

HP Process Advances the Welcome 'Unreliable Computing' Trend

Martin Reynolds

Hewlett-Packard's (HP's) new fault-tolerant circuit design will eventually allow nanotechnology-based computing to replace today's semiconductors. This "unreliable computing" approach will become pervasive in the coming decade.

NEWS ANALYSIS

Event

On 9 June 2005, Hewlett-Packard (HP) announced that its researchers have developed a new approach to future high-volume, nanotechnology-based circuit manufacturing. HP's nanotechnology circuit designs use a cross-bar architecture that accommodates faults in the circuits, which in turn means that production will be significantly higher-yield and cheaper. HP believes the technology will not be available in commercial products for at least 10 years.

Analysis

The HP research highlights an emerging and welcome trend that will become pervasive in the coming decade — the movement toward what Gartner calls unreliable computing. This seemingly paradoxical term refers to the ability to assemble devices that do not always function correctly into entirely reliable systems, through redundancy and self-correcting designs. This philosophy will extend from the smallest devices to the largest systems. The value of this approach lies in manufacturing systems' ability to produce 10 or even 100 times as many unreliable devices as reliable ones. The overhead required to create a reliable system from unreliable building blocks is high — perhaps consuming 25 percent of the devices — but the overall system will be dramatically more capable than systems built using a conventional architecture.

The increasing reliance on smaller devices is causing performance problems, because such devices are more affected by external influences such as radiation and electrical noise. Unreliable computing will be an essential tool for manufacturers of smaller devices in achieving the continuing price and performance improvements predicted by Moore's Law. However, unreliable computing also applies to large systems. Google, for example, uses low-cost components to assemble a very large computing infrastructure. Gartner estimates that the unreliable-computing approach allows Google to deliver resources at one-tenth the cost of a typical server infrastructure.

Recommendations: Recognize that unreliable computing, whether at the circuit level or the server level, will become pervasive throughout IT architectures in the coming decade. Plan for scale-out architectures wherever possible. Scale-out server architectures represent an evolutionary step toward making effective use of unreliable computing. Explore virtualization technologies as a way to transport applications between systems, because these will be critical to adapting applications to the new infrastructure.

Analytical Source: Martin Reynolds, Gartner Research

Recommended Reading and Related Research

- "Key Technologies Needed on the Road to Tera-Architectures" — Tera-architectures are one way to build the large, scalable infrastructure required for next-generation business applications. But they will require new software and hardware components. **By Martin Reynolds**
- "Intel Research Holds Promise for Dramatic IT Changes" — Intel research on computing and distributed systems is contributing to the new tera-architecture, which could significantly change how IT works. **By Martin Reynolds and Tom Austin**

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