Putting the SAFE back into Public Safety

GNSS JAMMING IMPACT ON EMERGENCY COMMUNICATIONS

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How can network timing survive a flood?

GNSS
Jamming
& Spoofing

What is *resilient* PNT?

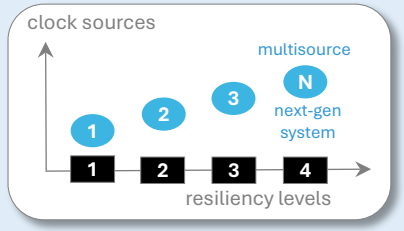
- Driven by US Federal Executive Order 13905 and UK & Euro Commissions
- **PNT** stands for **P**ositioning, **N**avigation & **T**iming. **T** enables **P** & **N**
- **Protect** government/industry critical infrastructure against PNT disruptions from GPS/GNSS jamming/spoofing & network timing cyberattacks

- **Deploy** resilient, assured & self-survivable PNT systems with defense-in-depth capability

- **Target** critical infrastructure under national security threats

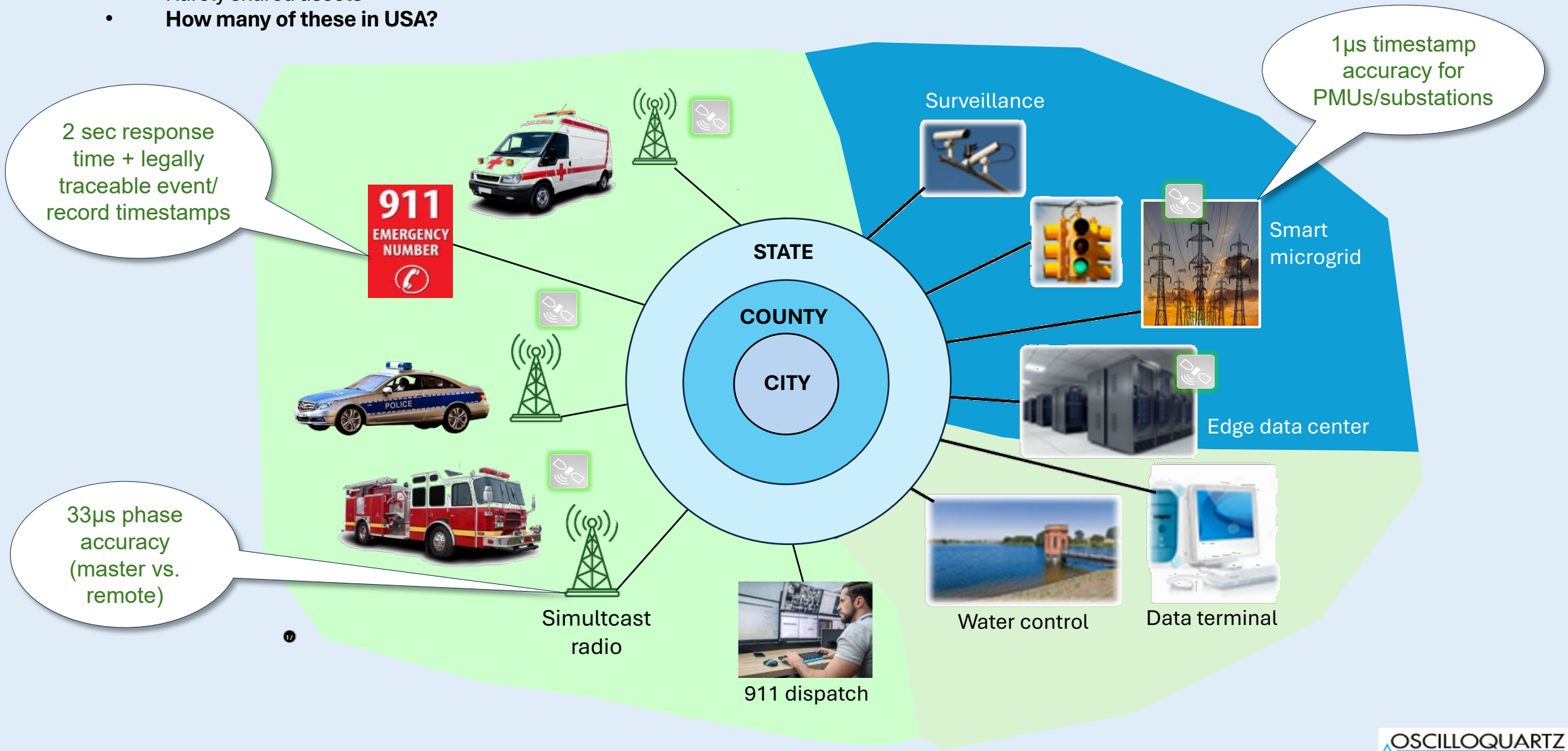
Power grids | Finance | E911/Public Safety | Transportation | Telecommunications | Data Centers

- **Use** published resilient PNT guidelines & standard in progress
  - DHS Resilient PNT Conformance Framework
  - NIST Cybersecurity Framework for PNT Profile
  - IEEE P1952 Resilient PNT for User Equipment Standard working group



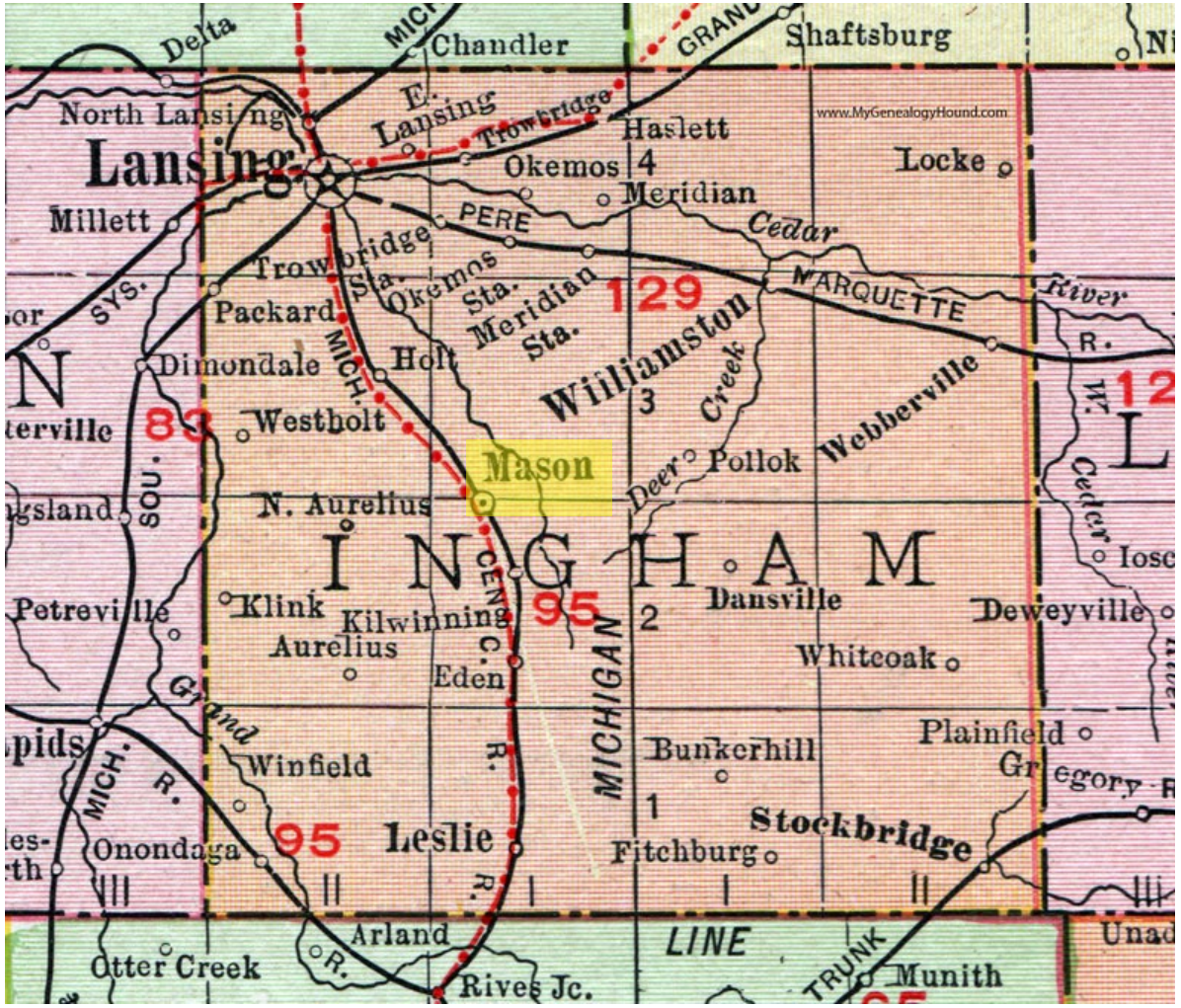
Municipal timing requirements by agency

- Multiple system owners in same geography
- Many differing timing & sync requirements
- Rarely shared assets
- **How many of these in USA?**



ANSWER: 49 State Capitals are also County Seats

- MI capital of Lansing is in Ingham County
- But is not county seat
- Mason, MI is Ingham County seat

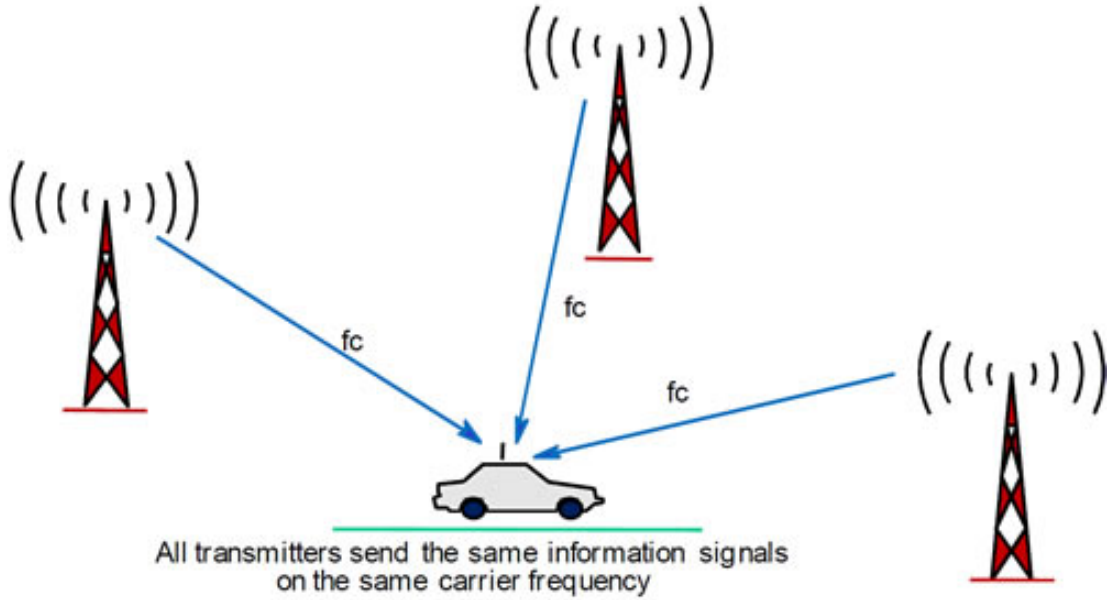


Small Town Public Safety Radio Systems – Typically Single Site

- Smaller jurisdictions require very simple radio network transmission designs
- Single transceiver
- Single site- high above town preferred
- External timing not a consideration

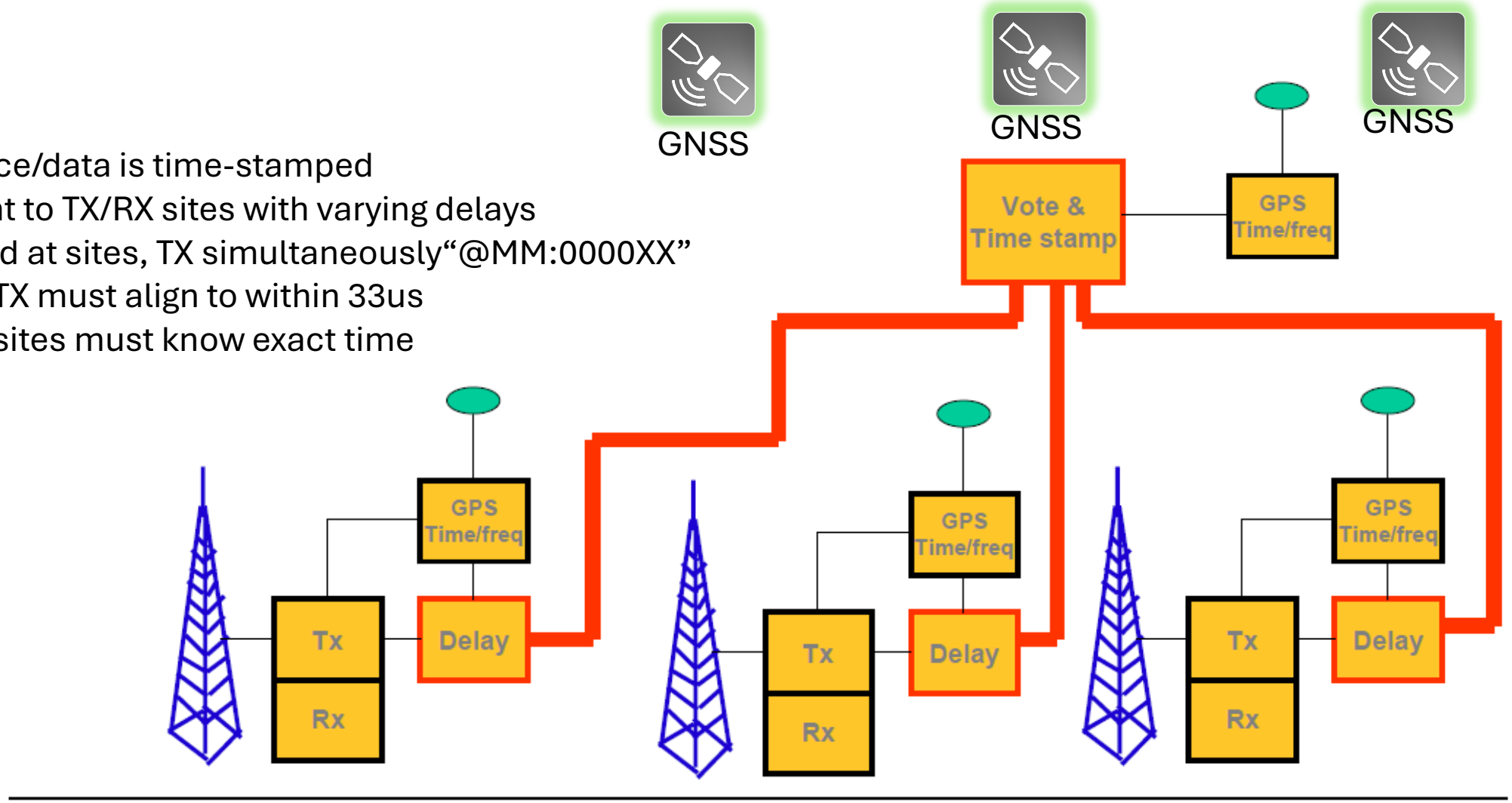
Urban Public Safety Radio Systems – Multiple Sites (simulcasting)

- Larger jurisdictions require more complex radio network transmission designs
- Multiple transceivers
- Carefully-engineered sites (transceiver spacing)
- All transmit on same frequency
- Strict timing requirements



Simulcasting Radio Systems

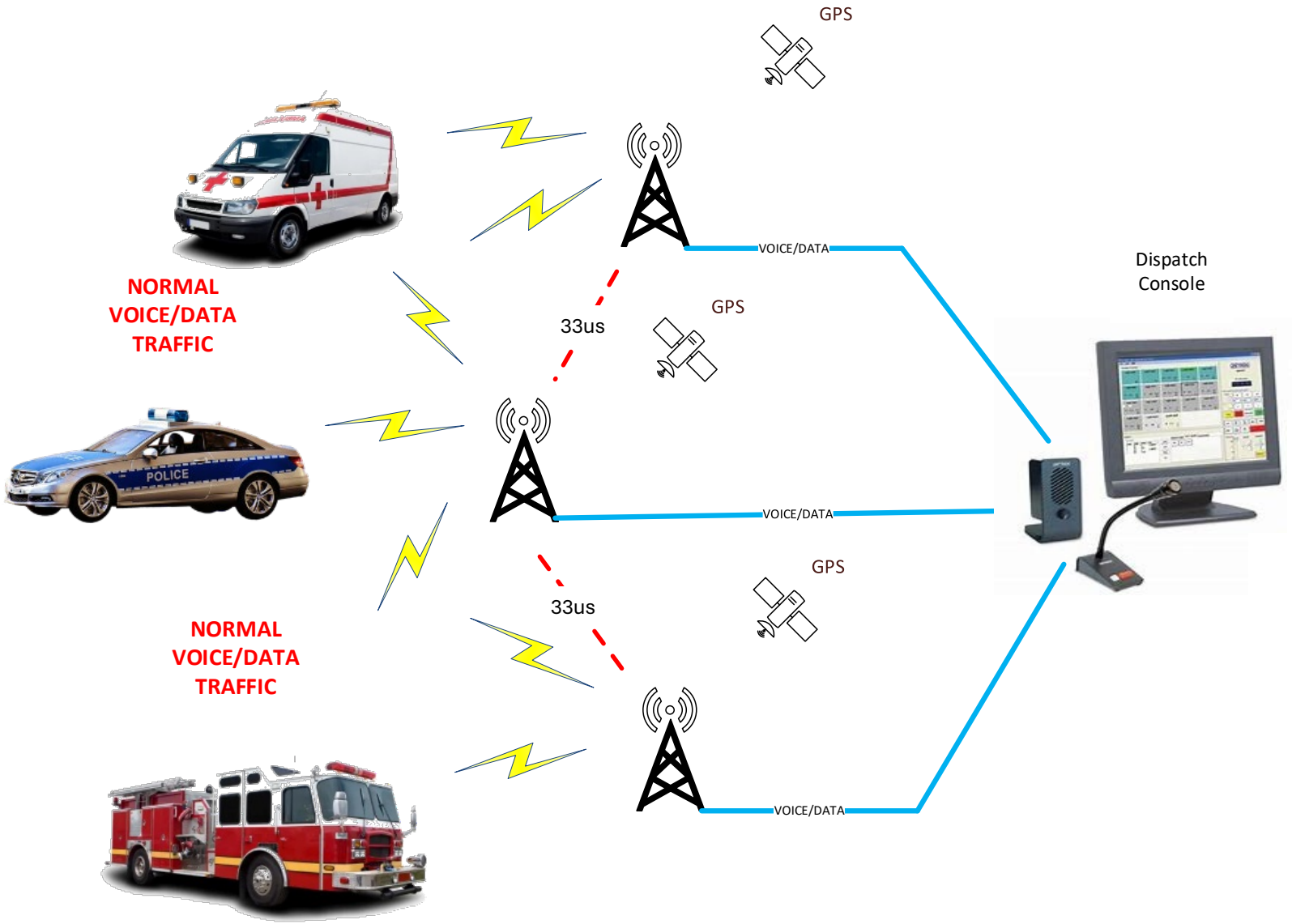
1. Voice/data is time-stamped
2. Sent to TX/RX sites with varying delays
3. Held at sites, TX simultaneously“@MM:0000XX”
4. All TX must align to within 33us
5. All sites must know exact time



Source: Motorola

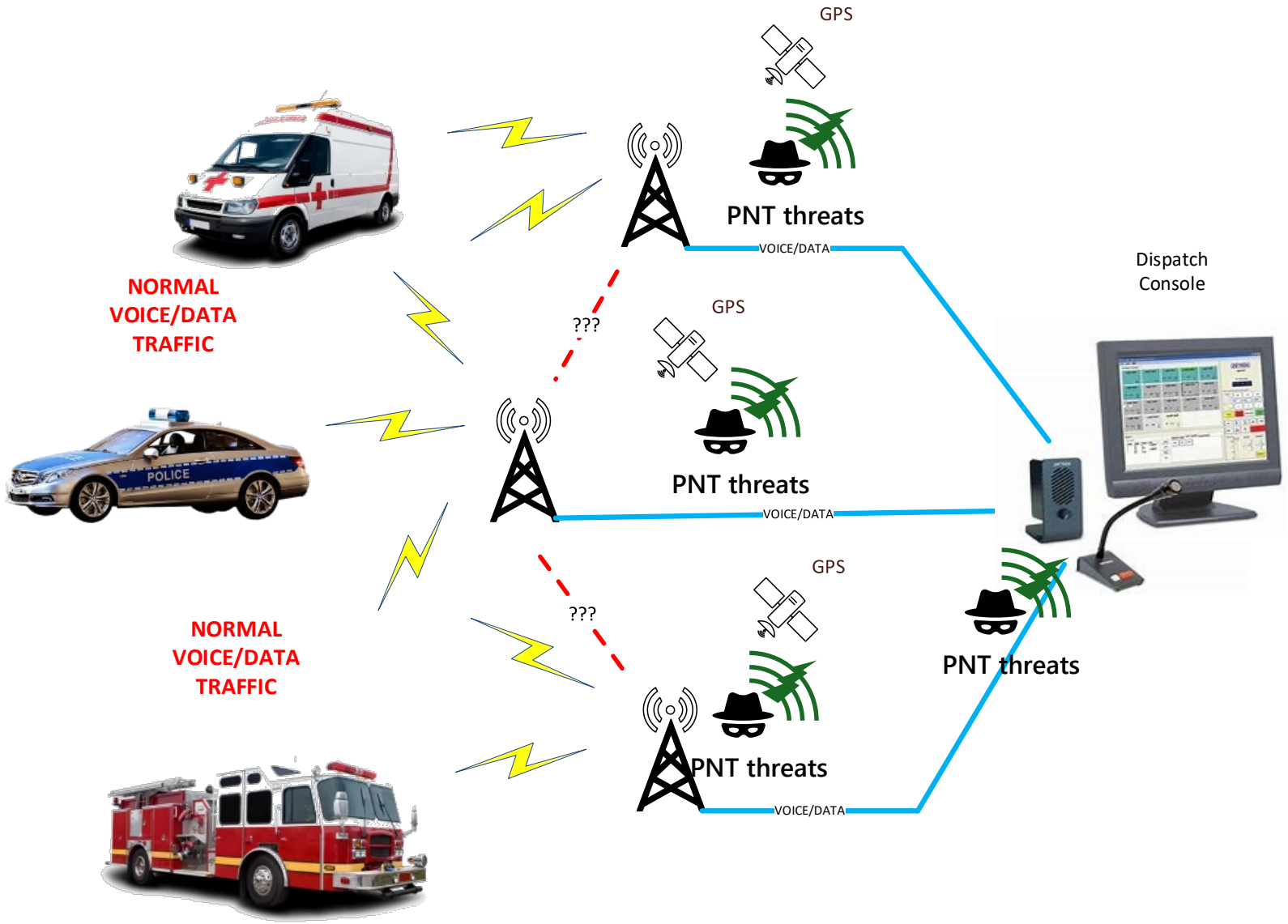
Simulcast Public Safety Radio System – Current Normal Operation

- Sites MUST maintain close phase correlation
- Legacy systems use L1 Band GPS-only
- Very vulnerable to jamming/spoofing



GPS Jamming and Simulcast Public Safety Radio Systems

- Jammin/spoofing is threat to phase correlation
- Legacy systems do have some holdover capability
- Not designed for long-term jamming/spoofing events



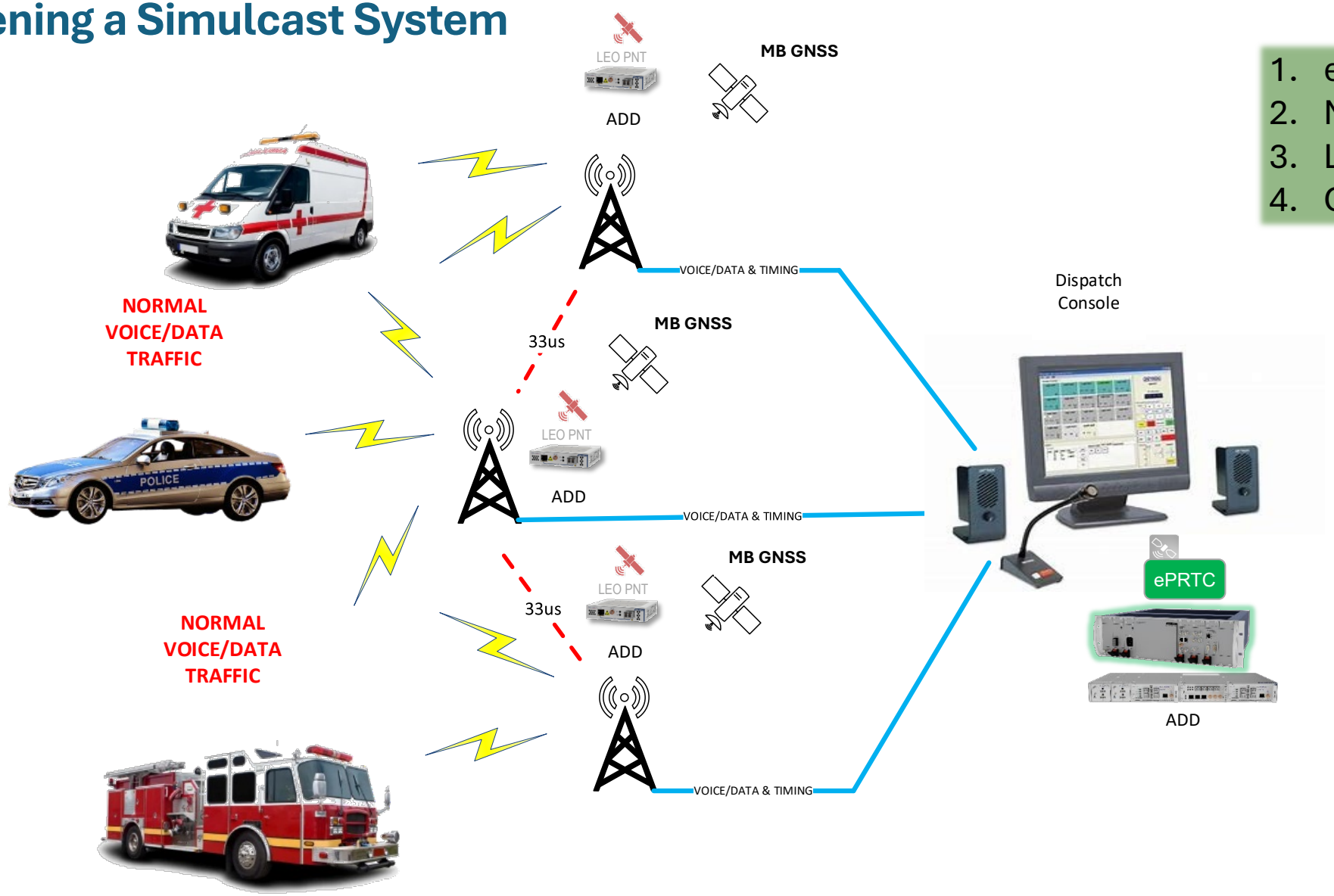
Real-World Example

MAJOR OUTAGE- Simulcast public safety radio system

- International Conference (United Nations)
- Rogue Nation Jammed GPS in Area
- Local Emergency Services Radio Network Disrupted
- Long Term Jamming (more than a day)
- Radio systems companies report growing issue worldwide

GPS Jamming and Simulcast Public Safety Radio Systems – Resist!

Hardening a Simulcast System



1. ePRTC
2. MultiBand GNSS
3. LEO
4. Other

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Conclusions/Assessments

Problems

1. “Naïve” Engineering
    a. Example: SS7 and SPAM CALLS
2. Irrational Behavior (Jammers/Hackers)

Solutions

1. “Adequate” Engineering
2. “Whack-a-Mole” Philosophy
    a. Wayne Gretzky – “Skate to where the puck is going, not where it’s been.”
3. Multifaceted Approach – No single points of failure

Thanks for investing your time with us!

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