Cross-Layer or Not?
10 dB or not 10 dB

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Recall Reasons for Layering

- Simple, modular, decoupled functionality.
- Changes in one layer does not effect others.
- Minimize “spaghetti” coding.
- Established legacy. Bugs worked out.
- Scalable (IPv6)

Adventures in Cross Layering will trigger “The Law of Unintended Consequences”.

Problems and Opportunities for Cross Layering

- Layering is too constraining and inefficient.
- In wireless, the physical layer plays a major role – fading, Multipath, interference mitigation requires involvement of MAC layer.
- Optimum routing in ad-hoc involves network layer.
- Smart Energy use, location and application awareness and security involves MAC, Network and application layers.

Military Wireless Networks (Intelligent Adversary)

- Jamming >sense, analyze and take action
  - FH, smart antenna, adaptive data, code rate, etc.
- LPI > adjust power, code rates, data rates
- Security > DOS, authentication, encryption
- Unique latency issues > real time control
- Partial destruction > rerouting
- Reconfigurable > change bands, signal formats
- Sensor networks

Unintended Consequences

- Tendency towards proprietary protocols.
  - Dissimilar, incompatible, away from universal.
  - Optimization for specific circumstances.
  - Legacy and universal acceptance is lost. Lifetime costs.
  - Inhibition of user creativity, impede technology growth.
- "Spaghetti code."
  - Inflexible, difficult to change.
  - Prone to flaws.
  - Prone to instabilities (loops with latencies).
  - Interactions may be adverse and cancel any gains.
- Optimization is a target for Intelligent Adversary

One Size Fits All Will Not Work

- Always have no cross layer as a backup
- Discrete Switchable Layer functionality