Consultation Paper No. 11/2012

Telecom Regulatory Authority of India

Consultation paper

On

Telecom network failures during Emergencies/Disasters – Priority routing of calls of persons engaged in 'response and recovery'

10th May, 2012

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PREFACE

Communication plays an important role during emergency and Disaster situations, particularly in rescue and relief operations for the affected people. Timely deployment and use of telecommunication resources play a crucial role in disaster mitigation and relief operations specially in a country like India which is prone to natural disasters like floods, earth-quakes, coastal cyclones etc on one hand and manmade disasters like accidents, terrorist attacks etc on other. Hence, putting in place processes and structures to ensure reliable means of communications during disasters/emergencies in India can definitely help in better response and recovery.

In this context, TRAI had issued a pre-consultation paper on 8th November, 2011 on "Priority call routing in Telecom networks for persons engaged in 'response and recovery' work during emergencies".

This Consultation paper on Telecom network failures during Emergencies/Disasters – Priority routing of calls of persons engaged in 'response and recovery' has been prepared on the basis of the comments received from the stakeholders on the Pre-consultation paper and considering the international practices. The consultation paper has been placed on TRAI website www.trai.gov.in.

Written comments on the issues raised in the Consultation paper are invited from the stakeholders by 11th June 2012 and counter-comments by 18th June 2012. The comments and counter-comments may be sent, preferably in electronic form. For any clarification/ information, Shri Sanjeev Banzal, Advisor (MN), TRAI, may be contacted at Telephone No. +91-11-23210481 Fax No. +91-11-23212014 or email at advmn@trai.gov.in.

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INTRODUCTION

1 Under section 11(1)(a) (iv) of TRAI Act 2000 (as amended), Telecom Regulatory Authority of India (TRAI) is entrusted with responsibility of promoting efficiency in the operations of telecommunication services so as to facilitate growth in such services. Further, under section 11(1)(a)vii of TRAI Act 2000 (as amended), TRAI can make recommendations on any matter relatable to telecommunication industry in general.

Background

2 Communication plays an important role during emergency and Disaster situations, particularly in emergency rescue and relief operations for the affected people.

3 Natural Disasters cannot be prevented at the present level of Science & Technology (S&T) and community may have to live with certain level of risk – the level of risk depending on the level of S&T available for induction in Disaster Management and the resources made available by the Government for its actual induction, for holistic management of disaster in a proactive way. Holistic management of disaster calls for assigning priority in the prevention, mitigation & preparedness activities in the pre-disaster scenario of the DM continuum, while strengthening the efforts for faster and more efficient response through properly trained personnel equipped with advanced equipment/ instruments and building better recovery during rehabilitation and reconstruction period.

4 Timely deployment and use of telecommunication resources play a crucial role in disaster mitigation and relief operations. It is extremely important to establish telecommunication resources at the national level and cooperation amongst various member States and non-state entities to facilitate the use of the same.

5 The draft New Telecom Policy (NTP)-2011 released by DoT states emphasises the need to built resilient telecom networks in India. References made in the draft NTP-11 are as below -

Para 13 of Preamble - NTP-2011 recognizes the importance of creation of the robust and resilient telecom networks for adequately addressing the need for proactive support for mitigating disasters, natural and manmade

Para 5.13 of Strategies - To prescribe sectoral Standard Operating Procedures for effective and early mitigation during disasters and emergencies. To mandate Telecom Service Providers to provide alternative reliable means of communication at the time of disaster by creating appropriate regulatory framework.

Para 7.7 of Strategies - To promote creation of robust, reliable and resilient communication networks

These provisions of the draft telecom policy have far reaching implications for a country like India which is prone to natural disasters like floods, earth-quakes, coastal cyclones etc on one hand and manmade disasters like accidents, terrorist attacks etc on other. Hence, putting in place processes and structures to ensure reliable means of communications during disasters/emergencies in India will definitely help in better response and recovery.

6 The importance of telecommunication during emergencies resurfaced during bomb-blasts in Mumbai on 13th July 2011, where it was reported that the response was affected due to congestion in the cellular mobile network of Mumbai. In order to facilitate a mechanism wherein important functionaries engaged in 'response and recovery' work during emergencies get the calls on priority, TRAI had issued a pre-consultation paper on 8th November, 2011 on '**Priority call routing' in Telecom networks for persons engaged in 'response and recovery' work during emergencies'**, in which stakeholder's inputs/comments/views/papers were solicited on-

a. Any aspect, in general, of making Indian telecom networks resilient so as to be effective during disasters/emergency situations.

b. In particular, the aspect of 'Priority call routing' in telecom networks for persons engaged in 'response and recovery' work during emergencies.

7 Several inputs have been received from various stakeholders, which have been incorporated in this consultation paper.

8 The consultation paper is divided into four chapters. The first chapter covers the role and importance of telecommunications during disasters/emergencies and various phases of disaster management. The second chapter discusses some of the possible technical solutions to tackle network congestion problems that may arise just after the disaster has hit. The third chapter discusses some of the models that have been deployed successfully in developed countries to counter the network congestion problem by routing the calls of persons engaged in relief and rescue works on priority basis. The fourth chapter discusses some of the possible approaches to implement priority routing in Indian networks along with the issues that are involved. In fifth chapter, the issues for consultation have been summarized.

CHAPTER I: Emergency/Disaster and its impact on telecommunications

Critical role of Telecommunications in emergencies/disasters

1.1 Telecommunication has a significant social, cultural and economic impact on modern society. Many research studies have shown the macroeconomic link between good telecommunication infrastructure and economic growth. Telecommunication has played a significant role in social relationships by helping people staying connected to family and friends. Culturally, telecommunication has impacted the society by way of increased access to music and film. It has also transformed the way people receive their news. Apart from playing significant role in economic, social and cultural development, modern telecommunications infrastructure has also provided effective tools to enable human establishments to cope with crisis, and quickly restore disrupted social and economic activities. Role of telecommunication has been significant in 'response and recovery' during emergency situations.

1.2 By definition, an Emergency is a situation requiring urgent response. An emergency situation might develop into a Disaster[1], either due to its nature, or as a consequence of insufficient response to the initial event. The breakdown of crucial communications is one of the most widely shared characteristics of all disasters. Depending on the circumstances, initial response to disasters can be further corroborated by additional intervention that can be easily and effectively mobilized using Telecommunications. The International Telecommunication Union(ITU)'s constitution emphasizes the role that telecommunication can play during

[1] As per the *The Disaster Management Act, 2005*, "disaster" means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area. [http://ndma.gov.in/ndma/pdf/DM_Act2005.pdf]

the times of emergency and states that ITU shall "promote the adoption of measures for ensuring the safety of life through the cooperation of telecommunication services".

1.3 However, the critical role of telecommunications during emergencies has been limited by the increased vulnerability to system failures. As "the most complicated machine ever constructed by human beings,"[2] historically the telephone system has been highly susceptible to physical destruction during emergencies/disaster. The failure of telecommunications infrastructure, partial or complete, leads to preventable loss of life and damage to property, by causing delays in disaster relief efforts. Despite the increasing resiliency of modern telecommunications networks to physical damage, the risk associated with communications failures remains serious because of growing dependence upon these tools in emergency operations. Earthquakes can sever cables and can bring down the mobile towers. During wars, these systems are usually the first sites to be targeted. The destruction of telecommunications networks as a battlefield tactic dates back to the first use of the telegraph in the U.S. Civil War[3]

1.4 Even in the most developed economies, calamitous events regularly overwhelm telecommunications grids. Communications failures in New York City on 11th September, 2001 contributed directly to the loss of at least 300 firefighters.[4, 5]

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[2] J R Piece and AM Noll. 1990. Signals: *The Science of Telecommunications. (*Scientific American Library: New York). p. 4.

[3] "*Smithsonian Institution During the Civil War*" . (The Smithsonian Institution: Washington, DC) [http://www.civilwar.si.edu/smithsonian_siduringthewar.html]

[4] National Commission on Terrorist Attacks Upon the United States. 2004. *The 9/11 Commission Report:* final Report of the National Commission on Terrorist Attacks Upon the United States (Authorized Edition).

[5] McKinsey & Co. 2002. "Increasing FDNY's Preparedness" (City of New York: New York) [http://www.nyc.gov/htmlfdny/htmlmck_report/index.shtml]

1.5 Evidence from recent disasters clearly indicates that the rapidly advancing capabilities of civilian communications networks, their wider availability, and their widespread standardization have made them indispensable for ad hoc inter-organizational communications among official emergency responders.[6]

Reasons for telecommunications failures during disasters

1.6 During disasters, telecommunications infrastructure failures occur through a variety of mechanisms. The disaster can impact the telecommunication infrastructure manifolds, e.g. the buildings collapse, power supply gets disrupted, roads are blocked, fire breaks out, telephone exchanges/switches get overloaded, towers get twisted, cables get washed away etc. There are two broad categories of communication system failure during a crisis[7]:

(a) Loss of infrastructure - Loss of infrastructure occurs where some, or all elements, of a system are lost to damage or other impacts (e.g. power blackouts) that result in total loss of access. The loss of infrastructure can be further divided into –

i. <u>Physical destruction of network components</u> –

The most common and well-documented cause of telecommunication failures in disasters has been the physical destruction of network infrastructure. Service disruptions caused by physical destruction also tend to be more severe and last longer than those caused by disconnection or congestion because of the time and funding needed to repair or replace systems. Being one of the most sophisticated but

[6] Anthony M. Townsend and Mitchell L. Moss, April 2005. Telecommunications infrastructure in disasters : Preparing Cities for Crisis Communications

[7] Anthony M. Townsend and Mitchell L. Moss, April 2005, Ibid.

fragile urban infrastructure, telecommunications networks are damaged in nearly every major urban disaster.

ii. Disruption in supporting network infrastructure:-

Telecommunications networks rely upon many other local and regional technical systems to ensure their proper operation. These supporting infrastructures often lack resiliency to physical damage. Electrical distribution systems are by far the most important supporting infrastructure for telecommunications networks. Electrical power is key requirement for operating all modern telecommunications equipment. However, so far electric power distribution systems lack the "self-healing" capabilities of telecommunications networks, although future improvements are expected to give power networks greater capabilities in this area[8]. During the earthquake of Loma Prieta in 1989, 154 of 160 central offices in Northern California lost power. Even back-up power systems at 6 of those 154 failed[9]. Next critical supporting is cooling systems (e.g aftermath of Northridge earthquake)[10]. Disruption in transport networks is another way by which critical fuel and manpower supplies can be blocked from reaching the telecommunication network centers and can precipitate telecom network break-down.

Supporting infrastructure failure and Congestion in the mobile network was observed during the Sikkim earthquake on 18th September 2011 which affected part of Bihar, Jharkand and West Bengal. It was observed from analysis of reports from these regions that:

[8] Anthony M. Townsend and Mitchell L. Moss, April 2005, Ibid

[9] A Barnum. January 19, 1994. "*Bay Area firms took heed after Loma Prieta*". San Francisco Chronicle.

[10] EQE International. 1994. "*The January 17, 1994 Northridge, California Earthquake*". [http://www.lafire.com/famous_fires/940117_NorthridgeEarthquake/quake/00_EQE_contents.htm]

- The call attempts of various operators increased between 1.2 to 3 times between 18-22 hrs of 18th September, 2011 and accordingly impact on CCR was substantial.
- Some BTS sites were affected because of Power unavailability and some sites were affected because of inaccessibility to the sites
- The report on QoS parameters clearly showed increased BTS unavailability.
- Some of the BTS sites got down due to battery bank/power plant let down in the shelter, power from Electricity Board not available, DG foundation broken and access issues in the affected areas of West Bengal including Sikkim.

It can be seen that outages caused by disruptions in supporting infrastructure though are less common than outages caused by physical damage but they tend to be far more widespread and damaging to response and recovery efforts.

(b) Overload / Network congestion –

1.7 Historically, major disasters are immediately followed by an intense burst in telecommunications traffic which can congest even the best-managed networks resulting in call-blockages and lost-messages. Crisis generates intense human need for communication - to coordinate response activities, to convey news and information about affected groups and individuals, and as a panic reaction to crisis. Most communications networks are engineered for peak load at levels well beneath the demands placed on them during disasters because of the cost factors involved. Aftermath of Northridge earthquake of 1994, due to massive equipment failures and overloaded lines made it nearly impossible to reach area by phone" [11]. However, companies such as AT&T dramatically improved their disaster management performance in light of the Northridge experience.

[11] A Faiola and T Reed. January 18, 1994. "*L.A. communications in chaos*". Miami Herald. p A11.

By prioritizing the use of circuits for outbound calls, long-distance carriers were able to provide residents of affected areas with the ability to notify loved ones of their whereabouts and status.[12] Another example in which cellular telephone networks were effectively brought down by congestion is of September 11, 2001, which was also a major disaster. According to carriers' reports to the FCC, there was a ten-fold increase in call volumes during peak hours just after the attacks, led to a 92 percent block rate on New York City's cellular phone networks. In Washington, the blocked call ratio was less severe, but still unacceptable.[13] After the 2004 tsunami struck Phuket, Thailand, cell phone networks (as well as landlines) were congested, leaving only SMS operational.[14]

1.8 In India also congestion was observed during bomb blasts. When the bomb blast occurred in Mumbai on 11th July 2006, the congestion in Network was observed. TRAI had collected data from various operators on the issue from the telecom service providers operating in Mumbai service area. It was observed that the numbers of call attempts made just after the blasts on 11th July 2006 were 3-7 times more than the normal day call attempts due to which the switches went in overload conditions. Similarly, the volume of the traffic carried by the different networks after the bomb blast was around 30% of more than the normal day traffic volumes. Similarly congestion in network was also observed when the bomb blasts occurred in Bangalore on 25th July 2008 and in Ahmedabad on 26th July 2008. From the data collected by TRAI it was observed that the networks experienced heavy congestion due to increase in call

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[12] Anthony M. Townsend and Mitchell L. Moss, April 2005, Ibid.

[13] National Research Council. Computer Science and Telecommunications Board. 2003. *The Internet Under Crisis Conditions: Learning From September 11.* (National Academies Press: Washington, DC). Can be accessed at http://www.nap.edu/openbook.php?record_id=10569&page=R1

[14] K Karnjanatawe. February 23, 2005. *"Role of ICT in disaster examined"*. Bangkok Post.

attempts upto 4 times. Repeated call attempts led to call rejections which were reflected in sharp dip in Call set-up success rate (CSSR). Similar conditions were observed during network congestion after the bomb blasts occurred in Mumbai on 13th July 2011 also.

1.9 These experiences corroborates that disasters/emergencies, trigger tremendous telephone traffic in the landline and wireless networks and can cripple the telephone services of entire regions. Not only during disasters, but also on festivals/New-Year, high telephone traffic can lead to congestion in the telephone network thus preventing access to circuits. Personnel at all levels of government and other important organizations/NGOs compete with the public for these congested landline and wireless resources. During such times of emergency, crisis, or war, Government machinery/personnel need assurance that their calls will go through.

1.10 Both loss of Infrastructure and network congestion can be combined. The loss of infrastructure mostly results into network congestion. Sometimes even the congestion in networks can lead to failure of network elements.

Categorisation of telecommunication failure during disaster based on type/geographical spread

1.11 In the inputs given by some of the stakeholders in response to TRAI's pre-consultation paper, these stakeholders have opined that various kinds of disasters have different communication needs and these affect the functioning and reach of telecom networks in different ways.

1.12 The disaster affecting the telecom services may be categorised as :

a. **Wide Spread Disaster:** like high cyclone in coaster areas, earthquakes of high intensity, landslides in hilly area, sea erosion, dam burst, etc
b. **Local Disaster**: like floods, land slide, tsunami, etc.

c. **Manmade Disaster**: accidents like train/aircraft accident, bomb attacks etc

1.13 While some of the emergency situations may be highly localized, others may spread over large geographical locations. Some of the situations may result in transient network outages for a short duration, others may require prolonged state of relief and rescue spread over a large geographical location. The different situations warrant different approaches and hence a classification of failure of telecommunication during emergency/disaster is must. The size/nature of the disaster is not the determining factor of the effect on telecom infrastructure; rather it's how the destruction affects the facilities/network for communications. For example, despite the devastating effect of Tsunami on human establishments, remarkably, and counter-intuitively, undersea fiber optic cables in the Indian Ocean survived largely unscathed.[15]

Failure of telecommunication and various phases of disaster

1.14 A research study, funded by National Science Foundation (NSF), was taken up in USA in 1970s on "Reconstruction Following Disaster" which analyzed the role of telecommunications networks in disaster recovery.[16] Based on their study of disasters in different regions and historical settings, four phases in chronology of disaster recovery were proposed:

1. Emergency responses
2. Restoration and repair
3. Reconstruction of the destroyed for functional replacement
4. Reconstruction for redevelopment

[15] N Willing. December 29, 2004. *"Tsunami telecom recovery continues"*. Light Reading. [http://www/lightreading.com]

[16] J Eugene Haas et al., eds. 1977. *Reconstruction Following Disaster.* (Cambridge, Massachusetts: MIT Press). Relevant chapter available at http://www.rwkates.org/pdfs/b1977.01_CH1.pdf

1.15 A similar phased approach for disasters is also documented by National Disaster Management Authority (NDMA) in India. According to NDMA, a typical Disaster Management continuum comprising of six elements i.e., Prevention, Mitigation and Preparedness in pre-disaster phase, and Response, Rehabilitation and Reconstruction in post-disaster phase, defines the complete approach to Disaster Management[17].

1.16 The emergency response activities are taken up immediately and while the rest of the phases take lot of time – sometimes months and even years. It's the emergency response that is the most crucial of all the four phases (listed in para 1.14) as it is during this period that maximum impact of a response by way of saving human life can be seen. Once a disaster has begun, emergency response activities commence almost immediately through the efforts of bystanders. This period is characterized by "coping actions" stemming from death, destruction, and evacuation."[18]

1.17 In some countries there are official public safety systems that provide skilled emergency responders with the capacity to gather casualty and damage assessment information and coordinate their life-saving and containment activities during disasters. Public safety networks are engineered to provide basic voice communications to support intra-organizational communications during disasters but can be prone to failure in extreme circumstances. But in many cases, such as inter-agency emergency communications, civil networks are the only readily available channels. Because of the pace of innovation and investment that has occurred since the mid-1990s, the capabilities of public

[17] http://ndma.gov.in/ndma/approachdm.html as accessed on 16th January, 2011

[18] Haas et. al., Ibid.

telecommunications networks match or exceed that of government-administered emergency communications systems. Particularly in very large disasters that involve official response from multiple government agencies and multiple jurisdictions, the public switched telephone network - both wired and wireless - has become a primary medium for emergency communications. This is because the wide variety of radio equipment used by various public safety organizations is frequently incompatible, preventing communications between responders from neighboring jurisdictions.

1.18 Also, civil networks often provide greater capability for data communications than their public safety counterparts. In the networks of emergency and law enforcement agencies, data communications is often provided with very limited transmission capacity. Further, such networks have not upgraded their capacity as quickly as civil networks. Once the disaster event has ended and emergency response can begin, civil telecommunications networks take on additional critical roles. While public officials direct these relief efforts, civilians, NGOs and the private sector play a crucial role in providing assisting capabilities. Further, Non-governmental organizations bear much of the burden of disaster relief, and since they do not have access to the public safety networks, they need to rely on the public mobile networks for coordinating their efforts.

1.19 It is this crucial emergency phase of response during which the integrity of communications is at greatest risk and it is this phase that is most likely to be affected by the network congestions. With lives at risk, it is also the phase where the consequences of failure are the greatest. In the emergency phases of disaster the focus of official response is on preventing loss of life and, if possible, damage to property. In these urgent moments, any communications failure has the potential to paralyze these efforts, and this scenario has been repeated in disaster

after disaster. Congestion is perhaps the most difficult threat to official responders, because its transient nature defies diagnosis. **"Telephone Networks are not so much destroyed as congested into uselessness."**[19] Congestion in networks during the response phase of emergency situations can paralyze official responses, challenge containment, and delay mobilization of broader relief efforts and hence ***this consultation paper primarily focuses on the network congestion issue and is an attempt to find ways and means to ensure that the network congestion bottlenecks are soothed out at least for personnel working in government machinery and other organizations who are responsible for 'response and recovery' during such disasters.***

[19] E M Noam and H Sato. 1996. "*Kobe's lesson: dial 711 for "open" emergency communications*" Science.

CHAPTER II: Possible technical solutions to Network congestion

This Chapter discusses the possible technical solutions to the problem of network congestion during emergency situations along with their pros & cons.

Over-dimensioning of Core network

2.1 As mentioned in previous Chapter, the traffic volume increases considerably during the emergency situations. To handle this increased volume of traffic during such emergencies, the obvious solution is to dimension the core network of the TSPs for extra capacity. Currently the network dimensioning is done by TSPs and TRAI has not given any directions in this respect. The guiding principle behind the network dimensioning is that the TSP should be able to meet out the required quality of service parameters.

Over dimensioning of POIs

2.2 From the data collected by TRAI after some of the disaster/emergencies, it appears that the numbers of POIs between some operators are operating at optimal numbers and are not dimensioned to take care of extra load. During the increased traffic, individual network elements like Switches, BTSs etc handled the increased call attempts to a large extent, the bottlenecks became obvious at Point of Interconnections(POIs). The dimensioning of POI circuits needs to be looked into so as to handle the burst in traffic during emergencies. The numbers of POIs between operators are normally dimensioned by Telecom Service Providers (TSPs) so as to handle the peak traffic, while maintaining the Quality of Service parameters as defined by TRAI.

Priority call routing for personnel involved in 'response and recovery'

2.3 The possibility of giving priority to certain users like Police, Hospital, Heads of departments involved in response to the disasters, Blood banks etc can be explored so as to ascertain that during such an incidence calls to/from certain key agencies and persons get priority on the network. The likelihood of getting network resources for such users to complete the call will then be much higher.

2.4 In United Kingdom, the Priority call routing system named as Mobile Telecommunication Privileged Access Scheme (MTPAS) is based on access category/priority that is given for certain users for intra-Operator and inter-operator network calls. Similarly in USA Wireless Priority Service (WPS) and Government Emergency Telecommunications Service (GETS) are the priority call routing systems for certain users that are based on 'access-code' dialing. These systems along with other international practices have been discussed in following Chapters so as to understand various options.

2.5 International Telecommunication Union (ITU) also came out with recommendation E.106[20] that was approved on 31st October 2003 by ITU-T Study-Group2 (2001-2004) under the WTSA Resolution1. This Recommendation describes an international preference scheme for the use of public telecommunications by national authorities for emergency and disaster relief operations. The International Emergency Preference Scheme (IEPS) for Disaster Relief Operations is needed when there is a crisis situation causing an increased demand for telecommunications when use of the International Telephone Service may be restricted due to damage, reduced capacity, congestion or faults. ITU-T Recommendation E.106 International Emergency Preference Scheme (IEPS) for disaster relief operations has been discussed in detail in **Annex.**

[20] http://www.itu.int/rec/T-REC-E.106-200310-I/en

Other suggestions offered in response to Pre-consultation paper of TRAI

2.6 In response to TRAI's pre-consultation paper, some of the other suggestions received were -

a) Restrict PSTN and PLMN network use to civilians during disaster or emergency situation.

b) Reserve some channels dedicatedly for selected officials

c) Low preference or complete blockage of all incoming or outgoing ILD calls which free more channels on networks and also avoid fake and terror calls, if any.

d) Mandate TSP's to deployed stand alone switch to avoid load congestion or natural disaster network failure.

e) to remove load on Telecom network Mobile and PSTN operator can play request IVR like "Currently due to emergency all node are out of service please help authorities to recover from this emergency, Help to recover from this situation" due to this people may stop calling and more resources will be free for use for officials.

2.7 One of the stakeholders has opined out that Loss of infrastructure and Overload/Network congestion pose different challenges when they occur individually and together depending on the nature of emergency/disaster. For example priority call routing may not address leadership communication requirements in case of loss of infrastructure, particularly in the crucial initial stages. GETS/WPS are just a brick in the wall of Emergency Communications and must be viewed accordingly. Priority call routing cannot serve as the mainstay of first responder communications. 'Fairness' of the concept lies in the fact that, as the emergency extends in the time dimension two things are happening (a) the first responder radio network has stabilized and the satellite–based Emergency Communication assets of the Disaster Management agencies have been rolled out (b) the Mobile Service Provider has restored and temporarily augment local

communication capacity; otherwise priority routing will deprive the calling from subscribers, whose own requirements to communicate are peaking as the duration of emergency extends in time. This is the reason that, from the point of good governance, priority routing comes with associated telecommunication measures such as 'disaster message Boards' etc. which takes care of the communication requirements of the non-priority user in the interim.

2.8 There is no doubt that an approach to build resilient telecom networks so as to cater to communications during disaster/emergencies should be a comprehensive one and should *inter alia* include - the network dimensioning, emergency communication alternatives like satellite radios/ ham radios, comprehensive strategy to rebuilt/repair lost infrastructure, alternate network capabilities etc. But such a comprehensive approach would be time and cost consuming. It is imperative to make a beginning with solutions that can be implemented fast and without much costs and then move on to strengthen other capabilities. For these reasons this consultation paper focuses on the issue of priority call routing in particular.

CHAPTER III: Priority Call routing - International practices

3.1 During times of emergency/crisis/war, to ensure that calls of Government machinery/personnel and other important organizations/NGOs go through the telecom network, some systems have been developed in various countries as detailed below -

UNITED STATES

(A) Government Emergency Telecommunications Service (GETS)

The concept of GETS[21]

3.2 The Government Emergency Telecommunications Service (GETS) is an emergency phone service provided by the National Communications System (NCS) in the Office of Cybersecurity and Communications Division, National Protection and Programs Directorate, Department of Homeland Security. GETS supports Federal, State, local, and tribal government, industry, and non-governmental organization (NGO) personnel in performing their National Security and Emergency Preparedness (NS/EP) missions. GETS provides emergency access and priority processing in the local and long distance segments of the Public Switched Telephone Network (PSTN).

3.3 Using enhancements based on existing commercial technology, GETS allows the National Security or Emergency Preparedness (NS/EP) community to communicate over existing Public Switched Telephone Network (PSTN) paths with a high likelihood of call completion during the most severe conditions of high-traffic congestion and disruption. The result is a cost effective, easy-to-use telephone service that is accessed through a simple dialing plan and Personal Identification Number (PIN) card verification methodology. It is maintained in a constant state of readiness and provides a cost-effective

[21] Based on information available in public domain at http://gets.ncs.gov/

means to overcome network outages through such methods routing alternatives, priority service and other enhancements that do not exist for normal PSTN calls.

3.4 GETS services are provided over three categories of networks. These networks are as follows:

1) The major long-distance networks provided by Interexchange Carriers (IXCs) - AT&T, Verizon and Sprint - including their international services.
2) The local networks provided by Local Exchange Carriers (LECs) such as the Regional Bell Operating Companies (RBOCS) and Independent Telephone Companies (ITCs), cellular carriers and personal communications services (PCS).
3) Government-leased networks, including the Federal Telecommunications System (FTS) and the Defense Information System Network (DISN).

GETS Access

3.5 GETS is accessed through a universal access number 1-710-NCS-GETS (1-710-627-4387) using common telephone equipment such as a standard desk set, facsimile, modem, or wireless phone. The dialing plan is based on the North American Numbering Plan (NANP) area code that is reserved for National Security/Emergency Preparedness (NS/EP) use. This area code is valid in the three interexchange carriers (IXCs) that support GETS (AT&T, Verizon Business, and Sprint) and all local exchange carriers (LECs), wireless carriers, and foreign carriers. The normal access mode is through user's pre-subscribed long distance carrier by dialing the universal access number (provided to qualified users on a GETS dialing card). If this is not successful or if user is not subscribed to one of the GETS IXCs, he may access GETS by first dialing 1010288 for AT&T, 1010222 for Verizon Business, or 1010333 for Sprint, followed by the universal access number. A prompt will direct the entry of the GETS PIN and the telephone number. Once a user has been authenticated as a valid user, the call is

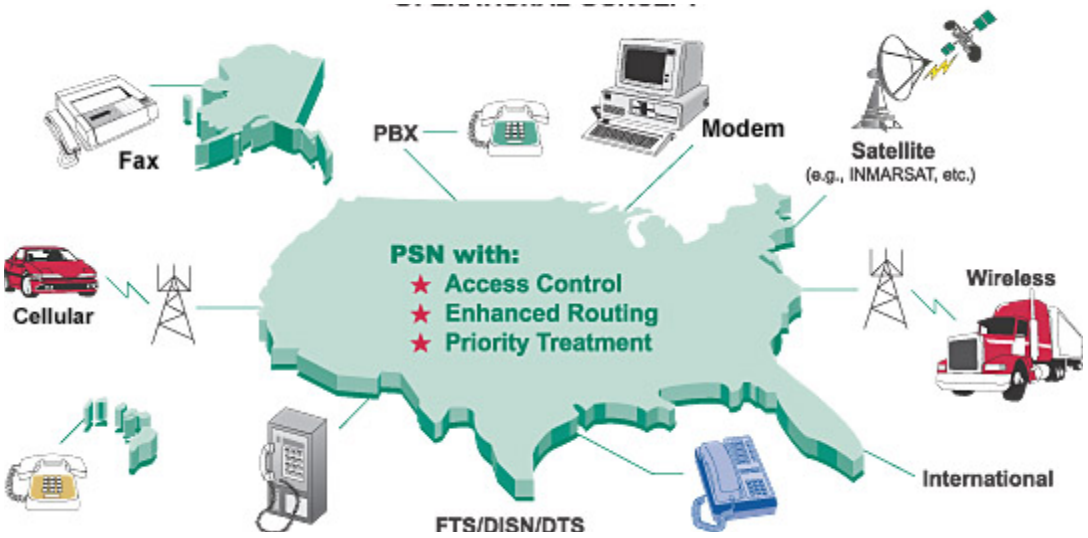
identified as an National Security and Emergency Preparedness (NS/EP) call and receives priority treatment. Users dial a country code and then the GETS 710 number. The GETS system is available worldwide with the limitation that priority routing is only available from U.S. Carriers who participate in the program. LECs, wireless, and foreign carriers will route GETS calls to one of the three GETS IXCs, who have each implemented enhanced routing services for GETS calls in their networks. Enhanced routing capabilities have also been implemented in many LEC networks also. It is not possible to use GETS to dial a toll-free destination number.

3.6 GETS traffic receives priority treatment over normal traffic through:

- Controls such as trunk queuing, trunk sub-grouping, or trunk reservation
- Exemption from protective network management controls, which are used to reduce network congestion
- High probability of completion (HPC) capability to provide
    - NS/EP identification
    - Priority signaling

These features enhance the capability of NS/EP calls to be completed in congested networks. GETS will not preempt public traffic, nor are there levels of precedence in GETS.

Figure - GETS Operational Concept



Funding for GETS

3.7 There are two sources of funding for GETS. There is an annual budget to compensate carriers, systems integrators, and large switch manufacturers for the investments required to support GETS. In addition, there are user fees. The charge is for usage when making calls using a GETS card. GETS calls are billed at a rate of 7 cents or 10 cents per minute (depending on carrier and other factors) for calls within the United States and its territories, Canada, and most of the Caribbean. The cost is higher if operator assisted or originating from certain pay phones. International calls are billed at commercial rates, though international calling privileges are restricted to those cards so authorized by your organization's Point of Contact (POC) or alternate. Federal government organizations are exempt from billing until an annual threshold for GETS calls has been exceeded. However, the National Communications System (NCS) reserves the right to bill federal users for GETS calls if there has been fraud, waste, or abuse using your GETS card.

3.8 For organizations outside the federal government, a Program Designator Code (PDC) is required to establish a billing account for payment of GETS calls placed by members of participating organizations. GETS charges are payable to the contracting office i.e. Defense Information Technology Contracting Organization (DITCO). Details on paying these charges would be included with the bill participating organizations receive from them.

3.9 The use of GETS services by authorized nonfederal users, including local governments, state governments, and certain nonprofit entities, like the Salvation Army and Red Cross, is billed for the cost of the calls, as required by federal law. Each year NCS establishes a budget for the expected cost of user fees. Monthly carrier payments are drawn from this fund. NCS receives a monthly call detail report from the carriers identifying all GETS calls. The NCS staff reviews these calls to check that only authorized personnel are using the service and to identify cases of possible abuse.

Performance of GETS so far

3.10 GETS is designed to provide 90% call completion rates when call volume is eight times greater than normal capacity. In actual emergencies, GETS has consistently met or exceeded this completion rate. There have been relatively very few times where GETS operation has been necessary. During the Nisqually Earthquake near Seattle in 2001, there were almost 400 successful GETS calls. Hurricane Opal in 1995 saw over 2000 successful GETS calls. Both of these emergencies were major operational successes for GETS.[22] The terrorist attack on September 11th, 2001 again showed the GETS program to be very capable, although one major flaw came to light and is in the process of being remedied. The first major hurdle of the terrorist attack was the flood of communication that hit the public networks during and after the attack. It is estimated that traffic increased by 400%

[22] US GETS market Insight http://www.corp.att.com/stateandlocal/docs/US_GETS_Market_Insight.pdf

above normal in traffic levels. Both the Pentagon and the World Trade Center Towers were three of the largest communications hubs in the world. The World Trade Center alone housed several billion dollars worth of communications equipment and numerous cellular towers. Even with the communications infrastructure destruction the success rate of GETS calls was 95% completion rate during the 9/11 tragedy.

3.11 The major problem with the GETS system was the inability to prioritize wireless calls. This meant that GETS user attempting to use the GETS system through a wireless device had to first get connected to the wireless network before accessing the GETS system. This was very problematic during the crisis because of the overload in wireless communications and damage to infrastructure. As a resolution to this problem, on April 17, 2002 the NCS approved a subcontract award from DynCorp to VoiceStream for Wireless Priority Service (WPS) for the Washington, DC and New York City areas. Wireless Priority Service (WPS) is a similar priority call routing arrangement in US wireless networks and is discussed in WPS section.

GETS Eligibility Criteria

3.12 There are five broad categories that serve as guidelines for determining eligibility for GETS. These users may be in Federal, State, local, or tribal government, critical infrastructure sectors in industry, or non-profit organizations that perform critical National Security and Emergency Preparedness (NS/EP) functions. Typical GETS users are responsible for the command and control functions critical to management of and response to national security and emergency situations, particularly during the first 24 to 72 hours following an event. A similar hierarchy exists in WPS system and has been discussed in detail in following sections.

GETS - Key features summarized

3.13 Key features of GETS can be summed up as follows -

- Toll-free access number with alternate numbers for direct carrier access
- Access control using Personal Identification Numbers (PINs)
- Failsafe access - if the access control system fails, GETS calls would automatically be allowed to complete
- Enhanced routing to one of the three interexchange (long distance) carriers
- Alternate carrier routing in the event one of the carriers is unavailable
- Priority treatment with trunk queuing, sub-grouping, and reservation
- Exemption from restrictive network management controls during congestion
- International calling (when requested and authorized in advance)
- Interoperability with other networks
- Number translation (for special users)

(B) Wireless Priority Service (WPS)[23]

What is WPS?

3.14 The Nationwide Wireless Priority Service (WPS) is a system in the United States that allows high-priority emergency telephone calls to avoid congestion on wireless telephone networks. This complements the Government Emergency Telecommunications Service (GETS), which allows such calls to avoid congestion on landline networks. The service is overseen by the Federal Communications Commission and administered by the National Communications System in the Department of Homeland Security.

[23] The details in this section are based on information provided in public domain at http://wps.ncs.gov/index.html

3.15 The FCC rules do not require cellular providers to offer WPS; it is a voluntary offering. Although the FCC maintains oversight of the WPS program, the Department of Homeland Security's National Communications System (NCS) is responsible for its day-to-day administration.

3.16 During emergencies, WPS gives authorized NS/EP personnel priority cellular access before subscribers who do not have WPS. Even absent emergencies, some towers and networks receive more calls than they can handle. WPS allows high-priority calls to bypass that congestion and receive priority by dialing *+272+DST_NUMBER+send (the 'star' key followed by 272 followed by the destination number followed by the dial key).

3.17 Before using the system, each user must receive authorization from the National Communications System and subscribe to the service with a participating provider.

3.18 Although the system is said to ensure a high probability of call completion, it is not without serious limitations. The WPS will not preempt calls in progress, so the user will have to wait for bandwidth to open. It is also not yet supported by all carriers. In order for a call to work, telephone infrastructure must be powered and functioning. Finally, a call that receives priority using WPS does not automatically get priority on landline networks. Therefore, congestion on the Public Switched Telephone Network may prevent the call from completion unless the user makes additional steps to access the GETS service for landline calls as well. Because of these and other limitations, the WPS explicitly does not guarantee call completion.

WPS - Service Description

3.19 WPS is an add-on feature subscribed on a per-cell phone basis that works with existing cell phones in WPS enabled cellular networks; no special phones are required. WPS provides priority for emergency calls through a

combination of special cellular network features and the same "High Probability of Completion" features used by GETS. These are detailed below:

i. *Originating Radio Channel Priority:* WPS addresses congestion in the local radio access channel (or cell), which is often the reason that cellular calls cannot be made during heavy calling periods or when damage to network infrastructure occurs. WPS automatically provides priority access to local radio channels, placing WPS calls in queue for the next available channel if a channel is not immediately available. Originating Radio Channel Priority requires WPS feature activation on the calling cellular phone. WPS calls do not preempt calls in progress nor will WPS users monopolize all available cellular resources.

ii. *High* Probability *of Completion Features*: When a radio access channel becomes available and the call proceeds, WPS calls are assigned a unique "NS/EP" call marking by the cellular network switching equipment. This marking triggers industry standard *High Probability of Completion (HPC)* features residing in most U.S. telecommunications networks as calls are routed from the originating cell to the called cellular or landline phone. These HPC features significantly increase the probability of call completion should the call encounter network congestion or blockage beyond the originating cell. Thus, WPS calls receive similar "across the network" priority as GETS calls without having to dial the GETS access number and PIN.

iii. *Terminating Radio Channel Priority:* Incoming WPS (and GETS) calls to cell phones served by WPS enabled cellular networks automatically receive priority access to local radio channels, placing incoming GETS and WPS calls in queue for the next available channel if a channel is not immediately available. Terminating Radio Channel Priority does

not require the called cellular phone to be subscribed to WPS. Incoming GETS and WPS calls do not preempt cellular calls in progress nor will they monopolize all available cellular resources.

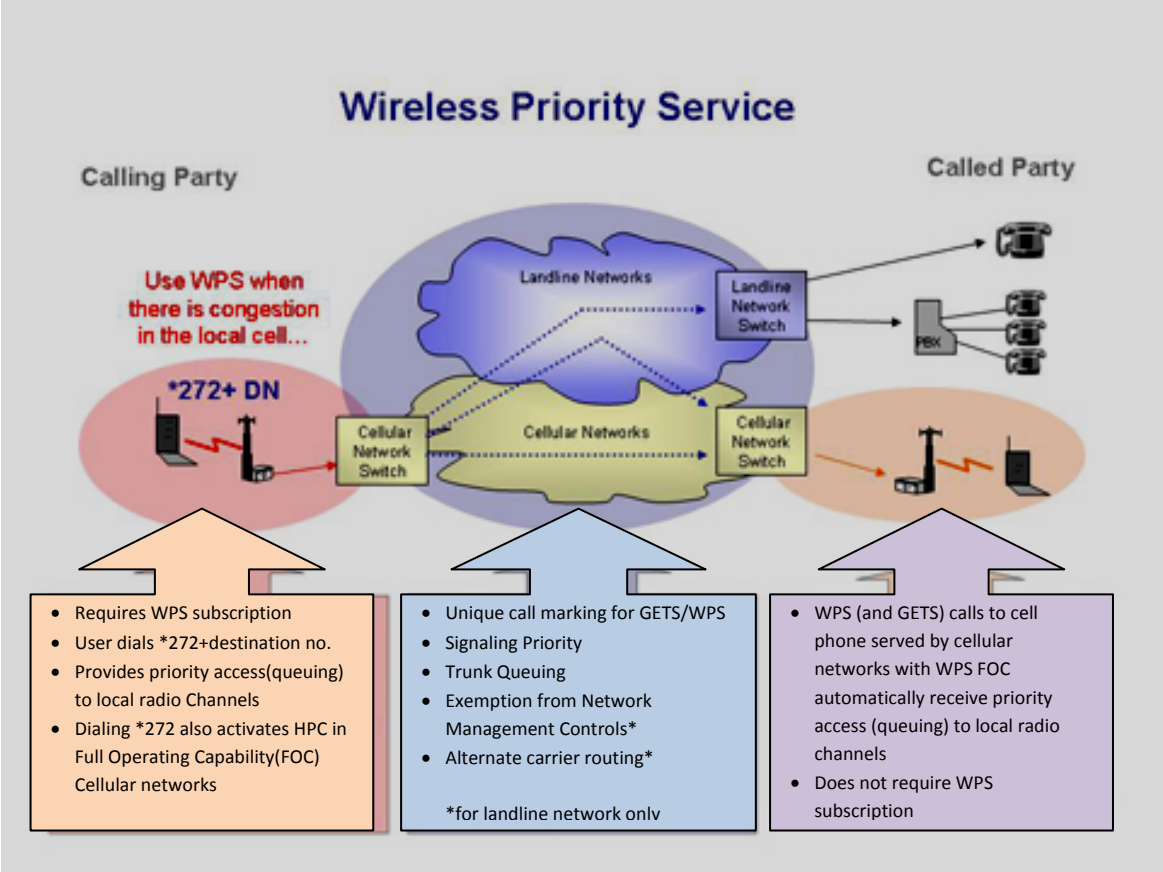


Figure 2 – How Wireless Priority Service Works

Source - http://wps.ncs.gov/images/diagram01a.jpg

WPS structure

3.20 WPS and its companion priority service, the Government Emergency Telecommunications Service (GETS), are requested through a secure on-line system GETS-WPS Information Delivery Service (G-WIDS) on WPS website (wps.ncs.gov) or on Telephone: (866-NCS-CALL). Before requests can be submitted each organization needs to establish a G-WIDS Point of Contact (POC). Most organizations have a single POC (and Alternate POC) for administering both GETS and WPS. However, large or geographically disbursed organizations may elect to establish separate POCs to administer

GETS and WPS for different departments and/or locations. The GETS/WPS POC serves as each organization's program administrator. Once an organization has an established POC, they can request GETS and WPS. Upon WPS approval, POC forwards carrier account activation information to NCS. NCS orders WPS feature added to user's basic service if user does not already have carrier service, user acquires basic commercial service The NCS recommends that each WPS user also have a GETS card. Carrier personnel are unable to process requests for WPS directly. All WPS service requests must be made through G-WIDS.

3.21 Service Availability - Wireless Priority Service is widely available from Alltel, AT&T, Cellcom, Cellular South, SouthernLINC, Sprint Nextel, Sprint PCS, T-Mobile, and Verizon Wireless. Cellular service provider participation in the WPS program is voluntary. Participating service providers typically deploy WPS in stages until service is available in most coverage areas and functionality has reached Full Operating Capability (FOC).

3.22 Changing Service Providers - Should a WPS user wish to change service providers, whether transferring their existing telephone number or obtaining a new number, they must have their POC submit a change request through G-WIDS. The NCS will coordinate between service providers to transfer the WPS subscription, if WPS is available, to the new service provider. The service transfer cannot be arranged through the new service provider

WPS NS/EP criteria for defining users

3.23 Different priority levels have been defined for various types of eligible WPS users as follows –

Priority 1 - Executive Leadership and Policy Makers

3.24 Users who qualify for the Executive Leadership and Policy Makers priority has been assigned priority one. A limited number of CMRS technicians who are essential to restoring the CMRS networks shall also receive this highest priority treatment. Examples of those eligible include:

a) The President of the United States, the Secretary of Defense, selected military leaders, and the minimum number of senior staff necessary to support these officials

b) State governors, lieutenant governors, cabinet-level officials responsible for public safety and health, and the minimum number of senior staff necessary to support these officials

c) Mayors, county commissioners, and the minimum number of senior staff to support these officials

Priority 2 - Disaster Response/Military Command and Control

3.25 Users who qualify for the Disaster Response/Military Command and Control priority will be assigned priority two. Individuals eligible for this priority include personnel key to managing the initial response to an emergency at the local, state, regional and federal levels. Personnel selected for this priority should be responsible for ensuring the viability or reconstruction of the basic infrastructure in an emergency area. In addition, personnel essential to continuity of government and national security functions (such as the conduct of international affairs and intelligence activities) are also included in this priority. Examples of those eligible include:

a) Federal emergency operations center coordinators, e.g., Manager, National Coordinating Center for Telecommunications, National Interagency Fire Center, Federal Coordinating Officer, Federal Emergency Communications Coordinator, Director of Military Support

b) State emergency Services director, National Guard Leadership, State and Federal Damage assessment Team Leaders
c) Federal, state and local personnel with continuity of government responsibilities
d) Incident Command Center Managers, local emergency managers, other state and local elected public safety officials
e) Federal personnel with intelligence and diplomatic responsibilities.

Priority 3 - Public Health, Safety, and Law Enforcement Command

3.26 Users who qualify for the Public Health, Safety, and Law Enforcement Command priority will be assigned priority three. Eligible for this priority are individuals who direct operations critical to life, property, and maintenance of law and order immediately following an event. Examples of those eligible include:

1. Federal law enforcement command
2. State police leadership
3. Local fire and law enforcement command
4. Emergency medical service leaders
5. Search and rescue team leaders
6. Emergency communications coordinators

Priority 4 - Public Services/Utilities and Public Welfare

3.27 Users who qualify for the Public Services/Utilities and Public Welfare priority will be assigned priority four. Eligible for this priority are those users whose responsibilities include managing public works and utility infrastructure damage assessment and restoration efforts and transportation to accomplish emergency response activities. Examples of those eligible include:

1. Army Corps of Engineers leadership
2. Power, water and sewage and telecommunications utilities
3. Transportation leadership

Priority 5 - Disaster Recovery

3.28 Users who qualify for the Disaster Recovery priority will be assigned priority five. Eligible for this priority are those individuals responsible for managing a variety of recovery operations after the initial response has been accomplished. These functions may include managing medical resources such as supplies, personnel, or patients in medical facilities. Other activities such as coordination to establish and stock shelters, to obtain detailed damage assessments, or to support key disaster field office personnel may be included. Examples of those eligible include:

1. Medical recovery operations leadership
2. Detailed damage assessment leadership
3. Disaster shelter coordination and management
4. Critical Disaster Field Office support personnel

WPS Costs

3.29 Costs may vary by cellular carrier, but they are limited to a maximum $10 one-time activation fee, a $4.50 per-month service fee, and $ .75 per minute for WPS (*272) calls. WPS charges are in addition to the basic calling plan. Applicable WPS charges are billed on the existing cellular service provider invoice and are payable directly to the cellular service provider.

United Kingdom(UK)

(C) Access Overload Control (ACCOLC)

3.30 Access Overload Control is a procedure in the United Kingdom for restricting mobile telephone usage in the event of emergencies. This scheme allows the mobile telephone networks to restrict access in a specific area to registered numbers only and is normally invoked by the Police Incident Commander (although it can be invoked by the Cabinet Office).

The emergency services are responsible for registering their key numbers in advance. ACCOLC was replaced by MTPAS (Mobile Telecommunication Privileged Access Scheme) in 2009.

Mobile Telecommunication Privileged Access Scheme (MTPAS)

Purpose of MTPAS

3.31 The purpose of MTPAS is to restrict civilian access to cellular phone networks during emergencies. This actively prevents civilian usage from congesting the cell networks, thus allowing emergency services personnel priority for communications. It also serves to control information flow in and out of a declared emergency area in case of an incident. If networks become congested, handsets installed with a privileged access SIM will stand a much higher likelihood of being able to connect to their network and make calls than other customers. Special SIMs are only available to entitled users within the emergency services community and not to members of the public.

3.32 Mobile telephones work on a cell basis. In the United Kingdom, the cells adjacent to the incident are identified and MTPAS is implemented on those cells alone. MTPAS-aware telephones are allowed access to the network and all other users will receive a fast beep (called a Fast Busy Signal). Once the call is connected to the network it is routed like any other call. If the user receives a recording that all lines are busy or engaged tone then it indicates that MTPAS is not being utilised.

3.33 As MTPAS can be a frustration to normal network users in case of network overload, in Britain it is normally only initiated after careful consideration. The authority of a British Police "Gold" is required (major incident control is named in three tiers in the UK, gold, silver and bronze, in accordance with the London Emergency Services Liaison Panel, a group responsible for creating best-agreed procedures for dealing with various emergency

situations) after consideration with the co-coordinating group. The Police Gold Commander will speak to dedicated staff at the Mobile network operator, and this will be followed up by a specially designed fax message, in accordance with the Home Office Document "Process for the Management of the Mobile Telecommunications Privileged Access Scheme (MTPAS)".

3.34 The Police Gold Commander's pro-forma fax reads: "This message serves to advise you that a Strategic Command Group (SCG) is being established in response to a major incident in the UK. As a result of the incident, your network may experience an abnormally high concentration of calls. If your network becomes congested, your assistance is requested to provide customers with SIMs allocated to classes 12, 13 and 14 a much higher likelihood of being able to make calls than customers allocated to other classes.", and gives space for the Police to identify the geographic location of the incident.

3.35 Not all calling by regular mobiles is prevented. Calls to an emergency services number (911, 112, 999) will ignore all MTPAS or global action messages. MTPAS is a partnership of the Cabinet Office, Regional Government Offices, Local Resilience Forums' Telecommunications Sub Groups (TSGs) and the responder community. It replaced ACCOLC in 2009, and during the crossover period SIM cards registered in the ACCOLC scheme continued to gain priority. The changeover to MTPAS was made in order to "devolve responsibility and management of the Scheme to the local level", "coordinate a common approach to the Scheme in England and Wales", improve the effectiveness by further limiting the number of users, and to "ensure clarity regarding activation of the scheme."

3.36 MTPAS is only available to Category 1 and 2 Responders (as defined in the Civil Contingencies Act 2004) and partner organizations which directly support them at the scene of an emergency incident.

3.37 The TSGs have responsibility for coordinating the Scheme in their local resilience area. Responder organizations which currently don't use privileged access SIMs for their staff's mobile phones are required to contact local TSG for information on how to join the Scheme. Every organization has designated MTPAS Point of Contact. Some responder organizations works on a national basis, rather than locally, these organizations are coordinated by a central government department.

3.38 MTPAS devolves responsibility and management of the Scheme to the local level where there is better understanding of the requirements of local responder organizations entitled to be a part of the Scheme Objectives.

Activation Arrangements

3.39 The MTPAS access class may be indicated on the SIM card or in protected storage on the handset itself, by a set of numbers in the range 0 - 15 giving a total of 16 flag bits in the Global action message. It is not hierarchical so it can allow level 1 access while disallowing level 6 access. If the 16 bit control word is, 1010-0000-0011-1111 only phones with the MTPAS access level of 1, 3, 11, 12, 13, 14, 15 & 16 will accept request for placing a call. It is important to note that the decision whether to permit a call is not made by the cellular network but by the handset itself.

3.40 In Britain, ordinary cellphone users have numbers in the range 0 - 9. Higher priority users are allocated numbers 12-14. During an emergency, some or all access classes in the range 0 - 9 are disabled. If the overload condition continues, mobiles with access classes level 10, 11, then 12 and so on may also be disabled by the cellular network operator.

Cost

3.41 There are no costs attached to MTPAS: this is both for the provision of SIMs to an entitled organisation (in addition to the usual and agreed contract costs). Neither there is any remuneration for loss of service if network restrictions are necessary during an emergency response.

MTPAS 2-Way paging

3.42 In UK, for a long time pagers have been used by the emergency response community to reliably get messages to their staff. As of 2009, all 2-way pagers from Page One Communications that are in use by Category 1 and 2 responders are enabled for use with the MTPAS. These 2-way pagers are a reliable means of communication that combines the speed, reliability and broadcast ability of paging, with the auto acknowledgement and response functions. And provide following benefits to the responder organisation:

- Message Delivery Confirmation, which allows the organisation to know that the paging message has been successfully delivered;
- 2-Way Group Messaging, to see all individual responses to a group message.
- The reply status of the group is updated in real time and the group location information is displayed on a map.
- GPS (Global Positioning System), providing recent location information on every reply message.
- The individual user benefits from the ability to reply to a pager message via the mobile network.
- Recipients can choose from up to eight text based responses which can be chosen by the organisation.

3.43 The Cabinet Office has agreement with telecom service providers O2 and PageOne, for supplying all Entitled Organizations with 2-way pagers already fitted with MTPAS SIMs. While only Entitled Organizations can

purchase MTPAS 2-way pagers, there are not the same restrictions about who within the Entitled Organization can be issued these devices nor are there any restrictions about how many of the devices can be used within an Entitled Organization. The reason for this is that the reply functions of 2-way pagers work over the mobile network and have very little impact on the overall level of traffic going over the network.

Over-the-air (OTA) provisioning

3.44 MTPAS has entered into an agreement with Vodafone by which mobile Network Service Providers (NSPs) can change the access of a SIM (from normal public access to privileged access and vice versa) remotely, also called over-the-air (OTA). Before this technology was available, all mobile devices with SIMs that had normal public access could only be given privileged access by physically changing the SIM, which was provided by the mobile NSP. An OTA change to a SIM's access is preferable to physically changing the SIM because it can be done quickly and easily once the mobile Network Service Provider receives the request and means the user should not have their service interrupted while SIMs are changed over in their handset. Vodafone provide an OTA service and follow it up with a text message to inform the user of the change. All entitled organizations with MTPAS SIMs must deregister any privileged access SIM that's no longer required. This allows emergency responders who really need privileged access to the mobile networks to have it when it really counts.

Agencies involved in UK in response & recovery during emergencies

3.45 The main agencies and sectors that are likely to become engaged in the response to, and recovery from, emergencies at the local level in both England and Wales are :

Category 1 responders

- Police services
- Fire and rescue services
- Health bodies
- Maritime and Coastguard Agency
- Local authorities
- Environment Agency

Category 2 responders; and

- Utilities
- Telecommunications
- Transport providers
- Highways Agency

CANADA

3.46 In Canada, Industry Canada's Emergency Telecommunications team is responsible for emergency telecommunications planning, preparedness and response. Their responsibilities stem from the Emergency Management Act and the Radiocommunication Act. In collaboration with federal and provincial governments and the telecommunications industry, Industry Canada's Emergency Telecommunications team**:**

- develops, maintains and executes emergency telecommunications plans;
- provides advice and assistance to mitigate and address the disruptive effects of emergencies on telecommunications;
- participates in the development of a national public alerting service;
- facilitates the movement of telecommunications equipment and services during emergencies, nationally and internationally;
- manages programs to help ensure the availability of essential telecommunications during periods of system overload or degradation; and

- manages programs to help ensure the continuity of telecommunications services for all Canadians.

3.47 Industry Canada's Emergency Telecommunications team works closely with federal and provincial emergency measures organizations and the telecommunications industry throughout Canada. Together, they develop best practices in emergency planning and foster important links within the telecommunications community. Through this collaboration, they develop national programs, establish mutual aid agreements and plans, and provide coordination assistance for emergency telecommunications in response to a crisis or disaster.

3.48 The major telecom operators in Canada, had been participating in the Priority Access for Dialing (PAD) program[24] on a voluntary basis and offering PAD free of charge. PAD provides dial tone to designated essential lines on the Public Switched Telephone Network (PSTN). However, the Priority Access for Dialing program has ended as of December 31, 2010. But telcos continues to support Wireless Priority Service (WPS) which is system that is similar to WPS in USA.

[24] http://www.ic.gc.ca/eic/site/et-tdu.nsf/eng/h_wj00016.html as accessed on 27th Feb, 2012

CHAPTER IV: Telecommunications during emergencies/disasters Suggested approach for India and issues involved

Dimensioning of Core networks

4.1 As mentioned in the Chapter-II, from the data collected by TRAI after some of the disaster/emergencies, it appears that the numbers of POIs between some operators are operating at optimal numbers and are not dimensioned to take care of extra load. During the increased traffic, though individual network elements like Switches, BTSs etc are capable of handling the increased call attempts to a large extent, the bottlenecks become obvious at Point of Interconnections(POIs). The dimensioning of POI circuits needs to be looked into so as to handle the burst in traffic during emergencies. While over dimensioning of network has the benefit like it can take care of the traffic bursts during emergencies to some extent. Further with higher dimensioning will result in better control the quality of service aspects to a large extent. However, over-dimensioning network elements involves costs to the TSPs, who may pass the cost of over-dimensioned network to the customers. In that event, the customers will end-up paying unnecessarily for the network that would otherwise be lying unused. Further, the traffic volumes during bursts cannot be predicted and will vary on the severity of incidences/calamities/disasters. Hence it is practically very difficult to decide on the network dimensions.

<u>Issues for consultation</u> –

4.2 If one has to go by the approach of over-dimensioning the networks to cater to traffic bursts, the questions that arise are –

a. **Should there be a direction from TRAI on the network dimensioning - both for operating in normal as well as emergency situations? Please Justify your answer.**

Priority call routing

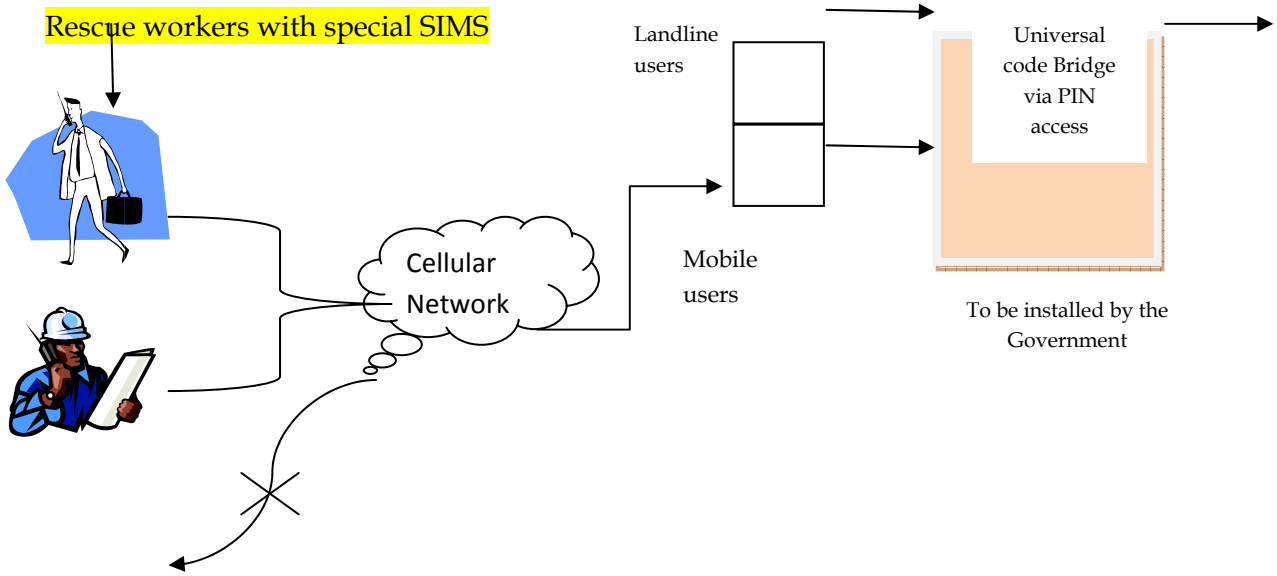
4.3 Based on the implementation in various countries and also on the suggestions given by the stakeholders following three approaches can be suggested for India:–

Model A - Solution which is a combination of MTPAS of UK and GETS of US

4.4 One of the ways to implement the priority call routing during disasters is by implementing a system/solution, which is a combination of both MTPAS of UK and GETS of US, usage of which can be governed by the extremity and the requirement of the situation.

4.5 It may be noted that in the MTPAS system, the civilian usage of the network in certain areas (Cell or group of Cell Sites) is completely prohibited and communication is made available to the entitled users via special SIMs. Since Mobile has become a primary mode of communication in India, hence this method has to be used with extreme caution. Whereas the GETS system allows high priority calls to bypass the congested network and receive priority by dialing a universal code say XXXXX+ PIN+ destination number without majorly affecting the services offered to other users. In view of this a solution which is a combination of both MTPAS of UK and GETS of US can be a better approach.

4.6 A diagram representation of the solution (MTPAS with GETS priority) is as below:



Model B - Solution based on MVNO concept

4.7 In the pre-consultation paper, one of the stakeholders have suggested that if we aim to offer prioritized service to a subscriber base that is a part of the emergency response, disaster management and rescue team for accessing the telecom infrastructure in event of an emergency, we need to keep in mind that the group of subscribers in question may be spread across multiple mobile service providers or operators. The group of subscribers may not need prioritized access all the time and may need it only in certain events. The prioritized access can be made available on-demand, and the subscribers can be treated like normal users otherwise. Wireless cellular operators cover most of the areas in the country and in most of the geographical areas there are more than one operator and hence, wireless based solution can provide the required reach and redundancy. Accordingly, the stakeholder has suggested following method to support traffic for high priority subscribers which, as per the stakeholder, can also

support on-demand resource allocation, ensure network availability for the said subscribers, ensuring inter-connection/switching of calls among users of this group as well as ensure QoS for establishing and managing the network

Suggested Model by the stakeholder:

4.8 In its response to the pre-consultation paper the stakeholder has mentioned that the following aspects, if implemented through a policy initiation, can ensure wireless coverage with elevated priority access to the radio resources :

a. Network operator for emergency: All mobile operators to provide an Emergency Virtual Network Operator service similar to an MVNO. This virtual operator shall have subscriptions from among their regular subscribers as approved by a central committee. The capacity of this virtual operator shall be dynamic and the percentage share of the total capacity will depend upon the severity of the emergency and its impact. The virtual operator shall cater only to the Emergency Response Group. During regular (non-emergency) state, the virtual operator shall lie inactive. This 'special virtual operator' may be invoked only in emergency situations by a pre-determined chain of command.

b. Resources for the Emergency-MVNO: Emergency levels (say 1 through 5) can be pre-decided. A pre-decided percentage of network resources to be allotted for the Emergency-MVNO in the respective emergency level need to be in place. As and when required, depending on the nature of emergency, the Emergency-MVNO has to be invoked and the corresponding share of network resources must be made available to the Emergency-MVNO.

c. Ensuring Network Coverage: Intra-Circle roaming across all Emergency-MVNOs may also be allowed and enabled. This will

ensure that all users of the Emergency-MVNO have access to any network as long as there is network coverage by at-least one mobile operator. This would ensure network availability to all subscribers in the rescue team even in cases of damage to infrastructure of certain network operator(s).

d. Ensuring Backhaul Connectivity: Network operators must ensure during emergencies that connectivity across Emergency-MVNOs get priority in the backhaul and call terminations. The inter-connectivity among various operators of GSM, CDMA, Landline and BWA should have a priority access for emergency traffic.

e. Controlled group of subscribers: The Emergency-MVNO SIM cards should be provided only to users who belong to a pre-approved group of organizations OR entities. The list of organizations and entities should be authorized by the competent authority in the government.

f. Ensuring Response Time: The virtual operator execution methods should be pre-decided and it should take less than 10 minutes to activate the emergency network once instructed and authorized. The access method to invoke the emergency mode should have redundancy and should not be solely dependent upon the popular infrastructure network. The control should be available at one common point in each circle (e.g. MSC/NOC).

Issues involved with the suggested MVNO based approach:

4.9 In the suggested approach there are following issues involved:

4.9.1 MVNO is yet to be introduced in Indian Telecom Market by the Government. Even if the MVNO concept is implemented for the limited purpose of introducing priority call routing during emergencies/disasters, then also for implementation in India, telecom operators should have technically compatible equipments in place to enable the Virtual Operator infrastructure concept.

4.9.2 the emergency response group subscribers should be given a special SIM and this group should be identified/approved by the appropriate government body.

4.9.3 An executive team for set-up of the Emergency-MVNO should be established. This executive team should consist of government officials and members from each operator.

4.9.4 the network security considerations would be required to be appropriately handled.

Model C - Solution based on Enhanced Multi-Level Precedence & Pre-emption" (as per 3GPP TS 23.067)

4.10 One of the stakeholders have suggested to meet the "Priority call routing in Mobile networks during emergencies" requirement through "Enhanced Multi-Level Precedence & Pre-emption" which is detailed in 3GPP TS 23.067

4.11 The eMLPP service provides different levels of priority which are applied at call set-up and in the case of handover. The service provides a higher grade of service for urgent or emergency calls. It allows priority handling of calls, provision of priority information by the mobile user during call establishment, allows queuing in radio network based on the priority, pre-emption of radio resources and called party pre-emption by high priority calls. A pre-emption can result in disconnecting an ongoing low priority call in order to establish a call with higher priority.

Technical Description:

4.12 The Enhanced Multi-Level Precedence and pre-emption service (eMLPP) provides up to 7 priority levels (A, B, 0, 1, 2, 3, 4) for call set-up and for call continuity in the case of handover. The maximum eMLPP priority level of a

subscriber is set at subscription time by the service provider. The service subscriber may use the Call Independent Supplementary Service Procedures to change the default eMLPP priority level in the HLR. The subscriber may also get information about his eMLPP default level and his maximum eMLPP priority level for which he is entitled.

4.13 The subscriber may select a priority level on a per call basis. At call set up, the calling eMLPP subscriber can indicate the eMLPP priority level that he needs for the call. The MSC assigns the requested value to the call with the following exemption:

- If the requested value is higher than the maximum eMLPP value for the subscriber, the MSC/VLR assigns to the mobile originated call the maximum eMLPP level.
- If the calling subscriber has not requested any eMLPP priority level, MSC assigns the subscriber's default eMLPP level to the mobile originated call.

4.14 In case the calling subscriber does not have an eMLPP subscription, the granted eMLPP for mobile originating calls is an MSC's default value which can be set by the operator.

4.15 For the mobile terminated call, the granted eMLPP is the same as for the mobile originated call except for the case, that the signaling system does not support the transfer of the priority information. In this case, a network default value is used.

4.16 For emergency calls, an operator defined default eMLPP value is used. The granted eMLPP for emergency call is not indicated to the calling subscriber and is not transferred via ISUP.

4.17 According to the granted eMLPP priority level for the mobile originated call and for the mobile terminated call, the originating MSC and terminating MSC respectively can:

- Request the BSC (GSM) or RNC (WCDMA) to assign the radio resources with different priority levels.
- Request the BSC (GSM) to queue the call during traffic channel assignment.
- Request the BSC(GSM) or RNC(WCDMA) to pre-empt an ongoing call with lower priority level in the case of congestion in the channel allocation.

4.18 The operator can define which priority levels can override the outgoing call barring supplementary services. This will allow mobile users, which are normally barred for all outgoing calls, to place high priority calls, if necessary.

4.19 The granted eMLPP priority level is sent to subscriber in case eMLPP is subscribed, call it's not an emergency call and the terminal used for the call is not GSM phase1. The granted eMLPP for the mobile originated call and for the mobile terminated call can be included in the related call data records. Pre-emption of a call is indicated in the call data record and can be used for charging purposes. The feature requires MAPv3 for the transfer of eMLPP related subscriber data and MAPv2 for the supplementary service operations.

4.20 **Issues for consultation**–

a. **In your opinion, which of the three possibilities (as discussed above in this Chapter) would be best suited for implementation in India and Why? In case there is any other methodology that is suggested, the details of the same may be provided?**

a. **Is priority call routing for certain users based on Enhanced Multi-Level Precedence and pre-emption service (eMLPP) possible in intra-operator and inter-operator scenario in your network?**

(a) If yes, provide the detail methodology that you will suggest for its implementation in India.

(b) If no, please indicate the time and costs required to upgrade your network and implement the same in your network.

Identifying organizations and personnel working in these organizations for giving priority routing

4.21 If any of the above three or any similar system is put in place in India for implementing Priority call routing in telecom networks in India during emergencies one of the issues would be identification of the organizations involved in 'response and recovery' and personnel working in such organizations who should get priority routing. One of the stakeholders have suggested that the priority call routing should be restricted to relief agencies and workers only and should not be made available for any other agency, as breakdown of civil mobile services can create even more chaos. Therefore this system should be used with extreme care and stringent procedure like in US/UK be laid down for emergency authorization/ entitlement. The details of the organizations identified for giving priority routing have been discussed in detail in para 3.23 to 3.28 for USA and para 3.45 for UK.

4.22 **Issues for consultation** –

a) **Which organizations and government departments that are involved in 'response and recovery' during emergency situations do you think should be part of this scheme?**

b) **What mechanism should be followed to identify which personnel working in organizations identified in (a) above should get priority routing?**

Structure, role and reporting of the unit that will be entrusted with the responsibility of implementing and monitoring the proposed scheme

4.23 The approach to making the telecom networks resilient can be effective only when a particular body is given the responsibility of developing, maintaining and executing the emergency telecommunications plans. A holistic approach towards managing telecommunication during emergencies/disasters can be adopted over a period of time only when an exclusive body is setup for the same. For example, the WPS service is overseen by the Federal Communications Commission and administered by the National Communications System in the Department of Homeland Security. In Canada, Industry Canada's Emergency Telecommunications team is responsible for emergency telecommunications planning, preparedness and response and works in collaboration with federal and provincial governments and the telecommunications industry to achieve this goal. In UK The Cabinet Office Civil Contingencies Secretariat (CCS) has taken the helm in defining different resilient communication options which are available to responders as part of privileged access schemes.

4.24 In India also, if such a scheme is implemented the structure, role and reporting of the unit that should be entrusted with the responsibility of implementing and monitoring the proposed scheme will be issues that need to be addressed.

4.25 **Issues for consultation** –

a) **In your opinion should there be a separate Unit/Division under DoT / TRAI to monitor the implementation of the scheme. If yes, what should be the structure and role of this unit?**

Service delivery and costs

4.26 If priority call routing scheme is implemented in India, the service delivery model needs to be finalized. In USA and UK implementation, there is a defined point of contact for each organization that is required to use web based application for placing requests for providing the service to different users. For the same the service delivery model would be required to be defined in detail. Some of the key design elements of the service delivery model can be:

a) Web based application
b) Identification of points of contacts
c) Standard operating procedure(SOP) for requesting priority SIM
d) Procedure for activating the service
e) Payments of bills
f) Complain handling and resolution.

4.27 Another issue that requires deliberation is how the service will be charged. The charges levied in some of the models implemented globally have been discussed in detail in chapter III. In Canada, the major telecom operators, had been participating in the Priority Access for Dialing (PAD) program on a voluntary basis and offering PAD free of charge. Whereas in USA Costs may vary by cellular carrier, but they are limited to a maximum one-time activation fee, a per-month service fee, and per minute WPS (*272) calls. WPS charges are in addition to the basic calling plan. Applicable WPS charges are billed on the existing cellular service provider invoice and are payable directly to the cellular service provider.

4.28**Issues for consultation** –

a. **In your opinion what can be the major bottlenecks in service delivery of priority call routing?**
b. **How should the service delivery model for implementing the priority call routing be designed?**
c. **What charges, if any, should be levied from the users for availing the facility of priority call routing? Please justify your answer.**

CHAPTER V: Summary of Issues for consultation

The questions that have been raised for consultation in this paper are summarized below for convenience of the stakeholders to submit their comments –

5.1 Should there be a direction from regulator on the network dimensioning - both for operating in normal as well as emergency situations?

5.2 In your opinion, which of the three possibilities as discussed in Chapter IV i.e. (a)Solutions based on combination of MTPAS of UK and GETS of US (b) Solution based on MVNO concept (c)Solution based on eMLPP would be best suited for implementation in India and Why? In case there is any other methodology that is suggested, the details of the same may be provided?

5.3 Is priority call routing for certain users based on Enhanced Multi-Level Precedence and pre-emption service (eMLPP) possible in intra-operator and inter-operator scenario in your network?

(a) If yes, provide the detail methodology that you will suggest for its implementation in India.

(b) If no, please indicate the time and costs required to upgrade your network and implement the same in your network.

5.4 Which organizations and government departments that are involved in 'response and recovery' during emergency situations do you think should be part of this scheme?

5.5 What mechanism should be followed to identify which personnel working in organizations identified in Q5.4 above should get priority routing?

5.6 In your opinion should there be a separate Unit/Division under DoT / TRAI to monitor the implementation of the scheme. If yes, what should be the structure and role of this unit?

5.7 In your opinion what can be the major bottlenecks in service delivery of priority call routing?

5.8 How should the service delivery model for implementing the priority call routing be designed?

5.9 What charges, if any, should be levied from the users for availing the facility of priority call routing? Please justify your answer.

Annex

ITU-T Recommendation E.106
International Emergency Preference Scheme (IEPS)
for disaster relief operations

1 Introduction

International Telecommunication Union (ITU) came out with recommendation E.106[25] that was approved on 31 October 2003 by ITU-T Study Group 2 (2001-2004) under the WTSA Resolution 1. This Recommendation describes an international preference scheme for the use of public telecommunications by national authorities for emergency and disaster relief operations. The International Emergency Preference Scheme (IEPS) for Disaster Relief Operations is needed when there is a crisis situation causing an increased demand for telecommunications when use of the International Telephone Service may be restricted due to damage, reduced capacity, congestion or faults.

In a crisis situation, there is a need for telecommunications among IEPS users of public telecommunications networks, such as the PSTN, ISDN or PLMN. These communications, which are regarded as essential, will be needed at the same time as the public will be attempting an increased number of calls during the period when the telecommunications networks may be restricted due to damage, congestion or faults. Therefore, in crisis situations there is a requirement for IEPS users of public telecommunications to have preferential treatment.

[25] http://www.itu.int/rec/T-REC-E.106-200310-I/en

Many countries have, or are developing, national preference schemes to allow preferential treatment for such national traffic. However, during a crisis, it is important for an international support scheme to allow communications between the IEPS users in one country and their correspondents in another. The International Emergency Preference Scheme(IEPS) for Disaster Relief Operations addresses this international support scheme.

This preference scheme is only intended for use by IEPS users to be able to place calls with preference. Public emergency services, on the other hand, are intended for use by members of the general public to request services such as fire, police, and medical. They are often invoked by a short access code.

The IEPS enables the use of public telecommunications by national authorities for emergency and disaster relief operations. It allows users, authorized by national authorities, to have access to the International Telephone Service[26], while this service is restricted either due to damage, congestion or faults, or any combination of these. This Recommendation describes the functional requirements, features, access and the operational management of the IEPS

2 Technical definitions

The two ITU recommendations i.e. E.106 and E.107, together defines the following terms –

a) **IEPS user:** User authorized by a national authority to have access to IEPS. The specific mechanism that a national authority uses to authorize a user is a national matter and is outside the scope of this Recommendation.

[26] As described in ITU-T Recommendations E.105, http://www.itu.int/rec/T-REC-E.105-199208-I/en

b) **Emergency Telecommunications Service (ETS):** A national service providing priority telecommunications to the ETS authorized users in times of disaster and emergencies.

c) **ETS user:** A user authorized to obtain priority telecommunications in national and/or international emergency situations.

d) **priority treatment capabilities:** Capabilities that provide priority in the use of telecommunications network resources, allowing a higher probability of end-to-end telecommunications and use of telecommunication applications.

3 Technical features of IEPS

Calls from IEPS users should be suitably marked[27] at the network entrance and such markings should be associated with the call to completion (i.e., EPS calls should be marked from end to end).

The essential network features for the successful operation of IEPS are:

a) Priority dial tone;

b) Priority call setup, including priority queuing schemes; and

c) Exemption from restrictive management controls, such as call gapping.

All IEPS calls will be of the same call class such that there will be only one level of priority for IEPS calls, however, some implementations may

[27] Call Marking: A specific identifying mark is associated with the call which prompts operational elements of the public switched network to provide advantages in signaling, switching and traffic routing over non-marked calls. Call marking facilities are available in modern signaling networks and these can be used by the telecommunications providers to allow call completion advantages to preference user's calls. The call marking, marking interpretation and the processing arrangements will have to be specified and fully agreed at the gateway points. Arrangements to transfer the marked signals would also need to be agreed with non-participating intermediate service providers of the transit networks.

provide enhanced service features by analyzing additional signaling information provided by the call initiator. It is essential that the information relating to level of priority be carried transparently across the initiating and transiting networks and presented to the destination network.

Transit networks not supporting the IEPS concept should not be required to examine the preference information but should simply pass the signaling information without any change.

Pre-emption in the Public Network (i.e., terminating any existing call) should not be provided.

4 Operational management of the IEPS

Requests for enabling the IEPS should be coordinated. IEPS users are to be determined by designated authorities. The criteria for selection that the designated authority may wish to consider are listed as, but are not limited to, the following items:

- Civil defense/"home defense", e.g., public warning systems;
- Diplomatic and other vital governmental purposes;
- State security purposes including customs and immigration;
- Emergency services by local authorities, including police, fire services, etc.;
- Posts and telecommunications service providers, for maintaining their service provision to other essential users;
- Public utilities including energy, water supplies, etc.;
- Medical services;
- Air and sea rescue.

To optimize the success of these calls there should be exemption from any restrictive network management controls. There should be preferential access to network resources. These preferential calls might also circumvent terminating user-invoked network features that might prevent alerting such as, for example, do not disturb or call screening.

If a network element is not able to respond to the preferential call request, the routing of the call should not be adversely affected, nor should any preference indicators be removed.