Continuing Innovation IN INFORMATION TECHNOLOGY

NRC CSTB
2012 CRA Snowbird Conference

NRC CSTB, 1995

Clearly **linked government investments in** academic and industry **research to new IT industries** with more than $1B in annual revenue

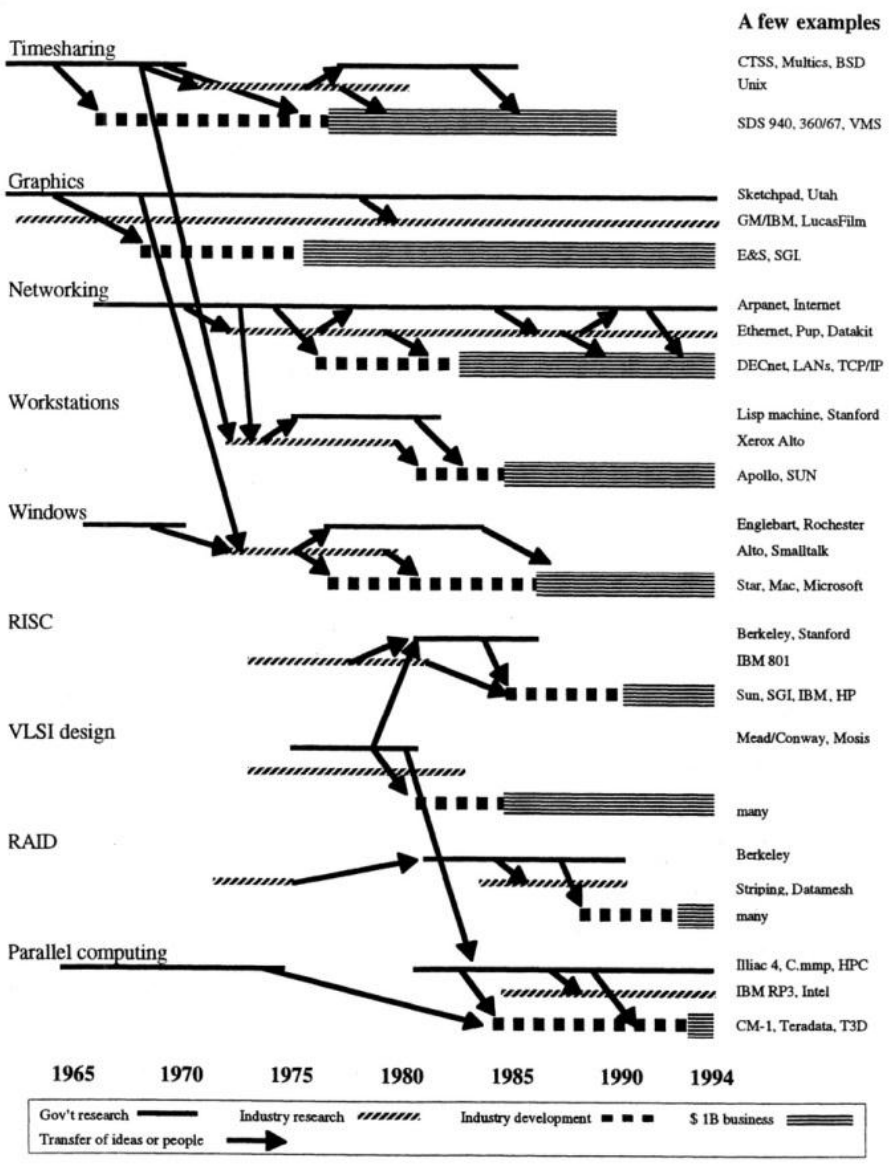


FIGURE ES.1 Government-sponsored computing research and development stimulates creation of innovative ideas and industries. Dates apply to horizontal bars, but not to arrows showing transfer of ideas and people.

Key points

The essential role of the **federal government**

The **rich interplay** between academia, industry, and gov't

The long and **unpredictable incubation period** for research

The importance of **unanticipated results** and synergies

The economic benefits of IT continue to grow

ICT industries grew by 16.3% in 2010; nearly **5% of US GDP**
[Bureau of Economic Analysis]

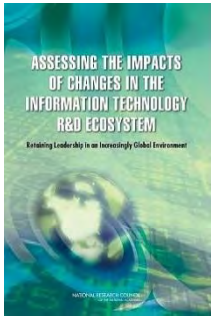
Federal funding in FY2010 for NIT R&D was **<0.03% US GDP**
[National Research Council]

The above reflects only the direct benefits of IT, not the full benefits

And the "tiretracks" continues to be an effective tool

1995

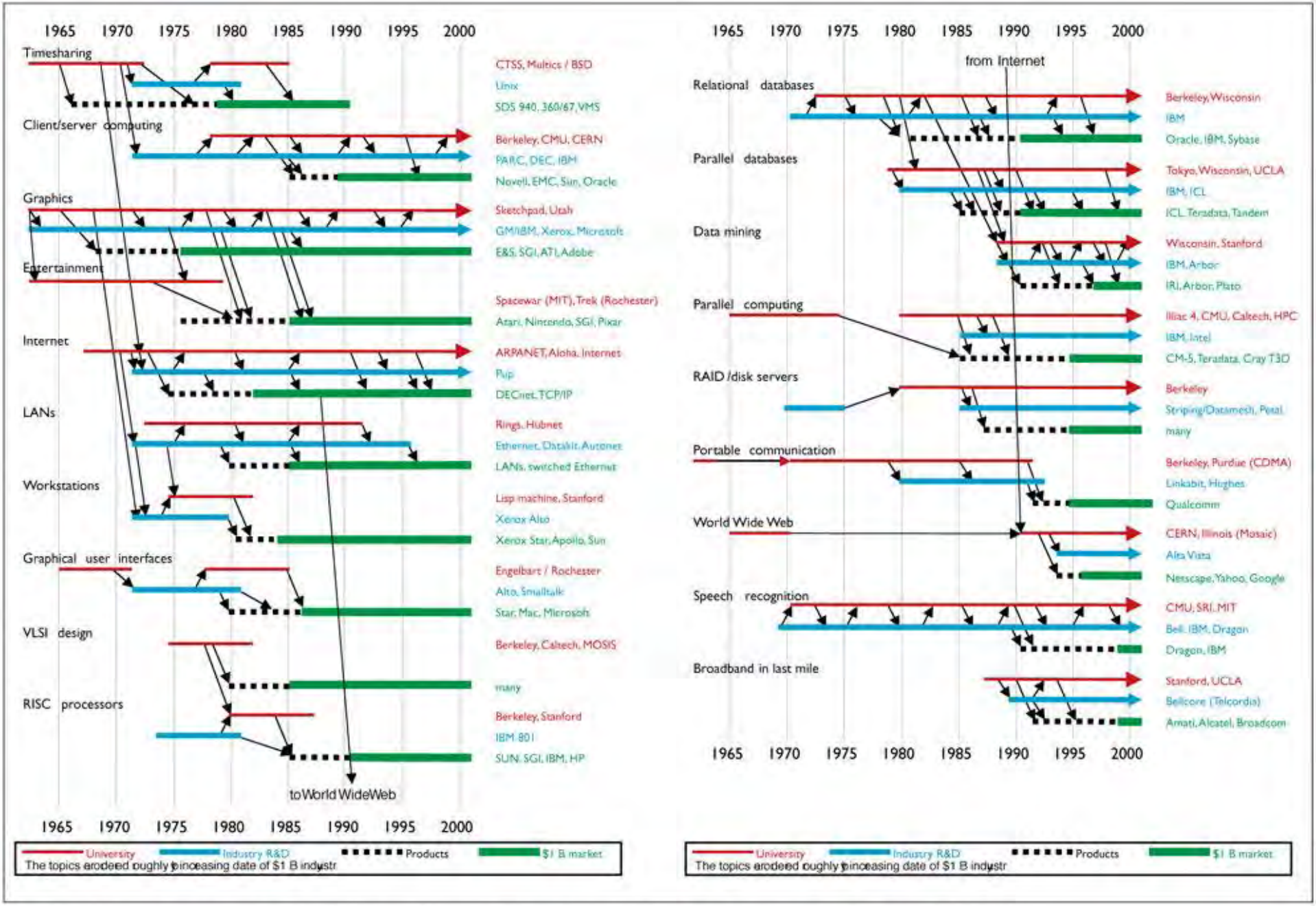
2003



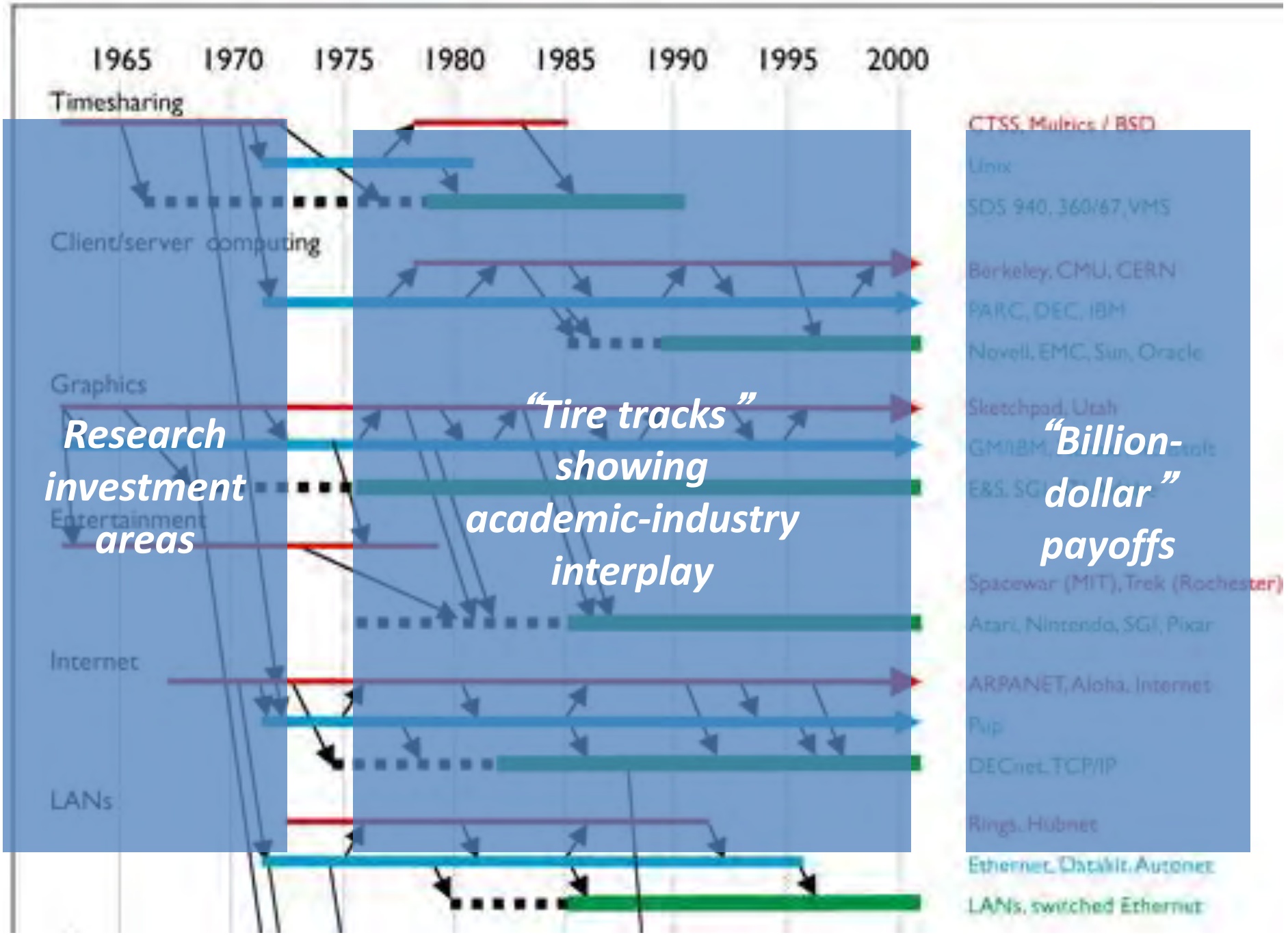
2009

For 2012

"A small committee will update a previously issued figure depicting the role that government-supported academic, and industrial research plays in the formation of major new IT capabilities…"



Source: From [6], reprinted with permission from the National Academy of Sciences, courtesy of the National Academies Press, Washington D.C. © 2003.


1965
1970
1975
1980
1985
1990
1995
2000
Timesharing
Client/server computing
Graphics
Entertainment
Internet
LANs
CTSS, Multics / BSD
Unix
SDS 940, 360/67, VMS
Berkeley, CMU, CERN
PARC, DEC, IBM
Novell, EMC, Sun, Oracle
Sketchpad, Utah
Spacewar (MIT), Trek (Rochester)
Atari, Nintendo, SGI, Pixar
ARPANET, Aloha, Internet
Pup
DECnet, TCP/IP
Rings, Hubnet
Ethernet, Datakit, Autonet
LANs, switched Ethernet
Research investment areas
"Tire tracks" showing academic-industry interplay
"Billion-dollar" payoffs

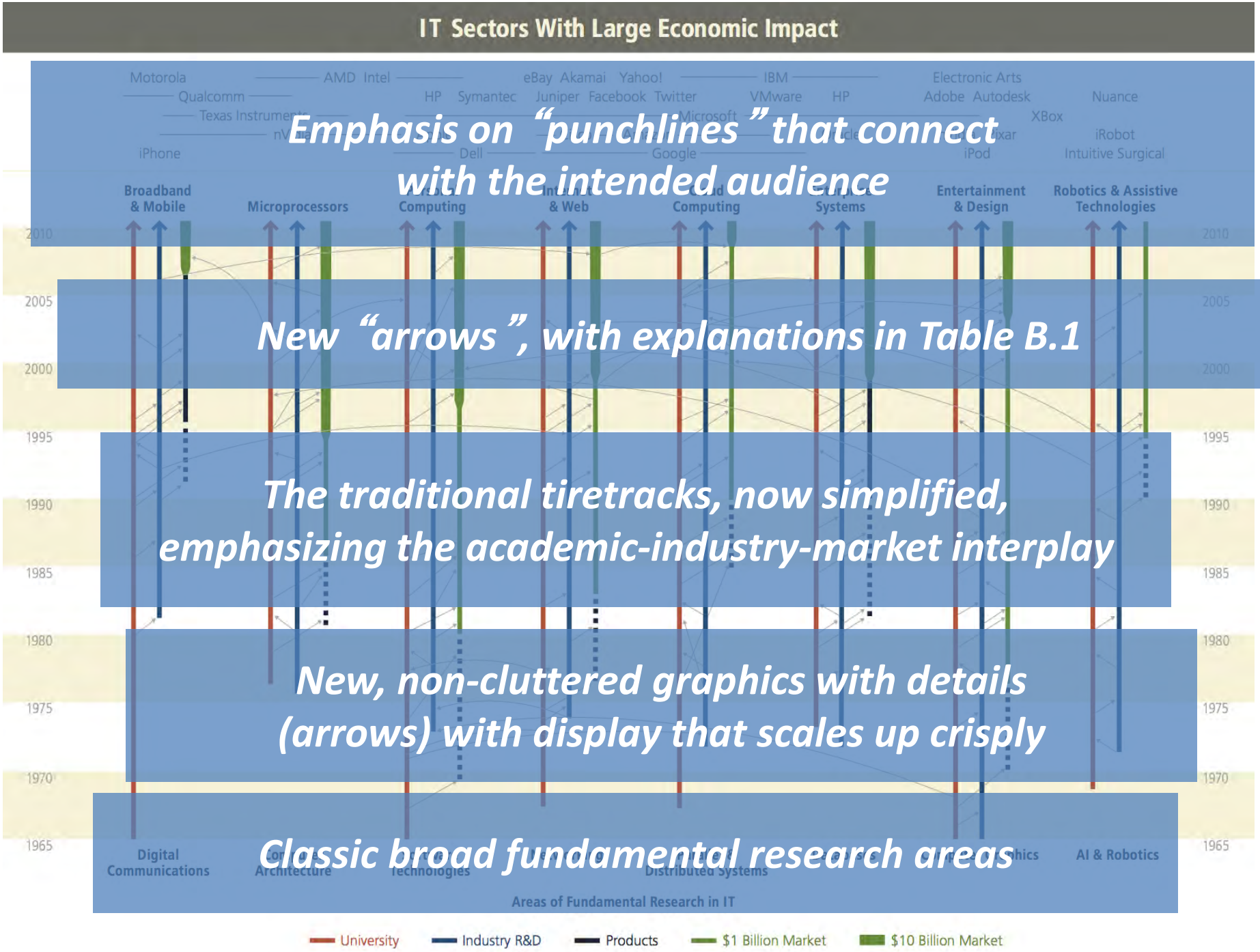
Guiding principles

Emphasize **audience-appropriate payoffs**

Tell impact stories; worry less about historical completeness

Keep in mind that **less can be more**

Set the stage for **future updates** and refinements


IT Sectors With Large Economic Impact
Motorola
AMD
Intel
Qualcomm
HP
Symantec
eBay
Akamai
Yahoo!
Juniper
Facebook
Twitter
IBM
VMware
HP
Electronic Arts
Adobe
Autodesk
Nuance
Texas Instruments
XBox
iPhone
Dell
Google
iPod
iRobot
Intuitive Surgical
Broadband & Mobile
Microprocessors
Computing
& Web
Computing
Systems
Entertainment & Design
Robotics & Assistive Technologies
2010
2005
2000
1995
1990
1985
1980
1975
1970
1965
Digital Communications
Architecture
Technologies
Distributed Systems
AI & Robotics
Areas of Fundamental Research in IT
University
Industry R&D
Products
$1 Billion Market
$10 Billion Market
Emphasis on "punchlines" that connect with the intended audience
New "arrows", with explanations in Table B.1
The traditional tiretracks, now simplified, emphasizing the academic-industry-market interplay
New, non-cluttered graphics with details (arrows) with display that scales up crisply
Classic broad fundamental research areas

Panelists

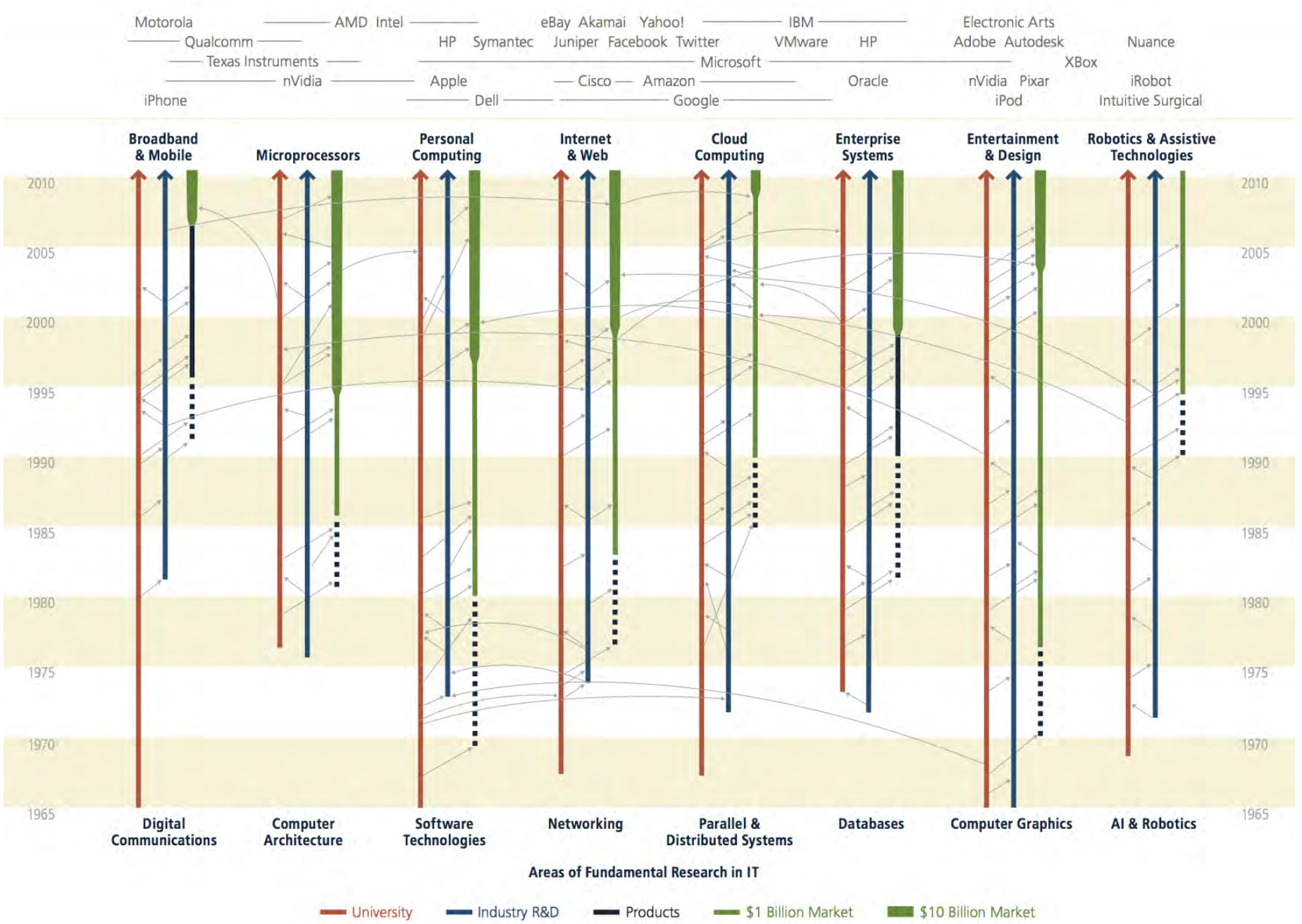
David Culler, UC-Berkeley

Laura Haas, IBM

Ed Lazowska, UW

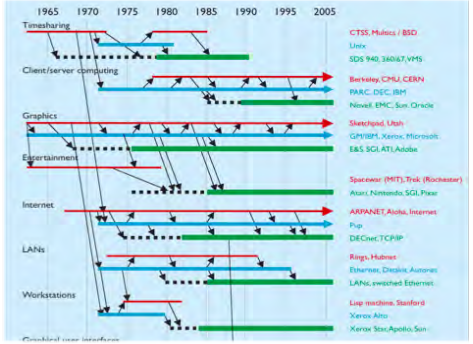
Peter Norvig, Google

IT Sectors With Large Economic Impact



CSTB…

- Explains how IT evolves, the role of R&D, and the role of different contributors—public and private—to that process
- Guides the evolution of IT research programs and stimulating work in emerging/key areas
  - Computing performance, software, health IT, biometrics, wireless, embedded sensor networks, …
- Explicates the workings of the Internet and charting its evolution
- Provides unclassified analysis of offensive side of cybersecurity, fostering public discussion and debate
- Recommends better approaches for IT development in the federal government
  - Medicare, social security, FBI, …
- Provides an evaluation framework for assessing information-based homeland security programs
- Recommends defense IT acquisition reforms



The New York Times

April 30, 2009

Panel Warns U.S. on Cyberwar Plans

By JOHN MARKOFF and THOM SHANKER

To do so, GAO developed a systematic evaluation framework based on recommendations and best practices outlined by the National Research Council, industry practices, and prior GAO reports. GAO compared its

Acknowledgments

Today’s panelists

Numerous reviews and contributors

Gene Spafford

Butler Lampson and Ed Lazowska

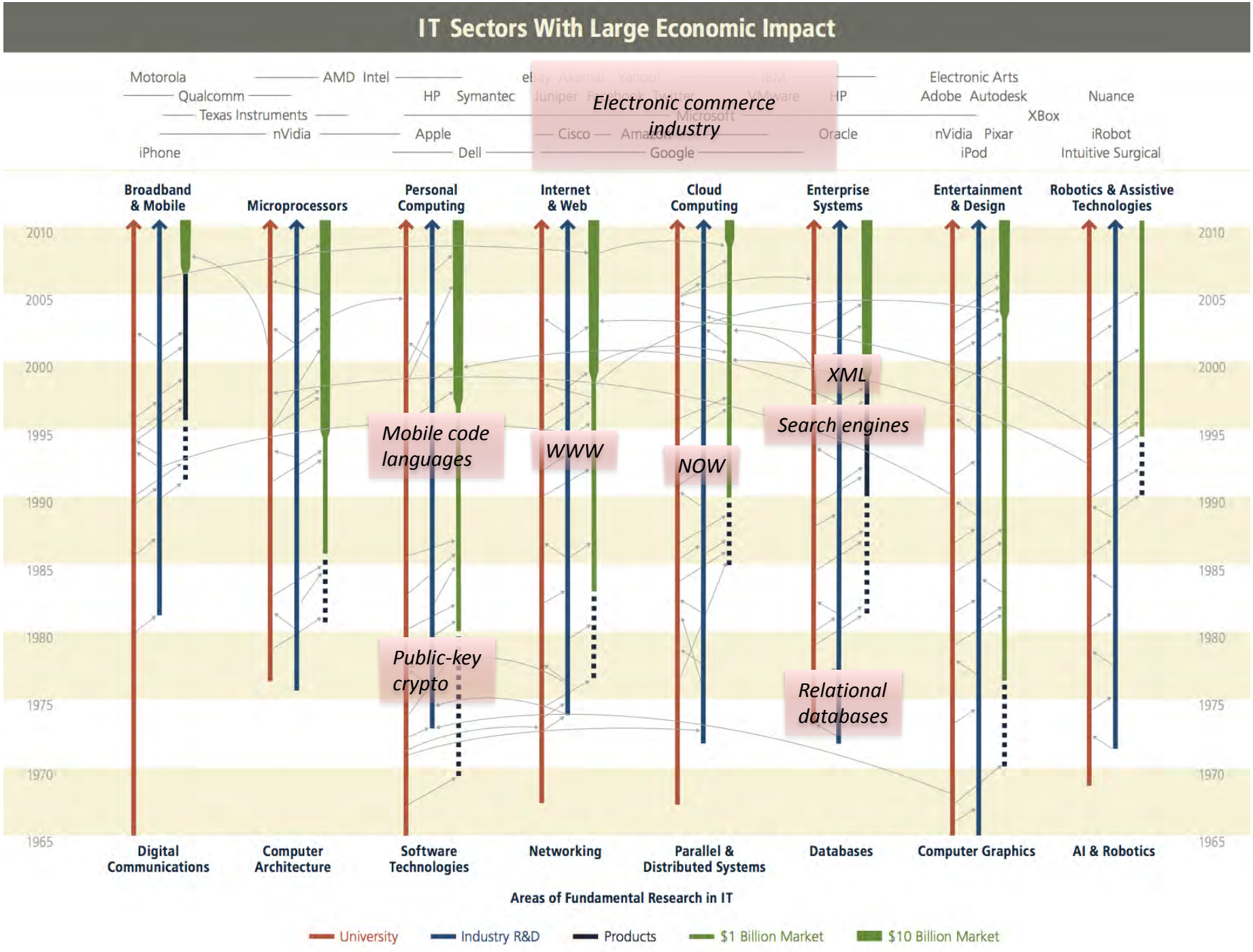
CSTB and subcommittee members

Jon Eisenberg and Emily Ann Meyer

Thank you!

The report and slide available at www.cstb.org

[extras]


IT Sectors With Large Economic Impact
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Symantec
Texas Instruments
nVidia
Apple
Cisco
Oracle
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Dell
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Autodesk
Nuance
XBox
nVidia
Pixar
iRobot
iPod
Intuitive Surgical
Electronic commerce industry
Broadband & Mobile
Microprocessors
Personal Computing
Internet & Web
Cloud Computing
Enterprise Systems
Entertainment & Design
Robotics & Assistive Technologies
2010
2005
2000
1995
1990
1985
1980
1975
1970
1965
Mobile code languages
WWW
NOW
XML
Search engines
Public-key crypto
Relational databases
Digital Communications
Computer Architecture
Software Technologies
Networking
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Bottom line: **Leadership in IT** depends on a **commitment to research**

Focal points for the update

- **Audience**:
  - Policymakers
  - “Yeah, it sure takes a long time to understand and explain that diagram.”

- **Product**:
  - A powerpoint friendly figure + report
  - Stick with what works, but update & streamline