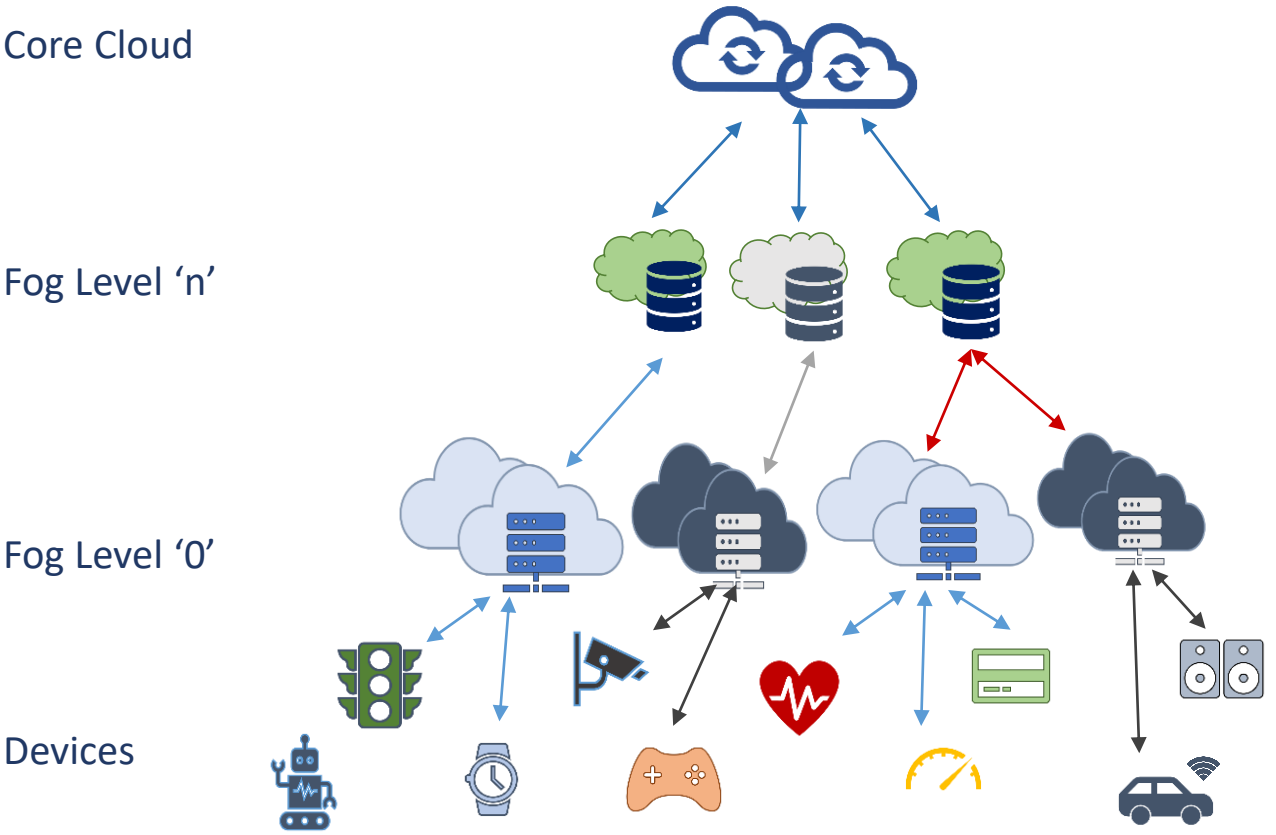
Broadband Public Safety Communication

Using Fog/Edge Computing for Mission Critical Communication

What is Fog Computing?

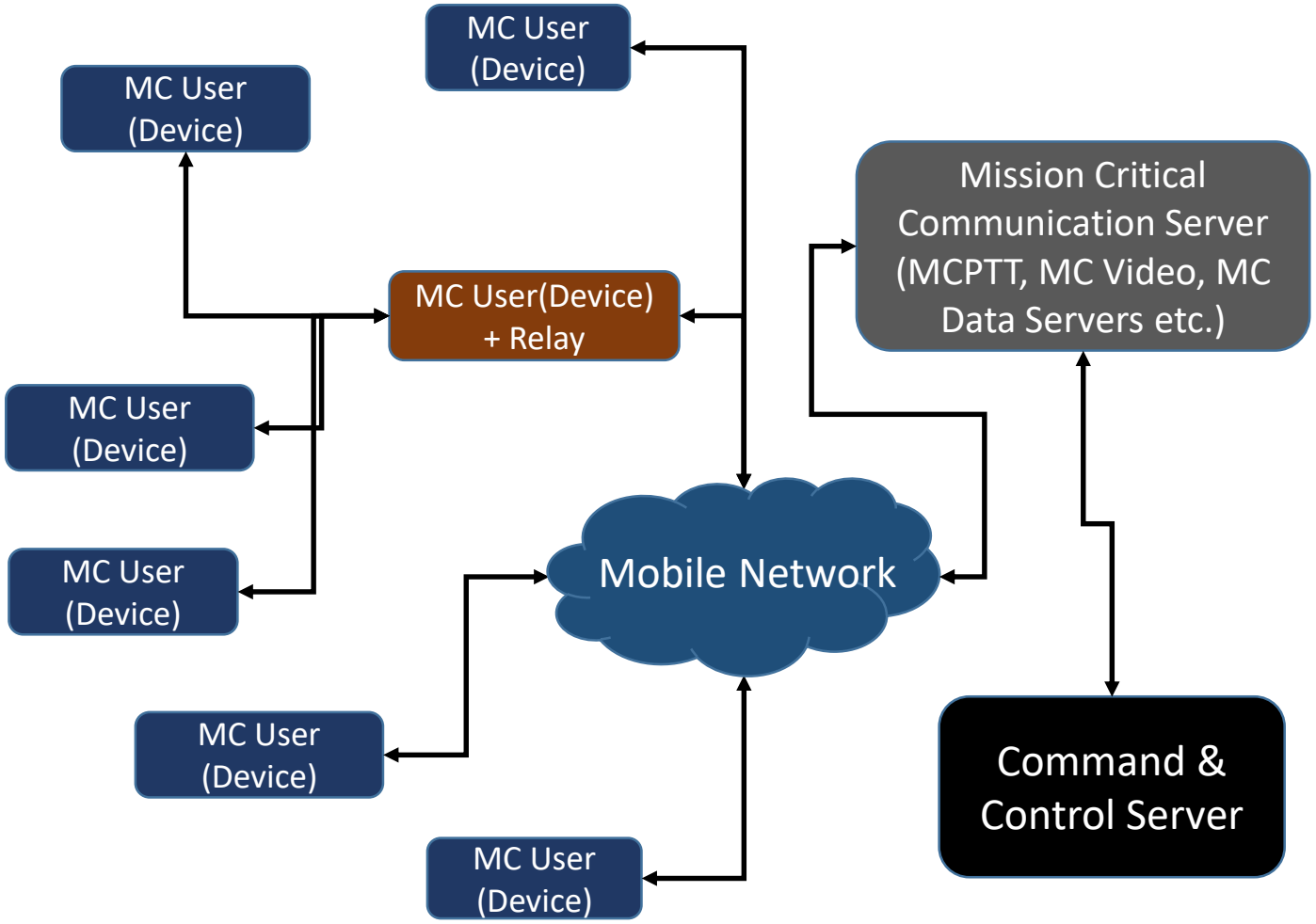
- Fog - **F**rom c**O**re to ed**G**e
  - A Smaller Cloud Near the User
    - in the edge
  - Between Devices and Core Cloud
- Support for Lower Latency Applications
- Reduced Network Bandwidth Usage
- Possibility of a Hierarchical Organization
  - Multiple Fog Levels
- However, there is an Issue
  - Can’t handle Mobility of Devices - Distributed Architecture
- Need to form Continuum with Core Cloud for Mobility
  - Fog for Stationary Devices
  - Core Cloud for Mobile ones
  - Fog and Core Cloud Complement each other
- Edge Computing
  - A Similar Concept as Fog Computing



Public Safety Communication

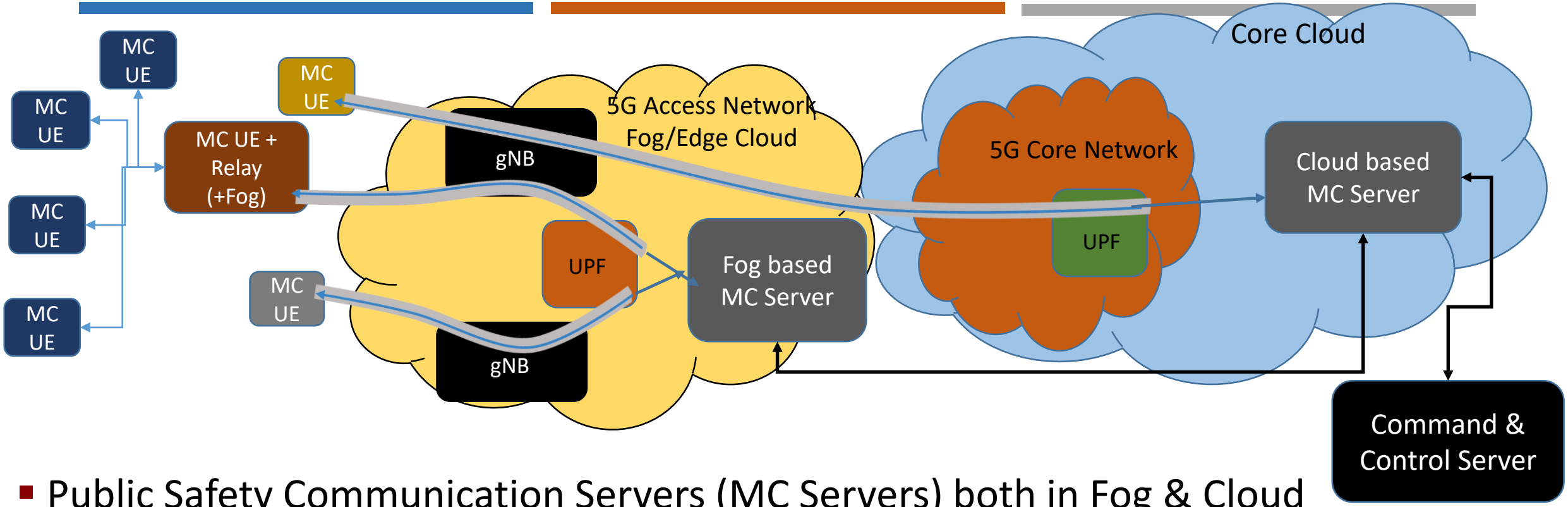
- Public Safety Communication
  - Used by Law Enforcement Agencies, Fire Brigade etc.
  - For Public Safety & Disaster Recovery
- Mission Critical Communication
  - Low Latency Communication
  - Reliable, Resilient & Secure
  - Immediate connectivity
- Group Communication
  - Communication within select groups
- Voice/Video/Data Communication
  - Rapid exchange of Contextual information
- Many times - It is Localized Communication

Public Safety Communication - System Architecture



- Mission Critical Users (MC users)
  - Personnel involved in Rescue/Relief Operations
    - Typically Mobile
    - Security Personnel, Healthcare Professionals etc.
  - MC Devices
    - Device used by MC users for Communication
  - Some MC Devices act as Relays for other Devices
- MC Server
  - Facilitates Communication between MC Users
  - Group Communication
  - One to One Communication
  - Voice call, Video Transfer, Data Transfer
- MC Server & MC Users
  - Connected via a Mobile Network
  - Tetra/P25 Now, LTE/5G in Near Future
- Command & Control Server (Command Centre)
  - MC User with Special Privileges
  - Guides Rescue/Relief operation
  - Typically Collocated with MC Server - Can use Mobile Network Infrastructure also for Communication

Public Safety Communication - Using 5G & Fog Computing



- Public Safety Communication Servers (MC Servers) both in Fog & Cloud
- Localized Communication between Devices facilitated by Fog Servers
  - Relay based Fog Element between a set of UEs
  - Fog Element in the vicinity of gNB too (in Access Fog)
- UE can communicate via Core Cloud also, if needed

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- Explore Fog/Edge and Cloud Based Architecture for Public Safety Communication System
  - Explore the efficacy of Fog Controllers in supporting
    - Low latency data flows
    - Immediate Connectivity and Communication within a group
  - Explore Cloud based SDN Controller
    - For management of Overlay Networks
    - Authentication of devices, to ensure secure communication
- Design of Overlay Networks for Public Safety Communication
  - Explore usage of SDN paradigm to control & manage the overlay network
- Develop highly available and resilient network architectures for Rapidly Deployable Public Safety Communication system
- Usage of SDN Paradigm for LTE based Network-in-a-Box solution for Rapidly Deployable Public Safety Communication system

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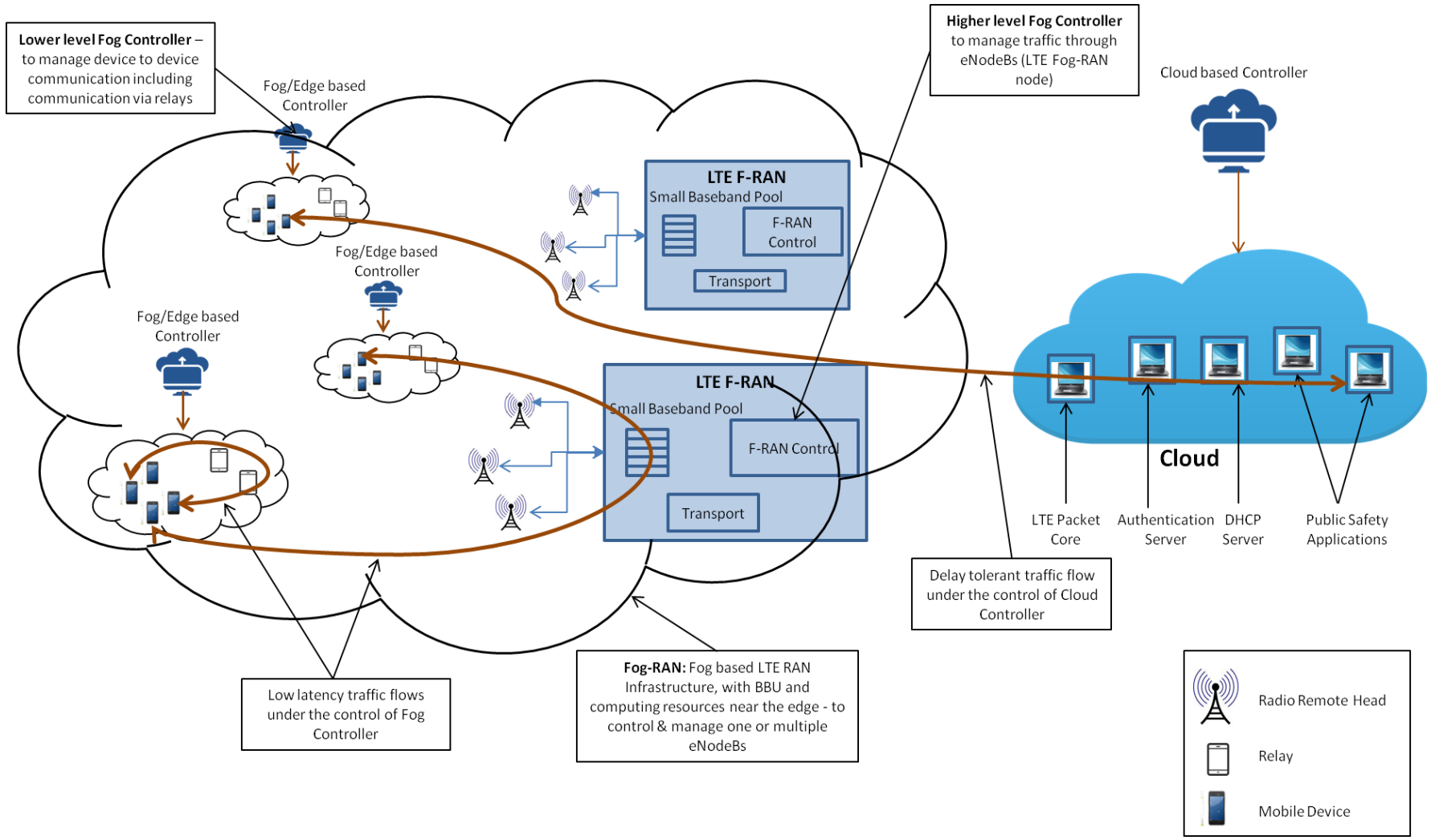
- Fog Based Architecture for Public safety Communication



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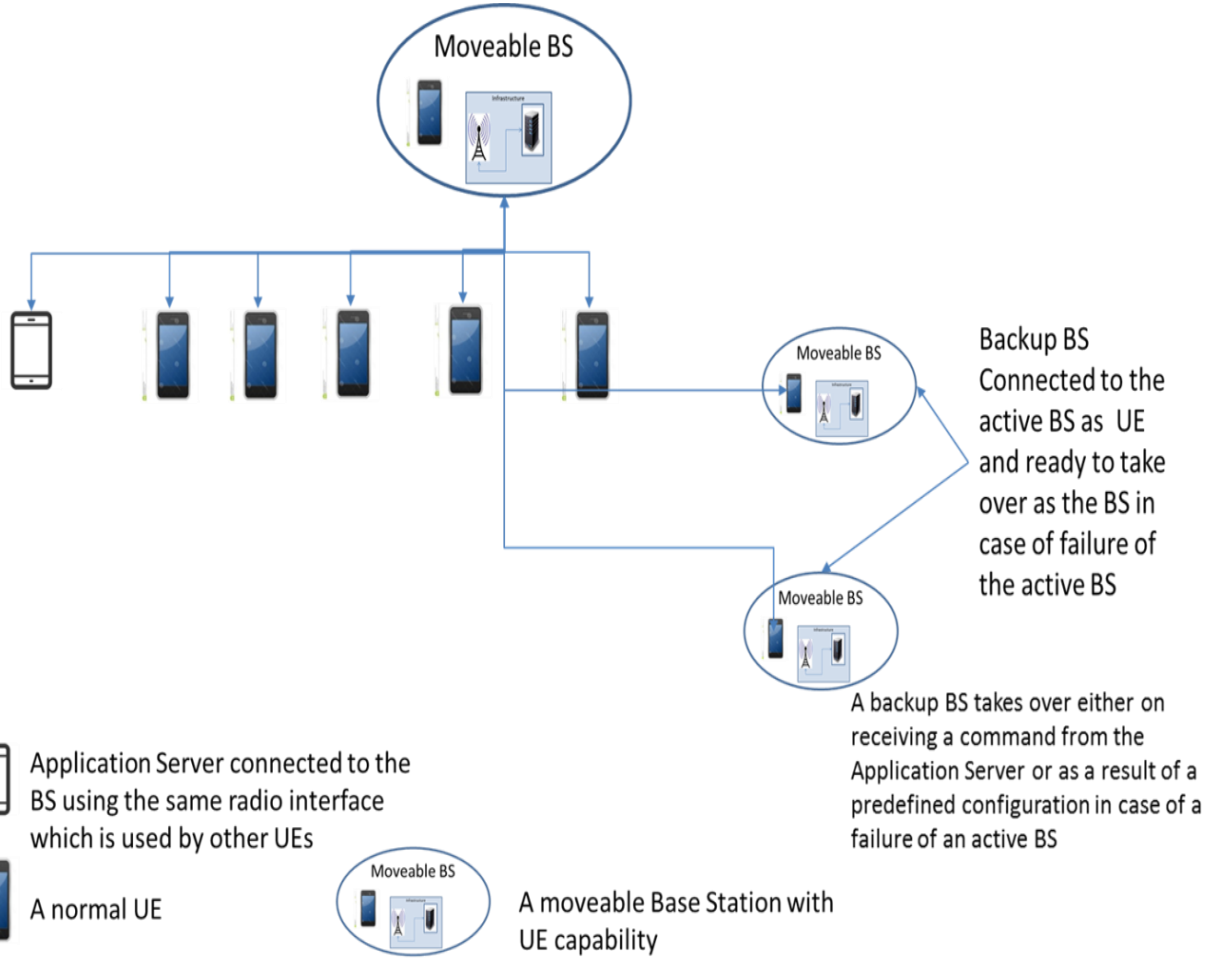
- Highly Available and Resilient Network Architecture for Rapidly Deployable Public Safety Communication system

  - Utilizing LTE Wireless link as the backhaul (self-backhaul)
  - Development of an SDN based LTE Network in-a-box (NIB) architecture
  - Exploring the usage of a movable vehicle, e.g., an Unmanned Aerial Vehicle(UAV) or a Terrestrial Vehicle as the LTE NIB platform



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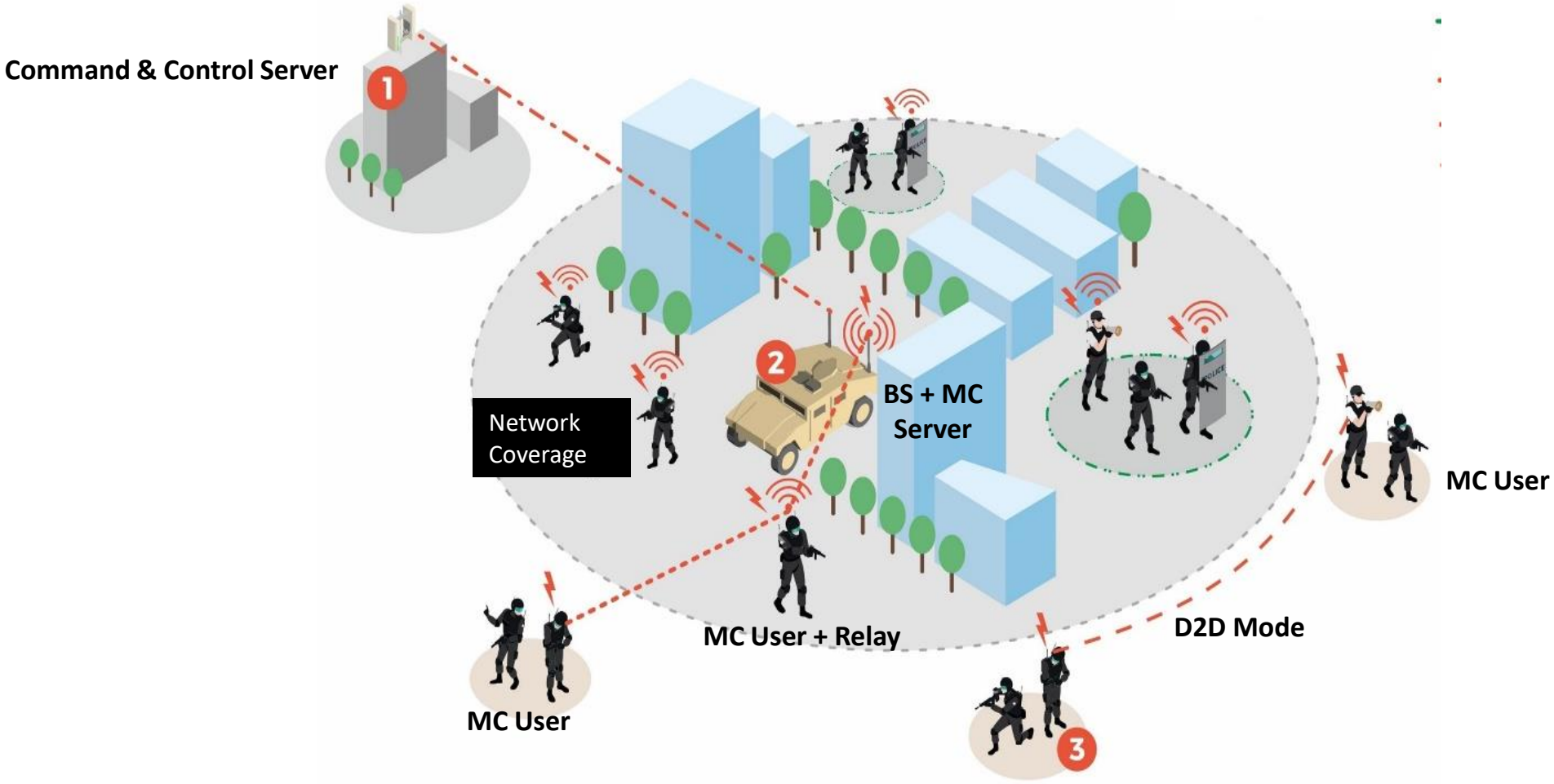
- A Rapidly Deployable Public Safety Communication System



THANK YOU