“Last Mile” Communications Solutions for ITS

Presented by:

George Gener
Iteris Inc.
Senior Program Manager
(208) 345-4630
www.iteris.com

Jim Larsen
ADA County Highway District (ACHD)
Supervisor, Congestion Management
(208) 387-6193
jlarsen@achd.ada.id.us.com
What we will cover?

- Assumption: Ethernet backbone ongoing or goal
- Assumption: Centralized control of ITS devices is goal

- Case Study – ACHD systems Boise, Idaho
- Ethernet Communications/Designs
- Options for deploying beyond the “last edge switch”
- System options:
  - Ethernet over Wireless and copper
  - Point to Point solutions
  - ISP Based solutions
    - Satellite
    - Internet connections
    - Phone drops

- Site Requirements
- Lessons Learned
What we will not cover?

- Detailed Costs
- Detailed Designs
- Technology Details
- Vendor Favorites
- Detailed ISP based solutions
ACHD, Boise Idaho – Case Study (current)

Greater Anchorage population: Approx. 370K

Treasure Valley population: Approx. 600K
ACHD, Boise Idaho – Case Study (current)

**LEGEND**

- **Existing**
  - Existing 36 strand SMFO
  - Existing 72 strand SMFO
  - Existing 12 strand SMFO
  - Existing 24 strand SMFO

- **Proposed**
  - Recommended 36 strand SMFO
  - Recommended 72 strand Trunk SMFO
  - Potential Hub Site/Agency

- **Fiber Deployment Strategies**
  - Long Term
  - Medium Term
  - Short Term

- **H**
  - Existing Hub Site/Agency

- **H**
  - Key Partner Agency/Potential Hub

**Ring Diagram**

- Rings 1 through 9
- Lines indicate fiber deployment strategies
- Solid lines represent long-term deployment
- Dashed lines represent medium-term deployment
- Dotted lines represent short-term deployment

**MAP**

- Key locations:
  - Caldwell
  - Eagle
  - Boise
  - Nampa
  - Kuna

-Major roads and interchanges are labeled.

**NOT TO SCALE**

- Map is a representation for illustrative purposes.
ACHD, Boise Idaho – Case Study (Goal)

Ethernet Fiber Communications - Goal

Other Remote ITS Devices
What Options Exist?

- Agency owned Wireless
- Agency owned Ethernet over copper
- Satellite – Typically ISP based
- Wireless ISP “shared bandwidth”
- POTS
Wireless

- Licensed / Unlicensed
- CDPD > GPRS (cellular)
- Broadband Wireless Solutions (802.11X standards)
- Frequency Hopping Spread Spectrum
- 900MHz, 2.4GHz, 4.9 GHz, and 5.8GHz options unlicensed (in US)
  - 900 – 902 to 928MHz, 26 MHz wide
  - 2.4 – 2.40 to 2.4835 GHz, 83.5 MHz wide
  - 4.9 – 4.94GHz to 4.99GHz, 50 MHz wide
  - 5.8 – 5.725GHz to 5.850GHz, 125 MHz wide
Wireless

- When cable is not an option
  - private property, construction
  - roads or highway
  - rivers, railroad tracks, ....
  - No trenching possible

- Installation
  - Gets you up and running faster
    - Needed yesterday!
    - Police, Construction, Maintenance Operations
    - May not require site license
    - Pre-fiber or “last leg” to fiber
  - Re-locatable

- Ownership
  - Unlike ISDN, ATM,... you own the equipment
Wireless Budgetary

- **Wireless Costs**
  - Compared to fiber, less expensive to deploy
    - ISDN, T-1, T-2, ... re-occurring costs
    - Bandwidth is expensive
    - CODECs, transceivers expensive

- 5 mile run - Does it compare?
Wireless Budgetary

Traditional Cable/Fiber - ~$40 per foot

<table>
<thead>
<tr>
<th>Distance</th>
<th>Cost per mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 mile</td>
<td>$56,000.00</td>
</tr>
<tr>
<td>1/2 mile</td>
<td>$112,000.00</td>
</tr>
<tr>
<td>1 mile</td>
<td>$224,000.00</td>
</tr>
<tr>
<td>5 miles</td>
<td>$1,120,000.00</td>
</tr>
</tbody>
</table>

Cable/Fiber
Cost increases with distance

Wireless Solution ~$15,000.00

<table>
<thead>
<tr>
<th>Distance</th>
<th>Cost per foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4 mile</td>
<td>$10.71</td>
</tr>
<tr>
<td>1/2 mile</td>
<td>$5.36</td>
</tr>
<tr>
<td>1 mile</td>
<td>$2.68</td>
</tr>
<tr>
<td>5 miles</td>
<td>$0.54</td>
</tr>
</tbody>
</table>

Wireless
Cost falls with distance
Wireless Budgetary

- Remote CCTV Costs involved
  - Camera system
    - IP PTZ camera – ($2500+)
    - IP Fixed camera – ($1500+)
  - Video and PTZ transmission
    - 5.8 GHz long range, 5 to 20 miles ($6,000+)
    - 2.4 GHz shorter range, up to 5 miles ($4500+)
  - Power, Poles, etc.
  - Lift vehicle – (30’ to 60’+) both ends of project
Wireless Site Considerations

- **Power**
  - 120VAC or 12v
  - Solar power

- **Line of Site**
  - Trees, buildings, obstructions
  - Maximize height 30+ feet
  - Repeaters
    - Conflicting signals
  - Areas can be saturated

- **Mounting, weatherproofing**

- **Lightning Protection**
  - PolyPhaser - [www.polyphaser.com](http://www.polyphaser.com)

- **Security**
**Ethernet over Copper**

- When TWP pair already in conduits
- Distance between sites is less than 5 miles
- Congested or high profile areas
- No new trenching allowed
- ISP service is too expensive
- Slightly less expensive compared to wireless
Ethernet over Copper
Ethernet over Copper

- **Actelis Networks® Options:**
  - ML600 Ethernet Access Devices (EAD)
  - Ethernet over the existing copper and fiber infrastructure.
  - Ethernet in the First Mile (EFM) EADs - up to 100 Mbps on existing copper pairs.
  - Available in 2 to 8 copper pairs and fiber configurations, with (4) 10/100 Base TX
  - Can be deployed in a Point-to-Point, Add-Drop chain, or Point-to-Multi-Point.
Quick Eagle Networks® Option:

- maximum data rates of up to 45 Mbps (DL4840 model), 68 Mbps (DL4860 model), or 91 Mbps (DL4880 model)
- 5.69 Mbps or 11.38 Mbps per G.SHDSL port over 2 or 4-wire ordinary phone lines or available TWP
- Integrated four-port, auto-sensing 10/100 Mbps Ethernet switch
- Can be deployed in a Point-to-Point, Add-Drop chain, or Point-to-Multi-Point, Star, Ring.
Vendors

- Wireless ITS oriented vendors
  - ENCOM - (www.encom.com)
  - Intuiicom - (www.intuiicom.com)
  - CISCO - (www.cisco.com)
  - PROXIM (OriNOCO) Tsunami (www.proxim.com)
  - Premier Wireless - (www.premierwirelessinc.com)
  - FireTide Networks - (www.firetide.com)
  - Motorola (Canopy) - (www.motorola.com)
- Related vendors
  - Etherwan - (www.etherwan.com)
  - MOXA - (www.moxa.com)
  - Ruggedcom - (www.ruggedcom.com)
  - PolyPhaser - (www.polyphaser.com)
  - Pacific Wireless - (www.pacwireless.com)
- Ethernet over copper
  - Actelis Networks - (www.actellis.com)
  - Quick Eagle Networks - (www.quickeagle.com)
Vendors

What to look for?

- Hardened, proven components – NEMA TS2
- Product support – design, setup and maintenance
- Full motion, PTZ control and data communications
- Installers/Integrators familiar with the product
- The obvious......value/cost/quality
Lessons Learned

- Good vendor software is critical to good installation
- Keep it simple
  - Data can be difficult
  - Same protocols preferred
  - PTZ issues can arise
  - Site survey or Spectrum Analysis
- Documentation is Critical
  - Keep track of channels
  - Organization
  - Save configuration files for all sites
- Cabling
  - Seal all connections
  - Local Codes
Maintenance

- Proper tools
  - Field CCTV monitor
  - Color Bar Generator
  - Back-up equipment
  - Patience
  - Supportive crew
  - Vendor Software
- Understanding of the technology
- Site Knowledge
  - Lines of sight and possible conflicts
  - Antenna alignment and polarization
- Boom lift
Questions?

What is your experience?