

Course 330

Real-World Non-Technical Introduction to 1xRTT (Fast Data and more Capacity too!)

Contents

- What exactly is 1xRTT?
 - What cool stuff can a customer do with 1xRTT?
 - Live Demonstration
- Competitive Survey of Wireless Technologies and Operators
 - Wireless companies using CDMA, TDMA, GSM, IDEN
- A Quick Semi-Technical Walk-Through of how 1xRTT works
 - How our network equipment is arranged to operate with 1xRTT
- How the 1xRTT Signal is different and better than original CDMA
 - different information handling, more room, less errors
- What other fast data services are coming in the future?
 - 1xEV-DO, 1xEV-DV, UMTS WCDMA – what they are and when they will be launched commercially
- What are the best ways to “pitch” 1xRTT to customers?
 - Discussion of 1xRTT Applications and their advantages
 - PC, PDA, special phone applications
- Open Questions and Answers

Just what exactly *is* 1xRTT?!!

What *Is* 1xRTT?!

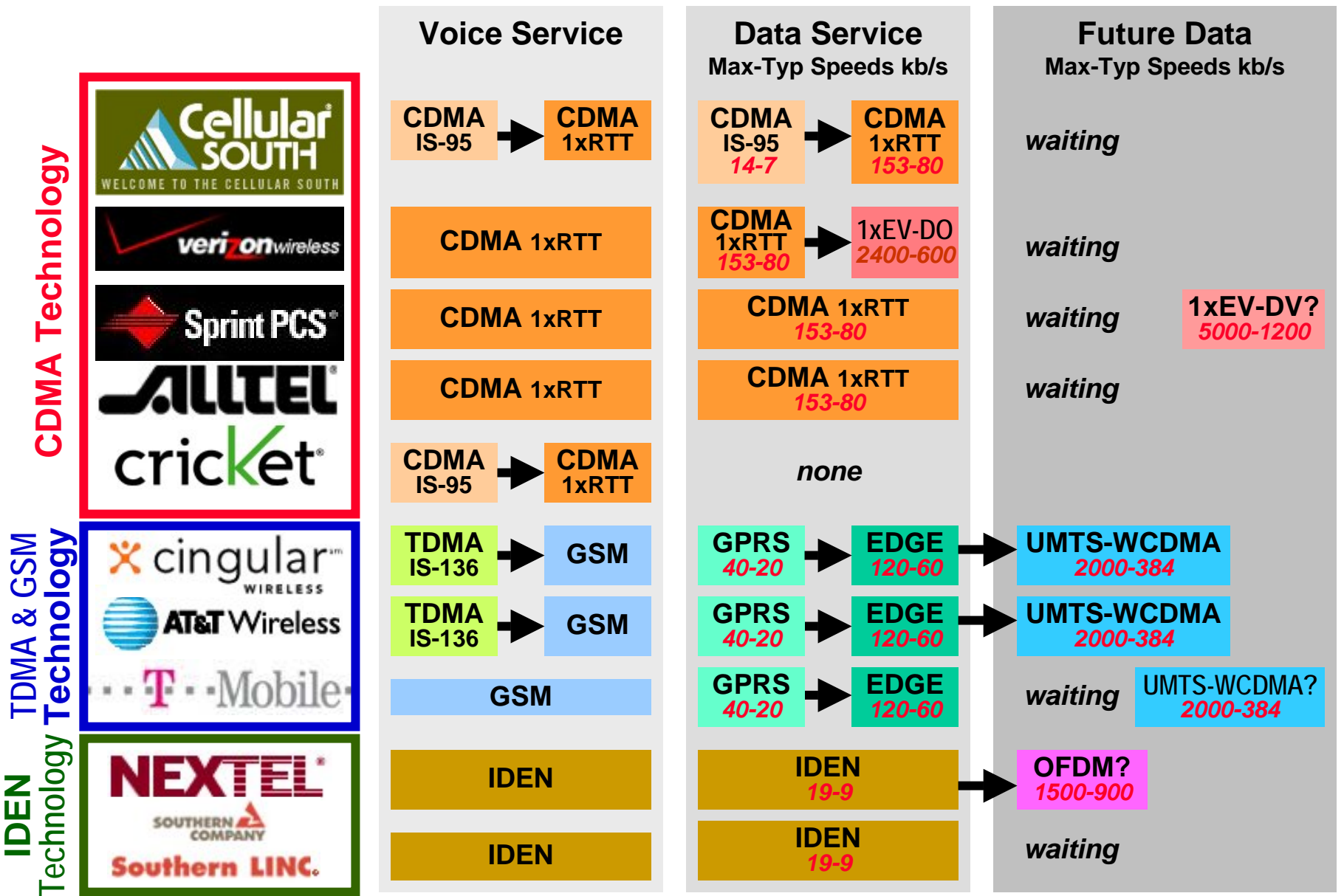
- 1xRTT is an improved type of CDMA signal
 - it uses an improved kind of RF modulation for a better signal
 - it can carry up to double the customer “stuff” compared to old standard CDMA signals (IS-95)
 - that means up to twice as many people talking per tower with slightly better voice quality than original CDMA
 - OR a mix of more people and fast computer data, too with slightly better voice quality than original CDMA
- Existing towers’ equipment can be upgraded to handle 1xRTT
- Old (“IS-95”) CDMA Phones will still work with 1xRTT towers
 - but only new 1xRTT phones will be able to do fast data
- Non-upgraded Towers can serve both IS-95 and 1xRTT Phones
 - but the new 1xRTT phones can’t do fast data when talking through an old non-upgraded tower

Competitive Wireless Showdown: Who's the Coolest?

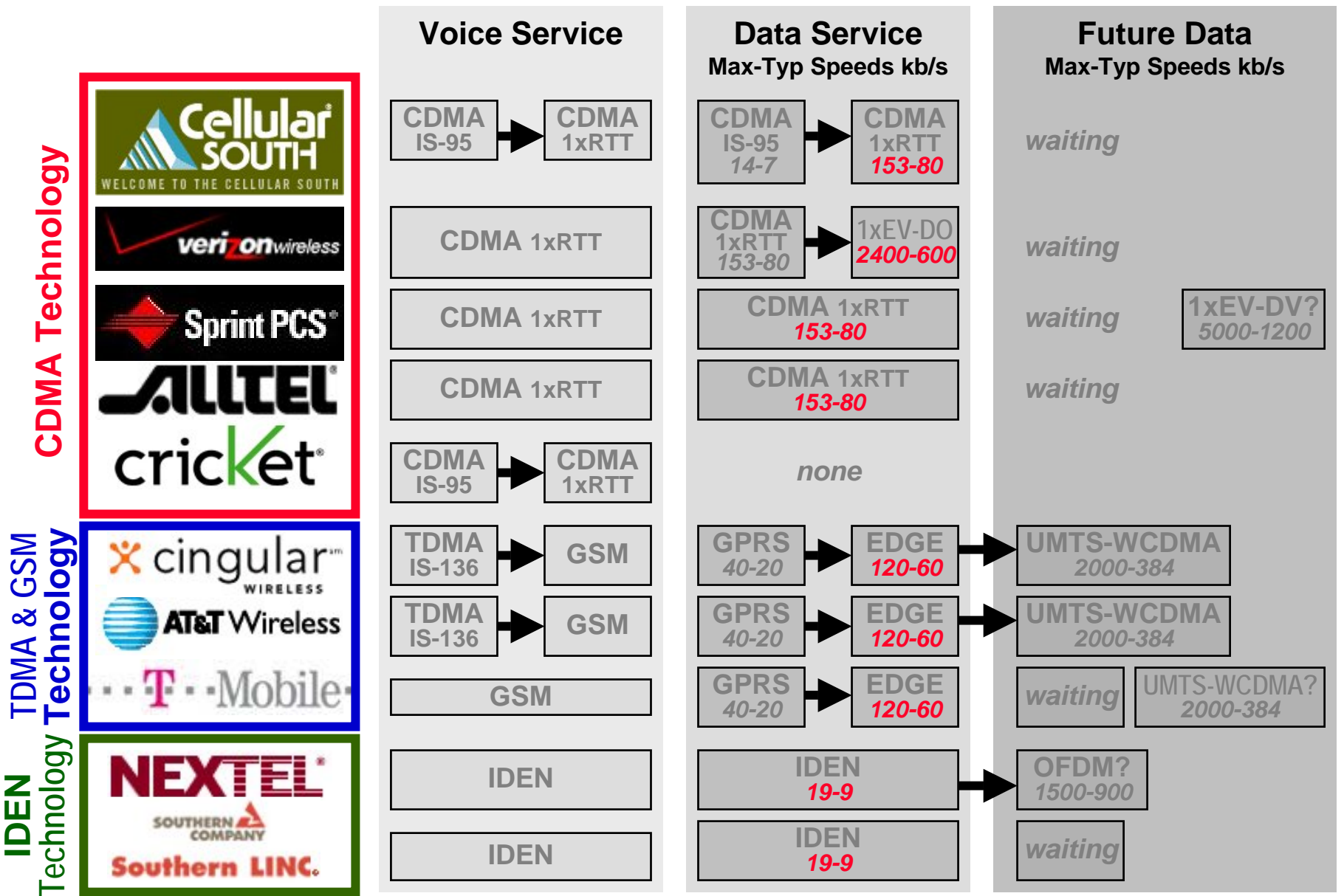
Wireless Competition and Cool Features

- All wireless companies are racing to offer customers better service
 - less expensive plans
 - more expanded coverage
 - more features and capabilities
 - more capacity on the network, for more calls/more revenue
- New Technologies are being phased in
 - the old technologies are “Second Generation”
 - the new technologies are “Third Generation”

Who's Doing What Technologies? Who's Fastest?

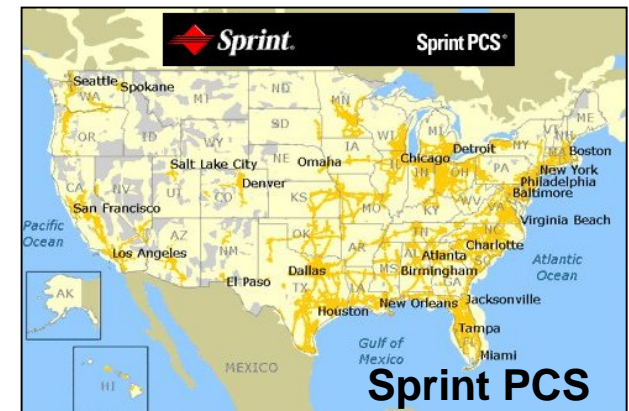
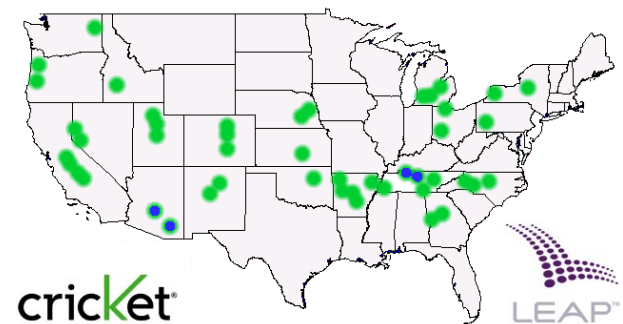
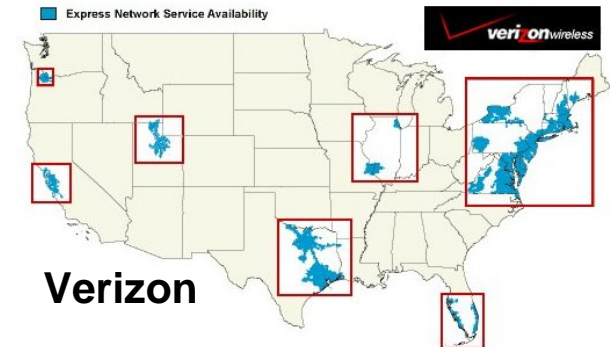


Data Speeds: The 2004-2005 Situation

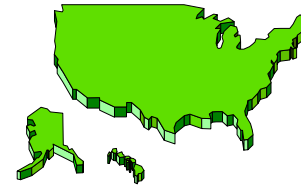
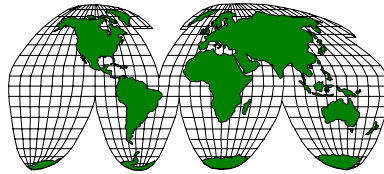


CDMA2000 1xRTT Deployment

- 1xRTT has finally launched in US markets in 2002
- Verizon was first to market, launching 1xRTT in seven regions in 1Q2002
 - IS-95 and 1xRTT RC3 voice services
 - 1xRTT RC3 data: “Express Network”
 - Verizon Lucent and Nortel markets have launched; Motorola markets will follow around year-end 2002
- Leap Wireless “Cricket” deployed RC3 in selected markets 1Q2002
 - motivated solely by voice capacity gains, not planning to offer data
- Sprint PCS launched 1xRTT *nationwide* in August 2002
 - IS-95 and 1xRTT RC3 voice services
 - 1xRTT data services
 - “Picture phone” devices expected by year-end 2002



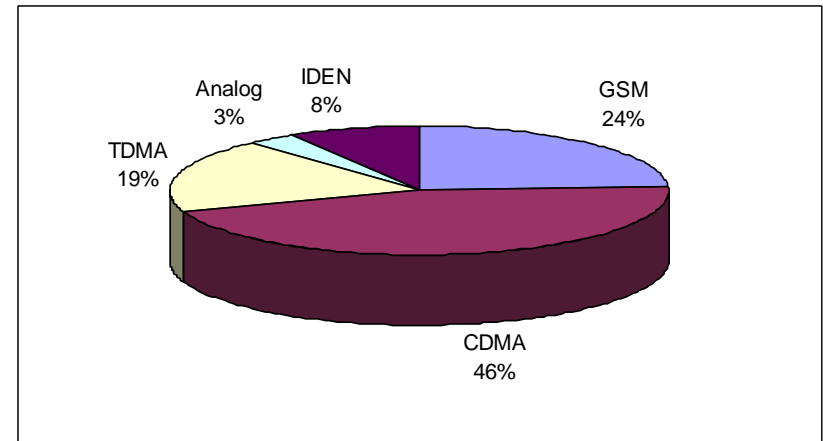
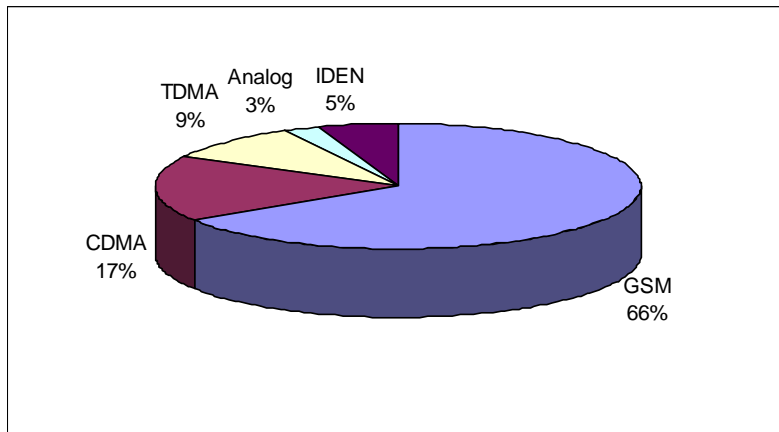
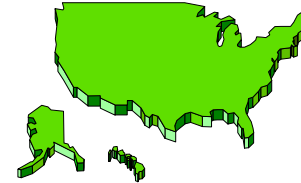
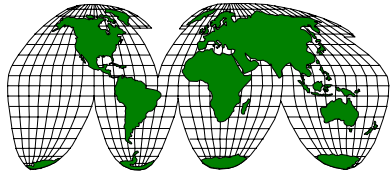
Global and US Wireless Snapshot 4Q 2003



	Worldwide		USA	
Total Wireless Users	1,320,000,000	100%	141,000,000	100%
GSM users	870,000,000	65.9%	33,732,506	23.9%
CDMA users	224,000,000	17.0%	64,503,287	45.7%
TDMA users	124,000,000	9.4%	26,375,232	18.6%
IDEN users	68,000,000	5.2%	11,978,382	8.5%
Analog users	34,000,000	2.6%	4,510,594	3.2%

- Total Worldwide Wireless customers surpassed total worldwide landline customers at year-end 2002, with 1,00,080,000 of each.
- 2/3 of worldwide wireless customers use the GSM technology
- CDMA is second-most-prevalent with 17.0%
- In the US, CDMA is the most prevalent technology at 45.7%
- Both CDMA and GSM are growing in the US
 - most IS-136 TDMA systems are converting to GSM + GPRS + EDGE

Global and US Wireless Users by Technology



- GSM is by far the dominant global technology
- CDMA is dominant in its country of origin, the USA
- The IS-136 TDMA community is rapidly implementing GSM
 - primary motivation is to provide GPRS and/or EDGE fast data

US Wireless Operators: Technologies and Subscribers

141,000,000	Totals:	64,503,287	33,732,506	26,275,232	11,978,382	4,510,594
Company	Subscribers	CDMA	GSM	TDMA	IDEN	Analog
Verizon	33,166,130	29,849,517				3,316,613
Cingular	22,348,869		11,174,435	11,174,435		
AT&T Wireless	21,328,373		10,664,187	10,664,187		
Sprint PCS	15,103,346	15,103,346				
Nextel	10,817,261				10,817,261	
T-Mobile	10,102,914		10,102,914			
Alltel	7,755,772	6,980,195				775,577
US Cellular	4,184,035	2,928,824		836,807		418,403
Leap Wireless	1,530,744	1,530,744				
Western Wireless	1,224,596		1,224,596			
Dobson	1,122,546	1,122,546				
Quest	1,020,496	1,020,496				
Nextel Partners	895,792				895,792	
Triton PCS	847,012		423,506	423,506		
Rural Cellular Corp.	736,801			736,801		
Alamosa Holdings	634,749	634,749				
Airgate PCS	601,518	601,518				
US Unwired	552,374	552,374				
Centennial	540,863			540,863		
Midwest Wireless	288,313	288,313				
SouthernLINC	265,329				265,329	
Ntelos	256,166	256,166				
Horizon PCS	246,858	246,858				
Ubiquitel	239,408	239,408				
MetroPCS	1,694,024	1,694,024				
Cellular South	561,273	280,636		280,636		
Commnet PCS	357,174			357,174		
NewComm	306,149	306,149				
West Coast PCs	295,944	295,944				
Meriwether Communications	275,534			275,534		
Touch America	224,509	224,509				
Airadigm Communications	163,279			163,279		
Cellcom	163,279	163,279				
Conestoga Wireless	142,869		142,869			
Lewis and Clark	132,665			132,665		
Public Service Cellular	112,255			112,255		
Entertainment Unlimited	112,255			112,255		
NPI Wireless	112,255			112,255		
Poplar PCS	102,050	102,050				
CorrWireless	102,050			102,050		
Iowa Wireless	102,050			102,050		
NTCH	81,640	81,640				
Edge Wireless	75,006			75,006		
Skagit Wireless	73,476			73,476		

Survey of Wireless Data Technologies

Technology	Speed, b/s			Commercial In Year	Access Type	Observations & Comments
	Max.	Typ.	Min.			
AMPS	9,600	4,800	2,400	1989	Dialup	Raw analog channel, use MNP or equivalent
TDMA IS-136	19,200	9,600	2,400	1995	Packet & Dialup	Works, but so slow - never popular
GSM	9,600	4,800	1,200	1992	Packet & Dialup	Works, but so slow - never popular
GSM HSCSD	30,000	19,200	9,600	1999	Packet	Popular in some countries; never widespread
IDEN	19,200	19,200	2,400	1998	Packet	Flexible but never widely accepted
CDMA IS-95	14,400	14,400	1,200	1995	Packet & Dialup	Works, but so slow - never popular
CDMA IS-95B	76,800	19,200	1,200	1998	Packet & Dialup	Never popular with operators; little hardware
CDPD	19,200	4,800	1,200	1993	Packet	Old workhorse; operators never dimensioned well; main users Law Enforcement; discontinued 2004
MOBITEX	9,600	9,600	1,200	1998	Packet	Flexible on pagers and PDA but networks overwhelmed with traffic, very slow and congested
GPRS	40,000	30,000	9,600	2002	Packet	Rapidly increasing popularity, phones, PDAS
EDGE	200,000	90,000	28,800	2003	Packet	Rapidly increasing popularity in US; Europe slow to adopt; placebo for UMTS?
CDMA2000 1xRTT RC3	153,600	90,000	30,000	2002	Packet	For Mobility Applications. Widespread popularity in US, Korea, Japan
CDMA2000 1xRTT RC4	307,200	180,000	60,000	2003		For Fixed Wireless; not widely exploited
CDMA2000 1xEV-DO	2,400,000	600,000	153,600	2003	Packet	Rapidly increasing popularity in US, Korea, Japan; E Europe using on 450
CDMA2000 1xEV-DV	5,000,000	1,200,000	153,600	2005?	Packet	Still awaiting commercial deployment. Very little exposure
UMTS WCDMA	2,000,000	384,000	150,000	2002	Packet	Still mired in operator & auction finances; some bugs; handsets scarce
TD-SCDMA				2005?	Packet	Ongoing development; major activity in China and by Siemens
OFDM	1,500,000	900,000	300,000	2004	Packet	Flarion's FLASH OFDM implementation, trial in NC; low latency (20 ms)

- This summary is a work-in-progress, tracking latest experiences and reports from all the high-tier (provider-network-oriented) 2G and 3G wireless data technologies
- Have actual experiences to share, latest announced details, or corrections to the above? Email to Scott@ScottBaxter.com. Thanks for your comments!

CDMA Technology Migration Path to 3G

		CDMAone		CDMA2000/IS-2000		
Generation	1G	2G	2G	2.5G or 3?	3G	3G
Technology	AMPS	IS-95A/J-Std008	IS-95B	IS-2000: 1xRTT	IS-2000: 3xRTT	1xEV: 1xEV-DO or 1Xtreme
Signal Bandwidth, #Users	30 kHz. 1	1250 kHz. 20-35	1250 kHz. 25-40	1250 kHz. 50-80 voice and data	F: 3x 1250k R: 3687k 120-210 per 3 carriers	1250 kHz. Many packet users
Data Capabilities	None, 2.4K by modem	14.4K	64K	153K 307K 230K	1.0 Mb/s	2.4 Mb/s (1xEV-DO) 5 Mb/s (1Xtreme)
Features: Incremental Progress	First System, Capacity & Handoffs	First CDMA, Capacity, Quality	<ul style="list-style-type: none"> •Improved Access •Smarter Handoffs 	<ul style="list-style-type: none"> •Enhanced Access •Channel Structure 	Faster data rates on shared 3-carrier bundle	Faster data rates on dedicated 1x RF data carrier

GSM Technology Migration Path to 3G

Generation	1G	2G	2.5G or 3?	3G	3G
Technology	various analog	GSM	GPRS	EDGE	UMTS UTRA WCDMA
Signal Bandwidth, #Users	various	200 kHz. 7.5 avg.	200 kHz. Many Pkt. users	200 kHz. fast data many users	3.84 MHz. up to 200+ voice users and data
Data Capabilities	various	none	9-160 Kb/s (conditions determine)	384 Kb/s mobile user	2Mb/s static user
Features: Incremental Progress	various	Europe's first Digital wireless	<ul style="list-style-type: none"> •Packet IP access •Multiple attached users 	Faster data rates on dedicated 200 kHz data carrier	Integrated voice and data

TDMA IS-136 Technology Migration Path to 3G

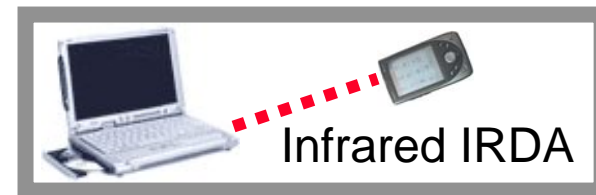
familiar GSM path!

Generation	1G	2G	2G	2G	2.5G or 3?	3G	3G
Technology	AMPS	CDPD	TDMA IS-54 IS-136	GSM	GPRS	EDGE	UMTS UTRA WCDMA
Signal Bandwidth, #Users	30 kHz. 1	30 kHz. Many Pkt Usrs	30 kHz. 3 users	200 kHz. 7.5 avg.	200 kHz. Many Pkt. users	200 kHz. fast data many users	3.84 MHz. up to 200+ voice users and data
Data Capabilities	None, 2.4K by modem	19.2 kbps	none	none	9-160 Kb/s (conditions determine)	384 Kb/s mobile user	2Mb/s static user
Features: Incremental Progress	First System, Capacity & Handoffs	US Packet Data Svc.	USA's first Digital wireless	Europe's first Digital wireless	<ul style="list-style-type: none"> •Packet IP access •Multiple attached users 	Faster data rates on dedicated 200 kHz data carrier	Integrated voice and data

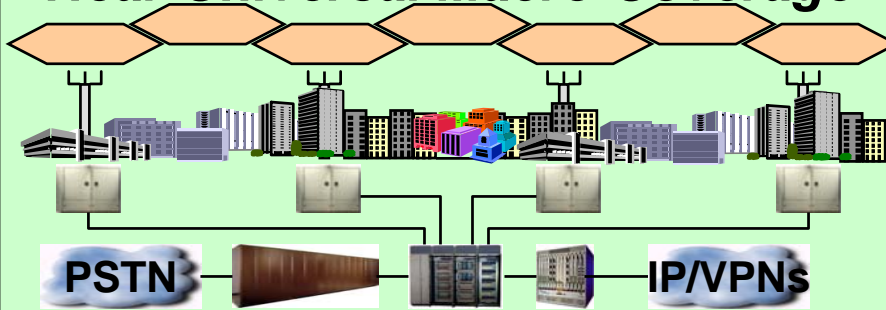



Unlicensed Broadband Transmission Technologies

							High Hopes!	
Technology	Infrared IRDA	Bluetooth	802.11b	802.11a	HIPERLAN Type 1	HIPERLAN Type 2	802.16	802.20 Mobile BWA
Frequency Band	Optical	2.4 GHz	2.4 GHz	5 GHz	5 GHz	5 GHz	2-11 GHz 10-66 GHz	
Access Method	Single User per Optical Carrier	various	DSSS	DSSS	OFDM	various.	TDD, FDD various	
Modulation Type	various	GFSK FH	CCK	BPSK, QPSK, 16QAM, or 64QAM	FSK or GMSK	BPSK, QPSK, 16QAM, or 64QAM	BPSK to 256QAM OFDM	
Max Raw Data Rate	4 Mb/s	1 Mb/s	11 Mb/s	54 Mb/s	23.5 Mb/s	54 Mb/s	54 Mb/s	

Not BWA; for comparison only



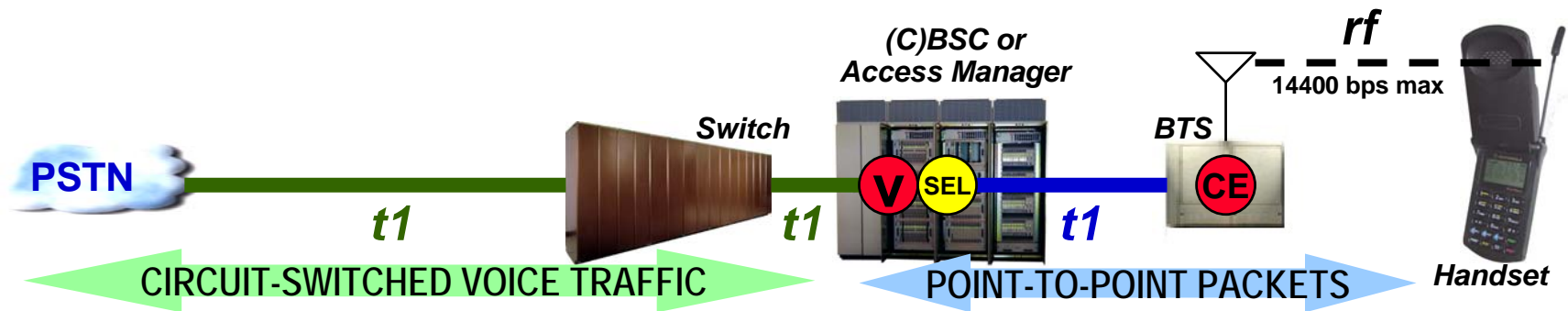
4G – Evolution or Revolution?

Technology	Environment	Service Provider/ Infrastructure Owner
<p>High-Tier \$\$\$</p> <p>1G: AMPS</p> <p>2G: TDMA, GSM, IS95 CDMA, IDEN</p> <p>2.5G: GPRS, EDGE</p> <p>3G: IS2000 1xRTT, 1xEV DO, 1xEV DV UMTS WCDMA</p>	<p><i>Near-Universal Macro-Coverage</i></p> 	
<p>Low-Tier \$</p> <p>4G: Wireless LAN 802.11b “Wi-Fi” 802.11a, g HIPERLAN Type 1 HIPERLAN Type 2 Bluetooth Infrared</p>		

- There's a revolution going on!
 - New 2.5G services arriving now, new 3G arriving 2002 through 2005
 - A groundswell of commercial (and even free!) WILAN deployment
- 3G networks and 4G networks have their own unique advantages
- Ultimately 3G and 4G will be integrated by wireless operators!

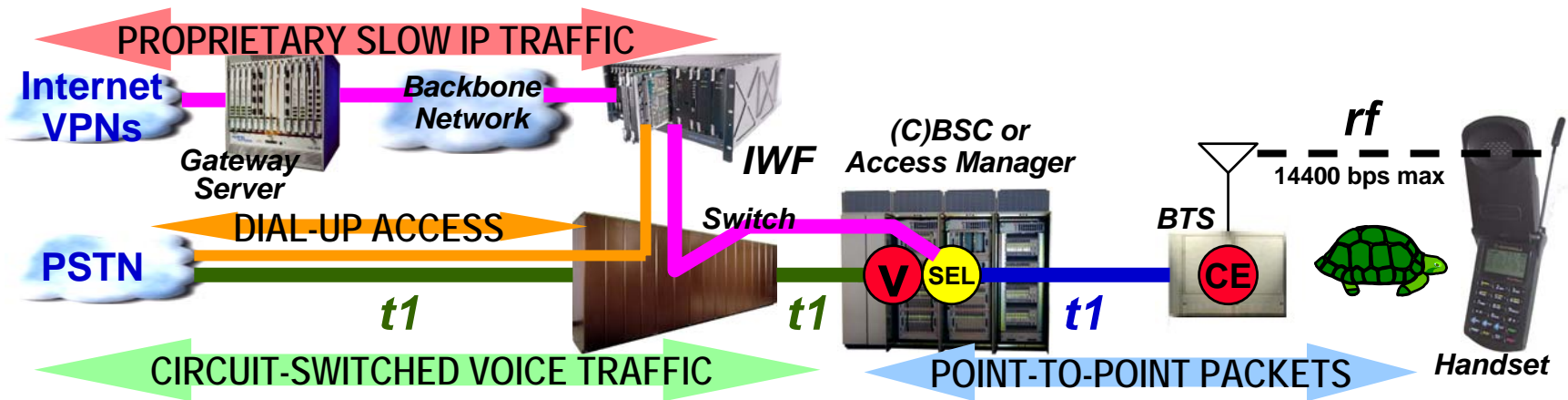
A Semi-Technical Walk-Through of 1xRTT: The Network Equipment

A 2G IS-95 CDMA Voice Network



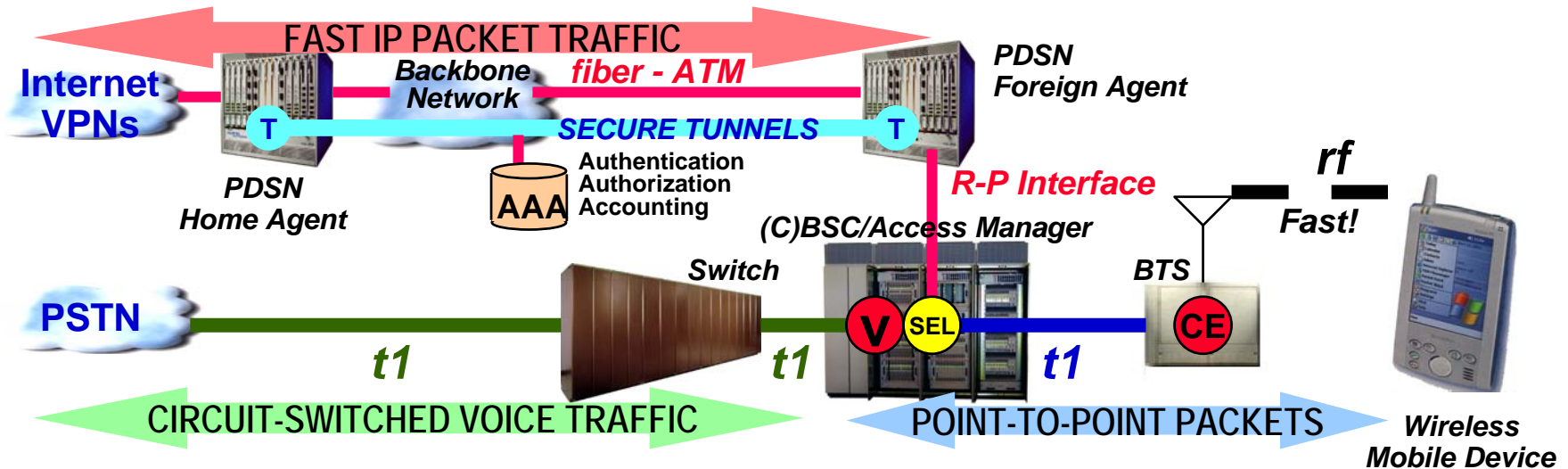
- Original CDMA networks used IS-95 technology to carry mainly voice calls
- The structure of the system was arranged specifically to make steady connections for voice calls
- The type of radio connections were arranged specifically to make steady connections for voice calls
- This type of connection is called “circuit switched”, since the connection begins at the start of the call, and stays steadily connected until the callers hang up

2G IS-95 CDMA Network with 2G Slow Data Using the Interworking Function (IWF)



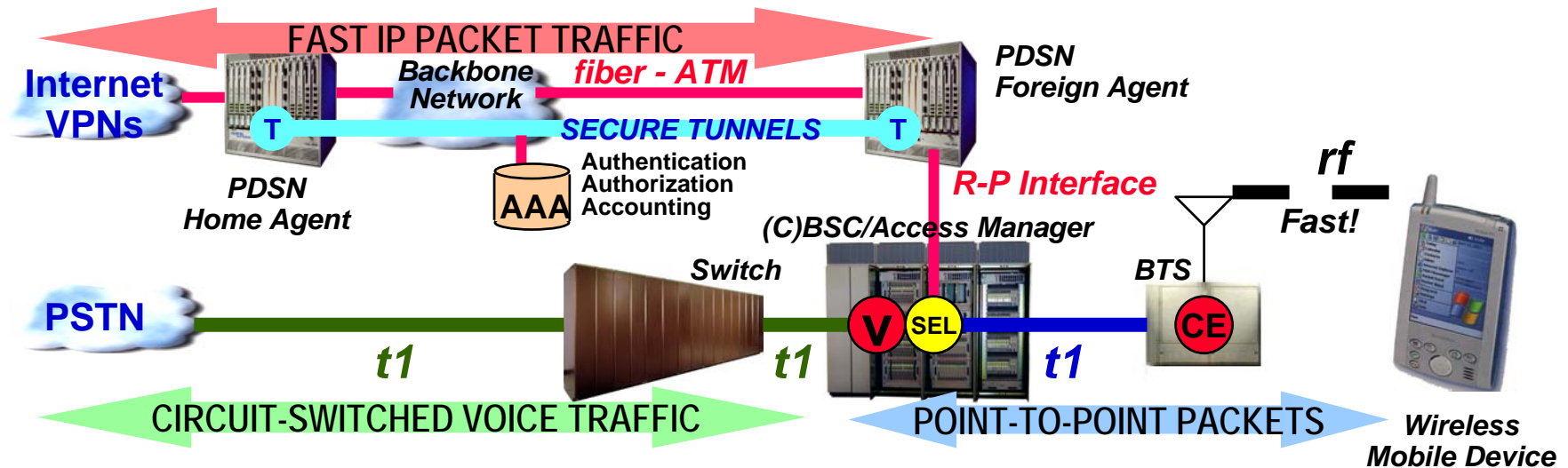
- It was possible to carry data on original CDMA IS-95 networks
- but the data rode inside circuit-switched connections, just like voice calls
 - the maximum bit speed of the connections was 14400 bits/second
 - for internet traffic at this speed, about half the bits are administrative packet headers and only half are actual customer information bits
 - so the user's real information bit speed ('throughput') was only about 7000 bits/second
 - that's only about 1/7 as fast as a dialup phone line connection at home! No wonder it was never popular for web-surfing....

A 3G 1xRTT CDMA Network with Fast Data



- Today's 1xRTT CDMA networks have more bit-carrying capacity in their signals, and mobiles can reserve much faster channels for their data connections
- Speeds of 153K (and even 307K in some cases) are possible
 - when the system is busy, the average speeds are about 60-80 Kbps
- Also the connection type is a true internet-protocol (IP) packet connection, so there's no need to use local dialup numbers – your information goes straight into or comes straight from the internet through high speed routers called PDSNs

3G 1xRTT CDMA Network Element Descriptions

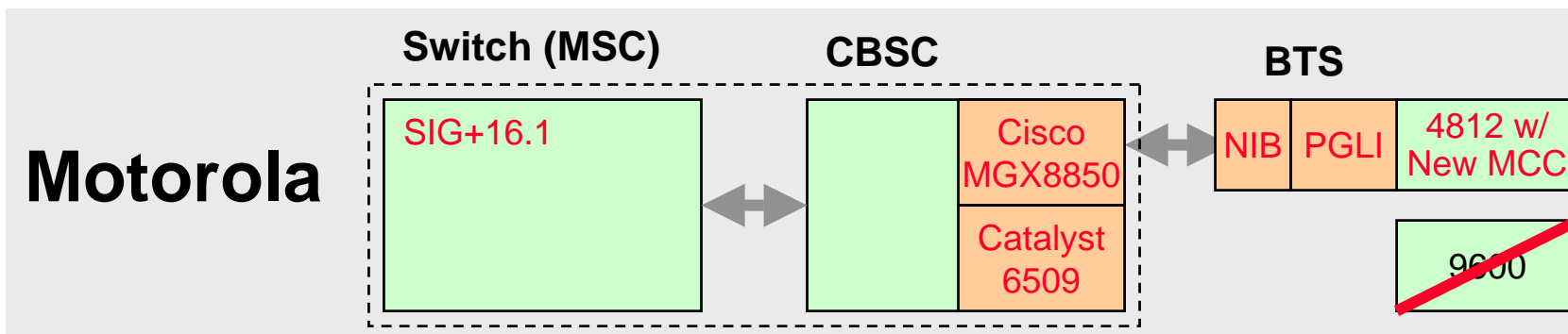
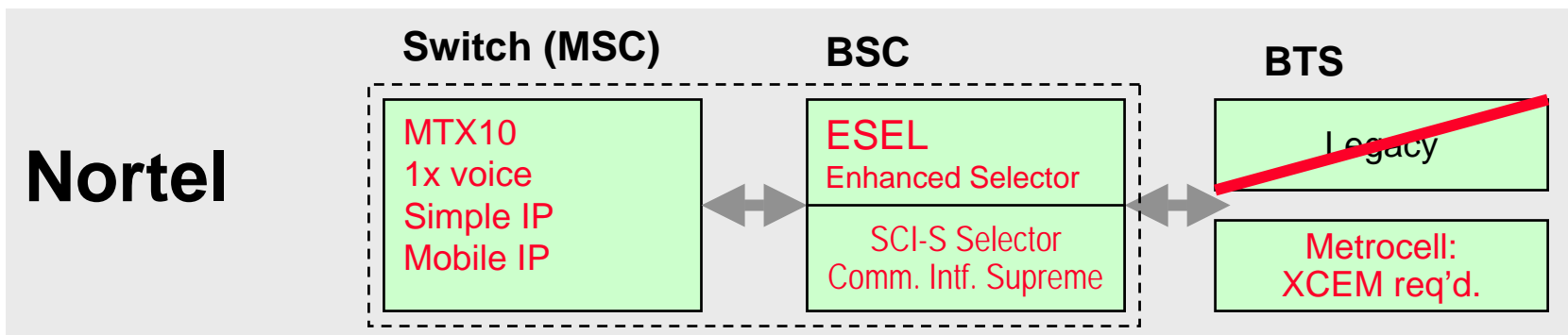
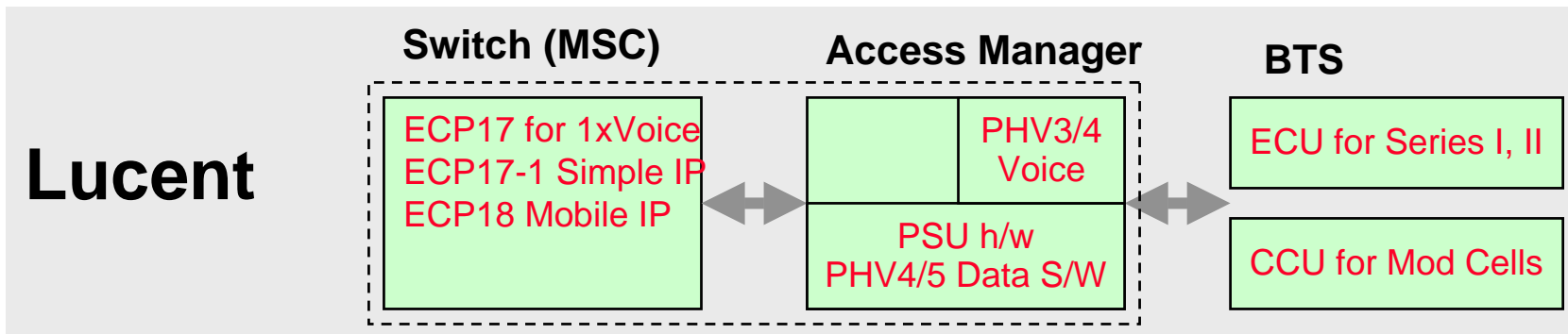


AAA - Authentication, Authorization, and Accounting - may include both home and broker-provided functions
BSC - Base Station Controller: vocoders and packet router
BTS - Base Transceiver Station
radio equipment
HA - Home Agent, **HN** - Home Network
IP access for Mobile IP on home and roaming networks
IWF - Interworking Function
provides necessary protocol conversions

MSC - Mobile Switching Center
voice/circuit-switched network hub
PDN - Packet Data Network
private, public, internet packet networks
PDSN - Packet Data Serving Node
routes user data packets to/from destinations
PSTN - Public Switched Telephone Network
VLR - Visitor Location Register
HLR - Home Location Register

Network Upgrades Required for 1xRTT

In addition to new equipment (PDSNs, AAA, backbone network) other new software and hardware are required.

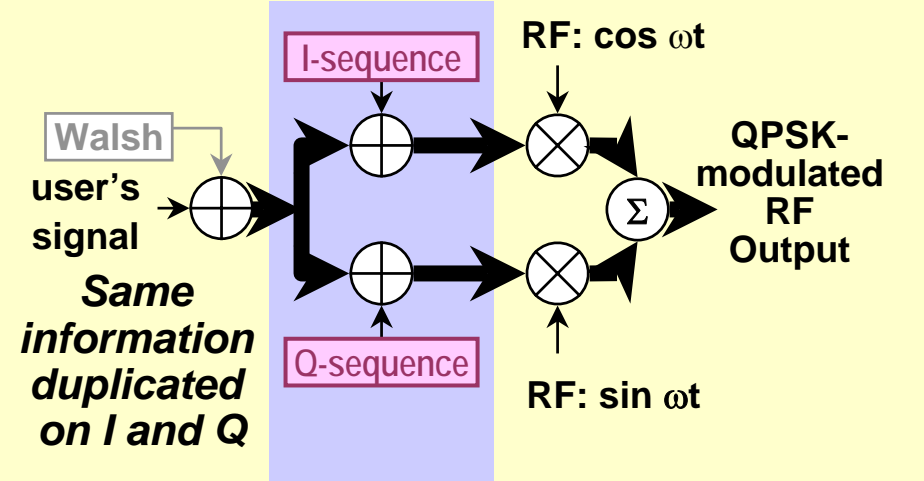


How the 1xRTT Radio Signal is Different from Original CDMA

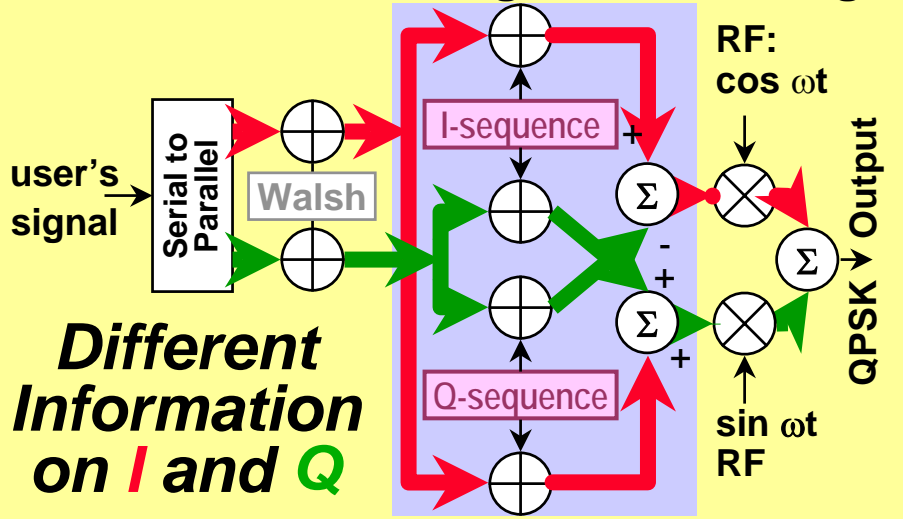
How the 1xRTT Signal is Better than IS-95

- Original IS-95 CDMA embedded two exact duplicates of a user's voice or data into the signal
 - but during signal fades, both copies were lost!
 - no benefit was gained having the double copies in the signal – they just wasted $\frac{1}{2}$ the space!
- In new 1xRTT CDMA, *differently coded* copies of voice or data are embedded in the signal
 - the two copies are independent of each other, and each has the full recipe for the voice or data, but not exactly in step together
 - So when a fade happens, each side can replace what was lost on the other side during the fade
- So in 1xRTT, we have Twice the Information Capacity of IS-95, and better quality too!

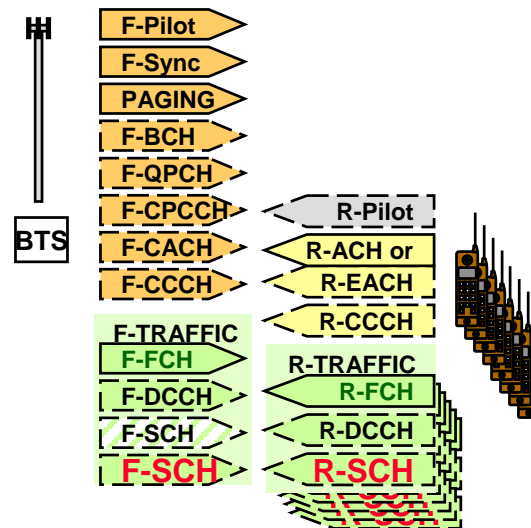
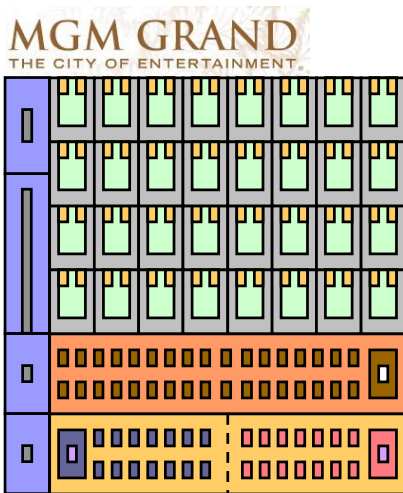
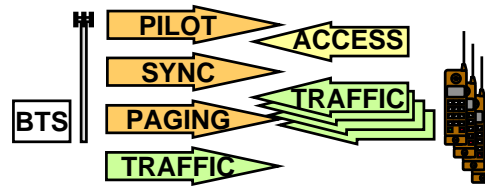
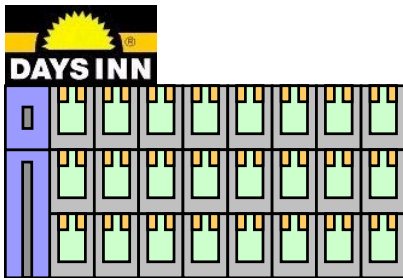
Original IS-95 CDMA Signal Processing



New CDMA 1xRTT Signal Processing



CDMA Towers are like Radio “Hotels”



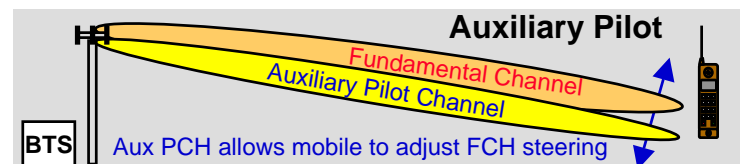
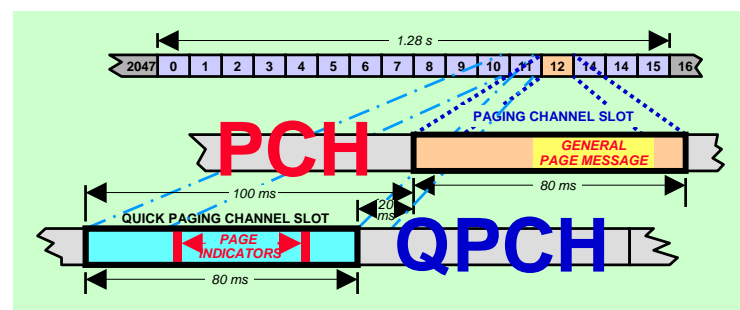
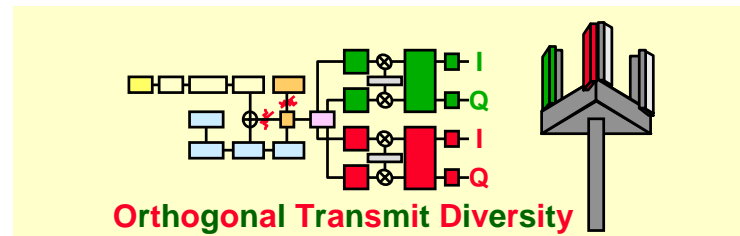
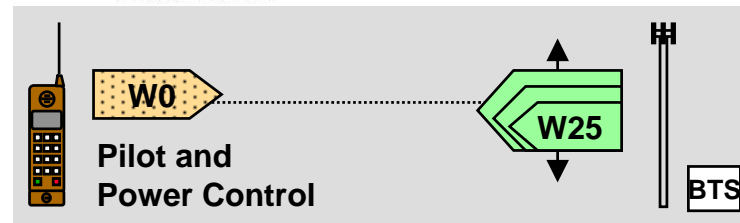
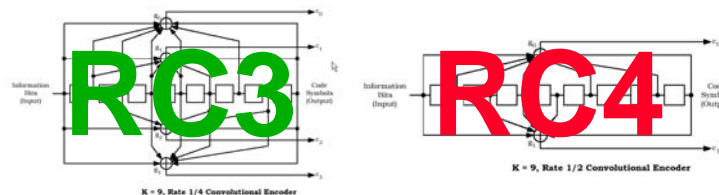
- Doubling the amount of space in a hotel allows more rooms and maybe even additional kinds of rooms
 - regular rooms for guests
 - booked overnight
 - meeting rooms, banquet halls
 - for bigger events, rented by the hour

- In the same way, Doubling the bit capacity of a CDMA tower gives it more room for channels
 - regular channels for voice
 - assigned for entire calls
 - fast channels for data
 - assigned for fast bursts to whoever needs data

Other Major 1xRTT Features

- The signal uses more advanced error-correcting coding, for better quality
- The mobiles can control the power the tower sends them faster than ever before, to avoid fading and muting
- There's an optional feature called OTD to provide better receive quality for stationary users in buildings
- There's a special feature called QPCH to stretch the standby battery life of the mobiles
- There are special kinds of channels the tower can send to implement electronically-steerable beam antennas* in the future, for even better coverage

* dynamic adaptive phased array "smart antennas"

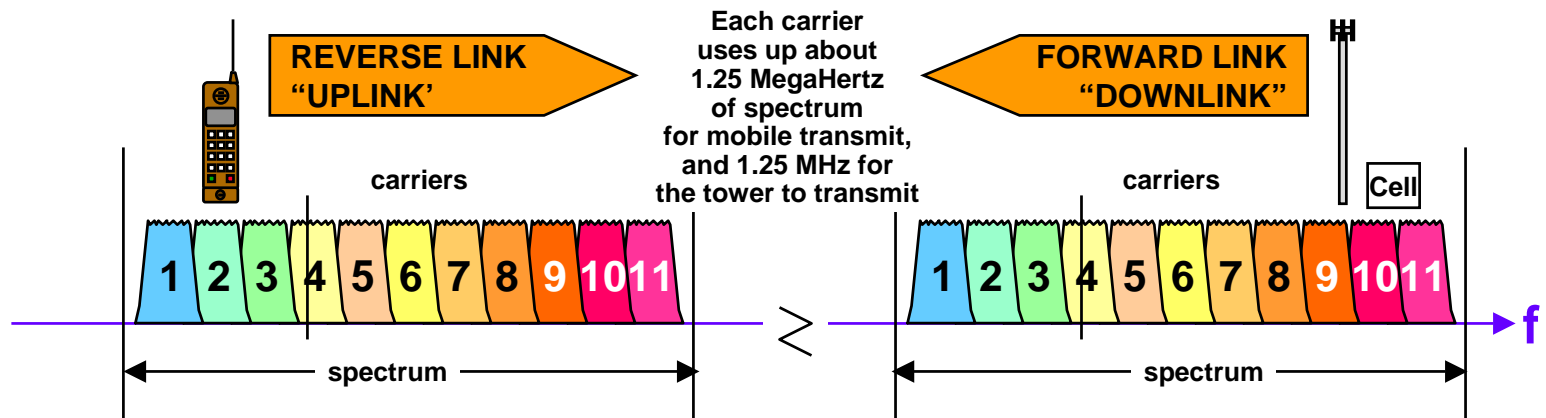


CDMA2000 1xRTT Compatibility with IS-95



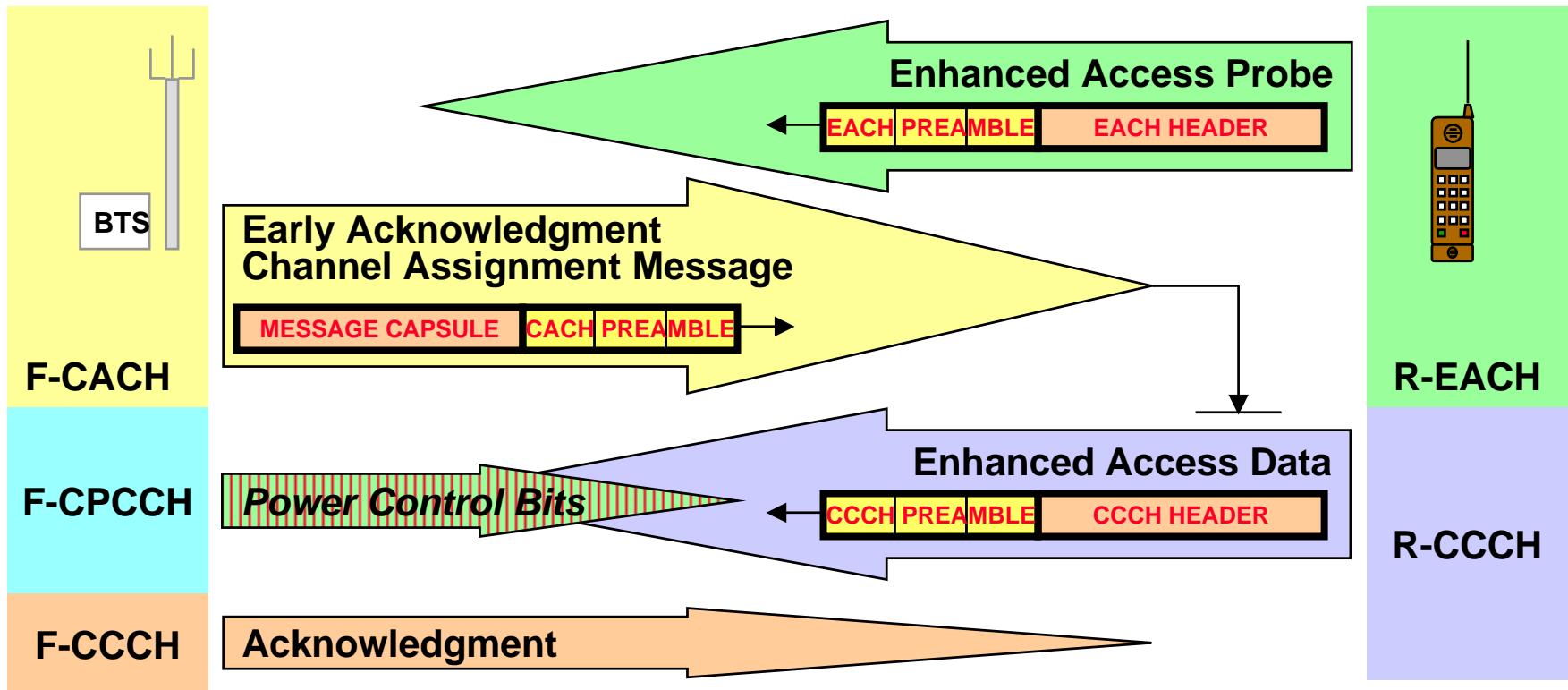
- A new 1xRTT-equipped tower can handle both old IS-95 mobiles and 1xRTT mobiles at the same time
 - the new 1xRTT mobiles get to use the improved signal for better voice quality and fast data
 - the old IS-95 mobiles get the same quality they have always had, but aren't capable of using fast data
- A new 1xRTT mobile can work on both 1xRTT and IS-95 towers
 - on the 1xRTT towers it gets all the benefits of 1xRTT
 - on the IS-95 towers, it performs just like an old IS-95 mobile
- An old IS-95 mobile can work on both 1xRTT and IS-95 towers
 - on old IS-95 towers, it gets the same performance as always
 - on the new 1xRTT towers, it gets the same performance as always
 - it's not capable of fast data, so it doesn't know what it's missing!

System Capacity – Carriers and Sectors



- In each of our licensed areas, we have a certain amount of spectrum
- We build whatever equipment is needed to fill up our spectrum with one or more CDMA signals – to carry whatever amount of calls occur in the area
 - each independent CDMA signal is called a “carrier”
 - depending on how much spectrum our license gives us, we may have room for three, four, five, six, or in some cases even 10 or 11 carriers
 - each tower uses separate equipment and antennas pointing in different directions. Their coverage areas are called “sectors”
 - The same radio frequency can be used independently on each sector
- On one carrier, one sector:
 - about 30-40 people can talk in IS-95 with no data usage
 - about 40-50 people can talk in 1xRTT with some data usage
 - about 60 people can talk in 1xRTT if there’s no data usage

Power Controlled Reservation Access Mode

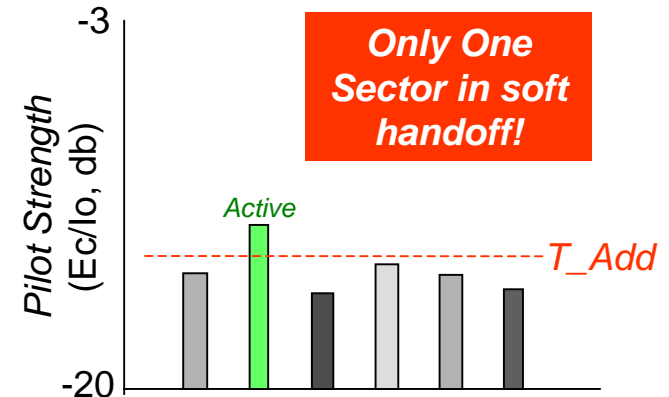
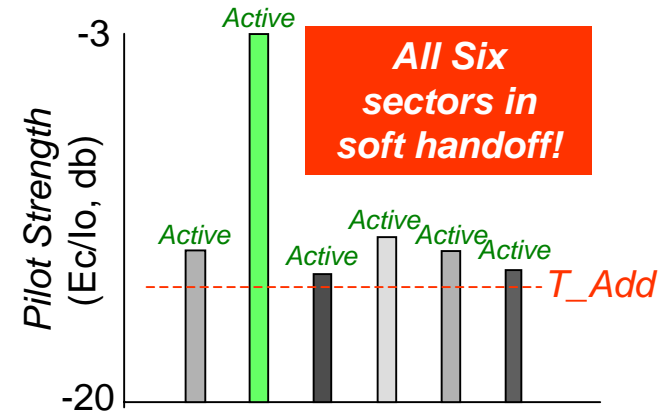


Reservation Access Mode procedures:

- On R-EACH, mobile asks permission to transmit
- The associated F-CACH gives permission
- Mobile transmits on R-CCCH during scheduled slot
- F-CPCCH gives power control during R-CCCH transmission
- F-CCCH gives acknowledgment and TCH assignment, if needed

1xRTT offers Dynamic Handoff Thresholds for Better Handoff Performance

- 1xRTT offers more flexible handoff control parameters than IS-95
- Handoffs can be based on the need of the phone for additional signals rather than preset thresholds
- This feature reduces wasted usage of unnecessary sectors, while increasing the probability that a mobile in a bad location will be able to connect with enough sectors to be able to avoid a dropped call



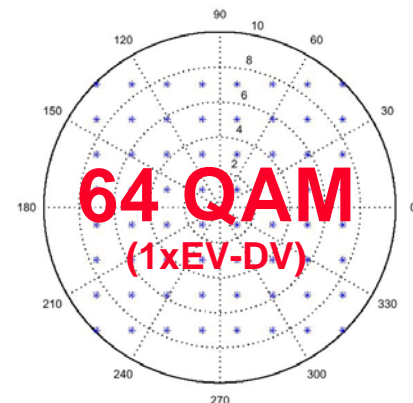
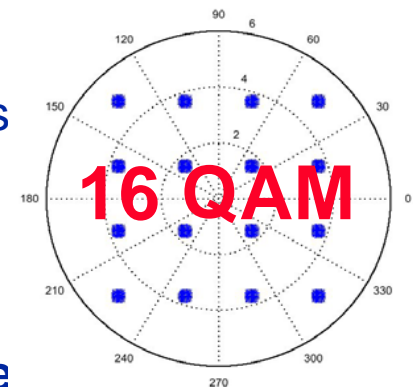
1xRTT Signal Options: "Radio Configurations"

Spreading Rate	Forward Link	Radio Configuration	Data Rates	Data Rates	Radio Configuration	Reverse Link
SR1 1xRTT 1 carrier 1.2288 MCPS	Required. IS-95B Compatible No CDMA2000 coding features	RC1	9600	9600	RC1	Required. IS-95B Compatible No CDMA2000 coding features
	Compatible with IS-95B RS2 No CDMA2000 coding features	RC2	14400	14400	RC2	Compatible with IS-95B RS2 No CDMA2000 coding features
	Quarter-rate convolutional or Turbo Coding, base rate 9600	RC3	9600 153600	9600 153600	RC3	Quarter rate convolutional or Turbo coding; Half rate convolutional or Turbo coding; base rate 9600
	Half-rate convolutional or Turbo Coding, base rate 9600	RC4	9600 307200	9600 307200		
	Quarter-rate convolutional or Turbo Coding, base rate 14400	RC5	14400 230400	14400 230400	RC4	Quarter rate convolutional or Turbo Coding, base rate 14400
SR3 3xRTT Fwd: 3 carriers 1.2288 MCPS Rev: 3.6864 MCPS	1/6 rate convolutional or Turbo coding, base rate 9600	RC6	9600 307200	9600 307200	RC5	Required. 1/4 or 1/3 convolutional or Turbo coding, base rate 9600
	Required. 1/3 rate convolutional or Turbo coding, base rate 9600	RC7	9600 614400	9600 614400		
	1/4 or 1/3 rate convolutional or Turbo coding, base rate 14400	RC8	14400 460800	14400 460800	RC6	1/4 or 1/2 convolutional or Turbo encoding, base rate 14400
	1/2 or 1/3 rate convolutional or Turbo encoder, base rate 14400	RC9	14400 1036800	14400 1036800		

**Is there even FASTER data
in our future?**

The 1xEV Technologies

- 1xEV, “1x Evolution”, is a family of alternative fast-data schemes that can be implemented on a 1x CDMA carrier.
- **1xEV DO** means “1x Evolution, Data Only”, originally proposed by Qualcomm as “High Data Rates” (HDR).
 - Up to **2.4576 Mbps forward, 153.6 kbps reverse**
 - A 1xEV DO carrier holds only packet data, and does not support circuit-switched voice
 - Commercially available in 2003
- 1xEV DV means “1x Evolution, Data and Voice”.
 - Max throughput of **5 Mbps forward, 307.2k reverse**
 - Backward compatible with IS-95/1xRTT voice calls on the same carrier as the data
 - *Not yet commercially available; work continues*
- All versions of 1xEV use advanced modulation techniques to achieve high throughputs.



What's Different about 1xEV-DO?

CHANNEL STRUCTURE

■ IS-95 and 1xRTT

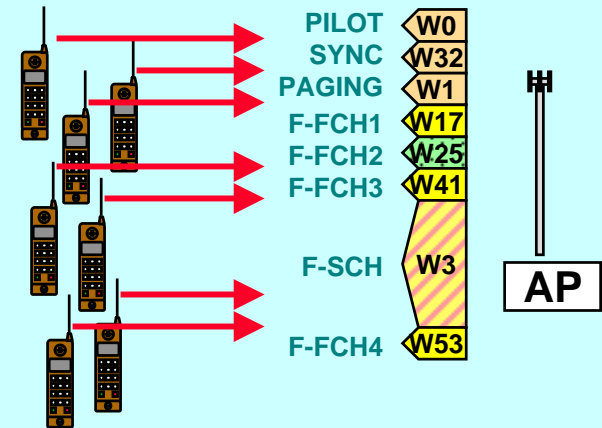
- many simultaneous users, each with steady forward and reverse traffic channels
- transmissions arranged, requested, confirmed by layer-3 messages – with some delay.....

■ 1xEV-DO

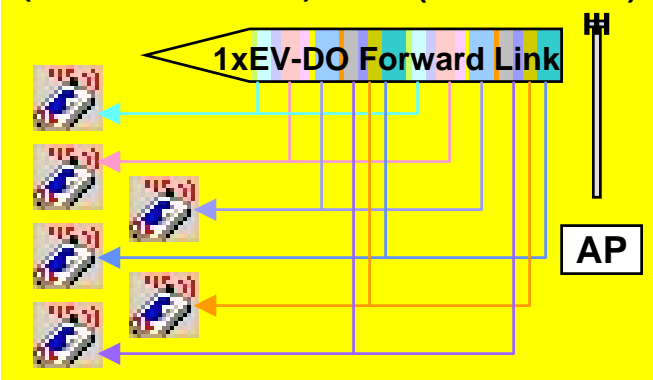
- Forward Link goes to one user at a time – TDMA!
- users are rapidly time-multiplexed, each receives fair share of available sector time
- instant preference given to user with ideal receiving conditions, to maximize average throughput
- transmissions arranged and requested via steady MAC-layer walsh streams – very immediate!

IS-95 AND 1xRTT

Many users' simultaneous forward and reverse traffic channels



ATs (Access Terminals) 1xEV-DO AP (Access Point)



Modulation and Coding Schemes of 1Xtreme

- 1Xtreme offers eight different coding schemes
- The best scheme for current channel conditions is dynamically selected
 - The AT measures the conditions and relays its requested rate to the AP

Scheme	Modulation Type	Channel Coding Rate
8	64-QAM	3/4
7	64-QAM	1/2
6	16-QAM	3/4
5	16-QAM	1/2
4	8-PSK	3/4
3	8-PSK	1/2
2	QPSK	3/4
1	QPSK	1/2

How Can You Pitch 1xRTT to Customers?

Introducing Customers to 1xRTT

- Customers have a wide range of interests and needs
 - some have real needs for data communications when mobile
 - others need only basic voice telephone service
- 1xEV-DO has benefits for both extremes
 - for customers needing data, 1xRTT offers better-than-dialup access speeds, almost everywhere the customer goes
 - this makes possible a whole new lifestyle using PCs, PDAs, and other portable data devices for business and personal communication literally anywhere
 - for voice users, 1xRTT offers slightly better voice quality and call reliability in both directions
 - longer talk times and standby times due to better power utilization and deeper idle mode sleep
 - and for our system, if all voice users changed to 1xRTT phones, we could serve almost twice as many users with the same number of towers and carriers/sectors!!

Selling 1xRTT Equipment

- Already today, 1xRTT voice-only and IS-95 voice-only phones cost about the same
 - so for voice users, no special selling is required; the mix of phones sold will rapidly move to 1xRTT-only in coming months
- 1xRTT data devices will require knowledgeable sales effort and customer education to recognize both the features of the equipment and the conveniences of using the equipment for mobile data
 - live demonstrations and application familiarity will be necessary to introduce customers to the possibilities
- Areas of familiarity needed include
 - basic advantages of our technology vs. our competitors'
 - basic PC data literacy – web surfing, email, etc.
 - other data devices – PDAs, remote cameras, alarms, etc
 - 1xRTT devices – devices we sell, what they can do, what's required for operation, useful accessories

Examples of 1xRTT Devices: PCMCIA Cards

1xRTT PCMCIA CARDS



- The heaviest 1xRTT users by data volume will usually be using laptop PCs for traditional web, email, and database access on the road
- Most of these users will have PCMCIA 1xRTT cards for their PCS
- Manufacturers include Sierra, GTran, Novatel, and others
- The cards come with PC software to manage the connection process and make the card appear to the PC as a modem or network card
- Customers using these devices are usually ecstatic – they can surf the web five times faster than a home dialup connection, anywhere! And the laptop battery life isn't dramatically reduced

Examples of 1xRTT Devices: Pocket PCs



- In general, Pocket-PC-based PDAs offer more graphic and multimedia capabilities than Palm-based PDAs, but they are more sluggish than Palm PDAs when providing personal information manager functions. As a result, they are more popular with technical people and multimedia users than businesspeople.
- These devices have full-featured email clients and web-browsers; they can view any website, do ftp file exchange, and much more
- Pocket PC devices in the top row have built-in 1xRTT modules
- Pocket PC devices in the bottom row require plug-in 1xRTT PCMCIA or CF cards like the Yiso modem shown at left

Examples of 1xRTT Devices: Palm PDAs

**Handspring
Treo 600**



- Personal Digital Assistants (PDAs) using the Palm operating system are the most popular and easy-to-use for non-technical customers
 - they include personal information managers (datebook, address book), general email, and can run a wide variety of downloadable software – spreadsheets, games, document viewers

**Kyocera
QCP7135**



**Samsung
SPH500**



- 1x-equipped palm PDAs come in conventional PDA styles like the Handspring Treo 600, and in clamshell phone styles like the Samsung SPH500 and Kyocera QCP7135
- Palm-based PDAs are more efficient for managing business information but have less graphic capabilities than PDAs using the Microsoft Pocket PC operating system
- Full-featured web browsers come with some of these devices; in others, it is necessary to download browser software from third parties

Special 1xRTT Applications

- 1xRTT enables many applications for business that were simply impractical or prohibitively expensive before:
 - remote alarm monitoring, telemetry, etc.
 - remote camera monitoring
 - control of remote devices – valves, gates, data collection devices
- Although some specialty items are marketed “ready to use” by small vendors, many applications of this type will require professional third-party help to equip the customer and get the application working
 - it’s advisable to have one or two specialists in the company who research and track down such vendors and consult with customers to help match customer needs with third-party suppliers for these special applications

Push-to-Talk Operation (PTT)

- During 2003 both Verizon and Sprint PCS introduced PTT operation in competition with Nextel and SouthernLinc
- The PTT application is actually a packet-data voice-over-IP application which uses the data capabilities of 1xRTT
- Providing PTT requires substantial system hardware and software resources, which wireless companies usually buy from third-party vendors and consultants
- Commercial 1xRTT handsets with PTT capability are already available
- If PTT would provide a major competitive edge, the company should investigate available sources for the system resources involved

Open Questions and Answers