Advanced Communication Systems for public safety

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Public Safety - Communication

• Public Safety functions
• Communication – end user needs
• New Communication technologies
  – 60 GHz / 80 GHz Gigabit wireless links
  – Intelligent Transport System spectrum
  – AVL in metro area
  – Passenger information systems
  – Vehicle health / safety reporting system
Public Safety functions

FCC Region-8 coordinates spectrum licenses of public safety users in CT, NJ, NY.

Responders to emergency

- Police – security, crime, safety, traffic
- Fire – fighting fire, hazard clearance,
- EMS – Ambulance and life support

Emergency Support services

- Transportation – MTA, NJ Transit, Port Authority
- Hospitals – emergency care
- Community services – elderly homes, others

All agencies work within Reg-8 to ensure that they don’t interfere with each other.
Communication – end user needs

- One-on-One and One-to-many conversations – professionals need Land Mobiles at work
- Wireless Tablets are needed for field personnel
- RFID devices for scanning (vehicle / card)
- Vehicle location services – for fleet management
- CCTV wireless links and Number plate recognition – security personnel
- Cell phones – public / official use (cellular system offers automatic priority channel allocation to public safety during emergency
Land Mobile Communication
One-on-One and One-to-many handsets

Handset / mounted unit

Mobile / Field units

Land mobile Network Infrastructure

Base Station Controller

Transmitter

Receiver

Modem

Comm. Processor

4 wire telephone line or Microwave

Base Station # 1

Base Station # 2 etc.,
Land Mobile Communication
One-on-One and One-to-many handsets

- Mostly Push-to-talk communication (Walkie-talkie type of handset) between driver and control center.
- Dispatcher / controller can multicast announcements or conference with a sub group of drivers on a route.
- Police, Fire and Transport agencies operate in licensed bands of VHF, UHF and 800 MHz.
- Stable and reliable communication – now converting to digital systems for increased capacity.
- Most communications are within the region – system supports interoperability channels between agencies.
- New allocations in the 700 MHz band by the FCC.
WLAN – Networks

4.9GHz Wireless Tablets for field personnel

- Tablet with access to data base – train / bus travel help info
- Laptop with access to Patient Records, ambulance vehicle location, site video
- Laptop with access to Records, police vehicle location

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WLAN - Networks

4.9 GHz Wireless Tablets for field personnel

- Post 911 the 4.9 GHz band was licensed for mobile broadband for public safety agencies – used mobile access during an emergency and temporary back haul from site of incident.
- Full mobility – including helicopter speeds.
- Used in bus depots / rail yards / train stations to connect WLAN devices to their Intranet.
- Not accessible by general public – secured broadband system (like WiFi but on a licensed band)
RFID - Scanning devices

Scanners for Rail / bus parts and cards

Wireless toll booths (Bridges / tunnels)
RFID - Scanning devices

- Metro Card swipes – passenger counting including transfer, expiry, elderly rate etc.
- Metro Card swipes – employees / on-duty persons are monitored (based on projects)
- Scanners connect to maintenance shop data bases – provides vehicle health info
- Toll booth RFID scanners for high speed (EZ pass) connect to traffic data base, user account and other services.
Vehicle location

- Used on trains for both signaling and passenger information boards
- Automated train control – self driven. Reduces distance between trains to 90 seconds
- Used by rail car maintenance personnel (whenever crew or train health parameters indicate any problem)
- Used by bus dispatchers to deploy additional vehicles during peak hour traffic. Used by maintenance personnel if bus breaks down.
CCTV wireless links and Number plate recognition - Security

- Multiple CCTV cameras used for property protection - connected by wireless links for viewing at security booths
- Used in rail yards to monitor portal and gates
- Police cars use car mounted cameras to view vehicle number plates to track suspects
- Traffic cameras connected by wireless links for connection to the Internet / traffic control
Cell phones - public / official

- Cell phone calls in the subways – offered in a few systems – under evaluation
- SMS on train / bus delay and weather related changes – currently available
- Handsets used by emergency personnel offer priority connection (system based).
New Communication technologies
New Communication technologies

- 60 GHz / 80 GHz Gigabit Ethernet links
- Intelligent Transport System band
- AVL in metro area
- Passenger information systems
- Vehicle health / safety messages - reporting system
IEEE New Communication technologies
60 GHz / 80 GHz Gigabit Ethernet links

Radiation maps for unlicensed bands 2.4, 24 and 60 GHz

Atmospheric and molecular absorption – attenuation peaks at 60 GHz due to absorption by oxygen in air.
New Communication technologies
60 GHz / 80 GHz Gigabit Ethernet links

- 60 GHz is secure since outside the beam signal attenuates by > 80dB. But oxygen absorption limits distances to 1 km.

- 70 / 80GHz provides greater distance (up to 4km) and is licensed to government agencies – excellent alternative to laying fiber.

- Narrow beam width of less than 3 degrees (typical < 0.9 degree) needs good alignment

- Systems offer standard 1000 base SX / LC connectors or 100 base with RJ-45 connectors
New Communication technologies

Intelligent Transport System band

- **5.850-5.925 GHz** licensed by FCC for DSRC (Dedicated Short Range Communication).

- Both the Road Side Units (RSU) and the On Board units (OBU) in a transport vehicle are licensed separately by the FCC.

- Vehicles on road – can communicate with traffic signals (extended green), way side booths

- Intelligent vehicle can communicate with other vehicles (no driver) – controlled traffic flow
New Communication technologies
AVL in metro area

- AVL (Automatic Vehicle Location) systems are typically based on GPS
- In a metro area line-of-sight to satellites is lost and usually compensated by dead-reckoning
- Wireless messages move between vehicle and control center and from control center to bus stops – data moves in short bursts in both direction
- Operating frequency band must be below 1000 MHz for effective communication – to cover long distance (FCC suggests 902-928 unlicensed band)
New Communication technologies

Passenger information systems

- Tunnel advertisement panels (EMI / EMC concerns)
- Text messages in subway trains (loading is wireless, but displayed from stored buffer).
- Safety and schedule info on SMS and blue tooth (connected through cellular and WiFi infrastructure)
- Satellite Digital Radio (above ground) – provides broadband broadcast channels
New Communication technologies

Vehicle health / safety reporting system

- Subway cars report health at select stations – using short wireless links
- Buses report through AVL system or using short wireless links at bus stops
- Bus depots use either 4.9GHz or other WLAN systems to report from maintenance shop to central database.
Back up slides
MTA companies
Metro area public transportation

- Commuter Buses
- City bus system
- Commuter trains
- Subway systems
- Bridges and tunnels
MTA Companies

- Communication infrastructure
- Expansion into new technologies
- Retro fit existing communication systems
- Interfaces to Police, Fire and EMS