

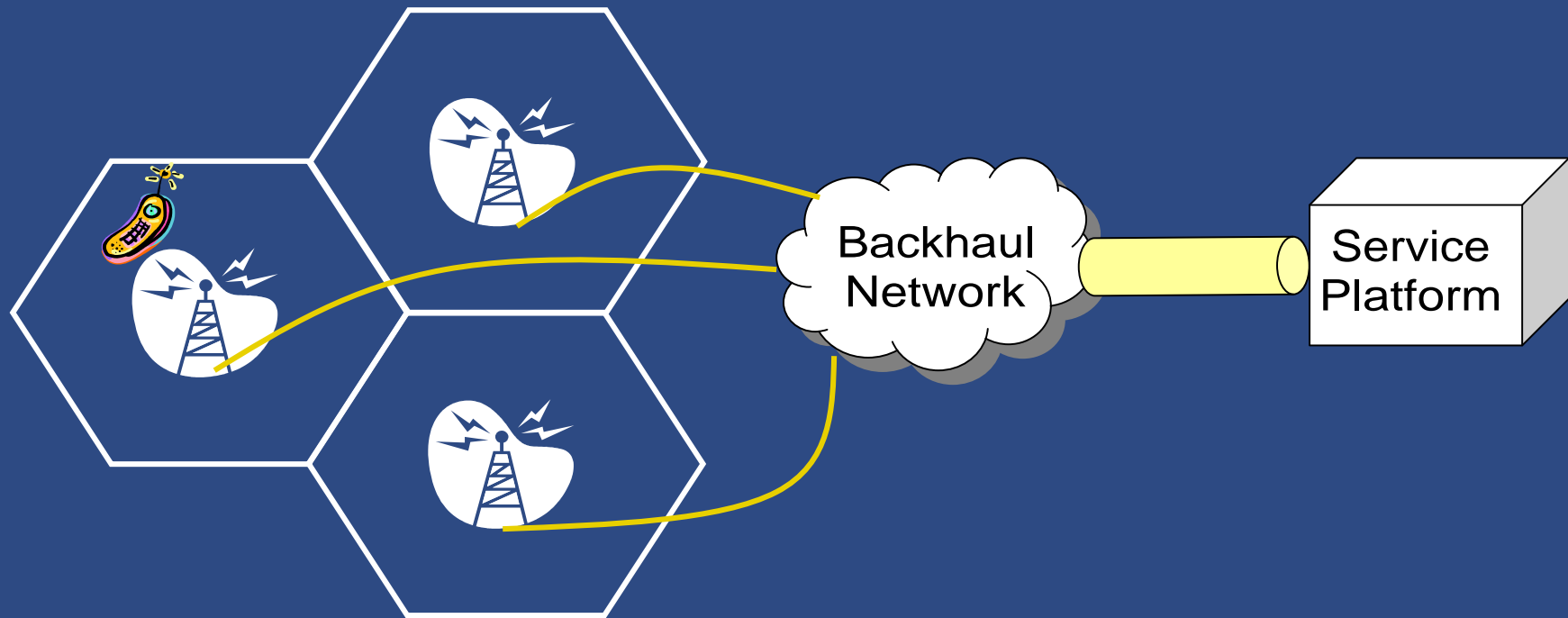
Broadband Anywhere ... What's Missing?

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Separating Vision and Technology

- Service vision
 - broadband
 - ubiquitous, predictable
 - affordable
- WiFi and 2/2.5/3G approaches
 - IP network evolution vs. PSTN evolution
 - local area coverage vs. wide area coverage
 - unlicensed spectrum vs. licensed spectrum

Wireless Network CapEx, OpEx



- CapEx components

- base stations
- site preparation
- service platforms
- spectrum

- OpEx components

- site leases
- backhaul
- network maintenance
- customer acquisition

Wi-Fi Will Not Provide Ubiquitous Broadband

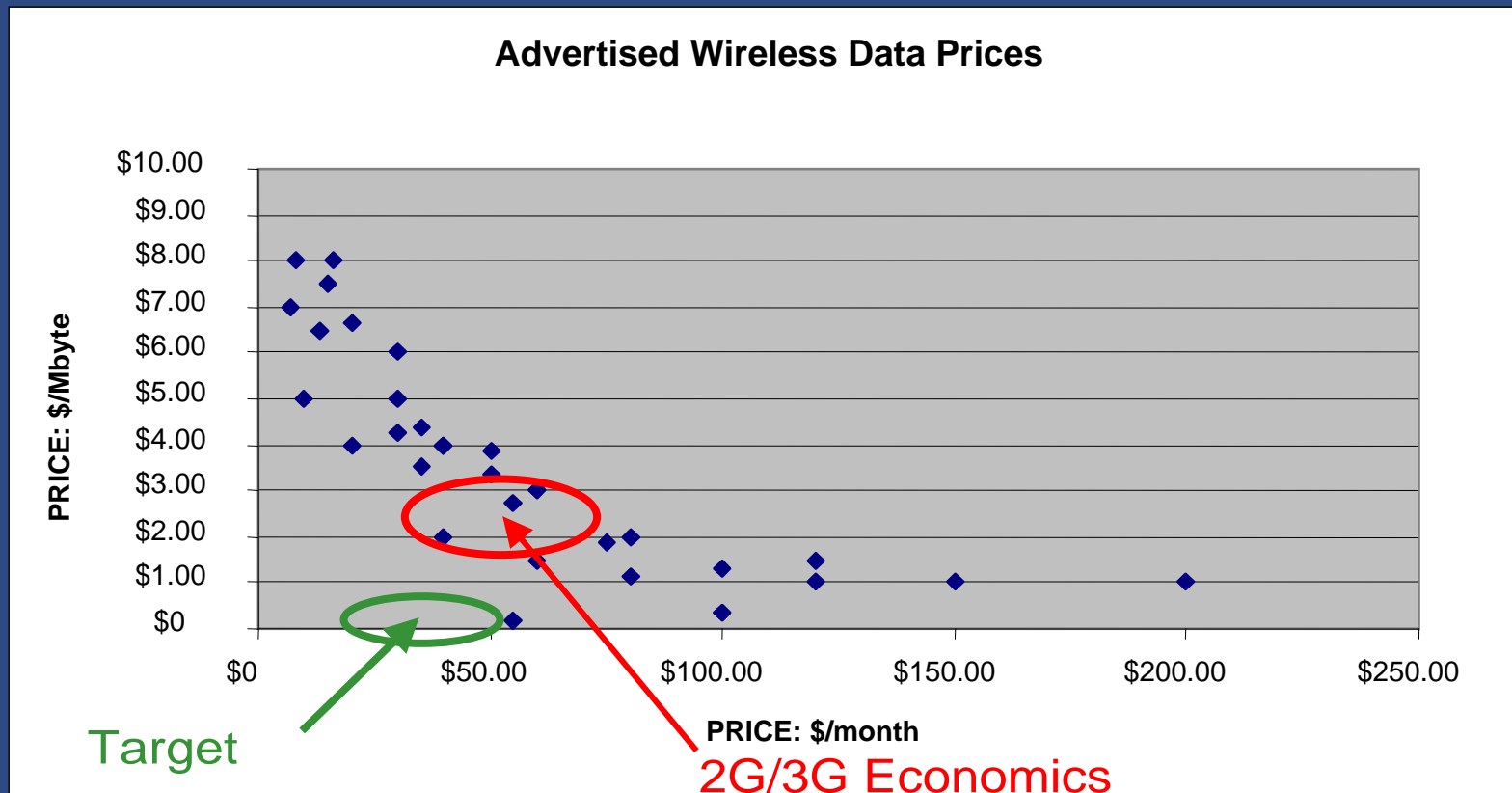
- Attractive unit economics
 - \$500 access points (base station)
 - inexpensive, sometimes free, site lease
- Unattractive network economics
 - limited range means many cells, many backhaul links
 - backhaul pricing inelastic
- Backhaul bandwidth determines user experience
 - 11 (54) Mbps is air-interface rate
 - backhaul typically 1.5 Mbps@\$500/mo, 11 Mbps@\$3000/mo
- Wi-Fi will constitute part of the solution
 - residential and enterprise LAN's
 - selected hot spots

3G Will Not Provide Affordable Broadband

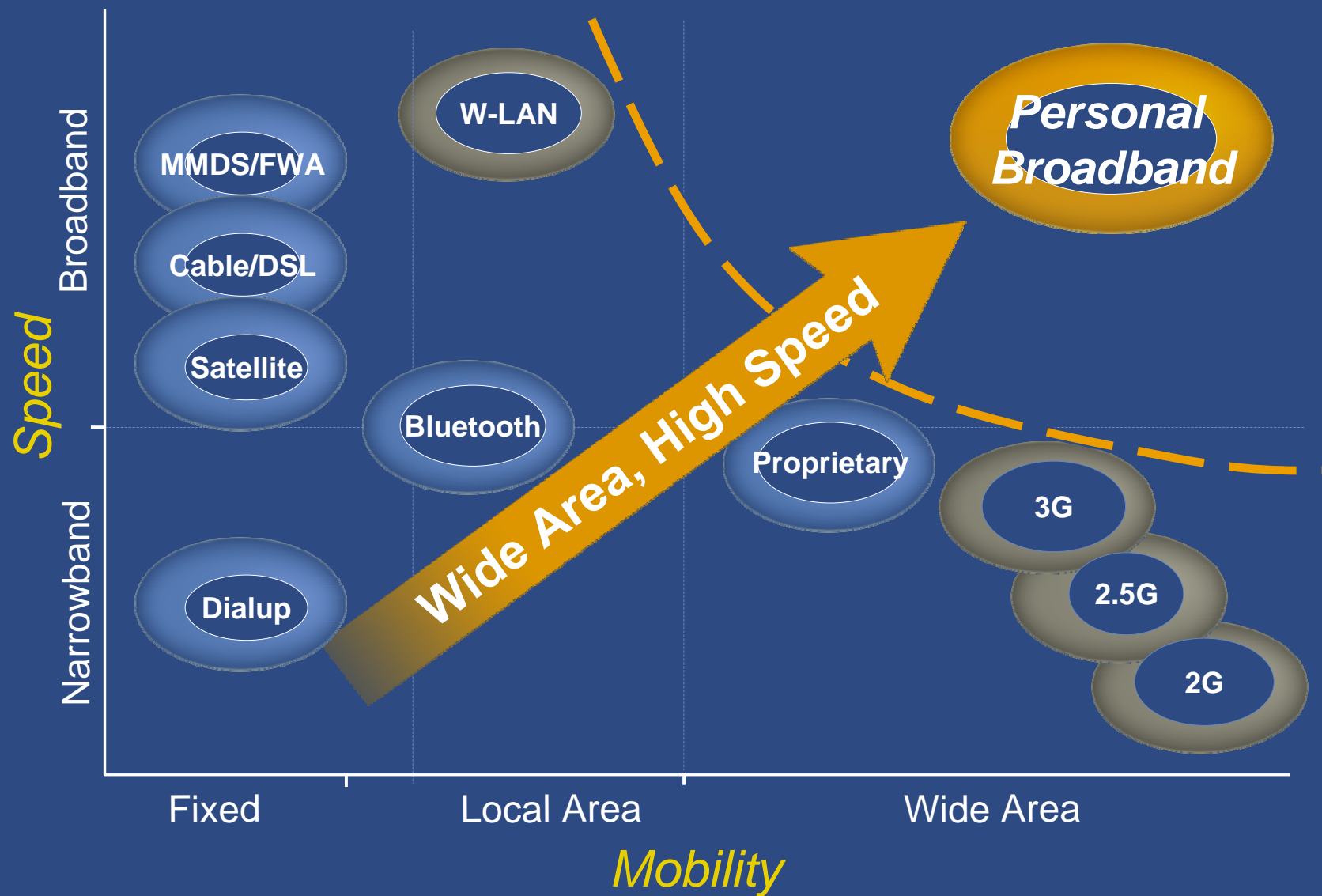
- Comparatively attractive network economics
 - licensed spectrum permits large cells
 - base station, backhaul costs amortized over many users
- Evolutionary step in technology and economics from 2G
 - voice support foremost design consideration
 - data economics no more than 50% improved from 2G
- Traditional cellular spectrum economics challenging
 - recent benchmarks, \$45/pop
 - at 10% penetration, \$450/sub just for spectrum
- 3G will constitute part of the solution
 - with 2G, ubiquitous coverage
 - at data rates comparable to dialup, 10's of kbps

2G, 3G Economics Off by 10x

- Wired consumer internet pricing at \$0.20/Mbyte
- Cellular customers pay \$2.50/Mbyte for voice + data



Access Landscape



Summary

- Separate service vision and technology discussions
- No single technology will address all needs
- 3G, WLAN complementary but incomplete
- Need wide-area broadband with consumer economics
- Solutions from ArrayComm and others address this space