

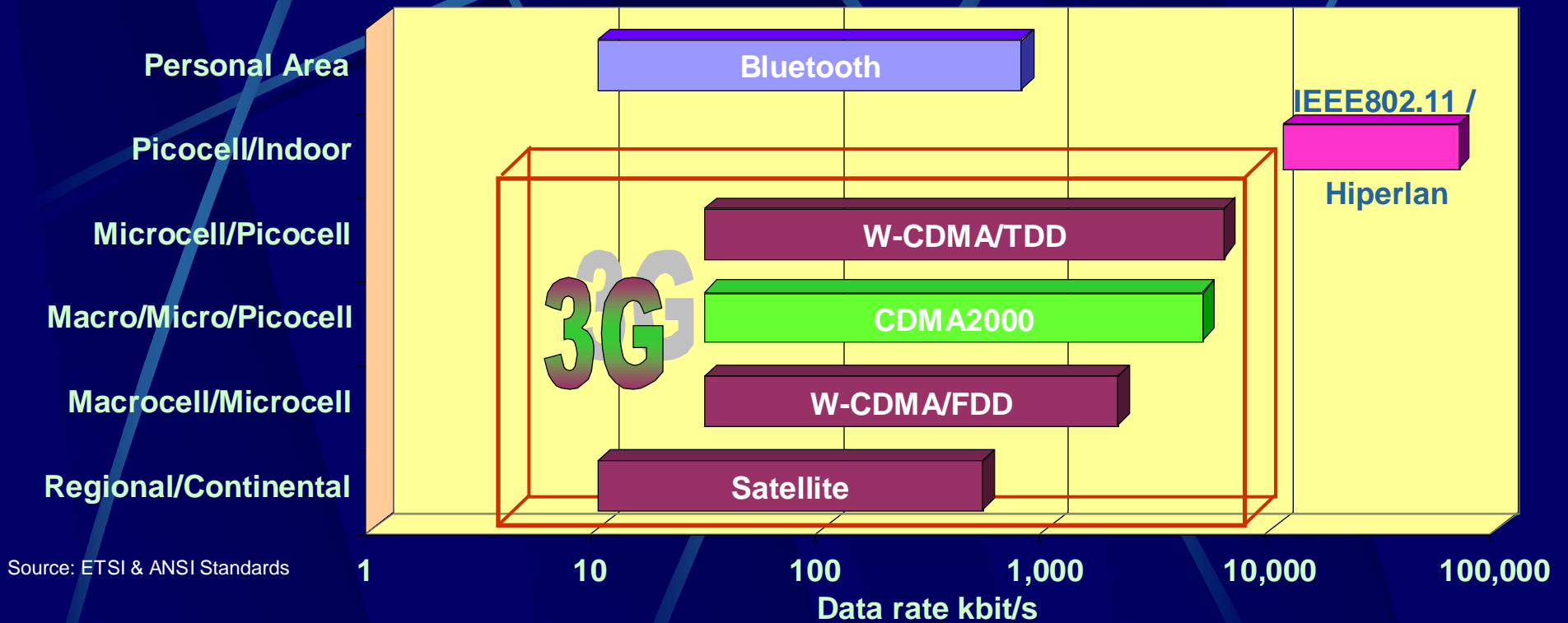
*Third-generation
Cellular: Technical and
Economic Challenges*

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Agenda

- Third Generation Cellular
- Technical Challenges: Range, Coverage, Capacity, & Spectrum
- Economic Challenges: Market Share & 3G Spectrum Auctions
- A Modest Proposal

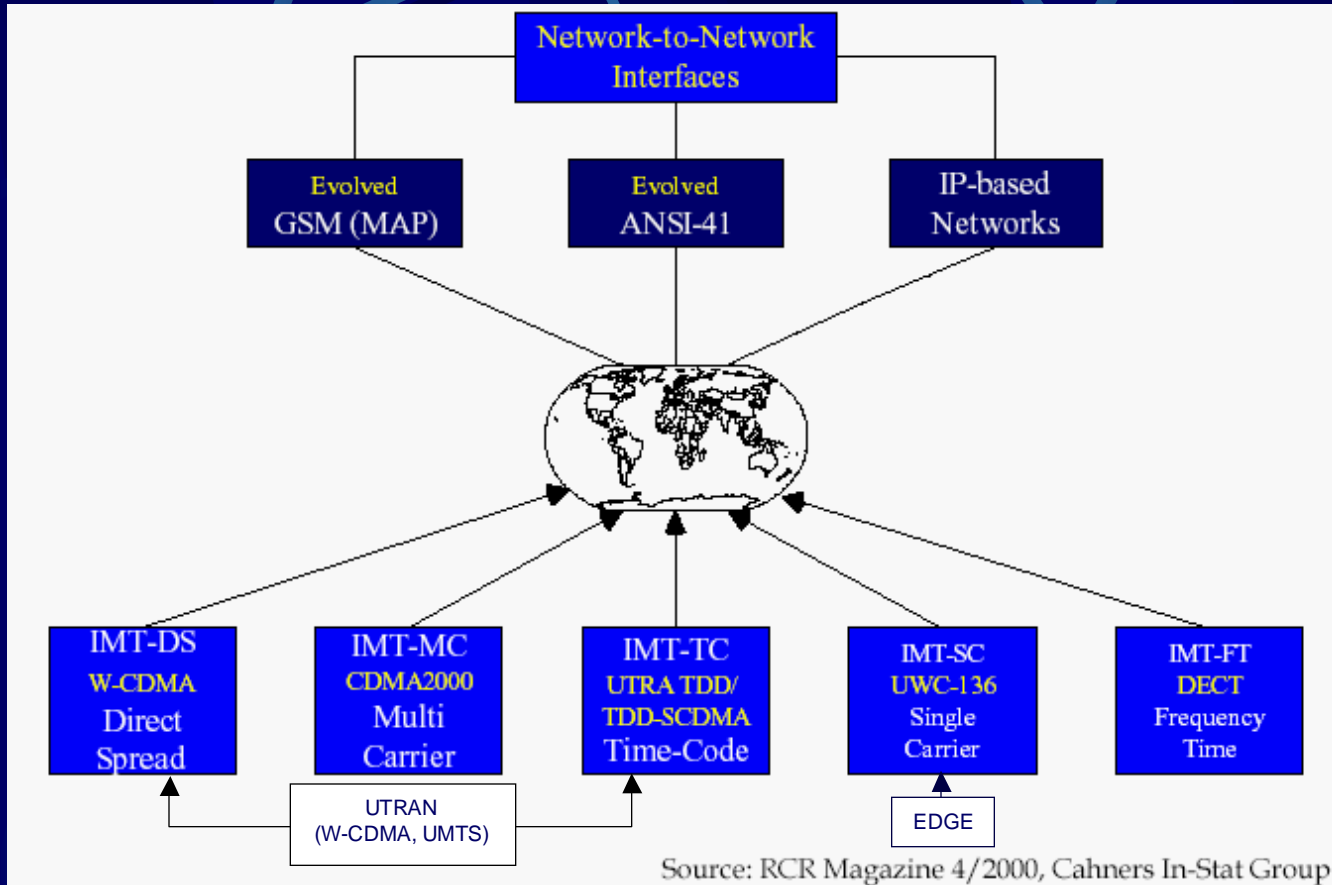
3G in the "Big Picture"



ETSI has created a hierarchy of personal communications modalities that provide the maximum data rate possible given where the customer is at a given time. In the US this is complemented by CDMA2000.

IMTS – 2000: 5 Standards

These are the terrestrial standards only. There will be satellite standards also. The GSM “camp” sponsors UTRAN; the CDMA camp sponsors IMT-MC (CDMA2000). The US TDMA camp sponsors EDGE (IMT-SC) and will migrate to W-CDMA.



What's Special About 3G?



Siemens



Motorola



Compaq

It's not just phones. It's PDAs, videophones, Internet browsing, location-based services, interactive games, and a whole lot more.



Ericsson

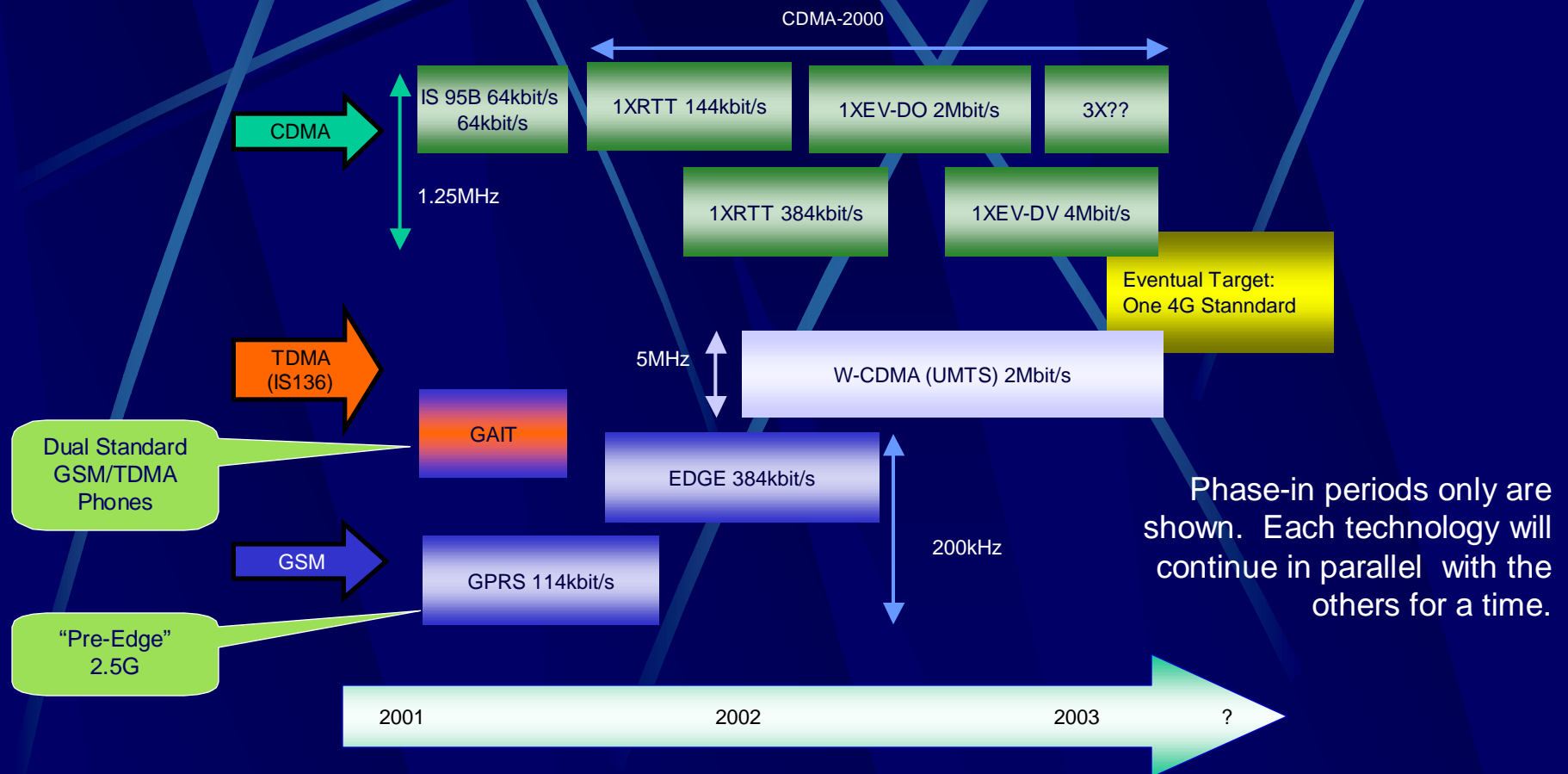


Panasonic



Nokia

Evolution of 3G Systems



Source: ITU

Timeline may be delayed due to economic technical and standards issues

3G Status

- CDMA2000 is operating in Korea with about a million customers. World availability expected mid – late 2002.
- W-CDMA is operating in Tokyo using Ericsson equipment. World availability expected late 2002 – first half 2003
- Cingular is rolling out GPRS (precursor to EDGE) nationwide in the US – a \$3B exercise

Range / Coverage

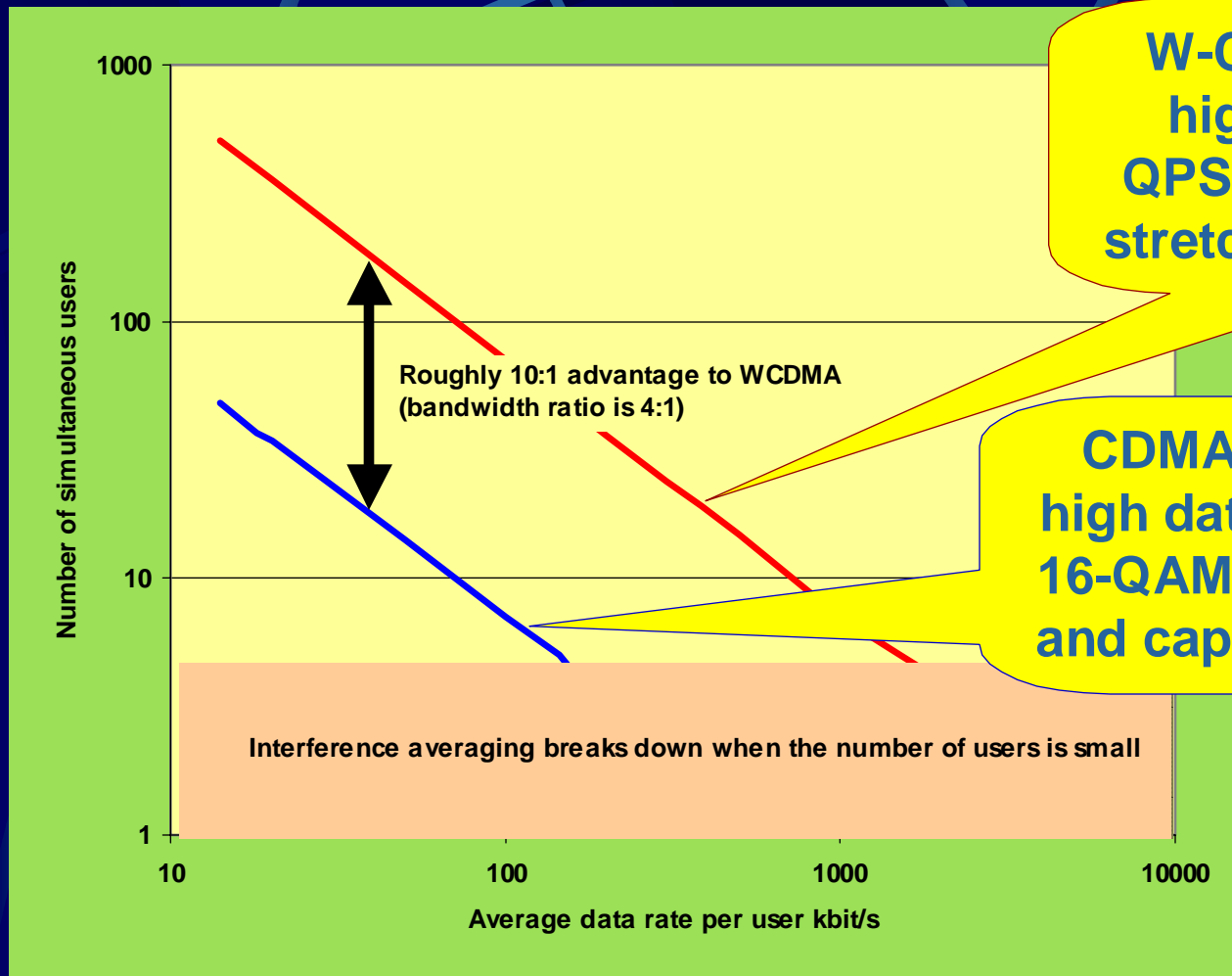
CDMA2000 operators will need to build more, smaller coverage cells to make this work

Source: JMS Worldwide
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	Standard	Max free space path loss dB			Cell Size	
		In-Building	Outdoor low mob	In-Vehicle	Radius from Base	Area
CDMA One- CDMA 2000	1xEV-DO	127.56	140.40	142.83	81%	65%
	1xRTT	127.76	n/a	142.32	77%	59%
	Base Case: IS-95	130.81	n/a	146.31	Base case	
GSM - W-CDMA	W-CDMA	129.06	150.36	146.02	99%	98%
	EDGE-2 (384kbit/s)	124.80	148.50	n/a	75%	56%
	EDGE-1 (144kbit/s)	n/a	n/a	143.30	87%	76%
	Base Case: GSM	129.20	n/a	145.40	Base case	

GSM operators are expected to build more base stations for EDGE – that they won't need for W-CDMA!

Capacity

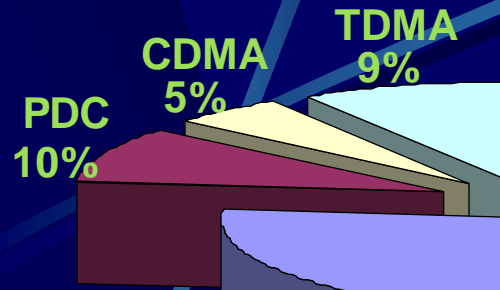


W-CDMA achieves its high data rates with QPSK – 2Mbit/s is not a stretch for a 5MHz signal

CDMA2000 achieves its high data rates by going to 16-QAM, losing link budget and capacity along the way

W-CDMA has 2.5 times the capacity of CDMA2000

Market Share



CDMA one and half of PDC transition to CDMA2000

GSM, TDMA and half of PDC transition to W-CDMA

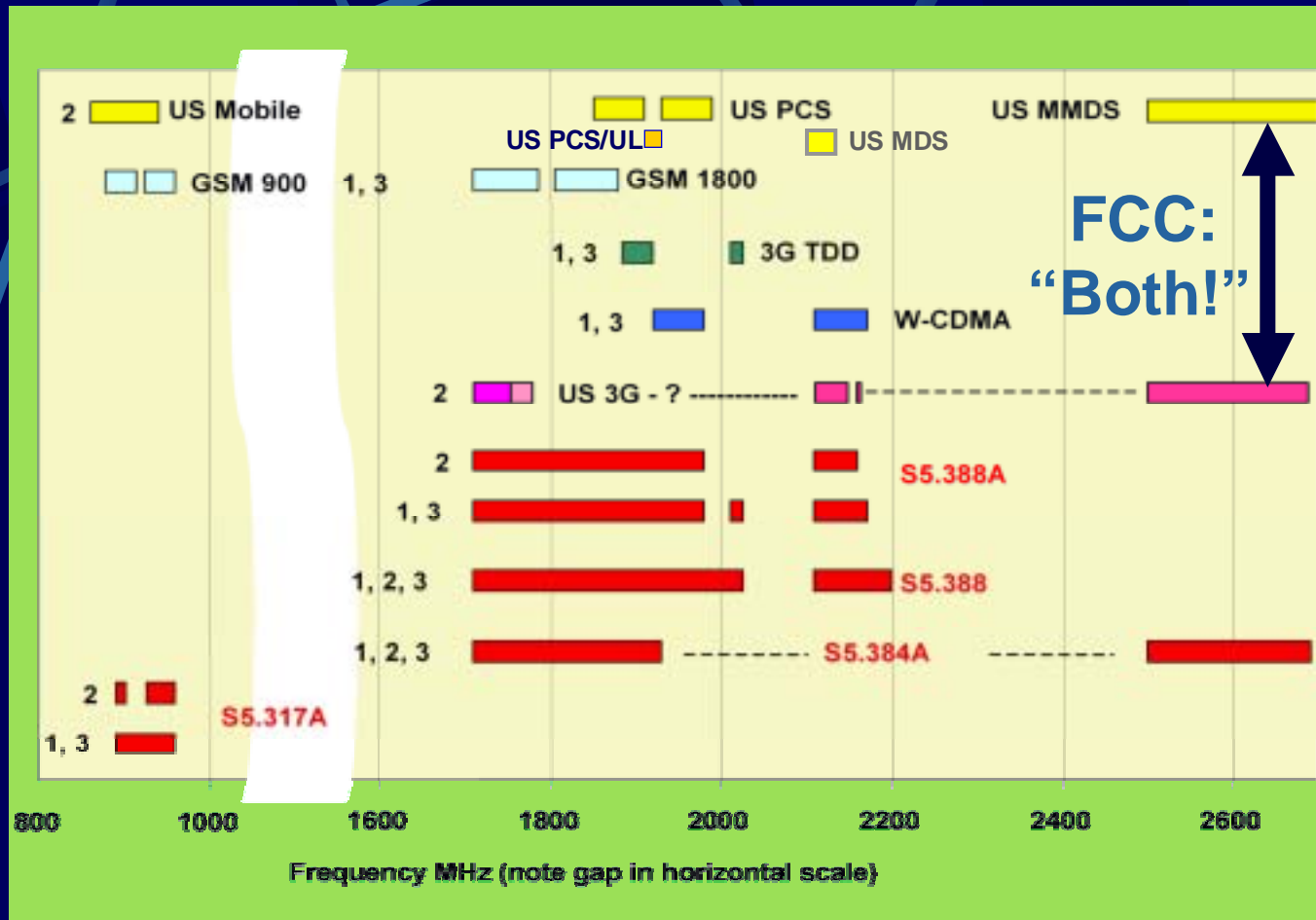
GSM 76%

CDMA2000 10%

W-CDMA 90%

Source: www.cellular.co.za

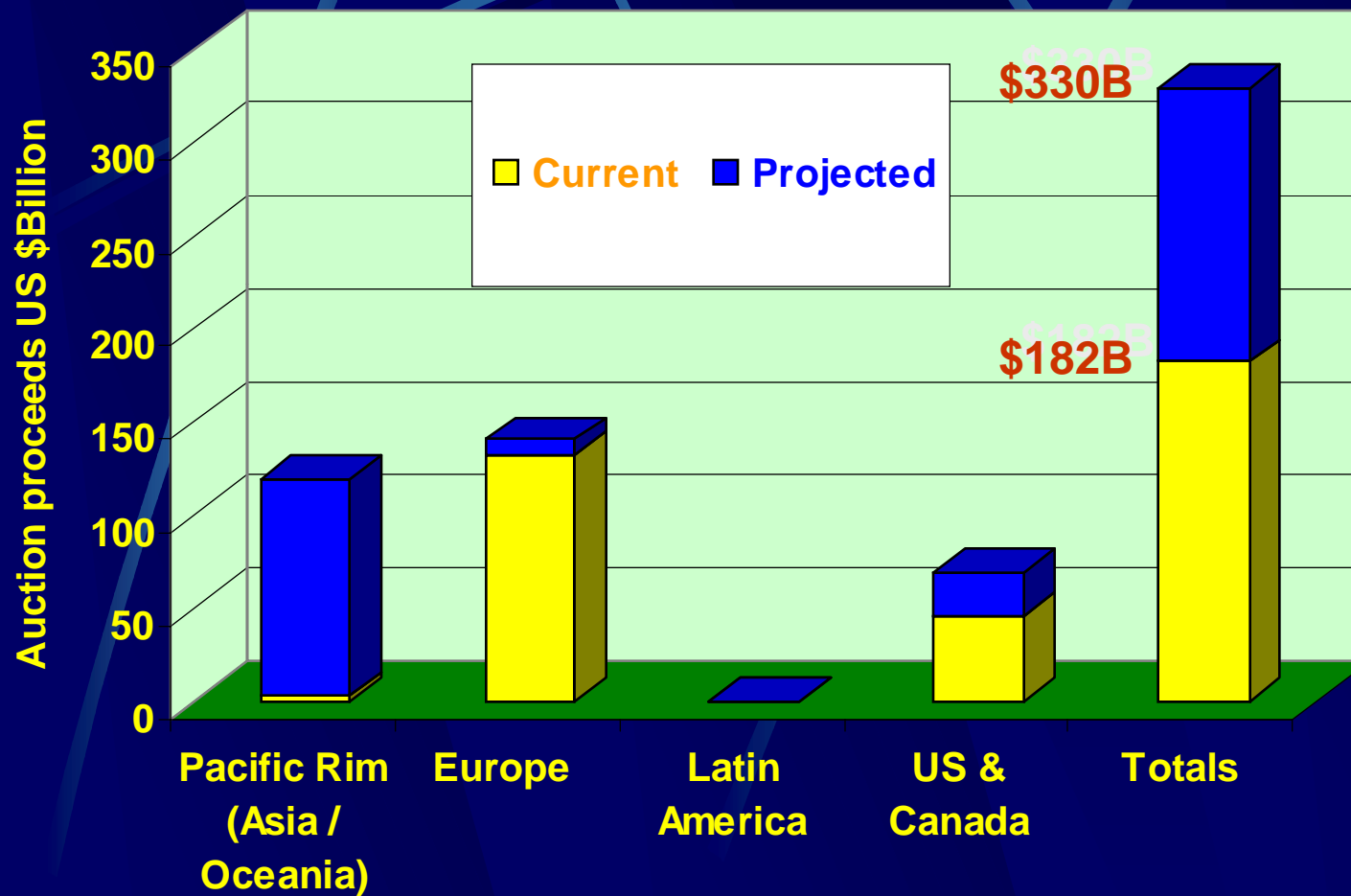
Spectrum Confusion



Sources:
ITU,
ERO,
FCC

Once again the US is isolated by the FCC's prior actions

Spectrum Auctions Worldwide



Hundreds of spectrum auctions have already been run. The proceeds so far - \$182B - are shown as "current". The "projected" numbers are based on demographics and announcements of future auctions.

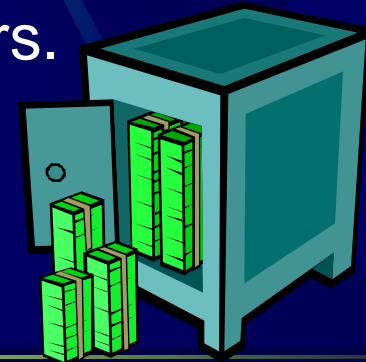
The Big Spenders

3G

	Auction Proceeds \$B	Proceeds per pop \$
UK	\$ 38.50	\$ 594.20
Germany	\$ 50.80	\$ 566.90
Italy	\$ 10.18	\$ 174.20
S. Korea	\$ 3.30	\$ 60.80
Holland	\$ 2.68	\$ 158.90

These “Top Five” 3G auctions, held in the last 18 months, account for more than 58% of the total \$182B proceeds collected from auctions worldwide over the past 15 years.

Altogether 3G auctions alone have accounted for \$142B of the total, or 78%





How Much is \$330B?



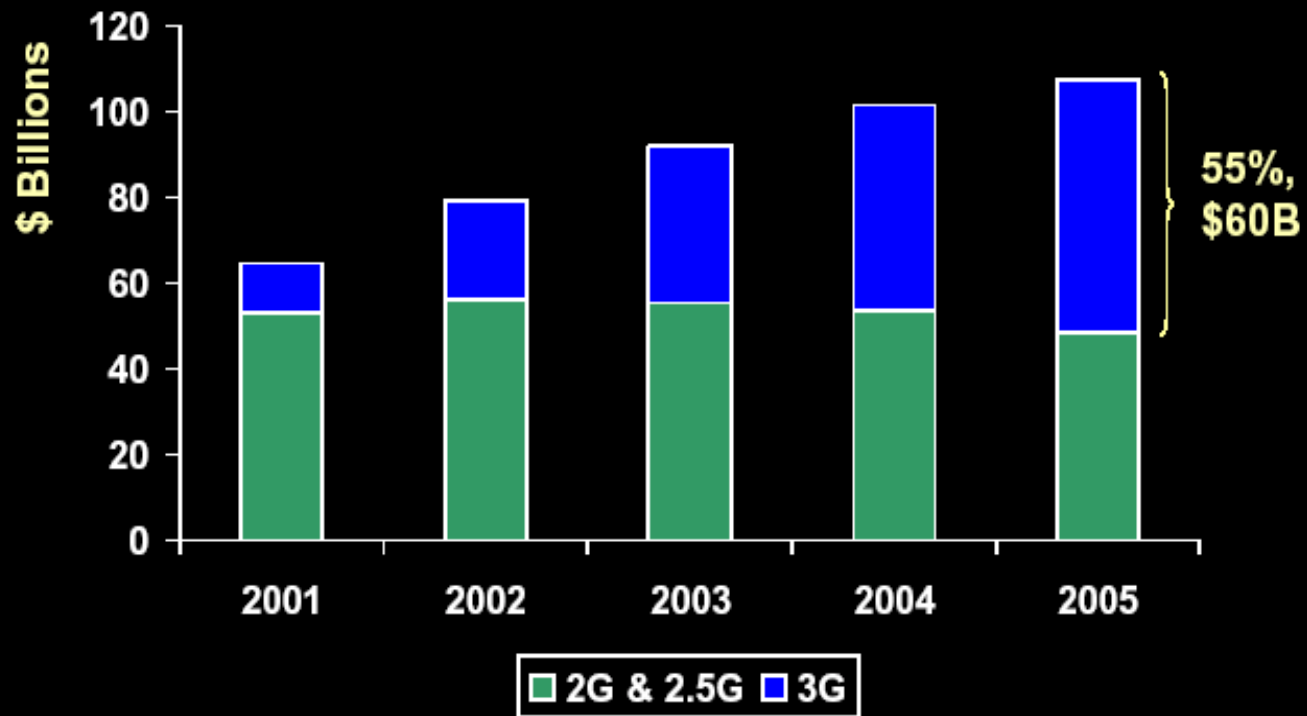
- It is the Gross Domestic Product of Switzerland.
- It is the combined annual revenue of Exxon-Mobil and General Electric
- It is \$1,172 for every man, woman and child living in the United States

“If you can count your money, you don't have a billion dollars”

... J Paul Getty

Air vs. Hardware

Wireless Telecom Equipment Spending

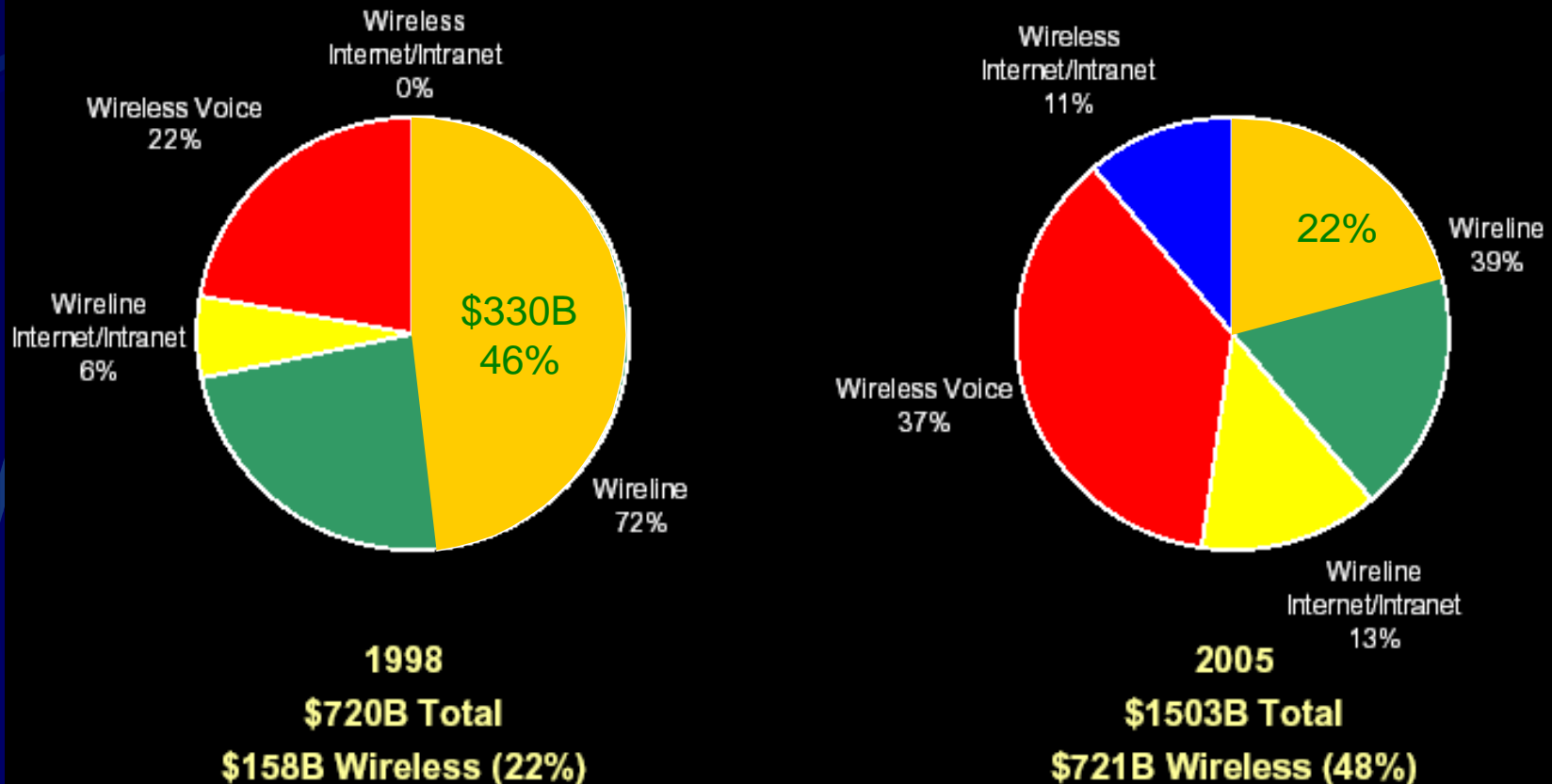


Source: Lehman, ISherpa

\$330B to the same scale

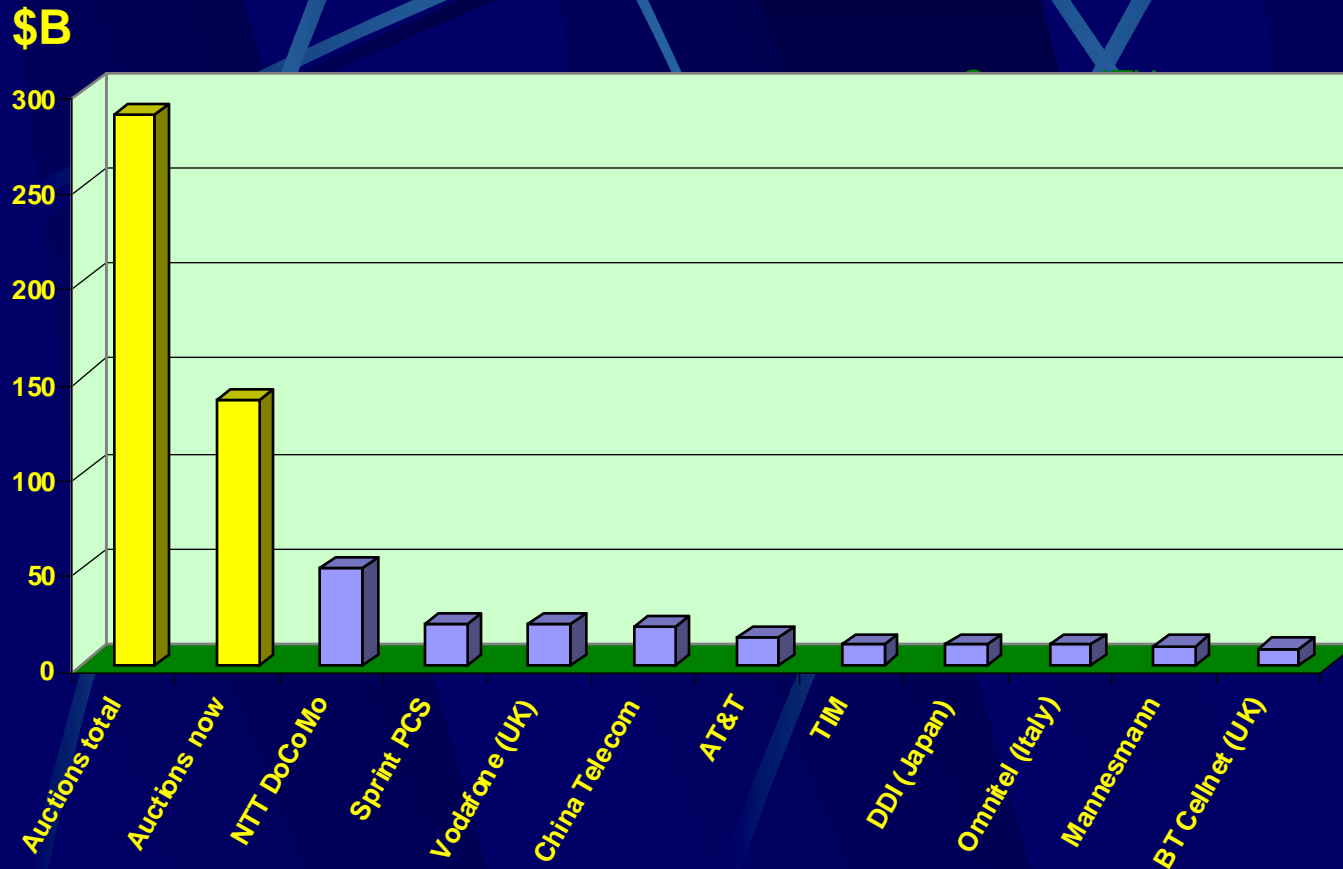
Air vs. Revenues

Telecom Revenues



Source: Nokia, Lehman

Air vs. Cellular 10



The Auctions are already level with the top 10 cellcos combined. If the projections are correct, it would be much larger than the top 20!

Mark Anderson's "Modest Proposal"

- The debt burden of 3G operators is as oppressive as that of some third world countries
- The wireless industry cannot recover this outlay, which was due to "extortion bidding"
- Governments should return the 3G money as an interest-free loan
- The EU has started hearings on the question
- The FCC has been forced to give up part of its anticipated revenue (NextWave case)

Source: <http://www.tapsns.com/newsitem.shtml?7-25-2001>

Conclusions

- 3G is late but provides a rich array of services that will likely stimulate the market
- CDMA2000 will have the toughest time – small market share, licensees often not receiving new spectrum
- W-CDMA won't be easy either – huge spectrum auction costs, later entry than CDMA2000

🌐 Thank You!

