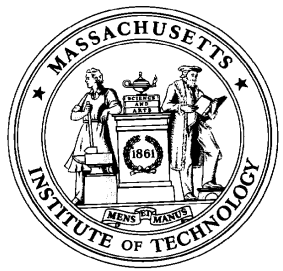
"I need someone well versed in the art of torture—do you know PowerPoint?"

Core-Edge Dynamics & Value Chain Roadmapping: A Personal History

Prof C. Fine



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January 2005

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Clockspeed published Fall 1998

Prof C. Fine

1. **Value Chains evolve over time**
2. **Benchmark the Fruit Flies**
3. **Power and Value move along the chain**
4. **We can model these dynamics**
5. **We can craft strategy w/ models of the dynamics.**
6. **Value Chain Design is a Core (Strategic) Competency**
7. **All Advantage is Temporary**

Value Chain Dynamics in a Fast Clockspeed World:
Study the Industry Fruitflies

Prof C. Fine

Evolution in the natural world:

FRUITFLIES
evolve faster than
MAMMALS
evolve faster than
REPTILES

THE KEY TOOL:

Cross-SPECIES Benchmarking of Dynamic Forces

Evolution in the industrial world:

INFOTAINMENT is faster than
MICROCHIPS is faster than
AUTOS evolve faster than
AIRCRAFT evolve faster than
MINERAL EXTRACTION

THE KEY TOOL:

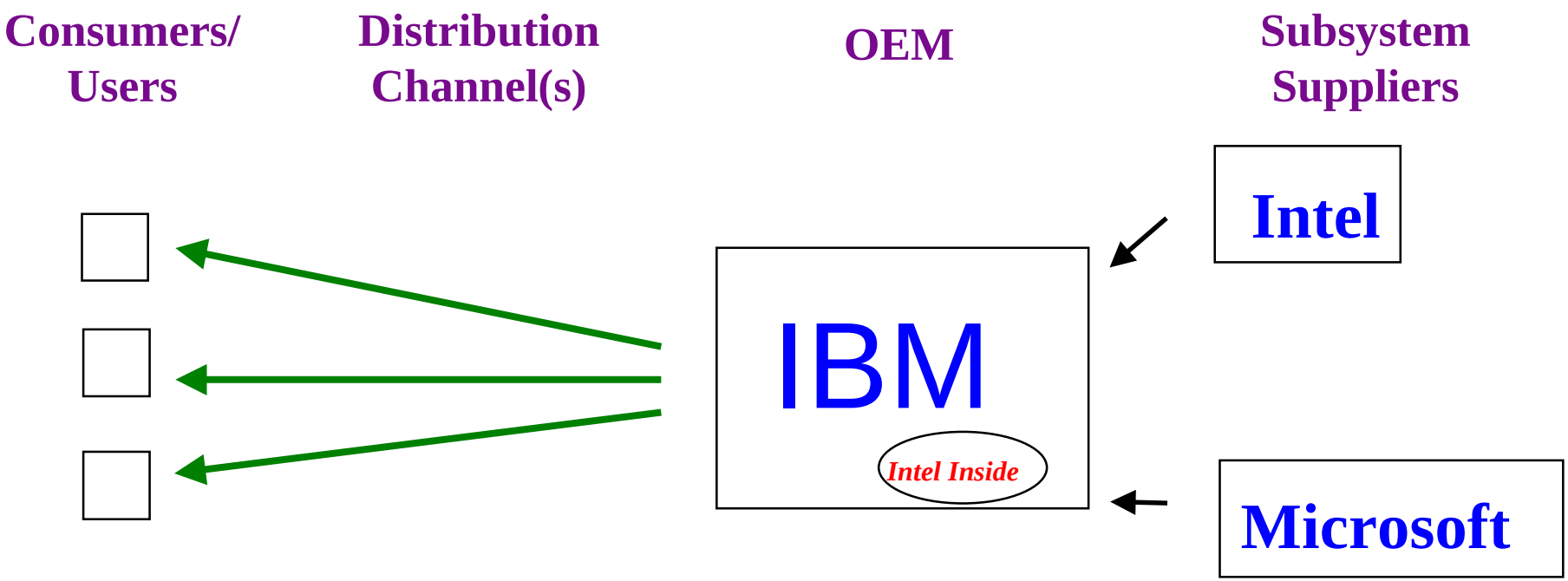
Cross-INDUSTRY Benchmarking of Dynamic Forces

The Strategic Impact of Project Design:

(Who let Intel Inside?)

Prof C. Fine

1980: IBM designs a product, a process, & a value ch



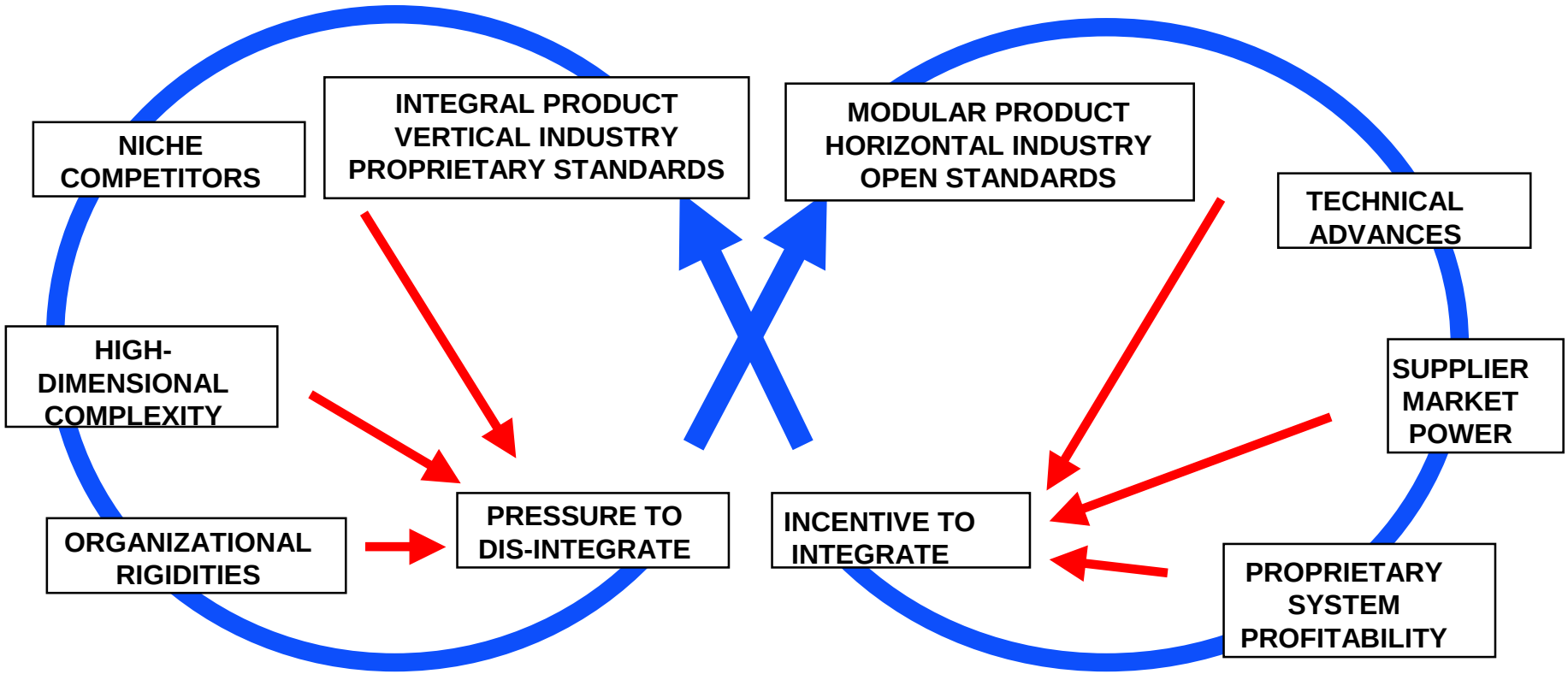
The Outcome:

- **A phenomenonally successful product design**
- **A disastrous value chain design (for IBM)**

THE DYNAMICS OF PRODUCT ARCHITECTURE STANDARDS,AND VALUE CHAIN STRUCTURE:

THE DOUBLE HELIX

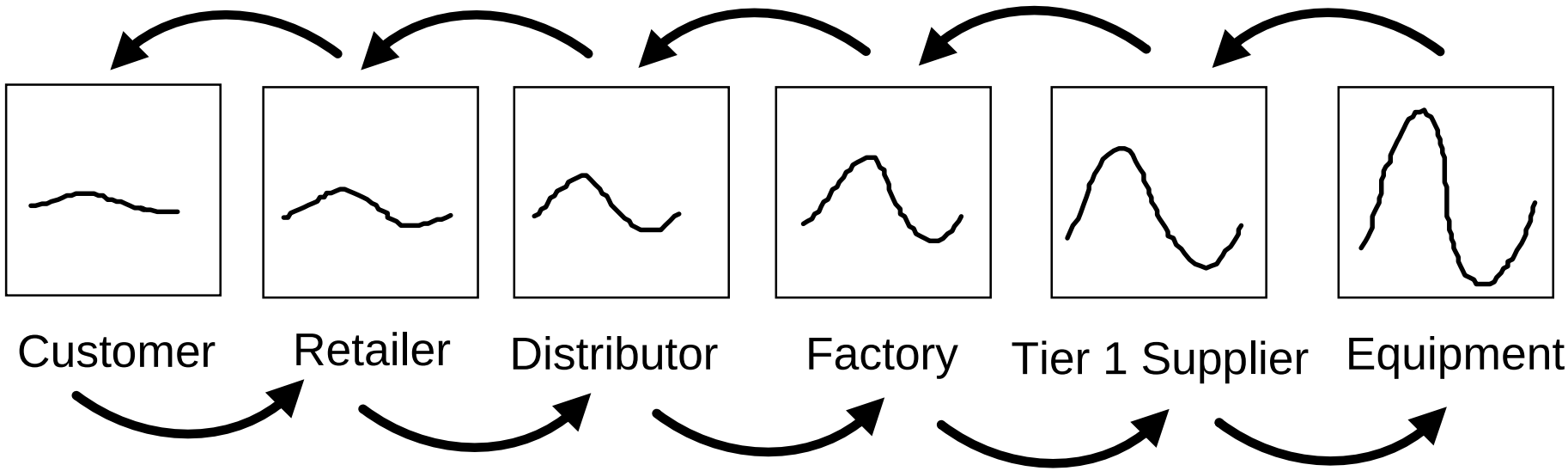
Prof C. Fine



Fine & Whitney, “Is the Make/Buy Decision Process a Core Competence?”

Volatility Amplification in the Supply Chain:
"The Bullwhip Effect"

Prof C. Fine

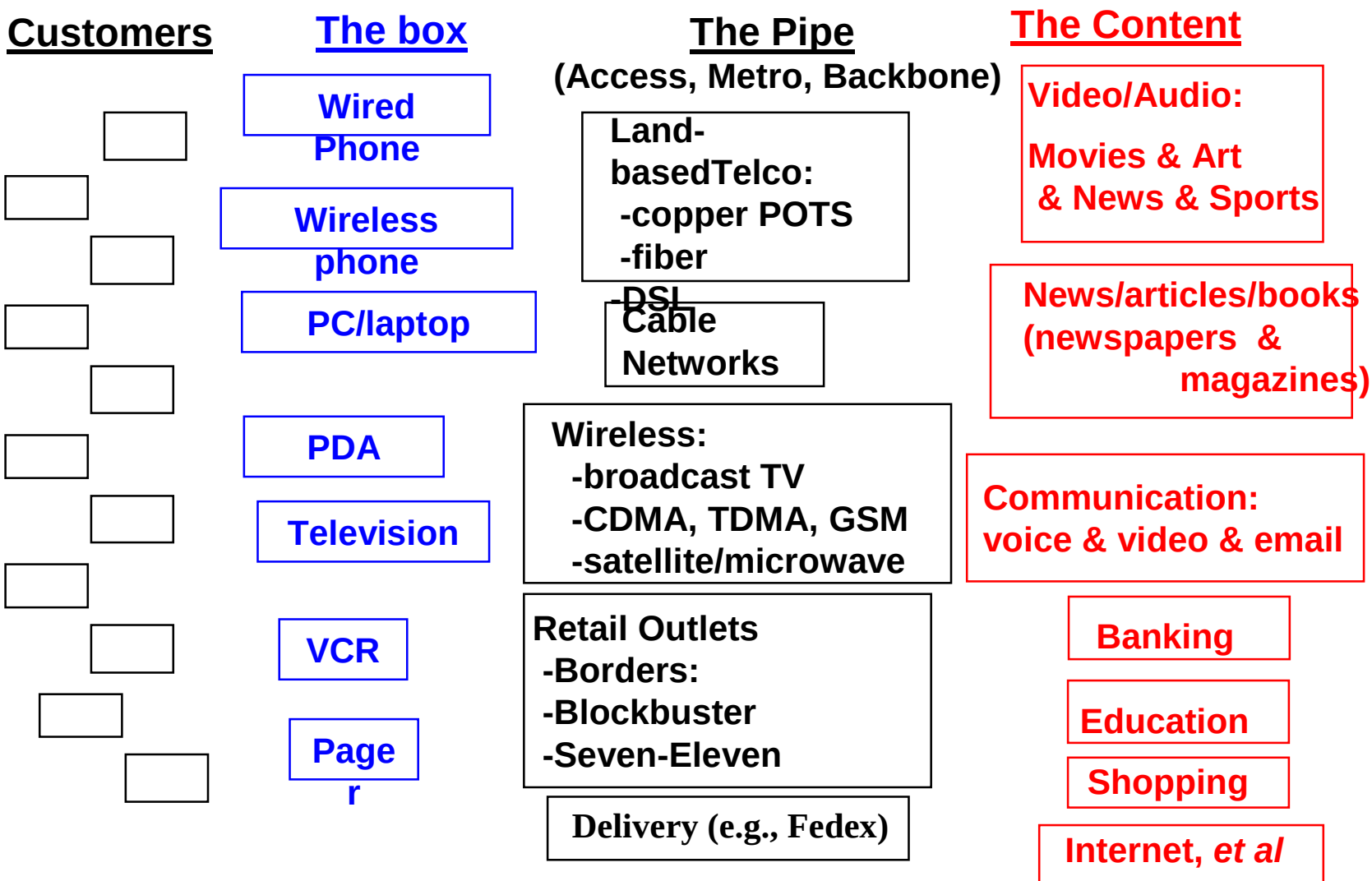


Information lags
Delivery lags
Over- and underordering
Misperceptions of feedback
Lumpiness in ordering
Chain accumulations

SOLUTIONS:
Countercyclical Markets
Countercyclical Technologies
Collaborative channel mgmt.
(Cincinnati Milacron & Boeing)

Media Supply Chains: An Industry at *Lightspeed*

Prof C. Fine



ALL COMPETITIVE ADVANTAGE IS TEMPORARY

Prof C. Fine

Autos:

Ford **in 1920,** ***GM*** **in 1955,** ***Toyota*** **in 1990**

Computing:

IBM **in 1970,** ***DEC*** **in 1980,** ***Wintel*** **in 1990**

World Dominion:

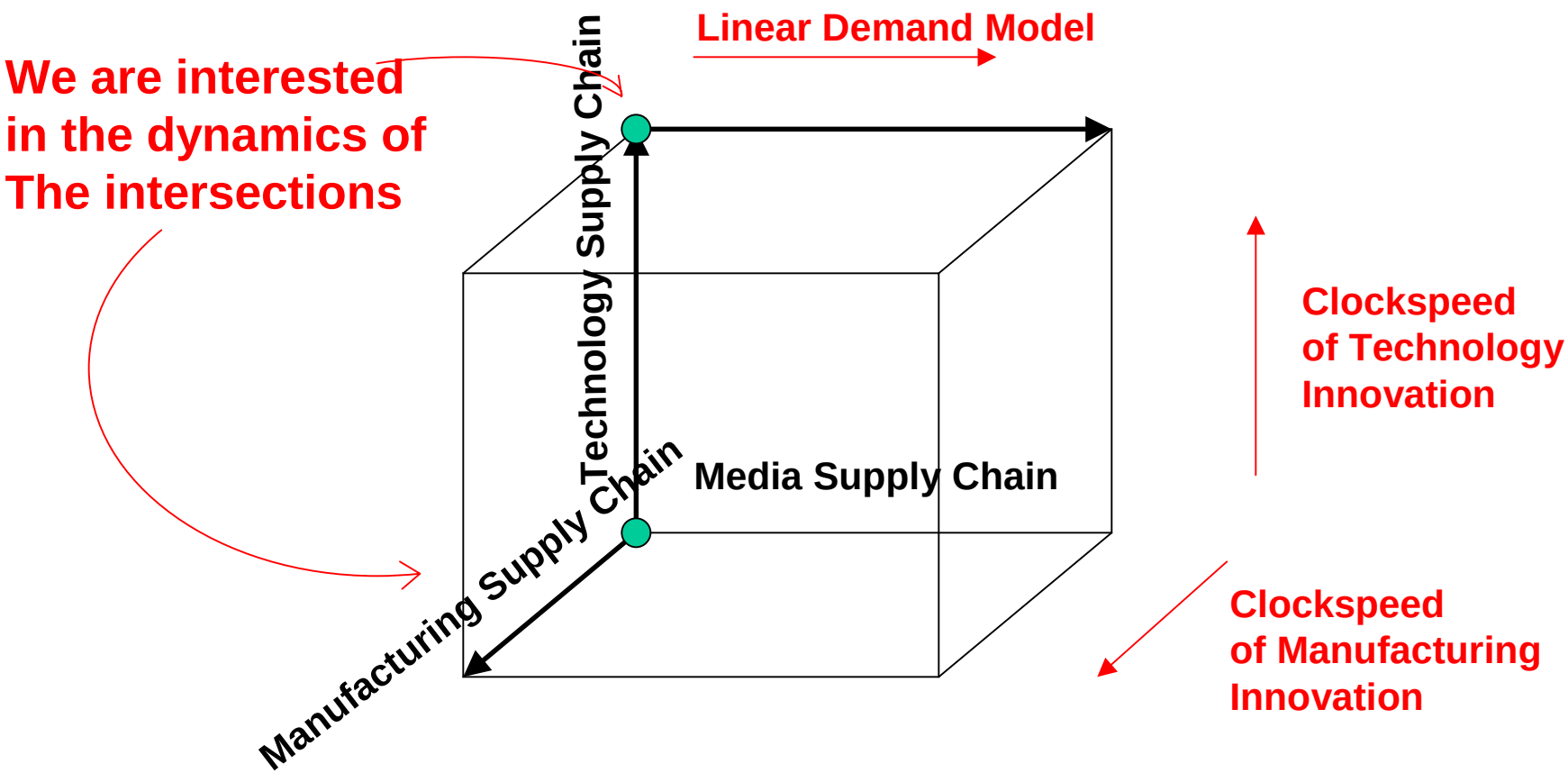
Greece **in 500 BC,** ***Rome*** **in 100AD,** ***G.B.*** **in 1800**

Sports:

Bruins **in 1971,** ***Celtics*** **in 1986,** ***Yankees*** **HA HA HA**

The faster the clockspeed, the shorter the reign

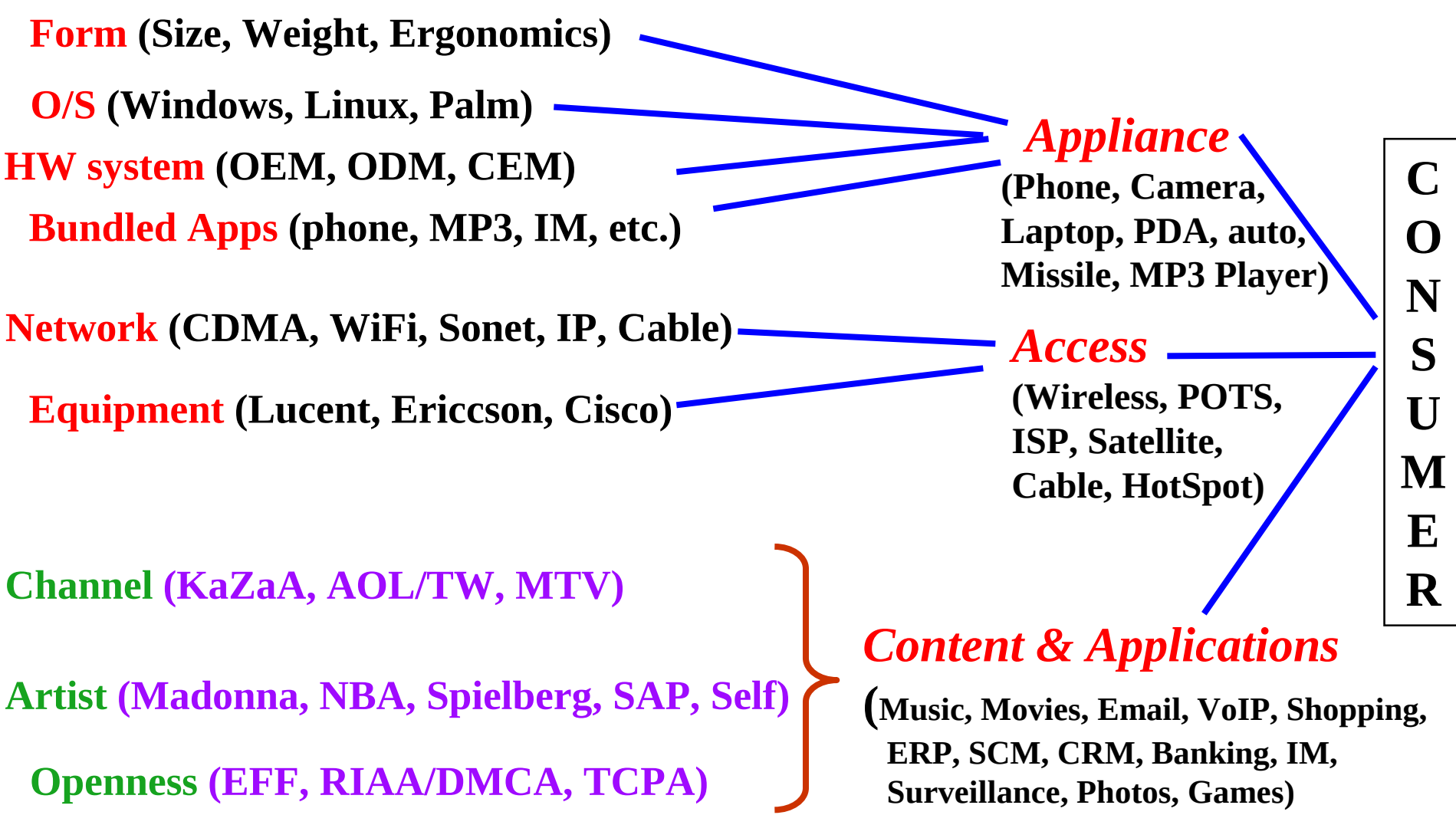
December 2000
3D Value Chain



Ryan & Berryman

2001: The consumer's view of the Communications Value Chain

Prof C. Fine



"Killer Technologies" of the Information Age: Semiconductors, Magnetic Memory, Optoelectronics

Prof C. Fine

"We define a *'killer technology'* as one that delivers enhanced systems performance of a factor of at least a hundred-fold per decade."

C.H.Fine & L.K. Kimerling, "Biography of a Killer Technology: Optoelectronics Drives Industrial Growth with the Speed of Light," published in 1997 by the Optoelectronics Industry Develoment Association, 2010 Mass Ave, NW, Suite 200, Wash. DC 20036-1023.

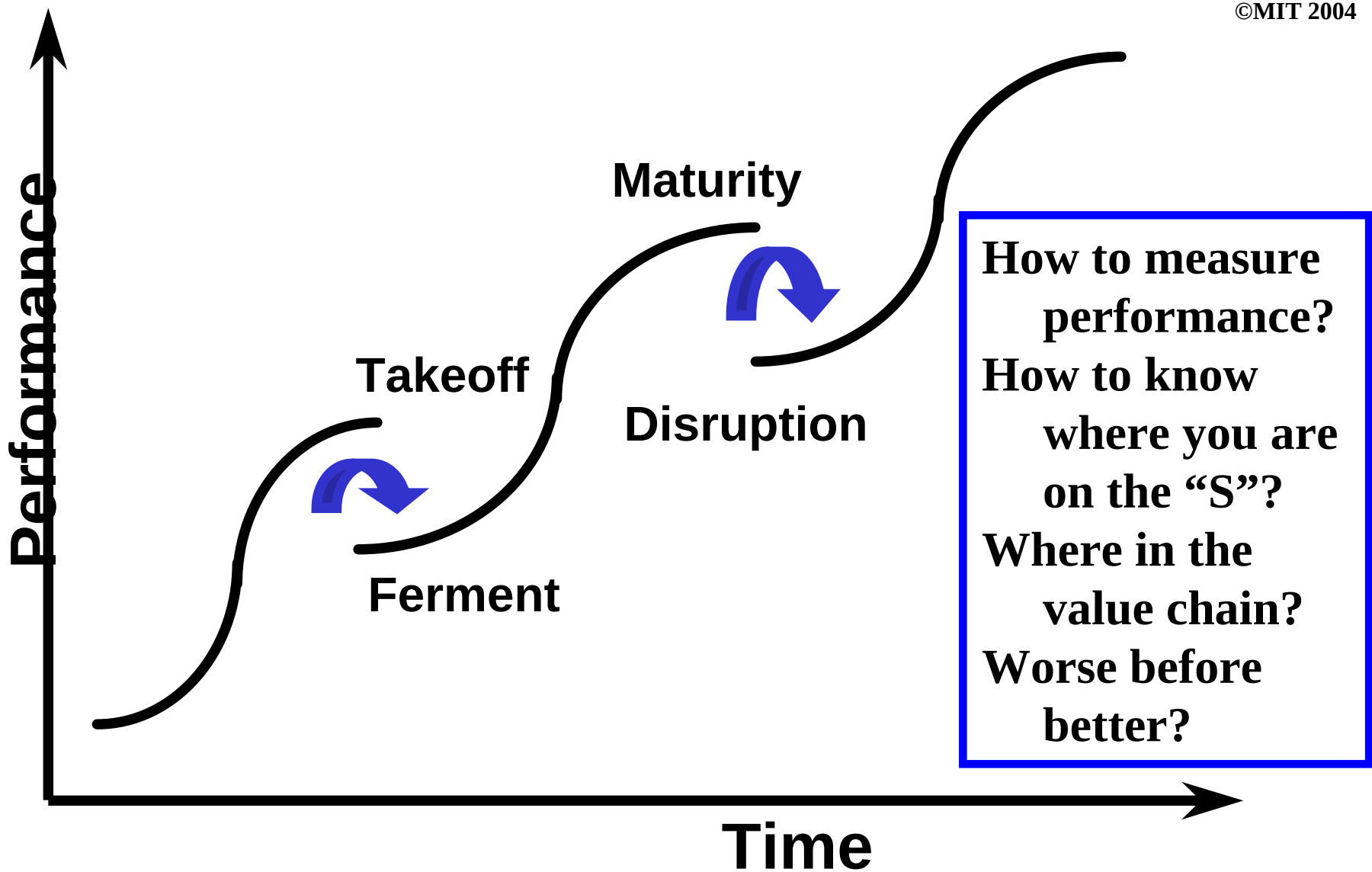
Killer Question:

Will *Integrated Optics* evolve linearly like Semiconductors with Moore's Law or like Disk Drives with repeated industry disruptions?

Innovation Dynamics can be

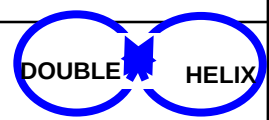
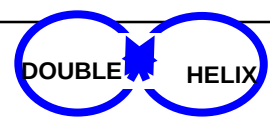
RADICAL *(disruptive)* or INCREMENTAL *(sustaining)*

Prof C. Fine



Optical Technology Evolution: Navigating the Generations with an Immature Technology

Prof C. Fine

	1	2	3	4	5
Timeline	Now	Starting	Starting	3-5 years	5-15 years
Stage	Discrete Components	Hybrid Integration	Low-level monolithic integration	Medium Monolithic integration	High-level monolithic integration
Examples	MUX/ DEMUX	TX/RX module OADM	TX/RX module OADM	OADM, Transponder Switch Matrix	Transponder
Core Techno-logies	FBGs, Thin-film, fused fiber, mirrors	Silicon Bench, Ceramic substrates	Silica Silicon InP	InP, ??	InP, ??
How many Functions?	1	2-5	2-5	5-10	10-XXX
Industry Structure	Integrated	Integrated/ Horizontal	Integrated /Horizontal		

Dr. Yanming Liu, MIT & Corning

Innovation along the Value Chain

Prof C. Fine

Consumers/ Users

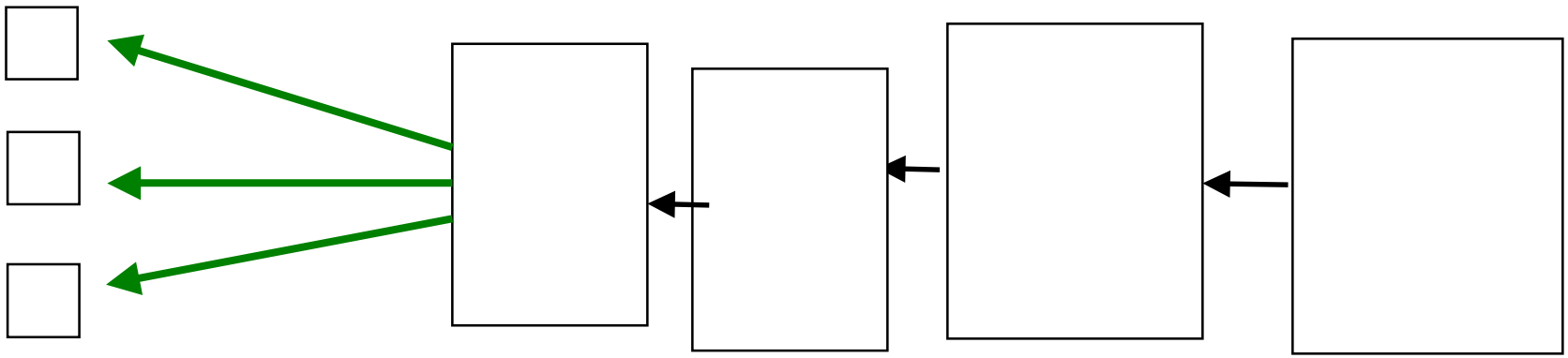
Marketing/ Distribution

Product/ Service

Manufact-uring

Subsystem Suppliers

Core Technology Suppliers



Napster
Apple II

Fedex
Walmart
Amazon
Dell
iTunes
eSchwab

Apple iPod
Palm
McDonald's
SWAir

minimill
beef packing
Toyota/Lean Prod.

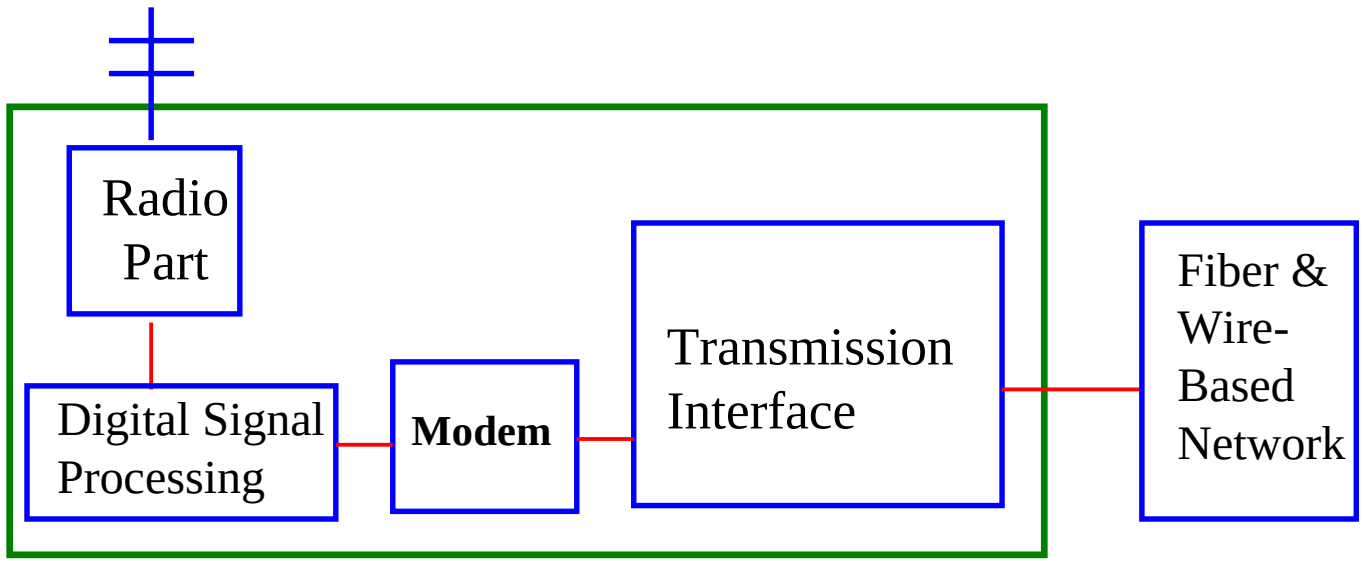
Toyota Hybrid Engine
Pixar Animatiom

Amgen
Qualcomm
Intel

WIRELESS VALUE CHAIN: MINI CASE EXAMPLE

Wireless Base Stations (WSB'S) comprise 4 key subsystems:

Prof C. Fine

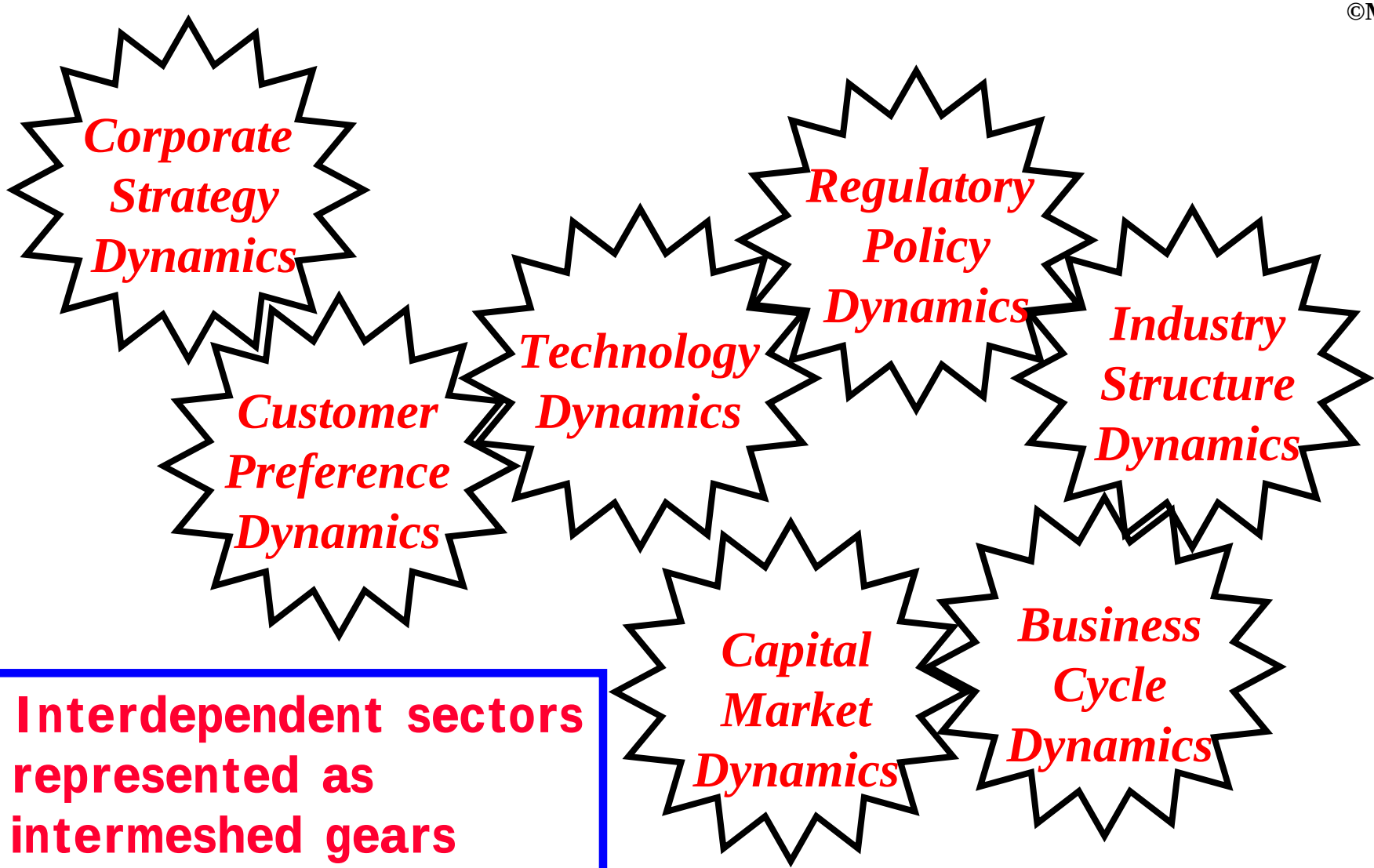


WSB architectures are
-integral & proprietary
Suppliers include: Nortel, Moto, Ericsson, Siemens, Nokia
Disruptive Modem advances (e.g., MUD) can double Base Station Capacity

Modular WSB's might
(1) Stimulate new WSB entrants (ala Dell)
(2) Stimulate standard subsystem suppliers
(3) lower prices to the network operators
(4) Speed base station performance imp.
(5) Increase demand for basestations due to improved price-performance ratios.

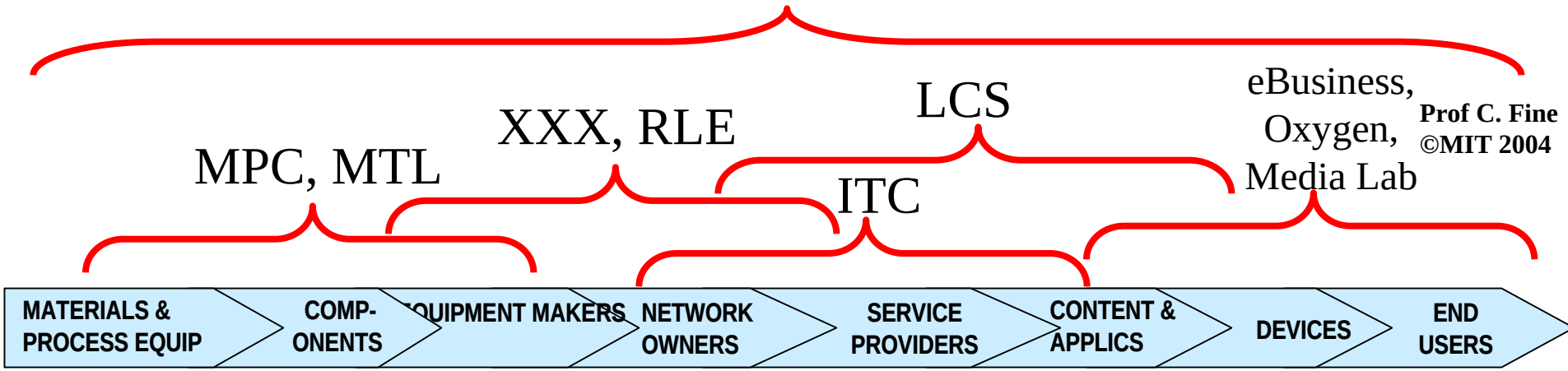
2002: The Gear Model

Prof C. Fine



Interdependent sectors represented as intermeshed gears

Proposed MIT Communications Roadmap Consortium



·Silicon ·Gaas ·InP ·Polymers ·Steppers ·Etchers ·MEMS ·Insertion ·Etc..	·Lasers ·Amplifiers ·Transceiver ·Filters ·Processors ·Memories ·Fiber ·ASICS ·MEMS ·DSP's ·Etc..	·Routers ·Switches ·Hubs ·Base Stations ·Satellites ·Servers ·Software ·O/S ·Etc..	·Wireless ·Backbone ·Metro ·Access ·Substations ·Satellites ·Broadcast Spectrum ·Communic Spectrum ·Etc..	·Long distance ·Local Phone ·Cellular ·ISP ·Broadcast ·Hot Spots ·Cable TV ·Satellite TV ·VPN's ·MVNO's ·Etc..	·Music ·Movies ·Email ·VoIP ·POTS ·Shopping ·ERP ·SCM, CRM •Surveillance •eBusiness ·Etc..	·Computers ·Phones ·Media Players • Cameras ·PDA's ·Weapons ·Etc..	·Business ·Consumer ·Gov't ·Military ·Education ·Medical ·Etc..

CROSS-INDUSTRY CHALLENGES (E.g.,)

Digital Rights ("To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;" U.S. Constitution, Article 1, Section 8, Clause 8)

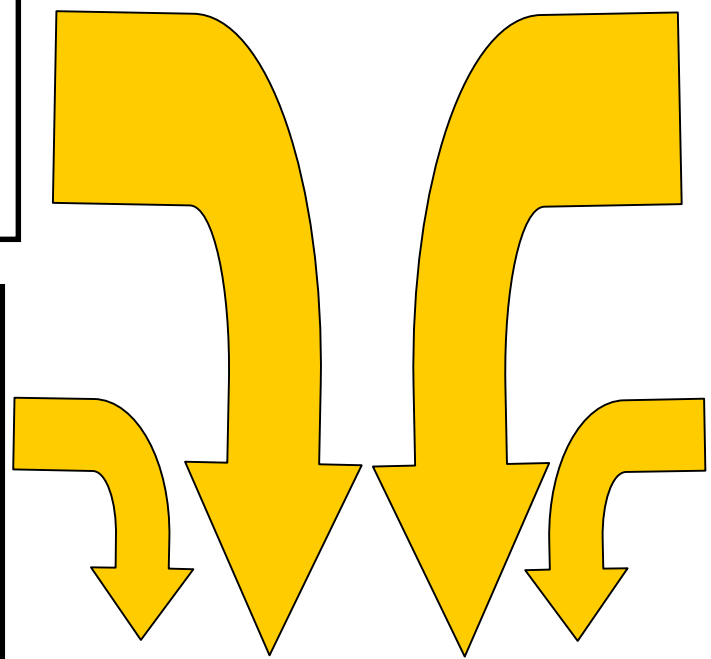
Access Architecture

Prof. C. Fine, MIT

Roadmapping Communications: What are the Premises?

Prof C. Fine

Communications Value Chain is in ill health (ROADKILL MAPPING?)



Silos in the value chain are interdependent (integrality).

Vertical *dis*integration is the dominant structure. Silo execs tend to focus on their own narrow slices. **Most industry consortia are *within*-silo.**

Absence of leadership and coordination across an interdependent value chain creates uncertainty, risk, and reluctance to invest.

SOME VALUE CHAIN COORDINATION COULD SPEED GROWTH.

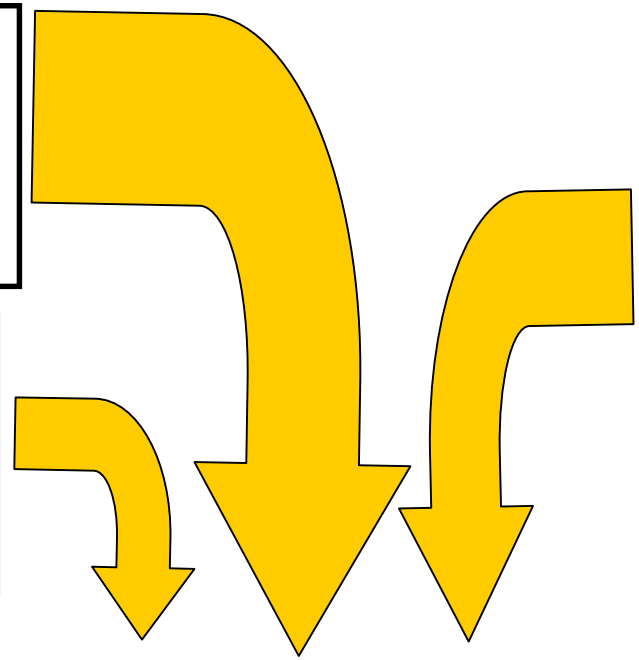
HOW TO ACHIEVE COORDINATION IN THE ABSENCE OF VERTICAL INTEGRATION?

Roadmapping Communications: What are the Premises?

Prof C. Fine

Technology dynamics, Industry dynamics, and Regulatory dynamics are interdependent.

Technology and industry roadmapping are typically done by different people



SIA roadmaps provided productive coordination in semiconductors, but focused only on technology & a narrow slice of the value chain. Industry growth was assumed.

--> Not a good model for Communications.

Productive roadmapping must encompass multiple links of the value chain, a multidisciplinary team, and the co-evolution of technology, industry, and regulatory policy.

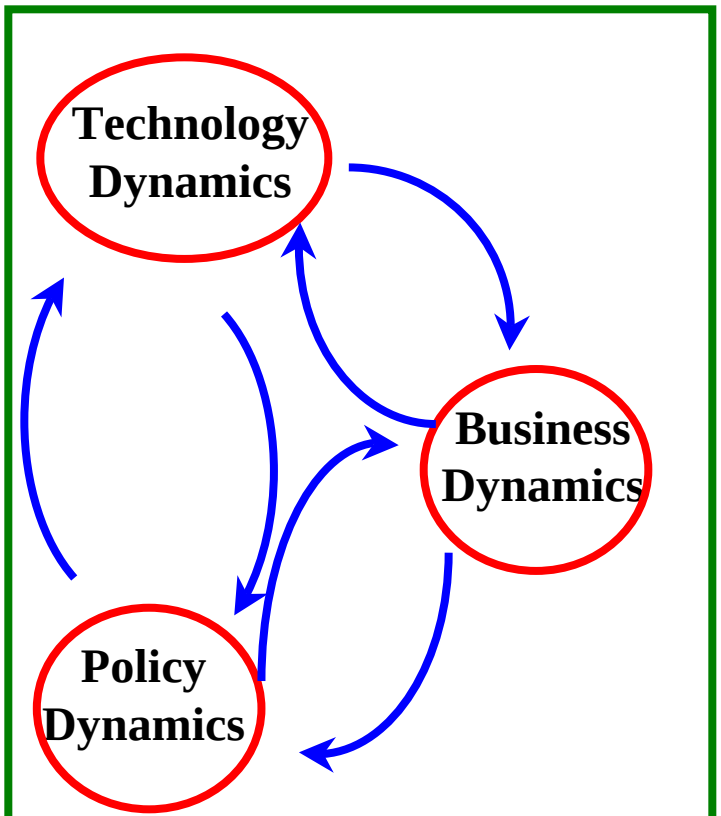
Another View of the Communications Value Chain

Prof C. Fine

MATERIALS & PROCESS EQUIP	COMP-ONENTS	EQUIPMENT MAKERS	NETWORK OWNERS	SERVICE PROVIDERS	CONTENT & APPLICS	APPLI-ANCES	END USERS
•Silicon •Gaas •InP •Polymers •Steppers •Etchers •MEMS •Insertion •Etc..	•Lasers •Amplifiers •Transceiver •Filters •Processors •Memories •Fiber •ASICS •MEMS •DSP's •Etc..	•Routers •Switches •Hubs •Base Stations •Satellites •Servers •Software •O/S •Etc..	•Wireless •Backbone •Metro •Access •Substations •Satellites •Broadcast Spectrum •Communic Spectrum •Etc..	•Long dist. •Local •Cellular •ISP •Broadcast •Hot Spots •Cable TV •Satellite TV •VPN's •MVNO's •Etc..	•Music •Movies •Email •VoIP •POTS •Shopping •ERP •SCM, CRM •Surveillance •eBusiness •Etc..	•Computers •Phones •Media Players • Cameras •PDA's •Automobile •Weapons •Etc..	•Business •Consumer •Gov't •Military •Education •Medical •Etc..

2003:MIT Communications Futures Program: Value Chain Dynamics and Disruptive Technologies

Prof C. Fine



CIPS **CFP/CII** **eBusiness**

Technology **Networks** **Users**

Optics
Electronics
Radio
Materials

Security/
Privacy
Core-Edge
Viral Radio
Broadband

Businesses &
Consumers
buy Devices,
Content,
Applications,
& Service

David Clark, Laboratory for Computer Science,
Charles Fine, Sloan School of Management, **Sharon Gillett**, CTPID
Andrew Lippman & **David P. Reed** MIT Media Laboratory

2003: Regulatory Policy Dynamics

	Regulation Reins in "Monopoly"	Shocks Happen	Environment Changes; Substitutes arise	Regulation Constrains response	Deregulation timing is Critical	Mistakes harm incumbents, consumers & taxpayers
RailRoads	Rockefellar & Morgan "Robber Barons"	Autos & Highways	Trucking arises	Prices, Exit, Innovation	1958 vs. 1980	Weak rail capabilities; Trucking dominant
Natural Gas	"Natural" Monopoly	Oil Embargo; Fall of Iran	Gas Demand Explodes	Low prices inhibit new supply	Long lag for new sources (1978 v 1989)	Shortages; price swings; LT consumer costs of take or pay contracts
Banking	Bank size limited to limit power	Inflation in the 1970's	Money Market Funds	Deposits Shrink; Riskier investments	1978 vs. 1989	S&L's died; $160B+ Bailout
Telecom	AT&T "natural" monopoly	Internet & Moore's Law	Wireless Broadband VOIP	TELRIC pricing; entry & exit; access fees	Wireless, BB, & VOIP less constrained than ILECs	Wireless success; wireline TBD

Conceptual Model: *The Dynamics of Regulation and Deregulation Processes*

Prof. C. Fine
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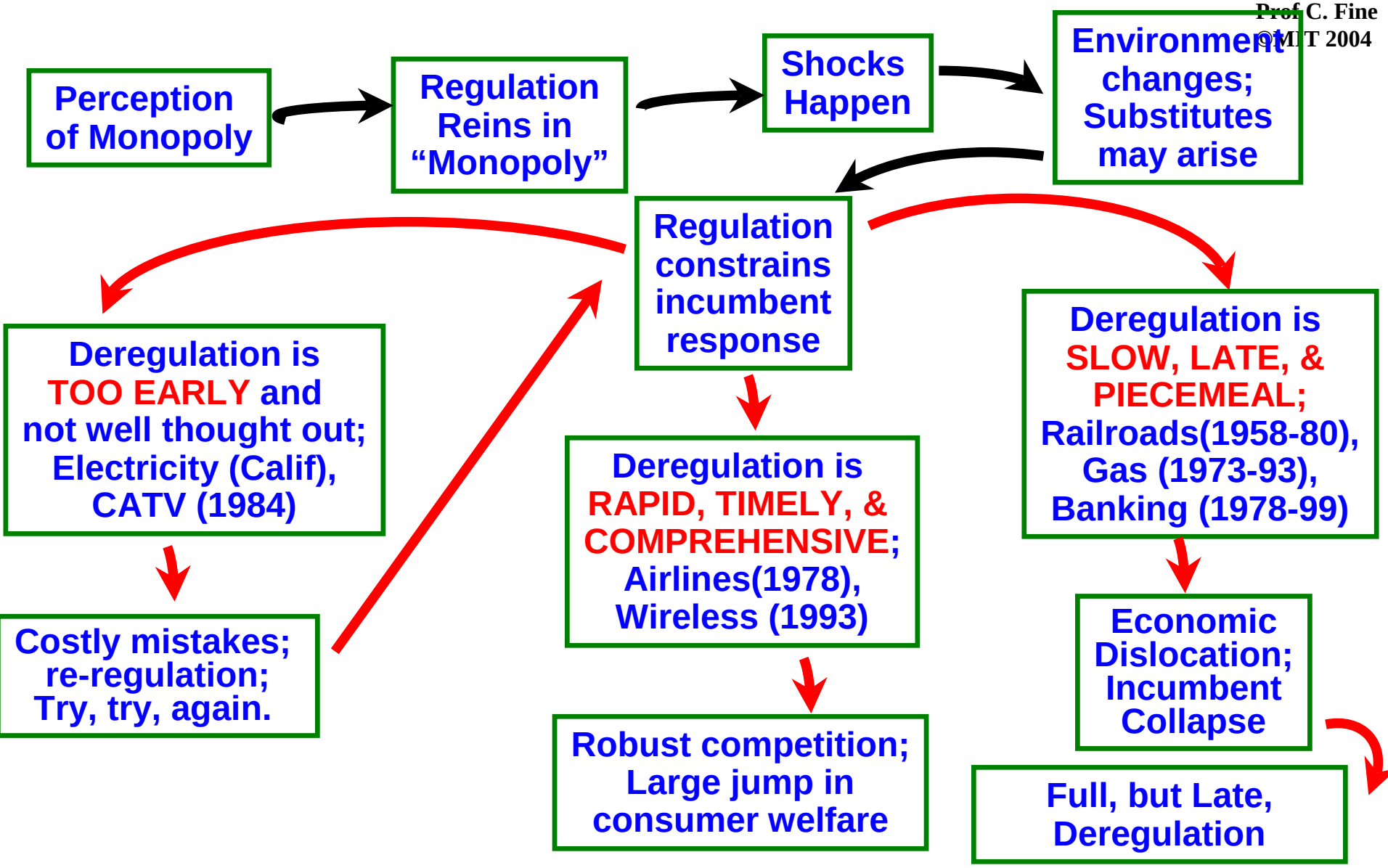
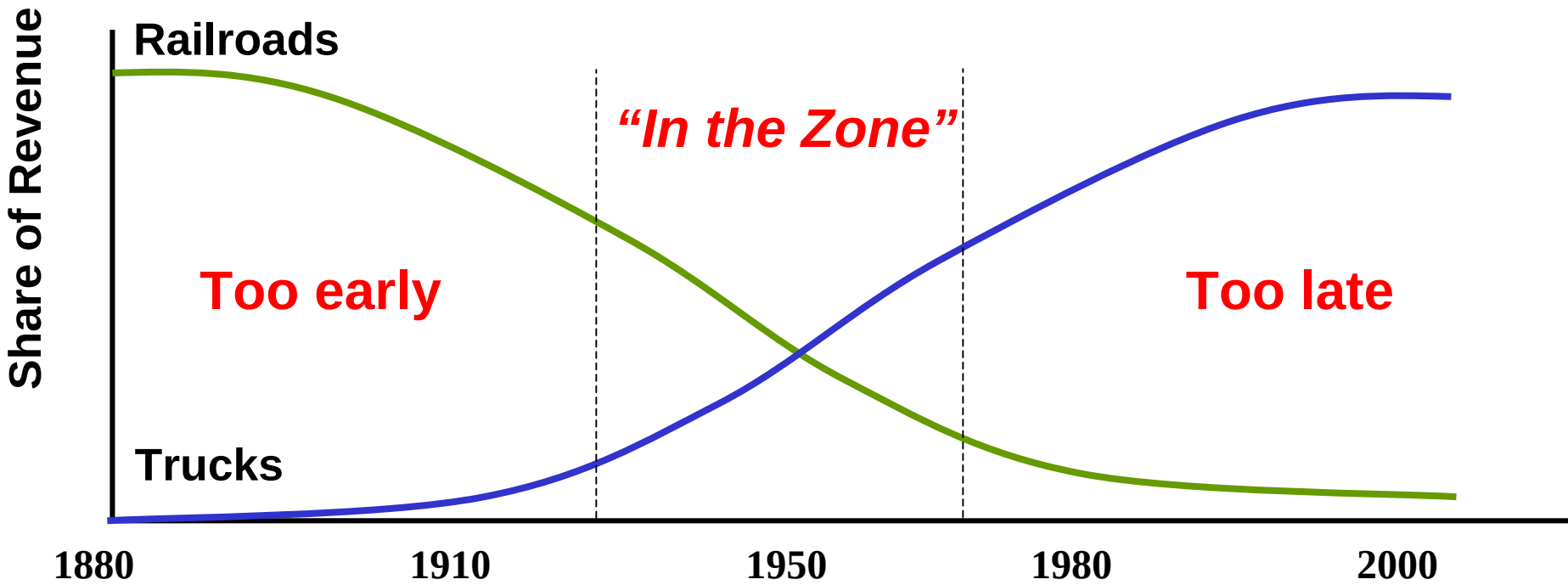


Freight Railroads vs. Trucks
The Dynamics of Industry Economics and the Optimal Timing of Deregulation

Prof C. Fine



Regulation reins in "monopoly"

Shocks happen; Environment changes; Substitutes mayarise

Regulation constrains response; deregulation timing is critical

If deregulation is SLOW, LATE, & PIECEMEAL; then Economic Dislocation; Incumbent Collapse

2004: Core-Edge Dynamics
Is there an economic future for the "Core?"

Prof C. Fine

No Opportunities?
Rotten to the Core?

BIG, FAT,
DUMB PIPE?

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

NO INVESTMENT RETURN => NO CORE?

Opportunities and Threats along the Communications Value Chain: Core-Edge Dynamics

Prof C. Fine

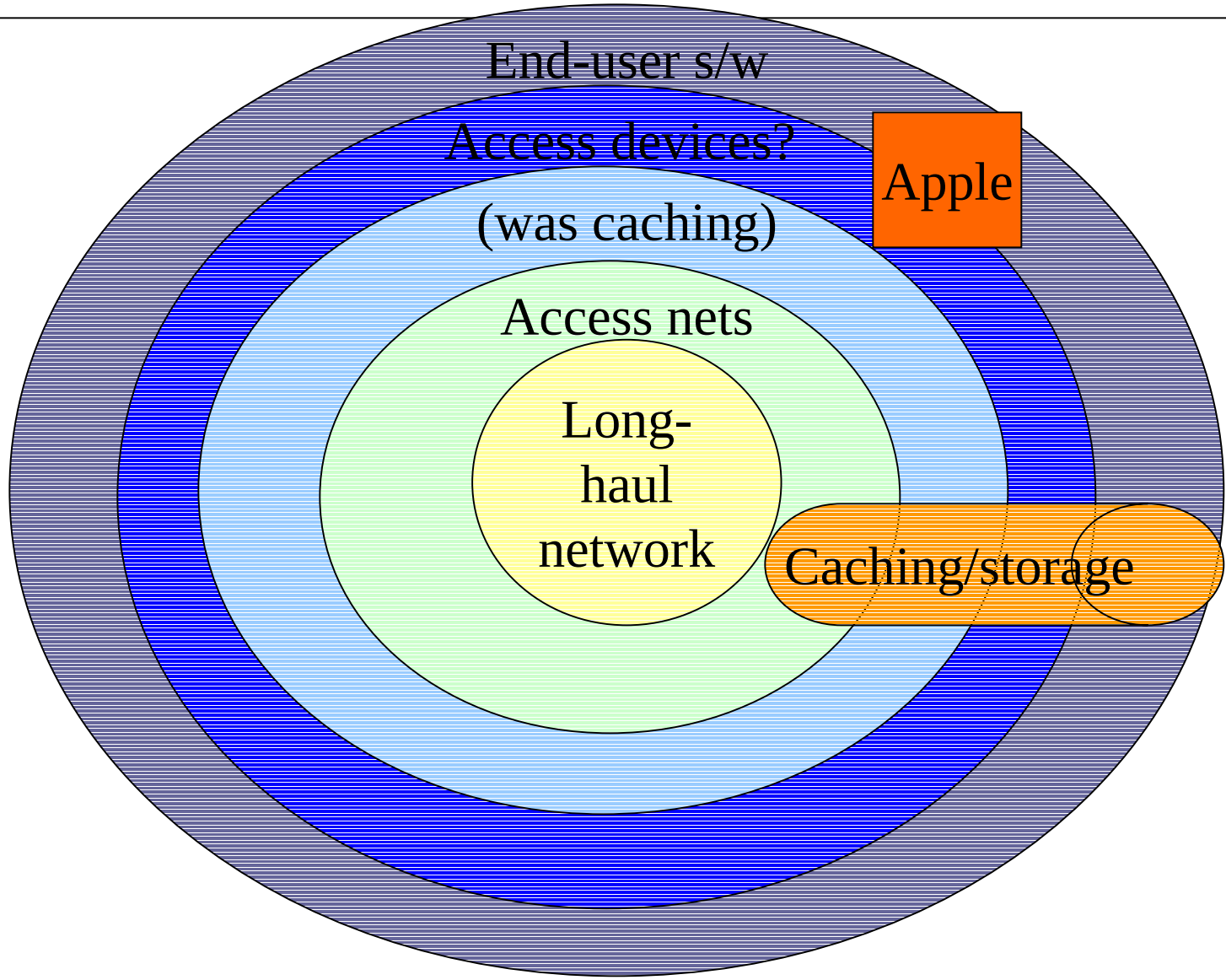
Premise #1: **Along the *Communications Value Chain*, Core vs. Edge activity and control in the network can usefully be distinguished (and there may be returns to taxonomic research for defining the core-edge spectrum).**

Premise #2: **Business models and business opportunities are distinctly different *in the core* vs. *on the edge.***

Premise #3: **Activities and control will move along the core-edge spectrum, sometimes with disruptive effects upon players in the *Communications Value Chain.***

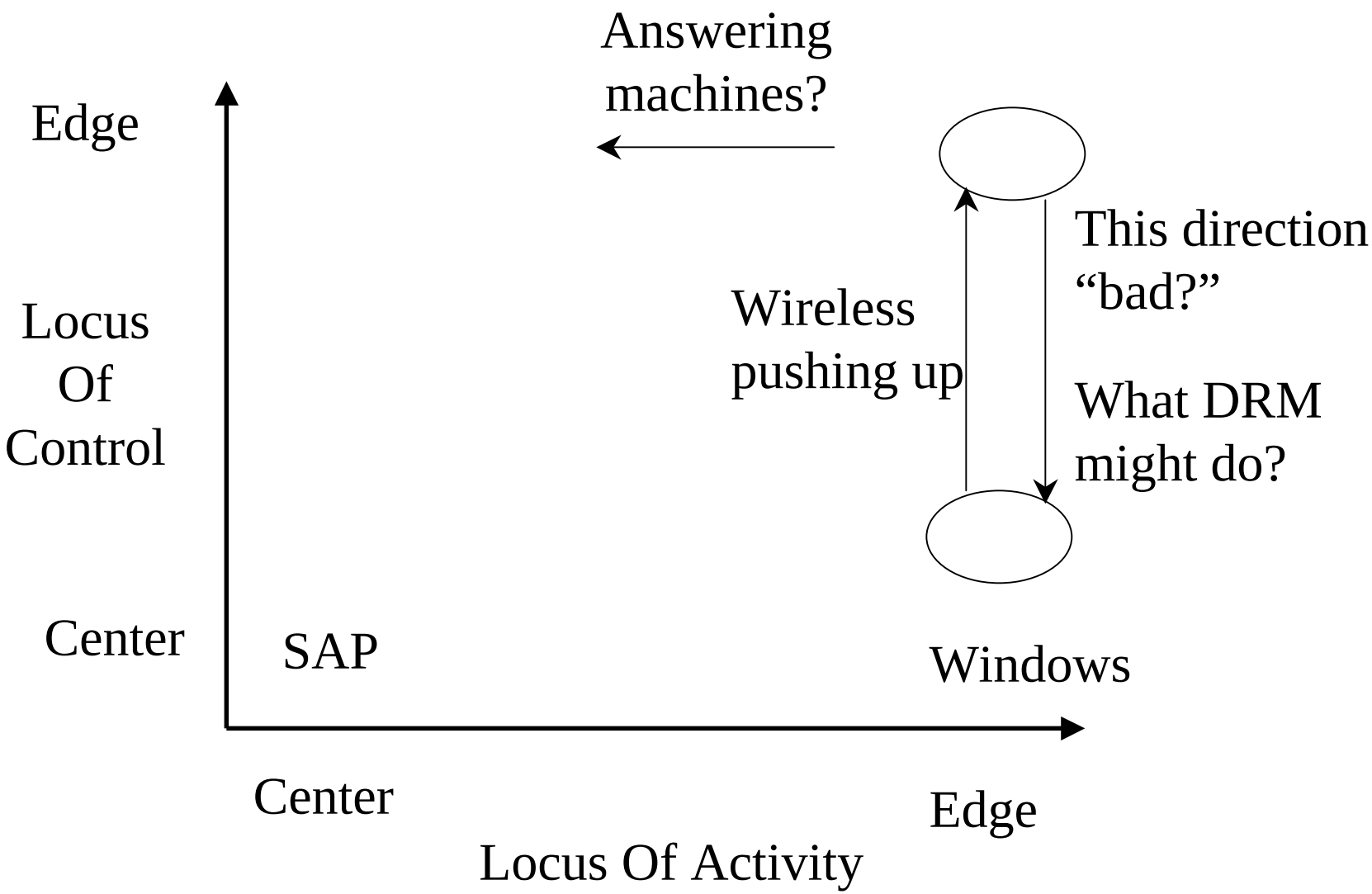
Taxonomy of Edge-v-Center

Prof C. Fine



Locus of Activity vs. Control, plus Dynamics

Prof C. Fine



Case Studies in Core-Edge Dynamics

Prof C. Fine

#1: Voice Communications (& Voicemail)

POTS through the backbone
to Vonage at the Edge
to Comcast/TW with end-to-end QOS

#2: Music: Storage, Search, Distribution, & Commerce

in iTunes, Kazaa, Napster, & Bluetooth

#3: Location-Based Services:

Collection, Aggregation, and Operation

#4: RFID tags and readers

Pushing out the edge by the billions

RFID tags push the boundaries of the Edge

. Fine
2004

1. DoD wartime needs will *prime the pump* for RFID technology and applications.
2. Walmart will add to this effect: box & pallet.
3. Pharmacies will do the same for item tagging.

RFID tag
5¢
10B/yr

Mobile phone chip
$20
500M/yr

Centrino
$800
40M/yr

What *disruptions* will be driven by the explosion of the edge?

Prof C. Fine

2004.
Ain't No Core.
NeverMore.

All Conclusions are *Temporary*

Prof C. Fine

Clockspeeds are increasing almost everywhere
Value Chains are changing rapidly