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Comment

Kobe's lesson: Dial 711 for 'open' emergency communications

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This Comment discusses the telecommunications aftermath of the Kobe earthquake and discusses the creation of a new disaster communications system. The basic lesson for telecommunications from the Kobe earthquake is that the usual approach of disaster information systems, traditionally based on a military-style top-down approach, is inadequate. It congests easily and cannot adjust to shocks. A better alternative is an open-access emergency system – open to inputs from a wide variety of public and private participants and with open access to that information. In Kobe the emergence of 'information volunteers' was a spontaneous step in the direction recommended, towards a '711' system.

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Tranquility and routine were abruptly shattered on 17 January 1995 in the Japanese port city of Kobe, where an earthquake struck at dawn, killing more than 5000 people and leaving many more homeless. The dazed survivors, together with their families and public safety agencies, immediately faced an information problem. What was going on? How could help be organized? What was the fate of their loved ones? A few months later we can assess how helpful modern communications and information was in producing answers to these questions.

The basic lesson from Kobe is that the usual approach of disaster communications, traditionally based on military-style public safety agencies that are operating in a top-down manner and share information with 'civilians' only on a 'need-to-know' basis, should be replaced. Instead we should set up an open-access emergency system – open to inputs from a wide variety of public and private participants and with open access to that information. Not only would such a system be more efficient as a tool of information and organization, but it would also be more resilient to the shocks of disaster.

There are always two ways to protect vital information. One is to design and build elaborate and hardened technical systems. This is expensive and will always miss unforeseen mishaps. The other approach is to decentralize the information system so that even if many of its parts are damaged the whole will continue to function.

A historic analogy: in the early days of the American republic important public documents were protected in archives and other storage facilities. Thomas Jefferson, here also ahead of his time, argued instead for protection by decentralization:

> Our experience has proved to us that a single copy, or a few, deposited in MS in the public offices cannot be relied on for any great length of time. The ravages of fire and of ferocious enemies have had but too much part in producing the very loss we now deplore . . . This leads us then to the only means of preserving . . . that is, a multiplication of printed copies.

Today, electronic information and communications technology makes it possible to organize emergency communications in a similarly decentralized fashion. To explore this approach, let us look at the experience of Kobe, both the positive and negative.

Telephone networks are not so much destroyed as congested into uselessness. In Kobe most lines and switches kept on going. Service was temporarily interrupted to about 20% of subscribers in the damaged areas, mostly due to power outages (285 000

subscriber lines), destruction of buildings (100 000 lines) and cut transmission links, mostly above ground (about 100 000 lines). For long-distance service, the trunks of NTT were fairly resilient. Among competing carriers, DDI's microwave transmission proved robust, while the fiber links of Teleway Japan (using its highway rights of way) were temporarily cut when the roads were destroyed.

Among the first things that needed fixing were ATM cash machines and financial networks. Survivors needed money to buy food; credit cards needed verification; and interbank transfers were urgently needed. Almost 500 ATM host computers and terminals, as well as the system management itself, were damaged, and their restoration proved difficult.

The main problem, however, was congestion rather than destruction. Because everyone was trying to call at the same time, nobody got through. Networks are designed to handle about 10% of their subscribers at one time. In Kobe traffic volume on the first day was 50 times the usual peak – way above capacity. Next day network demand was still 20 times normal peak. This is not a short-term problem for disaster areas. Experience shows that after a crisis the volume of calls stays heavy for a long time.

In Kobe, as before in California, most incoming long-distance calls were blocked in favor of outgoing calls. Emergency service (911, known in Japan as 119 and 110) received priority, but it congested almost immediately and became more of a source of frustration than help.

Mobile communications proved helpful in bypassing destroyed landlines. But they, too, were vulnerable and congested. Traffic volume was seven times normal. In heavily damaged areas one third of NTT's transmission towers were damaged or stopped working for lack of power. Emergency batteries proved inadequate. Adjacent towers often maintained coverage, but at the expense of capacity.

Disaster mitigation meets the prepared. Long in advance of disasters, the public should be educated in using telephones only minimally in such situations, and encouraged to pick a 'message meeting point'. Congestion control should receive priority. Collaborative multi-aid agreements among otherwise competing carriers, such as already exist in New York, should be reached and tested in advance. Inbound 800 numbers could let some long-distance calls through even while most are blocked. But no network can be designed economically to withstand the gravest and rarest of disasters and congestions. One must be realistic about the limitations of advanced planning.

Television and radio

Television provided the big picture, often from the over-dramatized perspective of hovering helicopters, but not the little-picture details which people on the scene really need. TV networks released only verified official information on the number of the dead and the magnitude of the earthquake, and, because these figures were underestimates, public recognition of the catastrophe was long delayed. A Kobe congressman called several members of the Japanese Diet in Tokyo, pleading for a declaration of national emergency and the dispatch of troops, but was disbelieved for hours, because early TV reports were much less disturbing.

Radio proved again very useful in emergencies. (The humble battery becomes critical in emergencies. It seems impossible to have too many.) In California the much-maligned talk radio shows provided tension-reducing two-way links and countered false rumors. In Japan, too, the number of calls to radio stations was large – 20 000 calls to FM Kobe, and 30 000 to NHK in four days.

Computer networks

The major lesson from Kobe is that computer networks and bulletin boards are more effective than voice telephone networks and broadcasting, once the immediate calamity is over.

In Kobe the 'Nifty' computer network quickly became a major meeting point. Nifty (as well as its rival PC-Van) established a special earthquake bulletin board. During its first week

5000 messages were posted, and accessed 650 000 times by 140 000 subscribers. Usage of the board was free, and Nifty matched charitable donations.

The first messages posted were about disaster and transportation conditions. Soon inquiries appeared from friends and relatives outside of Kobe. Initially only a few messages were sent by survivors since many of them had lost computers, telephones and power. But some Nifty members soon reached an access point in an adjacent prefecture.

One of the most interesting things to happen in Kobe was the emergence of 'information volunteers'. These were mostly outsiders who came into Kobe carrying their portable computers. They visited shelters, collected messages about survivors (some taken from handwritten notes attached to ruins), and sent out the specifics about needs. They created a meeting point between needs and help and coordinated supplies among shelters. They obtained regional data about food, water and hot bath opportunities, and put it on a regional map. Later they offered information about jobs, schooling and housing.

Many of the volunteers organized themselves over the network. For instance, a Nifty forum for railway enthusiasts delivered a message: 'Let's meet at the Osaka station at 8 o'clock this weekend and then go to Kobe to help. Each member should bring food and other supplies for survivors.' A forum for motorcycle owners organized its members to move into the damaged neighborhoods to help as well as to obtain information which was put on the network.

One software company designed an information system to track and register survivors. This system was first ignored by official agencies but received 3000–4000 inquiries within one day.

It is often feared that 'unofficial' information is inaccurate and not updated. However, once Nifty bulletin board information grew in volume it tended to be self-verifying. While some messages may have been inaccurate, their sum total offered a better picture than the official information collected in the traditional way. Information was periodically reviewed by a Nifty monitoring committee; the messages seem to have been generally informative, responsible and often quite interesting. Feedback among network members, as well as messages of thanks from those benefited, further encouraged reliability.

Government in the dark

Government authorities are just as much in the dark in a catastrophe as individuals are. During the Los Angeles quake President Clinton's early information sources were his brother and the TV news. In Japan, at its noontime meeting the government still believed the number of dead to be only about 200. To get a first-hand report the military sent a helicopter to videotape the damage, but it lacked telecommunications facilities to send the recording to Tokyo. Most information travelled up the hierarchical chains of command of rival ministries and was slowly coordinated to give a full official picture. Public notification was thus late and incomplete.

Emergency communications often failed. At the Ashiya fire department only two telephones out of six functioned, so that most incoming calls got a busy signal. Firefighters could not reach their own department, doctors or hospitals.

The usual response to problems of this sort is to call for a technological fix, such as the design of a still better communications system. Kobe illustrates the ultimate futility of this approach. Kobe's Prefecture has installed, at considerable expense ($80 million), a satellite communication system to connect it to local and national government, offices and public safety agencies. But in the crunch the costly system was useless. It quickly stopped working when the back-up batteries ran out and the back-up generators overheated due to the failure of water cooling. And the public safety organizations did not know how to take care of the system – for example, how to adjust the angle of the satellite dishes once they had been upset by the quake. Only two calls were logged in on the entire system on the morning of the calamity.

A new approach

None of this should be surprising. Governments usually get an incomplete and often slow picture from their field agents. Emergency systems can never be built to be foolproof and disaster proof. If anything, modern communications become more vulnerable as their electronics are hard to fix in the field, and as they become more dependent on outside power supplies. It is time to learn from these experiences and revise the basic philosophy of emergency communication. Emergencies are no time to maintain the attitude of military-style emergency operations that keep information close to the official vest.

Instead of high-tech constructions, another approach is needed – a decentralized and open system of interconnected computer servers, where individuals and emergency workers can deposit and collect information about the state of their neighborhood, family, business and whereabouts. It would be used by public safety agencies and insurance companies as a planning tool, and could send messages and instructions to targeted individuals or areas.

Such a '711' emergency information system (the number is available) would permit access to an 'emergency dial tone', enabling the access of interlinked emergency computer bulletin boards on a priority basis, with automatic cut-off after a few minutes. Because of its decentralization, including sites remote from the disaster area, and 'inter-net working' among multiple carriers, the system would be less vulnerable to shock. There could be a schematic display of a city, block by block. Individuals, rescuers, nonprofit organizations and information volunteers would log in information, whether by phone lines or over the air. Much of the information would also be available to distant parties. The system would give news organizations detailed information, link worldwide donors with actual needs, provide 'how-to' information, and reach specialized databases, for example about toxic substances. Certain communications might have to remain confidential or private and require special levels of access authorization, but that could be easily accomplished.

Most people today do not have access to computers, especially in an emergency. But once the immediate calamity is over and problems of coordination displace those of physical survival, they could use regular or mobile telephones to talk to volunteers supported by automatic equipment.

In Kobe the beginnings of such an information system are being introduced by equipping shelters and other public places with access to computer networks. (Schools, in general, make excellent emergency nodes for people, services and communications.) The Kobe city government is now providing public information on housing, transportation and schooling on the network. Kobe residents communicate with the world. A high-school class in New York collected donations and sent them to Kobe after seeing pictures of the damage on the Internet.

Who could set up such systems? Commercial and non-profit software developers would provide the shell that would be put by computer networks on the net; telecommunications carriers would offer access points and links; information volunteers would update the system once a disaster strikes; municipalities, community groups and volunteer rescue organizations would provide the basic municipal grid information which is the main expense. Unlike the 911 service (which would continue), a 711 system requires no costly operators on duty because it would not be a dispatch service but simply an information meeting place to which emergency agencies can plug in.

What is important is that, unlike the 911 system, the 711 system would not be a one-way, top-down communications system but a genuine interactive and horizontal communications medium connecting citizens, their friends and relatives, and rescue efforts. The technology is available and affordable; the user base is strong and growing. And the time is here and now.