

*Challenges in Information Technology After September 11*  
*CATT Panel Summary by David Goodman*

The world changed abruptly on the morning of September 11, 2001 when the World Trade Center was attacked. Although New York City felt the impact first and foremost, the effects of the attack are global and long lasting. On November 9, 2001 the Center for Advanced Technology in Telecommunications at Polytechnic University convened a panel with representatives of organizations that had to deal with the unprecedented challenges as they occurred. The purpose of the panel was to assess the ability of existing technology to cope with the challenges and to determine the need for innovations to overcome the weaknesses revealed on September 11 and afterward.

Three of the panelists are directly involved in network operations: James Brennan of NYSERNET, New York State's high-performance statewide academic and research network; Gaston Ormazabal of Verizon, the predominant local telephone company in New York City; and Joel Wien of Akamai, which distributes Internet content throughout the world. The other four panelists are network users: Avi Duvdevani, of the Department of Information Technology and Telecommunications of the New York City government; John Gilbert of Rudin Management, owner and manager of several large office buildings in Manhattan; Tom Cahill, formerly of J. P. Morgan Chase bank, now at Polytechnic University; and Tom Morgan, of Keyspan Energy, a gas and electric utility. The panel moderator was Mel Horwitch, Director of the Institute for Technology and Enterprise at Polytechnic University.

The panel addressed three sets of issues: communications needs and resources in responding to the emergency, long-term effects, and lessons for the future. Although the purpose of the panel was to examine infrastructure and technology, there was a high emotional/personal undercurrent to the discussions due to the proximity of the events in time and geography, and the relationship of panelists and audience to victims and survivors.

On the operational side, the most encouraging reports came from Joel Wien of Akamai who reported that the core of the Internet largely withstood the huge demand for service and the loss of physical resources in New York City. Akamai maintains 13,000 fault tolerant web servers worldwide, and its load sharing technology held up quite well in the face of an overall increase in traffic of a factor of four, and local increases of a factor of 1000. There were 100 billion hits on September 11 and 150 million live streams.

By contrast, the telephone network was unable to meet the demands placed on it. The widespread degradation of service in many parts of the United States and internationally was due largely to high calling volume and only partially to the effects of the physical damage near the World Trade Center and the Pentagon.

It was generally acknowledged that delay-tolerant packet switched data communications are inherently more robust to surges in demand and failure of network components than real-time conversational voice. There was a suggestion that voice-over-IP telephony

could do a better job than traditional circuit switched voice services. Another technology issue relates to prioritizing the assignment of overloaded resources according to the identities of the parties involved. It is my understanding that fixed telephone networks grant priority to emergency calls and to designated government lines and that cellular operators are under pressure to provide corresponding services.

The long-term effects of the attack have been concentrated in New York. A Verizon building, next to the World Trade Center, which suffered enormous damage, was home to 4.4 million data lines and 300,000 telephone circuits. Fortunately, the destruction of equipment in New York caused no large-scale disruptions to the nation's economy because the financial services industries, with headquarters concentrated in New York (banks, stock brokers, insurance companies) protected themselves by diversifying their information-technology resources geographically. However, this was not the situation for thousands of smaller businesses. Although 3000 people have worked continually since September 11 to repair the damage to Verizon facilities, many businesses and individuals had to wait two months and longer to recover their voice and data services.

The causes and remedies for this situation produced a lively discussion. Panelists and audience members close to the affected businesses expressed a sense of betrayal that their connections to the world were so vulnerable to damage at a single building. Not only were customers unaware of their vulnerability, but the effects also seemed randomly related to customer locations. Tom Morgan spoke about Metrotech, an office campus, which is the home of his company, thousands of Chase Bank employees, and of Polytechnic University. He observed that after the attack on the World Trade Center, some Metrotech tenants had full voice and data service, while others (including Polytechnic University) had no Internet connections at all for several weeks because their Internet service was switched through the damaged building. This situation raised the question of whether the connected companies could have shared resources with neighbors that were disconnected. John Gilbert mentioned that he was on a task force for Downtown with the goal of insuring that in the future buildings are "never down."

The resolution of these and other issues depend on institutional and commercial conditions as well as on technology. James Brennan pointed out that the number of service alternatives for consumers of information technology is contracting rapidly, as smaller Internet Service Providers and infrastructure operators either go out of business or are absorbed by larger companies. Indeed the City of New York, with 26 buildings, including its emergency operations center, in and near the World Trade Center was able to reactivate a bankrupt data network (Ricochet) in order to coordinate the city's emergency services. Avi Duvdevani also reported that contingency planning for the "Y2K" computer problems anticipated on January 1, 2000, served New York City government well during the disaster of September 11, 2001.

While the consolidation of service industries proceeds, there is no overall responsibility for guarding against large-scale disruption of services and responding to catastrophic emergencies. AT&T held this responsibility twenty years ago but the responsibility evaporated after the telephone monopoly was abolished. Panelists pointed out that there

is no federal or state government agency with the mandate and power to put emergency plans for information technology in place.

All in all, the panel and audience touched on a number of critical issues in ninety minutes. In addition to the emergencies of the type created on September 11, it was noted that we live in a more dangerous world than we supposed and that future attacks on our information infrastructure might take a different form from physical destruction of buildings and assaults on people. Although none of the issues could be resolved in the context of a panel discussion, one comment by a panelist perhaps conveys a consensus view: “In all of my future work I will be alert to threats to network survival and a myriad of other security needs”.

Owing to scheduling conflicts, there was no representative of a cellular service company on the panel. This was a big gap because cellphones played a major role in the drama of September 11 and its aftermath. Cellphone conversations were the last communications of several passengers on hijacked planes and people in doomed buildings. Cellphones also provided the means for family members and survivors to establish contact after the attacks. Cellular networks, in common with the fixed telephone network, were overloaded and the situation in New York was acute because approximately 15 base stations were destroyed. It was my experience, however, that my cellular service held up fairly well. I was at home, within 500 meters of the World Trade Center, when it was attacked. I received four phone calls on my wired phone after the attack but I was unable to place any calls. Eventually (after three hours), I made one important call on my cellphone to a very worried relative who was able to notify other family members that I survived. After I was evacuated by boat to New Jersey (about 1,500 meters from the World Trade Center), I was able to use the cellphone almost at will.

In the weeks following September 11, temporary cellular base stations appeared in many places in lower Manhattan and even in Brooklyn, evidence of the ability of cellular networks to add capacity quickly in hotspots. The availability of cellular service went a long way toward mitigating the effects of long-term outage of wired telephone services.

Although I felt that my cellular service held up reasonably well on September 11, the New York press conveys the impression that the public is strongly critical of the blockages in cellular networks at the height of the emergency. I think this frustration would have been less severe in other countries, where text message transmission (short message services) are much more prevalent than they are in the United States. Text messages could do a good job conveying the essential information that people desperately wanted to send and receive. Short message services benefit from the advantages of packet switching - tolerance to delays caused by high network traffic and robustness in the presence of equipment failure. Even if a terminal is in an area without service when a message is composed, the message will be sent or delivered when the device arrives in an active coverage area. In fact, the one consumer service that held up quite well on September 11 was two-way paging – a data service consisting entirely of short messages, with no voice transmission capability.