BEST PRACTICES

AT&T Network Continuity Overview

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The AT&T Global Network is the largest, most sophisticated communications network in the world. On an average business day, it delivers more combined data, voice and Internet traffic to more locations, more reliably, than any other network. It handles more than 3.8 Petabytes (Peta = Quadrillion) of data – that's equivalent to the printed contents of the Library of Congress in Washington, D.C. every 7.5 minutes-as well as 410 million voice calls.

AT&T Network Facts

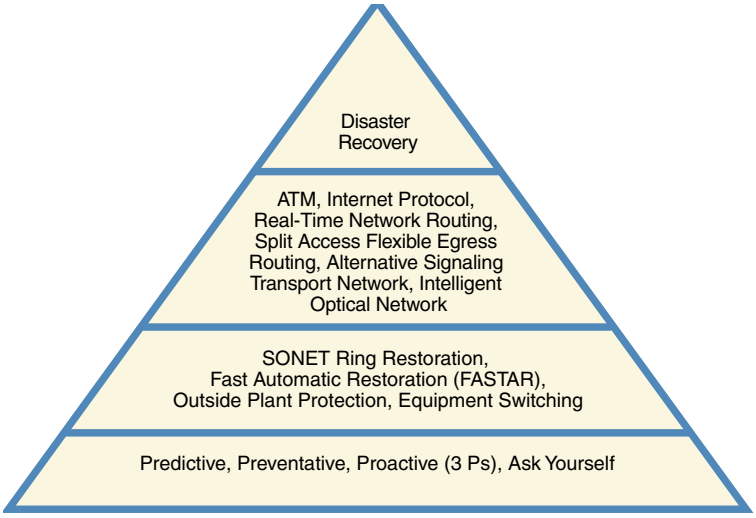
- AT&T has high-capacity fiber to more places than any other carrier
- More than 76,000 routes miles of fiber-optic cable. About 55,000 miles carry long-distance traffic; 21,000 miles support local service
- OC-48 service to more than 700 points-of-presence in the continental United States
- Can provide OC-192 services to any location on the domestic network
- Offers local business services in 91 major markets, using 158 local switches and more than 8,200 metropolitan SONET rings. More than 6,250 office building and customer locations are directly connected to the AT&T network with high-capacity fiber
- Long distance service everywhere (250 nations and territories)
- Dial up Internet access in almost 1500 cities in 59 countries via AT&T owned Points-of-Presence (POPs), Secure IP access in 66 countries via AT&T POPs
- AT&T is leading the explosion of e-commerce, streaming media and fast web connections
- First in the industry with an OC-192 (10 billion bits per second or 10 gigabits) Internet Protocol (IP) backbone coast to coast
- By placing web content closer to end users at the edge of the IP network, website download times are improved as much as 65%
- Fastest-performing IP backbone (as measure by Keynote Systems)
- Industry leader in the deployment of Dense Wave Division Multiplexing (DWDM) technology, with 1,300 systems in service
- First to test end-to-end OC768 transmission over field fiber using commercially deployable systems
- A mobile Network Continuity fleet of over 500 custom built trailers dedicated to supporting central offices in the event of a disaster

AT&T Network Reliability Design

AT&T provides a flexible and standardized set of networks and process where reliability is built into all layers and processes by design to eliminate failures impacting the customer. When an unavoidable failure occurs, this same architecture allows for rapid and automatic restoration of services.

AT&T Network Survivability Protocol

To achieve this vision, AT&T has employed various layers of protection supporting network survivability by preventing disruptions using defects per million process and when required, restoring the network in such a manner to minimize customer impact. The figure to the right depicts the AT&T Network Survivability Protocol. The layers represent the basic designs and process features that allow AT&T to operate the world's most reliable networks.



Process Layer

Predictive, Preventive, Proactive (3Ps) – an approach used by the network operations team based on predicting problems in advance and building intelligent systems and alarms into the network and rules and procedures to back them up. Failures are prevented or detected and corrected before service is affected. Defects per million have decreased by a significant order of magnitude since implementing this approach.

- Ask Yourself – the "Ask Yourself" program was designed to help achieve our goals of striving for flawless network services and loyal customers. It is a methodology that requires employees to address the potential impact of their work on network operations and customer service before they begin a task

Transport Layer

The second layer of the pyramid contains the automated systems, the physical layer and the daily protection of the physical plant, which transports calls and data traffic between AT&T offices.

- SONET Ring Restoration – AT&T's core network architecture consists of 4-Fiber Bi-direction Line Switched rings. Two fibers are for service and two fibers are for protection, which provides for self-healing restoration capabilities. In the event of a failure, traffic is automatically switched to a fully redundant backup facility, typically in less than 60 milliseconds.
- FAST Automatic Restoration (FASTAR®) – The AT&T IXC transport network uses the FASTAR® (FAST Automatic Restoration) system as one of its key tools to ensure network reliability. First introduced in 1992, the FASTAR® system instantly identifies fiber-optic cable failures on the core network and automatically begins rerouting circuits via spare capacity. Frequently, the FASTAR® system restores 90 to 95 percent of service within two to three minutes. In the vast majority of cases, the customer is unaware that there has been a problem.
- Outside Plan Protection – A cable failure of any size can have a far-reaching impact on our customers, reputation, and the AT&T corporate image. Detailed and specific AT&T plant protection practices are used at all times when work is performed around our buried facilities. In addition, AT&T participates in the various state "One Call" systems. During any excavation activities around the AT&T cable, our network technicians provide plant protection for the underground facilities. The responsibility of the AT&T technician is to locate and mark the cable, observe the contractor and stand by for restoration if necessary.

Switching Layer

The AT&T Switched Network – (ASN) equipment has various systems that support redundancy. The network uses these systems for self-healing in that they can detect failures or impairments and automatically switch to backup or redundant systems. Some switched based systems support access and egress traffic and others support AT&T's enhanced services. AT&T's circuit based switched network is the most reliable network in the industry. The core technology of this network is numerous 4ESS™ switches. These switches can handle up to 100,000 terminations each and switch 1+ million calls per hour. AT&T maintains expert tools and operational systems to support its switched network.

- Asynchronous Transfer Mode (ATM) – ATM is a high bandwidth, low delay, packet-like switching and multiplexing technique used over public and private networks. Usable capacity is segmented into fixed-size cells, consisting of header and information fields, allocated to services on demand.
- Internet Protocol (IP) – Internet Protocol (IP) is a layer 3 protocol that defines addresses used for peer-to-peer routing. IP uses standards describing software that keeps track of the inter-network addresses for different nodes, routes outgoing messages, and recognizes incoming messages.
- Real-Time Network Routing (RTNR) – Real Time Network Routing (RTNR) is a 4ESS™ switch to 4ESS™ switch adaptive routing method that finds idle paths in the intertoll AT&T Switched Network (ASN) on a per call basis. Basically speaking, every 4ESS™ switch in the network talks to every other switch in the network every five to ten seconds, so every switch knows the current status of every other switch at all times. Under normal circumstances, a call from San Francisco to Washington, D.C. is routed directly from the Bay Area to the nation's capital. However, if the direct path is experiencing high volume or some other abnormal condition, RTNR instantly reroutes that call, perhaps via Atlanta, Dallas or Minneapolis. In all, there are more than 100 possible routes for completing each call.
- Split Access Flexible Egress Routing (SAFER) – Split Access Flexible Egress Routing (SAFER) is a routing capability that allows multiple egress from the ASN for a given call destination. The SAFER feature also allows traffic to be distributed, by percent, to ensure that call attempts are evenly spread.
- Alternative Signaling Transport Network (ASTN) – Alternative Signaling Transport Network (ASTN) serves as a backup to the core-signaling network to protect an AT&T switching office from isolation when normal signaling is unavailable. When an event occurs, the processor of the failed switch is automatically re-homed to another signaling region until the failure is abated.
- Frame Relay – The Frame Relay network architecture is designed to provide reliable frame relay services. The network trunk design is resilient to single trunk failure and the switches are equipped with a dual processor and redundant power supply. To provide a reliable service to customers, various redundancy features have been implemented in the network. There is Access Card Redundancy, Access Link Redundancy, Link Redundancy between AXIS and BPX at AXIS (Y cable redundancy), AXIS Shelf Controller, BPX Controller and MGX-1 port card redundancy, which provides N+1 redundancy for all the service cards on the shelf. Spare switches and shelves are maintained in AT&T POPs in powered up mode to ensure spares are working as expected.
- Optional Fee Based Recovery Options – There are multiple fee based recovery options available to customers:
    - AT&T Bandwidth Manager (ABM) – Provides a full spectrum of network and bandwidth management capabilities, allowing subscribers to monitor, modify and/or grow their network to satisfy their current business data demands while optimizing its utilization. With ABM, network managers can fine-tune their network to handle the changing needs of applications, such as local area network interconnection and traffic load balancing.
    - T3 transfer Arrangement (T3TA) – The T3 Transfer Arrangement permits a customer to transfer from a T3 Access to the T3 Reserved network. In addition to connecting to the T3 Reserved Network, the T3 Transfer Arrangement also permits a customer to transfer or switch a T3 channel or service to another T3 channel or service. The T3 Transfer Arrangement also permits a customer to transfer or switch a T3

channel or services to a different customer's T3 channel or services. This service is especially attractive to customers who perform data vaulting between their data centers on a periodic basis or who have arrangements with disaster recovery providers.

- T1 Private Line – Network Protection Capability (NPC) protects against the failure of an inter-office channel (IOC). When a channel fails, a switching arrangement automatically transfers the data to a separately routed, terrestrial digital protection channel. NPC is for customers with mission critical applications who are willing to pay a premium to ensure seamless service during network failure. NPC offers customers a back-up solution that reconfigures their network manually in the case of failure. When a circuit fails, NPC brings customers back online as quickly as possible by automatically reconfiguring the network, saving the customer time and resources. NPC automatically protects customers from cable cuts, equipment failures and other network problems.
- Ultravailable – Customer managed solutions that provide private, high-speed fiber optic networks and the latest optical networking (DWDM) technologies for clients who require uninterrupted access to business operations. This solution will be designed, engineered and implemented to meet client's operational needs while transparently resolving single points of failure.
- High Speed Packet Services (Frame/ATM) – AT&T High-Speed Packet Service (HSPS) Disaster Recovery Options (DRO) is a family of packet data network redirection capabilities for Frame Relay (FR), Asynchronous Transfer Mode (ATM), FR/ATM Service Interworking (SIW) and customer Internet Protocol FR/ATM Virtual Private Network (IPFR/ATM VPN) Services. DRO is ideal for guarding against isolation or failure of a customer's Primary Location caused by a natural or man-made disaster.

Power and Infrastructure Standard for AT&T Central Offices

Even with controlled planning, maintenance and architecture design, which minimize infrastructure outages, failure risk cannot be completely eliminated. Hence some failure factor can be expected which can only be mitigated through Disaster Recovery. Each failure, no matter how small, damages reputation, brand, and revenue streams. The following table outlines various types of AT&T's buildings and describes how loss of a particular building type is related to potential impact in the network and prospective hazard rate.

Design Standards

Building Type/Impact	Meantime Between Failures (MTBF)
Type A – The loss of a building would be catastrophic isolating a major market or multiple switching nodes across multiple services.	Primary system MTBF is 2000 years.
Type B – The loss of a building would have a severe impact to customers. Isolating all or part of a major market or multiple switching nodes across multiple services.	Primary system MTBF is 500 years.
Type C – The loss of a building would have a serious impact to customers isolating part of a major market or one or more switching nodes for one or more services.	Primary system MTBF is 400 years.
Type D – The loss of a building would have a significant impact to customers isolating part of a major market or one or more switching nodes for one or more services.	Primary system MTBF is 300 years.
Type E – The loss of a building would have a small impact to customers. Isolation of customers/service should be low.	Primary system MTBF is 200 years.
Type F – The loss of a building would have a very small or no impact to customers.	Primary system MTBF is 50 years.

Central Office Power Overview

Power is critical to the operation of the network and provision of services. AT&T's telecommunication equipment operates from DC power supplied by batteries that are part of the DC power plant. The batteries are continuously charged by AC Power that has been converted to DC power by rectifiers within the power plant. The rectifiers take the AC power supplied by the local utility or by AT&T's alternate power sources (generators). Each of the battery plants is engineered so that they can supply power to the telecommunications equipment if the AC power fails.

All AT&T offices are tested regularly to assure that the supporting generators will automatically start and transfer into a power-providing role if the commercial utility power fails. Current guidelines for on-site storage facilities for fuel necessary to run supporting generators specify that each site maintain a supply to support a full load for a minimum of 72 hours. Fuel levels can also be remotely monitored by AT&T's Network Control Center.

An action plan has been developed for all offices to restore DC power in emergency situations such as when the commercial power and emergency generator have been interrupted. These plans address emergency power shift actions that personnel can take to extend the reserve time of the battery plant. Several additional program initiatives are targeted to a prioritized first wave of upgrades. These offices were chosen based on 4ESS™ switch functionality, volume of data network service supported, ability to recover from failures, and probability of power loss such as in earthquake zones.

All DC power plants providing power to the high capacity digital facility equipment will be diversified. Additional power plants are being added and existing power plants re-cabled to provide true redundant power sources to all equipment accepting diverse power inputs.

An aggressive program of updating the alarm and monitoring system has begun. All power alarms can be remotely monitored at the Network Control Center providing nationwide coverage. A new alarm system is also being deployed to update both the local alarm system within the building and the remote alarms for greater functionality and user friendliness.

Infrastructure Technical Services Group (ITSG)

The purpose of the Global Networking Technology Services (GNTS) Infrastructure Technical Services Group (ITSG) is to assist in the initiation, coordination, restoration and reconstitution of AT&T's telecommunications facilities under all conditions, crises or emergencies.

ITSG is responsible for providing Tier II and Tier III building infrastructure technical support for all infrastructure assets of AT&T; Domestic, International and Local. ITSG provides technical support for engineering, development and distribution of infrastructure bulletins, incident management, restoration of power/environmental equipment and the management of all aspects of programs within the Field and Center Technical Support (FACTS) Division.

- Tier II and Tier III Building Infrastructure Technical Support:
  - Provide 24x7 technical support and maintenance functions related to the infrastructure technologies
  - Perform installation reviews of infrastructure assets implemented into the network
  - Incident management for critical infrastructure, hurricanes and other disaster situations
  - Provide Communication, Command and Control Process (3CP) support to the Global Network Operations Center (GNOC) for disaster situations and resolution to network troubles related to the infrastructure technologies
  - Perform technical office reviews for standard adherence and assist with maintenance routines
  - Participate in national disaster exercises and deployment
  - Team member in development and management of OA hut acceptance process
  - Physically respond as necessary to critical infrastructure/environmental and disaster situations
- Power Trailers
  - Approximately 225 portable generator trailers including 3 portable DC power trailers with AC power capability
  - Ranging in size from 2 Meg to 3 kw
  - Over 80 Meg of combined power
- Environmental Trailers
  - Approximately 40 portable HVAC trailers
  - HVAC units range in size from 515 tons to 1 Ton units with combined cooling of over 15,000 tons
- Specialty Trailers
  - Approximately 60 specialty type trailers
  - Trailer Types include: Fuel Cell, Light towers, Pump, Fan, Cable Restoration, Sync, Switchgear, Load Banks, Transformer and Utility Trailers
  - Five additional fuel cells on skids ranging from 2,000 gallons to 500 gallons

Network Disaster Recovery Overview

Network Disaster Recovery (NDR) is part of AT&T Global Networking Technology Services (GNTS) that provides business continuity and recovery capabilities for the AT&T Global Network and external clients.

The Network Disaster Recovery (NDR) organization has been chartered to develop and maintain the necessary processes for recovery of functionality at critical locations.

From its beginning in 1992, NDR has grown its trademark inventory of trailerized equipment elements to over 150 units, pre-planned recovery for over 170 network offices and a diverse team of approximately 50 people throughout AT&T to plan and execute recovery using a patented process.

For the purposes of this document, AT&T Central Office (AT&T CO) will be used when describing Network Disaster Recovery plans or capabilities that are common to the response for a catastrophic loss of an AT&T Point of Presence (AT&T POP) or Service Wire Center (AT&T Switch Location).

Business Objectives

The primary role of the NDR organization is to restore the functionality for a central offices, network element or work center in the AT&T network that was completely destroyed or rendered useless by a natural or manmade disaster. Such restorations exceed the normal capabilities of the network operational processes and usually require long-term deployment of specialized equipment and resources. The goal is to restore functionality within 168 hours of being activated.

What is a Disaster

AT&T defines a disaster as the central office building and all the equipment, work centers and information systems contained within have been completely destroyed or rendered useless by any type of natural or man made disaster such as earthquake, fire, flood, volcanic eruptions, sabotage, terrorism or civil unrest.

Loss of AT&T CO to AT&T CO Facilities (IXC Network Specific)

The AT&T IXC (InterXchange Carrier) Transport network uses the FASTAR® (FAST Automatic Restoration) system as one of its key tools to ensure network reliability. First introduced in 1992, the FASTAR® system instantly identifies fiber-optic cable failures on the core network and automatically begins rerouting circuits via spare capacity. Frequently, the FASTAR® system restores 90 to 95 percent of service within two to three minutes. In the vast majority of cases, the customer is unaware that there has been a problem.

Catastrophic Loss of AT&T CO

AT&T has locally deployed On Site Work Force (OSWF) personnel who maintain and repair the various elements of the network. These personnel work in concert with various technical support and command organizations including the AT&T Global Network Operations Center (GNOC). Because of its ability to monitor the quality and level of service for the entire network, the AT&T GNOC provides the highest level of support and command when a significant network incident occurs. A process referred to as 3CP, the Communications, Command and Control Process, is used to manage network anomalies. We use network anomalies whenever parameters meet or exceed specific thresholds such as the number of blocked call attempts and Custom Service Digital Signal – Level 1 (DS1) Minutes of Outage. Disaster Recovery Plans (DRP) and Emergency Response Plans (ERP) have been developed and documented by appropriate organizations that fit under the 3CP umbrella. ERPs and DRPs allow organizations to readily respond to emergency situations from network, human resources, safety and security perspectives. The 3CP starts when the service impact to our customers reaches a specific Network Performance Level (NPL) or when it is invoked by organizations responsible for network support as determined by local conditions.

The Communications, Command and Control Process provides for:

- The timely assessment of potential or developing crises or disasters that have the potential to impact:
    1. Service to AT&T customers
    2. AT&T network equipment
    3.. AT&T employees
- An emergency communications process to notify the appropriate organizations that could be involved in the incident. Through this process, technology bridges are established so subject matter experts and field personnel can efficiently and appropriately share pertinent information concerning the restoration effort.
- The establishment of the Management Control Bridge (MCB), which is the primary means of decision making during a network incident. It is made up of a leadership team responsible for the overall maintenance and recovery effort, information flow and decision making during an incident.

The AT&T leadership team determines the appropriate response to a network event and activates the appropriate repair or recovery processes as required. In the event an AT&T CO is classified as destroyed or sustained major damage, which will require lengthy repair, the AT&T Network Disaster Recovery Team will be activated.

To accomplish NDR goals, AT&T has implemented highly reliable SONET rings, Intelligent Optical Network, high-tech tools such as Real Time Network Routing (RTNR) and FASTAR® and has established a Network Disaster Recovery (NDR) Team with patented equipment designed specifically for disaster recovery. The NDR Team is a mobile group of AT&T managers, engineers, and technicians that have received special training in the physical recovery of the AT&T network. Team members include highly skilled AT&T employees located across the nation who participate in disaster recovery exercises each year to retain and enhance their skills using the disaster recovery equipment and processes.

Recovery Strategies

AT&T NDR's recovery strategy has three primary goals:

- Route non-involved telecommunications traffic around an affected area
- Give the affected area communications access to the rest of the world
- Restore communications service to normal as quickly as possible through restoration and repair

The recovery process is initiated by either a directive from leadership, partners, and customers; a natural or man-made crisis; and/or a threat to the AT&T Global Network. The process is complete after the network resumes normal operations and is returned to the stand-by mode.

NDR Mission

Plan, establish, maintain, and augment the infrastructures, technologies, and processes required for crisis mode operations during a disaster or threat to:

- Minimize customer impact
- Recover critical network services both long distance and local connectivity
- Normalize operations to our fullest capabilities

- Establish emergency communications and network access
- Support humanitarian relief communications in a timely fashion, up to equipment limitations, for identified and unmitigatable risks associated with natural and man made events that are beyond the capabilities of normal operations. NDR uses its extensive satellite communications capabilities to provide communications support for relief efforts using links and specialized equipment. NDR can and has provided support for other telecommunications service providers when requested in extreme circumstances.

Recovery Time Objectives

The Recovery Time Objective (RTO) of the Network Disaster Recovery program is to recover the lost functionality of a destroyed AT&T Central Office within 168 hours from activation by the AT&T GNOC. From the time the NDR team is officially notified to deploy, the personnel and equipment will be on-site within 36-72 hours to begin recovery of the destroyed central office. During the next 48-72 hours, the NDR team will assemble all of the equipment and recover the service that normally passes through the destroyed building. During the subsequent 24 hours, the team will recover the originating and terminating traffic that was in the destroyed building. The 168-hour RTO covers most Central Offices including the 4ESS' switch locations. The actual recovery time achieved would be a factor of the distance from the NDR warehouse(s) (four geographically dispersed around the United States) and the size and complexity of the failed office.

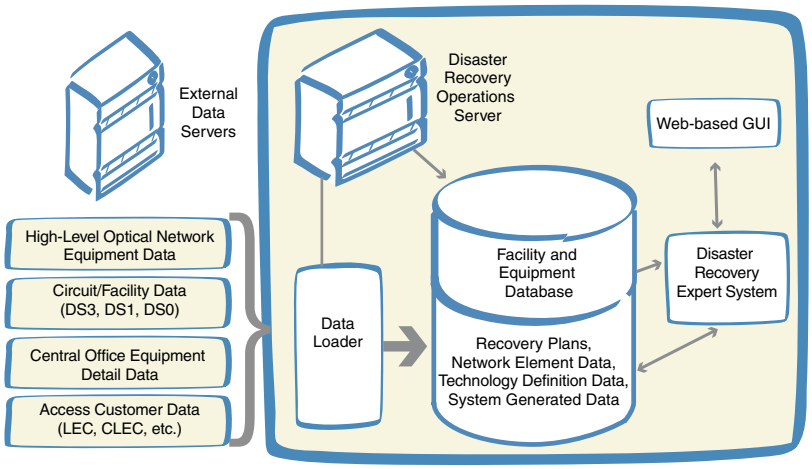
Time (Hours)	
0	AT&T Global Network Operations Center (GNOC) activates Network Disaster Recovery
+12-24	NDR Trailers deployed from warehouse(s)
+36-72	NDR Team and NDR Trailers at staging location from warehouse(s)
+108-168	Trailers positioned and leveled at recovery site. Trailers spliced into fiber optic cable that originally served the damaged network central office. Office facility configurations replicated using AT&T DECT LONESTAR or DIRECT
168	Service Recovered

AT&T Disaster Engineering Connection Technology (DECT)

The AT&T Disaster Engineering Connection Technology (DECT) team utilizes software developed by AT&T Labs specifically for the purpose of re-engineering network traffic utilizing AT&T's trailerized NDR assets. These software applications allow NDR to meet its Recovery Time Objectives (RTO) by supplying essential central office data and recovery information prior to the deployment and during the operational phase of a disaster event.

The heart of AT&T DECT is an expert system that accepts facility & Network Element (NE) information for the AT&T Network from our Databases of Record (DBORs), combined with replacement NE equipment stored in mobile trailers and a recovery site-plan (automatic or manual). This expert system recreates the failed central office by generating the specific inter & intra-trailer connectivity based on existing rules of recovery and the available recovery network elements in the AT&T NDR trailers.

The Disaster Intelligent Recovery Engineering Connection Technology (DIRECT) and Local Network Services Technology Automated Recovery (LONESTAR) systems support the automated re-engineering of circuits and facilities for AT&T Long Distance and Local Network services. These systems provide DECT with an on-line inventory of available transport, Digital Cross-connect Switch (DCS) and Voice Switching systems (Lucent 4ESS, 5ESS and Nortel DMS) and allow them to create recovery plans for connecting systems and restoring facilities for any AT&T Long Distance or Local office. Cable tags, Runsheets, DCS Script files, Office Facility/Equipment statistics and Recovery reports are some examples of the output generated by these systems that assist NDR in a central office recovery.



AT&T Disaster Engineering Connect Technology High Level Architecture

Methods of Recovery

AT&T utilizes four primary methods for the physical Network Disaster Recovery of its critical network elements. These strategies include: Mobile Recovery, Static Recovery, Hybrid Recovery, and Vendor Supported Recovery solutions. They are described in the table below.

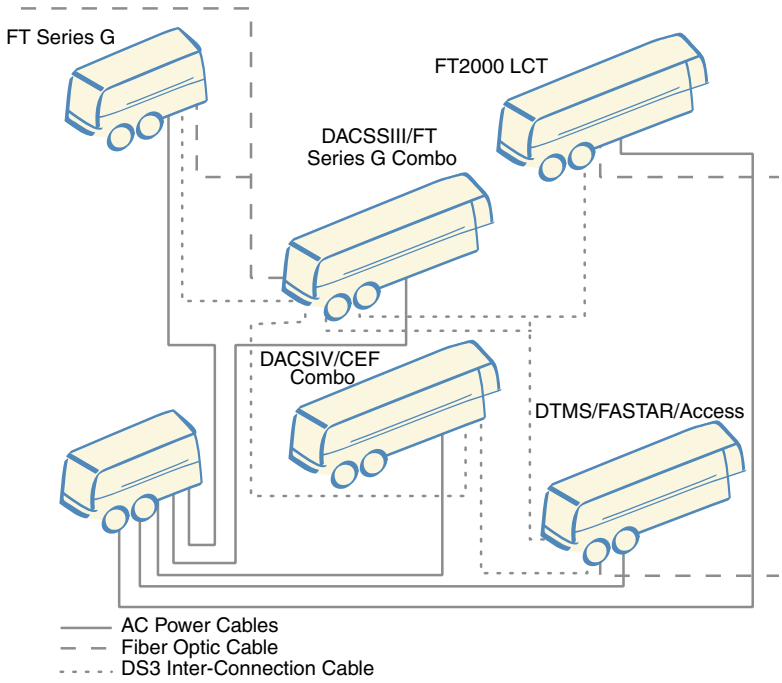
AT&T Recovery Strategy	Recovery Solution
Mobile Recovery Solution	Custom designed, engineered, and constructed trailers that support the network element recovery. This solution provides a replacement technology in a self-sufficient deployable unit.
Static Recovery Solution	Dedicated assets in the AT&T network specifically for Network Disaster Recovery. This solution is typically used for network elements that do not scale appropriately for a mobile solution.
Hybrid Recovery Solution	A Hybrid Recovery Solution includes the use of existing mobile assets (53-foot trailer equipped with power and HVAC) that have been constructed to support the timely installation of network elements. The required equipment is removed from existing AT&T equipment testing labs, maintenance spares, training facilities, or vendor stock and shipped to the disaster site. This is an alternative to having dedicated network elements installed in mobile recovery trailers. This strategy is usually used while we construct a dedicated solution or for smaller miscellaneous equipment that is easily shipped.
Vendor Supported Solution	Vendor Supported Solutions include agreements with our telecommunications equipment vendors to provide required recovery equipment from either existing stock or as "next off the line" material. This strategy is usually used while we construct a dedicated solution or for smaller miscellaneous equipment that is easily shipped.

AT&T Critical Network Element – Current Network Disaster Recovery Strategy

Critical Network Element	AT&T Recovery Strategy
Backbone Transport Network	Mobile Recovery
Lucent Technologies 4ESS™ Switch	Static Recovery
Lucent Technologies 5ESS® Switch	Mobile Recovery
ATM Switch	Mobile Recovery
Frame Relay Switch	Mobile Recovery
Local Network Services	Mobile Recovery
Nortel Networks DMS250/DMS500	Mobile Recovery

Backbone Transport Network, Mobile Recovery

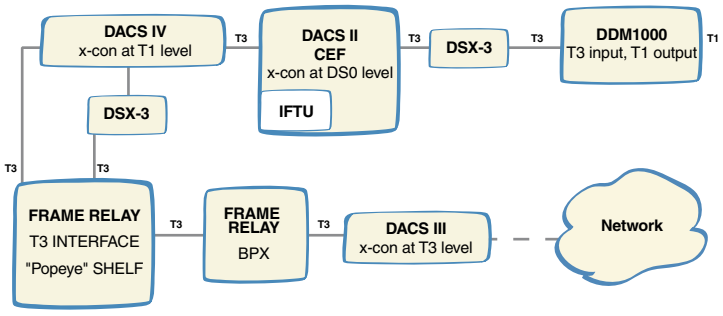
All of the telecommunications equipment required to recover a destroyed or heavily damaged AT&T Central Office is transported to a recovery site in specially designed technology trailers. Each trailer has self-contained power and environmental capabilities and houses a component of the network technology that would normally be part of a permanent installation. The basic foundation of this effort is the recovery of the backbone transport network that supports the AT&T Network Services.



Backbone Transport Network Disaster Recovery

Frame Relay Switch, Mobile Recovery

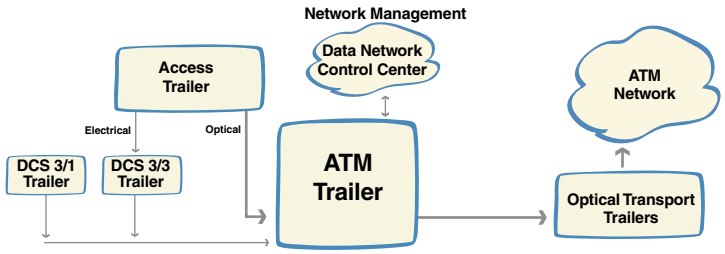
AT&T has developed a mobile recovery solution specific to its Frame Relay Switch Architecture. The self-sufficient trailers have two BPX 8620's and one MGX 8850 equipment required to support this solution. The trailer has 16,128 DSO recovery capability. The trailers were first field tested in the fourth quarter of 2000 at the NDR exercise in Phoenix, Arizona.



Frame Relay Recovery Architecture

ATM Switch, Mobile Recovery

NDR can recover ATM service using a trailer equipped with Lucent ATM switches. In their current configuration, the switches can handle circuits from T1 up to OC-12, with a net capacity equivalent to over 900 T3s. The trailer is pre-wired to nearly double this capacity with additional plug-ins and switches.



ATM Recovery Architecture

5ESS® Switch, Mobile Recovery

AT&T has a 5ESS® Disaster Recovery three-trailer set utilizing a Lucent Technologies 5ESS® 2000 switch core with seven Switch Module 2000 (SM2000) line/trunk growth units. This 5ESS® Network Disaster Recovery trailer set is capable of recovering approximately 68,500 lines/trunks.

AT&T has added a second 5ESS® recovery trailer utilizing a Lucent Technologies 5ESS® 2000 switch core and five Switch Module 2000 (SM2000) growth units capable of recovering approximately 63,000 line/trunks. Incorporating the new Communication Module Model 3 (CM3) technology, this 5ESS® trailer maximizes the recovery capabilities within a single container. It also utilizes the latest packet signaling technologies, eliminating the previous ring node architecture.

The 5ESS® trailers are strategically located to ensure minimum response time based on the location of our Metro and Intercity network switching offices.

Trailer Interior

5ESS® 3-Trailer Set

DMS Switch, Mobile Recovery

AT&T has a DMS500 Disaster Recovery trailer set utilizing a Nortel Networks DMS500 switch. This trailer set supports DMS500 and DMS250 switches for AT&T Long Distance and Local Services networks. The DMS trailerized set using Spectrum Peripheral Modules can recover up to 56,000 line/trunks and Extended Subscriber Modules up to 240 DS1s.

DMS Power

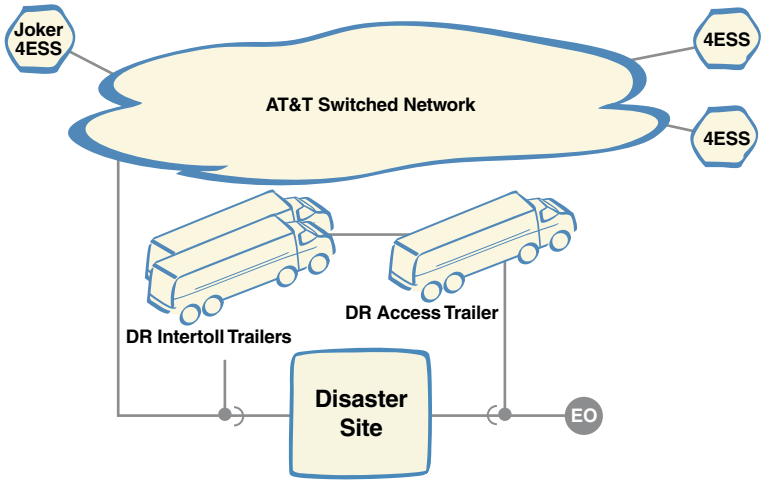
DMS Trailer Exterior

4ESS™ Switch, Static Recovery

AT&T has a Lucent Technologies 4ESS™ switch in a hardened underground location in our network that is dedicated to Network Disaster Recovery. It has the capability of being configured to assume the identity and replace any failed 4ESS™ in the AT&T Network. The combination of the trailerized transport elements, dedicated spare T3 (T3R & T3P) facilities and this spare 4ESS™ switch allows for the recovery of an AT&T 4ESS™ switch office should a catastrophic event occur.

The Disaster Recovery process for the 4ESS™ switch has five key components:

1. A centralized spare 4ESS™ switch maintained and connected to the network as a "live office" but with the capacity dedicated to Network Disaster Recovery
2. Office data, which is electronically backed up at regular intervals to a remote location near the spare switch
3. Processes/systems required to map data from failed elements to recovery elements
4. Trailerized Access/Egress equipment to replicate/recover elements in the failed location
5. A highly skilled and motivated Network Disaster Recovery Implementation Team with representation from key operational organizations



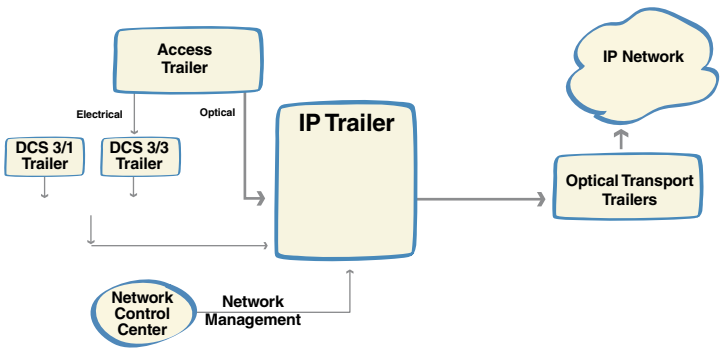
4ESS Disaster Recovery

IP Recovery

NDR's capability for IP recovery is a trailer packed with large-capacity routers by Cisco, Avici, and Juniper. These routers' net switching capacity is well into the terabit range (over 1000 Gigabits/second). When fully supplied with plug-ins, the trailer can ramp up to over 10,000 T3s of capacity and support recovery of circuits as large as OC-192.

- High capacity: With a single trailer, NDR can recover thousands of circuits at speeds up to 10Gbps
- Efficient design: Working with AT&T Labs, NDR has developed a design that can recover the largest AT&T common backbone sites using half the number of routers

IP Trailer

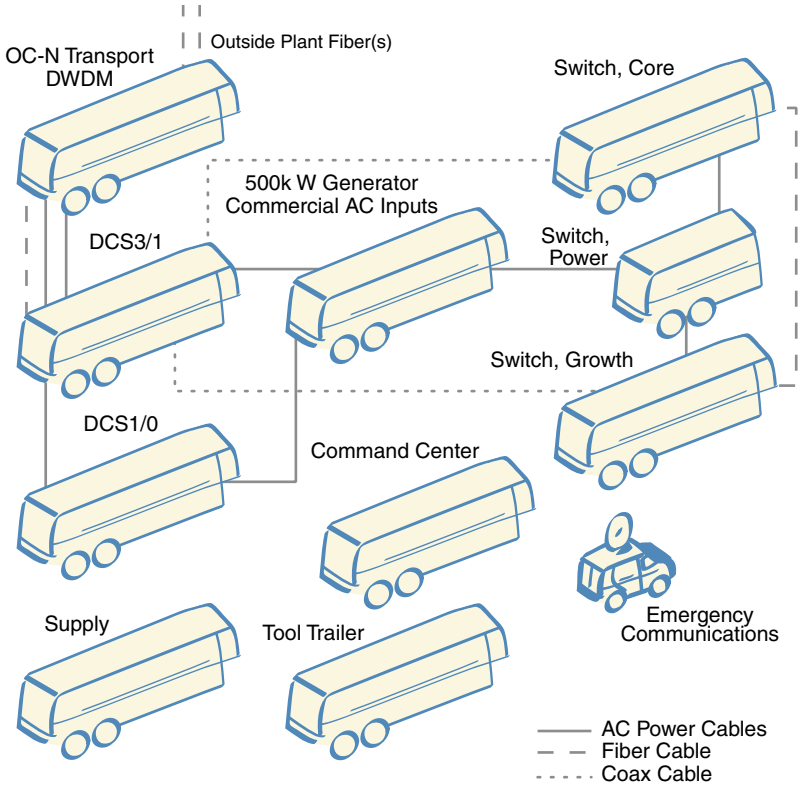


NDR IP Function Architecture

Metro Network Services, Mobile Recovery

AT&T has developed a Network Disaster Recovery capability for our Metro Network Services. Capabilities include switching and transport for DCS3/1, DCS 1/0, SONET Lightguide, and OC3/OC12/OC48/OC192 multiplexor network elements used by AT&T to provide local network services.

AT&T NDR has developed a trailerized solution to support optical metro deployment of MSP's (Multi-Services Platform) that connect to AT&T's DWDM backbone network.



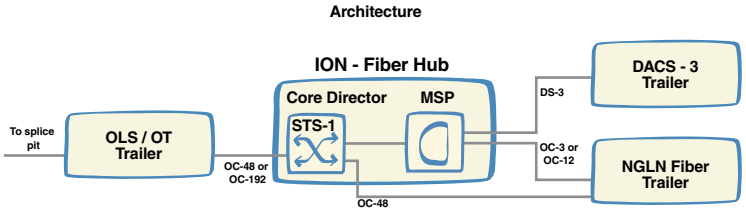
Metro Network Services Recovery Trailer Plan, Type I Node

Intelligent Optical Network

The vision of end-to-end interconnectivity with fast and simple provisioning of customer circuits and capital cost savings are the primary motivators for the Intelligent Optical Network and the processes that support it. The intelligent optical network and its technology and operational benefits include a suite of Multi-Service Platform (MSP) sub-networks interconnected by the Intelligent Optical Switch (IOS) mesh transport network. Key technology benefits that are extended are fast provisioning via "point and click" and improved restoration performance via IOS mesh restoration while meeting business objectives.

NDR has constructed a trailerized solution in the event of a catastrophic CNI office failure. NDR will be able to recover offices with the CoreDirector (IOS) and offices with MSPs for both long distance and local service applications.

CNI Hub

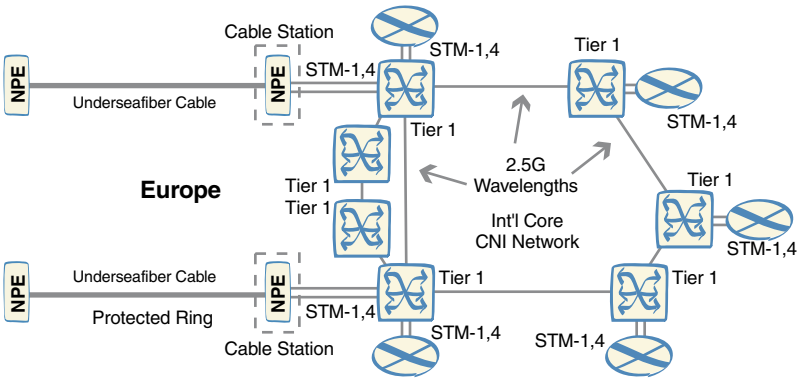


Architecture

Network Disaster Recovery, AT&T Global Network (AGN)

AT&T Network Disaster Recovery has developed two sets of disaster recovery containers to support AT&T Global Network (AGN) Tier 1, 2 and 3 POPs for our globally deployed services. These containers utilize Cisco routers, ATM switches, Catalyst switches, GIG-E switches, MSP interfaces and a CI IOS switch. AT&T has an AGN presence in over 130 cities worldwide with 146 nodes in 130 cities, and with the "Fly In" recovery containers AT&T can support the recovery of 'In-Country' AGN architecture.

In a disaster AT&T would bring these containers to an airport for transportation to the affected country. The Global NDR team will support the logistics for deployment, connection and shipping, where a planned transition to an In-Country team to maintain the container set in production. They utilize specially designed military style aluminium containers, sized to fit inside a standard 747 or any wide bodied freight carrier, supported by both shore provided power and/or generator, designed to handle a wide range of voltage inputs.



NDR AGN Network – EMEA

The containers for EMEA are staged in the UK on a specially built staging station, with the second set staged in one of the NDR warehouses in the U.S. The set staged outside the U.S are permanently connected to the AGN Core network to receive IOS upgrades and be under the EMEA IDNMC for 24x7x365 management and monitoring. The two sets are a mirror of each other in terms of technology and capability. They represent a unique recovery strategy in the MoW space and a significant investment in support of our global architecture and strategic network.

AT&T Network Disaster Recovery Photo Gallery

AT&T Network Disaster Recovery
World Trade Center Recovery Support

AT&T Network Disaster Recovery Team

The telecommunications equipment required to recover a destroyed or heavily damaged AT&T Central Office is transported to a recovery site in specially designed technology trailers. Each trailer has self-contained power and environmental capabilities and houses a component of the network technology that would normally be part of a permanent installation. The individual components are interconnected to match the unique configuration of the destroyed Central Office. NDR team members are

on-call 24 hours a day, seven days a week, and can be en route with the equipment to an incident within two hours of disaster activation. Specially designed tractor-trailer trucks, equipped with highly sophisticated equipment, are warehoused in several strategic locations across the country. This equipment generally travels by road, but in an extreme emergency, the trailers are designed to be shipped by rail or air. The AT&T Disaster Recovery team can restore the service once provided by a heavily damaged or destroyed office within a matter of days, rather than months. The team is also equipped to restore service by erecting a temporary microwave tower, installing a temporary satellite earth station, or establishing temporary calling centers that allow customers direct access to the AT&T network.

Emergency Communication Vehicle

View of NDR Trailers supporting the World Trade Center recovery efforts

AT&T Network Disaster Recovery World Trade Center Recovery Support

Between September 14 and October 4, 2001 NDR had an Emergency Communication Vehicle (ECV) deployed for humanitarian relief at the NYPD Headquarters in Manhattan and at the WTC disaster site. The ECV is a self-sufficient satellite-based deployable communications vehicle that provides voice and data connectivity over 96 voice/data channels. Over 20,000 calls were placed over the ECV link at the NYPD deployment and over 36,000 calls were placed during the Spirit of New York deployment.

AT&T Network Disaster Recovery Team

AT&T Network Disaster Recovery – Exercise Deployments

For more information, contact your AT&T Representative or visit us at www.att.com/ndr.

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