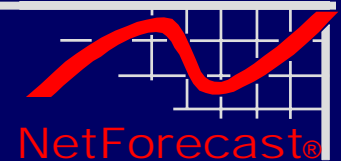


Demystifying Wireless Data: What You Need to Know Today

Virginia Piedmont Technology Council
March 11, 2004



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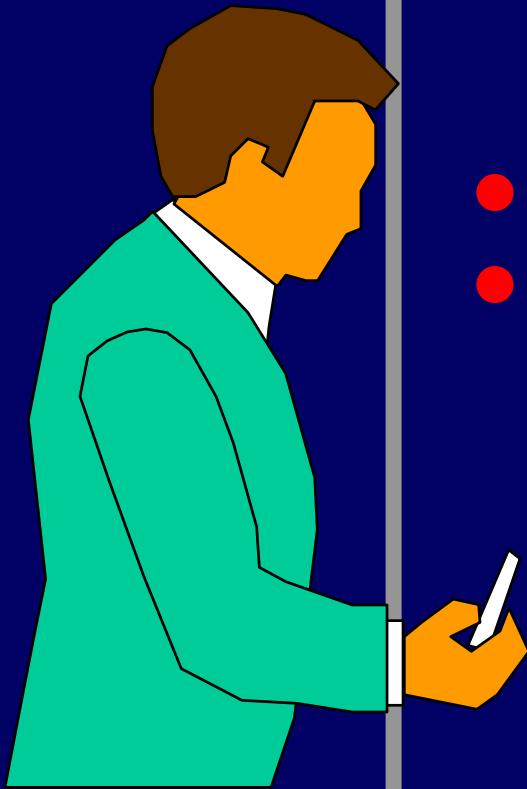
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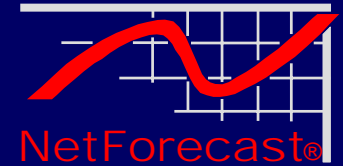
NetForecast Report 5068

Outline



- **Wireless Technology Alphabet Soup**
- **The Future of Wireless Data**

What Drives Wireless Adoption



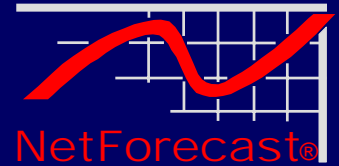
Need for Mobility

- People like to communicate and they are often mobile
 - 1/3 of the US workforce are away from their primary workplace at least 20% of the time (source: Yankee Group)
- Computing value is proportional to how well it is networked
 - Data gets stale very fast!

Limits to Wires

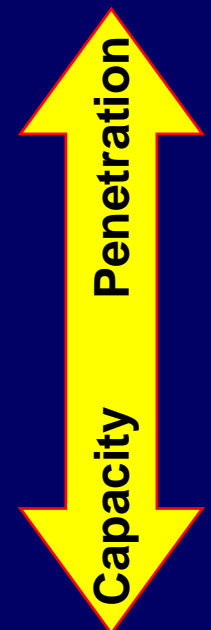
- Wires are wonderful but limited
 - The copper infrastructure is not growing very fast
 - More than 10% of US households are in rural locations
 - No wire: historic buildings, public places, hazardous places
- Fiber is generally deployed to large business establishments
 - 88% of US business sites are less than 20,000 sq ft in size (source: Dept Commerce)
 - 89% of US business establishments are not served by fiber (source: RHK)

Radio Spectrum

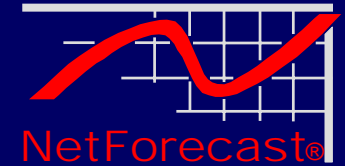


- **All of the useful radio spectrum is regulated by the FCC**
 - Some is permitted to be used without a license
- **Licensed**
 - 0.74-0.8 GHz UHF Television (some reclaimed for broadband wireless)
 - 2.3 Wireless communications service
 - 2.5-2.7 Multi-Channel Multipoint Distribution Service (MMDS)
- **Unlicensed**
 - 0.9-0.93 GHz Industrial, Scientific and Medical
 - 900 MHz band: garage-door openers, old cordless phones
 - 1.91-1.93 GHz Personal Communications
 - 2.4-2.48 GHz Industrial, Scientific and Medical
 - 2.5 GHz band: baby monitors, newest generation of cordless phones
 - 5.15-5.35 GHz National Information Infrastructure (NNI)
 - 5.73-7.83 GHz Upper National Information Infrastructure (UNNI)
 - 5.73-5.85 GHz Industrial, Scientific and Medical
 - 6.5-6.7 and 12.75-13.25 GHz FCC is opening additional spectrum

**Frequency
Effect**

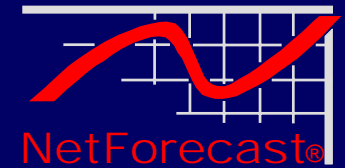


Wireless Personal-Area Networks (WPANs)



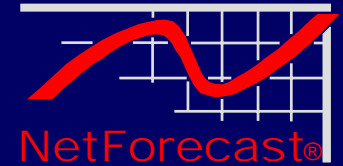
- **Wireless from head to toe**
- **Bluetooth**
 - Started by a group of vendors on the Baltic region (Denmark, Sweden, Norway and Finland)
 - Uses the 2.5 gigahertz with very weak signals of 1 milliwatt over 10 meters
 - Primary goal is occasional communications among digital devices
- **802.15**
 - The emerging international standard for similar applications
- **Wi-Media alliance for entertainment products**
- **Zigbee alliance for pico-radios and RFIDs, less range, no battery**

Wireless Local-Area Networks (WLANs)



- **Wireless for room or building of wired rooms**
 - Wireless Ethernet Compatibility Alliance (WECA) defines Wi-Fi compatibility
- **Wi-Fi Access Point (AP) and Wi-Fi card technologies**
 - 802.11a: 54, 48, 36, 24, 18, 12, 9 and 6 Mbps in 5 GHz band
 - 802.11b: 11, 5.5, 2, and 1 Mbps in 2.4 GHz band
 - 802.11g: 54, 48, 36, 24, 18, 12, 9, 6, 11, 5.5, 2, and 1 Mbps in 2.4 GHz band
- **Extremely popular**
 - The standard process worked – boxes are interoperable
 - Intel put it into a chip – the Centrino – and trying to get it into every device
 - An access point is installed very 4 seconds (source: Intel)
- **Hot-Spots provide access to the Internet**
 - Free or pay by the hour
 - Roaming services available
- **Enterprise solutions to wire a building or campus**
 - Many APs are be deployed
 - Add switching capability to permit automatic roaming through the building
 - Often add security and frequency management

Hot Spots Around Charlottesville



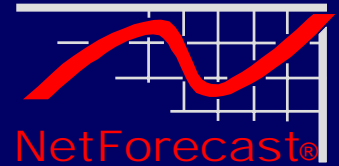
● Downtown Mall Area

- Mudhouse
- Rapture Restaurant
- Omni Hotel
- Gravity Lounge
- On the Mall near Christian's Pizza

● Other C-ville spots

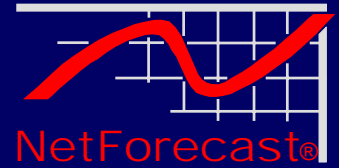
- Doubletree Hotel, Route 29
- Charlottesville Airport
- Java Java, on Ivy Road
- Starbucks, at The Corner

802.11 Security Issues



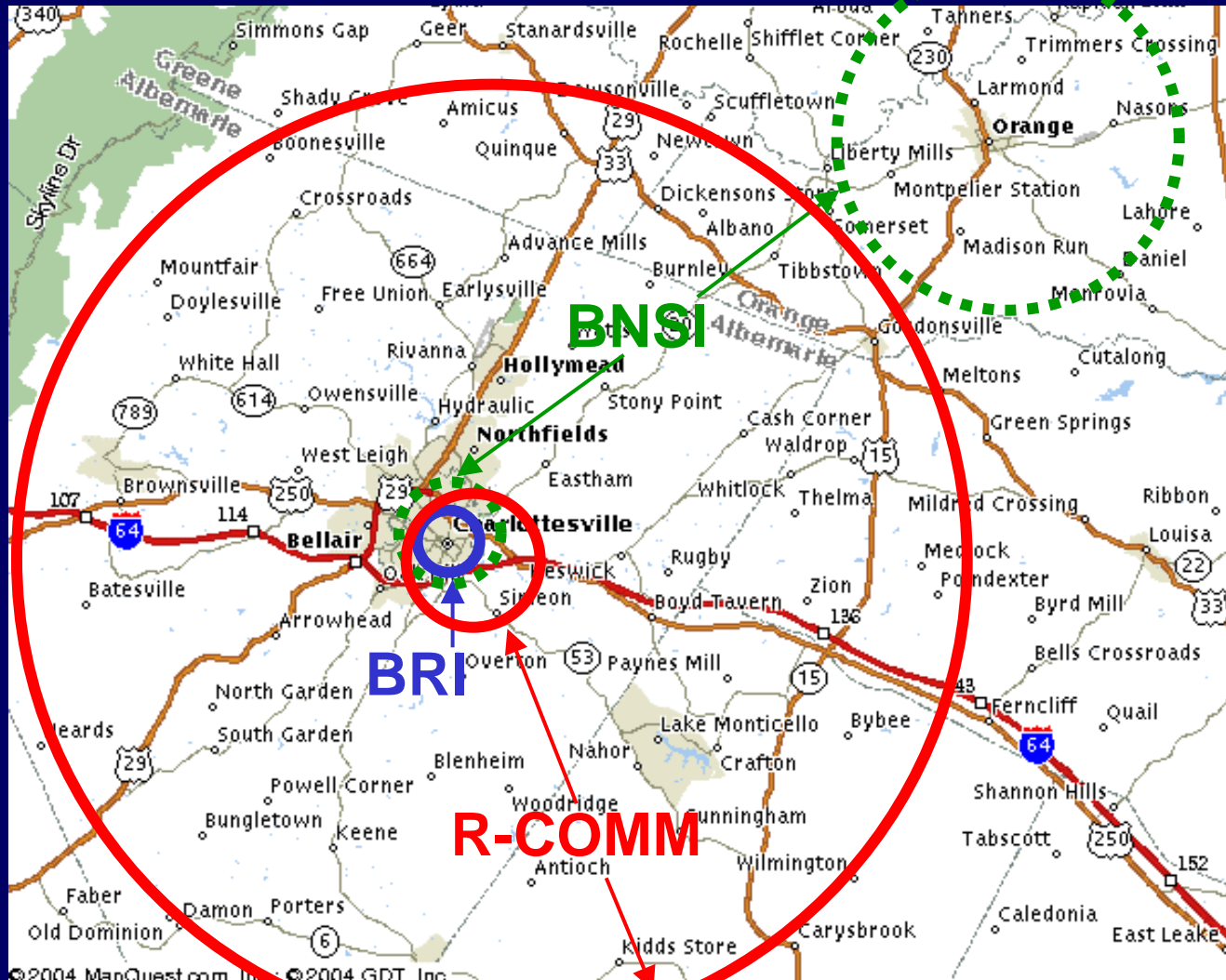
- **WEP (Wired Equivalent Privacy)**
 - Original 802.11 standards have weak security mechanisms
 - Default is to operate with no encryption
 - Encryption is an administrative hassle
 - And an eavesdropper can crack the key by analyzing the traffic
 - A very busy site can be cracked in less than 30 minutes
 - Other vulnerabilities like man-in-the-middle also exist
- **Simple steps can be taken to greatly reduce risk**
 - Change SSID, disable broadcast, use Wi-Fi Protected Access (WPA)
- **Many vendor security add-ons are also available**
- **802.11i will define the next generation of WPA**
 - Expect ratification of the standard this year
 - WPA2/802.11i products will be arriving by early next year

Wireless Metropolitan-Area Networks (WMANs)

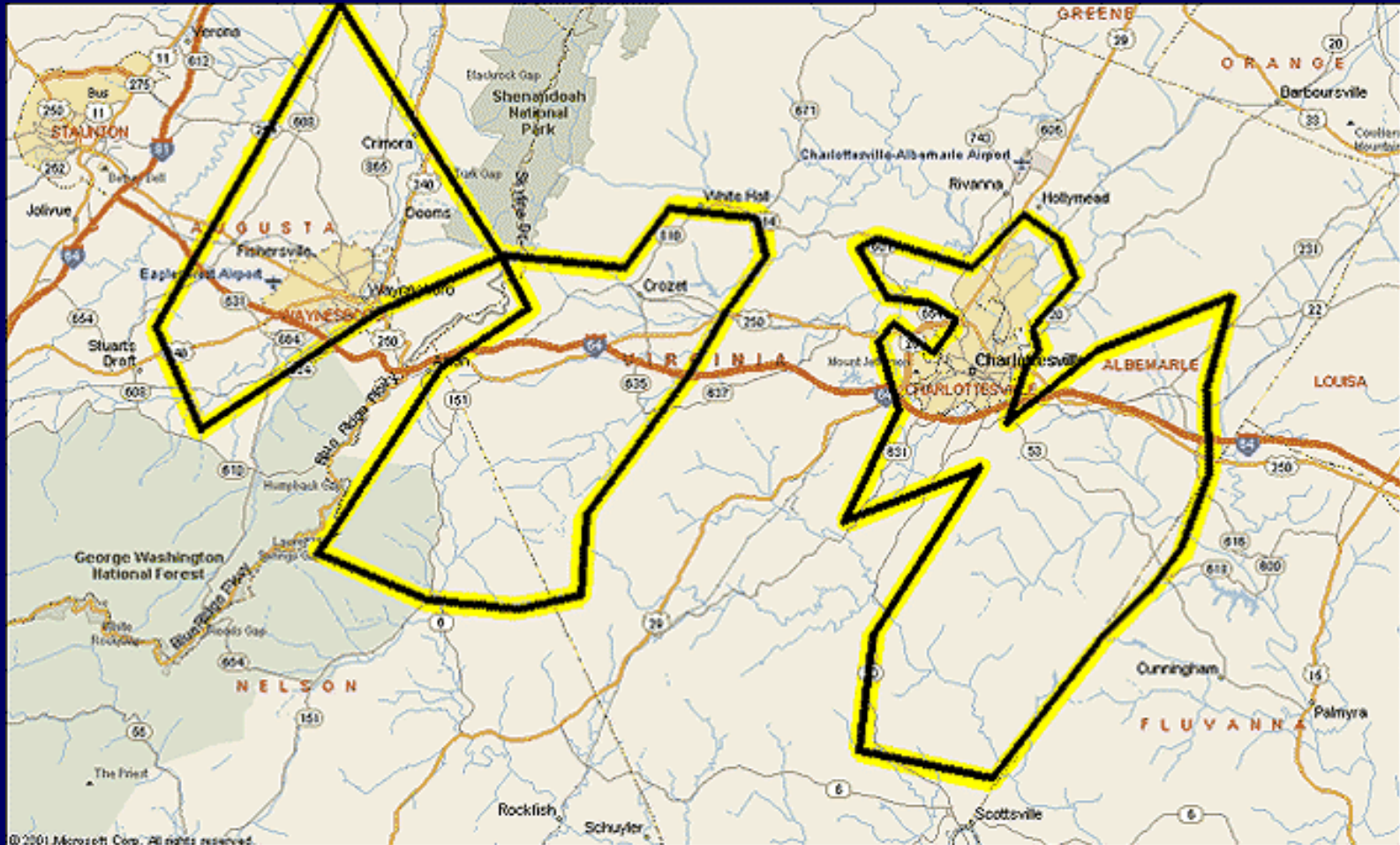


- **Broadband in 2-30 mile (line-of-site) distance range**
- **Proprietary solutions have existed for a long time**
 - Typically a by-pass technology
 - Licensed microwave, Directed infrared, LASER
- **802.11 used as a metro solution**
 - Rugged access point + smart antenna + good height
 - Called Wireless Internet Service Providers (WISPs)
 - Support mobile by adding a switching solution for many APs in a region
 - Starts to look like cellular data service
- **806.16 Emerging standard**
 - Broadband access in either licensed or unlicensed bands
 - 802.16e is the mobile version
 - Wi-Max Forum
 - Intel is behind this effort as well

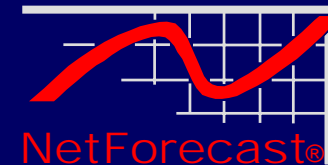
WMANs Around Charlottesville



nTelos Portable Broadband

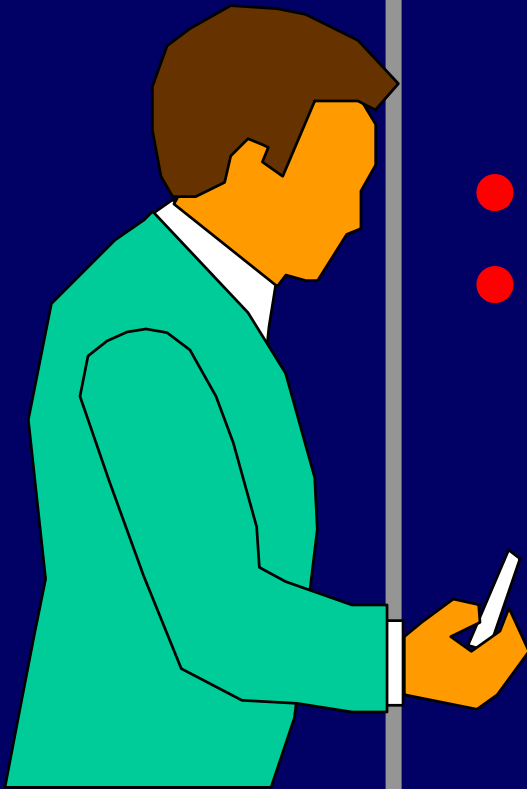


Wireless Wide-Area Networks (WWANs)



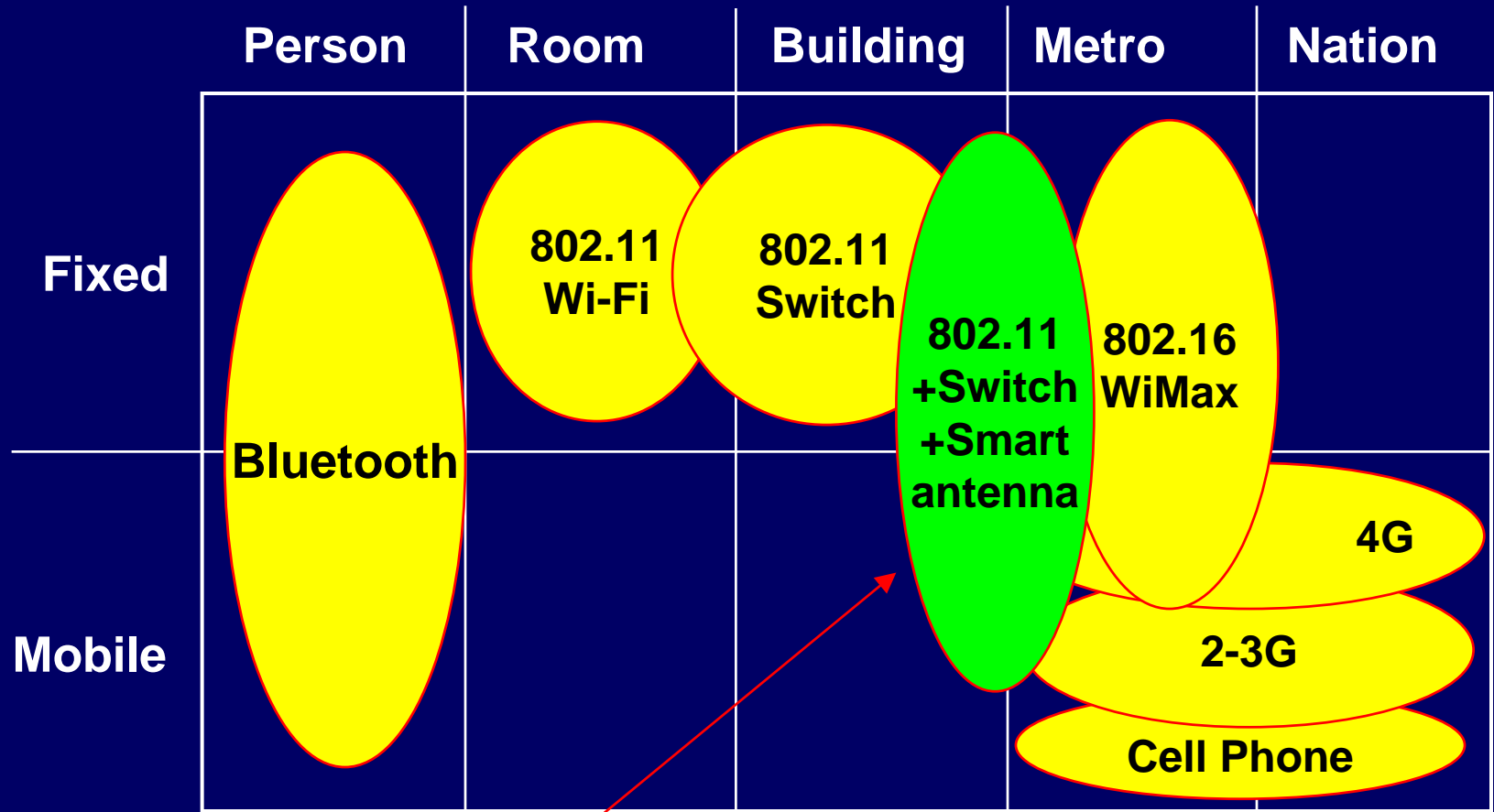
- **Wireless accessed locally but available nationally**
 - Use some form of communicating cells
 - Hand-offs between cells
- **First generation data was cell phones with data added**
 - CDPD – Cellular Digital Packet Data (being phased out this year)
 - MOBITEX – (Cingular)
- **Generations “G” are many ways to improve cellular**
 - **2G Added capacity (for the carrier) and some data on the circuit**
 - SMS, WAP, iMode
 - **2.5G Faster data rates**
 - Camera phones
 - **3G Starts to compete with Wi-Fi in speed**
 - Limited deployments, many versions of the standard
- **“4G” is not officially on a standards track, but**
 - Very high performance to compete with Wi-Fi with quality of service features
 - Data-only solution that is IP transport (voice can travel as data)
 - At least 5 vendors in the US building products

Outline



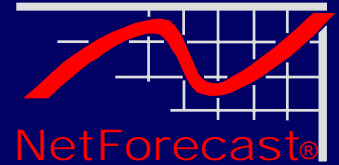
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The Basic Alternatives



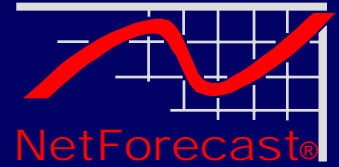
Not in the original plan

Licensed Spectrum is Important



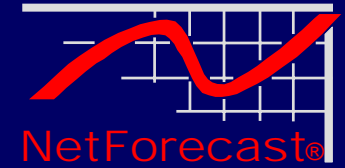
	Person	Room	Building	Metro	Nation
Licensed				Cell 4G Cell 2-3G Cell Phone	
Unlicensed	Bluetooth	802.11 Wi-Fi	802.11 Switch	802.11 +Switch +Smart anten. 802.16 WiMax	

Voice vs. Data



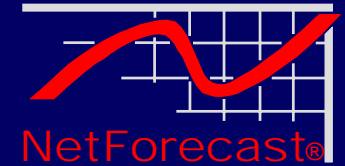
	Person	Room	Building	Metro	Nation
Data	Bluetooth	802.11 Wi-Fi	802.11 Switch	802.11 +Switch +Smart anten.	802.16 WiMax
Data+ Voice as data					
Voice+ Some data				Cell 2-3G	
Voice				Cell Phone	

Data Rates



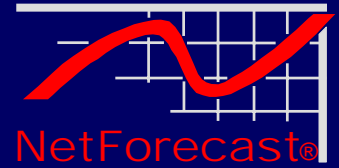
	Person	Room	Building	Metro	Nation
>10 Mbps		802.11		802.16	
1-10 Mbps				Cell 3-4G	
0.1-1 Mbps	Bluetooth			Cell 2G	
<100 Kbps				Cell Phone +	

WISPs Can Compete

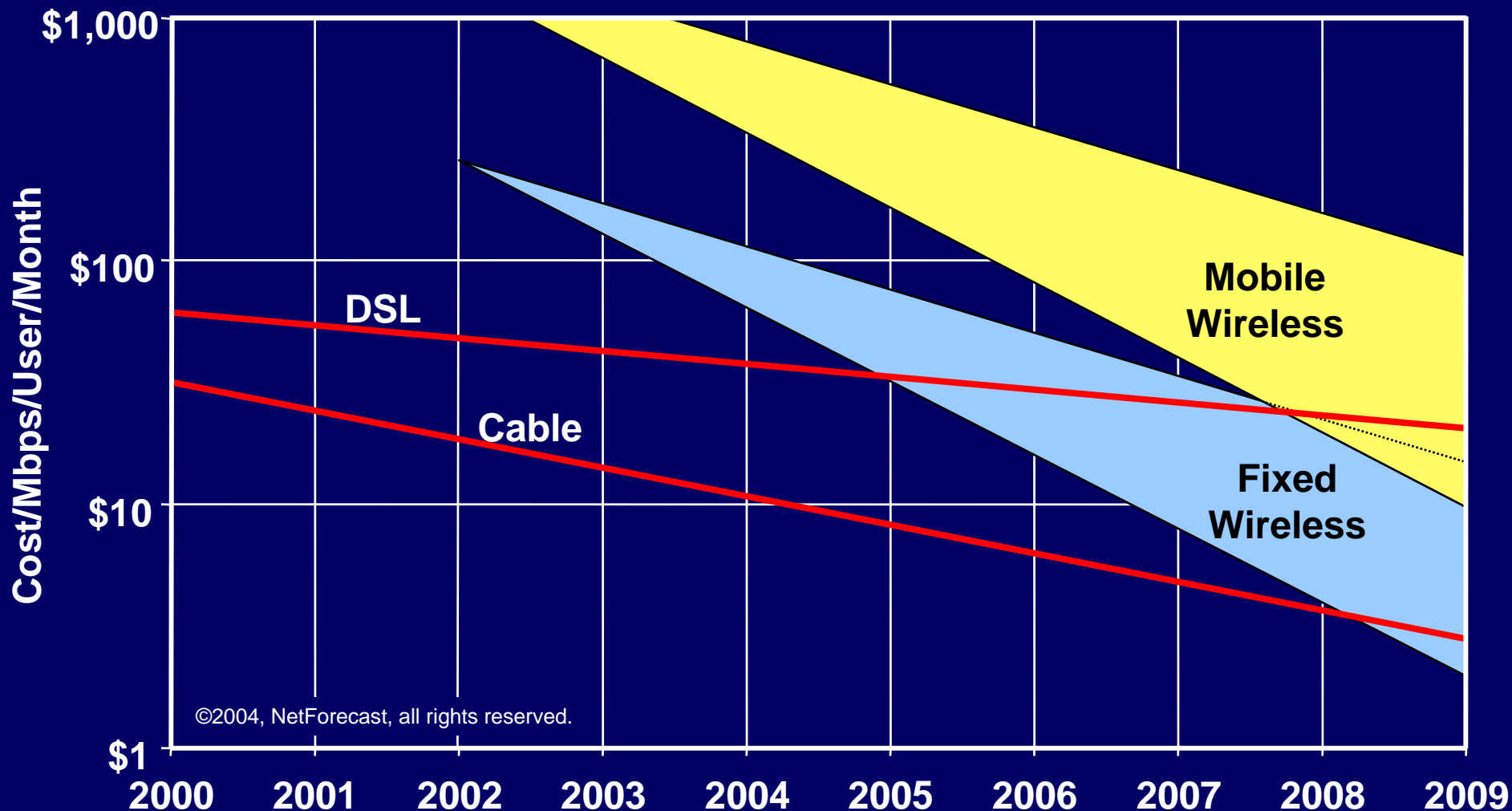
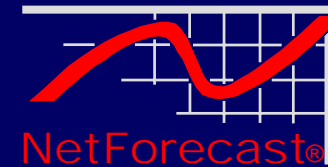


- **NetForecast cost model to operate an access service**
 - From industry sources and many carrier services
 - Determined costs for additional bandwidth and new technologies
 - Data is normalized into cost/Mbps/user/month
 - Models are based on United States carriers and costs
- **What is included**
 - Basic Internet access
 - Capital (depreciated) for equipment (new or incremental)
 - Local aggregation and up-link to a larger network
 - Up-link is shared but not over-subscribed
 - Installation, operations, maintenance
 - Customer service
- **What is excluded**
 - Typical Internet services in addition to access
 - Web hosting, email, chat, IM, VoIP, roaming dial-up, music download, online radio, home networking, personal firewalls, virus protection, spam filtering, banking, etc
 - Cross-business unit fees (if they exist)

Relentless Power of Exponential Change

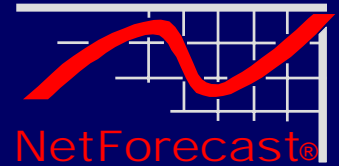


Cost Comparisons of Alternative Access Methods



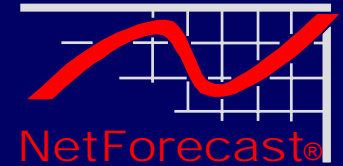
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Implications of Seamless Broadband Anywhere



- **Improved productivity**
 - Delivery drivers track inventory
 - Hospitals are letting nurses work their full shift caring for patients rather than losing an hour per shift to updating records
 - Similarly, police departments can keep a cop on the beat instead of in the office writing reports.
 - Eliminate clerical data entry errors
 - Provide timely information for the job at hand
- **Simpler computing**
 - Critical data required to operate a company will not walk home every day
 - Centralized data repository with seamless access anywhere
 - New lightweight terminals to access, use and process the data
 - The death of laptops as we know them!
- **More functions in the terminal**
 - The electronic wallet
 - The presentation controller
 - No more flashing digital clocks on our appliances!

Homeland Security Initiatives



- **First responders use licensed spectrum**
 - Good – no interference since each group has its own frequency
 - Bad – the other groups can't use the frequency when needed
 - Making the radios compatible has been a long and elusive goal
- **The data compatibility strategy**
 - Forget trying to fix the voice radios
 - Start over with a common wireless data network
 - Don't ask an operator to access a record, access it directly
- **Homeland Security 2004 funding request includes**
 - \$117 million for early support to IT and wireless communications
 - \$68 million for wireless radio communications
 - \$21 million for a security IT evaluation program
- **Several cities and towns have received grants**
 - Byproduct is a federally funded WISP for homes and businesses

Smart Strategies From Hard Data

Thank You

