C802.20-03/53

OPERATOR SYSTEM REQUIREMENTS FOR MBWA

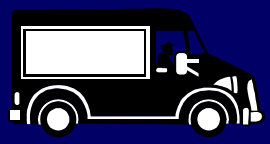
Khurram P. Sheikh
Chief Technology Advisor
Sprint
khurram.p.sheikh@mail.sprint.com

802.20 May 2003 session

TOTAL ACCESS

Home Domain

Video Streaming - Conferencing Apps



Field Service Apps

High BW Connectivity

Portable Remote Access Services

High BW Connectivity

Work Domain

Portable Office

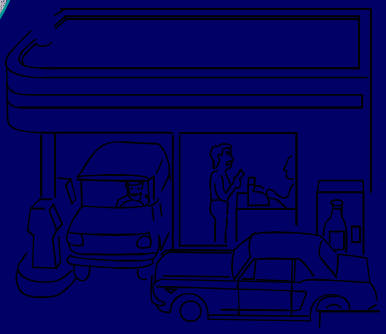
Seamless, Ubiquitous Experience

Campus W- PBX Services

Portable Services in Public Hot-Spots

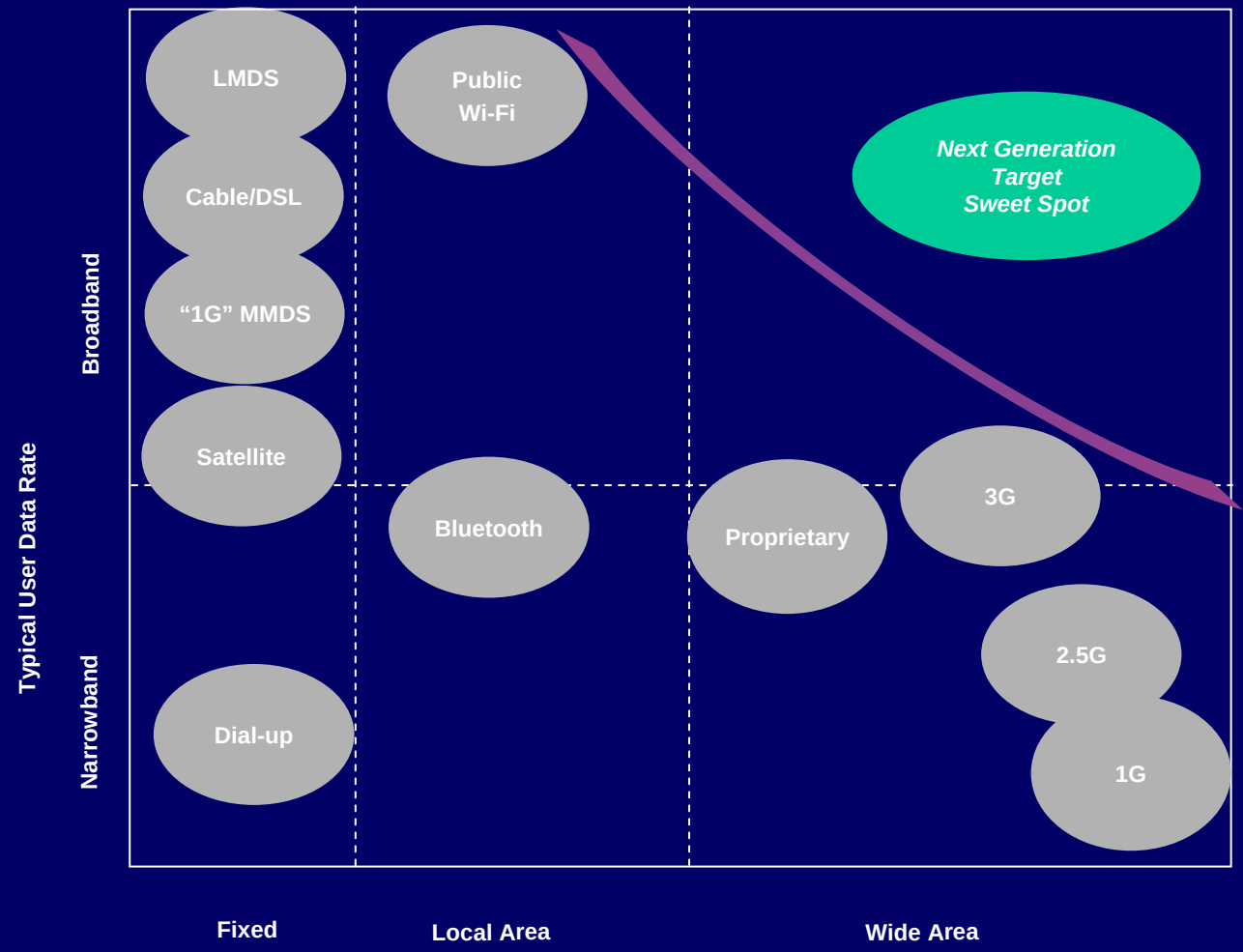
Mobile Office (Voice and Data Apps)

Elsewhere Domain



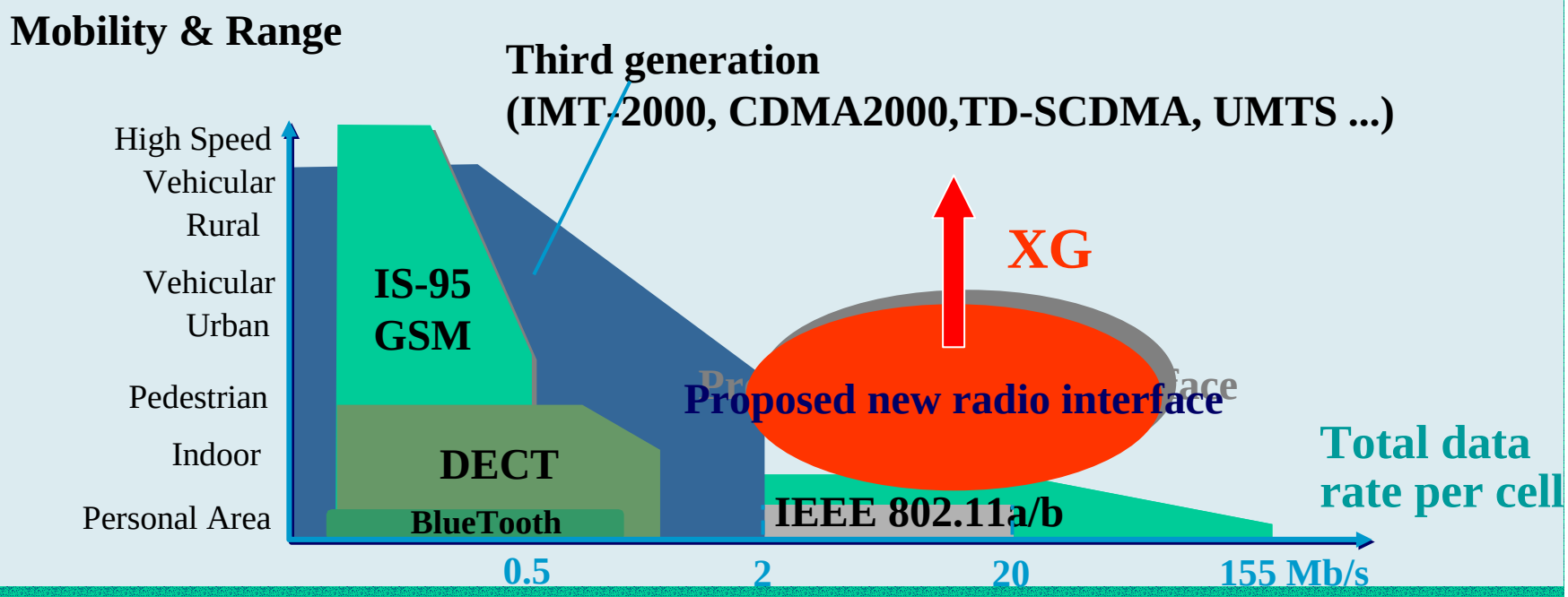
Mobile B-to-C M-Commerce Services

Broadband's "Sweet Spot"



Source: FCC, 2002, with modifications by author

Completing the picture with XG……..



Sprint

Characteristics for Next Gen BB Wireless Technology

- ***DSL/ Cable performance***
- ***Competitive Cost Structure***
- ***Portability to Mobility service model***

True Broadband Speeds	1 Mbps/user
NLOS Operation	up to 10 u-secs delay spread
High Link Budget	>160 dB
High # of Simultaneous Sessions	>100 per carrier
High Spectral Efficiency	> 2 bps/Hz/sector
Large Channel Bandwidths	>5 MHz
Low Latency	<50msecs
Deep Indoor Penetration	90th percentile inside
IP QoS	class, service, protocol, application based differentiation, VoIP
Portability	seamless IP session handover
Mobility	inter-cell handover up to 120 km/hr
IETF based L3+	standard IP based protocol support
Low Power Integrated CPE/PCMCIA	consumer device form factors

Next Gen BB Wireless Technology Characteristics (and biz case drivers)

- **True Broadband Speeds**: >1 Mbps/user bi-directional → compete w/ cable/DSL & differentiate from 3G
- **NLOS Operation**: upto 10usec delay spread → indoor self-install, retail distribution & low rate of returns
- **High Link Budget** (>160 dB) → Large Cell Sizes → Less Capex ,Less site acquisition & backhaul costs
- **High # of Simultaneous Sessions** (>100 per carrier) → Greater # of Subs/sector/carrier with broadband performance
- **Large Channel Bandwidths** (>5 MHz) → High Capital Efficiency
- **Low Latency** (<50 msecs) → Allow for high user performance & satisfaction
- **Deep Indoor Penetration** → Indoor reliability and portability
- **QoS** → Allow increased ARPU using VoIP/Streaming apps
- **Cellular Architecture** → Scalability/Portability & Mobility
- **Integrated MIMO** → High capacity/spectral efficiency/reliability (>2 bps/Hz/sector)
- **Mobile IP** → Seamless IP session handover/data mobility
- **Low Power Integrated CPE/PCMCIA** → Sub$100 CPE
- **Economical Cost Structure** (<$300/sub) → High ROI/NPV

Performance Characteristics

- **User Performance:** Tiered Service Offering (speeds will increase over time)
  - Average at Peak Busy Hour
    - 128 kbps up / 512 kbps down
    - 256 kbps up / 1 Mbps down
- **Bursting Capabilities:**
  - up to 1 Mbps DS and 256 kb US
- **RF Link Budget**: 160 dB minimum
  - Indoor Coverage - 90% indoor coverage at 1st floor, above grade and higher.
  - Outdoor Coverage – 90% coverage, within the cell and at cell edge.
- **Multipath Robustness/Delay Spread:** Initial system must support delay spreads of 5 to 10 microseconds without impairment.
- **Building Penetration Losses:** From Houston and Montreal trials
  - Suburban – 18 dB
  - Urban – 20 dB
  - Dense Urban – 22 dB
- **K-Factor:** Vendor must assume a Rayleigh fading channel, with a K-factor of 0.

Spectral Efficiency: Good-put

- Minimum DL=2bps/Hz/sector
- Minimum UL=1bps/Hz/sector

- **Network Availability**: 99.9% end to end
  - RF System Availability – 99.91%
  - Equipment Reliability –> 99.99%

- **Roundtrip Latency:** 100 ms end-to-end round trip system delay

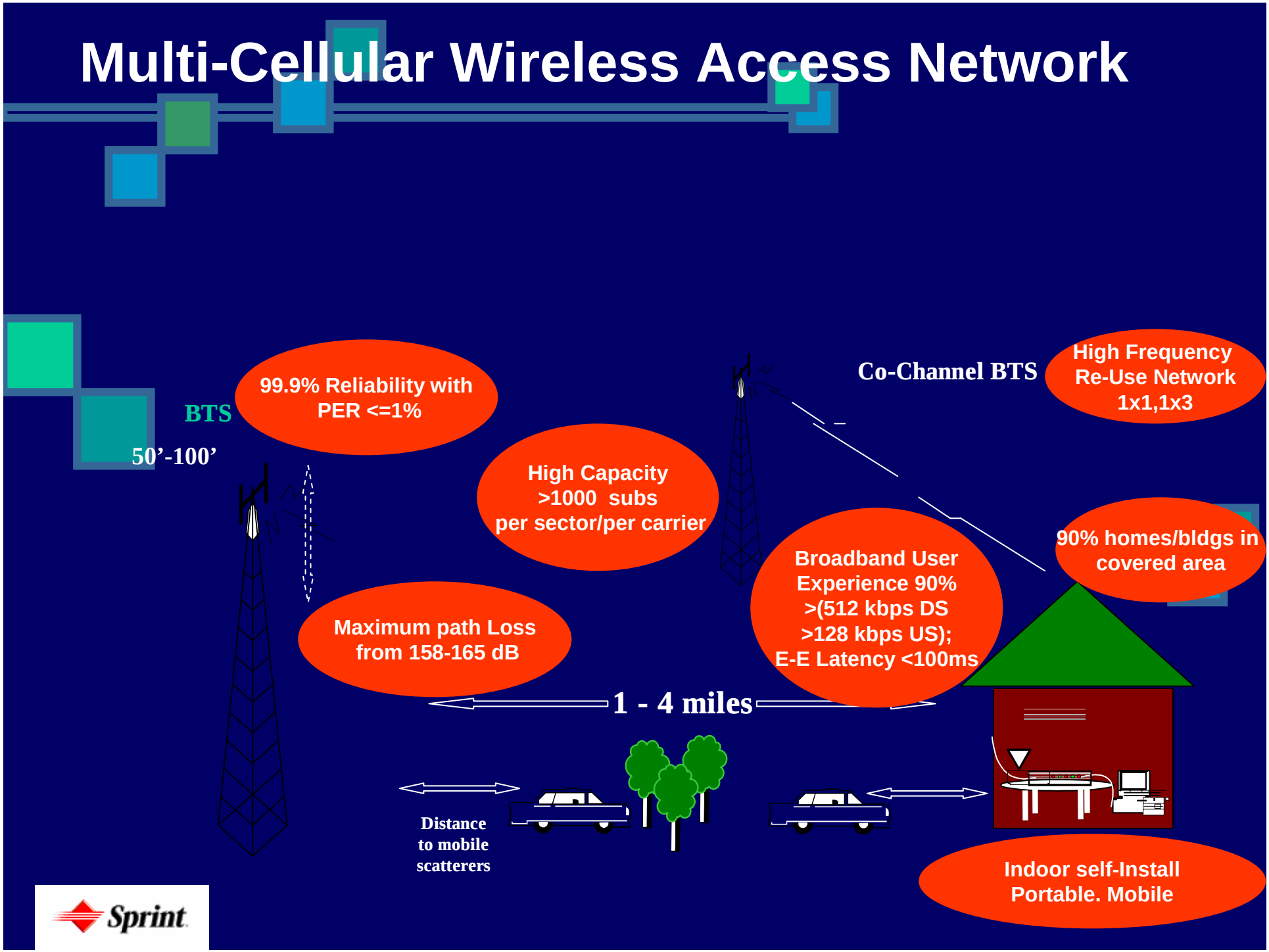
- **MAC Efficiency:** The overall MAC efficiency from Layer 1 through Layer 3 should be at least 75% or higher at capacity

- **High # of Simultaneous Sessions:**

- **Sector Load:** Must be able to support at least 1000 subscribers per carrier

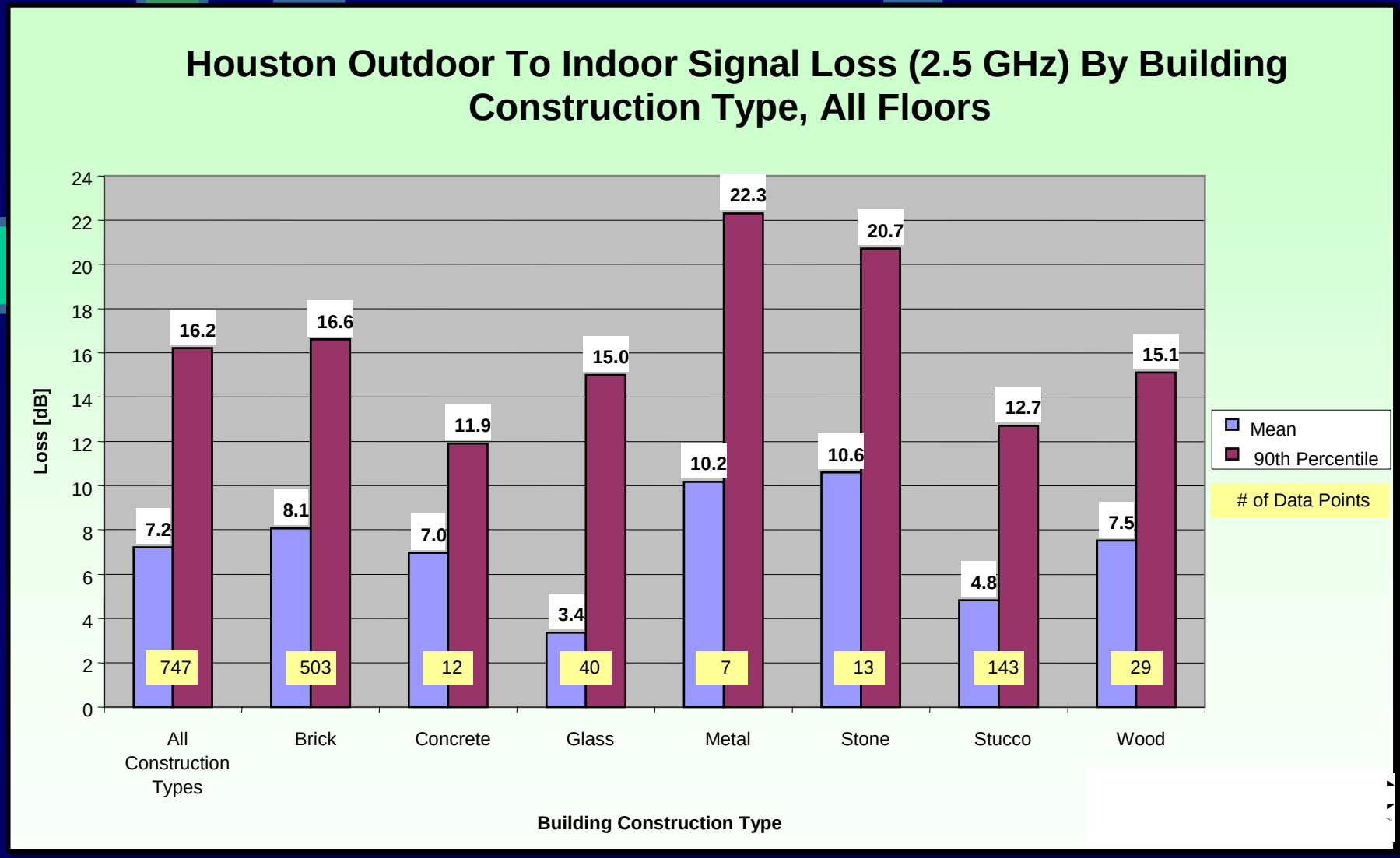
- **Packet Error Rate**
  - Data – better than 1%, after FEC before ARQ

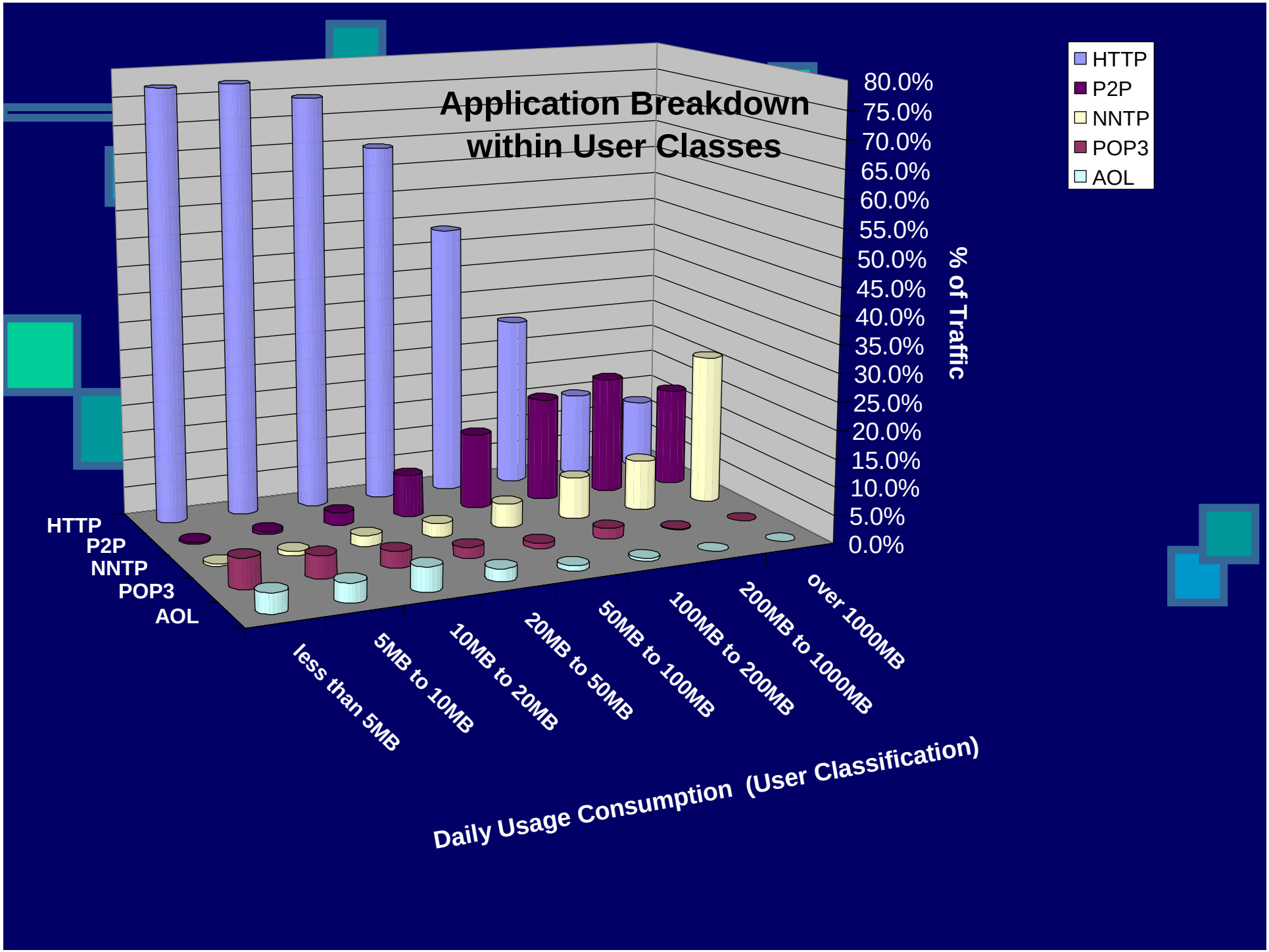
Multi-Cellular Wireless Access Network



Sprint

OUTDOOR TO INDOOR LOSS DISTRIBUTION




Application Breakdown within User Classes
HTTP
P2P
NNTP
POP3
AOL
80.0%
75.0%
70.0%
65.0%
60.0%
55.0%
50.0%
45.0%
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
% of Traffic
HTTP
P2P
NNTP
POP3
AOL
less than 5MB
5MB to 10MB
10MB to 20MB
20MB to 50MB
50MB to 100MB
100MB to 200MB
200MB to 1000MB
over 1000MB
Daily Usage Consumption (User Classification)

Q&A