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Challenges of Deploying Municipal Mesh Networks

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Challenge

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- One of the most significant challenges in designing and deploying a Wi-Fi network is identifying appropriate vertical assets for network Nodes and Back-haul.
- Vertical assets; buildings, light poles, towers, and terrain suitable for mounting wireless gear and establishing clear line of sight (LOS).

Clear Line of Sight (LOS)

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- Establishing a clear LOS between radios and potential subscriber facilities is a critical.
- The frequency of radio waves 802.11 a/b/g operates in is highly susceptible to interference by terrain and vegetation.
- Additionally, the materials used in construction also affect the ability for the signal to penetrate a facility.

Rule of Thumb for LOS

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- In an outdoor network the signal will lose one (db) decibel of your signal for every 3 meters of tree canopy the signal passes through.
- When your signal moves through a facility wall lose 20% of your signal for each wall to signal must penetrate.

Overcoming the obstacles

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- Overcoming obstacles is essential to establishing good link budgets between radio devices. There are three general approaches to deploying Wi-Fi networks in use today.

  1. Point to multipoint networks.
  2. Mesh networks
  3. Hybrid networks

Point to Multi Point

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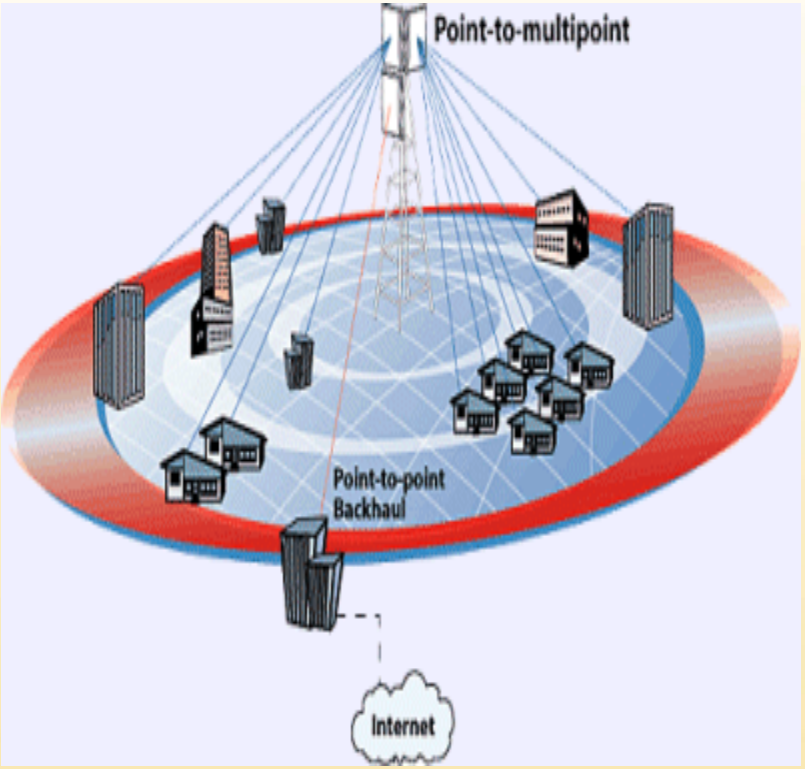
- In the point to multipoint of our environment you can only have central towers that communicate directly to client subscriber devices. (Motorola Canopy is a common point-to-point or point to multipoint network system)

- Subscriber devices will require a clear line of sight to the central tower. The central tower is where the data passes from the radio network to the physical network. (Generally 1.5 to 2 miles subscriber device and tower)



Mesh

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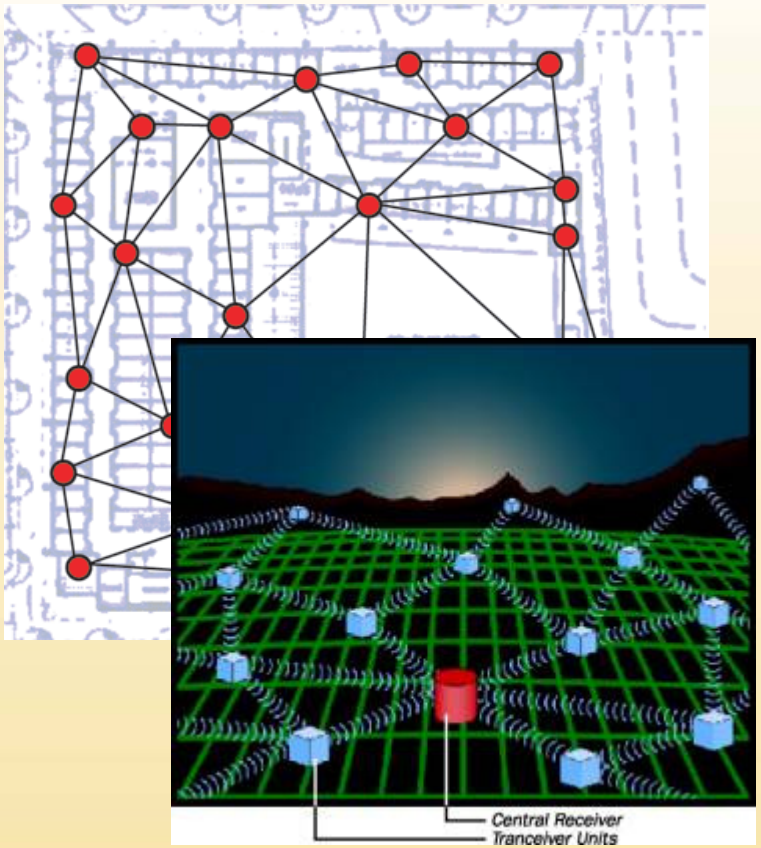
- In a mesh network, nodes within the network pass data from node to node to a central back-haul location with the data are transferred to the physical network.
- Data can travel via multiple dynamic paths across the network.
- The line of sight issues are generally restricted to node to node. (500 to 1000 feet) in a pure meshing environment than nodes may have multiple radios dedicated to passing data in and out of each node. As well as radios dedicated to serving subscriber devices.



Most Networks are Hybrid

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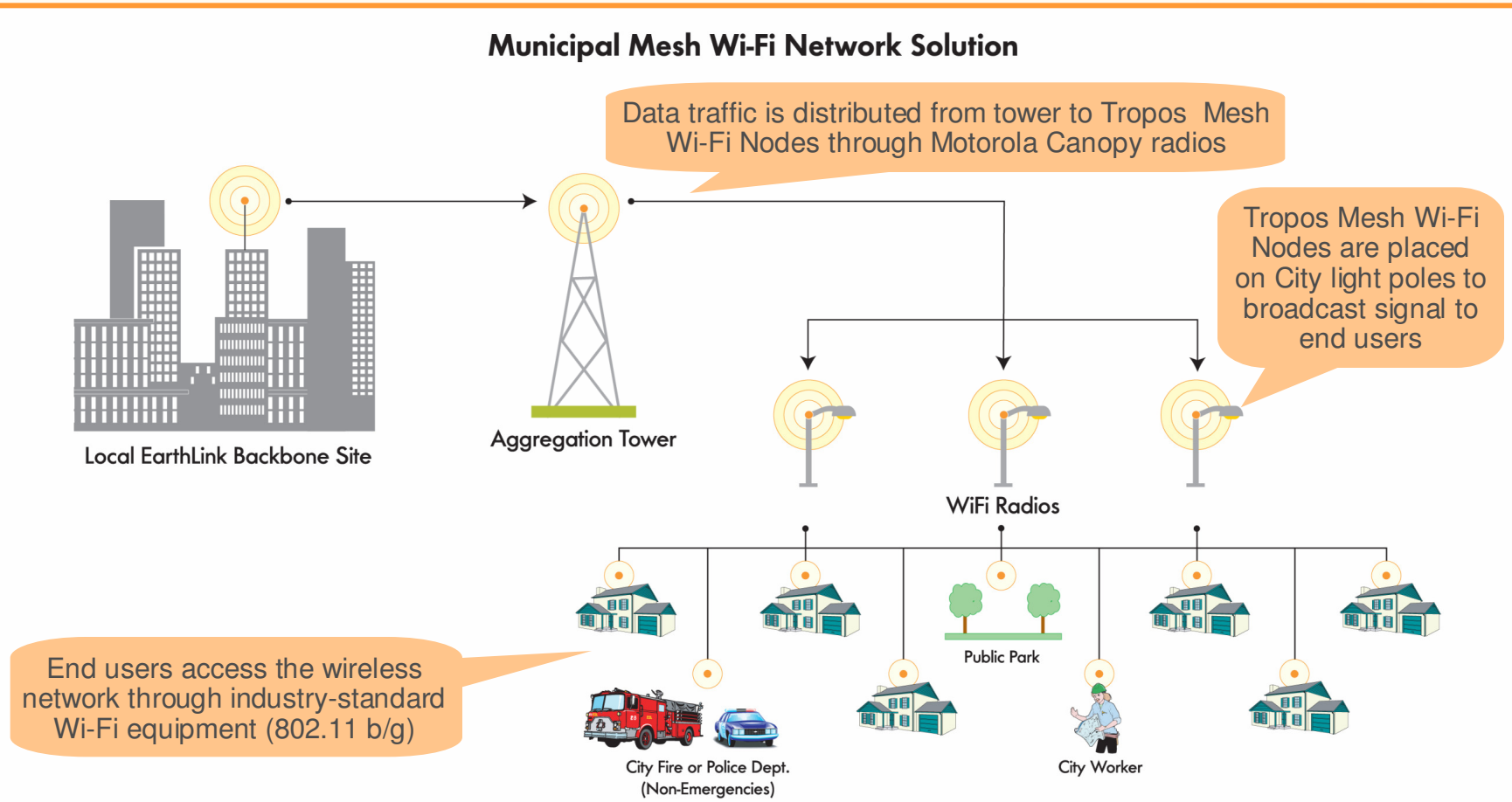

Ubiquitous Coverage

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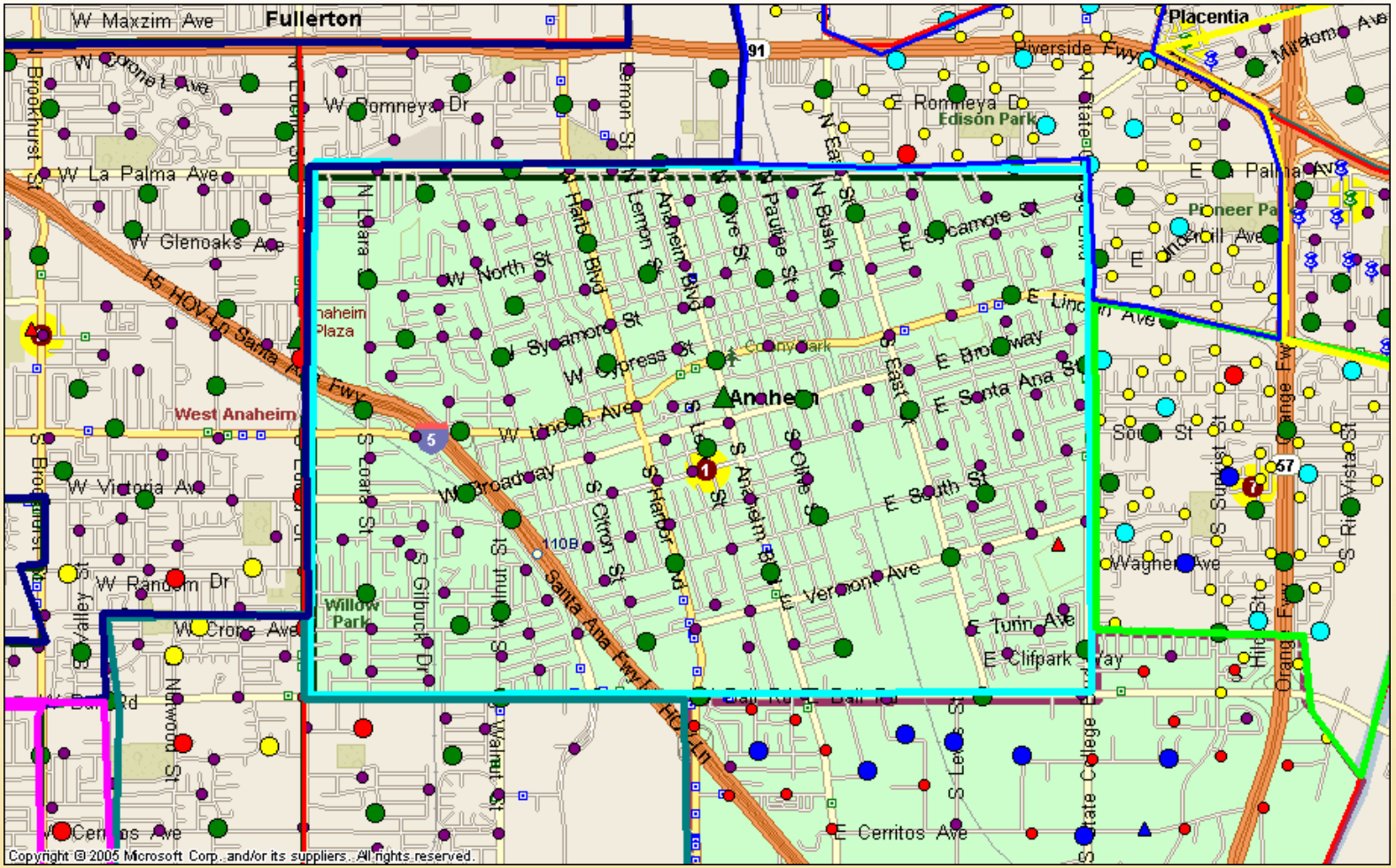

Ubiquitous Coverage

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- Given the environmental clutter, networks generally deploy as few as 30 nodes per sq. mile. I have seen as high as 60 in one sq. mile.
- Unfortunately finding poles to place nodes on can be a challenge. There are a number of forces working against complete coverage.

- Let's examine a few:

  1. The local utility rules and regulations
  2. Gang switched light poles
  3. Decorative light pole
  4. Privately owned and operated poles (Home owner association)
  5. No poles
  6. Trees - Trees - Trees
  7. Old infrastructure - No documentation

1. The local utility rules

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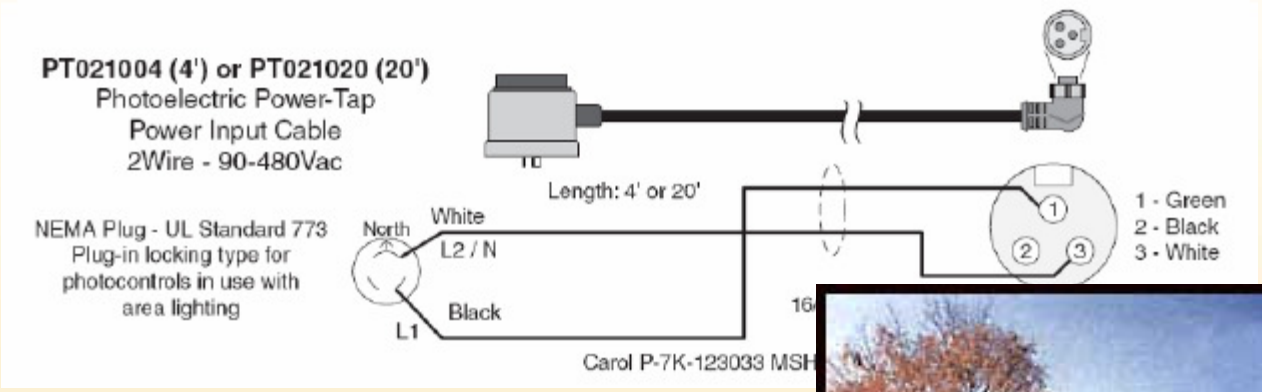
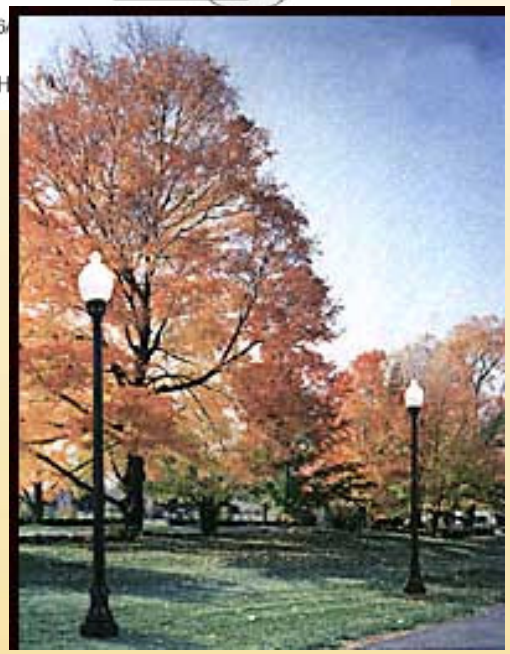
2. Gang switched light poles





- Network access only at night?
- Costs of use prohibitive, rewiring each pole.

3. Decorative light pole

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4. Privately owned and operated poles

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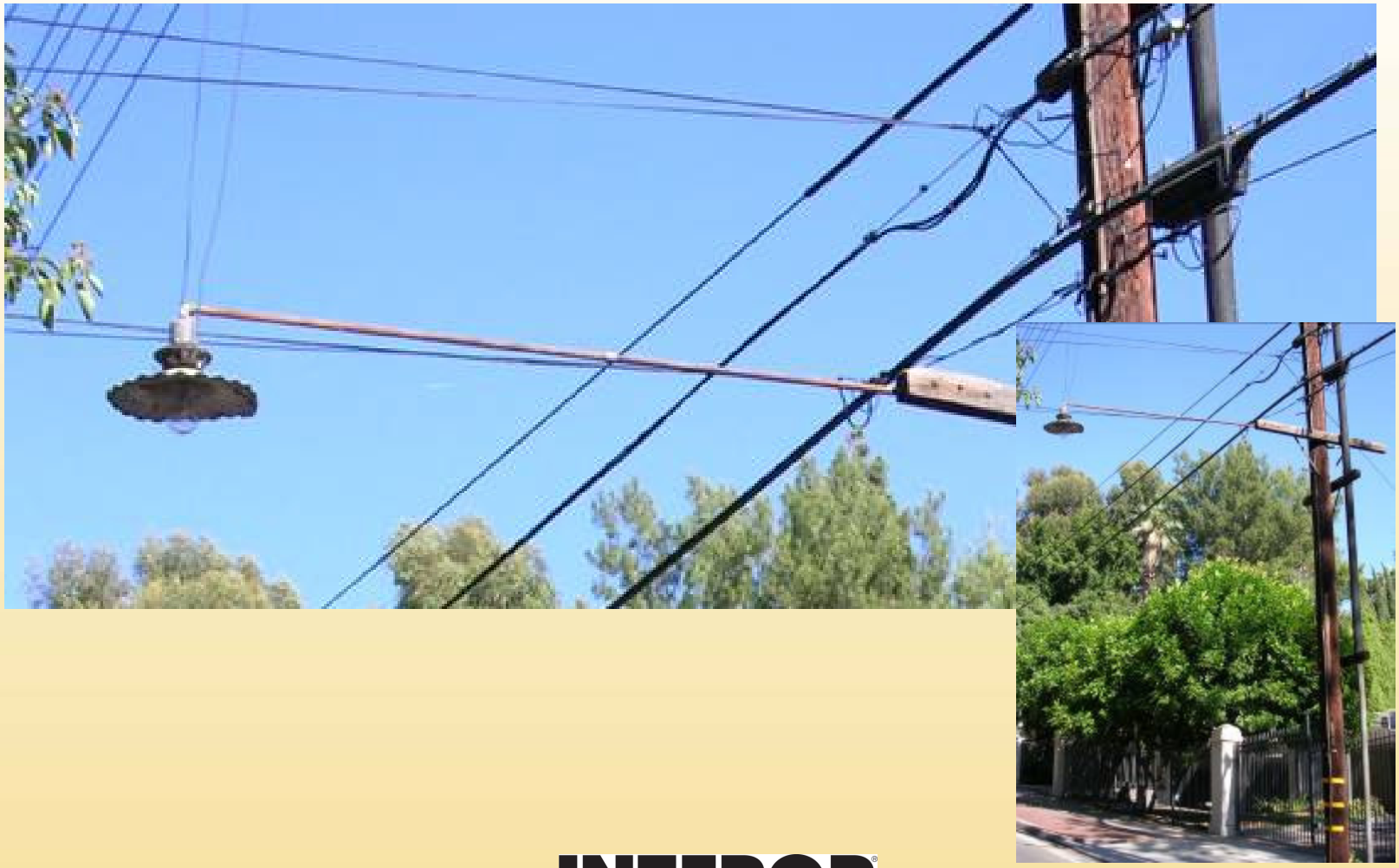

What can the city / wisp do

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- Prepare up to date data
  - GIS layers
    - Pole Data
    - Examine Power systems for pole
- Establish Ownership of Poles
- Expedite Zoning and Permitting
- Process review – Type and Classification
- Not Cellular Zoning Process
- Review local Utility Rules and Regulations

What can the city / wisp do

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- Do your home work
- Have clear expectations and goals
- Involve Stakeholders early, look for opportunities
- Ask Questions
  - Lots of Questions

Follow up

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- Contact Information
- This Presentation
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