Common Europe Luxembourg

Discovering IBM System i5 and i5/OS

Version 5 Release 4 Announcements (January 31st, 2006)
by Eddy Pasteger, REAL Solutions S.A.

Made on a Mac

Agenda

Introduction

- Upcoming Events

News from Hardware

- Processors
- Models
- Memory
- Input/Output Devices
- Firmware
- Consoles
- Planning Statements

News from Software

- Application Development
- Communications
- Database
- Backup & Recovery
- Availability

And More ...

- Technical Corner
- Product Preview

This presentation contains informations about IBM plans and directions. Such plans are subject to change without notice.

Contact Information

REAL Solutions S.A.
Rue d'Eich, 33
L-1461 Luxembourg

Eddy Pasteger
System Engineer Manager
System i Certified Solutions Expert

Voice : (+352) 43 65 22 1
Fax : (+352) 42 26 38
E-mail : eddy.pasteger@real.lu

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Discovering IBM System i5 and i5/OS Version 5 Release 4
Hardware Overview

Hardware Overview
Processors

Processors

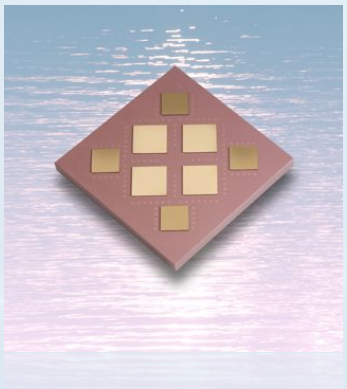
POWER Processor Roadmap

- Not just a Processor, but a Solution
- Balancing numerous aspects of performance to achieve a better result

Processors

Power5

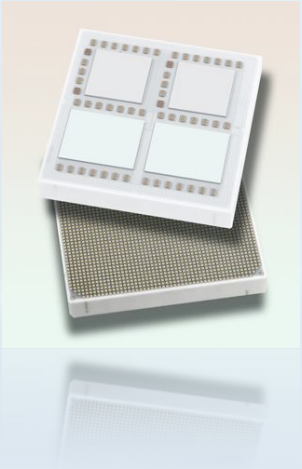
- Architecture & Lithography
  - 64-bit PowerPC
  - Silicon-on-insulator (SOI) and copper interconnects
  - 0.13 micron (130 nanometers)
- Characteristics
  - Multi-core chip
  - Simultaneous multi-threading
  - Integrated private level-1 cache and shared level-2 cache
  - Integrated level-3 Cache Controller
  - Integrated memory controller
  - Integrated distributed interconnect switch
  - Dynamic power management
  - Micro-partitioning hardware support
- Packaging and Speed
  - Single, DCM and MCM
  - Rated 1.50 GHz, 1.65 GHz and 1.90 GHz



Processors

Power5+

- Architecture & Lithography
  - 64-bit PowerPC
  - Silicon-on-insulator (SOI) and copper interconnects
  - 0.09 micron (90 nanometers)
- Characteristics
  - Multi-core chip
  - Simultaneous multi-threading
  - Integrated private level-1 cache and shared level-2 cache
  - Enhanced integrated level-3 cache controller
  - Enhanced integrated memory controller
  - Integrated distributed interconnect switch
  - Dynamic power management
  - Micro-partitioning hardware support
- Packaging and Speed
  - Single, DCM and MCM
  - Rated 1.65 GHz, 1.90 GHz and 2.20 GHz



Processors

Power6 (aka. ECLipz)

- Architecture & Lithography
  - 64-bit PowerPC
  - Silicon-on-insulator (SOI) and other (?) technologies
  - Combination of 90 and 65 nanometer lithography
- Characteristics
  - ?!
- Packaging and Speed
  - Expected to run between 4.00 GHz and 5.00 GHz
    - IBM Research claimed that the chip already passed 5.60 GHz
    - "Fast and Cool" ... no other comment on power requirement and heat
  - Expected for middle of 2007

Processors

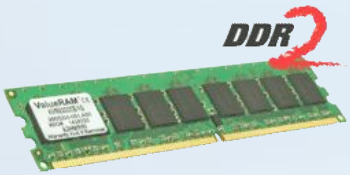
Power7

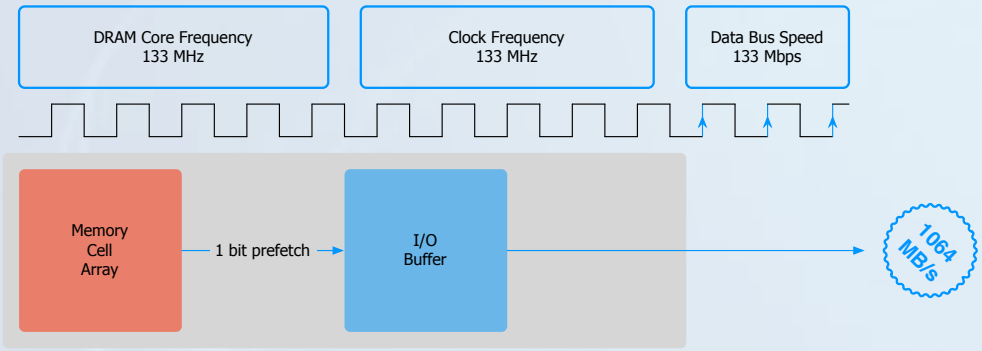
- Microprocessor currently in development at IBM Research since April 2005
  - → ?!

Hardware Overview
Main Storage

DDR-2 SDRAM

- Double Data Rate (Version 2)
  Synchronous Dynamic Random Access Memory

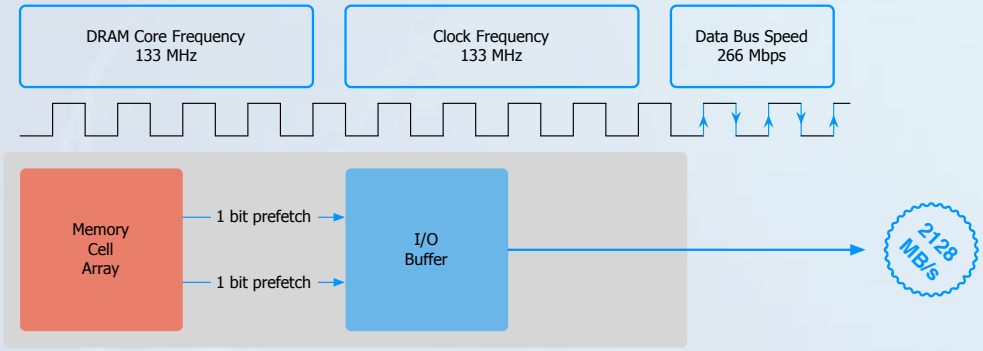




Understand : SDR SDRAM

- Single Data Rate SDRAM
  - Synchronous interface
    Transfers data on the rising edge of the clock pulse
  - Allow pipelining
    The chip can accept new command before it has finished the previous one
  - Simply called SDRAM rather than SDR SDRAM

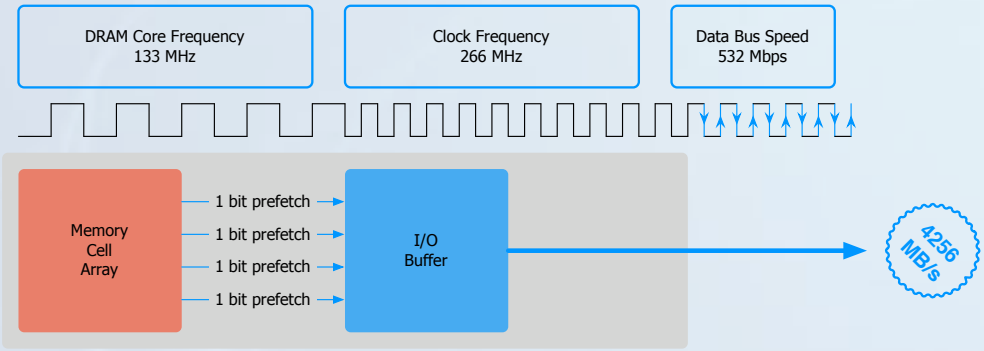
Main Storage



Understand : DDR SDRAM

- Double Data Rate SDRAM
  - Transfers data on both the rising and falling edges of the clock pulse (double pumped)
  - Achieve greater bandwidth

Main Storage



Understand : DDR-2 SDRAM

- DDR2 SDRAM : an improved DDR technology
  - Ability for much higher clock speeds
  - ...

Main Storage

	DDR	DDR-2	DDR-3
DRAM Core Frequency	from 100 to 200 MHz	from 100 to 200 MHz	from 100 to 200 MHz
Pre-fetch Buffer Size	2 bits	4 bits	8 bits
Bus Frequency	from 100 to 200 MHz	from 200 to 400 MHz	from 400 to 800 MHz
Data Rate	from 200 to 400 Mbps	from 400 to 800 Mbps	from 800 to 1600 Mbps
Data Bus	64 bits	64 bits	64 bits
Data Throughput	from 1600 to 3200 MB/s	from 3200 to 6400 MB/s	from 6400 to 12800 MB/s
Lithography	130 nm	130 nm	90 nm
Voltage	2.5 V	1.8 V	1.5 V
Packaging	184 pins DIMM	240 pins DIMM	?
Notes	used into eServer i5 (G1)	used into System i5 (G2)	specifications expected mid-2006
	used by QUADS	used by PAIRS	

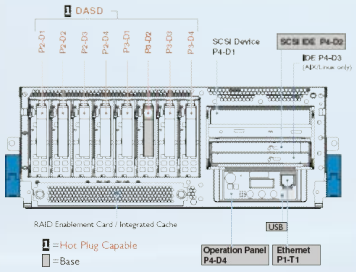
Hardware Overview
Models

The new System i5 family

System i5 model 520

Highlights

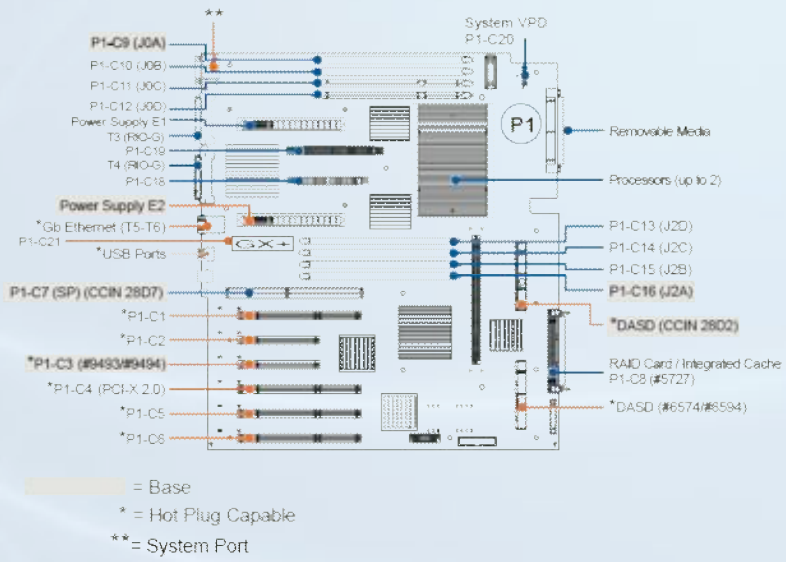
- Desk-side or Rack-mounted
  - 4 EIA Units
- Built-in Features
  - I/O controller with optional Cache/RAID-5 enabler
    - 1x slim internal optical unit
    - 1x internal tape unit
    - 2x 4x internal disk units
  - 2x ethernet ports
  - 2x HMC ports
- Redundant Features
- Up to 2-Ways
  - Computing power from 600 to 7100 CPW
- Runs with i5/OS V5R3 !



System i5 model 520

Physical Layout

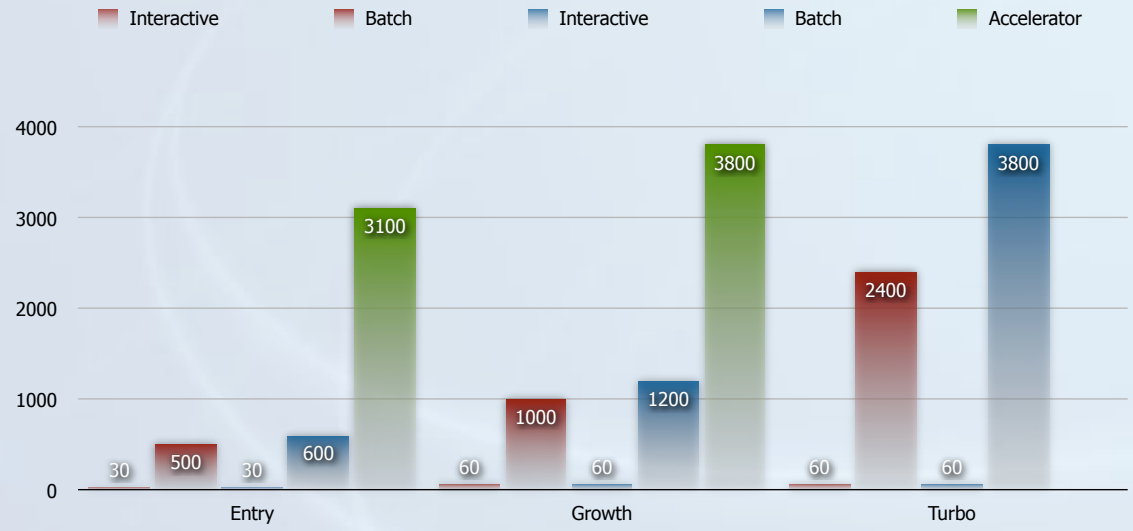
- 6x PCI-X Slots
  - 2x 32-bits
  - 2x 64 bits
  - 1x 64 bits DDR-2
- 1x Processor Chip
  - Up to 2 CPUs
- 8x Memory Slots
  - Filled by pairs



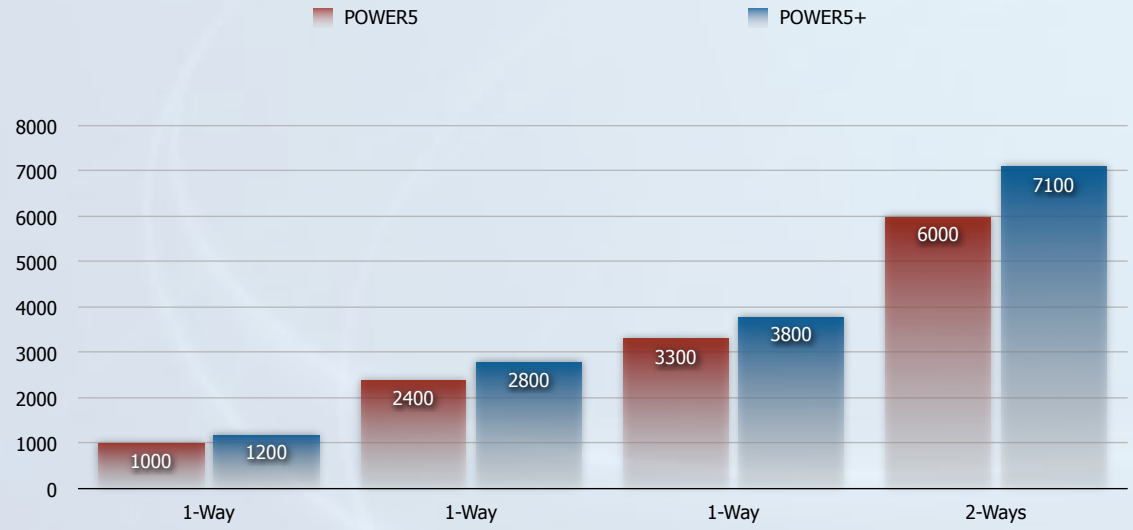
System i5 model 520

		Value			Standard		Enterprise		
Processor	**Type**	Power5+ 1.9 GHz							
	Number	1	1	1	1	1/2	1	1	1/2
	Cycles	20%	30%	100%	100%	100%	30%	70%	100%
	Accelerator	100%	100%	-	-	-	-	-	-
LPAR	**Base**	2	3	10	10	10/20	3	10	10/20
	Accelerator	10	10	-	-	-	-	-	-
Cache	**L2 (MB)**	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
	L3 (MB)	0	36	36	36	36	36	36	36
CPW	**Base**	600/30	1200/60	3800/60	3800/0	3800/0	1200/MAX	2800/MAX	3800/MAX
	Accelerator	3100/30	3800/60	-	-	-	-	-	-
	CoD	-	-	-	-	7100/0	-	-	7100/MAX
Main Storage	**DIMM**	2/8							
	GB	1/32							
HSL	**Loop**	0/1							
	Tower	0/6							
DASD	**Arms**	278							
	TB	38							
Software	**SLIC**	V5R3M5							
	i5/OS	V5R3M0							
	Group	P05	P10	P10	P10	P20	P10	P10	P20

Model 520 "Value" and "Express"



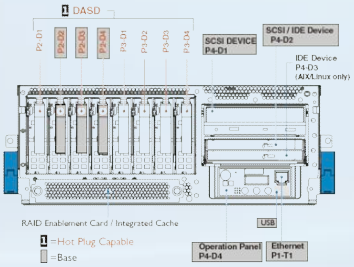
Model 520



System i5 model 550

Highlights

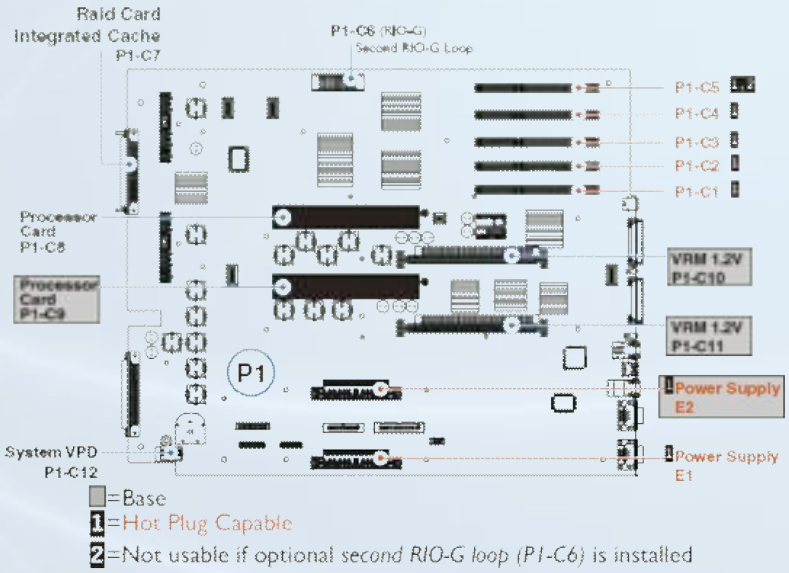
- Desk-side or Rack-mounted
  - 4 EIA Units
- Built-in Features
  - I/O controller with optional Cache/RAID-5 enabler
    - 1 slim internal optical unit
    - 1 internal tape unit
    - 2x 4 internal disk units
  - 2 ethernet ports
  - 2 HMC ports
- Redundant Features
- Up to 4-Ways
  - Computing power from 3800 to 14000 CPW
- Runs with i5/OS V5R3 !



System i5 model 550

Physical Layout

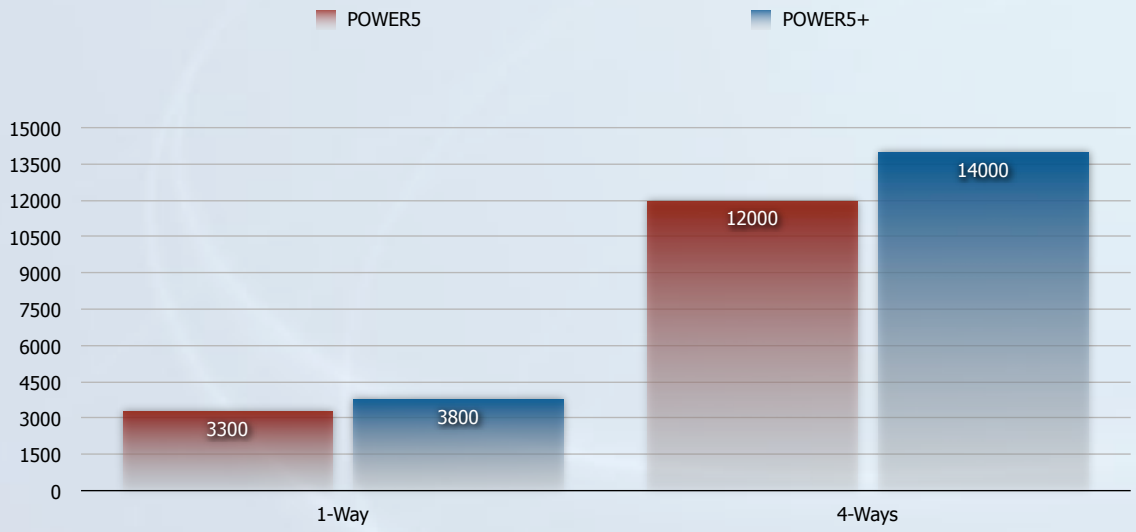
- 5x PCI-X Slots
  - 5x 64 bits
- 2x Processor Enclosures
  - 1x Chip
  - 2x CPUs
  - 8x Memory Slots



System i5 model 550

Processor	**Type**	Power5+ 1.9 GHz
	Number	1/4
LPAR	**Base**	10/40
Cache	**L2 (MB)**	1.9
	L3 (MB)	36
CPW	**Base**	3800
	CoD	14000
Package		Standard / Enterprise
Main Storage	**DIMM**	4/16
	GB	2/64
HSL	**Loop**	1/2
	Tower	0/12
DASD	**Arms**	548
	TB	74
Software	**SLIC**	V5R3M0
	i5/OS	V5R3M0
	Group	P20

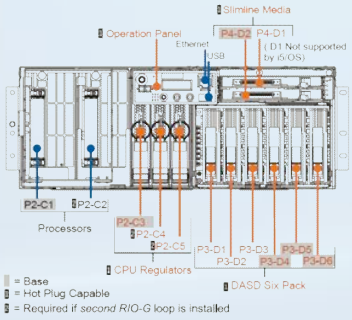
Model 550



System i5 model 570

Highlights

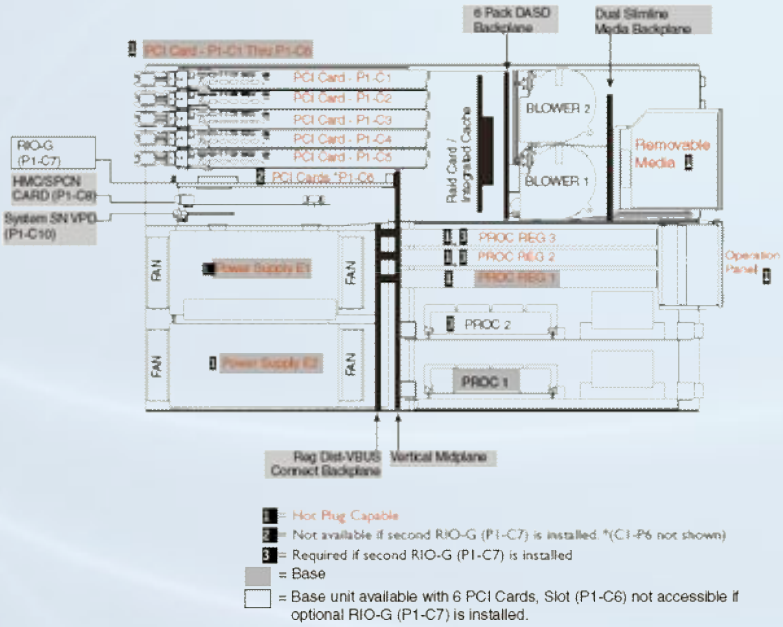
- Rack-mounted
  - 4 EIA Units per CEC
  - Up to 4 stackable CECs
- Built-in Features
  - I/O controller with optional Cache/RAID-5 enabler
    - 1 slim internal optical unit
    - 6 internal disk units
  - 2 Ethernet ports
  - 2 HMC ports
- Redundant Features
- Up to 16-Ways
  - Power from 8400 to 58500 CPW
- Runs with i5/OS V5R3 !



System i5 model 570

Physical Layout

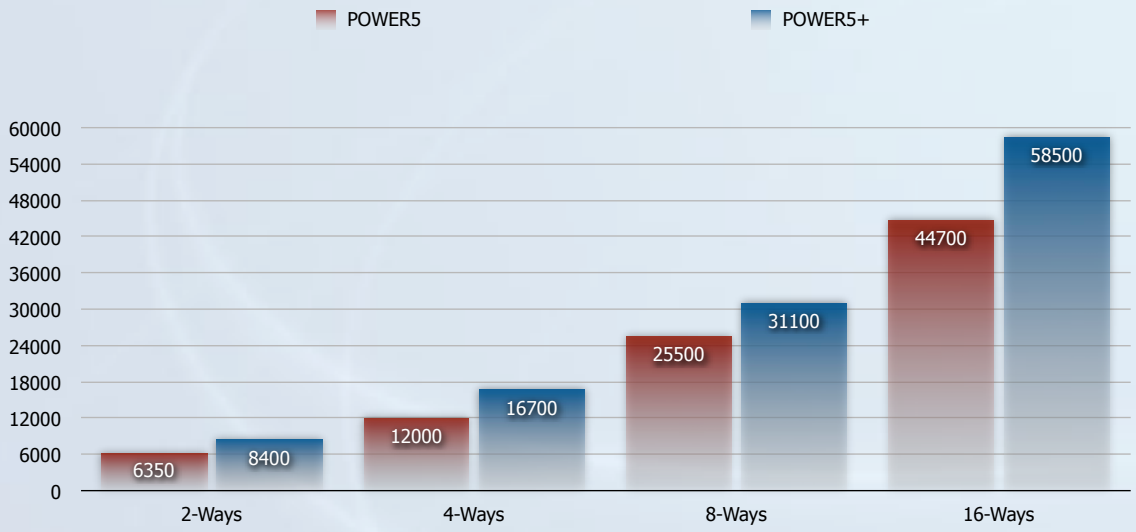
- 6x PCI-X Slots
  - 6x 64 bits
- 2x Processor Enclosures
  - 1x Chip
  - 2x CPUs
  - 8x Memory Slots
- Up to 4x Stackable CECs
  - Up to 16-Ways



System i5 model 570

Processor	**Type**	Power5+ 2.2 GHz		
	Number	2/4	4/8	8/16
LPAR	**Base**	20/40	40/80	80/160
Cache	**L2 (MB)**	1.9		
	L3 (MB)	36		
CPW	**Base**	8400	16700	31100
	CoD	16000	31100	58500
Package		Standard / Enterprise		
Main Storage	**DIMM**	8/16	16/32	32/64
	GB	4/128	8/256	16/512
HSL	**Loop**	1/2	2/4	4/8
	Tower	0/12	0/24	0/48
DASD	**Arms**	546	822	1374
	TB	74	112	188
Software	**SLIC**	V5R3M0		
	i5/OS	V5R3M0		
	Group	P30	P40	P40

Model 570



System i5 model 595

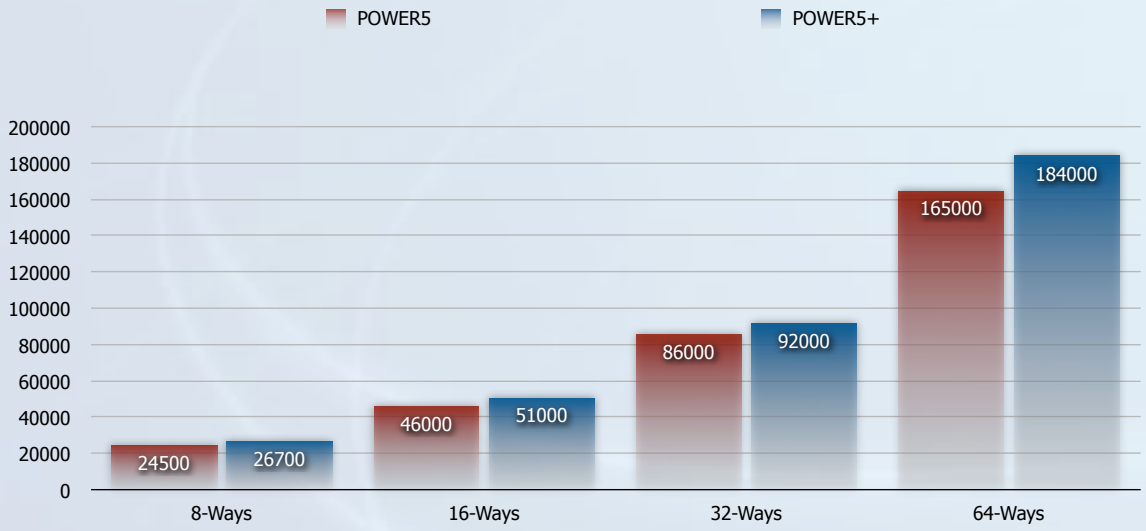
Highlights

- Up to 64-Ways
  - Computing power from 26700 to 184000 CPW
  - The most powerful Power5 technology-based system
  - Special US regulations exists in order to export to "some" countries
- Superlatives ...
  - Up to 2 TB of memory
  - Up to 382 TB of disk space
  - Up to 96 I/O drawers/towers
  - Up to 254 logical partitions
- Some other figures ...
  - 2-meters tall system unit, weights 2500 kg
  - Maximum power requirement : 22.7 kW
  - Maximum thermal output : 77500 BTU/h
  - Maximum noise emission : 68 dB
- Runs with i5/OS V5R3 !

System i5 model 595

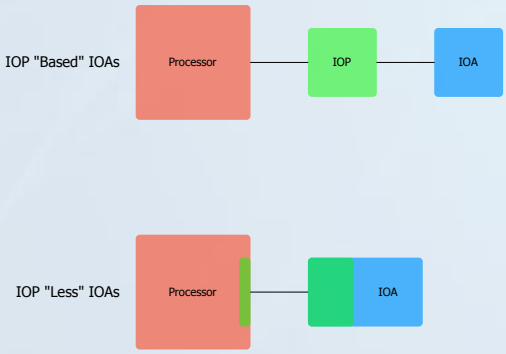
Processor	**Type**	Power5 1.9 GHz		
	Number	8/16	16/32	32/64
LPAR	**Base**	80/160	160/256	256
Cache	**L2 (MB)**	1.9		
	L3 (MB)	36		
CPW	**Base**	26700	51000	92000
	CoD	50500	92000	184000
Package		Standard / Enterprise		
Main Storage	**DIMM**	4/16	8/32	16/64
	GB	8/512	16/1024	32/2048
HSL	**Loop**	7	15	31
	Tower	0/36	0/72	0/96
DASD	**Arms**	1620	2700	2700
	TB	221	369	369
Software	**SLIC**	V5R3M0		
	i5/OS	V5R3M0		
	Group	P50	P50	P60

Model 595



Hardware Overview
Input/Output Devices

Smart IOA



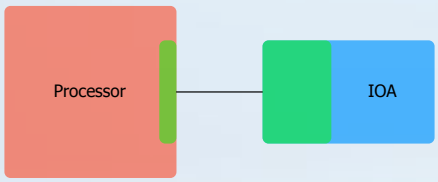
Smarter IOAs (IOP-Less) Direction

- IOA technology has evolved
  - IOA can take over IOP functionality
- Smarter IOA benefits includes :
  - Avoiding cost of IOP and PCI slot to hold IOP
  - Configuration flexibility including simpler LPAR I/O

Smart IOA

Smarter IOAs (IOP-Less) Categories

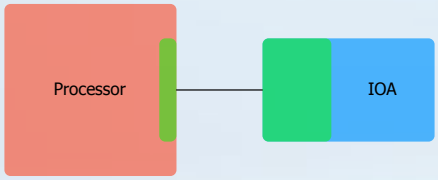
- IOP-based only
  - These IOAs still REQUIRES an IOP
- IOP-less only
  - These IOAs does CANNOT work with an IOP
- Dual-mode
  - If no IOP is present, the IOA work in IOP-less mode
  - If an IOP is present, the IOA works in IOP-based mode



Smart IOA

Smarter IOAs (IOP-Less) Transition

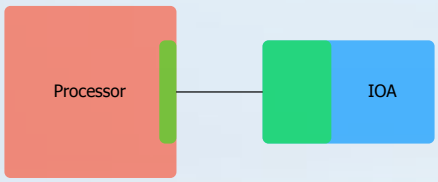
- Very simple from an high-level perspective
- For people laying out the detailed configurations ...
  - There are a few new things to keep in mind ...



Smart IOA

Smart IOAs (IOP-Less) Requisites

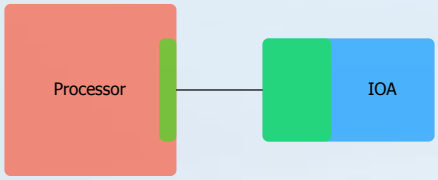
- Requires an eServer i5 or a System i5
- Requires i5/OS V5R4M0
  - Except for System i5 model 520



Smart IOA

Dual-mode IOAs Considerations

- New CECs
  - IOP-based mode supported with V5R3
  - IOP-less mode IOA requires V5R4
  - Except made of new System i5 model 520
    - SLIC V5R3M5 + i5/OS V5R3M0 w/ C6045530
- Old CECs
  - IOP-based mode supported with V5R3
  - IOP-less mode NOT supported (neither with V5R3 nor V5R4)
- I/O Drawers & Towers
  - IOP-based mode supported with V5R3
  - IOP-less mode supported with V5R4
  - Except made of new System i5 model 520
    - SLIC V5R3M5 + i5/OS V5R3M0 w/ C6045530
- Additional card requirements/rules may apply
- PTF may be required



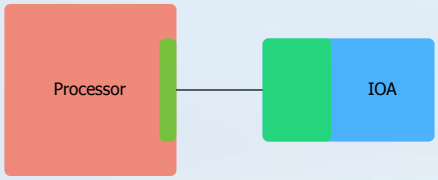
Smart IOA

	Minimum Release for System		IOP-less Mode	
	SLIC	**i5/OS**	**into CEC**	**into I/O drawer/tower**
Old Power5 CECs				
520	V5R3M0	V5R3M0	NOT Supported	V5R4
550	V5R3M0	V5R3M0	NOT Supported	V5R4
570	V5R3M0	V5R3M0	NOT Supported	V5R4
595	V5R3M0	V5R3M0	V5R4	V5R4
New Power5+ CECs				
520	V5R3M5	V5R3M0	V5R3	V5R3
550	V5R3M0	V5R3M0	V5R4	V5R4
570	V5R3M0	V5R3M0	V5R4	V5R4
595	V5R3M0	V5R3M0	V5R4	V5R4

Smart IOA

Smarter IOAs (IOP-Less) Rollout

- 2004
  - First LAN adapter
- 2005
  - Cryptographic adapter
- 2006
  - WAN adapter for ECS
  - Small cache disk controller
  - Small controller for internal optical and tape
- 200x - Future directions
  - More IOAs are planned to be introduced over time



#5700/#5701/#6800/#6801

1-Port 1-Gbps Ethernet LAN IOA

- Mode
  - IOP-based (#5700/#5701)
  - IOP-Less (#6800/#6801)
- #5700/#6800
  - Multimode optical fiber media
  - LC connector
  - Maximum 500 meters
  - 1 Gbps
- #5701/#6801
  - UTP CAT-5 media
  - RJ-45 connector
  - Maximum 100 meters
  - 1 Gbps or 100/10 Mbps
- Requires V5R4

Embedded 520/550/570 I/O Controllers

- Mode
  - Dual
  - Requires V5R4 on 550/570 to run IOP-less
- Disk Controller
  - 520/550 : 4/8 internal disk units
  - 570 : 6 disk units
  - Zero write cache
  - No RAID support
  - Mirroring via i5/OS
- Tape/Optical Controller
  - Internal DVD (RAM/ROM)
  - Internal tape units (LTO/QIC/VXA)

#5727/5728

Cache for Embedded 520/550/570 I/O Controller

- Mode
  - Dual
  - Requires V5R4 on 550/570 to run IOP-less
- Replaces #5709 and #5726
- Enhances Disk Controller
  - 20/550 : 4/8 internal disk units
  - 570 : 6 disk units
  - 40 MB write cache
  - RAID-5 enablement
  - Mirroring via i5/OS

#5736/#5766/#5775

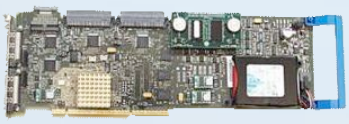
Entry Disk/Tape/Optical Controller IOA

- Mode
  - IOP-based (#5736)
  - IOP-less (#5775)
- Replaces #5702/#5712/#5705/#5715
- Disk Controller
  - Attaches up to 6 internal disk units
  - Zero write cache
  - No RAID support
  - Mirroring via i5/OS
- Tape/Optical Controller
  - Attaches up to 2 drives
  - External or Internal
  - SCSI-LVD interface
- Rules
  - Disk OR tape/optical, NOT BOTH
  - External tape drives are not supported in IOP-less mode

#5737/#5776

Entry RAID-5/RAID-6 Disk Controller - 90MB

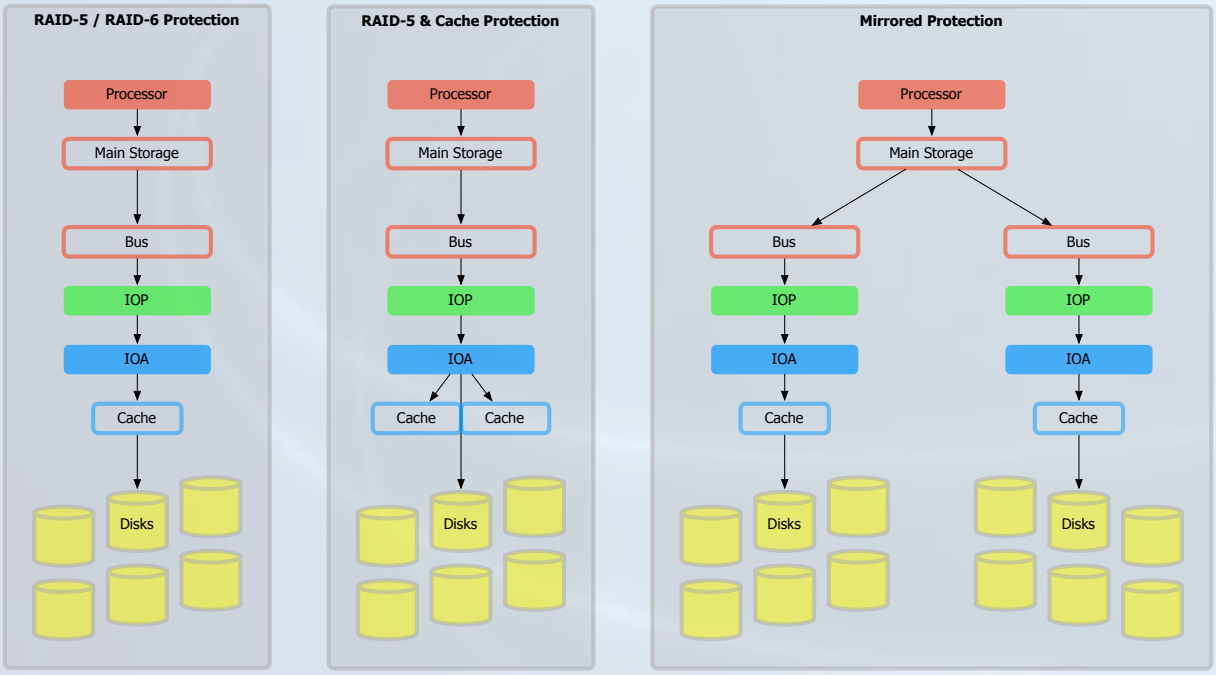
- Mode
  - IOP-based (#5737)
  - IOP-less (#5776)
- Replaces older #5703
- Features
  - Bigger 90 MB write cache
  - Attach up to 12 drives
  - RAID-5 and RAID-6 capability
- Requires V5R3 or V5R4 according placement



RAID-5 versus RAID-6

	RAID-5	RAID-6
Cost	Capacity of 1 disk unit per array	Capacity of 2 disk unit per array
Protection	Single unit failure per array	Double unit failure per array
Minimum array size	3 disk drives, same geometry	4 disk drives, same geometry
Maximum array size	18 disk drives	18 disk drives
Supporting disk controller	All RAID-enabled disk controllers	#5737/#5776
Supporting i5/OS	Lot of releases	V5R3 or later
Performance implication	Known	Similar to #5703 running RAID-5

About Disk Protection



About Disk Controllers

	Old Embedded Enablers	New Embedded Enablers	#5737/5776	#2757/#5581	#2780/#5580
Write Cache	16 MB	40MB	90 MB	256 MB	256 MB
Read Cache	-	-	-	-	1 GB
Performance	Poor	Better	Good	Better	Best
Concurrent Battery Maintenance	No	No	No	No	Yes
Auxiliary Write Cache	No	No	No	Yes (#5581)	Yes (#5580)
RAID Protection	RAID-5	RAID-5	RAID-5 + RAID-6	RAID-5	RAID-5
Maximum Drives	8	8	12	15 (#5581) 20 (#2757)	15 (#5580) 20 (#2780)
Controller Price	1x	1x	2x	4x	4x

#5760/#5761

4-Gbps Fibre Channel Disk/Tape IOA

- Mode
  - IOP-based, same requirements as previous IOAs
- Replaces older Fibre Channel Disk/Tape IOA
  - Can connect to 1/2/4-Gbps SAN
  - #5760 replaces #2766 and #2787
  - #5761 replaces #2765 and #5704
- Requires V5R3

About FC Disk Performance

Card	Speed	Throughput	CS Response Time	PDCU Response Time
#2766	1 Gbps	62 MBps	8.3 ms	2.9 ms
#2787	2 Gbps	86 MBps	5.7 ms	1.3 ms
#5760	4 Gbps	148 MBps	3.5 ms	1.2 ms
		70 % More	**38 % Faster**	**8% Faster**

Notes

- Measurements done during running the same workloads
  - CS = Collection Services : system response time
  - PDCU = Performance Data Collector Utility : storage subsystem response time
- IOA Improvement
  - If a #2787 really busy is attached to a 2 Gbps SAN fabric, you can see throughput improvements by going to a #5760, even if the SAN fabric stays at 2 Gbps

I/O Drawers & Towers

		#0588 (*)	#0595	#5094	#5294	#5790
Bus		3	2	3	6	2
Slots	**32-bits**	4	0	4	8	0
	64-bits	10	7	10	20	6
DASD		0	12	45	90	0
EIA Units		8	5	N/A	N/A	4 (half)
HSL	**Speed**	HSL-1	HSL-2	HSL-2	HSL-2	HSL-2
	D/T	1	1	1	2	1
Supported on		8xx and 5xx	8xx and 5xx	8xx and 5xx	8xx and 5xx	5xx

(*) Drawer #0588 will be withdrawn from marketing on June 2006

I/O Drawers & Towers

HSL Rules

- Base Rules
  - Maximum loop positions = 9
    - Maximum I/O drawer/tower positions = 6
    - Maximum IXA positions = 8
- OptiConnect Rules
  - With 2 systems
    - Maximum loop positions = 4
  - With 3 systems
    - Maximum loop positions = 0

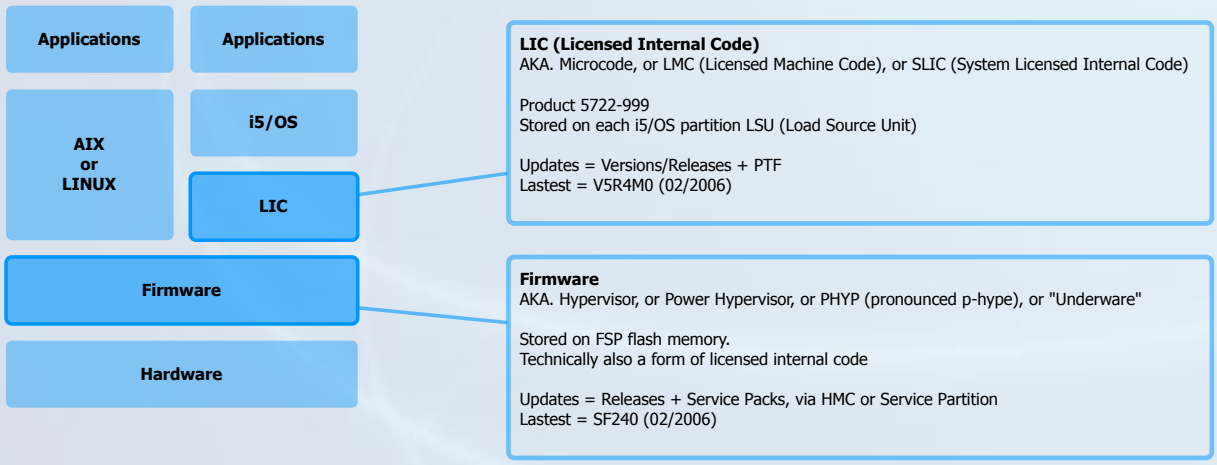
Model	HSL Loops
520	0/1
550	1/2
570	1/8
595	Up to 31

Internal Tape Units

Technology	Native Speed	Cartridge Capacity		Price
		Uncompressed	Compressed	
LTO-2	24 MBps	200 GB	400 GB	5x
VXA-320	12 MBps	160 GB	320 GB	1x
VXA-2	6 MBps	80 GB	160 GB	1x
QIC-50	5 MBps	50 GB	100 GB	6x
QIC-30	4 MBps	30 GB	60 GB	4x

Hardware Overview
Firmware

Firmware



Firmware

	HMC Release Level	System Firmware			
		Release Level	Availability	Base Level	Service Packs
GA7	V5R2	SF240	02/2006	201	
GA6	V5R1	SF235	10/2005	160	180, 185
GA5	V4R5	SF230	09/2005	120	126, 141, 145
GA4	V4R4	SF225	02/2005	96	
GA3	V4R3	SF222	11/2004	71	75, 81
GA2	V4R2	SF220	08/2004	43	45, 46, 49, 51
GA1	V4R1	SF210	06/2004	21	22, 23, 24, 25

Hardware Overview
Consoles

Consoles

Existing Console Remains

- Twinaxial Dumb Terminal
  - Via IOP-based twinaxial workstation controller
- WAN OpsConsole
  - Via IOP-based WAN adapter
- LAN OpsConsole
  - Via IOP-based LAN adapter
- HMC
  - Via virtual serial port

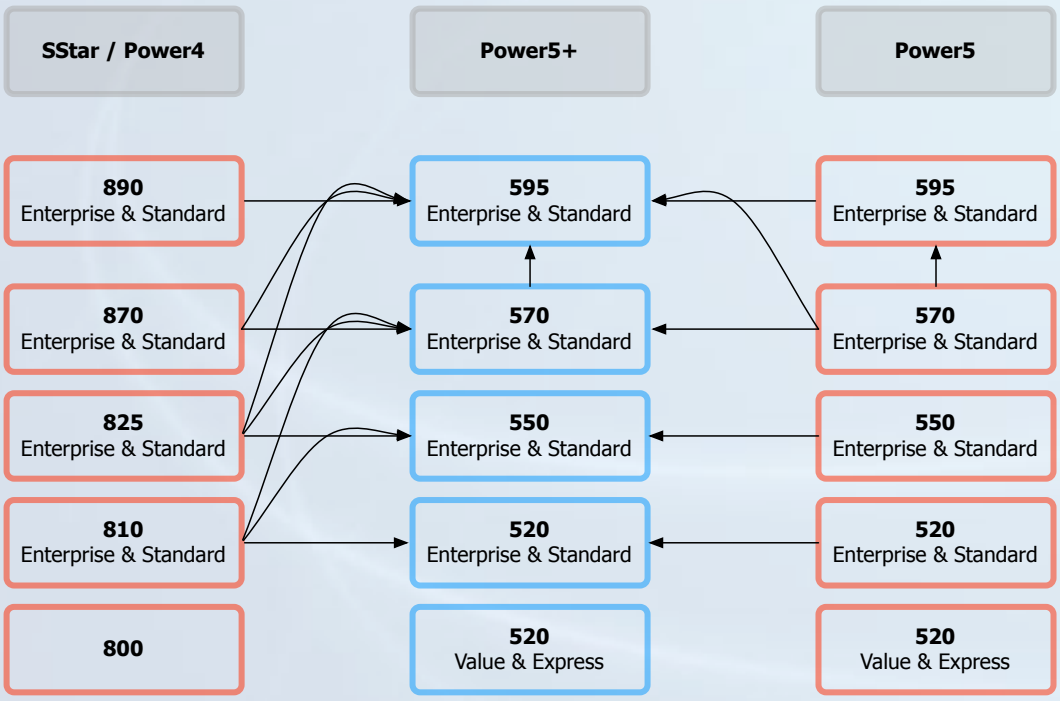
Consoles

Additional Consoles Options

- LAN OpsConsole
  - Via IOP-less 2-ports LAN adapter (#5706/#5707)
  - Via IOP-less embedded 2-ports LAN adapter
  - One port is dedicated to console function
  - Requires i5/OS V5R4, new Power5+ System i5 model 520 excepted
- Thin Console (SoD)
  - ?!

Hardware Overview
Planning Statements

Upgrade Paths



Upgrade Paths

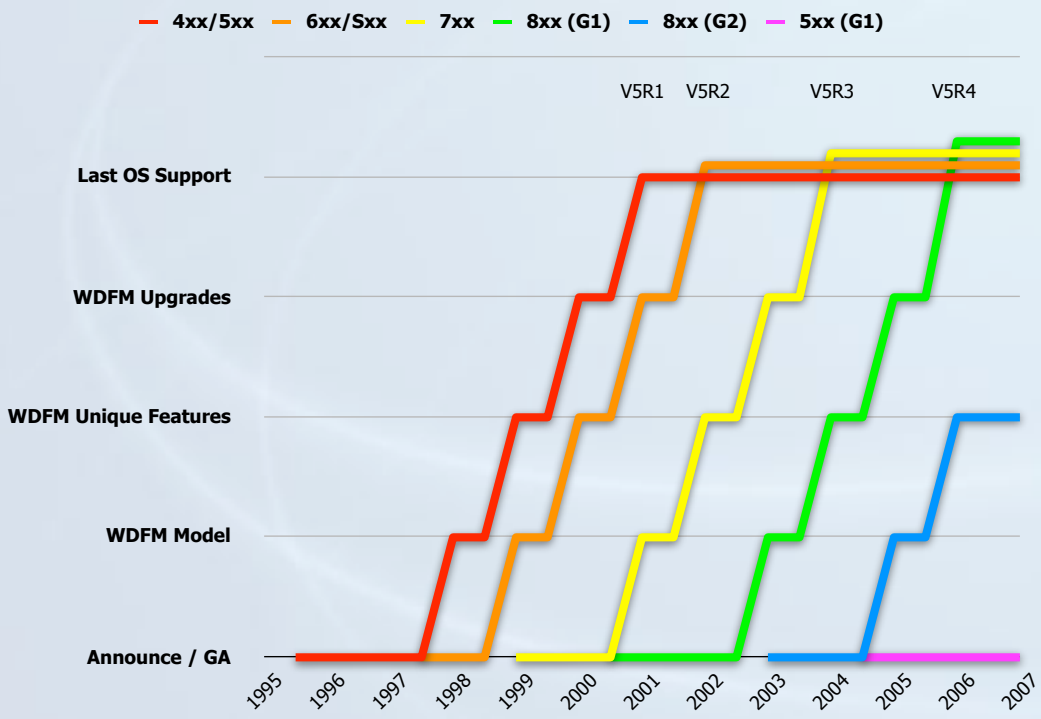
Memory Reuse

- Remember DDR vs. DDR-2
- NO memory reuse, excepted :
  - → Upgrades within same generation
  - → Upgrades from old eServer i5 model 595 to new System i5 model 595

Models with CUoD

- Existing upgrades rules/approach for "larger number n-ways"
  - → Can require two steps
- New upgrade rules for "same number n-ways"
  - → ?!

Models Life Spans



Common Europe Luxembourg

Discovering IBM System i5 and i5/OS Version 5 Release 4
Software Overview

V5R4 Software Overview
Application Development

What's new for CL programming ?

- CL enhancements in V5R3 made CL a stronger application development language
  - Multiple files per program
  - Support for integer variables
  - Control flow enhancements
    - DOWHILE, DOUNTIL, DOFOR, ITERATE, LEAVE, SELECT/WHEN/OTHERWISE

What's new for CL programming ?

- CL is further enhanced in V5R4 !
  - Support for subroutines
  - Support for pointers
  - Support for structures
    - Defined variables
    - Based variables
- CL can now take full advantage of the wide range of i5/OS APIs

Subroutines

```
PGM
:
DCLPRCOPT SUBRSTACK(99)
:
DCL VAL(&RESULT) TYPE(*INT) LEN(4)
:
:
CALLSUBR SUBR(SUBR1)
:
CALLSUBR SUBR(SUBR2) RTNVAL(&RESULT)
:
:
SUBR SUBR(SUBR1)
:
ENDSUBR
:
:
SUBR SUBR(SUBR2)
:
ENDSUBR RTNVAL(0)
:
ENDPGM
```


Defined Variables

- Defined variables make it easy to manage complex data structures ...

```
PGM
:
DCL VAR(&OBJECT) TYPE(*CHAR) LEN(20)
:
DCL VAR(&LIBNAME) TYPE(*CHAR) LEN(10) STG(*DEFINED) DEFVAR(&OBJECT)
DCL VAR(&OBJNAME) TYPE(*CHAR) LEN(10) STG(*DEFINED) DEFVAR(&OBJECT 11)
:
:
DCL VAR(&STRUCT) TYPE(*CHAR) LEN(50)
:
DCL VAR(&BINLEN) TYPE(*INT) LEN(4) STG(*DEFINED) DEFVAR(&STRUCT)
DCL VAR(&CHARLEN) TYPE(*CHAR) LEN(4) STG(*DEFINED) DEFVAR(&STRUCT)
:
:
ENDPGM
```

- Defined variables can be used to
  - Map different parts of the defined on variable
  - Map the same part of a given variable in different ways

Pointers

- New *PTR variable type
- New *NULL special value
- New %ADDRESS and %OFFSET built-in functions
  - %ADDRESS or %ADR
    - Used to test or change the address defined in a CL pointer
  - %OFFSET or %OFS
    - Used as a variable or as a value to change the address defined in a CL pointer
- New CHGPTR and CHGHLLPTR commands

Based Variables

- Based variables can be used to
  - Map variables passed to programs
  - Manipulate arrays of values

```
PGM
:
DCL VAR(&AUTO) TYPE(*CHAR) LEN(20)
DCL VAR(&PTR) TYPE(*PTR) ADDRESS(&AUTO)
DCL VAR(&BASED) TYPE(*CHAR) LEN(10) STG(*BASED) BASPTR(&PTR)
:
IF COND(%SST(&AUTO 1 10)*EQ &BASED) +
  THEN(CHGVAR VAR(%OFFSET(&PTR)) VALUE(%OFFSET(&PTR)+10))
:
ENDPGM
```

- The basing pointer must be set
  - Using the ADDRESS keyword on the DCL command
  - With the %ADDRESS built-in function
- After the basing pointer is set, based variables will look like local variables

V5R4 CL Programming Sample

```
PGM
:
DCL VAR(&USRLIBL) TYPE(*CHAR) LEN(2750)
DCL VAR(&PTR) TYPE(*PTR) ADDRESS(&USRLIBL)
DCL VAR(&LIB) TYPE(*CHAR) STG(*BASED) LEN(10) BASPTR(&PTR)
DCL VAR(&MESSAGE) TYPE(*CHAR) LEN(80) VALUE('Library #XXXX : YYYYYYYYYY')
DCL VAR(&P1) TYPE(*CHAR) STG(*DEFINED) LEN(4) DEFVAR(&MESSAGE 10)
DCL VAR(&P2) TYPE(*CHAR) STG(*DEFINED) LEN(10) DEFVAR(&MESSAGE 17)
DCL VAR(&I) TYPE(*INT) LEN(4) VALUE(1)
:
RTVJOBA USRLIBL(&USRLIBL)
:
DOWHILE COND((&LIB *NE ' ') *AND (&I *LE 250))
  CHGVAR VAR(&P1) VALUE(&I)
  CHGVAR VAR(&P2) VALUE(&LIB)
  SNDPGMMSG MSGID(CPF9897) MSGF(QCPFMSG) MSGDTA(&MESSAGE)
  CHGVAR VAR(%OFFSET(&PTR)) VALUE(%OFFSET(&PTR) + 11)
  CHGVAR VAR(&I) VALUE(&I + 1)
ENDDO
:
RETURN
ENDPGM
```


V5R4 CL Programming Sample

```
PGM
:
DCLF FILE(SUBSYSTEMS)
:
RECORD FORMAT NAME - SUBSYSTEMS
: CL VARIABLE               TYPE     LENGTH     PRECISION     TEXT
:   &SUBSYSTEMS             *CHAR     132
:
DCL VAR(&SBS) TYPE(*CHAR) STG(*DEFINED) LEN(10) DEFVAR(&SUBSYSTEMS 7)
DCL VAR(&STS) TYPE(*CHAR) STG(*DEFINED) LEN(6) DEFVAR(&SUBSYSTEMS 57)
DCL VAR(&EOF) TYPE(*LGL) VALUE('0')
:
:
:
OVRPRTF FILE(*PRTF) HOLD(*YES)
WRKSBS OUTPUT(*PRINT)
CRTPF FILE(QTEMP/SUBSYSTEMS) RCDLEN(132)
CPYSPLF FILE(QPDSPSBS) TOFILE(QTEMP/SUBSYSTEMS)
DLTSPLF FILE(QPDSPSBS)
DLTOVR FILE(*PRTF)
:
:
:
```

V5R4 CL Programming Sample

```
:
OVRDBF FILE(SUBSYSTEMS) TOFILE(QTEMP/SUBSYSTEMS)
RCVF
MONMSG MSGID(CPF0864) EXEC(CHGVAR VAR(&EOF) VALUE('1'))
:
DOWHILE COND(*NOT &EOF)
:
: IF COND(&STS *EQ 'ACTIVE') THEN(DO)
: :
: SELECT
: : WHEN COND(&SBS *EQ 'QCTL')
: : WHEN COND(&SBS *EQ 'QSYSWRK')
: : WHEN COND(&SBS *EQ 'QUSRWRK')
: : OTHERWISE CMD(ENDSBS SBS(&SBS) OPTION(*IMMED) ENDSBSOPT(*NOJOBLOG))
: ENDSELECT
: :
: ENDDO
:
RCVF
MONMSG MSGID(CPF0864) EXEC(CHGVAR VAR(&EOF) VALUE('1'))
:
ENDDO
:
```


V5R4 CL Programming Sample

```
:
:
:
DLTOVR FILE(SUBSYSTEMS)
DLTF FILE(QTEMP/SUBSYSTEMS)
:
RETURN
ENDPGM
```

Option	JDK	Java.home	Java.version
5	1.3	/QIBM/ProdData/Java400/jdk13	1.3
6	1.4	/QIBM/ProdData/Java400/jdk14	1.4
7	1.5 (J2SE 5.0)	/QIBM/ProdData/Java400/jdk15	1.5
8	1.5 (J2SE 5.0)	/QOpenSys/QIBM/ProdData/JavaVM/jdk50/32bit	1.5

What's new for Java programming ?

- Support for J2SE version 5.0, together with previous versions
- Java Cryptography Extensions (JCE) version 1.2
- Increased serviceability
- New Java tools

i5/OS V5R4 delivers two JVM and SDK environments

- "Native" 64-bit JVM
  - Shipped since 1998 with OS/400 V4R2
    - Implemented into SLIC
  - 64-bit mode on 64-bit hardware
  - Direct-execution capable
    - Transforms .class or .jar to an associated hidden *PGM via CRTJVAPGM
  - Automatic and concurrent garbage collection
  - Best choice for scalability and performance on high-end systems
- "New" 32-bit JVM
  - Implemented into PASE
  - Smaller memory footprint
  - Delivers as much as 20% improved performance
  - Better suited for small systems

Application Development

i5/OS V5R4 delivers two JVM and SDK environments

- 64-bit JVM is the default
- To switch 32-bit JVM, you need
  - To have 5722-JV1, Option 8 (J2SE 5.0 32-bit), installed
  - To set environment variable JAVA_HOME to '/QOpenSys/QIBM/ProdData/JavaVM/jdk50/32bit'
  - To test via RUNJVA *VERSION

Application Development

i5/OS V5R4 delivers two JVM and SDK environments

- 32-bit JMV objects are into i5/OS PASE storage
  - PASE is mapped on top of teraspace storage
  - Programs that use native methods must be enabled for teraspace storage model
  - Not the default settings : need to recompile !
  - MCH4443 (Invalid storage model for target program LOADLIB)

To be 32-bit or not, this is a checklist

- Does your application need a Java heap much greater than approximately 2 GB for higher performance ?
  - → If "YES" → 64-bit
- Does your application use computationally intensive algorithms for statistics, security, encryption, etc, which can benefit from high precision computation support ?
  - → If "YES" → 64-bit
- If you answer "NO" to all above questions, then 32-bit could be for you !

What's new for Java programming ?

- Support for J2SE version 5.0, together with previous versions
- Java Cryptography Extensions (JCE) version 1.2
  - → Standard extension to J2SE
  - → Compatible with implementation of Sun Microsystem
- Increased serviceability
  - → Immediate PTF rather than delayed ones
  - → No JVM can be active
    - Check via DSPJVMJOB
- New Java tools
  - → The "apt" tool to process program annotations (JSR 175)
  - → The "pack200" and "unpack200" tools to compress/decompress a jar file from a pack200 file

Application Development

What's new for RPG programming ?

- New operations code
  - EVAL-CORR
    - Automatic transfer of data between structures
  - XML-INTO
    - Read data from an XML document into a variable
  - XML-SAX
    - Initiates Simple API for XML (SAX) to parse an XML document
- New built-in functions
  - %HANDLER
    - Specify a handling procedure for an event
  - %XML
    - Specify an XML document and define the way it will be parsed
- Free format for embedded SQL statements
- Integrating RPG with Web Services
  - As web service provider
  - As web service requester

Application Development

WebSphere Development Studio (WDS)

- Server Tools
  - Application Development Toolset (ADTS)
  - ILE C/C++
  - ILE COBOL
  - ILE RPG
- Workstation Tools (aka. WDSC) Standard Edition
- Workstation Tools Advanced Edition
  - Available via Passport Advantage

WebSphere Development Studio (WDS)

- Workstation Tools (aka. WDSC)
  - Unlimited workstations license of WDSC Version 6.0 per System i5 with 5722-WDS V5R4 installed
  - WDSC Version 6.0
  - RWD (Rational Web Developer) Version 6.0
  - Remote System Explorer
  - i5/OS plug-ins to help Java, Web and Web Services developers to access i5/OS data and applications
  - i5/OS re-facing tools
    - WebFacing
    - HATS Version 6.0
  - Integrated i5/OS debugger for all languages
  - Code and VARPG Version 6.0
  - Rational Product Updater
- WDSC-Lite product preview
  - Light-weight edit/compile/debug environment for developing native applications
  - The objective is to have a tool able to run with 256 MB of RAM !

V5R4 Software Overview
Communications

SNA Application over IP Networks with Enterprise Extenders

- i5/OS supports SNA functions and protocols
- As time goes on, direct support of SNA capabilities by LAN devices is not available
  - Adapters
  - Switches
  - Routers

AnyNet

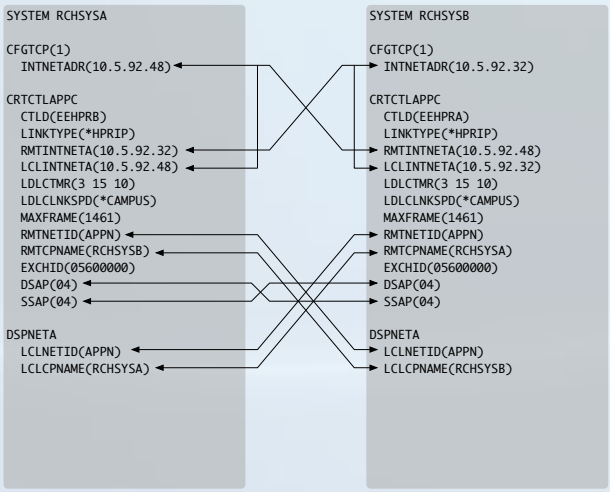
- Implementation of IBM Multi-Protocol Transport Architecture (MPTN)
  - Introduced in OS/400 V3R1
  - Brings support for SNA and APPC over TCP/IP
- Advantages
  - Network infrastructure only needs to support one protocol, namely IP
  - Endpoint systems need to support AnyNet
- Shortcomings
  - No support for APPN
  - No support for HPR
  - Only supports LEN nodes
  - System overhead
  - No support of CoS, so no traffic prioritization
    - IP routers are not "aware" of SNA priorities

Enterprise Extenders

- Purpose
  - Carry SNA traffic over IP networks
  - Maintaining SNA class of service to the maximum possible
- Benefits
  - Support HPR
  - Support APPN
  - Maintains SNA CoS
- IBM recommends that EE be used in place of AnyNet

Enterprise Extenders Configuration

- Network Attributes
  - Set "Allow HPR transport tower" to "*YES"
    - CHGNETA ALWHPRTWR(*YES)
- Line Description
- IP Interface
- APPC Controller
  - LINKTYPE(*HPRIP)
  - RMTINTNETA(...)
  - LCLINTNETA(...)
  - RMTNETID(...)
  - RMTCPNAME(...)
  - EXCHID(05600000)
- Matching Parameters !



IPv4 is now nearly 20-years old !

- Rapid growth of the Internet
  - Needs from more and more countries/continents
  - Unbalance of early address allocation
- Growing need for IP addresses
  - Multiple addresses per person
  - Internet access from anywhere
  - Pervasive computing
- Convergence of data, voice and video on IP
  - Need for more reliable and more scalable architecture
  - "Always-on" connections
- Security concerns
  - ...

What's new about IPv6 ?

- IPv6 is the "follow-on" to the current internet protocol, IPv4
  - Based on new IETF standards
  - Not backward compatible with IPv4
    - Coexistence with IPv4 is defined
    - Migration techniques from IPv4 are defined
- IPv6 expands the number of addresses available
  - IPv4 has 32-bits addresses
    - 4.294.967.296 addresses, and majority of them have already been assigned
    - Exhaust of unallocated IPv4 address pool is predicted in 2014
  - IPv6 has 64-bits addresses
    - 340.282.366.920.938.463.463.374.607.431.768.211.456 addresses !
    - 67 billions of billions of addresses per square millimeter of earth surface !

About IPv6 addresses ...

- IPv4 addresses are represented as dotted decimal strings
  - 127.0.0.1
- IPv6 addresses are represented as 8 blocks of 4 hexadecimal digits
  - FE80:0000:0000:0000:0211:24FF:FE27:00BF/64
  - FE80::0211:24FF:FE27:00BF/64
  - Upper 64-bits = Prefix, available for (sub-)network addressing and routing
  - Lower 64-bits = Host ID, typically generated from the interface MAC address
- Special addresses
  - Loopback address
    - ::1/128
  - Link-local prefix
    - FE80::/10
  - IPv4-mapped IPv6 address
    - ::FFFF:a.b.c.d/96

Features of IPv6

- Larger address space
  - Hierarchical addressing
    - Keep routing table small
    - Keep backbone routing efficient
  - Avoids fragmentation of address space
    - 64-bits ranges allocated to end-users
    - 96-bits ranges allocated to organizations
    - Easier administration and more efficient router configuration
  - Avoid the need break end-to-end nature of internet traffic
    - No more need to NAT !
- Stateless configuration of hosts
  - Neighbor discovery and automatic configuration for addressing and routing
  - Addresses generated from site-prefixes and host MAC address

Features of IPv6

- Are now protocol "built-in" features :
  - Support for encapsulation of other protocols
  - Support for class-of-service that distinguishes types of data
  - Support for network-layer security
    - Authentication and encryption
    - IPsec technology is part of the base protocol
  - Support for Jumbograms, Multicast
    - Part of the base protocol
- IPv4 and IPv6 coexistence
  - Dual Stack
    - Network stack that supports IPv4 and IPv6 sharing most of the code
  - Tunneling
    - Encapsulating IPv6 packets within IPv4
    - Using IPv4 as a link layer for IPv6
    - Aka. "6to4"

V5R4 IPv6 Enhancements

- V5R4 IPv6 support is "Production Ready"
  - Complete support of RFC3494 : "Basic Socket Extension for IPv6"
- Supported over
  - Loopback
  - All ethernet adapters
  - Virtual ethernet adapters between partitions
- Multiple ethernet adapters may be enabled for IPv6
  - Adapter sharing :
    IPv4, IPv6 and PPPoE can all be used on the same adapter
- Multicast is fully supported
- Fragmentation is fully supported

V5R4 IPv6 Restrictions

- V5R4 IPv6 does NOT provide support for :
  - CL commands to configure IPv6
  - IPsec/VPN over IPv6
  - Packet filtering, QoS and NAT
  - Virtual private address with IPv6
  - Local host table support for IPv6 host names
  - Ability to communicate with DNS over IPv6 network
  - Ability to use iSeries Navigator over IPv6 network

V5R4 IPv6 Considerations

- When upgrading from V5R2/V5R3 ...
  - Existing IPv6 is not migrated
  - Tunnels are no longer supported
- V5R2/V5R3 iSeries Navigator wizard no longer applies to V5R4
  - New interface to configure stateless address auto-configuration
  - New wizard to create IPv6 interface

V5R4 Software Overview
Database

Database

What's New ?

- SQL Enhancements
  - Full (100%) compliant with ISO/IEC 9075-2:2003 aka. "Core SQL-2003" open standard
  - Free-format RPG & SQL
  - Bigger limits
    - SQL statement size = Max. 2 MB
    - Tables per query = Max. 1000
    - Column name = Max. 128 Bytes
    - Stored procedures parameters = Max. 1024
    - Index keys size = Max. 32 KB
    - ...
  - Recursive SQL
  - ...
  - ...
  - ...
  - Go through InfoCenter/Database/SQL and check "What's new for V5R4"

Database

What's New ?

- Performance Enhancements
  - SQL Query Engine
    - LIKE & LOB support
    - Sensitive cursors
    - Autonomic indexes
  - Faster SQL procedural language
  - Enhanced MQT optimization
  - Faster XML extenders

Database

What's New ?

- Availability and Recovery Enhancements
  - Cross-reference files robustness
  - Progress indicator for RCLSTG SELECT(*DBXREF)
  - Library-level reclaim with RCLDBXREF command ...
  - Automatic journaling ...
  - Single journal support for 10.000.000 objects
  - SMAPP for EVIs

Reclaim DB Cross-Reference (RCLDBXREF)

- Provide a subset of the function provided by RCLSTG SELECT(*DBXREF)
  - Does not require the system to be in restricted state
  - Support a reclaim on a specific library
  - Provides progress indicator
- How to use ?
  - RCLDBXREF OPTION(*CHECK)
  - RCLDBXREF OPTION(*FIX) LIB(*ERR)
  - RCLDBXREF OPTION(*FIX) LIB(...)
- Be VERY VERY careful !
  - Do NOT interrupt the reclaim process
  - Do NOT attempt to use or modify objets in the library being reclaimed
  - Failure to this could cause unpredictable results
- RLCSTG may be required
  - CPF32AB - Database cross-reference information not recovered

Automatically Start Journalling

- QDFTJRN data area to be created into the library where the objects will be created
  - Beware of authorities
    - User must be authorized to the data area
    - User must be authorized to the journal
    - User must be authorized to start journaling
- What about IFS objects ?
  - STRJRN ... INHERIT(*YES)

Offset	Field	Type	Description
1	Library Name	CHAR(10)	Name of the library that contains the journal
11	Journal Name	CHAR(10)	Name of the journal to use to automatically start journaling
21	Repeats "Object Type" and "Option" as needed		
	Object Type	CHAR(10)	*FILE | *DTAARA | *DTAQ | *ALL | *NONE
	Option	CHAR(10)	*CREATE | *MOVE | *RESTORE | *ALLOPR

Database

What's New ?

- Database Simplification = Ease of Use and Management Improvements
  - Database Maps
  - Health Center
  - Import/Export
  - Index Advisor
  - Index Rebuilds
  - Show Indexes
  - SQL Plan Cache

Database

Database Maps

- An iSeries Navigator tool to visually represent the relationship between database objects

Database

Health Center

- An iSeries Navigator tool to capture information about your database
  - Displays system-wide database statisctics
  - Allows to check design limits
  - Allows to check size limits

Database

Import/Export

- An iSeries Navigator tool to import/export data from/to database files
  - An alternative to CPYFRMIMPF and CPYTOIMPF

System-Wide Index Advisor

- An iSeries Navigator tool to find advised indexes for you
  - Always active : no need to use a database monitor
  - Stored in QSYS2/SYSIXADV system table
  - Viewed at database, schema or table level
- Also available on V5R3 thru latest PTF group for DB2

Index Rebuilds

- An iSeries Navigator tool to manage the rebuild of the indexes
  - Get more information about why an index was invalidated
  - Alternative to EDTRBDAP

Show Indexes

- An iSeries Navigator tool to determine unnecessary indexes
  - Last use
  - Last statistic use
- Also available on V5R3 thru latest PTF group for DB2

SQL Plan Cache

- A repository that contains the access plans for queries optimized by SQE
  - Facilitates re-use of access plan when the same query is re-executed
  - Show run-time information for subsequent use and query optimization
  - Once a plan is created, it is available for all user and all queries
    - When an access plan is tuned, all queries benefits from the updated access plan
- An iSeries Navigator tool to drill and tune SQL access plans

V5R4 Software Overview
Backup & Recovery

Backup & Recovery

Spooled Files Support Overview

- Save & Restore of spooled files are now supported in i5/OS
  - Read it again if you do not believe it !
- Preserves spooled file data, spooled file identity and attributes
  - Spooled file name
  - Spooled file number
  - Spooled file date/time
  - Fully qualified job name
  - Job system name
- Some attributes may not be preserved
  - System/36 identifier
  - Output queue
  - ASP
  - Expiration date
  - Save/restore attributes

Spooled Files Support Overview

- Save and Restore of entire output queues
  - No support to save/restore individual spooled files
- Display media to see list of spooled files
  - DSPTAP, DSPOPT and DSPSAVF commands
  - Similar to displaying members in a database file
- Performance improvements
  - Spooled files saved and restored directly
  - No requirement for
    - Copying spooled file to database file
    - Document Library Objects (DLOs)
  - Faster than existing methods to save/restore spooled files
- BRMS uses new support
  - No user interface changes to BRMS
  - Performance improvements

Spooled Files Support Overview

- New SPLFDATA parameter on SAVxxx commands
  - SPLFDATA(*NONE)
  - SPLFDATA(*ALL)
- New SPLFDATA parameter on RSTxxx commands
  - SPLFDATA(*NONE)
  - SPLFDATA(*NEW)

- Save and Restore menu options (GO SAVE & GO RESTORE)
  - Optionally save/restore ALL spooled files

Virtual Tape Support

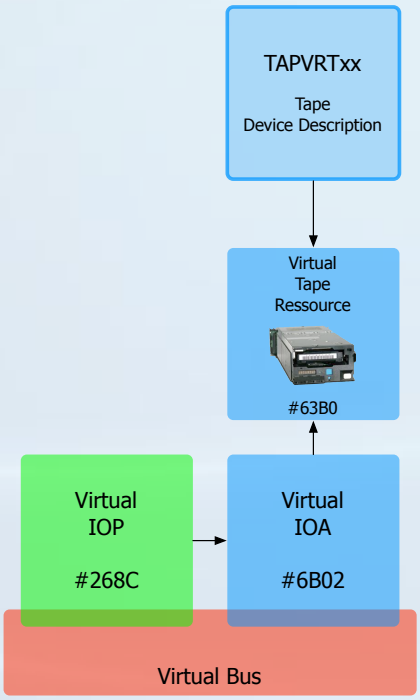
What is it ?

- A simulated tape environment within i5/OS !

Virtual Tape Support

Components

- Virtual Tape Device
  - A virtual tape device acts as real tape device
  - Virtual resources are automatically created
    - Maximum 35 virtual tape resources
  - CRTDEVTAP
    - DEV(TAPVRT01)
    - RSRCNAME(*VRT)

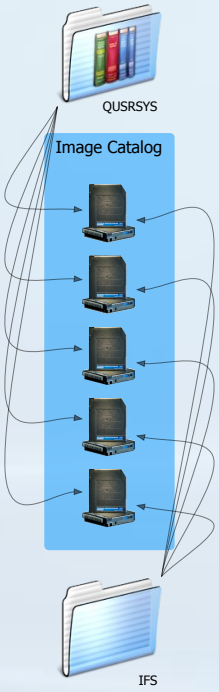


Virtual Tape Support

Components

- Image Catalog
  - Image catalog object (*IMGCLG) resides into QUSRSYS
    - Used to index virtual volumes
  - Directory in the integrated file system
    - Used to store virtual volumes
  - Maximum 256 virtual volumes per catalog

  - CRTIMGCLG
    - IMGCLG(VTS01)
    - DIR('/imgclg/vts01')
    - TYPE(*TAP)
    - CRTDIR(*YES)

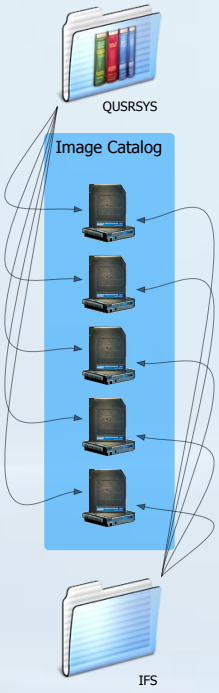


Virtual Tape Support

Components

- Image Catalog Entries (Virtual Tape Cartridges)
  - Stream files created into integrated file system
  - Maximum size is 1 TB
  - Can be stored into system ASP, user ASP or independent ASP
  - Virtual volumes can be write protected

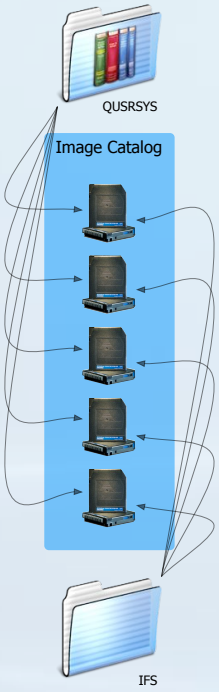
  - ADDIMGCLGE
    - IMGCLG(VTS01)
    - FROMFILE(*NEW)
    - TOFILE(Volume001)
    - VOLNAME(VOL001)
    - IMGSIZ(<megabytes>)
    - ALCSTG(*MIN | *IMGSIZ)
    - VOLTYP(*SL | *NL)
    - DENSITY(*VRT256K | *VRT240K | *VRT64K | *VRT32K)



Virtual Tape Support

Densities

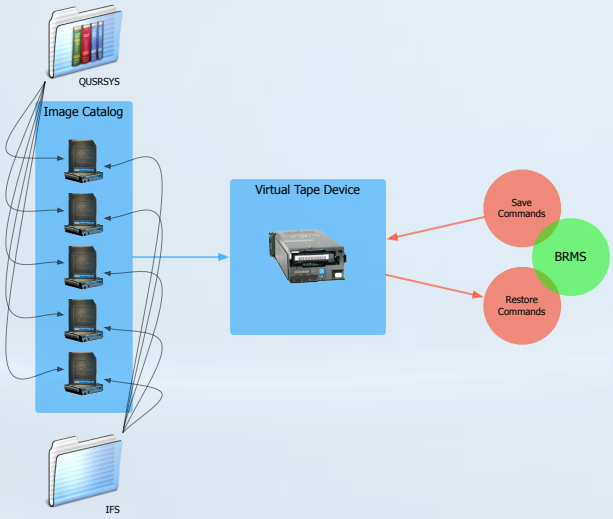
- Determines the block size !
  - *VRT256K
    - 357x, 358x, 359x, QIC (SLR)
  - *VRT240K
    - 348x, 349x, 7208, VXA
  - *VRT64K
    - 348x, 349x
  - *VRT32K
    - QIC
- Pay attention for tape duplication !
  - You can only duplicate to devices that support the same block size or greater



Virtual Tape Support

Usage

- LODIMGCLG
  - IMGCLG(VTS01)
  - DEV(TAPVRT01)
  - OPTION(*LOAD | *UNLOAD)
- VTS acts as a RACL
  - Not as TAPMLB
- SAVxxx
  - DEV(TAPVRT01)
  - VOL(VOL001)
- Automatic Volume Creation
  - ...



Virtual Tape Support

Benefits

- Reduces backup time
  - Disk-to-disk operations
  - Run concurrent backups, even if there is not enough physical tapes to do this
  - According good configuration and workload
- Reduces recovery time
- No media error
  - It's virtual !
  - No incomplete backup
  - No more problem with SWA checkpoint processing
- Leverages dynamic LPAR switchable devices
  - One physical tape device for multiple partitions ...

Virtual Tape Support

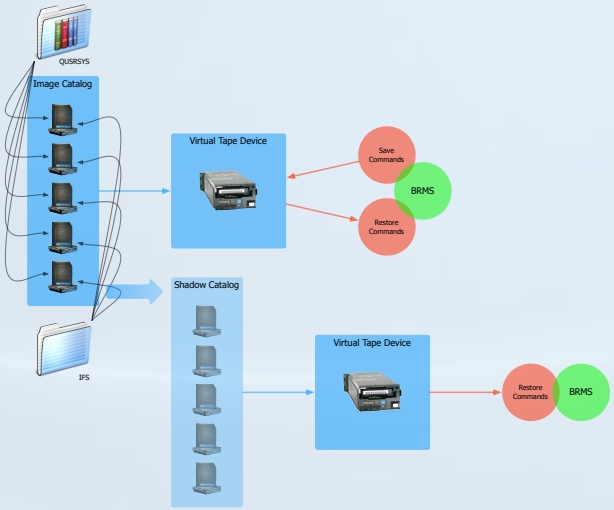
Disk Considerations

- For storing virtual images in your system ASP consider
  - Amount of disk arms
  - Free space
  - Data lost in case of a disk failure of the system ASP
- Benefits of storing virtual images in an user ASP or an independent ASP
  - Minimal impact on system performance
    - Consider ADDING disk units rather than MOVING disk units
    - A few huge capacity disks will be perfect
  - No data lost in case of a disk failure of the system ASP
- What about storing virtual images in a switchable independent ASP
  - Cluster environment
    - More complex, less flexible
  - Can be switched across partition/systems

Virtual Tape Support

Catalog Shadowing

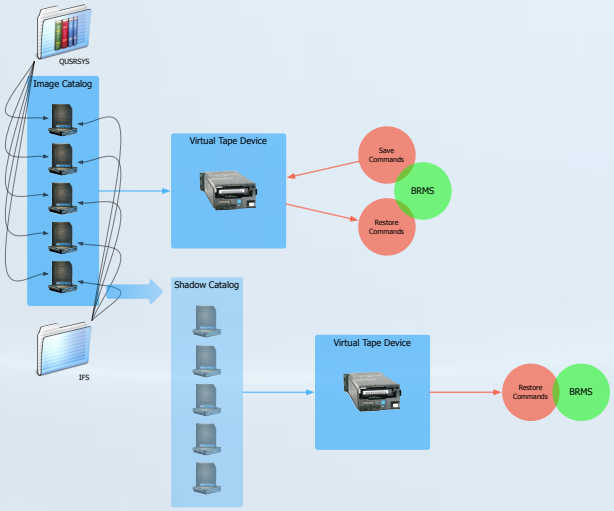
- Sharing one or many virtual images by more than one virtual unit !
- How ?
  - → By creating a "snapshot" of the original image catalog (point-in-time copy)
  - → CRTIMGCLG
    - IMGCLG(SHADOW01)
    - DIR(*REFIMGCLG)
    - TYPE(*TAP)
    - REFIMGCLG(VTS01)



Virtual Tape Support

Catalog Shadowing

- Sharing one or many virtual images by more than one virtual unit !
- Why ?
  - → To allow more than one operation to be performed at at time
  - → To reduce the amount of disk space required to perform some concurrent operations
  - → Can be used to allow user access to specific volumes within an image catalog
  - → To protect against accidental data deletion



Virtual Tape Support

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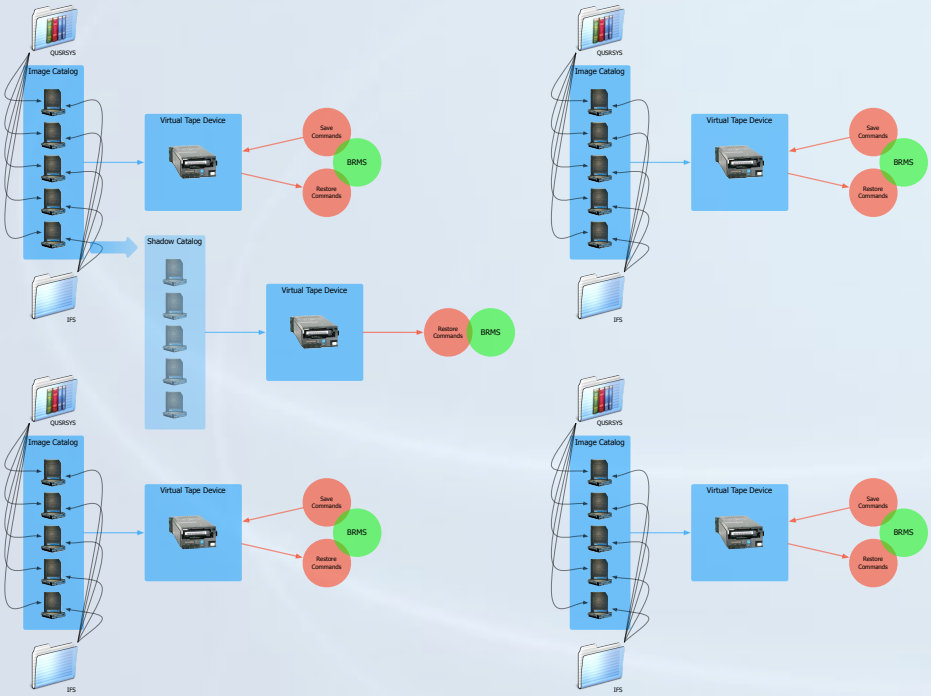
Virtual Tape Support

Operating Systems and Applications

- i5/OS Version 5 Release 4 and subsequent releases
  - Acts as a physical tape device
  - Support for all save/restore commands
  - Fully integrated with BRMS
- AIX
  - Not supported
- Linux
  - Linux on Intel (integrated xSeries) : supported
  - Linux on PowerPC (guest operating system) : supported
- Windows 2003
  - xSeries servers connected through the new iSCSI will be supported
  - xSeries servers connected through HSL are not supported

Virtual Tape Support



Backup & Recovery

IFS Parallel Save/Restore Support Overview

- Single SAV/RST command using multiple tape devices
- Reduces save/restore window for LARGE IFS objects
  - Large network storage spaces
  - Large Domino databases
  - Not intended for millions of less-than-1MB-in-size
    - Performance decreases with small objects
- Up to 32 tape devices in parallel
- Best use with BRMS

New SAVSYSINF and RSTSYSINF Commands

- New SAVe SYStem INFormation command
  - Performs a partial save of data saved by SAVe SYStem command
- Cumulative save since last SAVSYS
- Restricted state is not required
- Increase system availability
- Increase recovery time and complexity

Backup & Recovery

New SAVSYSINF and RSTSYSINF Commands

- New SAVe SYStem INFormation command
  - Performs a partial save of data saved by SAVe SYStem command
- Saves
  - Selected objects into library QSYS
    - *CLS, *CMD (since last SAVSYS), *DTAARA, *EDTD, *IGCTBL, *JOBD, *JOBQ, *JRN, *JRNRCV, *MSGF (since last SAVSYS), *MSGQ, *SBSD, *TBL
  - System reply list entries
  - Service attributes
  - Environment variables
  - Certain system values
  - Network attributes
  - PTFs applied since last SAVSYS

SAVSYSINF and PTFs

- Which PTF are saved ?
  - PTFs for 5722-999 and 5722-SS1
  - PTFs applied since last SAVSYS
  - PTFs present in the *SERVICE area
- PTF save files MUST remains on the system until next SAVSYS
  - Do not run DLTPTF command unless right before or right after SAVSYS
- Installing PTFs default does NOT restore the save files
  - Consider CHGSRVA CPYPTF(*YES)
  - Use consistently INSPTF CPYPTF(*YES)

New SAVSYSINF and RSTSYSINF Commands

- New SAVe SYStem INFormation command
  - Performs a partial save of data saved by SAVe SYStem command
- Does NOT saves
  - Licensed internal code
  - QSYS library
  - Security objects and user profiles
    - Use SAVSECDTA
  - Configuration objecrts
    - Use SAVCFG
  - Some system values
    - QPWDLVL
    - Related to date/time
    - System values that cannot be changed

RSTSYSINF and System Recovery

- SAVSYS and SAVSYSINF needs to be recovered
  - → RSTSYSINF is an additional step in the recovery checklist
- ! RSTSYSINF IS NOT TO BE USED FOR SYSTEM UPGRADES AND MIGRATION !

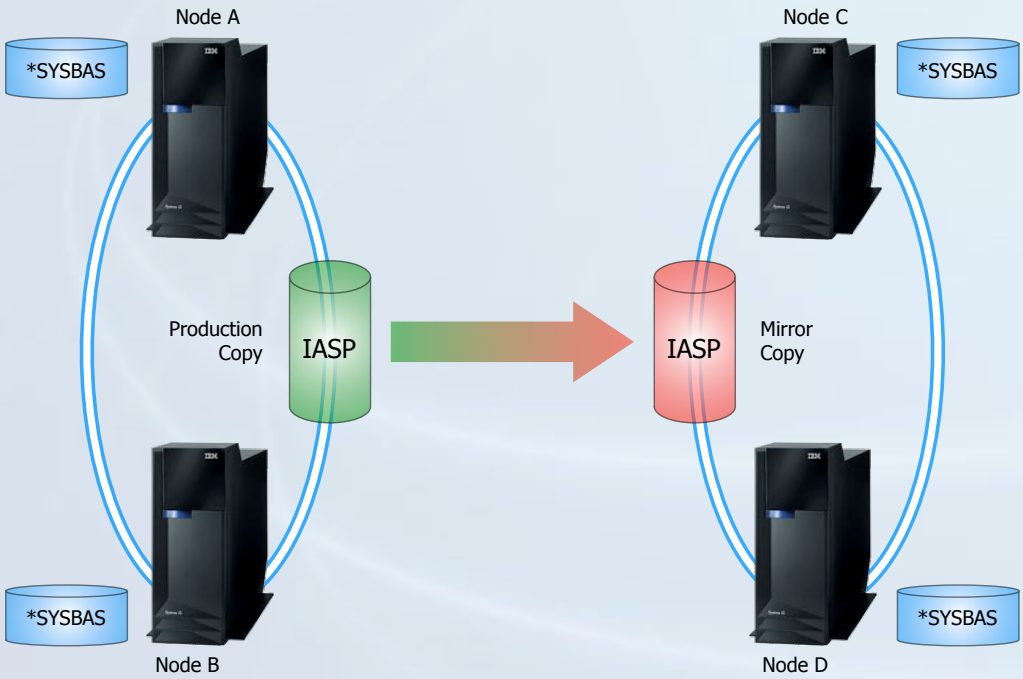
V5R4 Software Overview
Availability

Availability

Remember

- V5R1 brings independent ASPs and switchable independent ASPs
  - For IFS objects only
- V5R2 enhances it
  - Database objects within a (switchable) independent ASP
- V5R3 enhances it more
  - Support for OUTQs
  - Cross-site mirroring
- V5R4 enhances it more again
  - Cluster administrative domains
  - Cross-site mirroring partial synchronization

Availability



Availability

Cluster Administrative Domains

- Allows to keep operational environment synchronized
- Monitored resources
  - System values
  - User profiles
  - Job descriptions
  - Network attributes
  - System environment variables
  - TCP/IP attributes

Availability

XSM Mirror Copy Synchronization

- Required when
  - User detaches mirrored copy
  - User suspends geographic mirroring
  - Systems marks mirror copy as unusable
    - E.g. when a communication problem occurs
- Full synchronization
  - As in V5R3
- Partial synchronization
  - New in V5R4 !
  - Suspend with tracking
  - Changes on source side are tracked
  - Tracking space allocated into IASP
    - Size set by user
    - GUI shows percentage used
    - Only changed pages need to be resend at resume time

Availability

	Logical Replication	Switched Disks	Cross-Site Mirroring
Backup window reduction	**Yes**	**No**	**No**
Workload balancing	**Yes**	**No**	**No**
Planned maintenance	**Yes**	**Yes**	**Yes**
High availability for unplanned outage	**Yes**	**Yes**	**Yes**
Recovery for disaster outage	**Yes**	**No**	**Yes**

V5R4 Software Overview

Work Management

Work Management

How does V5R4 enhances spooled files management ?

- Spool files policy-based OUTQ management
  - Set expiration date or number-of-days for spooled files
    - Via new EXPDATE and DAYS parameters on printer files
    - Via new EXPDATE and DAYS parameters on OVRPRTF command
  - Then, delete expired spooled files
    - Via DLTEXPSPLF command

Work Management

How does V5R4 enhances spooled files management ?

- Changes on WRKSPLF command to allow more specific search
  - New generic capability for
    - User
    - Spooled file name
    - Job name
    - Job user
  - New filtering criteria
    - From/to time period parameters

Work Management

How does V5R4 enhances Job Logs ?

- Most jobs on the system have a job log associated with it
- Job log contains informations giving a good idea of how the job is running
  - When the job starts
  - When the job ends
  - What commands are running
  - Failure notices
  - Error messages

Work Management

V5R4 Brings Job Logs into the "On-Demand" World !

- The LOG parameter determines the information sent to the job log
  - Message logging level (0-4)
  - Message severity (0-99)
  - Level of message text (*SECLVL | *MSG | *NOLIST)

- But V5R4 allows you to control WHAT produces the job log
  - New "job log output" parameter
    - System value QLOGOUTPUT
    - Job description LOGOUTPUT
    - Job LOGOUTPUT
  - Values
    - *JOBLOGSVR = the job log server produces the job log
    - *JOBEND = the job itself produces the joblog
    - *PND = the job log is not produced at all (remains in a "pending" state)

Work Management

How does V5R4 enhances Reclaim Storage ?

- Function that correct, where possible ...
  - Objects that were incompletely updated
  - User profiles containing incorrect ownership information
  - Objects addressability (system directory)
  - Database cross-reference files
- Objects or portions of objects that cannot be recovered are deleted

Work Management

How does V5R4 enhances Reclaim Storage ?

- RCLSTG
  - ESTIMATE (*NO | *YES)
  - SELECT (*ALL | *DBXREF | *DIR)
  - OMIT (*NONE | *DBXREF | *DIR)
  - ASPDEV (*SYSBAS | ...)
- RCLSTG can now give estimations
  - Only after the first V5R3 run
  - Messages xxxxx indicates the estimated duration of each RCLSTG steps
- RCLSTG display now a progress status
  - Great !

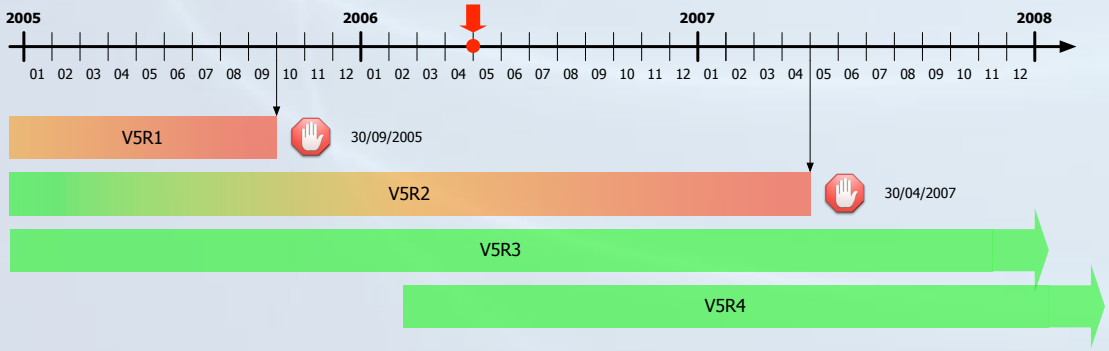
How does V5R4 enhances Reclaim Storage ?

- RCLLNK
  - Identifies and, if possible, correct problems in mounted file systems
  - Does no require to be into restricted state

Discovering IBM System i5 and i5/OS Version 5 Release 4
Technical Corner

Why Upgrade ?

- Benefits of new functionalities
- To stay "up-to-date" !



Upgrade Paths

- Direct Upgrade
  - From V5R2 and V5R3
    - You can upgrade from these versions to V5R4 following "Software Installation"
- Two-Step Upgrade
  - From V4R5 and V5R1
    - You can upgrade from these versions directly to V5R2 following "Software Installation"
    - Then you can upgrade from V5R2 to V5R4 following "Software Installation"
- No Upgrade Support
  - From V1RxMy, V2RxMy, V3RxMy, V4R1M0, V4R2M0, V4R3M0, V4R4M0
  - What does that mean ?
    - Because of important internal Operating System architecture changes, do NOT try to upgrade from these versions
    - Restore operations from these versions are allowed

Interoperability

- What is "Interoperability" ?
  - The ability of one system to exchange data or objects with another system
  - The exchange can be performed electronically or by physical media
  - Either system can initiate the exchange
  - If you have several systems in a network, they must be at interoperable releases
- V5R4 and FULLY interoperates with
  - V5R3M0
  - V5R2M0

Previous AS/400 and iSeries models

- i5/OS V5R4 does NOT support AS/400 !
- i5/OS V5R4 is the LAST release to support iSeries models 270, 820, 830 and 840 !
- Next release of i5/OS is planned to be supported on
  - iSeries models 800, 810, 825, 870, 890
  - All eServer i5 models
  - All System i5 models

Planning

- Check with software editors for applications compatibility with V5R4
  - Need for a specific release and/or corrective service level ?
- Review documentation
  - Software Installation
  - Memorandum to users
  - Preventive service planning
  - Information APARs
    - APAR II14131 contains a summary of PTFs that are required to upgrade to V5R4
- Verify contents of software package
  - Up to 15 CDs !
- Order Latest PTFs
  - Cumulative packages is no longer delivered with the distribution media
  - Cumulative packages is delivered with PTF groups for HIPER & DB2
  - PTFs required by the upgrade process

Planning, Planning

- ECS and Service Agent
  - PPP communications encryption are mandatory
- Cryptographic products are now part of the operating system
  - 5722-AC3
  - 5722-CE3

Planning, Planning, Planning

- Licensed program requires acceptance of Electronic Software Agreements
  - Upgrade will FAIL if you do not accept these agreements
- Check the console mode value
  - Through DST
- Download Software Keys
  - Now ONLY available online from the Internet
    - http://www.ibm.com/servers/eserver/ess
    - An IBM-ID is required
- Update Firmware
  - Through HMC or Service Partition
  - Minimum level is SF235_160

Planning, Planning, Planning, Planning

- LIC will require additional space
  - V5R4M0 LIC requires more space than previous releases
  - V5R3M5 LIC does not require to be extended
  - V5R3M0 and V5R2M0 LIC need additional space to be allocated
  - Upgrade will FAIL if you do not allocate the additional space
- The additional space allocation will require an IPL
  - Starting V5R4, future LIC additional space allocation can also be concurrent
- ! YOU MUST HAVE A LOAD-SOURCE DISK UNIT OF 17 GB OR LARGER !

Planning, Planning, Planning, Planning, Planning

- Install upgrade preparation PTFs
  - PTFs for Electronic Software Agreements
  - PTFs for Disk Configuration
  - PTF for Virtual Media Install
  - PTF for LIC additional space allocation
  - PTF for ...
- Create and populate your images catalogs
- Prepare to upgrade (GO LICPGM, Option 5)
  - Cleanup !
  - Create a custom list of software to install
  - Review and accept electronic software agreements
  - Allocate additional space for LIC
  - Verify internal system objects

Planning, Planning, Planning, Planning, Planning, Planning

- Perform a dual complete backup
  - GO SAVE, Option 21
- Upgrade
  - LIC
  - OS
  - LICPGM
- Install required PTFs
  - Cumulative packages
  - Group PTF
- Additional post-installation tasks ?
  - ...
- Perform a dual system backup
  - GO SAVE, Option 22

One more thing ...

Common Europe Luxembourg

Introducing IBM System i5 and i5/OS Version 5 Release 4
Intel Integration via iSCSI - Product Preview

Product Preview

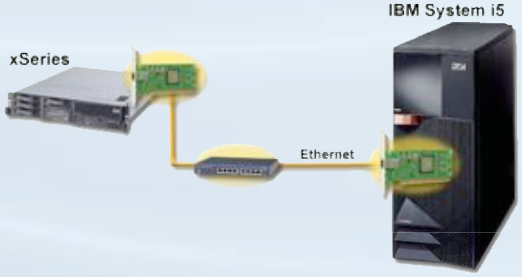
Intel Integration : Customer Requests

- We want more server per system !
- We want BladeCenter connection !
- We want lower hardware cost !
- We want broader range of xSeries !
- We want to leverage open standards !

Product Preview

Intel Integration : IBM Response

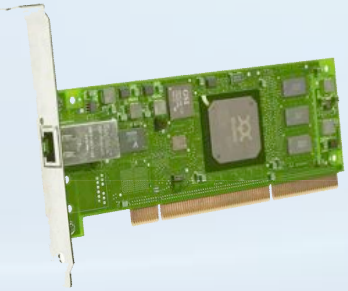
- We will integrate xSeries and BladeCenter via iSCSI !
- What is iSCSI ?
  - → Stands for "Internet Small Computer System Interface"
    - Technology made to sent SCSI commands across a TCP/IP network
    - It's a network standard used to link data storage facilities
- What is an iSCSI "initiator" ?
  - → System making iSCSI requests for data
- What is an iSCSI "target" ?
  - → System receiving iSCSI requests for data
- What is the transport mechanism ?
  - → Standard ethernet network !
  - → Standard TCP/IP !



Product Preview

Intel Integration via iSCSI - Target System Requirements

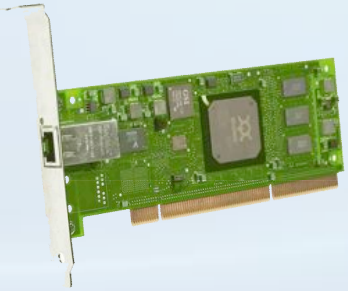
- Requires an eServer i5 or a System i5
  - Model 520, 550, 570 or 595
- Requires iSCSI HBA for System i5
  - #5783 - Copper HBA
  - #5784 - Fiber HBA
  - Smart IOA 32/64-bits 3.3v slot (64-bits recommended)
  - Will connect from 1 to 8 servers/blades
    - Depending on I/O bandwidth required by servers
- Requires i5/OS Version 5 Release 4
  - 5722-SS1, Option 29 : Integrated Server Support
  - 5722-SS1, Option 34 : Digital Certificate Manager
  - 5722-DG1 : HTTP Server
  - 5722-TC1 : TCP/IP Connectivity Utilities
  - 5722-XE1 : iSeries Access for Windows
  - 5733-VE2 : IBM Director v5.1
- Can coexist with previous integration technologies (IXA/IXS)



Product Preview

Intel Integration via iSCSI - Initiator System Requirements

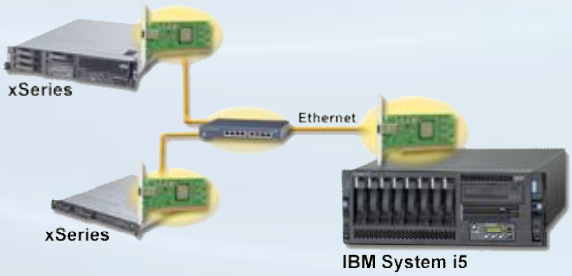
- Requires a supported xSeries Server or BladeCenter
  - xSeries Servers x460, x366, x346, x336, x236
  - BladeCenter #8667 with blade(s) HS20 #8843
- Requires iSCSI HBA for System i5
  - P/N 30R5201 - Copper HBA
  - P/N 30R5501 - Fiber HBA
  - P/N 32R1923 - Blade Expansion Card (2-ports)
- Requires Microsoft Windows Server 2003
  - Windows Server 2003 R2 Standard Edition
  - Windows Server 2003 R2 Enterprise Edition
  - Windows Server 2003 Standard Edition SP1
  - Windows Server 2003 Enterprise Edition SP1
  - Windows Server 2003 Web Edition SP1



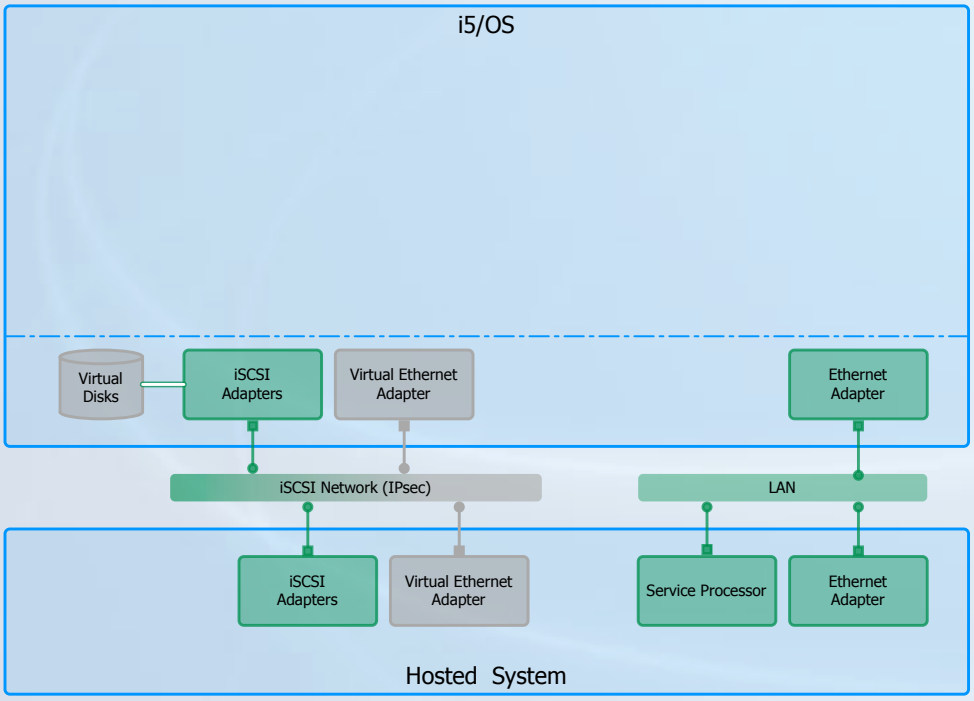
Product Preview

Intel Integration via iSCSI - Network Requirements

- Minimum Requirements (xSeries Servers)
  - A (good) 1 Gbps Layer-2 switch, copper or fiber ports, preferably dedicated to the iSCSI network
- Minimum Requirements (BladeCenter)
  - BladeCenter Ethernet I/O module switches, OR
  - BladeCenter pass-through I/O module AND an external 1 Gbps Layer-2 external switch
- Optional Requirements
  - Support for 9000-bytes "jumbo frame" for better performance
  - Extra ports to accommodate future growth
  - Managed switch functions, such as :
    - Port mirroring to accommodate sniffer
    - Statistics support
    - VLAN packet tagging
- Service processor connection
  - Layer-2 switch with ports for copper cables



Product Preview



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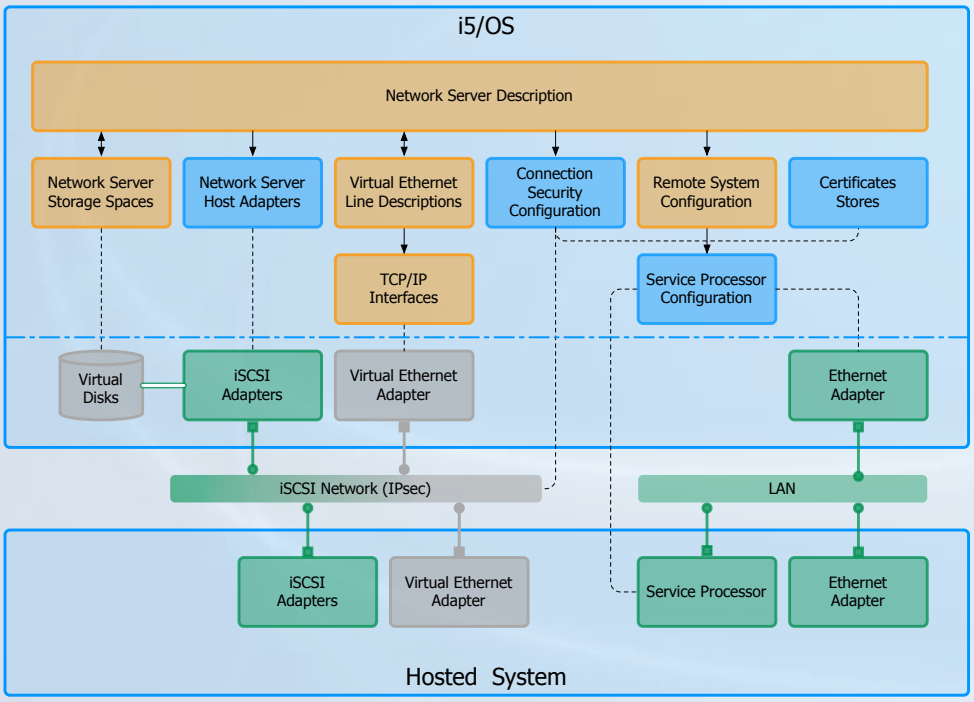
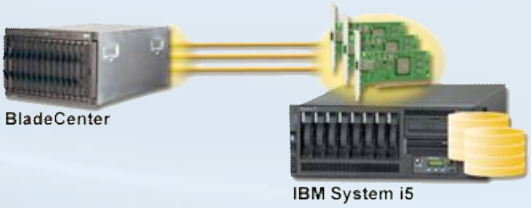


Product Preview

More ...



Questions & Answers

Thank You !

REAL Solutions S.A.
Rue d'Eich, 33
L-1461 Luxembourg

Eddy Pasteger
System Engineer Manager
System i Certified Solutions Expert

Voice : (+352) 43 65 22 1
Fax : (+352) 42 26 38
E-mail : eddy.pasteger@real.lu

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