

# **Programmability for Disaster Relief Networks**

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When considering disaster relief networks, there are two areas of the network that can be focused on. The first is to consider the portions of the network that are damaged and must be reconfigured and connectivity restored, to the extent possible, and automatically as far as possible. The second is to consider the portion of the network that is largely intact (e.g. far from the disaster site) and must respond to the specialized demands, as well as the increased demands, that arise for extra support due to the disaster. In both cases, in the future the network will increasingly be called upon, and we believe will be technically capable of, not only surviving the disaster, and providing basic connectivity even under extremely high loads, but supporting special disaster relief applications.

Examples of disaster relief applications include support for priority access (including priority dial tone or Web tone) for emergency personnel and policymakers; voice calls or multimedia exchange (e.g. messaging or video sessions) that receive high priority and are free from congestion restrictions; high-priority voice or data (e.g. SMS) broad/multicast in full-duplex or half-duplex ("push-to-talk") mode; rapid creation and teardown of multicast and priority groups; rapid activation and management of network policies regarding security, QoS etc. In some cases the applications themselves are similar to those used in normal circumstances but may have additional features or behavior under disaster scenarios. As far as possible, users using these facilities should obtain the same "look and feel" as when using the network under ordinary circumstances. Additionally, as relief and emergency response operations become more sophisticated, new applications will be developed and deployed.

In the past very specialized applications of this type, e.g. the U.S. Government Emergency Telecommunications Service (GETS) facility, have been provided in the Public Switched Telephone Network (PSTN) by embedding special functionality in the switches and by using some of the capabilities of the Advanced Intelligent Network (AIN) architecture. With the emergence of converged (packet, circuit and wireless) networks as well as deregulation, there is a general industry-wide trend to make these networks programmable, so as to reduce the cost and increase the speed of developing new applications, by means of Application Programming Interfaces (APIs) being created by industry fora such as JAIN, Parlay and IEEE P1520. Future disaster relief networks will also be converged networks (although the convergence may be partial or ad-hoc due to disruptions caused by the disaster or due to incomplete integration). It follows that disaster relief applications should be built using programmable network interfaces; conversely, the APIs being developed by fora such as JAIN and Parlay should provide the specialized facilities required for such applications.

We describe current industry efforts towards programmable disaster relief networks in the sense of features required for disaster relief applications in JAIN and Parlay APIs. Note however that introducing facilities at the API level for converged network is not enough; these must be implementable in a substantial portion of the diverse technologies and protocols that underlie converged networks. We present a simple example of API features for a disaster relief application in a converged network and illustrate how the API features can be implemented. We also discuss more advanced applications and areas requiring further development.