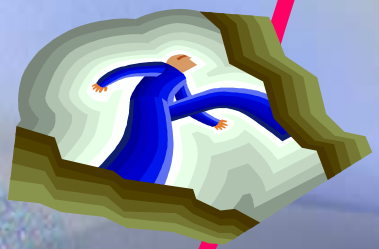
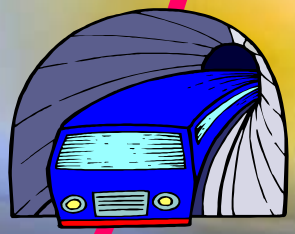
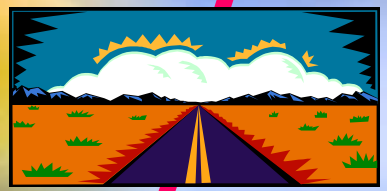
IPv6
FORUM
IPv6
The New Internet
Sep 6th, Rio De Janeiro

Technology & Progress Waves

Canals Railways Highways Telecommunications







1750 1800 1850 1900 1950 2000 2050

GOODS

PEOPLE

INFORMATION

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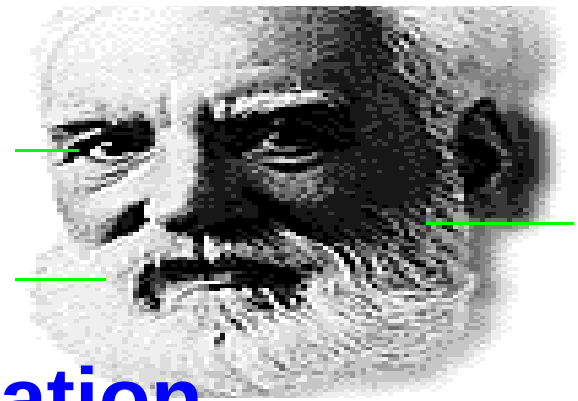
Famous Last Words

- ”The telephone would be used only to inform people of arrival of telegrams."

1876: Alexander G. BELL invents the PHONE

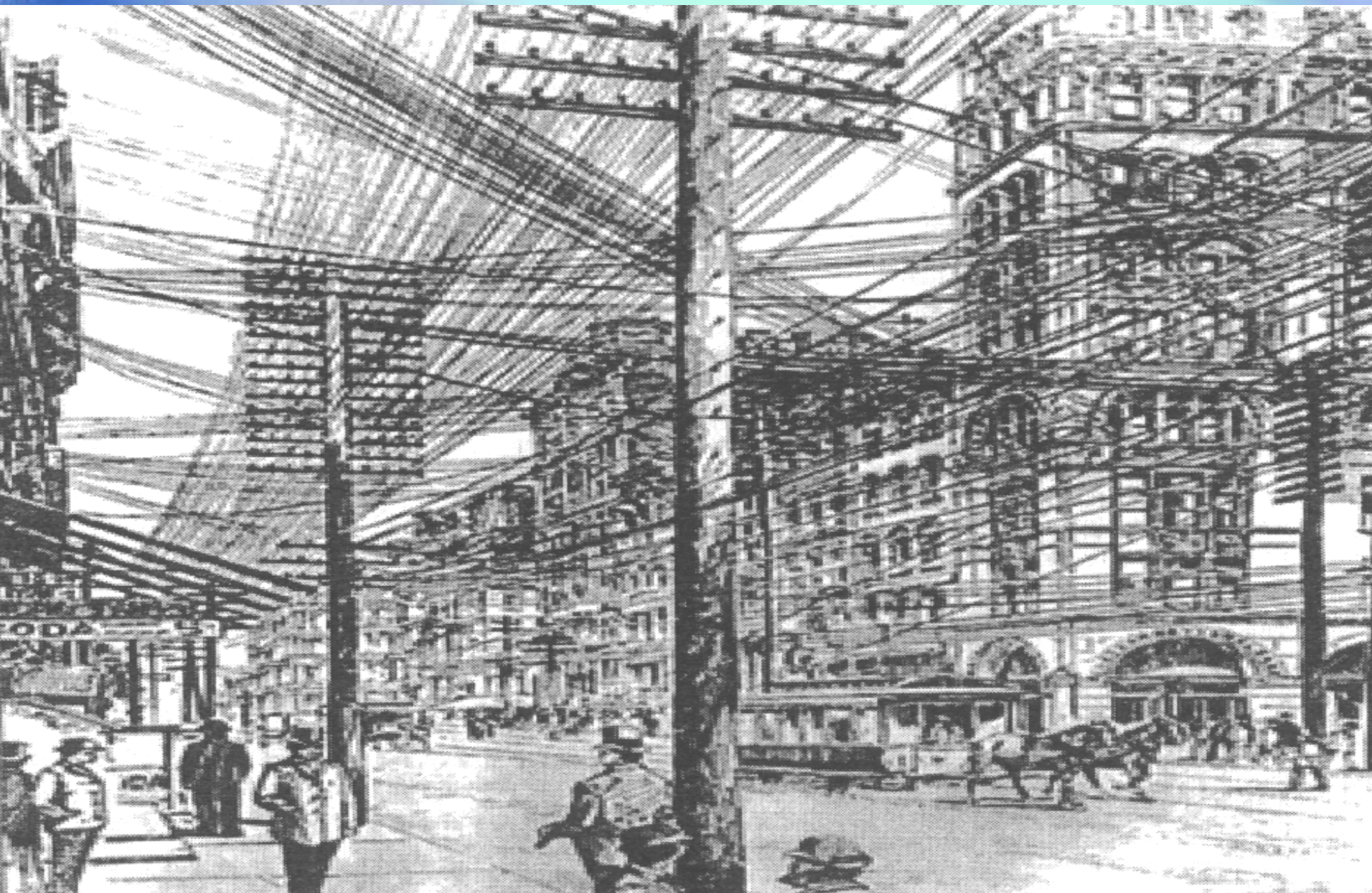
1838: Samuel MORSE invents the TELEGRAPH



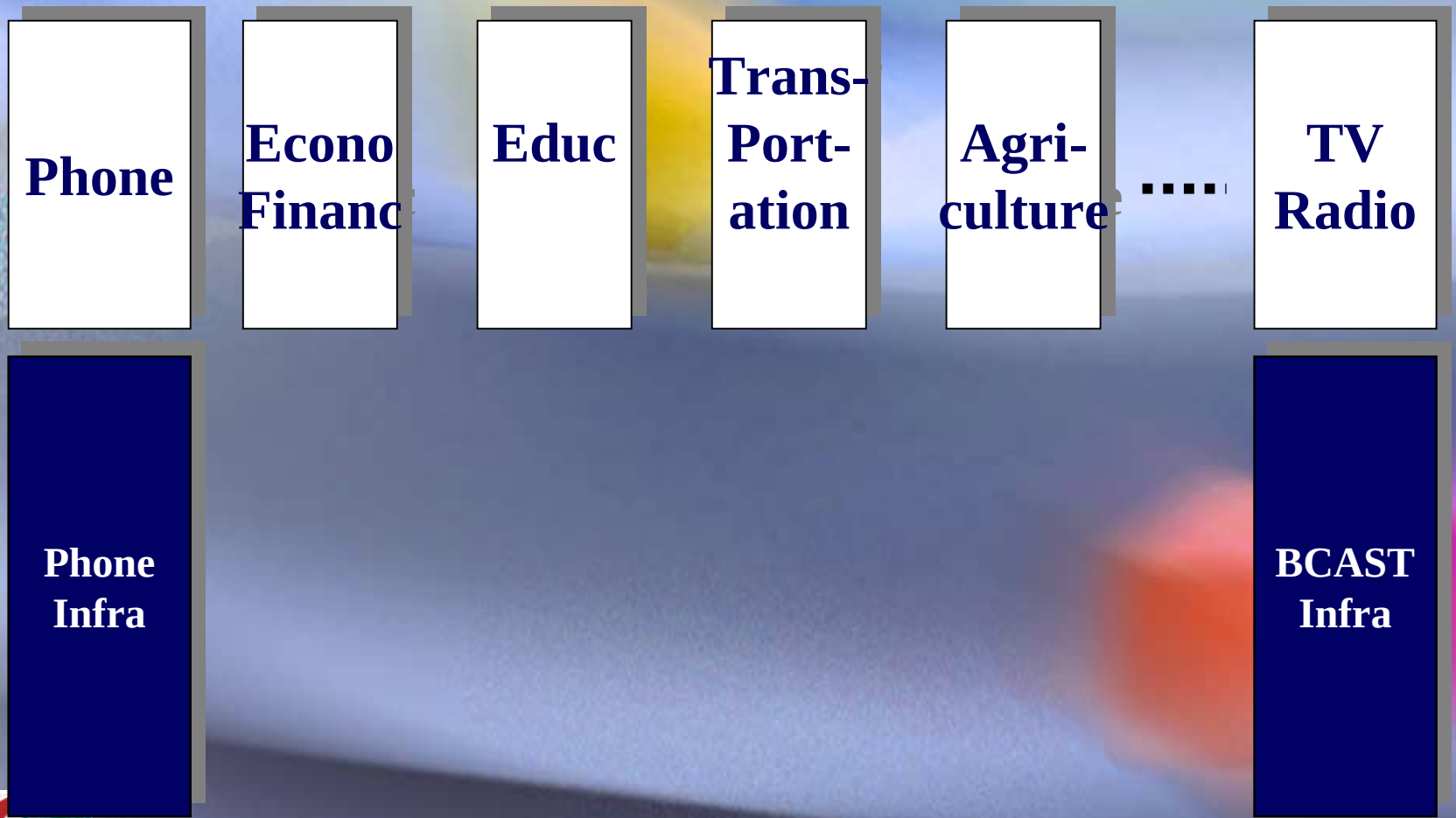
-- 15 % Penetration

-- 2 Days Walk for 1 Billion people

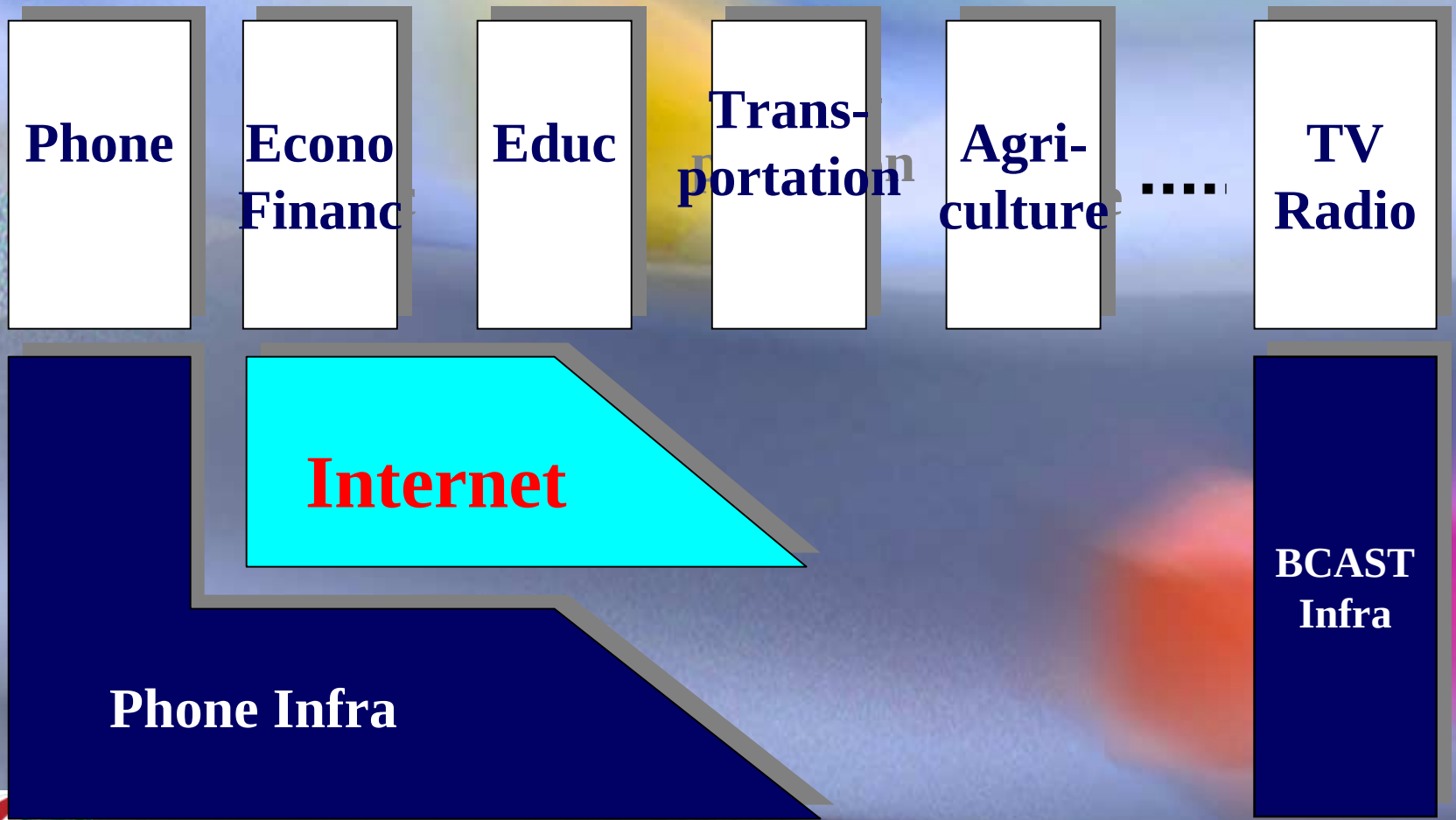
New York 1891, Broadway/John Street



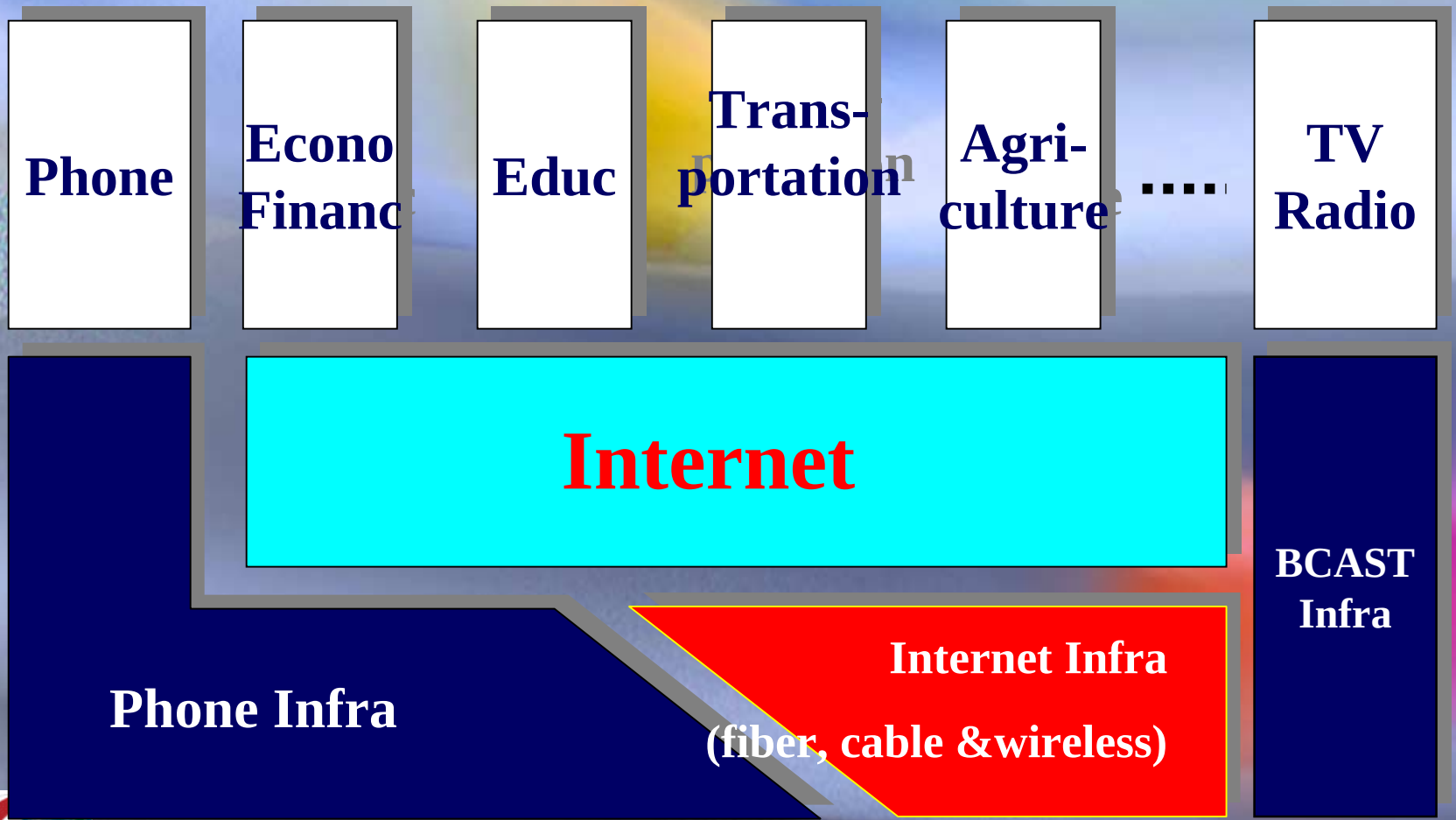
Analog Communication



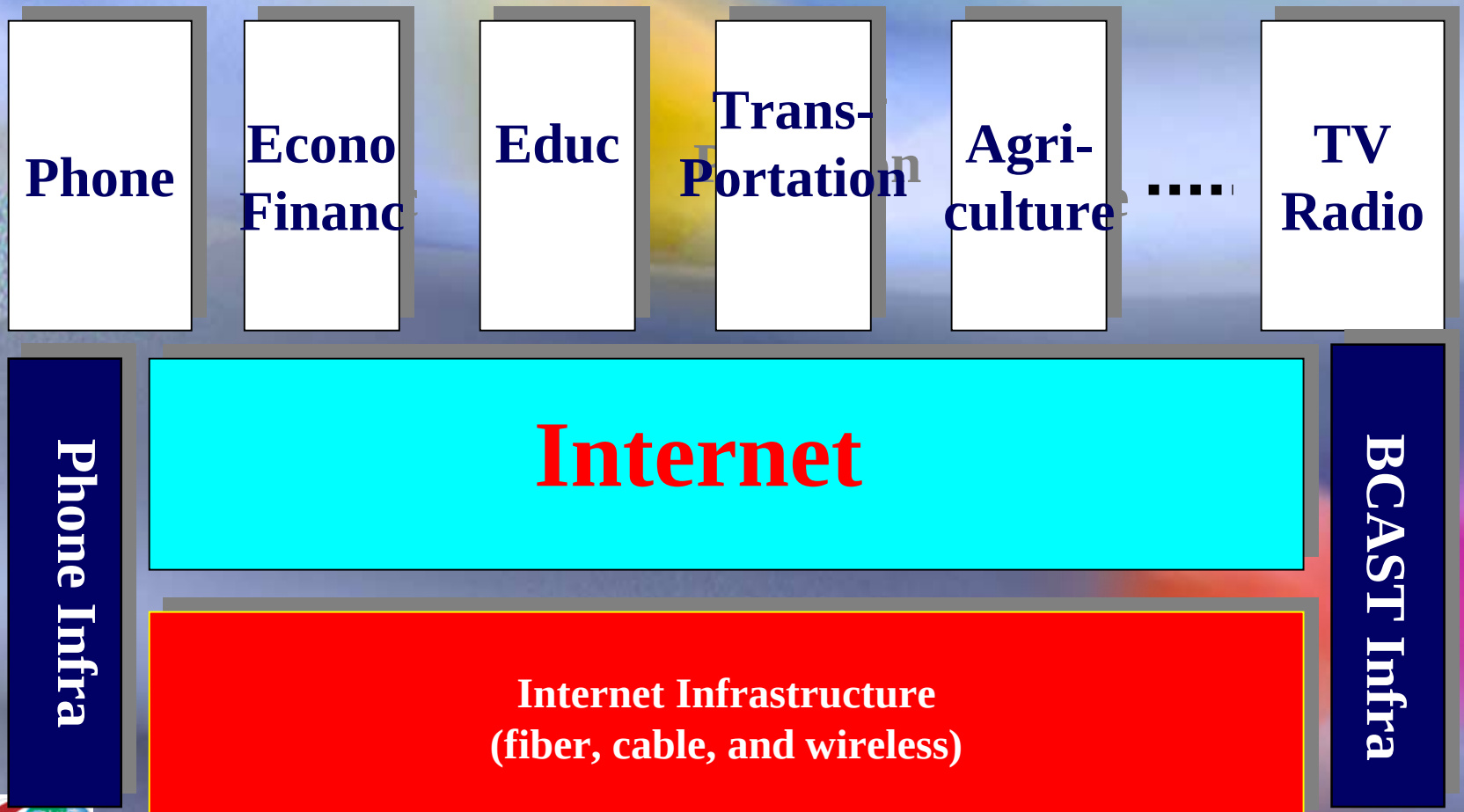
Internet: as of Yesterday



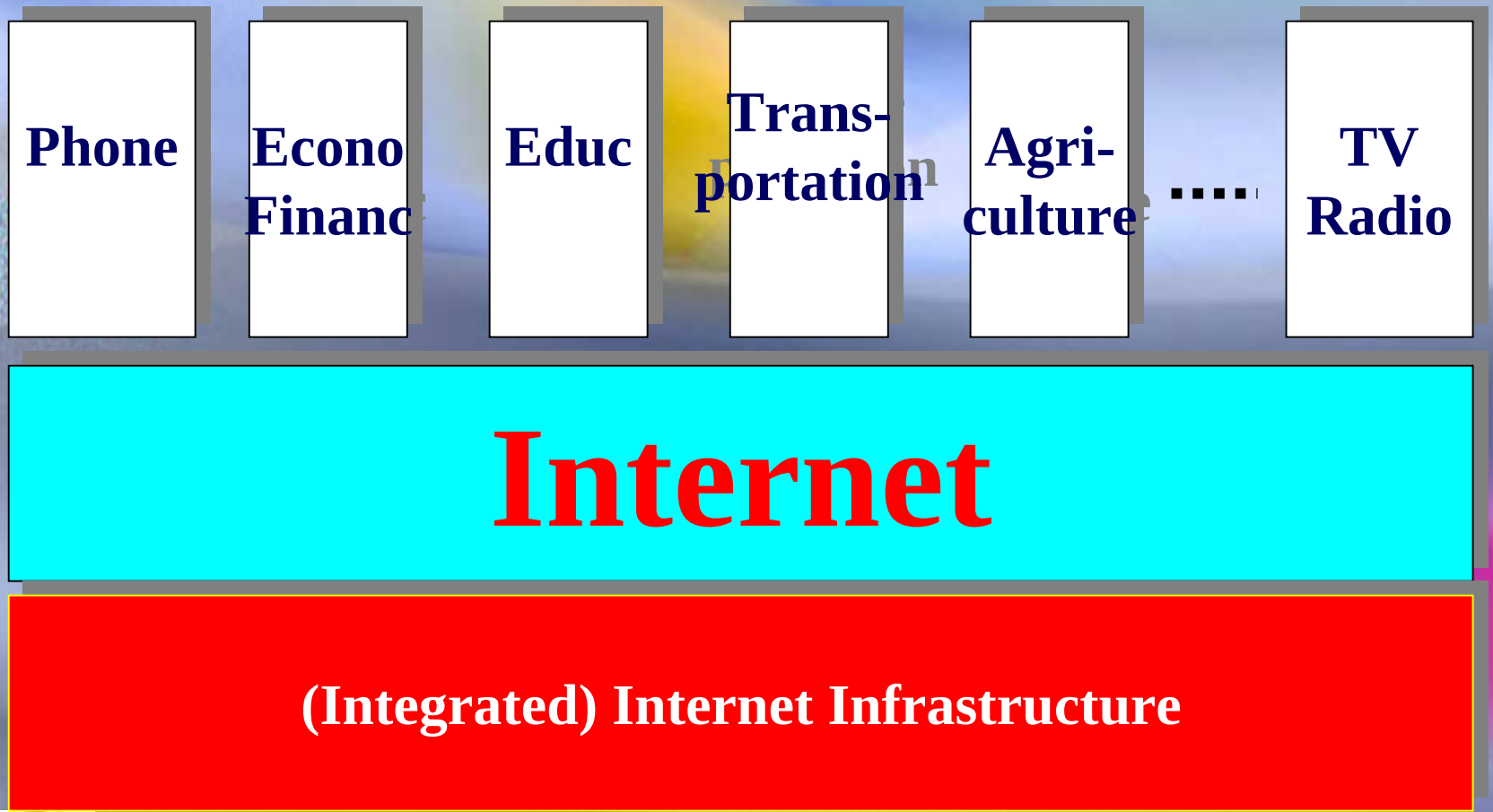
Internet: as of Today



Internet: as of Tomorrow

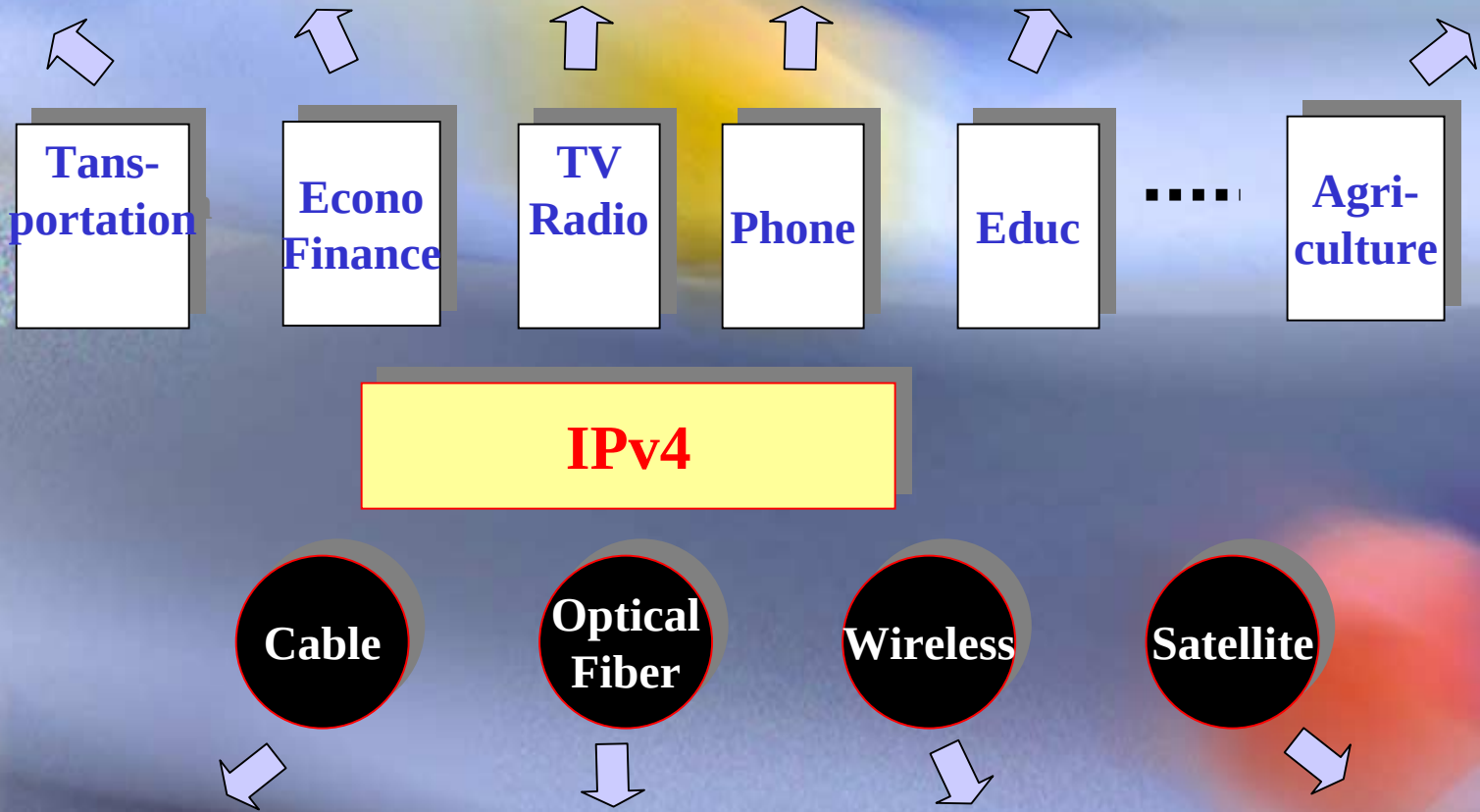


Internet Infrastructure for digital communication society

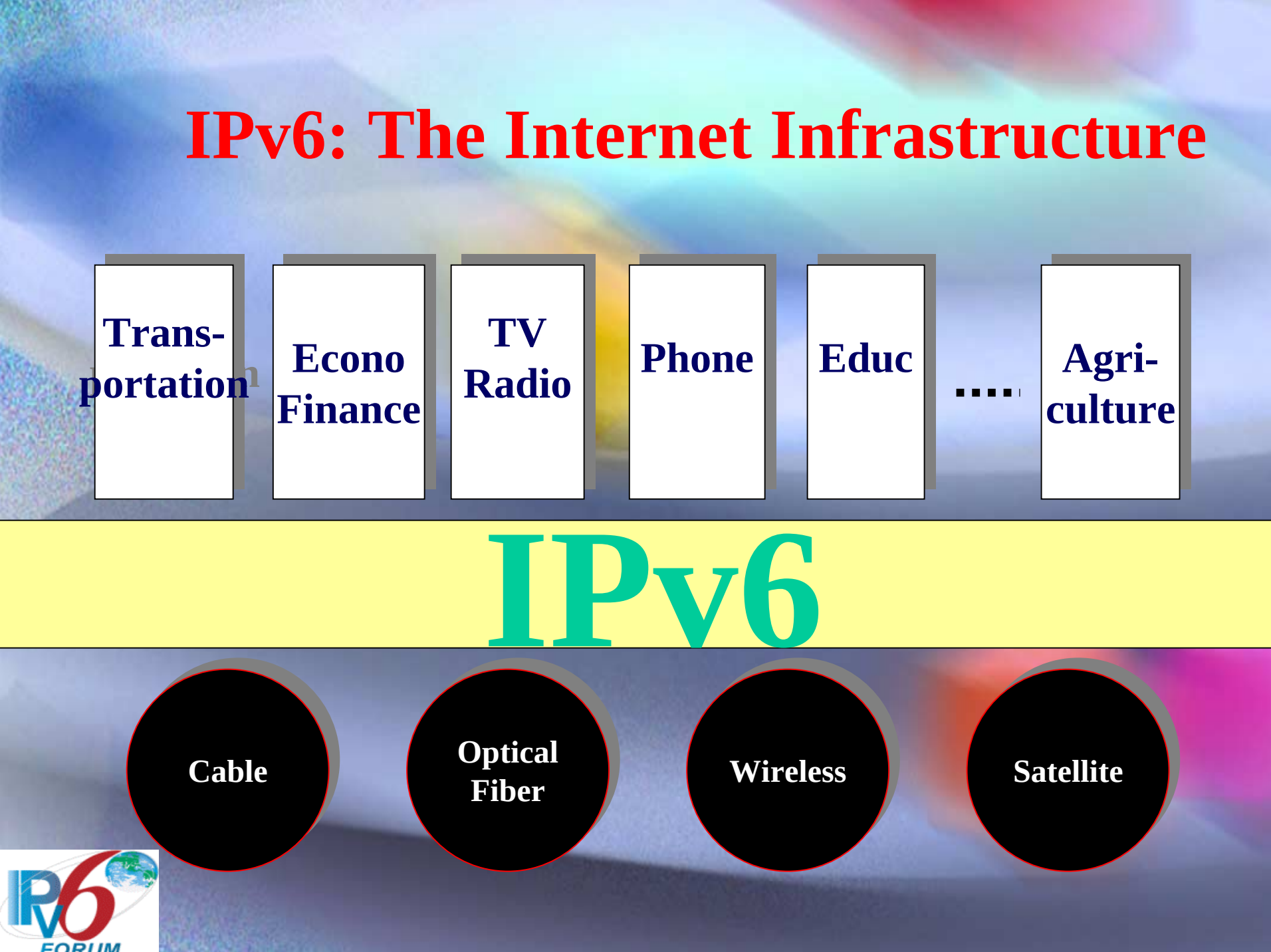


A testbed is VERY important!

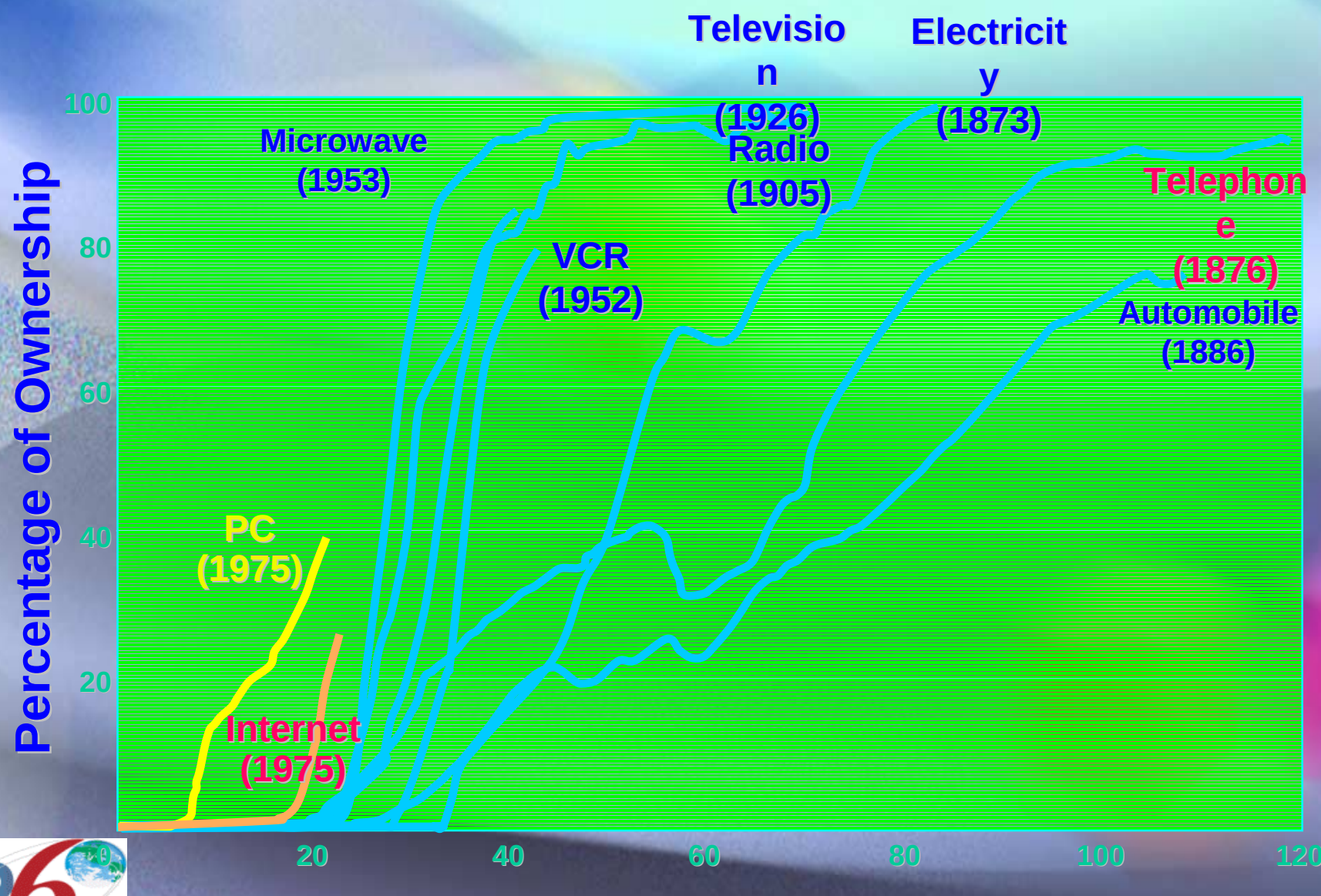
IPv4: Not enough IP addresses and growing requirements



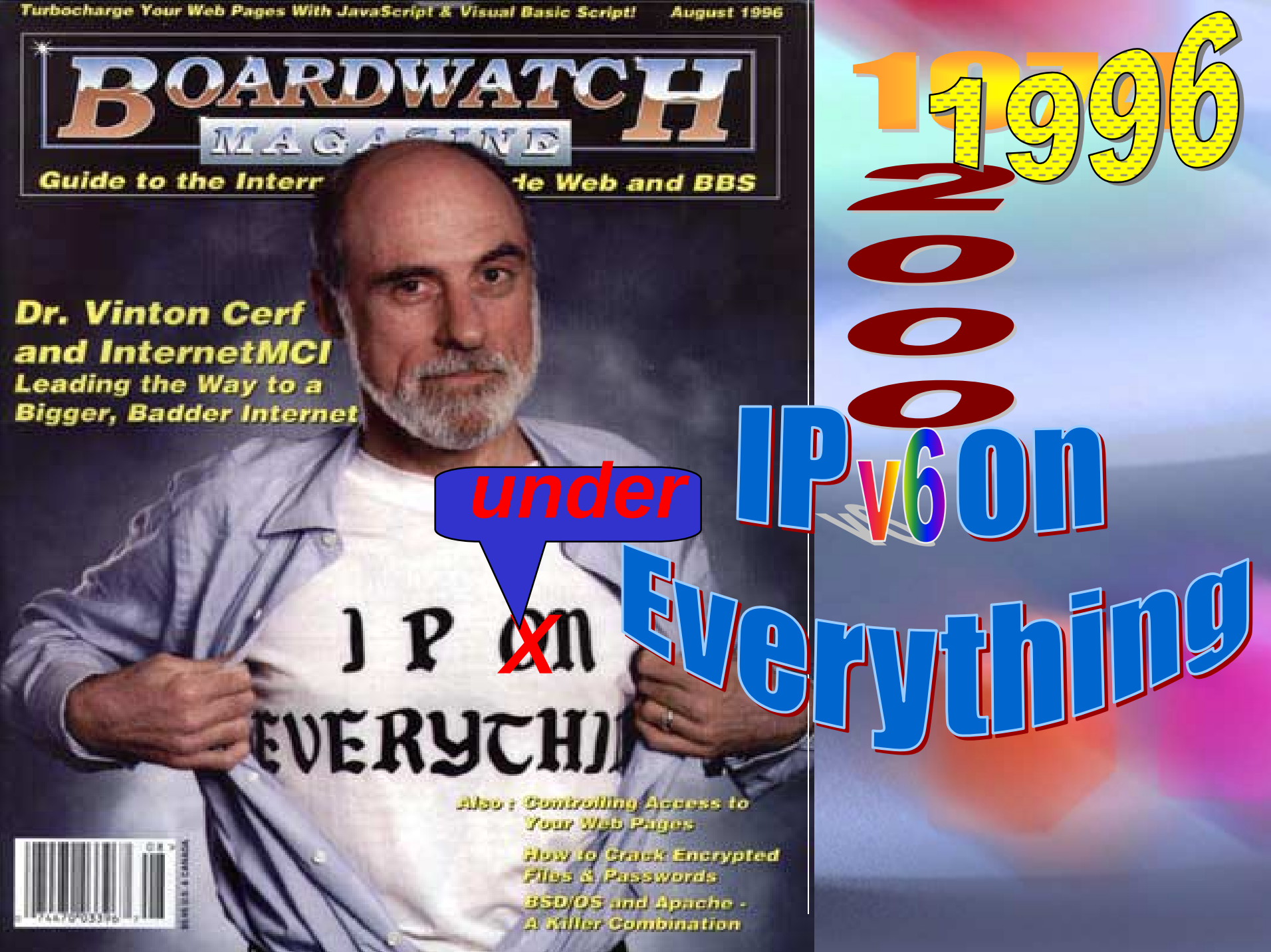
IPv6: The Internet Infrastructure



Industry Standards Drive Ubiquity



IPv6 FORUM


Turbocharge Your Web Pages With JavaScript & Visual Basic Script!
August 1996
BOARDWATCH
MAGAZINE
Guide to the Interr
de Web and BBS
Dr. Vinton Cerf
and InternetMCI
Leading the Way to a
Bigger, Badder Internet
I P on
EVERYTHI
Also : Controlling Access to
Your Web Pages
How to Crack Encrypted
Files & Passwords
BSD/OS and Apache -
A Killer Combination
1996
2000
IPv6On
Everything
under

Internet Generations

1 G
10 * 4
Professionals
Email, Ftp
9.6 k
Government Internet

ARPANET

Internet Generations

1 G	2 G
10 * 4	10 * 8
Professionals	Innovators
Email, Ftp	WWW
9.6 k	56 k
Government Internet	Public Internet

Internet Generations

1 G	2 G	3 G
10 * 4	10 * 9	10 * 38
Professionals	Innovators	Every-One & -Thing
Email, Ftp	WWW	Wireless, Streaming Media
DIAL-UP INTERNET		ALWAYS-ON
Government Internet	Public Internet	Global Internet

ARPANET INTERNET NEW INTERNET

Nothing HAPPENS Overnight

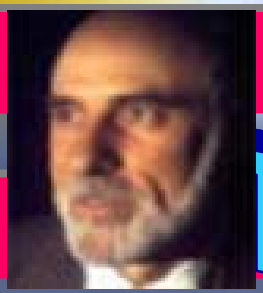
Internet TimeLine

- NCP Conception
- NCP Roll-Out
- IP Conception
- IPv4 Roll-Out
- *IPv6 Conception*
- *IPv6 Roll-Out*

1961 NCP 1969

1969 ARPANET 1982

1972



IPV4 INTERNET

1983

w!

1991

IPv6 99

2000

NEW INTERNET

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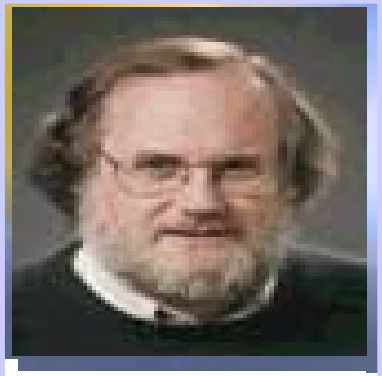
IPv6 Technical Directorate

Chair: **Jim Bound**

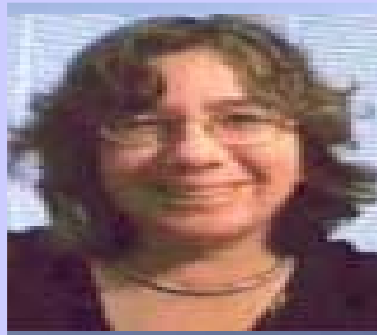
Scott Bradner

Brian Carpenter



Steve Deering

Christian Huitema



Allison Mankin

Matt Crawford

Charlie Perkins

Thomas Narten

Erik Nordmark

Thomas Ecklund

IPv6 Technical Directorate

Francis Dupont

Alain Durand

Jack McCann

Henk Steenman

Stephen Hayes

Stig Venas

Carl Williams

Brian Zill

Yanick Pouffary

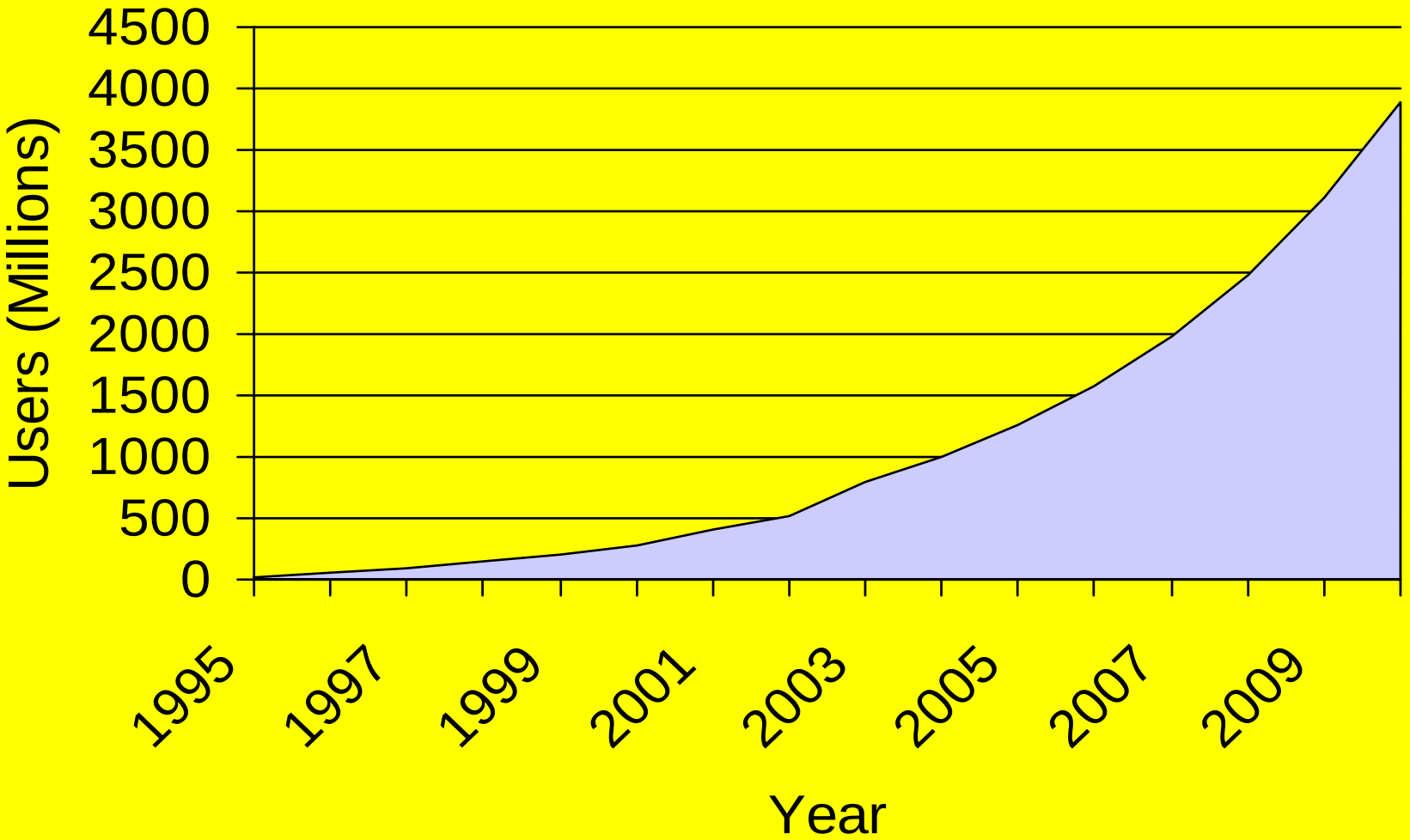
Dale Finkelson

Cyndi Jung

Peter Tattam

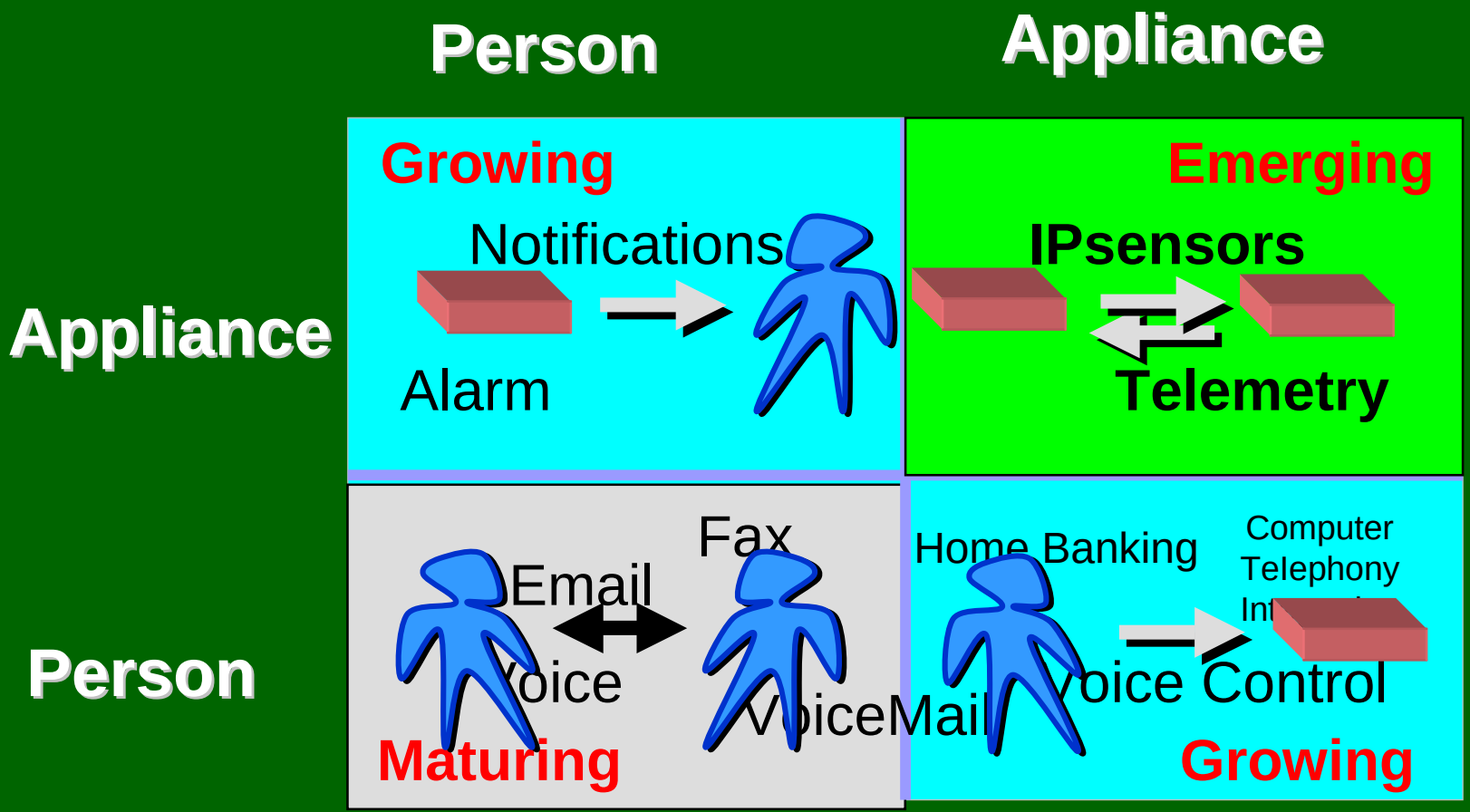
Brian Haberman

Internet User Trends

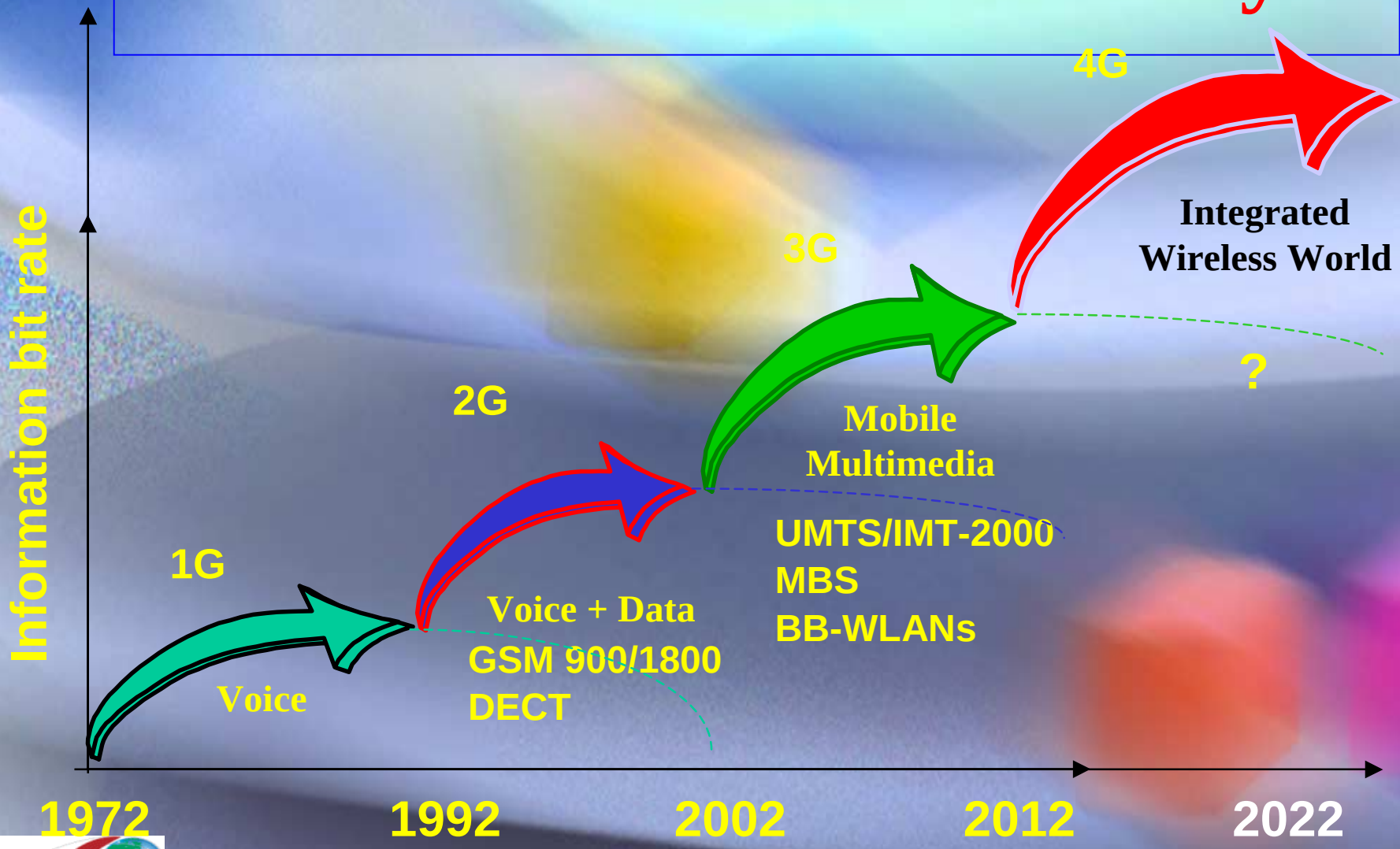


Source: Nua Internet Surveys + vgc projections

InfoCom Application Areas

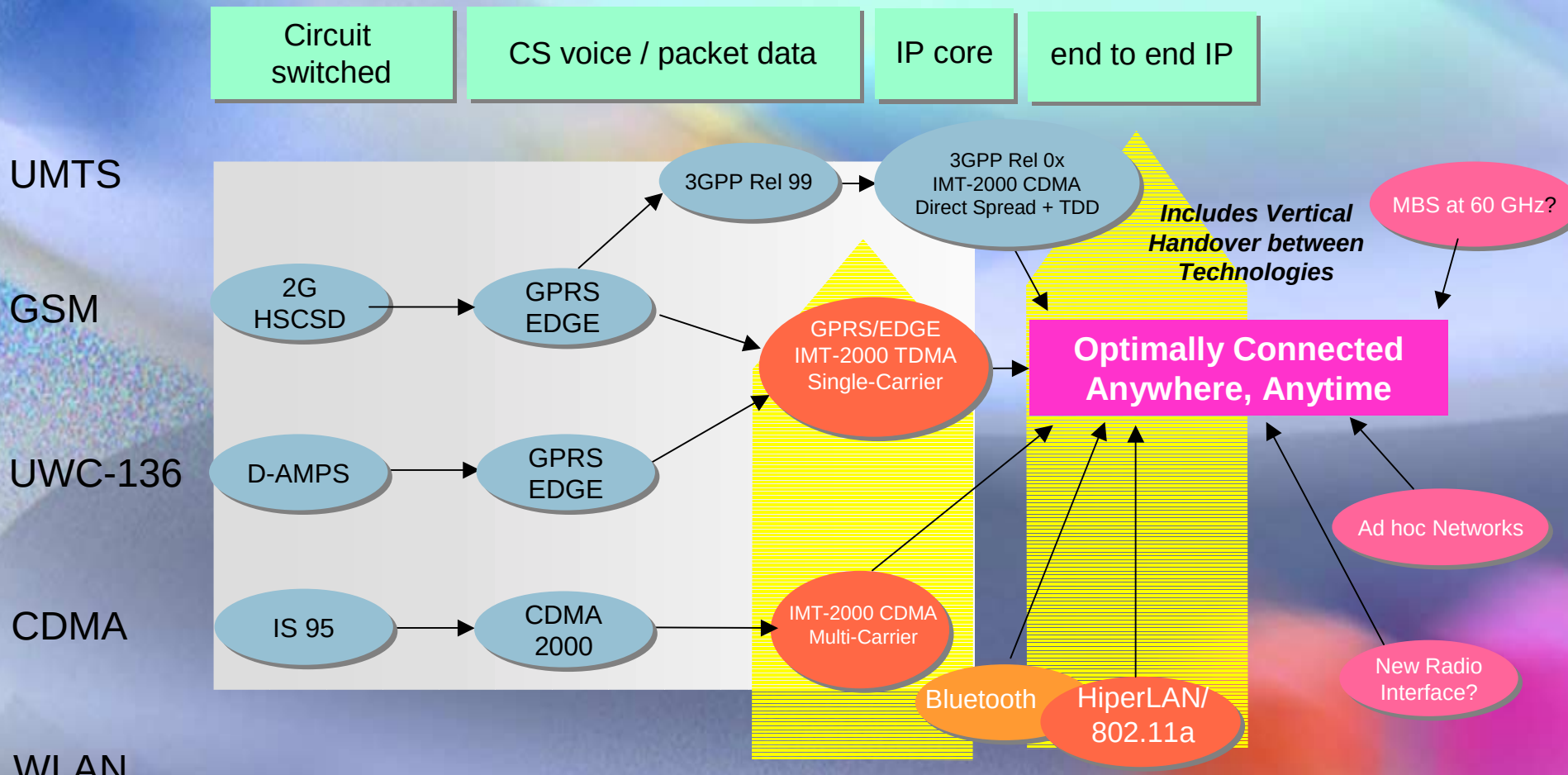


G - Evolution in continuity



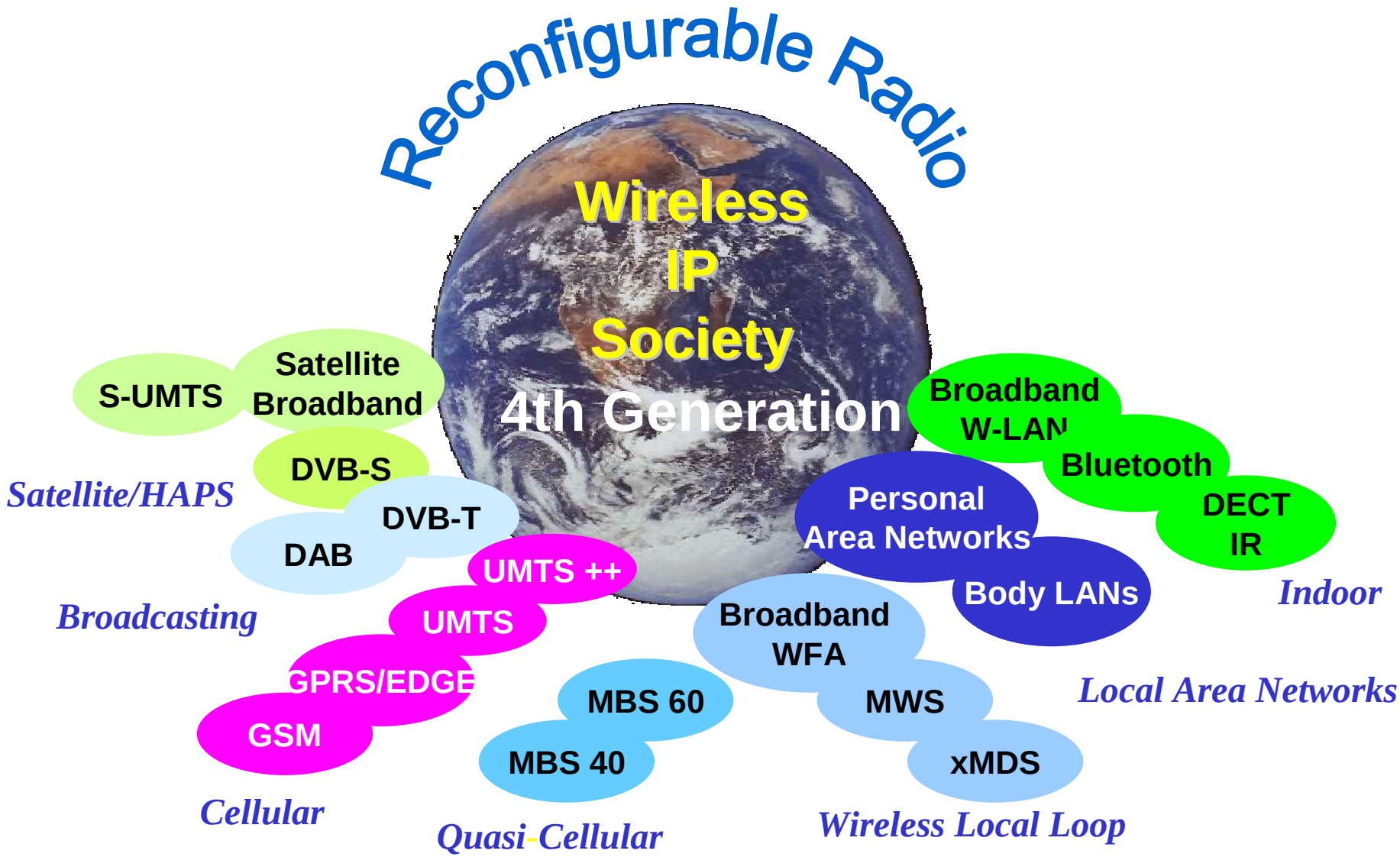
©JPER

Evolution from 2G to 3G and Beyond

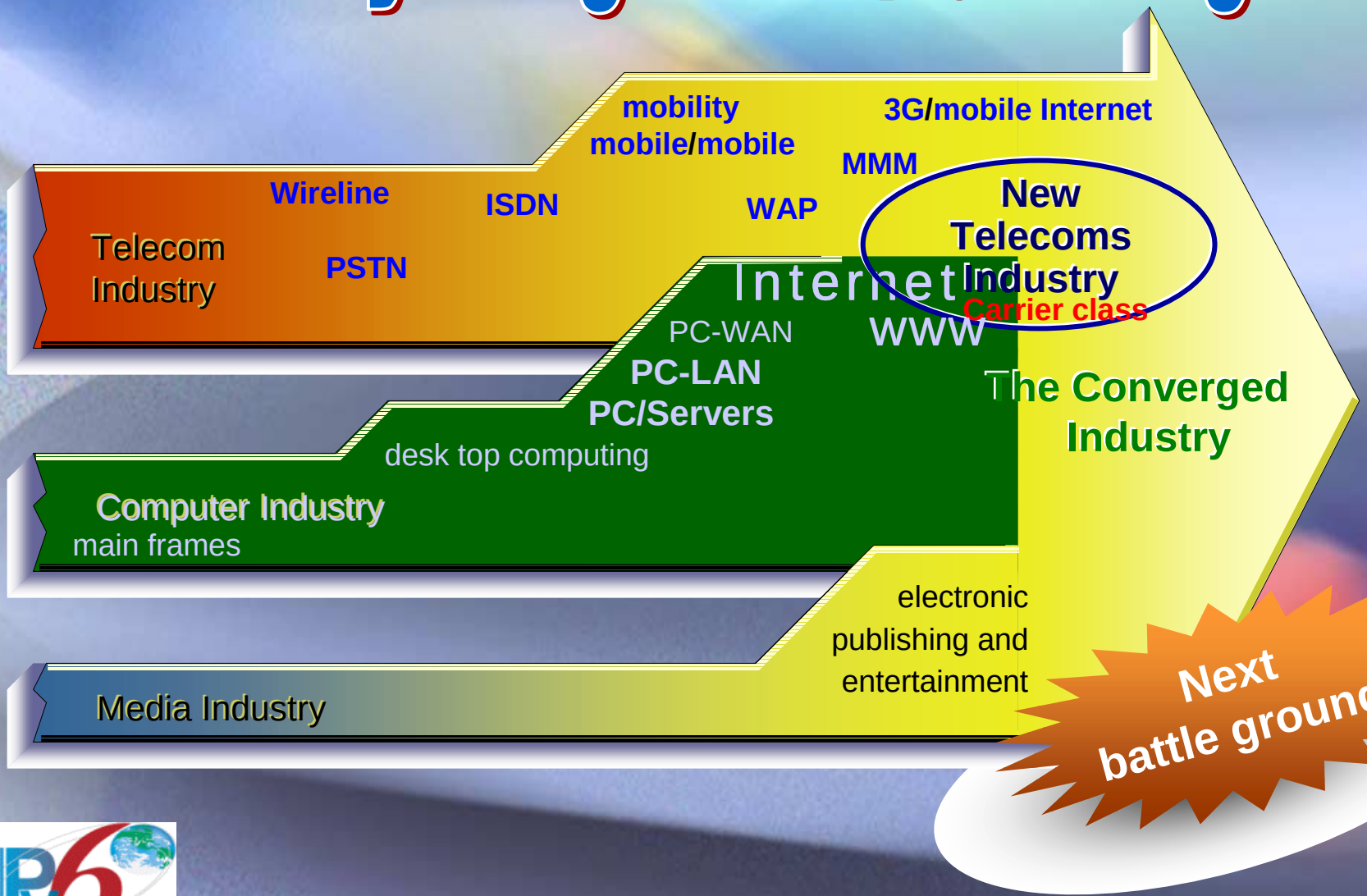


2G	evolved 2G	3G and beyond		
9.6-14.4 kbps	64-144 kbps	384 kbps-2 Mbps	384 kbps-20 Mbps	100 Mbps?

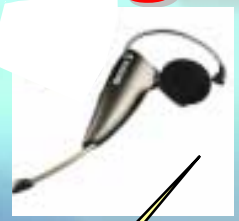
A Galaxy of heterogeneous networks

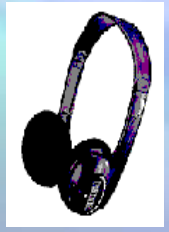


Industry Integration / Convergence



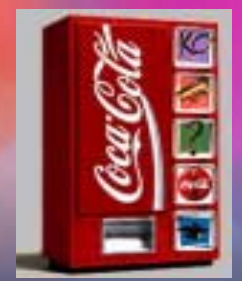
Vision: World at your fingertips





ADSL,
Cable TV,...

Service Gateway



IPv6 FORUM

What is the Key Enabler for Mass Deployment of Mobile IP-Services ??

It must be

!! Cheap cheap Chea

Cheap Cheap Cheap Cheap Cheap Cheap Cheap

2000 2001 2002 2003 2004 2005 (1 Billion Users Forecast)

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The Transparency of the Internet (Network Layer)

Why IPv6?

IPv6 FORUM

IP Robustness & Scalability

IPv4 IPv6

Address Space Shortage
Security
QoS
Mobility
Cost of System Management
Lack of Capability needed for Next Generation Applications

\- ?

Add-on Built-in

Y? N

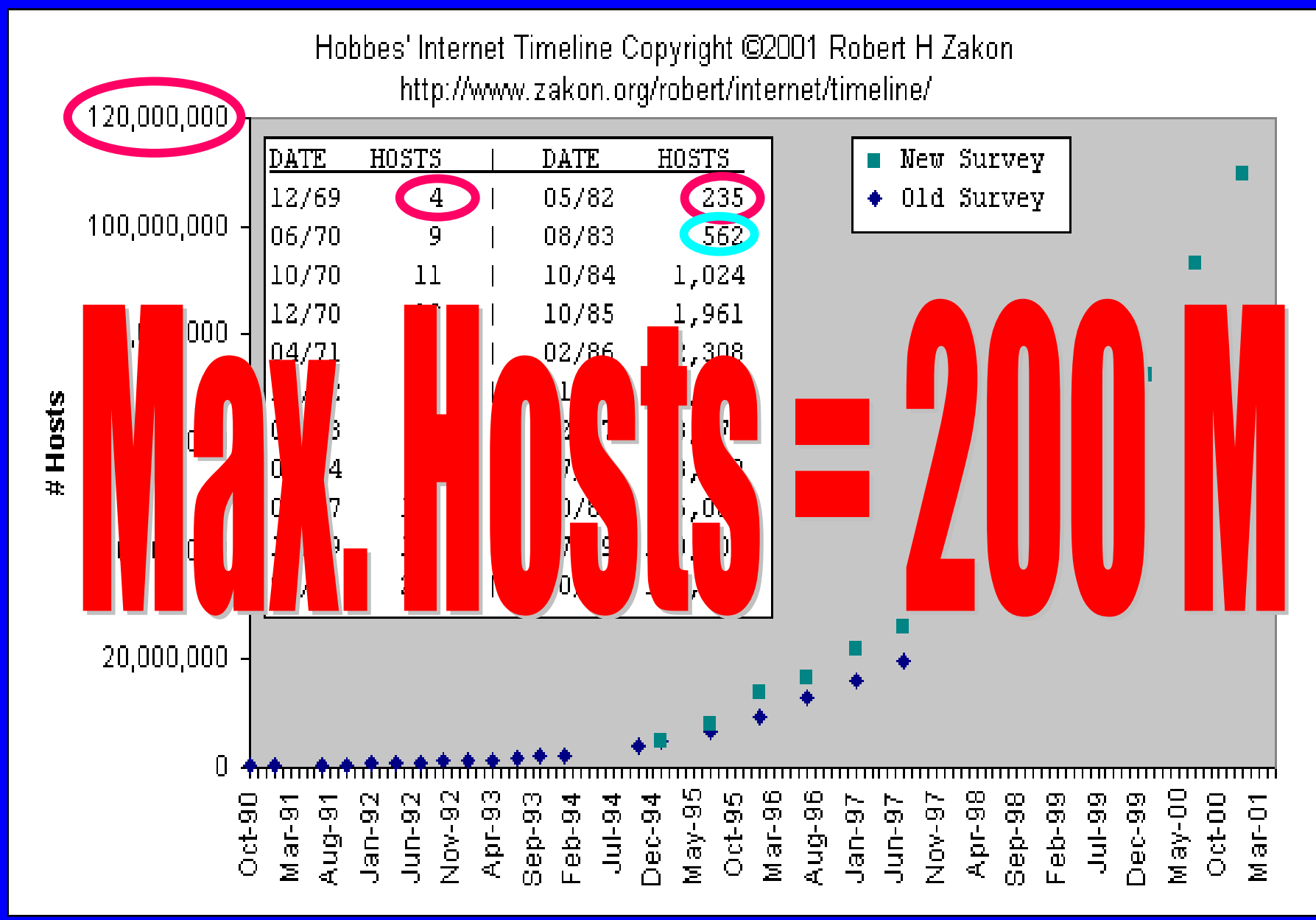
Pv4 NAT IPv6

1970 1980 1990 2001

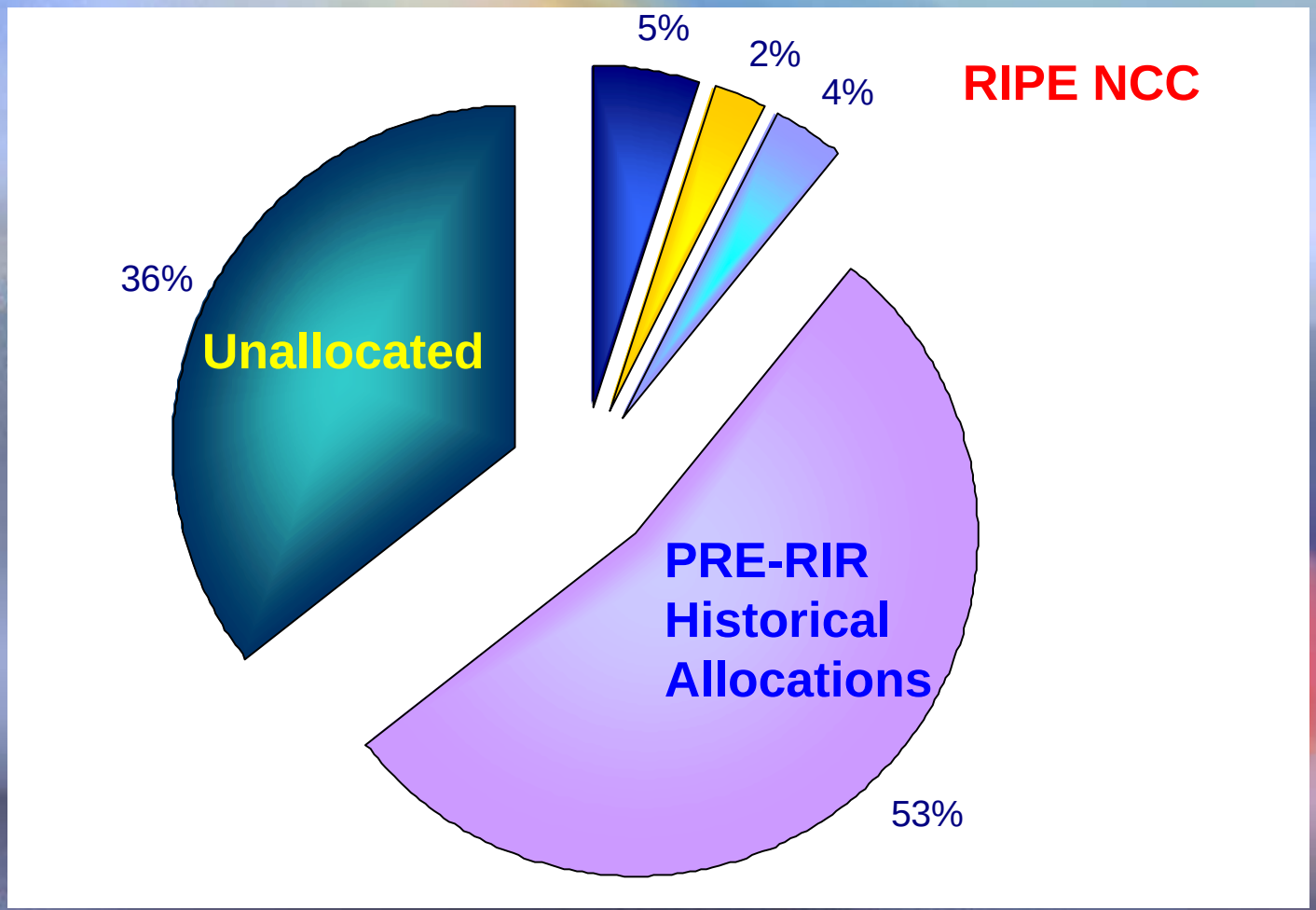
IPv4 is in the same state as DOS/Windows 3.1!

IPv6 FORUM

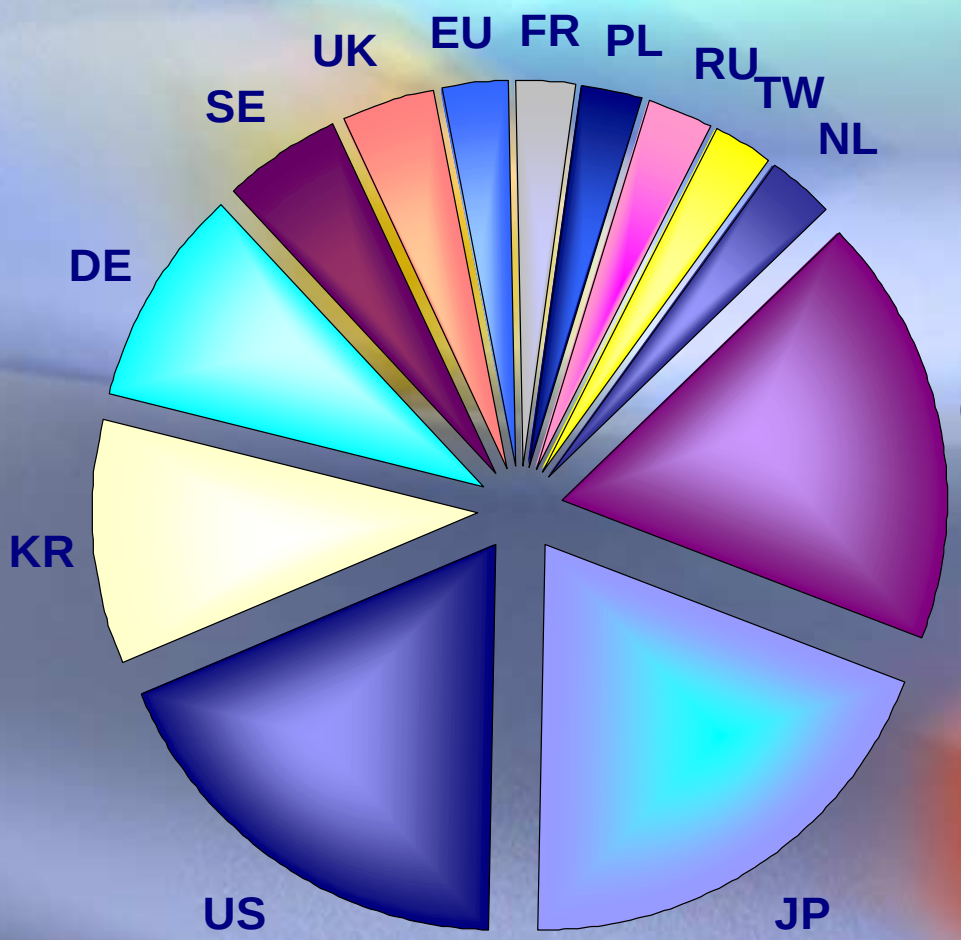
Always-On IP Addresses



Global Address Allocation



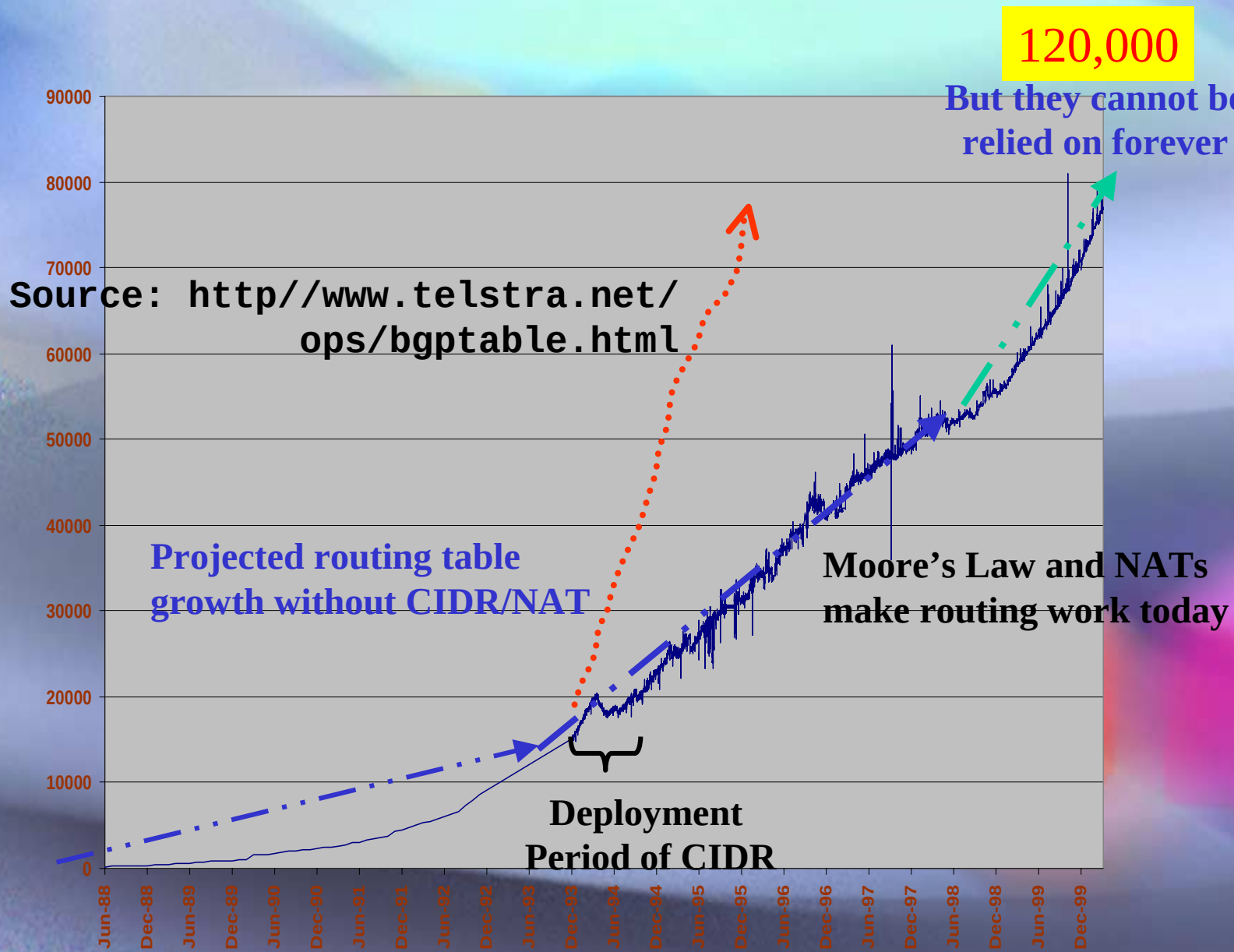
Global IPv6 Distribution



Wireless Mobility Neeed for Always-On IP Address Resource

Million	Year 2005	Year 2010
Mobile Phones	1500	3000
Mobile IP Phones	500	1000
1% Roaming	5	10
400 Wireless Networks	2000	4000

Growth in BGP Route Table



v6 Roadmap Scenaria

- IPv6 Deployment
- Address Transparency
- IPsec
- FOG
- Issues

v6 Roadmap Scenaria

	Scenario 1
IPv6 Deployment	Successful
Address Transparency	Restored e-2e
IPsec	Works e-2-e
FOG	Fog Clears!
Issues	Intranet, Proxies & Firewalls may remain

v6 Roadmap Scenaria

	Scenario 1	Scenario 2	
IPv6 Deployment	Successful	Complete Failure	
		Sub-scenario 1	
Address Transparency	Restored e-2e	Recycling IP Addresses	
IPsec	Works e-2-e	Limited	
FOG	Fog Clears!	Noticeble Fog	
Issues	Intranet, Proxies & Firewalls may remain	Generalised use of NAPT, RSIP?	

v6 Roadmap Scenaria

	Scenario 1	Scenario 2	
IPv6 Deployment	Successful	Complete Failure	
		Sub-secnario 1	Sub-scenario 2
Address Transparency	Restored e-2e	Recycling addresses	Exhaustion NAT-o-NAT
IPsec	Works e-2-e	Limited	Broken
FOG	Fog Clears!	Noticeble Fog	Permanet Thick Fog
Issues	Intranet, Proxies & Firewalls may remain	Generalised use of NAPT, RSIP?	NATs between even ISPs

v6 Roadmap Scenaria

	Scenario 1	Scenario 2		Scenario 3
IPv6 Deployment	Successful	Complete Failure		Partial
		Sub-secnario 2.1	Sub-scenario 2.2	
Address Transparency	Restored e-2e	Recycling addresses	Exhaustion NAT-o-NAT	Partial
IPsec	Works e-2-e	Limited	Broken	Partial
FOG	Fog Clears!	Noticeble Fog	Permanet Thick Fog	Noticeble Fog
Issues	Intranet, Proxies & Firewalls may remain	Generalised use of NAPT, RSIP?	NATs between even ISPs	Similar to v4-2-v6 Transition

The Culture Shock !

Bell Heads

The people who know how to operate massive mission - critical networks will control the Net

Net Heads

The people who get it will run it

Melting Pot

Established carriers will hire Internet geeks and buy ISPs, and NG service providers will bring in experienced pros

Bell Heads

- Central control is a must.
- The only way to scale the infrastructure is with a hierarchical, unified system architecture.
- Web-centric computing is an extension of the mainframe era.
- ‘Bet you `re glad you don`t have to reboot your phone when you need to dial 911!
- Contradiction: Deregulation and technical innovation have made it impossible to maintain control of ifThe System.lT

Net Heads

- ★ Chaos is good for creativity.
- The only way to scale the Net is with decentralized architecture and control.
- Peer-to-peer networking is an extension of the PC revolution.
- ★ Information (software, music, etc.) wants to be free. »
- Contradiction: Now that the 25-year adolescence of the Net is over, and businesses want to use it for e-commerce, the Net must grow up or get adult supervision.

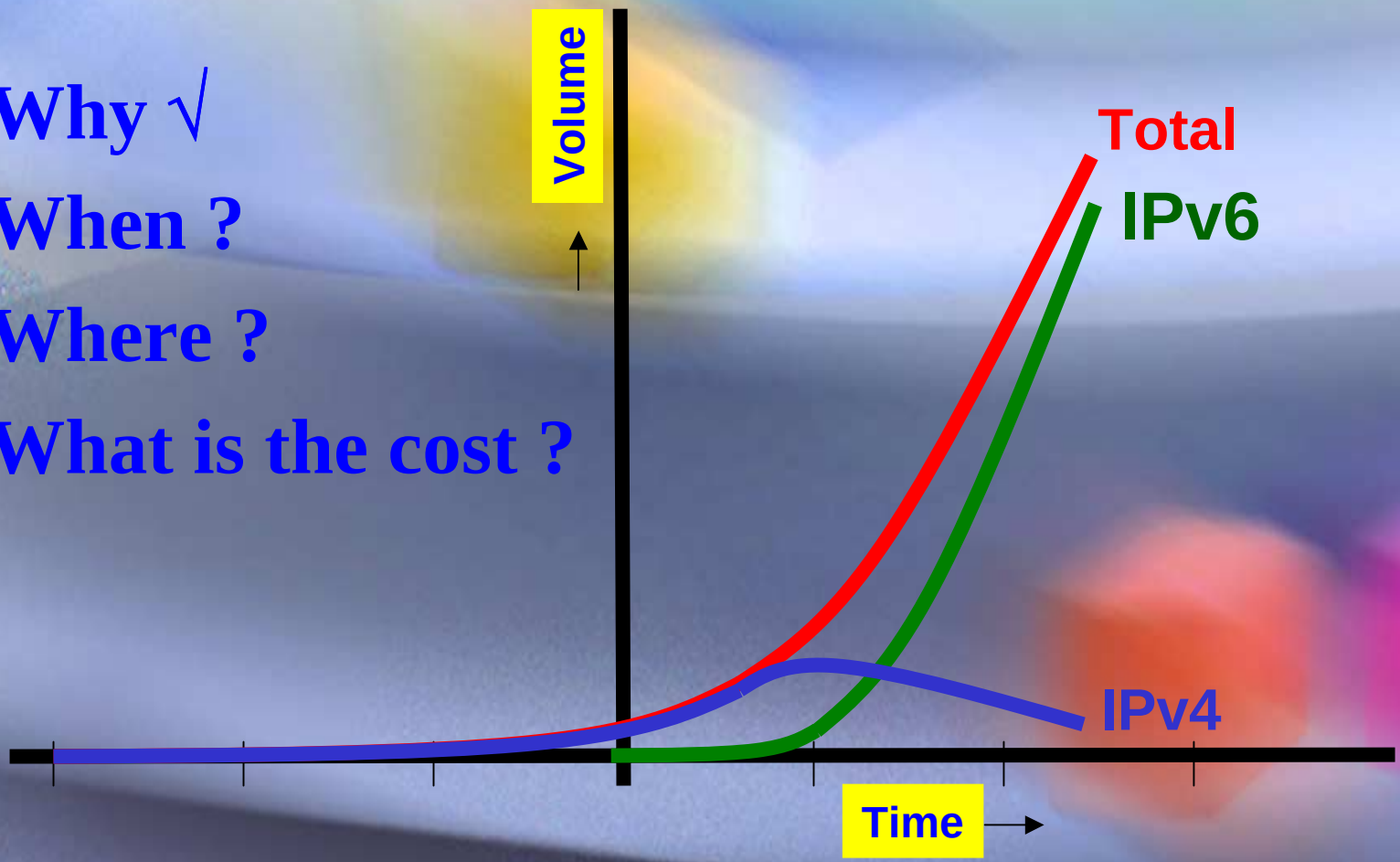
IPv6 : An e-Buisness Enabler

Critical Success Factor	Today with IPv4	*IPv6*
Cost Effectiveness	Costly workarounds	>1 billion addresses / person
Flexibility	Frequent renumbering as site grows	Simplified network planning and management
Reliability	Operational complexity	Return to simple and scalable architecture
Availability	Single points of failure	24x7 operation
Scalability	Client/server	Peer-to-peer
Accessibility	Obstacles to deploying next generation applications (e.g., VoIP)	Pervasive enabler Simplified application development
Security	Interferes with some applications	Enabler for end-to-end security

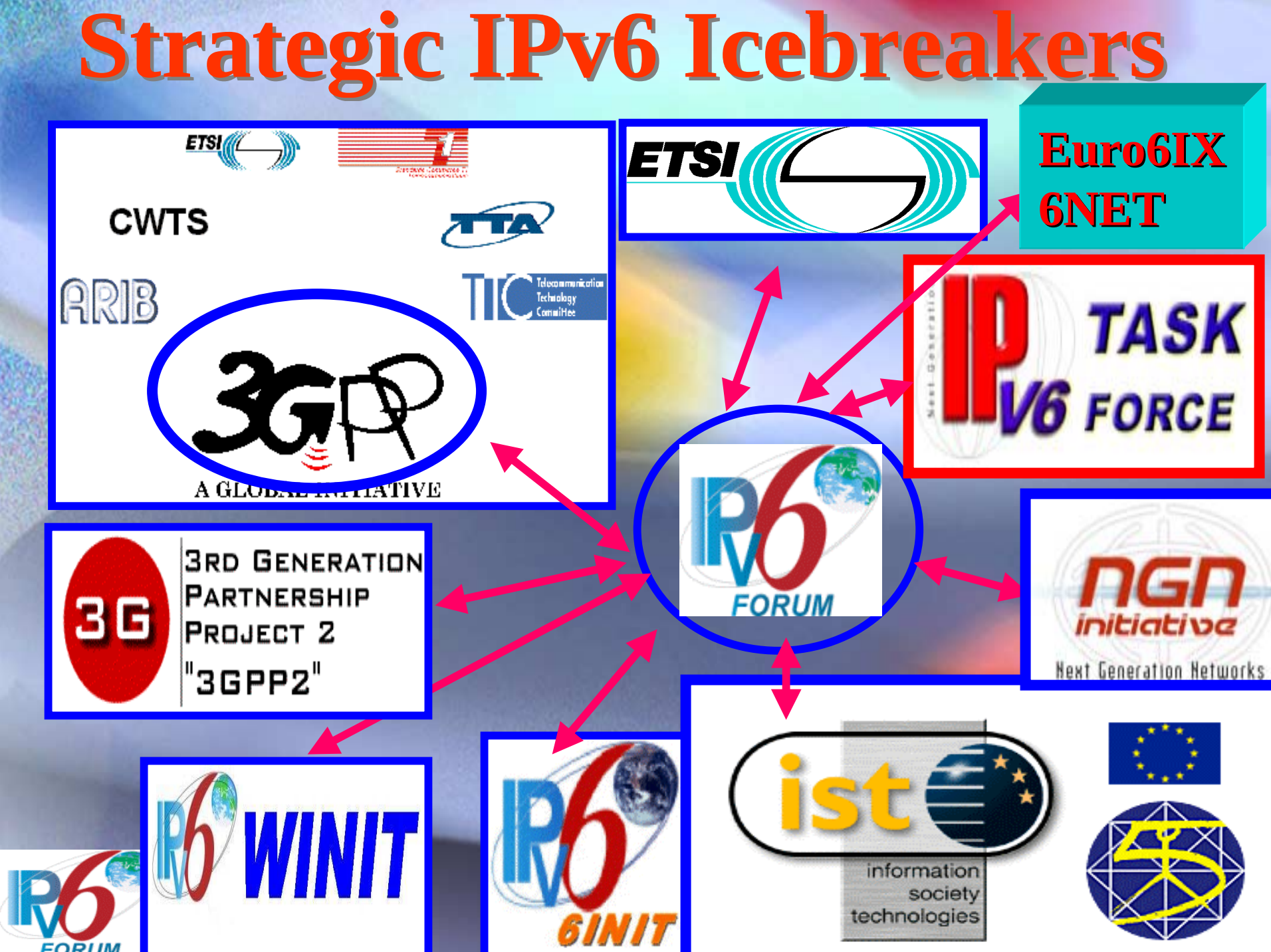
IPv6 FORUM

The BIG Questions!

- Why √
- When ?
- Where ?
- What is the cost ?



Strategic IPv6 Icebreakers



100% IPv6 readiness by 2005

- **Prime Mister of Japan Yoshiro Mori**
  - **– 80 M$**
- **Korean MIC followed Japan Feb 23, 2001**
  - **– 68 M$**

Japanese Deployment Efforts

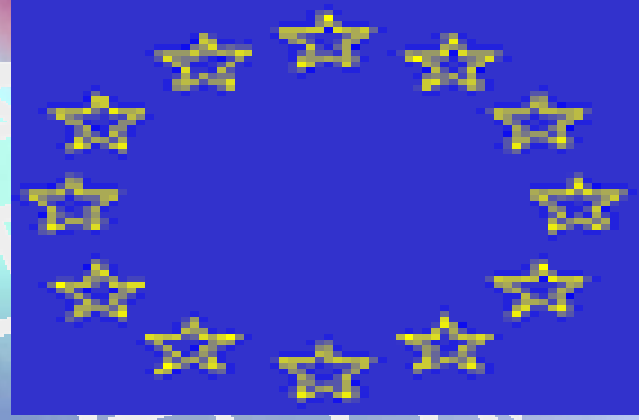
- Governmental
  - IPv6 Council (Kyogikai)
  - JGN (Japan Gigabit Network) IPv6
- R&D
  - WIDE IPv6 / NSPIXP6 / Kame / Usagi / TAHI
- Industrial
  - IAJapan IPv6 Deployment Committee
  - JPNIC IPv6 project
  - IPv6 Operation Study Group
- Publication
  - IPv6 Journal (RIIS)
  - v6start (Nikkei BP)

IPv6 Council

- Initiated by Ministry of Public Management, Home Affairs, Posts and Telecommunications
- Chair: Jun Murai
- Not only router vendors and service providers, but home appliance developers etc. are involved
- TAO (Telecommunications Advancement Organization of Japan) conducts a nation-wide IPv6 experiment including home appliance application development, using budget of 8 billion Yen (= $ 800k).

Next Generation

IPv6 TASK FORCE



An open "business discussion forum"

Catalyst for IPv6 Deployment acceleration

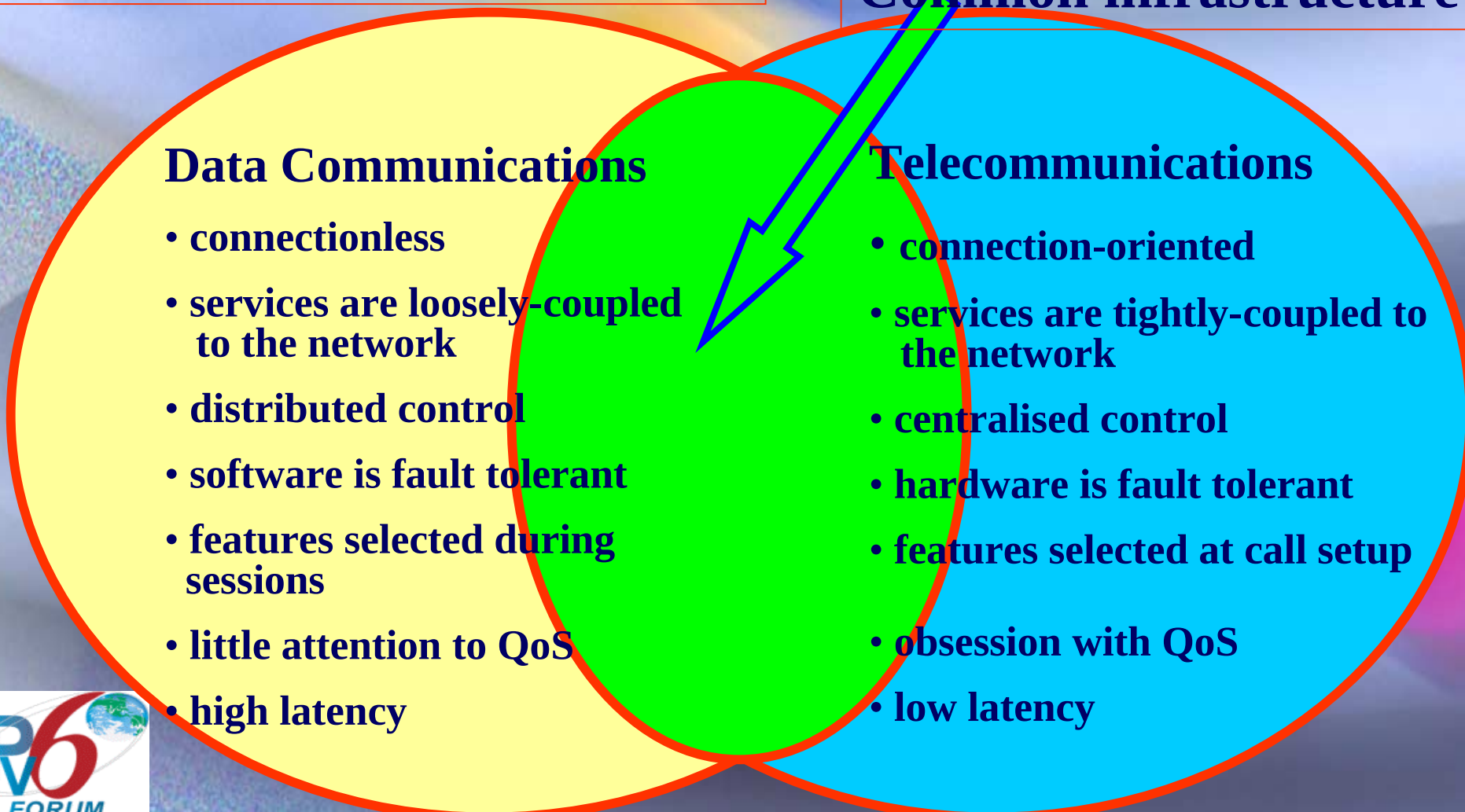
IPv6 FORUM

Convergence Issues

The telecoms and data worlds have different roots:

Common applications !

Common infrastructure



Identified Work

The telecoms and data worlds have different roots:

Common applications !

Common infrastructure

IPv6 Market Study

Numbering & Addressing

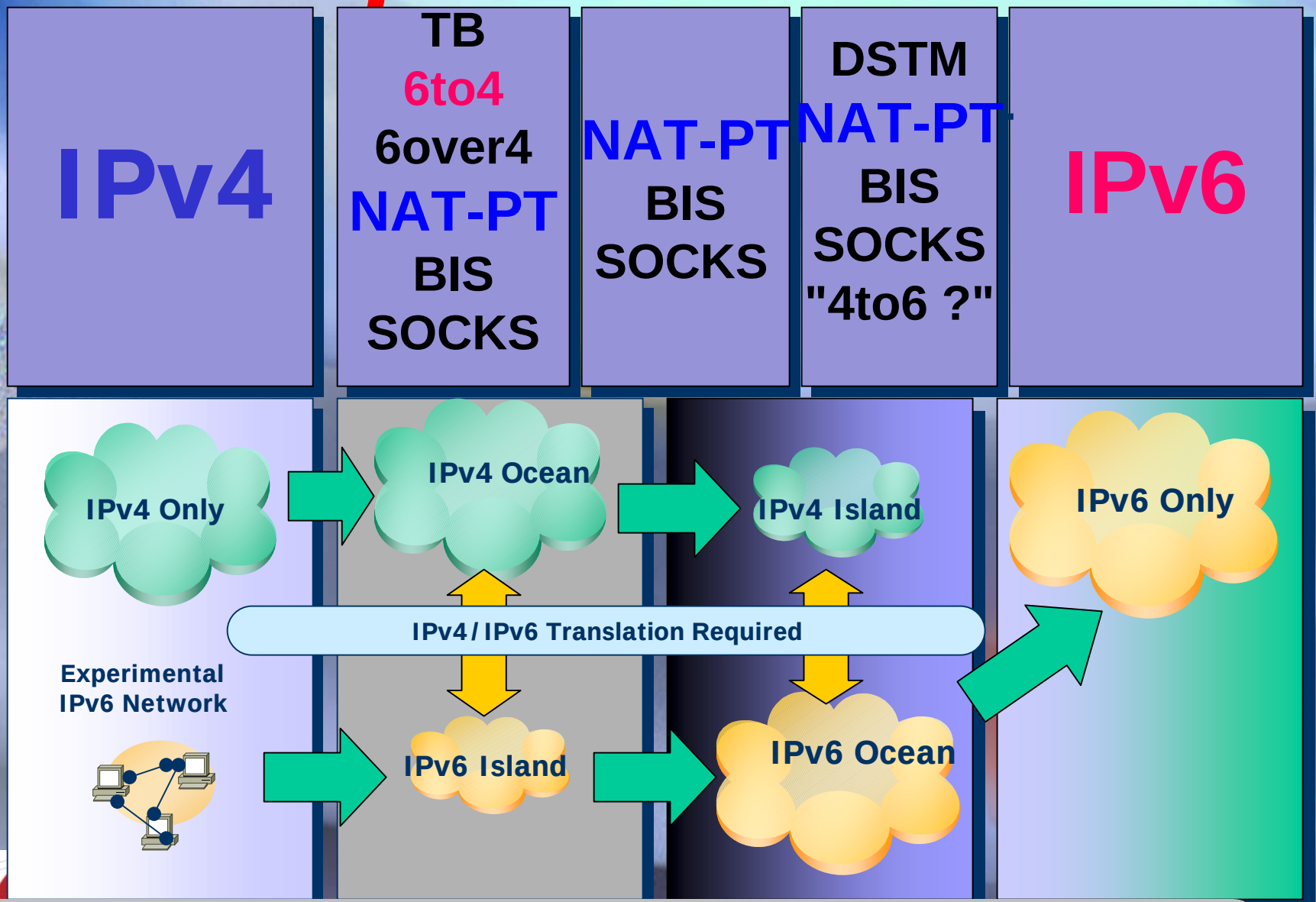
Large Scale IPv6 Trial Networks

Euro6IX + 6NET : 30 M$

Large Scale IPv6 Education Program

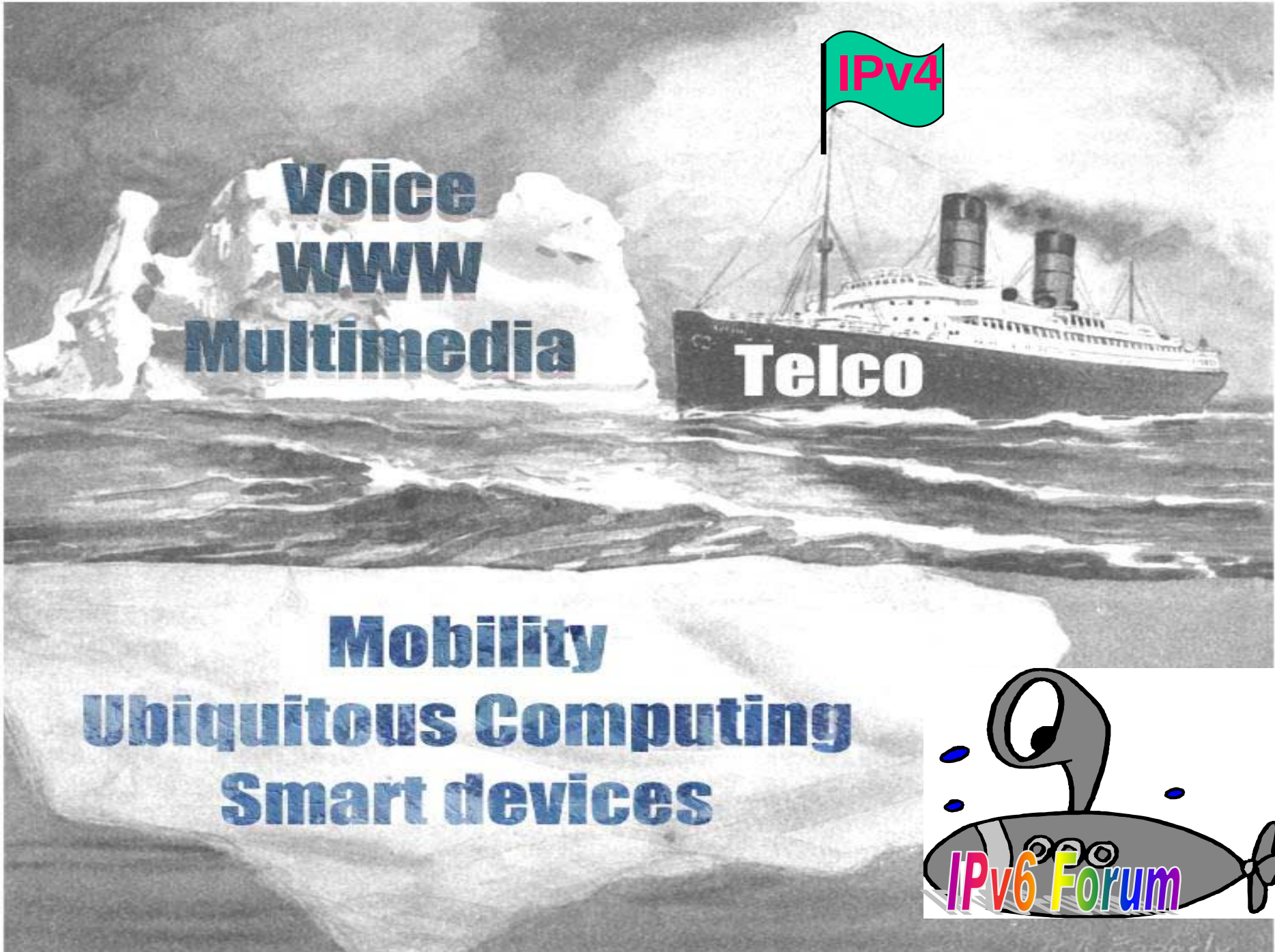
Transition Guidelines

Gracefull Transitions



IPv6 - a small step for IP but a giant leap for Telcos

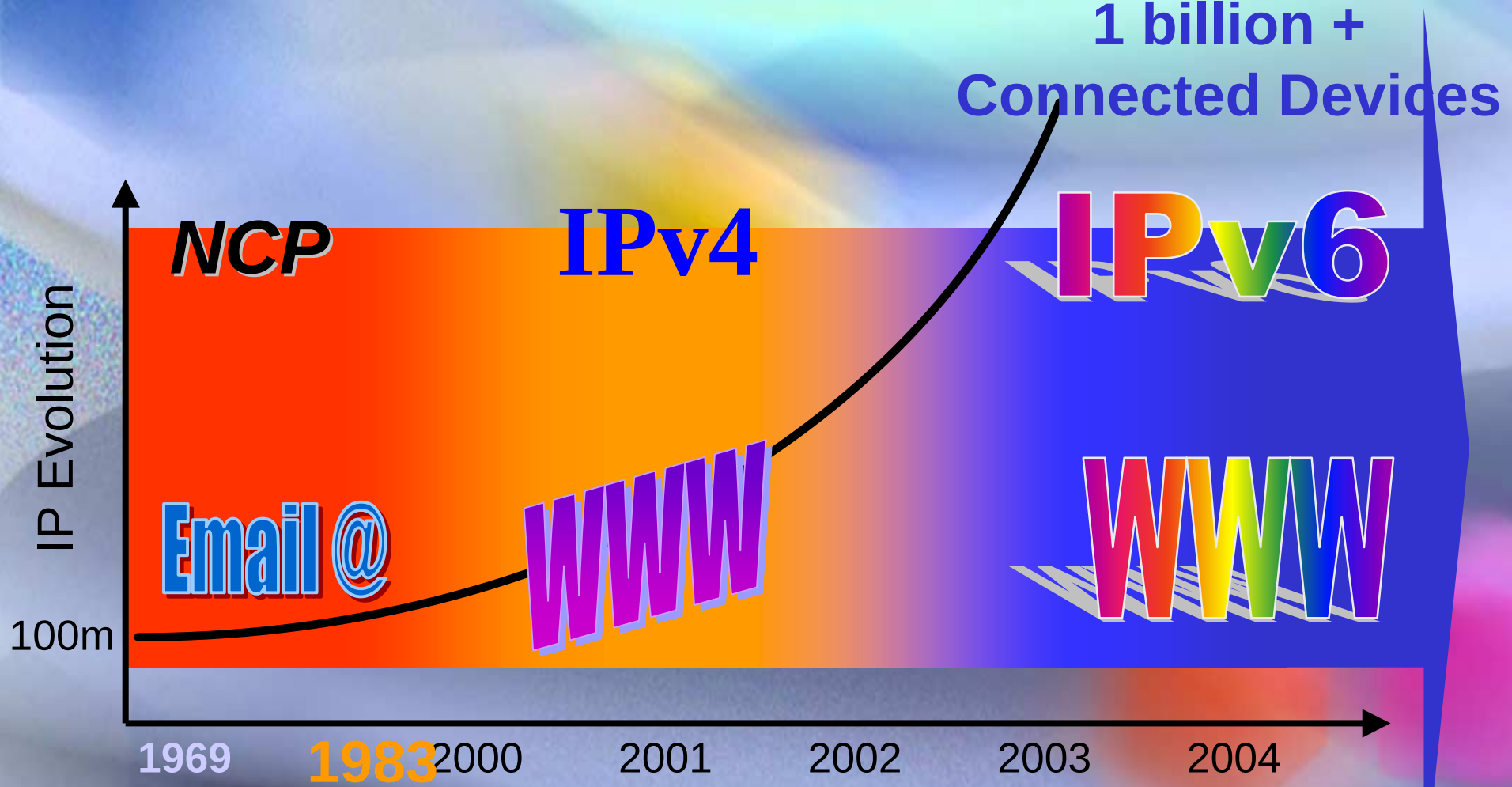
IPv6
the Internet Tidal Wave


IPv4
Voice
WWW
Multimedia
Telco
Mobility
Ubiquitous Computing
Smart devices
IPv6 Forum

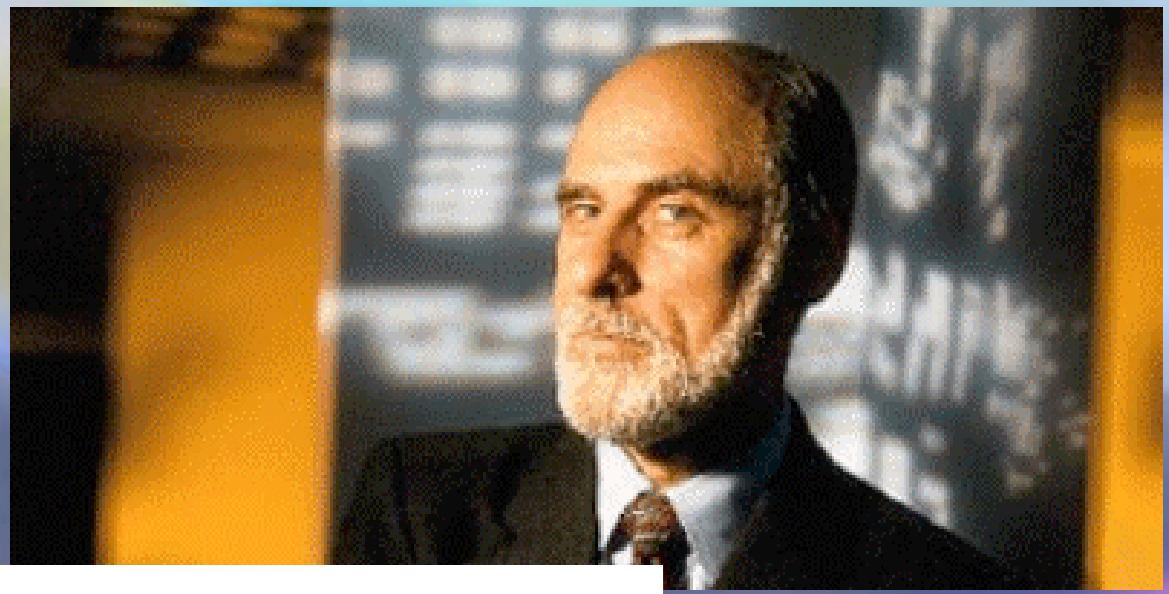
Why IPv6 is a Hot Story

- Y2K is Over; Media Needs a New High-Tech Story
- Any Doomsday Scenario for the Internet is Big News
  - –Denial of Service Attacks
- Internet Luminaries Are Talking about IPv6 More
  - - Cerf, Dyson, etc.

The New Internet



IPv6 FORUM



"IPv6 is here and now
So take the internet where no other network has gone before!"

Vint CERF

Honorary Chairman