Disaster Response

Business As Usual:
How AT&T deals with Natural Disasters

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DECEMBER 2014

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Glossary of Terms

CO	Central Office (US) Switching Centre (Rest of World)
COLT	Cell on Light Truck
COW	Cell on Wheels
DHS	Department of Homeland Security
ECV	Emergency Communications Vehicle
FEMA	Federal Emergency Management Agency
GNOC	Global Network Operations Centre
GPS	Global Positioning System
ICS	Incident Command System
ISO	International Standards Organisation
KwH	Kilowatt Hour
NCS	National Communications System
NDR	Network Disaster Recovery
NOC	Network Operations Centre
NFPA	National Fire Protection Association
NIMS	National Incident Management System
PBX	Private Branch Exchange: private company telephone network
PS Prep	Private Sector Preparedness
SIM	Subscriber Identity Module
SS7	Signalling System #7 – set of mobile telephony signalling protocols
UN ISDR	United Nation Office for Disaster Risk Reduction

Introduction

In today's globally linked world where businesses have a multinational reach, worldwide trade partners, complex interwoven supply chains and interdependencies, natural disasters have an ever wider reach. The knock-on effect of a natural disaster in one country or region can be felt in manufacturing or supply of a product or service in a different region of the world. The role of disaster risk reduction in the business world is taking on a greater importance and firms are strengthening their risk management capacities in order to remain competitive and ensure sustainability. Company disaster recovery plans are becoming more detailed and forcing those of their suppliers to become more rigorous also, through extensive auditing and supplier management practices.

While at a high level this appears to be a business continuity and revenue protection issue, it also has much broader implications for sustainable development advances globally. Countries and economies that are attempting to climb out of poverty will routinely be pushed back down by disasters that repeatedly strike. As an example, the Philippines was hit by Typhoon Bopha in 2012 which killed 1000 and caused US$ 780 million[1] in damage and less than one year later was hit by Typhoon Haiyan that left 6000 dead and caused US$ 10 billion in damage.[2] Whatever developmental gains had been achieved through recovery practices were swept away in the storm surge.

The United Nations International Strategy for Disaster Reduction (UN ISDR) Global Assessment Report on Disaster Risk Reduction 2013 reports that the total global annual loss from earthquakes is more than US$100 billion with the losses from tropical cyclones more than US$80 billion.[3] In real terms, it is mostly developed countries that experience the greater share of these economic losses whereas the most casualties, injuries and displacements are suffered by developing countries. The USA has suffered a lot in terms of absolute value of economic losses with the two most expensive cyclones in the past decade battering its eastern and southern seaboards, Katrina and Sandy in 2005 and 2012 respectively.

The US Department of Homeland Security (DHS) through the Federal Emergency Management Agency (FEMA) has handled disaster response since 1985. The number of presidentially activated FEMA engagements has increased from an average annual rate of 28 under Ronald Reagan to 140 under Barack Obama.[4] This reflects both an increasing global trend for natural disasters and their effect on the security and economic prosperity of the world's richest country. In order for a country to prepare and effectively, there needs to be contingency planning and information sharing between critical infrastructure suppliers, electricity providers, transportation networks and telecommunications players. Mobile operators are the most ubiquitous telecommunications service providers in the US with a current SIM penetration rate of 97% and up to 97% of the population covered by a mobile signal.[5] Mobile is used by many first responders as the primary means to communicate and to co-ordinate responses.

This case study from the GSMA Disaster Response programme details the extensive reach and rigorous procedures that make up the Network Disaster Recovery plan of the largest telecommunications provider in the USA, AT&T.

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1.   Declarations from Florencio "Butch" Barsana Abad, Secretary of the Philippine Department of Budget and Management
2.   Overall picture of natural catastrophes in 2013 dominated by weather extremes in Europe and Super-typhoon Haiyan – Munich Re
3.   Global Assessment Report on Disaster Risk Reduction 2013 – Published by the UN ISDR
4.   www.fema.gov/disasters and http://www.heritage.org/multimedia/infographic/2012/10/fema-declarations-by-year-and-by-presidential-administration
5.   GSMA Intelligence

Overview of Natural Disasters in the USA

| EARTHQUAKES - MODERATE | EARTHQUAKES - HIGH | FLOODS | HURRICANES | TORNADOS |
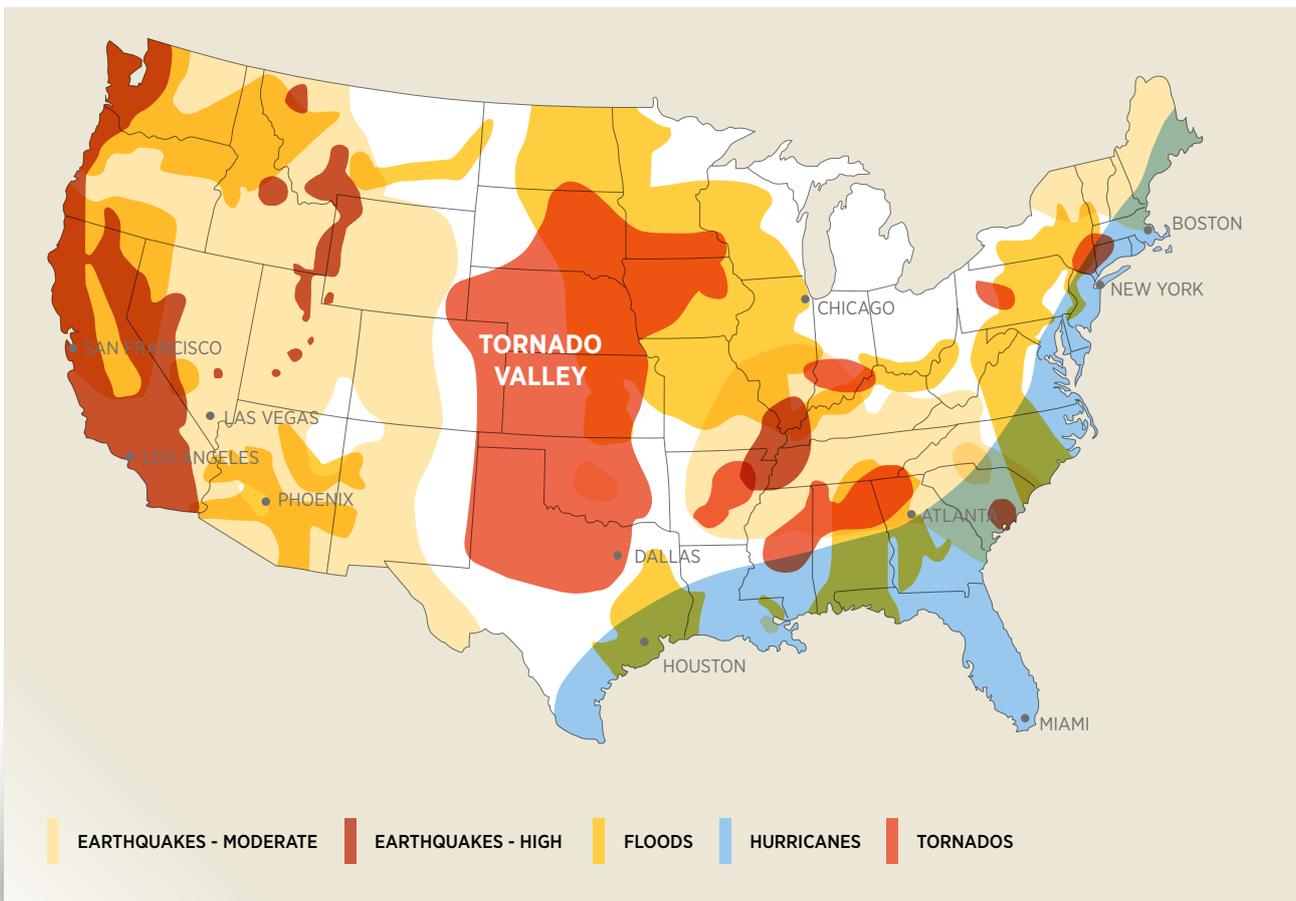
NATURAL DISASTER RISK MAP OF THE USA (SOURCE: CRISIS HQ)

POPULATION	319 million
GDP (PPP)	16,768 billion USD
GDP PER CAPITA (PPP)	50,700 USD
URBAN VS. RURAL SPLIT	80.7% vs. 19.3%

6. August 2014 Estimate from US Census Bureau https://www.census.gov/topics/population.html#
7. US Dept. of Commerce – Bureau of Economic Analysis - GDP, Second Quarter 2014 (2nd Estimate)
8. CIA World Factbook
9. 2010 US Census available at https://www.census.gov/geo/reference/ua/urban-rural-2010.html

The USA has varied geographies and climates across its almost 10 million sq. km. There are mountains in the west, vast plains in the centre regions and low mountains in the east. Climates change from arctic in Alaska to tropical in Florida to semi-arid in the Great Basin of the southwest. As can be expected from such a large and varied terrain with differing climates, the natural disaster profile of the USA is also wide-ranging. Hurricanes, tornadoes, winter storms, heat waves and earthquakes have all affected various regions of the country in the last century. The United States has a high degree of urbanisation, with almost 82% living in urban centres.[10] Such concentration of populations can make disasters more complex and compound their effects. The following tables show the loss data from disasters in the USA. In each case the estimated economic loss, fatalities and the number of affected peoples are shown. While tropical cyclones account for most of the fatalities and economic damage, flash flooding, thunderstorms and winter events are very numerous and also claim many lives.

TABLE 1
HISTORICAL NATURAL DISASTER LOSSES IN THE USA, 2003-2012

NATURAL DISASTER TYPE	NUMBER OF EVENTS	FATALITIES	ESTIMATED LOSSES (US $ M)
TROPICAL CYCLONE	46	1975	378,000
SEVERE THUNDERSTORM	775	1630	169,000
HEATWAVE/DROUGHT	21	425	48,000
WINTER EVENTS	114	765	22,000
RIVER FLOOD/FLASH FLOOD	162	245	23,000
WILDFIRE	253	112	15,000
EARTHQUAKE/TSUNAMI	29	6	1,000

SOURCE: MUNICH RE, NATCATSERVICE

TABLE 2
NATURAL DISASTER LOSSES IN THE USA, 2013

NATURAL DISASTER TYPE	NUMBER OF EVENTS	FATALITIES	ESTIMATED LOSSES (US $ M)
SEVERE THUNDERSTORM	69	110	16,341
WINTER STORM	11	43	2, 935
FLOOD	19	23	1929
WILDFIRE, HEAT AND DROUGHT	22	29	620

SOURCE: MUNICH RE, NATCATSERVICE

Intro to AT&T

AT&T is almost as old as the telephone itself. The Scotsman Alexander Graham Bell invented the telephone in 1875 while attempting to make a telegraph talk. He also incorporated a company in the same year called the Bell Telephone company to exploit the invention. A few years later the company AT&T was incorporated as a wholly owned subsidiary of what was then known as American Bell. 130 years later, what we know now as AT&T has been through many different commercial and legal entities with various restructurings along the way. Now headquartered in Dallas, Texas, in 2013 AT&T reported revenues of US$ 128.8 billion on total assets of US$ 277.8 billion. The three revenue drivers for AT&T are mobile, wireline data/managed IT services and voice or fixed line telephony services. AT&T currently has over 118 million mobile subscribers, over 16 million broadband customers and almost a quarter of a million employees. The number of business and enterprise customers is 3.5 million, ranging from regional Small or Medium Enterprises (SME) to all of the large multi-nationals from the Fortune 1000. The global reach of the firm is also enormous with a global backbone network that carries 67 petabytes of data traffic (equivalent to approximately 450 trillion standard text messages) on an average business day. The IP network infrastructure is available to 190 countries using over 3,800 service nodes, connects to 38 AT&T global internet data centers and is carried over more than 1,000,000 miles of optical fibre.

AT&T Network Disaster Recovery System

Staff Members

The AT&T Network Disaster Recovery (NDR) team was first established in the 1990s. There are currently 29 full-time staff members in the NDR team but a total of 100 people in the expanded emergency management team dealing with business continuity and emergency management. As with any disaster response or business continuity team, the team is made up of people with different skills, drawn from different business units across the company.

The permanent NDR staff members are divided into functional groups which are described in Table 3. Work is often completed across multiple functions however, particularly when at a recovery site. For example, the Asset Management team members often assist the Technology Operations team with equipment installations or modifications. Furthermore, this group works within the wider Operations Team once they arrive at a recovery site with the equipment. The part-time team is deliberately populated by staff from a wide variety of disciplines within AT&T; from network engineers and IT staff to corporate real estate and HR. This ensures that the NDR team is expert on everything from core network to radio frequencies to location and geography of each AT&T central office and network location.

TABLE 3
NDR FUNCTIONAL GROUPS

TEAM	FUNCTION
OPERATIONS	Works as Incident Command, event management and planning. This group also includes Special Operations (see later), logistics, finance, training, and systems development and support
TECHNOLOGY OPERATIONS	Design of recovery equipment, engineering, construction management and testing
STRATEGIC PLANNING	This group anticipates future recovery equipment requirements as the AT&T Network evolves and also plans future capital expenditure
ASSET MANAGEMENT	Maintains the extensive range of equipment in the warehouses and escorts equipment on deployments
MOST OF WORLD (MOW)	Operations for the rest of the global AT&T network. This team includes all of the elements outlined above but it is rolled up under one function because the equipment requirements are less than what is required in the domestic U.S.

> IT IS IMPORTANT THAT PERMANENT AND EXPANDED TEAM MEMBERS HAVE TRUST AND CONFIDENCE IN EACH OTHER ABILITIES ACROSS TECHNICAL COMPETENCIES AND PERSONAL MAKEUP TO PERFORM IN DIFFICULT WORKING ENVIRONMENTS DURING DISASTER EVENTS

Steve Poupos,
Director Network Disaster Recovery,
Business Continuity & Emergency
Management at AT&T.

The team responds to disasters at any site and this could be a large GSM switch, an internet data centre or multiple cell-sites.

The part-time team members are all AT&T staff members from around the USA and each one volunteers to be part of the NDR team. However, not all volunteers are accepted and applicants must have their capabilities carefully assessed. Some of the situations encountered at a disaster zone are harrowing and it requires a particular personality and set of skills to repeatedly work in such conditions. Volunteers are assessed during initial exercises and real deployments, and if selected to become part of the team are then trained fully. This enables both the NDR management and the volunteers themselves to assess their suitability. It is worth noting that some of the active volunteers already have first responder experience though prior service in the military or from volunteer fire departments.

Incident Management System

AT&T NDR manages its responses using an Incident Command System (ICS) that was first developed for wild fires in the 1970s; NDR adopted ICS in 2000. ICS is now an element of the National Incident Management System (NIMS) (see Table 4) which was initiated after the lessons learned in the response to 9/11. Inefficiencies identified during the 9/11 response where different agencies had different structures and workflows, led to the development of protocols that outline how responding agencies can structure their activities in a coordinated way. This allows companies and organisations to maximise their combined efforts in a complementary way.

TABLE 4
NATIONAL INCIDENT MANAGEMENT SYSTEM

WHAT NIMS IS:	WHAT NIMS IS NOT:
A COMPREHENSIVE, NATIONWIDE, SYSTEMATIC APPROACH TO INCIDENT MANAGEMENT	A response plan
A SET OF PREPAREDNESS CONCEPTS AND PRINCIPLES FOR ALL HAZARDS	Only the Incident Command System or an Organisational Chart
ESSENTIAL PRINCIPLES FOR A COMMON OPERATING PICTURE AND INTEROPERABILITY OF COMMUNICATIONS AND INFORMATION MANAGEMENT	A communications plan
STANDARDISED RESOURCE MANAGEMENT PROCEDURES	Only applicable to certain emergency management incident response personnel
SCALABLE, SO IT MAY BE USED FOR ALL INCIDENTS	Only used during large scale events

Logistical Challenges

There are many logistical processes that need to be followed during disaster responses in the US. There are papers to file with the Department of Transportation detailing the start and end of trip, roads and routes along the way, weights of all trailers in the fleet, possible exemptions from weigh stations due to the critical nature of the payload and safety reports. In addition there may be clearance required for personnel and equipment to enter a disaster area depending on the nature of the disaster; this is called "Access and Credentialing". When an emergency event occurs the overall event is handled by the Public Safety organizations (i.e. police force or fire departments) and there are times when entering the disaster area is very difficult (i.e. access). Individual responders are sometimes required to acquire the appropriate level of "credentials" to ensure they can perform both damage assessments and eventually recovery and restoration work.

Since AT&T has a global network, there is also similar paperwork to file for international deployments. All of the MoW equipment is designed to fly as well as travel by road. In these cases, there is an additional requirement to be aware of in advance; such as the relevant import/export fees and telecommunications equipment customs clearance procedures. AT&T monitors these regulations for all their key markets and has a constant contact with trade groups and relevant regulatory bodies in each country.

Disaster Exercises

> **"**
> THE EXERCISE IS A
> TECHNOLOGY DRILL WHERE
> WE SIMULATE THE KIND OF
> RECOVERY WE WOULD DO
> IF WE CAME INTO AN AREA
> AND HAD TO REPLACE A
> NETWORK OFFICE
> **"**
>
> *Kelly Morrison, NDR team*

NDR has held three or four full-scale disaster recovery exercises annually since 1993. The first recovery exercise was held in Georgia in 1993 and the most recent in Chicago in May 2014 marked the seventy-second. The exercises test as many of the NDR processes as possible, from the initial call out, to equipment logistics and transportation, to technology turn-up, testing and go-live. At these exercises, team members are given hands-on training on new technologies and the recovery equipment is operated in field type conditions. The drills are held in a wide variety of weather and settings. An exercise in Tampa, Florida was held in 35° C and one in Salt Lake City in Utah was held in 60 cm of snow.[11] These variations reflect the different geographies and disaster zones which the team will encounter in real-life. The exercises are not limited to the United States and some have been held in Canada and Europe. These quarterly exercises are place an emphasis (but not exclusively) on the volunteers as they have different daily jobs and their NDR skills need updating and require practice more than the full-time NDR members. Most importantly, as set-out in the NIMS guidelines, is the opportunity given to the NDR team to work with local emergency management agencies. For example, the team's most recent Special Operations (HAZMAT) exercise, conducted in September 2014 in northern Ohio, included a simulation with over twenty-five local, regional and state emergency response agencies. These agencies are listed in Table 5 and show the breadth and diversity of all the stakeholder, from the FBI to local community radio enthusiasts.

TABLE 5
LIST OF PARTNERS AT THE SPECIAL OPERATIONS EXERCISE IN OHIO, SEPTEMBER 2014

COUNTY AND REGIONAL PARTNERS	PRIVATE PARTNER	MEDINA COUNTY GOVERNMENT SUPPORT AGENCIES	MEDINA COUNTY SUPPORT AGENCIES	STATE AND FEDERAL AGENCIES
• Medina County Emergency Management Agency • Medina County Hazmat Team • Medina County Technical Rescue Team • Medina County Sheriff's Department • Medina Twp. Fire Department • Medina Twp. Police Department • Medina Fire Department • Granger Twp. Fire Department • Hinckley Twp. Fire Department • Erhart Fire Department • Brunswick Hills Twp. Fire Department • Sharon Twp. Fire Department • Medina Life Support Team • Southwest Emergency Response Team • Summit County Hazmat Team • Medina County Incident Management Assistance Team	• AT&T Network Disaster Recovery	• Medina County Commissioners • Local Emergency Planning Committee • Medina County Executive Board • Medina County Sanitary Engineers	• Medina County Amateur Radio Service • Community Emergency Response Team	• Ohio Search and Rescue Team • Ohio Emergency Management Agency • Ohio Environmental Protection Agency • Federal Bureau of Investigation

11. *Rapidly recovering from the catastrophic loss of a major telecommunications office* – Kelly Morrison, IEEE Communications Magazine, January 2011

At each stage of the exercise – which is often based on a previous real disaster – incident managers record key statistics, metrics and challenges-faced and these are reviewed afterwards in order to perform process improvement. This feedback mechanism has been a key feature in the fine-tuning of the team's response capabilities and highlights further training needs. It is worth noting that the exercises are also a requirement to maintain the DHS PS-Prep certification although AT&T had a long history of such practice before the certification was established.

PS-PREP CERTIFICATION

PS-Prep™ is a voluntary program that enables private and non-profit entities interested in instituting a comprehensive business continuity management system to become certified. It was established in 2007 when Congress directed the DHS to establish and implement a voluntary private sector preparedness accreditation and certification program. PS-Prep identifies best practices to assist action by the private sector in identifying hazards, assessing risks and impacts and developing mutual aid agreements. It includes standards from American National Standards, International Standards Organisation (ISO) and National Fire Protection Association (NFPA). AT&T, certified in 2012, was the first nationwide company to become so.

To date, AT&T has not undertaken blind exercises. Blind exercises involve the team entering the site with no prior information as to the nature and scale of the disaster. However, meticulously planned and informed exercises allow the rotation of NDR team members in and out of the site and exercise. Since this is a regular on-the-ground occurrence in long disaster responses such as that in Hurricane Sandy in 2012 this is extremely practical. AT&T does conduct blind tests in the Business Continuity domain but not usually for the field exercises. Field exercises tend to be 10 days long and are strong and rigorous. Blind exercises on a large scale in a large country are extremely costly with the extensive travel arrangements being last minute. Quite often the exercises mimic a disaster that has happened before or an exercise that has been conducted before, but not in the recent past. Prior to the most recent full exercise in Chicago in May 2014 the previous one was in Virginia where 70 people were on site for a week.

Recovery Exercise Process

Since the first such network disaster recovery exercise, AT&T have spent over 130,000 man-hours on these exercises. In real terms that is roughly equivalent to 812 months of one person's time. What are the key challenges involved in these exercises and what is the general procedure followed in moving from planning stage to completion?

EACH EXERCISE ASSUMES THAT ONLY

40%

OF LOCAL STAFFING RESOURCES ARE AVAILABLE

- First decision in the planning process is the choice of an exercise location. There are thousands of AT&T central office locations in the USA alone.

- Next the services at that site are examined and the services and configurations required to recover that location are mapped to the type of equipment trailers and personnel needed. This is generally a range from traditional SS7 to IP and TV services. Larger COs could draw equipment from 3 or 4 warehouses and put up to forty trailers on the road.

- Once the mapping of the requirements is complete, exercise incident command looks at logistics and regulations in order to meet the US Department of Transportation requirements. Whilst on the road the equipment needs protecting so warehouse teams travel in convoy.

- Each exercise assumes that only 40% of local staffing resources are available with the rest unavailable through fatality, trauma or simply searching for and looking for loved ones. As a result arrangements have to be made to fly in or drive in NDR staff from other locations in the US.

- Securing the recovery site is also an undertaking as the space required can be quite large and access to backhaul is critical. The optimum recovery location is a site adjacent to the destroyed site since this allows the easiest access to the fibre-optic ring that provides most of the backhaul. (In reality this is often impossible. For example, the World Trade Centre recovery site in September 2011 was across the Hudson River in New Jersey).

NDR TEAM MEMBER AT WORK ON SITE

This preparation reflects only the first stage; getting equipment and personnel to the exercise location. Once the equipment and personnel arrive on-site, subsequent procedures are followed to allow the teams to complete the exercise proper.

- The equipment is brought onto the site in a manner designed to ensure connectivity to each other and power outlets. As with any real life situation, access to power can be challenging and some exercises have required up to 500 KwH/VA of electrical power.

- Trailer positioning and leveling along with power connection and grounding can take hours to complete

- Equipment will be powered up and configurations will be loaded onto each node as per the services determined during planning stages

- These exercises mimic real disaster zones and as such the first priority is to establish through-service for the network as a while and only then will communications be re-established for the local communities.

Service in Support of Emergency Management Agencies

When NDR is deployed to provide emergency communications support for an emergency management agency the relationship can be formally structured within that agency's incident management structure or it may be ad hoc or fluid.

An example of a formal relationship is the deployment of a satellite COLT to provide mobile service at a remote wildfire command camp in the US. The wildfires are normally managed by a Federal team that uses the NIMS model. The AT&T NDR team and its services then become a function that reports directly to the site Incident Commander through the appropriate Communications Unit. There is usually a check-in at the beginning and end of each day to get an assessment of the camp's needs. The service NDR provides is just one element of the Communications Unit's responsibilities for the overall fire; they also manage the radios, repeaters, an on-site PBX, and often satellite-based Internet services.

On the other hand, oftentimes, the NDR team is asked to deploy a satellite COLT and/or ECV to provide communications at a temporary command or relief centre after a natural disaster such as a hurricane or a tornado. Federal, state, and local responders may all be massed in an area and need mobile, Wi-Fi, and/or VoIP communications. In such circumstances the NDR team generally reports back through AT&T's own ICS system to their National Communications System (NCS) representative at the DHS who received the initial request for services. An example from the Hurricane Sandy response was an ECV deployment to a relief/intake site in a parking lot in the Rockaways area of Queens. AT&T NDR provided wired Internet service for a FEMA and a NYC mobile command centre.

Special Skills

There is a Special Operations Team made up of 30 people, most of whom are volunteers with regular assignments in other parts of AT&T (e.g., Operations, IT, Environmental Health & Safety).. This special team is a fully functional Hazardous Material (HAZMAT) team. This team - which was created after 9/11 - is called upon if a situation arises where skilled people are needed to attend a site to repair broken network infrastructure and equipment where there is a chemical or nuclear spill or other release of hazardous material. Given the size and weight of the equipment (the self-contained breathing apparatus and air bottle alone weighs up to 11 Kgs) there is a strict physical requirement for these team members and levels of fitness are usually very high. This specialist team is required as part of the NDR system since these personnel can enter such sites where a chemical spill or nuclear particle radiation is present in order to do remediation on network equipment. Staff members who are qualified in this have the trust of their colleagues after undertaking such an onerous task. Not everyone is eager to or qualified to work in such conditions and it's no surprise that this specialist team at AT&T NDR is made up of around 33% former HAZMAT experts. As Mark Francis, VP of Technology Operations Planning at AT&T - who has ultimate responsibility for the NDR systems - says ''we do not do clean-up but we go in to save networks, not people''. **The key point is that these individuals risk their lives to recover the network, they are not hazmat clean up people, but operate in very dangerous environments to keep the network running that support critical infrastructure for public safety such as e-commerce and wireless.**

For AT&T Enterprise customers, the recovery exercise demonstrates a competitive advantage for business continuity management. Such customers are invited to part of the exercises where NDR field demonstrations and related activities are showcased. As telecommunications is a critical service for any business during disasters, AT&T is able to use their expertise in this area to protect the business interests and revenue of existing customers and to attract new ones.

A SATCOLT DEPLOYED IN ASPEN, COLORADO DURING A WILDFIRE

STAFF MEMBER INTERVIEW

Ron Anderson manages the western U.S. warehouse and has been on all of NDR's major deployments in the last 15 years. He has been part of the first-in crew for all of the satellite COLT deployments in the western US over the last several years. This is a full-time job that is 75% Asset Management and 25% Operations.

What do you like most about the role?

I like the opportunity to help the most. This may be corny but it is true. I like when I am at a disaster site and I can put a functioning phone in someone's hands and say ''this is for you'' and that person has the chance to call a loved one for the first time since disaster struck. The job is also fast paced and no two days are the same.

What is your daily routine day to day?

When you are not on a deployment you are self-managed and must be motivated. You are on call 24/7 so I am always primed and ready to travel. I have a series of daily routines to perform engine tests, battery tests and check that each piece of equipment is fully functioning. For instance, yesterday I found a problem with one of the diesel generators that took a couple of hours to diagnose and fix. You must be very mechanically inclined; perhaps *jack of all trades, master of none* describes it best. I can fix everything from VHF radios to truck engines and change tyres on semi-tractor trailers. You must be *situationally* aware.

When you are on a deployment it is very different. You have to be able to think on your feet and you have to know how to travel. The first thing is to mobilise all the personnel and the required equipment and logistics management is the name of the game. I know the weights, heights, tyre sizes and trip permits required for each piece of equipment and I know which drivers are licensed to drive which trailers. All of this is required for the US Dept. of Transportation. Then, of course, access to the recovery site can be an issue.

What has been the most challenging deployment you have been on in terms of access?

Gaining access to the Northern California bush-fire was extremely challenging. The only way in was a one lane road with only one travel direction at a time. There was a sheer rock wall on one side and a 400ft drop on the other. Upon first sighting it looked near impossible but I determined that if the Fire Service had brought a fire truck up there, then we could get a satellite COLT through there. Getting the same sort of big satellite COLTs onto the recovery site after Hurricane Sandy was also very challenging. While GPS is obviously extremely useful it does not always give the full story to truck drivers. We needed to pass under bridges that were 11 foot 6 inches in height with trucks that were 13 foot high. We ended up spending hours driving around just trying to find a way in avoiding these bridges.

Quite apart from this being your job it is a vocation as well. How has being on call 24/7 and sometimes for long engagements impacted on your personal life?

I don't think about that too much and I just enjoy being busy and helping. In any case, there is always someone who has it worse than you. I married a lady who is very understanding. That said I have a suitcase that is always packed with medium weight clothing for 10 days. This enables me to fly to all weather locations once a call comes in. My preference however, is to drive to the locations if at all possible. My car has a collection of both summer and winter clothes and a variety of tools.

Which was your longest deployment?

The Hurricane Katrina deployment was four weeks and I ended up sleeping in a sleeping bag for four weeks but I did so happily. Simply put I have a lot of skills that were needed so I chose to stay on-site even though rotation in and out was possible. We were on-site after 9/11 for eight weeks but in that situation incident command decreed that people rotated in and out after 10 or 12 days in order to take a break.

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What preparations have you undertaken to prepare yourself for some of the harrowing scenes that you have encountered over the last 15 years?

First of all it is important to note that AT&T NDR is not allowed onto a site until the emergency responders have allowed access. We are not the first responders. You always have it in mind that you are there to serve people and it's an honour to be able to do that. However, there have been some very sobering experiences and 9/11 was certainly one. Once you get on-site however, you simply roll with the flow and immediately start to perform your required tasks. Sometimes people are not able for the hard-core response but AT&T provides group classes to discuss mental and emotional difficulties and on larger deployments we travel with health officers.

To finish, I just want to say that this is a great job and I love the volunteer nature of what this team does. However, I also hope that we never need to deploy some of the stuff we have in reserve but that said it's very important to be prepared.

Learning from Experience

NDR uses an ICS software application to help manage information and document the progress of exercises and deployments. Activities are logged throughout an event by members of the command team but the majority of the entries are made by a staff member serving as a dedicated scribe. In this way, issues that arise with the equipment or the recovery processes are logged and tracked throughout each shift. Most issues are resolved quickly but, if a process needs to be modified or if a longer-term repair is required, the issue is tracked using this software after the event, and to its resolution, by NDR's Standards and Documentation Team.

As an example, one of the team-members responsible for power reported that during the Hartford, CT exercise in 2013, the types of lumber brought onto the site were not adequate to fabricate cable bridges to clear spill berms. The bridges were required to be 3 feet wide.

The documentation for the required lumber was changed to reflect this new requirement. Although simple in nature, this is exactly the kind of issue that is best discovered on an exercise and not during a real deployment. Occasionally, there are more significant issues but typically the issues are often related to a new piece of equipment or a new process that hasn't been tested in the field—or normal wear and tear that occurs when the equipment travels to from an event. This continual process improvement cycle, used over the past 20+ years, has refined processes and made the deployments relatively predictable, which is the purpose of exercises and documentation.

AT&T NDR Mobile Solution Fleet

The entire fleet of mobile trucks, units and trailers numbers over 320. Some of these are single vans and others are trailers requiring a truck cab for transport. A lot of the fleet carries only networking equipment – core or cellular – and others are command centres which are essentially fully mobile working offices or Network Operations Centres (NOCs).

TABLE 6
NDR FLEET OF TRAILERS

TRAILER	FUNCTION
EMERGENCY COMMUNICATIONS VEHICLE (ECV)	Provides satellite based VoIP, Ethernet and Wi-Fi service for the NDR team at the recovery site. Can also provide 3G via a microcell
SATELLITE CELL ON LIGHT TRUCK (*COLT)	Provides 2G, 3G and 4G service where normal service is unavailable. Often also seen at large sporting events or music concerts to augment existing coverage.
TECHNOLOGY TRAILERS	Contains the same type of network equipment found in a brick and mortar network switching centre.
600KW GENERATOR	Large portable power generator
POWER DISTRIBUTION	Acts as a sub-station for the recovery site by distributing power to each trailer
COMMAND TRAILER	Office trailer that acts as the working HQ from which recovery is manned. Provide connection back to the GNOC.
HARDWARE & MACHINE SHOP	Carries the tools and machinery needed to manually fix problems on site.
SECURITY TRAILER	Controls access to the recovery site which can be very sensitive.
HAZARDOUS MATERIAL RESPONSE	Houses HazMat suits, breathing apparatus and various gauges and meters.

The first unit to set-up is usually the Emergency Communications Vehicle (ECV) which is a fully self-sufficient four-wheel drive van or SUV; the localised network they provide can be up and running inside 20 minutes. The ECV has a dedicated generator on-board and comes equipped with a towing hitch for a support equipment trailer. ECVs have often been deployed by themselves to provide connectivity to emergency responders or for the large numbers of victims at a disaster intake centre.

Portable cell sites make up the next most deployed vehicle of the fleet. A Cell on Wheels (COW) or a Cell on Light Truck (COLT) can be used to replace a non-functioning base station. Mobile antennas are attached to a pneumatic mast on the COW or COLT that provides mobile network connectivity in the region. This cell is not stand-alone but it connected to the rest of the AT&T network via a backhaul link using either satellite or microwave. This enables the recovery site to ''see the rest of the network'' and allows communications in and out of the area. Importantly, in situations where there is a risk of congestion on the temporary site, the COW or COLT can be configured to only accept certain devices. This allows full access for NDR staff, incident commanders or emergency responders.

There are also over 95 technology semi-articulated trailers in the fleet. These trailers all house networking equipment such as switches, multiplexers, cable distributors, routers etc. that can be used to entirely rebuild a damaged switching centre. These trailers are unique in the industry and are built to completely replicate the original static office in terms of footprint, floor-plans and access. This ensures that once they are deployed, the operating technicians can use the same tools and processes as they can at home in their regular locations. The fleet includes a full IP office with the latest very high capacity technologies to replicate what is in the network.

Each switching centre has a different configuration so there is a snapshot taken several times a day at each one in case a disaster strikes and the most recent configuration for that location needs to be loaded into the equipment in a technology trailer. The trailer will also have lots of empty card slots in the hardware racks to accommodate changes and additional capacity as required. There is considerable virtual head-room and flexibility in each unit.

The hardware and machine shop trailer is an impressive array of tools and machines allowing technicians and engineers to do a full range of metal-working and wood-working on site in order to surmount problems encountered during the recovery. These large trailers are carefully stocked and maintained by full-time NDR staff members.

The remaining units in the fleet provide full capability for power generation and distribution, security offices and house the extensive equipment used by the HazMat teams. While the recovery site is chosen in order to access communications equipment, access to power can also be a concern. Often the national gird is unavailable in large complex disaster zones so the NDR fleet contains 600kW generator trailers. (As a guide a 25kW generator will run an average home for 72 hours or a typical telecommunications optical-fibre cabinet would require 5.5kW to function). For long deployments, there would be a need for refuelling trucks to visit the site to refuel the generator truck. Additionally, all of the technology trailers in the fleet would contain equipment with their own battery back-up for 12-18 hours as is standard for their static counterparts in the network proper.

The US portion of the fleet (the majority) is strategically positioned in 4 locations around the USA in order to access the most critical areas. The inventory in these locations changes depending on the season since the disaster profile of the contiguous USA changes also, as outlined previously. The natural hazard profile of the West coast during the summer is different to that of the South in early autumn or the North East during the winter months.

THE INSIDE OF A TECHNOLOGY TRAILER

NDR Real-Life Deployments

As discussed previously, the range of deployments of the NDR reflects the full geography of the US and the spectrum of possible natural disasters. Luckily, there has been no major seismic activity within the USA since the establishment of the team but practically every other type of natural disaster has been responded to. The following section outlines some of the natural disaster deployments from November 2012 to August 2014.

Tornado, May 2013 - Moore, Oklahoma

An NDR satellite COLT and an ECV was deployed to Moore, OK in May 2013 after the community was heavily damaged by an EF-5 tornado (Enhanced Fujita Scale categorisation which corresponds to a rating of "incredible").[12] The tornado carved a trail as much as 1.3 miles wide and 17 miles long, leaving 25 people dead and destroying over 1000 homes and businesses.[13] The ECV provided Internet (Wi-Fi) service for emergency responders at a fire station in Moore. The satellite enabled COLT augmented service at an existing cell site in Moore.

Wildfire, June 2013 - Colorado Springs, Colorado

The NDR team provided emergency communications support, with a satellite COLT and an ECV, for the Type 1 incident command site of the Black Forest wildfire in Colorado Springs, CO for nine days in June 2013.

Wildfire, July 2013 - Lakeshore, California

A satellite COLT was deployed in July 2013 to augment mobile coverage at the Aspen Wildfire Command Camp in Lakeshore, CA. The COLT remained in service for fifteen days and was then redeployed to provide service near Hoopa, CA.

Wildfire, August/September 2013- Hoopa, California

The NDR team provided mobile service using a satellite COLT for the command camps of the Butler and Salmon River wildfire near Hoopa, CA for thirty days in August and September 2013. The COLT was turned down and moved mid-deployment when the command site for the Butler fire was merged with the camp of the Salmon River fire.

Flooding, September 2013 - Estes Park, Colorado

In September 2013, NDR deployed a satellite COLT to help re-establish mobile service in Estes Park, CO after the permanent cell sites became isolated during severe canyon flooding that washed out a local exchange carrier fibre route in several locations. The floods killed eight people with a further six people still missing.[14] The COLT remained in service for ten days, augmenting coverage, after the LEC completed a temporary repair and normal cell service was restored.

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12. For more information on tornado classification please see National Oceanic and Atmospheric Administration of the US government at http://www.spc.noaa.gov/efscale/
13. Story available on Oklahoma's News 9 at http://www.news9.com/story/24020267/victims-to-be-remembered-6-months-after-may-20-tornado
14. Los Angeles Times accessed at http://www.latimes.com/nation/nationnow/la-na-nn-colorado-floods-missing-20130923-story.html

THE SCENE AWAITING THE NDR TEAM UPON THE ARRIVAL TO GALVESTON, TX AFTER HURRICANE IKE IN 2008

Mudslide, March 2014 - Oso, Washington

An NDR Satellite enabled COLT was deployed to Darrington, WA in March 2014 to augment mobile coverage for the recovery effort at the Oso, WA mudslide; it remained in service for twenty-five days while the recovery operations continued.

Tornadoes, April 2014 - Oklahoma and Arkansas

NDR deployed a satellite COLT to Quapaw, OK in April 2014 to provide service after the town was heavily damaged by a tornado. It remained in service for seven days and was then moved to Mayflower, AR where it augmented coverage for another ten days. Mayflower was struck by the same band of storms that originally hit Quapaw. Complex Wildfire, August 2014 - Northern California

At the end of July 2014, 955 down lightning strikes were recorded in the area. As of August 1st, these lightning strikes had resulted in at least 26 fires. An NDR Satellite COLT was deployed near Etna, CA in August 2014 to provide mobile service for the US Fire Service command camp of the July Complex Fire.

Complex Wildfire, August 2014 - Northern California

At the end of July 2014, 955 down lightning strikes were recorded in the area. As of August 1st, these lightning strikes had resulted in at least 26 fires.[15] An NDR Satellite COLT was deployed near Etna, CA in August 2014 to provide mobile service for the US Fire Service command camp of the July Complex Fire.

Hurricane Sandy, October 2012 – New York and New Jersey

NDR was activated for Hurricane Sandy on October 28, 2012, to provide emergency communications support in New York and New Jersey. Team members and equipment were dispatched from the southeast warehouse on October 29 and the northeast warehouse prepared to deploy teams and equipment. The first ECVs were turned up in Morristown, NJ and Huntington, NY on October 30.

At the peak of NDR's response, the team had Satellite COLTs, a Satellite COWs, ECVs, an ECP (Emergency Communications Portable), and a phone charging trailer deployed across the storm's most severely impacted areas including the Rockaway Peninsula (Queens), Brooklyn, Staten Island, Oceanside (NY), and Lavallette/Seaside Heights, NJ. Over forty NDR Operations Team full-time and volunteer members supported the deployment.

At the close of business on November 21, NDR had ECVs in service at a FEMA and NY Office of Emergency Management relief site in the heavily damaged Rockaway Peninsula (Queens), a SatCOLT on the southern edge of Brooklyn (Manhattan Beach), an ECV at a relief compound on the east side of Staten Island, a SatCOLT in Lavallette, NJ (barrier island), and an ECP at an AT&T staging/logistics site in Morristown, NJ.

The last active SatCOLT, at Manhattan Beach, was turned down on Saturday, December 22 2012.

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15.   Details of the incident can be found at the US government incident reporting website at http://inciweb.nwcg.gov/incident/4035/

Conclusion

This case study details the extensive preparedness and response activities undertaken by AT&T in dealing with natural disasters. The NDR team has clear guidance and leadership from AT&T executives and plays a key role in helping to protect revenue, save costs for the wider AT&T business and in turn build a strong reputation with clients which in turn attracts new business. The existence of a consistent and stable core team, strong management and following a structured path within a response framework, has enabled the NDR team to help protect the lives of their staff, the wellbeing of their subscribers, their business assets and the community at large. In such a large and populous country with a varied natural disaster risk profile, AT&T is already one of the foremost private sector organisations in responding to disasters. In summary the key lessons for other operators are:

Cross-Functional NDR Team

The existence of a cross-functional NDR team is critical. Made-up of both full time members and volunteers the AT&T NDR team is carefully chosen to reflect their skillset, experience, knowledge and capacity to perform under pressure. This team also has a stable structure and an internal continuity, as referenced by the interview with the veteran Ron Anderson.

Disaster Exercises and Partnerships

Disaster exercises gives NDR staff experience of reacting to disasters, working in often harrowing conditions and training in what the requirements are. Furthermore, the exercises strengthen partnerships across the departments within the mobile operator and those partnerships with external agencies such as the fire department and police service. These exercises also give the NDR team management observations and data which they can feed back into their existing plans to fine tune them for efficiency.

Certifications

Following a framework in order to become certified adds a structure to the preparedness and recovery plans. It also gives confidence to team members, the wider business staff and clients that best-practice is being followed. While achieving the certification in the first place is very important, it should be noted that regular audits and maintaining the certification further strengthens the business processes around the NDR team.

Fleet of Recovery Equipment

The extensive investment poured into the hardware, equipment and assets used by the NDR team is unparalleled. While the most regularly used equipment is the ECV or the SatColt, AT&T have preparations made for the recovery of large switching centres and IP hubs through the development of other extensive recovery equipment. In a telecommunications environment which is dynamic and progressive by its very nature, the team develops and evolves recovery equipment to match all new developments within their business.

AT&T have helped lead the way for other operators around the world to develop similar recovery teams and plans and build effective partnerships in their own countries. Given the requests from emergency responders, the humanitarian community and the clients of telecommunications firms to play an increasing role in disaster response, it has never been more pressing for the mobile operators to help change the face of disaster response.

About the GSM Association

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

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