



Recent Investigations and Future Developments in the Wireless Front

Ricardo Carrano

Agenda

- 9.1 Recommendations
 - Some maybe 9.2, some maybe 8.2.1
- Princeton stuff
 - Not research, ready to go
- Libertas Thin Firmware
 - AP and o12s
- 8.2 Recommendations

Recommendations

- **Implementation**
- **Diagnose**
- **Test**

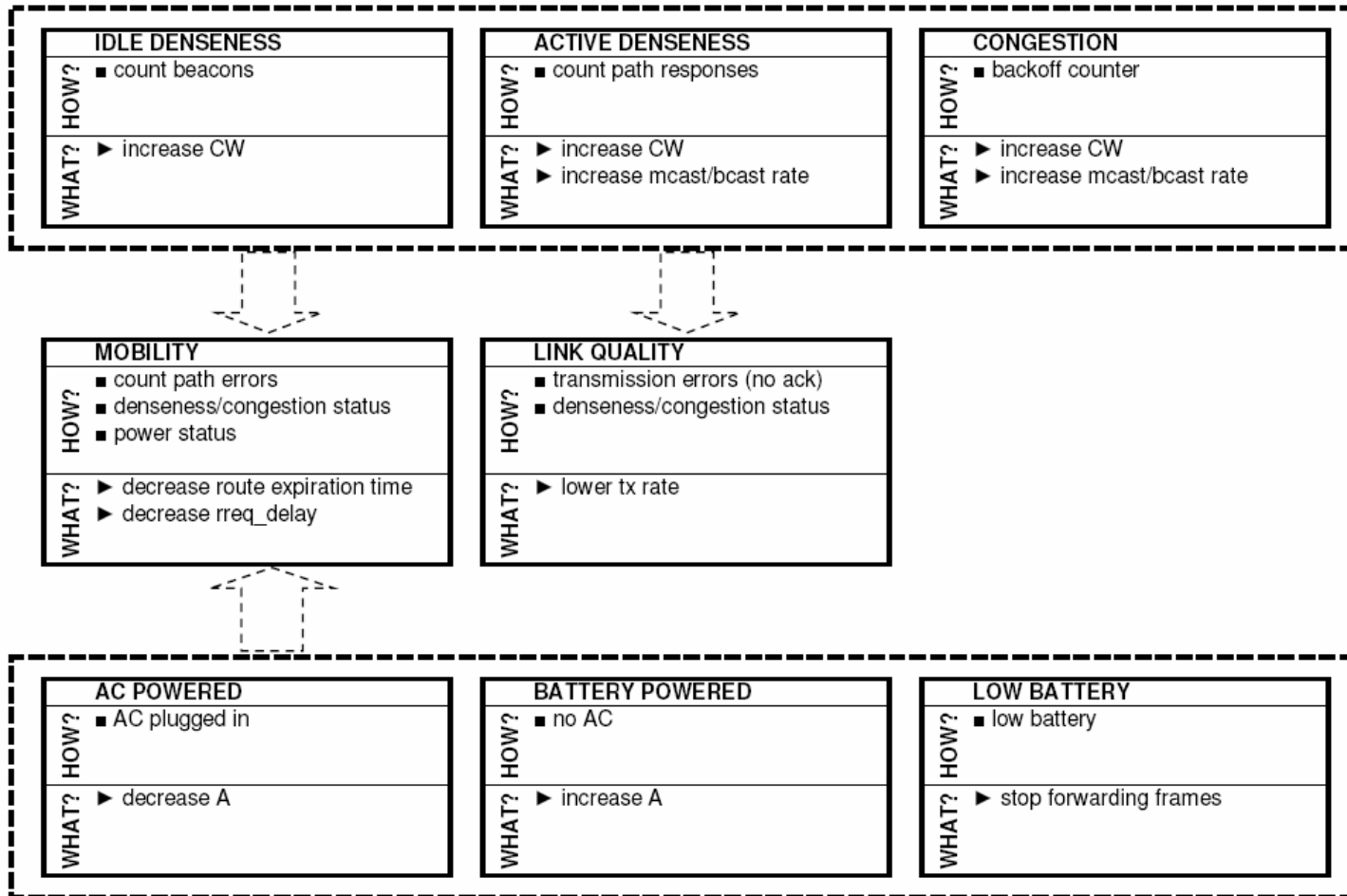
Implement Recommendations

- **I1. Detect and Adapt: The Mesh Adaptation Daemon**
- **I2. Reduce the management traffic**
- **I3. Implement a better rate adaptation algorithm**
- **I4. Agnosticism of the presence service**
- **I5. Implement a new (PHY) Physical layer**
- **I6. Adjust costs (metric) in each of the PREQs**
- **I7. Improve Network Wide Broadcast spectrum efficiency**
- **I8. Improve ip addressing scheme in the mesh**
- **I9. New version of NetworkManager**
- **I10. Increase Route Expiration time**
- **I11. Change Contention Window Size**

(I1) Detect and Adapt

- different animals
 - dense mesh and a sparse mesh
 - 1cc and Piratininga
 - Infra mode vs mesh mode
 - XO vs Active antenna

Mesh Adaptation Daemon



Example heuristics

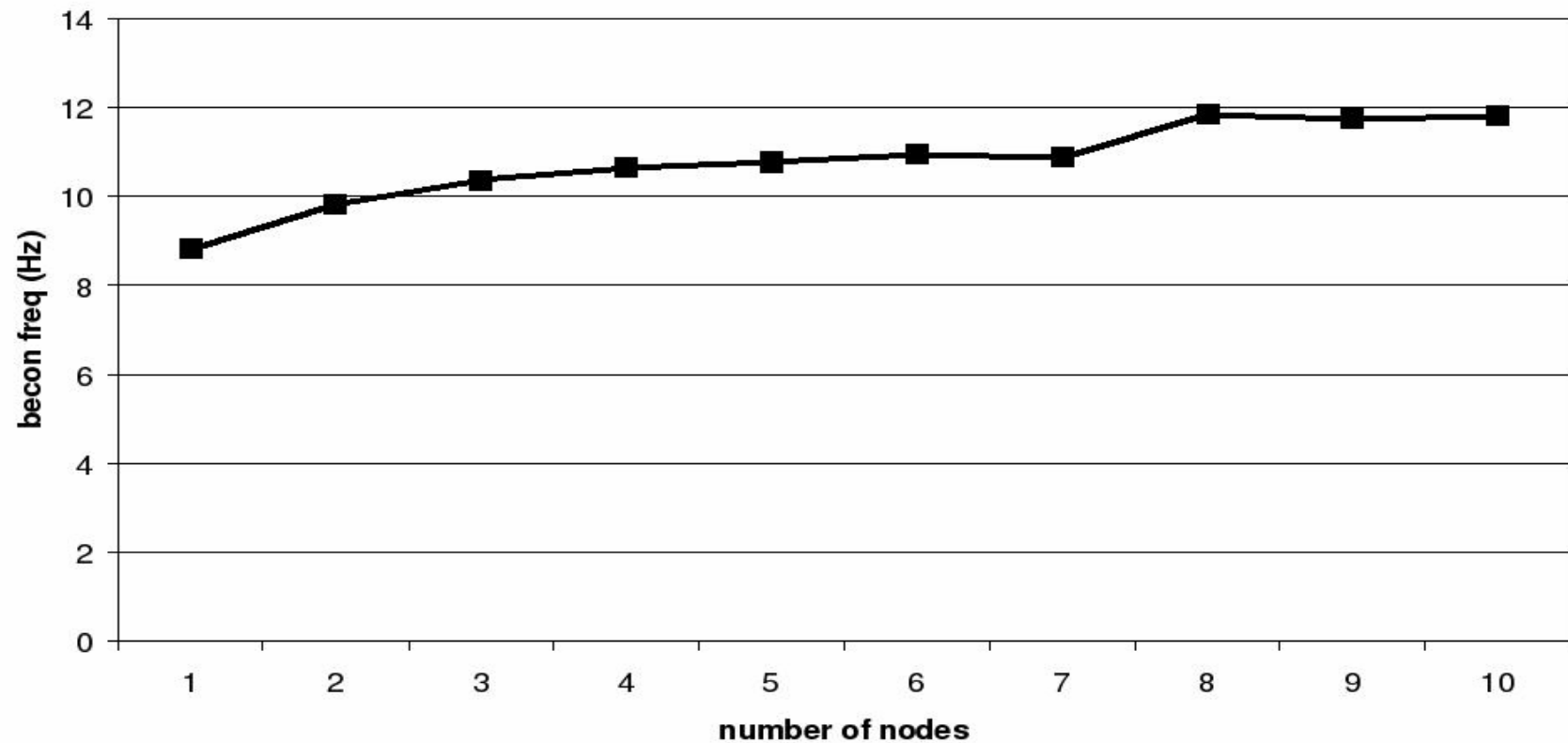
- Density vs Multicast Rate
 - In a dense mesh cloud we should increase the multicast/broadcast rate.
 - The higher the rate a frame is transmitted
 - the less airtime it consumes
 - the shorter the distance
- Power vs Metrics
 - If a node runs on battery, it should advertise worse metrics

(I2) Management traffic

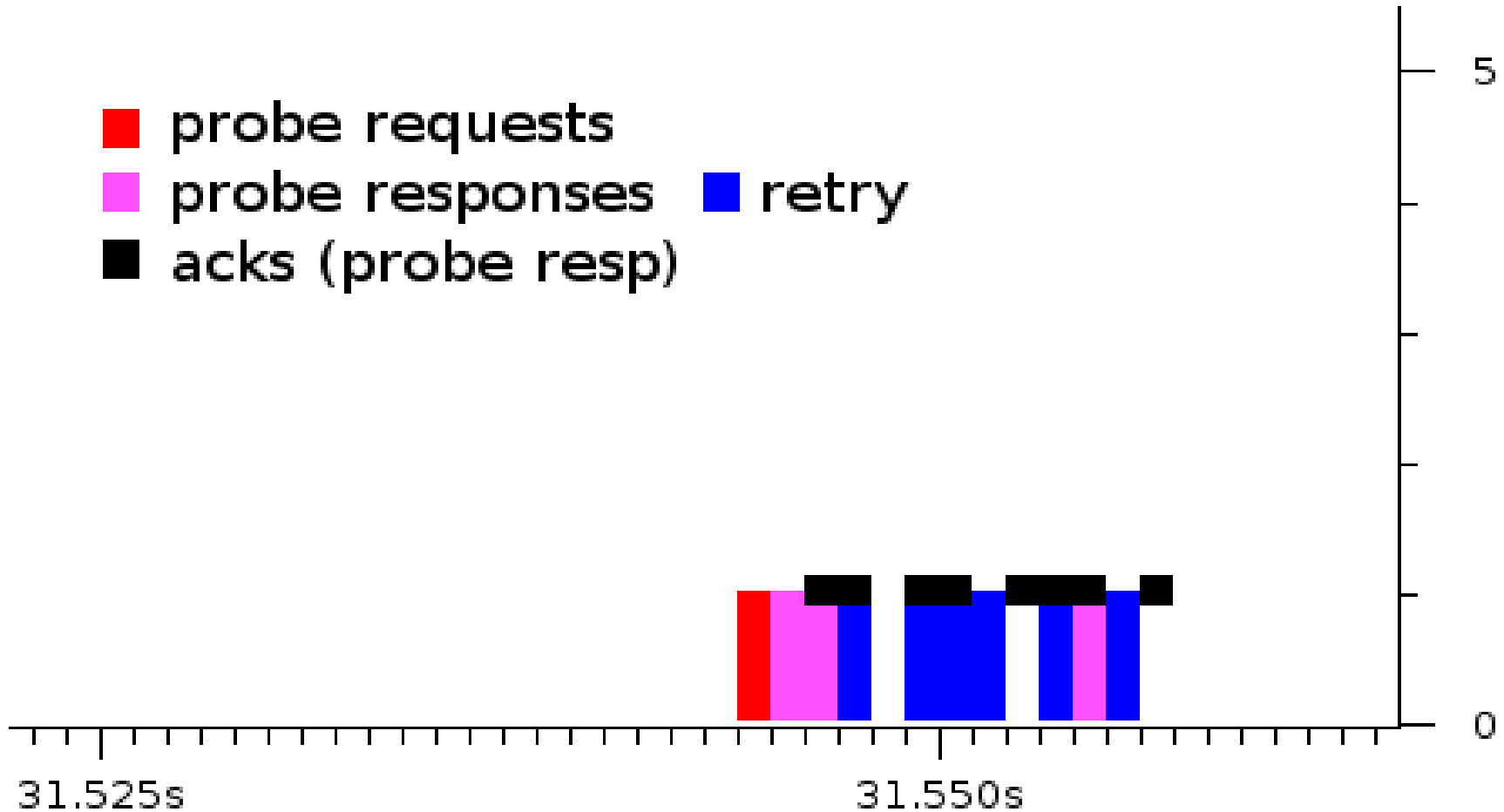
- Management frames transport announcement information
 - Beacons
 - Probe Request/Response

Beacon Frequency

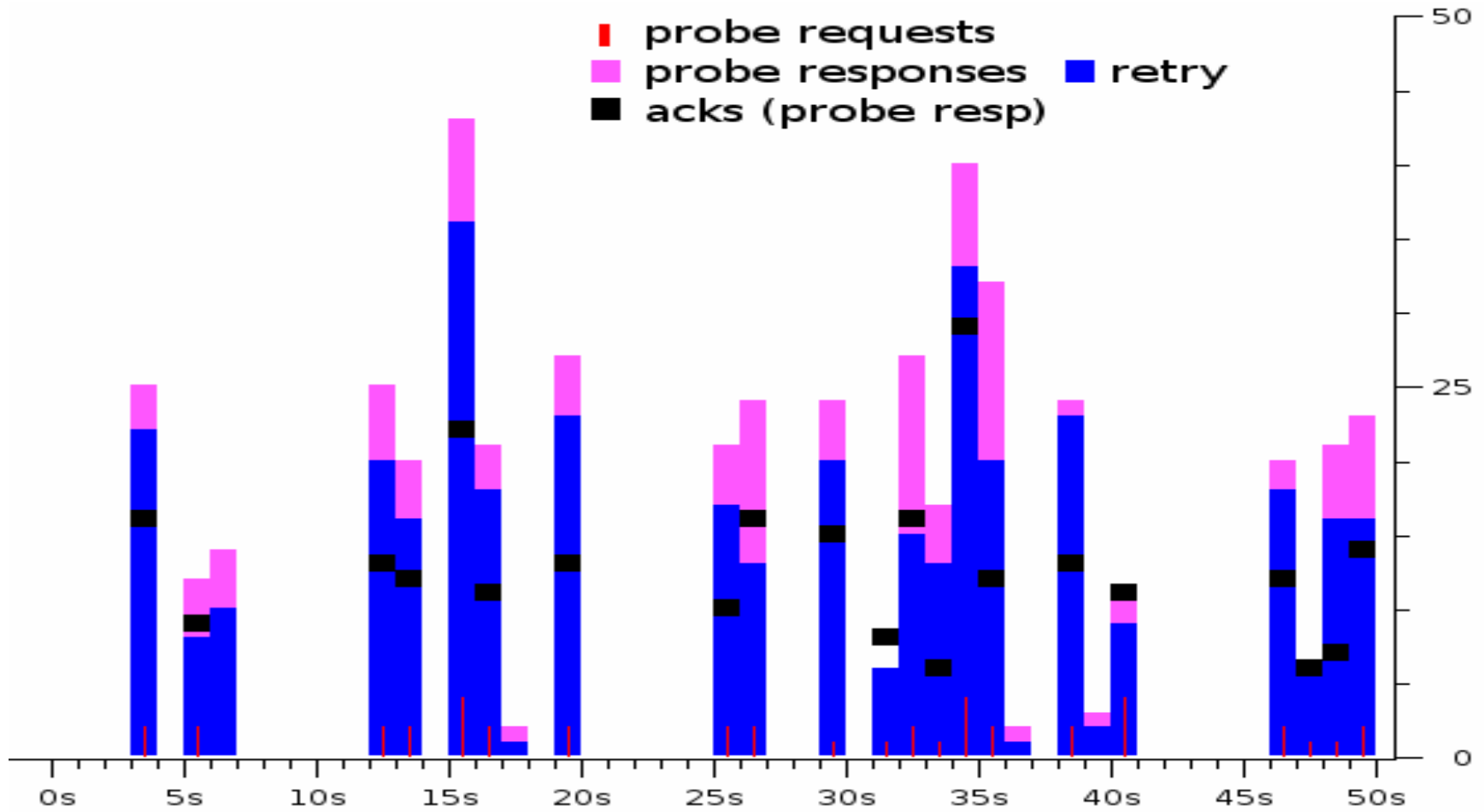
Aggregated beacon frequency (Hz)



Probe storms



Probe storms



Reduce Management Traffic

- Decrease beacon frequency
 - From 10Hz to 1Hz
- Reduce probe traffic
 - Probe Response Retries

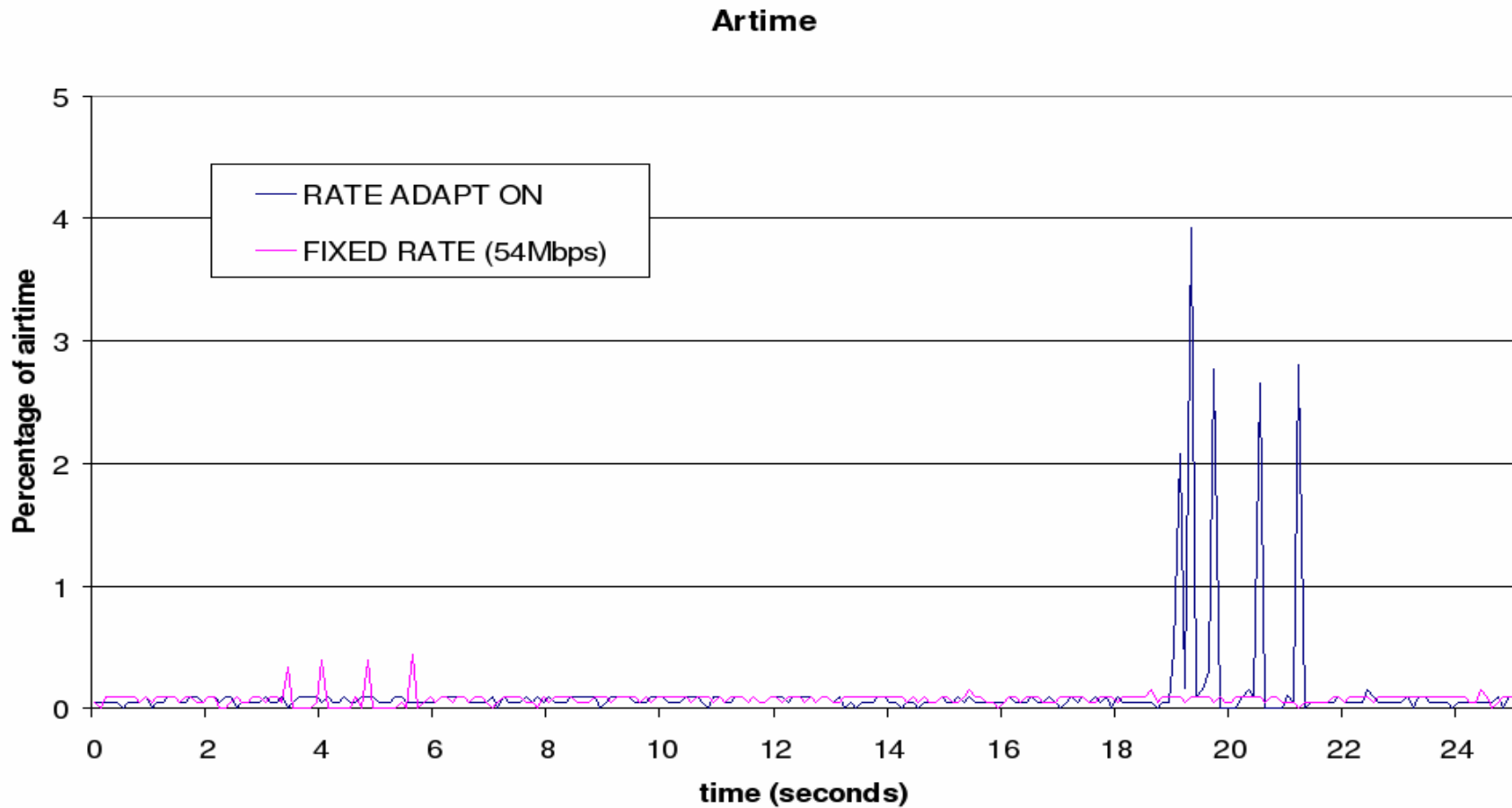
Rate Adaptation Logic (I3)

- XO can transmit frames at many data rates
 - 54, 48, 36, 24, 18, 12, 9, 6 Mbps (802.11g)
 - 11, 5.5, 2, 1 Mbps (802.11b)
- The higher the rate a frame is transmitted
 - the less airtime it consumes
 - the higher the probability of corruption

Rate Adaptation Logic

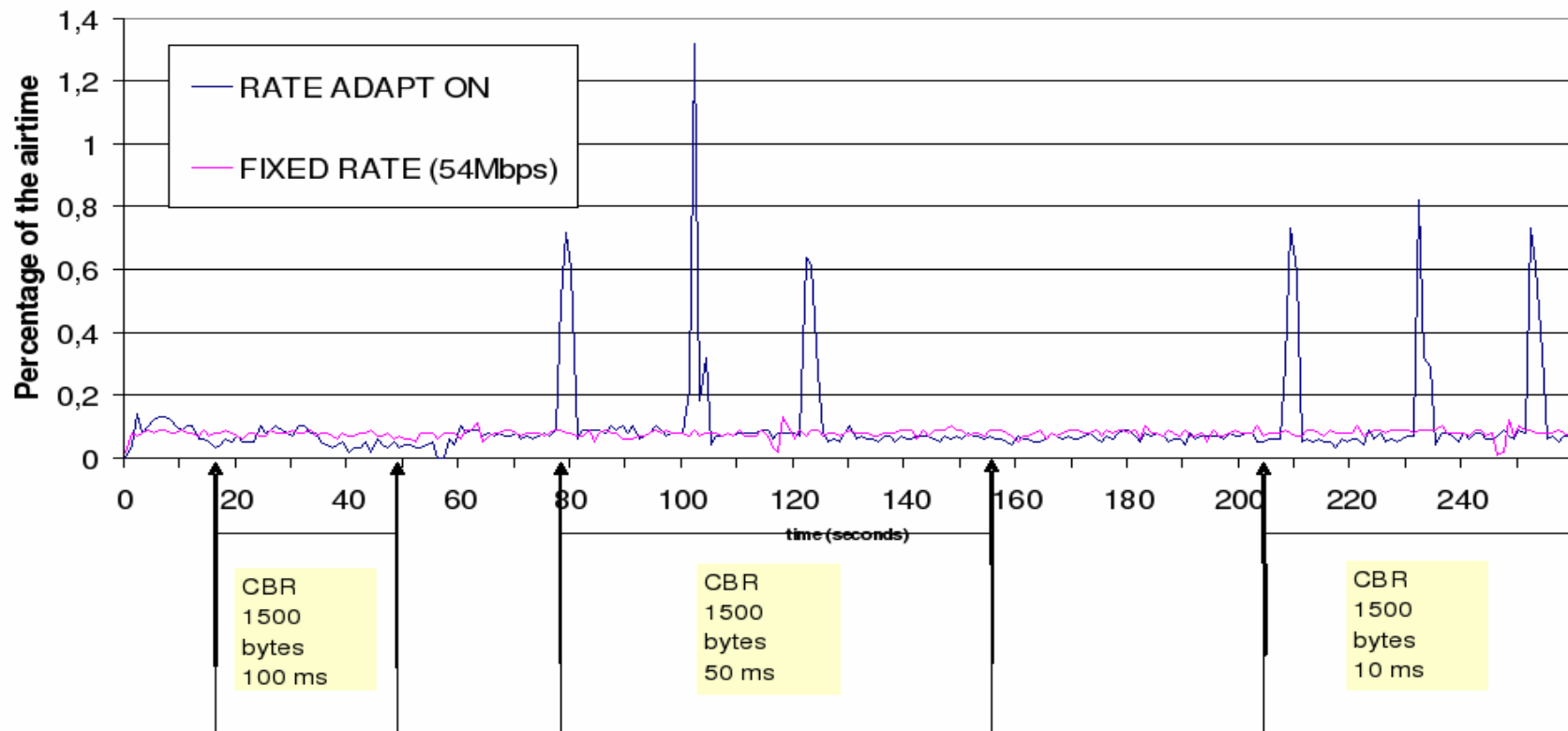
- ARF
 - If a given number of consecutive frames
 - Fail ► decrease rate
 - Success ► increase rate
 - Main issue
 - No distinction between losses due to noise and due to congestion

Making things worse



Making things worse

Airtime consumption as a varying CBR flow is activated



Metrics (I6)

- Adjust values for metrics
 - Costs for PREQs (54, 36, 11 and 1Mbps)
 - Current values: 13, 28, 46, 64
 - Proposed values:
 - XO: (963, 1073, 1997, 12906)
 - Active antenna: (962, 1072, 1996, 12905)
 - Better yet: MAD (take other metrics into account)
 - Battery
 - Mobility

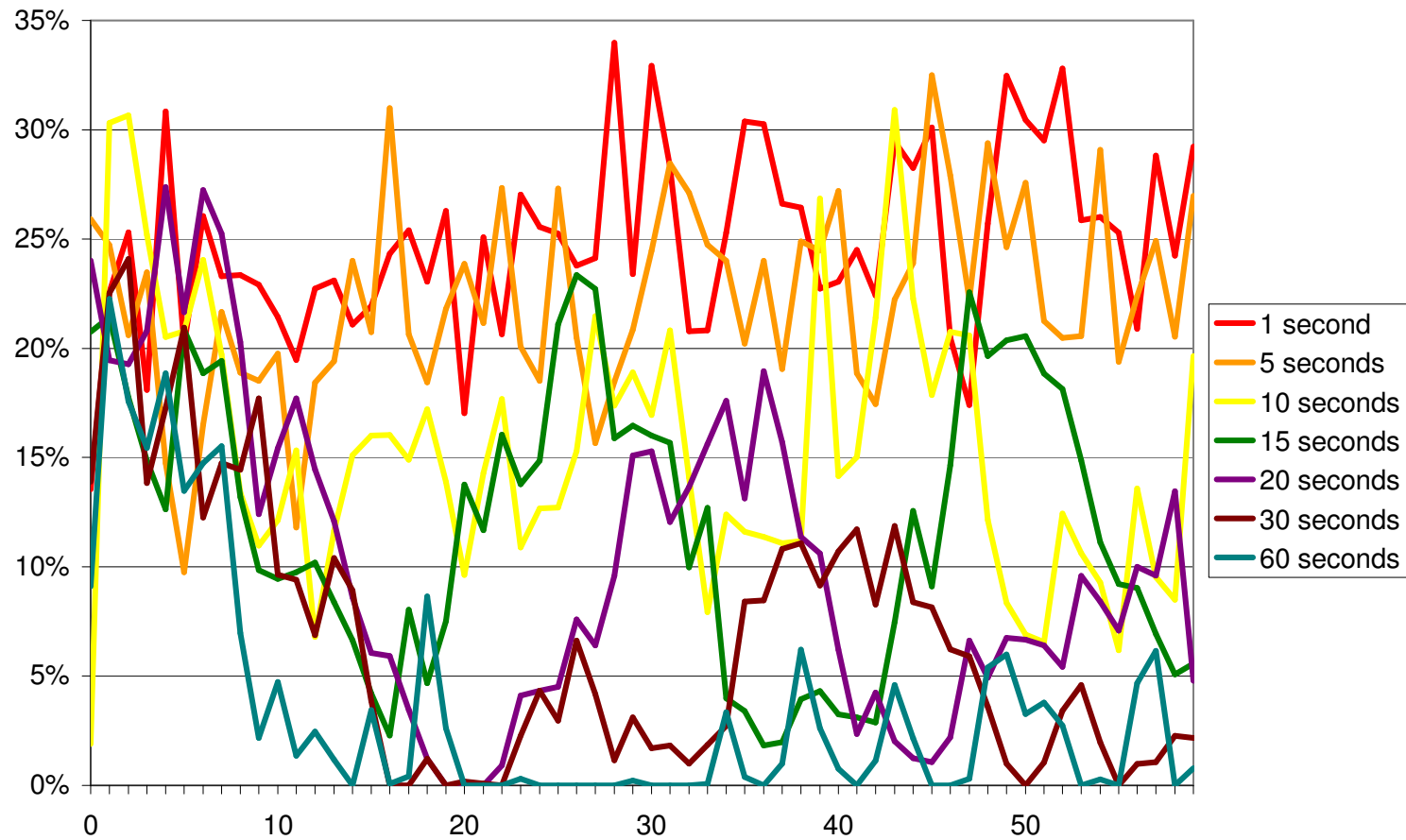
NWB efficiency (I7)

- A mesh need to be flooded
 - Some information has to achieve all the XO's
 - Presence information
 - Path discovery mechanism
 - We want to do it more efficiently than Simple Flood
 - SBA (Scalable Broadcast Algorithm)

Route Expiration Time (I10)

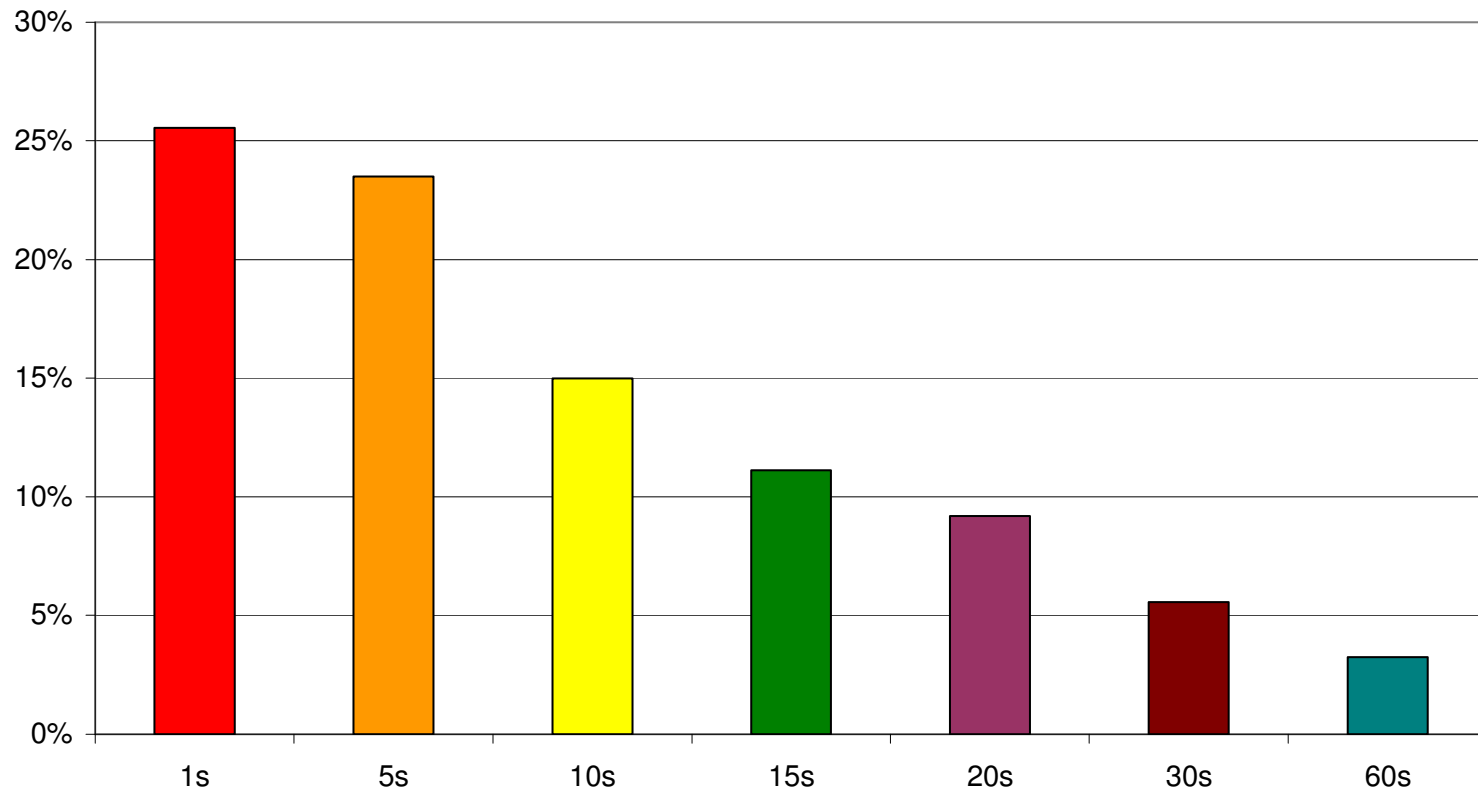
- After X seconds every path will be rediscovered
 - Flood the mesh cloud
- The tradeoff
 - Frozen vs Clogged

Colorful Graph



Mean Airtime Taken

Mean airtime consumption



Route Expiration Time

- Currently this time is 10 seconds
- Recommended value is 20 seconds
- Better yet: again adapt: MAD
 - Mobility
 - Density

Contention Window (I11)

- Stations (XOs) that have data to transfer will wait for a random number of time slots before sending the frames
- The number of time slots is determined by the Contention Window
 - XO previous default: [7,15]
 - Suggested values: [31,1023]

Diagnose and Testing

- D1. The manually added path enigma
- D2. The Internal Flow control black hole

- T1. Test facilities
- T2. Test suite
- T3. Simulation environments

Princeton

- Hash cache
 - Much more efficient than squid
- TCP
 - More suitable for poor links
- PlanetLab
 - Deploy and manage school servers

Thin Firmware

- MAC Sublayer (PLME + MLME)
 - Thin Firmware (PLME only)
 - Thick Firmware (PLME + MLME)
- Authenticate, Deauthenticate, Associate, Disassociate, Reassociate, Beacon, Probe
- Currently Linux community leans towards softmac/thin firmware

The XO as an AP

- XOs can be access points
- Thin firmware
 - Firmware
 - Driver
 - Hostap

o11s

- Unicast Forwarding
- {Broad,Multi}cast controlled flooding.
- Hybrid Wireless Mesh Protocol
- Airtime link metric
- Mesh Peer Links
- Per-neighbor rate adaptation
- Mesh beaconing and scanning
- Mesh ID

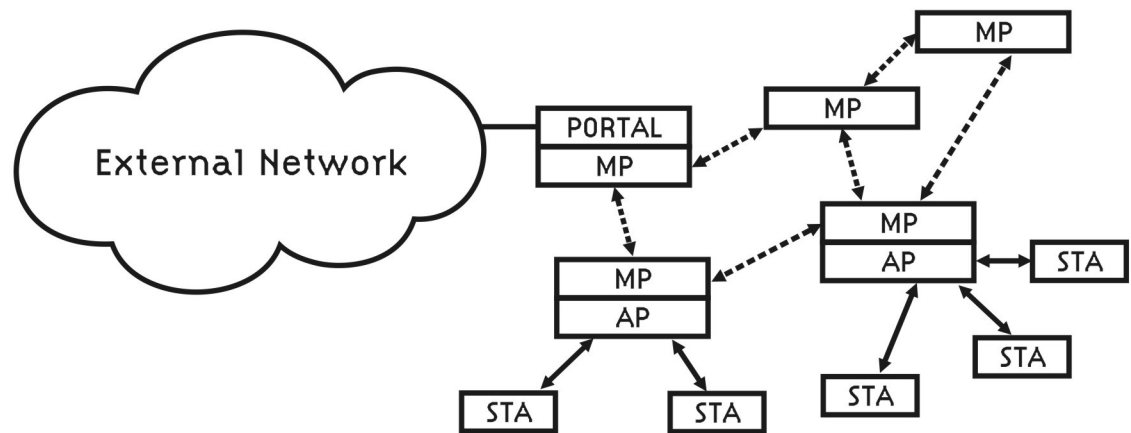
8.2 Recommendations

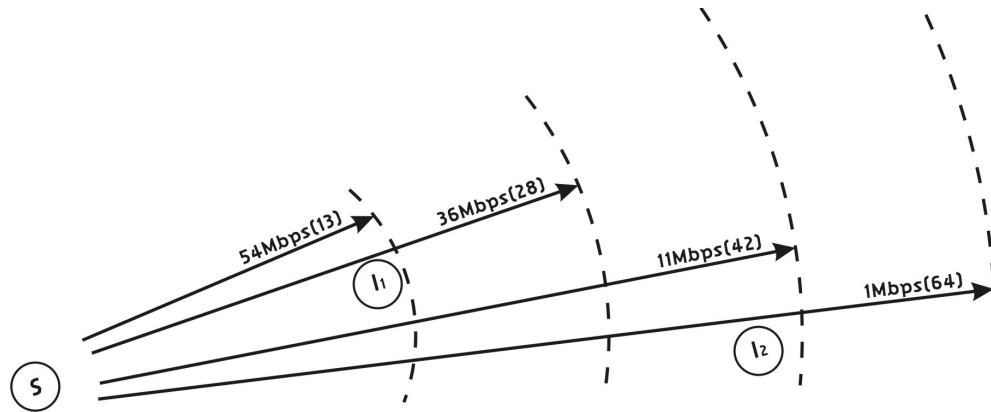
- Wireless crashes
 - New driver in 2.6.25
 - Action: Marvell released 22.p18
- No msh0
- Collaboration
 - Telepathy issues
 - Action: Generate logs and send them to Collabora
- Suspend related
 - udev?
 - Action: Cozybit is looking into the driver
- Duplicated AP
 - NetworkManager and Sugar
 - Action: Look into NM

References

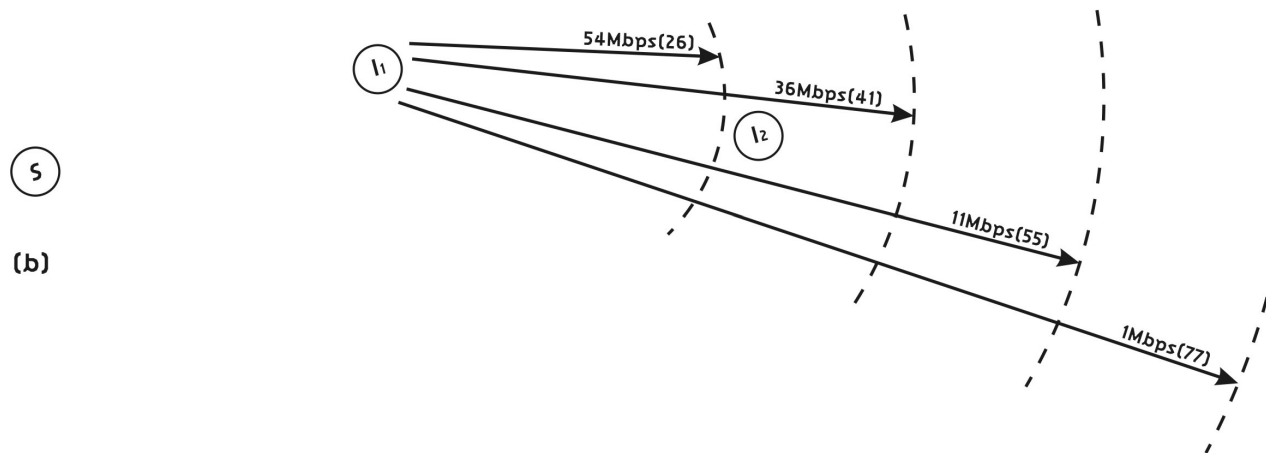
- http://wiki.laptop.org/go/Wireless_Recommendations
- http://wiki.laptop.org/go/Path_Discovery_Mechanism:Metrics
- http://wiki.laptop.org/go/XO_as_AP

Thanks for your time!





(a)



(b)