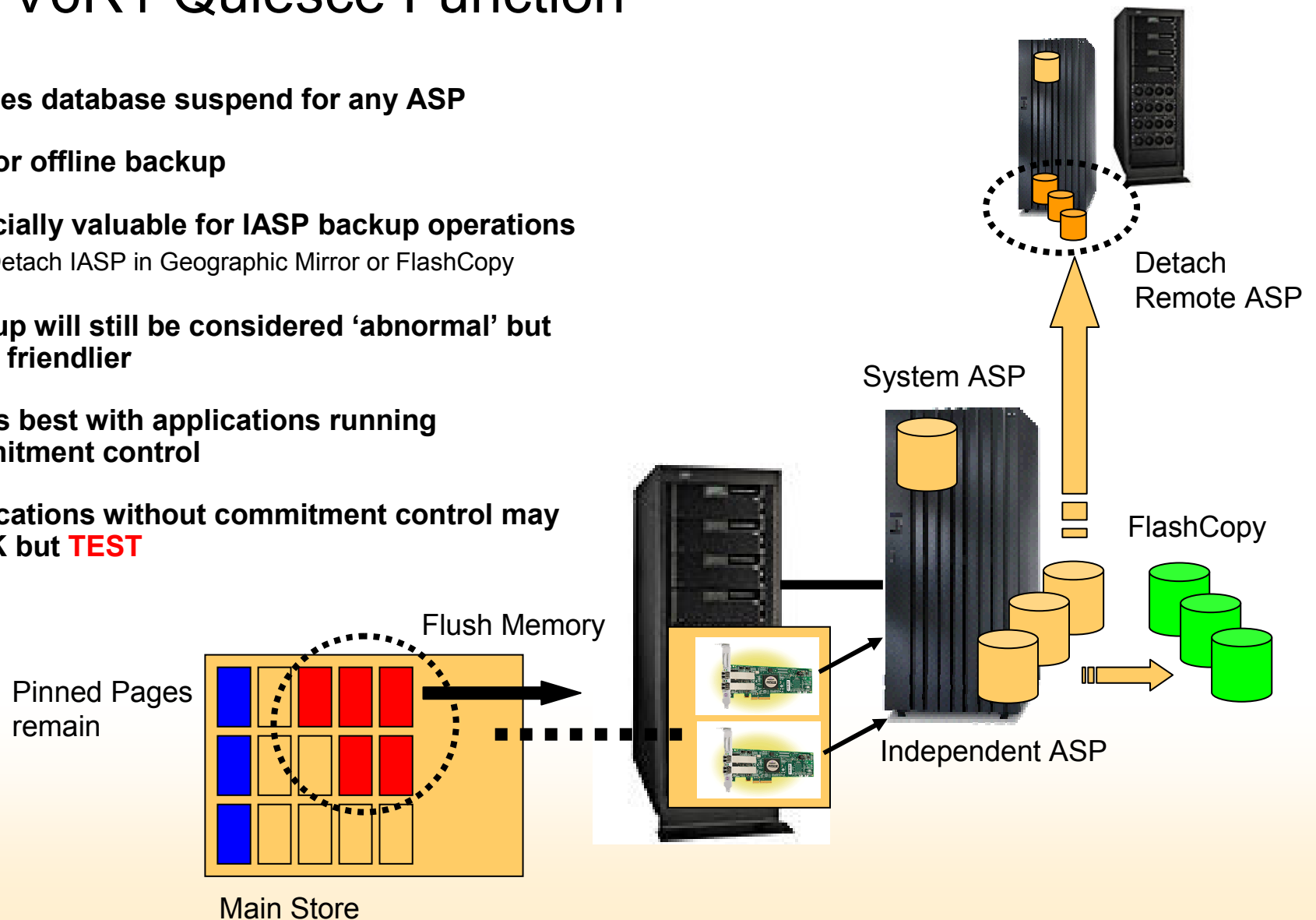
Data Resilience technologies - Logical Replication

Most widely deployed data resiliency topology for iSeries

- Typically deployed via an HA Business Partner solution package
  - E.g. Lakeview Technologies, Vision Solutions, Datamirror, Maximum Availability, iTera, Traders

**Replication done on object basis (file, data area, program, etc.) near real-time**

- OS/400 Journaling provides 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
- Very flexible (any hardware, various OS release, most ISV software, etc.)

Considerations:

- Complexity of setup and maintenance
- Consistency between journaled and non-journaled objects

Integrated or SAN
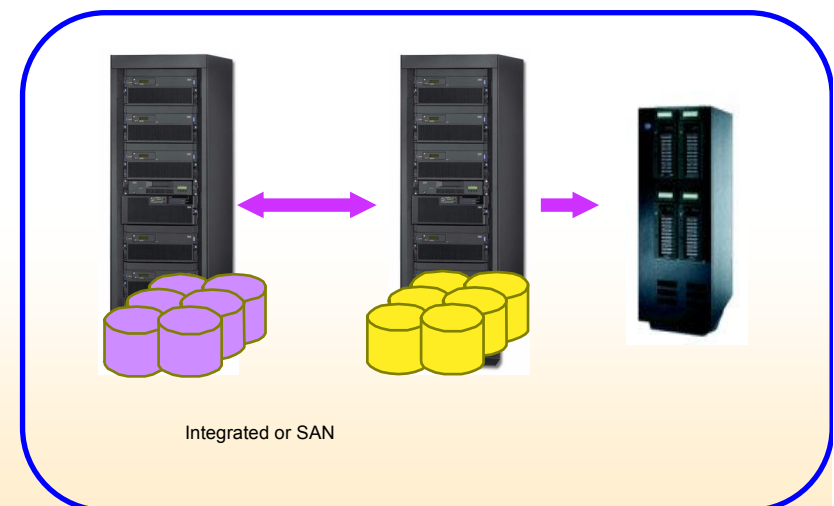
Data Resilience technologies – switchable iASPs

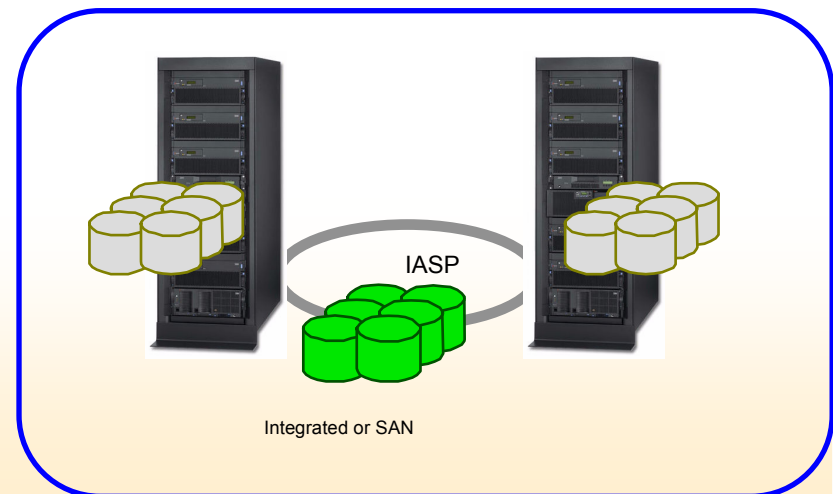**iASPs – Independent Auxiliary Storage Pools**

- Switch disks between partitions or servers

Benefits:

- Provides support for planned maintenance

Considerations:

- Single point of failure – only one set of disks
- Limited by cabling distance
- No 'read-only' copy

IASP

Integrated or SAN

Data Resilience technologies – Cross Site Mirroring (XSM)
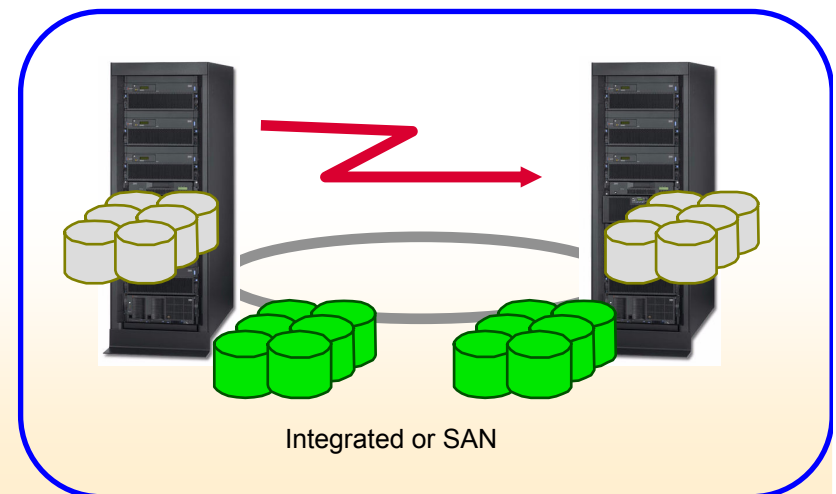
Utilises switchable iASPs

- Can be internal or external disk

Benefits:

- Only objects in iASPs are copied
- Simpler to manage – everything in iASP is copied

Considerations:

- Application must support iASPs
- Disks split between system ASP and iASPs
  - Plan for performance
- No 'read-only' copy on target side

Integrated or SAN

Data Resilience technologies – TotalStorage mirroring
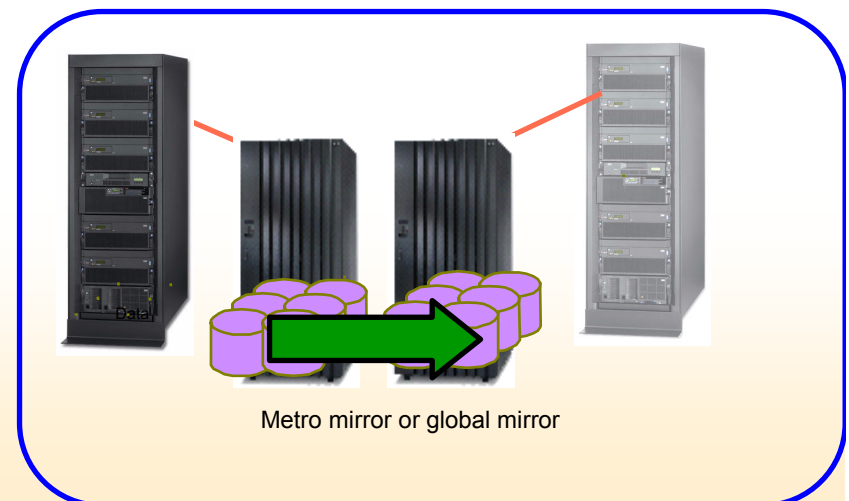
SAN-based replication

- Bit level copy
- Synchronous (Metro mirror) or asynchronous (Global mirror)

Benefits:

- Standard cross-platform solution
- Simpler to manage – everything is automatically copied – but requires SAN skills

Considerations:

- To mirror entire system, requires boot from SAN – only supported on POWER5
- No 'read-only' copy on target side
- When role swap, abnormal IPL on target
  - D/R rather than HA solution
- If mirroring everything (temp objects, system objects)
  - Requires high bandwidth
  - -> Consider combining with iASPs

Metro mirror or global mirror

Data Resilience technologies – TotalStorage mirroring with iASPs and Copy services toolkit

SAN-based replication

- Bit level copy
- Synchronous (Metro mirror) or asynchronous (Global mirror)

Benefits:

- Standard cross-platform solution
- Only objects in iASPs are copied – less bandwidth required
- Simpler to manage – everything in iASP is copied – but requires SAN skills

Considerations:

- Application must support iASPs
- Disks split between system ASP and iASPs
    - Plan for performance
- No 'read-only' copy on target side
- Requires Copy services toolkit

Metro mirror or global mirror
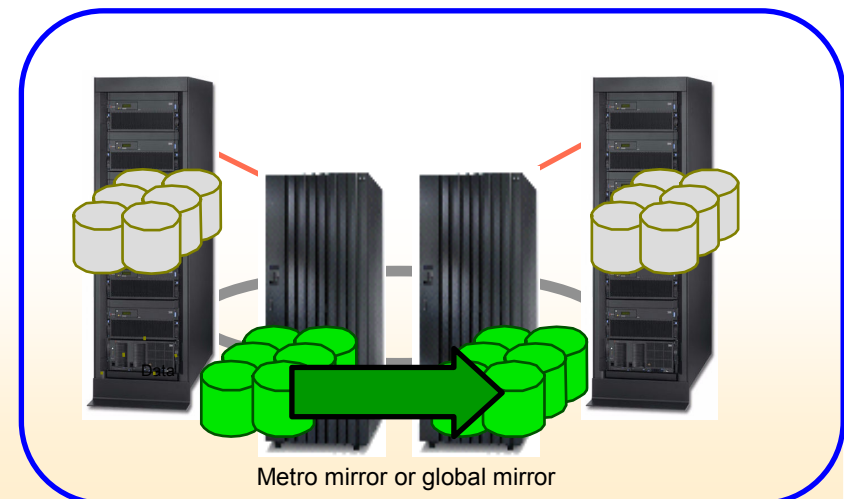
# The New Capacity BackUp Edition Highlights

✓ Dramatic new flexibility enables CBU Editions to support the full range of business resiliency requirements from Disaster Recovery to High Availability

✓ Clients may now permanently activate standby processors to support additional applications or high availability operations

✓ Clients may now use processors on a CBU Edition to provide failover/role-swap for processors on its "paired" production system without purchasing additional i5/OS licenses or Enterprise Enablement features, when the respective primary system processors are inactive

✓ Additional CBU Edition offerings deliver CBU options to a broader set of mid-market and enterprise clients

- i520 (1w, 1-2w)

- i525 (1-2w)

- i550 (1-4w)

- i570 (1-4w, 1-8w, 2-16w)

- i595 (2-16w, 4-32w)

- CBU Editions to support Standard & Enterprise Edition primary systems

=Activated processor
=Base processor
=Standby processor

www.ibm.com/systems/i/hardware/cbu

i want an i.
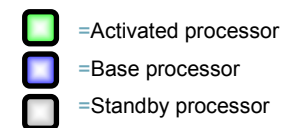
System i Capacity BackUp Edition Offering

- **Offering intended for:**
  - Cost Effective disaster recovery for multiple environments including i5/OS, AIX and Linux
  - Dynamic HA clustering environments
  - Standard & Enterprise Edition Systems

- **Offering** *now* **enables:**
  - Purchase of permanent processor activations
  - Temporary transfer of i5/OS license entitlements from primary to CBU system
  - Temporary transfer of enterprise enablement entitlements* from primary to CBU system (assuming systems have 5250 OLTP capability)
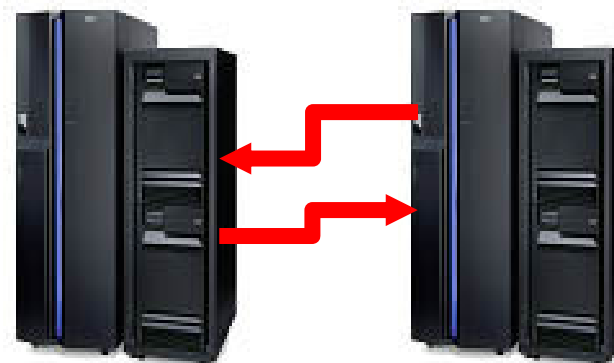
Prerequisites
  - Primary server must be a 825/870/890 or a matching model 520/525/550/570/595
  - Primary server must be equal to or larger than its CBU pairing
  - If primary is Enterprise Edition, paired with CBU Enterprise Edition (both have 5250 OLTP). If primary is Standard Edition, paired with CBU Standard Edition.
  - Registration of primary system and CBU Edition is required prior to CBU order (new box or MES upgrade) being manufactured. Go to: *www.ibm.com/systems/i/hardware/cbu*

* Enterprise enablement 5xx terminology, but the concept applies to 8xx primary systems. If a processor's worth of 5250 capacity is not being used on the primary 8xx Enterprise Edition system, it can be temporarily transferred to a CBU Edition system
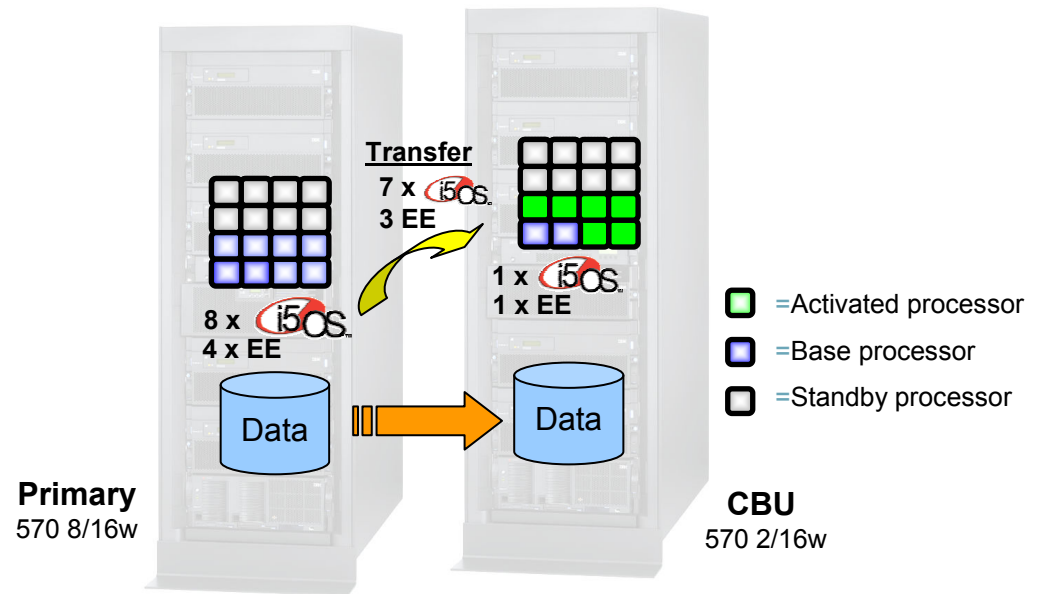
i want an i.

Positioning The HA & CBU Editions

	HA Edition	Earlier CBU Edition	*Enhanced* CBU Edition
Disaster Recovery	Yes	Yes	**Yes**
High Availability	Yes	No	**Yes**
Solutions/options which allow edition to be ordered:			
HA ISV Solutions	Yes	Yes	**Yes**
Independent Auxiliary Storage Pools	No	Yes	**Yes**
Cross Site Mirroring (XSM)	No	Yes	**Yes**
IBM DS8000	No	Yes	**Yes**
Permanent processor activations	Yes	No	**Yes**
Temporary i5/OS, AIX 5L, Linux entitlement transfers	No	No	**Yes**
Temporary enterprise enablement entitlement transfers	No	No	**Yes**
Pre-requisite of a primary system	Yes	No	**Yes**
Upgrade into edition from 810/825/870/890	No	No	**Yes**
Registration of primary system to qualify	Yes	No	**Yes**
No charge On/Off CoD if primary system down by disaster	No	Yes	**Yes**
Primary system must be same size or larger	Yes	No	**Yes**

Example: CBU for HA / Failover (planned/unplanned outages)

Client wants to use a CBU system to support planned outages for their production system

1. Purchase i570 2/16w CBU Edition

2. Purchase 6 additional permanent processor activations for CBU Edition

3. Register at CBU website to enable 7 processors on CBU as eligible for temporary transfer of i5/OS license entitlement and Enterprise Enablement features


Transfer
7 x i5OS
3 EE

8 x i5OS
4 x EE

1 x i5OS
1 x EE

Data → Data

Primary
570 8/16w

CBU
570 2/16w

☐ =Activated processor
☐ =Base processor
☐ =Standby processor

570 8/16w Enterprise Edition	£481K
–8 base processors –1 base i5/OS license & 1 EE	
Additional permanent processor activations (0)	£0K
i5/OS licenses (7 x £43K)	£305K
Enterprise Enablements (all)	£107K
Total	**£893K**

570 2/16w CBU Enterprise Edition	£252K
–2 base processors –1 base i5/OS license & 1 EE	
Additional permanent processor activations (6)	£45K
Additional i5/OS licenses (0)	£0K
Additional Enterprise Enablements (0)	£0K
Total	**£297K**

Prices are for illustration only and are subject to change without notice

i want an i.

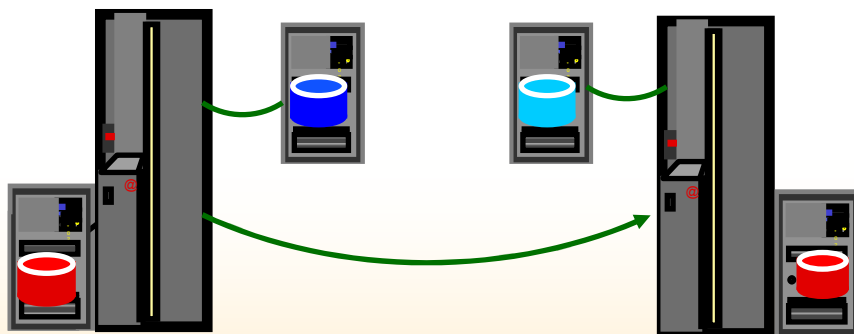# What is Switched Disk and XSM

Standalone IASP
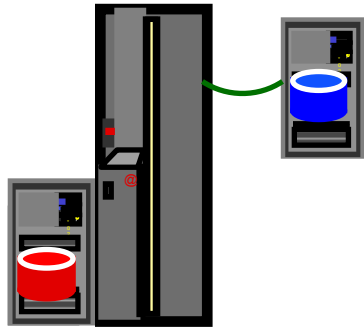
Switched Disk
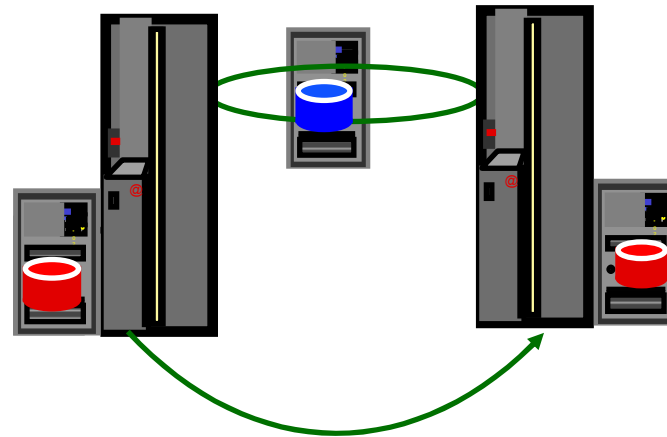
Cross Site Mirroring

Switched Disk and XSM
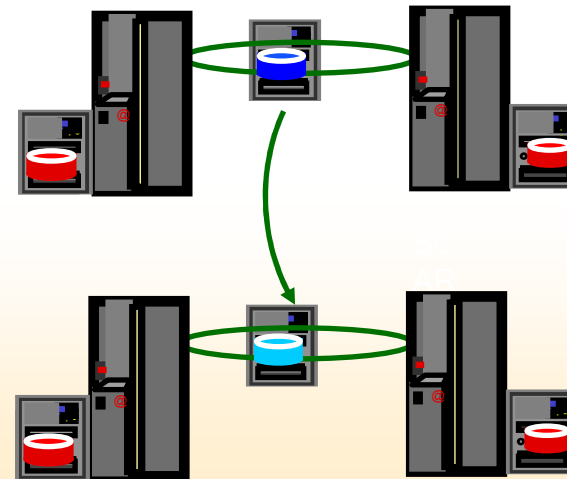
TS7520/TS7530 Product Overview

TS7530 Virtualization Engine Announcement

- **Announced: May 13, 2008**
- **General Availability: June 13, 2008**
- **New HW Based compression support**

  – Optional feature code: up to 2 cards per Server

  – Potentially reduce disk space

  – Potentially increased backup performance utilizing compression

- **1TB drive integration**

  – Scaleable configurations up to 1.7PB useable - RAID 5

  – Support for new TS7530 and existing TS7520

  – RAID 6

- **New Server refresh**
- **RETAIN Call Home Support**
- **System i Support**

TS7500 Virtualization Basics

- **Emulates most recent IBM Tape Libraries and Drives:**
    - TS3500, TS3100, TS3200, TS3310, TS3400, 3582, 3583
    - LTO2, LTO3, LTO4, 3592, TS1120, TS1130

- **Physically attaches most recent IBM Tape Libraries and Drives:**
    - TS3500, TS3100, TS3200, TS3310, TS3400, 3494, 3582, 3583
    - LTO2, LTO3, LTO4, 3592, TS1120, TS1130

    Supported by multiple backup applications
    - IBM Tivoli Storage Manager
    - BRMS
    - Symantec Netbackup
    - HP Dataprotector

IBM TS7530 Component Overview

- **TS7530** Virtualization Engine **(3954-CV7)** - Intel-based appliance

- TS7520 Virtualization Engine Cache Controller (3955-SV6)

- TS7520 Virtualization Engine Cache Module (3955-SX6)

- TS7500 **V3R1** Software provides FC connection management, tape emulation **(5697-P19)**

- IBM 3952-F05 Tape Frame

Base Frame

Expansion Frame

Over 55 Years of Tape Innovation

- **Starting in 1952**
  - IBM 726 Tape Unit
    - **7,500 characters per second**
    - 100 bits per inch
- **and continuing in 2008**
  - IBM TS1130 Tape Drive
    - **up to 160MBps[1]**
    - up to 1TB[1]

1848
George Boole invents binary algebra

1952
IBM 726
1st magnetic tape drive

1964
IBM 2104
1st read/back drive

1995
IBM 3590

2000
LTO Gen1

2002
LTO Gen2

2004
LTO Gen3

2007
LTO Gen4

O P E N

E N T E R P R I S E

1928, IBM invents the 80 column Punch Card

1959
IBM 729
1st read/write drive

1984
IBM 3480
1st cartridge drive

1999
IBM 3590E

2003
3592 Gen1

2005
3592 Gen2

2008
3592 Gen3
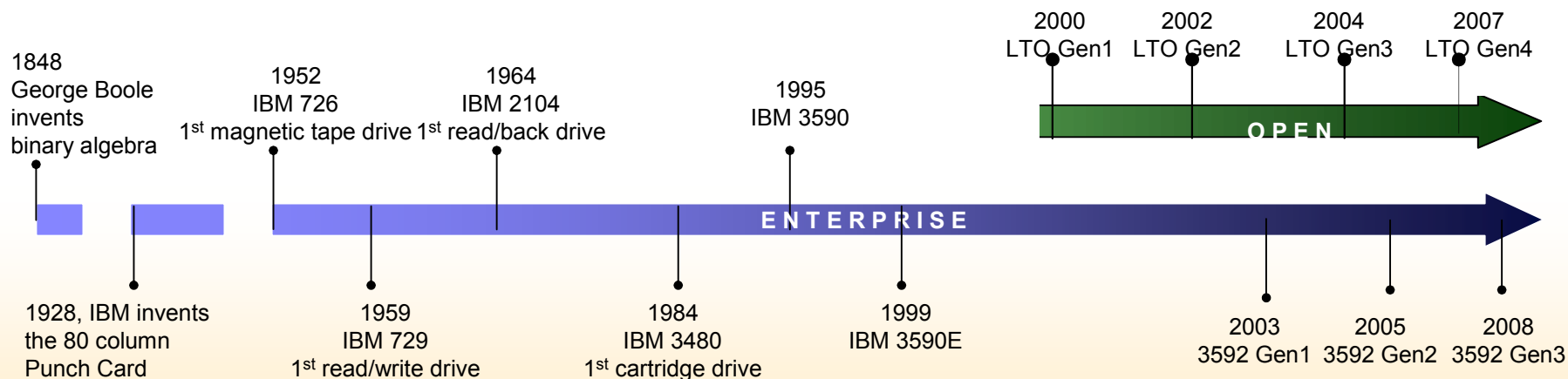
[1] represents maximum native performance or cartridge capacity

TS1130 Tape Drive Overview

- **Fastest 1TB Tape Drive**
- **3rd Generation of 3592 enterprise tape drive roadmap**
  - 160MBps performance (up to 350MBps at 3:1 compression)
  - 1TB native capacity cartridges (up to 3TB at 3:1 compression)
    - Re-Writable and Write Once Read Many (WORM)
  - 4Gbps dual ported fibre
  - Supports data encryption and key management
  - MES upgrade for TS1120 available (3592-EU6)
- **Attaches to**
  - <u>All</u> IBM Systems (IBM System z™ via TS1120 Controller)
  - Selected HP and Sun Microsystems servers
  - Selected versions of Microsoft Windows™
  - Selected Linux editions
- **Supported in**
  - IBM TS3400, TS3500 and 3494 tape libraries
  - IBM 3592 C20 silo compatible frame
  - IBM 7014 Rack

TS1130 = 3592-E06/EU6 = Jaguar 3

New for Gen 3 – TS1120 to TS1130 Drive Upgrade

- **New Model 3592-EU6**
  - Existing 3592-E05 canister upgraded to be functionally equivalent to the 3592-E06
    - Upgrade ordered via MES Model Conversion
  - 3592-EU6 inherits the 3592-E05 serial number
    - 3592-EU6 will assume only any remaining warranty entitlements or the service status of 3592-E05 that has been upgraded
- **Model upgrades beyond the EU6 will not be available**

Some day, maybe

Future Drive

Never

3592-E06

3592-EU6

TS1130 Media Compatibility

- **Supports 3592 rewriteable and WORM cartridges**
- **Supports three cartridge lengths**

  – JJ and JR cartridges provide rapid access to data

  – JA and JW cartridges provide fast access to data or high capacity

 – JB and JX extended data cartridges provide higher capacity

- **Gen 1, Gen 2 or Gen 3 cartridge formats supported**

  – TS1130 tape drives can read Gen 1 and read and write Gen 2 formats

  – TS1120 tape drives can read or write Gen 1 or Gen 2 formats

  – 3592 J1A tape drives can read or write the Gen 1 format

3592 Cartridge Media		TS1130 Tape Drive		TS1120 Tape Drive		3592 J1A Tape Drive	
Type	Format	Capacity	Performance	Capacity	Performance	Capacity	Performance
JJ / JR	Gen 1	60GB	71MBps	60GB	50MBps	60GB	40MBps
	Gen 2	100GB	143MBps	100GB	104MBps		
	Gen 3	128GB	143MBps				
JA / JW	Gen 1	300GB	71MBps	300GB	50MBps	300GB	40MBps
	Gen 2	500GB	143MBps	500GB	104MBps		
	Gen 3	640GB	143MBps				
JB / JX	Gen 2	700GB	150MBps	700GB	104MBps		
	Gen 3	1TB	160MBps				

TS1130 Tape Drive Operation

- **Five servo bands**
  - Servo bands recorded during manufacturing
  - Multiple servo locations within each band
- **Four data bands**
  - 288 tracks per band (1152 tracks)
  - Drive takes 72 'passes' to write a full tape
- **Data is written to 16 tracks at a time**
  - Cartridges are available in three lengths or capacities
  - Cartridges are available in re-writable and write once read many (WORM)
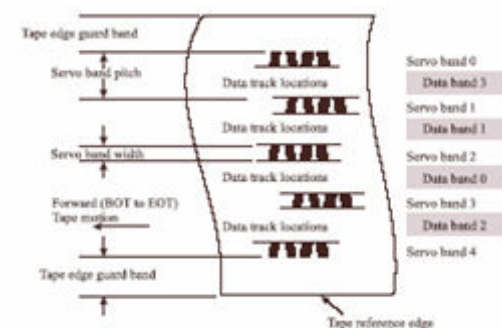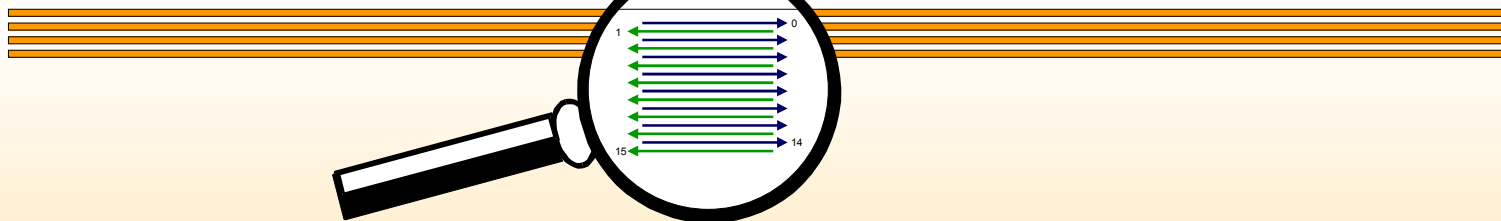
Speed Matching

- **Drive dynamically compensates for slow server**
- **Automatically adjusts data rates to**
  - 163, 134, 109, 83, 56, 43 MBps for 3592 JB cartridges initialized in Gen 3 format
  - 150, 127, 104, 78, 52, 40 MBps for 3592 JB cartridges initialized in Gen 2 format
  - 71, 59, 47, 36, 24, 19, 13 MBps for 3592 JA cartridges initialized in Gen 1 format
- **Effectively minimizes backhitching**
- **Extends the life of the media**
- **Increases performance**
- **Increases throughput**
  - Adjust tape speed based on host data rate
  - Calculates effective host data rate (EHDR)
  - Optimizes data rate by selecting optimal EHDR
  - Forces speed changes mid-wrap if advantageous
  - Minimizes time to record data

Thank You & Questions?

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