RISC

Strategy

9-Jun-1988

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For Internal Use Only

Fundamental Problem

- RISC microprocessors offer 2 to 3 times the performance of a VAX microprocessor in the same technology
- VAX/VMS systems will be at a severe competitive disadvantage compared to RISC based systems
- We need to provide an easy migration path for VAX/VMS customers to a compatible platform with competitive price/performance

Related Problems

- UNIX is emerging as an industry standard operating system with a potentially large market
- We will need to introduce a 64-bit architecture in the mid 1990's

Original PRISM Plan

- Define a 32-bit RISC architecture with plaaned extension to 64 bits, and support for SMP, vectors, and VMS-like features
- Develop a set of products based on the 32-bit PRISM architecture
  - Workstations for UNIX marketplace
  - Data base servers
  - Compute servers
  - Use MICA as the proprietary operating system for servers and to introduce VMS compatible features
- Define a common software architecture to leverage a common set of layered products for PRISM/Ultrix, PRISM/Mica, and VAX/VMS
- Protect customer investment in VMS applications
- Use 32-bit PRISM systems to develop new software that can be migrated to 64-bit architecture later

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Advantages of PRISM Strategy

- Shared low level operating system components for Ultrix and MICA
- Common layered software for Ultrix and MICA
- Choice between Ultrix and MICA based on customer preference instead of richness of layered product set
- Does not force VMS customers to UNIX for good price/performance
- Provides Unix with standard UNIX tools and prorietary VMS layered products
- Minimizes duplication of development resources for dual operating system strategy

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Customer Choices

- Stay with VAX/VMS with its rich software environment but poor price/performance
- Switch to MICA and use subset of VMS tools but at better price/performance
- Switch to Ultrix and use subset of VMS tools

Worksystems Competition

- SUN products based on licensed SPARC chips
- HP products based on proprietary architecture
- Anticipated IBM products based on proprietary architecture
- Apollo products based on proprietary architecture
- DG, Tektronix based on Motorola M88000
- Silicon Graphics based on MIPSCO chips

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Scenario without PRISM

- Customers perceive VMS as a non-competitive platform
- No migration path to a VMS compatible RISC platform
- Painful migration to industry standard Unix is the only way to achieve competitive price/performance
- Do we need VMS tools on Unix for product differentiation?
- What are the advantages of Digital's Unix?
- How about Sun, HP, or IBM?

Key Strategic Issues

- Will VAXes be competitive?
- Do our VAX/VMS customers need a VMS compatible migration path to a better price/performance alternative soon?
- Can a VMS compatible solution be provided without a complete set of 32-bit PRISM products?
- Can we succeed in the Unix marketplace without large amounts of Digital value added software?
- Can a value added Unix system be provided in a timely manner without PRISM?
- Can we meet the needs of the VMS customer base without PRISM?
- How long will our VMS customer base wait for competitive VMS compatible RISC products from Digital before switching to Unix?

Possible Scenarios

- Pursue a PRISM only strategy with more aggressive semiconductor plan based on technology partnerships with outside companies
- Aggressive PRISM plan, but add MIPSCO based low end workstation as a backup
- PRISM based products for VMS customers, MIPSCO for UNIX
- Rejected Alternatives
  - MIPSCO for workstations, PRISM goes directly to 64 bits
  - MIPSCO for everything

PRISM Only Strategy

- Advantages
  - Single hardware platform for Unix and "VMS"
  - Minimum redundant development
  - VMS layered products available to Unix users
- Disadvantages
  - All eggs in PRISM basket
  - May not be perceived as standard Unix by Unix purists
  - First products get to market 3-6 month late
  - Unix market cannot take advantage of semiconductor chips
- Corrections needed to current PRISM plan
  - Solve uPRISM chip price and availability problems by working with outside foundry
  - Staff up aggressively for CMOS-3, CMOS-4, bipolar chips
  - Establish technology partnerships to ensure availability of leading edge semiconductor technology for PRISM chips
  - Add Personal PRISM to plan
  - Aggressively migrate VMS software environment to PRISM

Dual Architecture Strategy

- Full set of PRISM products as a migration path for VMS customers
- Family of MIPSCO products for industry standard UNIX marketplace
  - Chips and compilers from MIPSCO
  - DECnet and DECwindows from Digital
  - Other layered software from third parties
  - IEEE floating point
- Overlapping product families
- Hardware engineering costs can be reduced by using common hardware platforms for both families with differences limited to CPU
- Clear separation between proprietary software and public software

Advantages of Proprietary Architecture

- Control over architectural features provided to support system goals
  - Multiprocessing
  - Vector processing
  - Ease of migration to 64 bits in the future
  - Support for operating system features such as multithreading, ASTs, etc
- Proprietary architecture can be licensed to leverage industry semiconductor technology
- Perceived as a technology leader by the market
- Ability to leverage existing proprietary software technology and products
- Disadvantages
  - Dependent on internal semiconductor technology unless technology partnerships are established
  - Difficult to take advantages of external innovations

From: TLE::DECEAT::BHANDARKAR "10-Jun-1988 1347" 10-JUN-1988 14:23
To: @PLANA,BHANDARKAR
Subj: EPA mileage rating

Be careful when you look at MIPSCO's performance claims. First of all the MIPSCO presentation shows a range of numbers for their parts as follows:

R2000	5-12 VUPS
R3000	20-40 VUPS
R4000	50-100 VUPS
R6000	65-180 VUPS

The only chips that they have today are the R2000 chips. The first parts in early 1986 ran at 8 MHz, followed by 12.5 MHz, 15 MHZ, and very recently 16.7 MHz. MIPSCO's names for their systems with these parts and their claimed performance is as follows

M/500	8 MHz	5 VUPs
M/800	12.5 MHz	8 VUPs
M/1000	15 MHZ	10 VUPs
M/120-5	16.7 MHz	12 VUPs

Based on this fact one should interpret the range of numbers to mean that the low number is what they hope to achieve with first pass parts if they run at speed (the original R2000 was announced as a 8-16 MHz part at first ship). The high number is what they might be able to do in 2 years through process improvements and/or mid-life redesign.

How accurate are their claimed numbers? Mike Greenfield in ESG ran a suite of 80 Fortran benchmarks on a M/1000 an found that the geometric mean was 2.66 times a MicroVAX 3000. This means that the M/1000 is 2.5*2.66 or 6.65 VUPs. Additionally, 2 of the benchmarks in the Digital Review set (lahydr and laintp) took 40 times longer to run than the published numbers from MIPSCO (these were excluded from the computation of the geometric mean).

The Sun-4 tested out at 1.82*2.5 or 4.55 VUPs.

The VAX 8550 tested out at 2.03*2.5 or 5.1 VUPs.

My conclusion:

Divide SUN's claimed VUPs by 2 to get their real performance.

Take 2/3 or MIPSCO's claim to get their real performance. If you want to be generous make it 75% of claimed number.

Of course, we all know that the real performance of our "upto 6 times 780" VAX 8550 is 5 VUPs, confirmed my this benchmark study.

Dileep

From: TLE::DECEAT::BHANDARKAR "10-Jun-1988 1246" 10-JUN-1988 12:50
To: @PLANA
Subj: If you agree with this write a similar letter to your "congressman"

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Interoffice Memorandum

To: Jack Smith
cc: Bill Demmer
PRISM Architecture Team
STF

Date: 10 June 1988
From: Dileep Bhandarkar
Dept: Mid Range Systems
Technical Director
Ext: 293-5350
Loc: BXB1-1/E11
ENET: DECEAT::BHANDARKAR

Subject: Our RISC strategy

RISC microprocessors offer a factor of 2 to 3 times better price performance than VAX microprocessors. Further, if you compare RISC microprocessors with our large ECL gate array VAXes, the price/performance advantage is even higher (closer to 7:1). This poses a significant problem for our VMS customer base, especially in the technical market place.

Our PRISM products provide an easy migration path for our VMS customers who are sensitive to price/performance. The PRISM hardware and software architecture are designed to ensure a smooth transition from VAX to PRISM while protecting the customer's investment in VMS applications.

Without an aggressive PRISM plan we will force this VMS customer base away from our prorietary systems into the world of non-captive Unix. If customers have to go through the pain and cost of software conversion, they will consider all of the available Unix systems as possible candidates. Vendors such as HP and Sun have a good chance to taking these VMS customers away from us.

The PRISM architecture allows us to build a robust, world class operating system with VMS compatibility with features such as symmetric multiprocessing, parallel processing, and vector processing. The PRISM architecture also provides a planned migration path to 64-bits, while maintaining the software features initially developed for 32 bit systems.

I believe that PRISM is absolutely critical to our future. We cannot afford to neglect the needs of our VMS customer base. We do need to be more aggressive with our PRISM program, especially with respect to semiconductor plans. The biggest thing that is needed here is CONSISTENT MANAGEMENT RECOGNITION OF PRISM AS A MAJOR STRATEGIC PROGRAM critical to the success of the company in the next decade.

The current PRISM plan includes the needs to the Unix market. This is largely predicated on the belief (espoused by Don McInnis and others in marketing) that we need to offer our VMS layered products on Ultrix. If

that is indeed an erroneous assumption, and if there is concern about the availability of the right semiconductor chips at the right time for the Unix market, then it would be reasonable to consider the ADDITION of a set of workstation and simple server products based on MIPSCO to our current product plans. The affordability of this option can be enhanced by buying out as much as possible (hardware and software) and minimizing the burden on internal engineering resources. Further savings can be obtained by using common workstation hardware platforms for both MIPSCO and PRISM based workstations with common graphics, memory, and I/O subsystems, power and packaging.

Given the strategic significance of PRISM, we have only 2 viable alternatives:

1. Do it all with PRISM and add additional resources needed to ensure success.

2. Target PRISM aggressive for the VMS compatible market with a full line of workstations and and multiprocessor servers. Use MIPSCO based workstations and uniprocessor servers for UNIX market based largely on third party software.

If you are seriously considering a MIPSCO only plan, I would highly recommend a detailed review of MIPSCO's current capabilities and a detailed plan for a MIPSCO based products with enough analysis to ensure that we will not encounter major show stoppers later. It would also help to have the new strategy clearly written down so we all have the same understanding of what it is and why we believe that it will succeed.