

Wireless Grows Up

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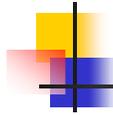


Our Objectives for This Morning...

- Why the interest in wireless?
- How it (almost always) works
- Classes of wireless systems and products
- Exciting opportunities



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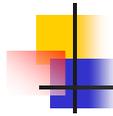


You Need to Know About Wireless Because...

- Business is about *communication*
 - Within the enterprise
 - With customers and prospects
 - With partners, distributors, suppliers, ...
- Timely access to information may be the last good competitive differentiator
- *Mobile people with mobile computers need mobile networks*



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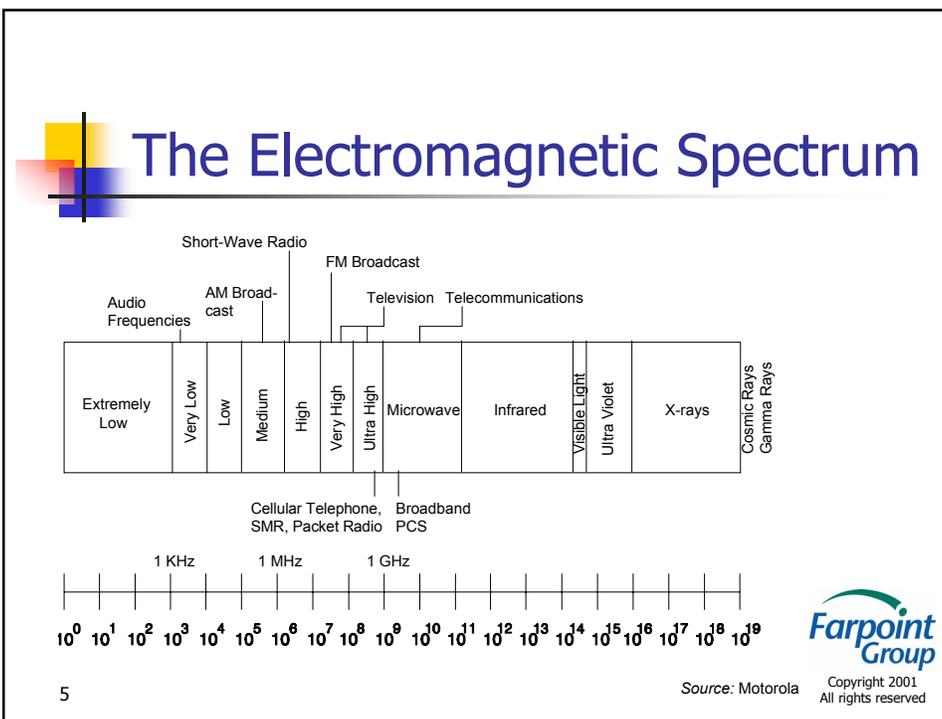


What is Wireless?

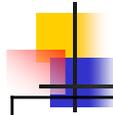
- Communication via the *electromagnetic spectrum*
 - A property of the known universe
- We *modulate* a carrier wave at a given *frequency* and with a given *bandwidth*, send it out over the air, and (if we're lucky) receive it at the other end
 - Radios are modems connected to antennas
 - Wireless behaves somewhat "statistically"
- Less range = greater reliability and throughput
- Heavily regulated worldwide



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- # When is Wireless Appropriate?
- *Three key justifications*
 - Where wire will not go
 - When wireless is less expensive than wire
 - Life-cycle analysis
 - When mobility is a factor (*the killer app*)
 - If at least one of these conditions isn't satisfied, then use wire!
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Wireless Voice Systems

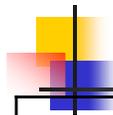
	Coverage	Applications	User Fee?	Other Features
Consumer Cordless Phones	Residence	Residential mobility and convenience	No	Emerging Data (HomeRF; Bluetooth)
Business Cordless Phones	Building/Campus	Enterprise mobility; vertical apps	No	Microcellular
Specialized Mobile Radio	Metropolitan Area	Vehicles (fleets)	Yes/No	PTT; some digital (ESMR)
Cellular/PCS	Regional/National	Personal communications	Yes	Limited data; generational transitions
Satellites	Global	Rural areas	Yes	GEOS and LEOS

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Wireless Data Systems

	Coverage	Applications	User Fee?	Typical Throughput
PANs	Desktop, room	Point-to-point cable replacement	No	728 Kbps (Bluetooth), 4 Mbps (IrDA)
LANs	Floor, building, campus	All LAN functions plus mobility	No	11 Mbps (802.11b), 54 Mbps (802.11a)
Bridges	To 25 miles	Leased service replacement	Yes (licensed systems), No	2 – 155 Mbps; to 2.5 – 10 Gbps optical
MANs	Metropolitan areas	WLL, Internet service, Internet, private nets	Yes (licensed systems), No	30 Kbps – 4+ Mbps
WANs	Regional, national	Same as MANs; typically cellular. Also paging and packet radio	Yes	9.6/14.4 Kbps (2G)

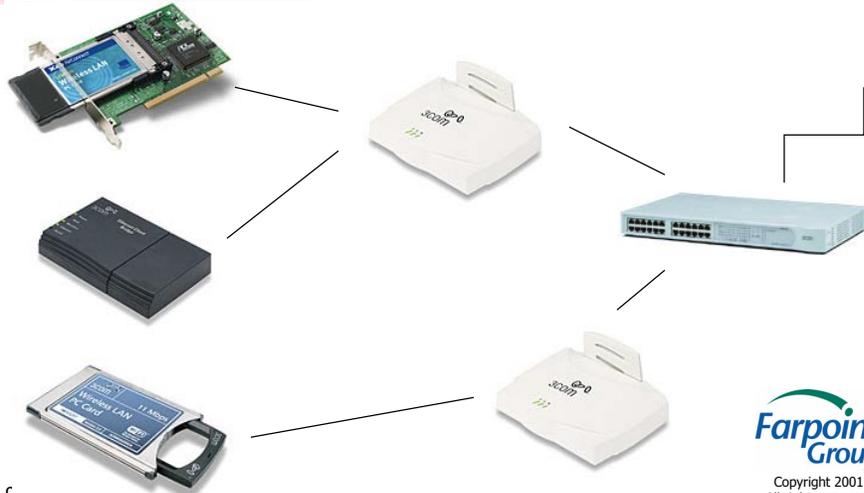
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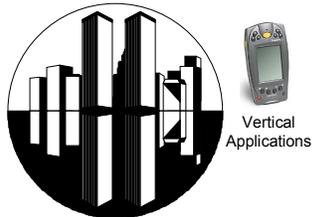
What is a Wireless LAN (WLAN)?



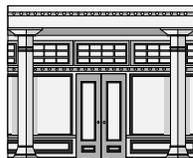
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Four Opportunities

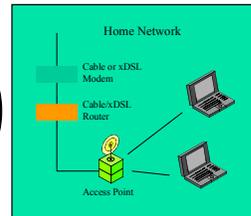


The Enterprise
 Small Business/SOHO



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The Residence



Public Access/
 Hot Spots/
 "Visitor-Based Networks"

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The Bluetooth/WPAN Challenge

- Bluetooth was conceived as a serial-port replacement
 - An "RF IrDA"
- But – it adds voice and networking
- Unique features – service discovery, application profiles
- IEEE 802.15 – standardization
 - .1 – Bluetooth PHY and MAC
 - .2 – Coexistence (recommended practice)
 - Interference will become more common...
 - .3 - >20 Mbps
 - A direct challenge to 802.11?
 - .4 – Pico-radios



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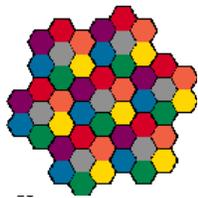
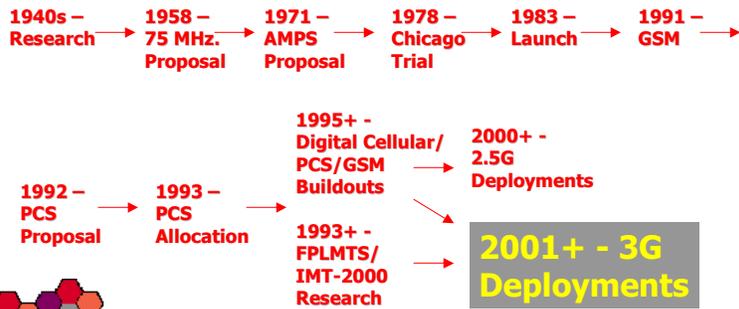
Bluetooth vs. 802.11b

	Bluetooth	802.11b
Mission	Voice, cable replacement, network access, "credit card", synchronization, ...	LAN augmentation, LAN replacement, cost reduction, mobility
Throughput (max)	721/57.5 Kbps, 432 Kbps symmetric, voice channels	11/5.5/2/1 Mbps
Range (nominal)	3, 10, 100 meters	100 meters
Frequency	2.4 GHz.	2.4 GHz.
Modulation	FHSS (1600 hops/sec)	DS-CCK, up to 11 channels
Topologies	Peer, piconet, scatternet, access point (no roaming)	Peer, access point
Cost (chips/PC Cards)	US\$25/\$150	US\$20/\$100



Source: Farpoint Group

Cellular: A Brief History



Source: Farpoint Group



Smartphones



Nokia 9210



Ericsson R280 WAP phone



Novatel Merlin G100 (GSM)



Ericsson R380



14 Kyocera 6035



Motorola Accompli™ 009 Personal Interactive Communicator



Novatel Minstrel M500 (CDPD)





What is 3G?

- 1G: Analogue
 - Numerous incompatibilities
 - Poor voice quality and security
 - 9.6+ Kbps circuit data
- 2G: Digital
 - Improved capacity
 - (Eventually..) improved voice quality
 - 9.6/14.4 Kbps circuit data; SMS; WAP; i-mode
 - 2.5G – to 64+ Kbps (GPRS; IS-95B)
- 3G: Broadband
 - Eliminate performance differences between landlines and wireless
 - Provide new revenue opportunities for carriers



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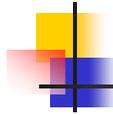


Why 3G?

- The voice market in industrial economies is starting to saturate
 - >60% penetration in some countries
 - More competition; declining ARPUs
- New radio technologies enable mobile broadband
 - WCDMA (“W” = “wideband”)
 - Design points: 144 Kbps/384 Kbps/2 Mbps
- Data and the Internet are driving the overall communications market
 - As important to wireless as they are to wireline



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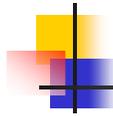


3G Objectives and Benefits

- Functional equivalence with landlines
 - Performance (including QoS)
 - Services
- Improvements over 2G
 - Battery life
 - Voice quality
 - Hard handoff (picocells to satellites!)
- Support for location-based services (LBS)



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More Objectives and Benefits

- Support for all current value-added voice services
- Improved OSS (carriers' #1 request)
- Coexistence, ease of migration, or overlay implementation
- Bandwidth on demand
- Improved encryption/authentication
- Extensibility and growth
 - E.g., to 5, 10, 20+ MHz. bandwidths



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Key Challenges and Barriers



Subscriber Units –

- Screen size
- User interface
- Battery life



Wireless Networks –

- Throughput
- Capacity
- Coverage
- Support for time-boundedness

?

The Business Model –

- Voice/data balance
- Pricing
- Content availability



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3G Phones



Nokia Concept II



Nokia Concept IV

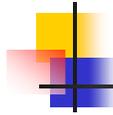


Ericsson Communicator

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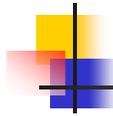
Other Hot Topics

- Wireless middleware
 - Matching applications/networks/devices
 - Wireless Application Protocol (WAP); i-mode
- Location-based services
- M-Commerce
 - *The killer app for wide-area wireless*
- "Internet Everywhere"
- Wireless multimedia
 - Bandwidth *and* time-boundedness



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Thank You!



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