Moving Toward Effortless Networking

John Callahan

Networking has never been considered a particularly effortless process. It has never been simple to set up a network of devices or to connect new devices to a network. For example, users frequently must install network cards and often must spend considerable time configuring devices they want to add to a network. In addition, all devices on a network generally must operate on the same platform. Devices operating on different platforms generally cannot connect to the same network. This has limited the ability of organizations and users to make the most of networking's potential.

This situation may be about to change. Several leading industry players are releasing or working on *effortless-networking* technology. In addition to making the networking process simpler, effortless networking technologies also promise to provide users with more power and functionality by letting them access printers, faxes, or even supercomputers via the network.

The technologies would permit device-independent, location-independent networking; enable peer-to-peer communication between devices; and let users instantly and automatically link to a network.

Editor: Lee Garber, *Computer*, 10662 Los Vaqueros Circle, PO Box 3014, Los Alamitos, CA 90720-1314; l.garber@computer.org

The technology promises to make networking easier and to provide users with more power and functionality.

Jini, announced recently by Sun Microsystems; MCoM (Mobile Communicator/Communication), a project now under way at Microsoft Research; and the Salutation project, undertaken by a consortium of about 30 leading computer and peripheral manufacturers, hold the promise of radically changing the ways networks are used, the types of services available to users, and the ease of accessing these services.

Jini would let enabled devices form a federation of Java Virtual Machines (JVMs). These devices could simply connect to a LAN, communicate with each other, and access each other's services.

The MCoM project, which is still in the early stages of development, is exploring a set of networking capabilities that would employ radio-frequency technology to offer wireless, continuous connectivity.

The Salutation Consortium has designed a protocol that it hopes will serve as an architecture for effortless networking. Salutation technology would, in essence, serve as middleware that would let otherwise incompatible devices interoperate.

These technologies, if widely adopted, could change the nature of networking and the face of the networking industry. Users could easily form networks, and new devices could easily join in, all without the traditional intervention of operating systems and drivers.

Because devices could link directly to each other without mediation by operating systems or drivers, the OS would no longer play such a vital role in networking. This could, of course, dramatically affect such OS makers as Microsoft.

In addition, effortless networking would let devices easily communicate and share services, which could open up new opportunities for distributed computing. Organizations and individuals could gain access to vast networked resources.

Of course, this will only happen if effortless-networking technology matures, proves itself scalable and secure, and is adopted by a significant number of users. And if various users adopt incompatible effortless-networking technologies, true connectivity won't be realized. The technology's future thus may be a long way off.

JINI: THE NETWORK DIAL TONE

Jini (http://java.sun.com/products/jini/index.html) is the result of a research project begun in 1994 at Sun's Aspen Smallworks, a research facility run by company cofounder and vice president Bill Joy.

Using the analogy of a telephone network, Sun says that Jini would provide a *network dial tone*. Users could join a Jini network and have direct and automatic access to all hardware- and software-based services available on the network, including those of PCs, disk drives, printers, encryption products, and even supercomputers.

In essence, said Jini product manager Theresa Lanowitz, the Jini architecture will serve as glue that lets enabled hardware, software, and services interact in

the network environment. Figure 1 illustrates Jini's architecture.

Jini technology would run a set of Java class libraries on top of various devices' Java virtual machine (JVM) implementations. Jini would also specify APIs for various networking hardware infrastructures and APIs for various operating systems.

Jini-enabled devices could thus form a federation of JVMs that could communicate with each other. Any device with a JVM could become Jini-enabled, noted Jini product director Mike Clary. Java's platform independence would permit otherwise incompatible devices to communicate, according to Sun.

To enable the technology to work with even small devices with little memory capacity, Sun shrunk Jini's core discovery and lookup portions into 48 Kbytes of Java software binaries, Lanowitz said.

In Jini's initial implementation, devices used wireline technology to connect to a network. However, Sun hopes to untether commercial versions by using wireless technology, which the company is currently testing in a beta version of Jini, Lanowitz said.

When a user connects a Jini-enabled device to the network, the device would send a 512-byte multicast discovery packet. The Jini lookup service would respond to the device, which would then upload its characteristics, including services offered and interface requirements. Other devices on the network could then determine how to communicate with the new device. The lookup service would generally reside on a server on a Jini network, although devices could also perform lookup on a peer-to-peer basis.

Sun has about 30 partners that plan to manufacture Jini-enabled products, including Canon, Computer Associates, Epson, Ericsson, FedEx, Mitsubishi, Novell, Quantum, Seagate, and Toshiba.

Paul Borrill, Quantum's vice president and chief architect, said, "Jini provides the opportunity for Quantum to attach our storage systems (disk and tape drives) directly to the network to provide storage and backup services to network users."

Borrill said the company is working on Jini-enabled products but is not sure when it will release them.

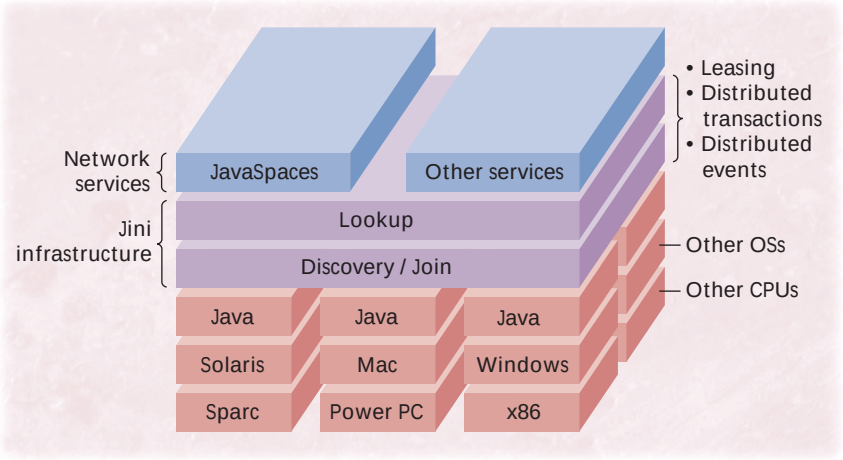

Figure 1. In Jini's architecture, the discovery/join layer is where devices or applications register with the network for the first time. Using a process called leasing, they register for only a limited amount of time and must regularly reregister. That way, the system doesn't have to keep information about devices or applications that don't want to remain on the network. The lookup layer posts information about services available throughout the network and can hold drivers or driver interfaces for use by clients. Jini also permits peer lookup. Jini's Java API facilitates distributed events and manages distributed transactions. To further facilitate distributed computing, Jini provides network services. JavaSpaces is designed to provide a mechanism for dynamic communication and coordination of objects between Java-based network resources. As the figure shows, Jini is designed to work with various operating systems and CPUs.

MCOM: WIRELESS NETWORK ADAPTER

Researcher Victor Bahl kicked off the MCoM project when he moved to Microsoft Research last year from Digital. As currently planned, an MCoM wireless adapter would fit into various devices and let them communicate across platforms.

MCoM wireless network adapters would permit communication via radio-frequency wireless technology. The adapters would be small enough to work with digital cameras, set-top boxes, and other consumer electronic devices that could connect to a network. Initially, Microsoft envisions MCoM being used in personal digital assistants and handheld personal computers.

Users could connect to the network wherever they are. MCoM would permit automatic device registration and service lookup and would automatically provide subscribed services, such as the delivery of e-mail or stock quotes.

Bahl said he is not sure when MCoM products will be released. Microsoft Research is just beginning to build MCoM prototypes. Microsoft will subsequently build a second generation of prototypes and distribute them throughout Microsoft Research for initial usability testing.

Eventually, he said, Microsoft's Windows NT group will develop MCoM-based server software. The Windows CE group will work with hardware vendors, such as Hewlett-Packard, to include MCoM capabilities within handheld PCs and other products.

Bahl said, "Our goal is to make wireless networking cheap and very accessible. Wireless Ethernet has been around since 1990 but hasn't achieved widespread deployment. At $495 for an adapter and $1,300 for a point of presence, it's been too expensive.

"But for now, MCoM is research," Bahl said. "I have to prove it can be done."

SALUTATION

The Salutation Consortium (http://www.salutation.org)—a group that includes such companies as Adobe,

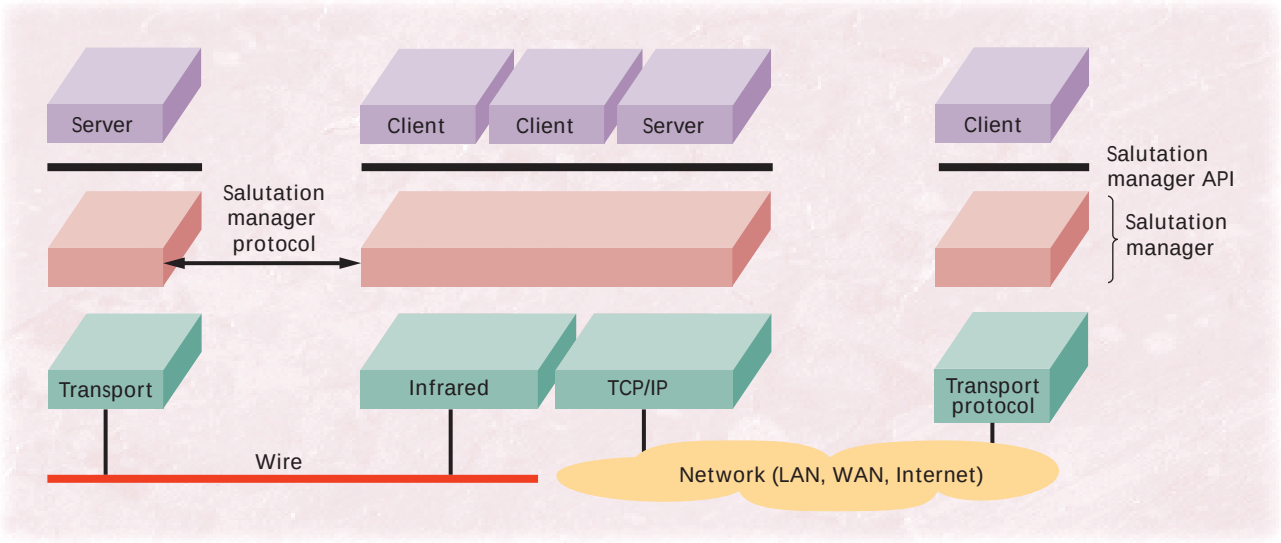

Figure 2. The Salutation manager and Salutation manager API play central roles in Salutation technology. When Salutation-compliant entities (devices, applications, or services) join a network, they register and provide information about themselves, via the API. The information is then registered with the Salutation manager. When one networked entity wants to find and access another (for example, if a laptop wants to access a fax server with specific capabilities), it uses the API to send a detailed request via its manager. The manager then uses the Salutation protocol to look on the network for devices that satisfy the request. If a suitable device is found, the managers of both entities communicate, via the Salutation Manager Protocol. The API then serves as the interface between the entities themselves. In essence, Salutation managers act as service brokers that let networked entities discover and use each other's capabilities. As shown, Salutation can connect entities that are physically linked or that must link via a LAN, WAN, or the Internet.

Canon, Cisco, H-P, IBM, Novell, Sun, and Toshiba—is working on the Salutation Architecture Specification.

The project was originally called SmartOffice and initially focused on office-equipment interoperability. However, work now focuses on all types of devices, applications, and services that can communicate over a network.

Rather than provide interoperability between devices, the open architecture would, in essence, serve as middleware by permitting and facilitating interoperation. Figure 2 illustrates the way the technology works.

A device that conforms to the Salutation architecture would broadcast a query to find another enabled resource on the network. The sending device could identify the resource's capabilities, determine which protocols it could use to access the desired services, and determine how to best use the services.

According to Robert Pescoe, president of senior Technical Staff Consulting and the Salutation Consortium's first president, "Salutation is designed to operate over all types of networks."

The consortium, which manages the Salutation Architecture Specification, has made the technology available to companies that want to use it. According to Pescoe, there are several Salutation-enabled products, including fax machines, in Japan.

Current consortium president Dick Osterman said, "We anticipate more products in the US in the next six months.

"The consortium recognizes that we need to build momentum in the US," he said. "Salutation is meant for the networked environment. The US is ahead of the rest of the world in the networked environment. For Salutation to be successful, it has to be successful in the US."

CHALLENGES AND OBSTACLES

While effortless networks offer numerous potential advantages, they also face some potential problems.

For example, effortless networks could face scalability problems. As many devices take advantage of the ability to connect easily to a network, particularly over the Internet, the network could face serious bandwidth limitations.

In fact, David Smith, an analyst with the Gartner Group market research firm, called Jini "a toy technology" because it hasn't demonstrated the ability to scale. "The potential exists when it scales up to the Internet," Smith said. "Jini works only in a LAN now. In its current form, Jini is inherently unscalable."

Effortless-networking technology will also have to prove that it is secure and that it can appeal to a significant number of users. Meanwhile, if users adopt effortless-networking technologies that aren't compatible, they will limit their ability to communicate.

However, said Smith, the concept behind effortless networking has a good chance of succeeding in the long run. For example, he said, "Even if the technology that introduces the concept [Jini] doesn't succeed, the market leaders will introduce products based on the concept."❖

John Callahan is a Seattle-based technology writer. Contact him at johnc@itr.com.