2008 TAPR Conference Proceedings
3990 Virginia Avenue
Shoreview, MN 55126

It's the Network

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Abstract: Viewed in traditional Amateur Radio terms, the average cellular telephone handset is not very impressive. It has limited RF power output, a fixed, built in antenna, and you can't even select the operating frequency. These devices do though leverage billions of dollars in worldwide network investment. Until Amateur Radio starts to think beyond just home stations and at more fixed infrastructure and networking, our emergency communications capabilities, particularly in the digital arena, will be limited.

One evening in mid 2002 I checked into the Minnesota Section Phone Net. It was one of those days when we had some traffic- a periodic military Divisional Reunion, and about five messages were being held for us. It took quite a while for these to be sent and for operators in each of the areas to be rounded up. I think we got all five or maybe four of the five messages handled in the half hour the net normally runs.

Later that week, in June 2002, there was an article in the Wall Street Journal talking about how hospitals would have to improvise a response to a "dirty bomb" attack (1). While the article focused on the notion of limited emergency room capacity and shortages of decontamination facilities, the point was that we were not prepared for many types of terrorist incidents or accidents.

This was before the massive build-up in Federal and other funding for terrorism response, and the widespread adoption of the Incident Command System. If there had been an incident, say in Minneapolis, it is likely Amateur Radio would have played a role. So the question was, if we had to help with a mass evacuation as an example, would we have the tools to do the job?

The short answer is no. We could probably handle the message volumes needed for internal Amateur radio purposes; we would not have much if any spare capacity to provide for served agencies, which is of course a key mission for us. I have stopped showing our 1920 era radiogram form to served agencies, who have not appreciated the historical context here in light of their serious mission objectives.

Most agencies are besieged with proposals from vendors and consultants for state of the art digital emergency response technology. As was stated in the Editorial in QST in September 2007, (2) the emergency management community is pushing toward a digital response, and we can either fight that and be left behind, or return, as the FCC rules suggest, to a leadership position.

Home Stations

There are some things we can do at an individual home station to get more digital ready. Having Internet is a start, as that is pretty universal, and is also the source of most news and software updates. If the Internet is up, being able to relay messages that way and look up information is perfectly fine. Internet linked repeaters can be accessed, and you have a range of available services.

Winlink/Airmail is another good tool, which can provide in and out of region mail services. These can use the Internet, or HF. HF is great, as you can reach out of region mail servers, who may not be impacted by local Internet outages as an example. One issue though with Airmail- you are capacity constrained, and have to seek permission to send large volumes of messages. And the system is Internet based- it may be impacted by Internet issues, such as in a Pandemic Flu scenario. In Pandemic Flu, it is anticipated there will be a gradual deterioration of fixed utility infrastructure, depending on the length and severity of the infection outbreak. There is a very low cost Airmail option still available – Pactor 1.

You can also put up a packet station, which uses our venerable but reliable AX.25 capabilities. If you have some area infrastructure, you can use that, such as BBSs. APRS is a similar use case. Various forms of D-Star are available for home users as well, leveraging in place repeaters.

If you have an extra analog phone lines, a fax server or even VoIP gateway can be set up. It is reasonable to use analog wired phone lines as a back up to cellular voice networks, as they do not share critical infrastructure much at a very local level (i.e. cell tower radio/trunk overloads) and have excellent power backup systems.

Shared Facilities/Clubs

It is pretty hard to put up high end shared facilities such as repeaters in the middle of a disaster. So clubs and other groups should be thinking ahead- and negotiating sites. There are already quite a few FM voice repeaters in place in most areas.

Packet nodes are easy to set up, and might cost $300-$600. These support modest data rates, but even if you have a BBS set up and are running at 1200 bps, you might be able to handle 30-60 characters per second over the system. This is far faster on a sustained basis that most manual traffic handling systems. Larger wide area packet networks are effective, particularly if you have good long haul coverage using commercial/government sites and multiple redundant nodes and solid RF paths. The idea is to be able to still pass traffic with 40 percent of your nodes offline. (20-40 Percent is the expected infection rate in Pandemic Influenza, and is a good model for a degraded system).

Clubs can set up D-Star DD mode repeater modules. These are not repeaters, as they are simplex. These support a data rate of 90-100kbps. Web based applications work fine, so operator training is minimized. We use ours for database updates and queries, and were able to handle a metro-wide response to a small to medium sized mass casualty incident with 50 EMS transports in a few hours and hundreds of database queries and thousands of updates over a few hours. On a good site, these can serve multiple remote users and database servers over about a 10-12 mile range. These machines can in turn be linked for better coverage. The very popular notion of Internet linking here is a possible failure mode.

Clubs can also set up BBS systems, mail servers and databases. Databases are key to a coordinated response. If you get a call to set up an ad-hoc field hospital, triage center and or vaccination station, the agencies will want some sort of data capability to track people or logistics. One must take care to not try to collect social security numbers or patient specific medical condition information on our open systems and radio channels. But that leaves a lot of other applications.

We are big fans of a mail and conference package called Citadel. It has an intuitive interface, and supports web users via D-Star and Internet and 802.11. It also has a character mode interface for packet or Telnet users. We like the “conference room” feature it has.

Tactical Support/ Case Study

The model we have used is the “call in the night” approach. If we get a call/message to set up an ad-hoc operations center, what do we have on the shelf? There is a tendency, even for professionals, to assume that some or all of the normal fixed utility infrastructure is in place. This might include cellular phones, wireless internet, power, gas stations etc. This was not the case in Hurricane Katrina, and is a good model for us. So the scenario of needing to set up a field triage center for 10,000 people might be a case study.

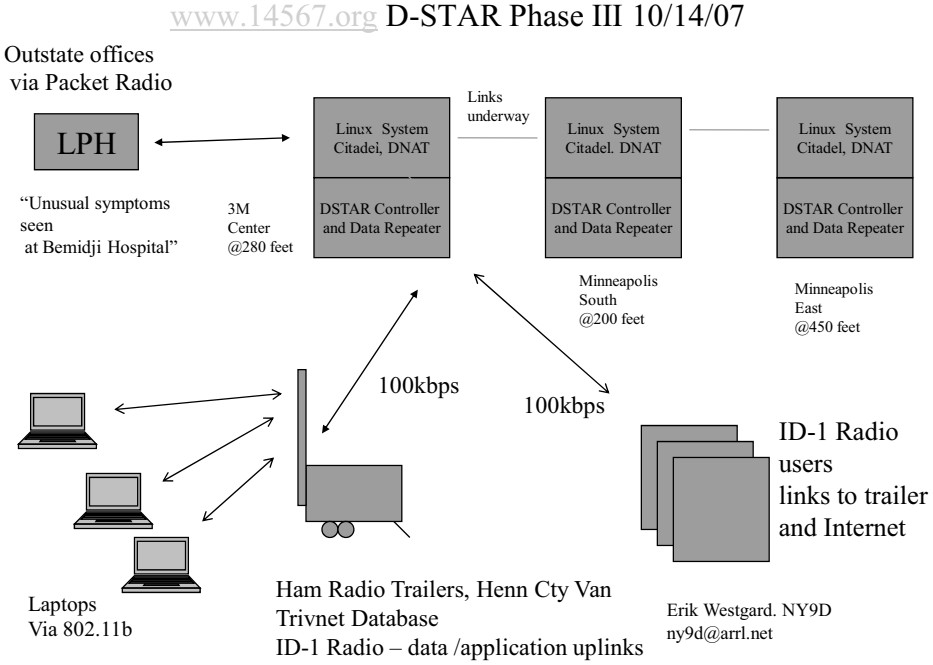
We would roll one of our vans/trailers (assume one of the owners is out of town), and set up. We might have AC power, we might not. We put up our tower, and connect to our packet and D-Star networks. We still have service even if 40%+ of those nodes are down. We can put up HF, and get Airmail going. We then set up a database server, or use one that is up on the network already. We can get basic Internet in an emergency via D-Star – we have multiple “dormant” remote Internet gateways on various ISPs which can be activated.

We have a dozen laptop computers ready, linked via an access point and tower mounted omni gain antennas for 802.11b/g. If we are in a building (likely), we can set up an access point in the building, connected back to trailer via an 802.11b bridge and dish antennas. We can also run a big piece of Cat 5 cable if available. We use

normal commercial /surplus equipment here- there is no need for the use of high power or Amateur frequencies. This also allows encryption on these links only to the database. We are not fans of payload encryption for emergency response, but this does increase flexibility and security.

If wireless or other Internet is available, we can connect to that. We then set up our IP phone system, (Asterisk) and deploy up to a dozen IP phones. Phones are familiar to all kinds of personnel, and do not require licensed operators or training. If every desk in a field hospital admission office needs to have a licensed operator, that is pretty limiting. If any analog phone trunks are available, we can tie into those. If wireless internet is up, we have a prepaid account at an IP telephony provider (SIP trunking) in Canada. We can "top up" that account via PayPal.

We don't have a satellite system, which many agencies such as the Red Cross use. This would require a steady monthly bill. But it could be added on.



The Future

One area that is interesting to us is ad-hoc networking. This is the idea that 802.11 wireless access points start to behave more autonomously, and link to each other and do path discovery. At a disaster scene, if multiple vans/trailers/units arrive and are set up, they will "discover" each other. This is helpful if you have five trailers and van, but only one has satellite Internet. No network administrator is needed- the systems find these paths by themselves. This capability is available commercially and via open source on certain wireless access points.

One other problem that needs solving- particularly over packet, is the need to address callsign authentication. This is supported by the FCC rules, and we need a way to determine if a person at the other end of a packet message is really that person. The tools to do this, such as via a digital signature, are available.

Conclusion

If you consider some real world disaster scenarios, where Amateur Radio might be used, do you have the tools and importantly the network, ready ahead of time? If you do, and are trained and certified on techniques such as ICS/NIMS, you can play an important part in leading real time emergency communications, as opposed to being on the sidelines.

References:

(1) Chase, Marilyn, and Rachel Zimmerman. "If "Dirty Bomb" Hits, Hospitals Must Improvise." Wall Street Journal 12 June 2002, sec. B: 1+.
(2) Sumner, David. "When All Else Fails...Amateur Radio." QST Sept. 2007: 9.

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