Shannon *Knows* Compaq

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VAX to the Future: The Path Forward for the VAX Customer Base

With well over half a million systems sold over the course of more than two decades, VAX/VMS ranks as one of the industry's most popular commercial and technical computing platforms. Over the past 22 years, the VAX architecture amassed an enviable track record including a uniprocessor performance range of one to more than 160 across three technology generations, a user base in excess of 10M, consistent price-and-performance improvements, and a leadership role in distributed computing.

The VAX 11/780, introduced in 1977, set the standard for 32-bit superminicomputers, and the 1983 debut of VMScluster software extended mainframe-class scalability and availability to the computing midrange. Two years later, the MicroVAX II dramatically reduced the cost of 32-bit computing by delivering superminicomputer performance at 16-bit minicomputer prices. Today, the OpenVMS operating system, developed in conjunction with the VAX architecture, is the standard by which "bet-your-business" computing is judged.

History and the ever-accelerating pace of technological change prove that all computer architectures have finite lifespans. The 32-bit VAX architecture is no exception. Concurrent with the introduction of the last VAX enhancement in late 1996, Digital published a VAX product roadmap with a clearly-defined Y2K end point. During the fall 1998 eureka98 and DECUS US Chapter symposia, Compaq delivered VAX Update presentations that provided additional details on the VAX roadmap and end-of-life schedule. And several months ago, Compaq announced last order and delivery dates for VAX systems. The last order date for VAXstation 4000 systems was September 30, 1999; VAX 4000 and MicroVAX 3100 platforms will be orderable through September 30, 2000.

While the majority of VAX/VMS customers already have moved on to more capable, scalable, cost-effective platforms, and while Compaq will continue to support the VAX platform for at least a decade beyond its retirement, the handwriting is on the wall for the remainder of the VAX base. Platform replacement no longer is a matter of "should I stay or should I go" but "how do I get there from here?" This issue of *Shannon Knows Compaq* examines some of the options available to VAX/VMS customers, and offers our suggestions on the best ways to "get there from here." We'll also discuss why Compaq's Alpha architecture is the destination of choice for VAX users.

The VAX End Game

The phase-out of the VAX platform should come as no surprise to the customer base. In fact, the retirement of a 20-year-old hardware architecture reflects a natural evolutionary process. When the first PDP-11 systems were introduced in the 1960s, their 16-bit architecture reflected cutting-edge technology. By the early 1970s, ongoing advances in hardware design, declining memory costs, and growing application requirements rendered the evolution to a 32-bit architecture a foregone conclusion. Digital and a host of rival minicomputer vendors acted accordingly, designing and deploying a variety of 32-bit platforms during the mid to late 1970s. The 32-bit architecture that characterized the superminicomputer generation was state-of-the-art when the VAX 11/780 debuted in 1977, but by the mid-1980s hardware designers concluded that 32-bit systems would be supplanted by 64-bit platforms in the coming decade. Once again, technological advances, decreasing component costs, and increasing application requirements precipitated the transition to a more capable and scalable architectural environment.

The transition is in no way related to, nor has it been accelerated by, the acquisition of Digital by Compaq Computer Corporation. Indeed, when Alpha systems were announced on November 10, 1992, Digital made it clear that the 64-bit Alpha architecture would supplant the 32-bit incumbent based on customer adoption rates. During the Alpha announcement, Digital executives suggested that the architectural transition would take about four years. This assertion was based on historical evidence, including the PDP-8 to PDP-11 and PDP-11 to VAX transitions. Customer buying decisions and shipment rates for new Alpha systems validated the corporate party line: by 1995, Alpha shipments exceeded VAX shipments by a significant majority. As of last year, annual VAX revenues declined to ~$200M while Alpha revenues now exceed $4B per year and continue to grow.

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As with the PDP-11 before it, the VAX architecture did not suffer overnight obsolescence with the introduction of a more capable successor. Just prior to the debut of the first Alpha systems, advances in process technology endowed the VAX architecture with a thirteenfold performance improvement over a 39-month period. Moreover, VAX systems enjoyed several significant price and performance enhancements in the Alpha era. Product refreshes incorporating faster CPUs, industry-standard memory, new I/O and mass storage options, and new packaging reflected a substantial ongoing investment in the VAX customer base.

But all good things must come to a natural end, and such is the case with the VAX architecture. Not only have VAX systems lagged in contrast with the price-and-performance improvements exhibited by Alpha and competitive platforms, but architectural limitations, I/O and peripheral support, applications and OS compatibility, and scalability issues increasingly marginalize the VAX platform.

The Economic Imperative

VAX systems no longer are economically compelling to Compaq or to the customer base. A comparison of entry VAX and Alpha server and workstation prices underscores the growing disparity in the cost of these systems. For example, an entry Compaq AlphaServer DS10 OpenVMS system with 128MB of memory and a 10GB IDE disk lists for about $7,400. A comparable MicroVAX 3100 Model 88 system with 16MB of memory and a 1GB disk costs $19,600. Similarly, an OpenVMS-based AlphaStation XP900 system with 128MB of memory lists for $7,298, almost $10K less than the comparable entry VAX offering, the $17,285 16MB VAXstation 4000-96. In most cases, system options and peripherals are more attractively priced on the Alpha platform: a 64MB memory module for an AlphaStation XP900 lists for $538, while 64MB of ECC memory for a VAXstation is priced at $4,160. When items such as maintenance costs and power consumption are factored in to the equation, Alpha systems offer far superior total cost of ownership.

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The End of the Line

The VAX platform received its last major overhaul nearly three years ago. The VAX 4000 Model 108 "Catamount" system introduced in late 1996 represented the final significant VAX system enhancement. As the VAX product management team stated during the VAX 4000 Model 108 rollout, no further enhancements are planned. Due to architectural limitations, ongoing development of 32-bit VAX microprocessors ceased with the 1996 announcement. All future VAX orders will be fulfilled with the existing inventory of CPU chips and components. As Compaq has noted, supply constraints have reduced inventories of certain VAX systems to what the firm calls "finite quantities." Similar constraints increasingly affect the availability of add-on or replacement parts: owners of older -generation VAXes often find it difficult to obtain replacement components for their systems.

Peripheral Interests

Recent advances in I/O subsystem and peripheral technology transcend the capabilities of VAX systems. Mass storage represents an ever-increasing portion of hardware expenditures, and the VAX platform is incompatible with industry-standard PCI-based controllers and storage devices. Moreover, emerging I/O technologies such as Fibre Channel, Memory Channel, and System I/O are not supported on VAX systems. Compaq and other leading vendors are now articulating next-generation storage initiatives predicated on these faster, better, cheaper interconnect and storage technologies. In a business environment characterized by steadily rising mass storage and I/O bandwidth requirements and declining product costs, the ability to fully capitalize on the latest and most cost-effective storage products and technologies is a key customer concern.

The 33rd Bit

A 32-bit architecture is an anachronism in a 64-bit world. During the past five years, computer system "metrics" have taken on an entirely new dimension. Processor performance remains a primary consideration, but transcending the limitations of 32-bit CPU architectures is now equally important. Memory prices continue to plummet, rendering addressing space at least as important as megahertz ratings. Today, 64-bit memory addressing is a key component of the plan-to-purchase decision. The oft-delayed but highly-publicized Intel IA-64 architecture, not to mention Hewlett Packard's end-of-life PA-RISC processor family, and Sun Microsystems' equally-delayed UltraSparc III processor, offer proof that 64-bitness is now a major concern in the computing mainstream.

Digital first began touting the benefits of larger address spaces when the 64-bit Alpha architecture and the 64-bit DEC OSF/1 Unix operating system were introduced in late 1992. For several years thereafter, Alpha and DEC OSF/1 served as the industry's only complete 64-bit

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hardware/software/applications environment. In April 1995, Oracle Corporation provided the first commercial validation of 64-bit computing during the Oracle7/ AlphaServer 8400 product rollout. This announcement offered concrete proof of the benefits inherent in large address spaces, and VLM64 (Very Large Memory-64 Bit Addressing) immediately became a key product attribute. Rival vendors, including HP, IBM, SGI, and Sun Microsystems—who heretofore minimized the significance of 64-bitness—rapidly changed their tune and their marketing messages.

Given the increasing significance of 64-bit addressing in the commercial and technical computing environment, and given the increasing weight of the memory addressing factor in the plan to purchase decision, the 32-bit architectural limitation of the VAX platform looms ever larger. Since the VAX architecture reserves only one-half of its address space for applications, VAX systems can support applications no larger than 2GB. The current Alpha memory management architecture supports up to 8TB of addressable memory; future Alpha implementations will offer significantly greater addressing support.

The Growing Apps Gap

Emerging standards and declining ISV support increasingly limit the VAX applications portfolio. In addition to being incapable of supporting the growing number of applications that exploit very large memory, the VAX architecture's inability to emulate the IEEE arithmetic mandated by the Java language specifications renders the platform incompatible with applications based on this pervasive language and environment.

No less important is partner support: based on reduced customer demand, ISVs are accelerating the retirement of their VAX-based applications. The shrinking applications base and diminishing ISV support pose increasing problems for VAX customers.

Size *Does* Matter

VAX systems no longer offer competitive performance or scalability. Although some customers who remain on the VAX platform may be satisfied with the performance of their hardware, the "bang for the buck" metric increasingly favors system replacement. On the performance front, a top-of-the-line 6-CPU VAX 7860 delivers ~1765 transactions per second while an eight-processor AlphaServer GS140 6/525 delivers ~12,500 TPS. The soon-to-ship AlphaServer GS-series 700Mhz EV67 upgrade should provide ~30 percent more performance than the incumbent system.

At the low end, the disparity is even more pronounced: an entry MicroVAX 3188 is rated at ~110 TPS, while an entry Compaq AlphaServer DS10 delivers ~2267 TPS. On a raw performance basis, the DS10 offers more than 20 times the compute power of its VAX counterpart. On a price-and-performance basis, the Alpha system looks even better: an entry VAX 3188 goes for $18,700, while an entry AlphaServer DS10 OpenVMS system costs about $7,400. Based on cost per transaction, the entry Alpha system offers more than 75 times the performance of its VAX equivalent.

System scalability is another important metric. A fully-configured VAX 7860 supports a maximum of six CPUs, while a fully-configured AlphaServer GS140 currently can support up to 14 CPUs. Within the next several months, Compaq will increase the single-system scalability of enterprise-class AlphaServers to 16 CPUs; support for 32-processor systems will be forthcoming thereafter. While few customers require this level of expandability today, the increasing demands that e-commerce, database, and enterprise apps impose on hardware resources render system upgrade and expansion capabilities an important part of the plan to purchase decision. Recent scalability-related problems at e-commerce sites such as eBay underscore the critical importance of hardware "headroom" in the e-business realm.

Where Do I Go From Here?

Although Compaq will continue to support the VAX base for years to come, it is incumbent upon VAX customers to begin planning for a near-term platform transition. A platform transition—or "migration"—is an inflection point that provides a natural opportunity for customers to reevaluate their options and commitments. Faced with the prospect of rehosting their mission-critical apps and hardware infrastructures, savvy customers will investigate all available alternatives, including those offered by competitors. In an effort to exploit this opportunity, several vendors have targeted the VAX base with replacement campaigns that include generous trade-in allowances and migration assistance.

While these alternatives may seem appealing to some customers, *SKC* maintains that Compaq's Alpha platform provides the easiest, most natural, and most cost-effective upgrade path for VAX/VMS customers. The relative ease of this move combines with the price, performance, and expandability advantages of Alpha systems over their VAX predecessors to make Alpha the destination of choice for VAX users. For OpenVMS customers who want to continue to use the OpenVMS operating system, the platform replacement decision is quite simple: Alpha is the only game in town. However, *SKC* would strongly argue that Alpha is an equally attractive platform for customers who choose to migrate to a Unix or Linux environment.

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The Three Faces of Migration

Migrations may be inevitable, but they are never fun, and never pretty. Accordingly, customers should carefully evaluate the potential disruptiveness of the replacement path they choose. Depending on the selected target environment, a platform transition can be relatively simple, or it can be an exceedingly difficult multidimensional undertaking. As a minimum, "migrating" customers must replace their hardware platforms. In a worst-case scenario, prospective emigres also must replace their operating systems, middleware, and applications. Given that a customer's OS and apps generally represent a far greater financial and intellectual investment than does the underlying hardware, minimal disruption is Priority One when it comes to platform transition.

Those OpenVMS customers who choose a "minimalist" migration strategy should find the road to Alpha to be a relatively easy path to take. Compaq's OpenVMS engineers spent more than 200 person-years porting the OpenVMS OS to the Alpha architecture, and as a result, a VAX to Alpha transition preserves the bulk of customer investments in a trusted, familiar, and mature operating environment.

VAX migration was a high-priority concern during the development of the Alpha architecture: *SKC* estimates that at least one-third of the ~$1.5B research and development costs associated with the Alpha program were "migration-related." OpenVMS Engineering devoted significant resources to maximizing VAX-Alpha interoperability, upgrading the OpenVMS OS and key applications to 64-bit status, and rendering 32-bit VAX/VMS applications Alpha-ready via the "VEST" binary code translation tool. Also known as DECmigrate, the binary code translation facility enables VAX users to run the majority of their "legacy" VMS applications on Alpha platforms without recompilation.

Destination Alpha

SKC believes there are a number of compelling reasons why VAX customers should opt for Alpha-based solutions. Compaq's commitment to Alpha is underscored by the firm's decision to base future Himalaya NonStop systems on Alpha EV7 processors. The formation of Alpha Processor Incorporated and Samsung's adoption of the Alpha chip also bode well for the proliferation and long-term viability of the Alpha architecture. The Alpha OEM marketplace continues to expand, and *SKC* anticipates the near-term announcement of a foundry agreement through which IBM Corporation will join Intel and Samsung as Alpha fabricators.

With a few very brief exceptions, Alpha has been the fastest processor on the planet since its introduction in 1992. The Alpha processor roadmap portends continued price-and-performance leadership into the next millennium. Over the past seven years, Alpha system prices have plunged, while Alpha processor performance has increased dramatically. We expect this trend not only to continue, but to substantially accelerate.

By the end of this year, Alpha EV68 microprocessors could run as fast as 1GHz, and the next two generations of Alpha technology are expected to provide a minimum fourfold boost in processor performance over the next several years. No less important is the fact that future Alpha CPU implementations will incorporate hardware features designed to minimize the cost of Alpha uniprocessor and very large SMP systems alike.

There is, of course, more to a computing platform than a fast microprocessor. System packaging and interconnect technology are equally important. Compaq early this year began rolling out a family of switch-based AlphaServers that offer substantially greater performance and price-performance than their predecessors. With the debut of the AlphaServer DS10, DS20, and ES40, Compaq completely overhauled the entry through midrange AlphaServer lineup.

Anticipated to debut later this year is a family of switch-based, modular GS-series enterprise servers that will deliver unparalleled levels of performance and scalability to high-end Alpha users. (According to one Compaq executive, a 16-node cluster of 64-CPU EV8-based GS-series systems could offer as much as one hundred million times the performance of a VAX 11/725 uniprocessor!) More information on the new Alpha SMP systems is expected in the near term.

The latest generation of Compaq AlphaServers have been well-received by the customer base and by new customers as well. During 2FQ99, low end and midrange Alpha sales increased by more than 35 percent quarter-to-quarter, and by more than 24 percent year-over-year. Alpha price-and-performance has increased even more dramatically: at the high end, the recently-announced Compaq AlphaServer GS60E starts at under $100K for a dual-processor system with 2GB of memory. This is less than one-third the list price of the original AlphaServer 8200.

Given the performance differential between the 300MHz EV5 processor contained in the original 8200 and the 525MHz EV6 CPU used in the GS60E, an entry GS60E reflects a minimum sixfold price-and-performance improvement over the initial enterprise-class offering.

The midrange AlphaServer ES40 costs ~20 percent less than its predecessor, and the AlphaServer DS20 departmental system is an

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even better value. At the bottom of the Alpha lineup, Linux-based Compaq AlphaServer DS10 configurations start at about $3,500. Since January 1998, entry Alpha system prices have declined by more than two-thirds, and forthcoming low-end AlphaServers promise to further reduce the cost of Alpha-based computing.

Recent pricing changes on OS and layered software for midrange and entry enterprise AlphaServers render these systems an even better value. With the introduction of the AlphaServer GS60E, Compaq slashed OS and layered software prices by an average of 50 percent for this system by moving them from the enterprise to the departmental pricing tier. An OpenVMScluster license for a GS60 server listed for about $35K; the same software goes for ~$17K on a new GS60E system. The GS60E repricing initiative follows a similar price reduction on AlphaServer ES40 system software.

Have It Your Way

The VAX customer base has been subjected to overtures from vendors who specialize in Unix, Windows, or other proprietary OSes. In the increasingly-heterogeneous OS world, such options are worthy of consideration. An overriding concern for most customers is a computing environment that offers flexibility as well as scalability. And in this regard, Alpha truly excels.

Alpha's support for OpenVMS, Tru64 UNIX and Linux ensures that customers are not locked in to a specific operating environment. A decision to buy an Alpha/ OpenVMS system today does not preclude a customer from transitioning to any of these popular OSes. By contrast, a migration to a SPARC-based platform restricts the emigre to Solaris, while a transition to PA-RISC limits the customer to the HP-UX OS and applications suite. Similarly, a move to IBM's PowerPC architecture locks the customer into the AIX environment. Customers who opt to replace their VAX systems with IA-32 solutions not only face a non-trivial migration of their hardware, operating system, and applications, they face another near-term migration to the IA-64 architecture when it begins shipping sometime next year.

SKC believes the vast majority of VAX customers will choose to remain on OpenVMS, and Compaq is devoting substantial financial and engineering resources to ongoing OpenVMS enhancements. Nevertheless, support for alternative operating systems is equally important. When viewed in light of Unix and Linux, the most popular alternatives to "proprietary" OSes, the Alpha platform offers some compelling advantages.

New releases of Compaq's Tru64 UNIX OS and TruCluster software bring the firm's 64-bit Unix and clustering solutions into near-parity with OpenVMS offerings. The hard-partitioning capabilities of the latest version of Tru64 UNIX not only are compatible with current Alpha enterprise servers, but will fully exploit the next-generation AlphaServer GS-series family that will debut later this year. In addition, Tru64 UNIX has been 64-bit compliant since its introduction, and the operating system now boasts a portfolio of more than 5,000 64-bit applications.

No less important are Compaq's engineering efforts in the Linux space: Compaq has been actively involved in Linux development for over five years, and the firm continues to increase its support for this popular 64-bit Unix alternative. Compaq recently became the first vendor to support Linux on a 4-way SMP platform, and the Compaq AlphaServer DS10 boasts the industry's best SPECint95 and SPECfp95 performance on a Linux uniprocessor system. Compaq already has ported several of its Tru64 UNIX compilers and tools to the Alpha/Linux environment; additional ports are now underway.

The Road Ahead for OpenVMS

Some observers continue to question the long-term future of the operating system, but Compaq continues to put its money where its mouth is when it comes to OpenVMS. The firm's OpenVMS Group boasts a staff of over 550 developers, engineers, and marketing specialists supported by an annual investment of over $250M. The OpenVMS business remains solidly profitable, and OpenVMS-related revenues actually posted a modest year-over-year increase in FY98. Moreover, OpenVMS continues to attract new customers: in FY98 more than 15 percent of the OpenVMS business came from new accounts, including a full-scale deployment at the International Securities Exchange.

Compaq early this year outlined a 5-year OpenVMS "rolling roadmap" that calls for new OS releases every 12 to 18 months. Being a mature and robust OS, OpenVMS has very few chinks in its feature and functionality armor: the OS already possesses the scalability, availability, security, reliability, and manageability attributes that remain long-term futures in Microsoft Windows NT and in the competitive UNIX OS realm. Accordingly, the OpenVMS enhancement game plan focuses primarily on Web-based features that support Compaq's NonStop eBusiness strategy, and on new mainframe-class operating system capabilities.

While Compaq recently made a business decision to decommit from supporting future versions of Microsoft Windows on the Alpha platform, OpenVMS and Windows interoperability remains a high priority within the firm's OpenVMS Engineering group.

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Galactic Implications

Compaq's approach to fortifying OpenVMS with even greater levels of scalability, availability, and reliability is exemplified by the Galaxy Software Architecture. Formally unveiled in conjunction with OpenVMS Version 7.2 last October, the Galaxy Software Architecture on OpenVMS allows multiple instances of OpenVMS to execute cooperatively within a single computer. The Galaxy architecture's Adaptive Partitioned Multiprocessing (APMP) environment uniquely enables OpenVMS to deliver near-linear scaling even in very large SMP systems. Galaxy technology will permit OpenVMS to fully exploit the capabilities of Compaq's next-generation enterprise servers.

Moreover, because the Galaxy design is not OpenVMS-specific, it will enable closer affinity between OpenVMS, Tru64 UNIX, and Linux. At the Spring 1999 DECUS US Chapter Symposium in Providence, RI, Compaq demonstrated Galaxy configurations that embraced Linux as well as OpenVMS. These technology demonstrations provide evidence that users will be able to run OpenVMS and other OSes on future Alpha servers, thereby capitalizing on the "bulletproof" attributes of OpenVMS as well as the benefits of alternative environments.

In late 1999, Galaxy Phase II will introduce support for next-generation AlphaServers with up to 32 processors, thus allowing customers to create as many as 8 OpenVMS instances on a 32-CPU system. Also planned for Phase II are CPU hot-swapping, LAN over shared memory, and RAMdisk support in shared memory. In Y2K, Galaxy Phase III will add support for EV7 processors, AlphaServer configurations with more than 32 CPUs, DLM data in shared memory, and self-healing tools. Galaxy Phase IV, which will focus on continued performance improvements, enhanced system availability, and management tools, is already on the timetable for post-Y2K deployment.

How Do I Get There from Here?

Compaq offers a variety of migration programs and financial incentives to ease the burden of platform transition. Prospective VAX emigres can use VAX to Alpha Migration Assessment services and VAX to Alpha System and Application Migration Analysis and Design services to develop a step-by-step plan for platform replacement. When it comes time to actually make the transition, VAX to Alpha System and Application Migration services are available to help customers rehost their OS and apps on the Alpha platform.

To ease the financial impact of migration, Compaq offers VAX to Alpha trade-in programs as well as a 75 percent credit for old VAX software licenses. Periodically, the firm offers additional trade-in incentives on selected VAX systems. More information on these programs is available at Compaq's website or from Compaq and channel partner sales representatives.

Staying the Course

Those customers who opt to remain on the VAX platform can count on Compaq to provide ongoing support for the next decade. In fact, Compaq's North America Customer Services organization on July 28 sent a letter to VAX users confirming that Compaq Services intends to continue supporting VAX customers through the year 2010. As stated in the customer letter, Compaq will "continue to provide a full range of preventive, performance optimization, and remedial services for VAX/OpenVMS systems." The firm additionally will continue to provide service and support to help customers protect their VAX/ OpenVMS investments and avoid disruption in their production environments.

Compaq will continue to develop new releases of OpenVMS for the VAX environment, but the main focus of such releases will be on mixed-architecture cluster support. Most new OpenVMS capabilities—such as enhanced Galaxy support and improved Windows interoperability—will be delivered on Alpha only. Accordingly, VAX customers should carefully evaluate their ongoing requirements before deciding whether to "stay or go."

Based on price and performance, applications availability, and system expandability, *Shannon Knows Compaq* believes many VAX users will find OpenVMS on Alpha is the best path forward. ■