

# The Pieces Are All In Place Has The Wireless Revolution Begun?



i n v e n t

**Andrew M. Seybold**

**andy@outlook4mobility.com**



# Andrew Seybold Group, LLC

*Computing and Communications Industry  
Consulting Services*

FORBES / ANDREW SEYBOLD'S  
**WIRELESS**  
OUTLOOK

**The Wireless Experience**  
**Comprehensive Wireless Data Sales Training**



[www.outlook4mobility.com](http://www.outlook4mobility.com)



# Agenda

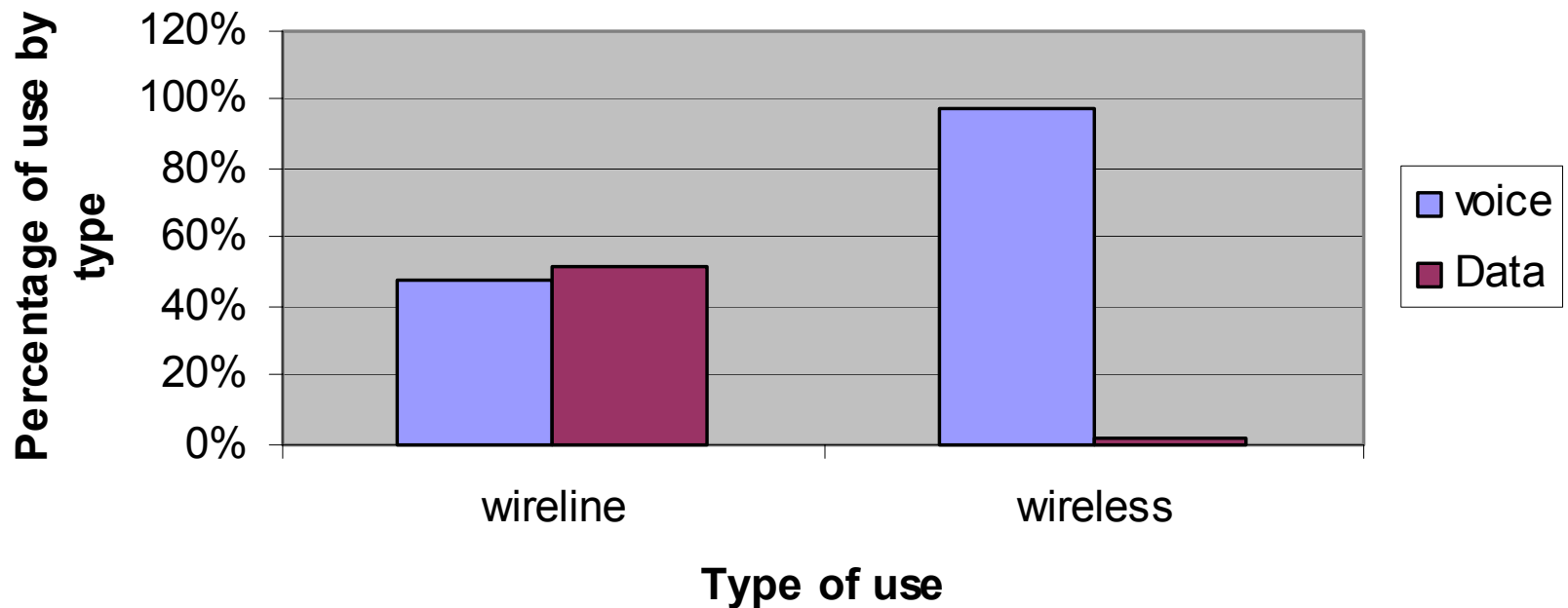
- The Future—Is it Wireless?
- U.S. Market Overview
- Wireless Data Pricing and ROI
- Today's Directions and Issues
- Moving From Wired To Wireless
- WiFi or 3G?
- Wireless Roadmaps: Reality
- Information Delivery When Wireless
- Wireless Data 2002/2003
- Q and A

## Wired And Wireless Quote

**Negroponte Switch: “...anything that moves needs to be wireless. Phones, largely wired at the time, would go wireless, and TV, largely wireless, would get wired.”**

# Is The Future Wireless Data? Will Wireless Follow Wired?

## Voice vs Data Minute Usage





# U.S. Wireless Market Overview



# Wireless Network Choices

Big Leos  
(Satellite)

Little Leos  
(Satellite)

Teledesic  
(Satellite)

WI-FI

UMTS

AMPS/CDPD  
Cellular

iDEN

AMPS  
Cellular

GSM/GPRS

CDMA/AMPS  
Cellular

Is  
being  
Reborn  
?

Iridium

802.11a



TDMA/AMPS  
Cellular/PCS

CDMA  
2000 1X

~~Metricom~~

Bluetooth

Weblink Wireless  
Two-Way

SkyTel  
Two-Way

~~PCS Net  
Voice Paging~~

One-Way  
Paging  
(Multiple)

Cingular Interactive  
(BSWD)

Motient  
(ARDIS)

~~Home RF~~

**Dead: PCSI Voice Paging**

# Wireless Technologies

CDMA

TDMA

Mobile

PDC

iMode

WCDMA

iDEN

GSM

G3G

REFLEX

IS-95B

GPRS

EDGE

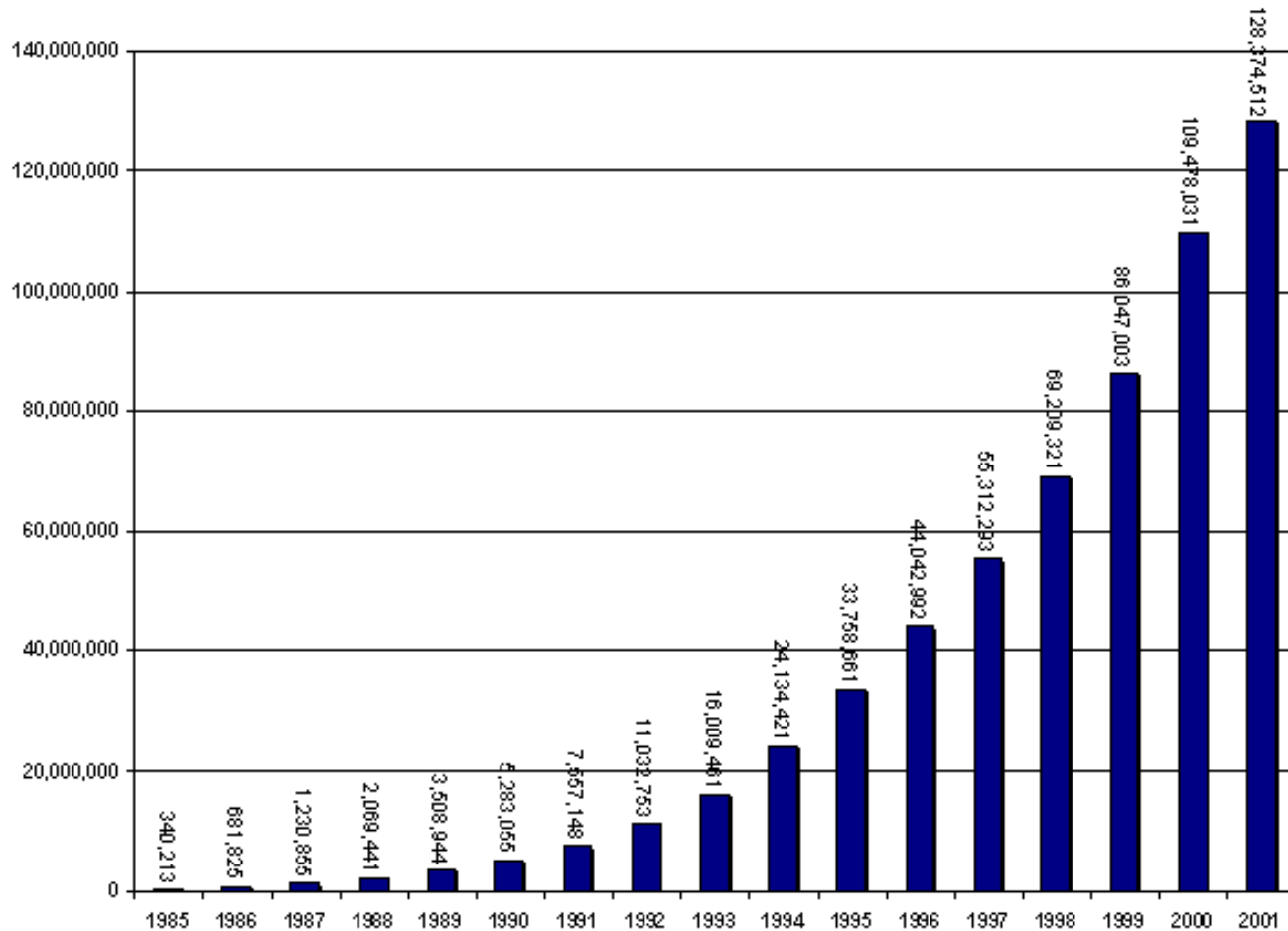
DataTAC

PHS

cdma2000 1X



# Wireless Subscribers: 1985 – 2001

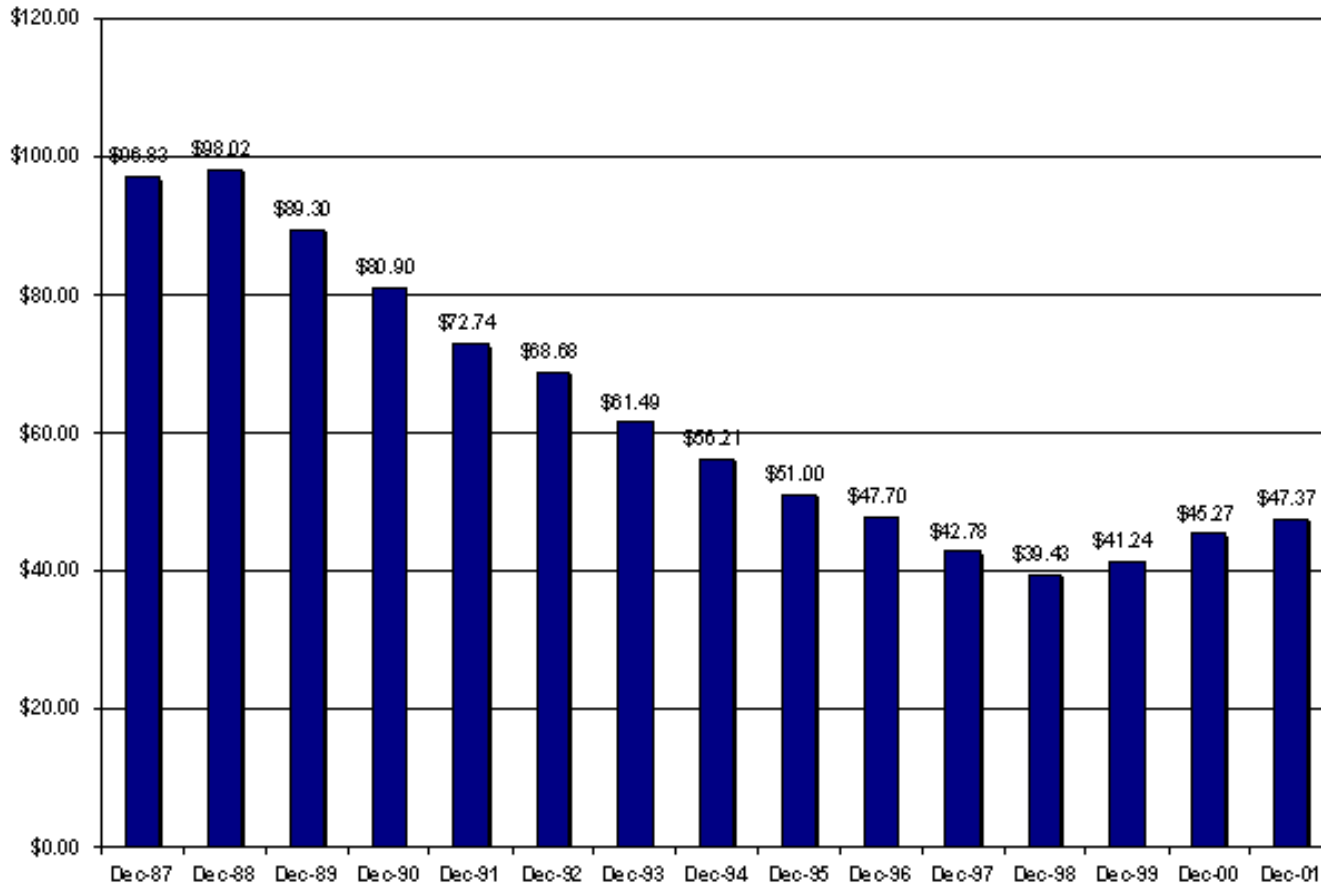


Source: CTIA

- Subscribers are up 17.3% since December 2000
- Growth rate is slowing



# Cellular Price Averages \$47.37/mo.



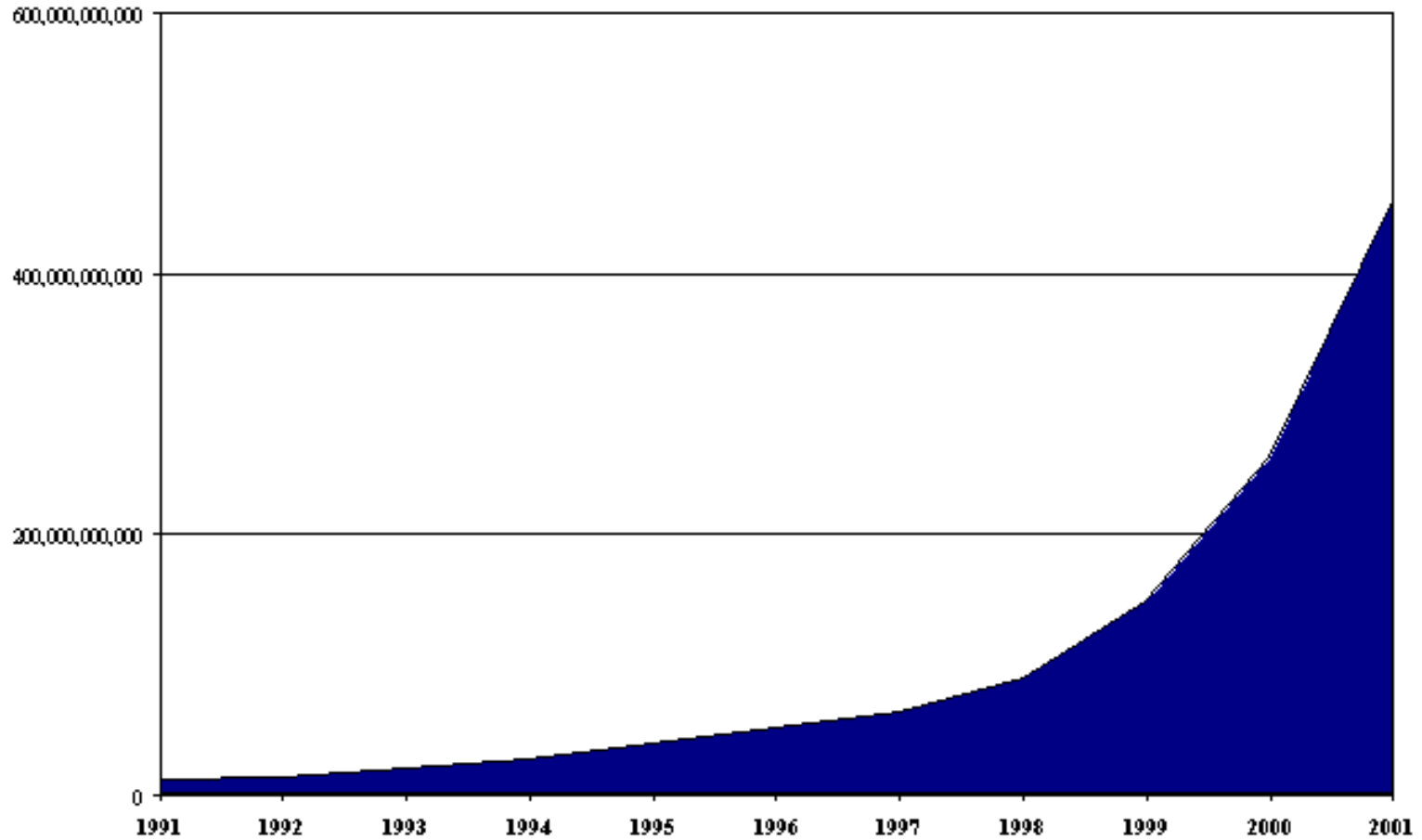
Source: CTIA

- Average Local Monthly Bill is up 4.6% year over year
- Monthly bill goes up but MOU goes through the roof

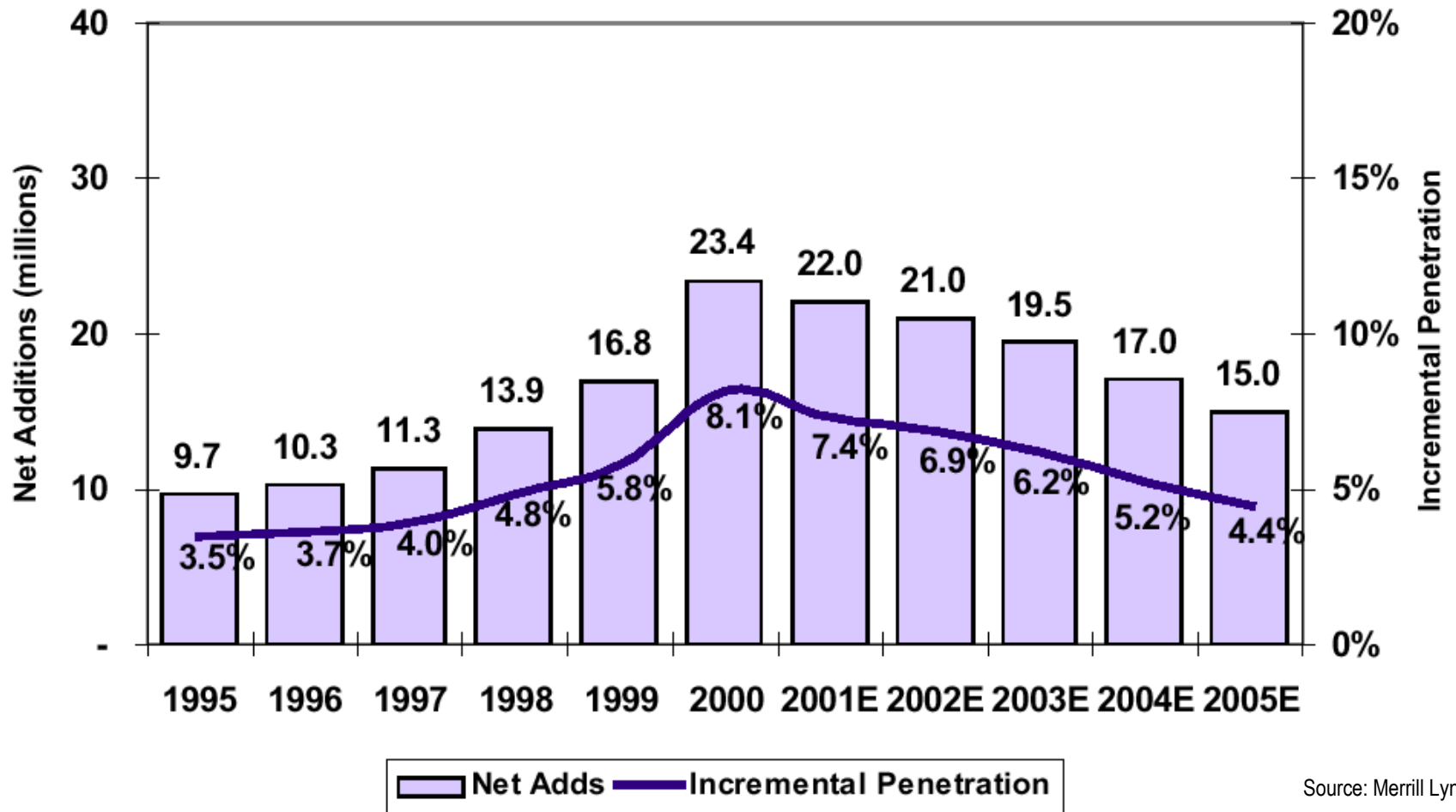




# Minutes Of Use Up 75%



# Saturation Has Begun



Source: Merrill Lynch

# Worldwide Mobile Terminals

Worldwide Mobile Terminal Sales to End-User Estimates for 1Q02 (Thousands of Units)

Company	1Q02 Market		1Q01 Market		Growth (%)
	1Q02 Sales	Share (%)	1Q01 Sales	Share (%)	
Nokia	32,531	34.7	33,506	34.4	-2.9
Motorola	14,533	15.5	13,225	13.6	9.9
Samsung	9,030	9.6	6,076	6.2	48.6
Siemens	8,229	8.8	6,633	6.8	24.1
Sony Ericsson	6,009	6.4	N/A*	N/A*	N/A*
Others	23,424	25.0	37,987	39.0	-38.3
<b>Total</b>	<b>93,755</b>	<b>100.0</b>	<b>97,427</b>	<b>100.0</b>	<b>-3.8</b>

\* Note: Sony Ericsson did not exist in 1Q01.

The respective sales to end-users were Sony 1.9 million units, Ericsson 6.4 million.

Source: Gartner Dataquest (May 2002)

# Take-Away Points

- Wireless Operators are fighting for New Revenue
- Average Revenue Per User (voice) is falling
- Data Services mean a new source of revenue
- Corporate data usage will drive data demand
- Corporate users are therefore in the driver's seat
- The networks all support data services to some extent
- Devices are available
- Wireless Data Services are ready for prime time!



# Wireless Data Pricing

# Wireless Data Value

## EMPLOYEE COST

- + Salary
- + Benefits
- + Furniture, Equipment, Facilities
- + Other Allocated Expenses
- ≈ \$120K to \$300K/year/employee
- ≈ **\$1 to \$3 per minute per employee**

## AVERAGE SAVINGS

- ~~60~~ **60 min per day**
- x \$2 per minute cost
- ≈ ~~\$1200 per day per employee~~
- ≈ ~~\$2660 per month per employee~~



# Wireless Data Value

## EMPLOYEE COST

- + Salary
  - + Benefits
  - + Furniture, Equipment, Facilities
  - + Other Allocated Expenses
- ≈ \$120K to \$300K/year/employee
- ≈ **\$1 to \$3 per minute per employee**

## AVERAGE SAVINGS

- 60 min per day  
x \$2 per minute cost
- ≈ \$120 per day per employee or
- ≈ **\$2,600 per month per employee**

# Wireless Data Value

## EMPLOYEE COST

- + Salary
  - + Benefits
  - + Furniture, Equipment, Facilities
  - + Other Allocated Expenses
- ≈ \$120K to \$300K/year/employee
- ≈ **\$1 to \$3 per minute per employee**

## AVERAGE SAVINGS

- 5 min per day  
x \$2 per minute cost
- ≈ \$10 per day per employee or  
≈ **\$216 per month per employee**

# Wireless Data Value

## EMPLOYEE COST

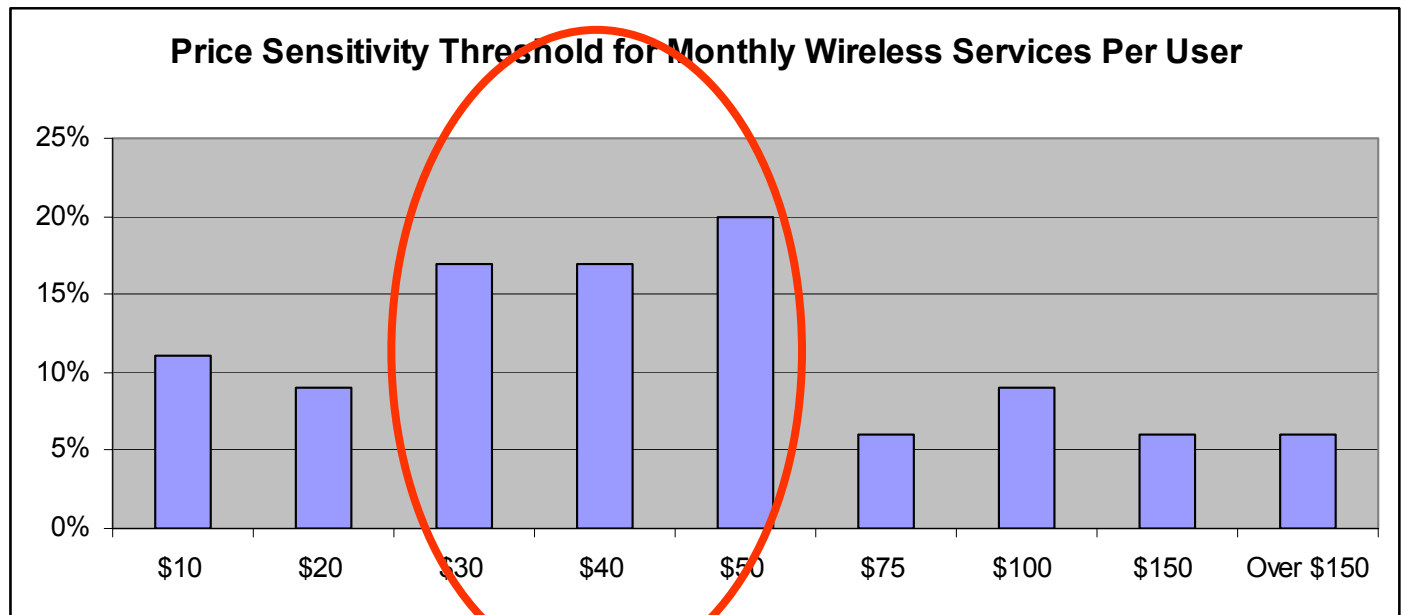
- + Salary
  - + Benefits
  - + Furniture, Equipment, Facilities
  - + Other Allocated Expenses
- ≈ \$120K to \$300K/year/employee
- ≈ **\$1 to \$3 per minute per employee**

## AVERAGE SAVINGS

- 2 min per day
  - x \$2 per minute cost
- ≈ \$4 per day per employee or
- ≈ **\$86 per month per employee**

# Reality Of Price Expectations

## What Will Corporations Pay For Data Services?



Source: Outlook 4Mobility, 7/2001

**Expectations—less that \$50/mo**

# Data Pricing—What Is A Megabyte?

- Desktop/laptop usage
- Here are some typical examples of 1 MB of data
  - Outlook/Exchange session
    - Synchronize, download and read 20 emails
    - Send 5 emails
  - 150 to 200 POP3 email messages (no attachments)
  - 3 – 4 medium resolution photos
  - Browsing of 15 to 20 Web pages
- My typical use for 4 hours at work
  - Sent: 345 MB
  - Received: 710 MB



# Data Usage Varies By Device

- Laptop
  - Applications assume Ethernet-type connection
  - No attempt to conserve bytes



# Data Usage Varies By Device



- PDAs and Palmtops
  - Most PDAs, especially non-Pocket PC PDAs, use proxy servers for Web browsing
  - Most email services are tailored for PDAs and use significantly less data than laptops
  - Most other communications applications have been written assuming a low-bandwidth connection

# Data Usage Varies By Device



- Smartphones
  - Use PDA OS (operating system)
  - Web proxy services
  - Most email services are tailored wireless connectivity



# Data Usage Varies By Device



- Java Phones
  - Efficient use of wireless bandwidth
  - Typical downloads 10 – 30K, few up to 100K
  - Interactive applets send optimized data



# Announced Wireless Data Prices

## Pricing In The UK


<b>BT Cellnet (mmo2)</b>		
	<b>\$5.69</b>	<b>\$11.39</b>
Included MB per month	0	5
Included MB charge		\$ 2.28
Additional cost per megabyte	\$ 28.51	\$ 5.69


<b>Vodafone UK</b>				
	<b>Free</b>	<b>\$10.68</b>	<b>\$25.14</b>	<b>\$40.20</b>
Included MB per month	0	1	5	15
Included MB charge		\$ 10.68	\$ 5.03	\$ 2.68
Additional cost per megabyte	\$ 28.51	\$ 7.13	\$ 4.99	\$ 2.57


**Around \$5.00 megabyte**



# GPRS Wireless Data Pricing

 MY WIRELESS WINDOW	Cingular Wireless			
	\$6.99	\$14.99	\$29.99	\$49.99
Included MB per month	1	3	7	13
Included MB charge	\$ 6.99	\$ 5.00	\$ 4.28	\$ 3.85
Additional cost per megabyte	\$ 30.72	\$ 30.72	\$ 30.72	\$ 30.72

	AT&T Wireless			
	\$15.99	\$39.99	\$79.99	\$199.99
Included MB per month	2	10	40	200
Included MB charge	\$ 8.00	\$ 4.00	\$ 2.00	\$ 1.00
Additional cost per megabyte	\$ 7.99	\$ 3.99	\$ 2.05	\$ 1.02

 Global Wireless by T-Mobile	VoiceStream (T-Mobile) Wireless			
	\$19.99	\$39.99	\$59.95	Roaming
Included MB per month	2	10	20	
Included MB charge	\$ 10.00	\$ 4.00	\$ 3.00	
Additional cost per megabyte	\$ 5.00	\$ 4.00	\$ 4.00	\$ 10.00



# CDMA Wireless Data Pricing

Sprint PCS®	Sprint PCS				
	\$39.99	\$59.99	\$79.99	\$99.99	\$119.99
Included MB per month	20	40	70	Unlimited	120
Included MB charge	\$ 2.00	\$ 1.50	\$ 1.14	N/A	\$ 1.00
Additional cost per megabyte	\$ 2.05	\$ 2.05	\$ 2.05	N/A	\$ 1.02


Verizon Wireless	Verizon Wireless Megabyte Pricing					
	\$35.00	\$55.00	\$75.00	\$99.99	\$100.00	\$150.00
Included MB per month	10	20	40	Unlimited	75	150
Included MB charge	\$ 3.50	\$ 2.75	\$ 1.88	N/A	\$ 1.33	\$ 1.00
Additional cost per megabyte	\$ 8.19	\$ 6.14	\$ 5.12	N/A	\$ 4.10	\$ 2.56

Verizon also offers data by the minute, priced as same as voice usage.



# Verizon Wireless Data Prices

- Express Network
  - Plus data by the minute
- Unlimited Express Network
  - \$99.99 unlimited data

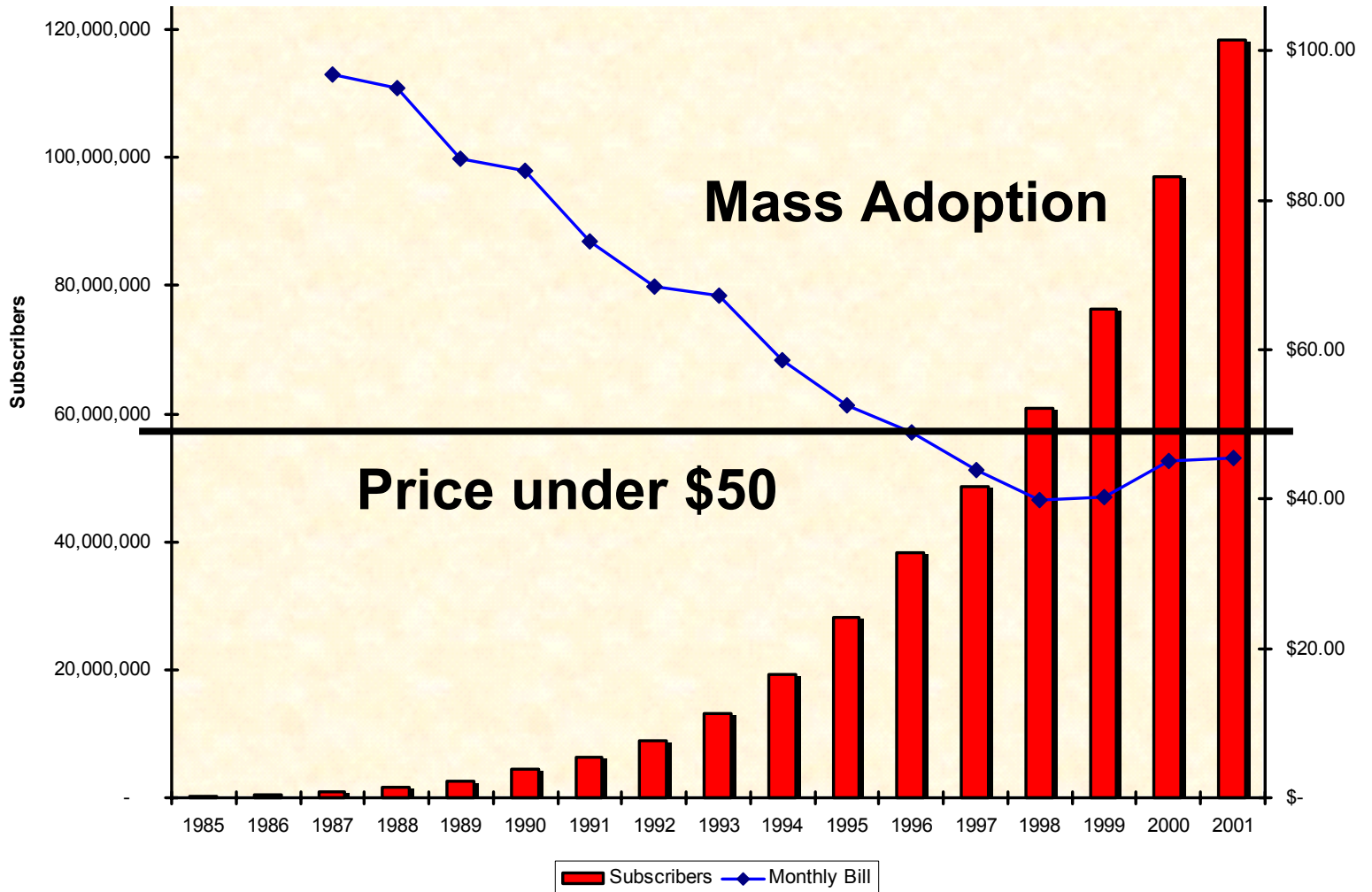
		<b>Verizon Wireless Megabyte Pricing</b>				
	<b>\$35.00</b>	<b>\$55.00</b>	<b>\$75.00</b>	<b>\$100.00</b>	<b>\$150.00</b>	
Included MB per month	10	20	40	75	150	
Included MB charge	\$ 3.50	\$ 2.75	\$ 1.88	\$ 1.33	\$ 1.00	
Additional cost per megabyte	\$ 8.19	\$ 6.14	\$ 5.12	\$ 4.10	\$ 2.56	

# Solutions To Control Data Costs

- Management tools
  - Electronic billing and analysis
  - Shared minutes (share across enterprise & pooling data)
- Mobility platforms
  - Email, calendar and CRM management
    - HP Enterprise Solutions
    - Microsoft Mobile Workplace Solutions
    - Sprint PCS Business Connection Enterprise Edition
    - Various third-party solutions
  - XML conversion platforms
  - Web proxy services
- Compression software
  - Bytemobile and others



# Price Must Be Right For Mass Adoption



# Take-Away Points

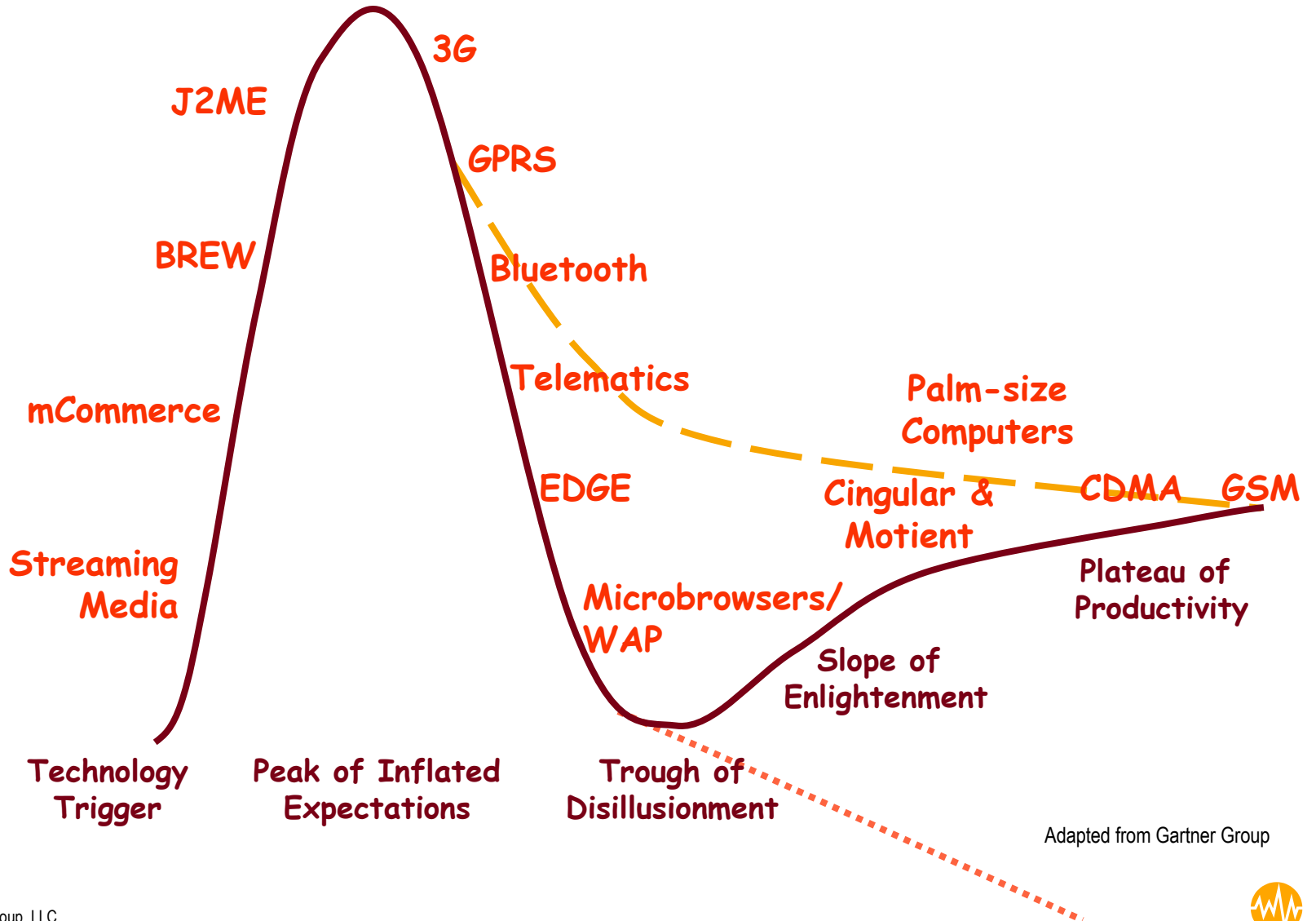
1. Can justify moderate wireless data costs of about \$200 per month based on productivity improvements
2. Budget expectations—wireless data service cost less than \$50 per month
3. Current pricing for a megabyte of data
  - Range: \$1 to \$30 per megabyte
  - Average: \$4 to \$5 per megabyte
4. Current pricing is too high for mass adoption
5. To drive wireless data market growth, lessons from the voice model need to be followed
  - Encourage use
    - Off-peak price incentives
    - Bargain data applications—messaging, entertainment
  - Low equipment costs
  - Near-flat-rate pricing





# Today's Directions And Issues

# Wireless Hype Cycle



Adapted from Gartner Group



# The Real Issue With Wireless Data

- Is it wireless network speed?
- Is it wireless coverage?
- Is it airtime cost?
- Is it device size?
- Is it device cost?
- Is it applications?

# It Is Not The Applications

- Many of the killer applications are here
  - Email
  - PIM
  - Instant messaging
  - Consumer information
  - CRM
  - SFA
  - Database access and applications
  - Telematics
  - Games



# The Issue: Usability Threshold

## When Do We Reach It?

- Device
  - Size
  - Display
  - Cost
  - Local storage
  - Integrated communications
  - Battery life
- Network
  - Speed
  - Airtime cost
  - Location services
  - Coverage
- User interface
  - Graphical
  - Display size/readability
  - Input
    - Keypad
    - Pen
    - Keyboard
    - Voice
- Application navigation
  - Workflow design
  - Custom and dynamic preferences
  - Automatic location data

# End-To-End Solutions

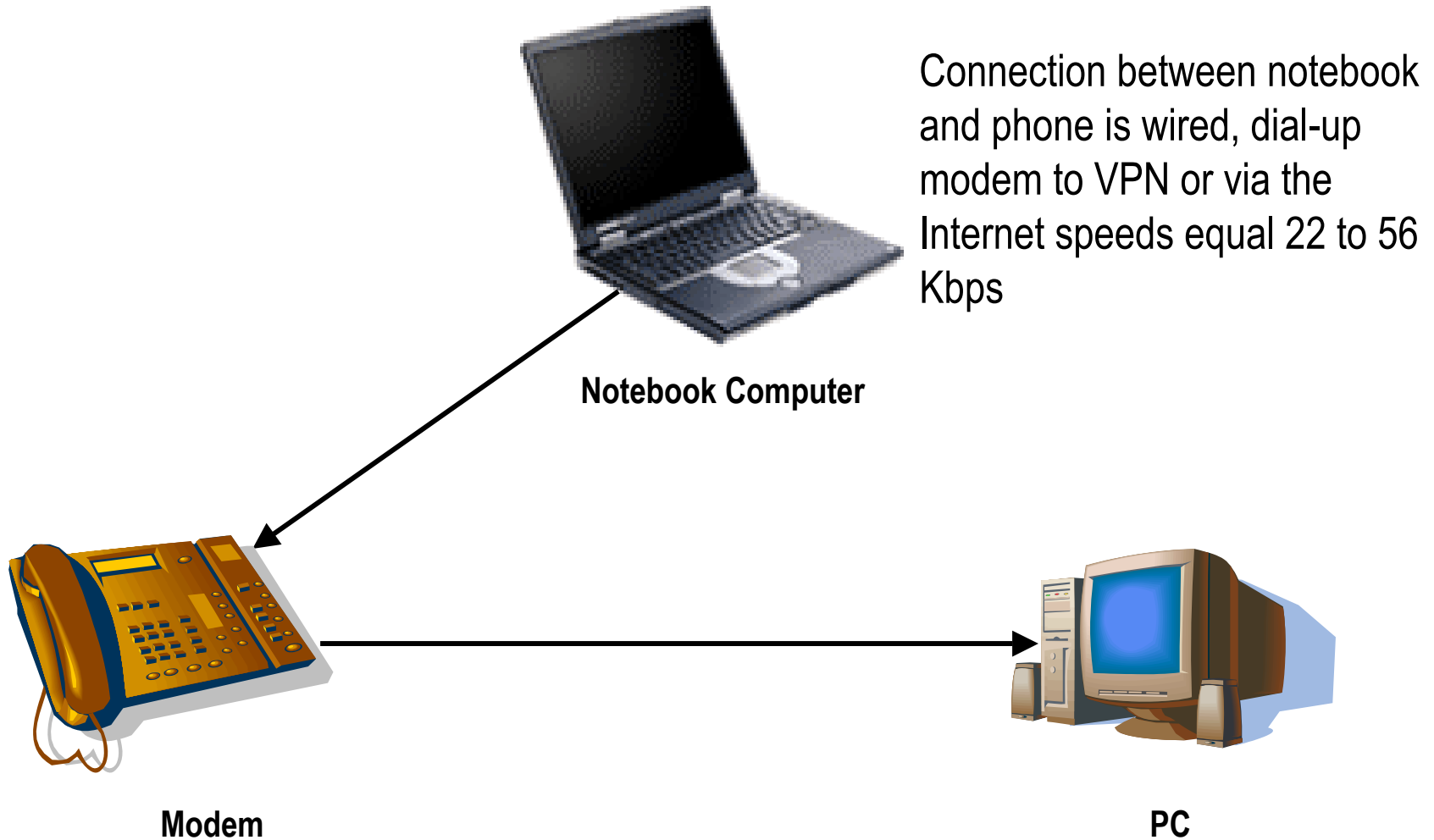
- Don't spend too much time choosing "a" wireless network
- Work with end-to-end solutions providers such as HP
- Spend time and effort on back-end and end-user issues
- Treat wireless transport as something that will change over time
  - Data speeds will get better
  - Latency will get better
  - Price points will get lower
- The technology is here today to support wireless mobility
- The issue is to be able to deliver information when it is needed where it is needed in a secure fashion



# Moving From Wired To Wireless

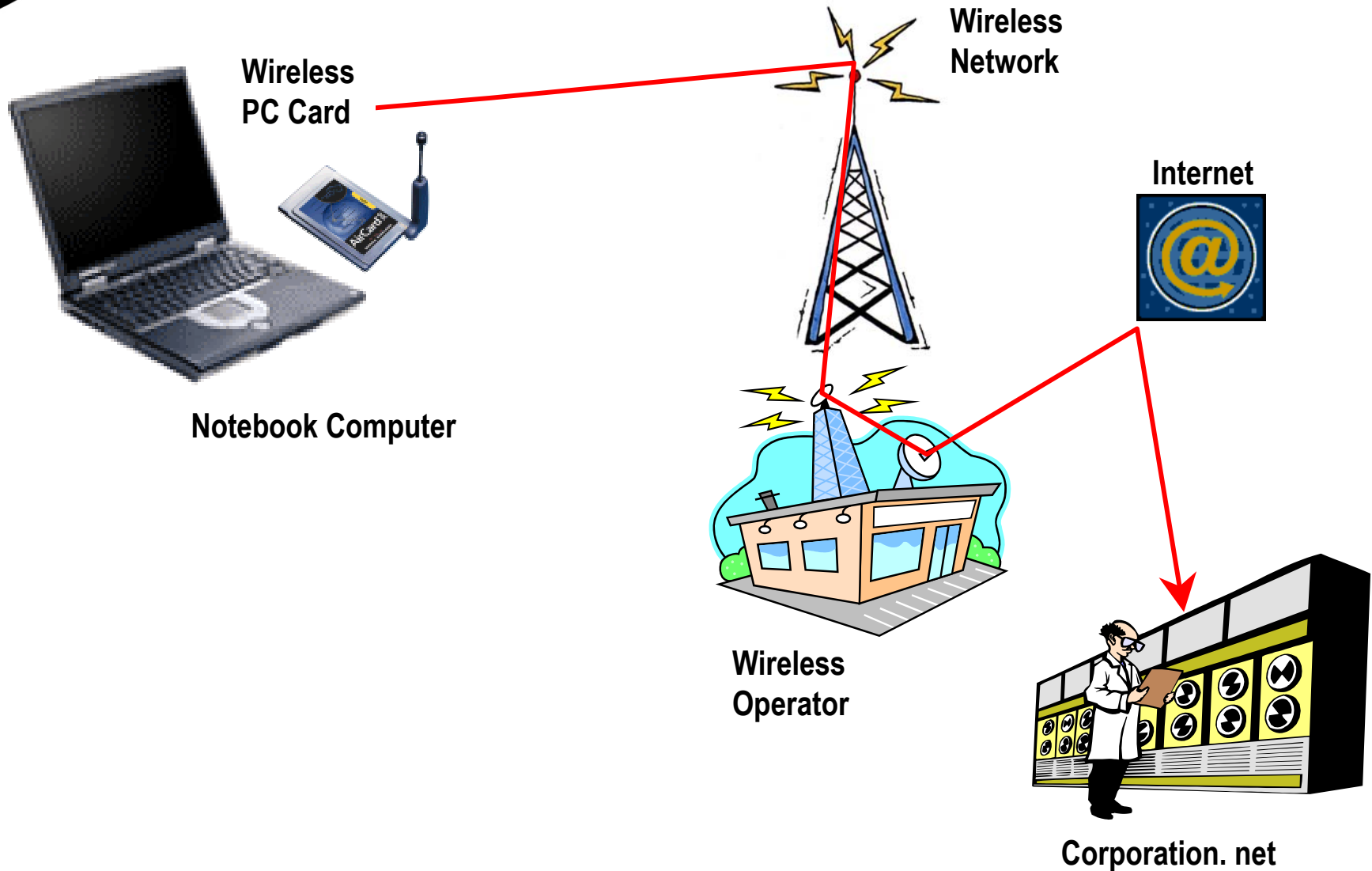
## A Real-World Example

# An Example Of Yesterday's Technology





# An Example of Today's Technology



# Today and Tomorrow: 2002/2003



**Hi-Res Digital Camera**

Digital camera equipped with Bluetooth, a short-range wireless wire

PDA equipped with Bluetooth receives the image, displays it and then sends it to a wireless phone

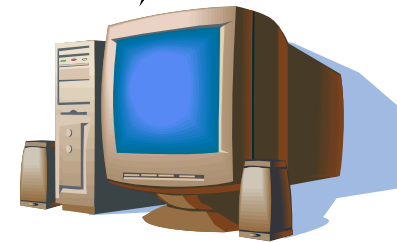
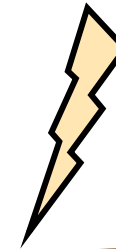
The wireless phone sends it over the wide-area digital wireless network



**Color PDA**

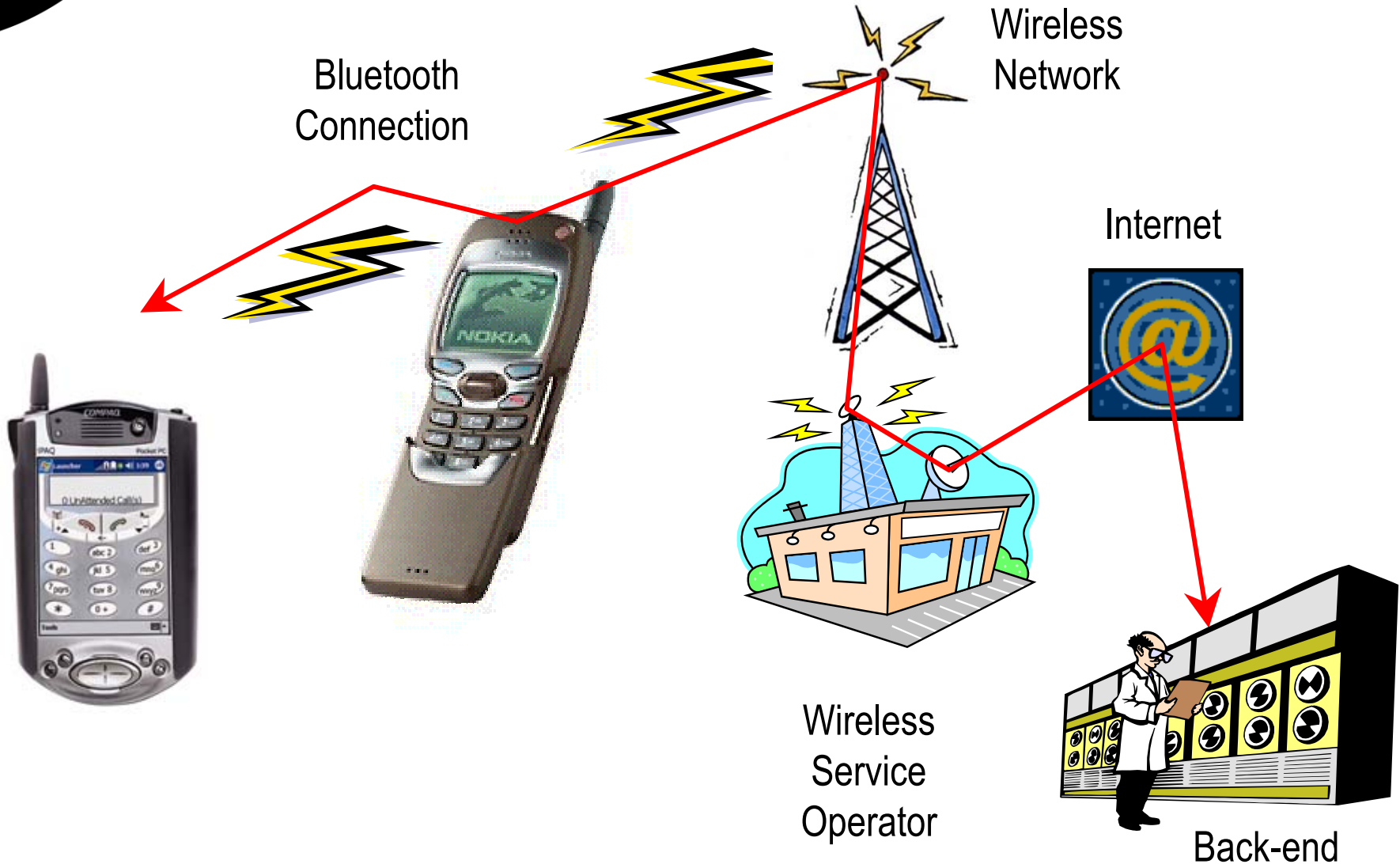


**Wireless Phone**

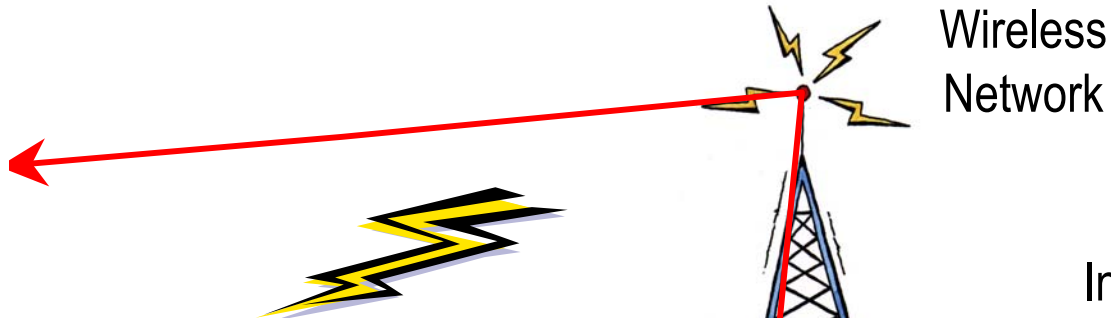


**PC**

# Scenario 1 — Bluetooth

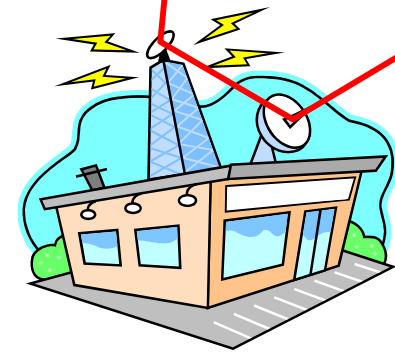


# Scenario 2 — PDA Phone



Wireless Network

Internet



Wireless Service Operator



carrier.net

Bluetooth Connection





# WiFi or 802.11x

## License-Free, High-Speed Wireless Data (and voice in the future)

# Setting The Stage

- What Is WiFi Anyway?
  - 802.11b, 802.11a, 802.11g
- 3G, What Data Speeds?
- Trends That Play Here
- The Business Models
- WiFi and 3G: Friends or Foes?
- Spoilers: Are There Any?
- Conclusions

# WiFi: IEEE Standards

- 802.11b (today's prevalent technology)
  - 2.4 GHz: Maximum Data Speed 11 Mbps (5-6 real)
    - Same band as all microwave ovens
    - Lots of voice phones, other devices
- 802.11a (vying to become tomorrow's winner)
  - 5 GHz: Maximum Data Speed 54 Mbps (30-40 real)
    - More spectrum
    - Less distance
    - About the same cost
- 802.11g (specs not yet ready for prime time)
  - 2.4 GHz: Maximum Data Speed 50 Kbps (real unknown)
  - Same technology as used in 802.11a

# 3G What Data Speeds When?

- CDMA2000 1X and 1x EVDO
  - Available today in many countries including the U.S.
    - 1X: Peak to 144 Kbps (average 50-70 Kbps)
    - EV-DO commercial in Korea (Average 500-700 Kbps)
      - Being tested in other countries including U.S.
- EDGE (upgrade to GSM/GPRS networks)
  - Supports data speeds of “over 384 Kbps”<sup>1</sup>
  - Being rolled out in U.S. 2003-2004?
- UMTS/WCDMA
  - Available in Tokyo and Isle of Man
    - WCDMA peak data speed “up to 2 Mbps”
    - UMTS/WCDMA is late to market
      - Europe will see UMTS in urban areas in late 2003/2004



# Trends That Affect 3G/WLANs

- Intel
  - By 2003 the Banias Mobile Processor family will be closely tied to both 802.11b and a.
- Microsoft
  - Big supporter of WiFi, starting to develop products for WiFi
- 802.11b “hotspots” growing in number by the day
- CDMA2000 1X PC Cards on the market today
  - Notebooks and PDAs can make use of 1X from Sprint PCS and Verizon
- T-Mobile owns MobileStar
- Sprint PCS invested in Boingo
- Access points and PC Cards coming down in price
- Bluetooth is very late to market but coming

# WiFi And 3G Business Models

- Both WiFi and 3G pricing is too high today
  - Pricing models are confusing
- Too many WiFi “hotspot” providers
  - Customers will NOT sign up with multiple providers
  - No one is yet making money with WiFi hotspots
- “Free” WiFi access
  - Free access is not consistent—comes and goes
- 3G: Voice will help carry the cost of data
  - Data available for notebooks, PDAs and phones
- WiFi: Data-only services today
  - Data services available ONLY on notebooks and PDAs
- Wireless wide-area network operators are “interested” in WiFi as an adjunct to their 3G systems

# WiFi And 3G: Friends Or Foes?

- WiFi is being driven by the computer industry
- 3G is being driven by the wireless industry
- Most wide-area network operators are interested in WiFi as an adjunct to their 3G offerings
  - Verizon: “We cannot afford to build out our 3G capacity for 30-minute usage spikes at every airline gate—WiFi is a perfect way of handling these usage spikes” (Dick Lynch, CTO, Verizon Wireless)
  - T-Mobile owns MobileStar
  - Sprint PCS is an investor in Boingo
  - Rumors persist that a consortium of wide-area network operators are looking into WiFi deployments
- Can data-only networks make money?
  - No one has been successful yet
  - Perhaps WiFi needs wide-area more than wide-area needs WiFi

# Conclusions


- WiFi and wide-area systems are complementary
- Customers must receive a single bill for both services
- There are some potential spoilers on the horizon for 802.11b
- Pricing has to be low enough to attract more users and high enough that providers can make money
- Data-only network providers are the most vulnerable moving forward
- Both will be successful when and IF their implementation is easy enough for mass adoption...a big IF right now!



# Wireless Roadmaps



# Packet-Data Network Roadmap

Wide-Area Wireless US Summary		1999				2000				2001				2002				2003			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Cingular Interactive	Mobitex (BellSouth Wireless Data) 8 Kbps Packet																				
Motient	DataTAC (American Mobile ARDIS) 9.6 Kbps and 19.2 Kbps Packet																				
AT&T and Verizon	CDPD 19.2 Kbps Packet																				
						 Los Angeles Online															

© 1999 Andrew Seybold Group, LLC 10-Oct-02





# 2.5 And 3G U.S. Wireless Data

U.S. Wide-Area 2.5 and 3G Wireless Networks	2001				2002				2003				2004				2005			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
CDMA2000 1X [3G] Verizon and Sprint PCS (144 Kbps)																				
CDMA2000 1x [3G] Verizon and Sprint PCS (288 Kbps)																				
CDMA2000 1xEV-DO [3G] Verizon Wireless (2.4 Mbps)																				
GPRS [2.5G] (9.6 Kbps/38.4 Kbps)																				
WCDMA [3G] AT&T Wireless (384 Kbps)																				

# Peak And Average Data Rates

Technology	Peak (Kbps)	Realistic (Kbps)	When (Nationwide)
GPRS	115	25	2002 (1)
EDGE	384	75-100	Never (2)
WCDMA (UMTS)	2,000	800	2007+ (3)
CDMA2000 1X	144	40-80	2002 (4)
CDMA2000 1x EV DO	2,400	800	2004 (5)

1. Available in most markets by the end of 2002
2. Used only in dense urban cores and hotspots
3. Spectrum and technology problems may push out
4. Sprint PCS Now, Verizon by early 2003
5. Used only in metro areas



# Real GPRS and EDGE Data Rates

**Table 1: GPRS and EDGE data rates**

	Peak Network Speed	Peak Device Speed	Average PC Browser Speed (loaded network)	Average Streaming Media Speed (loaded network)
GPRS	115 kbps	53 kbps	20-30 kbps	10-20 kbps
EDGE	384 kbps	237 kbps	80-130 kbps	20-40 kbps

- If you don't believe us, believe AT&T
- More details at

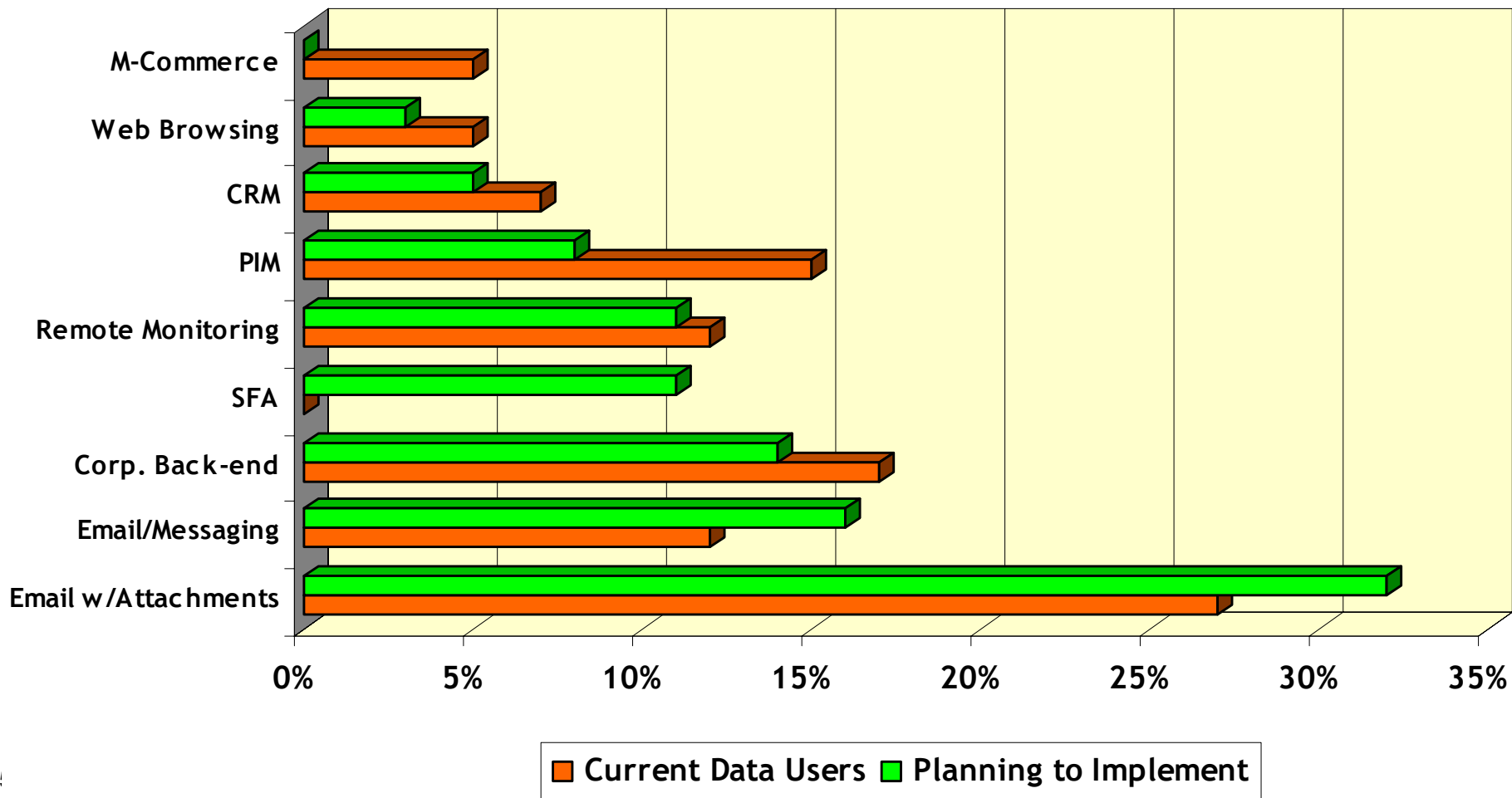
[http://attws.com/3G/TechnologyCenter/network/speeds\\_speeds.htm](http://attws.com/3G/TechnologyCenter/network/speeds_speeds.htm)



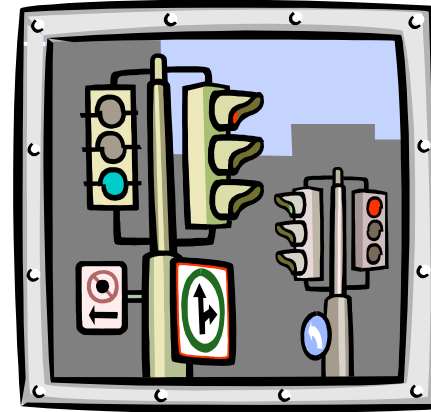
# Information Delivery Needs Are Different When Mobile

## Don't "Port" Desktop Experiences To Handheld Computers

# Enterprise Wireless Applications



# Mobile Environment Is Different— Attention, Distraction, Focus



# Mobile Environment Is Different— Devices



- Displays
- Input capabilities



# Browsing Should Be Last Resort



- Display
  - Need to take advantage of every pixel
  - Small size often requires different layout of information
  - Color enhances readability
- Input
  - Mobile applications need to anticipate better than desktop
  - Keyboard preferred by many for messaging applications



# Active Content Is —



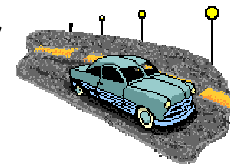
- Integrated within applications (e.g., Pocket PC Date Book)
- Transparent entry
- Automatically updated
- Seamless
- Automatic notification of changes



# Active Content Example



- Flight to Dallas
  - Enter in Microsoft Outlook
    - Airline, flight number and hotel
  - Resulting actions on mobile device
    - Departure and arrival times appear in calendar
      - Any changes create an alert and notification
    - Dallas weather icon summary in calendar
      - Notification of unusual weather conditions
    - Driving directions from airport to hotel in calendar
    - Restaurant list within 3 miles of hotel
      - Preferences allow a short, targeted list

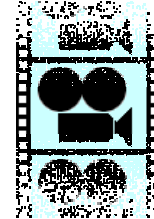
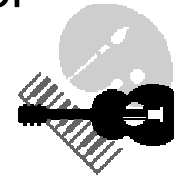




# Active Content Example



- Clear Time — Evening in Dallas is free
  - Resulting actions — based on personal preferences
    - Professional sports games dropped into calendar or
    - Concerts dropped into calendar or
    - Films dropped into calendar
  - Additional capabilities
    - Ticket link
    - Directions
- Drive to client
  - Resulting actions
    - Directions again
    - News icon
    - Order status summary
    - White page look-up from contact list



# Analysis



- User experience is critical for success
- Need new approaches for handheld devices
- Browser should be last resort for application interface
- Usability is the most important factor for success
  - Wireless data will explode when user interface solution is developed



# Wireless Data In 2002-3

**Where Are We?**

**Is It Safe To Implement Wireless Data?**

# All Of The Pieces Are In Place

- Data networks are/will be ready
  - Data-only networks: 3 with data speeds of 20K or less
  - Voice-and-data networks coming online
    - GPRS (AT&T, Cingular, VoiceStream at 20-50 Kbps)
    - Cdma2000 1x (Verizon, Sprint and others at 60-80 Kbps)
  
- Devices will be plentiful by late-2002
  - Smartphones
  - Feature phones
  - Browser phones
  - PDAs
  - Keyboard-centric devices with voice capabilities

# All Of The Pieces Are In Place

- Information access
  - Corporate information access providers
    - Hosted externally
    - Behind firewall
  - Data can be secured
  
- Corporations want data access
  - Many CTO and IT managers have wireless budgets
  - Field forces putting pressure on companies for access
  
- Automobile industry pushing telematics
  - Want to add data to voice-only services
  
- Location-based services catching on
  - Know where I am, get me the information I need

# Analysis

- User experience is critical for success
- Wide choice of devices available
- The pieces are all in place
  - It still takes time and understanding to implement end-to-end solutions
  - There are companies that know how to do this
- Usability is the most important factor for success
  - Wireless data will explode when all of the pieces are in place
- Wireless Access to Corporate Data is a real competitive advantage

# Thank you!

# Questions, Comments, Information, Rebuttals

