

OpenVMS Emulation on PCs

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According to HP's latest roadmap for OpenVMS,¹ OpenVMS on Integrity will be supported for several years. However, support for OpenVMS on VAX and Alpha machines may potentially end in the next two to three years. Many OpenVMS systems have been running critical applications for decades. Reprogramming these applications to run on different machines is an expensive, time-consuming, and risky proposition.

One alternative is to not touch the applications, but to run them under emulation on modern-day commodity x.86 PC servers. In this article, we review vtAlpha and vtVAX, a pair of emulators that allow OpenVMS and Tru64 applications to run unchanged on bare-metal or virtualized Intel or AMD x86 servers. vtAlpha is a product of AVTware (<http://www.avtware.com/>) and vtVAX is a product of Vere (rhymes with *fair*) Technologies (<http://www.vax-alpha-emulation.com/>). Both companies sell both products, and both products are mutually supported by the companies' respective resellers.

The Advantages of Emulation

Aged software is reliable. Its bugs have been worked out, its features have been fine-tuned, and its users have mastered it. Good software does not wear out and often does not become obsolete.

So why not keep it? If migration to a different platform is considered, a major investment looms, new bugs will be introduced, and users will have to be retrained. The emulation services provided by vtAlpha and vtVAX eliminate these problems. Migration to an x86 host simply requires the following:

- Install vtAlpha or vtVAX on the host machine.
- Define a specific Alpha or VAX configuration
- Copy the disk contents of the VAX or Alpha machine to the disks of the PC host.
- Boot the virtual Alpha or VAX machine in the same way as its physical counterpart.

At this point, the operating system, all HP utilities, all third-party products, and all custom applications will run in the same way that they did on their original physical system. No changes to applications are required. There is no user retraining nor are there system administration changes. Even program development remains the same. The vtAlpha or vtVAX virtualization layer ensures that the new hardware platform will behave exactly like the VAX or Alpha system that it replaced. Both the OpenVMS and Tru64 operating systems are supported.

Several ancillary advantages can also be realized:

- System reliability is improved since newer equipment is being used rather than aging disks and processors.

¹ HP Clarifies the Future of OpenVMS, *Availability Digest*, July 2013.
http://www.availabilitydigest.com/public_articles/0807/openvms.pdf

- Performance may be increased since today's commodity servers are much faster than the older VAX and Alpha servers, and higher speed networking is available.
- Maintenance expenses can be reduced because scarce Alpha and VAX components do not have to be found.
- The resulting PC hosts use less power, require less cooling, and take up less floor space than the older VAX and Alpha systems.
- The data center configuration becomes simpler since the VAX and Alpha applications are now running on the same systems as the company's Windows and Linux applications.

Common Characteristics of vtAlpha and vtVAX

vtAlpha and vtVAX have several features in common.

They both run on multi-core 64-bit x86 processors. These include Intel's Xeon and i7 processors and AMD's Opteron and Phenom processors.

Both vtAlpha and vtVAX can run on a bare-metal server (i.e., one with no other operating system), or they can run in a virtualized environment such as VMware, Hyper-V, Xen, or KVM. When running bare-metal, several instances of vtAlpha and vtVAX can run concurrently on the same host providing that there is enough processing power, memory, and network connections.

When running as a virtualized machine (VM) under VMware, a vtAlpha or a vtVAX VM can be migrated via vMotion from one physical host to another. This adds a degree of resiliency not found in the original physical systems.

Physical disks and tapes that were configured with the old system can be included in the new PC system, or they can be virtualized by the new system's disks. This brings several advantages:

- Application backup data from the old physical system does not have to be migrated. Compatible tape drives can be connected to the new PC host. The tapes can be read and written just like in the old system.
- Backups to virtual tape are disk-to-disk and consequently are much faster than backing up to physical tape. Backups can be written from disk to physical tape for archiving at a later time.
- Multiple physical disks on the old system can be consolidated onto one or a few disks on the new host.

Both vtAlpha and vtVAX support OpenVMS clusters and Tru64 TruClusters. Thus, the exceptional availability provided by clustered systems is available in the emulated environment.

There are some differences between the two products. They are discussed briefly in the following sections.

vtAlpha

Supported Systems

vtAlpha supports OpenVMS versions 6.2-1h3 and above and Tru64 versions 3.2C and above.

vtAlpha supports virtually all AlphaStations and AlphaServers. When building the emulated environment, it is only necessary to specify the Alpha model being emulated and its configuration. vtAlpha will build an exact image of the hardware that the software expects.

The emulated Alpha servers can be managed by vMonitor from anywhere in the network.

Host System Requirements

Though any of the Intel or AMD multi-core 64-bit x86 processors can be used, the Intel Xeon and the AMD Opteron processors are preferred because of their performance. One core is dedicated to each emulated Alpha CPU, and another core is needed for each two Alpha CPUs for I/O use.

The minimum amount of PC host memory required for an Alpha server is the memory that was configured for the physical server plus 25% plus one GB. More memory can be configured for performance improvement. vtAlpha supports up to 32 GB of memory per Alpha server.

Networking

The Alpha Ethernet Adapters are supported, including DE435, DE450, and DE500. Though these are 10-Mbps and 100-Mbps adapters, vtAlpha will take advantage of full-duplex, one-Gbps Ethernet adapters if they are configured on the PC host. Full support is provided for COM ports and serial communication adapters. Every virtualized Ethernet adapter or communication adapter can be mapped directly to its own physical adapter on the PC host. Moreover, vtAlpha also includes Virtual Network Switches that allow multiple virtual Ethernet adapters to share the same host link.

Storage

vtAlpha supports storage devices attached via virtual SCSI channels or FibreChannel adapters. Emulated disks may be physical disks attached directly to the PC host, or they may be virtualized. Virtualized disks are logical disks whose contents are contained in container files in the host's storage systems.

vtAlpha supports all Alpha legacy storage adapters, including MSCP, DSSI, IDE, and RAID. It also supports NFS file systems.

Likewise, tapes may be physically attached, or they may be virtualized on disk. Physical tapes are required for archival backup.

CD-ROM is supported both as a physical entity and as a virtualized logical CD-ROM.

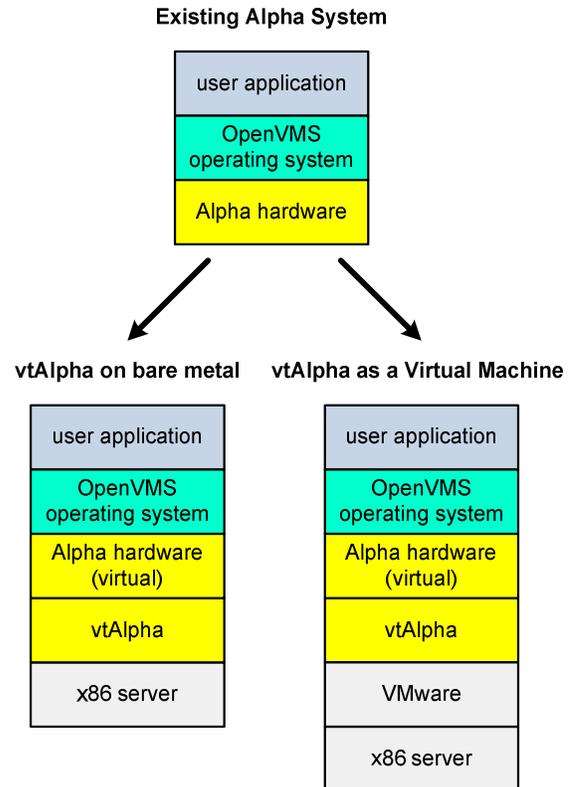
Direct-attached devices not known to vtAlpha can be attached via direct SCSI addressing.

vtVAX

Supported Systems

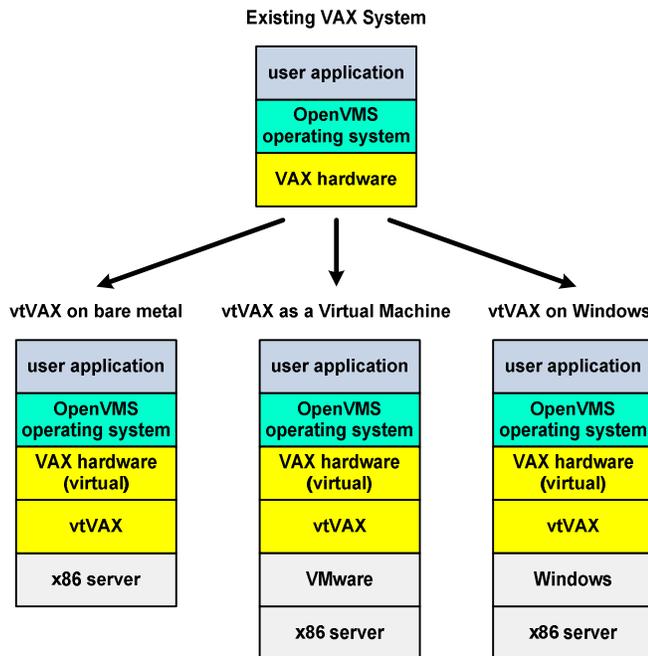
vtVAX is very much like vtAlpha and differs from it only in some details. vtVAX supports all VAX/VMS and OpenVMS versions beginning with version 4.3.

Like vtAlpha, vtVAX can run bare metal or as a host operating system in a virtualized environment using VMware, Hyper-V, XEN, or KVM. However, it can also run as an application in a Windows environment. Windows 7, Windows XP, Windows Server 2003, and Windows Server 2008 are supported.



vtVAX supports virtually all VAX, VAX server, MicroVAX, and VAXstation systems with up to 512 MB of memory. vtVAX also supports the virtualization of multi-CPU VAX systems such as the VAX6000 and VAX7000. In these systems, up to four CPUs and 3.5 GB of memory can be emulated.

When building the emulated environment, it is only necessary to specify the VAX configuration being emulated using the GUI-based Configuration Manager utility, copy the VAX disks to the PC host disks, start vtVAX, and boot the emulated VAX system. vtVAX will build an exact image of the hardware that the software expects. As an option, the vtVAX Instruction Caching option is available to dramatically improve the performance of CPU-intensive applications such as statistical analysis and business analytics



In addition to OpenVMS Clusters, vtVAX also supports VAXclusters.

Host System Requirements

As with vtAlpha, any of the Intel or AMD multi-core 64-bit x86 processors can be used. However, the Intel Xeon and the AMD Opteron processors are preferred because of their performance. Each instance of a VAX system requires two cores. The minimum supported processor speed is 1.6 GHz, though 2.4 GHz is preferred.

For each emulated VAX, the memory with which it was configured in its physical server is required plus 25% plus 2 GB.

Networking

vtVAX supports all VAX Ethernet adapters, including the DEQNA/DELQA (XQ), SGEC (EZ), and DEMNA (EX) adapters. Each adapter must be mapped to a dedicated physical Ethernet adapter on the host system. Gigabit full duplex Ethernet is supported.

Both DECnet and TCP/IP protocols are supported, and they can run concurrently.

Many VAX systems in control applications use custom-designed peripherals attached via Q-Bus adapters. These devices are supported via the NuVAX product (from The Logical Company) under which replacement Q-Bus adapters are developed for special devices.

Storage

As with vtAlpha, disks and tapes may be physical units attached to the PC host. Alternatively, they can be virtualized. The contents of virtualized disks reside on storage devices that are part of the PC host system. Several smaller VAX disks can be consolidated onto one or a few host disks.

Virtualized tape contents are stored on host disk. Logical devices can be backed up using the OpenVMS BACKUP utility. Backups can be moved to physical tape if necessary for archiving purposes. Because

existing tapes can be read by attaching the appropriate tape drive to the PC host, there is no need to migrate archived tapes for the new system.

Up to four Mass Storage Control Protocol (MSCP) controllers can be configured, each handling 32 disk or tape drives. Up to two SCSI bus systems with seven disk or tape units can be emulated. In addition, one virtual tape controller can handle up to 16 tape drives.

An emulated VAX system can integrate with modern data storage solutions, including RAID arrays, NAS, SAN, FibreChannel, FC/IC, FCoE, and cloud storage.

Licensing

The HP licenses that have been purchased for the original VAX or Alpha systems remain in effect for the emulated systems. However, HP requires that transfer licenses be obtained.

Licenses are stored on a low-profile USB dongle that plugs into the host PC. The USB license dongle is network capable. It can be stored on any server in the network that the licensed emulated vtAlpha or vtVAX can access. Disaster-recovery licenses support failover of a failed host to another host machine or to license a vtAlpha or vtVAX VM as it is migrated from one host to another in a virtualized environment.

Alternatively, a small vtLicense server that manages multiple licenses can be purchased and attached to the network. It is assigned a network address and can control licensing for all of the virtual vtAlphas and vtVAXs in the network. Multiple vtLicense servers can be configured in a network for redundancy should one fail. vtLicense servers with production and disaster-recovery keys allow the licensed software to continue in operation following a failover to a backup system or following a migration of a VM in a virtualized environment.



Summary

vtAlpha and vtVAX are but one example of existing products that support Alpha and VAX emulation. Other products include:

- Charon-VAX, Charon-Alpha, Personal Alpha (<http://www.stromasys.com/>)
- NuVAX (<http://www.logical-co.com/nuvax/>)
- Reviver VAX (<http://www.comwaretech.com/VAX/VAX-emulator.html>)
- Trailing Edge SIMH (<http://simh.trailing-edge.com/vax.html>) (available as open source)
- Avanti, FreeAXP, and support for the freeware SIMH (www.migrationspecialties.com)
- AlphaVM, AlphaVM-free (<http://emuvvm.com/>)

In addition, companies such as Nemonix Engineering (<http://www.nemonixengineering.com/>) provide support for current hardware installations of VAX and Alpha systems.

HP continues to support OpenVMS on its Integrity systems. These may be candidates in the future for emulation when HP product support ends.