

Obvius training

Advanced ModHopper RF

Agenda

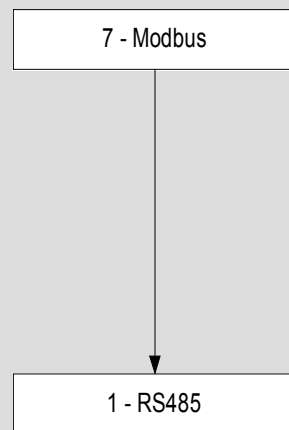
- ModHopper features and functions
- Mesh functionality
 - Routing
 - Link quality and budgets
 - Interference
- Modbus addressing and issues
 - RS 485 node detection
 - Data routing
- Miscellaneous

ModHopper operational overview

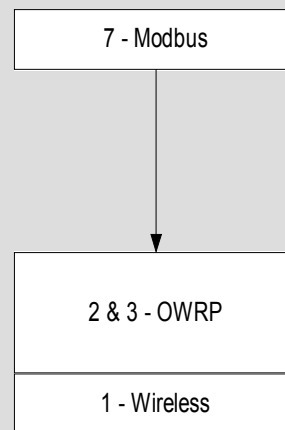
- ModHoppers and the OSI model

Packet Formats: 26 Aug 2004

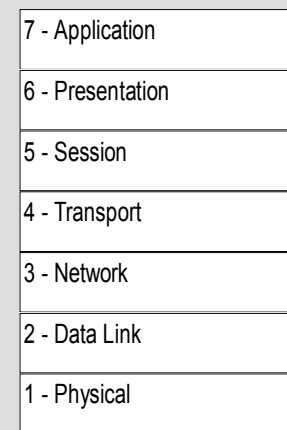
Standard Modbus Implementation



Wireless Modbus Implementation



OSI Model

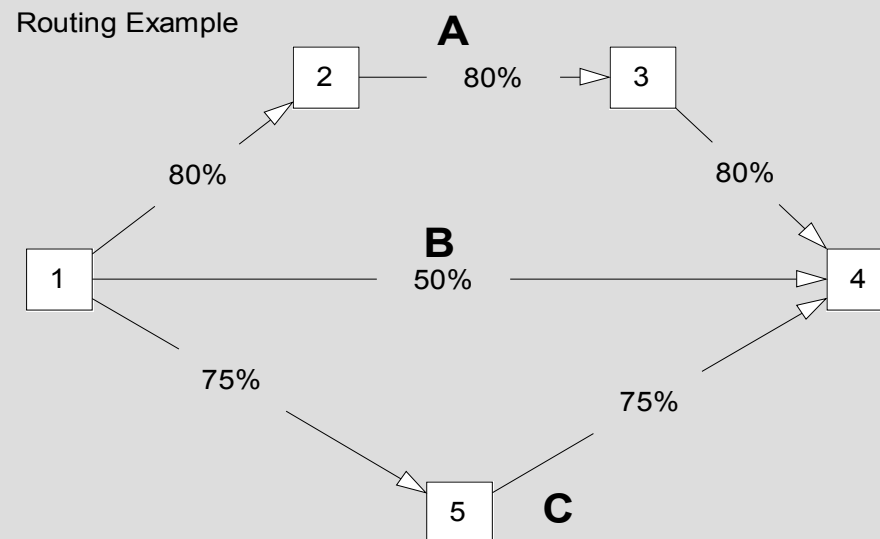


ModHopper Modbus functions

- MH routes modbus wirelessly
- Provides direct pass through for Modbus queries from Master to Slave
- Inspects CRC at end nodes
- Uses modbus registers for remote diagnostics

ModHopper mesh functions

- Organization of routes
 - Locate all peers on network
 - Evaluate each link for best delivery (hops and retry counts)
 - Find best known target for delivery
 - Minimize hops where possible:



Link quality issues

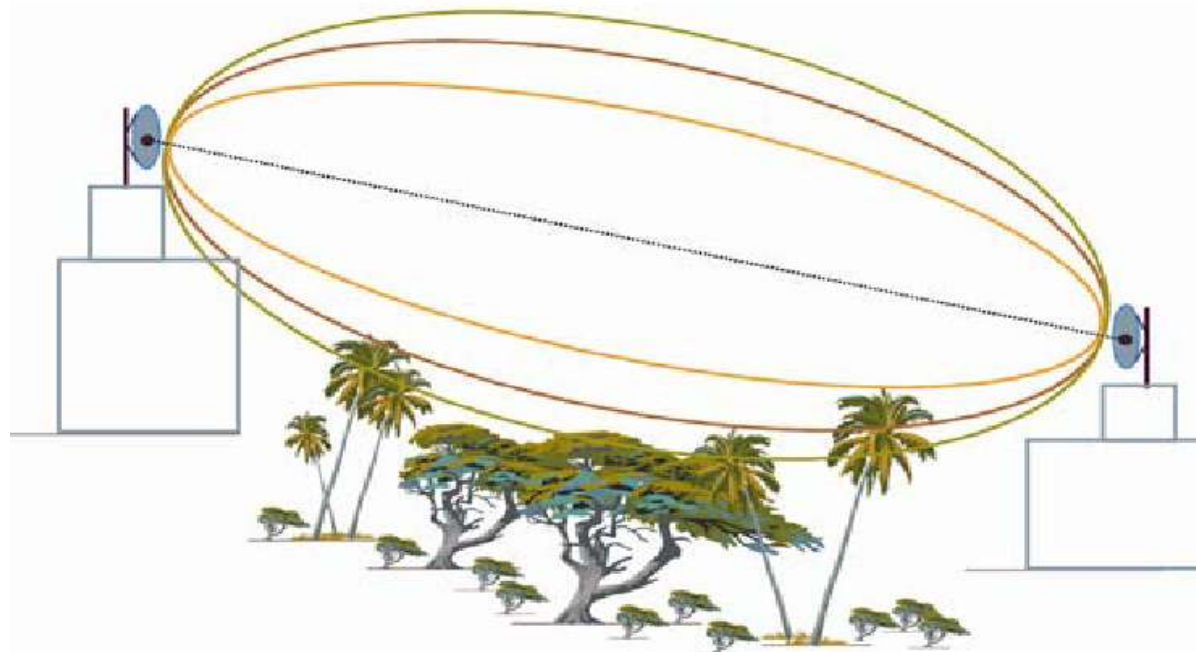
- RSSI
- Loud vs Good
- dB is a log scale (+3 dB = 2x power)
 - 1 mW = 0 dBm
 - 10 mW = 10 dBm
 - 100 mW = 20 dBm
 - 1 W = 30 dBm

Link budget estimation

Fresnel zone

(Example: 1000 ft between radios requires 16 ft diameter wide path at center)

Physical Obstructions overcome by antenna height



Link budget estimation (2)

- Indoor signal loss:
 - Link budget:
 - Transmit: 20 dB and Receive -107 dB; total 127 dB
 - Less receiver sensitivity is allowed if there are other sources of RF
 - 100 dB to 120 dB is generally a good working value
 - Free space signal loss (indoors):

Distance	900 Mhz free space loss
10 meters	72.5 dB
100 meters	92.5 dB
1000 meters	112.5 dB

Link budget estimation (3)

Material attenuation examples:

Glass 0.25" (6mm)	0.8 dB
Glass 0.5" (13mm)	2 dB
Lumber 3" (76mm)	2.8 dB
Brick 3.5" (89mm)	3.5 dB
Brick 7" (178mm)	5 dB
Brick 10.5" (267mm)	7 dB
Concrete 4" (102mm)	12 dB
Masonry Block 8" (203mm)	12 dB
Brick faced concrete 7.5 " (192mm)	14dB
Masonry Block 16" (406mm)	17dB
Concrete 8" (203mm)	23dB
Reinforced Concrete 3.5" (203mm)	27dB
Masonry Block 24" (610mm)	28dB
Concrete 12" (305mm)	35dB

Other mesh issues

- Sustained signal quality over time
- Options for dealing with interference
- Acknowledge/resend per hop

Modbus addressing

- RS 485 node detection
- Importance of unique addressing
- Routing of data to known destination
- No broadcast