

CHARON and ORACLE DB

# The Hybrid Emulation Solution

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When Virtual Becomes Reality

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# Stromasys

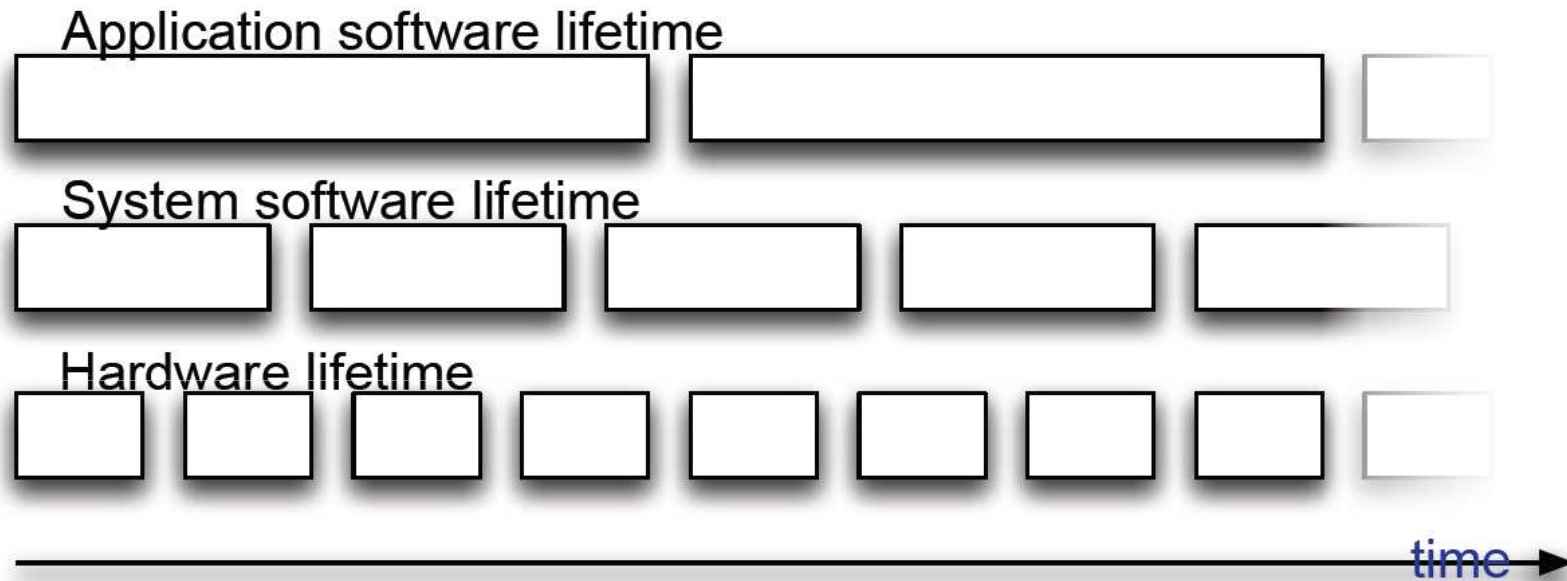


- A spin-off from DEC / Compaq / HP in 1998
- “Preserving SW investments over HW generations”
- Source code migrations, and
- Cross-platform virtual machines, sold under the CHARON brand name.
  - 1996: CHARON-11
  - 2000: CHARON-VAX
  - 2006: CHARON-AXP
  - *2011: CHARON-HP3000*



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## Challenge #1: Lifetime mismatch



Source: Lehrbuch der Softwaretechnik; Balzert; Spektrum Akademischer Verlag, 1996







## VAX and Alpha users, what now?

- *(Do nothing)*
- *(Replace application)*
- Binary translation
- Native migration
- Virtualization



## Binary translation

- From VAX to ALPHA: Using OMSVA
- From ALPHA to Itanium: Using OMSAI
- Both delivered by Stromasys to HP, freeware
- ✓ Fastest and most inexpensive solution
- ✓ Does not need the source code
- However, some serious limitations apply, such as the availability of older languages on the target platform
- User-mode applications, only
- VMS only
- Does not allow for future enhancements on target platform
- VAX to Itanium needs two steps
- Will impact performance
- Not all applications are binary translatable

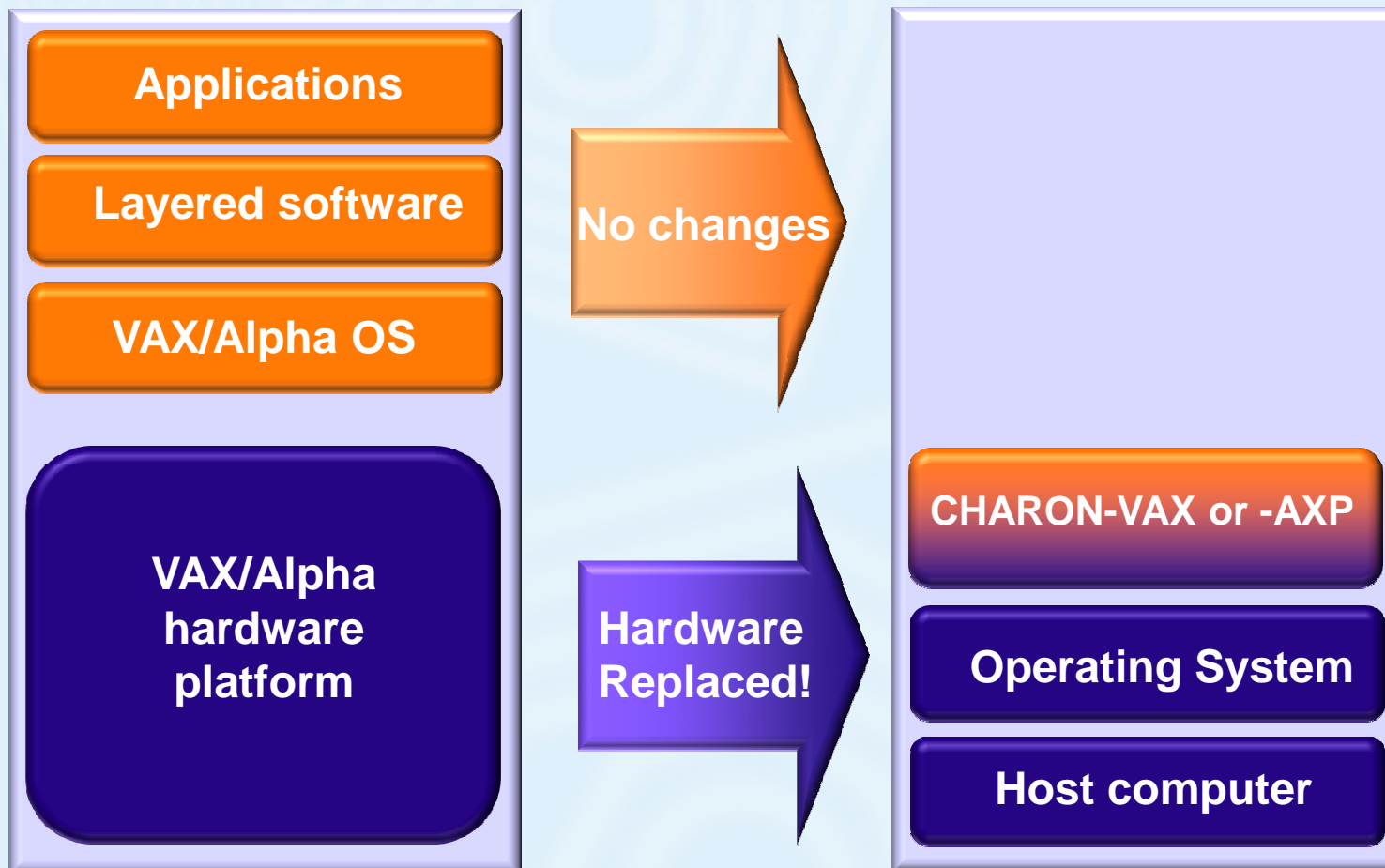


## Native migration to a new platform

- Produces native application on the target platform
- Almost every application can be migrated
- ✓ Partial redesign during migration allows for replacing the programming language, middleware, user interface and design
- ✓ Further development and maintenance on target platform
- ✓ May give a performance boost
- However, will take long to implement
- Presents serious risks (time, functionality, QA, re-certification)
- Source code needed



# HW virtualization, the principle



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# CHARON characteristics

## **Full hardware compatibility**

- Tested with DEC's diagnostics and architecture tests (AXE)

## **Operating System independent**

- Runs VMS, VAXEn, Tru64 UNIX, Ultrix, NetBSD, etc,
- All versions

## **Easy to migrate**

- No VAX/Alpha binary code changes
- No VAX/Alpha application source code required
- No special host system or VAX/Alpha Operating System drivers

## **Keep the benefits of current operating systems**

- Supports NI clustering, shared disk clustering, shadowing, striping
- DECnet, Ethernet, TCP/IP, LAT...
- VMS security

## **Add the benefits of modern technologies**

- Lower cost of ownership
- Higher performance
- Smaller system footprint
- Faster networking
- More and faster storage, SAN, NAS
- Hardware independency (upgradeable/replaceable host)
- Multiple virtual systems on one host, simple server consolidation



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## **Challenge #2:** **Benefit from future OracleDB developments**

- No further development of Oracle Classic database products on Itanium systems
- Requires careful evaluation for the OpenVMS and TRU64 community
- Without a change, the applications can no longer benefit from future OracleDB developments
- Moving applications to other platforms can be a desirable modernization, but requires a time frame and a cost that can range for significant to unbearable
- 'De-platforming' is not an action lightly undertaken for business critical software
- A more gradual approach that does not require in immediate application rewrite would be highly desirable.

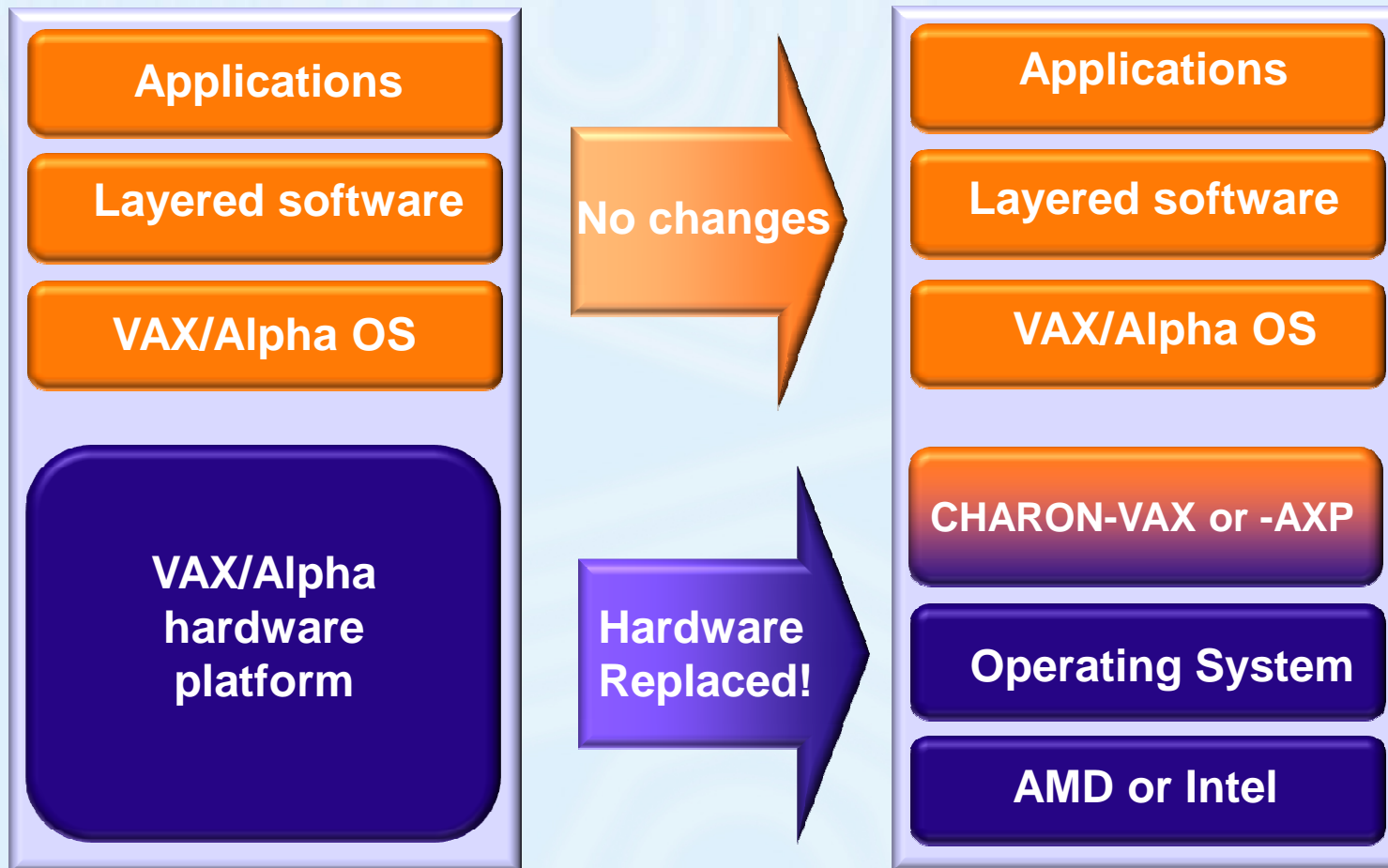


## CHARON architecture

- Developed in mid 1990s
- Tool for porting applications from a PDP-11 to an industry standard system, in multiple steps
  - Move the whole environment to the new host system
  - Later, move parts of the application to the native host system
    - Re-write code
    - Keep «tunnels» between the virtual and the host environment for communication between application parts



# HW virtualization, the principle

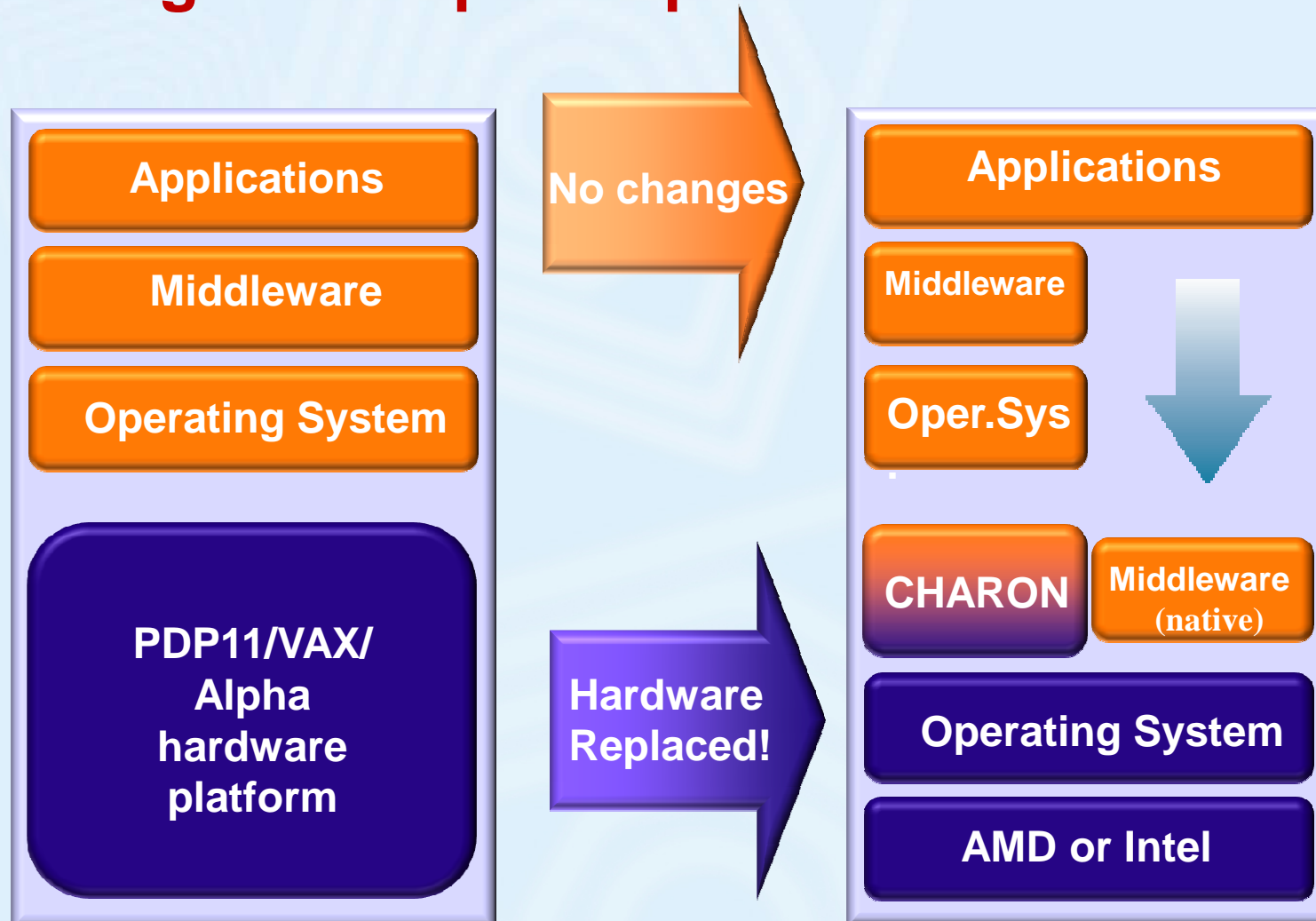


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## Porting in multiple steps

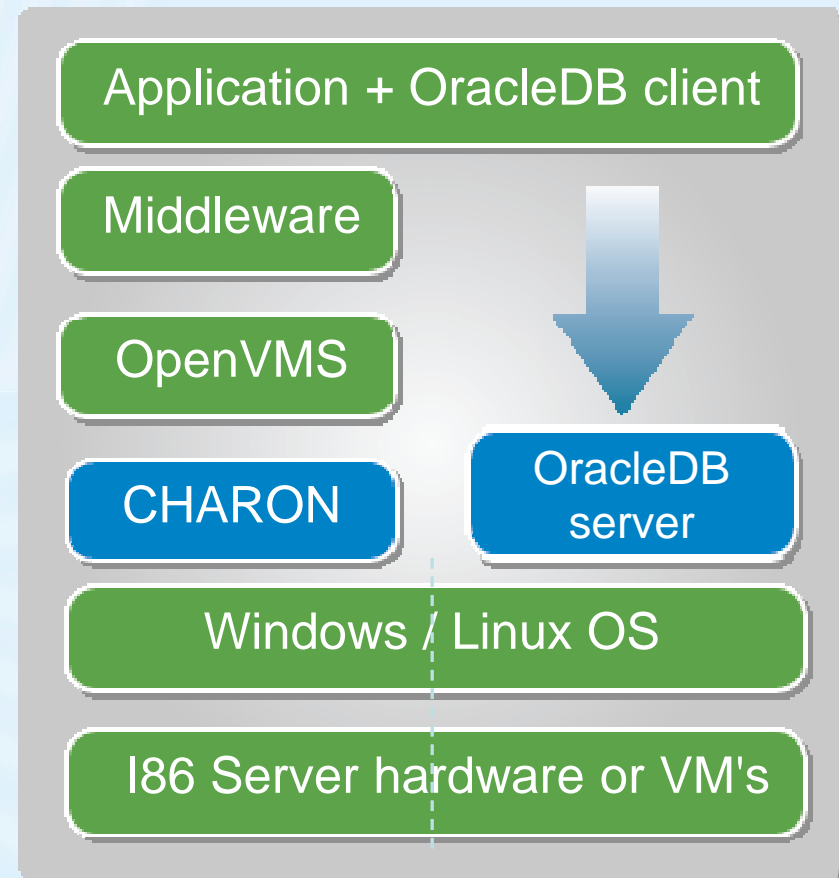
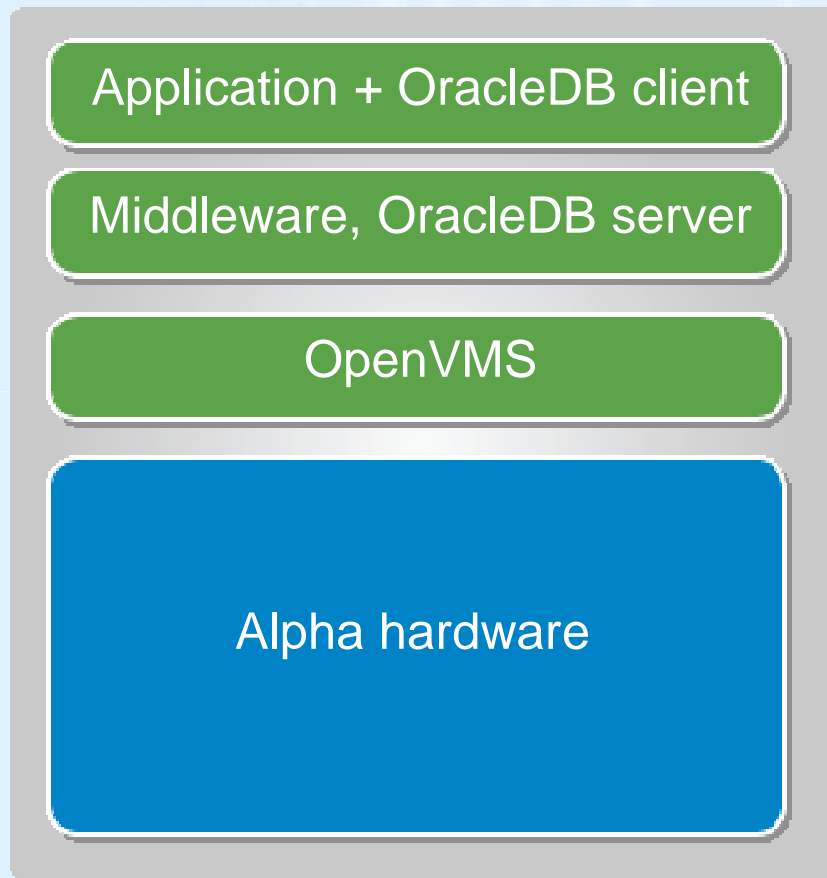


## Hybrid virtualization

- Modular components (e.g. the Oracle database) for which a compatible version on a new architecture exists, can be taken out of the virtual CHARON environment.
- Due to CHARON's and OracleDB's designs, this does not require any change in the original application



## Hybrid virtualization concept



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## The “hybrid migration”

- Install and run Oracle on Windows or Linux
- Export database from OpenVMS/Tru64 Unix to PC platform
- Keep the application running on CHARON-AXP
- No need to change application
- Oracle will enjoy the performance of the modern x86 platform
- The client will work with future releases of the Oracle database Server
- Stromasys and Oracle Database on OpenVMS engineering are working together to provide the OpenVMS and TRU64 community with a strategy to benefit optimally from Oracle database product upgrades



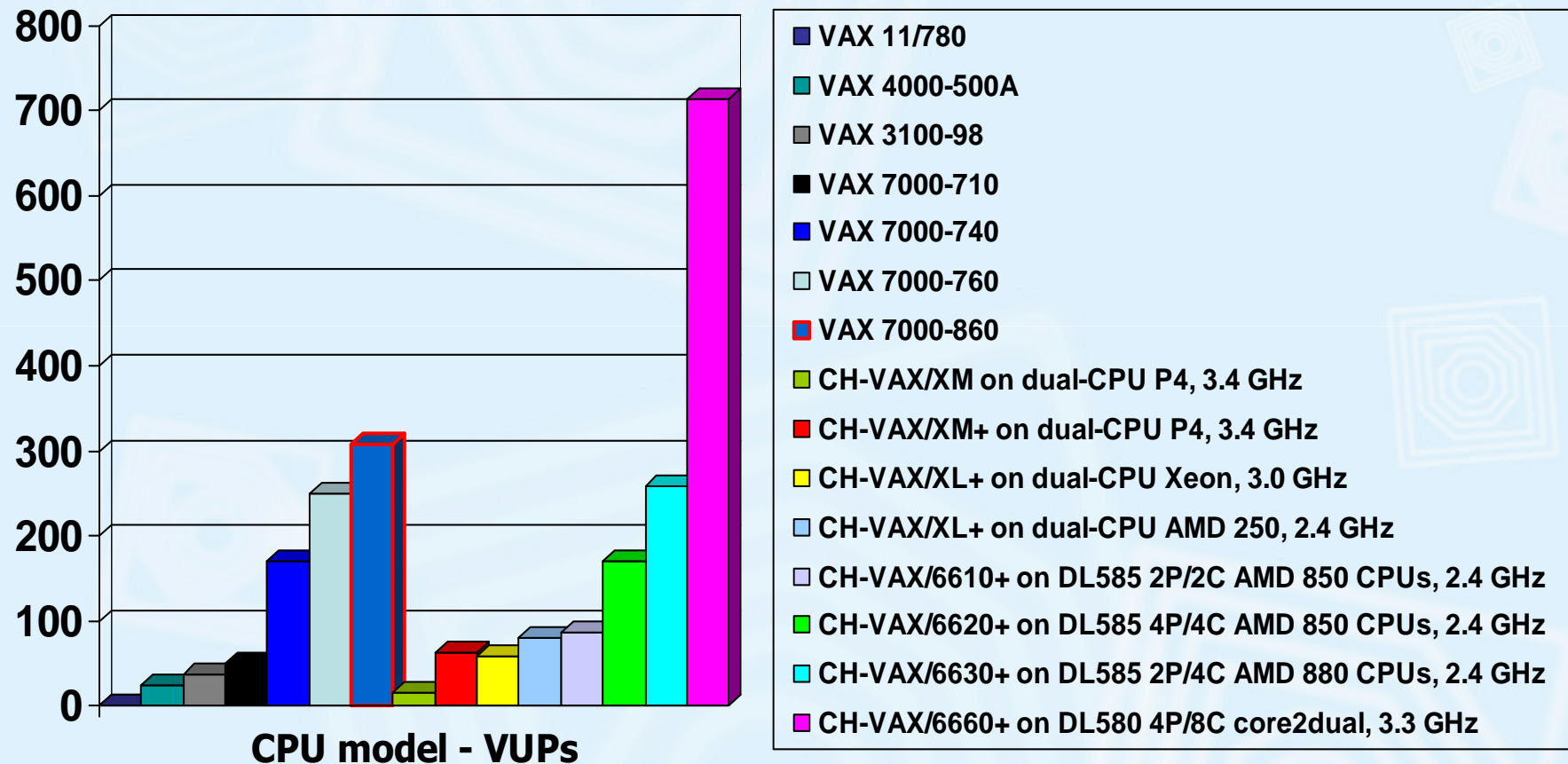


## Challenge #3: The performance

- CHARON-VAX
  - Much faster than any VAX that DEC ever designed
  - The performance scales with the host CPU tact frequency
- CHARON-AXP
  - Currently, the execution speed of a virtual Alpha CPU is limited by the current host technology at a level that is lower than that of the fastest hardware Alpha CPU (~1250 MHz)
  - With Alpha hardware emulation, the search for ever more performance has brought the hybrid solution back



# VAX performance



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# AlphaServer performance

## Single CPU comparison

AlphaServer 400 4/166	18%
AlphaServer 400 4/233	20%
AlphaServer 1000 4/200	31%
AlphaServer 2000 4/200	33%
AlphaServer 2100 4/200	33%
AlphaServer 1000 4/233	35%
AlphaServer 1000A 4/233	35%
AlphaServer 2000 4/233	35%
AlphaServer 2100 4/233	35%
AlphaServer 2000 4/275	42%
AlphaServer 2100 4/275	42%
AlphaServer 2100A 4/275	42%
AlphaServer 1000A 4/266	46%
AlphaServer 300 4/266	47%
AlphaServer 1000 4/266	47%
AlphaServer 2100 5/250	56%
AlphaServer 2100a 5/250	56%
AlphaServer 1000 5/300	61%
AlphaServer 1000A 5/300	61%
AlphaServer 2000 5/300	64%
AlphaServer 2100 5/300	64%
AlphaServer 2100a 5/300	64%
AlphaServer 800 5/333	66%
AlphaServer 1000A 5/333	66%
AlphaServer 2100 5/375	69%
AlphaServer 2100a 5/375	69%
AlphaServer 4000 5/300	69%
AlphaServer 4100 5/300	69%
AlphaServer 8x00 5/300	69%
AlphaServer 800 5/400	73%
AlphaServer 1000A 5/400	73%
AlphaServer 2000 5/375	77%

## STROMASYS VIRTUALIZATION TECHNOLOGIES



AlphaServer 8x00 5/350	89%
AlphaServer 8x00 5/440	95%
AlphaServer 1200 5/400	98%
AlphaServer 4000 5/400	98%
AlphaServer 4100 5/400	98%
AlphaServer 800 5/500	100%
AlphaServer 4000 5/466	106%
AlphaServer 4100 5/466	106%
AlphaServer 1000A 5/500	120%
AlphaServer 8x00 5/625	123%
AlphaServer 1200 5/533	156%
AlphaServer 4100 5/533	156%
AlphaServer 4100 5/600	176%
AlphaServer DS10 6/466	227%
AlphaServer DS20 6/500	237%
AlphaServer ES40 6/500	247%
AlphaServer GS60 6/525	250%
AlphaServer GS140 6/525	250%
AlphaServer GS60 6/575	270%
AlphaServer GS140 6/575	270%
AlphaServer DS20E 67/667	280%
AlphaServer ES40 67/667	280%
AlphaServer GS160 67/731	300%
AlphaServer GS320 67/731	300%
AlphaServer DS20E 68/833	310%
AlphaServer ES40 68/833	340%
AlphaServer DS15 1GHz	370%
AlphaServer DS25 1GHz	445%
AlphaServer ES45 68/1000	470%
AlphaServer ES45 68/1250	570%
AlphaServer ES47 1.15 GHz	570%
AlphaServer ES80 1.15 GHz	570%



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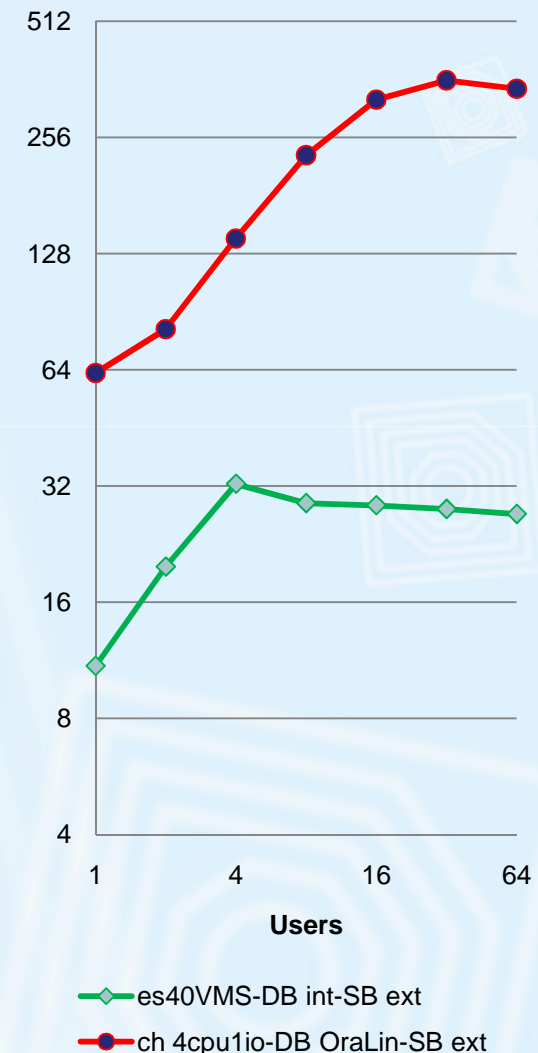
# Performance boost

## Oracle Swingbench

- On VMS 8.3 on CHARON-AXP emulating ES40 with 4 CPUs on a double CPU Intel X5660 (8 cores in total) hosting server. Oracle database and CHARON were installed and ran in parallel on Linux Fedora 14 64bit.
- On a physical AlphaServer ES40 with 4 EV67 667MHz CPUs. Oracle database and Swingbench client are installed in the same VMS 8.3 environment.



### TPS



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## Hybrid virtualization benefits

- The OpenVMS client can work transparently with the data that is exported from an OpenVMS OracleDB to a Linux OracleDB
  - Simple, automated process
  - Oracle tools available
- Oracle compatibility allows an immediate performance increase by placing the same data on a modern platform
- The (virtual) system hosting the application is off-loaded, resulting in higher available CPU power for the remaining parts of the application
- The client will work with future releases of the Oracle database Server



## Oracle Rdb

- Does not exist on I86 or SPARC
- However, the principle of splitting the Client and server over two virtual systems still applies, and will lighten the emulated system's load
- Stromasys and Oracle Rdb Engineering work together to develop a specific CHARON-AXP implementation (CHARON-AXP/RDB), optimized for Oracle Rdb server operation
- Techniques currently being investigated
  - Modification of Alpha memory mapping
  - a CPU that is optimized for the processing of database pointers,
  - a fast I/O path (with integrated iSCSI)



## Bottom line

- The next step in cross-platform virtualization: In a totally transparent way for the guest OS and its applications, divide the overall system in logical parts and provide the best performing (virtual) platform for each of the parts.
- As in the above OracleDB example, the total solution can run on a single host server (if powerful enough), but this strategy lends itself very well to the virtual environment of today's data center. Licensing costs of Middleware is often based on the total number of cores in the total system running the Middleware. In this case, since the performance in the local host and via a network connected server are similar, a separate host can be sized for just the Oracle Server needs.



## Why virtualization

- Hardware is end-of-life
- Service costs have increased significantly
- Operational costs (e.g. energy consumption, footprint) are excessive
- Application rewriting and re-certification may be expensive & risky
- Experts and/or application source code not always available
- Automatic binary conversion to OpenVMS/IPF does not always work
- Market expects modern platforms
- Higher performance needs
- Tru64 Unix





# Benefits

- Replace old and expensive HW by modern and **commodity** HW
- Significantly reduce cost of ownership
- Preserve current investments
  - Keep current applications
  - Keep current business processes, no impact on day-to day operations
  - No re-training, no re-staffing, **no re-certification**
- Extend on new platforms, create room for future growth
- Become HW independent
- Increase performance
- Scalable size and licensing conditions in line with client's needs
- Upgrade immediately, quickly, simply
- Reduce space needs significantly



## Some CHARON-VAX users

- BT, US Dept. of Defense (Pentagon), many Navies, Air Forces and Armies, Contraves, Dresdner Bank, Bosch, CMC Electronics, GAFSA, Bank Morval, Ferrero, Ishida, Brittany Ferries, Robotek, Stahlwerk Bous, Alcatel, Lexmark, many hospitals in USA and Australia, many counties in USA, EDF, Warner Robbins, Ship Analytics, Vattenfall, Dow Chemical, Bell Group, Janssen Pharmaceutica, ProQuest Allison, many universities, AKZO Nobel, General Dynamics, Rolls Royce, GE, P&R, Vodaphone, Philip Morris, Philips, Jaguar, Opel, British Energy, Elvia, Teijin Dupont, Optus, IASCO, NAMSA, Corus steel, Samsung, Toshiba, ABB, Raytheon, HP, EST Enerji, Nortel, Scania, VEBA, BREGA, Swedish Steel, Barco, Oracle, Agfa, Northrop Grumman, TRW, Airbus, Boeing, Lockheed, Voestalpine, Medisuisse, Migros PK, Spida, Vibro-Meter, Milano Railways, SBB/CFF, Hitachi, Nikon, Fujitsu, HSBC, EDS, Thales, Nokia, EADS, Ferrari, Ford, Fidelity ... and many others



# Some CHARON-AXP users

## Europe

- ✓ Arma Suisse
- ✓ BCC
- ✓ BP
- ✓ Bundeswehr
- ✓ Commerzbank
- ✓ Degremont
- ✓ Eurofighter
- ✓ European Space Agency
- ✓ Fugro UK
- ✓ Huntsmann Chemicals
- ✓ Gallimard France
- ✓ GlaxoSmithKline Italy
- ✓ Kirchenrat Stuttgart
- ✓ Metalli Italy
- ✓ Oto Melara
- ✓ Philips Medical Systems
- ✓ Police Netherlands
- ✓ RAF UK
- ✓ Stockholm Public Transport
- ✓ Urano Germany

## Global

- ✓ Nikon

## Americas

- ✓ ACSSD
- ✓ Brooks Automation
- ✓ Bureau of Census
- ✓ Cargill
- ✓ Catalyst Paper
- ✓ Caterpillar
- ✓ Cedar Rapids Corn Mill
- ✓ Central de Valores Chili
- ✓ City of Oklahoma
- ✓ Fedex
- ✓ General Dynamics
- ✓ ITT
- ✓ Jefferson Parish Sherriff
- ✓ New Brunswick Power
- ✓ OSPI
- ✓ Penton
- ✓ RL Polk
- ✓ South Central Power

## Australia/New Zealand

- ✓ ABC
- ✓ St. Vincents Hospitals
- ✓ Workcover
- ✓ Wyeth Pharmaceuticals



## For more information

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