



# The Internet Revolution: Past, Present and Future of Convergence in Communications

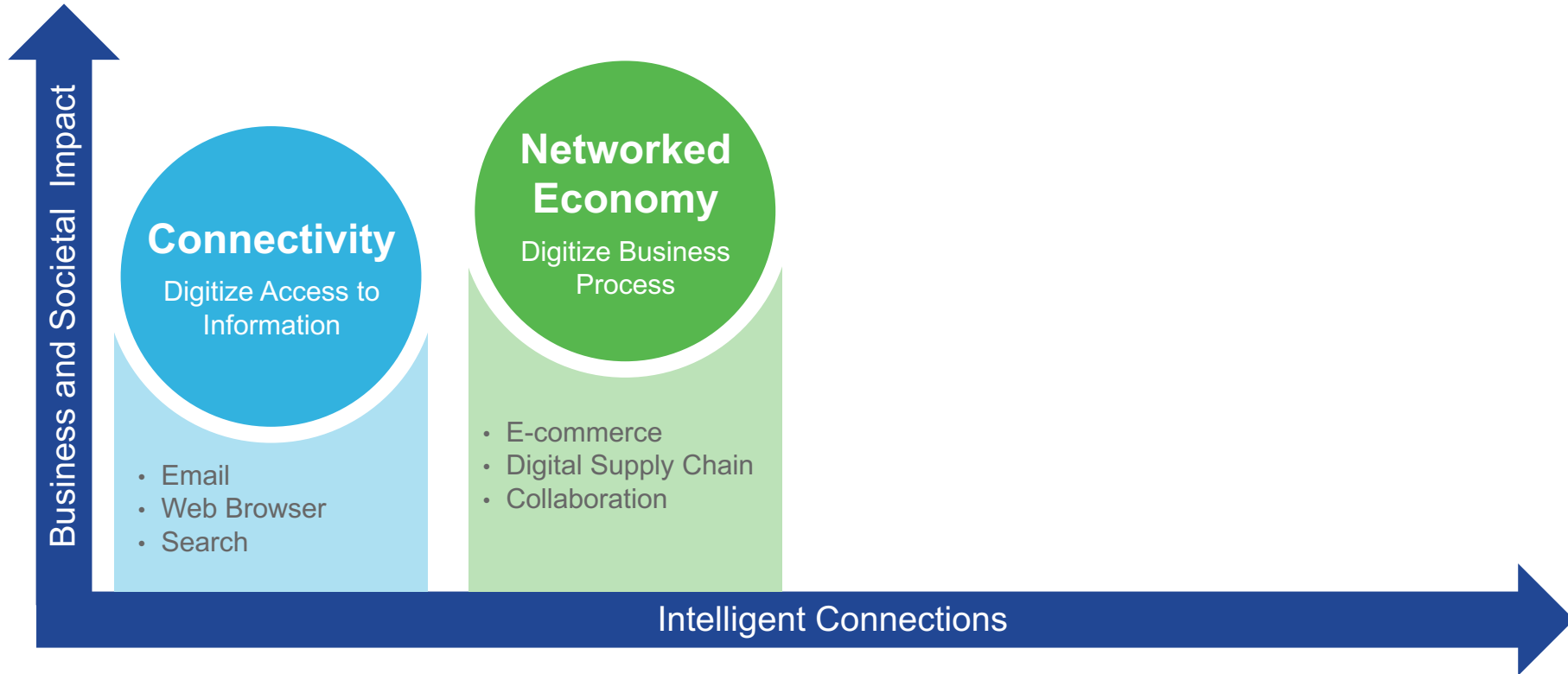
The 20<sup>th</sup> Anniversary of the Italian Chapter of the IIC

Dr. Robert Pepper  
Head, Global Connectivity Policy and Planning

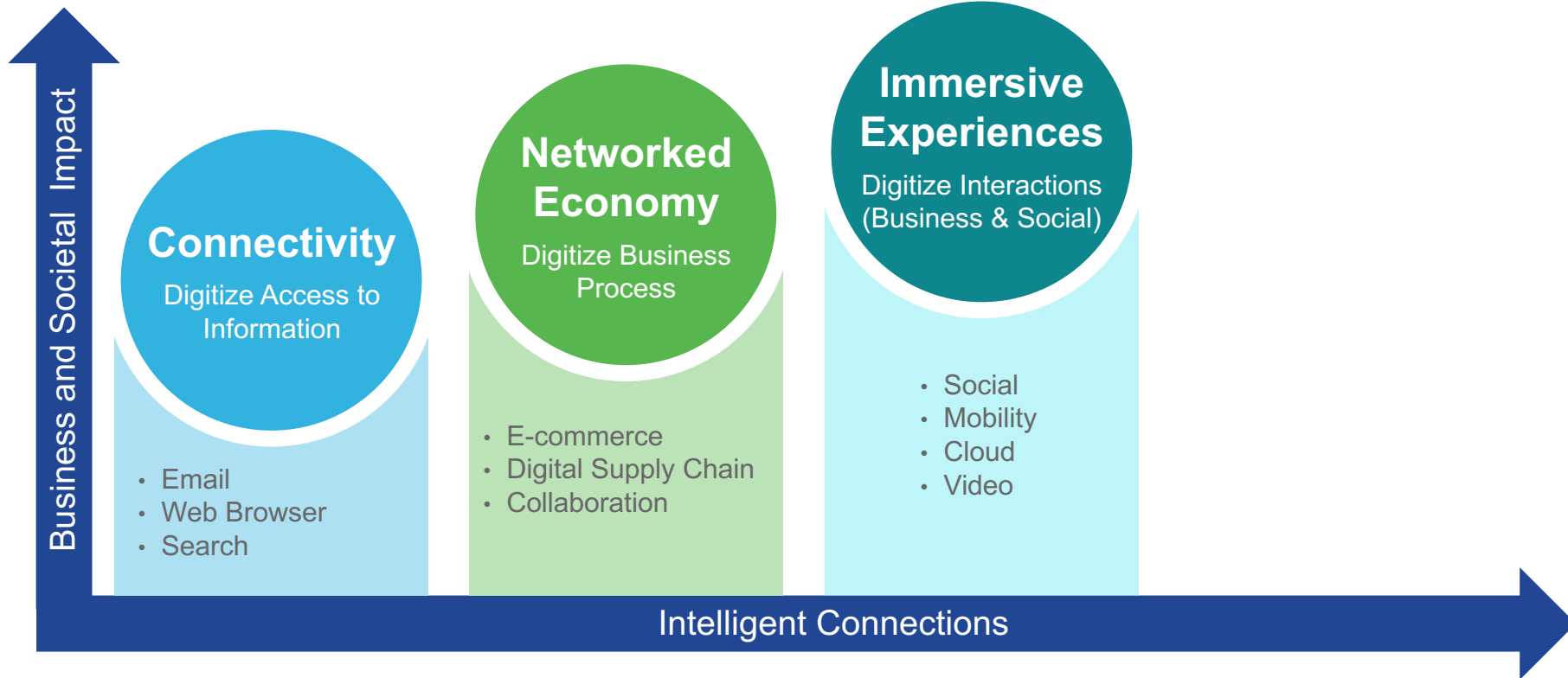
# Evolution of the Internet



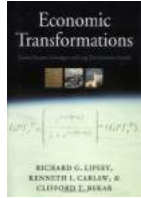
# Evolution of the Internet



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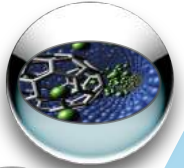
# Compute & the Internet: General Purpose Technologies



Long term economic growth is driven by pervasive General Purpose Technologies (GPT's)... and the Internet meets the criteria

Lipsey, Carlaw, Becker

The Internet of Nano-things  
(Biotech; Nanotech)



The Internet



Computers



Electricity



Railways



Printing Press



Sailing Ship



Writing



Wheel

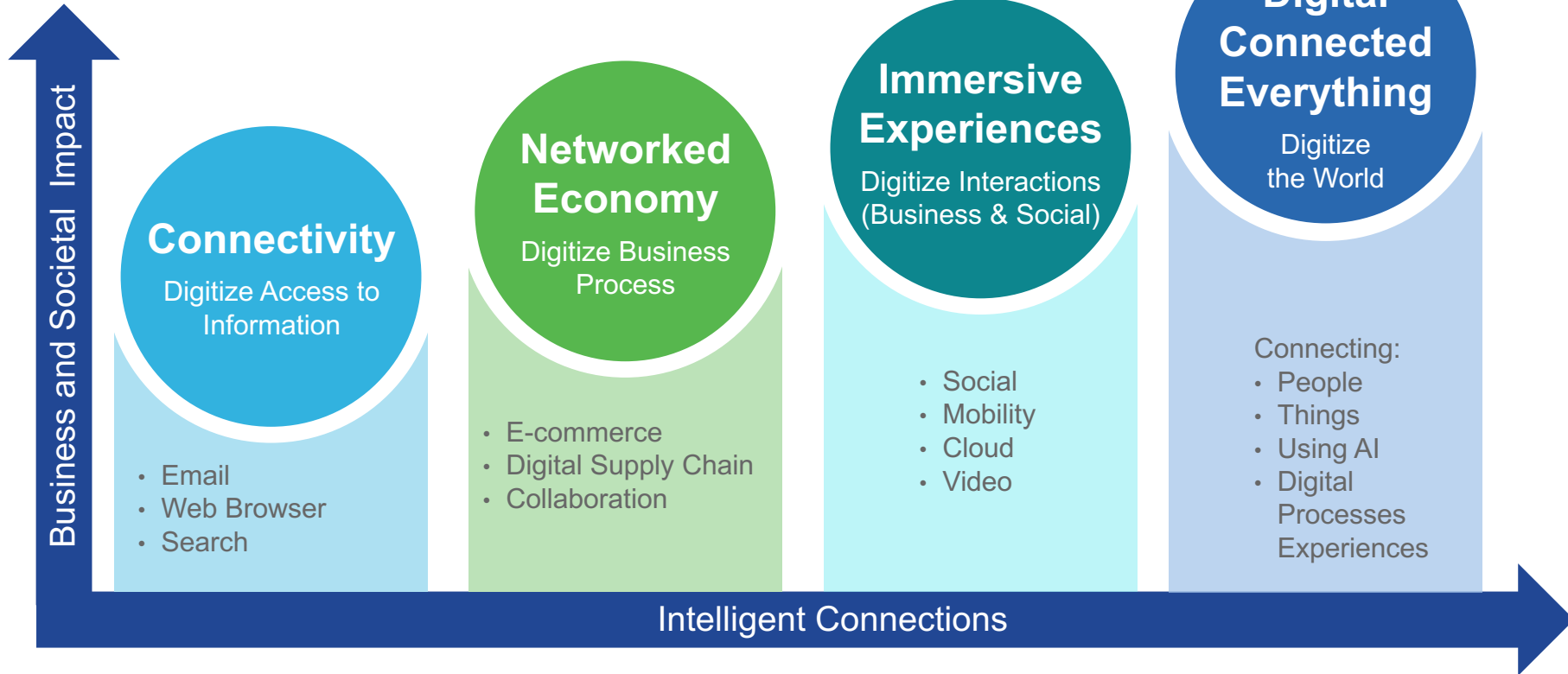


World GDP

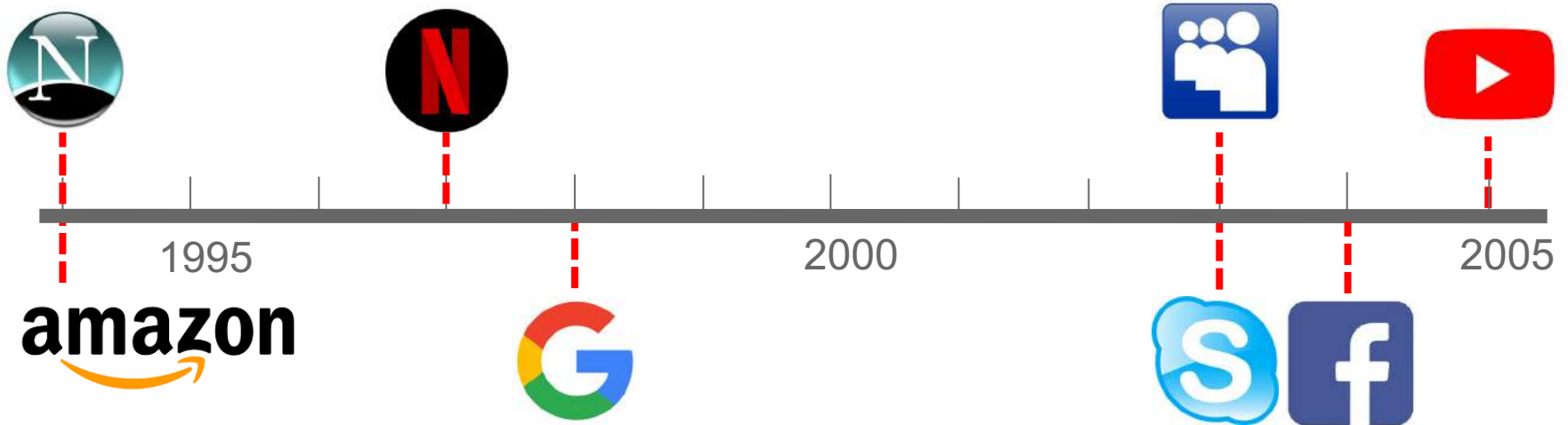
Time



# Evolution of the Internet



# Evolution of Internet Companies



# Largest Publicly Traded Companies

Rank	1997	2017
1	General Electric Company	Apple, Inc.
2	Ford Motor Company	Alphabet, Inc.
3	Nippon Telegraph and Telephone	Microsoft Corporation
4	The Coca-Cola Company	Amazon
5	Exxon Mobil Corporation	Berkshire Hathaway
6	Microsoft Corporation	Facebook
7	Merck & Co., Inc.	Exxon Mobil Corporation
8	Altria Group, Inc.	Johnson & Johnson
9	Toyota Motor Corporation	JP Morgan Chase
10	Deutsche Telekom AG	Wells Fargo
11	International Business Machines Corporation	Tencent Holdings Ltd
12	The Procter & Gamble Company	Alibaba Group
13	Intel Corporation	General Electric
14	American International Group, Inc.	Samsung Electronics
15	Wal-Mart Stores, Inc.	AT&T



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# 1997

## Internet Trends

- Increasing numbers of ISPs
  - » Over 4,000 in North America, and 31 national backbones  
(*Boardwatch July/August 1997 ISP Directory*)
- High rate of growth
  - » 1.2 million domain names as of 4/97, up from 30,000 in 1/94
- Innovation in both software and hardware
  - » Internet telephony
  - » Streaming audio/video
  - » Web TVs
  - » Wireless services
  - » Push media
  - » Networked interactive games
- Internet/online games
  - » Ultima Online sales: 40,000 units in 4 weeks
  - » Average number of players/game: 5,000
  - » Average time on-line: 6 hours/day



# 1997—Where We Were

- High speed Internet: 128kbps
- DSL emerging
- 2G mobile world, fierce mobile competition emerging—iPhone 10 years in future
- Three years before the “DotCom Bubble” Burst
- Internet starting to drive convergence

# 1997

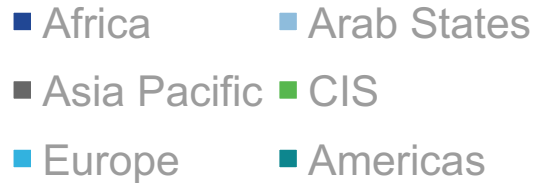
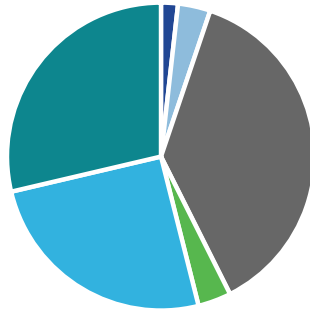
## **What Will the Future Look Like?**

- Bandwidth demand will keep growing
  - ◆ continued increase in Internet penetration
  - ◆ push media and streaming video
  - ◆ Internet games
  - ◆ electronic commerce
- Continued experimentation with business models
  - ◆ companies search for the "killer app" and a growth strategy
- Converged networks will begin to dominate
  - ◆ voice just one service on packet-switched data networks
  - ◆ will foster increased user choice and control
- Emergence of the "mission-critical" Internet
  - ◆ aka "The Net Grows Up"

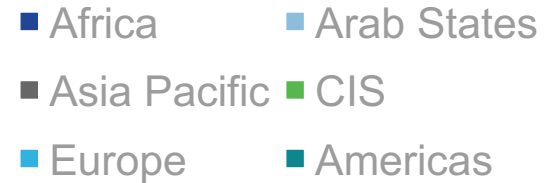
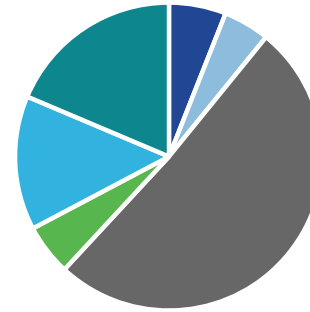


# From North America/Europe to Global Internet Users

1997

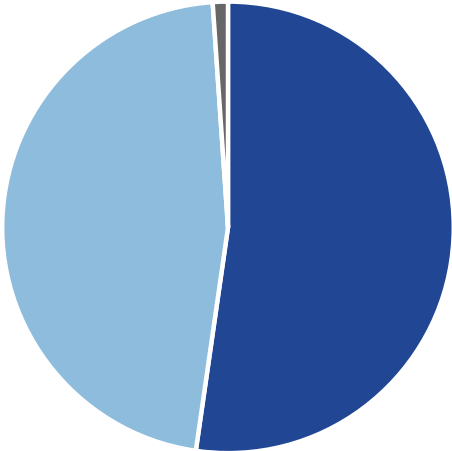


2017



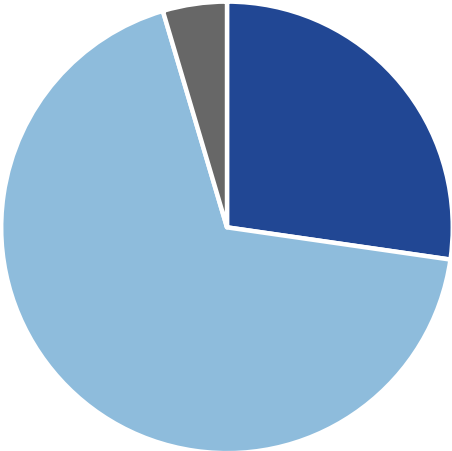
# From Developed to Global Internet Users

1997



■ Developed ■ Developing ■ LDCs

2017



■ Developed ■ Developing ■ LDCs

# 1997

## **The Paradigm Shift**

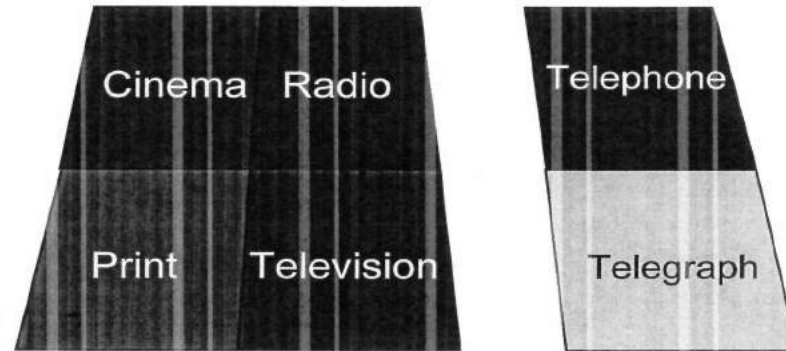
- Moving from circuit-switched voice to packet-switched open internetworks
- Decoupling network software from hardware
  - ◆ Users benefit immediately from rapid innovation in software, rather than waiting for extensive switch upgrades
  - ◆ Ability to take advantage of scale economies at the edge of the network
- Voice as one form of data, rather than struggling to transmit data through networks optimized for voice
- Traditional regulatory, policy, and business models no longer work





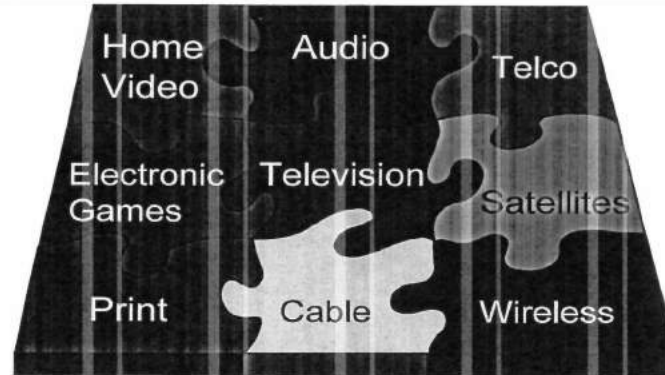
# 1997

## The Traditional Market and Regulatory Structure



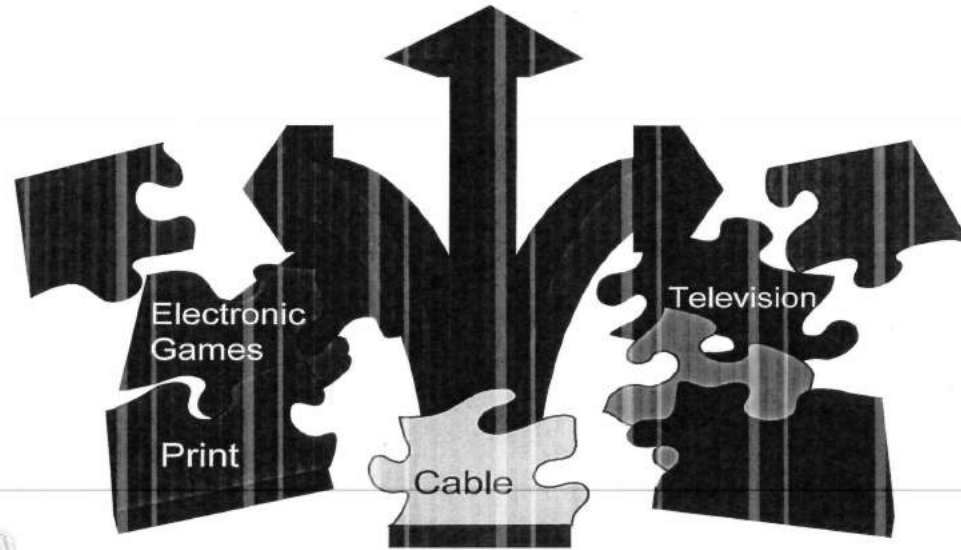
# 1997

## **Blurring Boundaries and Competition -- 1995-1998**



# 1997

## The New Reality: The Digital Revolution



Robert Pepper

The Internet and Telecommunications Policy

# 2017—Convergence is Here

- Digital transformation of everything—not just the Internet
- 80% Internet traffic is video
- Mobile Internet
- Social media creating new communities
- Wireless connections for devices
- Apps not applications
- User choice and control
- Pull not push

# 1997—Where We Were—Policy Debates

- EC Green Paper on Convergence
- FCC working paper, “Digital Tornado,” concludes: the USGs “efforts to avoid burdening the Internet with regulation should be looked upon as a major success, and should be continued”
- Most of industry and regulation still in silos
- Telcos complaining the Internet will crash their networks and destroy their business models

# Past is Prologue—The Policy Debate 2017

- Incumbents complaining about disruption from the Internet—not just telcos and broadcasters
  - Travel companies, publishers, movie theatres, taxis, retail, banks...
- Protecting the “Mission Critical” Internet
- Desperately seeking new business models
- The “level playing field”
- Regulate up or down?

1997

**The Internet:**  
**How to Regulate it, Tax it,  
and Prevent it from Growing**

**Dr. Robert M. Pepper**  
**Chief, Office of Plans and Policy**  
**Federal Communications Commission**  
**<rpepper@fcc.gov>**

December 1996



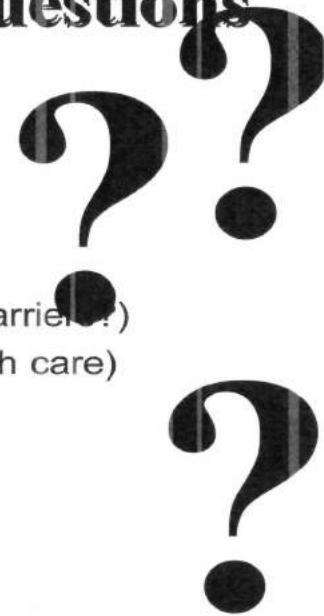
Robert M. Pepper

Internet Regulatory and Policy Issues

# 1997

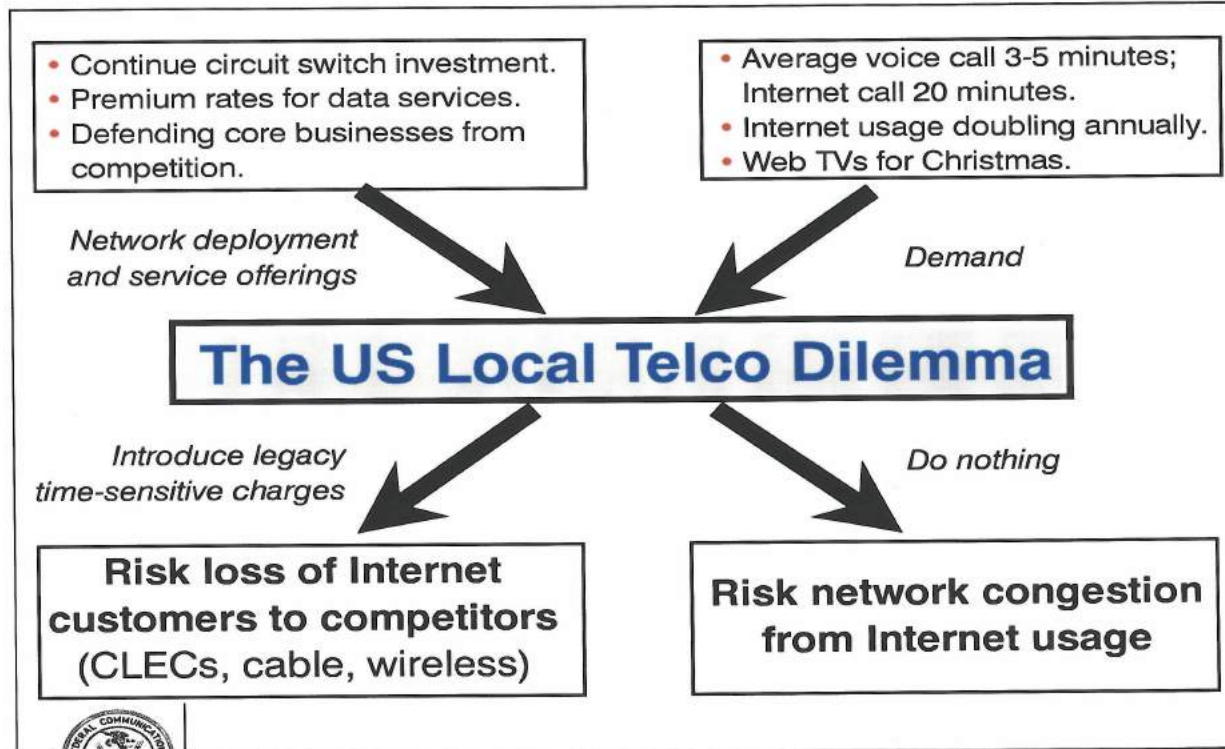
## **Emerging Net Policy Questions (Policy ≠ Regulation)**

- Network congestion
- Reliability and service quality
- Governance (e.g. domain names)
- Privacy
- Definitional issues (services? facilities? carriers?)
- Universal access (schools, libraries, health care)
- Support of traditional subsidies
- Inappropriate materials for children
- Liability
- Taxation
- Gambling
- Electronic Commerce





# 1997



Robert Pepper

Internet Regulatory and Policy Issues

# Digital Transformation of Telecom Need New Business Models

## Old Assumptions



- The product is voice
- The metric is minutes
- Distance matters
- Duration matters
- Location matters



## New Realities



- The product is connectivity
- The metric is bandwidth/throughput
- Distance insensitive
- Time insensitive
- Location insensitive

# 1997

## Lessons:

- Competition will happen, but needs constant attention
- The Internet is looming
- Regulators need humility as they can't predict competitors or entry strategies
- Be flexible



Robert Pepper

The Road to Competition

# Lessons—An Update

- Competition is here and evolving in new ways and needs to continue
- The Internet is everywhere
- Need humility as we can't predict technology nor how consumers and business will use it nor how markets will evolve
- Policy and regulation needs to be flexible and adaptive
- Need policies for innovation
- Once size does not fit all

