EPIC IS IN -- ALPHA IS OUT Impacts of the Recent High-End Computing Developments upon the SCADA/EMS Landscape

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On May 29, 2001, Intel unveiled the Itanium processor – a 64 bit EPIC (Explicit Parallel Instruction Computing) engine that competes directly with the RISC processors in the high-end server and workstation markets. Hewlett-Packard Co., a co-sponsor of the Itanium project, immediately detailed plans to ship Itanium-based rx4610/rx9610 servers and i2000 workstations running HP-UX, Linux and the 64 bit Windows Advanced Limited Edition operating systems.

More Itanium based products followed. IBM released the sSeriesx380 server and a 64-bit IntelliStation. The Itanium offerings from IBM support the Unix AIX-5L and Red Hat Linux 7.1 operating systems, as well as the new 64 bit Windows from Microsoft. Other significant announcements include the Compaq 64 bit Proliant, the Dell 730 Workstation, and the <u>e-@action</u> Enterprise Server ES7000 from Unisys, all under both Microsoft's Windows Advanced Limited Edition and Red Hat Linux.

At the same time, in a move aimed at cutting costs and emphasizing sales of industry-specific packages of computers, software and services over computer chips, Compaq said it planned to phase out the Alpha processors and to consolidate its entire 64-bit family of servers onto Itanium by 2004. The new family of Compaq enterprise servers will support Tru64 Unix, Open VMS, and NonStop Kernel, complementing the Windows 2000 and Linux operating systems.

The Intel announcement may signal the beginning of a new era in computing. If Itanium succeeds, a large-scale industry transition might begin, reducing the emphasis on proprietary RISC solutions in favor of a standard platform.

"The really important thing to walk away (from Monday's announcement) is that in the future, not many hardware vendors will support their own chip. It's too expensive and in the case of Compaq some customers weren't buying its Alpha chips because they knew Intel was coming out with Itanium this year. According to Brett Miller, an analyst at AG Edwards & Sons, high-end Unix servers will move to a standardized product just as it happened with the personal computer, workstations, low-end servers and storage" ("Digital Equip's Services Arm Still Valuable To Compaq", Donna Fuscaldo, Dow Jones Newswires, June 25, 2001).

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SUN Microsystems, whose Ultra Sparc chips are manufactured by Texas Instruments, had ported its Solaris operating system on Itanium as early as October 1999. Up to now, SUN has not released an Itanium-based product, but some analysts believe it may soon follow suite (Barron's, June 30, 2001). On the other hand, IBM unveiled a 200 GHz chip that is 100 times faster than the existing Intel processors. If perception is reality, the recent events may point at a bi-polar computing landscape entirely dominated by Intel and IBM.

On the other hand, the Compaq withdrawal of Alpha may be the consequence of continuing losses it sustained in the Unix market. Staggered by falling demand of its Alpha based Unix systems, Compaq announced massive restructuring and a major shift towards services, which seem to become its top priority.

Compaq is transferring significant Alpha microprocessor and compiler technology, tools and resources to Intel. It will make one more version of Alpha, called EV7, and then will migrate to Itanium. "We have a very clear roadmap," said Compaq Chief Executive Michael Cappellas. "There's nothing for a customer not to like." He added that using Itanium will boost confidence that may have been flagging among customers who were concerned that Compaq couldn't keep up with development of Alpha.

The ultimate objective of our analysis is to place the Itanium and Alpha announcements in the SCADA/EMS context. But before we attempt to do so, let's briefly examine the EPIC architecture and take a closer look at the Unix landscape.

What is EPIC?

EPIC stands for Explicitly Parallel Instruction Computing -- a new design philosophy going beyond the RISC and CISC processors that are available today. According to Intel, EPIC technology "enables greater instruction level parallelism than previous processor architectures, supporting higher levels of performance in targeted application segments".

The Itanium architecture is based on EPIC technology, which entails a combination of innovative features such as *predication, speculation* and *explicit parallelism*. It supports both 64 and 32 bit pointers and can access up to 18 billion of GBytes, thus enabling it to handle huge data sets. A Register Stock Engine (RSE) automatically saves/restores stock registers without software intervention. There are 15 execution units and 256 general and floating-point registers (compared with approximately 50 registers of a typical RISC architecture). The system bus is 64 bit wide and supports up to 4 processors. Initially, the Itanium processor-based systems will be available at 733 and 800 MHz in 2 MB and 4 MB L3 cache configurations.

Four operating systems are currently supported: Microsoft Windows XP 64-bit Edition and 64-bit Windows Advanced Server Limited Edition 2002, Linux (from four distributor companies - Red Hat, SUSE, Caldera and Turbo Linux), and two Unix versions - Hewlett Packard's HP-UX 11i v 1.5 and IBM's AIX-5L.

Initial benchmarks seem to indicate that Itanium has the potential to challenge the RISC processors. Table 1 provides the SPECInt_base_2000, SPECfp_base_2000, relative OLTP and LINPACK benchmarks for the SUN Microsystems Ultra Sparc III (850 MHz), IBM p640-B80 (375 MHz) and Itanium (800 MHz).

No.	Processor	SPECInt_bazse_2000	SPECfp_base_2000	Relative OLTP	LINPACK
1	IBM p640-B80	247	237	43*	1234
2	SUN Microsystems Ultra Sparc III	370	373	1.4**	1300
3	Intel Itanium***	370	711	1.8**	2380

Table 1 Initial Benchmarks

Compared to IBM RS/6000 Model 250

Compared to Ultra Sparc II 450 MHz

During the testing, the operating system and the benchmark were executing on separate processors

SPEC CPU2000 Performance – SPECfp2000

Itanium[™] processor delivers best-of-class floating point performance and competitive integer performance



SPEC CPU2000 Performance – SPECint2000 Itanium[™] Processor delivers best of class floating

point performance and competitive integer performance



Source: http://www.intel.com/eBusiness/products/ia64/overview/bm012101.htm

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The parallel nature of the architecture will probably provide for fast processing of *intrinsically parallel* data sets, such as relational databases and spreadsheets. For conventional engineering applications, however, we believe that the performance will probably depend upon:

- The ability of the optimizing compiler to identify parallelism in otherwise sequential algorithms
- The size of, and interdependencies between, the application modules with respect to the size of the cache
- A variety of other factors such as memory size, disk access time, I/O accesses, and the ability of the operating system to distribute tasks among the various processors.

Who's Who in Unix

On March 8, 2001, a Unix Focus Group was held in New York for research purposes. It looked at the Unix market in general, identified the features that appeal most to Unix users, and discussed the major Unix offerings in terms of popularity and viability. The Unix offerings discussed in the Focus Group included Linux, IBM AIX, SUN Solaris and Hewlett Packard HX. Here are some of the main conclusions the attendees unanimously agreed upon:

1. The Unix market encompasses enterprise and mission critical applications as well as control systems

- 2. Linux seems to appeal to everybody, but:
 - ^a its scope of applicability is not yet clearly defined, except, of course, for the internet servers area where it seems to be the platform of choice
 - the availability of tools, such as C, Fortran and C++, is unknown native C compilers do come with Linux, as part of the Unix tradition, but C compilers and cross compilers manufactured by major computer and/or software vendors supporting both Linux and at least a couple of other platforms, are still to come
- 3. The primary 5 (five) requirements that a Unix offering should meet are:
 - Support
 - Application availability
 - Manufacturer viability
 - Reliability
 - Performance
- 4. The Focus Group attendees were asked to characterize these operating systems as if they were ... persons (people). Here is what they had to say about:
 - Solaris popular, sexy (?), techie (?)
 - □ IBM solid, superior, savvy
- 5. IBM AIX and Santa Cruz Operation (SCO) Unix were considered the easiest and most userfriendly for porting applications native in other environments
- 6. SUN Solaris was identified as the target-platform of choice if there was a need to migrate
- 7. Hewlett Packard HX was unanimously rejected not because it would be a "bad" operating system, but because of lack of vendor support, absence of tools, and no industry interest

Conspicuously absent from the Focus Group discussions was Compaq Unix. Why? Was it a mistake? Or was it a deliberate sleep of memory? The answer came in an article published on April 20, 2001 in USA Today, which analyzed the Unix market. The data are summarized in Table 2.

No.	Unix Vendor Market Share			
		1998 [% of total market]	1999 [% of total market]	2000 [% of total market]
1	SUN Microsystems (Solaris)	28.5	32.5	40.0
2	IBM (AIX)	14.9	22.0	24.5
3	Hewlett Packard (HP-UX)	16.9	14.1	12.5
4	Compaq (Compaq Unix)	12.8	13.7	6.9
5	Dell	2.2	2.2	5.9

Table 2 Leading Unix Vendors

The numbers speak by themselves. Whereas SUN's and IBM's market share has increased by approximately 50%, with IBM almost doubling its Unix server sales, the Compaq Unix server sales in the year 2000 fell at less than half the number of sales in 1999. It is a bad sign when a computer company looses 50% of its share in a flagship market. And it is no good news either when the Unix offering of this same computer vendor is not even mentioned in a research meeting (quietly) organized by one of the industry's leaders for the purpose of determining in what direction is the Unix market going to move.

The June 2001 announcements fully confirmed these trends. EPIC is in, Alpha is out, and an entirely new Unix landscape started to emerge based on what might soon become the second truly open platform in the history of computing.

Impact on the SCADA/EMS Industry

Most of the current SCADA/EMS implementations are predicated on Compaq Alpha running under Tru64 Unix. The Alpha platform represented the next logical step for DEC VAX/VMS/OpenVMS systems, and appealed to users because of its scalability and superb price-performance characteristics. A relatively small segment of the industry has adopted IBM RISC/6000/AIX and SUN Microsystems Sparc/Solaris solutions. And an even smaller number of systems are using Hewlett Packard RISC machines under HP-UX.

So, what's the impact of the June 2001 announcements on the SCADA/EMS industry? At the first sight, this might mean obsolescence. Since the Alpha processor will be phased out sometime in 2004, the SCADA/EMS systems that use Alpha based machines would become obsolete. But this is an unlikely scenario. Rather, the vendors of Compaq based SCADA/EMS systems will probably start migrating their offerings as soon as Compaq makes available the Tru64 Unix and related tools such as C, C++ and Fortran compilers optimized for the EPIC architecture. An early indication that this is what will probably happen is the long list of third party system software and application providers that are already supporting Itanium – Oracle, Informix (now part of IBM), Computer Associates, Network Associates, and SAS, among many others.

Possible migration paths might also encompass support for alternate RISC based operating systems, such as AIX, Solaris or HP-UX. But porting millions of lines of code to another operating system is easier said than done. And since the outcome of the upcoming EPIC vs. RISC battle is yet to be determined, it is difficult, if not impossible, to predict who would port what – and on which target.

The future is far from certain. The electric industry is now waiting for the SCADA/EMS vendors to start their engines and come forward with crystal clear statements in the aftermath of the EPIC-Alpha announcements – and to unveil reasonable and credible plans to protect the customers' investment in SCADA/EMS computer and software solutions for the years to come.

New York, July 3, 2001

<u>Source</u>:

<u>http://www.intel.com/itanium</u> and related links <u>http://interactive.wsj.com/pages/techmain.htm</u> (Wall Street Journal) and related links <u>http://www.compaq.com/newsroom/pr/2001/pr2001062501.html</u> (June 25, 2001 Compaq-Intel Press Release) <u>http://www.computerworld.com</u> and related links