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Status
IA64 &
Portierung

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Commitment to our Customers

No changes to previously announced plans

+ one significant enhancement

- There is *no change* to our commitment to the *Alpha roadmap* through EV7/79 and Marvel
- There is *no change* to our commitment to *port OpenVMS* to Itanium and transition our Alpha customers over time
- There is *no change* to our commitment to *continue releases of Tru64UNIX on Alpha* through at least 2006

- Plus we will *enhance our UNIX* on Itanium™ by converging HP/UX and Tru64

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IA 64 Status

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Terminology

- IA-64
  - Intel® processor architecture
- Itanium™ processor family (IPF)
  - Family of microprocessors that implement IA-64
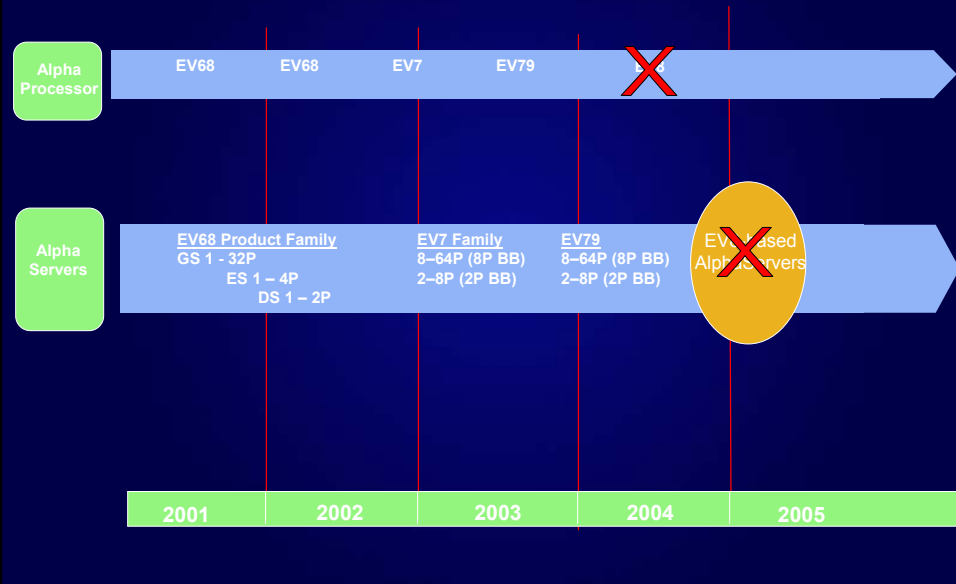- Itanium
  - Specific member of the family

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Reasons behind the IPF migration

- Business planning for the fiscal 2001 year precipitated a competitive analysis
- EV7 Marvel systems were clearly competitive industry leading products
- EV8 would be competitive but differentiation compared to previous products would be less
- Investment to execute flawlessly would be significant and resource availability added great risk
- Conclusion of the evaluation team was that we need a microprocessor partner (Intel IPF)
- Executive review and analysis lead to same conclusions and a collaboration with Intel was pursued.
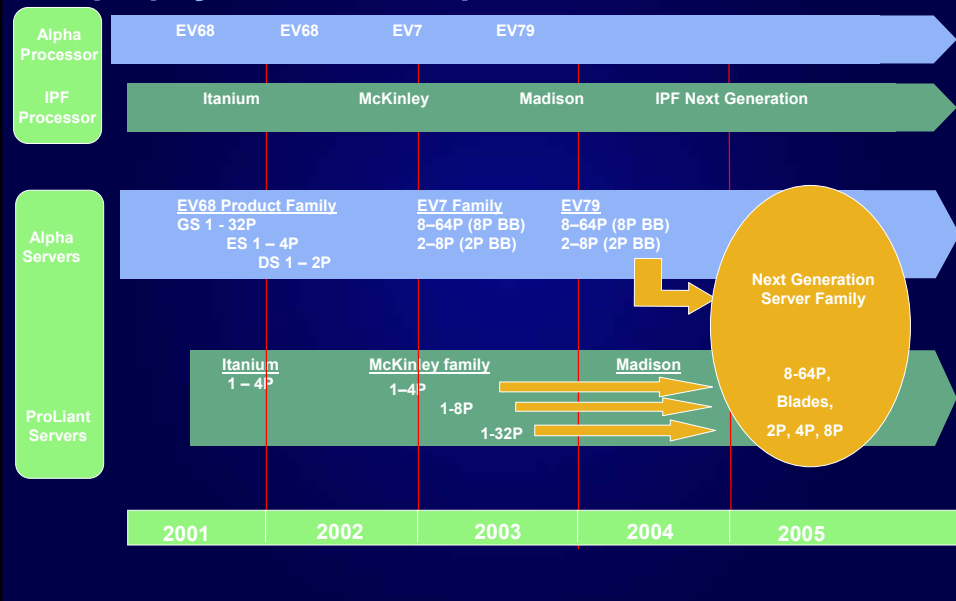

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Details of the Agreement

- Compaq will, over time, converge all 64-bit enterprise servers onto the Itanium™ Processor Family microprocessor architecture
- Compaq transfers 64-bit Alpha-based technology, tools, and resources to Intel to enhance Itanium™ Processor Family development
  - Includes compiler and microprocessor technology, compiler engineers, microprocessor engineers, infrastructure tools and support
  - Transferred Compaq resources and technology to accelerate the ramp of Intel's Itanium™ Processor Family capabilities
- Intel and Compaq commit significant joint resources and investments to bring the complete Compaq operating system environments and applications portfolios to Itanium™ -based enterprise servers
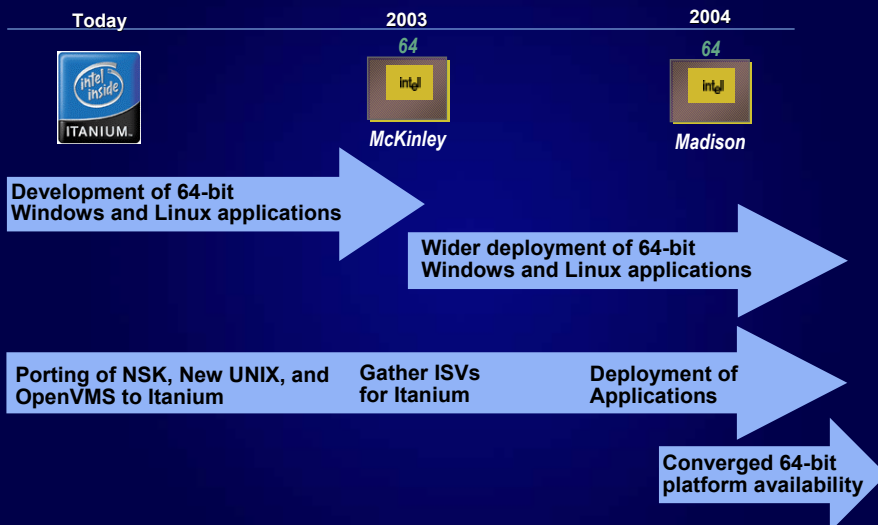
Compaq AlphaServer Roadmap

| Alpha Processor | EV68 | EV68 | EV7 | EV79 | ✗ | |

| Alpha Servers | EV68 Product Family
GS 1 - 32P
ES 1 – 4P
DS 1 – 2P | EV7 Family
8–64P (8P BB)
2–8P (2P BB) | EV79
8–64P (8P BB)
2–8P (2P BB) | EV79 Based Alpha Servers ✗ |

| 2001 | 2002 | 2003 | 2004 | 2005 |

Compaq System Roadmap with IPF

| Alpha Processor | EV68 | EV68 | EV7 | EV79 |

| IPF Processor | Itanium | McKinley | Madison | IPF Next Generation |

| Alpha Servers | EV68 Product Family
GS 1 - 32P
ES 1 – 4P
DS 1 – 2P | EV7 Family
8–64P (8P BB)
2–8P (2P BB) | EV79
8–64P (8P BB)
2–8P (2P BB) |

Next Generation
Server Family

| ProLiant Servers | Itanium
1 – 4P | McKinley family
1–4P
1-8P
1-32P | Madison |

8-64P,

Blades,

2P, 4P, 8P

| 2001 | 2002 | 2003 | 2004 | 2005 |

What does this mean?

- Systems that previously were all internal Compaq intellectual property, now contain Intel's intellectual property.
- Stricter control on information dissemination is required
- Software comes from 4 major sources:
  - OpenVMS
  - New Unix
  - Windows
  - Linux
- Protection of external IP prevents previous levels of detail without NDA's for both Compaq and the external partners

64-Bit Development and Deployment

Today	2003	2004

64 — ITANIUM.

64 — McKinley

64 — Madison

Development of 64-bit Windows and Linux applications

Wider deployment of 64-bit Windows and Linux applications

Porting of NSK, New UNIX, and OpenVMS to Itanium

Gather ISVs for Itanium

Deployment of Applications

Converged 64-bit platform availability

Alpha Status

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Alpha Microprocessor Roadmap

|	EV68C	EV68C	EV7	EV79
Chip Characteristics				
Frequency (GHz)	1	1.25	~1.2	~1.6-1.7
Power (W) max	65	75	155	120
Die Size (mm2)	125	125	400	300
Technology				
Vdd (V)	1.65	1.65	1.65	1.2
CMOS (drawn um)	0.18	0.18	0.18	0.13 - SOI
Packaging	FC/LGA	FC/LGA	FC/LGA	FC/LGA
Pins	675	675	1443	1443
Schedule				
FirstTapeOut	Mar-00	Mar-00	Apr-01	Q1'03
Volume	Apr-01	Dec-01	Q3'02	H1'04

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Alpha 21364 Features

- Alpha 21264 core with enhancements
- Integrated L2 Cache
- Integrated memory controller
- Integrated network interface
- Support for lock-step operation to enable high-availability systems.

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Alpha 21364 Technology

- 0.18 μm CMOS
- 1250 MHz
- 135 Watts @ 1.65 volts
- 4 cm^2
- 7 Layer Metal
- 152 million transistors
  - 15 million logic
  - 137 million SRAM

21364 System Block Diagram
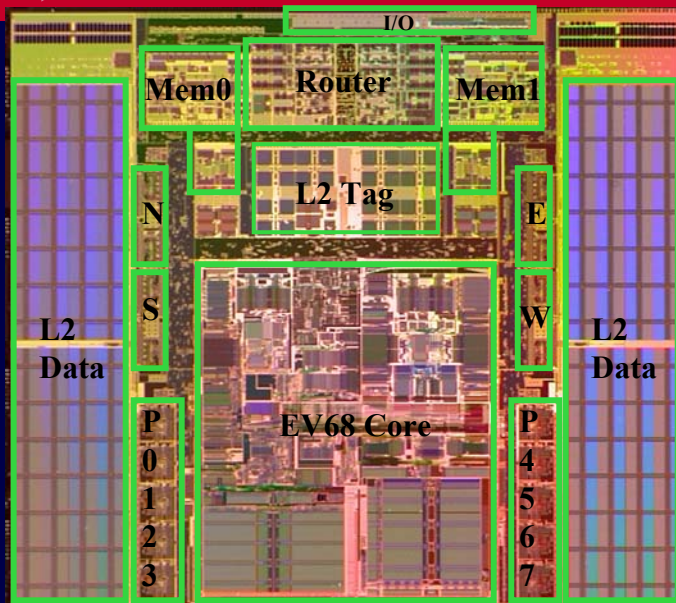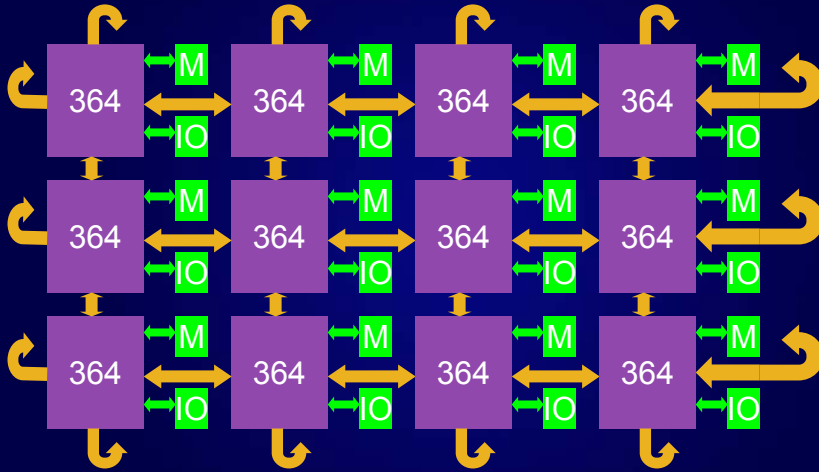
New Family of AlphaServers in 2003

- Small, entry-level systems at low prices, expandable in modular increments to large capacity

- Comprehensive and easy to use system management across the entire product family

- Partitions - Hard, Semi-Hard, & Soft - as small as 1 processor across the entire family

- Dependable systems with Hot-Swap and redundant CPUs, memory, disks, power, fans, and PCI-X options.

- Outstanding system performance

- All systems built with Compaq's industry standard memory, storage, network, and graphics options

- Scalable computing using with independent, modular components for I/O, memory, and processing

EV7 – The System is on the Silicon….
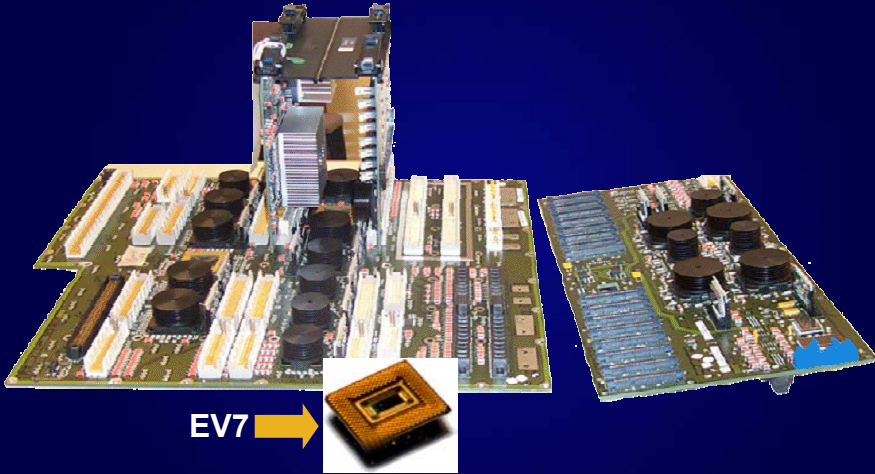
Compaq AlphaServer GS160/320 electronics gets replaced within the EV7 chip !

EV7 ➡️

Modular System Implementation

Wide Range of Capabilities

Common Components

- EV7 CPUs
- RAMbus Memory
- I/O: PCI-X & AGP 4X
- System Management

3 Base
System Drawers +
2 I/O Drawers

Supports the best, most price competitive industry standard devices available from Compaq

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No Changes
Delivering the *AlphaServer*™ roadmap

- **Full commitment to continue implementing the Alpha roadmap per the current plan-of-record**
  - Delivering improved performance and faster implementations of the Alpha microprocessor
  - Deliver EV7 and EV79 version of the Alpha processor, which will be used in our upcoming "Marvel" systems
  - Systems will support Tru64 UNIX and OpenVMS, as well as Linux
  - Continue to sell our Alpha systems as long as there is customer demand, which we anticipate to be at least several years beyond the introduction of the EV79 Alpha processor, with support continuing to extend a minimum of five years beyond that

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Tru64 UNIX™ Enterprise UNIX Product Directions

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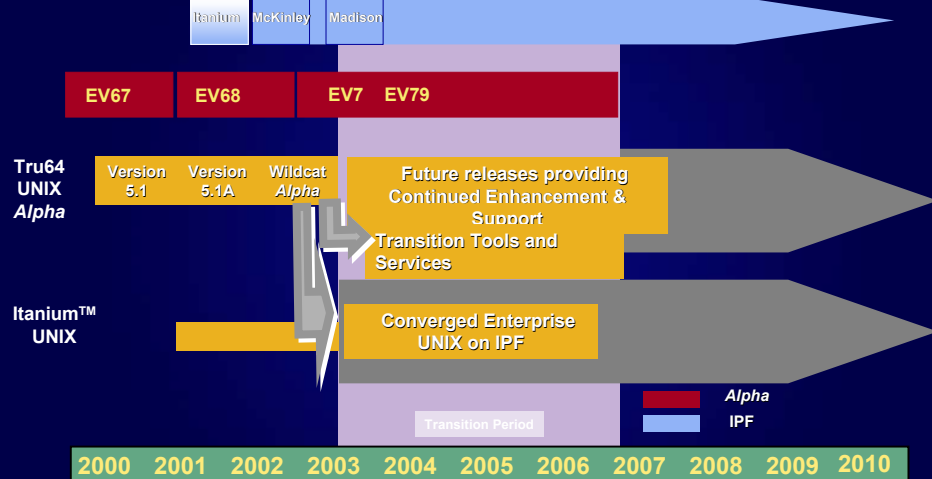### Delivering the *Tru64* UNIX on Alpha Roadmap

- **Commitment to continue implementing the *Tru64* UNIX on Alpha plan-of-record**
  - Alpha support
    - New family of EV7 based servers in late 2002/early 2003
  - Operating System enhancements
    - *Tru64* product enhancements in the Wildcat release
    - Additional operating systems enhancements committed through 2006

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One Significant Enhancement

Goal: Create the industry's best Enterprise Unix on Itanium ™

- Converge leadership technologies from both HP-UX and Tru64 UNIX
  - e.g. RAS functionality, clustering, performance oriented features, System Management, file & storage management, networking, APIs, etc.
- Assured Customer and ISV migration path
  - Source compatible upgrades from Tru64 UNIX
  - Continued support for Tru64 UNIX on Alpha long-term
- One unified and strengthened ISV portfolio on Itanium Family
  - Most Tru64 UNIX ISV partners are shared by HP-UX today

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Enterprise UNIX Roadmap for *Alpha*™ & Itanium™

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Major Focus: Customer investment protection & smooth transition to Itanium

- Continued support of Tru64 UNIX on Alpha (EV7/EV79)
- Move to an industry leading Enterprise UNIX on Itanium on **your timetable**
- "*Customer Assurance Program*" to enable customers' successful transition

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OpenVMS on the Itanium™ Processor Family

Base Operating System Implementation
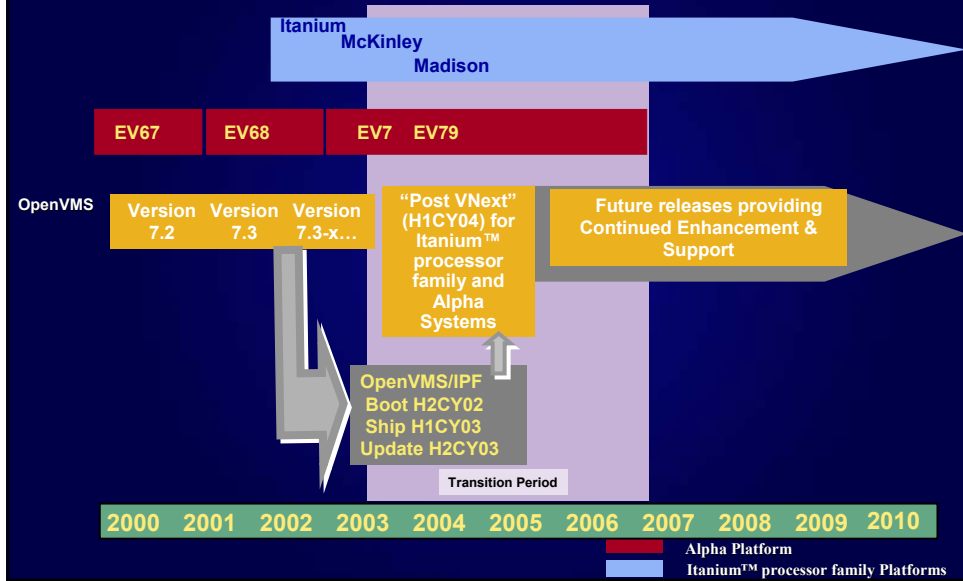
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No Changes
Delivering the OpenVMS Roadmap

- **Commitment to continue implementing the OpenVMS plan-of-record**
  - Alpha support
  - Continue Itanium™ port and release as scheduled
  - Migrate the OpenVMS application portfolio to Itanium™
    - Layered Software
    - ISV solutions

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OpenVMS Alpha and Itanium™ processor family porting timeline

Itanium
McKinley
Madison

EV67 | EV68 | EV7 EV79

OpenVMS

| Version 7.2 | Version 7.3 | Version 7.3-x… |

"Post VNext" (H1CY04) for Itanium™ processor family and Alpha Systems

Future releases providing Continued Enhancement & Support

OpenVMS/IPF Boot H2CY02 Ship H1CY03 Update H2CY03

Transition Period

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Alpha Platform
Itanium™ processor family Platforms

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H1 02 — H2 02 — H1 03 — H2 03 — H1 04

May
C, BLISS, IMACRO Cross Compilers; CRTL; Linkers; Librarian

July/August: 1st Boot occurs
August/September: Working Boot Environment
December: C, BLISS, IMACRO Native Compilers

H1 03: 1st Release Audience: Key ISVs, Partners, Early Adopters
OpenVMS/IPF - Alpha/IPF Common Source
CRTL, C, C++, Fortran, BLISS, IMACRO, Java
TCP/IP, DECnet Phase IV, DECset components
Full Support from Services

First Ship

H2 03: 2nd Release Audience: Key ISVs, Partners, Early Adopters
Limited cluster functionality
Additional Compilers: Pascal, BASIC, COBOL
LPs: Advanced Server, RTR, DECnet+, XML, Apache, NetBeans
Full Support from Services

OpenVMS Itanium™-based Servers Port Roadmap

Production Quality → **OpenVMS 3rd Release**

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OpenVMS Itanium™ processor family product porting rollout

H2 2003

OpenVMS core: Clusters - limited configurations, DECwindows Motif, Monitor Utility

Networks: DECnet Phase IV, DECnet-Plus, TCP/IP, Advanced Server, DFS

Compilers: C, C++, COBOL, BLISS, ADA, Java, Fortran, IMacro (Macro32 & AMacro port), CRTL, Pascal, BASIC

Development tools: LSE, CMS, MMS, DTM, Enterprise Toolkit

e-business: XML, CSWS (Apache), NetBeans, RTR, COM

2004

OpenVMS core: Expanding Clusters (multiple phases), Shadowing, DECram, RMS Journaling, GKS, Phigs, Media Mgmt Svcs, Galaxy

Networks: X.25

Development tools: PCA

e-business: Mozilla, BridgeWorks, Enterprise Directory

Mail & Messaging: MAILbus 400, IMAP4 Server

Service tools: WEBES

Middleware: DCE, ACMS, DECforms, FMS, DECforms and TP Web Connectors, TP Desktop Connector, Datatrieve

System management: Availability Mgr, Web Agents, TDC, OMS, ECP Tools, GCU/GCM

Storage products: ABS, SLS, SW RAID, DFO

Many others...

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What will not be ported:

- Products
  - not ported from VAX to Alpha
  - retired or in process of being retired (EOL established, occurs before IVMS release date)
  - with planned retirements (not yet formally implemented
  - with clear replacement strategies
  - in (or moving to) maintenance mode

- Exceptions: FMS and Datatrieve will be ported to Itanium (tm) processor family.

So, what's different? (1 of 3)

- Calling Standard
  - Intel® calling standard with OpenVMS modifications
    - Still being designed
  - All Compaq provided tools will "know" about these changes
  - Your code that "knows" about the standard may have to change
    - Most code not affected

So, what's different? (2 of 3)

- Object file format
  - ELF/DWARF industry standard
    - ELF - Executable and Linkable Format, IA-64 object code, images, etc.
    - DWARF - Debugging and traceback information (embedded in ELF).
  - All Compaq provided tools will "know" about these changes
  - User written code that "knows" the object file format may have to change
  - Image header "tricks" may no longer work (Flip a bit to turn on/off debugging)

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So, what's different? (3 of 3)

- Floating point data types
  - Itanium™ processor family supports IEEE float only
  - All compilers that currently support F, D, G, S, T, and X (S and T are native IEEE formats) should continue to do so on Itanium™ processor family
  - Documentation forthcoming with details
- Licensing
  - No change

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What code will I need to change?

- Architecture Specific code
  - Assembler code
- Build command files
  - `$ if .not. Alpha    ! Assumes VAX`
- C/C++ conditionals
  - `#ifndef Alpha        ! Assumes VAX`
- Alpha specific compiler built-ins may have to be recoded

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Binary Translator

- Will translate valid Alpha OpenVMS image
  - Image(s) must be linked on OpenVMS V6.2 or later
  - May directly translate VAX images
- Will translate images translated with DECmigrate
- Restrictions: native Alpha binary code
  - Only user- mode apps
  - Non privileged instruction
  - No self-modifying code
  - No system memory space reference
  - No user-written system services

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OpenVMS:
What version is being ported to Itanium?

We are adding IPF support to the Alpha code base to create a single set of sources.

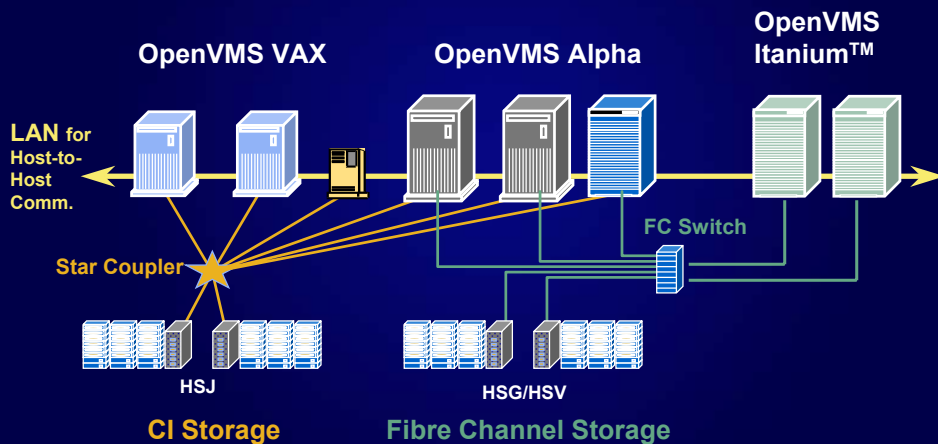We will build both Alpha & IPF releases from the same sources.

A future release will support IPF platforms. Its version number cannot be predicted at this time.

The first IPF release will reflect on-going development work as it is available.

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Alpha-to-Itanium vs. VAX-to-Alpha

- VAX-to-Alpha: huge volume of coding work
  - AMACRO and 1100+ VAX MACRO-32 modules
  - 32b to 64b
  - data alignment
  - atomicity
  - multiple, out-of-order execution streams
- Alpha-to-Itanium
  - much less coding but more complex

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Itanium™ comes to *OpenVMS* Clusters

OpenVMS VAX   OpenVMS Alpha   OpenVMS Itanium™

LAN for Host-to-Host Comm.

FC Switch

Star Coupler

HSJ   HSG/HSV

CI Storage   Fibre Channel Storage

Itanium™ comes to *OpenVMS* Clusters

- Clustering is a software architecture
  - underlying chip is easy to deal with
- Will initially support mixed Alpha-Itanium™ clusters in a phased roll out
- Evaluating customer interest in VAX mixed architecture cluster support

Portable OpenVMS

- 1978 VAX
- 1992 Alpha
- 2003 Itanium
- 200n ?