United Nations E/ESCAP/CICT(4)/5

Economic and Social Council

Distr.: General
15 August 2014

Original: English

Economic and Social Commission for Asia and the Pacific
Committee on Information and Communications Technology

Fourth session
Bangkok, 14-16 October 2014
Item 6 of the provisional agenda[*]
Information and communications technology as critical infrastructure for enhanced e-resilience and disaster risk management

Information and communications technology as critical infrastructure for enhanced e-resilience and disaster risk management

Note by the secretariat[**]

Summary

The smooth functioning of the domestic and international long-distance telecommunications infrastructure, which serves as the major supply line for the Internet, has never been so critical as it is now. In recognition of the importance of this infrastructure, new emphasis has been placed on the concept of e-resilience. Formerly based on older technologies, such as high-frequency radio links, microwave and satellite communications, the regional backbone of that infrastructure is now heavily dependent on fibre-optic technology. The Asia-Pacific information superhighway initiative is focused on promoting the resilience and performance of the network in order to facilitate seamless integration of submarine, terrestrial, microwave and other modes, including the so-called white-space spectrum.

The Internet should be considered critical infrastructure and given careful consideration in disaster management planning. In addition, the technologies concerned have become heavily embedded in a variety of other infrastructural components, such as management of the electrical grid and control systems. Therefore, an integrated approach to planning should be pursued.

The present document contains an outline of the current state of information and communications technology infrastructure as it relates to disaster management and highlights issues for consideration; it also contains recommendations for further action in order to ensure that the potential of information and communications technologies in disaster management is fully realized.

[*] E/ESCAP/CICT(4)/L.1.

[**] The late submission of the present document is due to the need to incorporate details of the deliberations on these issues by the Commission at its seventieth session from 4 to 8 August 2014.

Contents

I. Introduction

1. In the past, disaster management planning had been focused on such areas as power, water and sanitation, among others. Unfortunately, there are many instances in which communication services are not considered a priority when there is lack of access to these basic services. However, it is often access to accurate information that facilitates the restoration of the services and calms societal turmoil following a disaster. In order for information to be communicated, the underlying network must be functional. Similarly, in order to communicate accurate information, the supporting processes, such as institutions and policies, must exist. In addition, modern infrastructure often contains embedded information and communications technologies (ICTs) as part of an infrastructure control system, increasing the resilience and efficiency of the grids and networks.

2. In disaster management planning, information and communication networks may not appear to be as important as access to clean water, food and shelter, but access to relevant and timely information and communication helps promote more efficient disaster response systemically. In addition, with the

increasing interconnectedness of these infrastructure components, the risk of failure in one sector creating knock-on effects which have an impact on other systems is increased. Therefore, for disaster management, consideration must be given to bringing these infrastructure components together and planning for risk systemically.

3. In order for information to be communicated, the underlying network must function properly. Similarly, the supporting soft infrastructure, such as institutions and policies, must be available and reliable. ICT allows for documentation of needs and resources, spatial coordination, communication and facilitation of payments in the aftermath of disasters. ICT infrastructure plays different roles in different phases of the cycle.

4. Furthermore, in the publication entitled *Building Resilience to Natural Disasters and Major Economic Crises*,[1] which had been prepared as the theme study for the sixty-ninth session of the Commission in May 2013, it was found that the overlapping and interlinked nature of disaster shocks called for a more comprehensive and systemic approach to building resilience. In this regard, it called for the development of a road map to meet those needs in the region.

5. Against this backdrop, member States of ESCAP tasked the secretariat, through resolution 69/10 on promoting regional information and communications technology connectivity and building knowledge-networked societies in Asia and the Pacific, to promote the development of ICT infrastructure, including in-depth analysis of the policy and regulatory barriers that may impede efforts to synchronize the deployment of infrastructure across the region in a seamless manner. Furthermore, the secretariat was also requested, through Commission resolution 69/11, to take the lead in implementing the Asia-Pacific Plan of Action for Applications of Space Technology and Geographic Information Systems for Disaster Risk Reduction and Sustainable Development, 2012-2017 (Asia-Pacific Plan of Action) at the regional level, to harmonize and enhance existing regional initiatives, to pool expertise and resources at the regional and subregional levels and to act as a clearing house for good practices and lessons. The secretariat was also requested to organize a ministerial conference to evaluate the progress made in implementing resolution 69/11 as it related to space and geographic information system (GIS) applications in Asia and the Pacific.

6. Information and communications technology, usually understood as electronically mediated communication, storage and manipulation, allows for the necessary actions related to relief and recovery to be done in ways that are qualitatively superior to the alternatives:

(a) **Documentation of needs and resources.** The enhanced information-processing and visualization capabilities of modern computing hardware and software can, by themselves, enable better documentation of the needs that have to be met, which, when combined with GIS, further enhances these capabilities;

(b) **Spatial coordination.** ICTs allow for synchronous and asynchronous communication, enabling greater coordination of spatially separated actors. This is especially important when a disaster has a geographically wide scope (a tsunami or a cyclone/typhoon versus a localized landslide) and when physical transportation systems may have been degraded or even destroyed in the disaster. Even with localized disasters, ICT enables the

[1] United Nations publication, Sales No. E.13.II.F.3.

coordination of assistance from unaffected areas. When buildings have collapsed and roads have buckled, spatial coordination is difficult;

(c) **Publication.** ICT can also give a voice to the people affected, especially in terms of empowering them in their interactions with the relevant authorities, be they governmental or non-governmental bodies;

(d) **Facilitation of payments**. This particular function has not thus far been implemented in a disaster situation because payment disbursement through mobile telephones is a relatively new phenomenon. However, it does have potential benefits, as e-transactions through mobile telephones have become relatively ubiquitous in several countries.

II. Enhanced network resilience

7. The Internet is a robust virtual infrastructure comprising tens of thousands of communicating nodes; it has come to be relied upon across the world. In some cases, segments of this infrastructure, which keeps Internet traffic flowing worldwide, can be quite fragile, notably submarine cables and terrestrial fibre networks.

8. These networks have seen significant growth in use over time, requiring additional investment and expansion of this critical infrastructure. As a result, ESCAP members and associate members have experienced differing trends in the responsiveness of their networks. As measured by the latency experienced by users on the network, most countries have demonstrated reductions in latency, which implies improved user experiences and higher speeds of data transit. This trend is not universal however, with some countries experiencing slower data transit speeds, implying a need to address network performance over time (see table 1).

Table 1
Network latency experienced by users in selected countries

Country	**2010**	**2011**	**2012**	**2013**	**Percentage change**
Singapore	124.74	85.80	77.23	79.29	-36.43
Viet Nam	140.52	87.22	100.87	98.87	-29.64
China	133.15	114.28	150.95	102.64	-22.91
Iran (Islamic Republic of)	419.06	N/A	384.08	352.20	-15.96
Indonesia	172.95	151.14	143.31	149.07	-13.81
Philippines	160.53	138.65	148.25	150.51	-6.24
Russian Federation	78.58	80.46	69.90	73.95	-5.89
United Kingdom of Great Britain and Northern Ireland	69.92	64.24	62.63	66.28	-5.20
New Zealand	71.65	68.14	69.74	70.19	-2.04
Republic of Korea	42.72	45.61	44.46	43.48	1.77
France	85.42	83.35	85.36	95.04	11.26
Malaysia	101.88	93.57	98.70	114.14	12.04
United States of America	67.38	67.31	70.50	76.89	14.10
Australia	63.40	66.17	76.51	75.65	19.32
Netherlands	45.22	49.90	50.51	67.62	49.52
Turkey	78.85	76.72	87.42	123.25	56.31

Source: Speedtest.net (retrieved June 2014) and analysis by ESCAP.

9. These critical pieces of infrastructure are often at risk. On average, a submarine cable snaps once every three days whereas a terrestrial cable gets severed once every 30 minutes somewhere in the world. The global economy suffers an annual loss of US$ 26.5 billion due to such disruptions.[2] These events make it clear that those countries which deploy a diversity of connectivity across seas as well as over land are better positioned to survive shocks to their communications and control infrastructures.

10. Providing robust, diverse and resilient connectivity in the Pacific subregion is particularly challenging from a technical perspective. Low population densities in Pacific island countries and territories and difficult terrain make the use of fibre-optic technology cost prohibitive in many cases. Wireless technologies, such as satellite connectivity, have had drawbacks, including high cost, high latency and low capacity. However, improvements in available satellite services offer new options for consideration. For example, the use of satellites in closer orbit to the surface of the Earth (approximately 8,000 km) offers the possibility of significantly improved communications capacities over more distant satellite options, such as those in geosynchronous orbit (approximately 35,000 km). These more modern, higher-capacity satellites have the potential to deliver significant enhancements in latency throughout, as well as cost savings. In recognition of this potential, Governments of some countries in the region have pre-purchased capacity on such satellite networks in anticipation of the reaping the benefits of greater network diversity, resilience and performance.

11. With this in mind, disaster planning should foster a systemic response that includes training and human capacity-building for key national stakeholders, such as ICT regulators, policymakers, legislators and cyber security experts in charge of protecting global and national critical infrastructures. In addition, cooperation between government and the private sector is necessary in order to properly manage backbone infrastructure, including such aspects as resilience, industrial control systems, identity management, Internet root name server administration and spam regulation. Trainings and capacity-building activities should also address non-State actors, such as non-governmental organizations, academia and the technical community.

A. The need to shorten time and resource requirements to restore critical systems

12. In order to promote resilience, it is advantageous to design, from the beginning, critical infrastructure with disaster management in mind. By so doing, the capacity to restore systems to functionality is enhanced. By contrast, retrofitting such capabilities into existing systems can be unnecessarily expensive and time-consuming.

13. The Information Communication Council of Japan, after analysing the causes of service interruption in the wake of a catastrophe, proposed the following technical standards with the aim of strengthening the resilience of the communication infrastructure:[3]

[2] Data taken from infographic entitled “You’ve been cut, so what?” Available from www.ciena.com/resources/posters.

[3] Hiroyasu Hayashi, “ICT strategy for recovery of Japan”, 12th Asia-Pacific Telecommunity Policy and Regulatory Forum, May 2012. Available from www.apt.int/sites/default/files/2012/05/INP-13_ICT_Strategy_for_Recovery_of_Japan_PRF_Japan_rev.pdf.

(a) Increase the capacity of batteries and fuel for facilities that cover government buildings;

(b) Identify important base transceiver stations and provide backup circuits for those facilities. (Approximately 1,900 base transceiver stations, covering about 65 per cent of the population of Japan, are being equipped with electricity generators and/or 24-hour batteries as mechanisms to secure the telecommunication needs of the local government.);

(c) Identify important switching facilities of the core network and ensure that they are geographically well-distributed;

(d) Adhere to restriction-control guidelines to manage network traffic and congestion;

(e) Use a voice message delivery service that has the ability to avoid network congestion due to voice calls. (Other carriers are planning on starting the same service, which would enable operators to send messages to each other.);

(f) During emergency situations, direct maximum resources to basic communication services needed for carrying out rescue operations and confirming the safety of others, while reducing the priority for servicing other bandwidth-intensive video services.[4]

B. International standards and recommendations to be followed after disasters

14. The International Telecommunication Union (ITU) has also defined a number of standards and recommendations to be followed in times of disaster. One such standard is the International Emergency Preference Scheme (IEPS), which ensures that calls made by those involved in directing and coordinating relief operations get preferential treatment on public networks. IEPS is also operational for Internet protocol networks, cable networks and next-generation networks. Standards for emergency alert delivery have also been defined.[5]

15. ITU considers it vital to ensure that women are also engaged in disaster response programmes, because in many communities, women often are the primary communicators and primary caregivers and are more likely to heed warnings and plan for disasters. It is imperative therefore that Governments and disaster relief agencies involve women in their disaster preparedness programmes.[6]

---

[4] Hideo Tomioka, “Maintaining communications capabilities during major natural disasters and other emergency situations”, Ministry of Internal Affairs and Communication, 16 March 2012. Available from www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/Telecommunications_Policy_Division_MIC.pdf.

[5] International Telecommunication Union, “Handbook on emergency telecommunications – Appendices”, October 2005. Available from www.itu.int/ITU-D/emergencytelecoms/doc/handbook/pdf/Emergency_Telecom-e_appendices.pdf.

[6] International Telecommunication Union, “Emergency telecommunications: engendering prevention and response”, in *Handbook on Disaster Communications* (Geneva, ITU, 2001). Available from www.itu.int/ITU-D/gender/documents/emertelegenderfinal.pdf.

Box

Catalysing digital connectivity in rural areas: white-space spectrum management in the Philippines

The term "TV White Spaces" (TVWS) refers to unutilized television frequencies in the VHF (very high frequency) and UHF (ultra high frequency) bands.

In 2010 the United States Federal Communications Commission approved the use of TVWS for data communications. In the Philippines, the Information and Communications Technology Office of the Department of Science and Technology has been promoting the deployment of this new wireless data communications standard. TVWS has been found to be an ideal wireless data delivery medium for the Philippines, as it has long-distance propagation characteristics, and its signals have the ability to travel over water and hills and through thick foliage. Furthermore, the medium has proven to be a relatively inexpensive way of bringing high-speed Internet to underserved or unconnected areas and thus can play an important role in bridging the digital divide pending further roll-out of fibre-optic infrastructure. More importantly, it has the potential to act as a catalyst to increase demand and thus provide greater incentives for private sector investment in underserved areas.

Consequently, work is under way to utilize TVWS to support government initiatives requiring data connectivity, such as sensors used by Project NOAH for disaster mitigation, as well as a range of other applications related to education currently being developed by the Philippines Information and Communications Technology Office for the country's Department of Education through the Cloud Top Project and the initiatives being taken by the University of the Philippines' "TeleHealth Center".

Source: www.icto.dost.gov.ph/index.php/news-events/current-news/91-government-announces-tv-white-space-plans.

III. Information and communications technologies as critical infrastructure

A. ICT as a critical component of other infrastructure

16. The enhanced information-processing and visualization capabilities of modern hardware and software can, on their own, enable better documentation of the needs that have to be met, ranging from registries of the missing and injured, to medicines and food for the affected. ICTs enable coordination of spatially separated actors, especially when a disaster has a geographically wide scope and when physical transportation systems may have been degraded. ICTs can also give voice to the people affected, in terms of empowering people and authorities to communicate. Payment through mobile telephones has great potential in disaster relief processes.

17. If the above-mentioned functions are to be performed, it is necessary that ICT infrastructures survive the disaster. The many disasters experienced in the Asia-Pacific region in recent years have yielded insights that can contribute to ensuring greater e-resilience.

18. Following the 26 December 2004 tsunami in the Indian Ocean, the operators and the Communications Authority of Maldives took key steps to safeguard their communication networks in the event of another natural disaster. As a disaster mitigation step, two mobile network operators, Dhiraagu and Wataniya, have changed their network topologies from a series type to a ring, for the purpose of increasing resilience. In addition, two very small aperture terminals (VSATs) have been installed for emergency communications in strategic locations (Vilimalé and South Gan Island), which were selected based

on geographic dispersion of the two islands and population density. Other measures taken include the interconnection of the country's two submarine cables, one owned by the incumbent Dhiraagu and the other by a consortium that includes Wataniya and Focus Infocom, an Internet service provider. These measures will reduce the risk of completely losing connectivity with the international community. National roaming and priority calling that are activated with the official announcement of a disaster are other initiatives that have been taken by the operators in Maldives.

19. Currently, most backhaul traffic in Asia transits via international bandwidth hubs, such as Hong Kong, China; Mumbai, India; Singapore; and Tokyo. Cross-border terrestrial links between countries either are missing or, where they exist, are of low capacity, and do not form a coherent network. These links are often built by incumbent carriers; therefore, they are designed to route cross-border traffic onto their submarine networks, which limits realization of their full potential. If a regional network can be created by filling the gaps in the existing links, thus opening access to all operators, the result would be seamless regional integration, price declines and improved quality.

20. Redundancy and resilience should be explicitly considered when promoting the sharing of telecommunications infrastructure. Specifically, rules regarding critical infrastructure and essential facilities, such as undersea cable stations, should be formulated taking into account the need to reduce disaster risk. Especially in small island countries where there are few suitable sites, disaster management planners should earmark locations that are the least vulnerable to disasters and ensure that they are made available to ICT infrastructure operators.

21. In addition, a proactive approach to leveraging ICT for e-resilience should encourage private sector suppliers to diversify locations of critical infrastructure and deploy multiple technologies, for example, by ensuring that backup satellite connectivity is maintained even after fibre connectivity is widely deployed. Reliance on undersea cables should be balanced by utilization of terrestrial cables where possible and vice versa. Diversity of cable routes, which promotes a resilient infrastructure, should also be a policy objective. As such, encouraging terrestrial cable systems that run alongside the Asian Highway and the Trans-Asian Railway networks is an important consideration for utilizing ICT for improving resilience to disasters.

22. This is due to the fact that Asia experiences severe undersea earthquakes. For example, on 26 December 2006 the Hengchun earthquake off Taiwan Province of China devastated the Internet, voice and data services in China,