BBN TECHNOLOGIES

Internetwork Research Department

BBN's Internetwork Research department conducts research and development to meet the advanced network technology requirements of early adopting commercial and government customers. The department performs analysis and modeling, designs solutions to meet customer requirements, and validates those solutions via prototypes and/or simulations. Its diverse R&D areas offer staff opportunities to explore a wide variety of networking technologies, including:

- Network infrastructure security
- Network intrusion detection and traceback techniques
- Mobile & wireless networking algorithms and protocols
- Satellite networks, including satellite/Internet integration
- Novel routing solutions
- End-to-end transport protocols
- Very high speed network devices, including Internet routers
- Network management methods and architectures
- Network understanding techniques
- Efficient spectrum management
- Modulation and coding for wireless communication
- Quality-of-Service (QoS) provision and enforcement
- Architectures and protocols for advanced network services

Current Projects

XG Architecture and Protocols

The assignment of radio spectrum for specific uses and to specific users is a complex activity, typically performed centrally by one or more agencies in each country. The FCC does this in the U.S. for civilian uses. There is little useful radio spectrum that has not been so assigned. In spite of this apparent scarcity of spectrum, the actual use of spectrum is quite sparse. The goal of DARPA's NeXt General (XG) Communications program is the dynamic use of spectrum based on sensing actual use, rather than merely on static assignments. BBN has a major role in this program as the developer of the architecture for XG. One of BBN's significant developments is a language framework for expressing spectrum policy in a machine-readable form. This enables dynamic users of spectrum to adapt to the various policies that may apply to different portions of the spectrum.

Source Path Isolation Engine

The Source Path Isolation Engine (SPIE) is a system resident at or beside routers that enables IP traceback. IP traceback is the ability to identify the source of a particular IP packet given a copy of the packet to be traced, its destination, and an approximate time of receipt. Historically, tracing individual packets has required prohibitive amounts of memory; one of SPIE's key innovations is to reduce the memory requirement (down to 0.5% of link bandwidth per unit time) through the use of Bloom filters. By storing only packet digests, and not the packets themselves, SPIE also does not increase a network's vulnerability to eavesdropping. SPIE therefore allows routers to efficiently determine if they forwarded a particular packet within a specified time interval while maintaining the privacy of unrelated traffic.

Where Wizards Work

For over 50 years, the name BBN has been synonymous with technical innovation. For our customers, that means they can rely on us to solve problems that others are reluctant to tackle. For our employees, it means earning respect and recognition for their achievements and the opportunity to work on challenging, one-of-a kind R&D projects while collaborating with outstanding technical talents.

Katie Hafner dubbed Cambridge-based BBN "The Third University" in her book *Where Wizards Stay up Late*. The collegial, entrepreneurial BBN culture that Hafner describes in her account of the birth of the Internet persists today.

This combination of unique culture, exceptional technical talent, and meaningful work that uses technology to shape a better world means that BBN attracts talented candidates who value excellence and integrity.

Our passion for

Technical innovation & excellence

Creates practical solutions

To complex problems

Learn More!
To learn more about exciting employment opportunities available in Internetwork Research and other BBN departments, please visit: http://careers.bbn.com/

Space VPN
This research addresses the unique problems of multi-satellite networking for creating a secure IP-based communications infrastructure for SensorWebs in space. BBN's approach focuses on two critical aspects of the SensorWeb problem: the architectural framework for extending standard IPsec-based Virtual Private Networks to space and the Multi Satellite Network (MSN) technologies required to enable on-demand real-time access to on-board instruments, and integration with the terrestrial Internet. BBN's architectural framework integrates the use of low-cost ground stations, networking between satellites operating in diverse orbits and ground stations, the opportunistic use of the terrestrial Internet to fill in sparse areas in the satellite constellation, and standard secure IP (IPsec) tunnels terminating at the satellites or ground stations. The space network leverages technologies BBN has previously developed for NASA that integrate the use of dynamic null-steered multi-beams and BBN's Tdma with Cdma-encoding Multiple Access TCeMA, with network layer protocols optimized for space applications. A key result of this work will be the definition of a common ground/space networking capability that could be used to complement GEO relays in future NASA satellites and ground stations.

SINEW
The SINEW project is developing software that enables radio-networked computers to dynamically change their points of connection to the Internet without needing to change IP address. We do this using a flexible, BBN-developed variant of Mobile IP, along with ad hoc routing techniques that allow this system to scale to a large number of nodes. This project is being funded by the Office of Naval Research.

Low Energy Ad Hoc Networking
In collaboration with BBN's Mobile Networking Systems department, the Internetwork Research department has designed an ad hoc network protocol stack that provides true cross-layer optimizations from the transport layer all the way down to the radio, providing the best performance without the constraints of layering or pre-existing networking traditions. Furthermore, our design relies only on off-the-shelf parts for its ground-breaking operation but can utilize new advances as they become available and cost-effective.

Our innovations have shown a 50-300X reduction in the energy required per node without significantly affecting application constraints such as delay. BBN is moving forward with making the next generation of low energy networking a reality.

High Speed Network Systems
BBN is a leader in high-performance network systems design and is the only commercial center with such expertise that is not part of a network equipment vendor. Over the past several years, the Internetwork Research department has developed the system software and hardware architecture, design, and implementations of a number of gigabit and terabit network applications. These included the Multi-Gigabit Router—the first 50 Gb/s router architecture—, a commercial terabit router, several commercial and government cryptography gateways ranging from 1Gb/s to 110 Gb/s, and gigabit-speed network security devices.