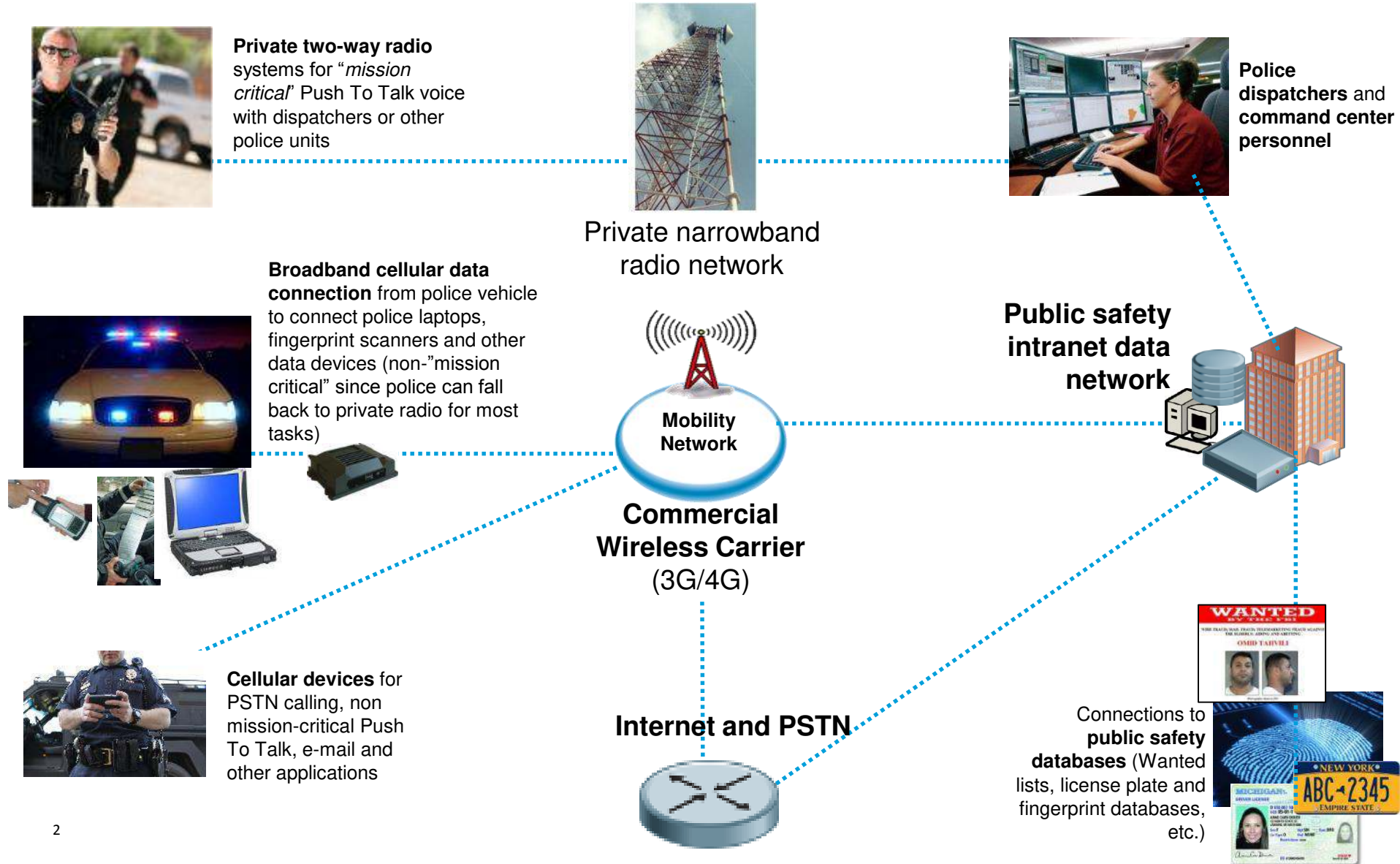


# Commercial Wireless Networks and Priority Access for Public Safety

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# Public Safety Wireless Communications Today



## What Are QoS and Priority, and Why Do You Need Them?

- Definitions
  - Priority: managing which users get access to the network there is congestion
  - Quality of Service (QoS): establishing minimum/maximum service quality parameters (throughput, latency, jitter, “guaranteed” levels, etc.)
- Why does public safety have an interest in QoS and priority?
  - All networks have bottlenecks and are potentially subject congestion
  - All commercial networks are designed to handle maximum “every day” usage, not “worst case scenario” usage
  - Increased usage of social media and reliance on mobile communications means that in a disaster/emergency situation, consumer usage will be high



## The History of Telecommunications QoS and Priority

- Federally planned, managed and funded initiative
  - Established in 1963
  - Overseen today by DHS Office of Emergency Communications (OEC)
- Voice priority services:
  - Secure Routing Arrangement Service (SRAS) – Special customer service (1986)
  - Telecommunications Service Priority (TSP) – Priority provision / restoration of telecom services (i.e., transport, service) (1990)
  - Government Emergency Telecommunications Services (GETS) – Priority voice-band wireline service offering HPC (1994)
  - Wireless Priority Service (WPS) – Priority voice-band wireless service offering HPC (2004)
- No current data priority services
- Under-utilized resource today for public safety





## WPS Approved Users and Priority Levels (1-2)

- Priority 1. Executive Leadership and Policy Makers
  - The President of the United States, the Secretary of Defense, the Secretary of Homeland Security, selected military leaders
  - State governors, lieutenant governors, cabinet-level officials responsible for public safety and health
  - Mayors, county commissioners
- Priority 2. Disaster Response/Military Command and Control
  - Federal emergency operations center coordinators, e.g., Manager, National Coordinating Center for Telecommunications, National Interagency Fire Center, Federal Coordinating Officer, Federal Emergency Communications Coordinator, Director of Military Support
  - State emergency services director, National Guard Leadership, State and Federal Damage Assessment Team Leaders
  - Federal, state and local personnel with continuity of government responsibilities
  - Incident Command Center Managers, local emergency managers, other state and local elected public safety officials
  - Federal personnel with intelligence and diplomatic responsibilities



## WPS Approved Users and Priority Levels (3-5)

- Priority 3. Public Health, Safety and Law Enforcement Command
  - Federal law enforcement command
  - State police leadership
  - Local fire and law enforcement command
  - Emergency medical service leaders
  - Search and rescue team leaders
  - Emergency communications coordinators
- Priority 4. Public Services/Utilities and Public Welfare
  - Army Corps of Engineers leadership
  - Power, water and sewage and telecommunications utilities
  - Transportation leadership
- Priority 5. Disaster Recovery
  - Medical recovery operations leadership
  - Detailed damage assessment leadership
  - Disaster shelter coordination and management
  - Critical Disaster Field Office support personnel



## What Is Wireless Priority Service?

- Access to WPS and GETS are managed through the DHS OEC
  - <https://www.dhs.gov/requesting-gets-and-wps>
  - Request service through your agency POC
- Supported by all major US carriers
- Features
  - Elevates the user's Access Class above the ranges used by normal users
  - Puts the user in queue for the next available voice channel on that cell tower
  - Low or zero monthly cost, per-minute use fees
- Limitations
  - Voice-only – no equivalent service for data today
  - VoLTE support plans under development
  - Some features may differ between CDMA and GSM carriers
  - FCC limitations on the number of WPS users who can be supported on a single tower simultaneously





## GETS/WPS User Experience

- Priority queueing – *not* ruthless pre-emption
- Using mobile?
  - Dial \*272 and destination number or GETS access number (recommended): (710) 627-4387
- Using PSTN, BVoIP?
  - Dial GETS access numbers – (710) 627-4387 (primary #) and various toll-free numbers supported by AT&T, VZ, and Sprint
- Listen for “bong” tone
- Enter 12 digit GETS calling card PIN
- Enter the destination number
- Wait for distant end ring or message
  - Up to 6 minutes (worst case) depending on transport availability affected by congestion and equipment impairment

The diagram illustrates the GETS/WPS user interface with callouts for various fields and instructions:

- GETS Access Number**: Points to the top right section of the interface.
- Toll Free number for each GETS carrier (backup)**: Points to the list of carrier numbers (AT&T, MCI, Sprint).
- Toll Free User Assistance number (24x7)**: Points to the bottom left section of the interface.
- 12 Digit Personal Identification Number (PIN)**: Points to the PIN input field.
- User Name and Organization**: Points to the Name and Organization input fields.

The interface itself contains the following text:

**GETS:** Dial 1-710-NCS-GETS (627-4387)  
At the tone, enter your PIN.  
When prompted, dial your destination number (area code + number).  
If you cannot complete a call, use a different long distance carrier:  
AT&T: 1-888-288-4387 -or- 1010 + 288  
MCI: 1-800-900-4387 -or- 1010 + 222  
Sprint: 1-800-257-8373 -or- 1010 + 333  
+1-710-627-4387

**WPS:** From a Wireless Priority Service enabled device:  
Dial \*272 before any call, including a GETS call.

**Assistance:** For help or to report trouble, dial 1-800-818-GETS (4387) or 1-703-818-GETS (4387).  
**Test Calls:** Make periodic GETS calls to 1-703-818-3924.

US GOVERNMENT PROPERTY. If found, return to:  
NCS (N2), 701 South Court House Road, Arlington, VA 22204-2198  
WARNING: For Official Use Only by Authorized Personnel.

**Government Emergency Telecommunications Service**

**1234 5678 9012**

**Name:**  
**Organization:**



## The Evolution of Wireless QoS Capabilities

- Earlier generations of wireless technology were “voice-first” – circuit switched bearers
  - Data was added to GSM as Circuit Switched Data with 9.6 kbps capabilities in “1G”
  - Progressed to 200-400 kbps in “2G” then 1.5-3 Mbps in “3G”
  - Supported voice prioritization but data standards were not designed with differentiated services in mind
- LTE changes all this – it’s a data network “under the hood” with voice as an application over the packet switched network
  - QoS and priority/pre-emption capabilities were designed into LTE from the start
  - Supports Access Classes
  - Introduces new capabilities such as Allocation Retention Priority (ARP) and QoS Class Identifiers (QCI)
  - Guaranteed Bit Rate (GBR) and non-GBR bearers



## Primary Standards-Based LTE QoS Capabilities In Detail

- QCI (QoS Class Identifier): A scalar that defines bearer level packet forwarding treatment.
- ARP (Allocation and Retention Priority): Defines a priority level used by admission control to decide whether a bearer establishment / modification request can be accepted or rejected due to resource limitations.
- Two major types of bearers: Guaranteed Bit Rate (GBR) and Non-Guaranteed Bit Rate (Non-GBR)
  - A GBR bearer:
    - Has a minimum amount of bandwidth that is reserved by the network
    - Always consumes resources in a radio base station regardless of whether it is used or not
    - Should not experience packet loss on the radio link or the IP network due to congestion
    - Defined with the lower latency and jitter tolerances that are typically required by real-time services
  - A Non-GBR bearer:
    - Does not have specific network bandwidth allocation and is for best-effort services (e.g. file downloads, email, and Internet browsing)
    - Will experience packet loss when a network is congested
    - Does not have a maximum bit rate specified on a per-bearer basis. However, an aggregate maximum bit rate (AMBR) will be specified on a per-subscriber basis for all non-GBR bearers.
- ACB (Access Class Barring): Allows for prevention of selected classes of users from sending initial access messages for load control reasons.

## (Over) Simplifying the LTE Quality of Service Model

**Access Class**

**QCI**

**ARP Value**

UNITED TSA Pre✓ Premier Access

NEJSRD 4A 128  
UA1214 EDEN9A4D

CARL/JEFFREY  
UA-\*\*\*\*\*533, Premier Gold, Star Alliance Gold

Denver to Seattle/Tacoma

UA1214 GATE BOARDING BEGINS SEAT  
**DEN-SEA** NOT YET **9:33 PM** **4A**  
THU 10 JUL 2014 ASSIGNED Boarding Ends: 9:53 PM Window  
Flight Departs: 10:08 PM First  
Flight Arrives: 11:59 PM

BOARDING GROUP **1**

Confirmation: MZJSRD  
eTicket 01674605846966

A STAR ALLIANCE MEMBER

## Potential Applications For QoS and Priority

- Fine-grained control:
  - By user
  - By application
  - By port/protocol
  - By destination
- Public safety applications:
  - Tiered priority for selected users
  - Emergency call/imminent peril priority
  - “Guaranteed” bit rate for video, CAD or other applications
- Commercial applications:
  - Videoconferencing
  - Streaming video/audio download
  - Application acceleration



- Best-Effort does not perform reordering of packets.
- DiffServ differentiates between flows and assigns policies to those flows.
- IntServ makes a strict bandwidth reservation for an application.



## Commercial LTE Quality of Service Offerings In-Market Today

- AT&T Dynamic Traffic Management

[https://www.wireless.att.com/businesscenter/en\\_US/pdf/att-dynamic-traffic-management-product-brief-010816.pdf](https://www.wireless.att.com/businesscenter/en_US/pdf/att-dynamic-traffic-management-product-brief-010816.pdf)

- Verizon Private Network Traffic Management

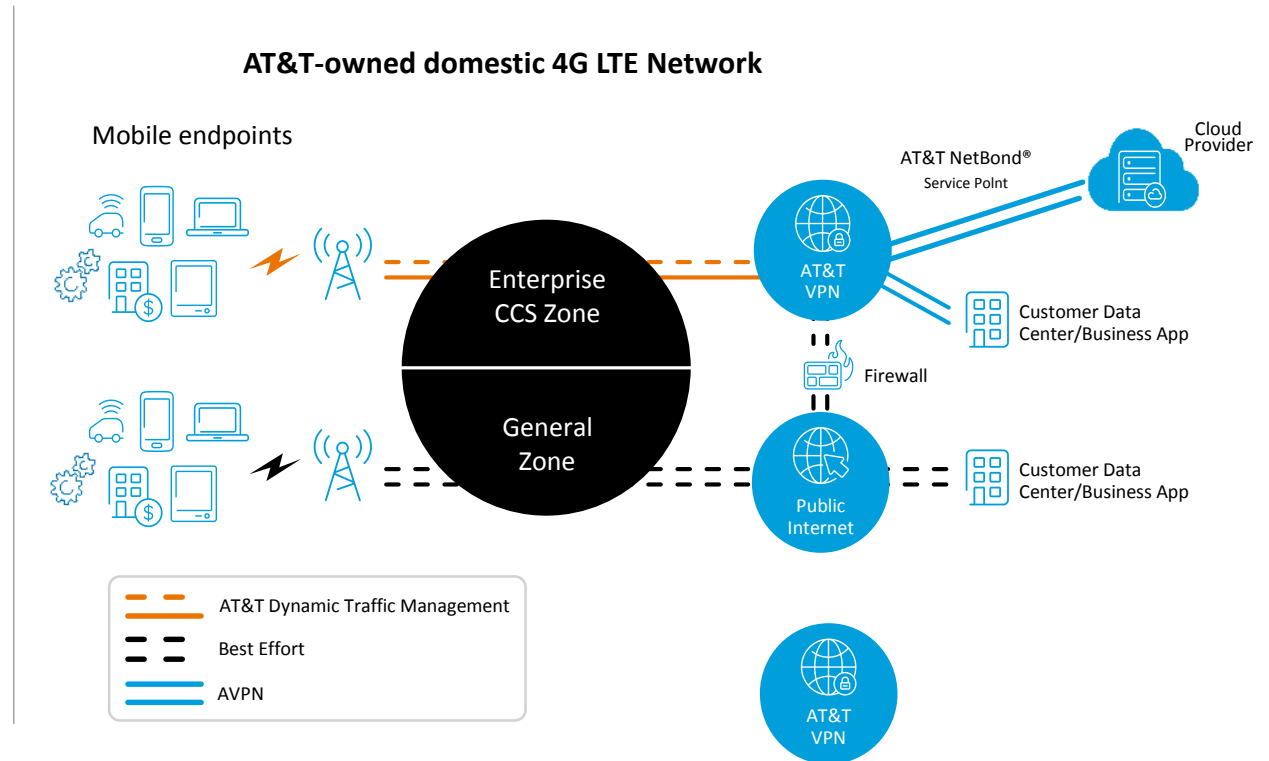
<http://www.verizonenterprise.com/products/networking/private-network/>

## AT&T Dynamic Traffic Management – Public Safety

### AT&T Dynamic Traffic Management – Public Safety | End-to-End Experience

#### AT&T Dynamic Traffic Management with Commercial Connectivity Services enables:

- Passing class of service markings between wireless and wireline networks including AT&T Virtual Private Network for an end-to-end solution.
- Prioritizing critical data from your mobile endpoints all the way to your cloud-based applications with AT&T NetBond.
- Enabling primary and backup wireless 4G LTE routers to use Differentiated Services (DSCP).
- No limit on throughput rate for prioritized data.



## The Hidden Problems With QoS and Priority

- 1.) User experience:** QoS functions more like an insurance policy than a “speed boost”
- 2.) Dilution:** the more users and applications are “special,” the less special they become

