Communications for Rural ITS

New approaches and challenges

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WSDOT’s 310 Wireless communications Sites

Includes sites for voice communications and ITS equipment locations
WSDOT’s Wireless ITS locations ~ 150

Does not show substantial ITS deployment supported with fiber optic communications.
ITS equipment connected via Wireless

- Electronic message signs
- Variable speed limit systems
- Remote weather information stations (RWIS)
- Highway Advisory Radio (HAR) and connected sign beacons
- License plate readers
- Traffic detection (radar, etc)
- Cameras - full motion PTZ and snap shot
Why Wireless Data?

- Lower cost per mile as compared to fiber in rural areas
- IP standards have increased competition and decreased equipment costs by almost 50% in the last 10 years.
- Potential wide area of coverage
- Higher reliability than commercial services (DSL and copper)
- Lack of acceptable commercial services in rural areas.
- Potentially less expensive over time compared to leased services particularly cell
- Not a replacement for fiber
New approaches

- **Backhaul**
  - Capacity needs to match the need: WSDOT’s wireless backbone is up 155MBs
  - IP based connectivity
    - Serial to Ethernet converters for legacy devices

- **Connectivity**
  - Point to Point & Point to Multipoint
  - Medium speed wide area coverage

- **Licensed or Unlicensed**
  - 4.9 GHz, new licensed spectrum for public safety. Can be deployed for up to one year before a license is required.
Connectivity - Point to point

- **Backhaul**
  - Backbone or dedicated local short haul
  - Licensed
  - Longer distanced up to 50 miles
  - Fixed Higher Capacity up to 155 MBs
  - Lower cost per mile compared to fiber for rural areas
  - Requires Line of sight
  - IP based
Connectivity:
Point to Point & Point to Multipoint

- Licensed or Unlicensed
- Distances up to 30 miles
- Capacity up to 24MBs
  - Longer the distance the lower the bandwidth
- IP based
- Line of sight or near line of sight
- All ITS devices including full motion PTZ
Connectivity: Wide Area Coverage

- Licensed
- Distances up to 50 miles
- Lower bandwidth up to 64KBs
  - Bandwidth is fixed 64KB or 32KB
- One base can handle several ITS devices
- IP based
- Non Line of sight
- All ITS devices except full motion PTZ
- Support mobile applications
Connectivity  - Wide Area

- Wide area coverage from a selected site. WSDOT Gabi, Burch and Goat Mt communication sites provide over 6000 square miles of coverage.
Connectivity - Wide Area

- Near line of site at 49 miles.

<table>
<thead>
<tr>
<th>Location</th>
<th>Frequency (MHz)</th>
<th>Percent (F1)</th>
<th>Latitudinal Location</th>
<th>Longitudinal Location</th>
<th>Elevation (ft AGL)</th>
<th>Azimuth</th>
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<td>Burch Mtn.</td>
<td>799.2</td>
<td>100.00, 50.00, 0.00</td>
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WS DOT - NCR Burch Mt. to Dodson Rd VMS

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Connectivity  - Wide Area

- Near line of site at 49 miles.
- RWIS, Sign Control and Snap Shot Camera
Connectivity - Wide Area

- Non Line of sight Sign Control
Licensed or Unlicensed

- Licensed
  - 6Ghz, 11GHz, 18GHz and 23GHz up to 155MBs
    - Advantages – no interference
    - Disadvantages – higher costs
  - 4.9 GHz up to 24MBs
    - Advantages – no interference, lower costs
    - Disadvantages – limited bandwidth

- Unlicensed
  - 900Mhz, 2GHz and 5.8GHz up to 24MBs
    - Advantages – deploy quickly, low cost
    - Disadvantages – possible interference in urban areas
    - Risk of future interference
Challenges – Bandwidth and Location

➢ Wireless can be bandwidth limited
  ▪ Use higher capacity equipment to connect hubs or sites together and to get back to the Traffic Management Center
  ▪ Use Point to Point and Multipoint systems to connect to Devices that need bandwidths over 64KBs (PTZ Cameras)
  ▪ Use Wide area systems to connect more devices over a greater distance or where you do not have line of site or only need moderate bandwidth
  ▪ Plan accordingly – know your backhaul capability

➢ Location
  ▪ Take into consideration your wireless connection when locating an ITS Device
  ▪ Line of site provides the best reliability for Point to Point and Multipoint systems
  ▪ Do you anticipate mobile data needs in your future?
Challenges – Equipment and Costs

- **Equipment Type**
  - Licensed
  - Unlicensed

- **Costs**
  - High capacity, High reliable microwave backhaul - $50K to $60K per end
  - Lower capacity, Point to Point and Multipoint - $2K to $4K per end
  - Wide area 64Kbs $20k per repeater or site and $2.5k per radio at an ITS location
Challenges – Standards and Product Life Cycle

- Standardization and Product Life Cycle
  - Microwave backhaul and Wide area equipment typically have a longer product life cycle 15 to 20 years.
    - Easier to standardize on equipment
  - Point to point and Multipoint systems have shorter life cycles. They tend to follow a PC (consumer electronics) type trend.
    - Challenging to standardize on equipment and sometimes a vendor