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Think fast

on 17 December 2000, 22:00

by [Niall McKay](#)

Let's face it: the Internet is stupid. Sure, it may have revolutionized the world as we know it, but it really is kind of dumb. It simply takes packets, reads the address headers, then shunts them on to their destination. It doesn't matter what they are, who they're from, or where they're going. For something generating billions of new dollars and totally revamping communications, wouldn't you think it would have gotten smarter by now?

If Jonathan Smith, a professor of computer and information science at the University of Pennsylvania, has his way, it definitely will. The Internet will become smart enough to, for example, protect itself from malicious hacker attacks, upgrade itself on the fly, charge users on a per-packet basis, or even decide that one piece of information -- such as a video stream or audio file -- is more important than another and make sure it arrives at its destination quickly and in one piece.

That's the sort of network we need if we are going to have true distributed computing. And distributed computing is the only way we'll achieve quality mobile (phone) commerce, location-based computing, and wireless Internet services.

Mr. Smith has devoted his life to designing this kind of network. In 1993, Mr. Smith, David Tennenhouse of the Massachusetts Institute of Technology, and some folks at the University of Arizona, Columbia University, and Bellcore (now [Telcordia Technologies](#)) developed the concept of "active networks." An active network is simply a distributed computer insofar as "the network," as [Sun Microsystems](#) likes to say, "is the computer." Back then the project was called Protocol Booster, and it provided a new way to develop protocol software. The [Defense Advanced Research Projects Agency](#) was quick to recognize the promise of the new technology and doled out \$25 million to 20 research establishments. Now MIT, the Georgia Institute of Technology, and [BBN Technologies](#) are actively working on the technology.

SMART MONEY

But it isn't just the government and research institutions that find the concept of intelligent networks interesting. Last year, [Intel](#) bought an active-networks startup called NetBoost, and has integrated some of this technology into its IXE 100 router products. Companies like [Cisco Systems](#) are beginning to ship routers with microprocessors, instead of with plain old ASIC chips, so applications can run on the network.

The idea is simple, according to Mr. Smith: take a piece of networking equipment and turn it into a computer that can receive commands from a user. To do this, he suggests, you first take a router and replace the ASIC chip with an all-purpose processor, like a StrongARM running a Java Virtual Machine. Then embed small software programs into the header information in data packets. That way data traveling over the Internet (through the router) can reprogram the Internet on the fly and allow network administrators to customize the information flow.

On one hand, this will slow down the Net because many packets traveling through the router will have a small program to run. On the other hand, however, the Net's newfound intelligence should make it much more efficient.

For example, data traveling over a wireless link is noisy. This noise is typically misinterpreted by routers as congestion, and because of this the routers tend to drop the packets. According to Mr. Smith, the routers should just pump the packets as hard as they can to ensure that they arrive at their destination.

Unfortunately, the current Internet doesn't distinguish between wireless data and conventional traffic. Wireless devices have less intelligence locally and therefore may be better served by a more intelligent network to provide the services they need. "Currently, if I have a Philadelphia cell phone and I'm traveling in San Francisco with a colleague and he rings me," explains Mr. Smith, "the signal would be routed to Philadelphia and then back to San Francisco, even if we are sitting right next to each other."

With active-network technology, the network would realize that the phone signals are coming from the same cell and would then create a direct connection. And with this in mind, the network could be programmed to track an individual, rather than a telephone number. It also can allow applications to do location-based computing for the individual. While traveling with a cell phone in New York, for example, the network might be able to suggest a hotel.

With active networks, services may be independently deployed by software rather than by having to replace every network router and hub. "When network administrators want to upgrade networks, they would simply send out software patches," says Mr. Smith.

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