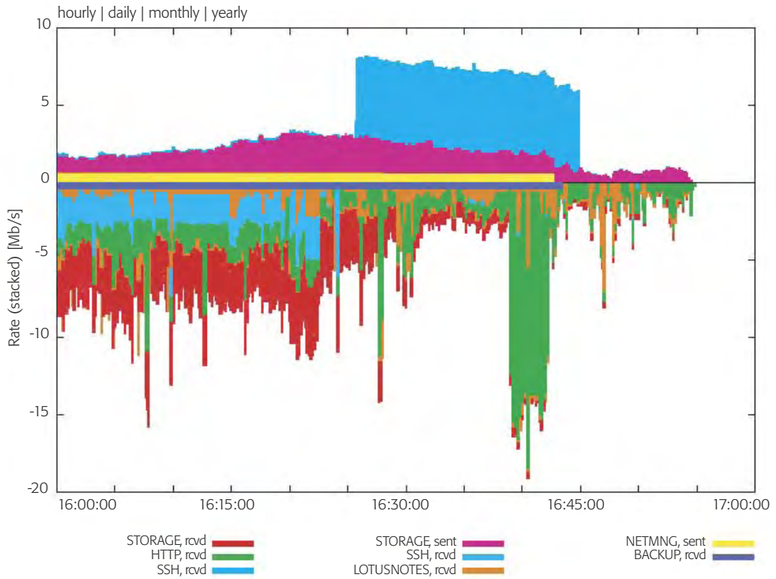
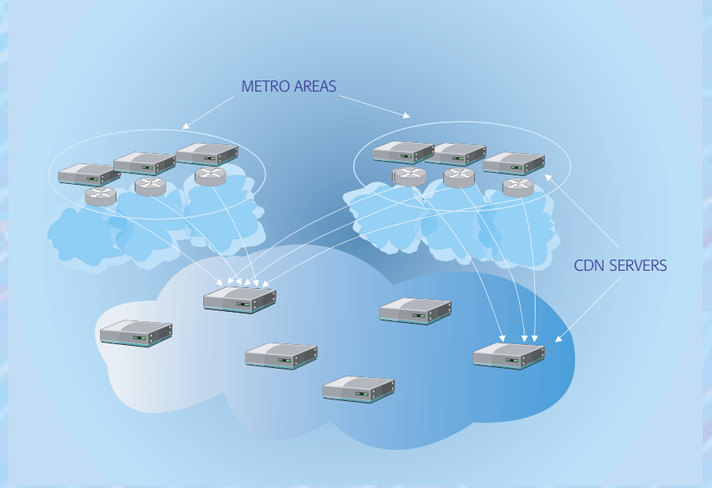
COMMUNICATIONS AND NETWORKING

Over the past three decades, IBM Research has played a key role in the development of communications and networking technology, with a broad range of contributions to IBM products, standards, and fundamental advances in the field. For example, our researchers made important contributions to versions of the IBM Systems Network Architecture (SNA), which held sway in the business communications arena for many years. Research was involved in the development of the National Science Foundation NETwork (NSFNET), the precursor to the Internet, and in several important Internet standards, such as the Open Shortest Path First (OSPF) routing protocol, Mobile IP, Border Gateway Protocol (BGP), and policy-based network management. IBM's token-ring architecture of the mid-1980s became an industry standard for local area networks. The Prizma switch led to new advances in the development of Asynchronous Transfer Mode (ATM). Trellis-coded modulation, invented at Research, became the core technology for modems. Fundamental contributions were also made to the science of capacity planning and management of computer networks.

With the unprecedented adoption of Internet protocols and the commoditization of core network technologies, IBM's research agenda has changed direction and is centered on exploring solutions and systems that exploit the network in new ways. Complementing the shift in focus within the broader network community towards research in overlay infrastructure, such as Planet Lab and peer-to-peer technology, IBM's technical activities are focused on developing scalability techniques for servers for new workloads in the network and on expanding the concept of the virtualized network.



Network profiling as an example for advanced resource monitoring.



Content Distribution – Virtualizing Networks for Improved Performance.

SCALABLE SERVER INFRASTRUCTURE

As Moore's Law appears to be approaching a dead end due to power and form-factor issues in hardware, the rate of growth in network capacity is outstripping the increase in processor capacity. As a result, innovative software and hardware technologies, enabling servers to keep up with the high volume of network data into the servers, have become increasingly important. IBM researchers are investigating innovative ways to improve the scalability of network function processing in high-volume servers. These include techniques to accelerate network interconnections, develop benchmarks for emerging workloads, and new software components for server networking needs. Technologies such as Voice over IP (VoIP) will significantly change the nature of workload on networked servers from traditional Web-based interactions and will necessitate increased reliability and quality of service. IBM's goal is to understand the nature and performance characteristics of networked servers under these new types of workloads, including VoIP, IP Multimedia Subsystems (IMS), and network games.

NETWORK VIRTUALIZATION

Although the technologies in the core network have standardized, several key challenges remain in the area of end-to-end performance, availability, and manageability of networked systems. The concept of a virtualized network, where the connectivity functions offered by the network are conglomerated into simplified end-to-end abstractions, provides a way to manage these attributes, as well as a potential way to introduce new capabilities to augment the network core. Novel network management technologies that assist in the concept of network virtualization, including monitoring, device discovery, control and presence information, multi-homing, scalable multi-party communications, and on demand networking, are key to IBM's current and future networking research.

Tight control of resource provisioning requires advanced resource monitoring.