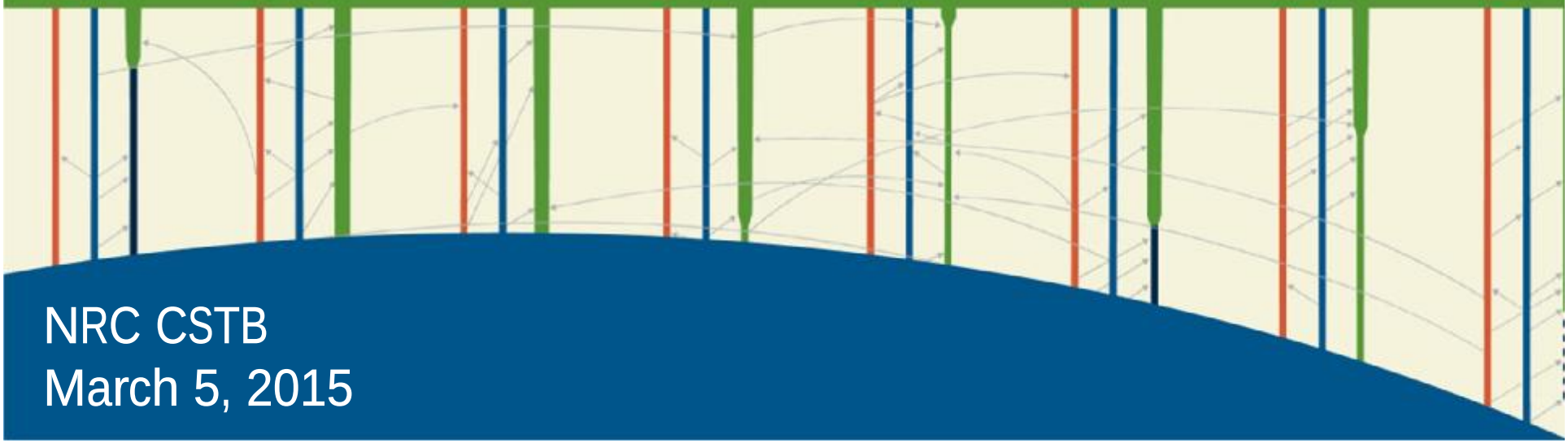
Continuing Innovation IN INFORMATION TECHNOLOGY



NRC CSTB
March 5, 2015

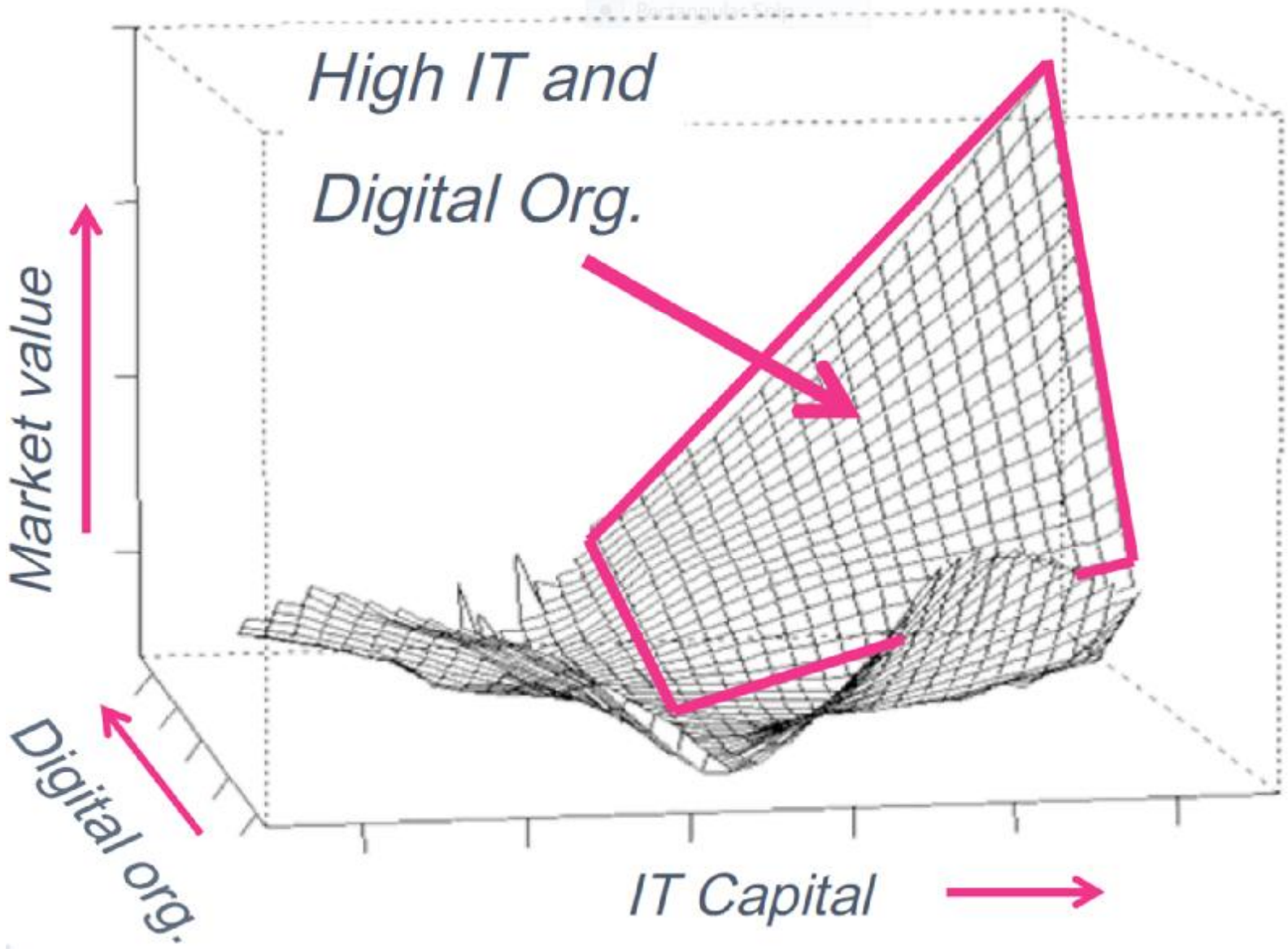
The economic impact of information technology

ICT industry value-add to GDP grew by nearly 10% over past 5 years; 5.7% of 2013 US GDP [BEA]

Projected job growth 2012-20 of 28-32% in s/w dev+related [NRC]

Internet directly supports 21% of GDP growth in mature economies [McKinsey Global]

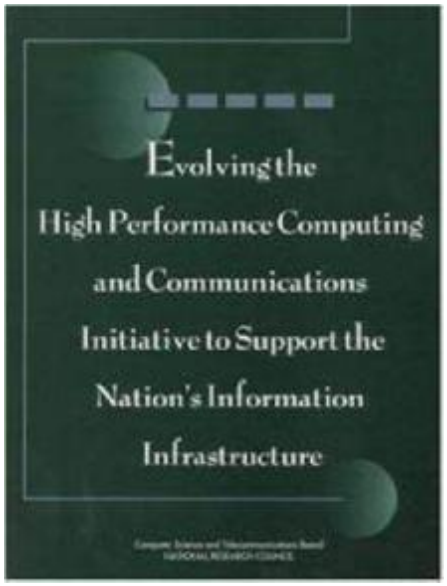
Federal funding in FY2010 for NIT R&D was <0.03% US GDP [NRC]



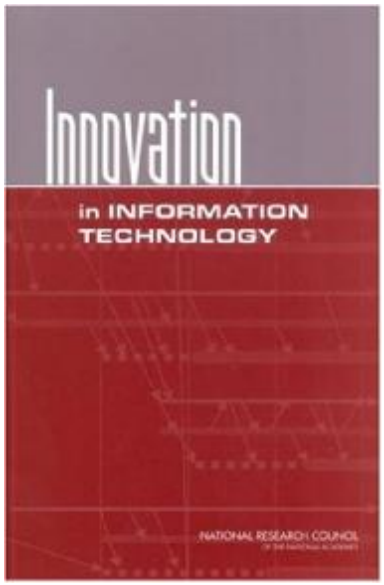
Brynjolfsson, Hitt, and Yang 2002

How did we get here?

A recurring subject of study by NRC

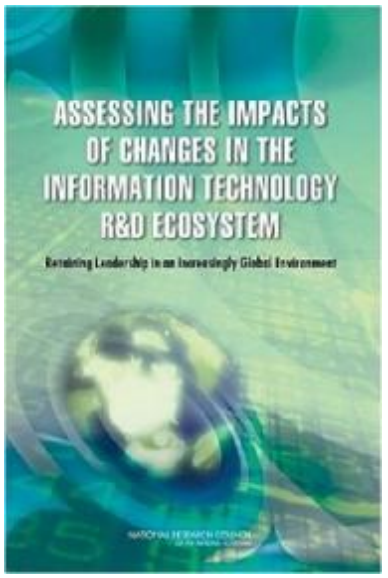


1995



2003

2011



2009

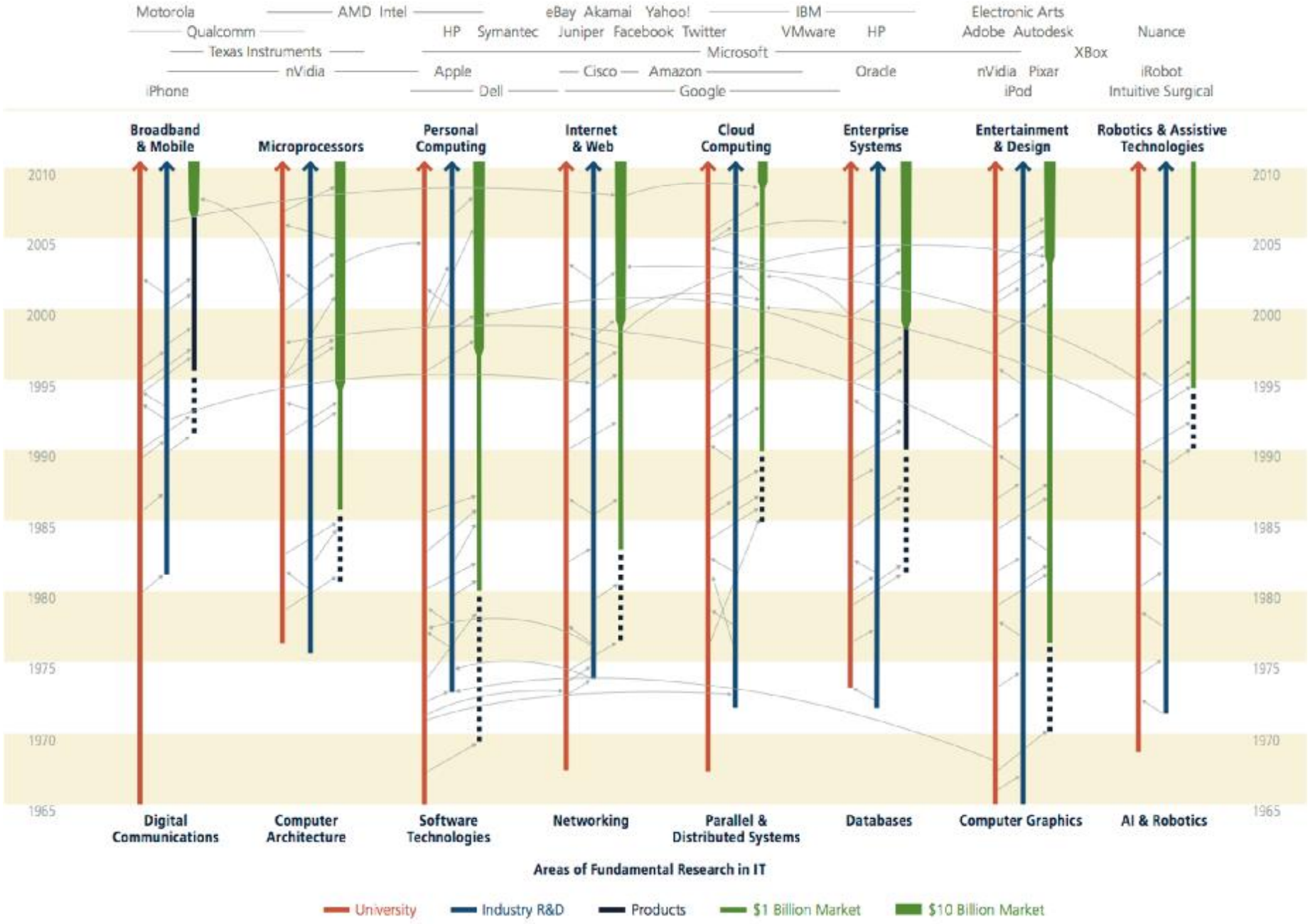
NRC's findings

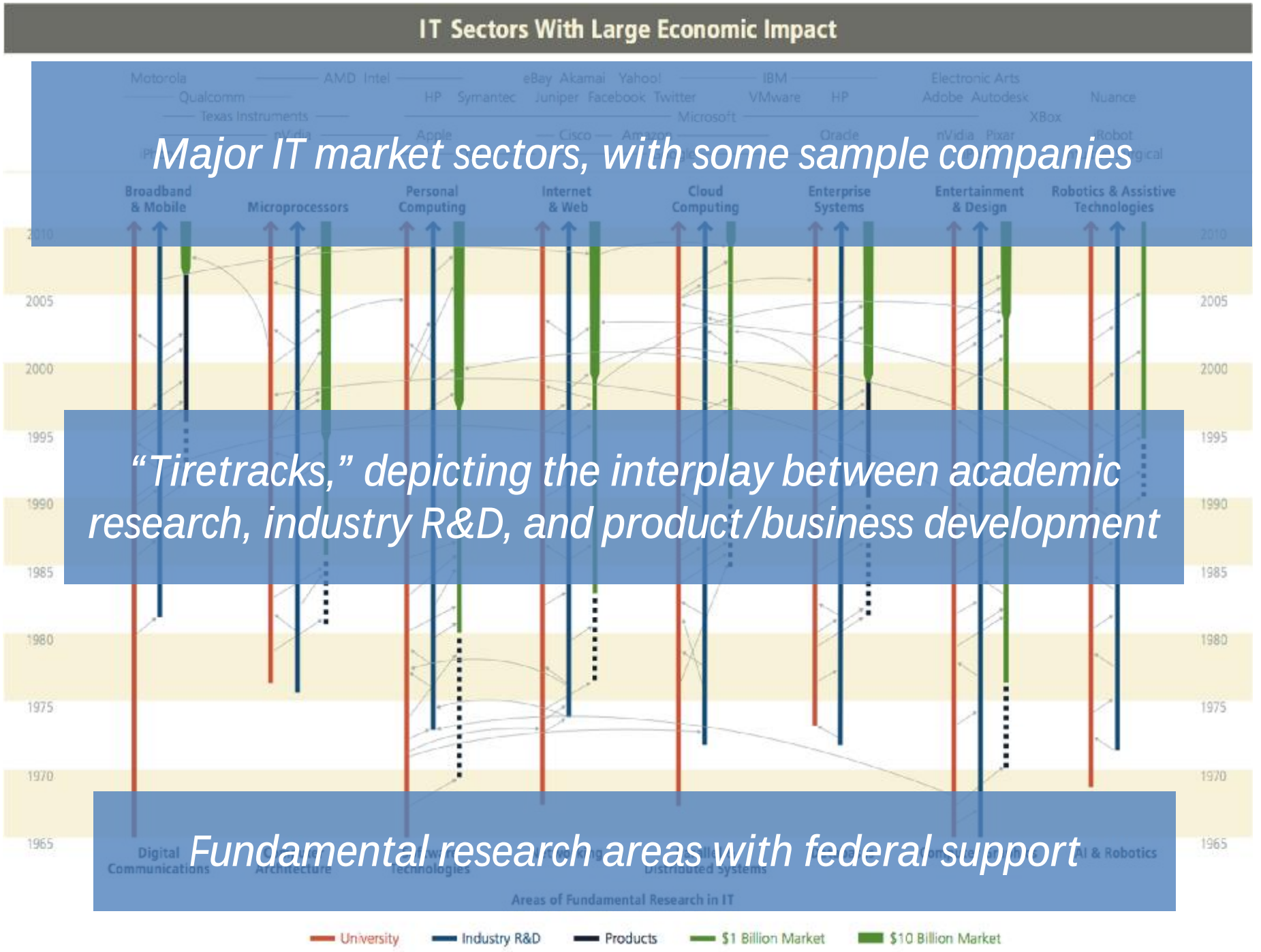
An innovation ecosystem involving gov't, academic, industry

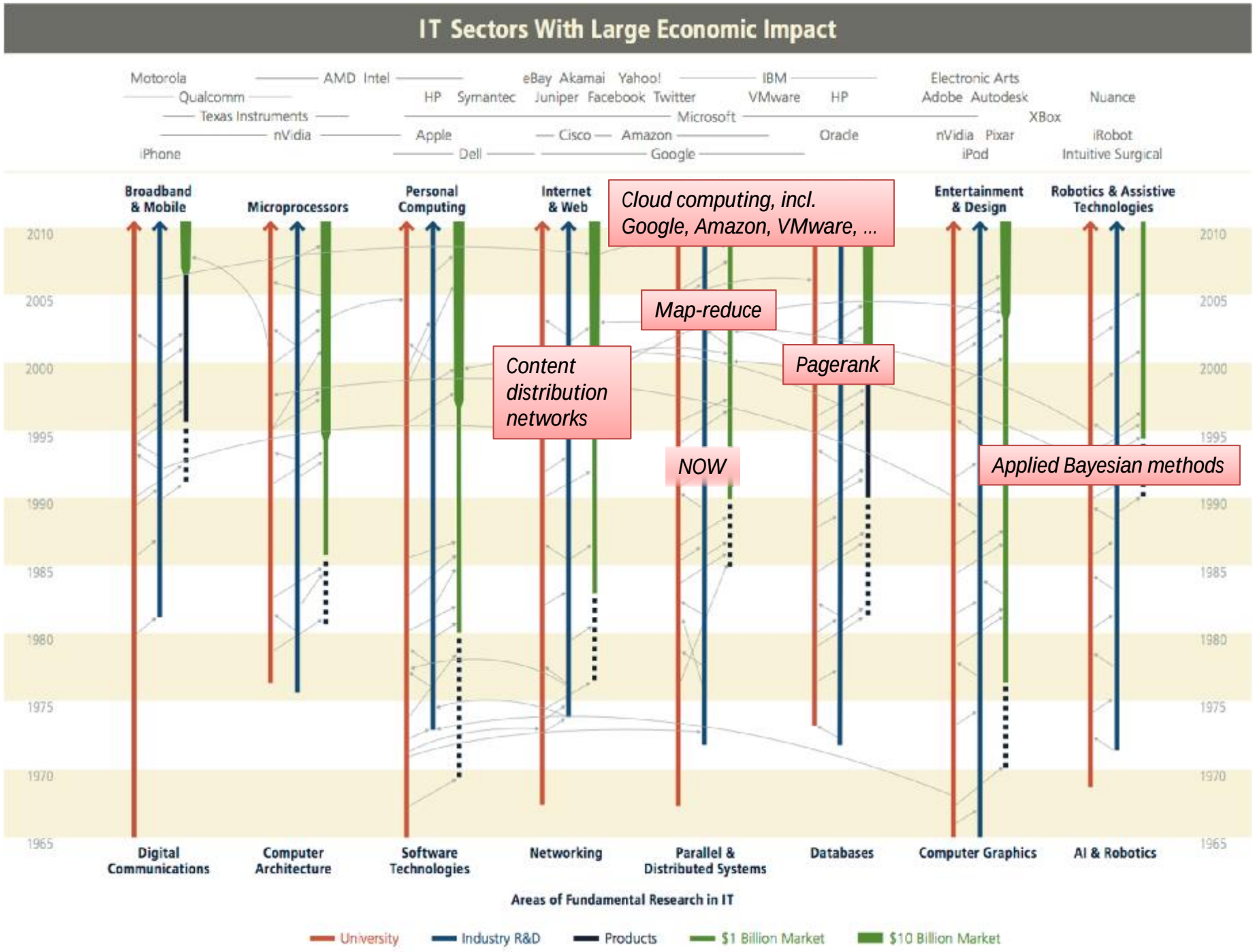
The ability to sustain 10-15 yr time from research breakthrough to economic impact

Uniqueness in harnessing technological surprise and unanticipated impacts

IT Sectors With Large Economic Impact



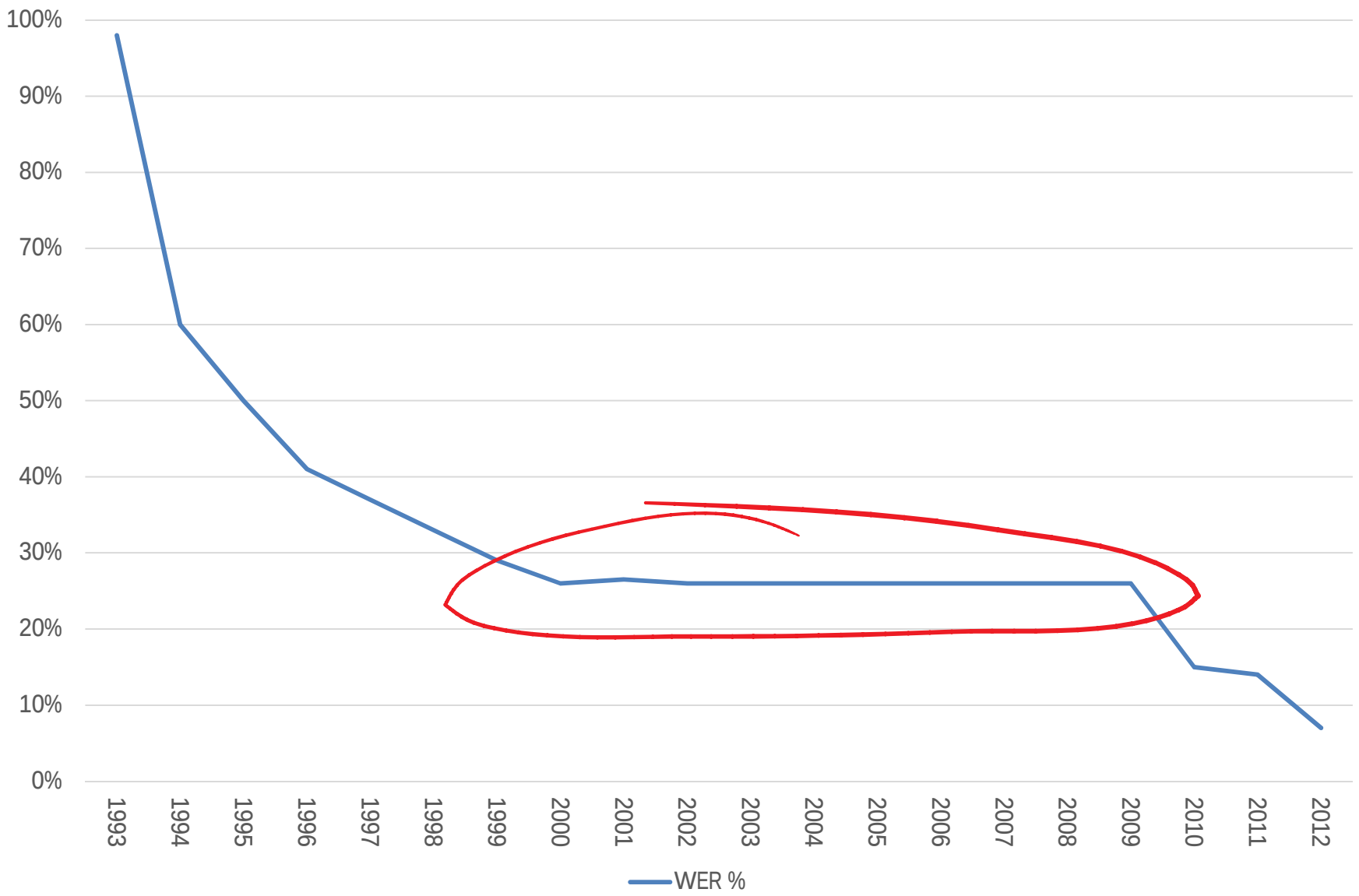

IT Sectors With Large Economic Impact
Major IT market sectors, with some sample companies
Broadband & Mobile
Microprocessors
Personal Computing
Internet & Web
Cloud Computing
Enterprise Systems
Entertainment & Design
Robotics & Assistive Technologies
"Tiretracks," depicting the interplay between academic research, industry R&D, and product/business development
Fundamental research areas with federal support
Areas of Fundamental Research in IT
University
Industry R&D
Products
$1 Billion Market
$10 Billion Market


IT Sectors With Large Economic Impact
Motorola
Qualcomm
Texas Instruments
nVidia
iPhone
AMD
Intel
Apple
Dell
HP
Symantec
eBay
Akamai
Yahoo!
Juniper
Facebook
Twitter
Microsoft
Cisco
Amazon
Google
IBM
VMware
HP
Oracle
Electronic Arts
Adobe
Autodesk
nVidia
Pixar
iPod
Nuance
XBox
iRobot
Intuitive Surgical
Broadband & Mobile
Microprocessors
Personal Computing
Internet & Web
Entertainment & Design
Robotics & Assistive Technologies
Cloud computing, incl. Google, Amazon, VMware, ...
Map-reduce
Content distribution networks
Pagerank
NOW
Applied Bayesian methods
2010
2005
2000
1995
1990
1985
1980
1975
1970
1965
Digital Communications
Computer Architecture
Software Technologies
Networking
Parallel & Distributed Systems
Databases
Computer Graphics
AI & Robotics
Areas of Fundamental Research in IT
University
Industry R&D
Products
$1 Billion Market
$10 Billion Market

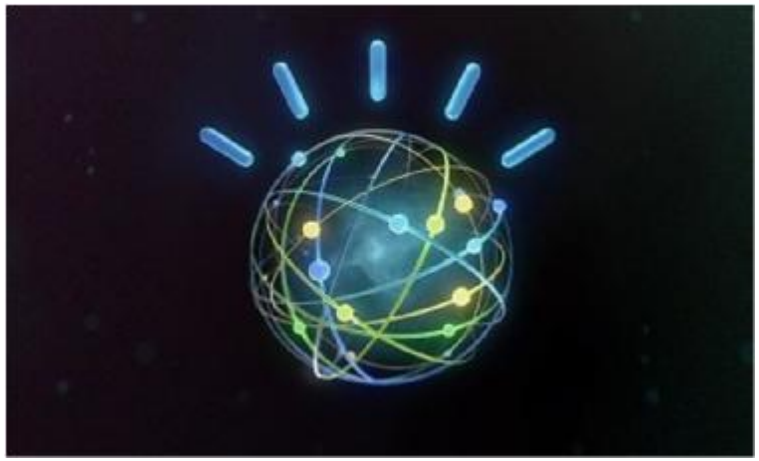
Workshop agenda

8:30 – 9:00	**Robotics, Automation, and the Future of Transportation** Rodney Brooks, Rethink Robotics
9:00 – 10:30	**User Experience and Social Computing** Scott Hudson, Carnegie Mellon University Duncan Watts, Microsoft *Moderator: Beth Mynatt, Georgia Institute of Technology*
10:30	**Break**
11:00-11:30	**History of Wearables** Thad Starner, Georgia Institute of Technology
11:30	**Lunch**
12:30 – 1:30 PM	**Computer architecture, hardware, and systems** Margaret Martinosi, Princeton University Bob Colwell, Intel (retired) *Moderator: Barbara Liskov, Massachusetts Institute of Technology*
1:30 – 2:30	**Machine Learning and Artificial Intelligence** Jaime Carbonell, Carnegie Mellon University Eric Horvitz, Microsoft *Moderator: Peter Lee, Microsoft Research*
2:30 -2:45	**Break**
2:45 – 4:00	**Communications** Vint Cerf, Google David Culler, University of California, Berkeley Andrea Goldsmith, Stanford University *Moderator: Mark Dean, University of Tennessee, Knoxville*
4:00 – 4:30	**Cybersecurity/privacy/critical infrastructure** Stefan Savage, University of California, San Diego
4:30 – 5:30	**Value of Research Funding for Innovation** Deborah Estrin, Cornell Farnam Jahanian, Carnegie Mellon University *Moderator: Peter Lee , Microsoft Research*
5:30	Reception

We will hear from scholars and experts, some of whom “were there” – and others who will be there – on their reflections on the innovation ecosystem



Progress in automatic speech recognition



Research is a long game. Most modern IT companies have limited expenditures that look beyond one product cycle.

The Internet

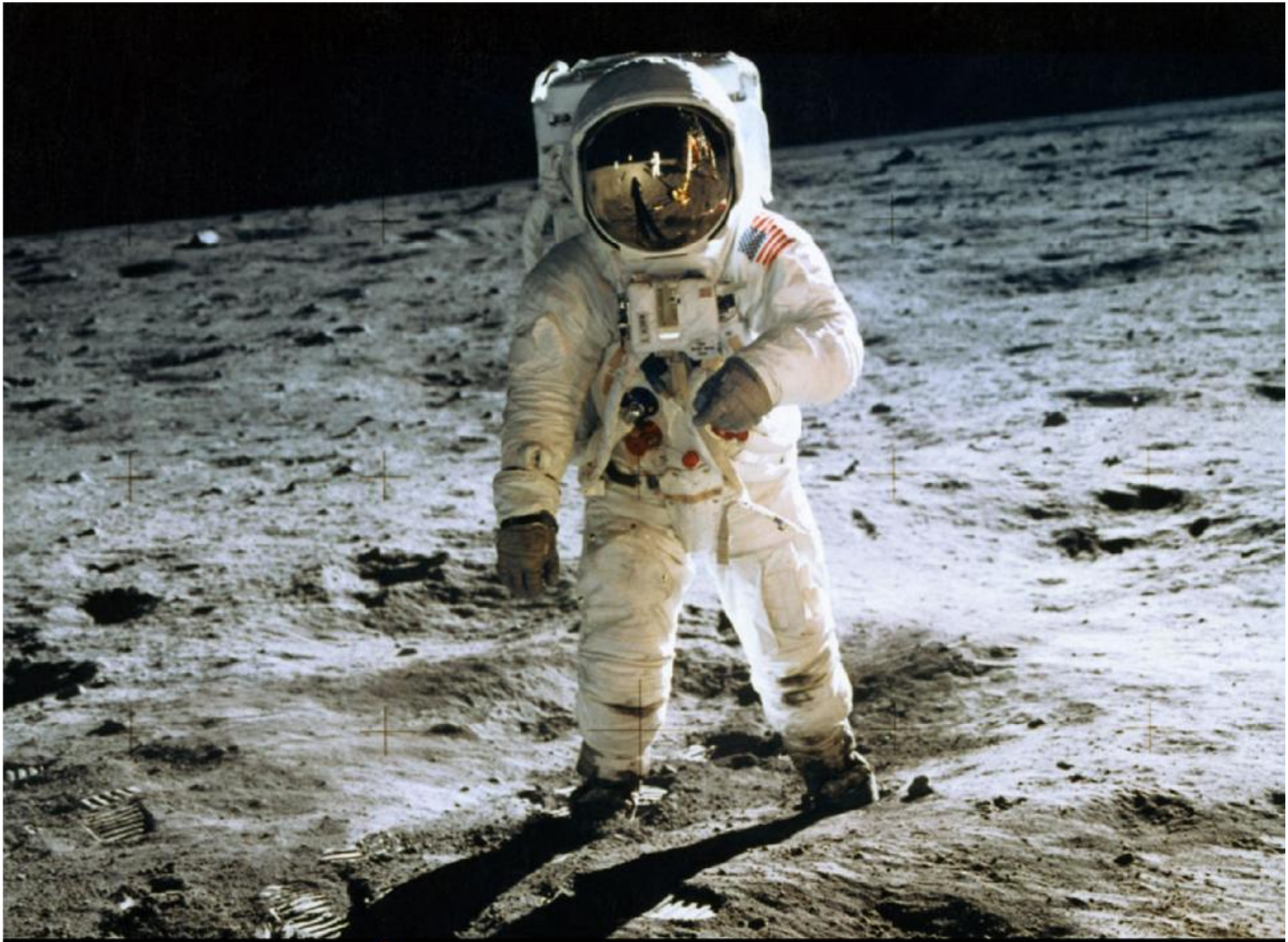
1966: First experiments in digital packet switching

1968: ARPA issues RFQ for IMPs

AT&T says it will never work, and even if it does, no one will care

1969: Len Kleinrock's student (Charley Kline) attempts remote login from UCLA SDS Sigma 7 to SRI SDS 940

29OCT69	1100	LOADED UP. PROGRAM FOR BEN BARKER BBN	CSK
	22:30	talked to SRI Host to Host	CSK
		Left up. Program running after sending a host dead message to imp.	CSK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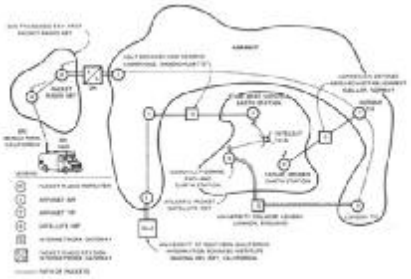
Which had more impact?



Has your child been to the moon?

Acknowledgments

NRC and NSF

Mark Dean, Tennessee

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Yann LeCun, Facebook & NYU

Barbara Liskov, MIT

Beth Mynatt, Georgia Tech

Virginia Bacon Talati, NRC

Jonathan Eisenberg, NRC

Shenae Bradley, NRC