Quality of Service Priority and Preemption

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What are Quality of Service, Priority and Preemption (QPP)?

- **Quality of Service** – Quality of Service is the overall performance of a telephony or data network, particularly as seen by the users of the network. To measure quality of service quantitatively, several related aspects of the network service are often considered, such as error rates, bandwidth, throughput, transmission delay, availability and jitter.
- **Priority** – Priority is a network capability that enables a user's application or usage of the network to take precedence over another user's application or usage of the network.
- **Preemption** – A network capability that permits authorized high priority traffic, e.g., coming from public safety or first responders, to take over resources assigned to lower priority traffic, e.g., private traffic.

Yeah I know That, But What Does This Mean?

- Quality of Service, Priority and Preemption are very broad terms for a very large set of 3GPP features and functionality that FirstNet and its partner will utilize to ensure that the first responders have priority access to Band 14 when they need it and if the situation requires it, prioritization among first responders.

Dedicated Bearer

Best Effort

Default Bearer

Guaranteed Bit Rate

ARP

QCI

UE MBR

We Speak Different Languages

Does It Work When I Need It?

I Must Have Priority

Man-Down Must Work

Operations

Public Safety

Guaranteed Bit Rate

Best Effort

UE MBR

Jitter

Throughput

Dedicated Bearer

Default Bearer

QCI

Delay

ARP

Cellular Engineers

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Default Bearer

QCI

ARP

Delay

Preemption = lower UE MBR
Priority = ARP and …
Quality of Service = QCI and GBR

Public Safety

We Need A Rosetta Stone

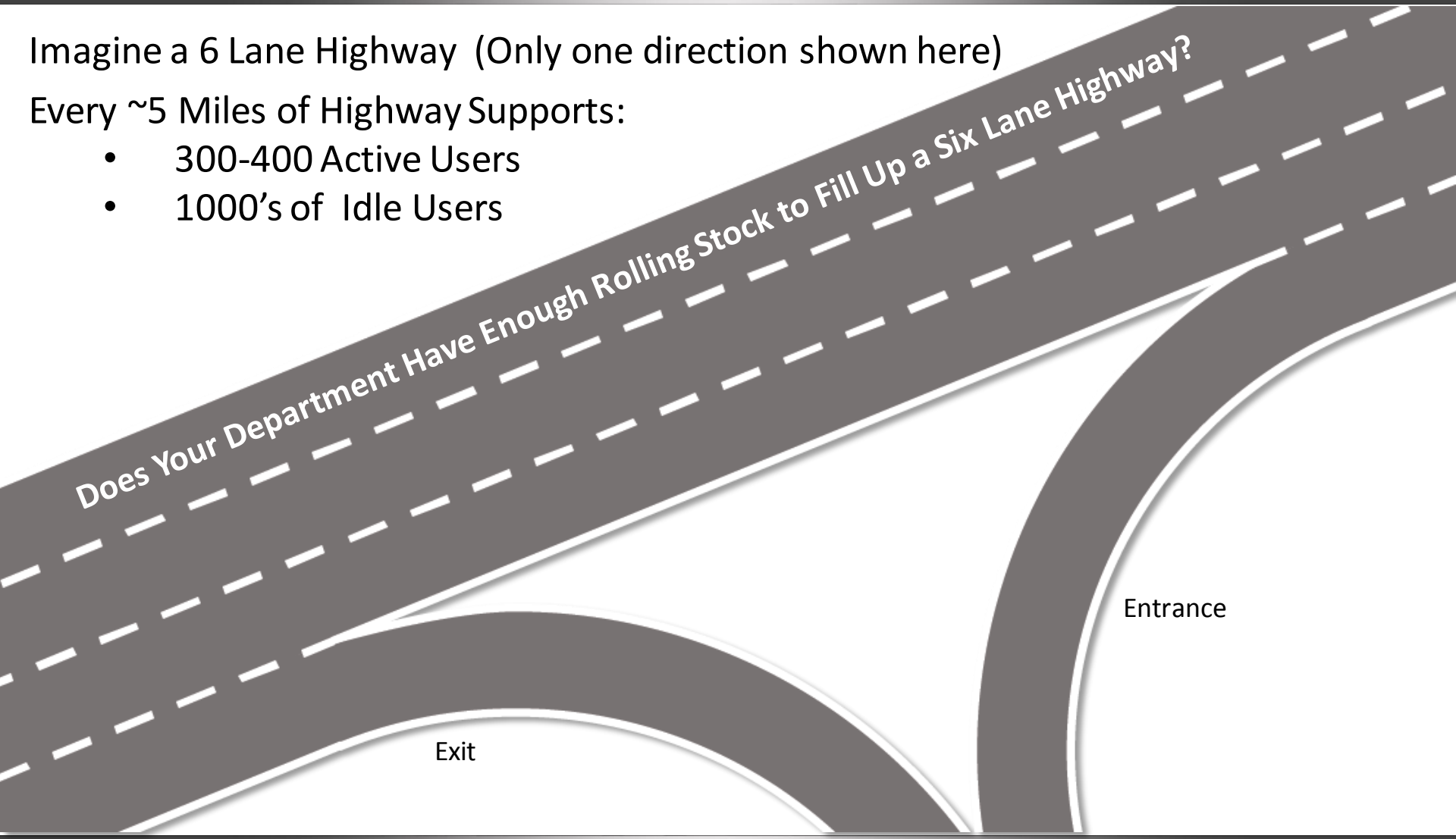
Cellular Engineers

The FirstNet Network

Imagine a 6 Lane Highway (Only one direction shown here)

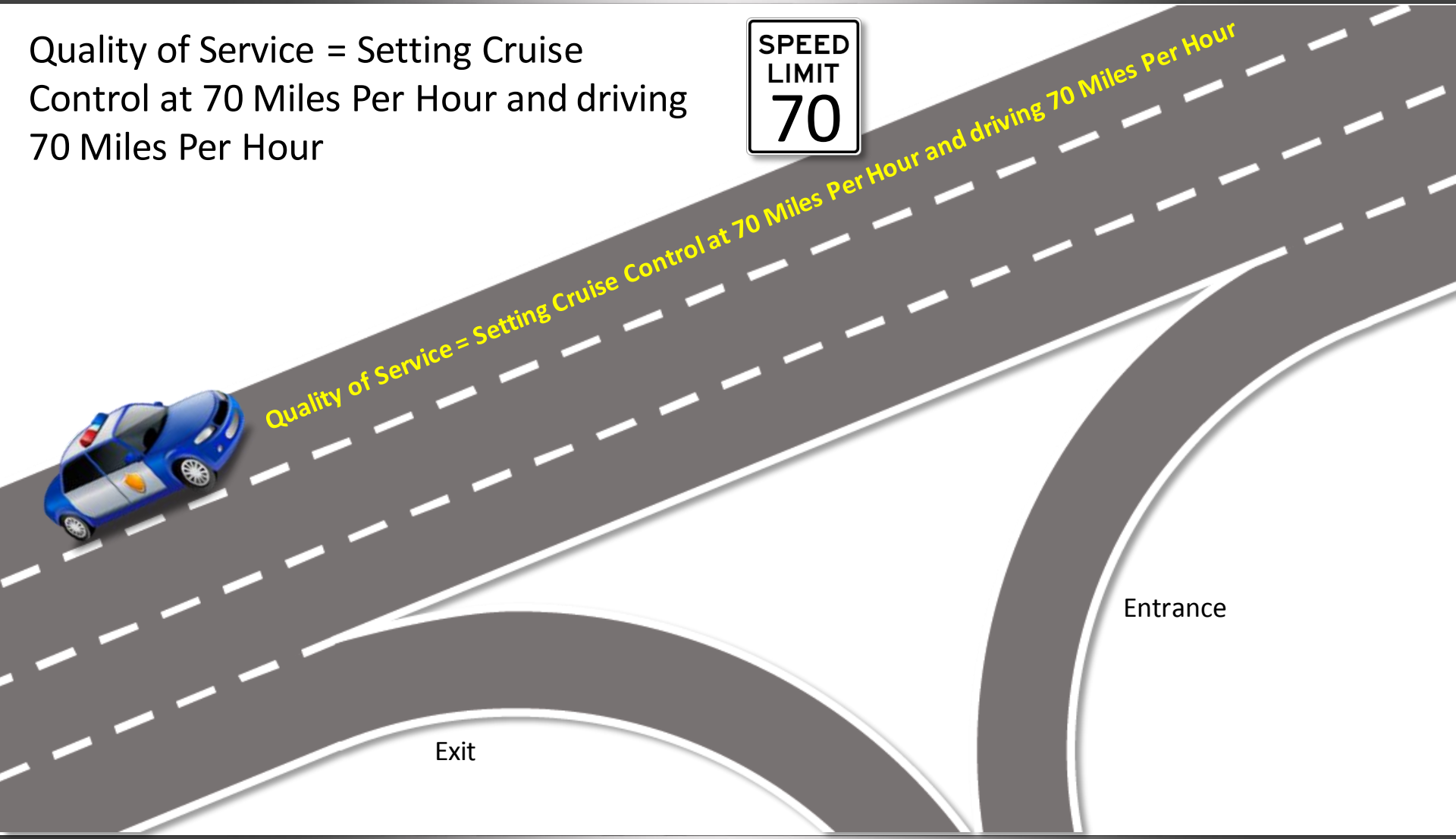
Every ~5 Miles of Highway Supports:

- 300-400 Active Users
- 1000's of Idle Users



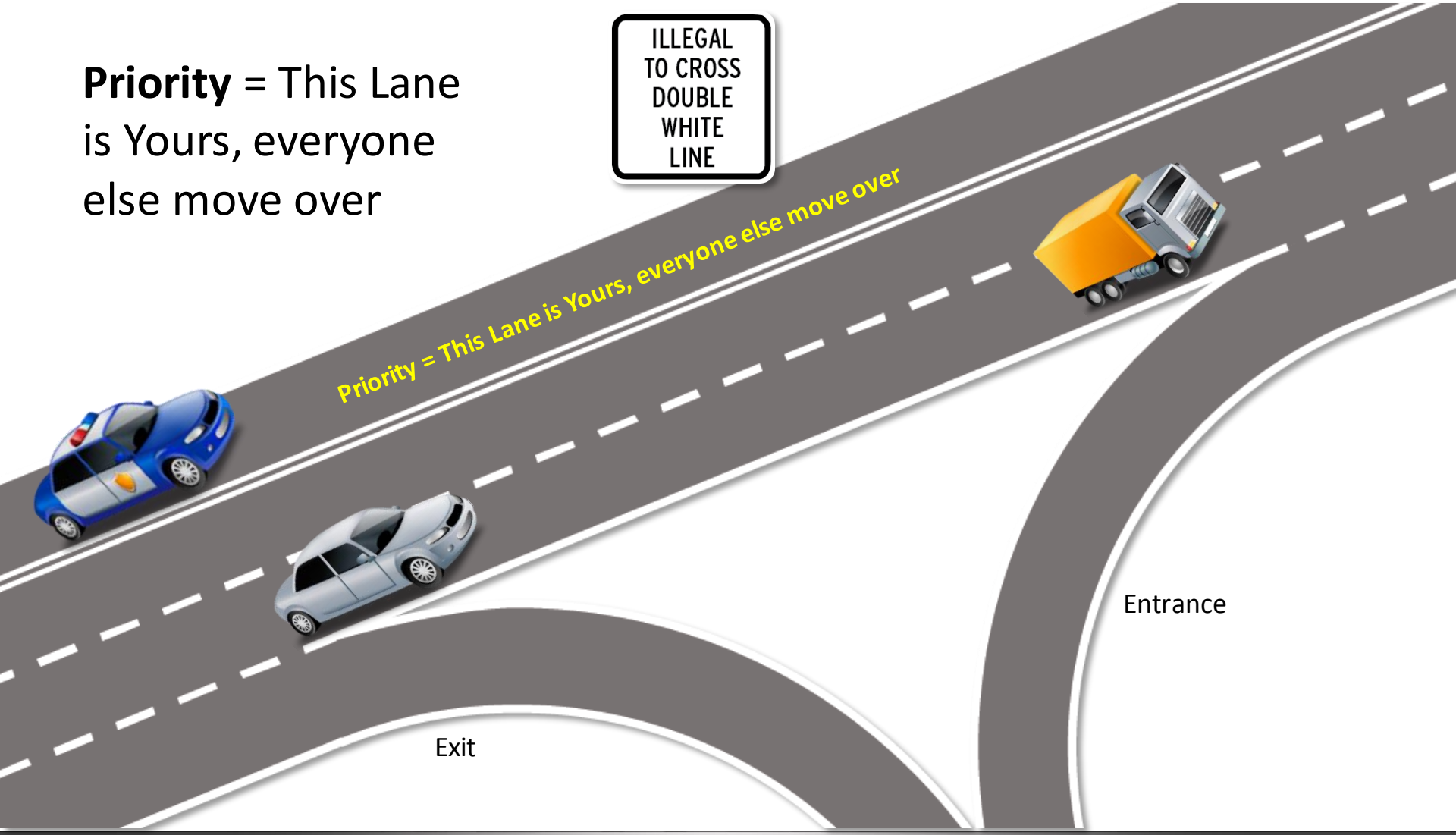
Quality of Service

Quality of Service = Setting Cruise Control at 70 Miles Per Hour and driving 70 Miles Per Hour



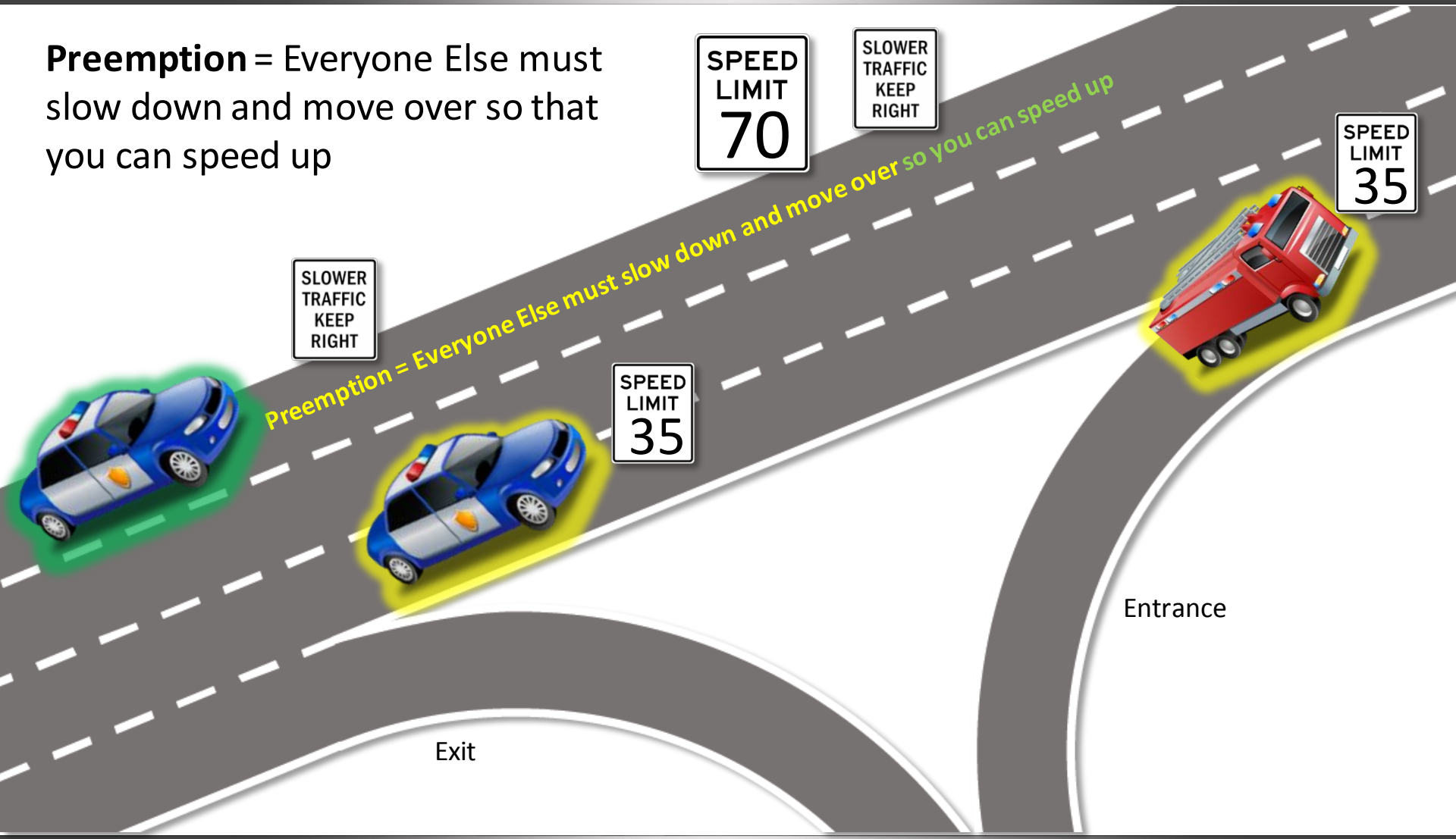
Priority

Priority = This Lane is Yours, everyone else move over



Preemption:
Among First Responders

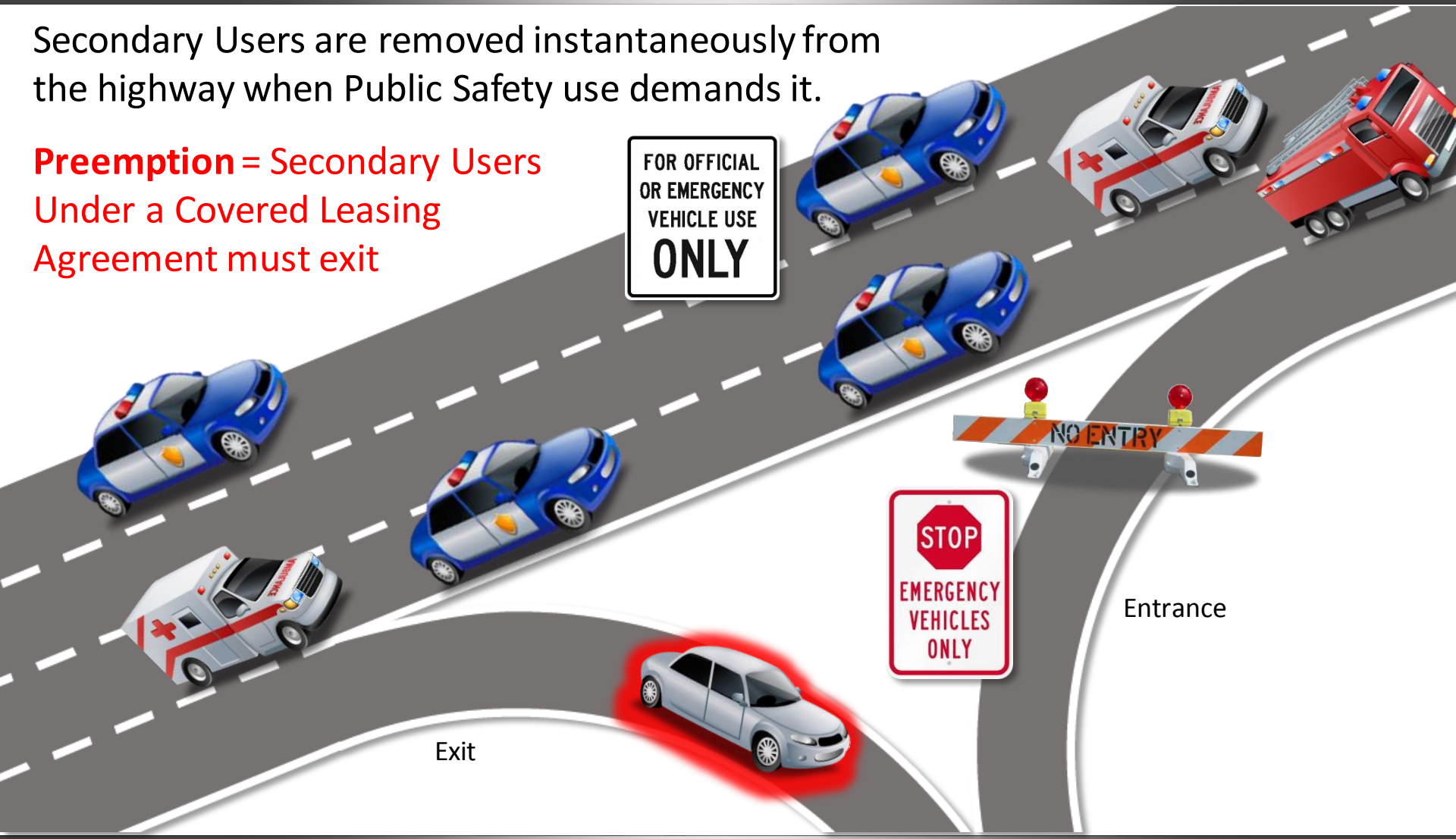
Preemption = Everyone Else must slow down and move over so that you can speed up



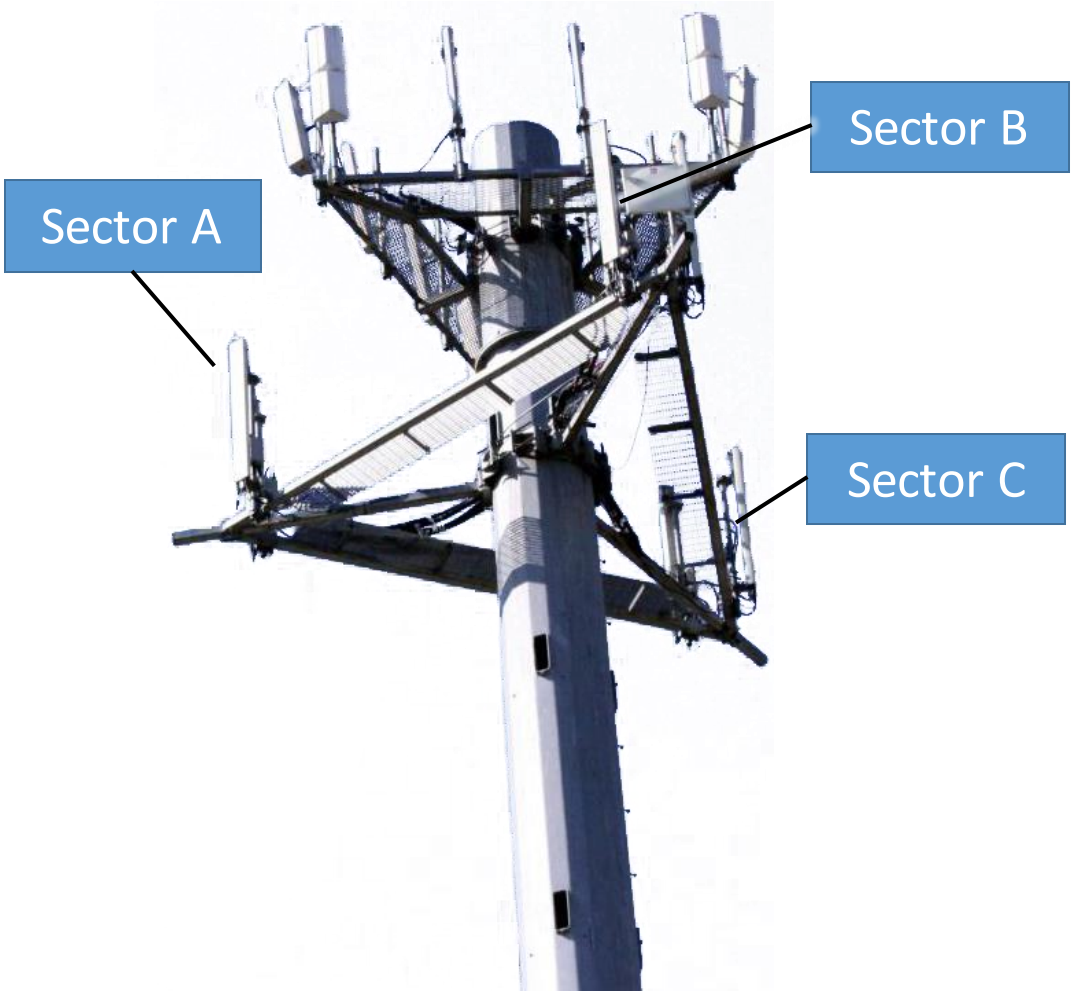
Preemption:
Between Primary Users and Secondary Users Under a CLA

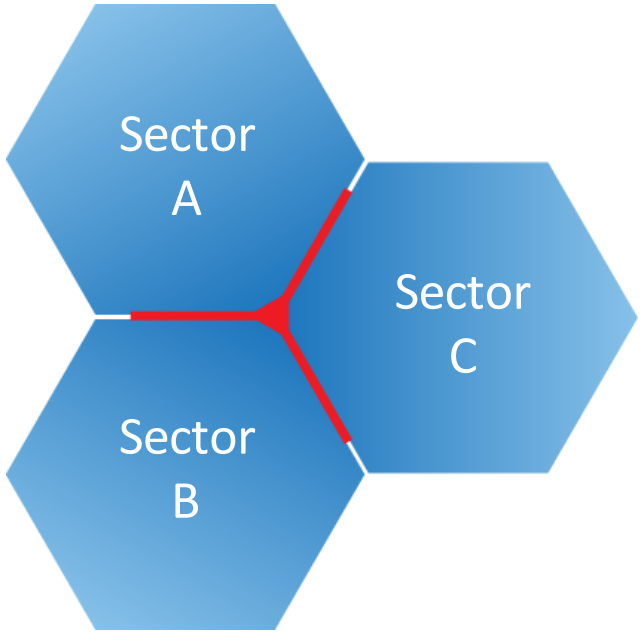
Secondary Users are removed instantaneously from the highway when Public Safety use demands it.

Preemption = Secondary Users Under a Covered Leasing Agreement must exit



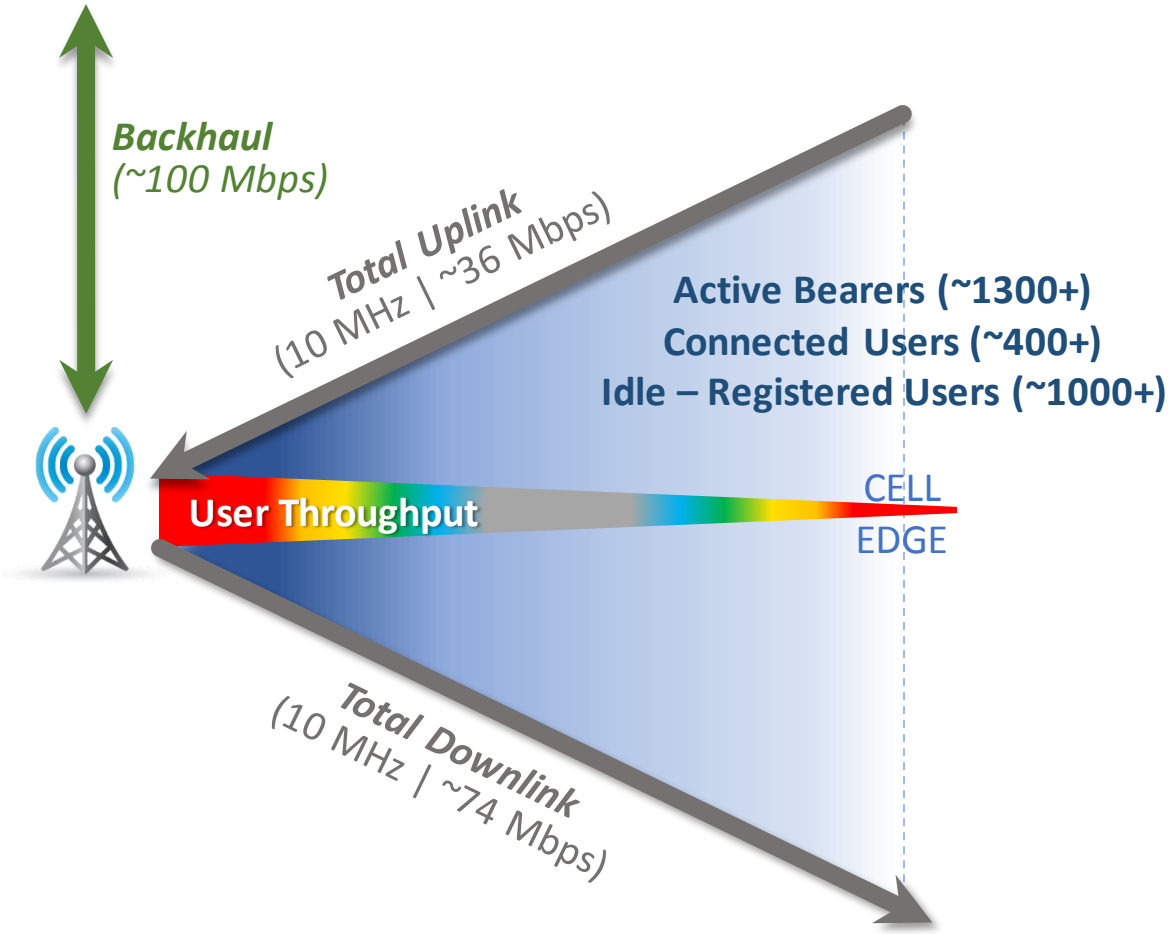
LTE is a “Cellular” Technology

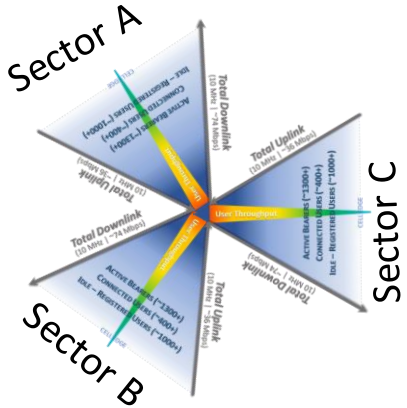




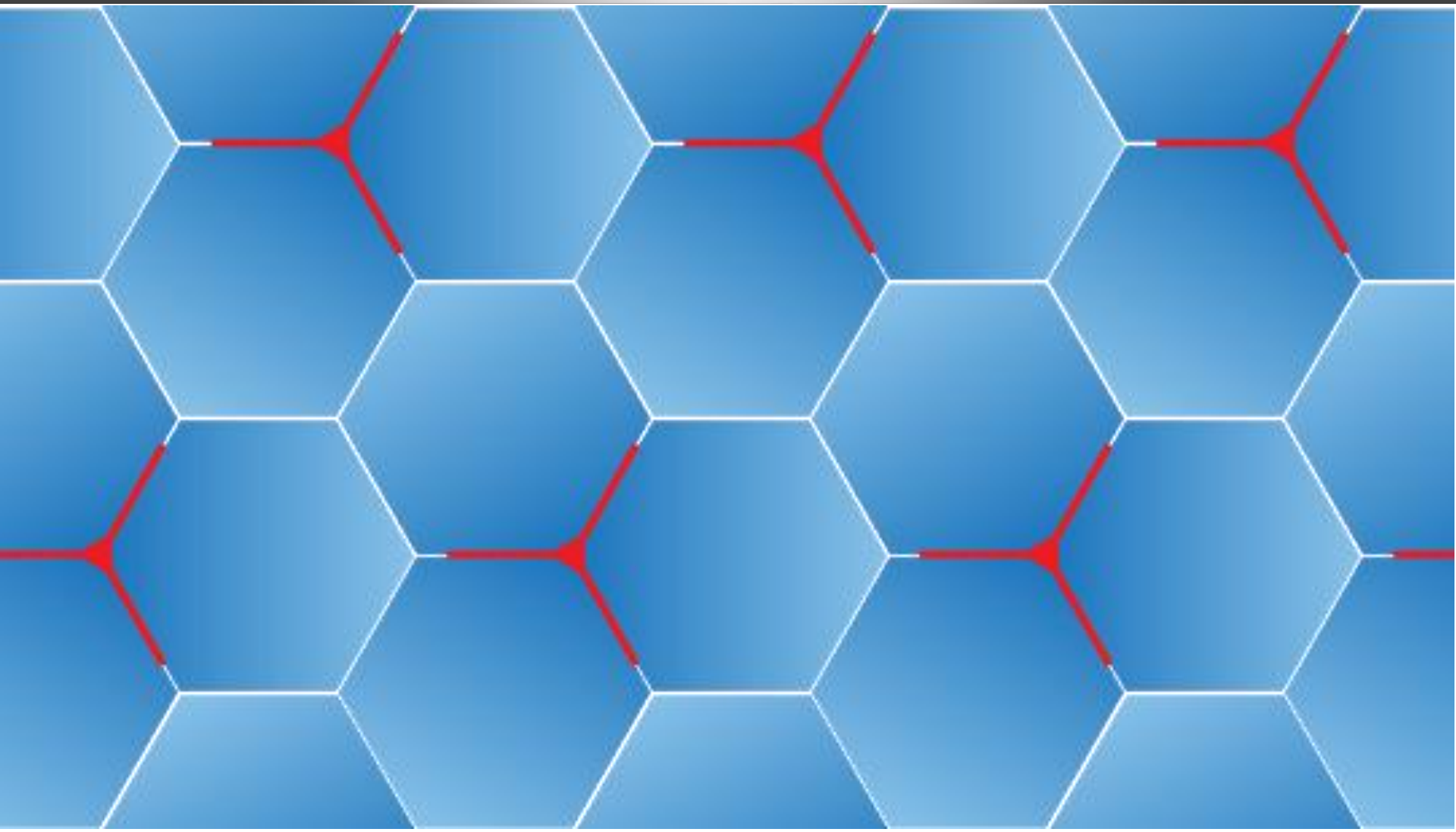
One “Cell” Site
With 3 Sectors

Cell-Sector Capacity





An Ideal Coverage Map



A Realistic Coverage Map

Excellent Signal

Very Good Signal

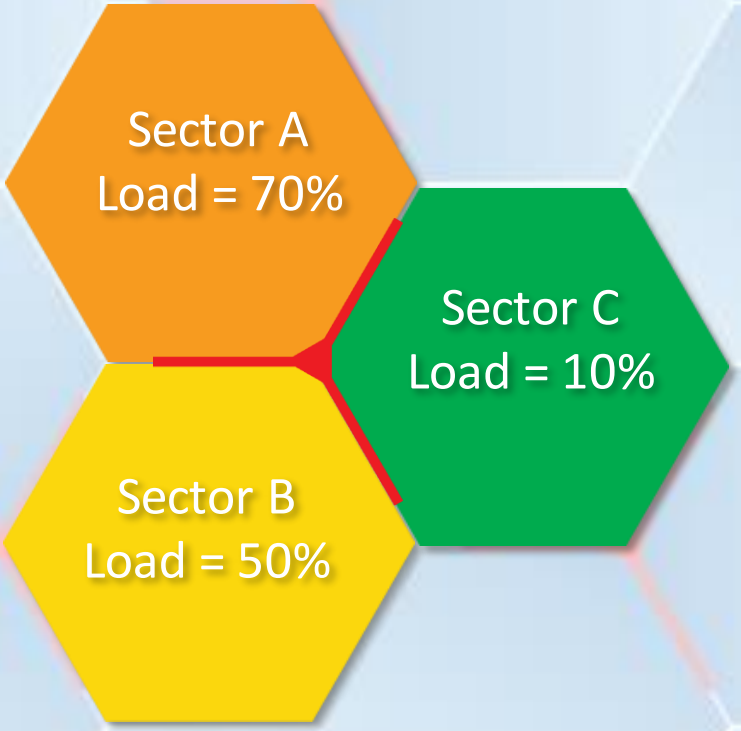
Good Signal

Acceptable Signal

Poor Signal

No Signal

Each Sector Can Be Independently Managed

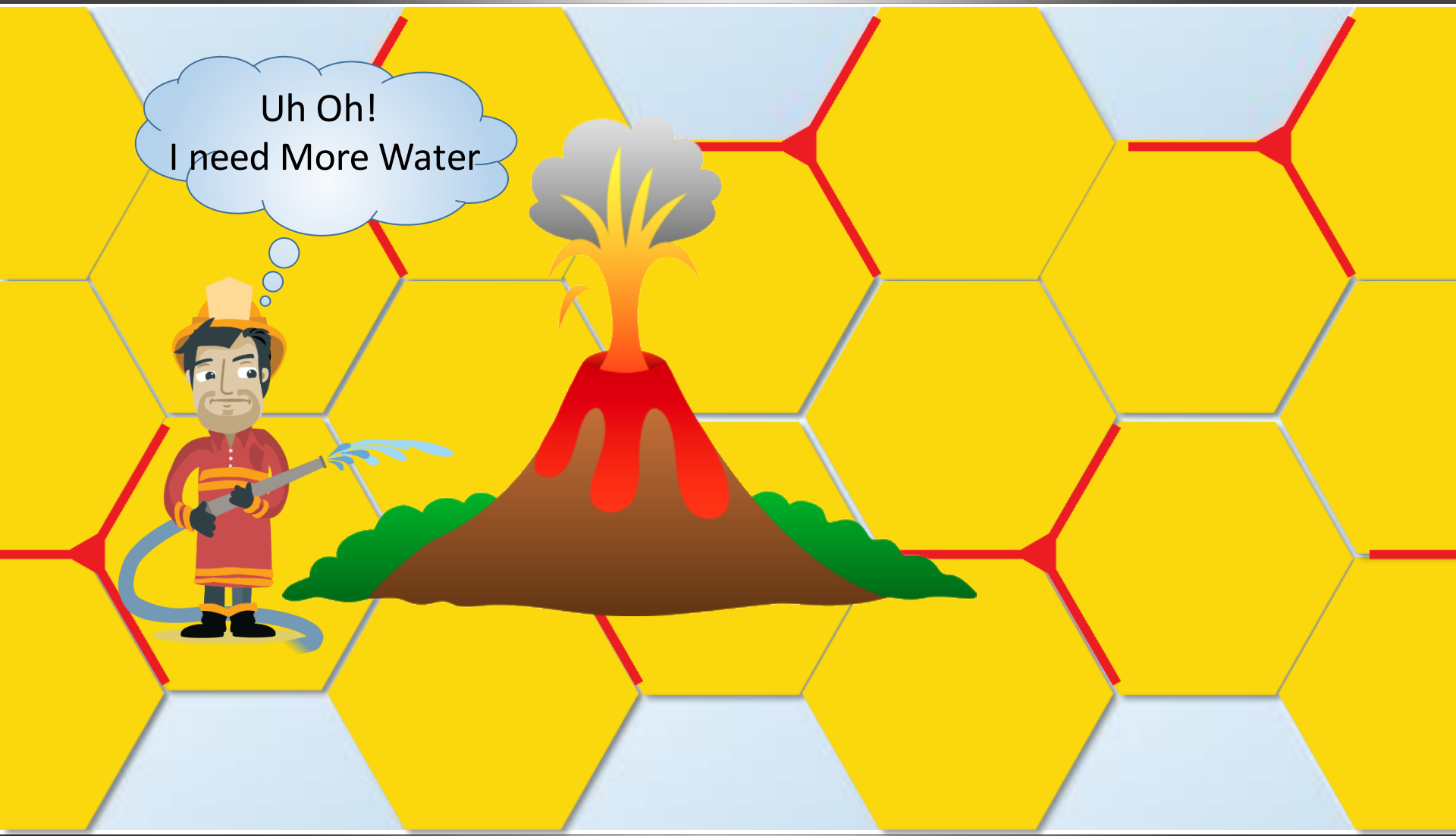


QPP Control – Single Sector

QPP Control – Two Adjoining Sectors

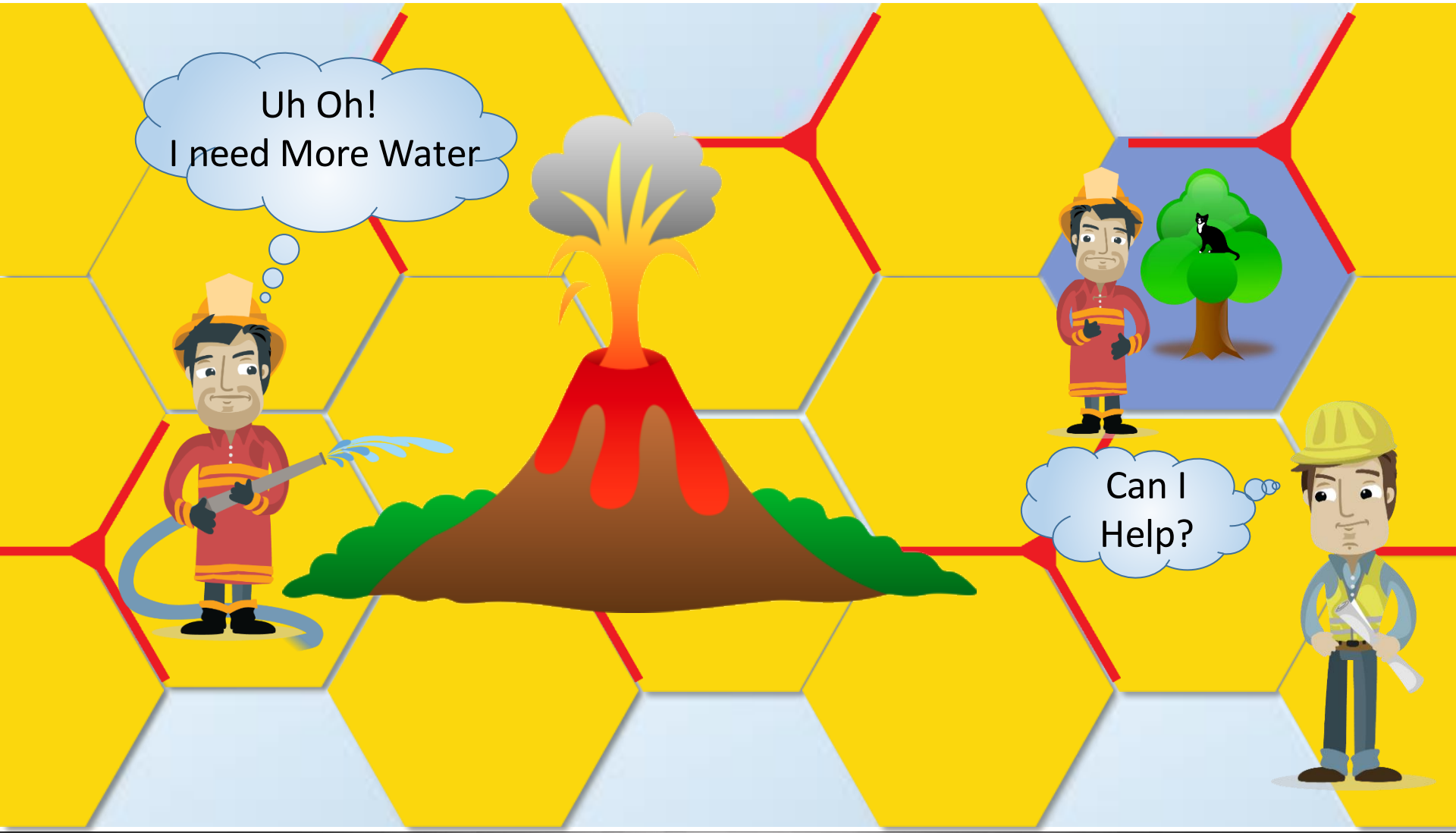
QPP Control – Three Adjoining Sectors

QPP Control – Multiple Cell Sites



QPP Control – Multiple Incidents Independently

QPP Control – Now What to Do?



Rosetta Stone – The QPP Framework

- The QPP Framework is a construct that
  - Allows engineers and first responders to talk about QPP without diving too deeply into each other area of expertise
  - Enables a way to describe network functionality
  - Describes what the network needs to know in order to make decisions in the rare cases that the network become overloaded with first responder traffic

The QPP Framework – At a High Level

- Every Cell Sector Across the Nation will be in one of three states
  - **Static** – The network will automatically apply QPP based on what has been pre-configured when provisioned
  - **Dynamic** – The network will accept input from First Responders to help mitigate congestion between First Responders.
  - **Controlled** – The network must have input to reduce congestion between First Responders.
- The network can also handle a man down or responder emergency situation at the same time
- When needed, the network will take resources from secondary users to give to first responders