

Public Safety Communications Research Program

March 2016 –

End-to-End QoS & Priority Service for Public Safety

Vihang Jani , vihang.jani@nist.gov

- **Today's Talk**
- QPP Overview
- Video Quality
- Looking Ahead SDN



Public Safety Priority, Preemption and QoS

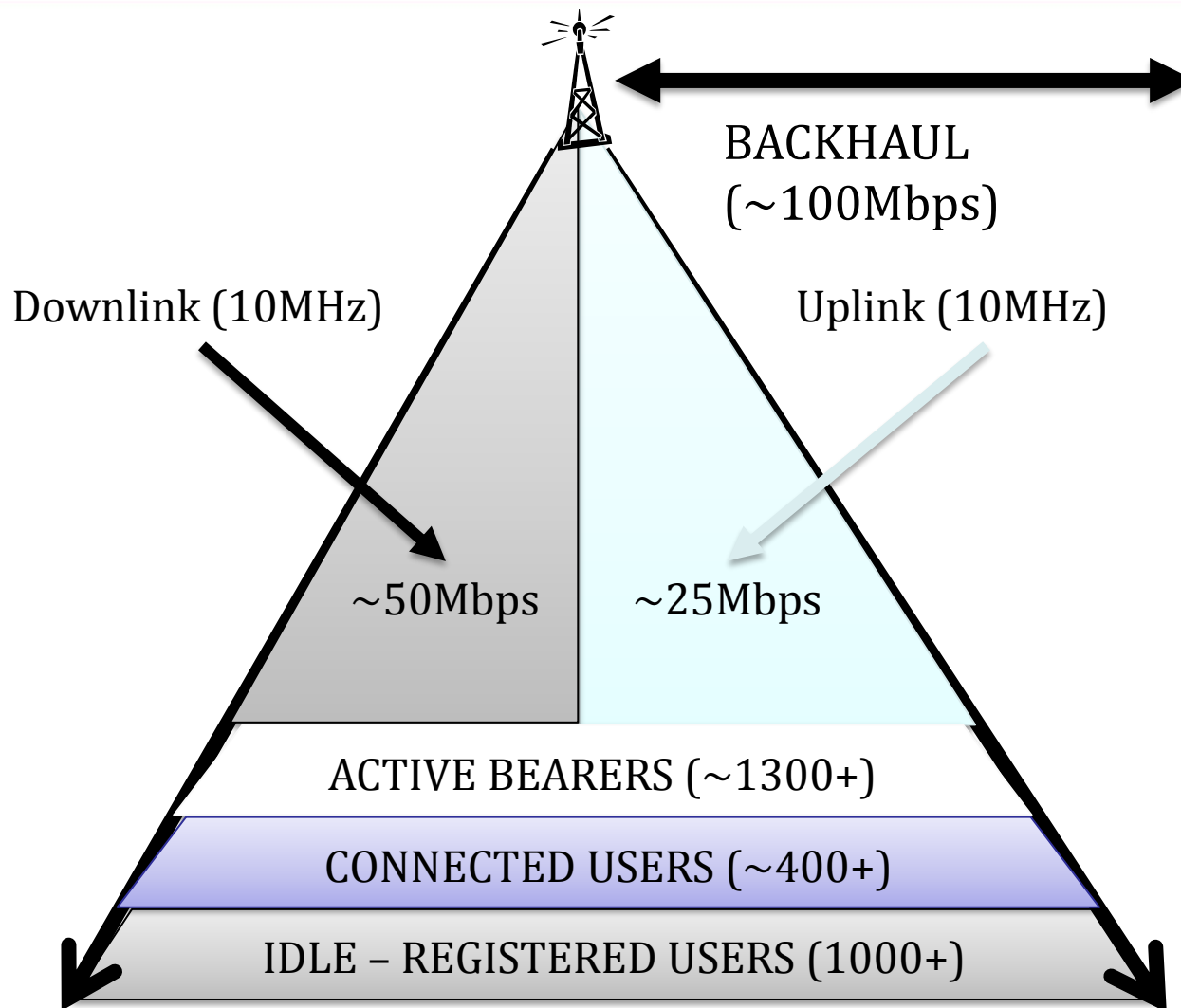
Key Thought....



The needs of public safety and first responders are diverse.

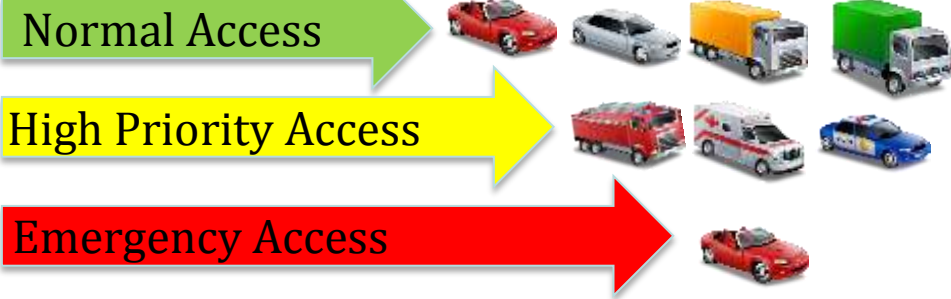
What works for one discipline may not work for another.

LTE 101 "The Cell"

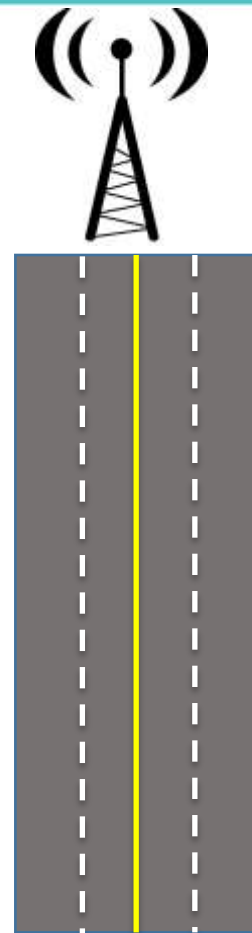


If you can't get access to the network, the network doesn't do you any good.

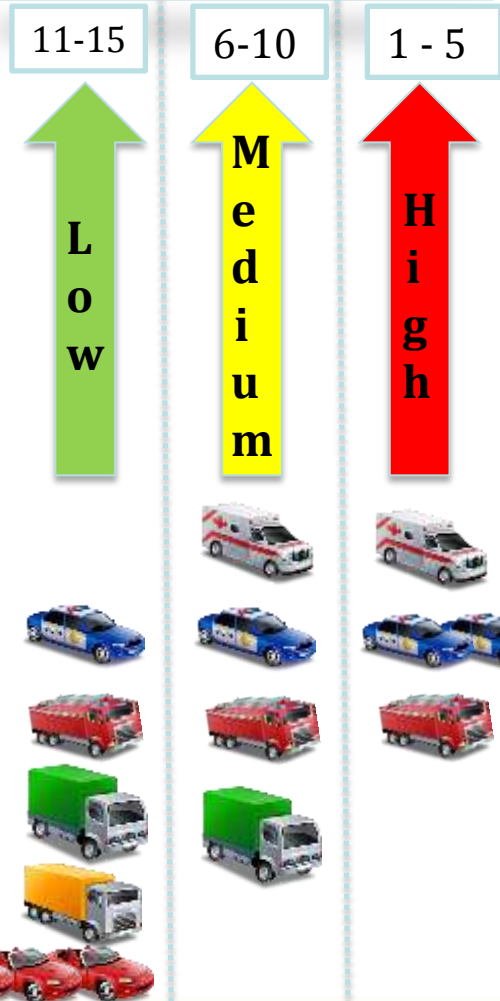
Establishment Priority (RF)



Note: A device supports up to 8 active connections at one time.

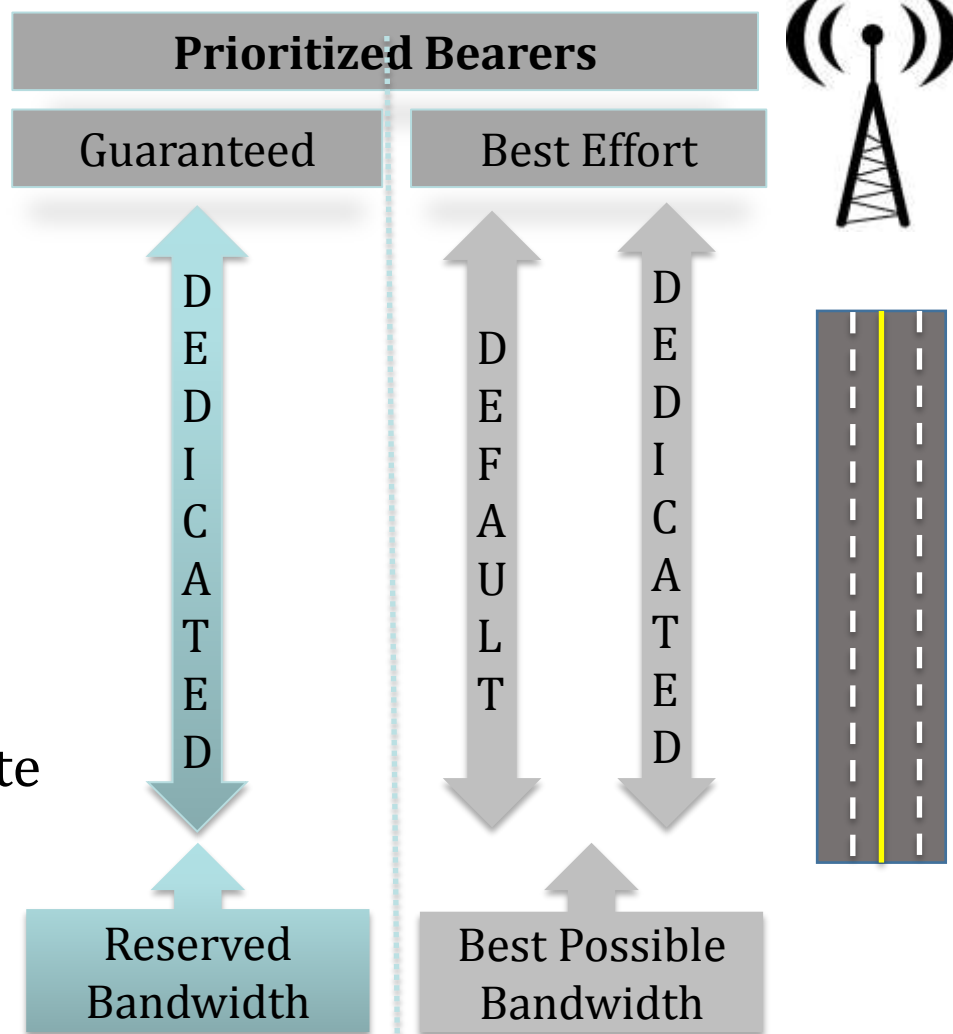


Allocation Priority (Data/Voice/Video)



Once you are in, you need a set of rules that ensures your applications work.

- Application Performance Parameters
 - Packet Priority
 - Packet Loss, Packet Delay
 - Maximum/Guaranteed Bitrate
 - Aggregate Maximum Bitrate
 - Preemption Vulnerability
 - Preemption Capability



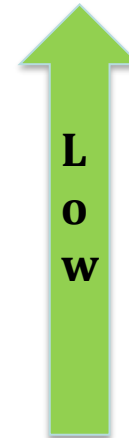
When the network becomes congested, resources may need to be preempted.

+ Retention is triggered during extreme overload events

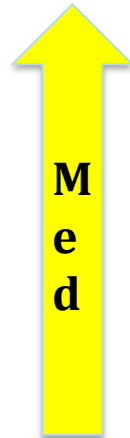
- Preemption is triggered when resources are exhausted

Prioritized Bearers

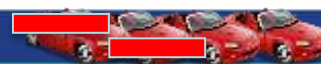
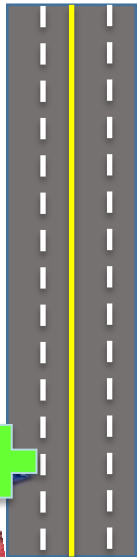
11-15



6-10



1 - 5



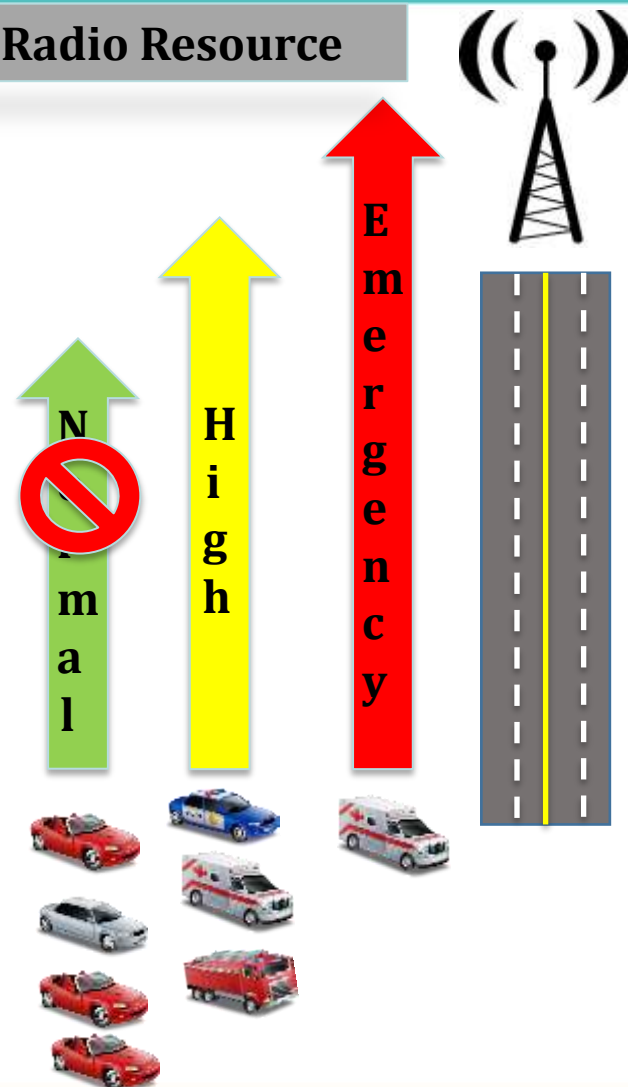
If there is a security concern or extreme event, you may need to restrict access to users.

Automatic Access Class Barring (ACB) can either discourage users, or completely prohibit them from accessing the system for a period of time.

Key attributes

- Barring Probability Factor (0-100%)
- Barring Time (seconds)

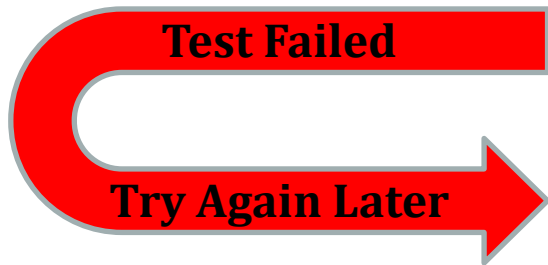
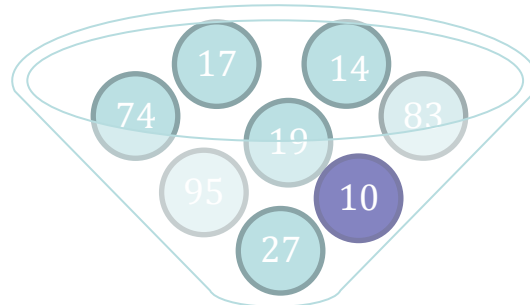
Radio Resource



Priority Preemption of Users

When access is restricted, the device is required to run a “test” to determine whether it can attempt to access.

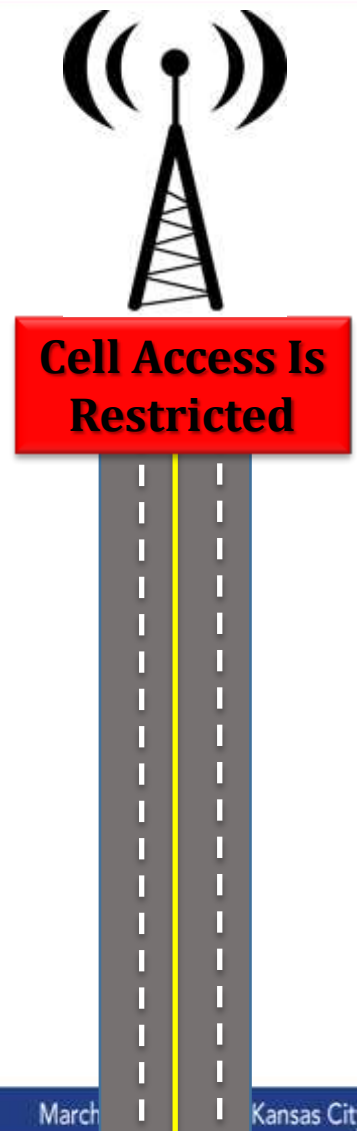
Factor = 25%



<



> > >



High Priority
QCI 6



Normal Priority
QCI 9



# of Users	Throughput per user	Video Quality QCI 6	Video Quality QCI 9
100	0.5 Mb (low rate streaming)	Good	Good



Local Control – 200 Users(100Mbps demand)

High Priority
QCI 0



Normal Priority
QCI 9



# of Users	Throughput per user	Video Quality QCI 9 -> QCI6	Video Quality QCI 9
200	0.5 Mb (low rate streaming)	Not Viewable ->Good	Not Viewable



Application Pre-emption – 100 Users (50Mbps demand)

High Priority
High Priority
Dedicated Bearer
Pre-emption Capable
ARP = 3
Pre-emption Capable



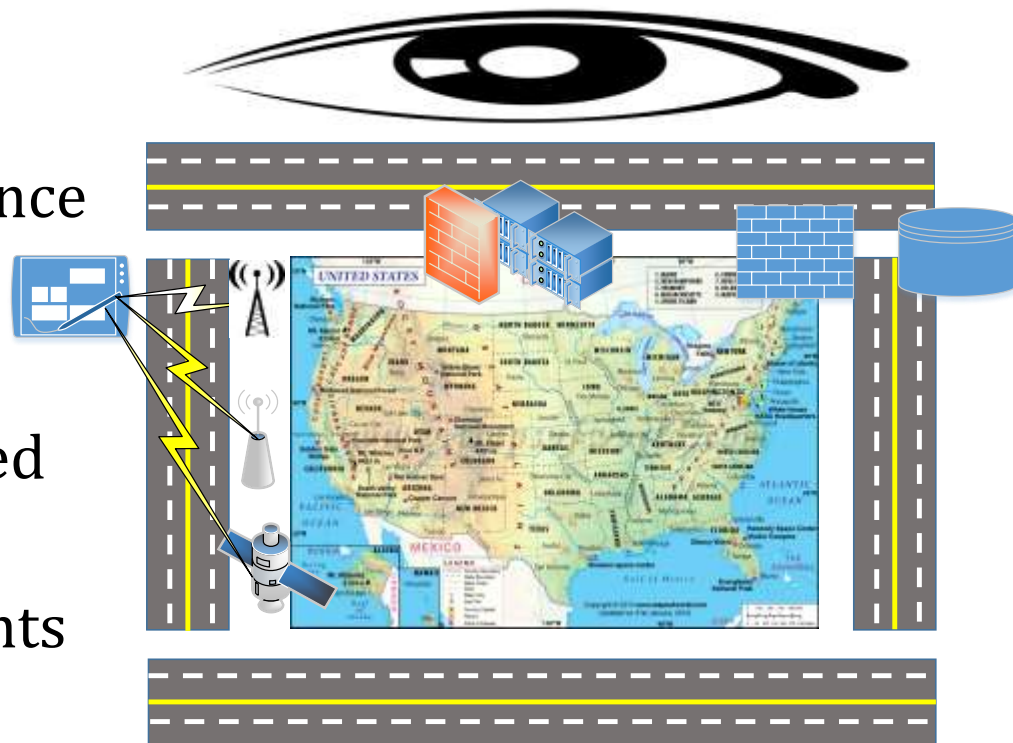
Normal Priority
Pre-empted
Dedicated Bearer
Using
Default Bearer
ARP = 7
Vulnerable to Pre-emption



# of Users	Throughput per user	Video Quality
50	0.5 Mb	Dedicated Bearers QCI = 2, ARP = 6
50	0.5 Mb	Default



- End User Quality of Experience
- Network Dynamics and Orchestration
- Application Aware Optimized Network
- E2E Service Level Agreements



Takeaway:

Public Safety's needs are diverse.

End-User Quality of Experience is a key to First Responder.

Thank You!