



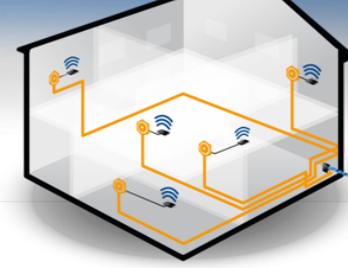
Wi-Fi® In-premise Problems

Kinney Bacon, PE
Principal Engineer
Premises Technology
Cox Communications



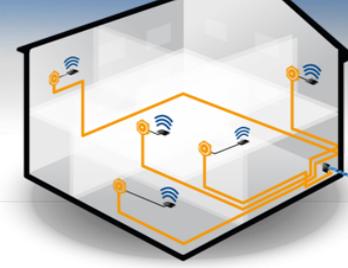
MoCA® Makes
Wi-Fi™ Better

What are Premises?



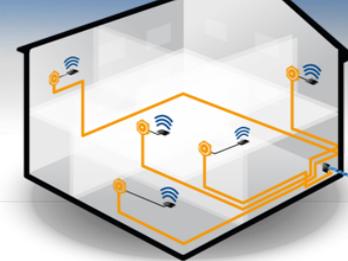
- The following are considered to be premises.
 - Single family unit (SFU)
 - Generally a single building with one family.
 - Others that can be treated as an SFU:
 - A duplex, triplex, etc (two or more families in a single building)
 - Interior generally wood studs with drywall and wood floors.
 - Problem units can have plaster walls, metal studs, concrete floors, etc.
 - Multiple dwelling Unit (MDU)
 - Generally apartments, condominiums, townhomes.
 - Can be single to many stories tall.
 - Interior can be wood studs with drywall to concrete floors and walls.
 - Small to medium business (SMB)
 - Can be a single building to a strip mall business to one or two stories in a skyscraper.
 - Interior can be wood studs with drywall to metal studs with cubicles to concrete floor and walls.
 - Institutions not considered for this discussion (schools, hospitals, nursing homes, jails, etc.)

Not all Premises are Created Equal



- There will always be premises that are problems.
- There are too many variables to come up with a one size fits all solution for Wi-Fi.
- You need a tool box available so that you can pick the correct tool for the situation.
 - “I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail.”
Abraham Maslow

Wall Street Journal Article



Culprit in Wi-Fi Failures: Chicken Wire

By Geoffrey A. Fowler

Dec. 31, 2009

- Two things beloved by San Francisco resident Galen Pewtherer that just couldn't get along: his Edwardian-style house and wireless Internet access.
- In 2008, Mr. Pewtherer tried to replace his old-fashioned cable Internet connection with a Wi-Fi network that he could share with other tenants in his building. "It turned out to be impossible," says the 38-year-old program manager at Cisco Systems Inc. "We couldn't get signal in or out of one room."
- That is because Mr. Pewtherer's 80-year-old building in the Mission District, like thousands of other old homes in the Bay Area, was built with the technological equivalent of kryptonite in its walls: chicken wire. **Metal wiring inside old plaster walls blocks wireless signals**, frustrating San Francisco residents as wireless-equipped devices like iPhones and laptops proliferate.

Premises Construction Issues



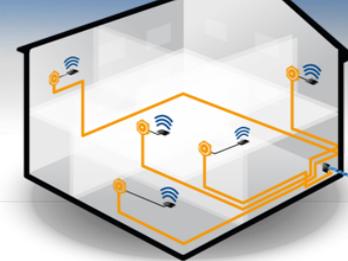
- Examples of materials which impede RF signals
 - Plaster walls w/metal backing
 - Drywall was invented in 1916.
 - Didn't really catch on till post-WW2, hence most older homes have RF resistant plaster walls.
 - Concrete walls/floors/ceilings
 - Generally found in a business premise but sometimes in residential homes (especially w/heated floors as heated floors usually include pipes filled with water).
 - Some building have firewalls which can impede RF signals.
 - Mirrors
 - Mirrors have metal backings, a Wi-Fi signal's kryptonite.
 - Some premises have a lot of mirrors.
 - Energy Efficient Windows
 - Uses transparent metallic films.
 - Can impede outside use.
 - Metal Window Blinds
 - Can impede outside use.
 - Cubicle Walls
 - Generally consists of cloth over metal frame.

Premises Environment



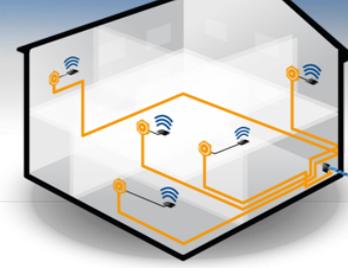
- The location of a premise can impede or degrade Wi-Fi operation
 - Outside interference
 - Radar
 - Microwaves (not just microwave ovens but also general microwave communication)
 - Other ISM band users
 - Electrical noise (harmonics)
 - Wi-Fi congestion
 - Typically in an MDU or business environment
 - Airtime hogs
 - Hidden nodes

Possible Current Solutions (What tools are available)



- **Wireless Solution – Run a Wi-Fi Mesh**
 - Runs into same problems w/premise construction & environment
 - Usually contributes to making congestion even worse
- **Wired Solution – Wi-Fi Extender with wired backbone**
 - **Ethernet**
 - If it's there, but usually not in many SFUs and MDUs, more prevalent in SMBs
 - Premise could be rewired but that's expensive
 - Up to 2.5 Gbps possible but typically 1 Gbps
 - Ethernet switch required for > 2 connections
 - Privacy – data on the wire is in the clear
 - **MoCA**
 - If coax currently exists, then excellent solution
 - For cable operators, best solution since coax usually exists
 - Up to 2.5 Gbps (MoCA 2.5), 1 Gbps (MoCA 2.0 bonded)
 - Compatible with cable and satellite systems
 - MoCA band D is > 1 GHz
 - MoCA Band E is 500 – 600 MHz
 - Already deployed in many cable systems
 - No external switches required (mesh solution) for up to 16 connections
 - Privacy – data on the wire encrypted (if enabled)
 - POE (Point of Entry) filter recommended

Possible Current Solutions (continued)



- **Wired Solutions**
 - **PowerLine**
 - US homes wired with two different circuits (240 VAC split to 120 VAC)
 - Powerline uses ground wire to cross the circuits
 - Not simple for pre-1960s premises
 - Unless premise rewired, usually no ground wire is present
 - A bridge can be installed but needs certified electrician
 - Generally can get up to 200 Mbps
 - **G.hn**
 - Not commonly used in the cable industry
 - Coax version not compatible with cable TV signals
 - Can get up to 2 Gbps