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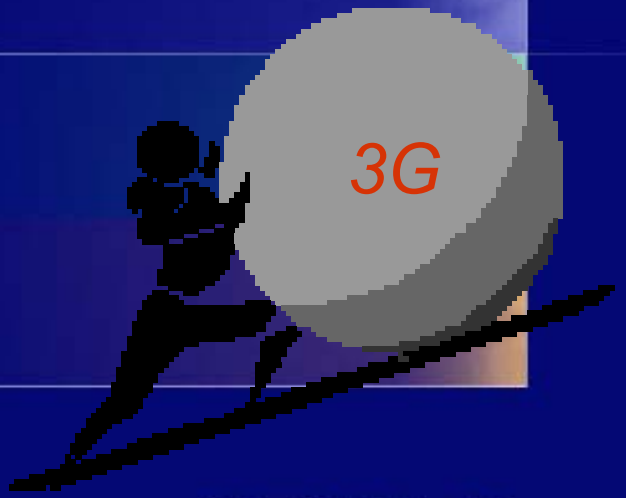
Teaching Elephants to Dance – 3G and the Challenge of Change



COMNET Conference
Washington, D.C.
January 29, 2003

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The Current Climate

Telecommunications Services

Telecommunications Equipment

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Wireless & Mobile Network Infrastructure

EPILOGUE AS PROLOGUE

- 3G is not dead.
- The key logic for deployment of next-gen wireless remains solid:
  - Capacity constraints
  - New revenue streams, particularly data services
  - Operational efficiencies

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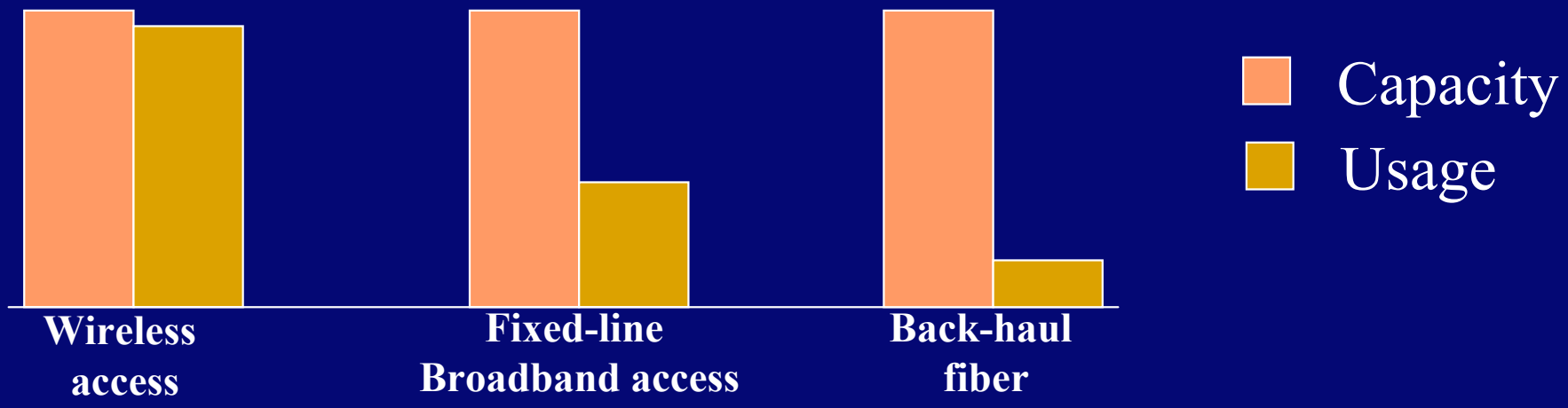
Key drivers to network deployment

1. Capacity Constraint, by comparison (indicative only)



2. New Revenue Potential: Data services
   - MMS/SMS, Gaming, Entertainment
   - Location-based services, Information services

3. Operational Efficiencies
   - Both CDMA2000 and W-CDMA provide operational efficiencies

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Agenda

1. What is 3G and why the excitement?
2. Generations and standards
3. Standards & geographies
4. Subsystems, coordination and delays
5. Mobile infrastructure market size
6. Key trends
7. Operators & vendors to watch
8. Key take-home points

What Is 3G?

Formally, 3G is a family of air-interface standards

- Anytime, anywhere connectivity
- High data transmission rates, specifically:
  - 144 kbps in high mobility contexts (while driving),
  - 384 kbps in low mobility contexts (for pedestrians)
  - 2 Mbps for stationary wireless connection (indoors)
- Worldwide roaming capability
- Ability to support of high-quality MM services
- Real time location-based services
- Interoperability with fixed-line networks

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The Promise of 3G

Wireless Wrist Assist PDAs

Wearable Wireless

Wireless Communicators

Location Tags

Pocket Navigators

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Hype and Reality

Hype

- Streaming audio / video
- Video on demand
- Full web surfing
- High color, full motion graphics

Reality

- SMS / MMS
- Email
- Instant messaging
- Wireless data, or mobile Internet

Wireless Data or Mobile Internet

Mobile Internet is different than fixed-line Internet

With fixed-line Internet:

- Network is transparent,
- Customer is “invisible”
- Customer behavior is difficult to track, and so,
- Customer is difficult to serve

In a mobile environment, the network knows …

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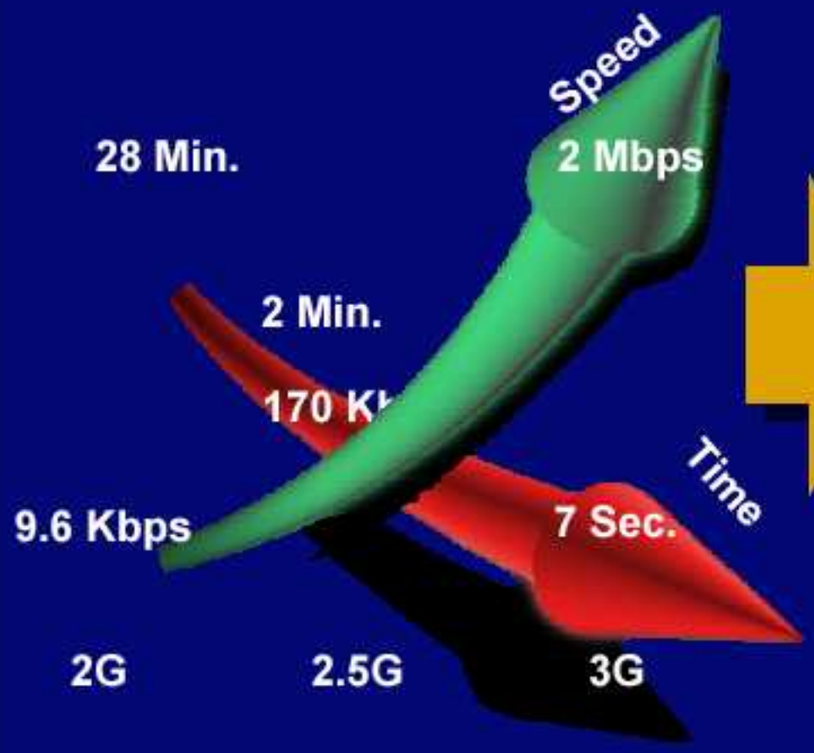
Wireless Data, 3G & Opportunity

Enabling technology



Speed, cost & intelligence

Potential for new services

Personalized suites of mobile, MM apps

Application communities

- Consumers
- Office Workers
- Personal Apps
- On the Move
- Transactions

Flexible app bundles for key user communities

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Where's the Content?

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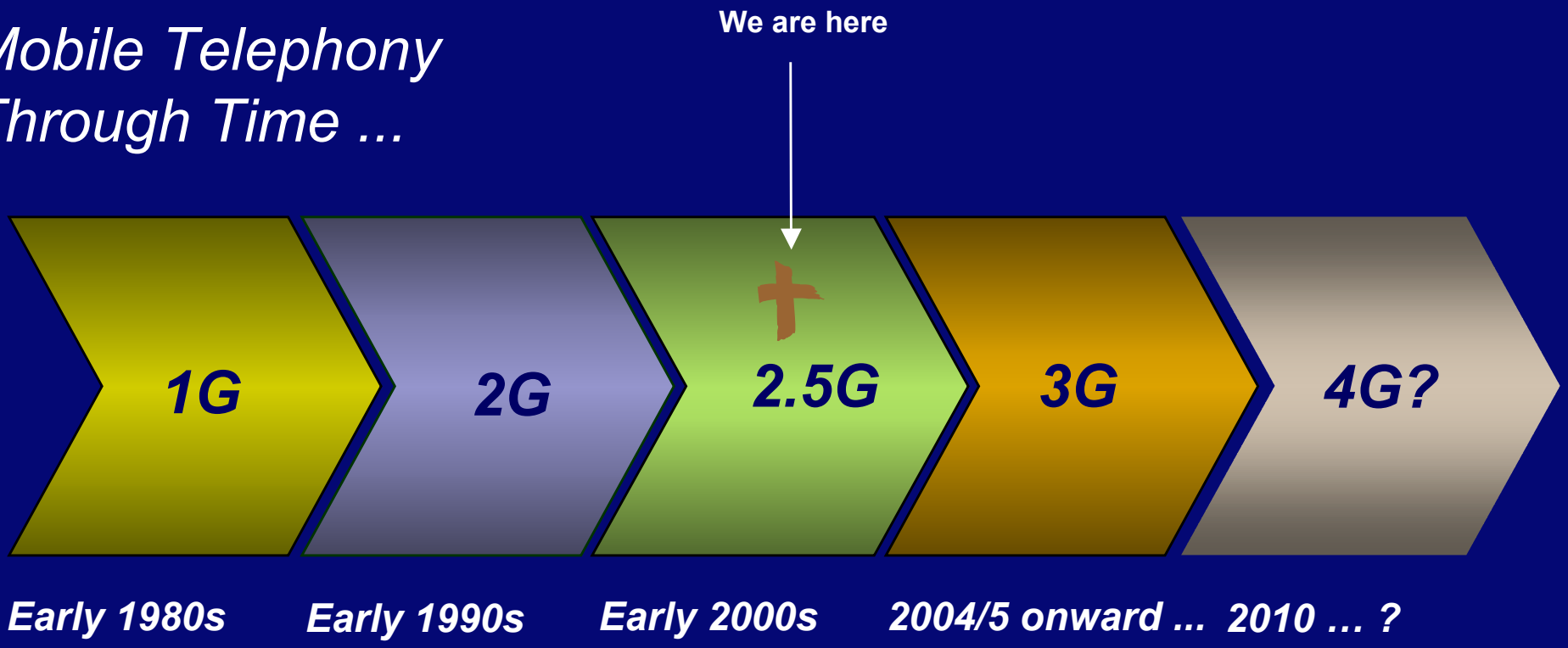
G Is for Generation

Mobile Telephony Through Time ...



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How Do Mobile Generations Differ?

Technology	FDMA	TDMA/ CDMA	TDMA/ CDMA	CDMA	OFDM?
Standards	AMPS, TAC NMT, other	GSM, PDC TDMA IS 136 CDMA IS 95	GPRS, CDMA 1x EDGE	WCDMA, CDMA 1x EV	Unclear
Transmission data rates	9.6kbps	9.6Kbps – 14.4Kbps	115kbps GPRS 144kbps 1X	384kbps – 2Mbps	10Mbps and beyond
Functionality supported	Voice	Voice & some data	Voice & data	Voice, data, & multimedia	Voice, data, MM, and VR?
Switching protocols	Circuit switched	Circuit switched	Packet switched	Packet Switched, IP	Packet switched
Customer focus	Biz customer	Biz & consumer	← Virtual Personal Network →		

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Standards, Geographies & Migration Paths

US & Canada
CDMA 52% (> CDMA2000)
GSM 35% (> EDGE/UMTS)
TDMA 13% (> GPRS/EDGE)

European Union
GSM 100% (>GPRS >UMTS >EDGE?)

Japan
PDC 67% (>UMTS)
CDMA 33% (>CDMA2000)

S. Korea
CDMA > CDMA2000
CDMA > WCDMA ?

Latin America
Mostly TDMA
(> UNCLEAR)

Rest of the World
GSM 48% (>GPRS/WCDMA)
CDMA 34% (>CDMA2000)
TDMA 18% (> UNCLEAR)

China
GSM 92% (>GPRS/WCDMA?)
CDMA 8% (> CDMA2000)

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(Preliminary percentages, as of 2002 end)

Market & Infrastructure Trends — Global

CARRIERS

- Capex reductions
- A global slowdown, slowing subscriber growth
- Developing world sees more prepaid growth
- Slower transition: GPRS to UMTS
- Search continues for killer apps
- Managing network migration: When data takeoff?
- Biz model shift — dumb pipe to VAS,
  facilities to content provisioning
- Inflection point for TDMA operators

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Wireless & Mobile: Key Trends /Global

EQUIPMENT VENDORS

- Increasingly Competitive Markets
- Learning curves and price erosions

- Network technology — circuit to packet to IP
- How to manage R&D for multiple standards

- Increasing technology complexity of networks
- Competing networks, niche networks

- Interoperability among standards, in live networks

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M & I Trends — North America

- Spectrum issues, hence EDGE
- Next Gen investments: CDMA 1X / GPRS & EDGE
- Network sharing, to speed offerings

- Room for increased mobile penetration
  - Currently 50% (EU 65+%)
  - Migrating users from voice to data

- Called Party Pays remains an issue
- Location based services gain salience after 9/11

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M & I Trends — Western Europe

- Significant operator debts from spectrum auctions
- Meltdown? Or mere investment write-down by few?
- High mobile penetration, reaching saturation level
- Focus on high ARPU quality subscribers
- GPRS to have longer play, EDGE after UMTS?
- Network sharing, to reduce deployment costs
- 2003 to see interoperability testing in live networks

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M & I Trends - Asia Pacific

Japan / S. Korea

- Early adoption of 3G business model in Japan
- Japan, South Korea on high-end spending path
- I-mode, KDDI and Sha-mail

China / Developing Asia

- Enormous CDMA growth, GSM expansion in China
- 2G - 2.5G investment to continue through 2002 - 04
- Worldís largest subscriber base (and growing)
  - But prepaid, and voice oriented
- State emphasis on local production
- Developing Asia (e.g., India) coming on board with 2G/2.5G spending

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M & I Trends — Latin America

- Operator consolidation imminent
- Emergence of pan-regional players
- New spectrum allocation
- Enormous subscriber growth
  - But prepaid, and voice oriented
  - Wireline replacement
- TDMA inflection point

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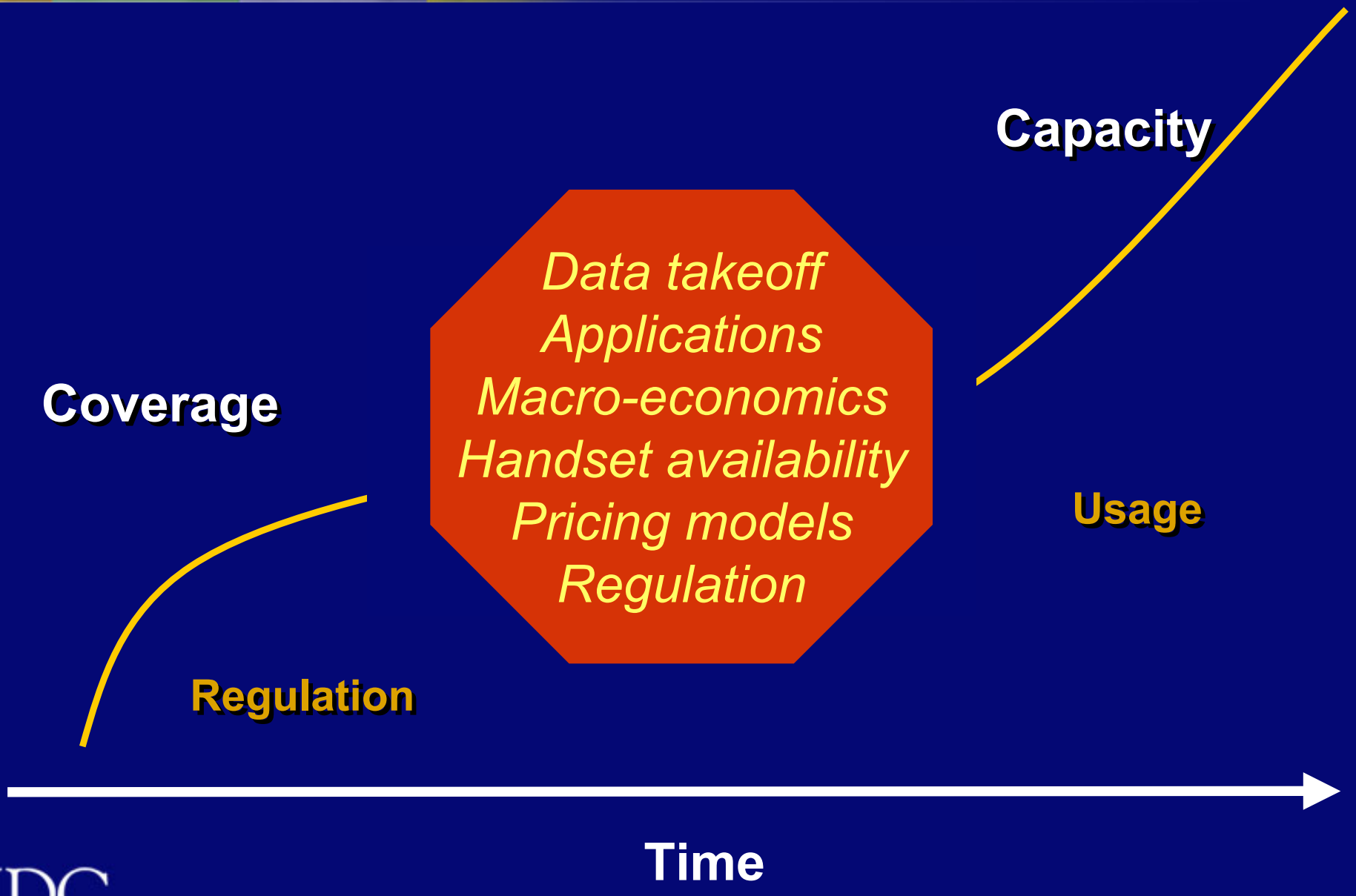
When Will 3G Be Available?



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3G is about Collaboration

Professional Services

- Design
- Consulting
- Deployment
- Integration

Support & Maintenance

Production

Applications

Enterprise Apps: Groupware, EIA, ERP, CRM, SCM, etc.
Entertainment: Games, music, sports
Commerce: Banking, trading, ticketing, shopping

Travel | Banking | Healthcare | Gov't | Etc.

Vertical Apps

Enterprise Infrastructure Hardware, Security, Middleware, Management

Distribution

SMS/ MMS | App Servers | Location | Voice Portal | Storage

Network Infrastructure

RAN Standards: GSM, PDC, TDMA, iDEN, CDMA IX, WCDMA
Radio Access: BTS, BSC, Node-B, etc.
CORE: IWF, MSC, PDSN, SGSN, GGSN, RNC, etc.
Services: OSS, Network management, Billing, etc.

Consumption

Access Devices & Terminals

Operating Systems: PalmOS, EPOC32, WIN CE, PocketPC, RIM OS, cHTML, WML, Symbian, Java ME
Devices: 2G, 3G phones, SmartPhones, PDAs, pagers, PCs
Semiconductors: ASICs, chipsets, Flash/SRAM, DSP

Mobile Operators

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Source: IDC, 2002

Why Elephants Must Learn to Dance

- For 3G to succeed, 3 sub-systems must work together
  - Production sub-system (applications, services from data comm world)
  - Distribution sub-system (networks, from the telecom world)
  - Consumption sub-system (access devices, from consumer electronics; chipsets, from folks in semiconductor industry)

- Elephants must learn to dance!

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Consider MMS

Discounts ☺

Sports

Insurance

Shopping

Opera

Movie ads

Holidays

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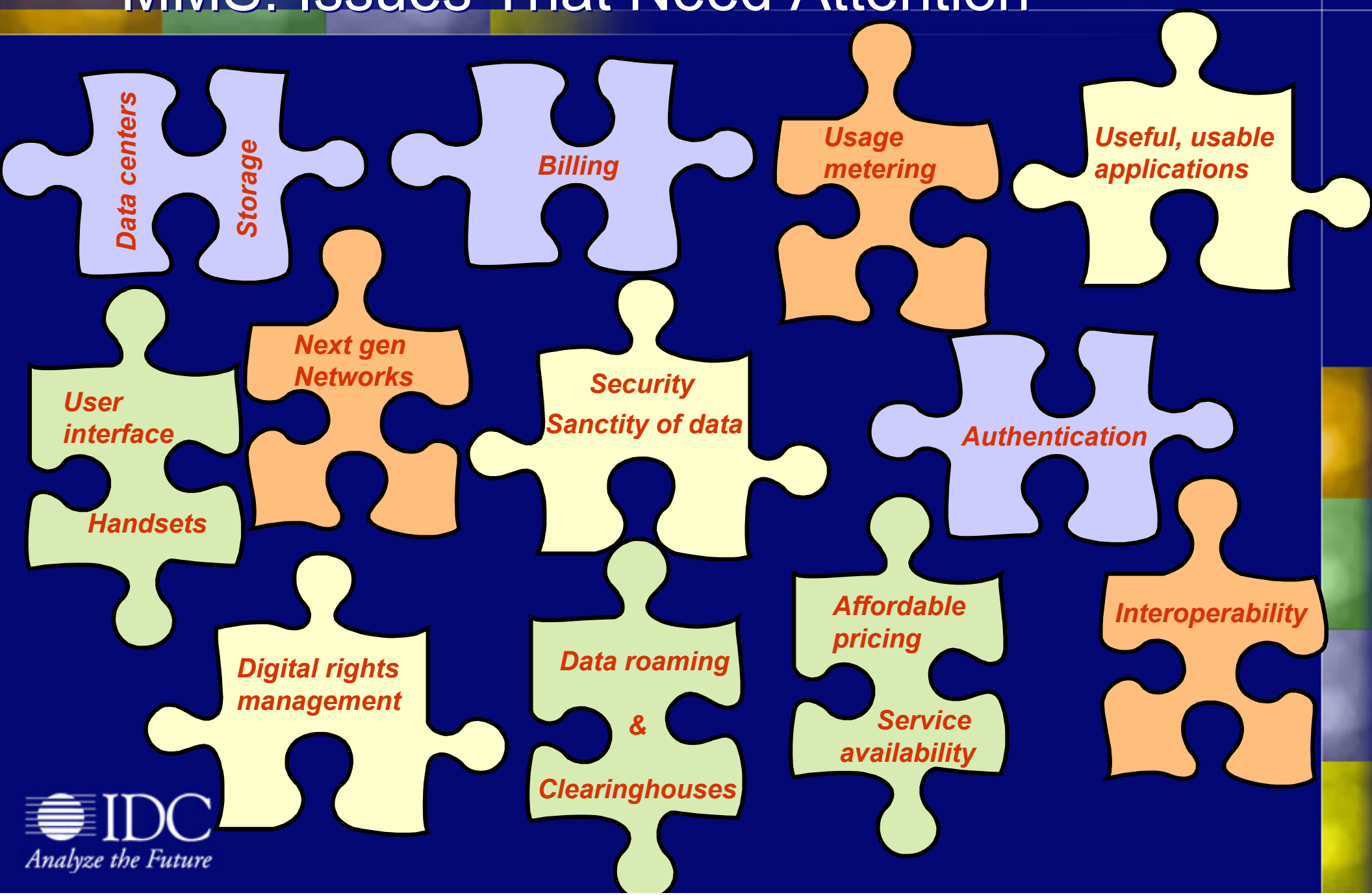
MMS: Issues That Need Attention



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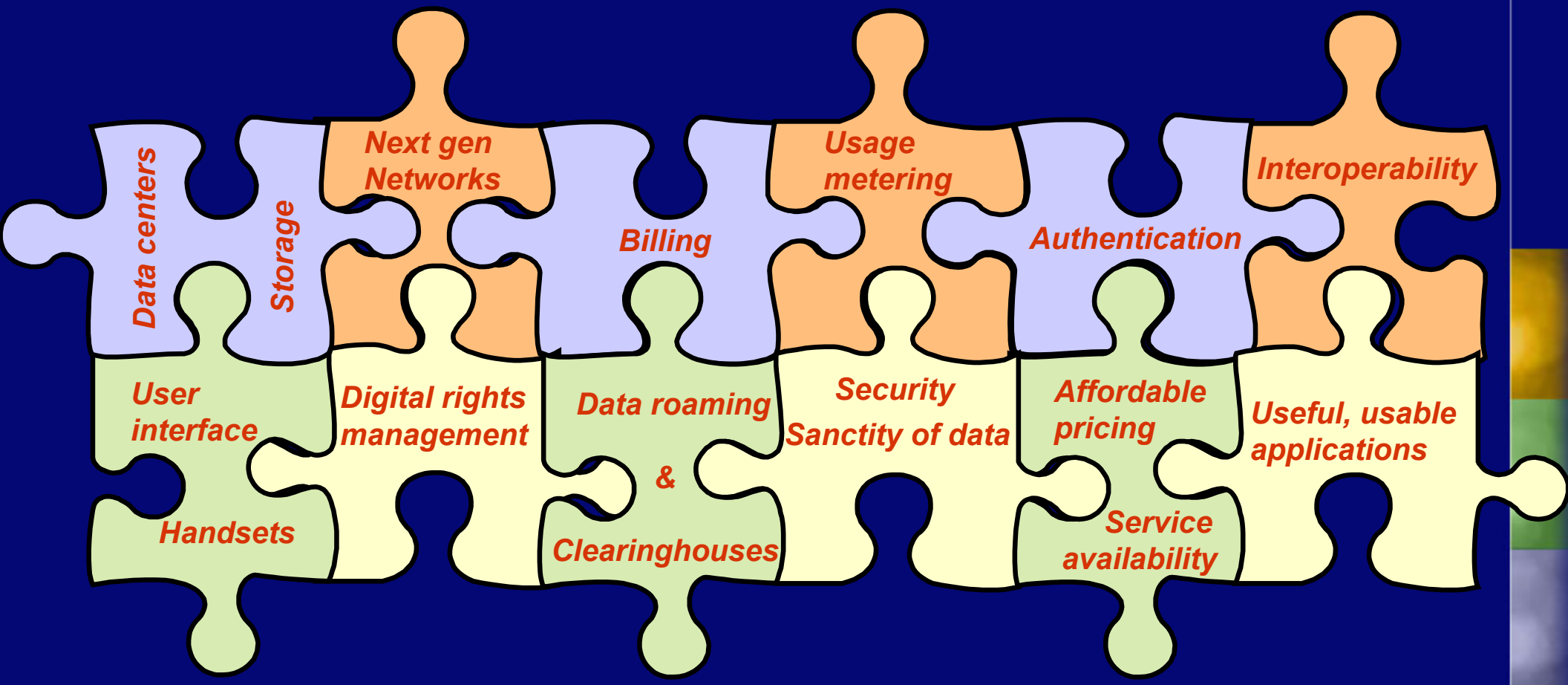
MMS: All These Need to Come Together



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Cost of coordination is paid in currency of time

The Key Challenge of Change

- The Idealist / Strategic Gap
  - Idealist View: Normative, what should be
    Anchored in a notion of social good
  - Strategic View: Anchored in ROI considerations
    Show me the money!

- Of course, vendors and policymakers will seek to push the idealist view.
- Network operators, responding to shareholders and ratings agencies, will follow the strategic course.

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3G Will Happen: Too Much at Stake!

Investors

Industry Employees

National Governments

Content Providers

Advertisers & Agencies

Wireless ASPs

Service Providers

Middleware Vendors

Handset Vendors

Equipment Vendors

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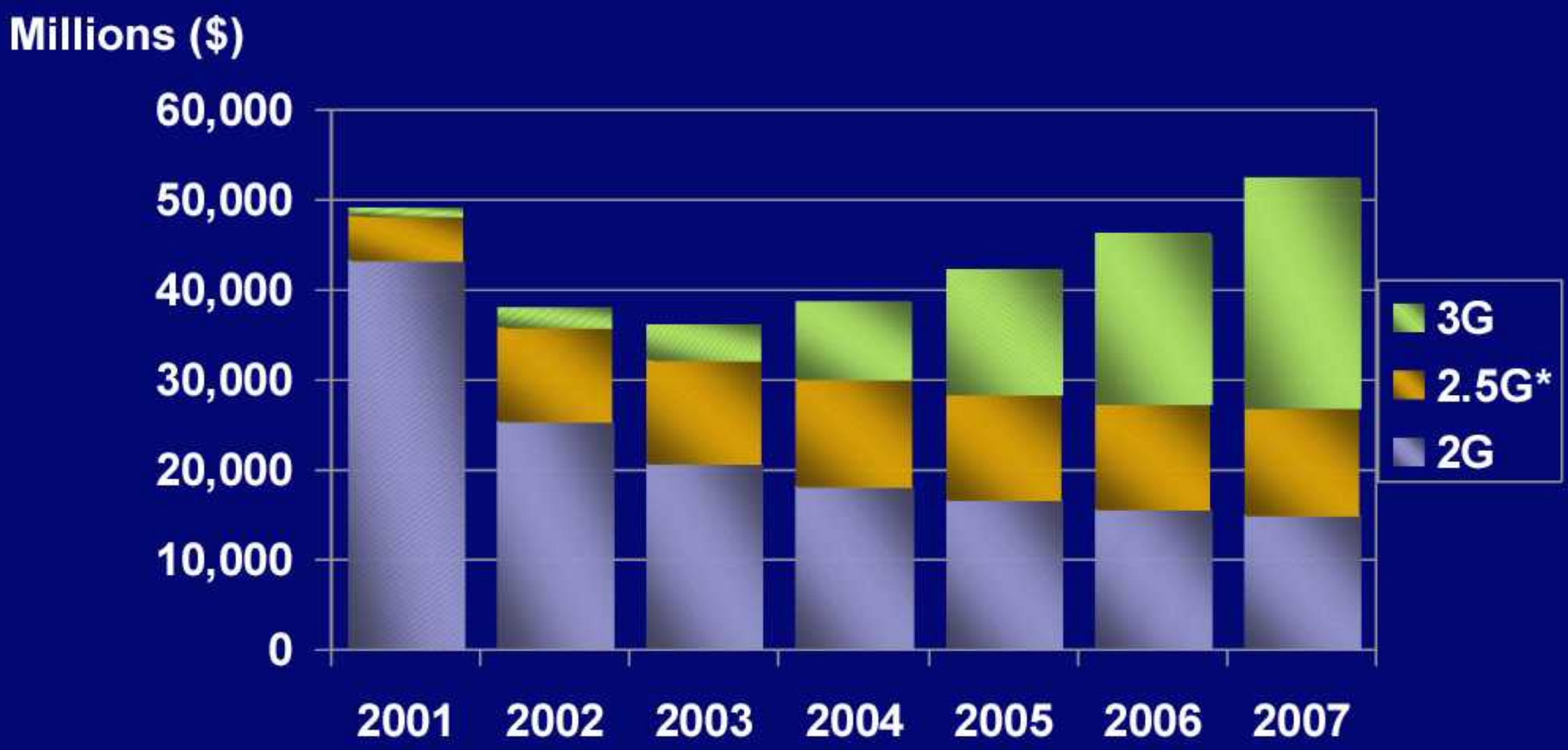
Worldwide Mobile Infrastructure Spending by Network Operators (2002–2007)



• CDMA1x/EDGE considered as 2.5G

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Some Key Operators to Watch

North America

- AT&T Wireless
- Bell Mobility
- Cingular
- Nextel
- Sprint PCS
- Verizon Wireless
- T-Mobil VoiceStream

Western Europe

- KPN Mobil
- mmO2
- Orange
- Vodafone
- Telefonica
- TIM
- T-Mobil

Asia/Pacific

- China Mobile
- China Unicom
- Hutchison
- KDDI
- NTT DoCoMo
- SK Telecom
- Telstra

Latin America

- America Movil
- Bell South Int'l
- Telefonica
- Telcel

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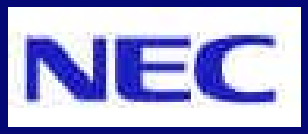
Key Equipment Vendors to Watch

Pack leaders

Regional players

Other majors



Other players

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Key Take-Home Points

- The future is wireless. The future is mobile.
  And 3G is happening – though not in Internet time!
- Essential rationale for 3G is intact
- Wireless data presents a tremendous opportunity.
  Network speed & bandwidth are key.
- Separation of infrastructure and services creates opportunities — and risks!
- MMS likely to help create a mobile data culture
- 3G network deployment is going to be driven by strategic intent of operators, not a sense of idealistic mission
- Elephants must learn to dance, given interdependencies.
- Regulators will play a key role.

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Thank you.

Any Questions?

Please email me at

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