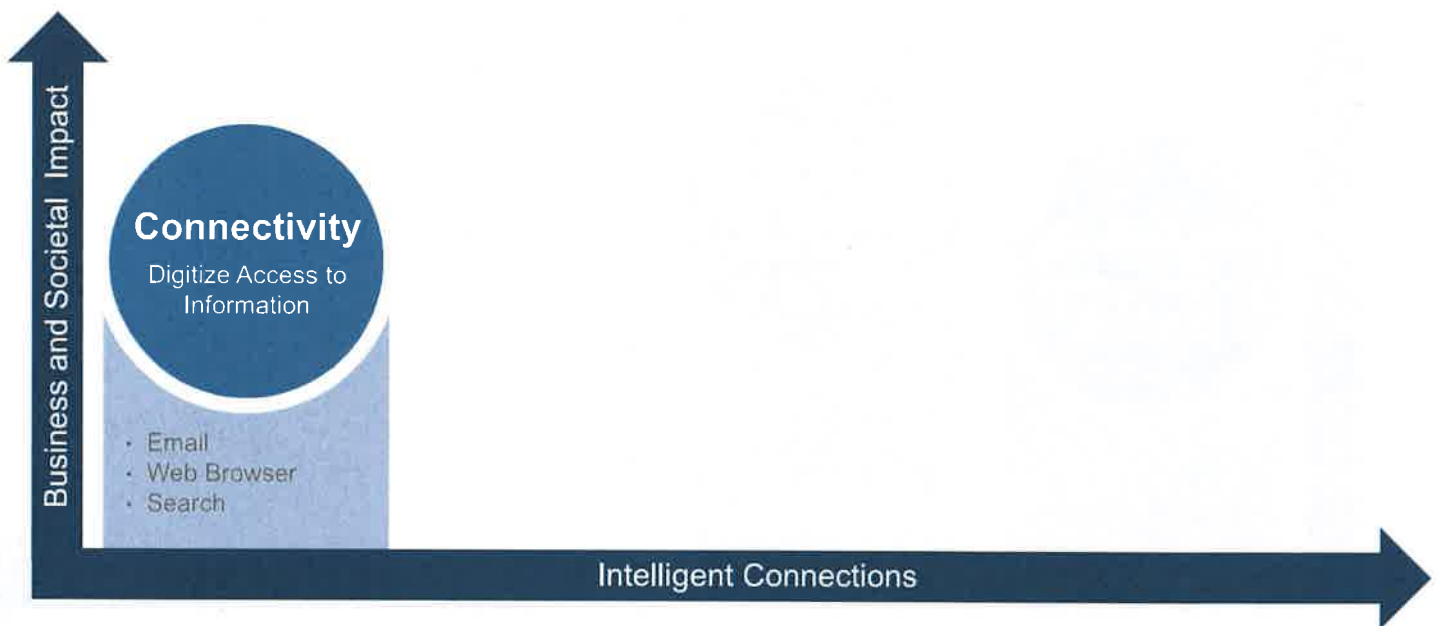
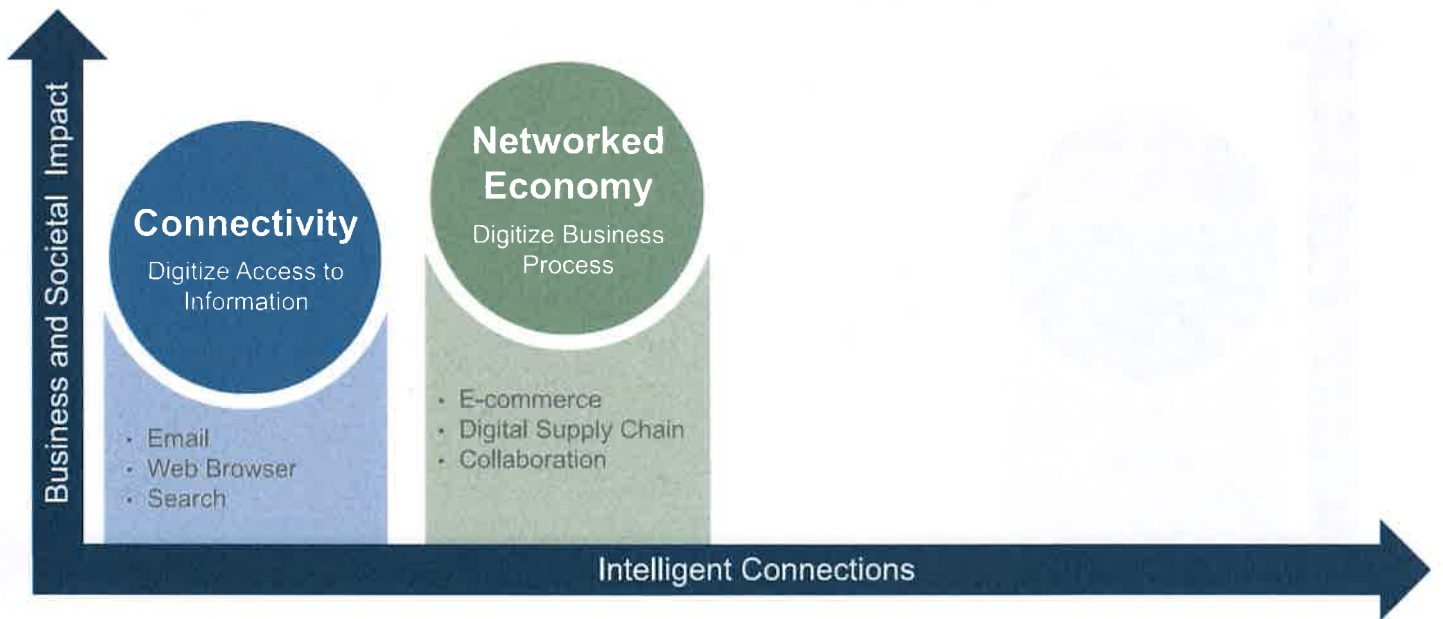


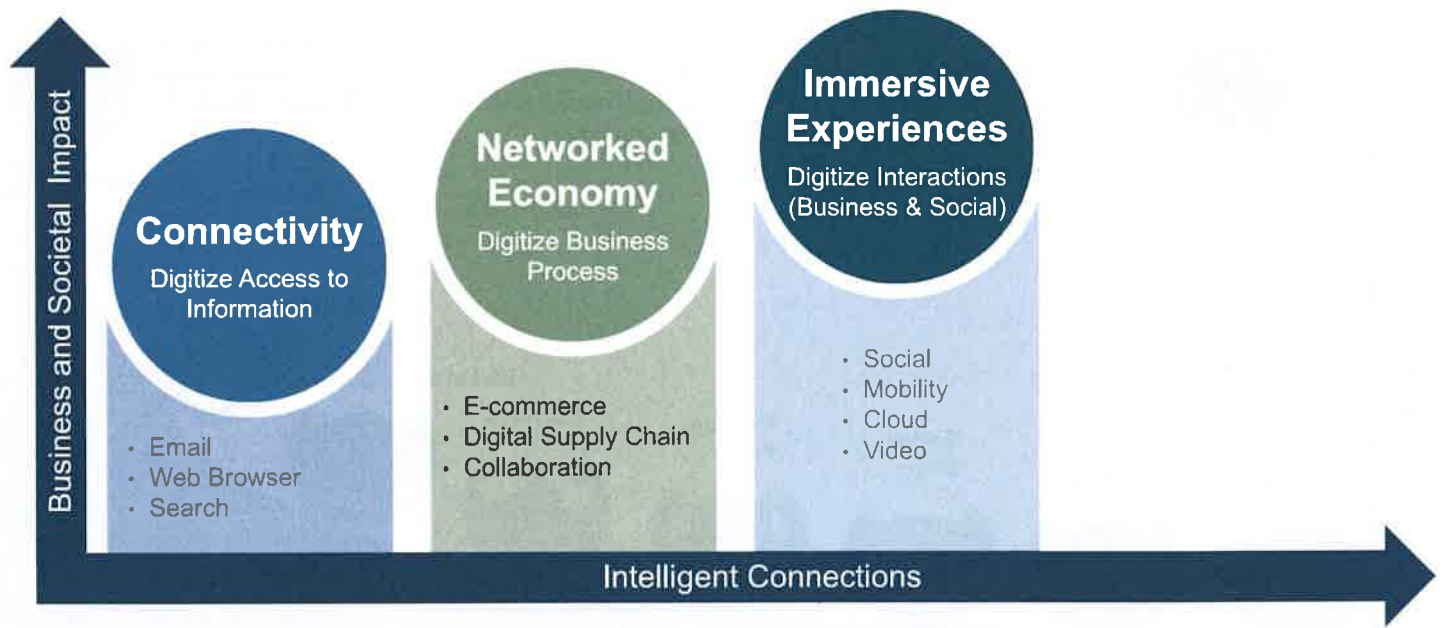
Evolution of the Internet



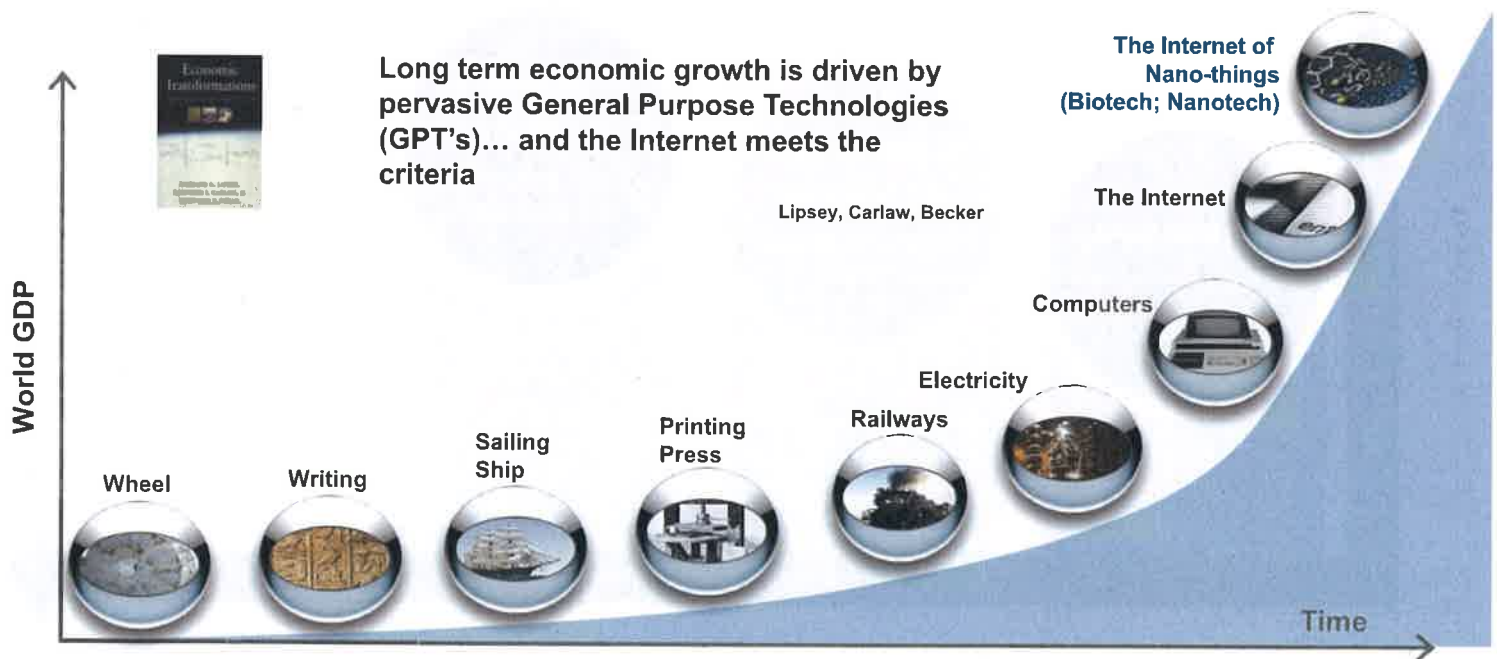
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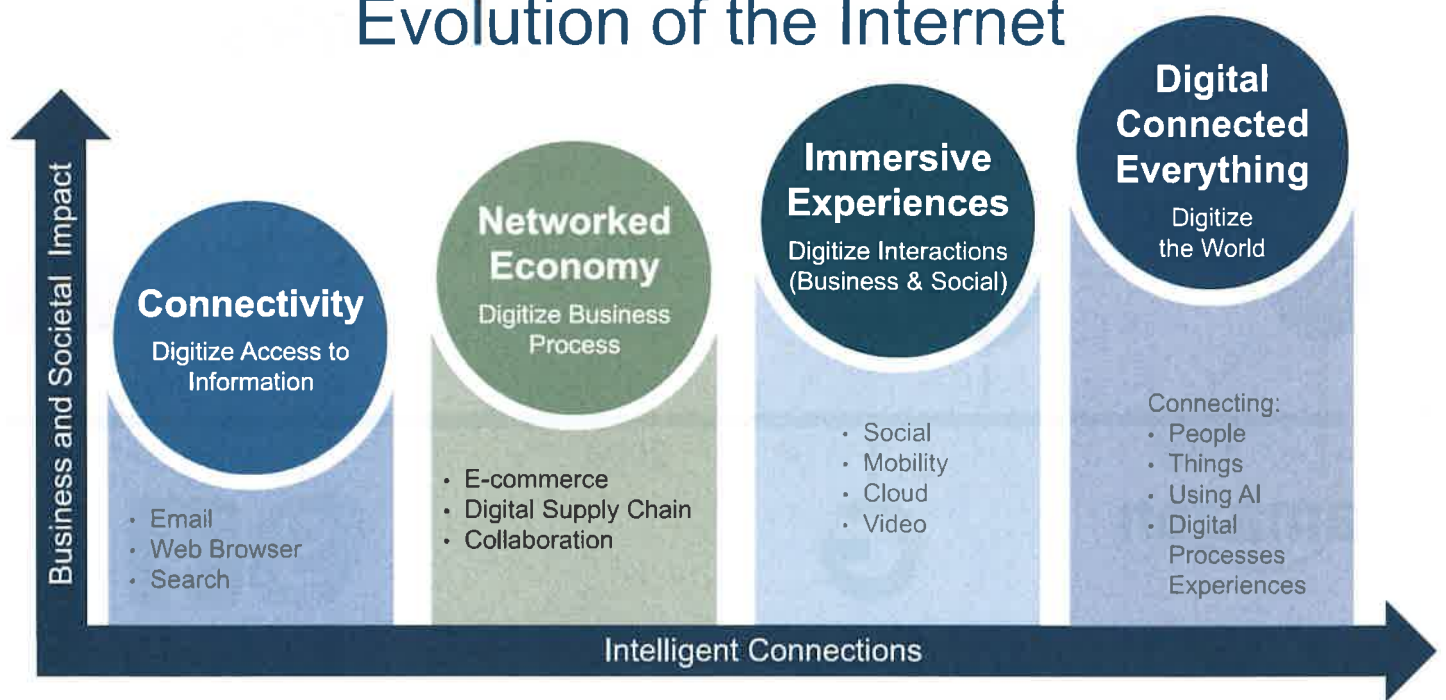
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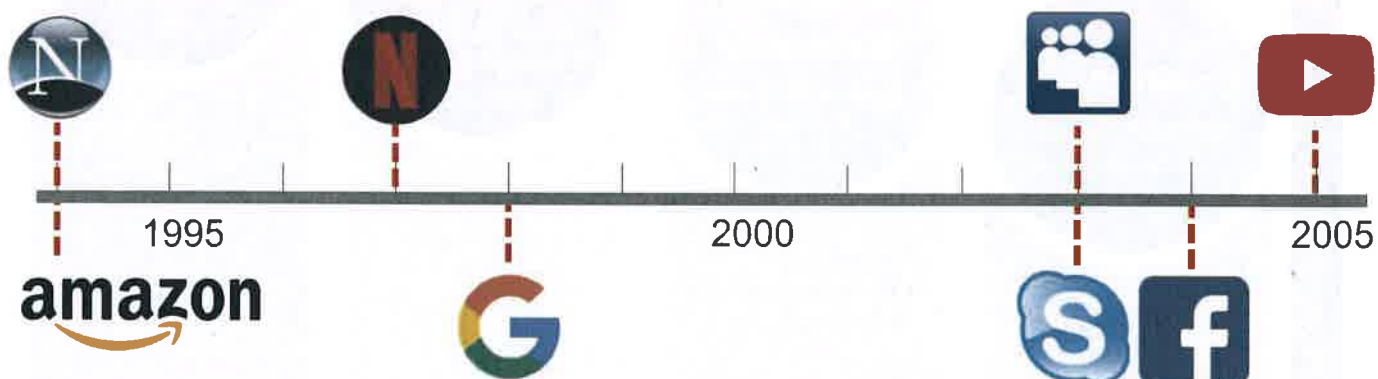
Compute & the Internet: General Purpose Technologies



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

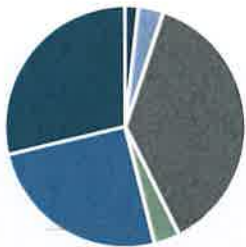
What Will the Future Look Like?

- **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"

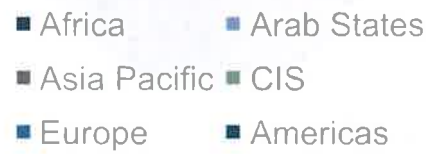
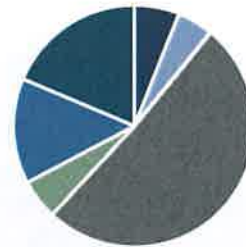


From North America/Europe to Global Internet Users

1997

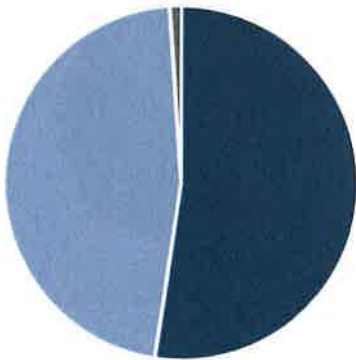


2017



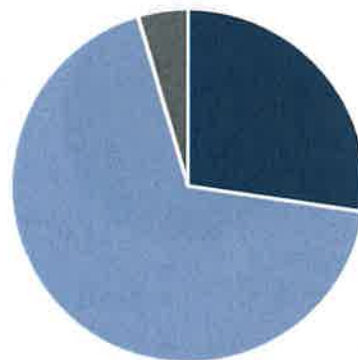
From Developed to Global Internet Users

1997



■ Developed ■ Developing ■ LDCs

2017



■ Developed ■ Developing ■ LDCs

1997

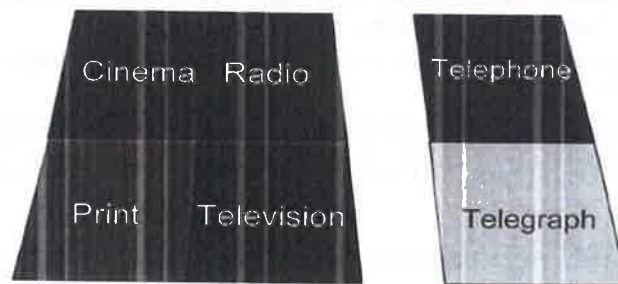
The Paradigm Shift

- 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

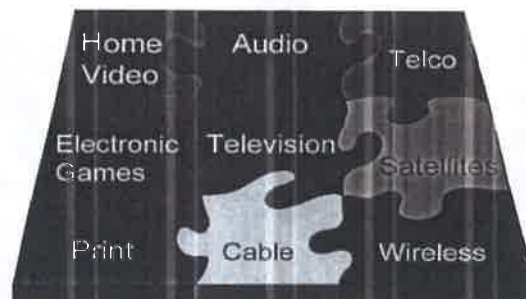


Robert Pepper

The Internet and Telecommunications Policy

1997

Blurring Boundaries and Competition -- 1995-1998

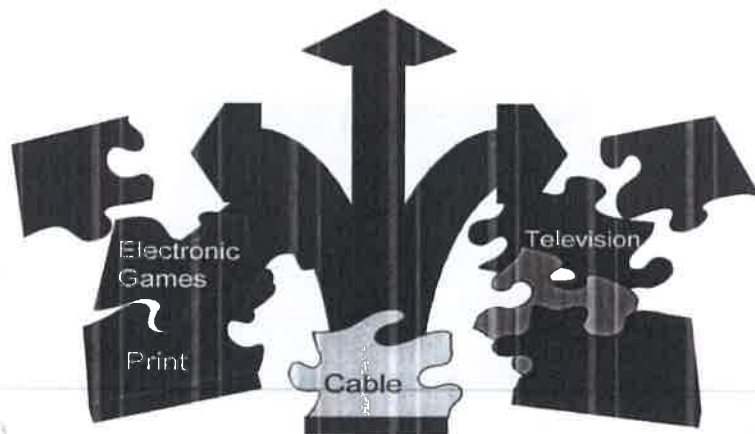


Robert Pepper

The Internet and Telecommunications Policy

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



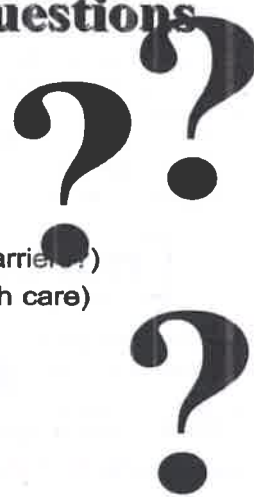
Robert M. Pepper

Internet Policy and Policy Issues

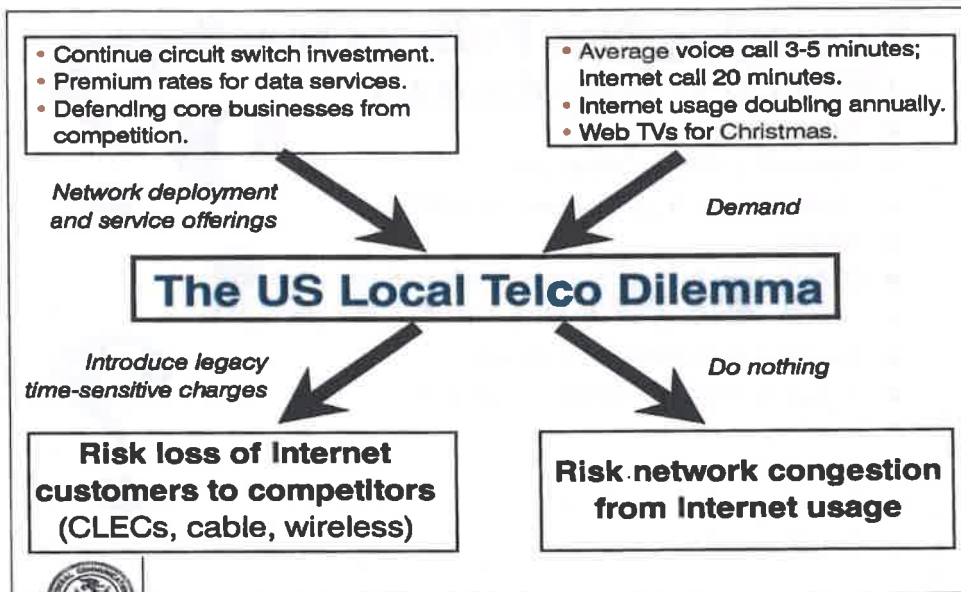
1997

Emerging Net Policy Questions (Policy \neq 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



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**



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

