



IPv6

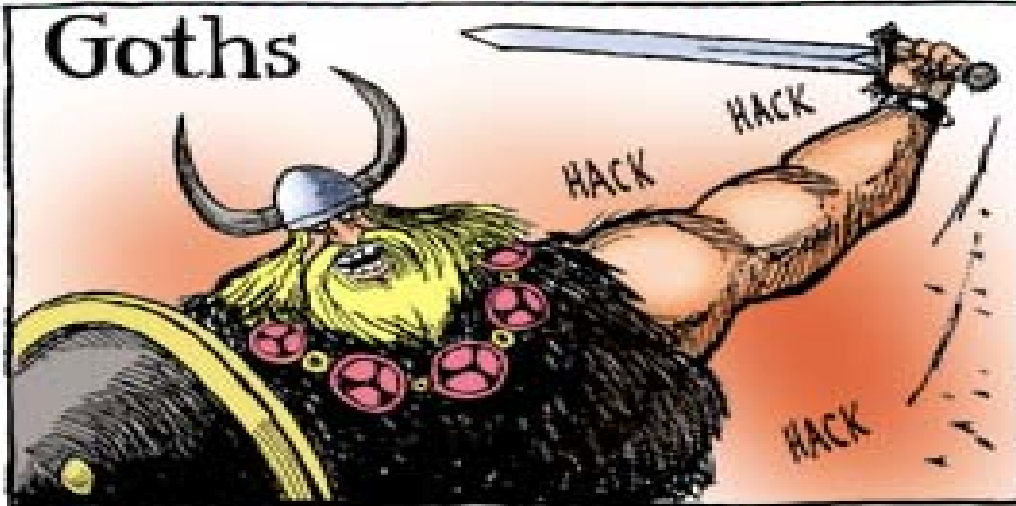
The New Internet

MADRID 2001

# TAMING THE NET

BRINGING CIVILIZATION TO ITS KNEES...

Goths



Vandals



Huns



KEVIN SIERS ©2000  
THE CARLOTTE OBSERVER

Geeks

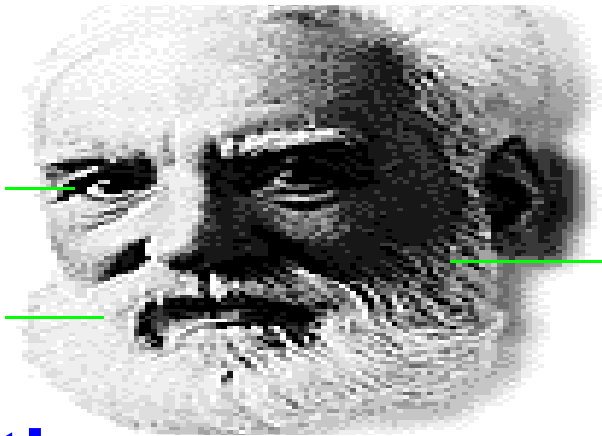


# Famous Last Words

- "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



# Famous Last Words

- "I think there is a world market for maybe five computers."

-- Thomas Watson, chairman of IBM, 1943.

- "640K ought to be enough for anybody."

-- Bill Gates, 1981

# Famous Last Words

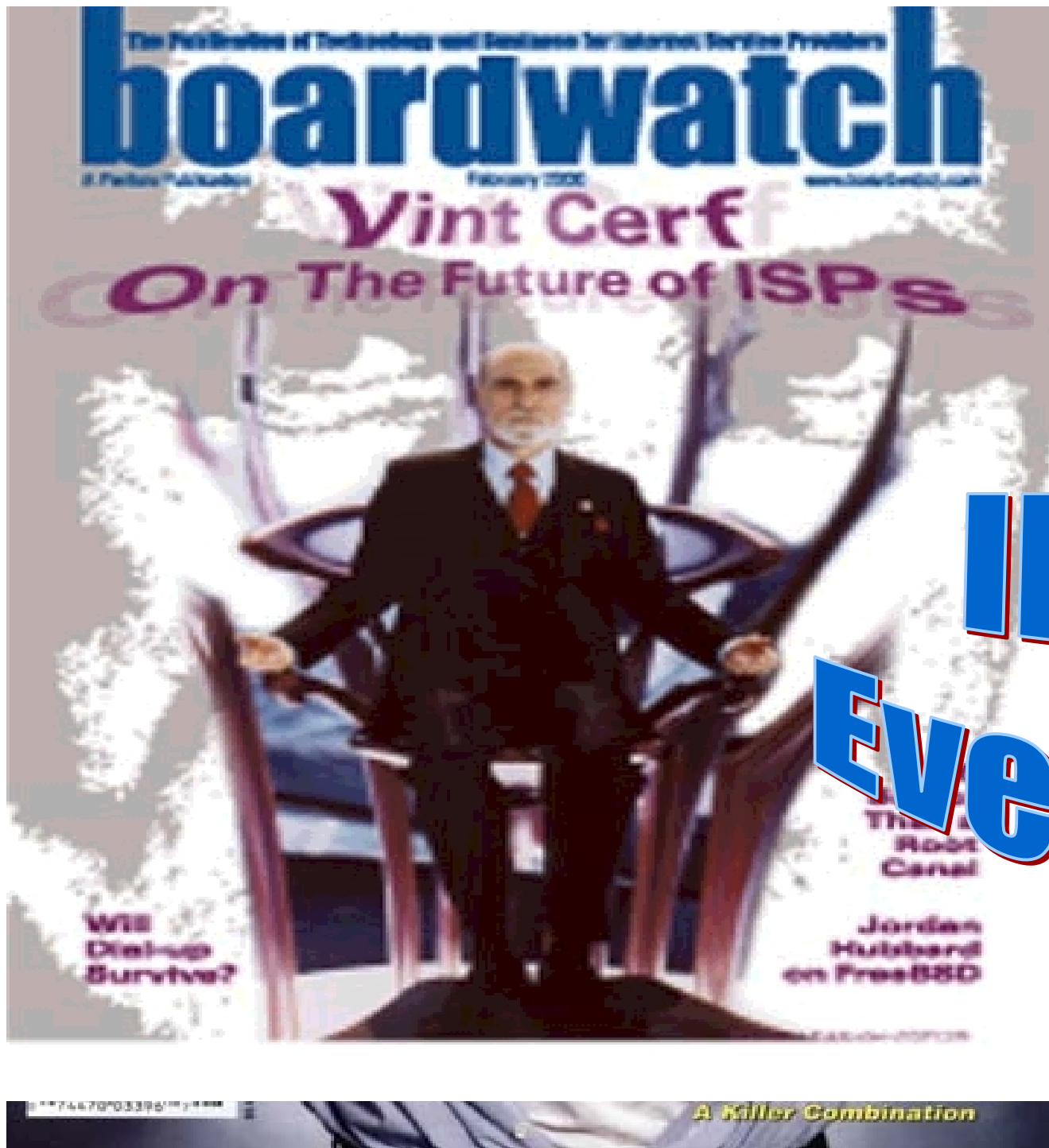
- “32 bits should be enough address space for Internet”

-- Vint Cerf, 1977

- “Not everything that can be counted, counts.

And not everything that counts, can be counted”

-- Einstein, 1879-1955



1996

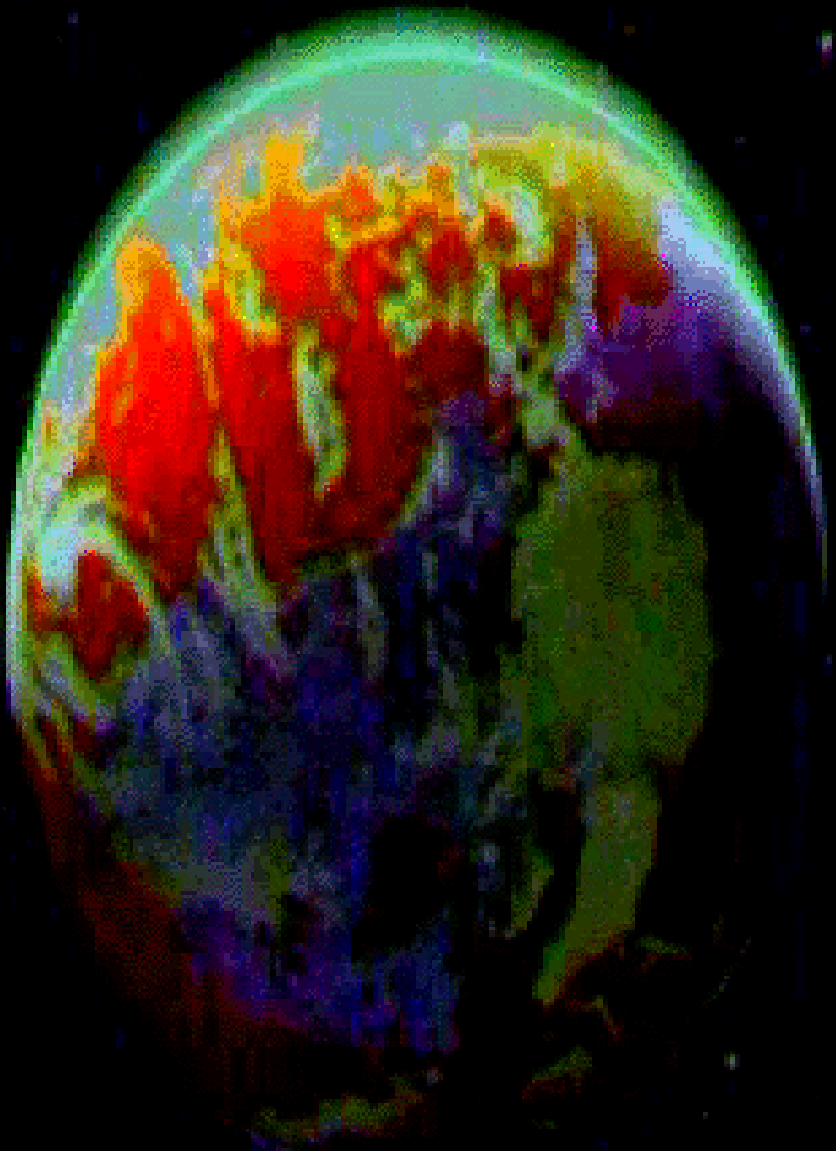
2000

IPv6 on

Everything

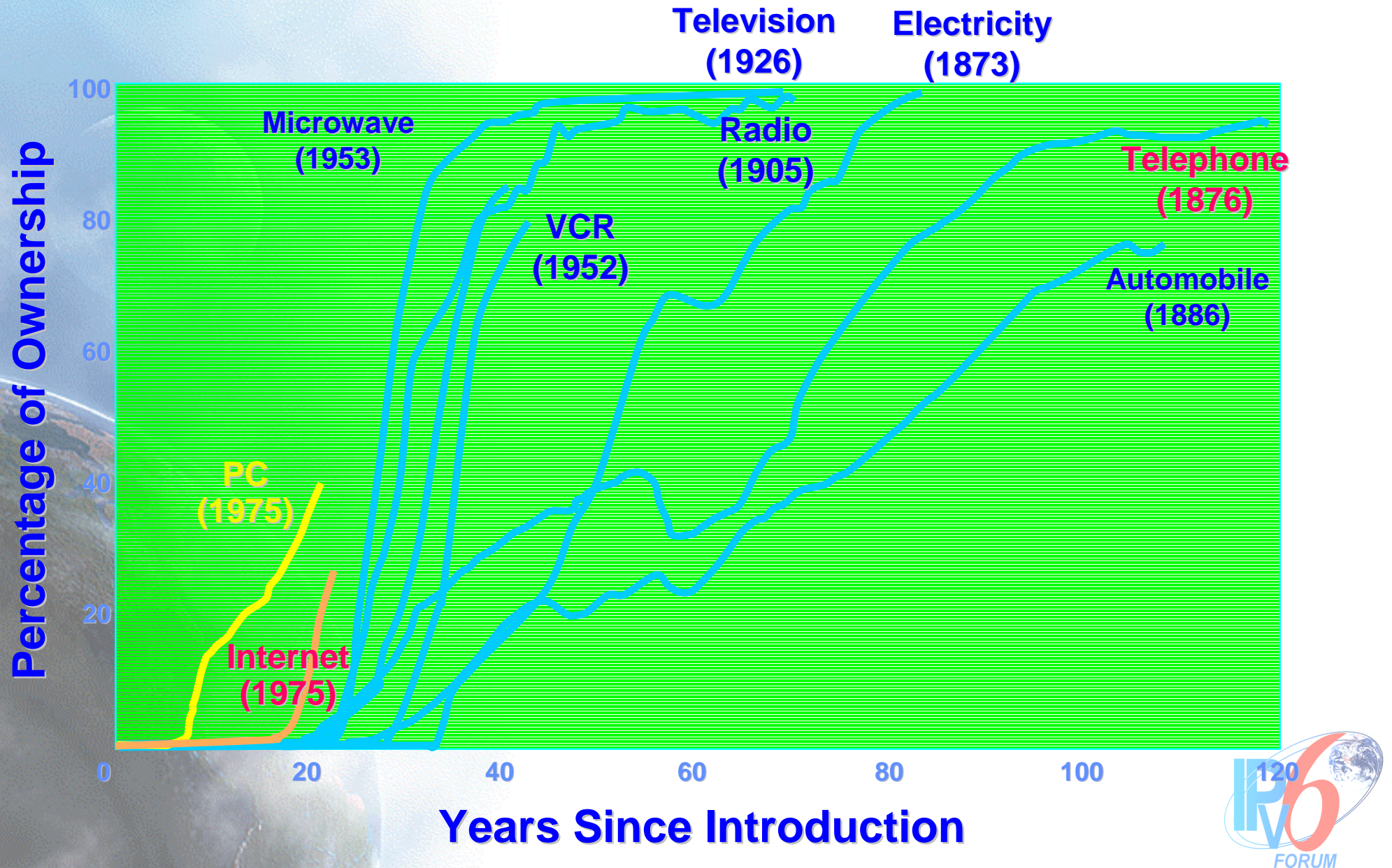






# Nothing Happens Overnight

# Industry Standards Drive Ubiquity





# Internet TimeLine

NCP Conception

1961

NCP

1969

NCP Roll-Out

1969

ARPANET

1982

IP Conception

1972



IPv4  
TERNE



IPv4 Roll-Out

1983

IPv6 Conception

1991



IPv6

1995



IPv6 Roll-Out

2000



NEW INTERNET



# 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	
ARPANET	INTERNET	

# Internet Generations

1 G	2 G	3 G
$10^4$	$10^8$	$10^{10}$
Professionals	Innovators	Everyone
Email, Ftp	WWW	Wireless, Streaming Media
<b>DIAL-UP INTERNET</b>		<b>ALWAYS-ON</b>
Government Internet	Public Internet	Global Internet
<b>ARPANET</b>	<b>INTERNET</b>	<b>NEW INTERNET</b>



# Users on the Internet

Mar 10, 2000

Sept 11, 2000

Jan 28, 2001

● CAN/US

● Europe -

● Asia/Pac -

● Latin Am -

● Africa -

● Total -

232

305

395 Mio

Source: Telcordia



# Will IP Scale and remain Robust?

- 75% of traffic on Internet is WWW
- 3 Million Web Sites (est. Jan 1999)
- 700 Million web pages (and dark info)
- Data Domination (20% voice, 80% data)
- 8000 ISPs worldwide (4700+ in U.S.)
- Traffic growth 100-1000%/year reported

**300 M - 1000 M users by Dec 2003**



# Can the Internet run Quality & Security in one go?

- Internet multicast “video”, telephony and “radio”
- Transport of Internet traffic on cable, direct broadcast satellite, radio and broadcast TV
- **Real-time quality of service support, VoIP**
- Mutual Reinforcement among media (print, TV, radio, web, email)

# Internet-enabled Devices

## In need of IP Addresses, at least!

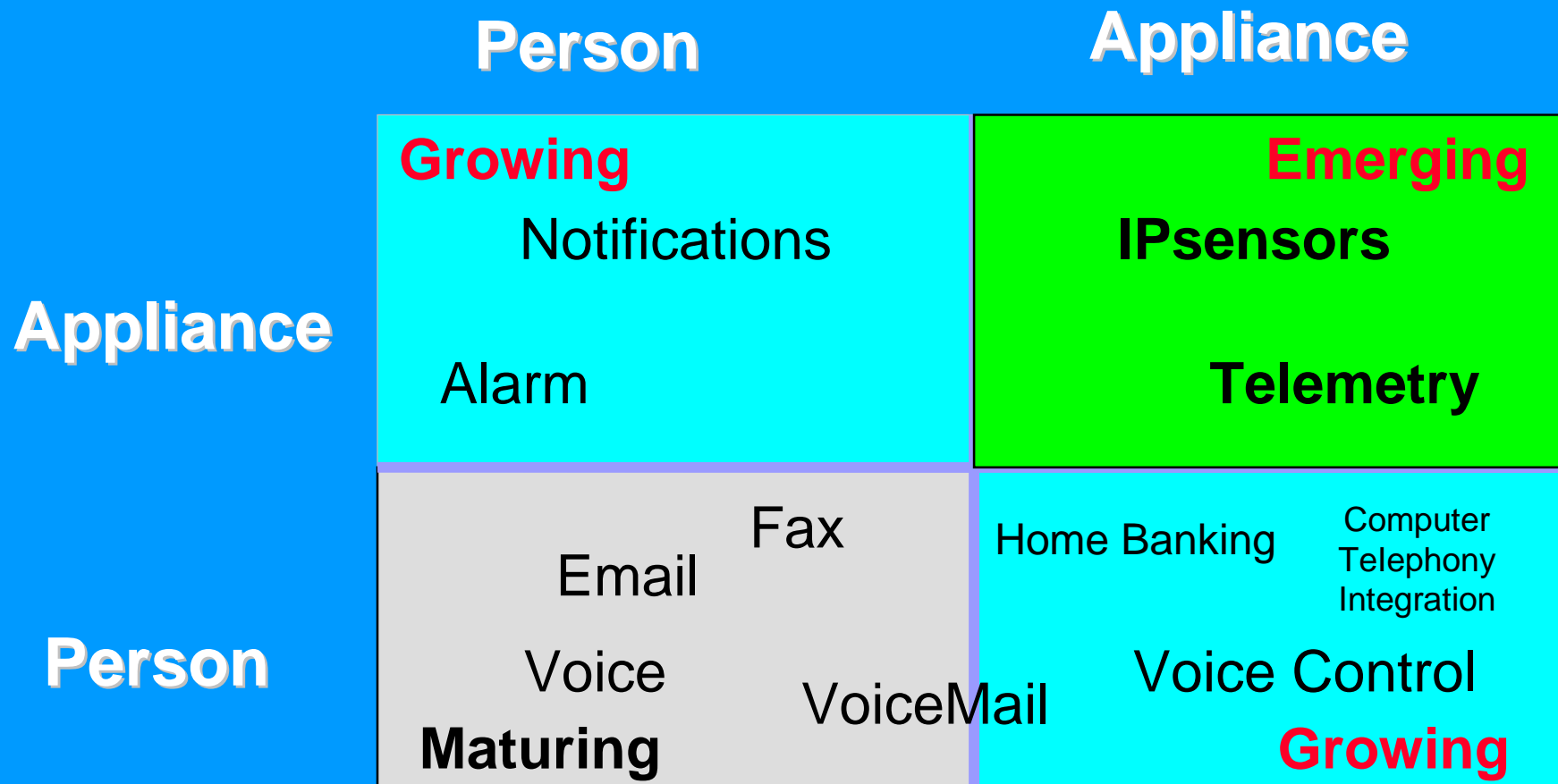
- Information appliances

- 1997 - 3 M, 1998 - 6 M, 2002 - 56 M  
(IDC)

- WebTV, Palm-Pilot, Nokia 9000, Sony, Nintendo, Sega games
- Wearable computers (Hardwear?, Underware?)



# InfoCom Application Areas



the curfew key?



Source: Cadence, 1998

the refrigerator **Search** engine?



the mother-in-law **tracker?**



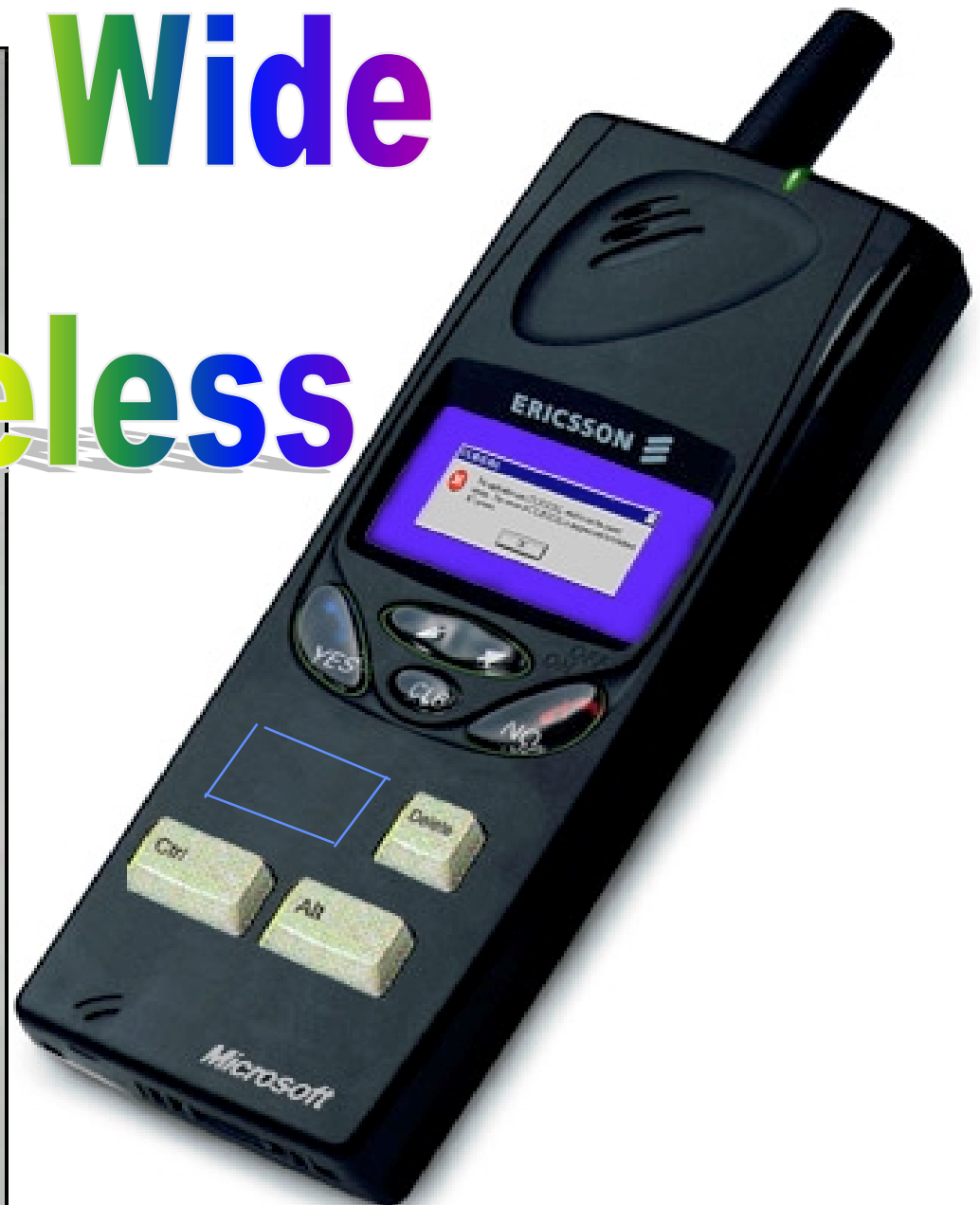




Looking for Killer Apps?

World Wide

Wireless



# Any Time, Any Where





# Future Services

Voice still key service

Mobile e-mail

Mobile E-commerce

Mobile internet

Mobile office

Vertical applications

Mobile images



# Vision: World at your fingertips

ADSL, Cable TV, ...

**Service Gateway**

**PhoneCash™**

To pay	
\$22.25	Store

OK Account Cancel


**Previous transactions**

Amount	Description
\$13.79	Johnson's
\$12.00	Johnson's
\$2.60	Johnson's
\$32.56	Johnson's
\$44.25	Johnson's
\$6.60	Johnson's
\$6.76	Johnson's

FORUM

# Service Gateway

# Service Gateway



PhoneCash™

Price	Store
\$12.25	Smith's

Previous transactions

\$13.50	Johnson's
\$2.60	Arnold's
\$33.50	Kelch's
\$8.35	Johnson's

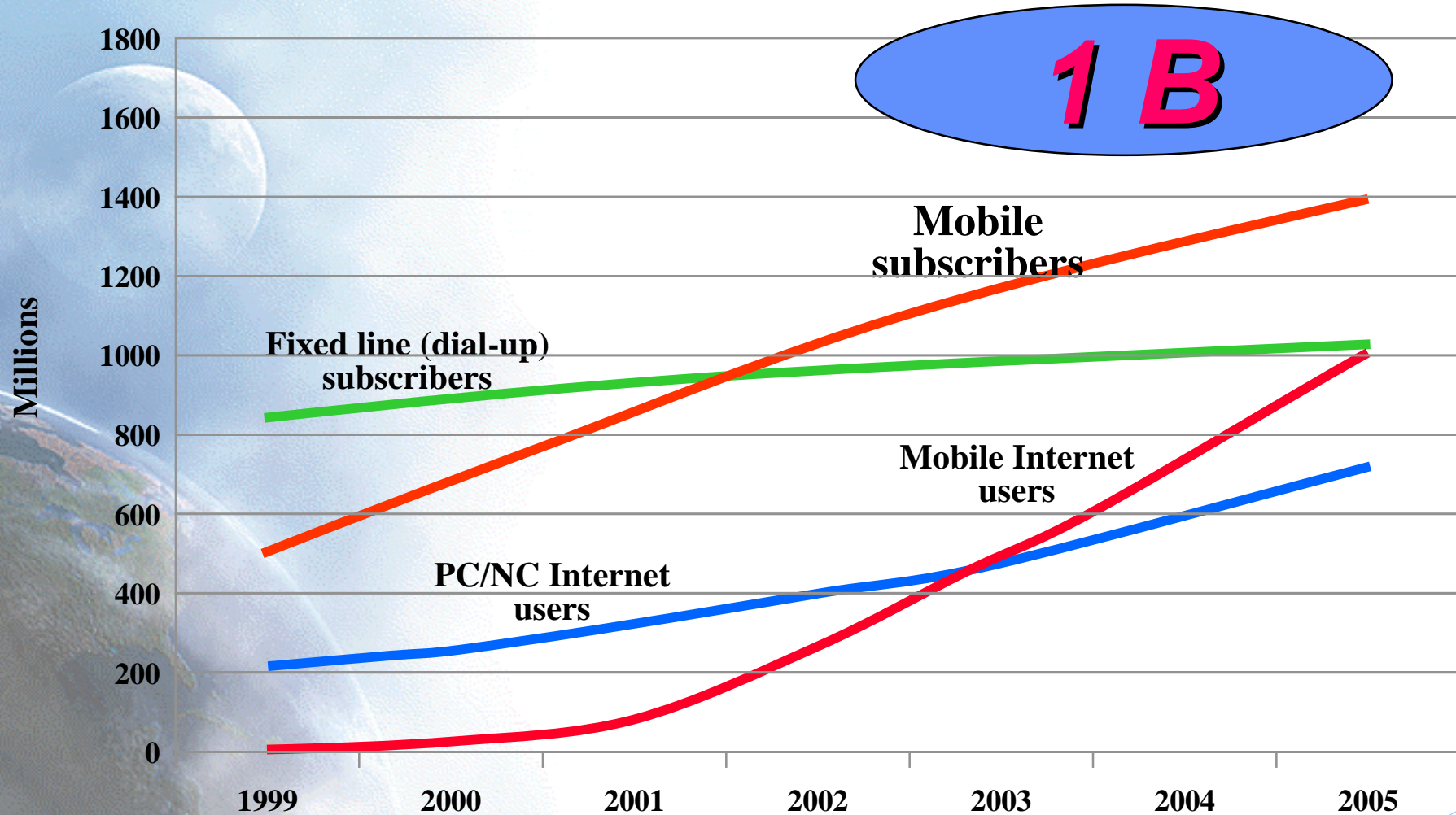
6.75 Switch's  
Person





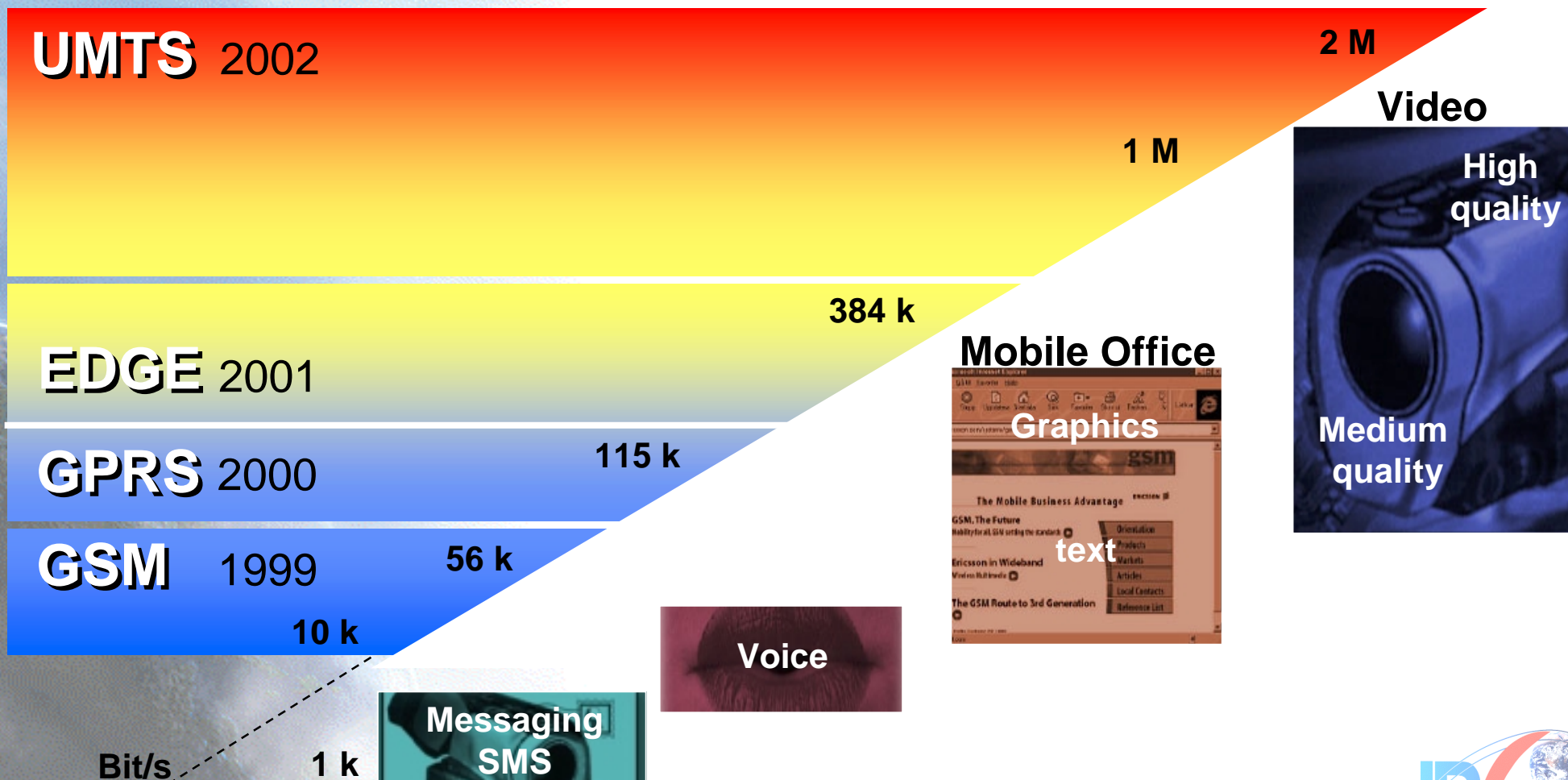
# The Rush to the Billion!

**Mobile Internet: 'in 4 years as large as 10 years GSM today'**





# System Capabilities & Use Data-rate Requirements



# Global IP v6 Mobility

Seamless services

Mobile  
Information  
Society

Wireless,  
secure,  
high speed  
access

Fast  
Internet  
& Intranet

Shared  
databases &  
applications

IPv6

Mobile  
multimedia

Messaging  
internet  
always on

Mobile  
telephony

Wide Area  
Coverage

Local Area  
Coverage





# 3G-IPv6 Service Perspective

Reconfigurable Radio

**Wireless  
Information  
Society**

**4th Generation**

**IPv6**

S-UMTS

Satellite  
Broadband

Broadband  
W-LAN

DVB-S

Bluetooth

*Satellite/HAPS*

DVB-T

IR

DAB

Personal  
Area Networks

*Indoor*

UMTS ++

*Broadcasting*

UMTS

Body LANs

*Local Area Networks*

GPRS/EDGE

Broadband  
WFA

MBS 60

MWS

GSM

MBS 40

xMDS

*Cellular*

*Quasi-Cellular*

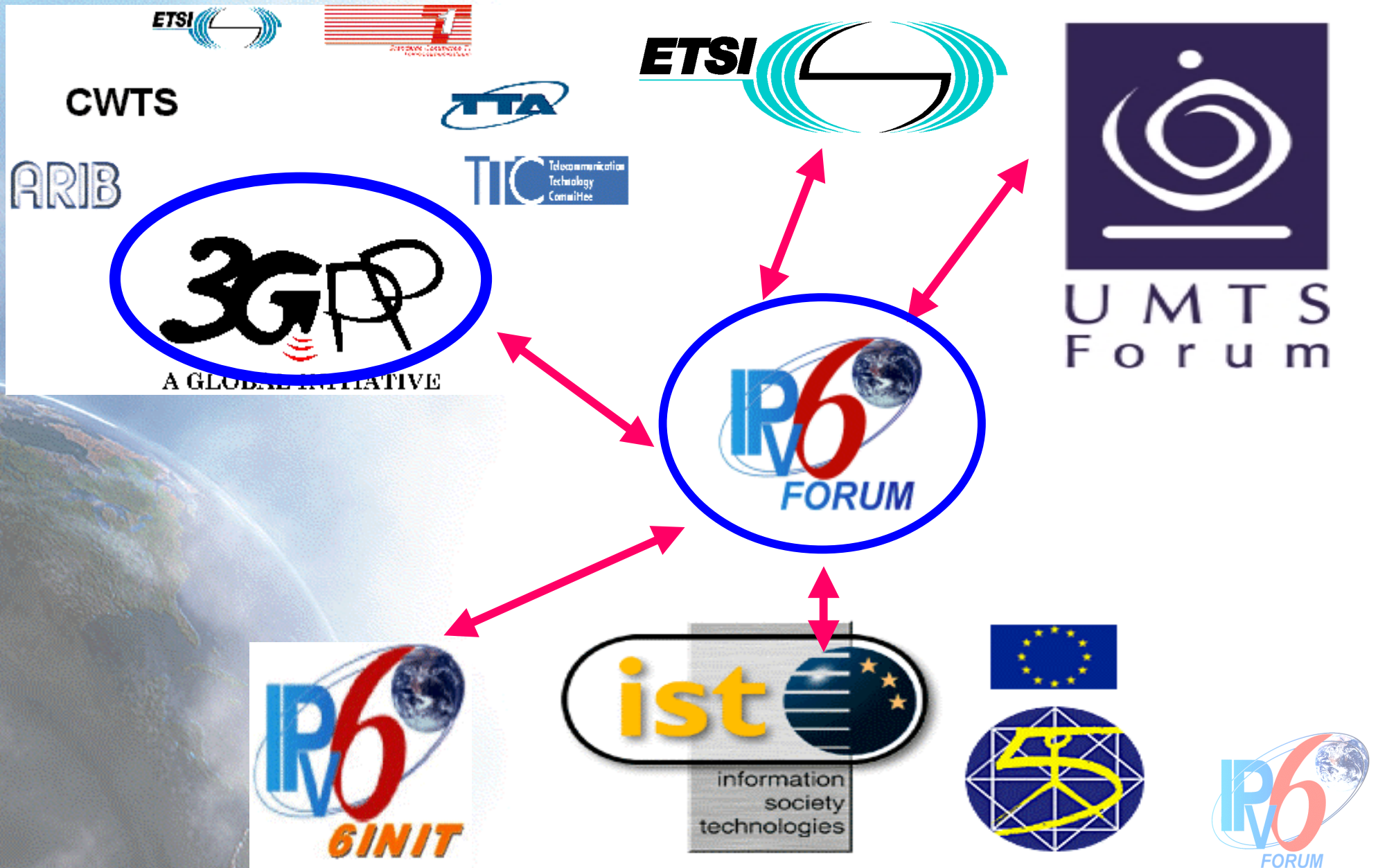
*Wireless Local Loop*

*Source: Joao DaSilva*





# Strategic IPv6 Icebreakers



# 100% IPv6 readiness by 2005

- Prime Minister, Yoshiro Mori
- Jun Murai's Speech at IST 2000 in Nice





# The Transparency of the Internet (Network Layer)

## Why IPv6?





# Internet Scaling challenges

**QoS**



**Great IP  
Address  
Crunch**

**Accurate system  
information**

***Security***



**Authentication and  
usage tracking**



**Maintain IS technical  
advantage**

# IP Robustness & Scalability

IPv4 IPv6

Address Space Shortage

Security

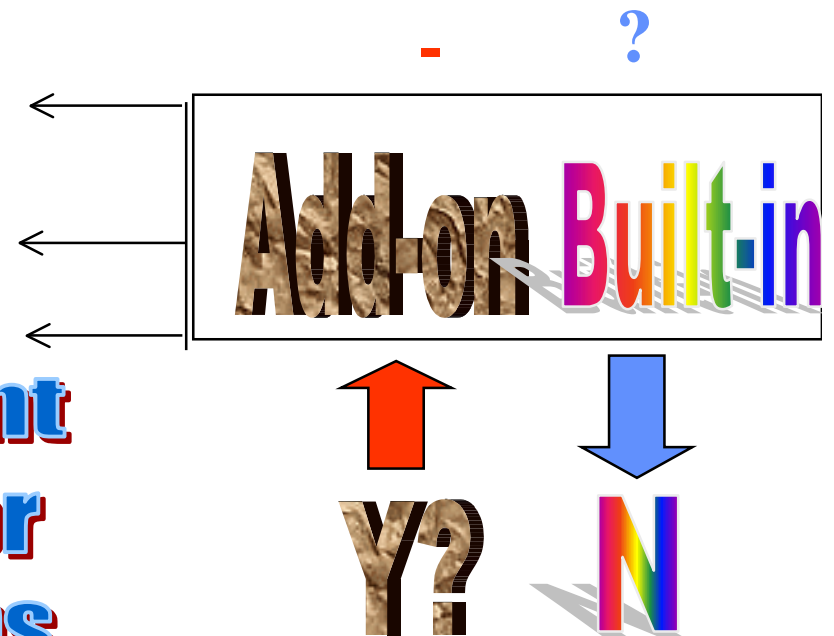
QoS

Mobility

Cost of System Management

Lack of Capability needed for

Next Generation Applications



1970

1980

1990

2000

Pv4

NAT

IPv6

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





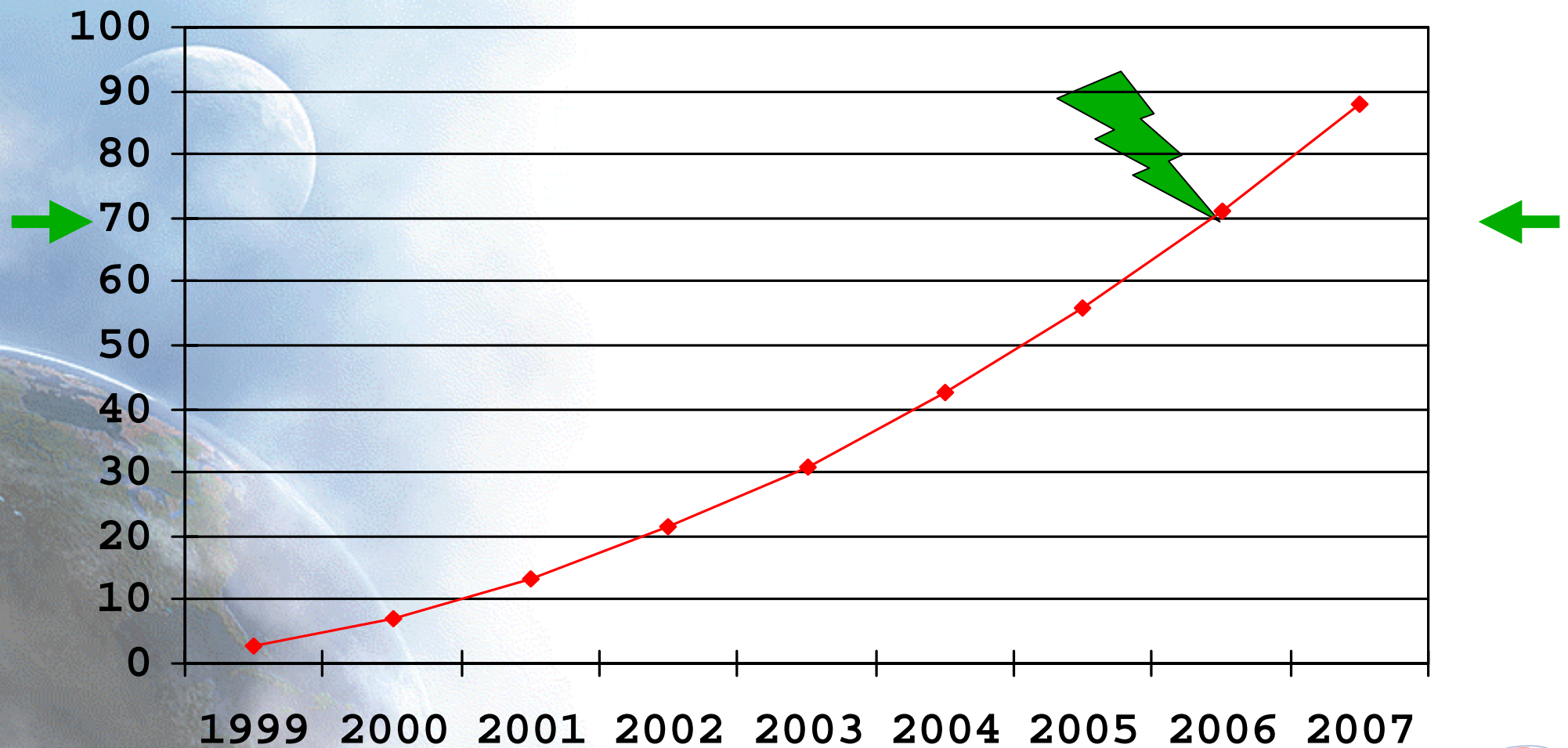
# IPv4 Address Usage Estimate

- Approximately **70** units are left = **27 %**
  - Here one unit means 1/256 of the total IPv4 address space size, i.e. /8 (=equivalent size of Class A)
- Address Usage Rate (units per a year)

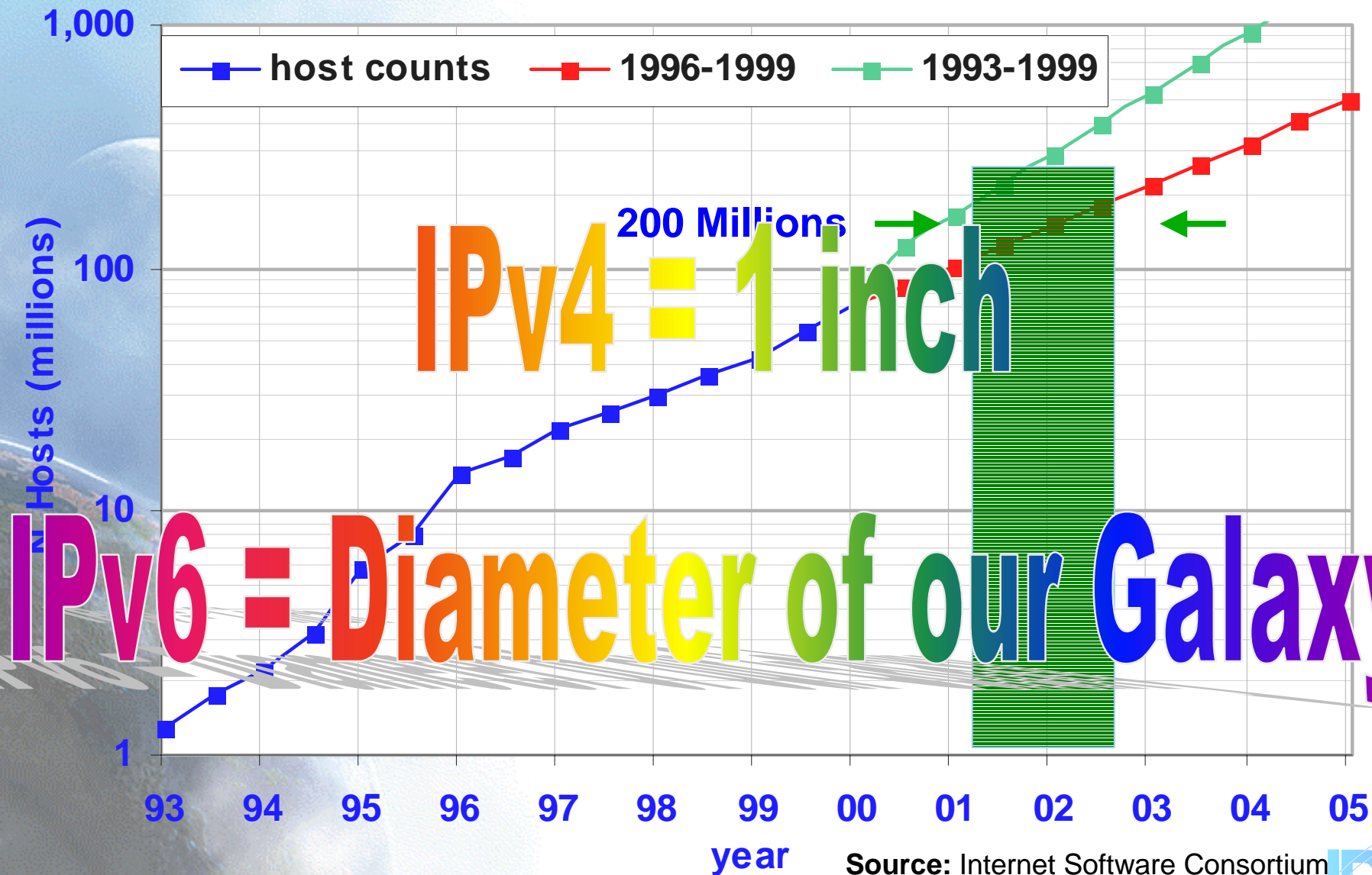
	RIPE/NCC (Europe)	APNIC (AsiaPacific)	ARIN (America)	Total
1998			0.77	
1999	0.8	0.58	1.29	2.67
2000	1.2	1.16	2.08	4.44
2001				??



# IPv4 Address Usage Estimate



# Internet IP Address Need forecasts



Source: Internet Software Consortium  
(<http://www.isc.org>)



# **Wireless Mobility Needed for Always-On IP Address Resource**

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





IPv6

The Internet

Is a Mess

**IPv4**

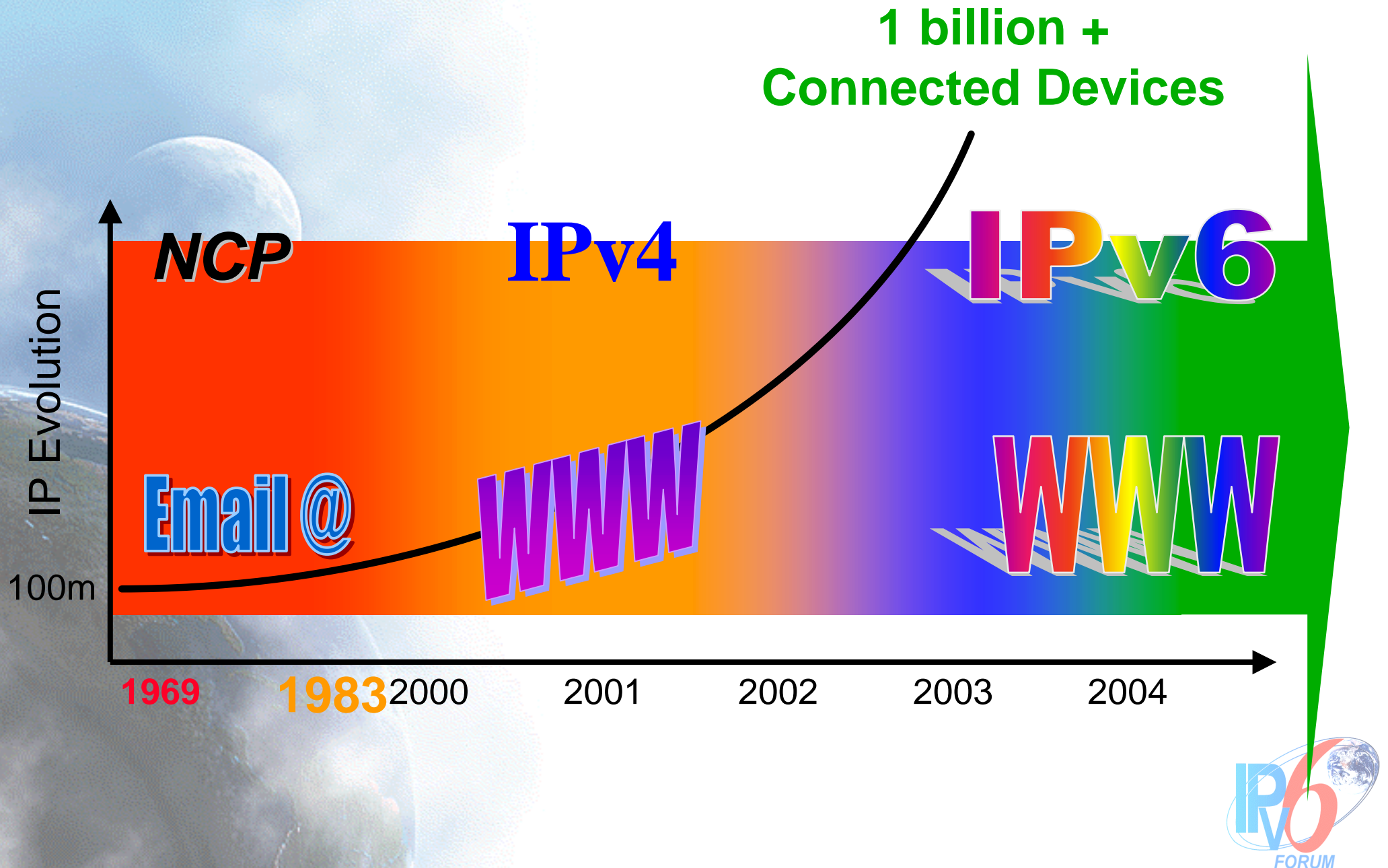
**Voice  
WWW  
Multimedia**

**Telco**

**Mobility  
Ubiquitous Computing  
Smart devices**

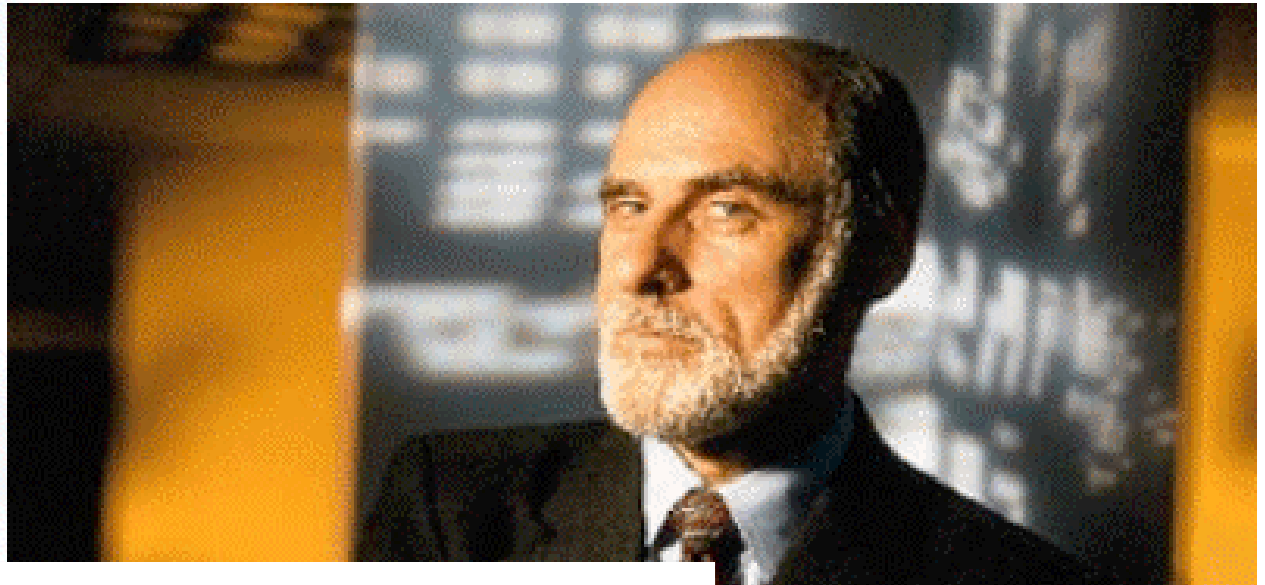


# The New Internet





# IPv6 FORUM



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

**Vint CERF**  
**Honorary Chairman**

