HP Tru64 UNIX® V5.1B & HP TruCluster Server V5.1B Technical Update

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Business Critical Systems

HP WORLD 2003
Solutions and Technology Conference & Expo

Agenda

- Sessions of interest
- HP Tru64 UNIX® Roadmaps
- HP Tru64 UNIX V5.1B
- HP TruCluster V5.1B
- Post HP Tru64 UNIX V5.1B
- Future Releases

Sessions of Interest

- **2139** ”Securing Tru64 UNIX Step by Step”
- **2092** “Best Practices for Patching Tru64 UNIX and TruClusters”
- **2153** ”Tru64 UNIX to HP-UX Application Migration Tools”
- **2174** “Breaking the SAN Barrier with Tru64”
- **2147** ”Tru64 UNIX and HP-UX: A Side-by-Side Comparison of OS”
- **2300** ”HP-UX and Tru64 UNIX: A Side-by-Side Comparison of Storage”
- **2090** ”Nuts and Bolts of Enhanced Security Management”

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- HP TruCluster V5.1B
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- Future Releases

Tru64 UNIX® V5.1B and Updates

V5.1B, with its enhancements, will be supported for at least 5 years beyond last sale date of AlphaServer systems

V5.1B-"Vail"
2003

- Scaling to 64 CPUs
- Continued leadership storage SAN support
- Resiliency enhancements
- Enhanced availability and disaster tolerance
- Migration tools availability

V5.1B-"Utah"
2004

- Support EV79 AlphaServers
- Improved storage management and new storage options
- Resiliency enhancements
- Cluster-wide process management
- HP-UX compatibility tools and libraries

Maintain binary compatibility
Continued focus on quality and stability

Tru64 UNIX® Support Roadmap

- **V5.1B (with Enhancements)**
  - Standard Support Until At Least 2011 !!
- **V5.1A**
  - PVS-SE Extended Until 28-Feb-05
- **V5.1**
  - PVS-SE Offered Until 29-Feb-04
- **V4.0F, V4.0G**
  - PVS-SE Extended 2 More Years to 30-Sep-05

Cross-Platform License Trade-in

Support* Customer	**HP allows trade-in of old licenses for New Licenses at no charge**
	You commit to continue support* on new licenses for one (1) year
Non-Support* Customer	**HP trades new licenses for for old licenses at 40% of new license price**
	You pre-pay support* on new licenses for at least one (1) year
* Support = Service contract with Rights to New Version (RTNV)	

- Trade-in applies to 'equivalent product' or operating environment licenses
  - For each licensed CPU on the old system, get credit for equivalent product or operating environment license for the new system, up to number of CPUs purchased
- Parallel usage of licenses on both platforms is allowed during transition

From	To
HP-UX HP9000	HP-UX on Integrity (Itanium based) Server or OpenVMS I64
Tru64 Unix Alpha	HP-UX HP9000, HP-UX on Integrity Server or OpenVMS I64
OpenVMS VAX or OpenVMS Alpha	OpenVMS I64, HP-UX on Integrity Server , or HP-UX HP9000
MPE/iX e3000	HP-UX HP9000, HP-UX on Integrity Server or OpenVMS I64

Tru64 UNIX® to HP-UX Operating Environment

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Trade-in Original Licenses	→	Credit for Equivalent OE License

Tru64 UNIX Product License	HP-UX Operating Environment
Tru64 UNIX Base	Foundation
Tru64 UNIX SMP Extension	
Tru64 UNIX Users	
Tru64 UNIX Server Extensions	
Internet Express	
AdvFS Utilities	Enterprise
Logical Storage Manager	
TruCluster Server	Mission Critical
or TruCluster Available Server	
or TruCluster Production Server	

Example: 4 CPU System

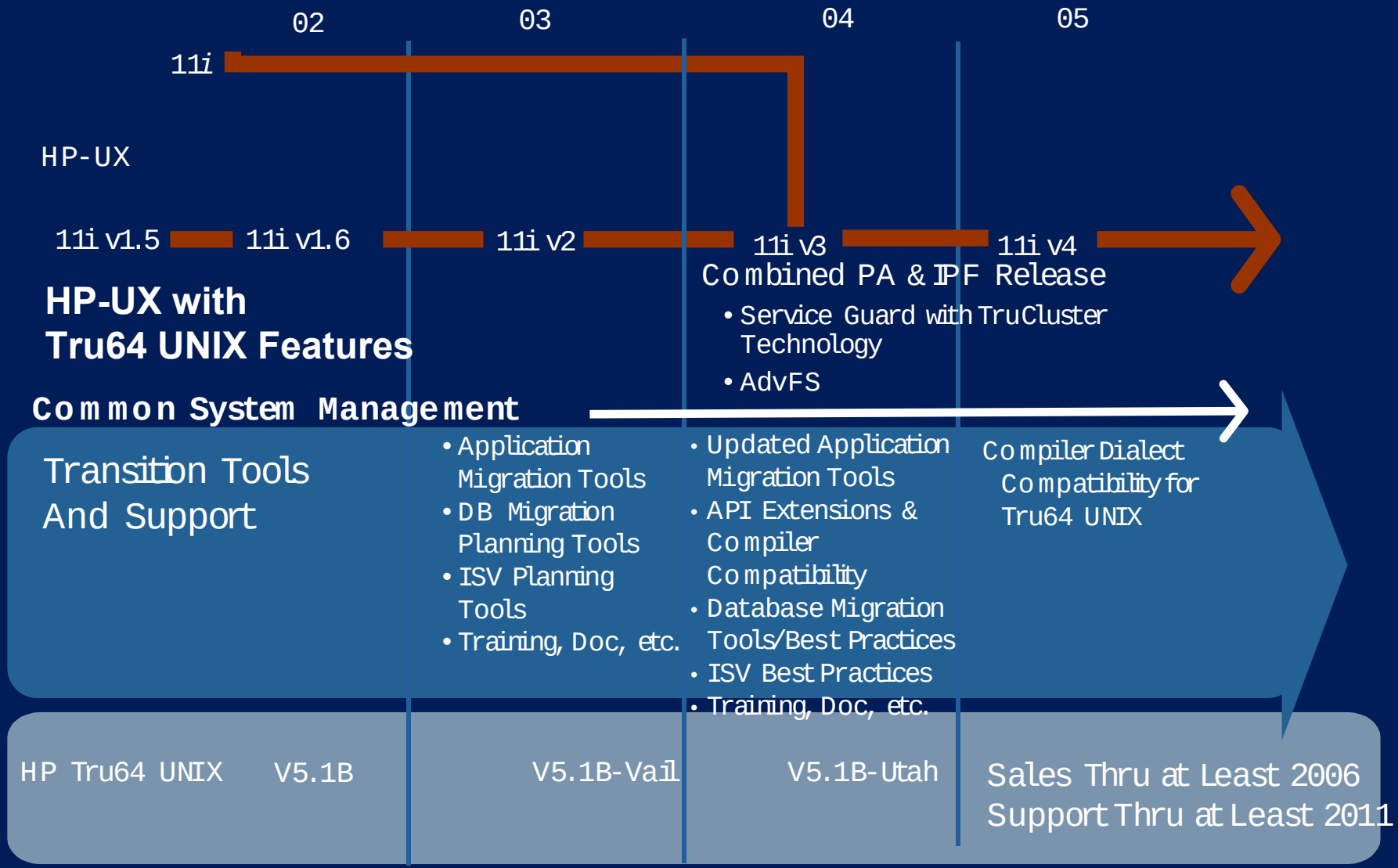
- Trade-in Tru64 Licenses for Base, SMPs, Users and Server Extension from a 4 CPU system
- Receive credit on up to 4 PPL licenses for HP-UX Foundation OE on Target System

- Trade-in all above plus AdvFS Utilities and/or Logical Storage Manager licenses
- Receive credit on up to 4 PPL licenses for HP-UX Enterprise OE on the Target System

- Trade-in all above plus TruCluster Server license
- Receive credit on up to 4 PPL licenses for HP-UX Mission Critical OE on the Target System

Proof of License required for trade-in

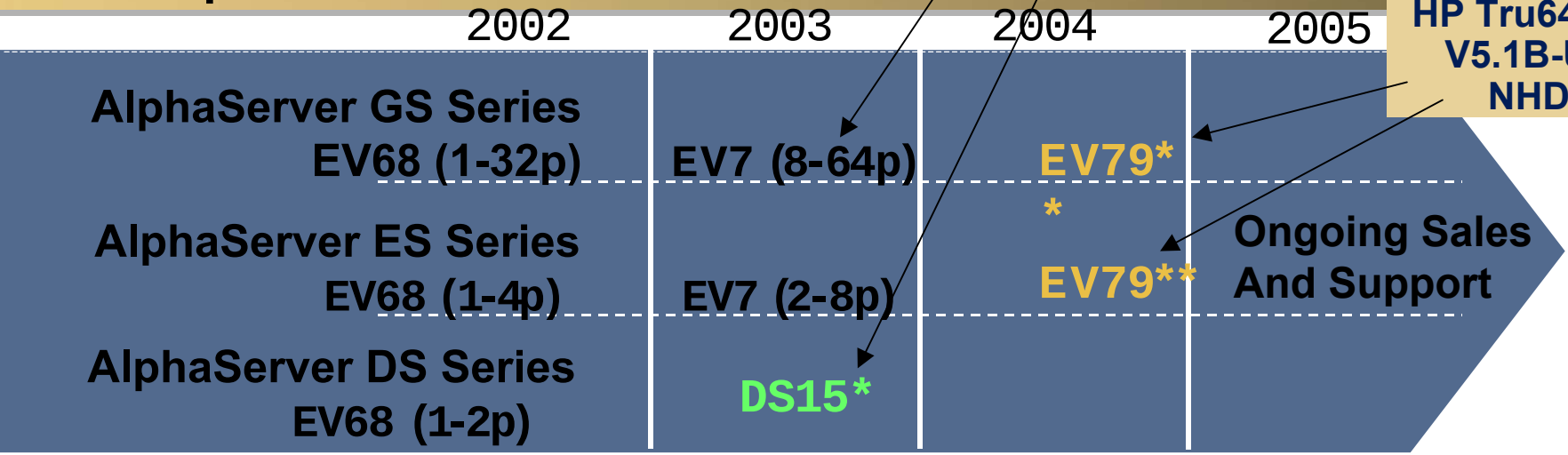
Product Transition to HP-UX 11*i* Support Tools When You're Ready



AlphaServer System Snapshot

HP Tru64 UNIX V5.1B-Vail NHD-7

HP Tru64 UNIX V5.1B-Utah NHD-8



*** DS15 (Q4 CY03)**

- Low-End Alpha-IPF Bridge Saleable Through 2006, Licensed à la DS10
- 3U Rackmount Server & Workstation
- Performance: EV68CB @ 1GHz, w/2 MB cache; Titan chipset - 2 GB/s Bdwth
- Slot-Saving Embedded Options
  - Two Ethernet (10/100 Mbit)
  - Ultra3 SCSI (Internal + External Ports)

**** EV79-Based AlphaServers Q3 CY04**

- Functionally Identical to EV7, but Smaller Dimensions
- State-of-the-Art Semiconductor FAB
  - Faster, Smaller Chip Structures
  - Lower Cost (More Die per Wafer)
- Target Top Speed: 1.4-1.5 GHz
- Lower Speed Bins Offered

Current as of July 11, 2003 – Tru64 UNIX future plans subject to change without notice – Customer Viewable

HP Internet Express Roadmap

Internet Express V5.9 FCS: Jul-02 (Actual)

- Admin enhance (complete)
- PHP conversion
- I18N capability complete
- OpenLDAP "commercialization"
- Netscape 6.x
- BIND 9.x
- Tomcat 4.0
- Smartfilter 3.1
- Update Open SW

Min OS - V5.0A

Internet Express V6.0 FCS: Dec-02 (Actual)

- Complete Admin PHP conversion
  - Mail and ftp
- Instant Messaging Server
- Apache 2.0
- Web Services – UDDI/WSDL
- IPv6 support
  - CYRUS IMAP
  - SQUID
- Update open software

Min OS - V5.0A

Internet Express V6.1 FCS: Jun-03 (Actual)

- Update primary Open Source components only
- iPlanet conversion assistance
- webmin admin utility (HP-UX migration)
- coordinate with HP-UX Internet Express V1

Min OS - V5.0A

Internet Express V6.2 FCS: Dec-03 (Target)

- New Components:
  - Bogofilter
  - EGD
  - Snort
- Cluster support
  - webmin
- Update
  - -Open Source components

Min OS - V5.0A

= **Shipping or Committed - Plan of Record**

= **In early planning phase**

Q2-2002 **Q4-2002** **Q2-2003** **Q4-2003**

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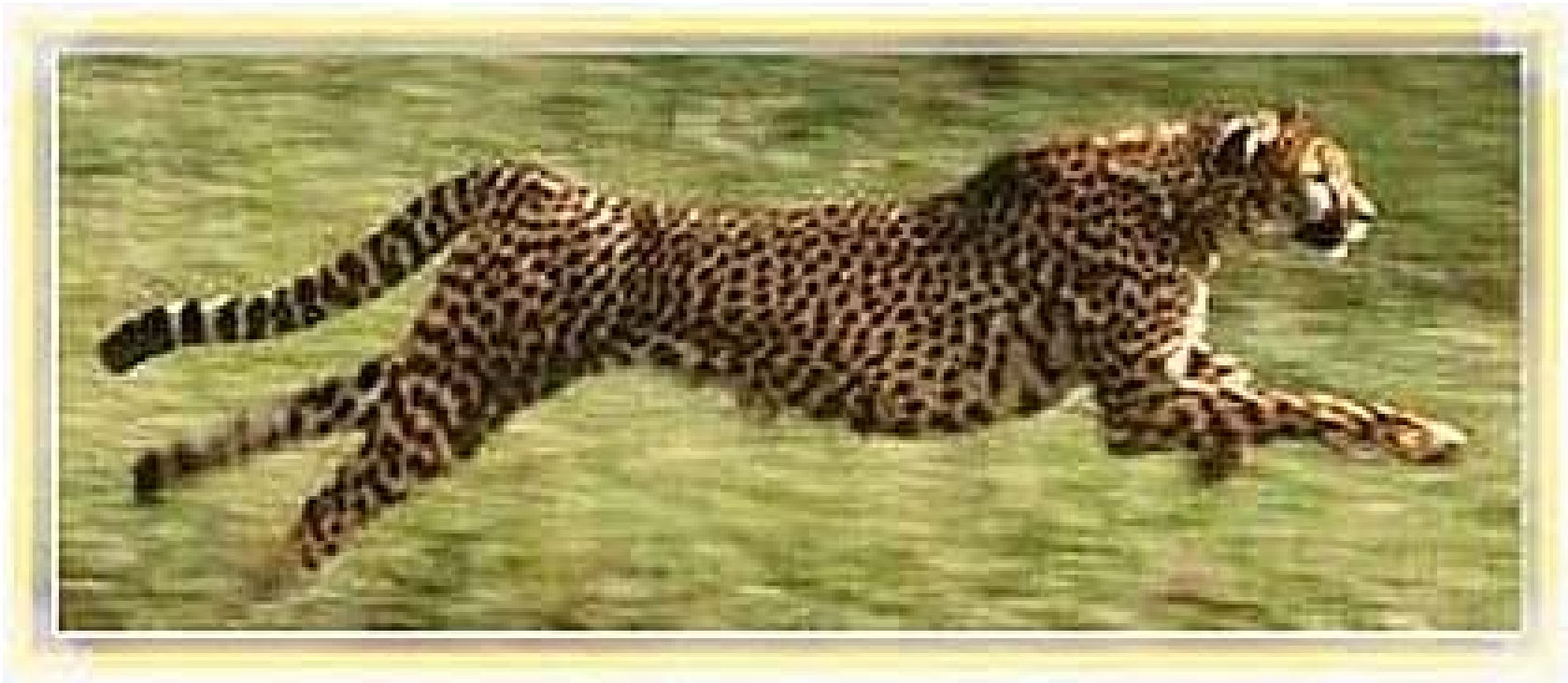
HP Tru64 UNIX® V5.1B "Wildcat"

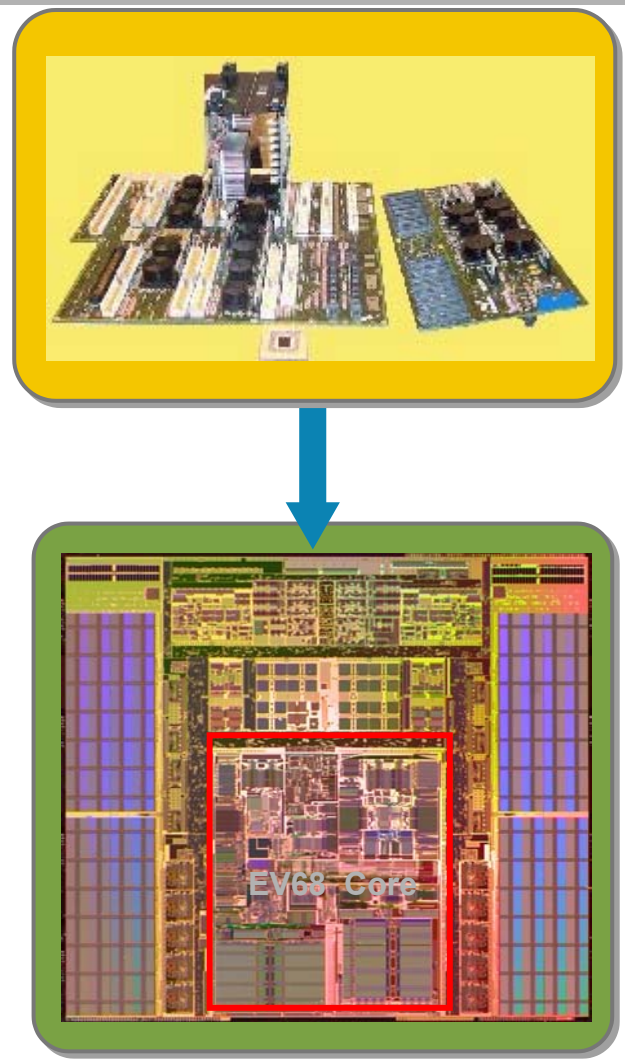


HP Tru64 UNIX® 5.1B

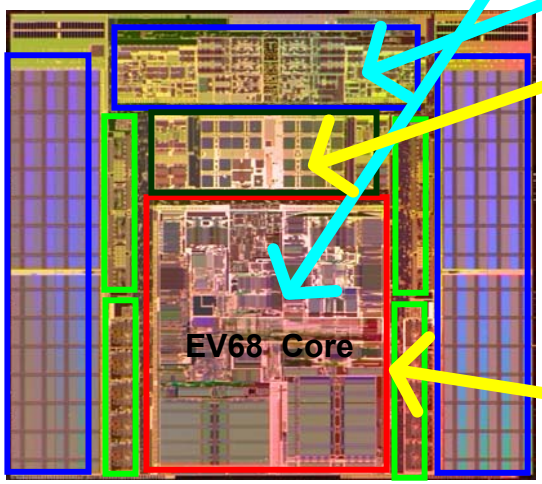
- What is this release about?
  - EV7 Alpha Chip Support
  - Big Pages Support
  - Base for Future Releases
  - Foundation for future

Version 5.1B EV7 infrastructure

- EV7 platform support 2-8, 16, 32 and 64 (Sept 03) CPUs
- Indictment
  - CPU
  - PCI
- on chip controllers
  - memory and I/O
- processor scheduler
  - mesh scheduler
  - NUMA gravity

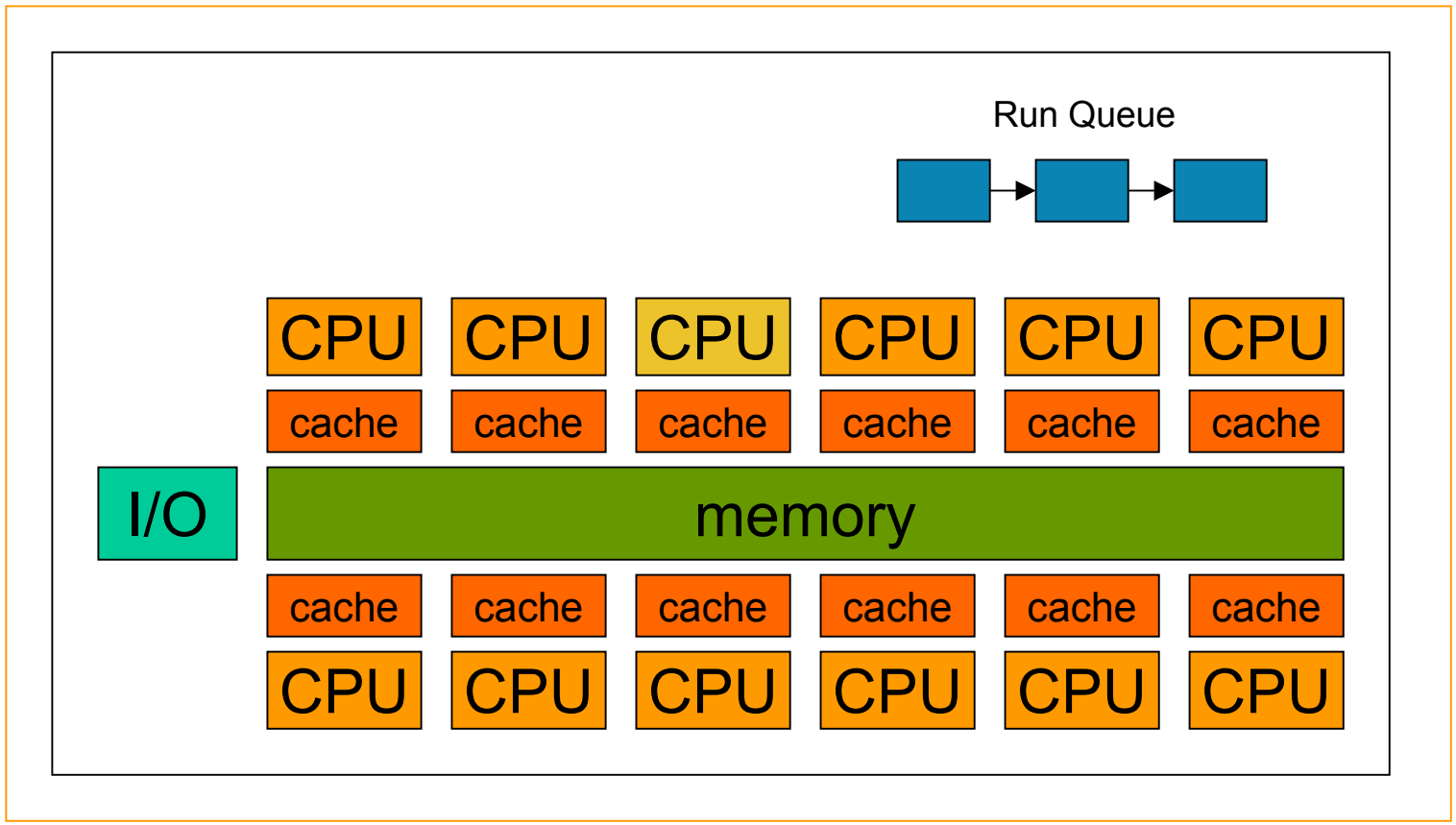


EV7 design innovation transparent to applications

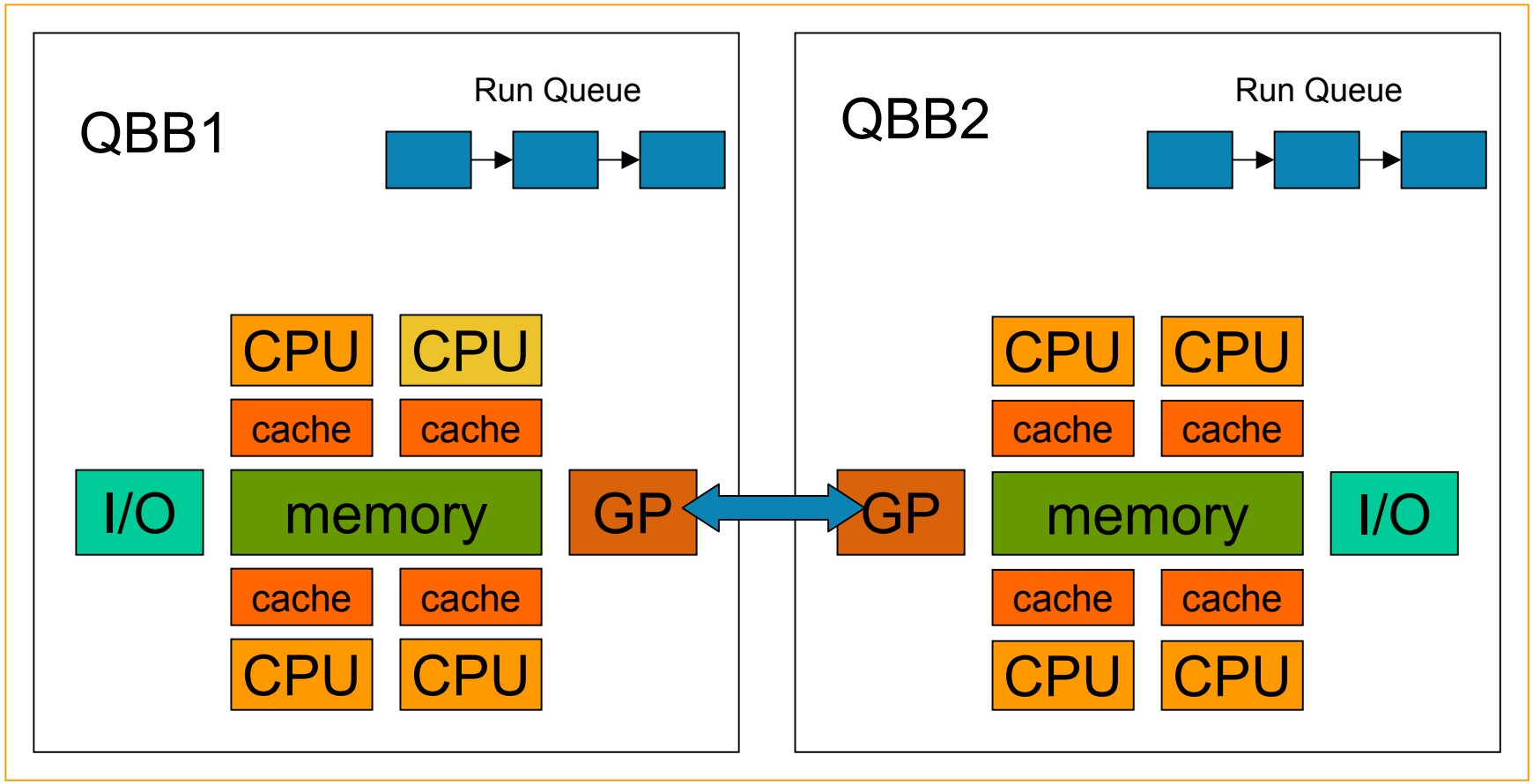


- EV6 core processor
  - No changes to compiler or code scheduling
  - Completely transparent to software
- Integrated memory & I/O controllers
  - benefit to HPTC applications
  - Transparent to applications
- NSEW CPU interconnects

Tru64 UNIX® support for the traditional SMP Architecture



GS80/160/320 Switched Architecture

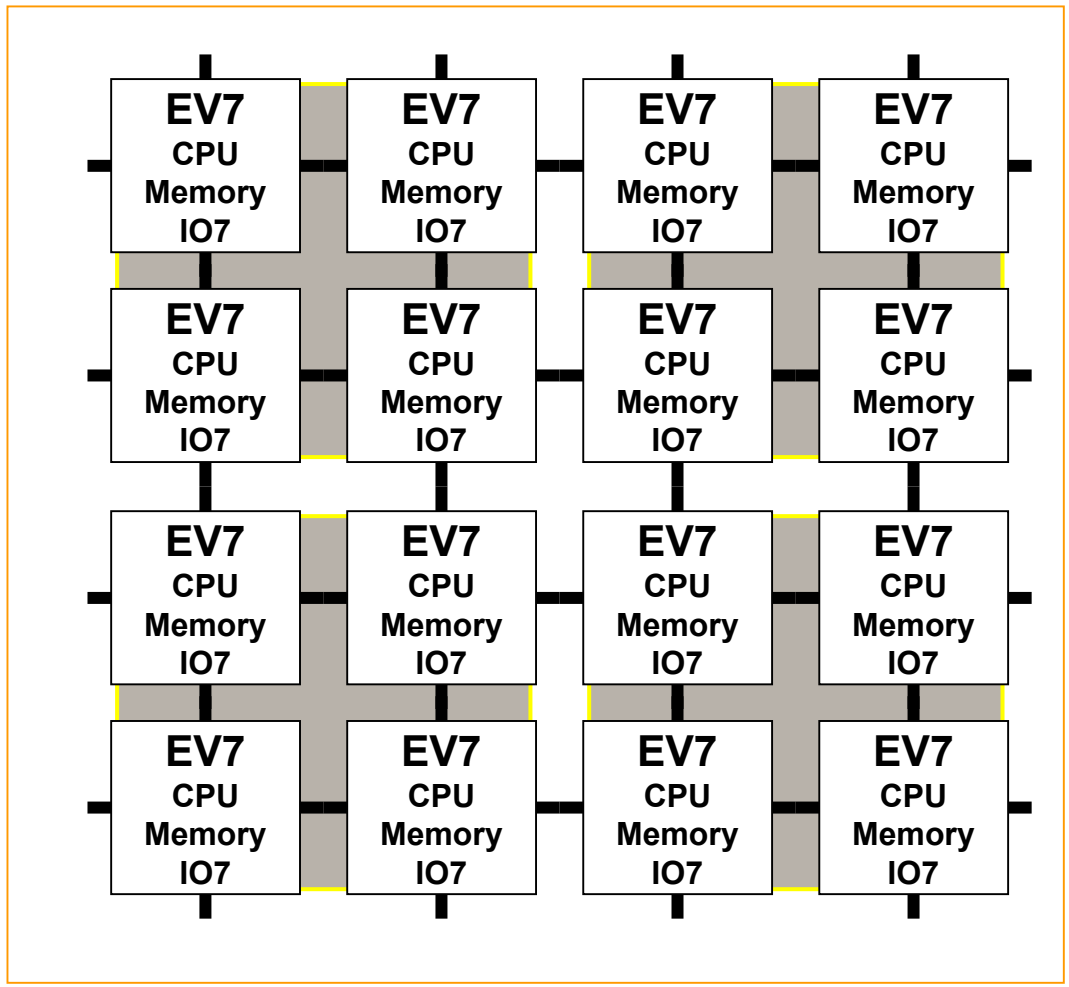


Interaction between EV7 Building Blocks

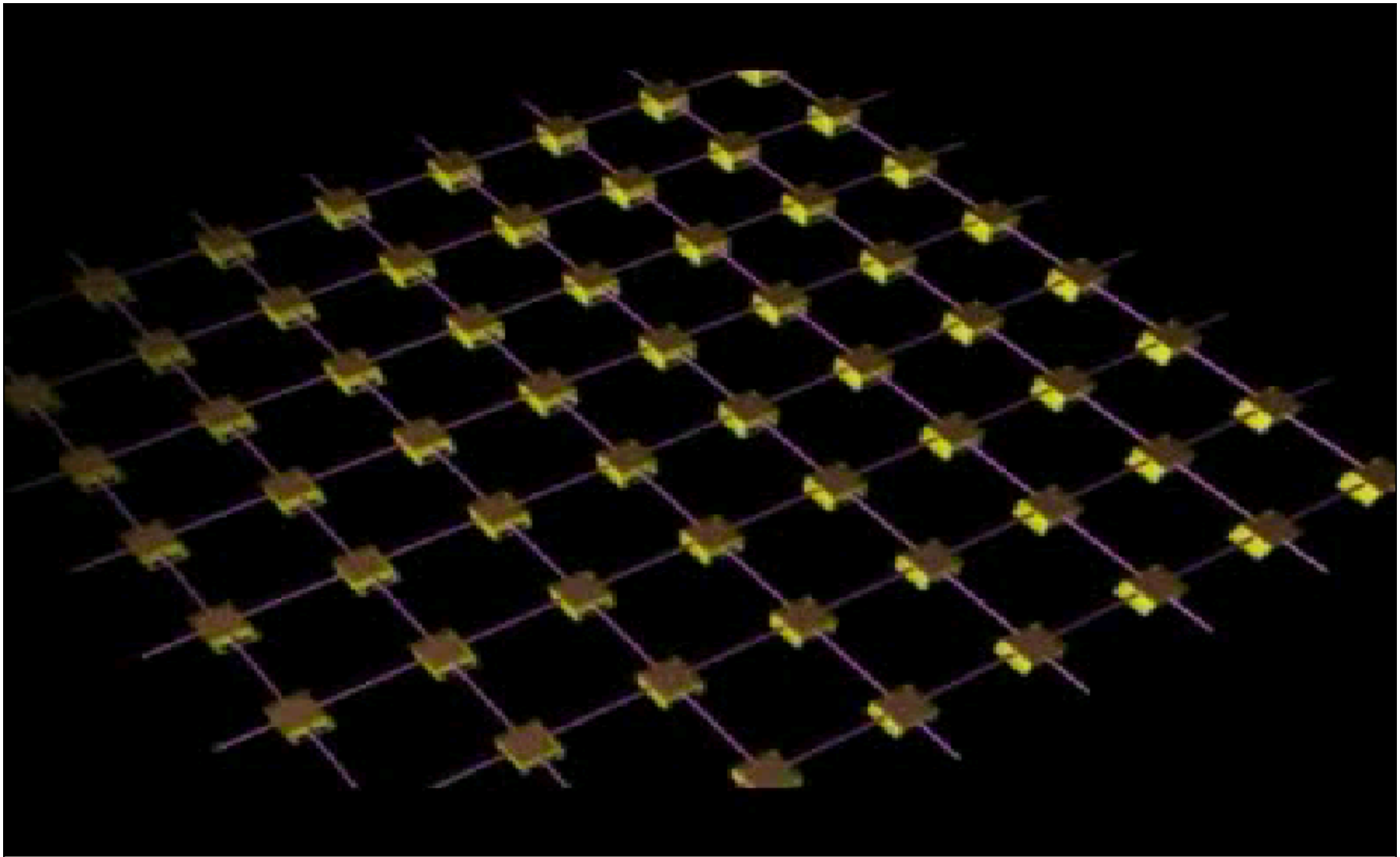
- A “Super-RAD”
  - SMP behavior inside
  - NUMA behavior between
  - 1 Run Queue

Legend:

- **System Building Block**
- **“Super RAD”**
- **Marvel System**



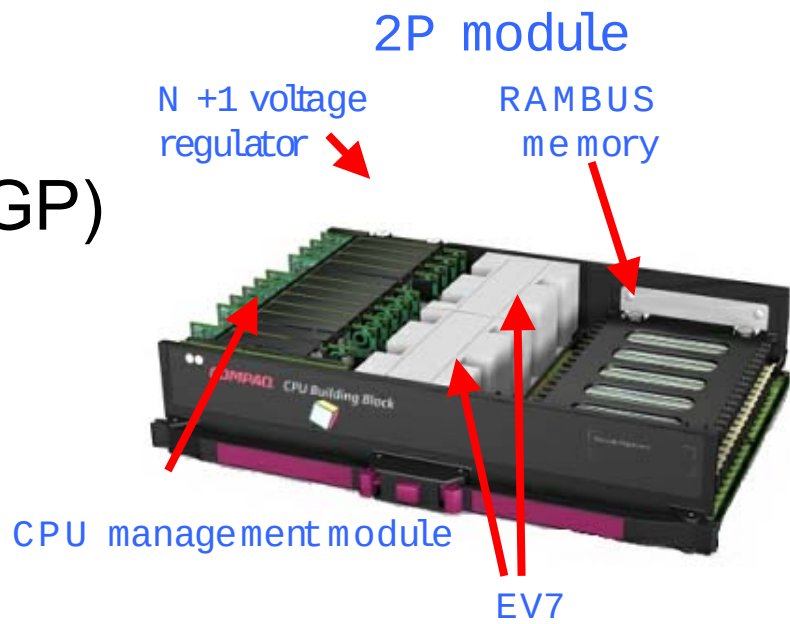
Enter the Mesh!



Toroid

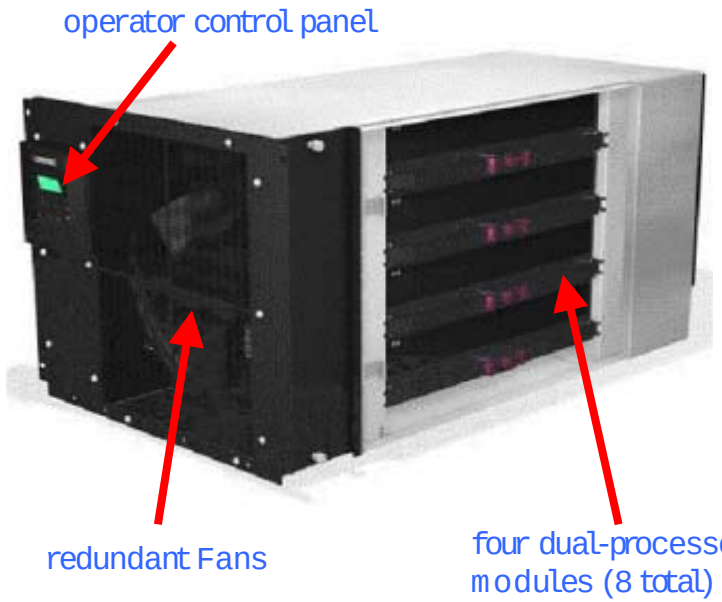
Dual processor building blocks

- Up to 8P configurations
- Up to 32GB memory per CPU
- 3 PCI-X/PCI buses (5 slots + 1 AGP)
- Port for external I/O expansion
- Integrated server management
- Hot swap redundant fans
- N +1 hot swap voltage regulators



8P Drawer building blocks

- Supports up to 4 dual processor modules
- 32GB maximum memory per CPU
- Up to 8 I/O expansion drawers per 8P drawer
- Four 8P drawers fit into a standard 2m rack
- Integrated server management module
- N +1 Hot swap redundant fans
- N +1 hot swap voltage regulators



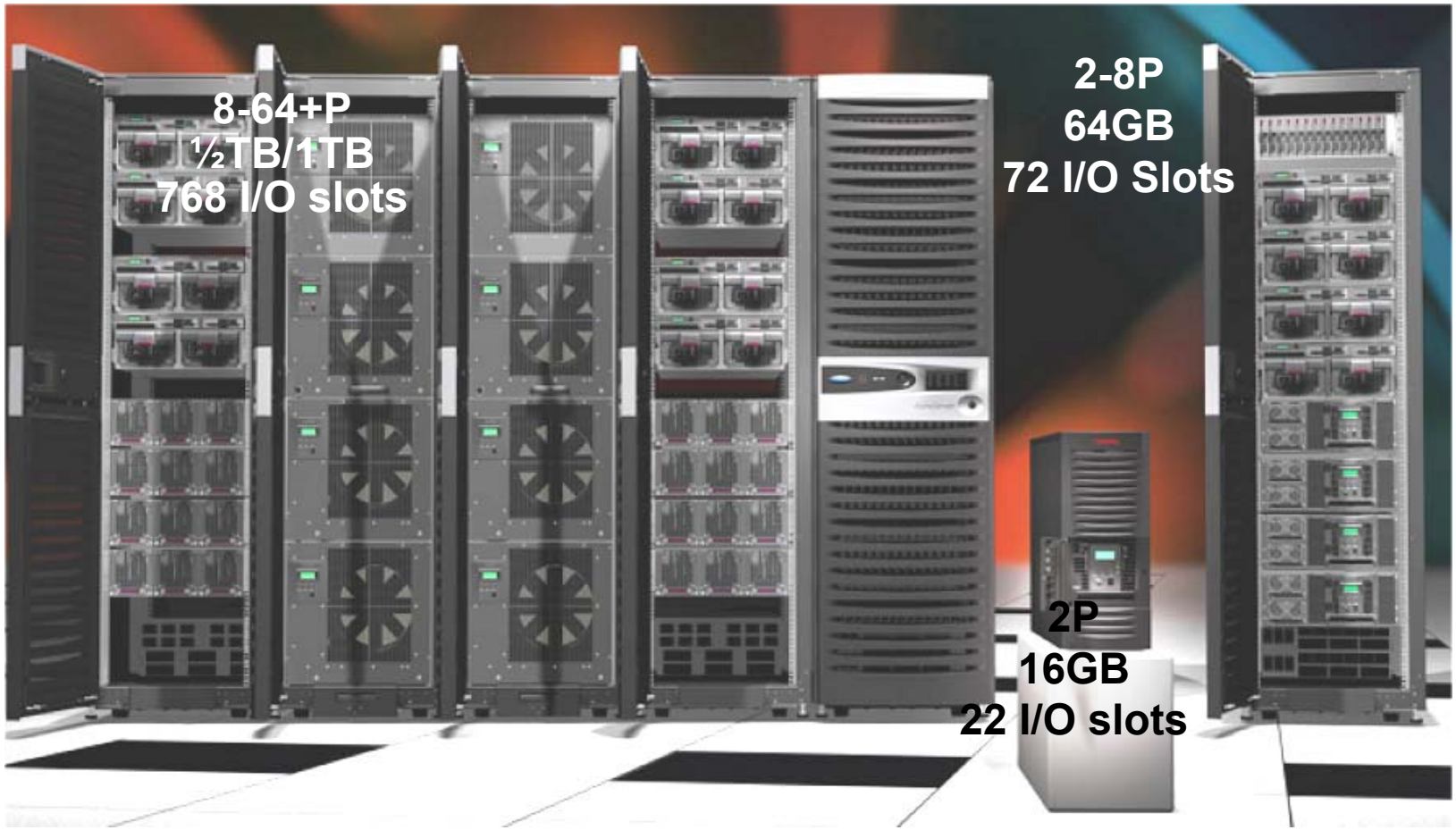
EV7 HW support continued

- Capacity on Demand
- Compaq Analyze
- CDROM Mastering R/W
- Sys Check
- XML enabled web browser
- Marvel Platform Management Utility
- PCI and CPU Indictment
- General Supported Options

EV7 HW support continued

- Memory Troller
  - For proactive memory failure detection
  - Default value: 4 percent per hour (range can be 1-100)
    - Will Troll all memory in 24hours
  - To discover current Troll rate
    - **# /sbin/sysconfig -q vm vm_troll_percent**
  - Can override default with line in /etc/sysconfigtab file
    - vm_troll_percent=*percent_rate*
  - To enable, disable or change at any time
    - **# /sbin/sysconfig -r vm vm_troll_percent=***percent_rate*
  - Accelerated Trolling: 101 percent
    - Will run Troller in accelerated mode and then disable
    - Good for running at off peak (can do 128 GB in 5 mins)

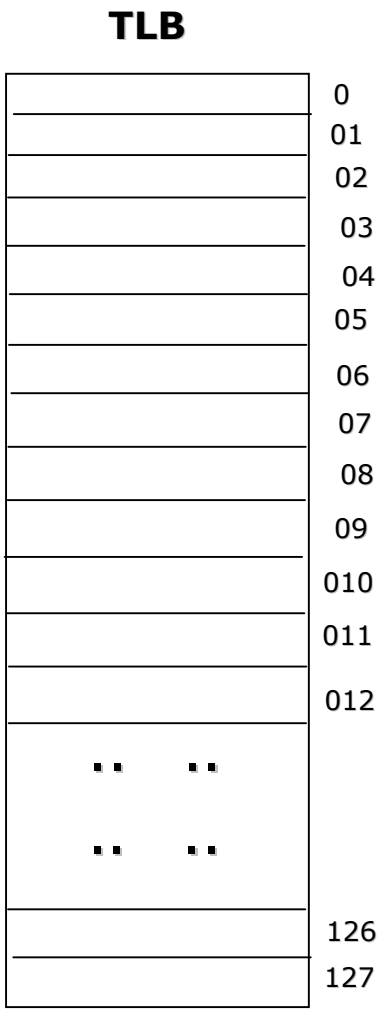
Absolutely Marvelous!!!!



Big Memory Pages

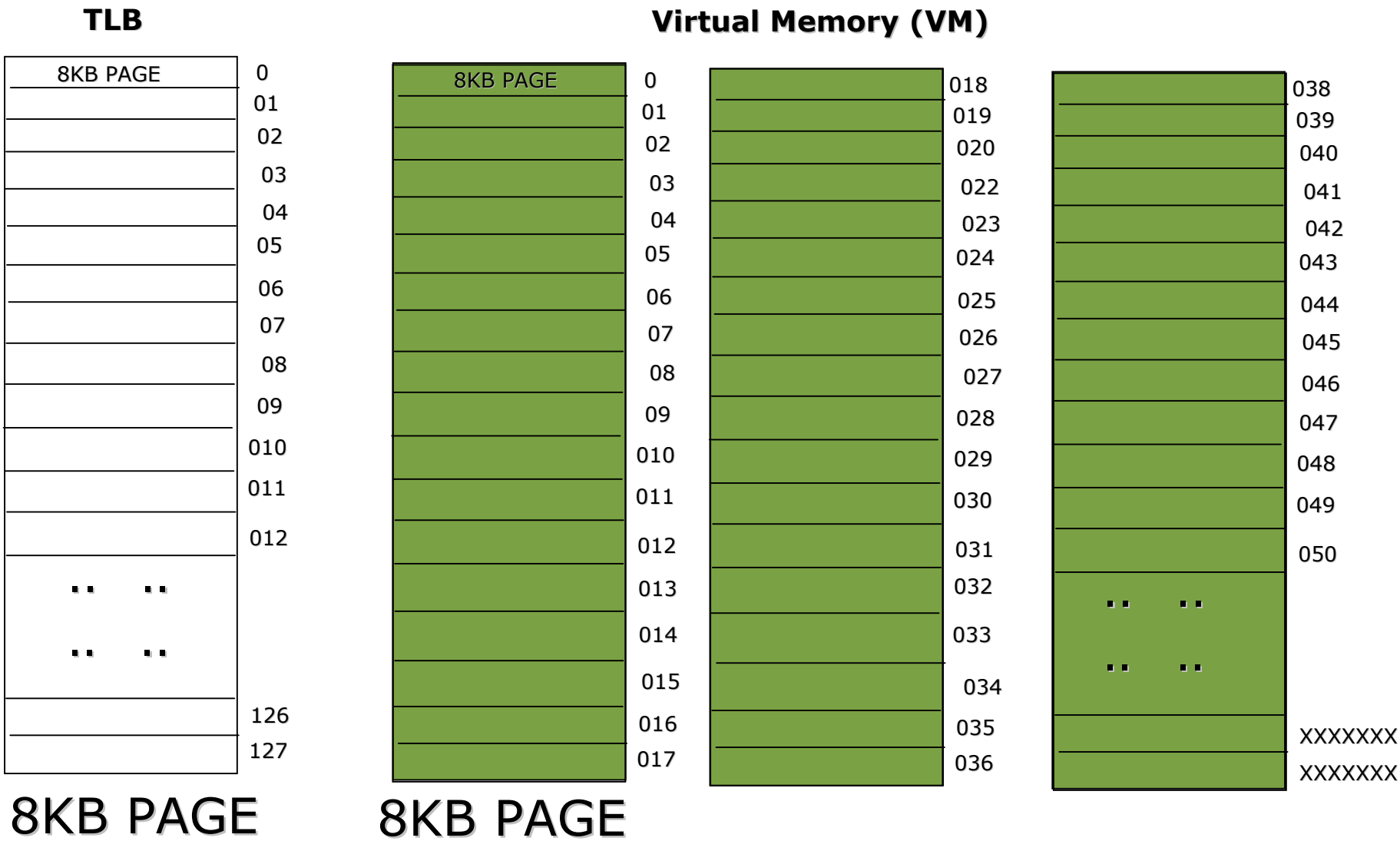
- Special Requirement from HTPC
- Will greatly improve performance of:
  - Memory Intensive Applications (i.e. DB)
  - Finite Element Applications (i.e.Modeling)

TLB or not TLB .....

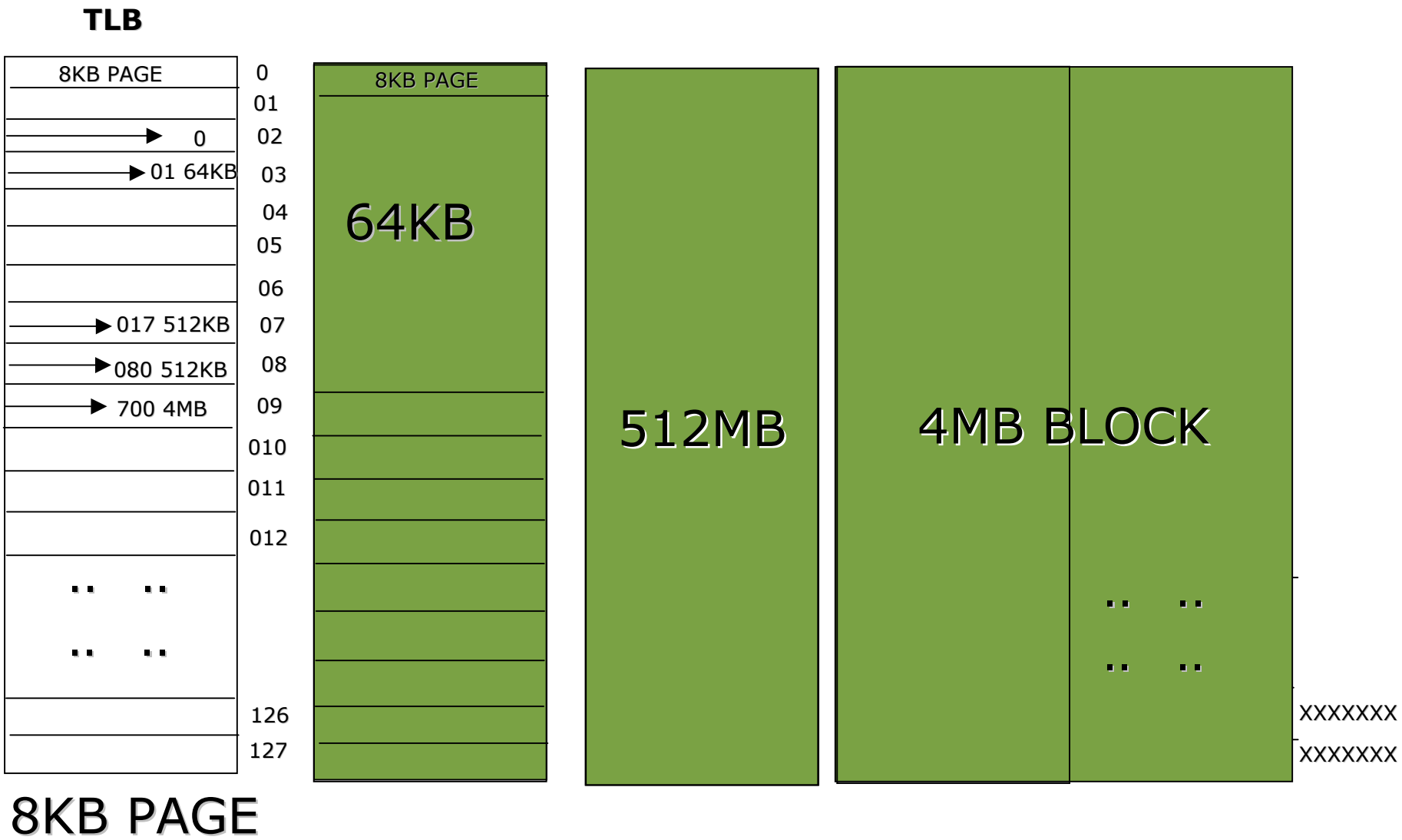


- What is the TLB?
  - Translation Buffer
  - FIFO Algorithm (First in First Out)
  - 128 address spaces
  - Each address space is 8 Kilobytes in size
  - Bottleneck for instruction plus data retrieval
    - First place which is checked for data
    - If data not in the TLB then has to search VM
    - Slows down system performance
    - Impacts Database/Application performance
  - What if we could reduce TLB misses?
    - Could improve System performance
    - Also improve application performance

Big Pages Disabled



Big Pages Enabled



Big Memory Pages Continued

- To enable:
  - vm_bigpg_enable=1
  - Then reboot system
- To disable:
  - vm_bigpg_enable=**0**
  - Then reboot system
- Gives you pages of 8KB, 64KB, 512KB and 4096KB.
- Reduces TLB misses thus improves its throughput.
- Kernel chooses optimized page size at runtime.
- Note System comes with this disabled.
- Proposed future enhancements.

Security Enhancements

- Bundled SSH
  - Based on application from SSH Communications Security.
  - Replaces traditional less secure commands
  - Command ‘rsh’ equivalent ssh2
  - Command ‘rlogin’ or telnet equivalent ssh2
  - Command ‘rcp’ or ‘ftp’ equivalent ‘scp2’ or ‘sftp’
  - root may set `EnforceSecureRutils=Yes` in `/etc/ssh2/ssh2_config`
  - User may set `EnforceSecureRutils=Yes` in `$HOME/.ssh2/ssh2_config`
- Will allow System Admins to force the use of SSH instead of rsh.

Secure Shell continued

- To start the **sshd2** daemon using the configuration information in the /etc/ssh2/sshd2_config file, enter:
  - **# /sbin/init.d/sshd start**
- To stop the **sshd2** daemon, enter:
  - **# /sbin/init.d/sshd stop**
- To restart the **sshd2** daemon using the configuration information in the /etc/ssh2/sshd2_config file, enter:
  - **# /sbin/init.d/sshd restart**
- To reset the **sshd2** daemon, enter:
  - **# /sbin/init.d/sshd reset**

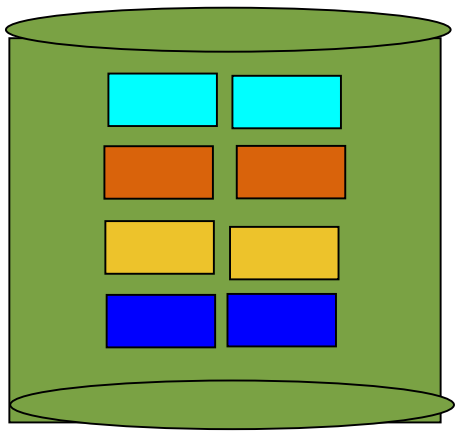
Security Enhancements, continued

- Pseudo Random Number Generator.
  - System captures timing of HW interrupts
  - Stores and shuffles timings (like a deck of cards)
  - Produces a random number when requested from deck.
- /dev/random
  - Greater possibility of randomness
  - will stall until it has sufficient entropy to fulfill the request
- /dev/urandom
  - Will always give you a number even it has only a few stored
  - theoretically may not be as random as /dev/random

Security Enhancements, continued

- Ease of Use Enhancements and Security Hardening
- Embed a Directory Server
  - OpenLDAP now available via the APCD
- Directory enabled authentication via LDAP
- Common Data Security Architecture

File Systems and Storage



- LSM Fast Plex Re-attach.
- What is LSM?
  - Logical Storage Manager Software
- What is a plex?
- What is a Volume?

Logical Storage Manager – Fast Plex Reattach

- Reduces re-silvering impact of LSM mirrors
  - Both time spent and I/O load during re-silvering
- Create a 'FPA' capable volume using top-down (TD) or bottom-up (BU) approach
  - `volassist` (TD)
  - `volplex,volsd,volmake,volume` (BU)
- Fast Plex Attach with `volassist`
  - `volassist addfpa volume [attrs]`

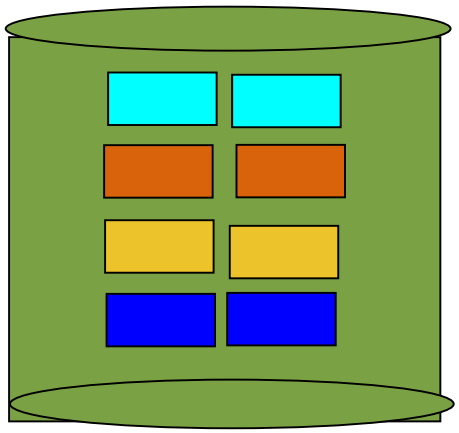
```
.. make volume <len> layout=mirror,fpa [attrs]
.. make volume <len> loglen=nn [attrs]
.. make volume <len> nfpalog=nn [attrs]
.. snapfast primary_volume secondary_volume
.. snapback secondary_volume primary_volume
```

Logical Storage Manager – Fast Plex Reattach

- `volassist snapfast primary_vol sec_vol`
  - Adds FPA log plex (primary) to the volume
  - Add FPA sub-disk (secondary) to the Active plex
  - Detatch Active plex (the migrant plex)
  - Use migrant plex to create secondary (aka snapshot of) volume
- `volassist snapback sec_vol primary vol`
  - Detatch migrant plex from secondary volume
  - Merge FPA for secondary volume with FPA of primary volume
  - Reattach migrant plex to primary volume and resilver
  - Disable FPA logging (disallow FPA-detatch until resilver completes)

LSM Fast Plex Reattach

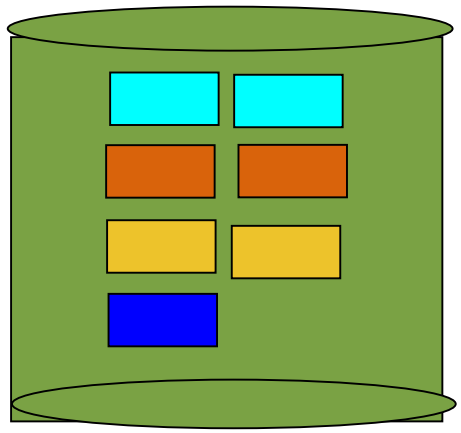
LSM Vol



Remove Plex from Vol

LSM Fast Plex Reattach

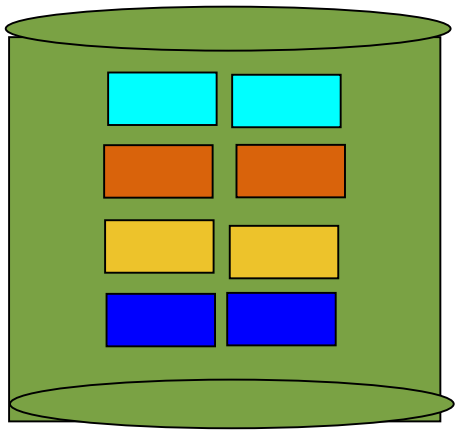
LSM Vol



remaining plex continues with reads and writes

LSM Fast Plex Reattach

Reattach Plex to Vol



- Updates only data which has changed data since the plex was detached.

Freeze and Thaw of AdvFS and CFS

- Ensuring Metadata Integrity by Freezing Domains
  - /sbin/freezefs [–t 0|time in seconds] /mount_point
  - metadata-consistent state until thawed
  - All of the filesets in the domain are frozen
  - All metadata is flushed to disk and is frozen
  - Operations such as read continue
- Thaw
  - By command /sbin/thawfs /mount_point
  - By timing out
  - by shutting down any cluster node of a frozen file system
  - In the event of a cluster node failure

LSM & HW snapshots

- Currently LSM actively rejects hardware generated clones and snapshots
  - Actually, any device that has a mismatched wwid listed in the configuration header for the volume is rejected as a clone/snapshot.
- `volclonedg` will allow hardware clones/snaps to be included in their own disk-group
- **# volclonedg -g dg1 dsk14 dsk15 dsk16 dsk17**
  - LSM creates the clone disk group and starts its volumes.
- Clone_disk_name: Has to be device, not partition

AdvFS LUN/UNIT Expansion

- LSM and hardware RAID controllers support dynamic growth of Volumes today.
  - AdvFS does not support this.

- Dynamic growth of LSM or hardware RAID volume is done independently of AdvFS, you must notify the domain when the size of a vol changes, therefore we use the mount command with the –o extend to achieve this:

  - If the fileset is not already mounted, enter:
    - mount -o extend domain#fileset /mountpoint

  - If the fileset is already mounted, enter:
    - mount -u -o extend domain#fileset /mountpoint

AdvFS vFast Utility

- vFast: Automatic Background Defragmentation
  - No administrative downtime for defragment operations
  - Negligible Impact to System Load & Performance
  - Automatic Free Space Consolidation
  - Automatic Load Balancing of I/O Across Volumes
  - Improved I/O Performance via Hot File Analysis of Frequently-Accessed Files
  - Command /sbin/advfs/vfast
- AdvFS Utilities License required for vFast
  - `/sbin/defragment` enabled as part of base OS license

Parallel HBA Probe

- New and improved storage bus scan algorithm
  - Scans all HBAs for devices *in parallel*
  - Significantly improves boot time on large configurations
- Large storage configurations took time to boot
  - One problem was serialized device scanning
- Parallel SCSI Bus Probe is ***disabled*** by default
  - To enable
    - parallel_edt_scan=1
  - To disable
    - parallel_edt_scan=0

Software Development

- Java SDK 1.3.1 with FastVM as default
  - Enabler for Netscape 6
- Java SDK 1.4.1
  - Available via APCD in late 2003 via kit update.

- DECthreads V3.20 Optimized for Marvel Support
  - Threads on a Leash Optimize Performance
  - Configurable-Length “Dog Chains” Vary Average Memory & I/O Access Times

- Mozilla LDAP C SDK instead of Netscape
  - Netscape has same APIs as LDAP C SDK

General Operating System

- Reduce Boot time of GS series machines
- New Printers Supported (ongoing effort)
  - http://www.tru64unix.compaq.com/printing/printers.html

  (BTW we need your help on migration plans from Tru64 to HP-UX)
  - http://h30097.www3.hp.com/printing/MigrationQuestionnaire.html
- Printing Supported via Sys Man
  - Configure and monitor print queues
  - Same functionality as is available from CDE
  - Requires X-Server on PC client
- Unicode 3.1 support
  - 44,946 extra char now supports 94,140 char
- Asian Language enhancements for Insight Manager

Networking

- IPv6 Production Mode
- Continued support of IPv4 Networks
- Dual Stack IPv4 and IPv6
- IPv6 Porting Tools
- IPSEC supported on IPv6
- Update POP and IMAP
- Updated via Internet Express
  - Bind 9
  - Sendmail

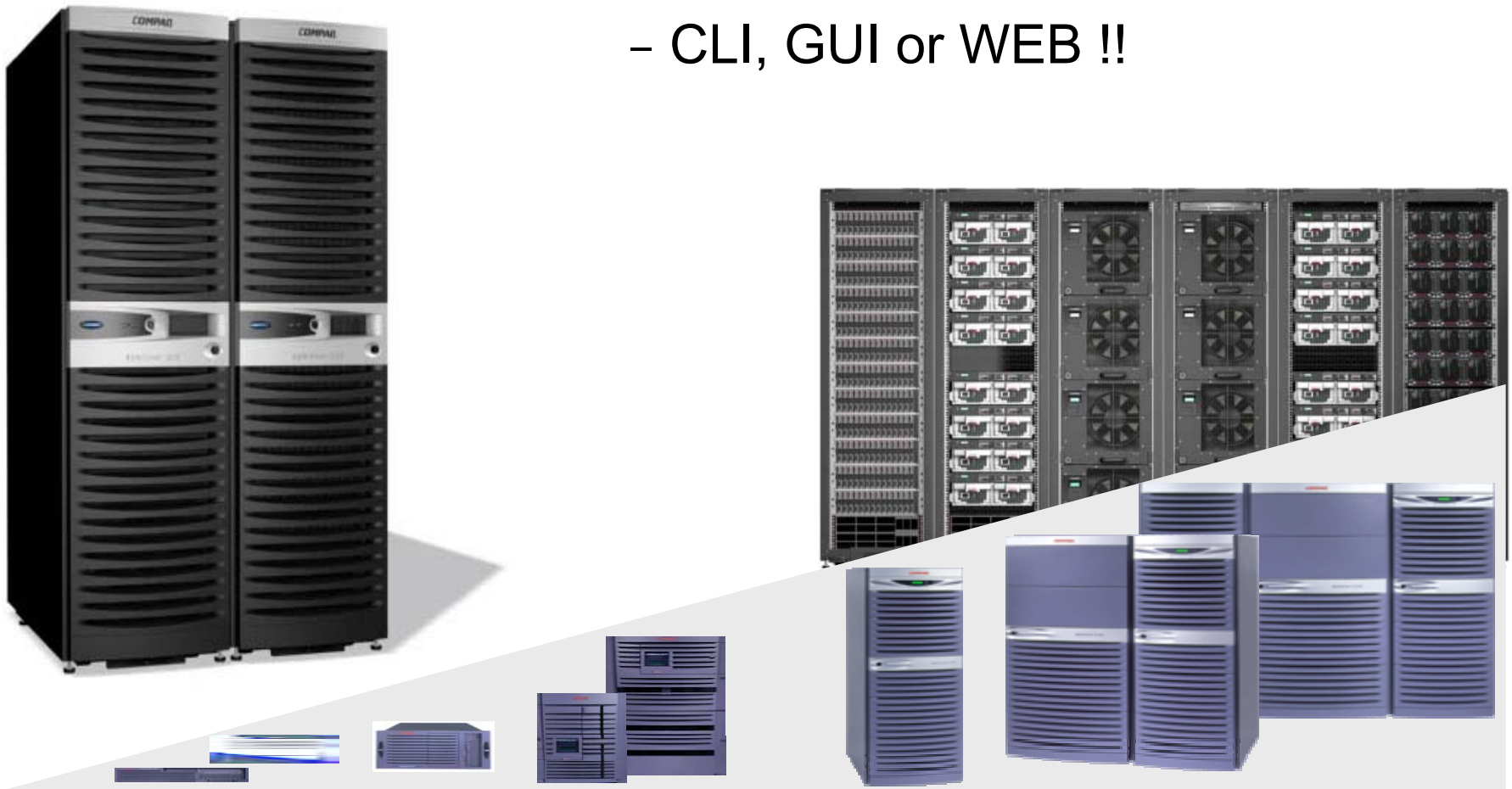
IPv6
Networking for the 21st Century

Serviceability & Sys Man

- Human Factors
- Environmental monitoring and condition handling
- Collgui enhancements
- SysCheck enhancements
- Kernel Crash Dump enhancement
- SysMan Enhancements
  - Storage Task Manager
  - Insight Manager
  - Event Manager

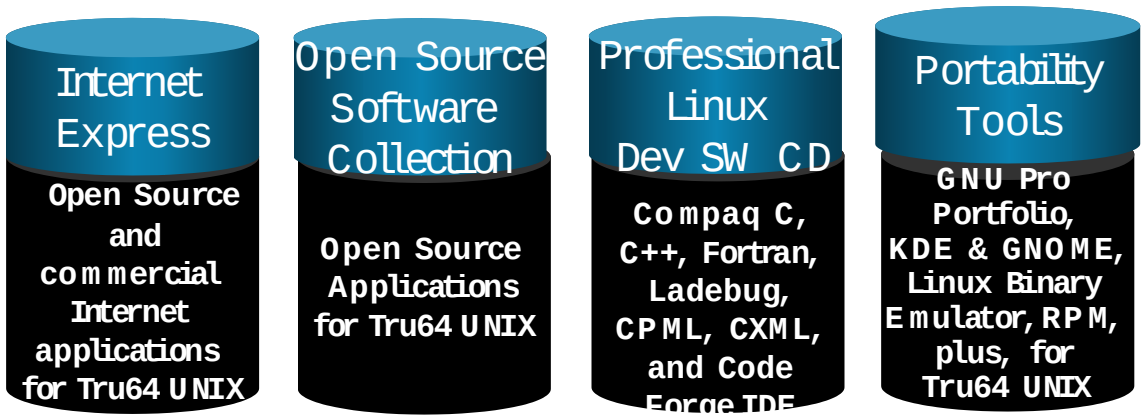
Manageability

- Manage your system from anywhere
  - CLI, GUI or WEB !!



Linux and Tru64 UNIX® Interoperability

- **Co-existence Within Heterogeneous Environment**
  - Leverages Low Cost, Open Source and Highly Scalable, Available & Manageable Environments
- **Application Mobility Across Platforms**
  - Economies of Scale of Linux as Primary Reference Platform
- **Complementary Tools & Applications**



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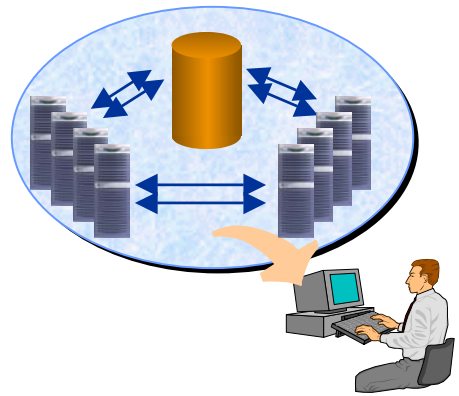
TruCluster Server V5.1B – CFS Dynamic Load Balancing

- Dynamic rebalancing based on
  - User defined policy and preference / connectivity / memory consumption / failover events / analysis
- Managed by `cfsd`
  - One `cfsd` per member
  - `cfsd` startup
    - Read config file (`/etc/cfsd.conf`)
    - Select leader
    - Ready to track statistics and do the work



- `kill –HUP <cfsd.pid>` to force re-read of config
- Recommend, considered, not considered, preferrred Ser
- Results from analysis logged in `/var/cluster/cfs/analysis.log`

TruCluster Server V5.1B – Balancing CAA App resources

- **/usr/sbin/caa_balance -all [-q]**
  - Attempts to find optimal member for all apps
  - -q Supress output from the command.
- **/usr/sbin/caa_balance -s** *source_member* **[-q]**
  - Optimal placement for apps on current member
- **/usr/sbin/caa_balance** *resource_name* **[...] [-q]**
  - /usr/sbin/caa_balance testapp

TruCluster Server V5.1B – CFS Mount Affinity

- Let's admin specify a cluster member as initial server for a file system.
  - Provides same functionality as the Sierra Cluster's member fstab feature (aka `fstab_member`)
- Most useful for NFS client file systems which cannot be relocated after they've been mounted
- Command

```
# mount -o server=<hostname>
```

TruCluster Server V5.1B – Parallel Roll Support

- Possible to roll more than one member at a time
  - "No" change to roll procedure
    - Order of operations
  - Overlapping "`clu_upgrade roll`" commands
    - Number of nodes rolled is limited by quorum configuration
    - Possible to roll both with and w/o adjusting quorum

      Number of members that can may "simultaneously" depends on vote configuration
    - Key Issue: reboot of a member ***cannot*** result in loss of quorum

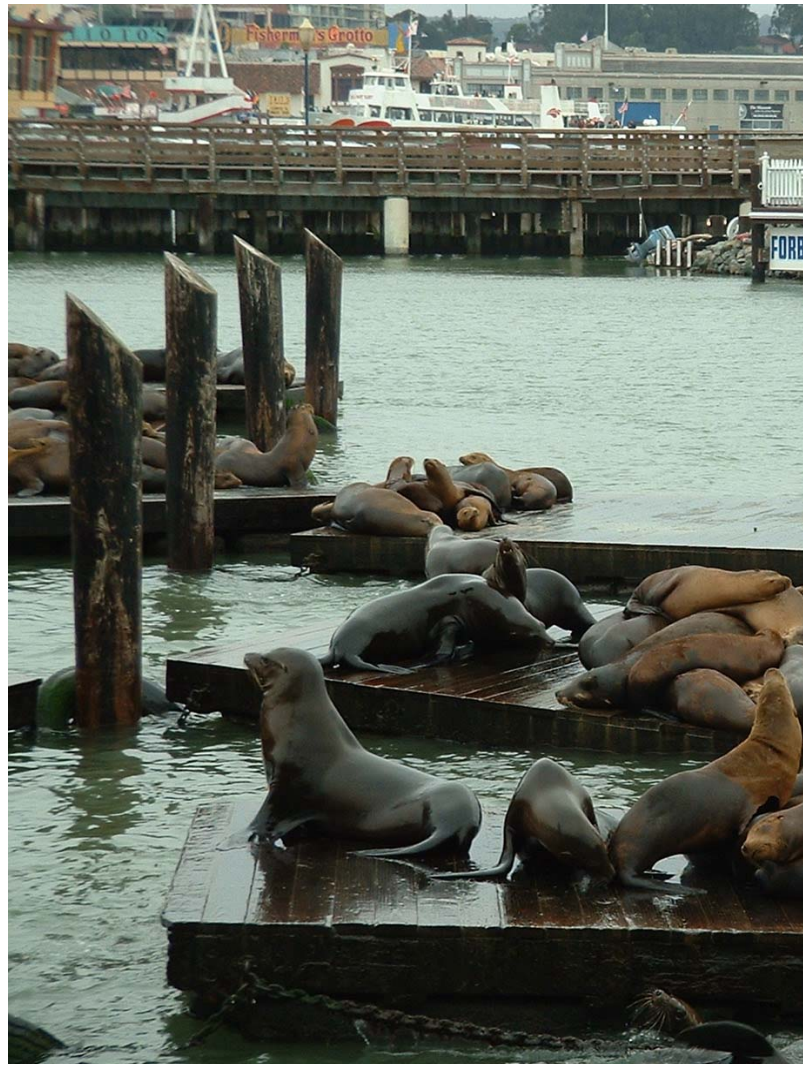
      Clu_upgrade will confirm that reboot will not affect quorum
- "`clu_upgrade undo`" is still a serial administrative "event"

TruCluster Server 5.1B cont'

- Auto Failback feature
  - Failback at requested time of day
  - Useful for off-lining system for Admin task
- Faster SW Upgrades
- Advanced Server for Tru64 UNIX (aka ASU)
  - Layered Product
  - Provides File and Print Services to NT environment
  - Used to need one license per cluster member
  - Now only need 1 licenses per cluster
  - Remember we use concurrent licenses
    - 10 concurrent licenses allows 10 concurrent ASU users on cluster

Retirements

- Hardware
  - Token Ring Network Support
  - HSZ10, 20, 40 and 50 (5.1a*5)
- Software
  - Decmigrate dbx utility
  - JDK 1.1.8
  - Performance Manager
  - Emxmgr (announced for future removal)
  - Automount Utility (in future rel)
  - iPlanet Directory Server



General Information

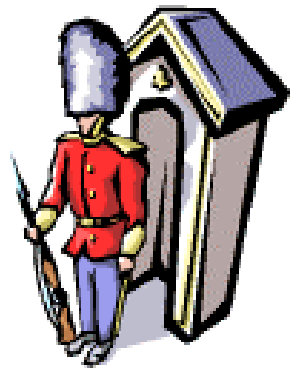
- Update Paths
  - 5.1 → 5.1B
  - 5.1A → 5.1B
  - 4.0G → 5.1 → 5.1B
  - 4.0F → 4.0G → 5.1 → 5.1B
- Licensing
  - 5.1A → 5.1B requires update license
  - 4.0x → 5.0x requires update license
- Contacts
  - Base OS Isaac.chute@hp.com
  - Clusters bob.grosso@hp.com

Agenda

- Sessions of interest
- HP Tru64 UNIX® Roadmaps
- HP Tru64 UNIX V5.1B
- HP TruCluster V5.1B
- Post HP Tru64 UNIX V5.1B
- Future Releases

Greater Security and Management Post 5.1B

- **Unprecedented Memory Attack Protection (PK2)**
  - Heap Buffer Overflow Protects Any Area of Program Memory from Executing Malicious Code
  - Even Apps Vulnerable to Heap Buffer Overflows E Impenetrable
  - Optional Activation



- **Better Performance Monitoring pmgrd (PK2)**
  - AdvFS, CPU, & Memory Metrics Monitoring via Collect Utility
- **Enhanced Manageability**
  - Greater Security and More Complete Coverage in Improved Tru64 UNIX Insight Manager Agent

More Robust Storage Software Post 5.1B

HP WORLD 2003
Solutions and Technology Conference & Expo

- **Storage Backup**
  - **Legato Networker® Single Server -** Already Bundled
  - ***New:*** **hp OpenView Data Protector**
    - Network-based Backup Protection
    - Local & SAN Backup Protection

- **Storage Management**
  - **hp OpenView Storage Area Manager –** Tru64 UNIX® Host Agent
  - Simplified & Automated Management of Storage Resources & Infrastructure

Expanded Storage Options Post 5.1B

- **KZPEA** – Shared JBOD Support
  - Dual Channel LVD PCI U160 SCSI Adapter
- **SmartArray 5300**
  - 2 & 4 Channel LVD SCSI Backplane Raid Controller
- **MSA 1000**
  - Entry-Level SAN
- **FibreChannel HBA**
  - LP9802: PCI-X Form Factor

Larger, More Scalable Storage Configurations Post 5.1B

- **Virtually Unlimited Connection Possibilities via FibreChannel**
  - 2 TB Physical Volume
  - 255 LUNS/Target
  - 255 Targets/Bus
  - 255 Busses/System
- **EVA/HSV Programs**
  - EVA 3000
  - EVA 5000 V3 (CA on HSV110)
- **XP 128/1024**
  - Expanded Support for Larger Configurations

Agenda

- Sessions of interest
- HP Tru64 UNIX® Roadmaps
- HP Tru64 UNIX V5.1B
- HP TruCluster V5.1B
- Post HP Tru64 UNIX V5.1B
- Future Releases

Versions 5.1B-1 & 5.1B-2

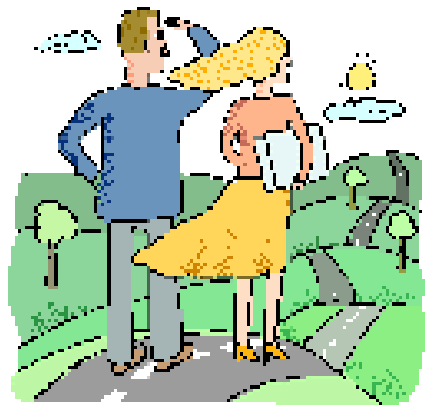
- Packaging Strategy for both releases
  - Vail = 5.1B-1 & Utah = 5.1B-2
  - Will not update Core Base OS
    - No update installed needed
    - Thus no need for ISV recertification
  - Will Provide functional enhancements via alternate means
    - Via a special Patch/Enhancement CD ROM
    - Some New products will go on the APCD
  - Will provide updates to Associated Products
  - Will deliver according to our announced Roadmaps

- WILL NOT BREAK BINARY COMPATIBILITY

HP Tru64 UNIX® Product directions

Areas of Investment

- ✓ **Quality and stability across entire system**
- ✓ **New hardware support – platforms and storage options**
- ✓ **More availability with less management**
- ✓ **Performance, capacity, and "head room"**
- ✓ **Continued storage integration**



Migration from Tru64 to HP-UX at customers schedule.

- STK – Software Transition Kit
  - Planning tool: Appscan (can run on binaries) on Tru64 UNIX®
  - Porting tool: STK on HP-UX and Tru64 (need sources)
  - Set of HP-UX man pages on Tru64 UNIX, specifically for developers
  - Deployment tool:migration environment on HP-UX Itanium
  - *WDB for Ladebug Users* Usage Guide

    http://h30097.www3.hp.com/transition/apps/wdb_ladebug
- Migration Programs
  - Workshops available
  - Account Consultancies available.
  - Transition Engineering Projects
  - www.hp.com/products1/evolution/alpha_retaintrust/

Extending Alpha Investment Prepare for Adaptive Enterprise

- **Stalker Communigate Pro**
  - **Messaging Solution**
  - **Has own Enterprise LDAP directory Server**
  - **Can interface with other LDAP directory Servers**
  - **Free Trial Version (full product)**
  - **Multiple platform support**
- **WebLogic Server**
  - Industry's leading Java Application Server
  - Free six-month license
- **Java 2 SDK V1.4.1**
  - Latest Version of Java Development Kit in support of WLS
  - Fully Java™-compatible, Alpha-optimized Advanced Compilation Technology (FastVM)

Future Enhancements
Optimized Hardware Utilization

- **High Performing Platform for EV7 Systems (32P, 64P) and *New* DS15 AlphaServer Systems**
  - More flexible, tailored deployment of Big Pages Memory Allocation via per-program tuning
  - Improved disk boot time performance
- **Per application Big Pages tunable added.**
- **Improved Serviceability**
  - Capacity on Demand EV7 (as of post-PK1)
  - Improved CPU off-Line capability

Expanded Storage and Manageability

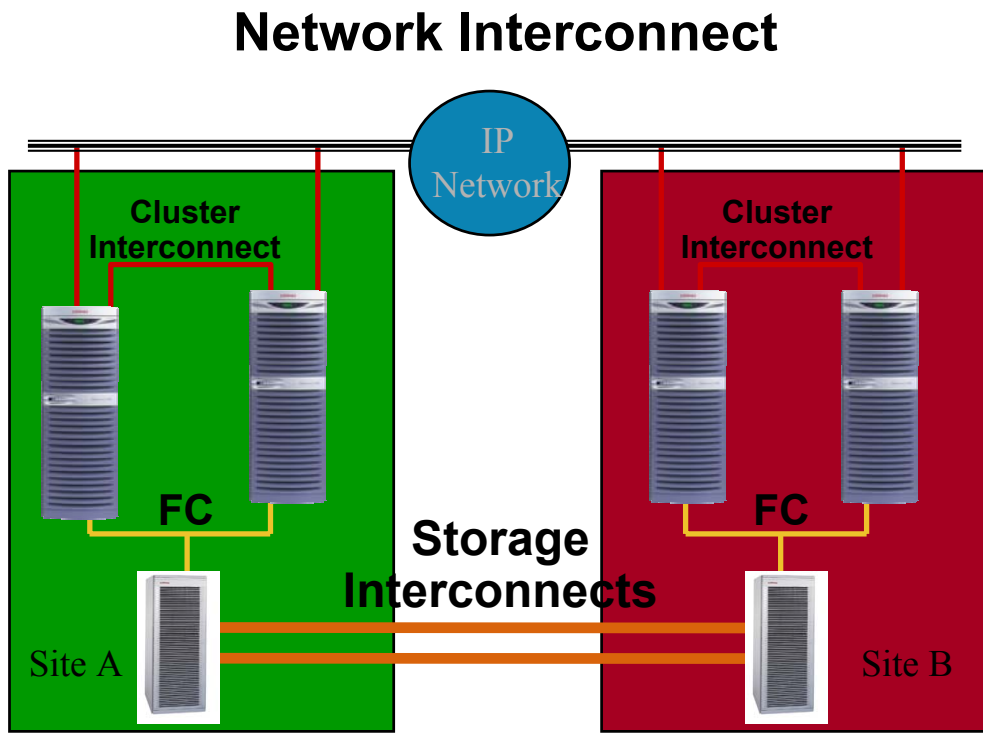
- **FibreChannel HBAs**
  - LP10000: dual channel and universal voltage
- **Storage Management**
  - Legato Networker® Single Server V7 included
- **Enhanced Manageability**
  - Support for additional SNMP trap events

Enhanced File Systems, Networking and Cluster

- **Greater file system scalability**
  - Storage reservation to reduce file I/O & CPU loads
  - More efficient directory locking
  - Faster file & directory name searches
  - Higher I/O throughput of LSM
  - Better file system recoverability
- **More efficient and flexible networking**
  - Faster network downloads
  - User-configurable Kerberos encryption
  - Dual channel GBE networking
- **Improved clusters on low & high ends**

Disaster Tolerant GeoPlex

- TruCluster Server high availability extended to multi-site disaster tolerance
- Simplified management of disaster-tolerant apps
- Geographically-dispersed configs: up to 100 KM
- Automatic application fail-over between individually clustered sites
- Manual controller-based replication fail-over
  - HSG80 DRM & EVA 5000



Tru64 UNIX® V5.1B-Utah and Enhancements

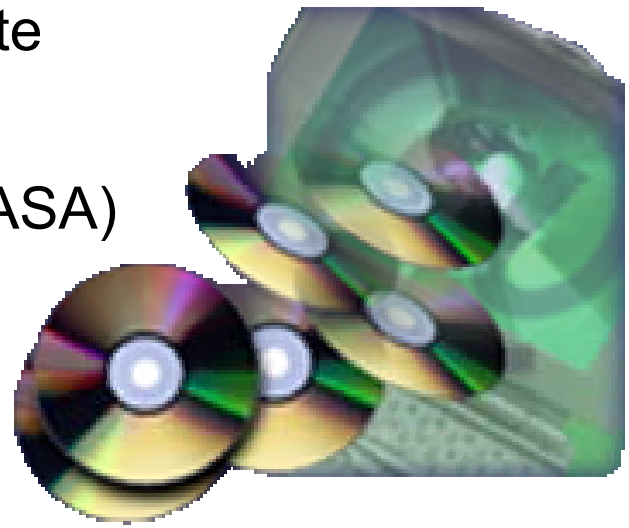
- **High Performing Platform for EV79 AlphaServers**
  - Mixed Speed CPU Support in Single Partition
  - Improved Large SMP & NUMA System Performance via Unified Buffer Cache Scaling
- **Page Tables via Big Pages**
- **Improved Serviceability**
  - Ability to Isolate & Remove from Service Failing Storage I/O & Network Adapters Without Unplanned Downtime

Continued Leadership in FS & Cluster Space

- **File System Improvements**
  - Continued Focus on Scalability
  - Self-Healing AdvFS
  - Easier System Administration & File System Tuning
- **Cluster and Networking Enhancements**
  - Faster Large System Mounting via CFS Upgrades
  - Better Performance via GbE Cluster Interconnect LAN Aggregation
  - More Efficient Problem Diagnosis & Debugging via Dynamically Loadable Packet Filters
  - Better 64P Performance, including 10GB Ethernet Support

Additional Storage Enhancements

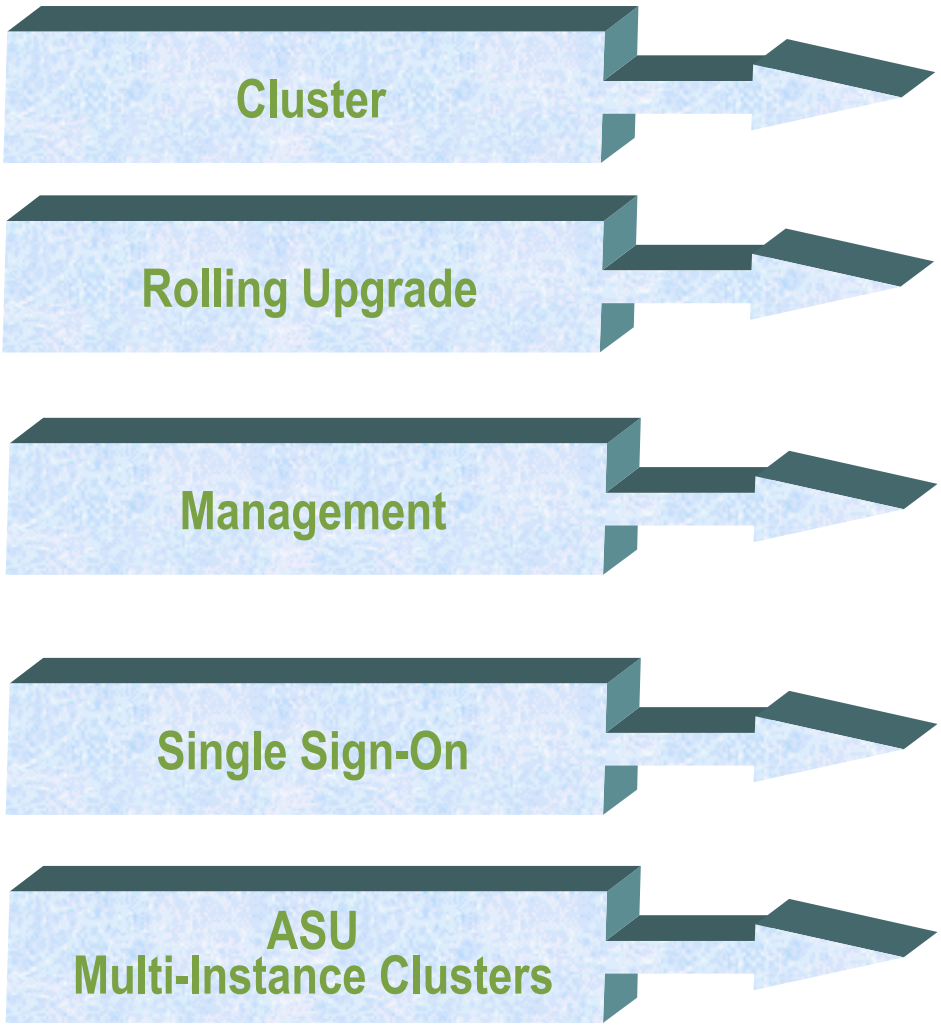
- **Support Evolution of StorageWorks Product Line**
  - MSA1000 Enhancements
  - EVA Follow-On Products
  - Improved Integration with XP Products
- **Improved Manageability**
  - Better Integration with OpenView Tool Suite
- **Data Replication**
  - Continuous Access Storage Appliance (CASA)
- **SmartArray 6400**
  - U320 SCSI Backplane Raid Controller
  - PCI-X Form Factor



Questions and Answers?

Interex, Encompass and HP bring you a powerful new HP World.

5.0A & 5.1 Highlights

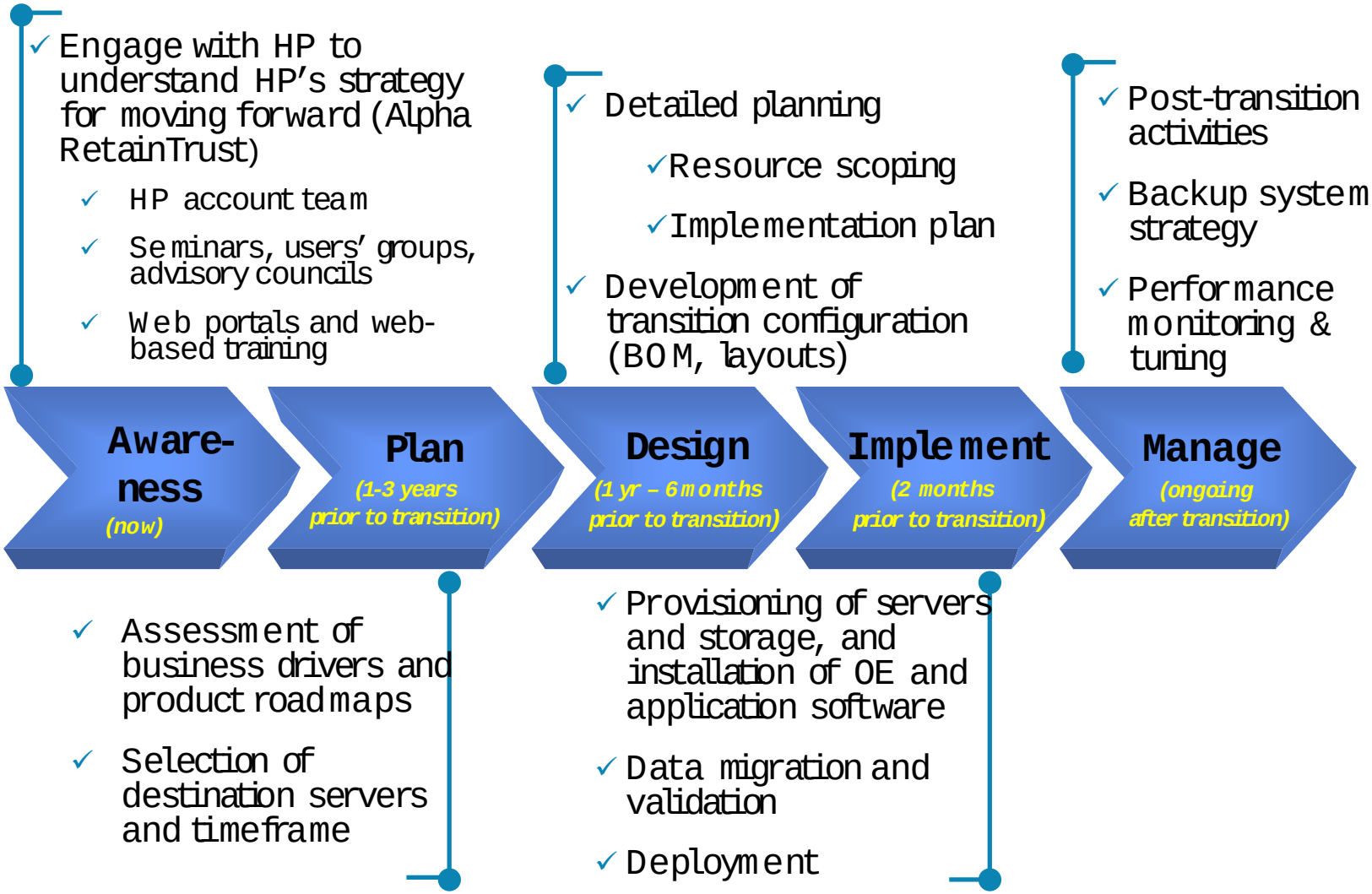


- *Single System Image*
- *Lower Cluster Admin overhead*
- *Best UNIX cluster in Business*
- *No need to take the cluster down to upgrade to subsequent versions*
- *System is available while patches are installed*
- *Easier to manage clusters*
- *Integrated with Compaq Insight Manager*
- *Performance analysis for lsmsa*
- *Single point of user account management for NT and Tru64 UNIX*
- *Only one password to remember*
- *File and print servers are always on*
- *Manage file and print servers as one system*

Highlights: Tru64 UNIX® V5.1A and TruCluster Server V5.1A?

Scalability	▪ **Mixed-speed CPUs (GS Series)** ▪ **Advanced File System DMAPI (Unitree only)** ▪ **OnLine Add and Remove (OLAR) of CPUs,**
Availability	▪ **LAN-based cluster interconnect: Ethernet 100 Mb, Gigabit Ethernet** (10/100 full duplex)** ▪ **Cluster FS enhancements (quotas, cached concurrent read, automatic load balancing)**
Security	▪ **SSO with Kerberos Client implementation** ▪ ssh and ipsec are also available for 5.1A from the website
File system	▪ **LSM cluster mirrored root support**
Networks/Internet	▪ **Enhanced IPsec and Further IPv6 Integration** ▪ **Link aggregation (network trunking)** ▪ **Compaq Secure Web Server**

Transition lifecycle: a systematic approach



Alpha RetainTrust Services and Resources