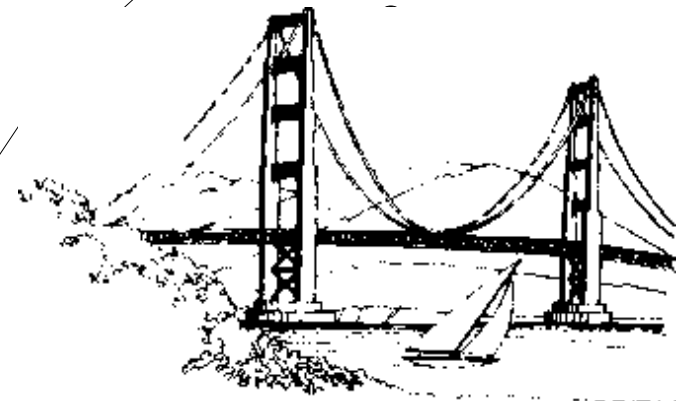

NETWORK INDUSTRY DYNAMICS

George Mattathil

August 14, 2004



- "AT&T posts \$12.7-billion loss for second quarter" - AP, July 2002
- "AT&T posts \$1.7 billion loss" - Telephony online, Jan 2001
- "\$80B loss for WorldCom" - BBC, Mar 2003
- "Lucent Posts \$8.8 Billion 4Q Loss" - REUTERS, Oct 2001
- "Lucent announces \$1 billion loss, layoffs" - IDG, Jan 2001
- "Nortel forecasts \$19.2B net Q2 loss; cuts 10,000 more jobs" - IDG, Jun 2001
- "Qwest: net loss of \$38.47 billion for 2002" - Denver Post, Feb 2004
- "Global Crossing: Quarterly Net loss of \$24.88 Billion Isn't a Typo" - Wall Street Journal, Mar 2004
- "Ericsson axes 17,000 jobs" - Guardian (UK), Apr 2002
- "Alcatel to post another huge loss; cutting 30,000 jobs over 2001 and 2002" - CNN (Europe), Apr 2002
- "Marconi losses reach £5.1bn" - BBC, Nov 2001



Agenda

- The meltdown
- How did this happen?
- Forces operating in the network sector
- Models to understand network industry
- Future outlook



When Will the Telecom Depression End?

"..full-blown industrial depression, one that has wiped out half a million jobs and \$2 trillion in U.S. market value."

- BusinessWeek Oct 2002



Cause

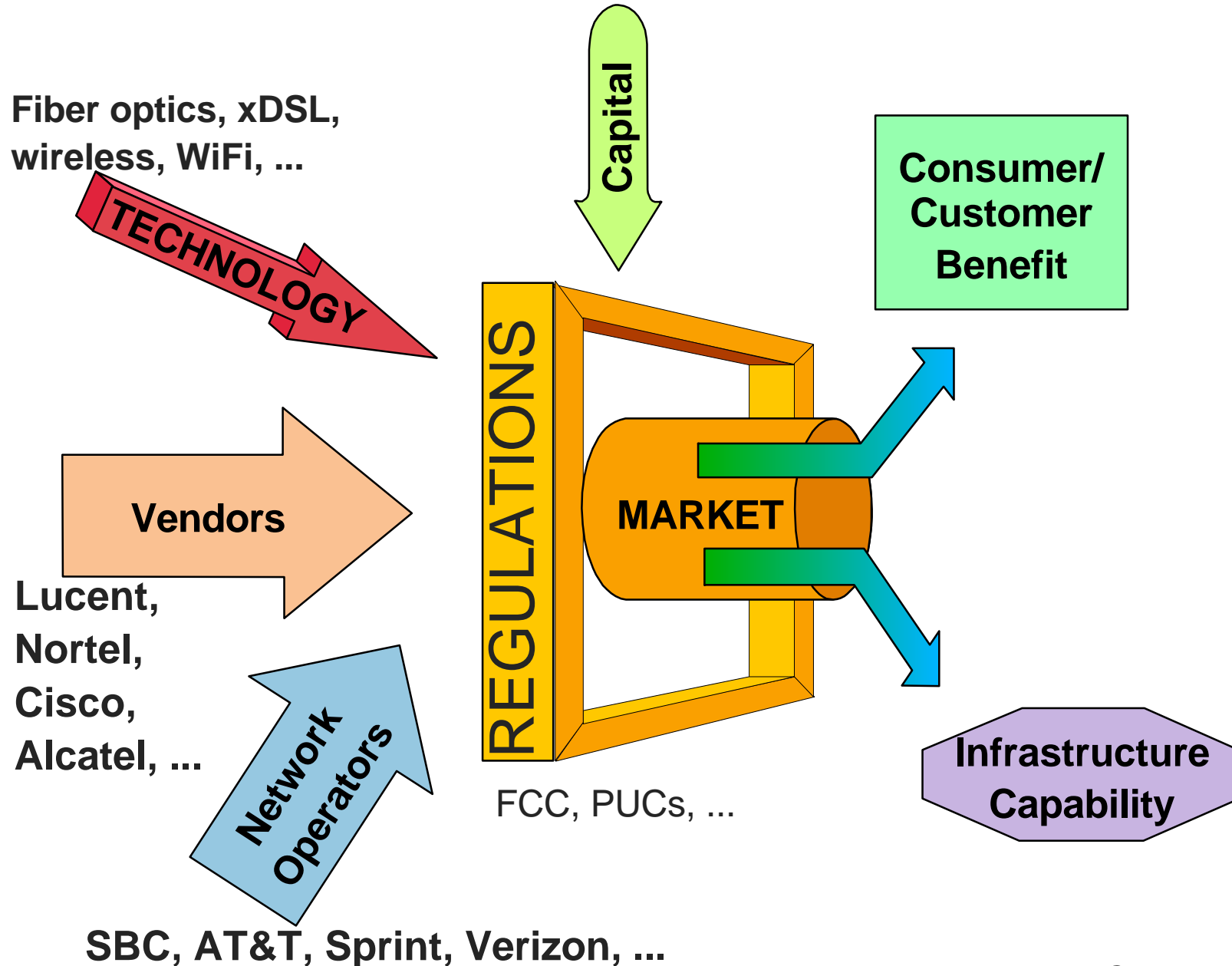
"Political (business) leaders without technical knowledge were making stupid technical decisions, and engineers did not care about the politics (business). There was (is) a great need for people with knowledge in both areas to help spur the growth of the whole telecommunications industry"

- Frank S. Barnes

2004 Winner, IEEE Gordon Prize



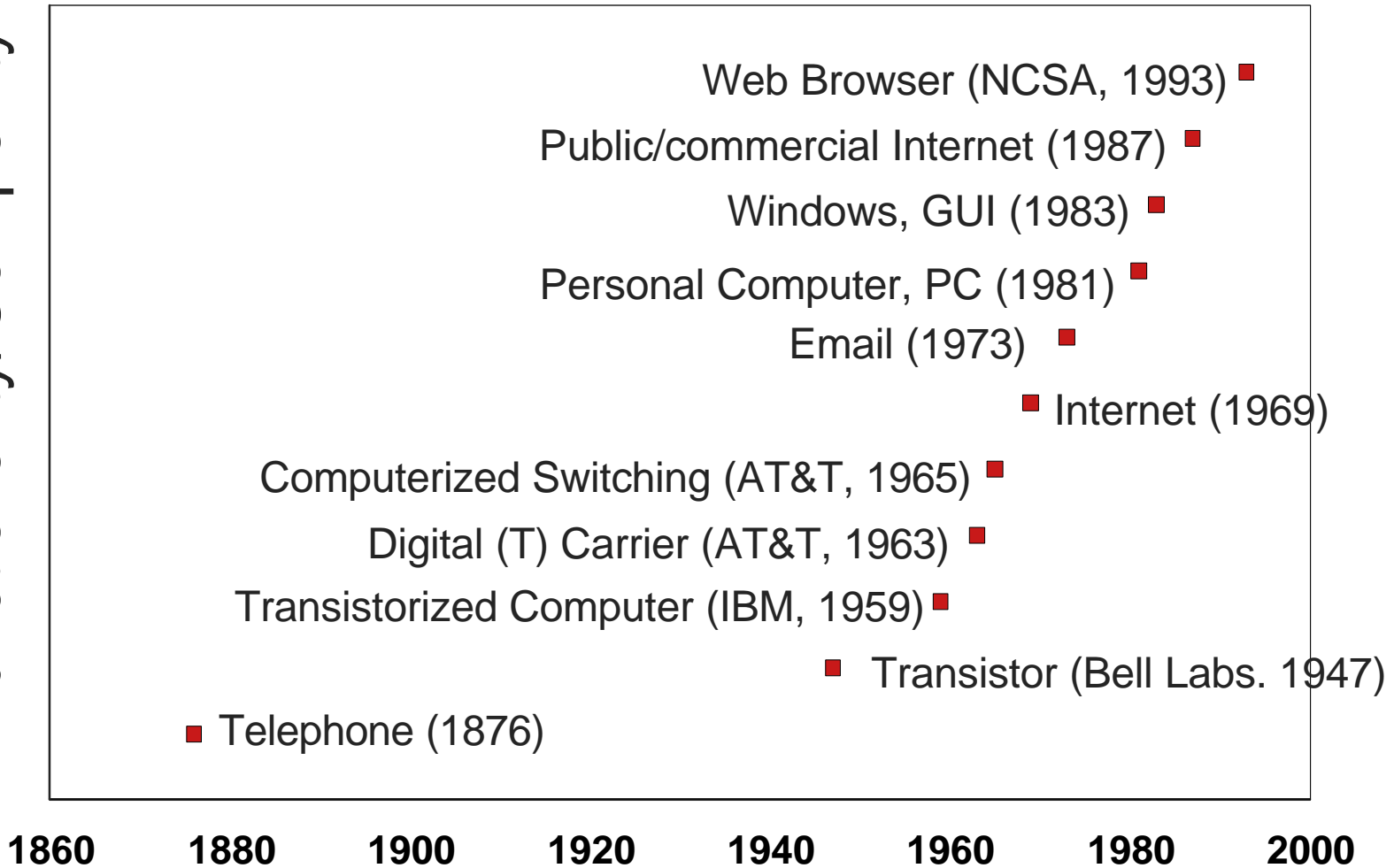
Network Marketplace





Key Developments

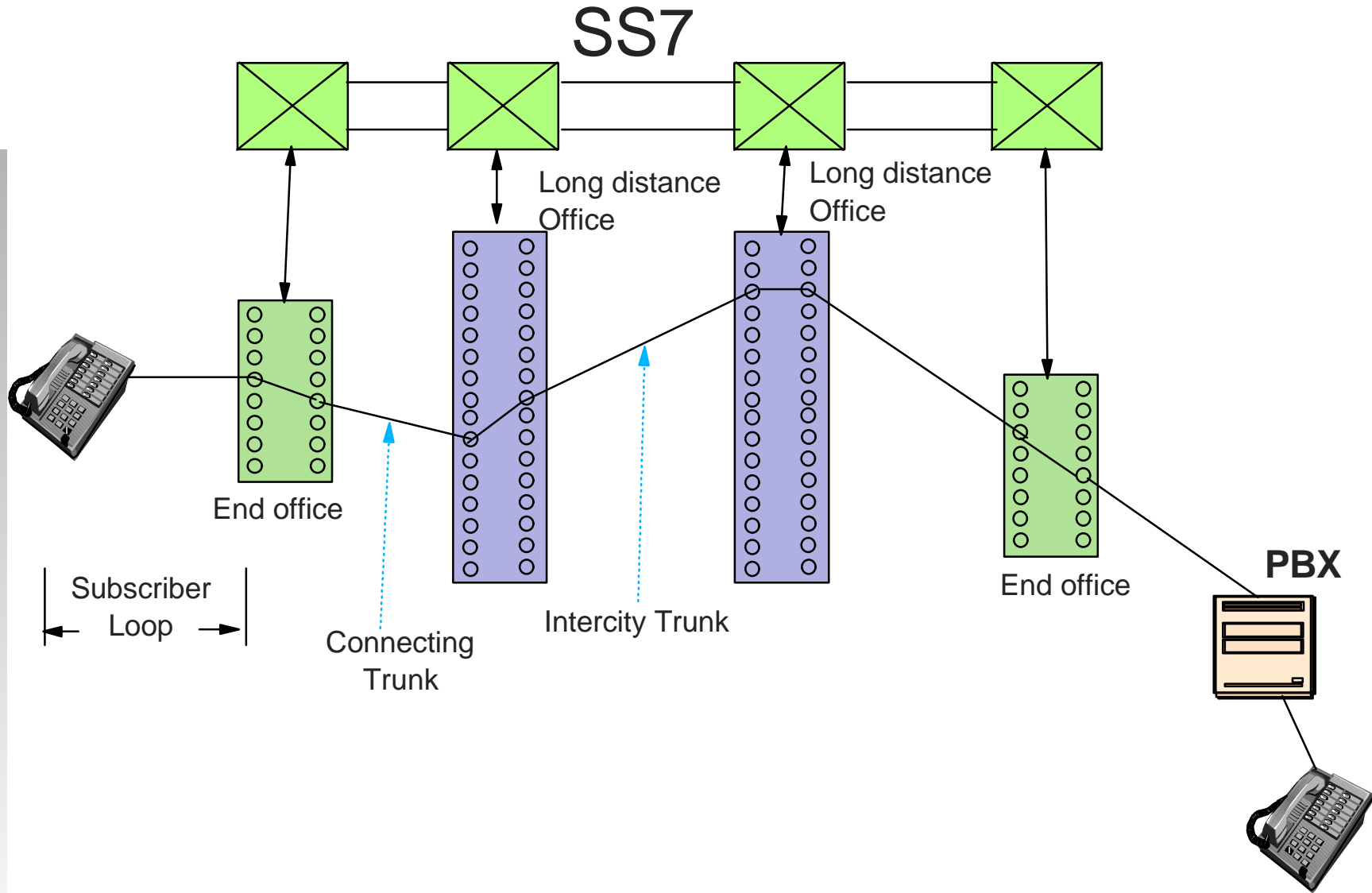
Functionality/Complexity



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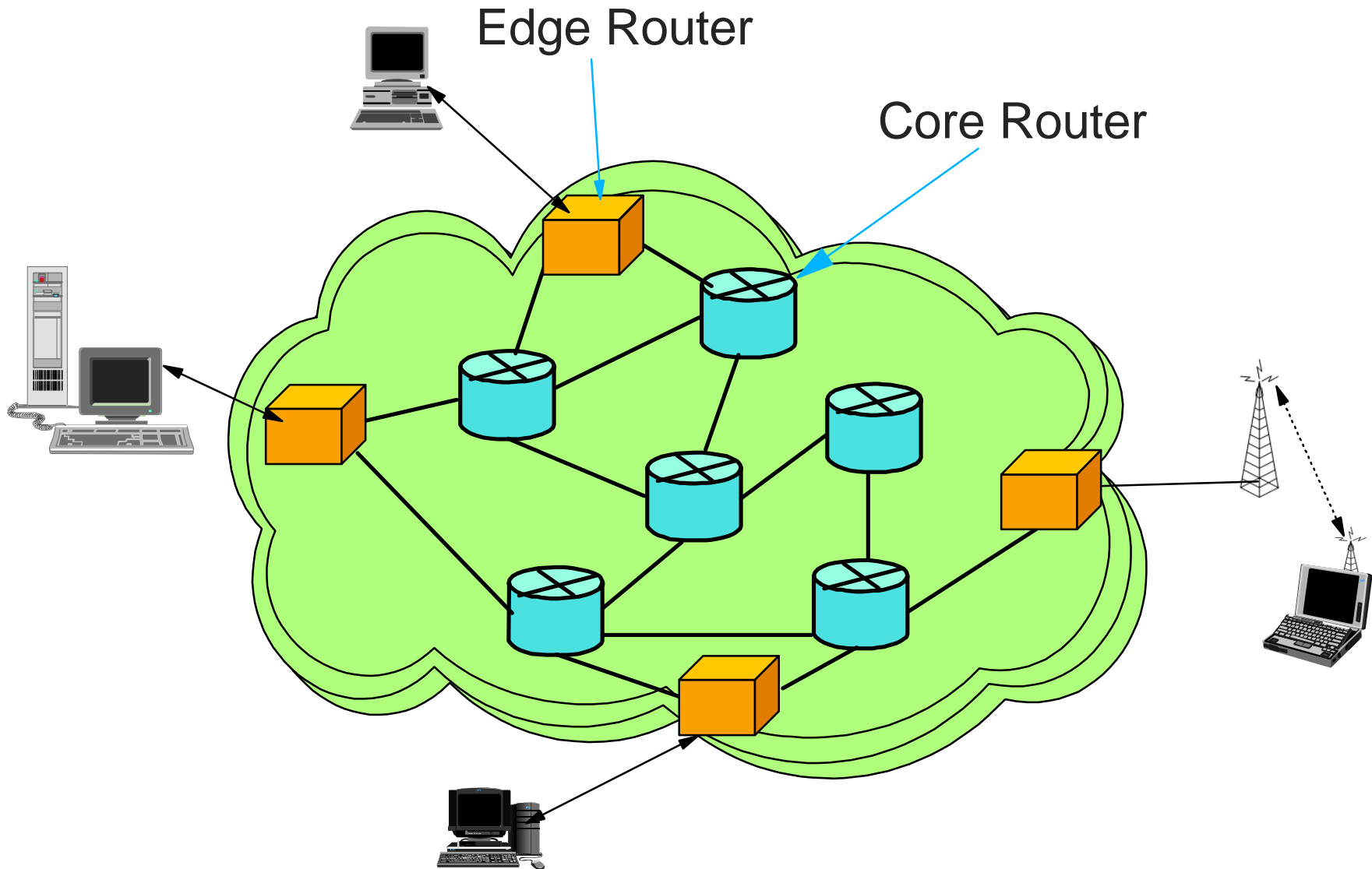


Phone (circuit) Network





Internet (packet) Network

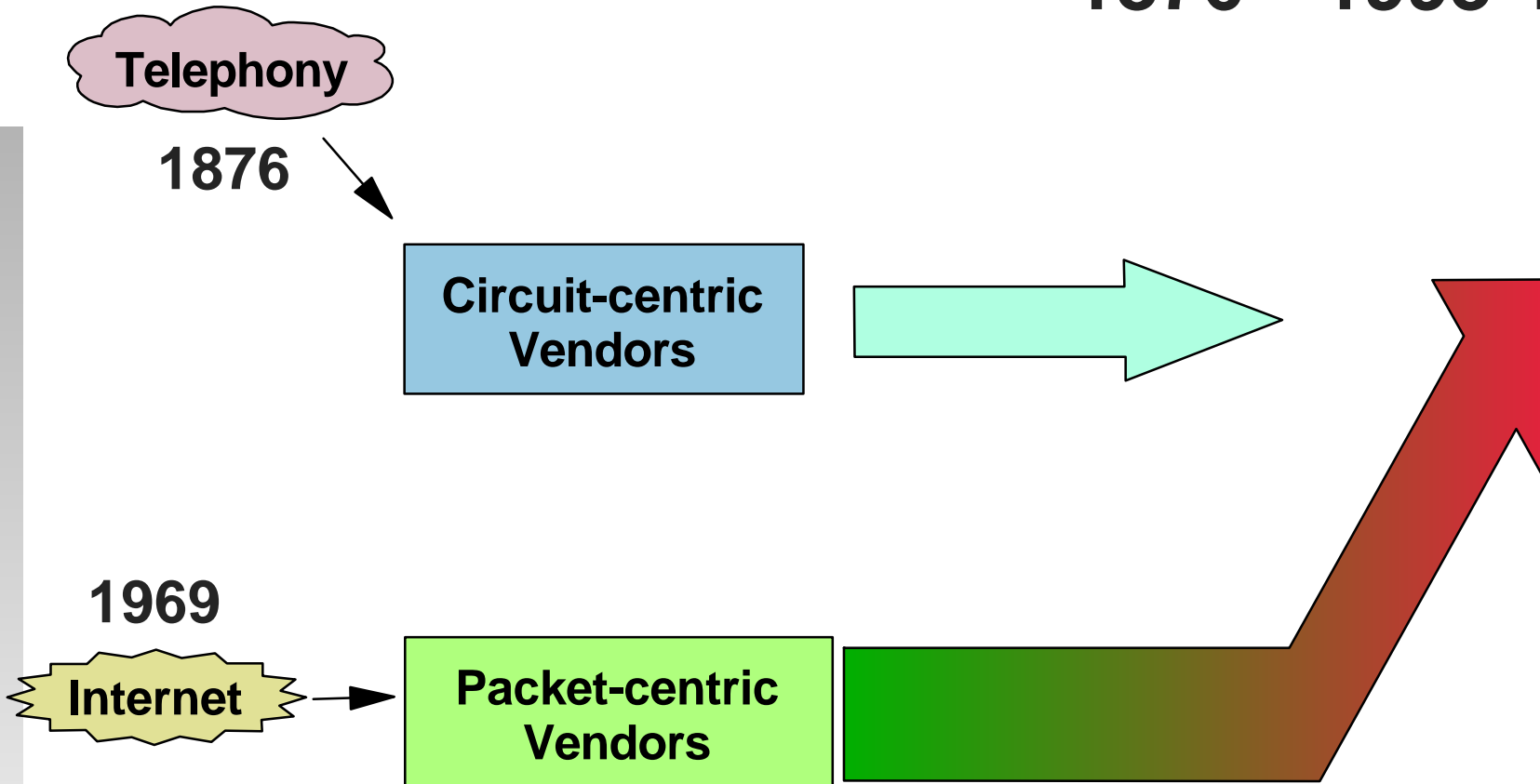


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Industry Dynamics

1876 - 1993-1997

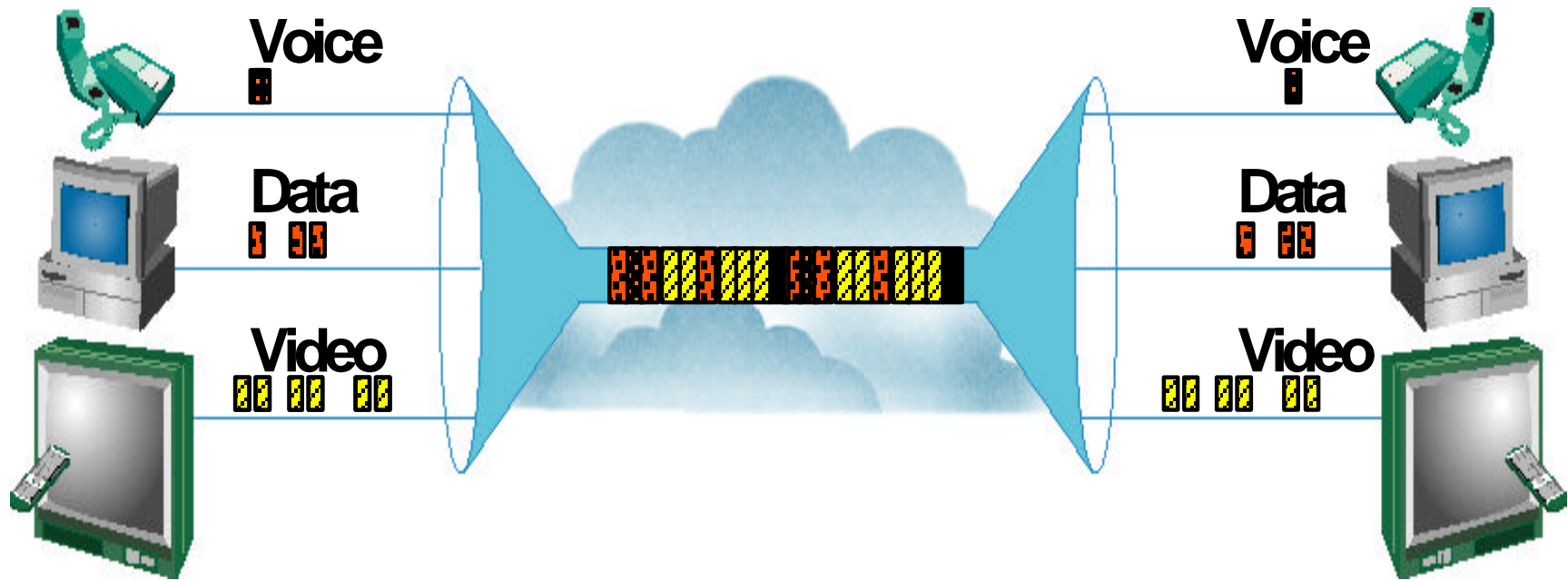


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Packet systems assimilate circuit systems



Packet-centric Model



(Homogeneous packet network)

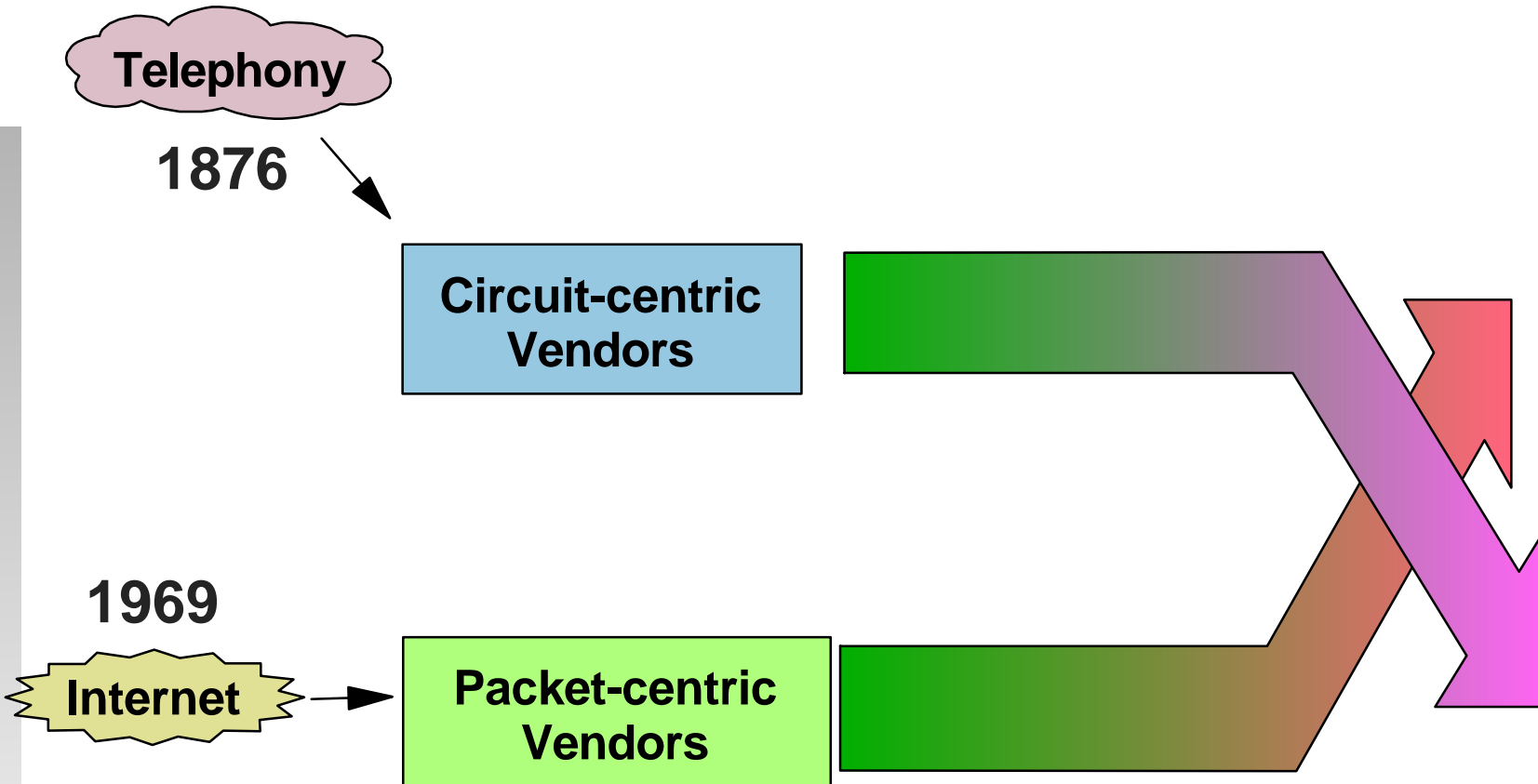
Source: Bellcore

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Industry Dynamics

1997-2003



Circuit-vendors counter attack

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Network Design Requirements

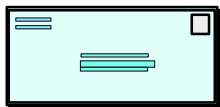
REALTIME



- ▲ Live signals
- ▲ Delay in-tolerant
- ▲ Circuit/TDM better

Circuit systems built for voice

NON-REALTIME

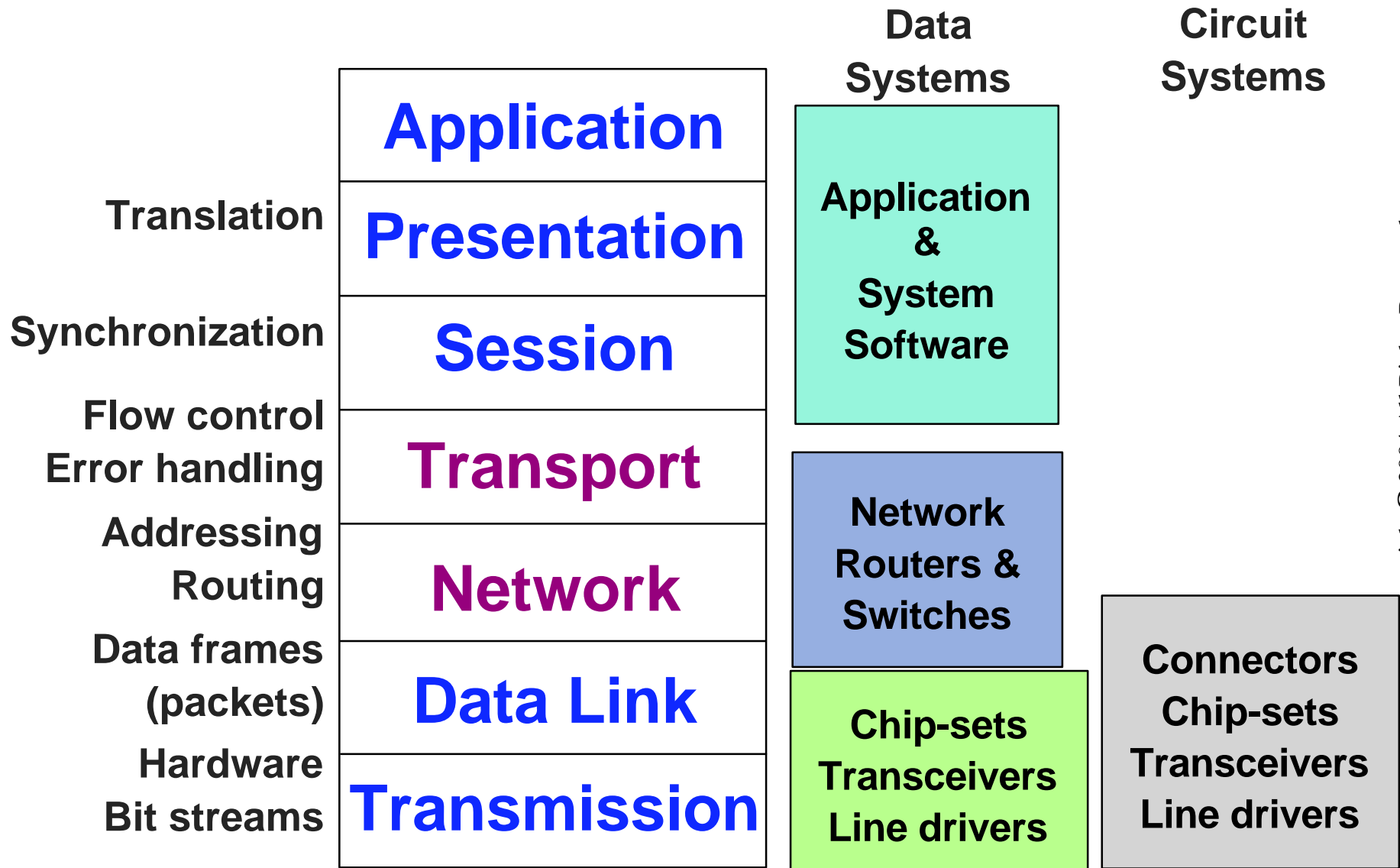


- ▲ Storable Data
- ▲ Delay tolerant
- ▲ Packet better

Internet built for computer-based data



OSI Model (Network Node)



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Two Mindsets

■ Packet -- (car rental)

- ▲ Build your own network features
- ▲ Permanent connections
- ▲ Lack distinctions between CPE* and Carrier systems

■ Circuit -- (airline / bus service)

- ▲ Provide "pipes" -- carrier model
- ▲ Give you the phone #, don't ask for ip address, DNS servers, etc.
- ▲ "On-demand" connections
- ▲ Clear distinctions between CPE* and Carrier systems

* CPE - Customer Premise Equipment



System Differences

Packet

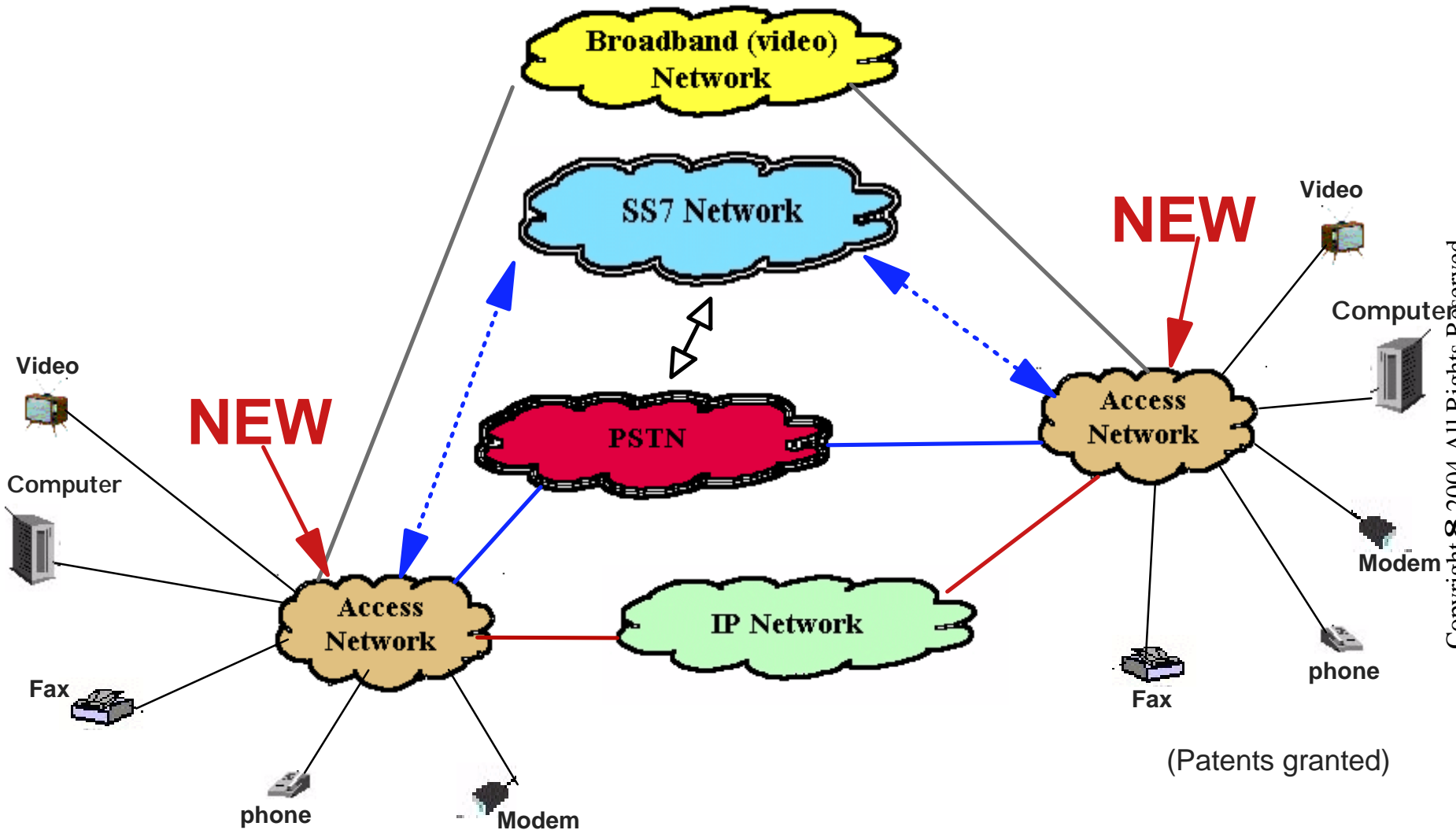
- "Best effort" system, without guarantees or perfection
- Store and forward
- Requires intermediate store and processing
- "In-band" signaling

Circuit / Time Division Multiplexing (TDM)

- 99.999% reliability (< 5 min downtime/year)
- Deterministic
- Need only intermediate signal regeneration
- "Out-of-band" signaling



Transfer Network™ Architecture (TNA™)



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support other specialized networks



Myths & Reality

Myths

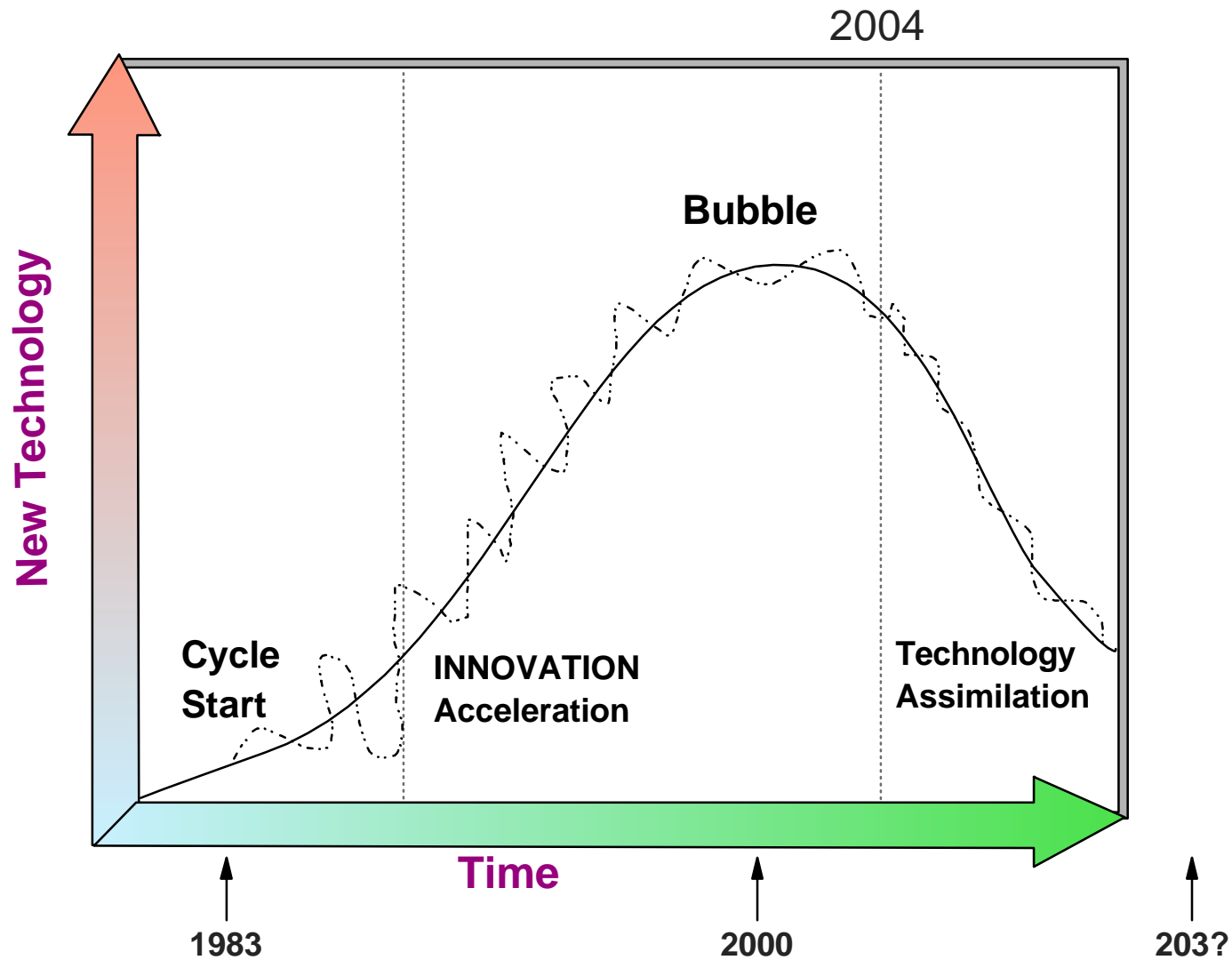
- Wireless for Broadband
- Fiber to home is economically viable
- Competition as a universal solution

Reality

- Network is a natural monopoly
- Wireline is necessary for effective Broadband
- High inertia for incumbents to change



Macro-cycle



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Kondratieff Waves: 1800-1843, 1844-1896, 1897-1945, 1946-
Bubbles: 1819, 1875, 1929, 2000

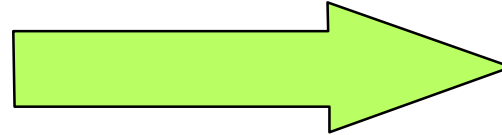


Industry Possibilities

2005-201?

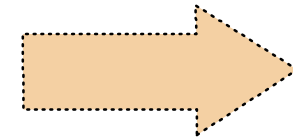
Telephony
1876

Circuit-centric
Vendors



Return to core strengths

Hybrid
Vendors



1969
Internet

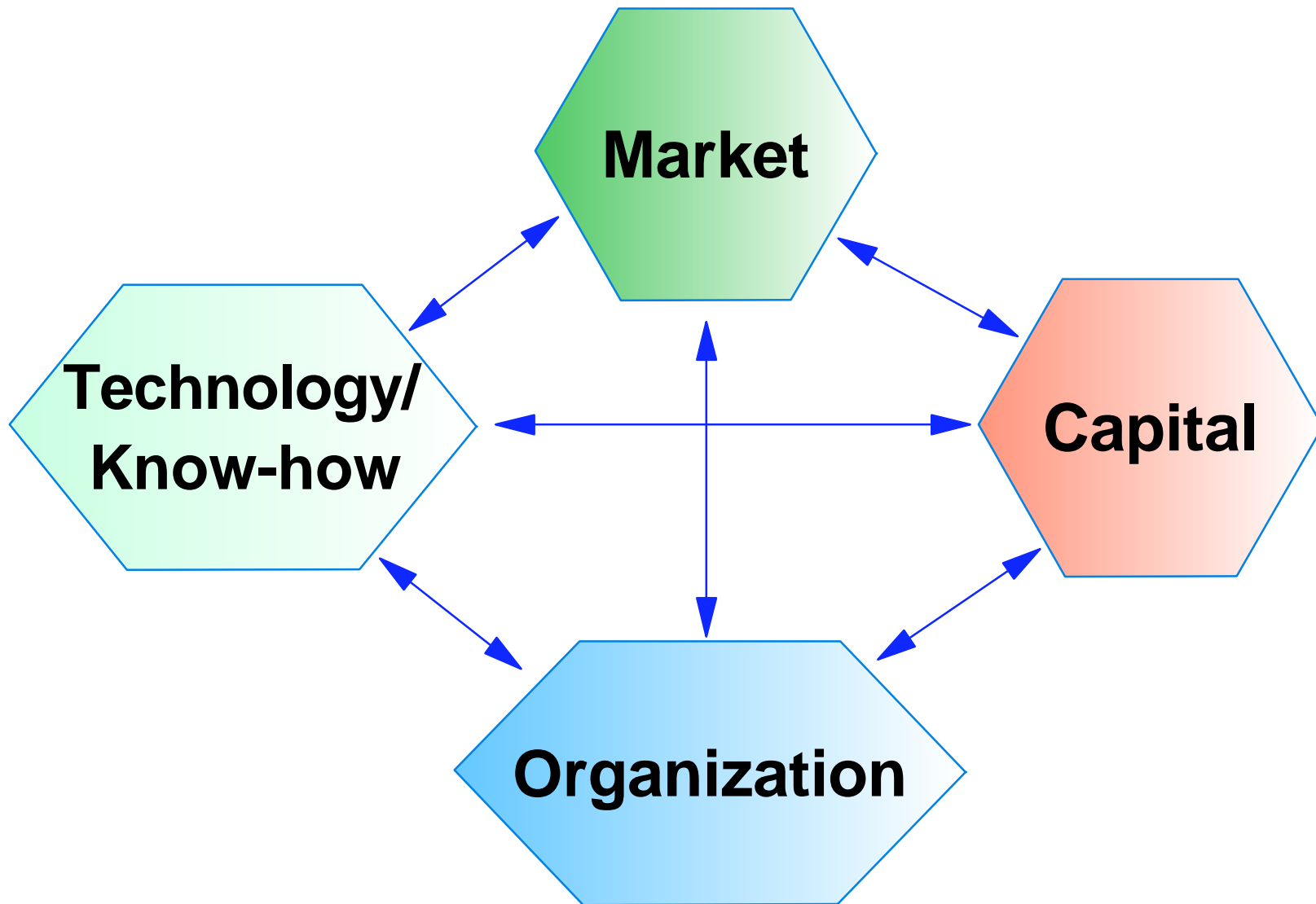
Packet-centric
Vendors



Stop mimicking circuit with packets,
and build better packet systems



Sustainable Business Model



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Contact information

- ▲ George Mattathil
- ▲ +1-650-837-0000
- ▲ george@StrategyGroup.net
- ▲ StrategyGroup.net