Mobile Network Restoration & Humanitarian Response

The Vodafone Foundation Instant Network Programme

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Introduction

After a natural disaster, the same mobile communication networks that help orchestrate a coordinated, effective response may be damaged when they are most needed. Mobile Network Operators (MNOs) recognise the need for rapid service restoration as they understand its burgeoning criticality to emergency responders when working to provide humanitarian relief to affected populations. Recently, many operators have invested in portable cell restoration solutions, such as Cell on Wheels (COW) and Cells on Light Trucks (COLT) in an effort to address this need. In addition to network restoration strategies, MNOs are simultaneously expanding their internal capacity and external partnerships – a restructuring that's necessary to face the challenges presented by natural disasters.

This case study examines The Vodafone Foundation and its Instant Network programme. The programme provides humanitarian relief through the deployment of a portable cell restoration solution to enable communications in disaster areas to support responders and populations affected by crisis.

The Aims and Premise of the Vodafone Foundation

The Vodafone Foundation was established in 2001 with the belief that mobile technologies can address some of the most pressing humanitarian challenges in the world and that mobile innovation can facilitate social change and improve people's lives. Vodafone Instant Network together with its Volunteer Programme form one of the Foundation's key CSR programmes, designed to support humanitarian response for affected populations following an emergency. The Foundation has been championing the importance of communications in disasters through its longstanding partnership with the NGO Télécoms Sans Frontières (TSF) and through its support of the Emergency Telecommunications Cluster (ETC) and the Cluster's lead agency, the World Food Program (WFP). The Foundation has been collaborating with WFP since 2007 by providing ICT emergency management training programmes.

For their part, TSF provide emergency telecommunications for agencies and affected populations after disasters and emergencies. Their staff members are often on the ground in a disaster area within 24 hours of a disaster, arriving at a time when the local communication infrastructure has been damaged or its performance severely limited. In the past, post-disaster communications were provided in the form of portable satellite-based communications for voice and data. These systems are quick to deploy and can function when terrestrial-based networks have been disrupted. However,

this traditional disaster communication landscape is changing as a result of the explosive growth of mobile usage around the world. Consequently, when disaster affected populations have themselves the means to communicate, they can aid recovery efforts in their own communities. Mobile is a form of communication on which people are increasingly dependent. Therefore, restoring the mobile network to operational levels as soon as possible after a disaster is critical.

Following a disaster, critical infrastructure issues affecting a mobile network often include a loss of cell sites due to damage to the site itself (or the transmission) and lack of power. Additionally, in the aftermath of a disaster quite often logistics and transport are also challenges and access to affected areas can be cut-off for larger vehicles and equipment. One of the fastest methods of restoring networks is therefore the rapid deployment of temporary and portable cell sites. In essence, cells are Base Transceiver Stations (BTS) that enable mobile communications to take place. The deployment of additional BTS can either reduce local network congestion or plug gaps in a damaged network. Due to the difficulties of access presented in the wake of by natural disasters, it becomes imperative that rapid, portable base stations (able to support both responders and the affected population) are deployed within the first 72 hours of a disaster. It was this need to have an ultra-portable technical solution that pre-empted the development of the Vodafone Foundation's Instant Network concept, in partnership with TSF and Huawei in April 2010.

What is the Instant Network Solution?

Vodafone's Instant Network is a portable mobile GSM BTS designed to be deployed rapidly wherever needed. It is based on Huawei's 'No-Frills BTS', the low power BTS3900E, but has been further developed jointly by Huawei and Vodafone Group Technology Networks in Madrid. The BTS is packed into four robust boxes (each weigh less than 32 Kg), making it easy to transport via commercial air services - a critical element in a sudden on-set disaster. The system can be deployed by trained personnel in less than 40 minutes and is able to provide GSM and 2G data services for a radius of up to 10 km on both 1800 and 900 spectrum bands.

The Instant Network system supports disaster-critical functions, such as a short message service centre (SMSC) which is used to control the delivery of SMSs, and the provision of both a local network emergency number and operator. These tools can assist in maintaining a central point of control and for dissemination of information during a disaster response.

What comprises the Vodafone Instant Network?

1st Box - Industrial Computer – This box acts as the local controller, provides the configuration interface and behaves as the Base Station Controller (BSC) and Mobile Switching Centre (MSC) of the BTS in standalone mode or provides the interface to the existing network if operating on the network . In addition, it provides the 48 V power sources to the radio devices.

2nd Box – the BTS – A unit with up to 6 transceivers (TRX) supplying 30W radio power and capable of operating on both the GSM 900 and 1800 bands. The unit performs all the signal processing, channel coding and decoding and modulation and demodulation, together with housing the power amplifiers capable of supporting up to 6 different radio frequencies.

3rd Box – Antenna – This is a 3.5m high omnidirectional antenna with a stable mounting support, enabling a range of approximately 10km.

4th Box – Various – This box contains power, Ethernet and antenna cables and mounting brackets for the mast in addition to other mission equipment such as phones, chargers and adaptors.

Optional Extras: There are also two optional boxes, one which packs a lightning protector for the antenna and the second which contains an optional lithium battery pack for the system which provides an autonomous run time of approximately 3 hours.

The system can be powered from an AC power supply at 110 V or 220V and consumes a maximum of 190 W of power. During an operation, the unit does not require cooling and can survive in a maximum operating temperature of 55 degrees. Practically speaking however, and in reflection of the environments in which the system is typically deployed, the unit is powered from generators or electricity sourced locally and the battery pack is not used. Vodafone engineers have even used car batteries and fuel from cars to power the generator when nothing more suitable was available. This example highlights the need for the programme staff to be flexible and adaptable to the environment as well as demonstrating the necessity for previously built relationships in order to gain access to affected areas and the ability to benefit from local fuel supply chains.

Once the BTS has been connected, the system must be configured via the interface on the industrial computer. The system can be configured in either of two modes; in local standalone mode or in normal mode. In standalone mode, the BTS runs a single cell that is not connected to another network, this means calls can only happen within that cell. In normal mode, the BTS runs a cell that is connected to a network which means that calls can be carried on the whole network.

Standalone Mode

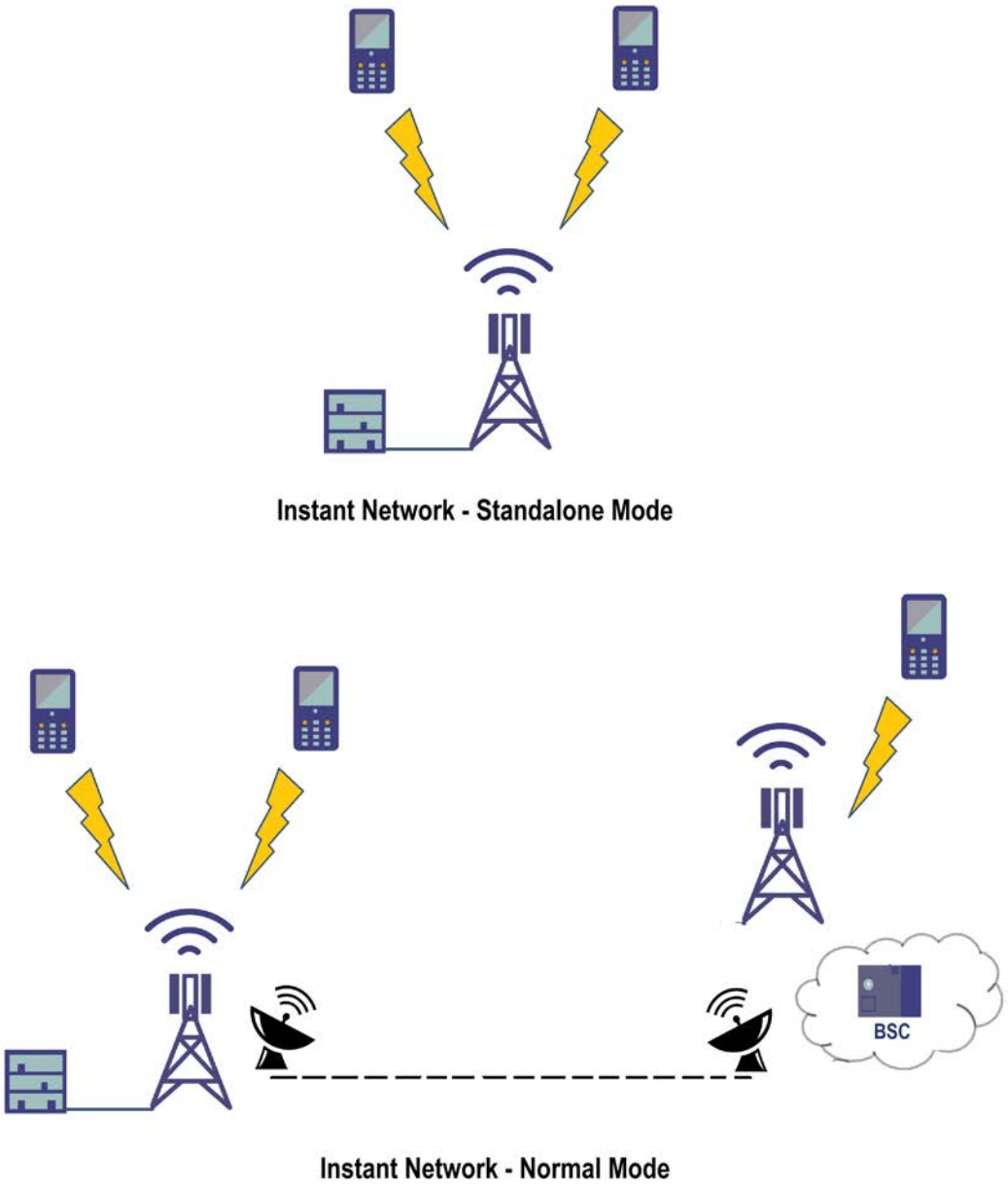
In standalone mode, the BTS is not connected to the BSC. The BTS sends all call signalling to the industrial computer, which functions as the BSC, MSC, Home Location Register (HLR), and SMSC to process voice and SMS services. In standalone mode, the Instant Network system supports up to 12,000 subscribers and 80 simultaneous calls.[1] In this mode, if desired the network could be left open to allow any mobile within range to connect and utilise the local network. However in order to manage congestion, access to the network can be controlled by registering SIM cards of emergency responders in the configuration software. Once a mobile has connected to the network it is allocated a local number, and users can then call or SMS other registered users on the Instant Network. This mode requires administration and management – a luxury that rapid responders don't often have. SIM cards of emergency personnel would need to be collated and added or preconfigured SIMS would need to be distributed to emergency responders. Administration would also be required to maintain a database of local contact numbers and to act as an operator to help distribute the local numbers.

Normal Mode

In normal mode, the BTS is configured to communicate properly with a compatible operator Huawei BSC typically using a connection to the internet via an IP backhaul over a Very Small Aperture Terminal (VSAT) satellite transmission. To enhance security the link can be made over a VPN solution. The industrial computer then manages

[1] This mode would be used either when a backhaul connection is not present or when none is required; for instance, when supplying a local network purely for the coordination of emergency responders. Use of this mode may be thought of as comparable with use of VHF handhelds in an emergency situation.

Figure 1 – Diagram showing the two modes of operation of the Instant Network



all the calling services in cooperation with the connected BSC, managing locally registered subscribers and calling services between these subscribers. If users are not registered locally, the computer routes the signalling through the network to the BSC. In normal mode the Instant Network system supports a maximum of 80 simultaneously calls

effectively functioning as a conventional BTS on the network of the host operator. Subscribers registered on the local network are able to make and receive calls and send SMS network wide using their existing number.

The Instant network supports EDGE data connections. The use of Data in disaster scenarios is becoming increasingly important both for responders and the affected population. Vodafone Instant Network programme manager, Oisín Walton, sees the Instant network solution developing 3G and 4G capability as satellite backhaul capacity becomes affordable enough to accommodate the increased bandwidth requirements.

At the core of the solution lies the ability for the Instant Network to connect users to people outside the disaster zone whilst operating in normal mode. This is done via the backhaul network. Therefore its deployment with VSAT or other backhaul transport is desirable and is the most usual mode of deployment. However a possible drawback is that it increases the size and complexity of the solution and that in order for the solution to be rapidly deployable, contracts for the provision of resilient backhaul have to be negotiated as part of disaster preparedness plans. It is therefore imperative that Vodafone have relations with MNOs in the affected country. The Instant Network programme while based on a technology solution is more about partnerships. Vodafone Instant Network Technical Consultant, Justin Waller, had this to say *''while other technical solutions exist with regard to mobile BTS, through Vodafone the Instant Network programme has the capability to deploy and operate our solution through partnerships, contracts and importantly access to spectrum in the affected country''.*

The portable BTS solution was officially announced at Mobile World Congress in 2011. Its first field test was carried out in November 2010 in the Spanish Pyrenees. It was then deployed during an exercise with the Catalan emergency services in Barcelona in November 2011. The exercise (a simulation of a train crash in a tunnel) involved 350 emergency personnel and mimicked a situation of severe network congestion that rendered the local mobile network inoperable. In this scenario, the Instant Network succeeded in enabling emergency responders to communicate and co-ordinate the response

In February 2012, Vodafone Foundation responded to a request from the Kenya Red Cross to provide support for the severe drought affecting East Africa. This drew together a multi-organisational team from the Vodafone Foundation, local operator Safaricom, TSF, Huawei and the Kenya Red Cross. The team deployed the Instant Network to the drought-affected region of Kaikor in Northern Kenya. At the time, Kaikor was without mobile coverage and the Red Cross and other responders were struggling with communications to assist their response. During the 47 days of the Kaikor mission, 264,104 calls were made. Twelve thousand free minutes were used by aid agencies to help coordinate their activities, and in humanitarian calling centres set up for the local population. Instant Network supported the roll out of M-Pesa, enabling the flow of funds and other financial transactions for the affected population. In April 2012, Safaricom installed a permanent BTS in the area to provide network services and the Instant Network was donated to the Kenya Red Cross for use in future emergencies

As part of the Instant Network Programme, The Vodafone Volunteer program was launched in June 2012 in order to develop a network of highly trained global network of emergency responders capable of deploying the Instant Network and other mobile technology that will enable relief work. The volunteer training curriculum is designed to familiarise volunteers with many aspects of disaster communications, including technical training on both the Instant Network and other emergency communication technologies such as satellite phones together with preparation for the emergency landscape of a disaster. Employees who complete training become part of an international network of emergency response volunteers. These volunteers remain on standby ready to deploy at short notice to the field in partnership with its emergency telecoms partners in the incident of a natural disaster or humanitarian emergency. In total there are currently 67 volunteers from 22 countries across Europe, Africa and the Pacific.

Vodafone Foundation Volunteers setting up the Instant Network in the Philippines after Typhoon Bopha, December 2012

Deploying the Instant Network

If a country is one in which Vodafone operates, the deployment of the Instant Network can be initiated by the Vodafone Foundation or the local Vodafone business unit. This is done after a preliminary assessment of the situation and in coordination with operating partners and in agreement with local authorities and in-country disaster management agencies. Vodafone Foundation is working to formalise the process so that Vodafone Foundation and its partners sign a bilateral MOU which would define roles and responsibilities in advance of an event. The request for deployment can also be initiated by a partner, including NGOs such as TSF, the United Nations, governments or partner market operators, as shall be detailed later.

If the country is not one in which Vodafone operates, deployment may be requested by one of its partners. Once the need has been established, Vodafone Foundation will communicate with local operators and the local regulatory body to obtain approval for the deployment of services. Bringing in external communications to support disaster response can present challenges. Telecommunication equipment is often subject to import restrictions or taxes and its importation frequently has to be cleared by the local telecommunication authority. Once the equipment has been successfully imported, its operation needs to be sanctioned by the regulatory authority. In conditions were a rapid response is needed, this can severely hamper the effectiveness of a mission. Therefore, it is important to establish prior relationships and partnerships with operators in the host country (if Vodafone do not operate there) in order to reduce the potential for delay.

The decision to deploy a team is made by discussion and coordination between Group level and regional hubs. When deployment is sanctioned the Vodafone Foundation will bear transport and volunteer costs and organise logistics to put a team on the ground between 24 – 48 hours after the event.

As outlined previously, the Instant Network behaves as a portable BTS on the host network, however in addition it also features local user control, SMS and cell broadcast services and is best used as a compliment to other existing network restoration solutions. Vodafone believes that it has the potential to give operator business units more flexibility in providing rapid disaster response and the capability to deploy where larger emergency network solutions such as COWs and COLTs may struggle for access. However, its lightweight and small-form factor could present challenges from a security perspective, as the units are highly portable and thus susceptible to theft. There are also weather protection considerations, for instance the industrial computer would need to be mounted in a sheltered environment to protect against water damage, the solution is best suited to consistently supervised emergency situations[2]. Although smaller than other restoration solutions, its use is suited to areas that have reasonable vehicular access, as the entire six-case solution weighs over 120 Kg. This enables it to be transported by any estate car, or 4x4, thereby enabling it to get to areas that larger less-portable solutions cannot reach. For longer-term installations, where access is not a problem and security is an issue, the traditional integrated COWs and COLTs may provide a more robust solution.

[2] In Kaikor, the team left and the Instant Network was put in a safe container and monitored remotely.

Working with Partners – The Key to Successful Instant Networks

"*Apart from its additional financial support, Vodafone enables TSF to go further in using innovative mobile solutions in emergencies to improve the communication capability of the humanitarian community involved in disaster response. We are able to respond to disasters faster and more effectively*" Jean-François Cazenave, President of TSF

A cornerstone of the Instant Network programme is a strong working relationship with the Vodafone Foundations current partners, Huawei, TSF and The Red Cross. The close collaboration between commercial and humanitarian organisations reflects a change in the nature of disaster response where a willingness to understand each other's points of view and work towards shared goals is being increasingly adopted. Huawei are highly committed to the programme; having provided a robust technical solution, they continue to dedicate resources to further development, support and training for Vodafone Foundation Instant Network teams. As a partner in the Instant Network Programme, TSF provides experienced technical personnel and the satellite backhaul which enables Vodafone Instant Network to operate in normal mode.

The International Federation of Red Cross and Red Crescent Societies is the world's largest humanitarian network, and as such typically has a strong in-country presence which enables it to mobilise quickly in disaster zones. The Vodafone Foundation hopes that Instant Network will build on existing Red Cross ICT capacity and expand humanitarian communications to larger segments of disaster-affected populations.

Based on the participation of volunteers, the Instant Network programme has been designed to provide humanitarian communications support globally. This began with the 30 countries in which Vodafone operates networks and then will be extended to its 50 operating partner networks in different phases. This initial distinction is predominantly a practical

one, as outlined before, since the importation and operation of cellular equipment into a disaster-affected country is often challenging (despite the existence of the Tampere Convention[3] which seeks to facilitate this process).

The Instant Network programme aims to address this problem in two ways:

I. The pre-positioning of equipment in countries that are served by Vodafone Foundation partnerships will avoid importation delays and avoid the regulatory challenges involving operating spectrum by using frequencies already assigned to the operator. It will also allow Instant Network to connect to a local network and avoid roaming charges.
II. When the equipment is not prepositioned locally and has to be carried in by trained support teams, Vodafone partner networks can assist in the importation and by assigning allocated operating frequencies. Looking to the future, Vodafone Foundation hopes to involve non-partner operators as the more kits deployed within the vicinity of a disaster, the quicker the restoration of vital services and the greater the humanitarian impact.

The programme is structured so that partners can purchase their own Instant Network solution hardware if required, which is currently priced at around 40,000 Euro.

Quite apart from the challenges presented by regulations and the importation of equipment, it is necessary to distribute the equipment strategically around the globe. While countries that are served by Vodafone or their partners will avoid importation delays there are specific regions of the world which are more disaster prone than others. Storing the equipment within easy flight access of major metropolises of these regions is important also. There are currently four global locations where the Instant Network Equipment is stored. These are shown in Table 1. A regional training occurred in Auckland in October 2012 where the majority of trainees were Vodafone New Zealand and Vodafone Fiji engineers or operational staff. Many participants had recent first-hand experience in coping with the series of devastating earthquakes that hit Christchurch in 2011. These experiences coupled with New Zealand's geographic location among the disaster hotspots of the Asia-Pacific so–called *Ring of Fire* make it a highly strategic location for the Instant Network's Asian response team. (The Ring of Fire, show in Figure 2, is an area where a large number of earthquakes and volcanic eruptions occur in the Pacific Ocean due to tectonic activity. However, this is not the only regional hazard as typhoons occur in the area also. These form in the mid-Pacific and often migrate in a westerly

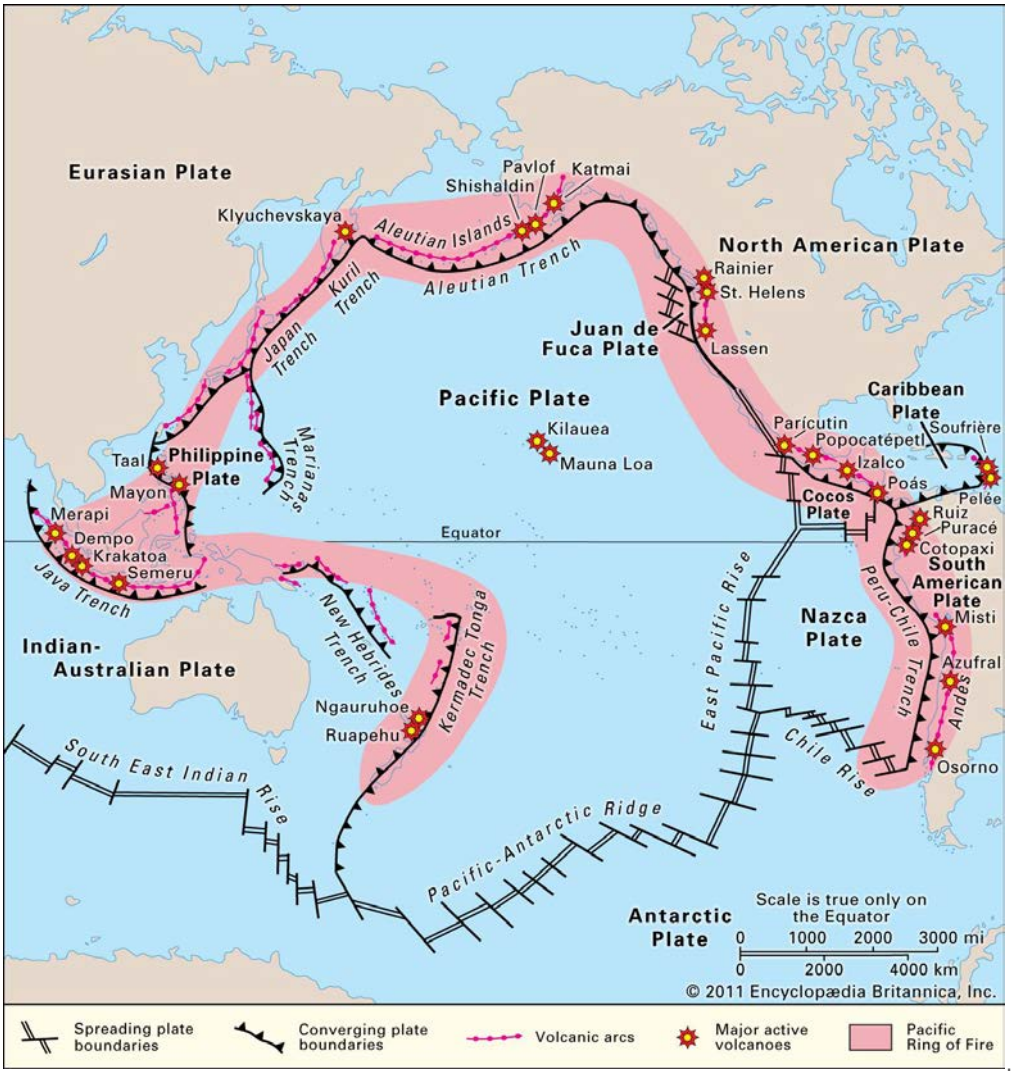
[3] The Tampere Convention came into force in 2005 and has been ratified by 46 countries. It calls on states to facilitate the provision of prompt telecommunication assistance to mitigate the impact of a disaster, and covers both the installation and operation of reliable, flexible telecommunication services. Regulatory barriers that impede the use of telecommunication resources for disasters are waived, including the licensing requirements to use allocated frequencies, restrictions on the import of telecommunication equipment, as well as limitations on the movement of humanitarian teams.

direction, often making landfall between Japan to the north and Mindanao, the Philippines to the south). Quite soon after this training, the Asia Pacific team were called into action.

Table 1 – Instant Network equipment locations and partners

Continent	Country	Partner
Europe	UK	Vodafone Foundation
Europe	Spain	Spanish Red Cross
Africa	Kenya	Kenyan Red Cross
Oceania	New Zealand	Vodafone New Zealand

Figure 2 – Pacific Ring of Fire



Examples from the Field

The Instant Network system was first field-tested under real post-disaster conditions after Typhoon Bopha hit Mindanao in the Philippines on the 4th December 2012. The typhoon devastated towns in Davao Oriental province on the eastern seaboard and much of the mobile communication infrastructure was severely damaged and non-operational. The newly trained Instant Network team departed from the New Zealand hub and in conjunction with local operator Smart and TSF succeeded in rapidly restoring a mobile network to the town of Baganga, one of the three towns virtually destroyed by the typhoon. Over 17 days, until the regular network was restored, this partnership supported by the technology of the Instant Network enabled nearly 300,000 calls and some 600,000 SMS messages thereby providing critical communications in the disaster zone.

Typhoon Haiyan (local name Yolanda) made initial landfall just before 5 a.m. local time on Friday November 8th 2013 in Eastern Samar the Philippines, about 650 kilometres southeast of Manila. The destruction was catastrophic as winds reached speeds of up to 379 km/h, making it the strongest typhoon to ever make landfall. While some evacuation had taken place before the storm struck, over 6,150 people lost their lives while 1785 people are still missing and a further 28,626 others were injured according to government sources on Jan 3rd 2014.

The National Disaster Risk Reduction and Management Council said the storm affected 16 million Filipinos, including 4 million who were forced out of their homes. The typhoon was accompanied by torrential rainfall, violent winds and dangerous storm surges as high as 15 feet was recorded in the city of Tacloban. Access to the affected area was severely limited due to infrastructural damage and debris blocking access.

There are two main MNOs in the Philippines, Smart and Globe. Smart had lost 1200 cell sites due to destruction and lack of transmission or power. This represented a massive percentage of their network in the affected area. This of course meant that survivors could not access mobile networks to inform loved ones of their whereabouts or look for family members and friends.

The destruction in Tacloban in the aftermath of Typhoon Yolanda, November 2013

The Vodafone Foundation Instant Network teams were en route to the Philippines as the typhoon was still active and arrived on the morning of Saturday November 9th. Meetings took place with the partner MNO Smart later that day in order to assess the damage and determine the most suitable location for two Instant Network deployments. On Sunday in Smart's offices in Manila, Vodafone Volunteers from Hungary and New Zealand together with Smart and Huawei engineers configured the two instant networks to run on the Smart network. Configuring the equipment beforehand is important to speed up deployment once in the field. Access to the worst affected areas was challenging and this made logistics difficult. The first Instant Network team deployed by helicopter to Borongan in Eastern Samar and the Instant Network was live and operating in normal mode on Tuesday November 12th. The second team travelled by helicopter to Palo, a region 15km south of Tacloban, one of the worst affected parts of the Philippines and was operational on Wednesday November 13th. The Vodafone Foundation team in each location was supported by partners Smart who provided logistics and engineering assistance and operated humanitarian calling services at each location, enabling free calls and phone charging for the local population. After a couple of days Smart's normal service was resumed in Borongan and the Vodafone Foundation team redeployed the equipment to Guiuan in Samar, where the typhoon first made landfall. In each location the Vodafone Foundation team stayed for a further week before handing the operation over to local Smart engineers who had been trained by the team in the use of the Vodafone Instant network.

Both systems stayed operational on the Smart network until 10th December. Throughout these 29 days, this partnership facilitated at least 443,000 calls and some 1,450,000 SMS messages. Mr Ramon Isberto, Head of Public Affairs at Smart said that "*network access through the Vodafone Instant Network calmed people down and the simple fact that the sense of isolation was broken brought joy to the people in the area*".

In addition to the provision of the Instant Network for sudden onset disasters, the equipment can also be deployed in emergency situations where the lack of communications is affecting safety and the coordination of the humanitarian response. One such example is the deployment of Instant Network to Yida in South Sudan. Yida is at present the largest refugee camp in South Sudan with a total of 73,000 inhabitants. The camp is operated by the United Nations High Commission for Refugees (UNHCR). Telecommunications at the camp is very limited as it is not currently covered by any terrestrial service from established operators. Prior to the formation of the refugee camp, Yida was a small village. In cooperation with partners UNHCR and local operator Zain an Instant Network system was installed in July 2013 inside the UNHCR compound providing GSM service at Yida. This enabled increased coordination of the relief operation by UNHCR and other agencies and enhanced security within the camp. The Instant Network was linked via a point-to-point VSAT system to Zain's headquarters in Juba, the capital of South Sudan.

The deployment was for a period of six months from July 2013 to January 2014 and during this time the Instant Network operated at full capacity. Part of the initial plan before deployment was that at the end of the six month project, Zain introduce a permanent cell site in the area. This was important from the perspective of both the Vodafone Foundation and the UNHCR as it ensures continuity of service for the camp and the agencies based there. This

represents a broadening of the utility of the Vodafone Foundation Instant Network as the phased roll-out of the programme continues.

Conclusion

The Vodafone Instant Network, whilst not suitable for all cell restoration situations, could provide a useful capability for operators to complement their existing disaster response toolkit. In general, rapidly deployable, lightweight solutions like the Instant Network should be considered by all MNOs looking to bolster their arsenal of disaster response kit. These types of solution have particular applicability for scenarios requiring a fast deployment of an incident command centre or to deliver voice and SMS connectivity to areas that are not normally connected.

Although the Instant Network's technical restoration component is the cornerstone, the heart of the initiative lies in its humanitarian programme, the provision of trained volunteers and fostering the partnerships and agreements that will enable its deployment. To amplify its impact, the programme aims to build further relationships with other humanitarian, mobile and technology stakeholders. As these partnerships develop and mature, Vodafone Foundation hopes that this will lead to a more coordinated and effective response from all actors, both local and International.

At the core of disaster response, communication challenges are not only presented by technical issues, but by inadequate coordination. In many ways, the effectiveness of the Instant Network Programme will lie in how it manages to be inclusive, drawing in diverse partners including governments, national disaster management agencies, emergency responders and operators from both within and ultimately from outside the Vodafone group. Since Vodafone Foundation has brought this programme to the market, other technical innovative solutions have followed suit and the GSMA Disaster Response look forward to seeing what this technology and the accompanying partnerships are capable of in the future.

Glossary of Terms

BSC	**Base Station Controller**	The BSC is responsible for the establishment, release and maintenance of all connections of cells that are connected to it.
BTS	**Base Transceiver Station**	Also called Base stations, these are the units which transmit/receive signals over the air. 1 BTS controls 1 Cell. Connection point for radio waves to the network.
COLT	**Cell on Light Truck**	This is a mobile BTS that can provide additional or temporary coverage on a network. It usually takes the form of a single van
COW	**Cell on Wheels**	This is a mobile BTS that is housed in a container that can be towed by a vehicle
EDGE	**Enhanced Data rates for GSM Evolution**	EDGE is considered a pre-3G data rate and is the successor of GPRS. It is known as 2.75G
HLR	**Home Location Register**	The HLR is the subscriber database of a GSM network. It contains a record for each subscriber about their available services
MSC	**Mobile Switch Centre**	The central element of a mobile telecommunication network. All connections between subscribers are switched/managed by the MSC
SMSC	**Short Message Service Centre**	Used to store and forward short messages from subscriber to subscriber
TRX	**Transceiver Module**	This is the sub-unit of the BTS and is the radio that performs the wireless signalling. A BTS can have multiple TRXs
VPN	**Virtual Private Network**	A private channel across the public internet
VSAT	**Very Small Aperture Satellite**	A satellite with a dish-shaped antenna commonly used in telecommunications and maritime communication networks

About the GSMA Association

The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress and Mobile Asia Expo.

For more information, please visit the GSMA corporate website at www.gsma.com. Follow the GSMA on Twitter: @GSMA.

About Mobile for Development - Serving the underserved through mobile

Mobile for Development brings together our mobile operator members, the wider mobile industry and the development community to drive commercial mobile services for underserved people in emerging markets. We identify opportunities for social, economic impact and stimulate the development of scalable, life-enhancing mobile services

About the GSMA Disaster Response Programme

The GSMA Mobile for Development Disaster Response Programme will work with mobile operators to determine how they can most effectively support each other and improve preparedness and resilience among networks in disasters. The programme will also identify how the mobile industry can best help affected citizens and humanitarian organisations on the ground following a crisis. We believe that when you restore the mobile network, you rebuild the human network.

Contact

For more information on the GSMA's Disaster Response Programme, please contact us on disasterresponse@gsma.com
http://www.gsma.com/mobilefordevelopment/programmes/disaster-response

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