

The Internet - a Tutorial for Physical Layer Engineers

karn@qualcomm.com

The Basic Problem

- Internet and Telcos are oil and water
 - different skill sets
 - different culture & philosophy
- The telco culture (unfortunately) permeates wireless cellular
- Little cultural exchange

The Need

- There's a real need for an IETF-blessed BCP document that tells telcos & physical layer designers what they need to know about the Internet
 - now that they actually care
- This would have been *very* useful to me 5-6 years ago at Qualcomm
 - it's still not too late, though

Experience: IP over IS-95 CDMA

- Proselytized end-to-end principle
 - *still* a lot of resistance - just as with the theory of evolution
- Designed lightweight radio link protocol
 - reduce frame loss rate to tolerable level
 - TCP, etc, still ultimately responsible
- Major battle, internally and externally
 - “We don’t like where this Internet stuff is leading”

Misplaced Priorities

- Missing stuff:
 - multicast support
 - TOS control of link-layer retransmission
 - **DEPLOYMENT!**
- Less-than-totally useful stuff:
 - short messaging
- Stuff better done at higher layer:
 - Wide-area mobility
 - Compression
 - Encryption
- Totally gratuitous stuff
 - AT modem & fax emulation
 - voice/data switching

Other Issues

- FEC & ARQ
 - what's the appropriate packet loss rate?
- “It's the latency, stupid!”
 - bandwidth & reliability matter only as they affect latency
- Management of connection-oriented channels
- Forget OSI

The real message

- “In protocol design, perfection has been reached not when there’s nothing left to add, but when there is nothing left to take away”
 - Ross Callon, RFC 1925