Value Chain Dynamics Working Group

Semi-Annual Meeting

May 24, 2006

Cambridge, MA

Today's Agenda

9:00	Introduction and updates
9:20	IP Video Case Study Introduction
10:15	15-minute break
10:30	Value Chain Dynamics Toolkit – part I
12:00	Lunch break
1:00	Value Chain Dynamics Toolkit – part II
2:00	VOIP System Dynamics Modeling
2:30	15-minute break
2:45	RFID System Dynamics Modeling
3:45	Next steps
4:15	Cocktails and appetizers next door

Introduction & updates

IP Video
Case Study Introduction

IPTV: A Short Overview, Marie Jose Montpetit, Motorola
IP Video: Enterprise Applications, Ken Gold, Nortel

IPTV:
A Short Overview

Marie-José Montpetit, Ph.D.
Motorola
Connected Homes Solutions
May 24th 2006

MOTOROLA

What is IPTV?

- IP over TV?
  - Is done in the DVB world
- TV over IP?
  - Video streaming has been here for a while (nRT and RT)
- A new model or a replication of current offerings?
  - IPTV as replicating cable (hybrids, broadcast centric)
  - Use the Internet paradigm? TV over IP?
- Is IPTV more than broadcast?
  - Quaduple play? Does that include mobile video?
  - Some new enhanced services?
  - Public vs. private networks

Architectures

- Video/broadcast centric
  - Should IPTV use what made digital broadcast TV great?
    - Ownership of the ingress and egress point as well as the core
    - End to end control of content and quality
    - On screen navigation and ease of use
    - Optimized for unidirectional broadcast/unicast
  - Network is essentially a “pipe”: intelligence mostly at the edges
  - Internet for broadcasters (and client/server providers)
- Internet Centric Architecture
  - Should IPTV use what made the Internet great?
    - Standard and horizontal network protocols
    - Distributed functionality
    - Multiple aggregation points
    - Intelligence in end points
    - Network of Networks
    - Network is a mesh
    - Optimized for bidirectional unicast.
    - End to end QoS an issue
  - Video for the Internet Service Providers (and MVNOs).
- Optimization point depends how content is used and the underlying business model

Is it just STBs?

- Content is shared with PCs or their devices using IP technologies
- The “device previously known as the STB”
  - No more TV "channels" but "streams“
- The device currently known as the “handheld”
  - Integrated streaming services between STBs, streaming devices, phones and PCs in and out of the house
- VOD over IP via the PC (Akimbo for example)
- Enhanced TV (games, video call in shows etc.)
- Users start seeing "screens" and not underlying technology
- TV becomes "portable" (see Slingbox, TiVO to go, video blogging, video podcasting etc.)
- TV on the web (Narrowstep)
- Horizontal view:
  - Impact on software/middleware
  - Impact on edge devices
  - Standards essential

Who, where, how?

- Only available where fiber is there already?
  - In the near future not only FTTH but FTTN or FTTC (ADSL2, ADSL2+, VDSL etc.)
  - Hybrid offerings: wireless (Wimax and 802.11n) and fiber
  - Cablelabs project on VoD over IP over DOCSIS bypass
  - Interesting fact is there are a lot of early adopters in neighborhoods without fiber access
- PON technologies bandwidth
  - About 30 Mbps (depends on PON type) per household
  - About 1.5 MPEG2 HD stream so enough for 1-2 HD and most current Internet content (as long as there is analog)
  - Stressful scenarios from “whole home DVR” solutions
- Current deployments impaired by their own success
  - Servers need to scale to demand

Optical Network Aspects

- Increase capacity
  - Switched models
- Increase stat mux
- Push network intelligence beyond the PON in the OLT/ONT
  - At what price?
- Lower costs devices enable deployment over larger areas
- Higher density/rate devices allow to better use deployed assets
  - Reduced reliance on switched video solution
    - The current DSL approach
    - This is a design choice that has a lot of impact on network architecture, services and performance
  - Higher rate per users enable more services (HD videoconferencing) while reducing some operational expenditures (related to current admission of HD sessions for example)
  - Better use of in-home networks

IPTV and Wireless Networks

- Streaming video and audio part of new wireless offerings
  - But still voice centric
  - Limitations:
    - Transcoding
    - Real time content
    - Capacity
      - Requires moving potentially large amounts of data across wireless bearers
      - New solutions
        - » Wimax
        - » 802.11n
        - » Direct RF to Fiber
- “Personal Broadband”
  - Use the wireless infrastructure for mobility, convergence, remote control and redirection
  - Enables the movement of content independent of location and time
  - Customization of offerings and user centric networking
  - Video services get out of the usual TV setup: TV for the iPOD generation
  - IMS model for distributed capabilities

Unicast, Multicast, Broadcast?

- Unicast perfect for “on demand”
  - Personalized content, advertisement, information only when requested
- But is this the only model?
  - 10 Mbps streams a strain (close to 20 in MPEG2)
    - Little muxing possible with current VOD models
  - Sharing?
    - Sports events, “catastrophes”, major events still attractive in a “broadcast” model
    - ‘Hit' TV as a communal experience for example the morning after a TV "event" (American Idol last episode)
- Mix of models here to stay and a major requirement for any future deployments
- How long will analog TV survive?
  - Analog TV dies on April 1, 2009
  - Digital penetration at 75% or more right now
  - Future of TV specific interfaces?

IPTV Legacy Issues

- From the broadcasters
  - Personalized advertisement
  - Local rules like sports blackout and certain programming
  - Channel Surfing
  - EAS (Emergency Alert Service)
  - Conditional Access
- From the wireless services
  - Small end devices and mobility issues
- From the Internet:
  - Policy: Copyrights/DRM/Security/Privacy
    - Network DVR (Maestro) failed because of content issues
    - Brokerage of DRM models
    - Parental control over content
  - Billing: flat rate vs. per service
    - “A la carte services”: IPTV ideal for “pick and choose” programming
    - Network neutrality
  - QoS and congestion
  - SIP, HTTP and RTSP: how do they work better together?

From everyone:

What is the business model?

IPTV Already? Was the future last year?

- IPTV is the “hot”topic
- Flurry of Standardization work:
  - TISPAN NGN, ITU-T, CableLabs, ATIS/IIF
  - Internet Streaming Media Alliance for promoting Open IPTV standards“
  - Mitch Kapor Backs Open Source Software For Simplifying Internet TV Sept. 6, 2005”
    - Participatory Culture Foundation wants to make it easy for anyone to be an Internet-TV broadcaster
    - Builds on Podcasting success
- Coming soon to a screen near you?
  - Virtual presence and ambient networks
  - IPTV communities as a social phenomenon
  - Technology agnostic access; network aware video applications

IPTV Already? A sample

- IPTV from the operators
  - Telcos
    - xDSL
    - PON/GPON
    - Hybrids
    - Variety of middleware providers
  - MSOs
    - Switched video
    - DOCSIS video bypass
    - OCAP in 2007 (not just for IPTV)
  - Common features:
    - Combine IP data services and VoIP with broadcast and on demand content
    - Rich media offerings and user friendly interfaces
    - STB connected to one another to create better services and leverage existing equipment (whole home DVR)
    - Collaboration with wireless operators for converged and network-based services
- IPTV from the Net
  - Bittorrent and Time Warner
  - Online content and poscasts:
  - NBC
  - Disney
  - ABC etc.
  - Google video
  - Narrowstep
  - Etc. (probably a few more each week)
  - Everyone is a broadcaster?
    - But some people are much better at doing it and people are ready to pay for it

Conclusion

- ***Is IPTV the "killer app"?***
- ***Need the network to be deployed but need the deployment to justify the network?***

Value Chain Dynamics Toolkit

Agenda

- Objectives
- Approach
- Anatomy of a tool
- The basic idea
- General guidelines
- The toolkit
- User Guide

Objectives

- Enable sponsors to take VCDWG learnings back to their organizations
- Provide a structure for systematic analysis of communications innovation
- Provide tools to generate “outcomes” in several stages
  - Learning
  - Cataloging
  - Mapping
  - Predicting
  - Positioning
- Sponsors can focus on any one tool, or aspect of a tool
- Today’s goal – preview the toolkit, test some tools, get your feedback

Approach

- Base tools on the core-edge methodology
- Initially low tech – manual, paper-based
- Develop generic & specialized worksheets
- Organize tools into modules (stages)
- Add new tools throughout research program
- Exercises are more “art” than “science” – *facilitation is key!*

Anatomy of a tool

Purpose

- What is the expected outcome/results of the tool – insights and/or output (e.g., a diagram, a list, etc.)

Background

- Explain the rationale/theory behind the tool
- Some tools will require deeper learning tools provided in the LEARN section

Process

- Outline of the steps

Guidelines

- Additional information regarding steps where necessary

The basic idea

1. Choose a type of service for analysis

2. Break it down to component parts
   - Individual services & functional elements

3. How are the parts organized?
   - Who provides what parts?
   - How does each part work? How do the different parts work together?
   - Where are key customer relationships? Where is value being captured? By whom? By what means?
   - What's the market share of the different business models?

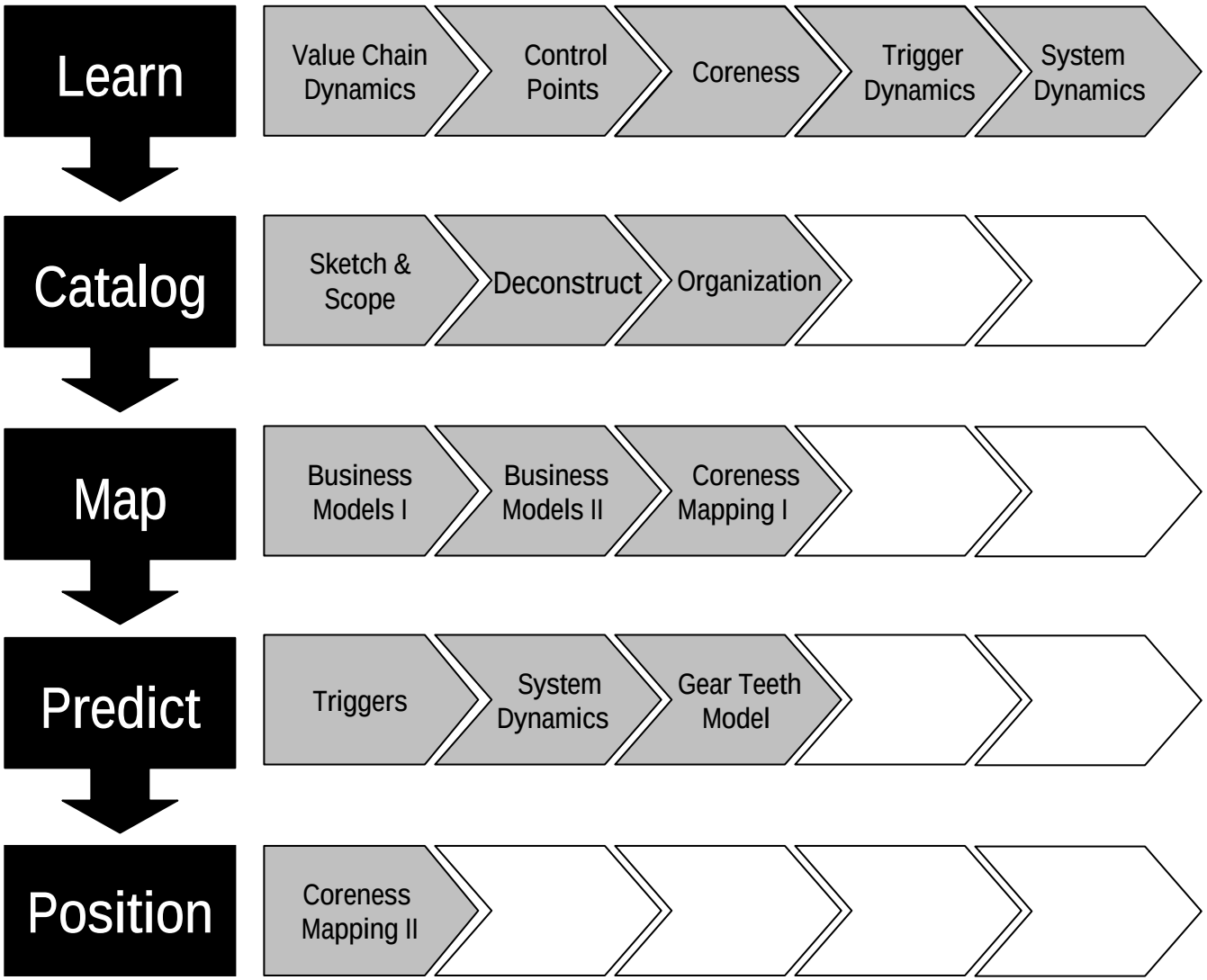
4. How & why is this changing over time?
   - Triggers and dynamics

General guidelines

- Remember this is art not science
  - The tools provide a common framework
  - They provoke discussion and generate insights

- Don’t get hung up on the steps
  - The tools are iterative
  - They can be done in any order
  - Skip steps if you want

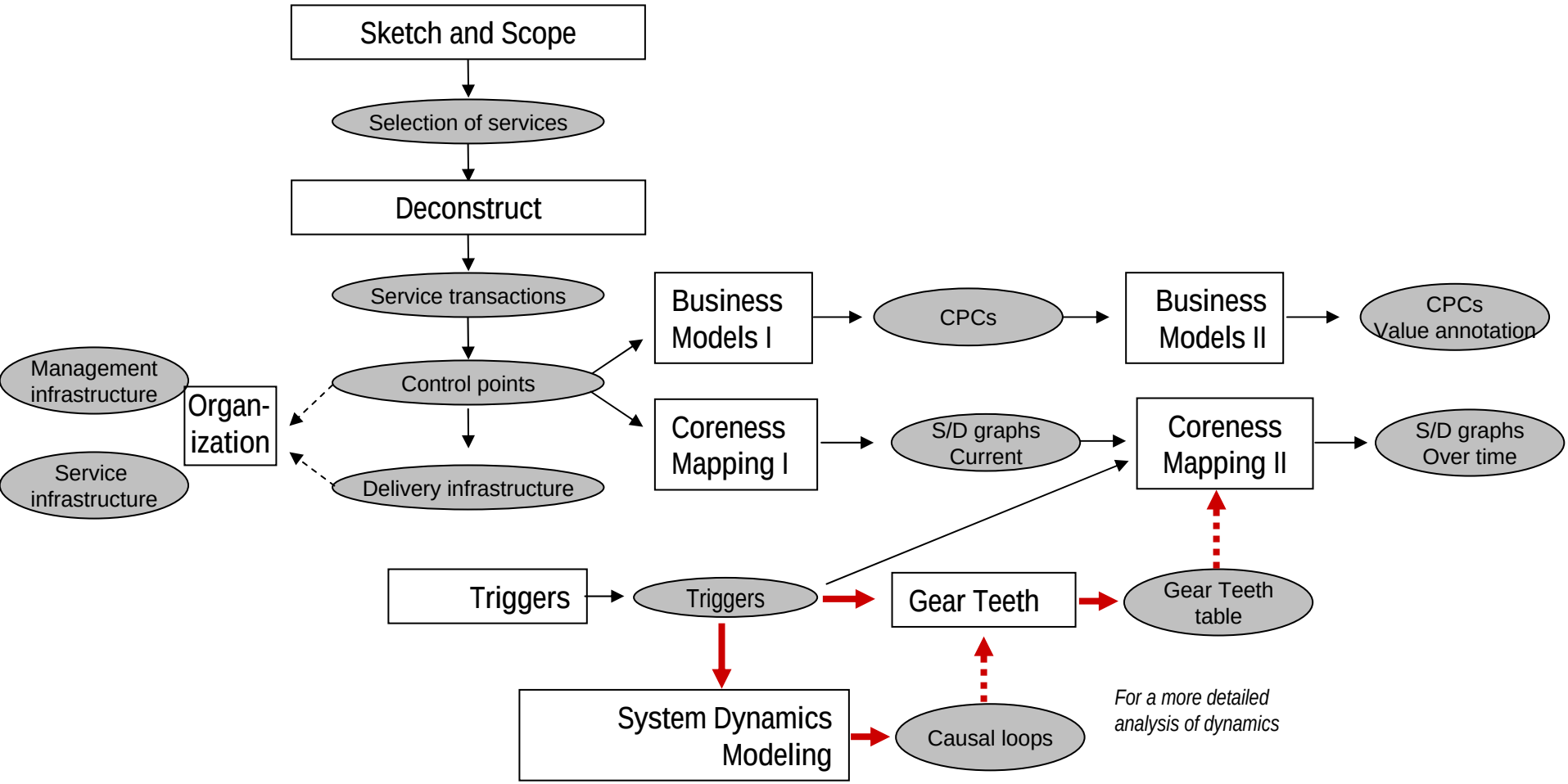
Contents of toolkit



The Tools

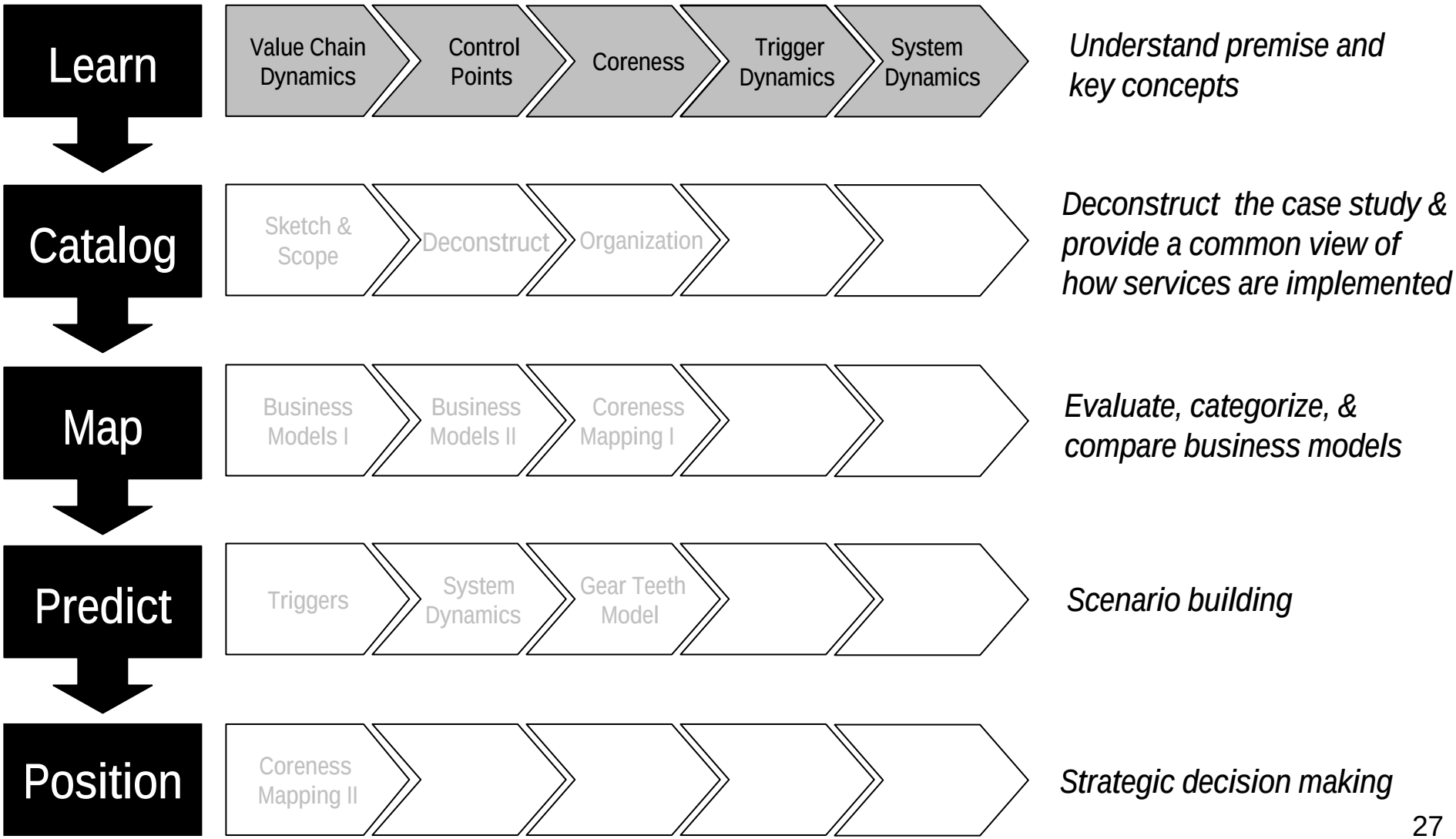
(go to other presentation)

Overview of Inputs and Outputs



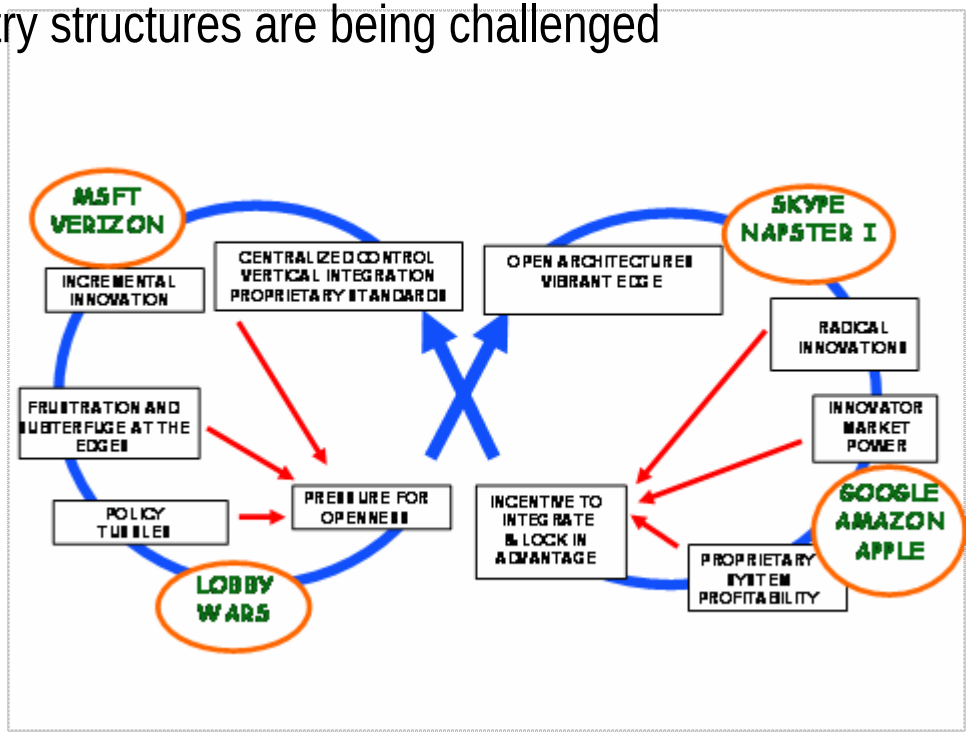
Value Chain Dynamics Toolkit

Learn



X1. Value Chain Dynamics

- Our work looks at how communication services are put together
- Yesterday: A network “core” supplied services comprised of tightly integrated features
- Today: Service and delivery features are decoupled. Services can be supplied from various points in the network.
- Innovation can occur anywhere, anytime, by anybody
- Established industry structures are being challenged

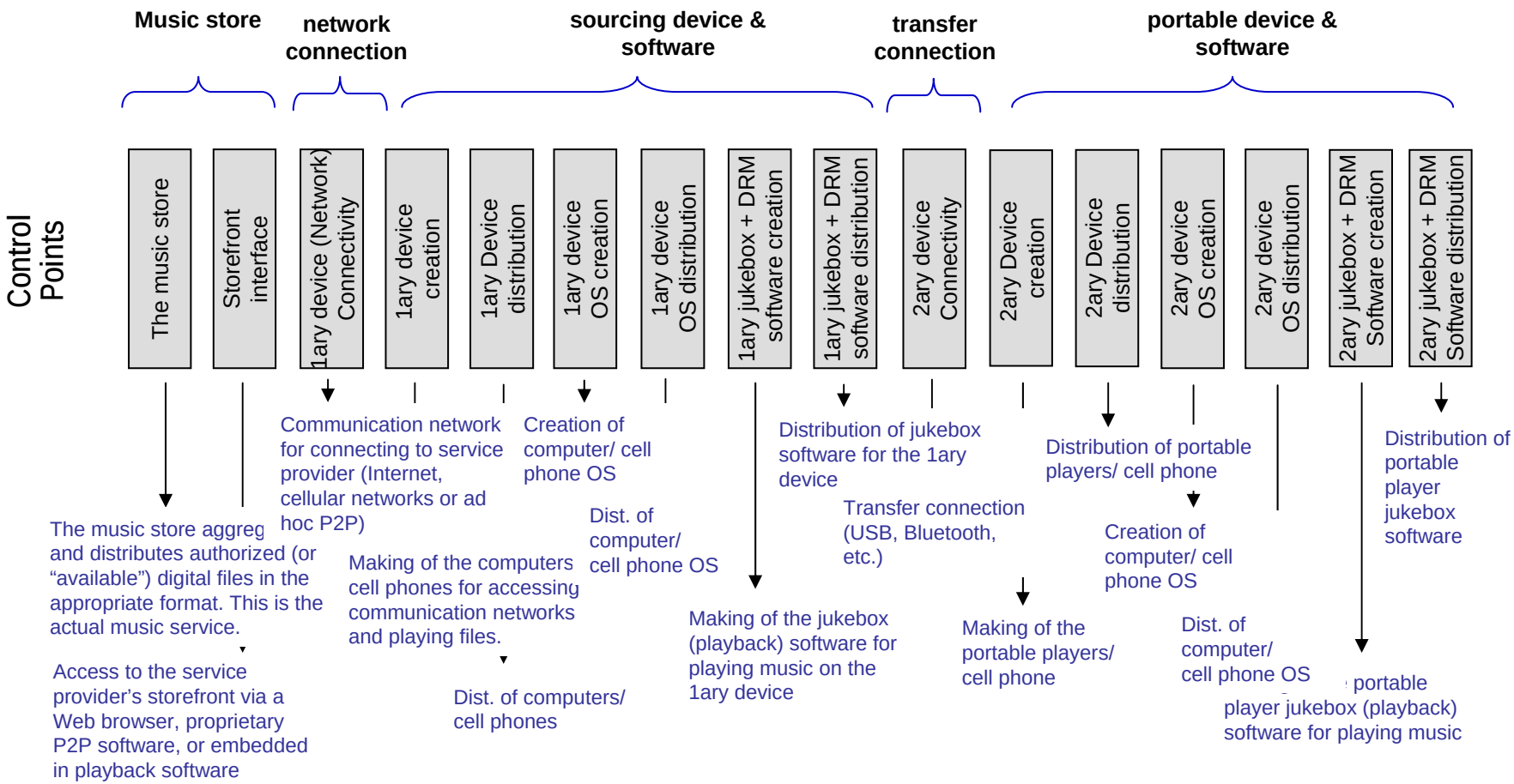


X2. Control Points

- Control points refer to the individual functional elements comprising a communication service
- All functional elements have the potential to serve as a control point, but the degree and scope of control that can be leveraged from a given control point will vary
- Control is exercised via business, regulatory, and/or technical means
- Business models are viewed as a collection of Control Points, organized in a particular way -- Control Point Constellations

X2. Control Points

Example: Digital Music Services



X3. Coreness

- Coreness addresses market conditions for Control Points
- Control Points are described in terms of 2 key properties
- *Scarcity* & *Demand* characterized traditional core services

Scarcity

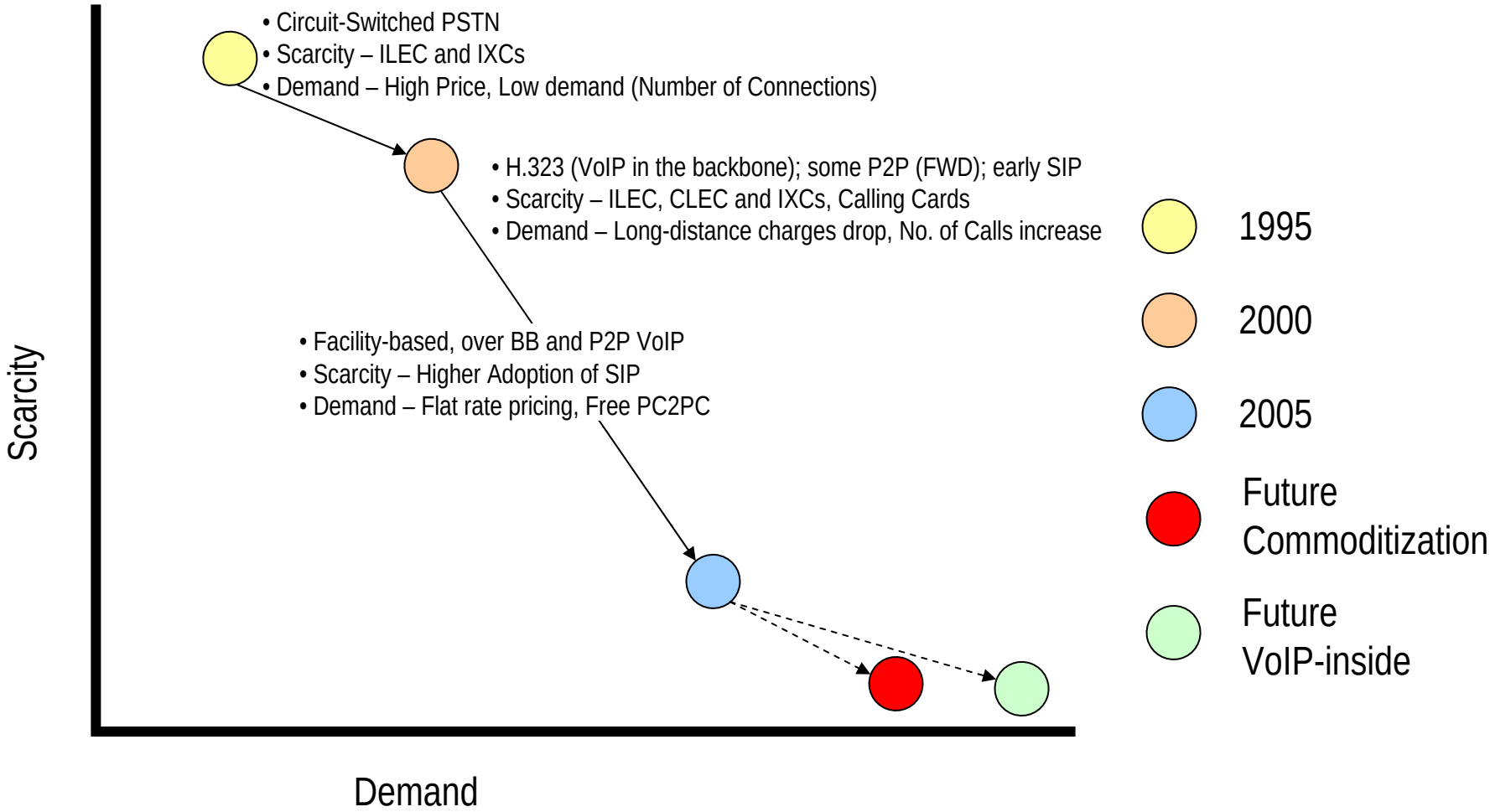
- Refers to the number of providers in the market relative to size of market
- High scarcity = monopoly conditions
- Low scarcity = commoditization
- Affected by technology, business, and/or regulation factors
- Influences how much value (revenue, customers) is captured
- But, is scarcity always a good thing?

Demand

- The potential market share that can be captured by a control point, or a service offering
- Measures include sales revenue, number of subscribers, etc.

X3. Coreness mapping

- Coreness of call signaling, VoIP example



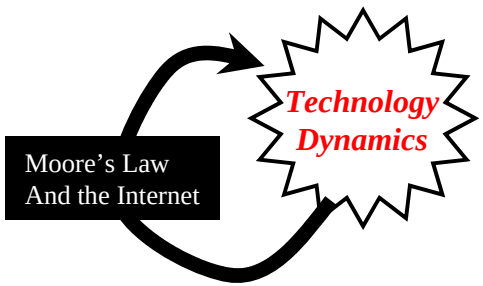
X4. Trigger Dynamics

- Trigger dynamics examine the forces that cause changes in business models and industry value chains
- Our approach takes into account 7 types of triggers, viewed in relation to one another, as a set of interlocking gears:
  - Technology
  - Regulation
  - Customer preference
  - Corporate strategy
  - Business cycles
  - Industry structure
  - Capital market

Note: A more simplified approach looks at 4 types of triggers, related to:
- Technology
- Business strategy
- Regulation
- Social behaviors

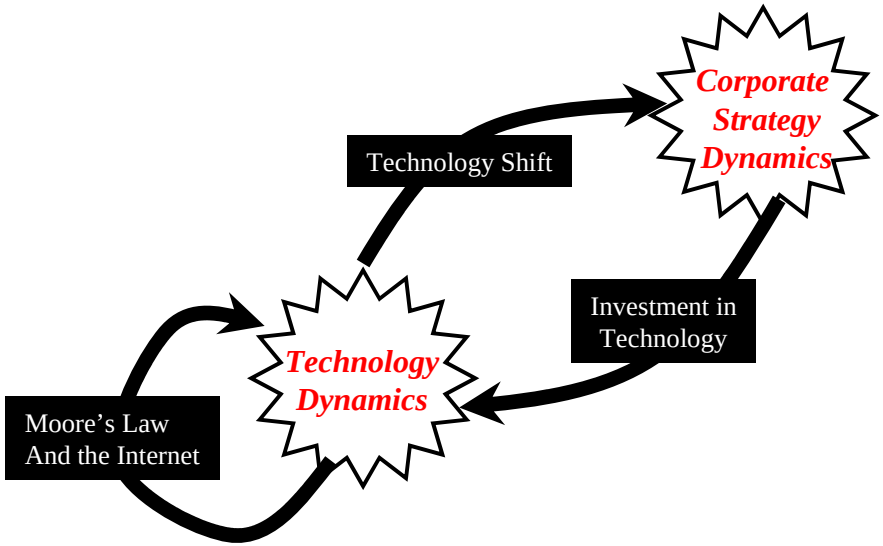
X4. Trigger Dynamics

It begins with Technology Dynamics



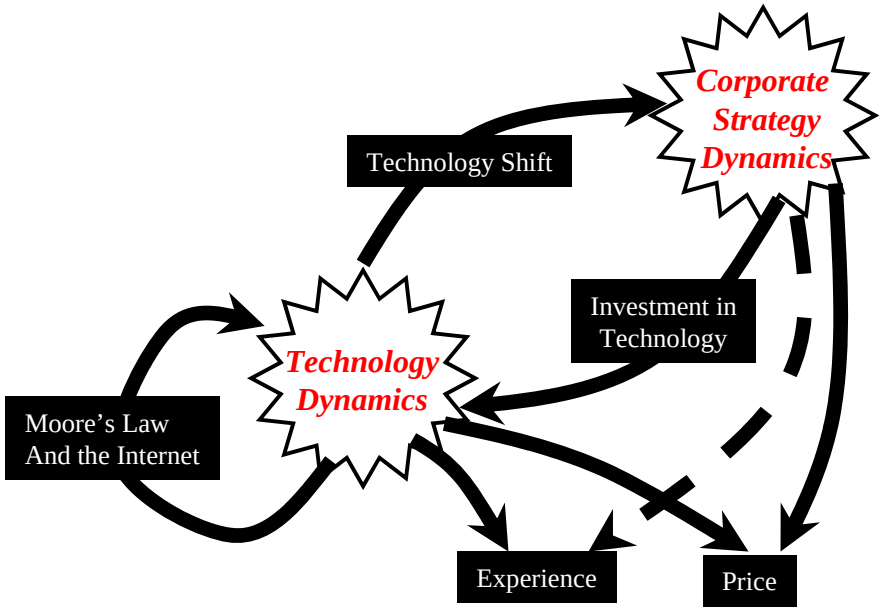
X4. Trigger Dynamics

New Technology drives Corporate Investments



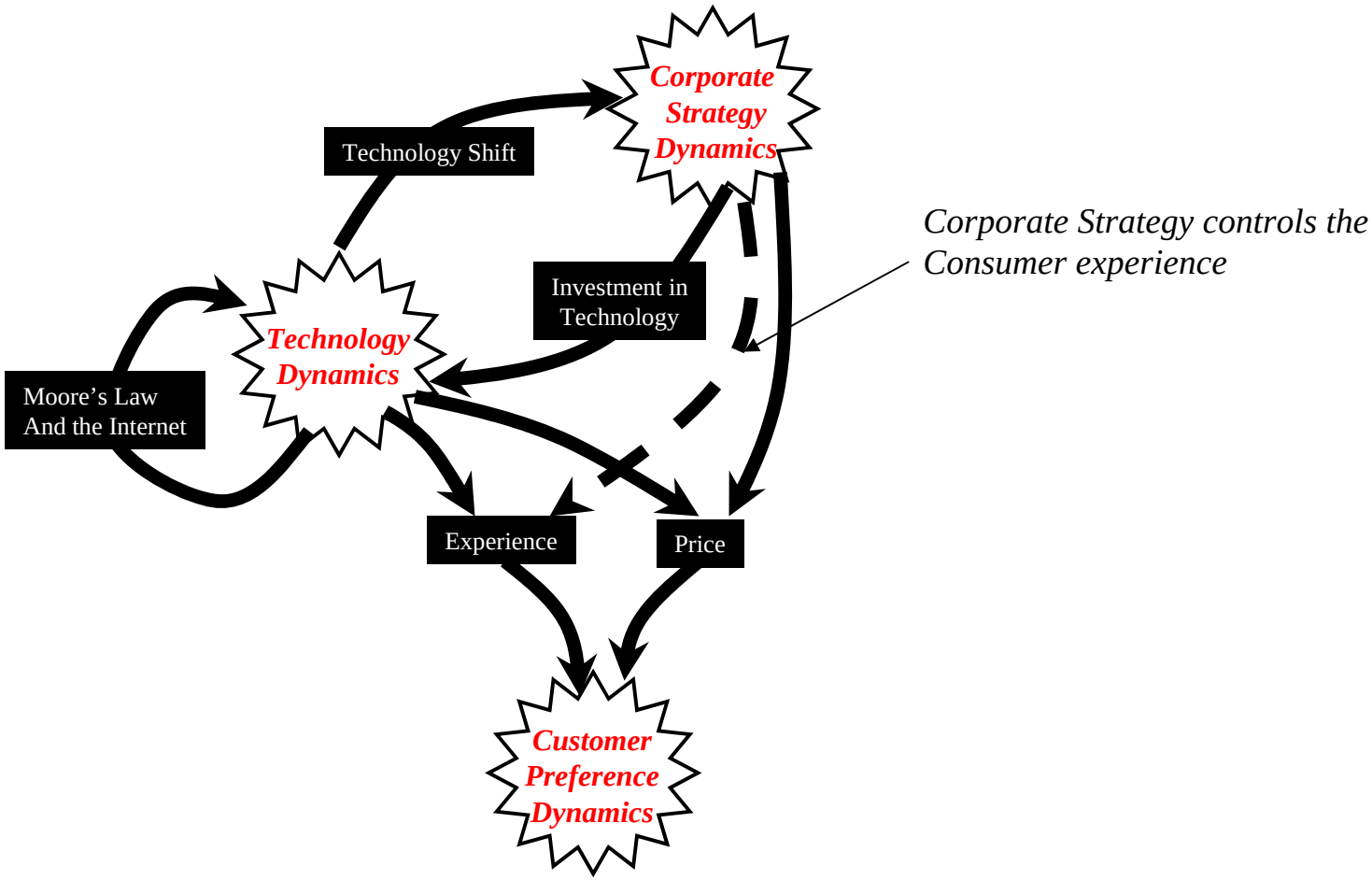
X4. Trigger Dynamics

Technology and Corporate Strategy shape Price and Experience



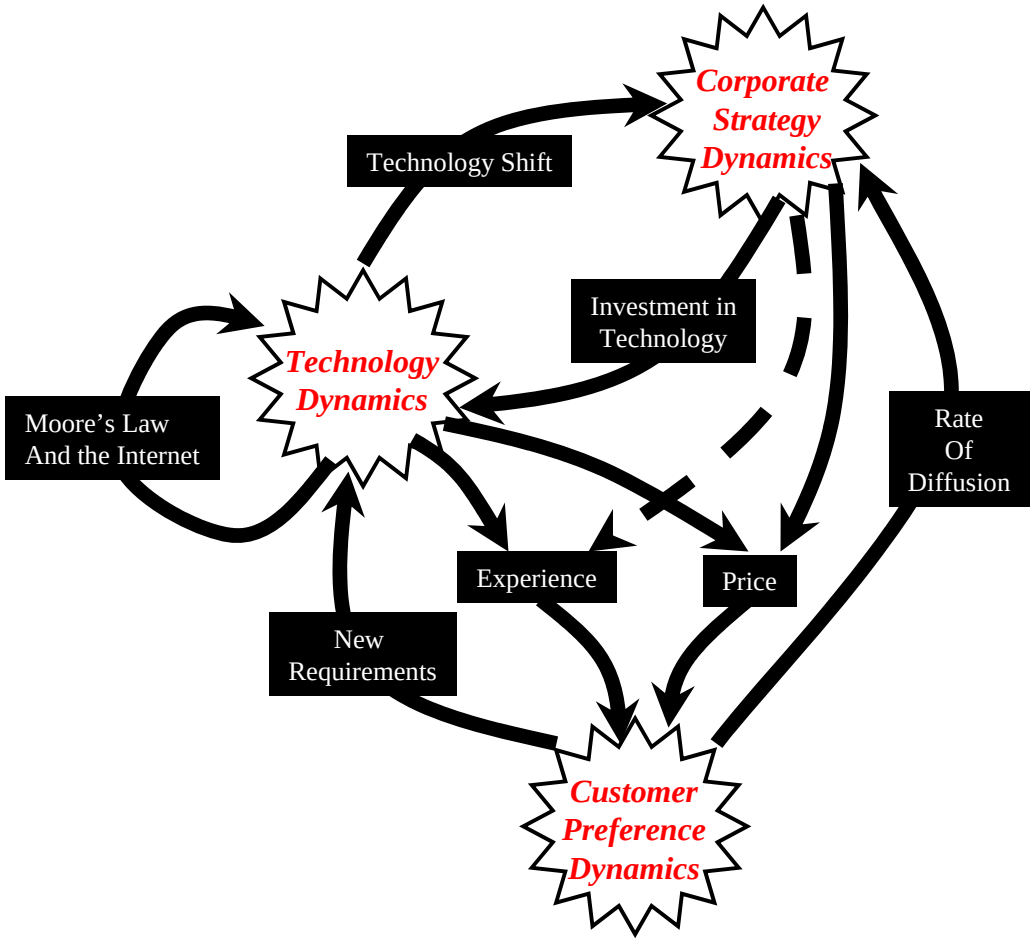
X4. Trigger Dynamics

Price and Experience shape Consumer Preferences



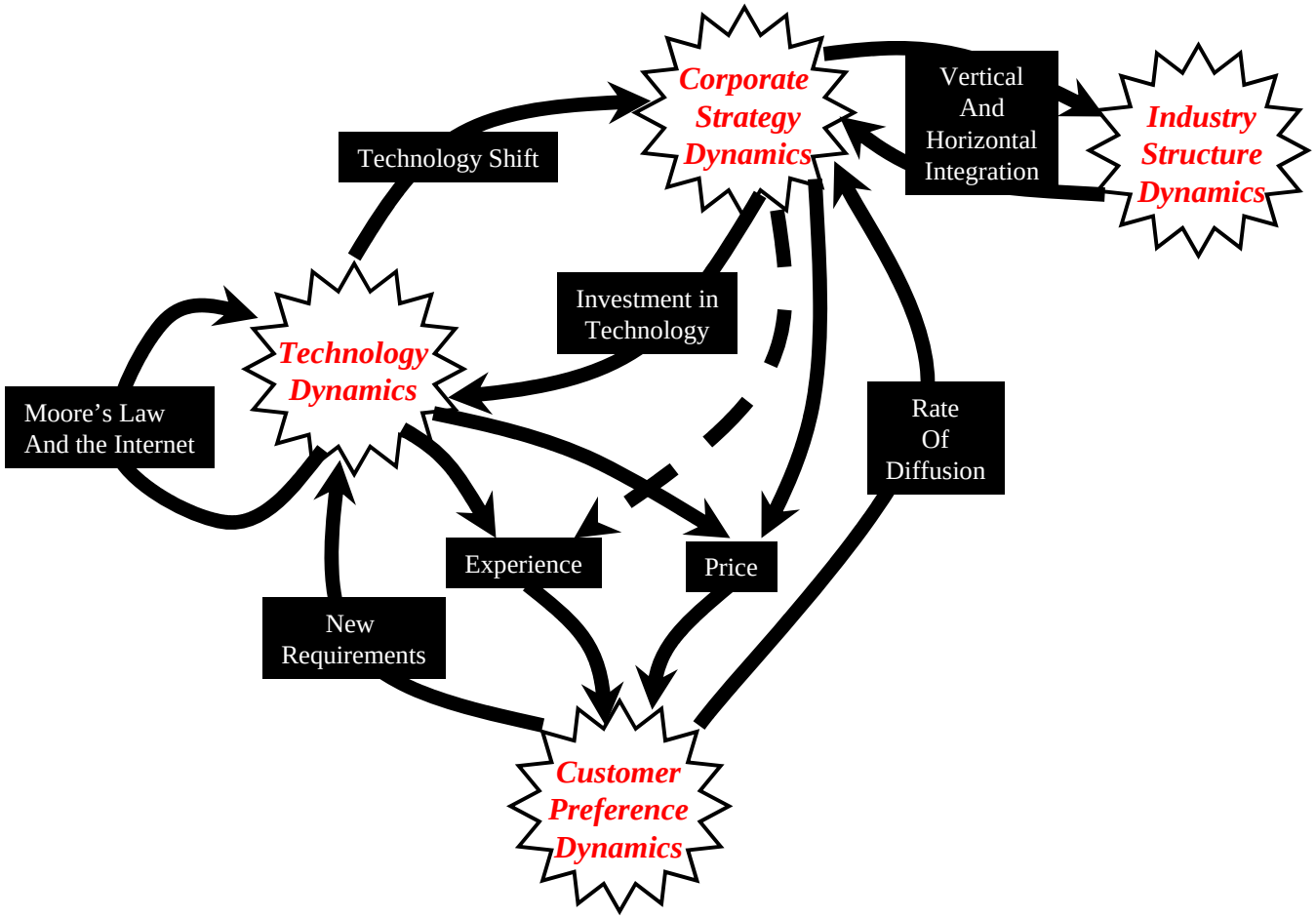
X4. Trigger Dynamics

Consumer Preferences churn Technology and Corporate Strategy Dynamics

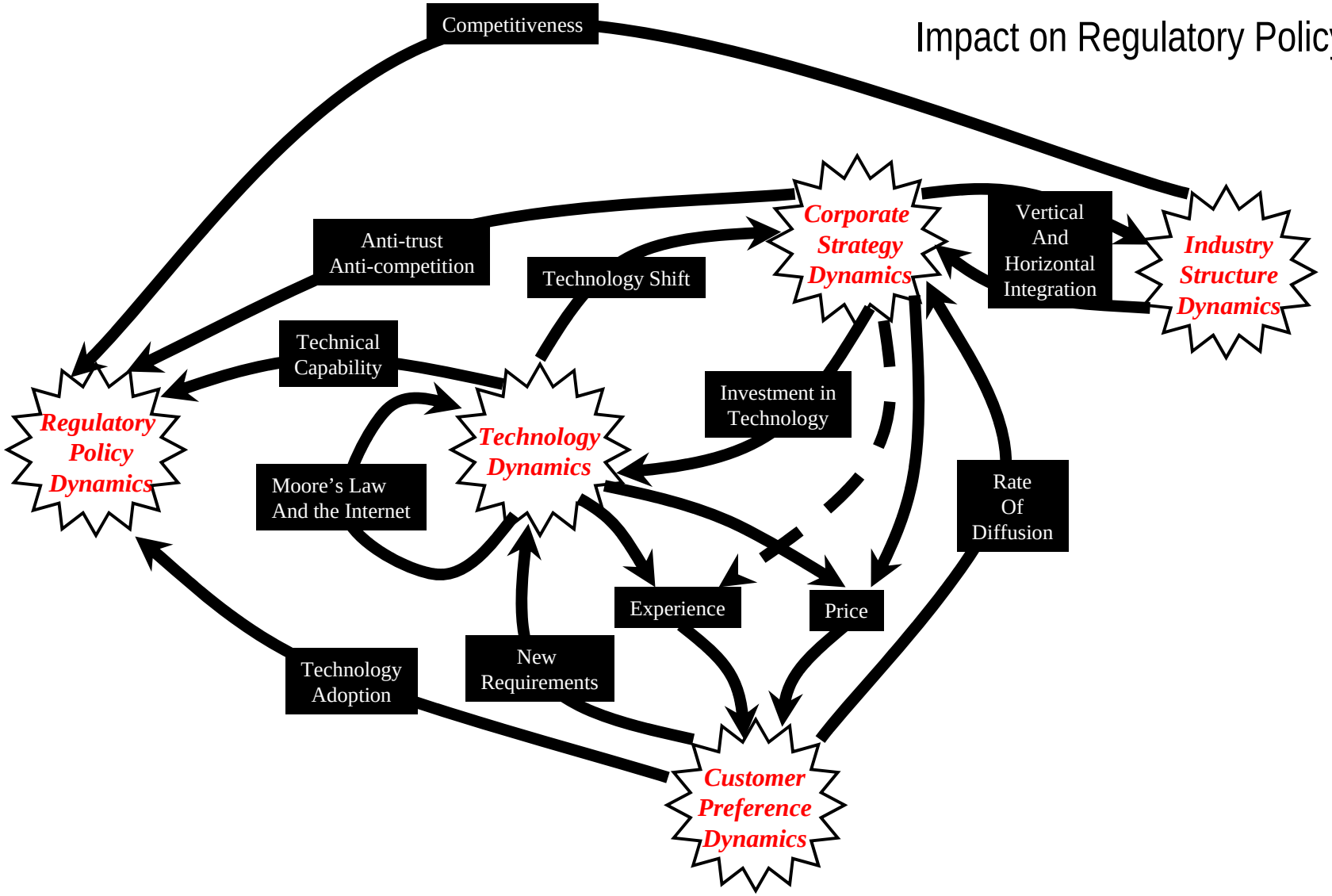


X4. Trigger Dynamics

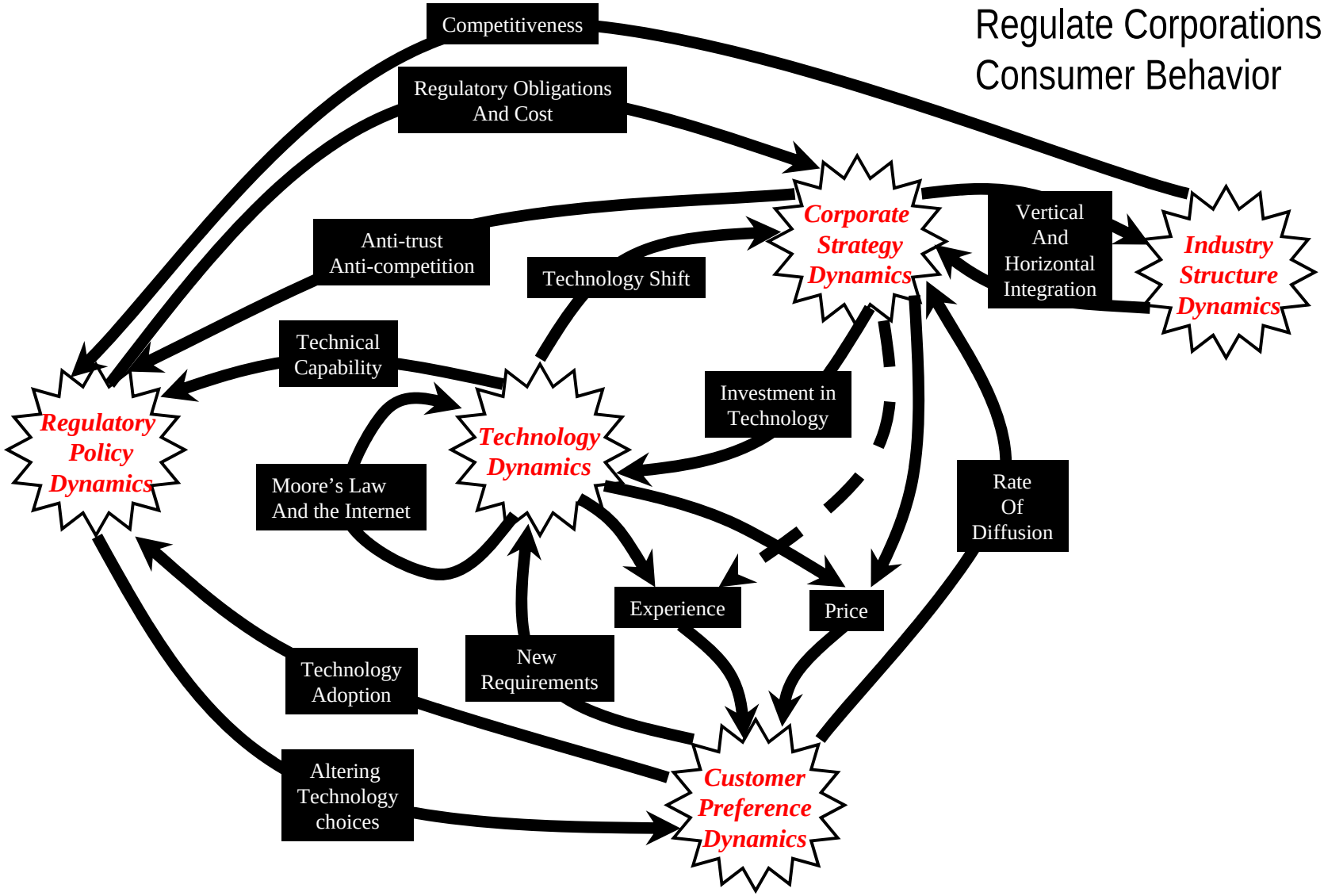
Corporate Strategy determines the Industry Structure



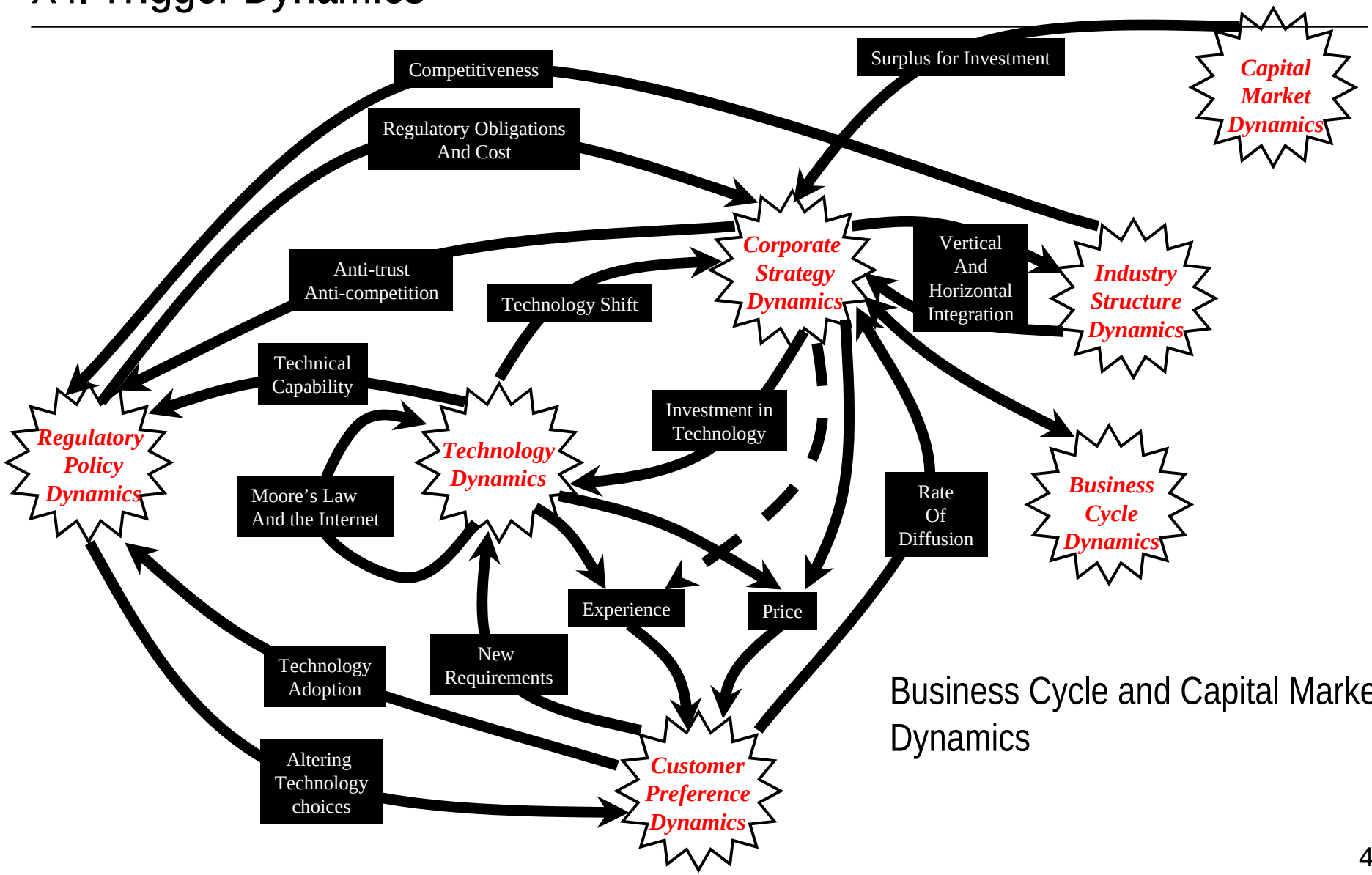
X4. Trigger Dynamics



X4. Trigger Dynamics



X4. Trigger Dynamics



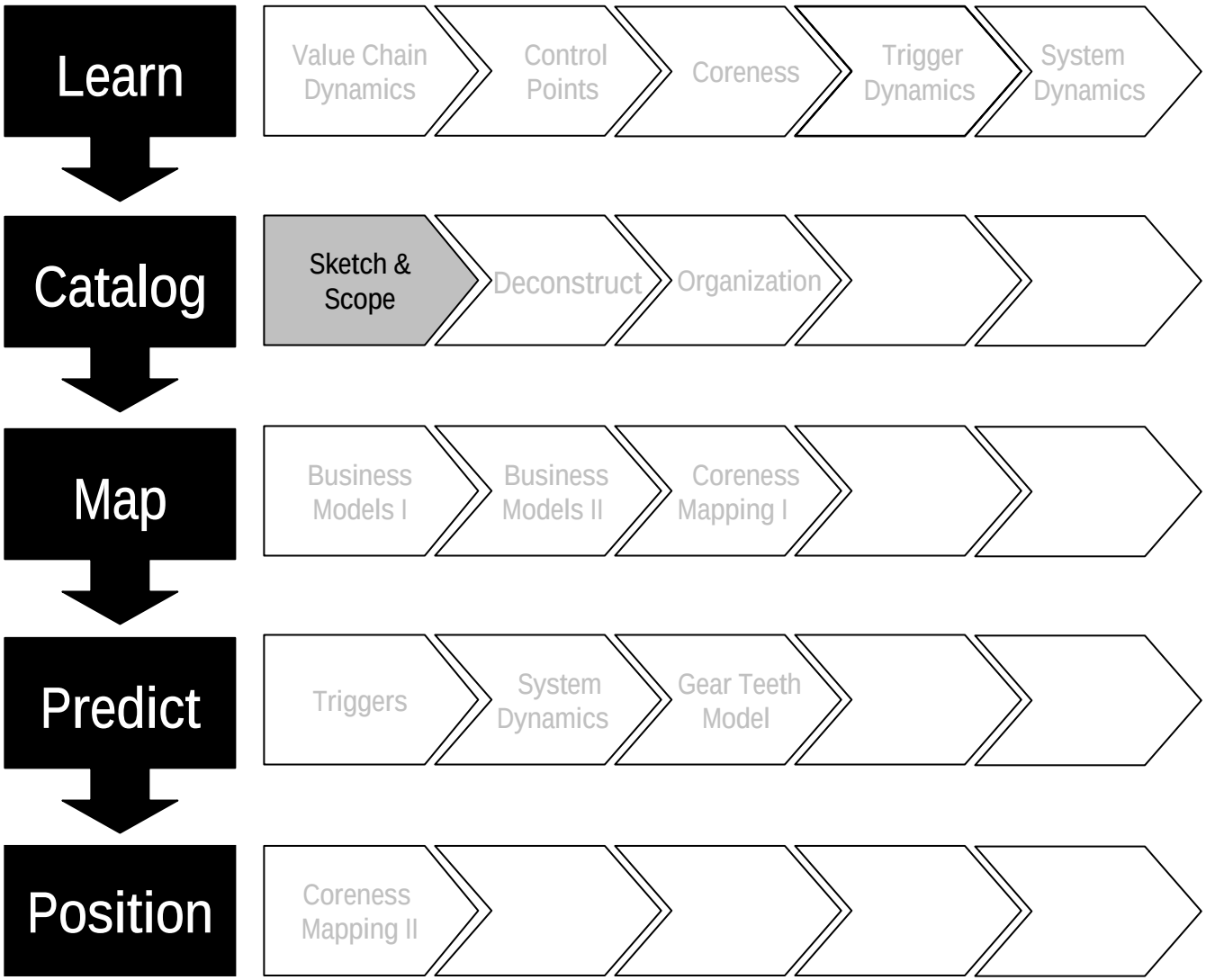
Business Cycle and Capital Market Dynamics

X5. System Dynamics Modeling

- System dynamics is a sophisticated methodology for studying and managing complex feedback systems.
- It demonstrates how structure determines system behavior.
- It is often used as a forecasting tool, and at other times a simulation tool.
- We use System Dynamics modeling to understand what triggers a change in the demand and scarcity of a service offering over time -- which triggers are strong and which are not.

Learning Tool to be inserted here…

A1. Sketch & Scope



A1. Sketch & Scope

Purpose

- Sketch out the space at a high level and create a common view for discussion
- Establish the scope of analysis and key scenarios

Background

- This tool serves as a starting point
- Identifies the key competitive tensions in the industry

Process

1. List relevant services
2. Categorize according to key differences in the delivery infrastructure
3. Identify secondary dimensions that differentiate service models
4. Create high-level categories for services
5. Establish scope of analysis

A1. Sketch & Scope

1. List service examples

Example: VOIP

- AT&T
- Comcast (VoCable)
- Verizon (VoDSL)
- VoIP over wireless
- Vonage
- FWD
- Skype
- Yahoo!
- IM

Example: IP Video

- Broadcast TV
- Cable TV
- Satellite TV
- Verizon
- ATT SureWest
- SaskTel
- MaLigne TV
- FastWeb
- PCCW
- Celfun
- iTunes videos
- Vcast
- Satellite phone
- DVB-H
- BitTorrent
- P2P Networks
- Google
- In2TV
- MTV
- ABC
- Joe Cartoon
- Homestar Runner
- Veoh
- Wkolphin
- MovieLink
- CinemaNow
- Akimbo
- ITVN
- Dave TV
- TiVo
- Brightcove
- YouTube
- iFilm
- BlipTV
- Personal web sites
- Podcasts

Guidelines

- List all service examples for a communication offering you can think of, even if you're not sure they belong, or if you can't find a specific example
- Include existing & potential services
- Cover as wide a territory as possible, you can scope it down later

A1. Sketch & Scope

2. Categorize according to key types of value chains

Example: VOIP

- VoIP in the Backbone
  - AT&T
- Facilities based IP Telephony
  - VoCable (Comcast)
  - VoDSL (Verizon)
  - VoIP over wireless
- VoIP over Broadband
  - Vonage
- P2P VoIP
  - FWD
  - Skype
  - Yahoo!
  - IM

Example: IP Video

- Traditional video
  - Broadcast networks
  - Cable networks
- Telco offerings
  - Verizon
  - ATT SureWest
  - SaskTel
  - MaLigne TV
  - FastWeb
  - PCCW
  - Celfun
- Mobile Video
  - iPod & PDAs
  - Cell phone
  - Satellite phone
  - DVB-H
  - BlipTV
- Video via Internet
  - Google
  - iTunes
  - In2TV
- Video via Internet (con't)
  - ABC
  - MTV
  - Joe Cartoon
  - BitTorrent
  - P2P Networks
  - Homestar Runner
  - Veoh
  - Wholphin
  - Movielink
  - CinemaNow
  - Akimbo
  - ITVN
  - Dave TV
  - TiVo
  - Brightcove
  - YouTube
  - iFilm
  - BlipTV
  - Personal web sites
  - Podcasts

Guidelines

- What are the immediate categories based on differences in delivery networks and end user devices used in the offering?
- Again, start wide, focus later

A1. Sketch & Scope

3a. Identify secondary dimensions that differentiate service models

Example: IP Video

- Delivery network
  - Traditional Cable
  - Satellite
  - Private Internet
  - Public Internet
  - Cellular networks
- Access device
  - TV (via STB)
  - PC
  - Cell phone
  - Portable player
- Creation models
  - Produced by TV or movie studio
  - User-created (“home videos”)
- Publishing models
  - Top-down publishing
  - Bottom-up (user-uploaded content)
- Aggregation models
  - Aggregated by an intermediary
  - Consumer direct channels
- User ownership models
  - Streaming
  - Download to own, download to rent
  - Subscription vs pay per show
- Temporal models
  - Scheduled
  - On-demand
  - Time-shifted (recorded)
- Spatial models
  - Fixed
  - Mobile
- Legal models
  - Authorized
  - Unauthorized
- Others?

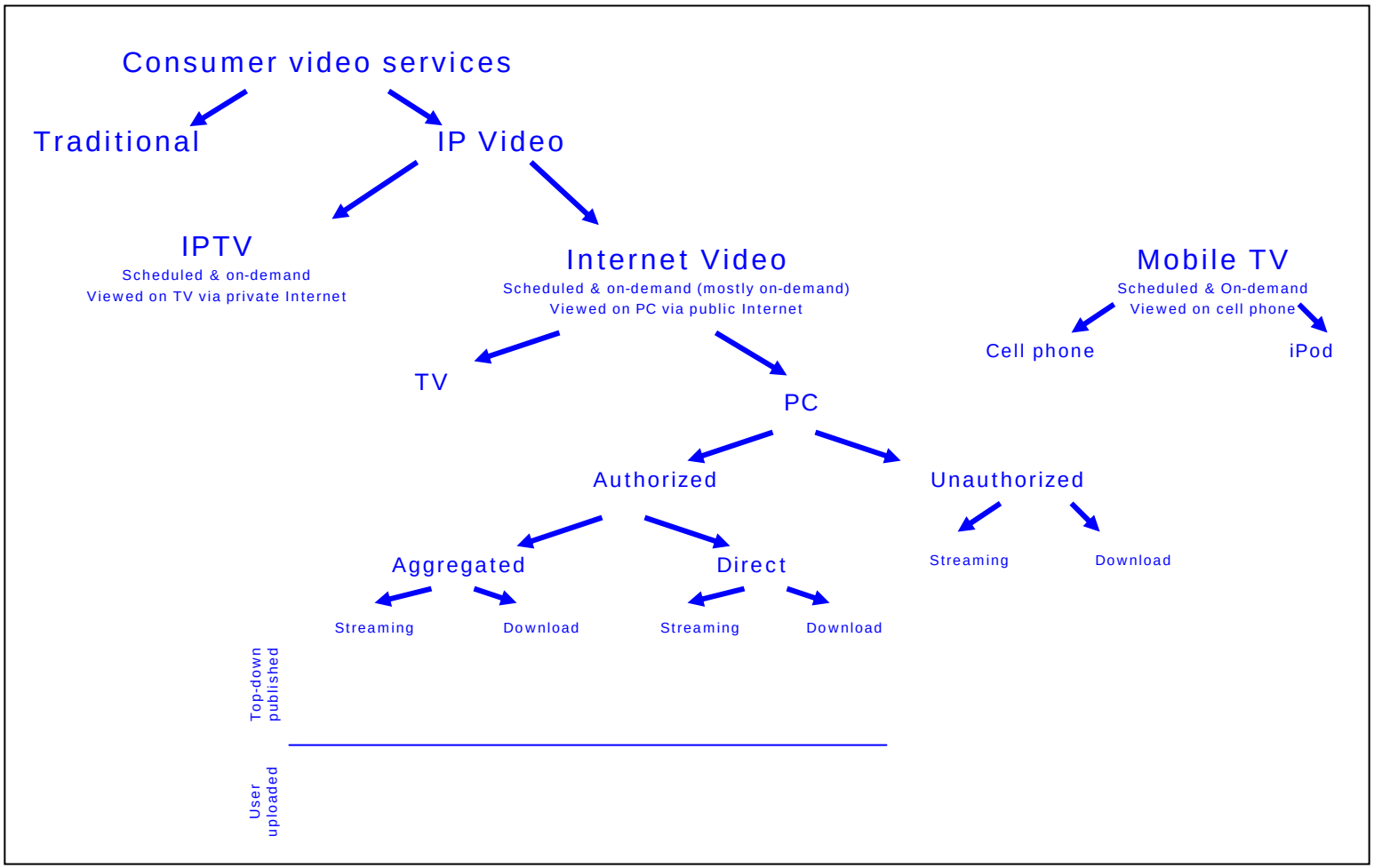
Guidelines

- Look for subcategories based on other dimensions that differentiate the various service models
- For some offerings, there may not be any relevant subcategories. For others there may be several.
- Look for dimensions that will differentiate competing, complementary, or substitute offerings

A1. Sketch & Scope

3b. Identify key dimensions that differentiate service models – graphic format

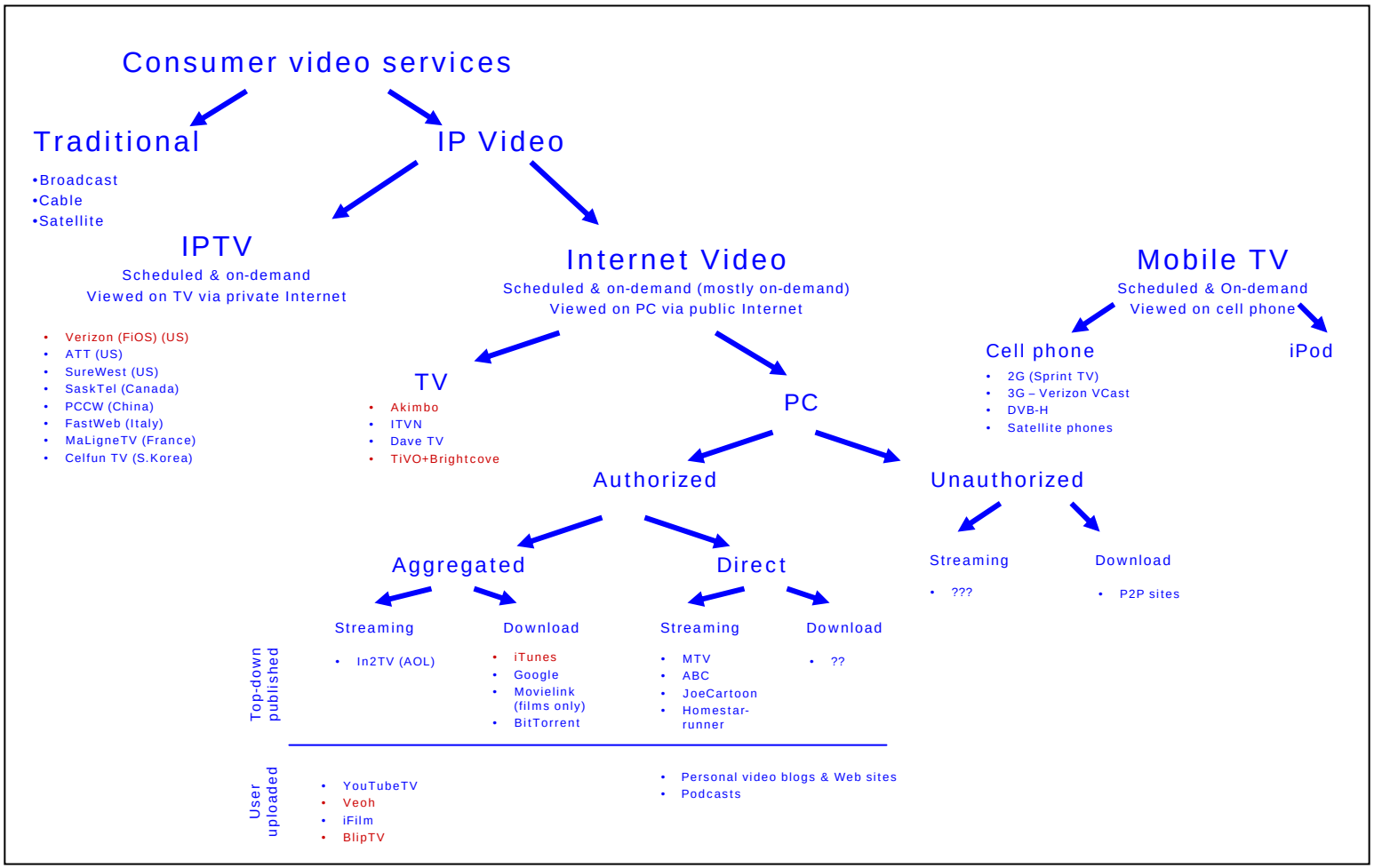
Example: IP Video



A1. Sketch & Scope

3c. Populate with services

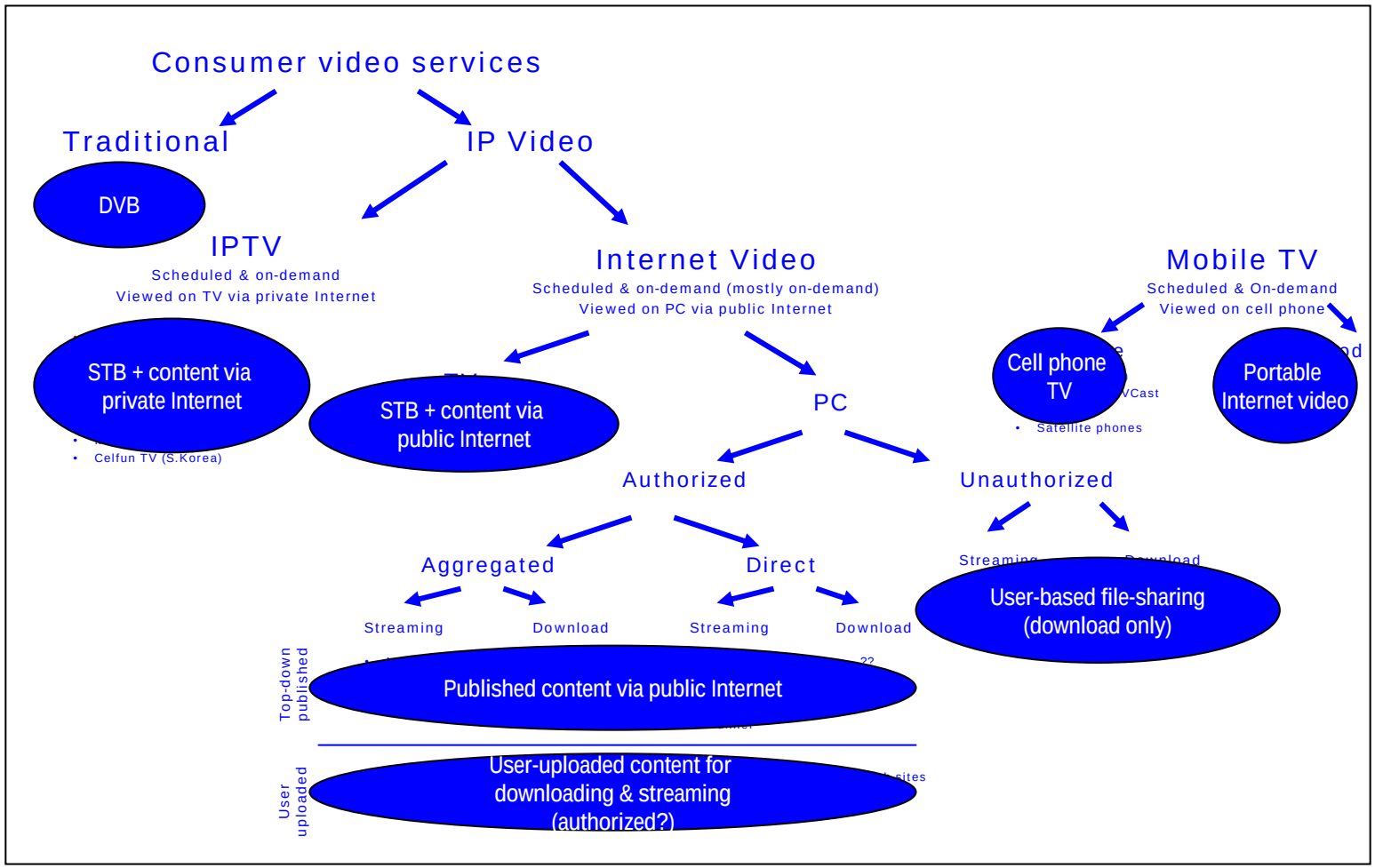
Example: IP Video



A1. Sketch & Scope

4. Identify high-level categories for services

Example: IP Video



Guidelines

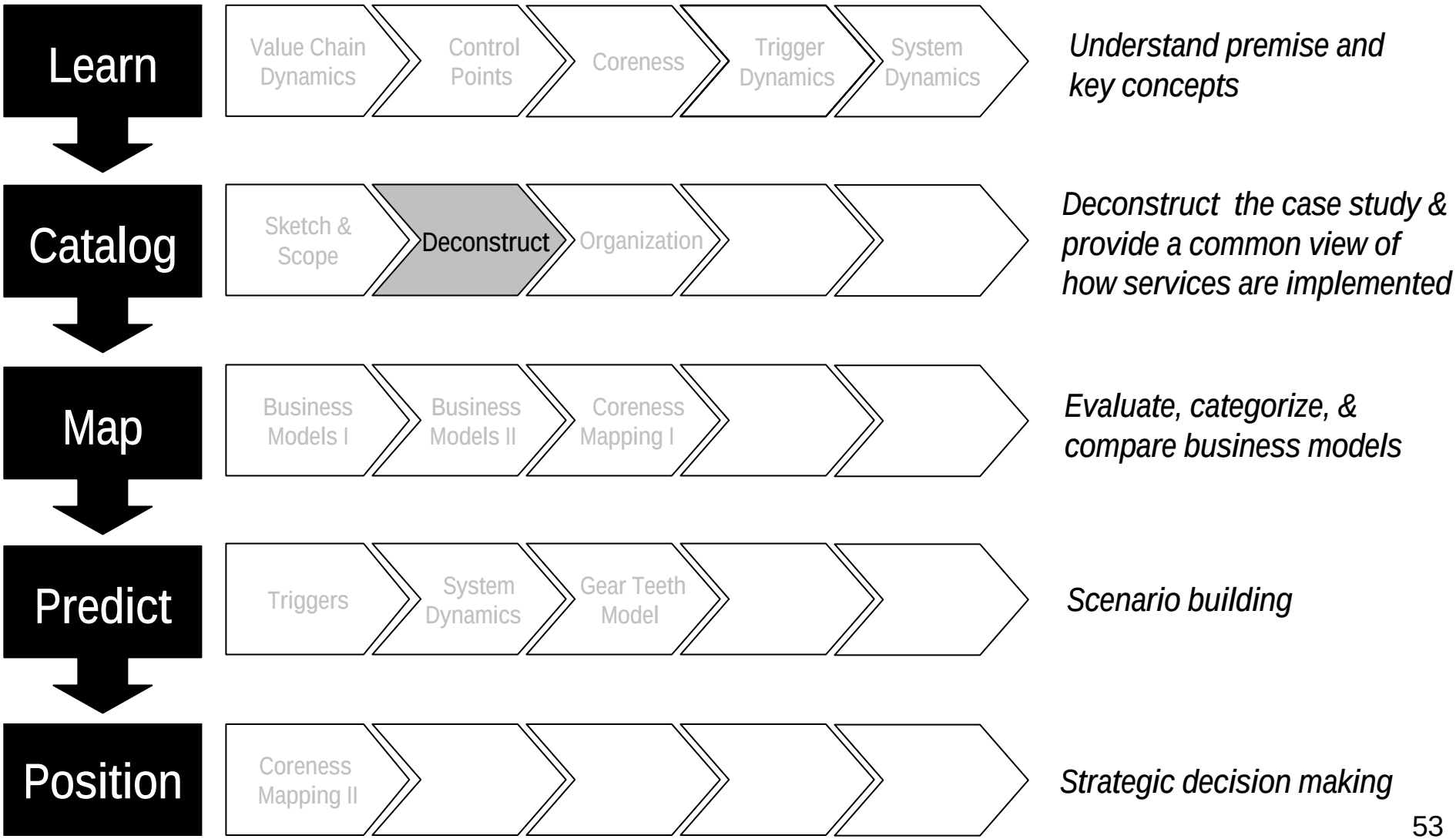
- This should produce a view of competing, complementary, or substitute offerings

A1. Sketch & Scope

5. Establish scope of analysis

- Choose the boundaries of the competitive landscape that you want to focus on.
- Which categories do you want to include in the analysis?

A2. Deconstruct



A2. Deconstruct

Purpose

- Decompose services into component parts
- Understand fundamental differences in service implementation

Background

- Our taxonomy breaks services down into 3 sets of components:
  1. *Service transactions* refer to the key tasks or activities involved in the implementation of a given service
  2. The *delivery infrastructure* comprises the architectural components used to deliver and consume the service
  3. *Control points* refer to the individual functional elements required to execute the service transactions

Process

1. Review Control Points Learning Tool
2. Choose a variety of services for comparison based on key service distinctions
3. List the individual transactions that comprise a given service
4. Identify the functional components required to execute the service transactions
5. Identify the delivery infrastructure required

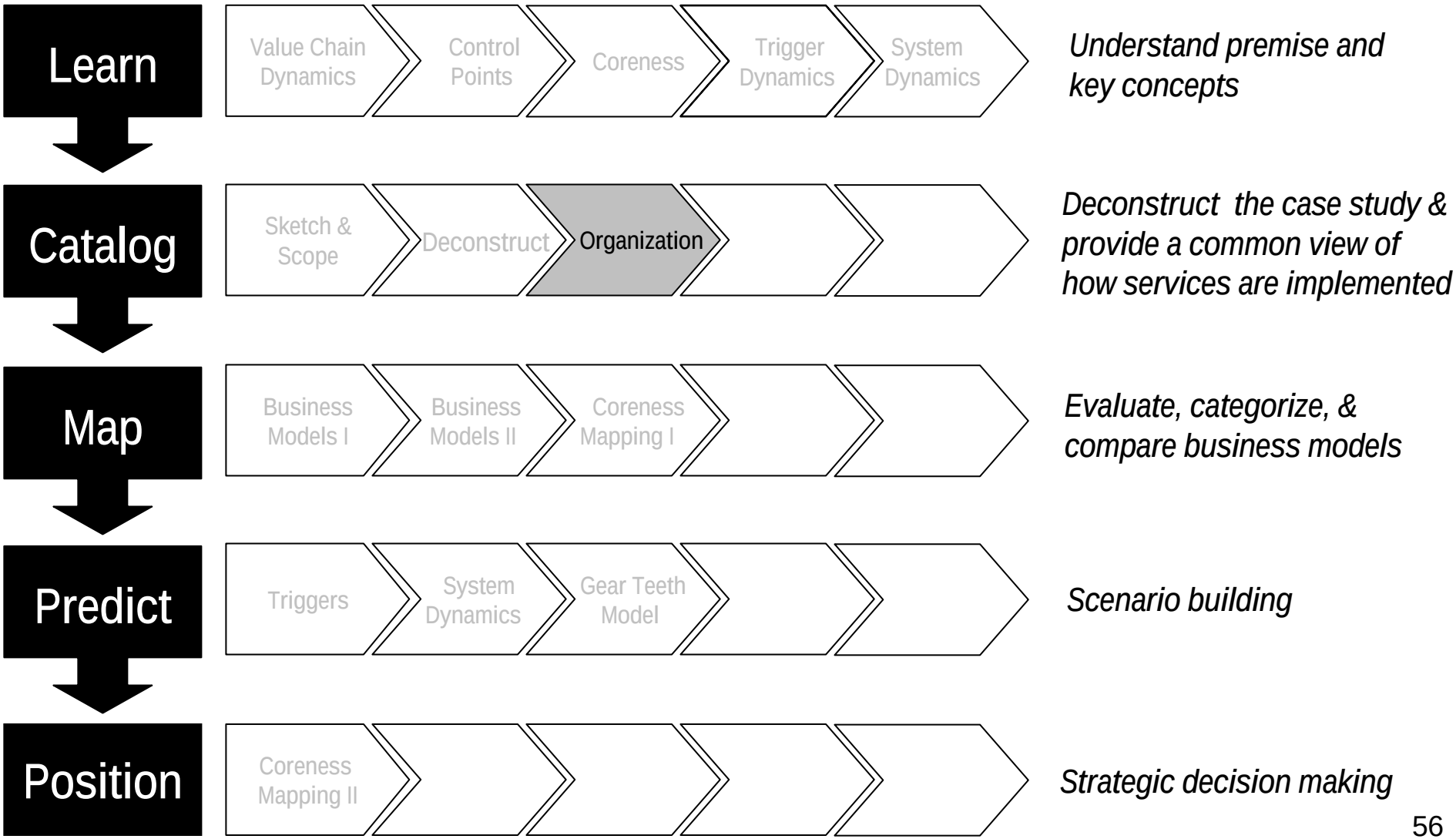
A2. Deconstruct

Example: VoIP

Guidelines
- Start wide, focus later
- Try to keep the same level of granularity across the various component categories
- Some services will share the same components, others will be based on unique combinations.
- Use graphics if it helps

	AT&T	Vonage	Skype
Service transactions	• Call signaling • Bit transport • Routing to PSAP • Disability Access – TTY, TRS signaling • Multiple phones – home wiring • Wiretapping – Call recording • Billing (tracking MOU)	• Call signaling • Routing to PSAP • Phone number to SIP URI mapping • Billing (flat rate, no MOU tracking)	• Call Signaling and Setup • Namespace and Presence Features • Preferential Routing for Quality
Delivery infrastructure	• local loop, national backbone, international backbone, CO, Class 5 and Class 4	• Phone Adaptor; SIP Server, SIP Gateway, [Owned by other entities - DSL Adaptor or Cable Modem, BB network,PSTN or Wireless Infrastructure]	• Application Software
Control points	• Local Loop, National Backbone • Circuit Switching – 100 years of Reliability, QoS • PSTN Features • Regulatory Compliance	• Phone Adapter, PC Application • SIP Signaling – virtual phone numbers, portability of phone service • Flat Rate Billing	• PC Application • Voice/Video/Data Convergence • Name Space

A3. Organization



A3. Organization

Purpose

- Understand the Management of the Control Points and Architecture of the Delivery Infrastructure

Background

- Control Points are primarily managed in a centralized of distributed manner.
  - Centralized Control Points are controlled from few physical locations relative to the number of physical locations involved in the service.
  - Distributed Control Points are controlled from many physical locations relative to the number of physical locations involved in the service.
- The architecture of the delivery infrastructure is classified as being centralized or distributed
  - Centralized: infrastructure resources are grouped together in few physical locations relative to the number of physical locations involved in service functionality.
  - Distributed: resources are spread around in many physical locations relative to the number of physical locations involved in the service functionality.

Process

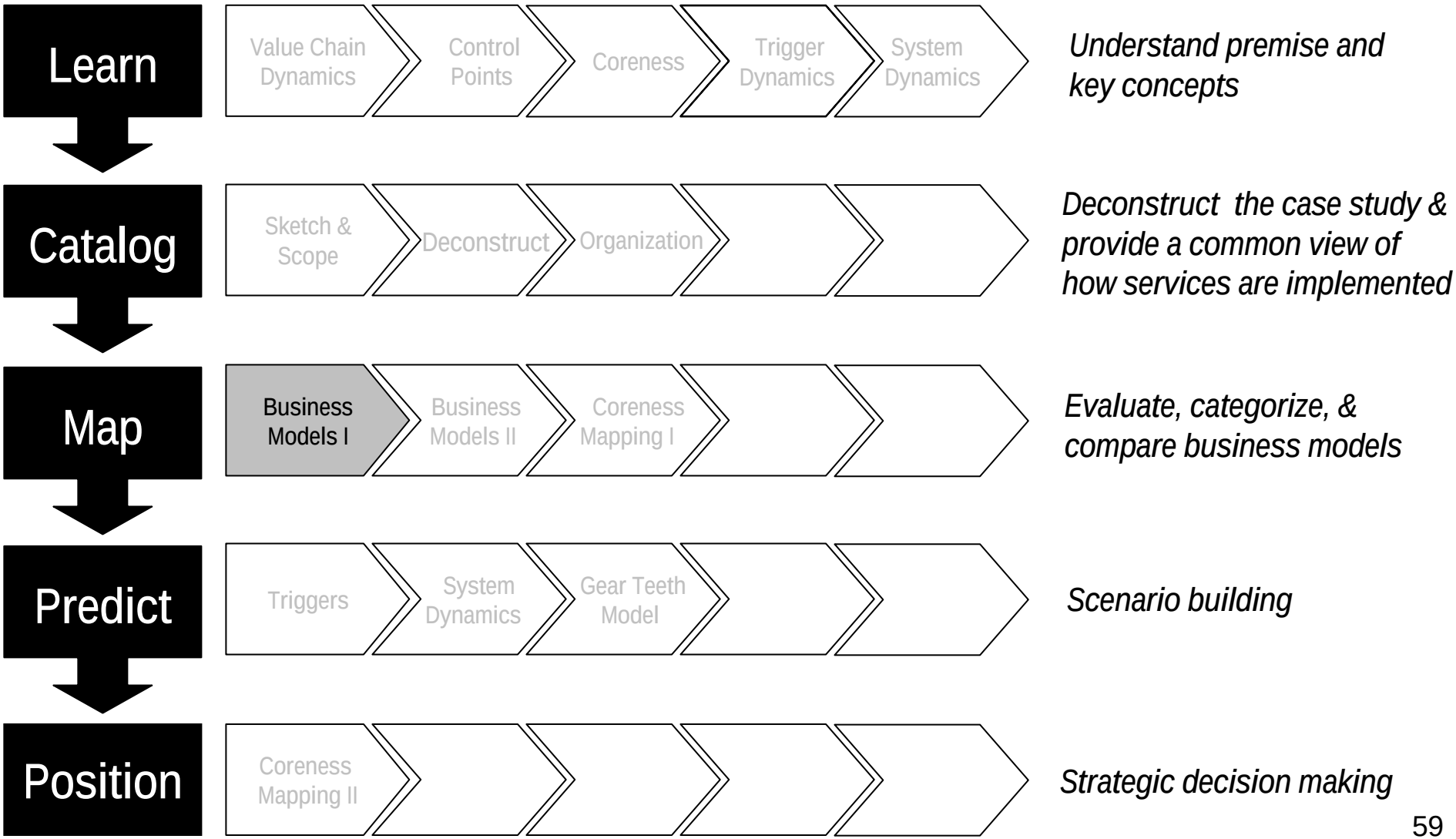
- Determine whether each Control Point is managed in a centralized of distributed manner.
- Determine whether each Delivery Infrastructure element is organized in a centralized or distributed manner.
- The outputs of this tool do not feed into any subsequent tools, rather they explore issues discussed in other CFP working groups.

A3. Organization

Example: VoIP

	AT&T		Vonage		Skype	
Control Points	• Local Loop, National Backbone	Centralized	• Phone Adapter, PC Application	Distributed	• PC Application	Distributed
	• Circuit Switching – 100 years of Reliability, QoS	Centralized	• SIP Signaling – virtual phone numbers, portability of phone service	Centralized	• Voice/Video/Data Convergence	Distributed
	• PSTN Features	Centralized	• Flat Rate Billing	Centralized	• Name Space	Centralized
	• Regulatory Compliance	Centralized				
Delivery infrastructure	• Local Loop	Centralized	• Phone Adaptor	Distributed	• Application software	Centralized
	• National backbone	Centralized	• SIP Server	Centralized		
	• International backbone	Centralized	• SIP Gateway	Centralized		
	• CO Class 5 & class 4	Centralized				

B1. Business Models I



B1. Business Models I – Control Point Constellations

Purpose

- To understand business models as a collection of Control Points

Background

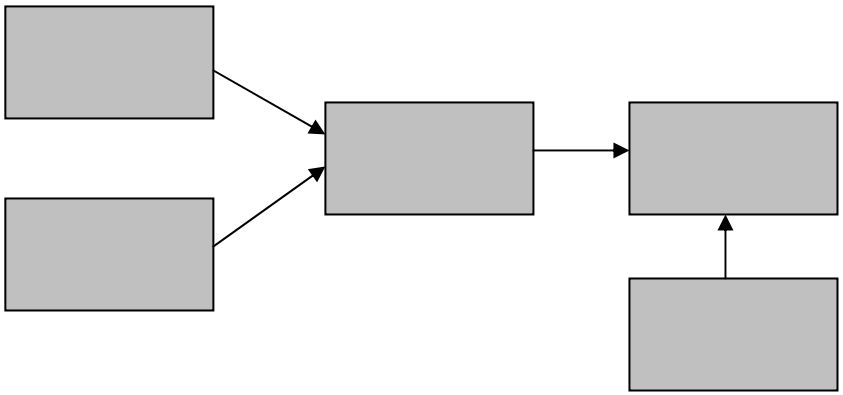
- In our analysis, a business model is viewed as a collection of Control Points, organized in particular way
- The diagrams are an attempt to show how the Control Points relate to each other in each business model

Process

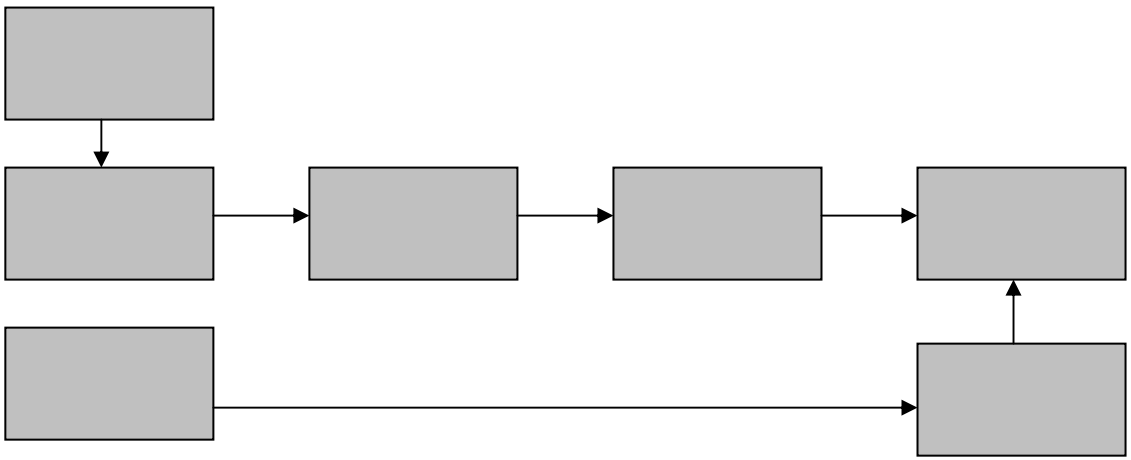
1. Using the Control Points identified in the previous exercise, map the relationship between Control Points, i.e., how do they flow and work together to result in a service?
2. Optional exercise involves categorizing CPC types

B1. Business Models I – Control Point Constellations

Service offering A



Service offering B

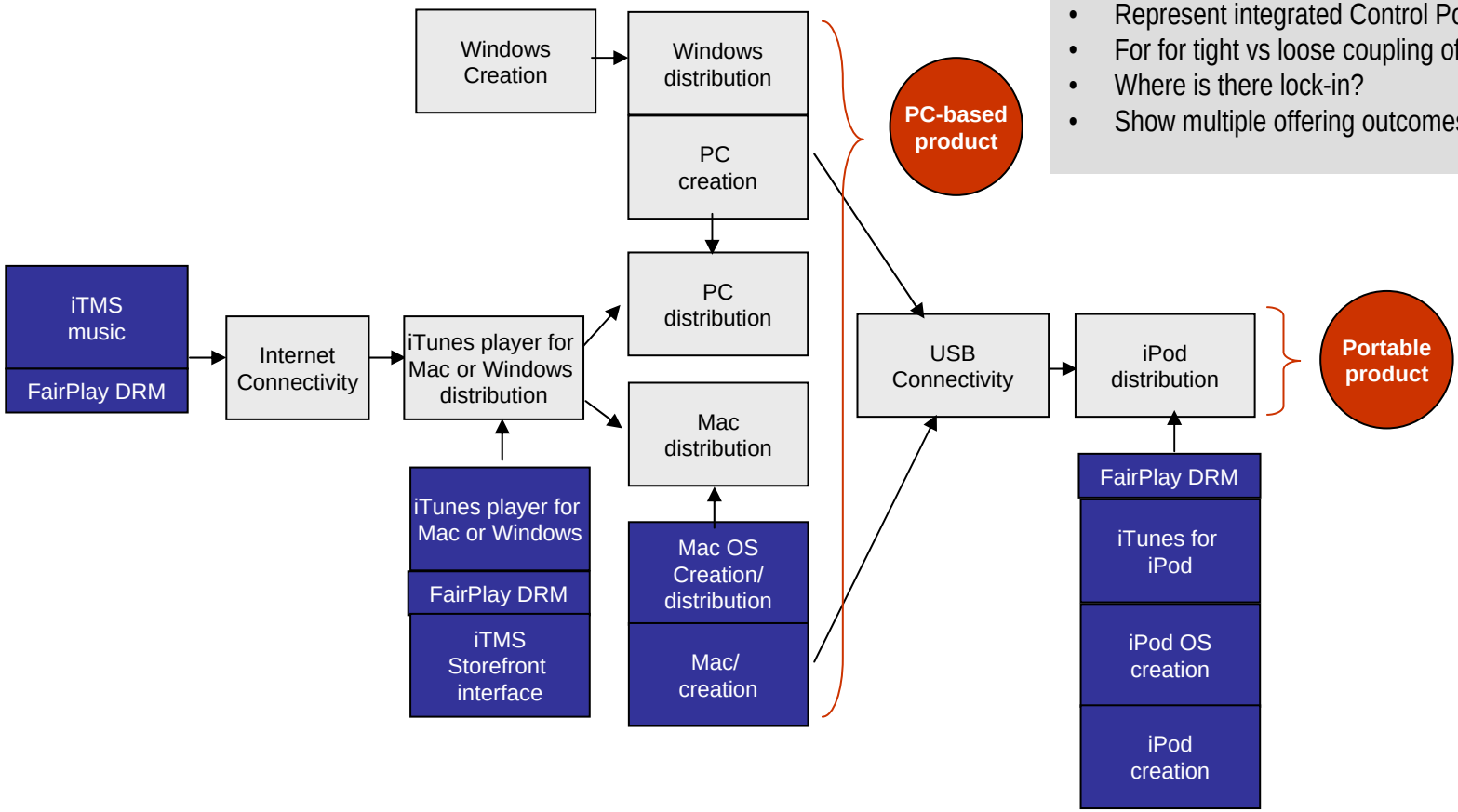


Guidelines

- Arrange Control Points in a logical sequence
- Indicate where components or bundles of components flow into one another
- Represent integrated Control Points as joined together
- For for tight vs loose coupling of components
- Where is there lock-in?
- Show multiple offering outcomes if applicable

B1. Business Models I – Control Point Constellations

Example: Digital Music Services



Guidelines

- Arrange Control Points in a logical sequence
- Indicate where components or bundles of components flow into one another
- Represent integrated Control Points as joined together
- For for tight vs loose coupling of components
- Where is there lock-in?
- Show multiple offering outcomes if applicable

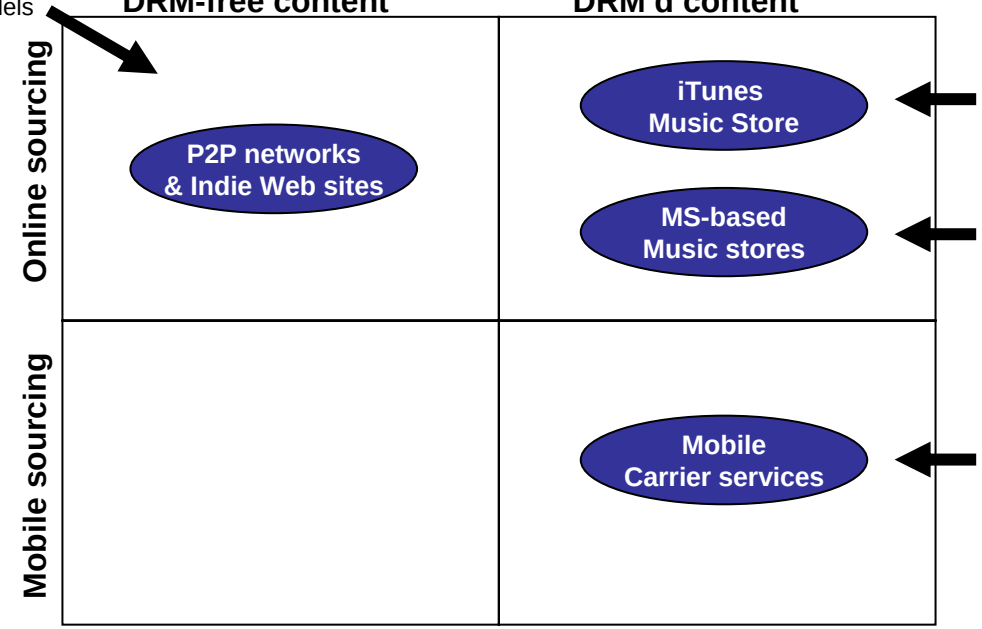
B1. Business Models I – Control Point Constellations

Example: Digital Music Services

Optional exercise

- Look for high level categories of CPCs based on their configuration

User-controlled networks and independent artists/ labels support "free" and/or untethered music models

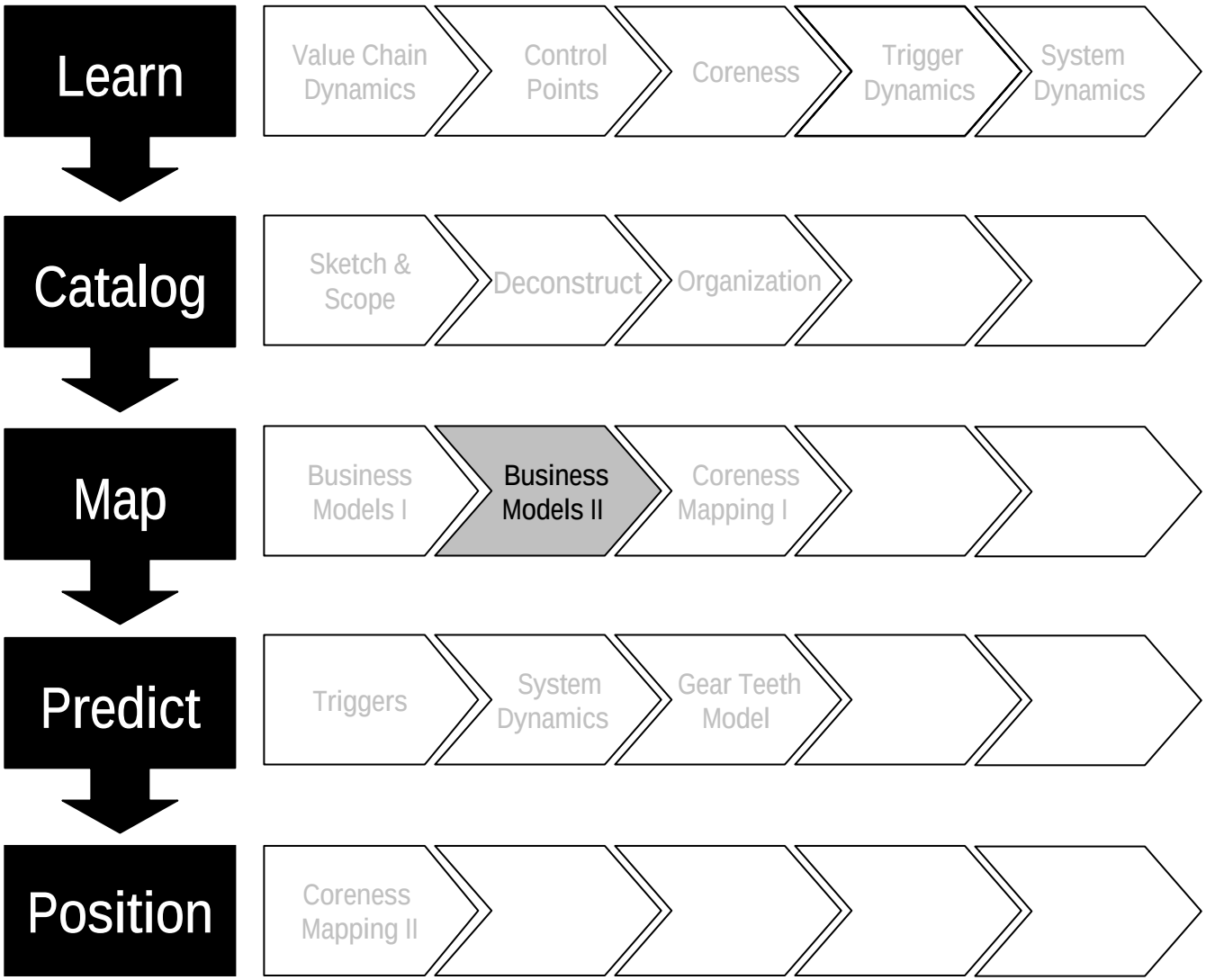


- Services provided by device manufactures like Apple (iTMS) and Sony (Connect)
- Dominated by iTunes
- Proprietary DRM (FairPlay) ties music to iPods

- MS-based stores supported by the Windows Media Player
- DRM ties music to WMP, which is tied to the Windows platform

- Wireless carriers build their own music stores

B2. Business Models II



B2. Business Models II – Value Annotation

Purpose

- Determine the value of Control Points

Description

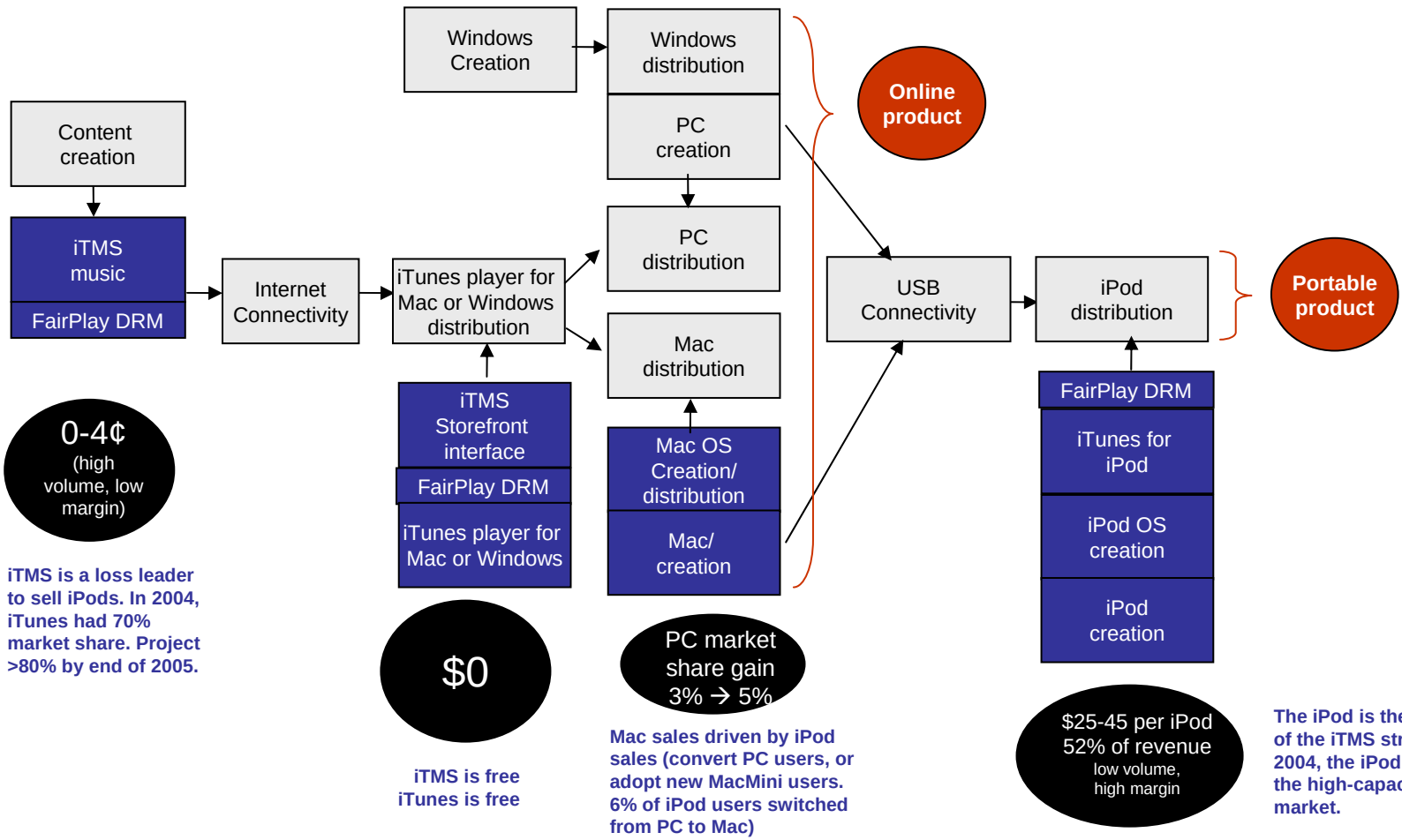
- Refers to the value that a control point or service can capture
- Value can be captured directly or indirectly
- This is the most difficult parameter to determine since it depends on a variety of factors, most notable interchangeability and demand
- Definition of “Value” is to be developed
- Value can be revenue ($$) but can also be non-monetary value, e.g., customers

Process

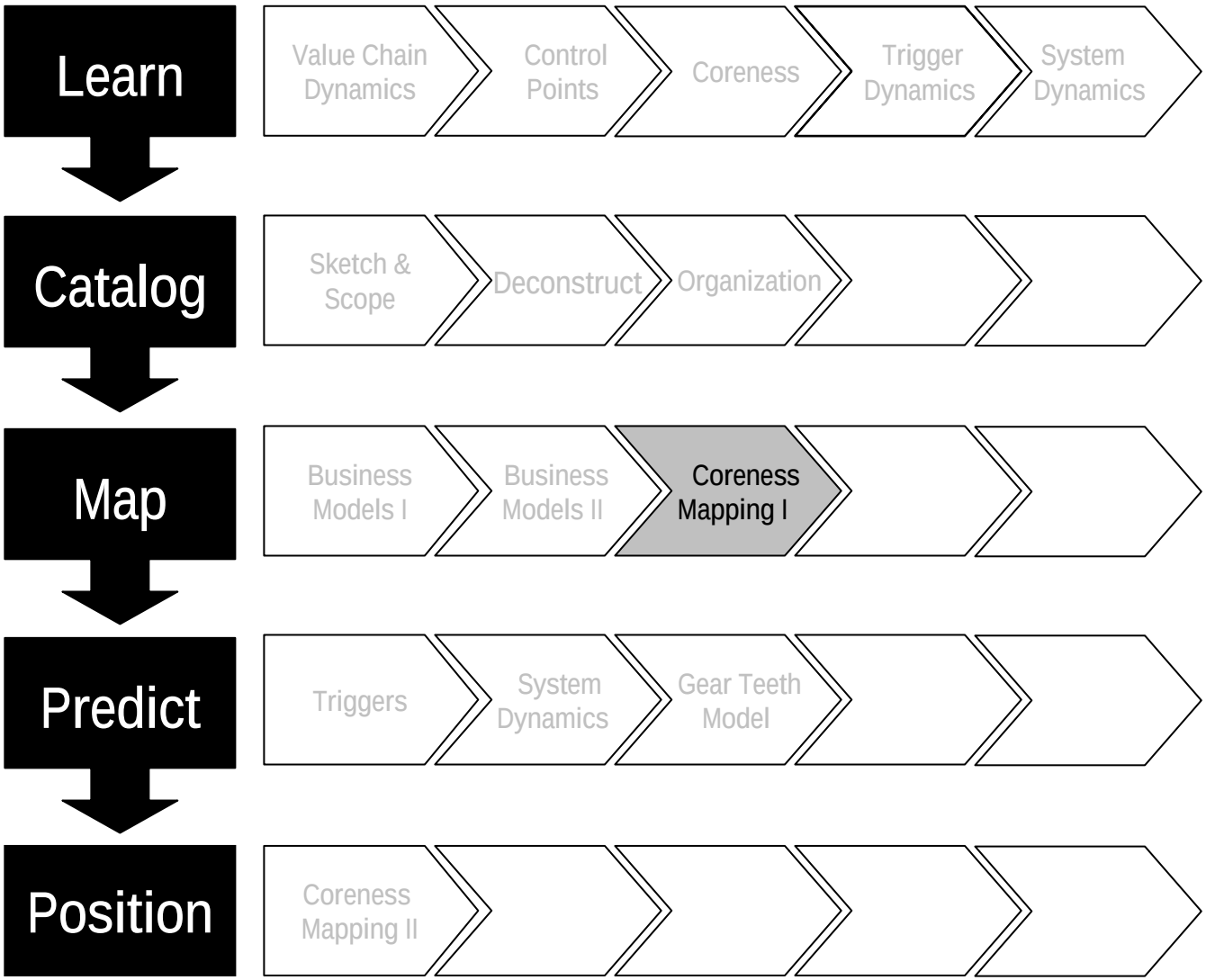
1. Annotate individual Control Points with value

B2. Business Models II – Value Annotation

Example: Digital Music Services



B3. Coreness Mapping I



B3. Coreness Mapping I

Purpose

- Examine current market conditions for individual Control Points

Description

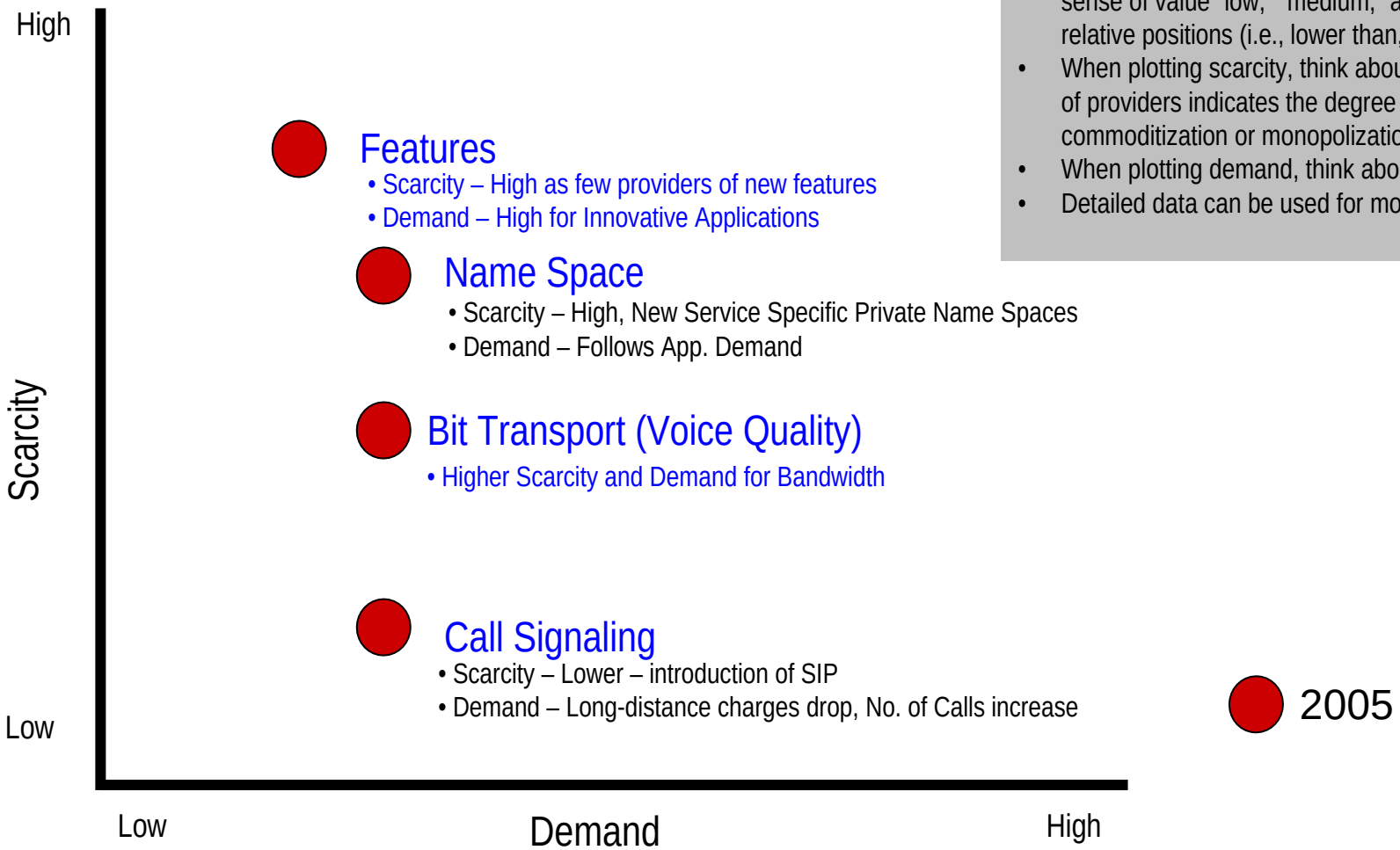
- Coreness addresses helps analyze market conditions for Control Points
- “Coreness” describes Control Points in terms of 2 key properties
  1) Scarcity: number of providers in the market
  2) Demand: potential market share

Process

1. Review Coreness Learning Tool
2. Plot Scarcity and Demand for each Control Point

B3. Coreness Mapping I

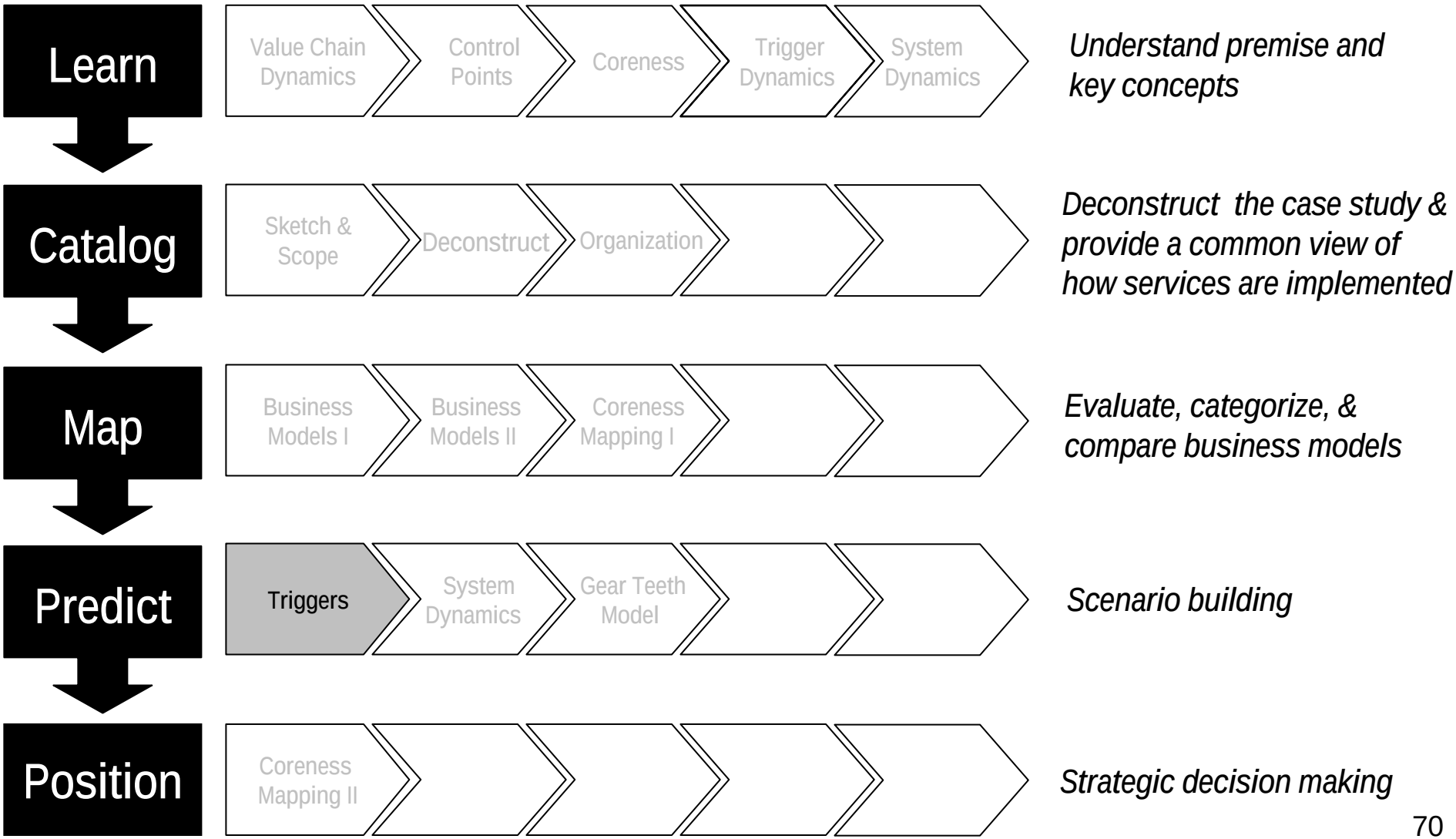
Example: VoIP



Guidelines

- Plot all Control Points on the same graph
- These are rough plots meant to give a general sense of value “low,” “medium,” and “high” values, relative positions (i.e., lower than, higher than)
- When plotting scarcity, think about how the number of providers indicates the degree of commoditization or monopolization of the market
- When plotting demand, think about market share
- Detailed data can be used for more precise graphs

C1. Triggers


Learn
Value Chain Dynamics
Control Points
Coreness
Trigger Dynamics
System Dynamics
Understand premise and key concepts
Catalog
Sketch & Scope
Deconstruct
Organization
Deconstruct the case study & provide a common view of how services are implemented
Map
Business Models I
Business Models II
Coreness Mapping I
Evaluate, categorize, & compare business models
Predict
Triggers
System Dynamics
Gear Teeth Model
Scenario building
Position
Coreness Mapping II
Strategic decision making

C1. Triggers

Purpose

- Identify forces that cause changes in business models and industry value chains

Description

- There are 7 types of triggers
  - Technology
  - Regulation
  - Customer preference
  - Corporate strategy
  - Business cycles
  - Industry structure
  - Capital market

Process

1. Review Trigger Dynamics Learning Tool
2. List triggers for each type
3. Optional – use simplified version instead
4. Triggers provide inputs to Coreness II, or Gear Teeth, or System Dynamics Modeling

C1. Triggers

1. List triggers for each category – VoIP Example

Technology

convergence
VoIP capable devices
voice quality
feature integration
service mobility options
number portability options
availability of virtual phone numbers
secondary phone numbers per line
security technologies
privacy technologies
encryption schemes
Latency
VoIP applications
arbitrage opportunity
new Features available
available features
size of namespace
PSTN interconnectivity
legacy feature Compatibility
broadband deployment
end-to-end IP networks
WiFi Hotspots
WiMax deployment
community networks

Regulation

propensity for deregulation
subsidies
barrier to entry
cost of regulation
unbundling local loop
congressional pressure
public pressure
lobbying
regulations
social regulation
economic regulation
interconnection charges
time to develop technology to meet regulatory needs
technology availble to meet regulatory needs
feasibility of developing technology
regulatory delays
regulatory unclarity

Industry Structure

Number of Namespaces
number of basic service providers
number of premium service providers
number of service providers
number of equipment providers
vertical disintegration
vertical integration
mergers and acquisitions

Customer Preferences

demand for features
stickiness to service
concern for privacy
concern for security
tolerance for voice quality
perceived coolness
peer pressure

Regulation

demand for features
stickiness to service
concern for privacy
concern for security
tolerance for voice quality
perceived coolness
peer pressure

Business Cycle

monthly price
Voice communications cost
cost pressures
pressure to reduce deployment costs
pressure to reduce operation costs
number of service providers
number of equipment providers
Number of developers
service and installation personelle

Corp. Strategy

call blocking
economic arbitrage
lobbying
number of basic service providers
number of premium service providers
service availability
monthly price
price bundling
in-service calling plans
cost of registring on the namespace

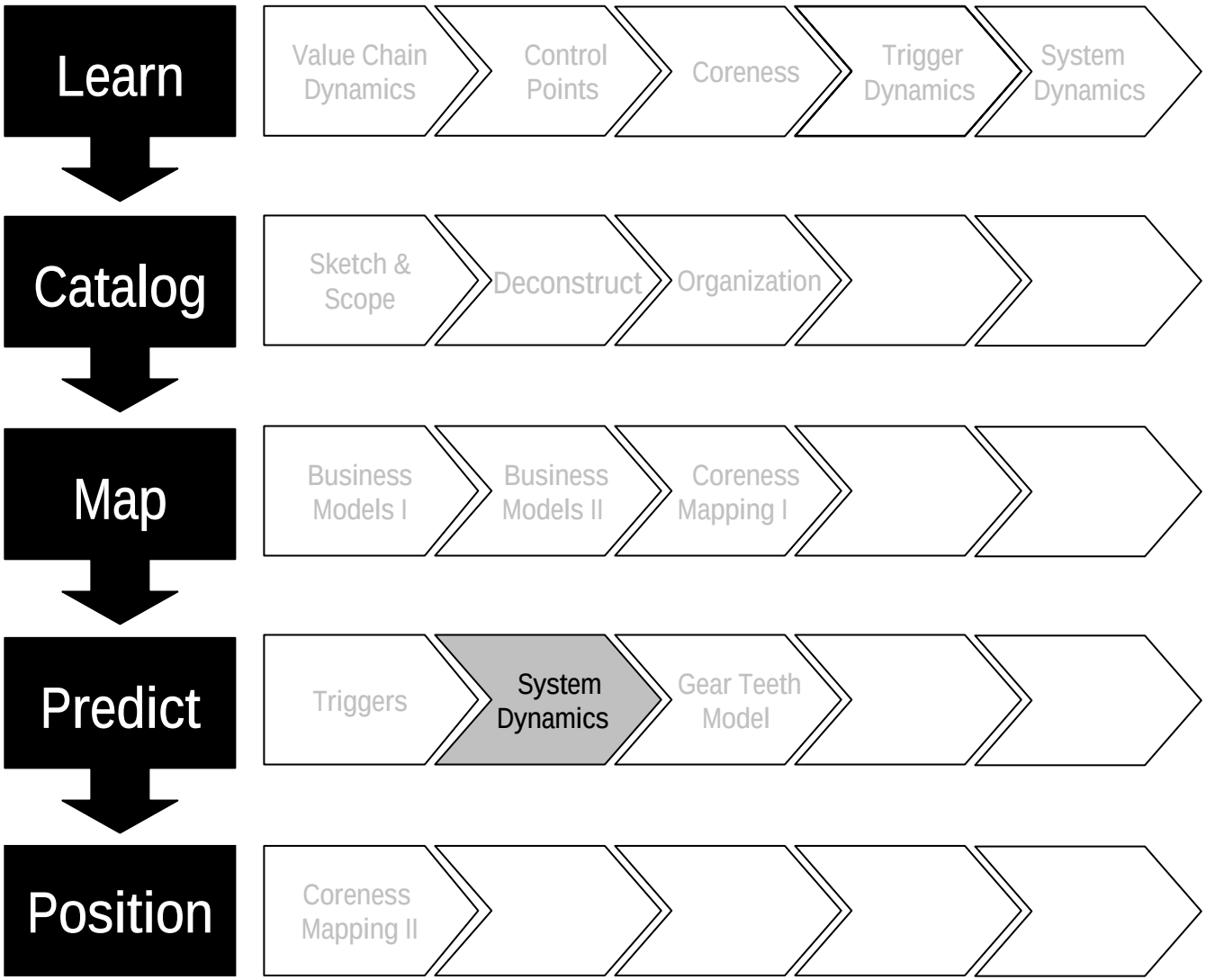
C1. Triggers

1. List triggers for each category – simplified version

Example: Digital Music Services

Technology	Regulation	Business strategy	Behaviors
• P2P networks enable unauthorized file-sharing • Portable digital players extend the digital user experience • DRM enables authorized services • Portable DRM enables "to-go" subscription models • Cell phones integrate music functionality • Portable devices integrate more media functionality • Mobile phone networks enable mobile procurement	• Copyright law • Legality of P2P networks • Economic (anti-trust)	• Free music competes with authorized services • Subscription models compete with pay per track • Singles compete with albums • Labels sign with digital services (or not) • DRM is used to tie music to software and/or hardware • Mobile carriers support or reject music phones • Mobile carriers create their own digital music services or partner with existing service providers • Lack of open DRM standards stifles growth of mobile market	*Users* • Create unauthorized P2P networks (start stealing) • Hack/circumvent DRM (keep on stealing) • Respond to legal action (stop stealing or get better at it) • Respond to legal alternatives (start buying) • Demand portable players • Demand music phones • Demand mobile procurement • Rent vs own • Share playlists rather than music files – rise of personal radio • Cultures/markets segment along architectural lines *Artists* • Choose free P2P vs legal online stores • Choose alternative license/compensation systems

C2. System Dynamics



C2. System Dynamics

Purpose

- Examine trigger dynamics at very detailed level

Description

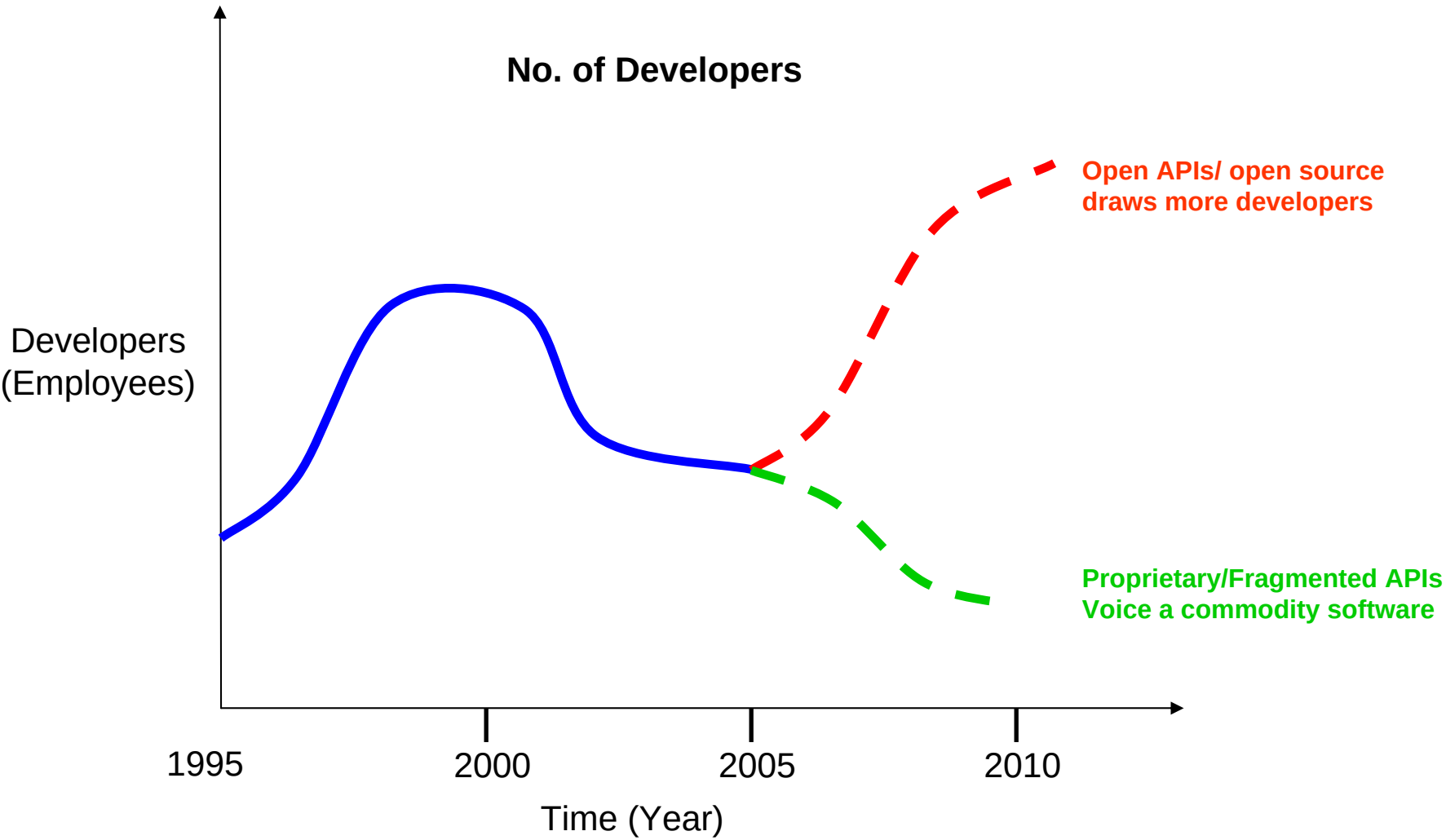
- System dynamics is a methodology for studying and managing complex feedback systems.
- It demonstrates how structure determines system behavior.
- It is often used as a forecasting tool, and at other times a simulation tool.

Process

- Review System Dynamics Learning tool
- Steps to be inserted here (This is a whole toolkit unto itself…)
- System Dynamics output can be used in Gear Teeth Model, or directly in Coreness Mapping II

C2. System Dynamics

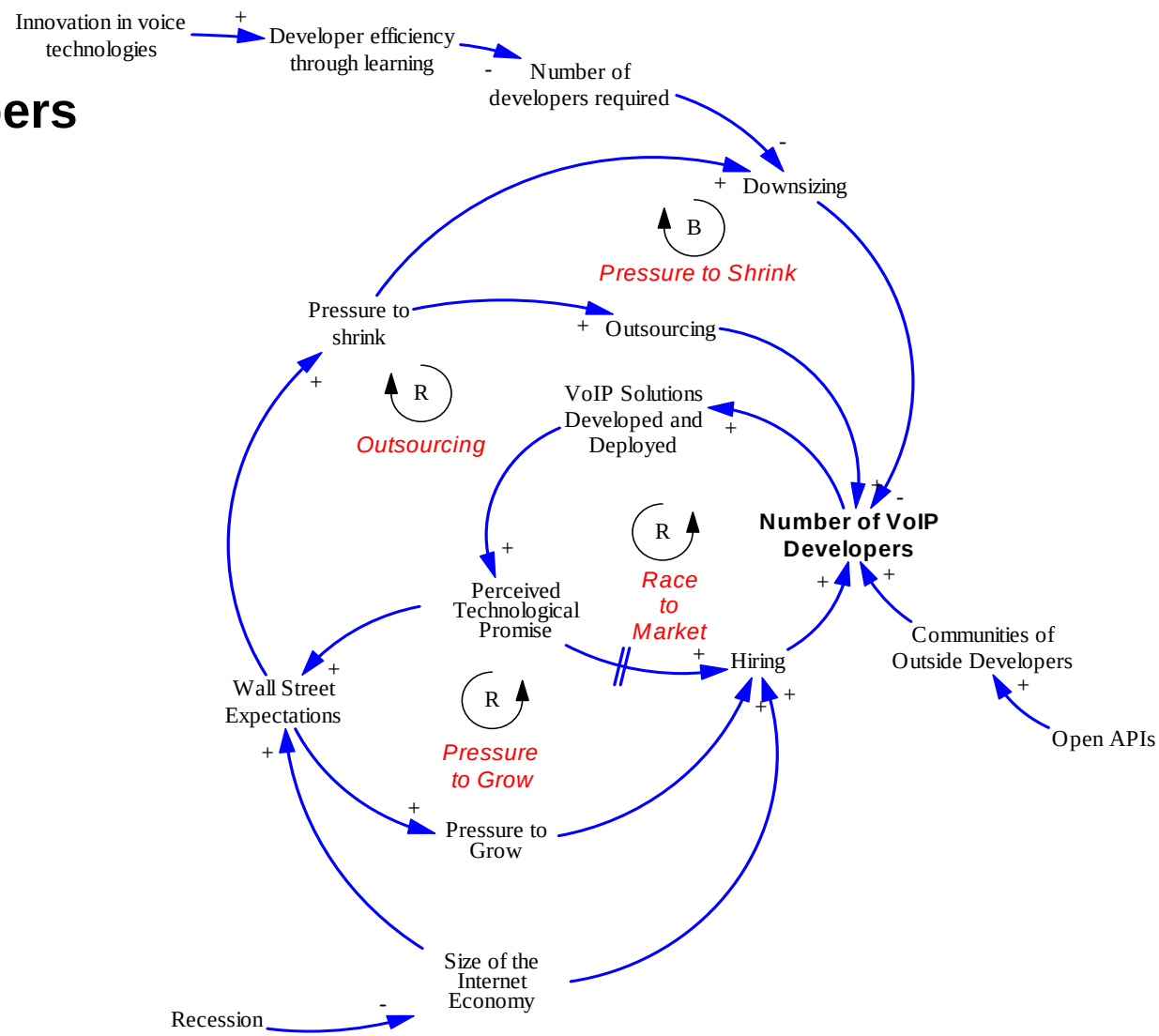
Example: VoIP



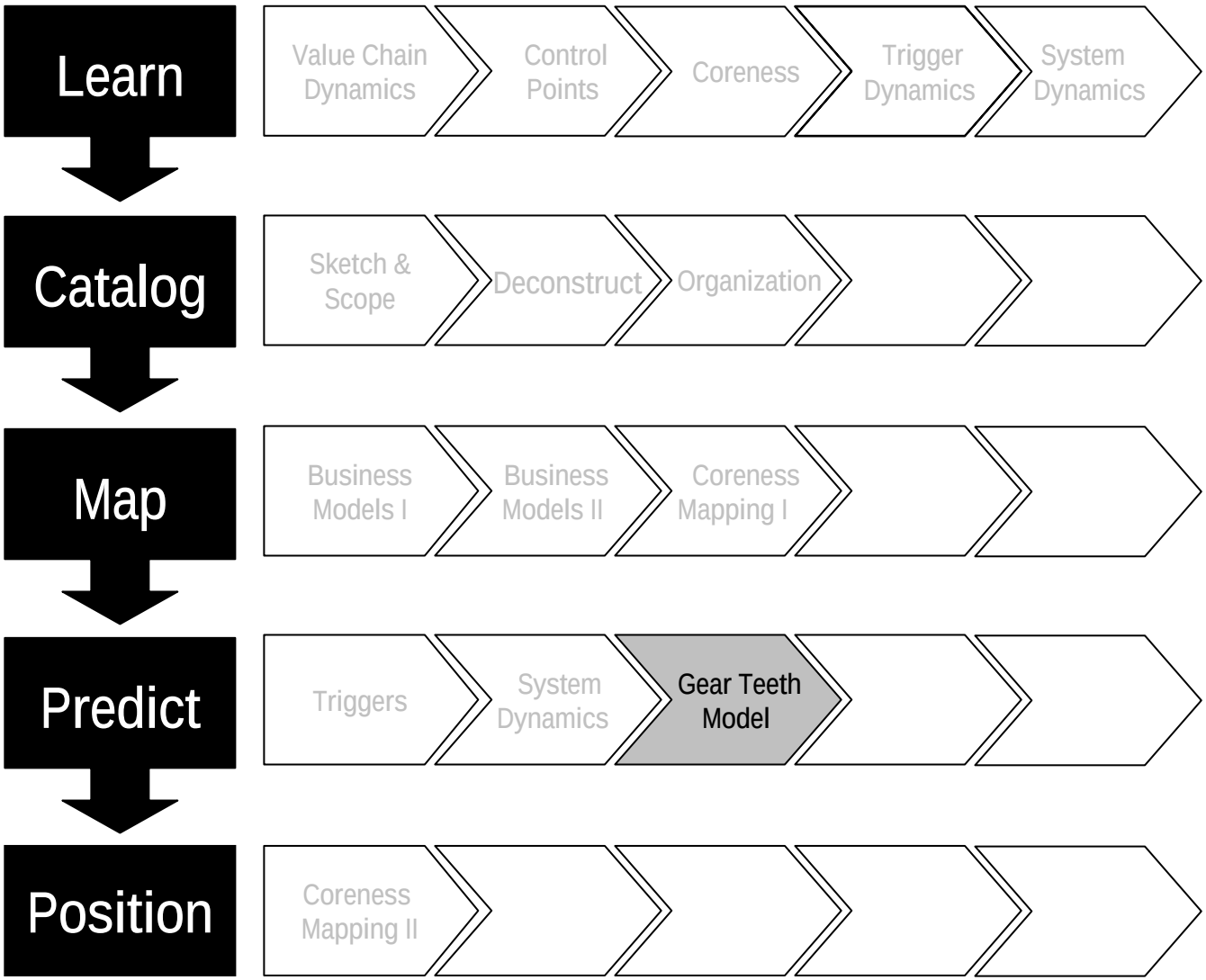
C2. System Dynamics

Example: VoIP

No. of VoIP Developers



C1. Gear Teeth Model



C3. Gear Teeth Model

Purpose

- Examine how triggers work together to cause changes in business models and the industry as a whole

Description

- Triggers can be viewed as working together, like a set of interlocking gears
- The Gear Teeth model looks at how the various triggers influence each other

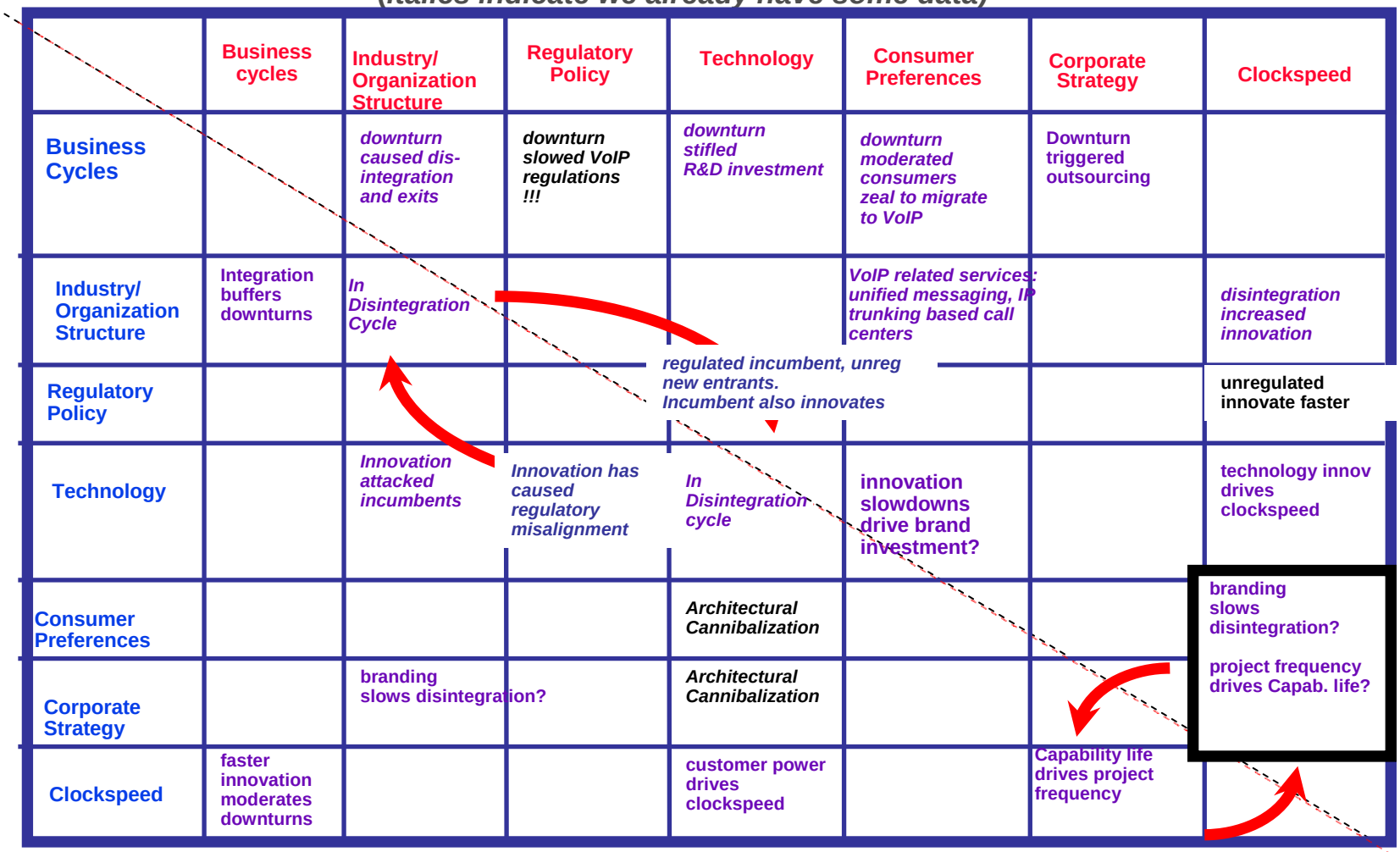
Process

1. Review Trigger Dynamics Learning Tool
2. Fill in the Gear Teeth table
3. Optional – use results of System Dynamics Tool for a more detailed analysis

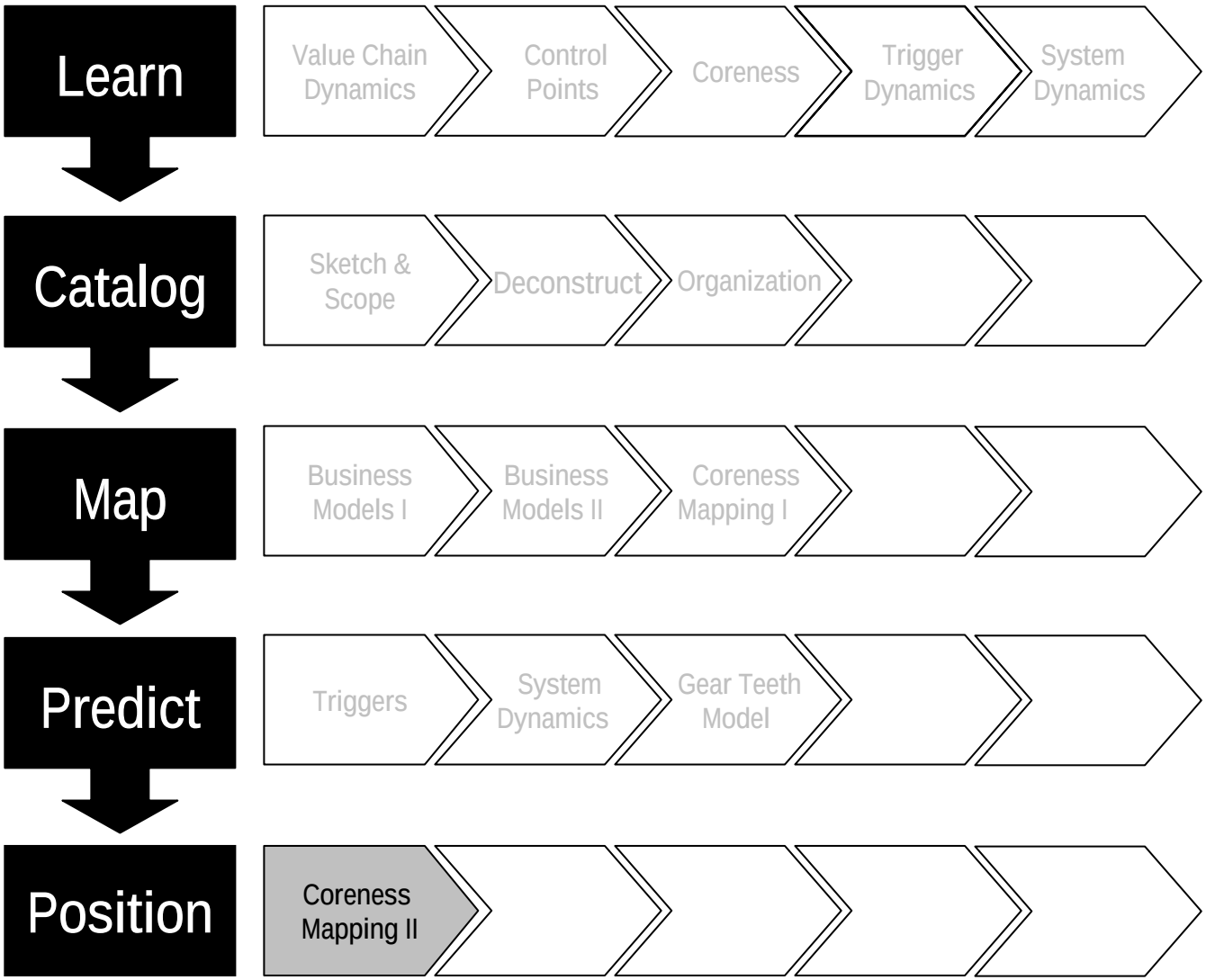
C2. Trigger Dynamics

Example: VoIP

(italics indicate we already have some data)



D1. Coreness Mapping II



D1. Coreness Mapping II – Control Point Level

Purpose

- Analyze trends in scarcity & control of Control Points over time
- Help determine market positioning

Description

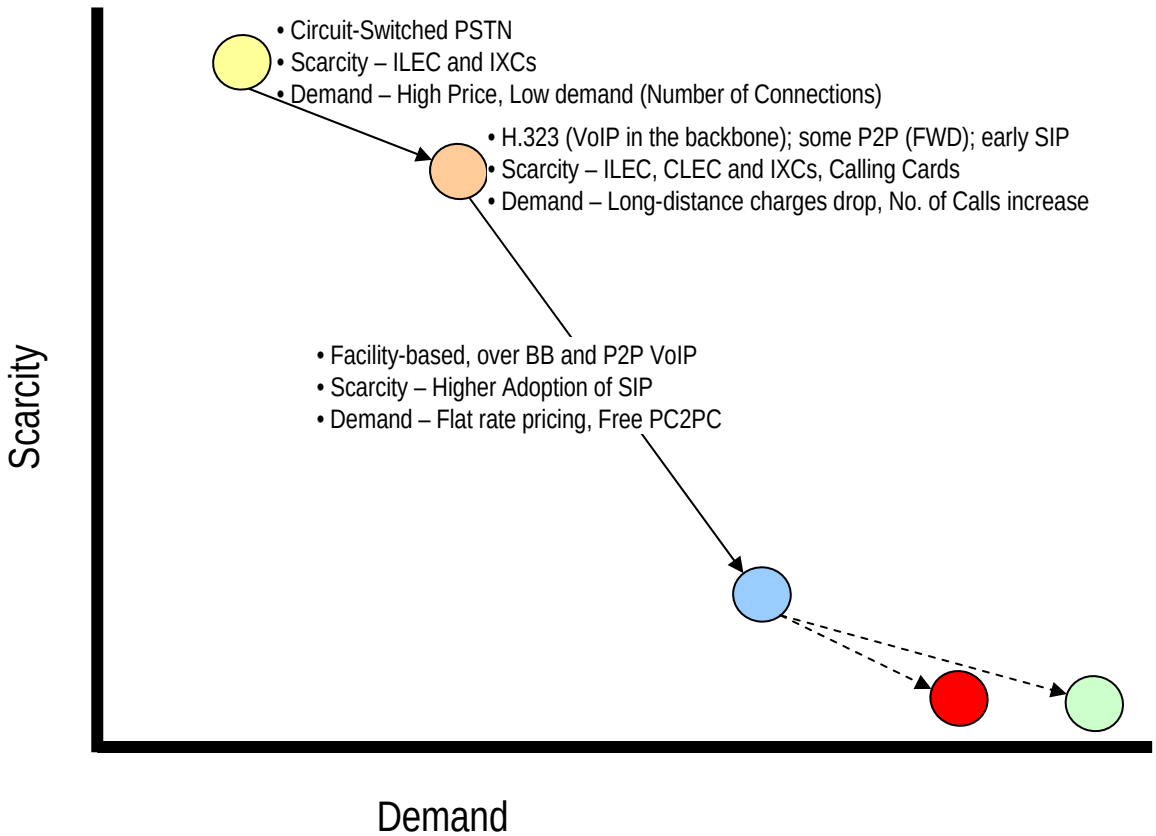
- Examines at Coreness over time
- Was previously known as “Coreness Tunnel”

Process

- Review Coreness Learning Tool
- Use outputs Triggers tool, or, if you want a more detailed analysis, use Gear Teeth and/or System Dynamics Modeling.
- Using Scarcity/Demand graphs from Coreness I tool, examine past and future trends within a desired time frame based on Triggers.

D1. Coreness Mapping II – Control Point Level

Coreness of call signaling, VoIP example



Guidelines

- These are rough plots meant to give a general sense of value "low," "medium," and "high" values, relative positions (i.e., lower than, higher than), and movement over time (i.e., increase, decrease)
- Use Trigger outputs to determine changes in Scarcity & Demand
- When plotting scarcity, think about how the number of providers indicates the degree of commoditization or monopolization of the market
- When plotting demand, think about market share
- Detailed data can be used for more precise graphs

1995

2000

2005

Future Commoditization

Future VoIP-inside

D1. Coreness Mapping II – Service Offering Level

Purpose

- Analyze trends in scarcity & control for the whole service offering (industry level) over time
- Help service providers determine market positioning

Description

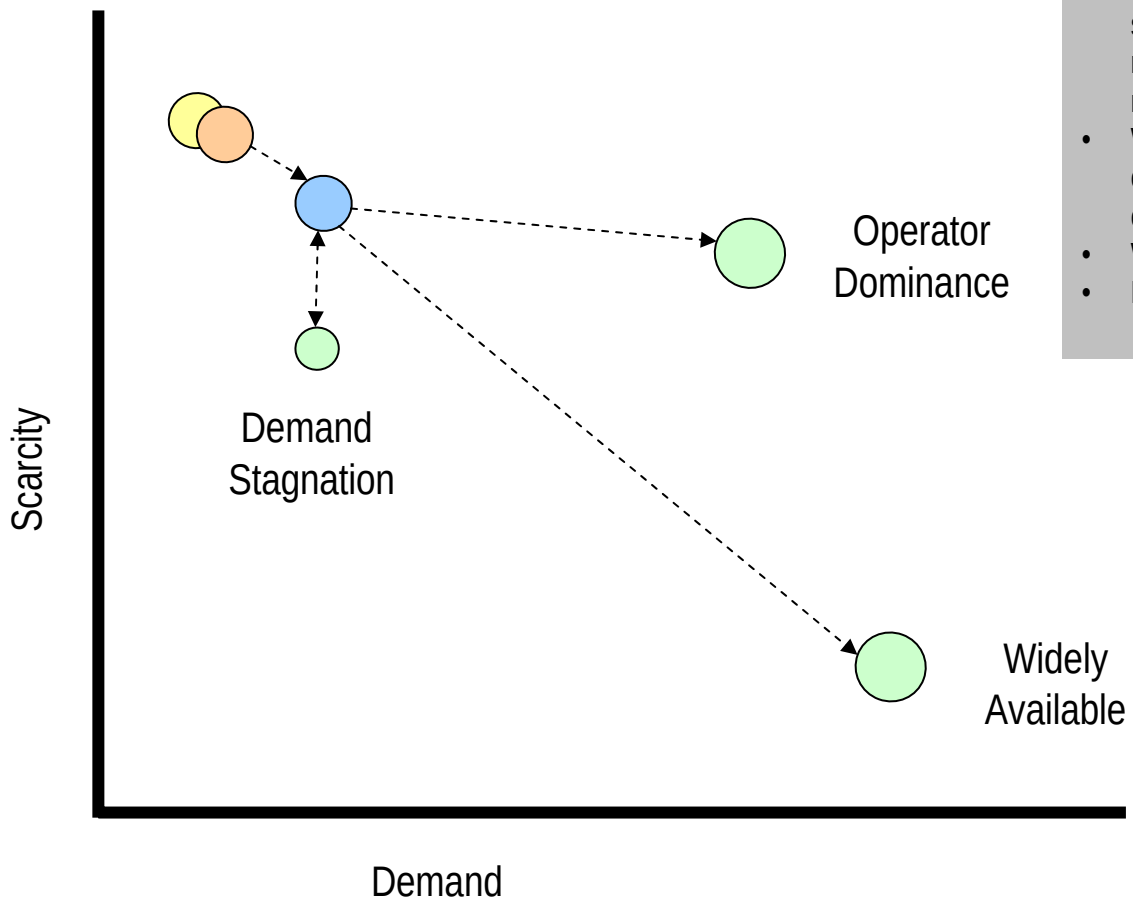
- Service offerings have to be viewed as an aggregate of CPs
- Was previously known as “Coreness Tunnel”

Process

- Review Coreness Learning Tool
- Use outputs Triggers tool, or, if you want a more detailed analysis, use Gear Teeth and/or System Dynamics Modeling.
- To be inserted here

D1. Coreness Mapping II – Service Offering Level

Example: Location Based Services



Guidelines

- [Insert explanation for how to view Service Offerings as "sum total" of Control Points.]
- These are rough plots meant to give a general sense of value "low," "medium," and "high" values, relative positions (i.e., lower than, higher than), and movement over time (i.e., increase, decrease)
- When plotting scarcity, think about how the number of providers indicates the degree of commoditization or monopolization of the market
- When plotting demand, think about market share
- Detailed data can be used for more precise graphs

User Guide – Glossary

Business model

Control

Control point

Control point constellation

Dynamics

Ecosystem

Gear teeth

Gear teeth model

Offering

Scarcity

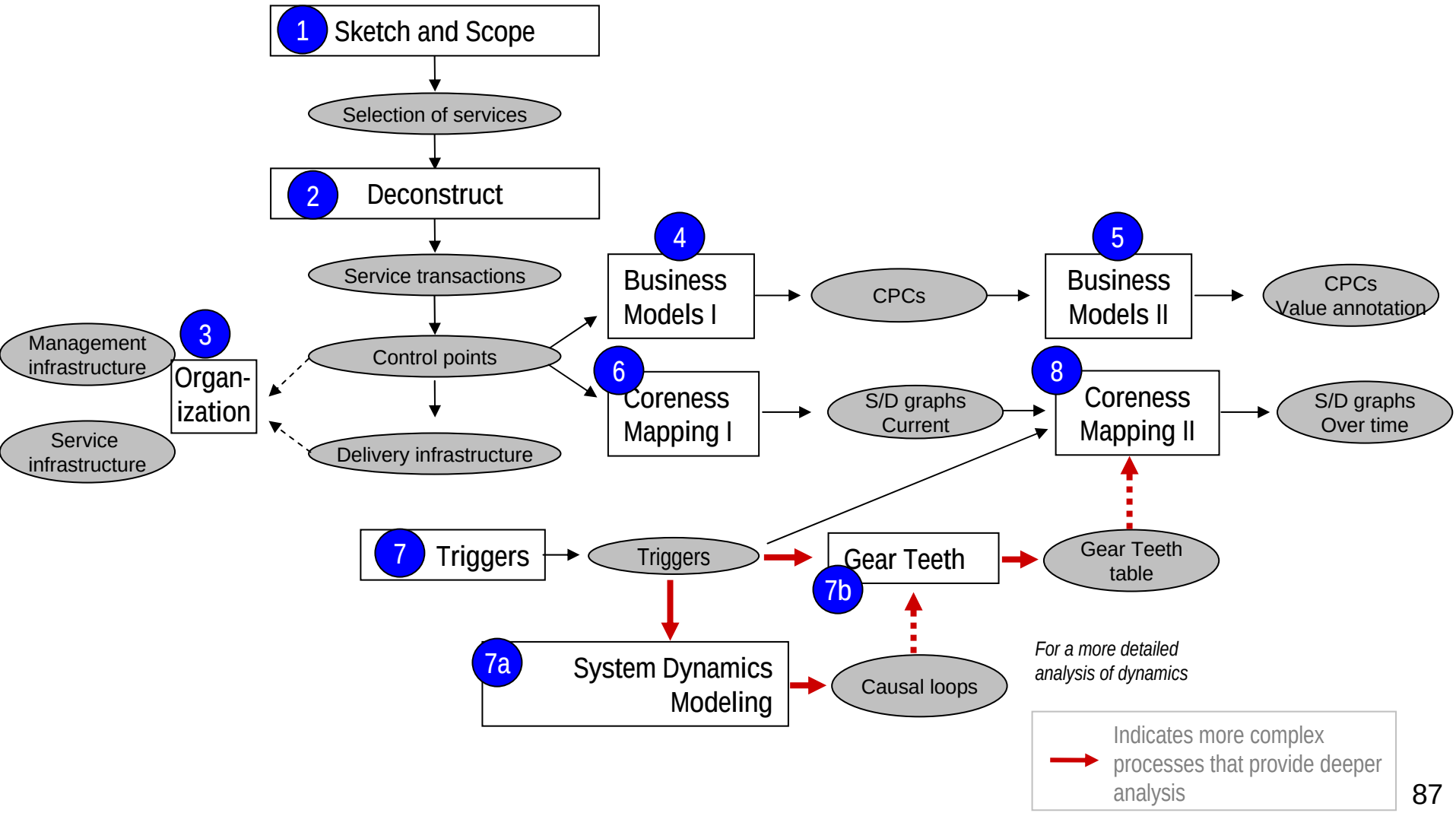
Service

Service transaction

Triggers

Trigger Dynamics

User Guide – Overview of Tools, Inputs & Outputs



User Guide – Overview of Tools, Inputs & Outputs

Tool	Description	Inputs	Outputs	Become inputs for…
Sketch and Scope	• Get high level view of competitive environment up front • Identify competing, complementary, substitute services • Select the services you want to analyze	• n/a	• List of services by value chain type • Dimensions for differentiating services • High level service categories • Scope	• Deconstruct

Deconstruct	• Deconstruct a representative group of services based on the taxonomy – 3 main categories of service elements
	  • Service transactions
	  • Control points
	  • Delivery infrastructure
		• List of services by value chain type	• List of service transactions
			• List of Control Points
			• List of delivery infrastructure components
				• Organization (List of Control Points and delivery infrastructure only)
				• Business models I (List of Control Points only)
				• Coreness I (List of Control Points only)

Organization	• Understand how Control Points are managed • Understand architecture of delivery infrastructure	• List of Control Points • List of delivery infrastructure components	• Management infrastructure table • Service infrastructure table	• Final output in this toolkit • Feeds into other working group concepts
Business models I – control point constellations (CPCs)	• Understand business models as control point constellations • Look for tightly integrated and loosely coupled components, i.e., where is there lock-in?	• List of Control Points	• Control point constellations • *Graphic should indicate tightly integrated or loosely-coupled components*	• Business models II
Business models II – Value annotation	• Annotate Control Points for a given business model (service offering) with Value (to be defined) • See how value is distributed	• Control point constellations	• Value annotation of CPCs • *Value has not been fully defined, start with revenue figures.*	• Final output

User Guide – Overview of Tools, Inputs & Outputs, con't

Tool	Description	Inputs	Outputs	Become inputs for…
Coreness I – Static analysis of Control Points	• Analyze the scarcity and demand of individual Control Points – market conditions for individual Control Points – at a particular moment in time • Look for threats and opps in terms of commoditization and monopolization	• Control points	• Scarcity/Demand graphs for individual Control Points	• Coreness II
Triggers	• What forces will cause changes in the coreness (increases or decreases in scarcity and demand) for the individual Control Points and/or for control point constellations as a whole?	n/a	• Triggers • (use Gears or simplified list for Coreness II, use Gears for Gear Teeth model)	• Coreness II • Gear Teeth
Coreness II – Coreness of Control Points over time	• Analyze trends in scarcity and demand of individual Control Points – market conditions for individual Control Points – over time – past, present, future	• Control points • Triggers • (Gears or simplified list)	• Coreness tunnel • (for individual Control Points)	• Final output
Coreness II – Coreness of Service Offering over time	• Analyze trends in scarcity and demand of a service offering over time – past, present, future • Service offerings have to be viewed as an aggregate of CPs • This gives a more general industry analysis	• Triggers • (Gears or simplified list)	• Coreness tunnel • (for individual Control Points)	• Final output
Gear Teeth	• Examine how the various triggers work together to cause changes in business models and the industry on the whole	• Triggers • (Gears) • Or Causal loops	• Gear Teeth table	• Final output
System Dynamics Modeling	• Examine trigger dynamics at a very deep, granular level • Look at individual causal loops	• Triggers? • Or other unrelated input?	• Causal loops	• Final output or • Gear Teeth table

VOIP System Dynamics Modeling Update

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Outline

- Transition (from the toolkit discussion)
- Recap
- Current Model
  - Causal Loop
  - Computer Simulation
- Current Challenges
- Next Steps

Transition (from the toolkit discussion)

From heuristics to modeling

1. Understand what triggers a change in the demand and scarcity of VoIP offerings over time.
2. Understand which triggers are strong and which are not.
3. Validate the core-edge taxonomy.

- What is a trigger? A cause or an effect?

  A -> B, but B -> C

- Nature of Triggers

Interconnectedness: A -> B, B -> C, but C-> A

Hierarchy: C <- B <- A

Recap

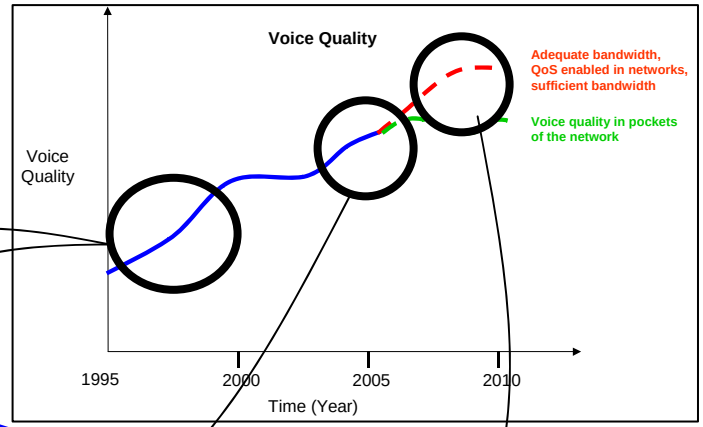
We began to model draw the causal loops for five variables…

1. Price
2. Hype
3. Voice Quality
4. Ease of Use
5. New VoIP Applications and Feature

We then put together the causal loops

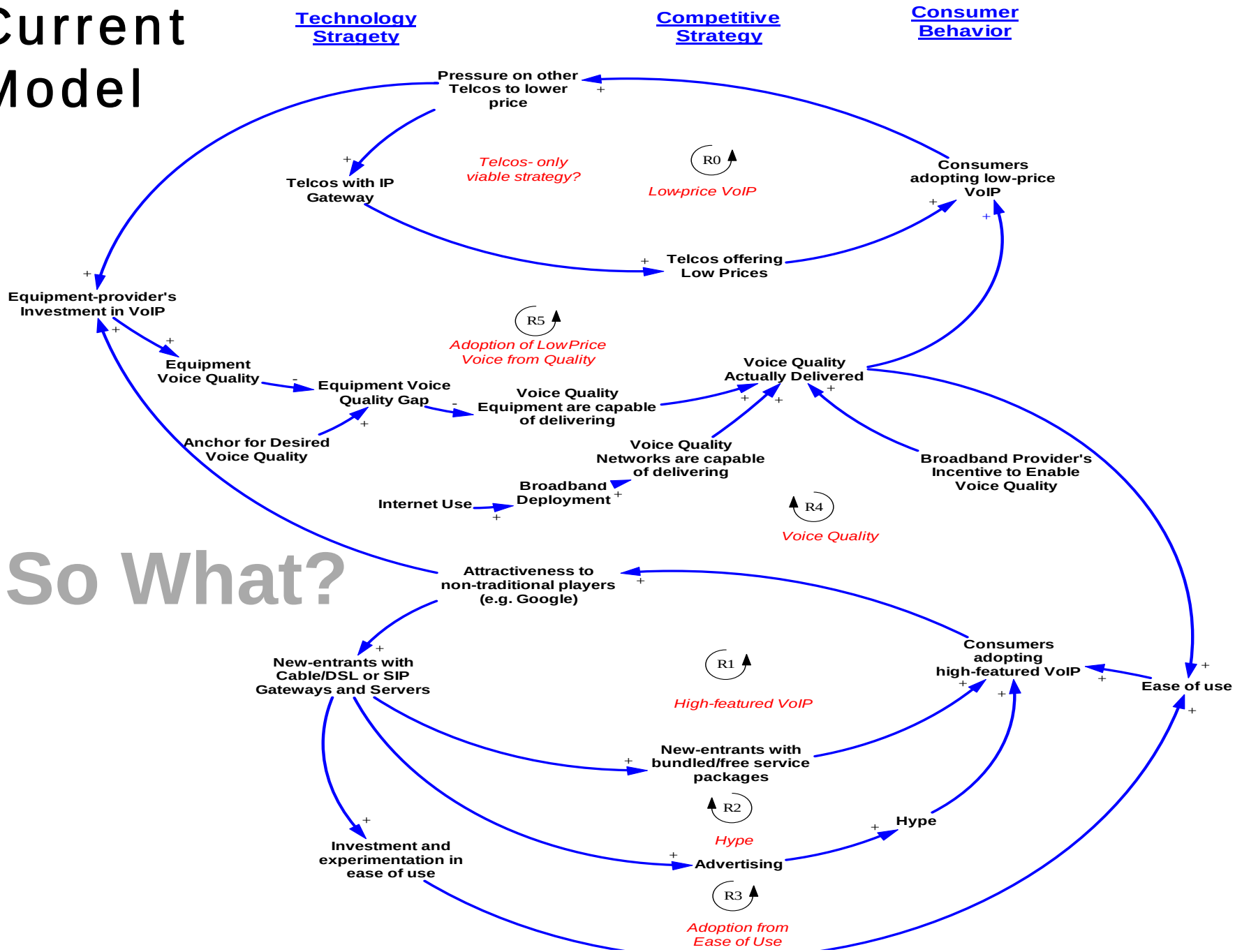
Recap

Causal Loops for Voice Quality

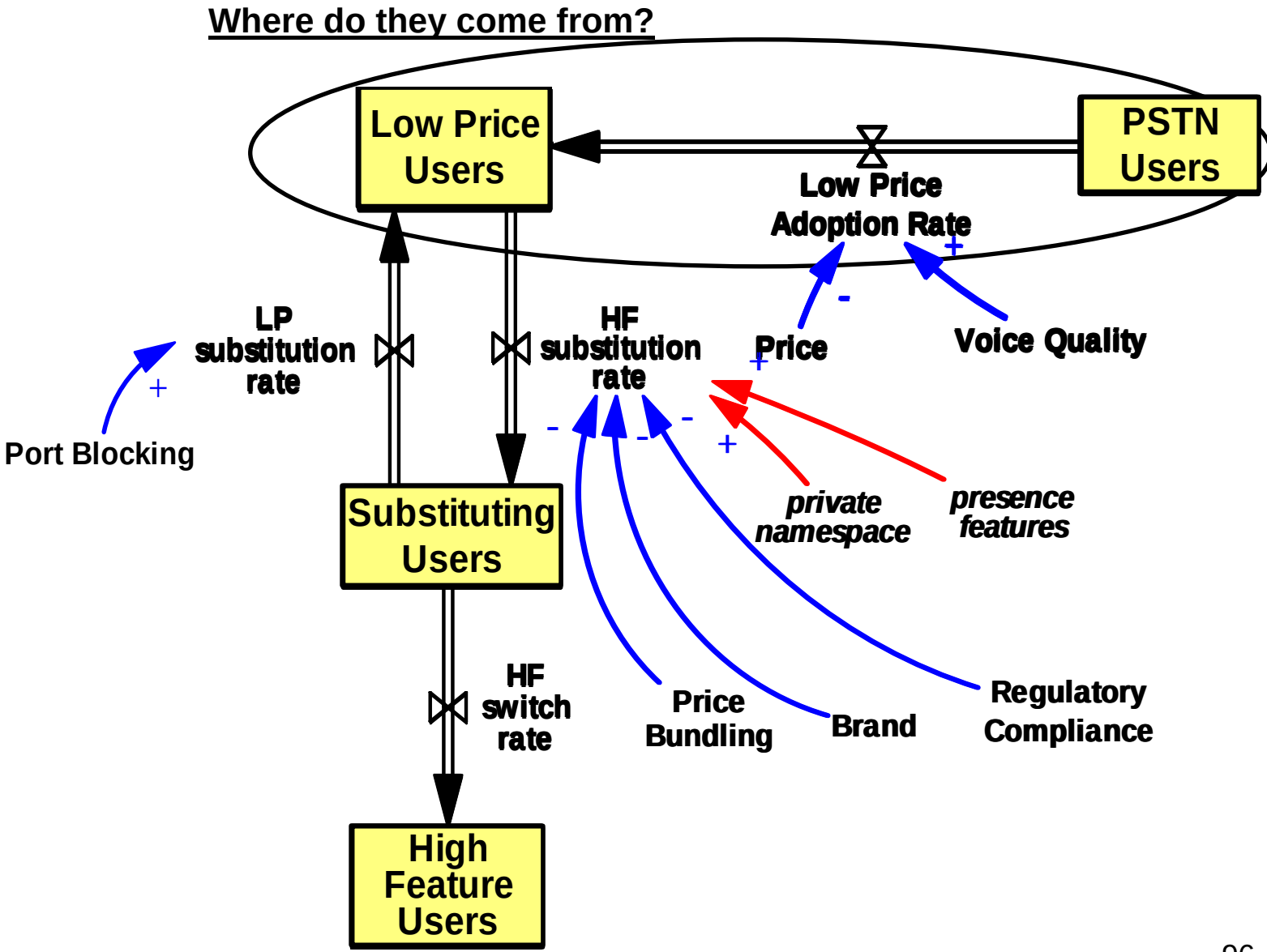


Economic Recession
Surplus in the economy
size of the Internet economy
equipment provider's perceived market potential
equipment purchase and deployment
BB Deployment
equipment provider investment in technology
Voice Quality
codec quality
available bandwidth
BB Provider's Revenue
BB incentive problem
VoIP developers
Other voice quality issues (latency, jitter)
BB Provider's Profit
Technology Maturity
QoS Support
Incentive for QoS Support
Business Models for QoS-based Charging
R

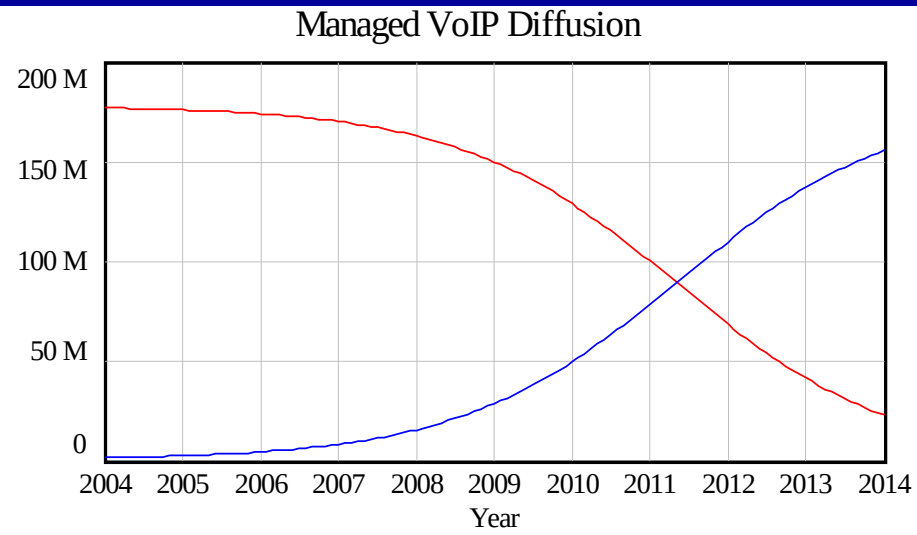
Current Model

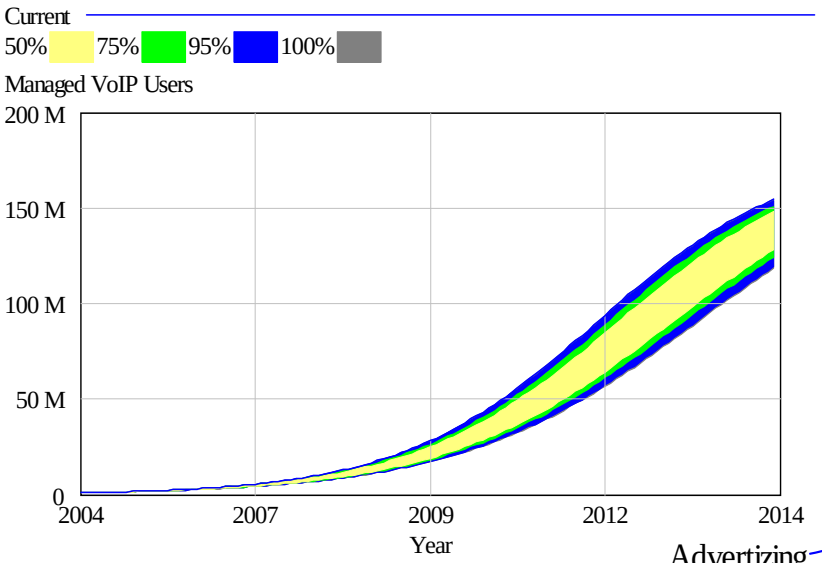


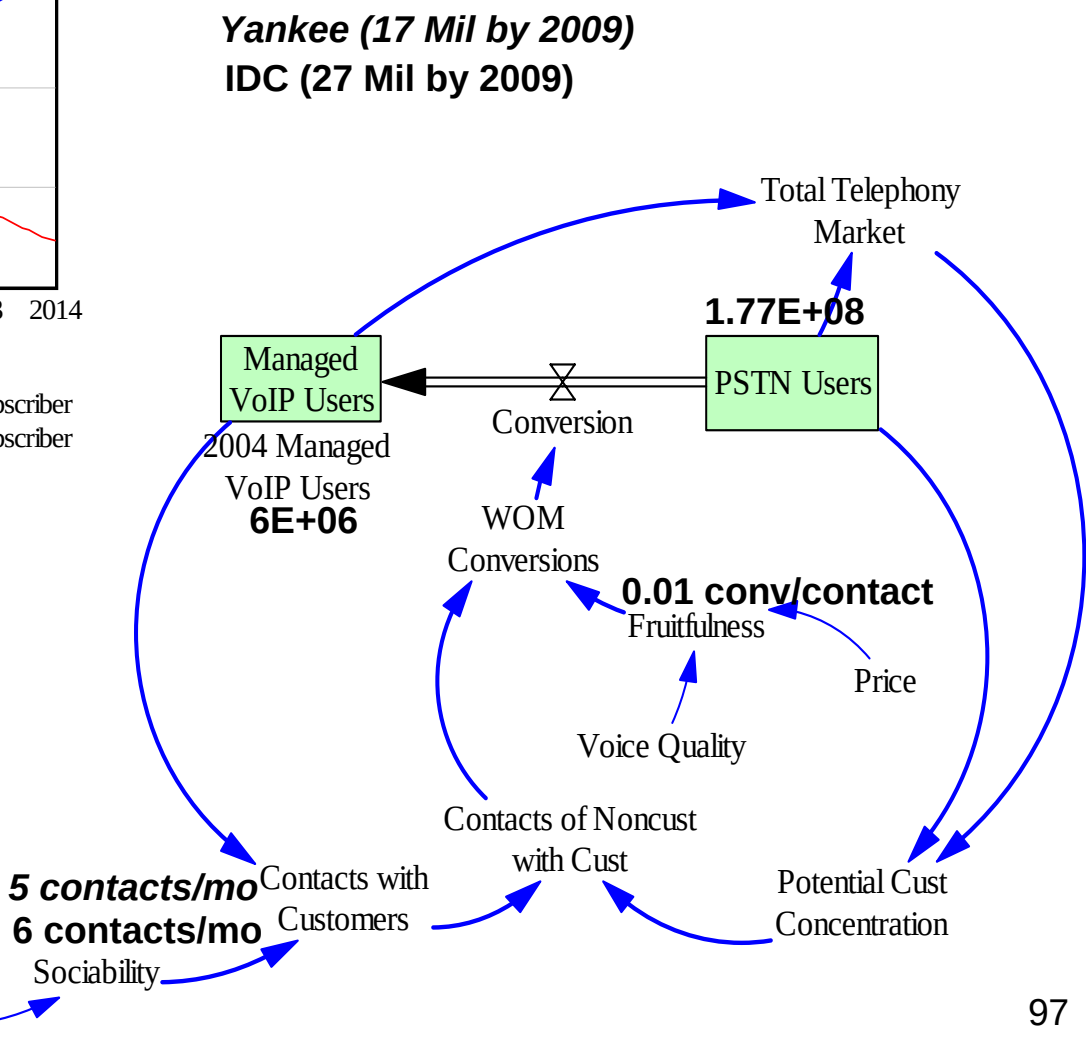
Moving to Computer Simulation



Simulating Adoption







Consumer Segmentation, Competition and Innovation

Who is in these boxes?

Late Adopters?

Enterprise?
Families?

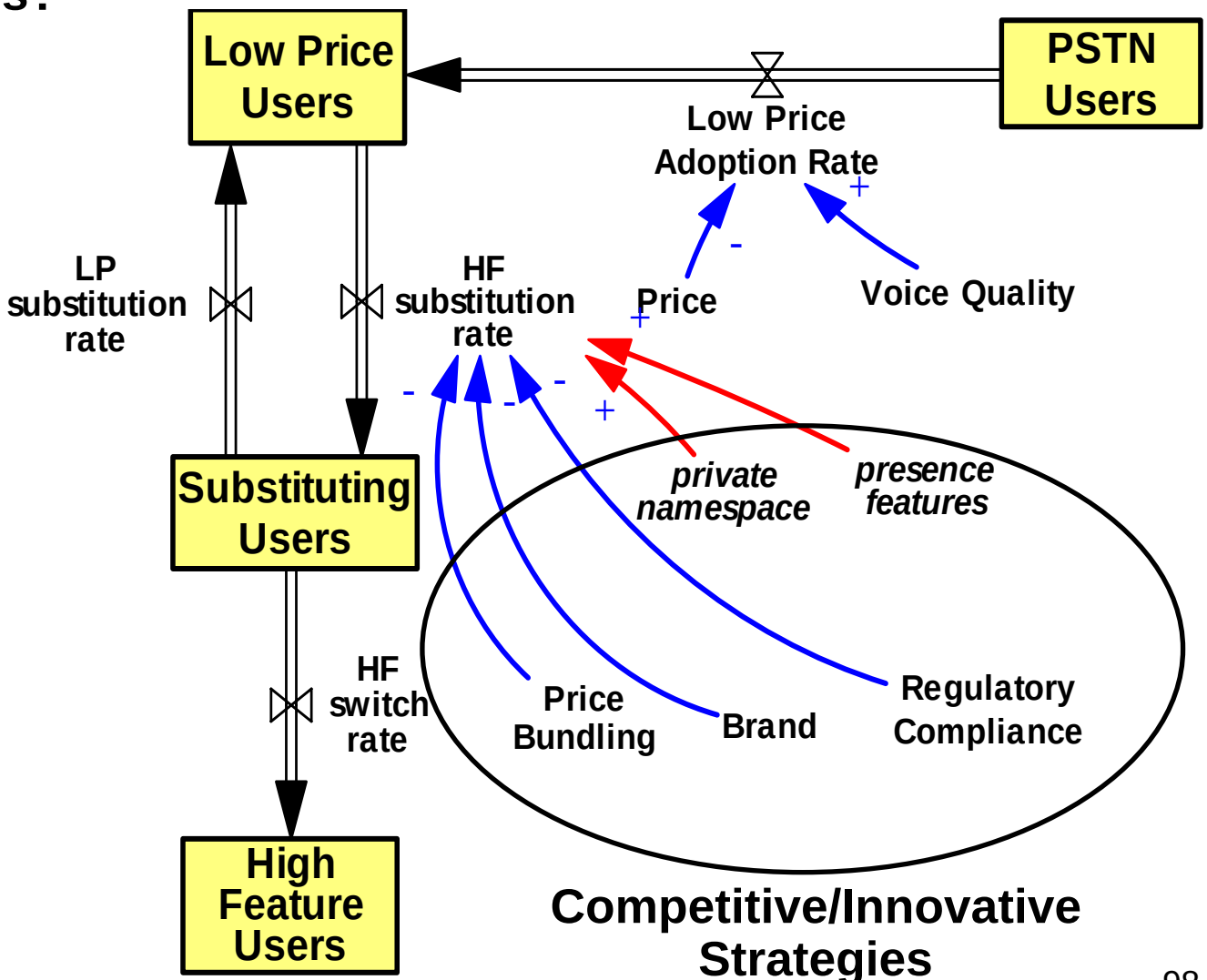
Seniors?

Early Adopters?

Individuals?

Youth?

Kids/Highschoolers?



Next Steps (Current Challenges)

Understand Consumer Segmentation

1. Interviews
2. Analyst Reports

Understand Competitive Strategies

1. Press Releases
2. Entrees/Exists

Understand Innovation Strategies

1. Patents
2. Product Releases

RFID
Research Update

Milind Tavshikar
MIT Sloan Fellow

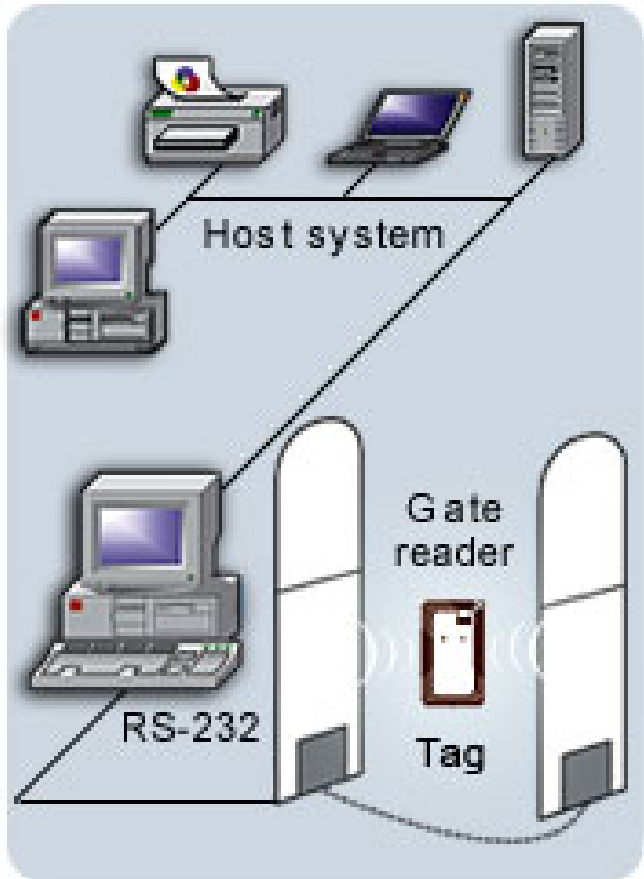
Value Chain Dynamics with relationship to RFID

- Information Processing Loop for business: Capture, Manage, Analyze, Access and Act
- RFID represents a significant development in the “Capture” area
- Yesterday: Capture is done offline and entered into systems via data feeds in a batch mode
- Today: Capture needs to be realtime increasing the efficiency of the information processing loop.
- Established industry structures are being challenged
- RFID is a capable of being a disruptive Innovation

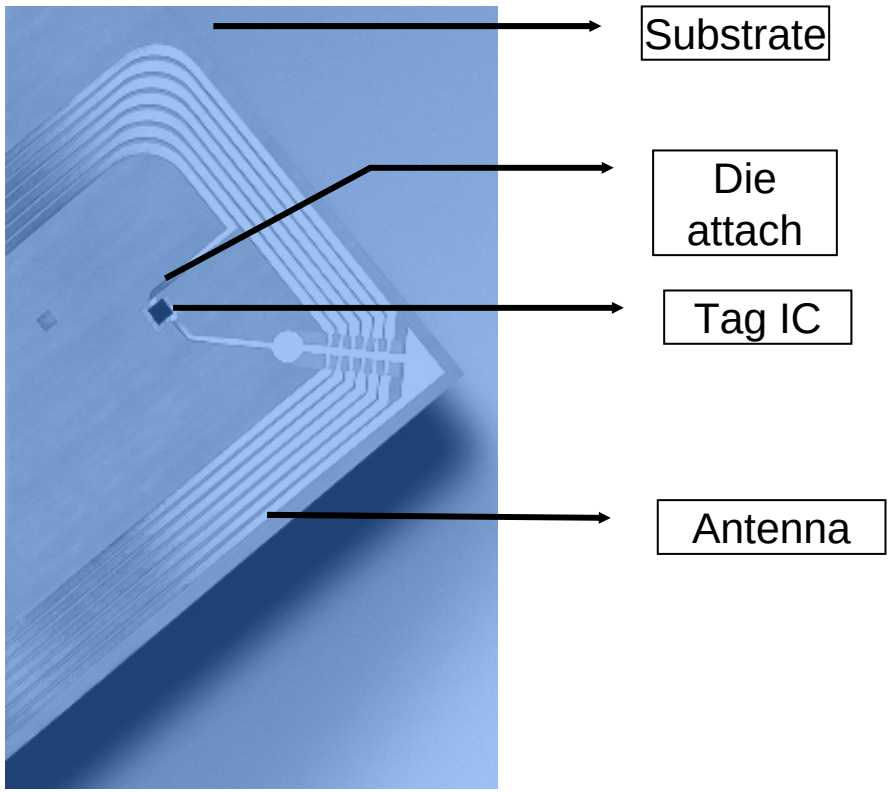
- Traditional
  - Mainframes
  - Less IT Driven
  - SCM:Weeks
  - Megabytes
- Internet
  - Distributed Computing
  - Network Driven
  - SCM:Days
  - Terrabytes
- Real-Time
  - Edge Computing
  - Event Driven
  - SCM:Near Realtime
  - Exabytes

RFID Primer – **Infrastructure Basics**

- RFID tag gets into reading device's electromagnetic field
- Tag receives the signal which energizes the passive tag
- Tag transmits the data stored in the IC in return
- Reader passes the information to the host system
- Host system can be connected into the Internet or company's ERP system
- Reader can also pass information to the tag which can be re-written or deactivated



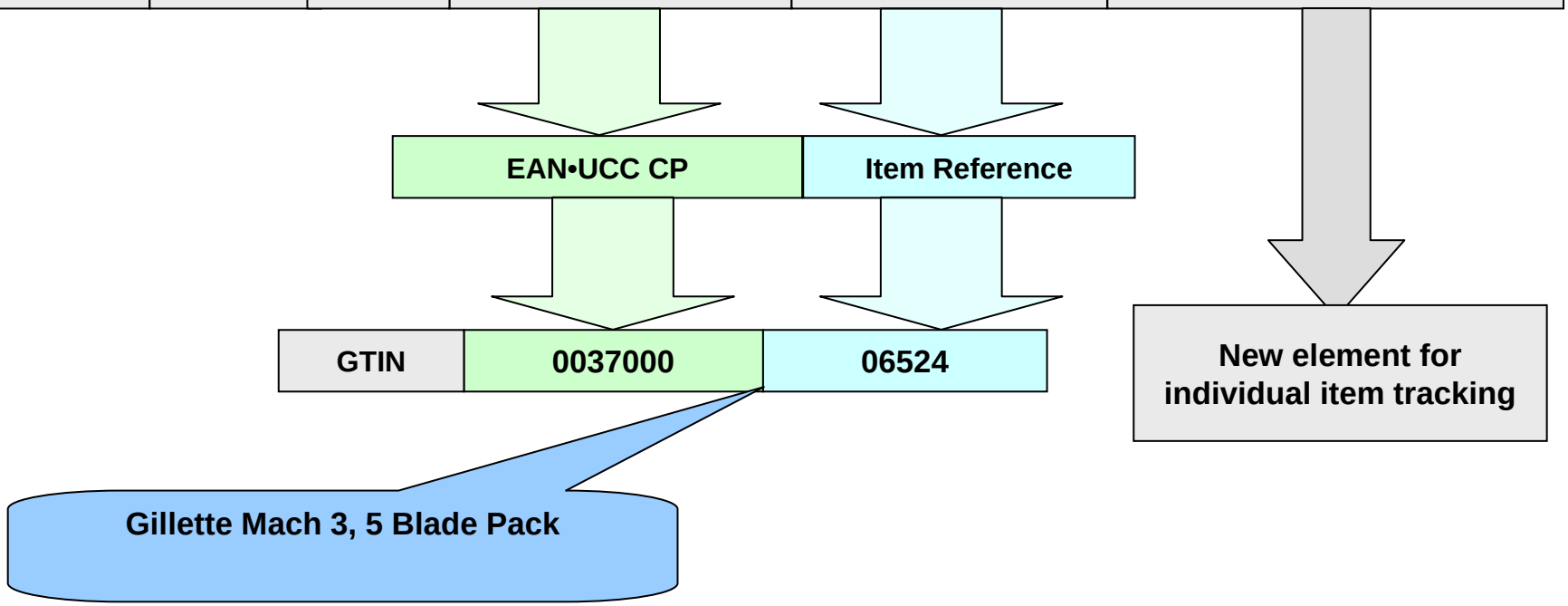
RFID Primer – **What is Radio Frequency IDentification?**



- No requirement for line-of-sight
- Dynamic information carrier (read/write)
- High memory capacity if needed
- Anti-collision (many tags can be read at the same time)
- Robust and reliable
- Performs in rugged, harsh environment
- Cheaper in long term
- No human intervention
- Reader virtually maintenance free

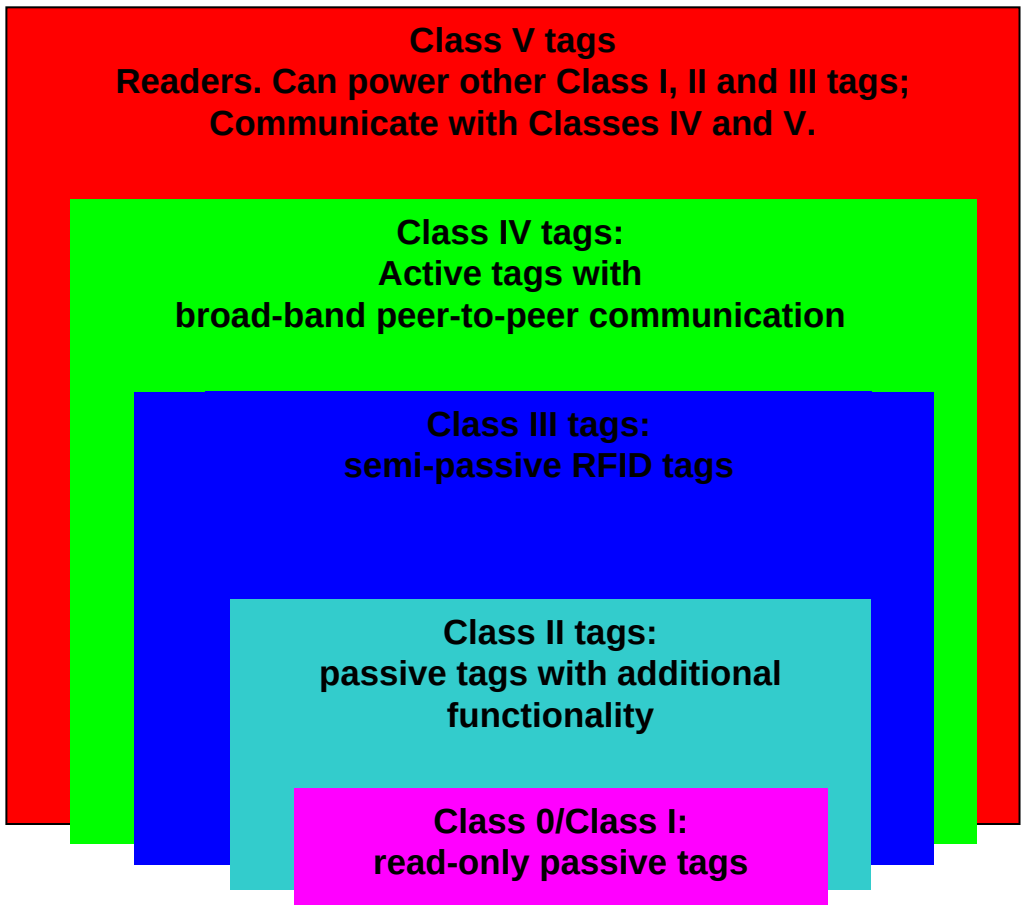
EPC Tag Specification

Element	Header	Type	EPC Manager	Object Class	Serial Number
Bits	8	4	27	17	40
$Value_{10}$	001	00	0-134,217,727	0-131,071	0-1,099,511,627,775



268 million companies can each categorize 16 million different products and each product category may contain over 687 billion individual items !!

More on Tags?



- Tags can be attached to almost anything:
  - pallets or cases of product
  - vehicles
  - company assets or personnel
  - items such as apparel, luggage, laundry
  - people, livestock, or pets
  - high value electronics such as computers, TVs, camcorders

Active Tags Vs Passive Tags

	Passive	Active
Feature	Identity	Store, Update, Authenticate, Securely Transmit
Cost	10c – 100c	$3 - $30
Range	Smaller	Larger
Memory Capacity	Smaller	Longer
Power Source	Radio Waves	Battery, Others
Applications	Retail	Animal Tagging, Shipping
Life	Unlimited – until killed	Limited by battery

More on Readers?

- Readers (interrogators) can be at a fixed point such as
  - Entrance/exit
  - Point of sale
  - Warehouse

- Readers can also be mobile -- tethered, hand-held, or wireless

Frequencies

LF
30-300KHz
Range: 1cm – 1.5m

HF
3-30MHz
Range: 1cm – 0.7m

VHF
30-300MHz
Range: 1 – 3m

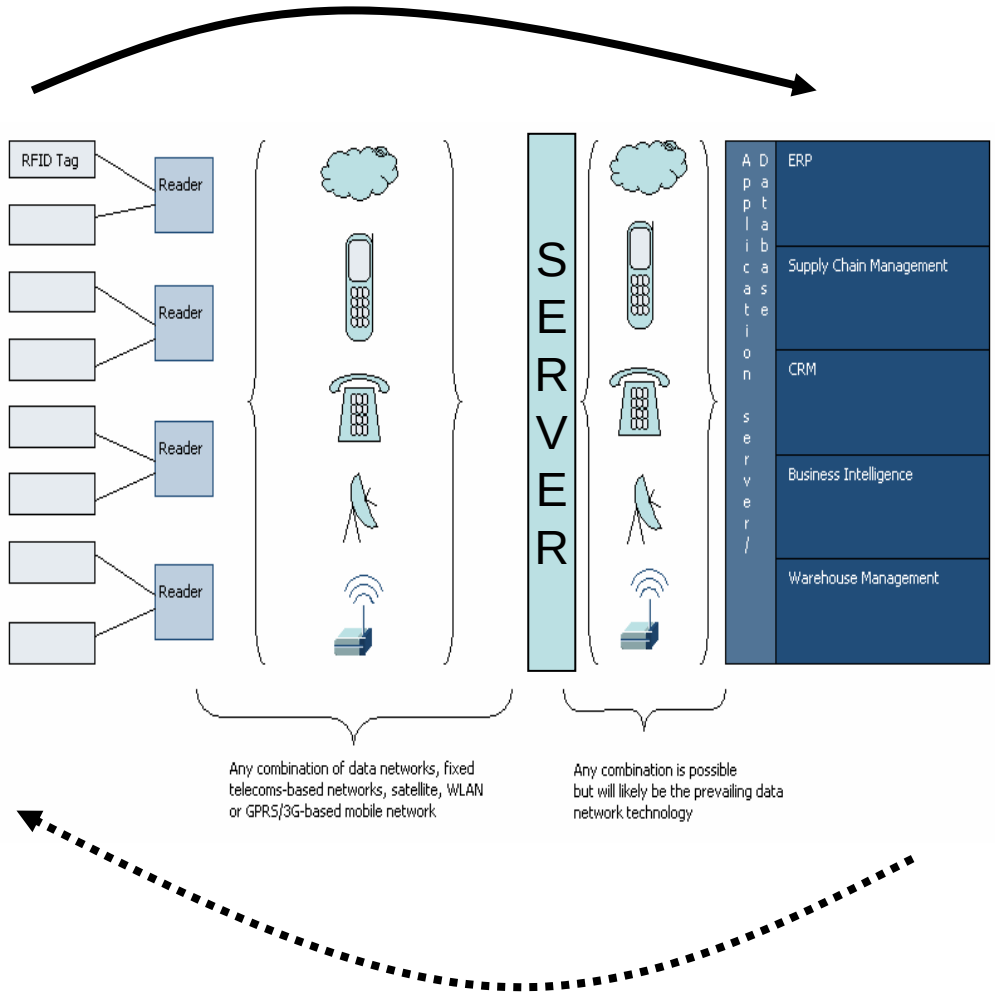
UHF
300-1000MHz
Range: 1 –3m

Microwave
1 GHz and up
Range: 1–10m

- Triggers
  - Distance
  - Cost
  - Physics of Reflection and Interference
  - Data Capacity
  - Data Rate
- Triggers..
  - Regulations
  - Supply Chain Partners
  - Security
  - Directionality
  - International Availability

Core: Communication from a Carrier Perspective

- Tags and Readers at the end users premises
- Data transmitted back to the server and processed
- Relevant Data sent to back office systems
- Data may flow back to the tag!

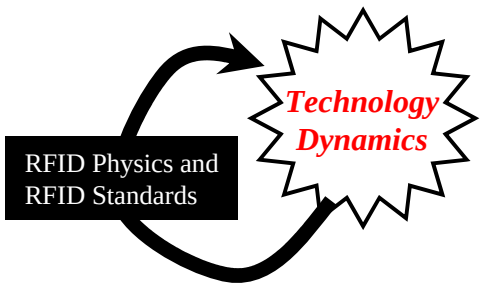


Trigger Dynamics and the Gear Teeth Model

- Triggers cause changes in business models (micro level) and industry value chains (macro level)
- Triggers include
  - Technology
  - Regulation
  - Customer preferences
  - Business strategy
  - Business cycles
  - Industry structure
  - Capital markets
- Triggers influence each other

Trigger Dynamics and the Gear Teeth Model

It begins with Technology Dynamics



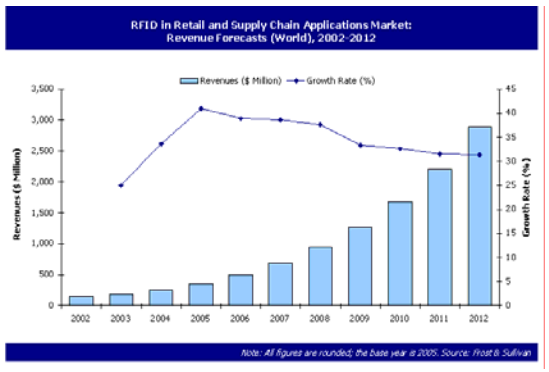
RF Technology used since World War II for data communication over radio waves

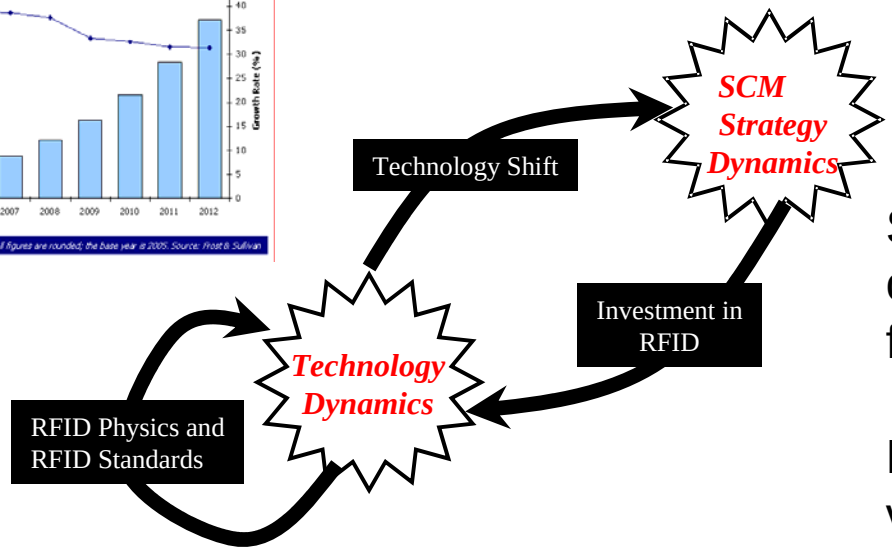
1999: MIT AutoID Labs created to further the concept of 'The Internet of Things" using RFID and Sensor Networks

2003:Transfers responsibility to EPC Global for further development of standards.

Trigger Dynamics and the Gear Teeth Model

RFID Technology drives Supply Chain Management Dynamics





Supply Chain Management chosen as the 'Low hanging fruit"

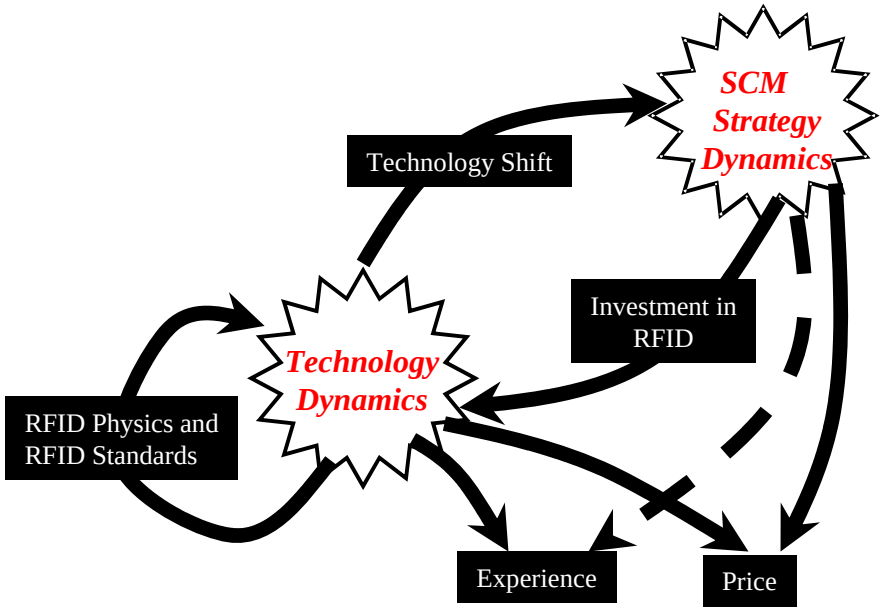
RFID to deliver near real-time visibility

RFID enabled supply chain = Collaborative scenario

CAGR of 25% over 2005-2012

Trigger Dynamics and the Gear Teeth Model

Technology and SCM Strategy shape Price and Experience



2003: Wal-Mart issues Mandate
2004: DoD issues Mandate

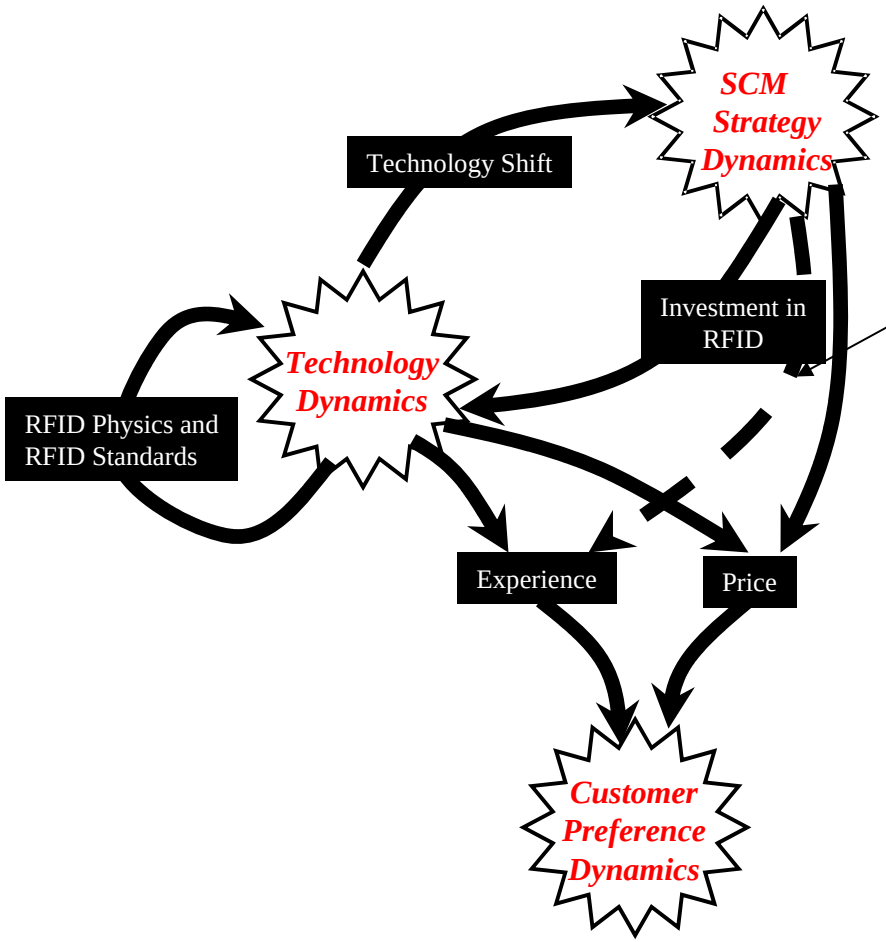
Heavy investment by largeCos
- Texas Instruments
- Motorola
- Hitachi
- IBM

NewCos Like
- Alien, Symbol, OAT

Price points of 5cents desired

Trigger Dynamics and the Gear Teeth Model

Price and Experience shape Consumer Preferences



SCM Strategy controls the Consumer experience

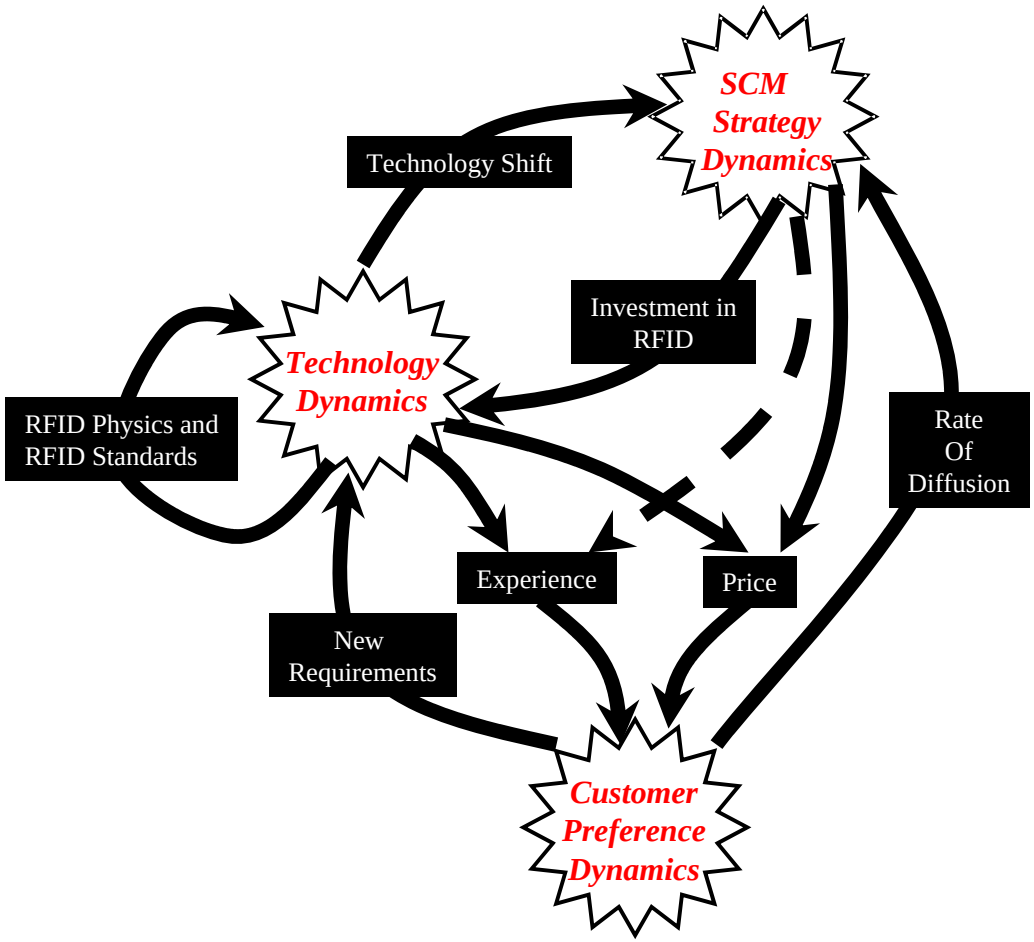
Wal-Mart gets 16% less OOS
Expands footprint

Benetton resigns RFID tagging
Sells company

ASP Model emerges
British Telecom starts offering
Hosted services

Trigger Dynamics and the Gear Teeth Model

Consumer Preferences churn Technology and Corporate Strategy Dynamics



Benefits for Retailers
•Retailers expand

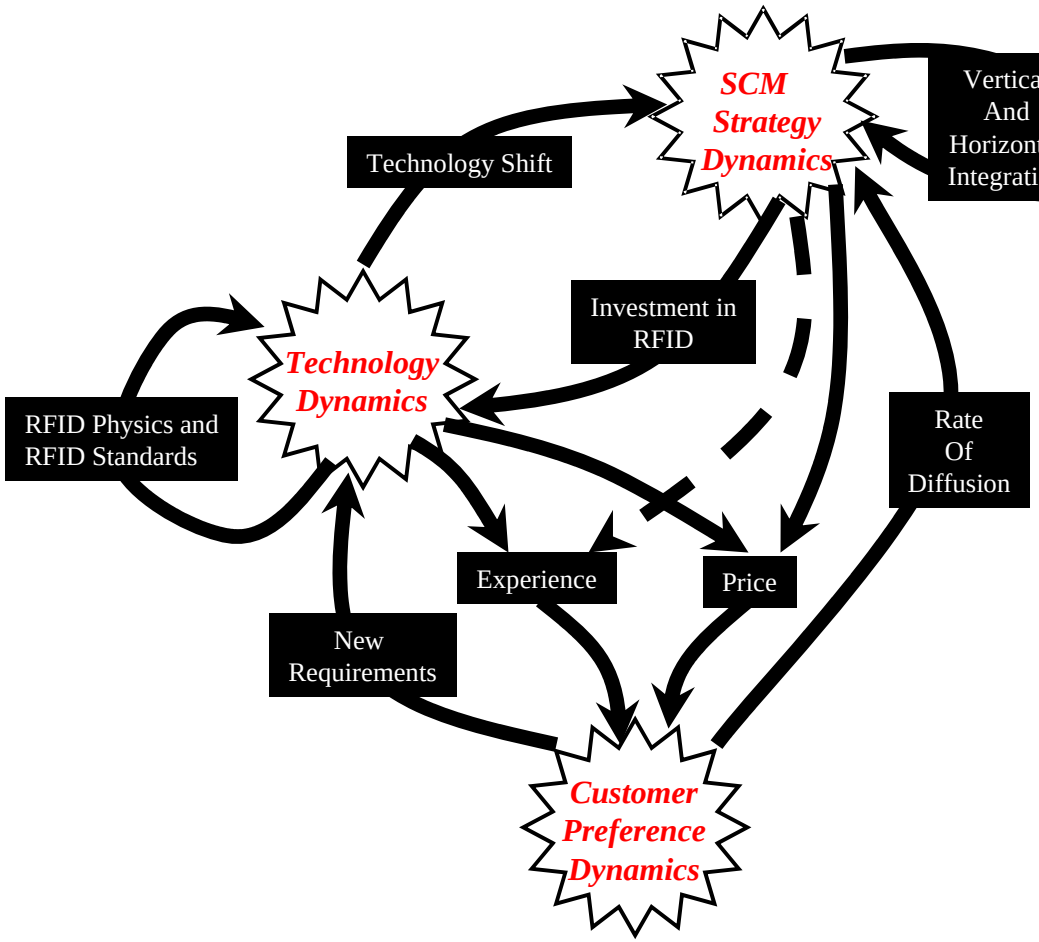
Added cost to Suppliers
•Suppliers resist

Privacy Concerns to endusers
•Jury is out

Competing Standards emerge
•WiFI, WiMax. Zigbee

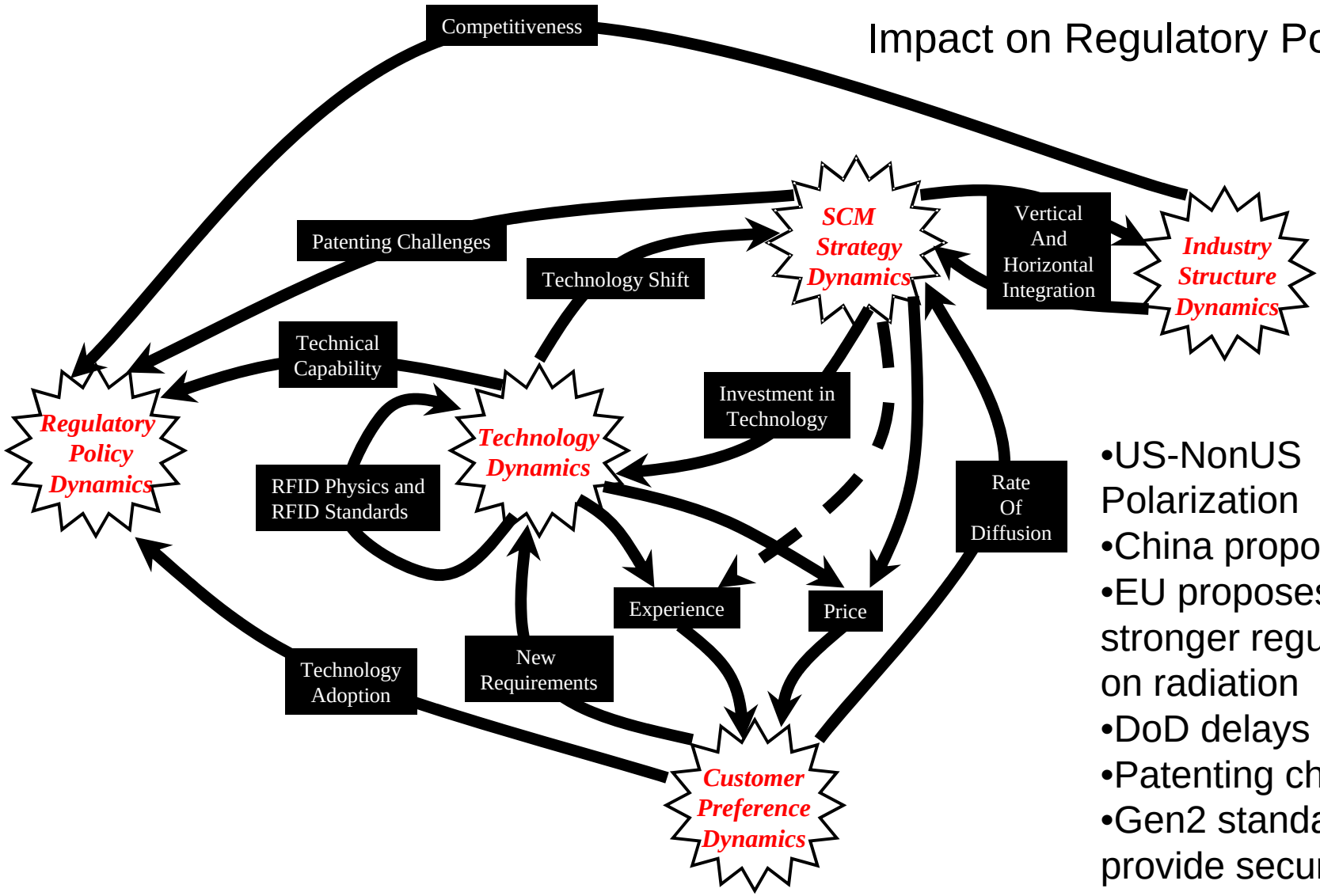
Trigger Dynamics and the Gear Teeth Model

Corporate Strategy determines the Industry Structure



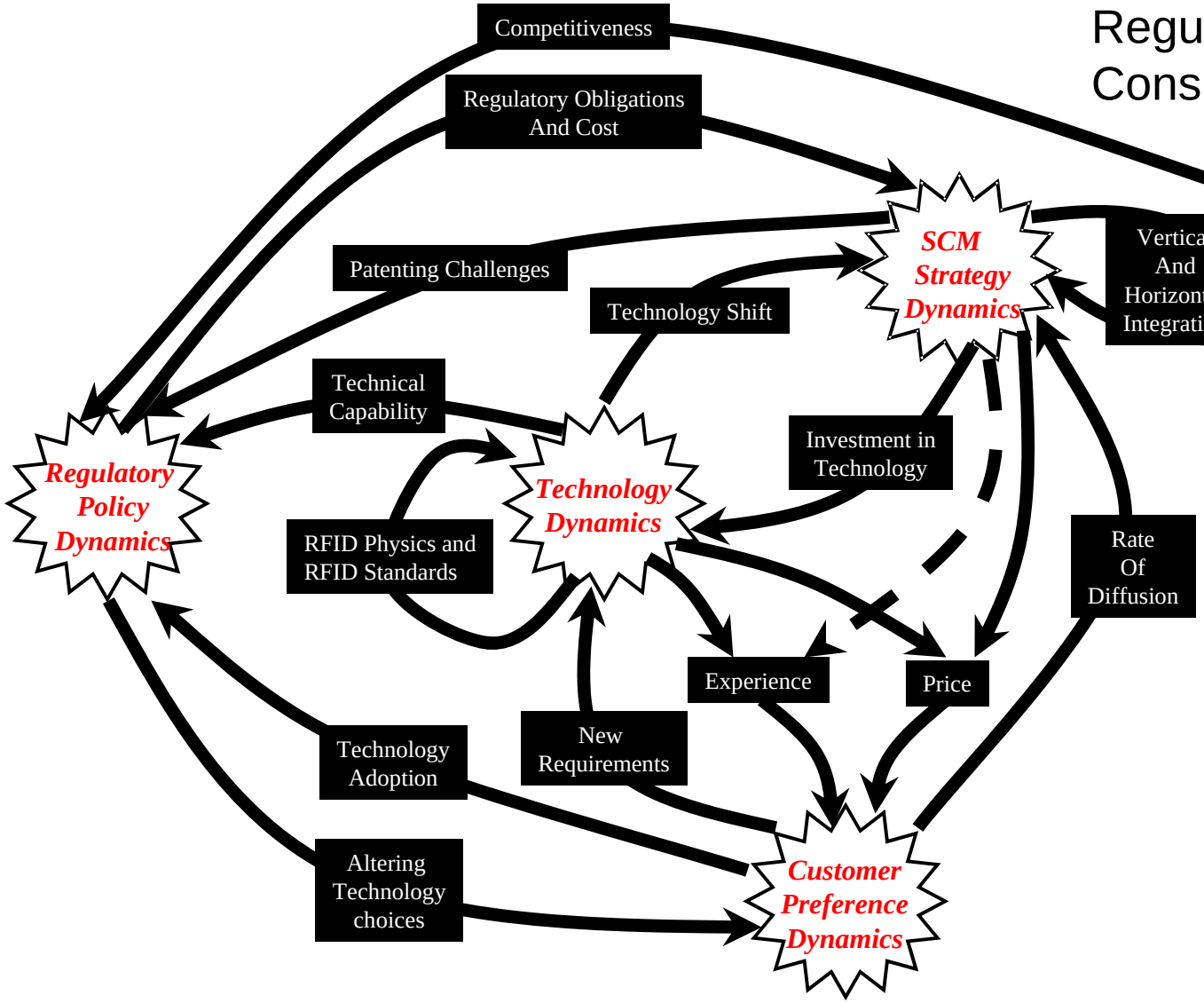
- 1000+ suppliers
- Telcos enter
  - BT, FT,Nokia
- Heavy M&A
  - Matrix
  - Savi
- EPC-IS challenged
- Closed Loop systems become popular
  - Marks and Spencer

Trigger Dynamics and the Gear Teeth Model



- US-NonUS Polarization
- China proposes R1
- EU proposes stronger regulations on radiation
- DoD delays rollout
- Patenting challenges
- Gen2 standards provide security

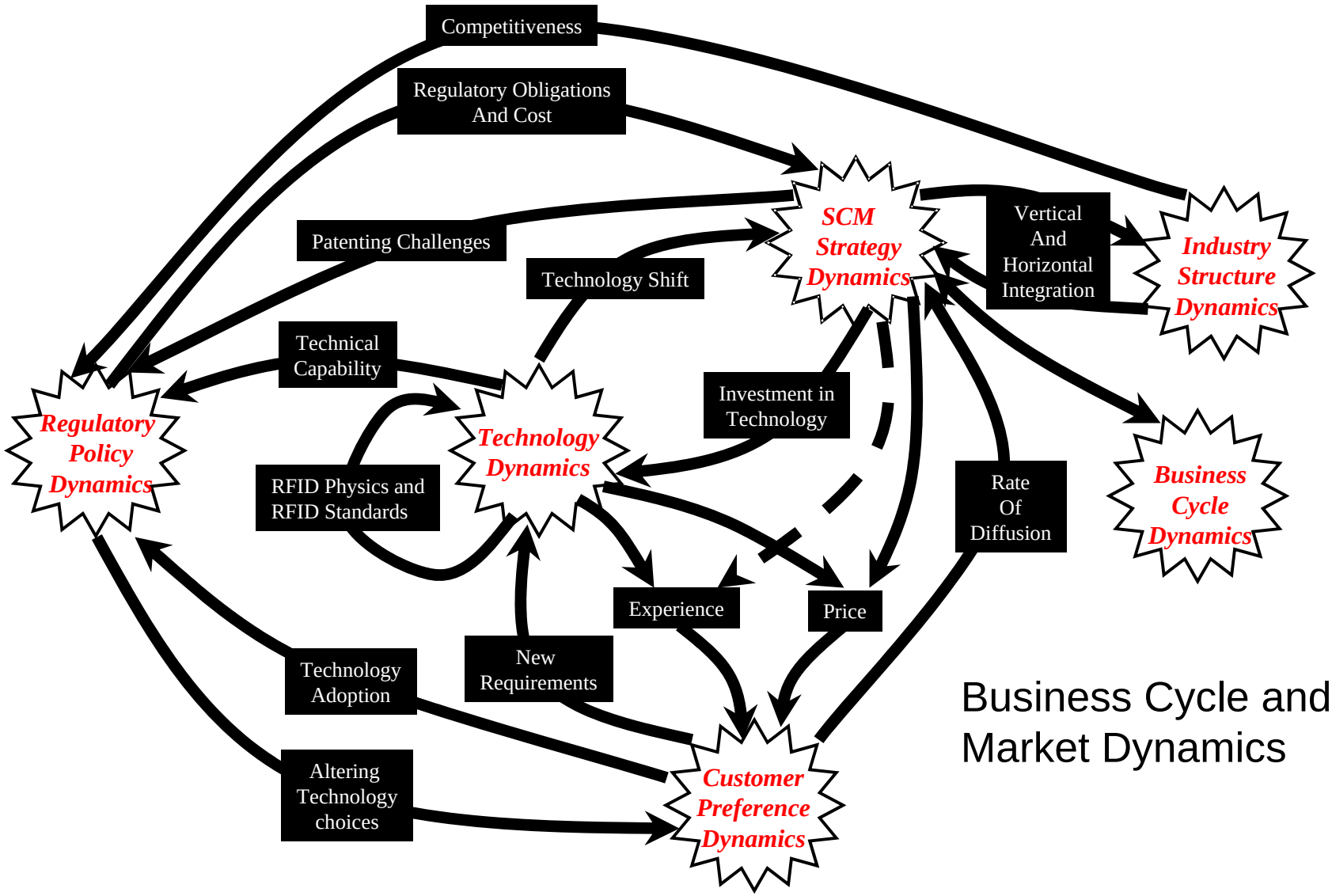
Trigger Dynamics and the Gear Teeth Model



Regulate Corporations and Consumer Behavior

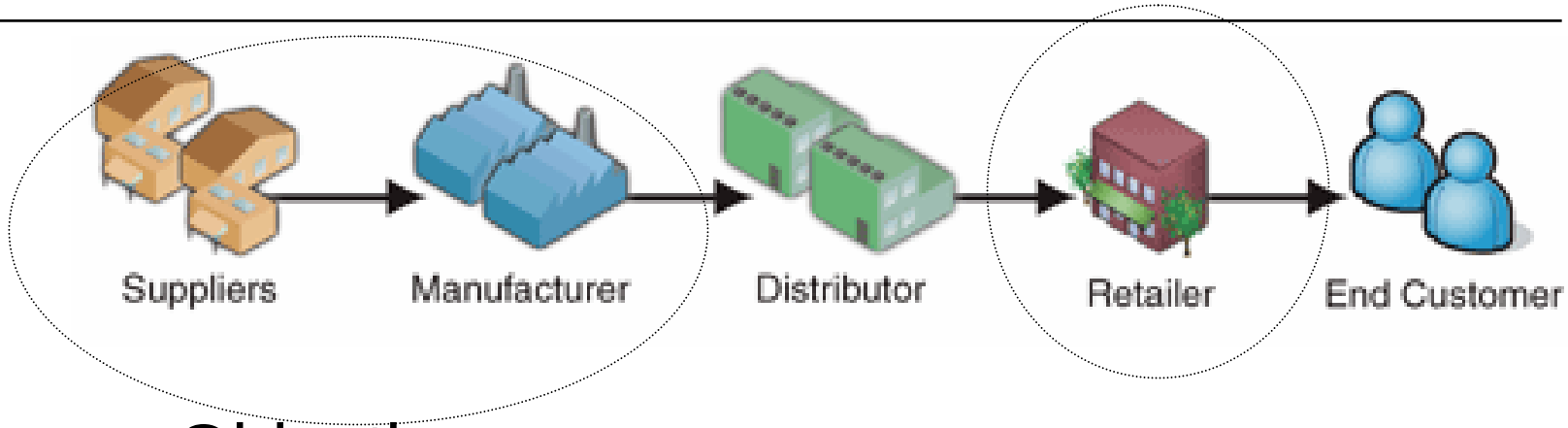
High cost of Gen2
Back to HF?
More Features = High Cost
More Safety = High Cost
More Complexity = High Cost

Trigger Dynamics and the Gear Teeth Model



Business Cycle and Capital Market Dynamics

Analysis



- Objective:
  - Analyze the Value Chain Dynamics (RFID) in the Retail Supply Chain
  - Make observations on Needs, Solution Scenarios, Challenges and ROI for each component
  - Attempt to model the above using System Dynamics Modeling

Retailer

- Critical Needs
  - **Including the consumer in the supply chain planning process**
  - Managing product life cycles
  - **Promotional planning**
  - Planning for seasonal products
  - **Determining cost-effective supply channels**
  - **Planning capacities at the store level**
- “Balancing better ROI with better shopping experiences for customers at the point of sale”

Drivers to the Retail Market

- Interest Generated through pilots
- Choices in levels of adoption
- Tag Reuse - Attractive investment option
- Increasing ROI in supply chain over time
- Better Marketing of Technology
- Prevalent Optimism about Technology

Constraints to Adoption in the Retail Market

- Huge Costs in Infrastructure and Implementation (Remember ERP?)
- Patent royalties
- Regulations on Power Use by RF devices
- Internationally usable frequency bands
- Customization Vs Commoditization

Other Challenges

- Data Management
- Privacy Issues
- Physics of ‘RFID’
- Lack of global standards.

Deployment Success Factors and ROI

- Management of
  - Hardware, Data, Integration and Process
- ROI
  - Reduction of 7.5% in Labor (Instore + Warehouse)
  - Reduction in OOS of $700,000 per 1B of sales/Yr
- Cost
  - 100,000 per DC and 50,000 per store
  - 35M – 40M for Systems Integration across the organization
- Bottom-line: Viable for > 5B Retailers with immediate ROI.

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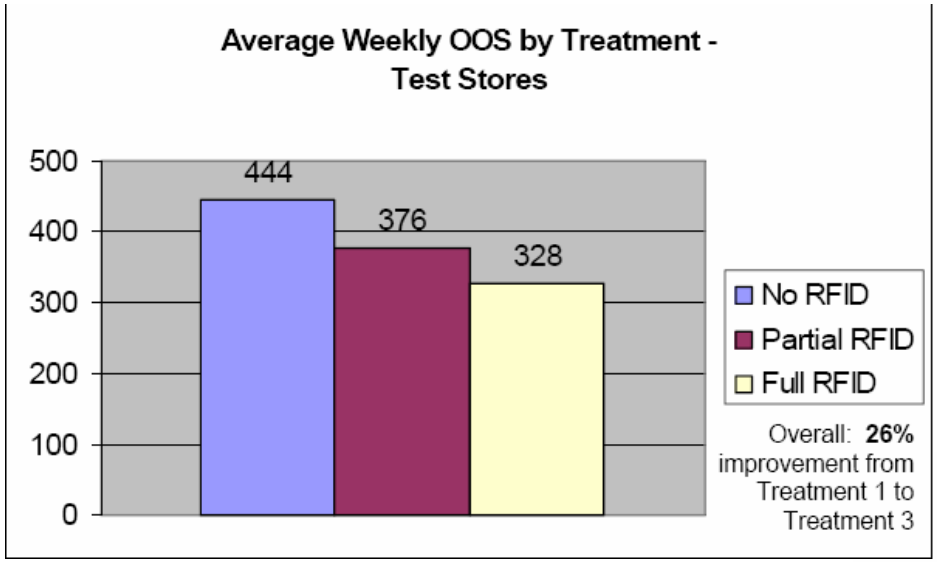
Case Study – Wal-Mart

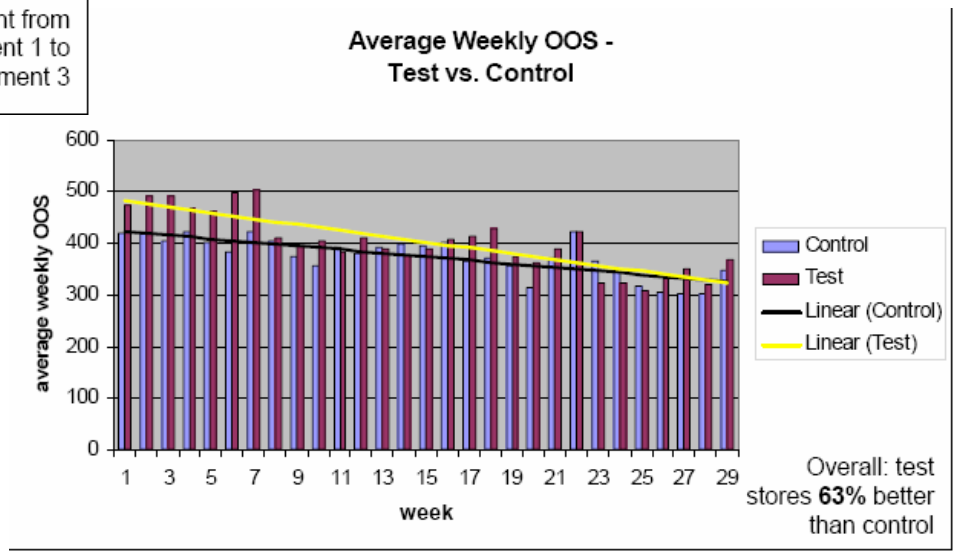
- Application:
  - Retail, Consumer Goods
- Level of RFID usage:
  - Pallet, Cases, Items
- Benefits sought:
  - Cost Reduction, Theft Prevention, Customer Service, Convenience and Speed of transaction.
- Project Status:
  - Initial Pilot completed, Trials ongoing
- Tags:
  - UHF Gen2 tags
- System:
  - Various Providers.

- Out Of Stock Study for Wal-Mart RFID*
- Scope
  - 12 test stores / 12 control stores, 6 supercenters, 3 division I, 3 neighborhood markets
- Control stores chosen to match test stores
- Stores in Texas and southern Oklahoma
- Scanning
- February 14 to September 12
  - Scanned daily for 210 days (29 Wal-Mart weeks)
  - Scanned most sections of the store (some exceptions)
- Started approximately same time each day and followed the same path

* Done by Univ. of Arkansas

Case Study – Wal-Mart



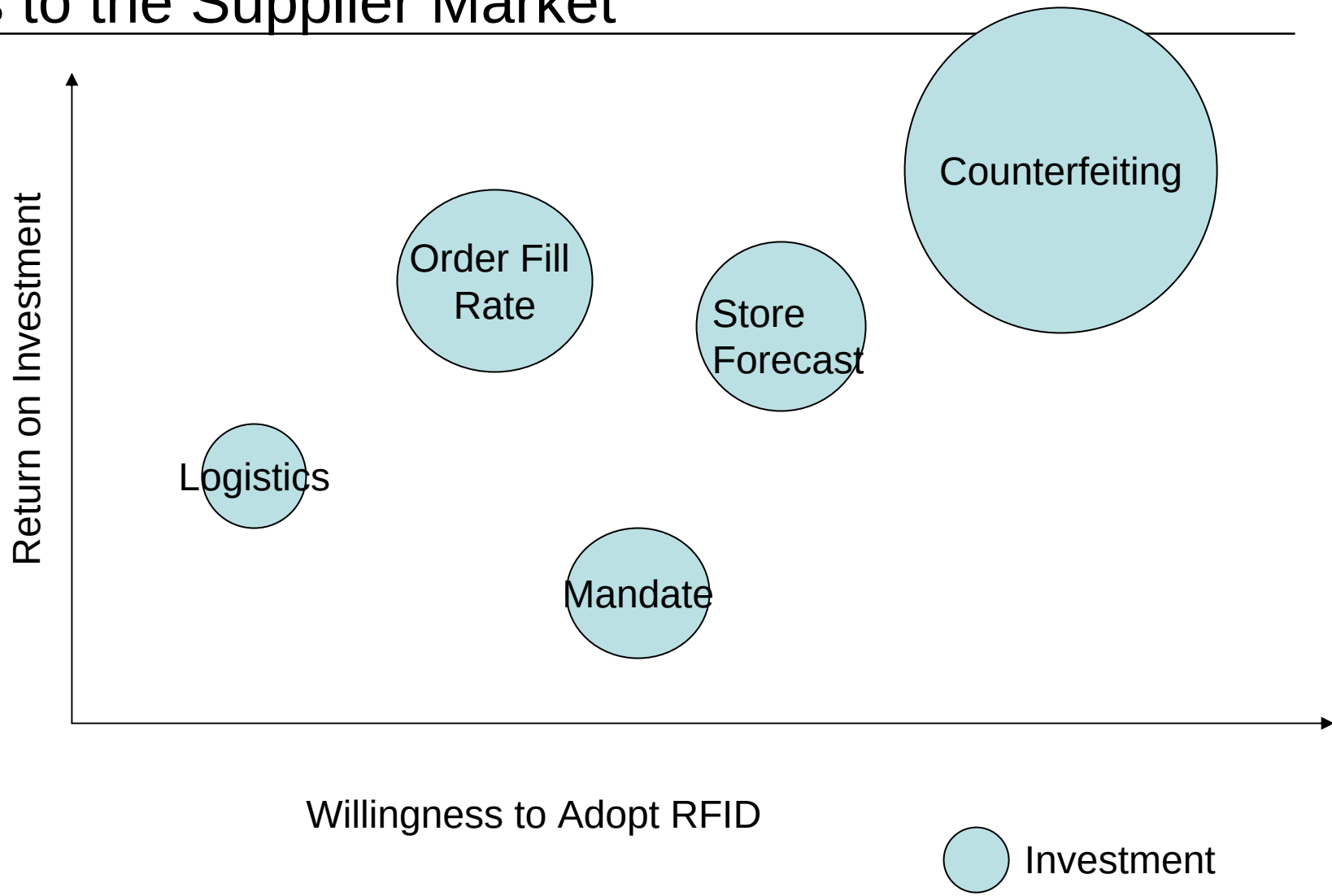


* Done by Univ. of Arkansas

Supplier

- Critical Needs
  - Accurate Demand Forecasts (From Stores)
  - Higher order fill rates, increased inventory velocity, faster order processing, shorter lead times
  - Transport Efficiencies (Automated Route Management, Cross Docking)
  - Overcome a Bullwhip effect
  - Manage Recalls and Returns effectively
  - Comply with Regulations
  - Reduce Counterfeiting
- Better Processes to Reduce costs and increase revenue

Drivers to the Supplier Market



Constraints

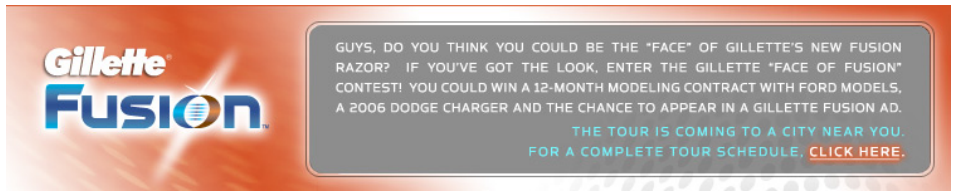
- Anything more than slap and ship needs significant more investments
- Item Level Tagging is cost prohibitive for most items in the supply chain
- Lack of collaboration amongst trading partners especially retailers and logistics providers.
- Data Management Capabilities lacking at suppliers end.
- No clear ROI benefits seen yet.

Deployment Success Factors

- Cost of tags to drop
- Critical Mass of retailers to exist
- ROI : Company ships 50 Million Cases to Wal-Mart
  - @ 20C per tag, it takes a $10Million Cost
  - $1 M for additional Infrastructure
- Needs 11M in additional savings to break even
- Great Majority of suppliers find that RFID offers a Poor ROI at this time

Case Study - Gillette

- Application:
  - Retail, Consumer Goods, Razors
- Level of RFID usage:
  - Item Level
- Benefits sought:
  - Anti Counterfeiting
- Project Status:
  - Trials Completed. Implemented with Fusion Product Line in 2006.
- Tags:
  - UHF Gen2 tags
- System:
  - Alien Technologies, OAT systems, SAP, Sun Microsystems

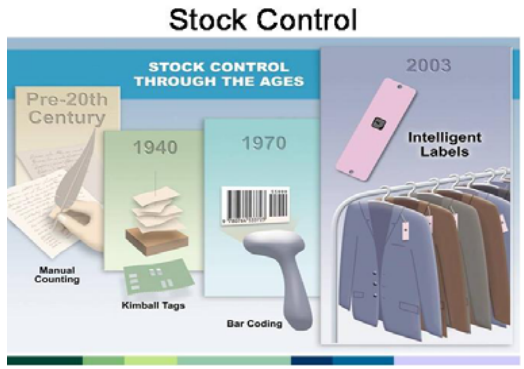


- Worlds most stolen branded product
- Promotions
- Large Theft Rates
- Real Time Stock Details

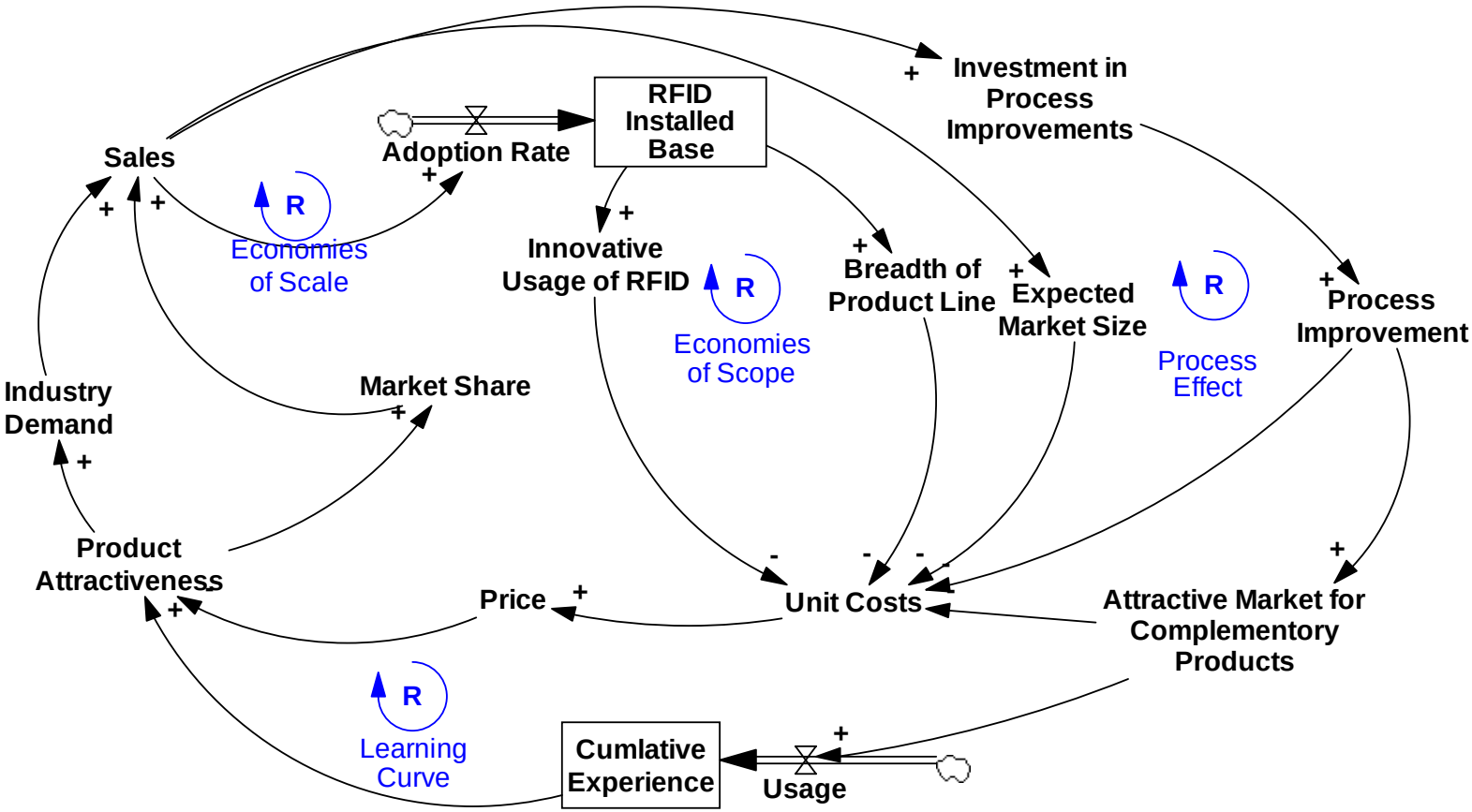
Case Study – Closed Loop

look behind the label

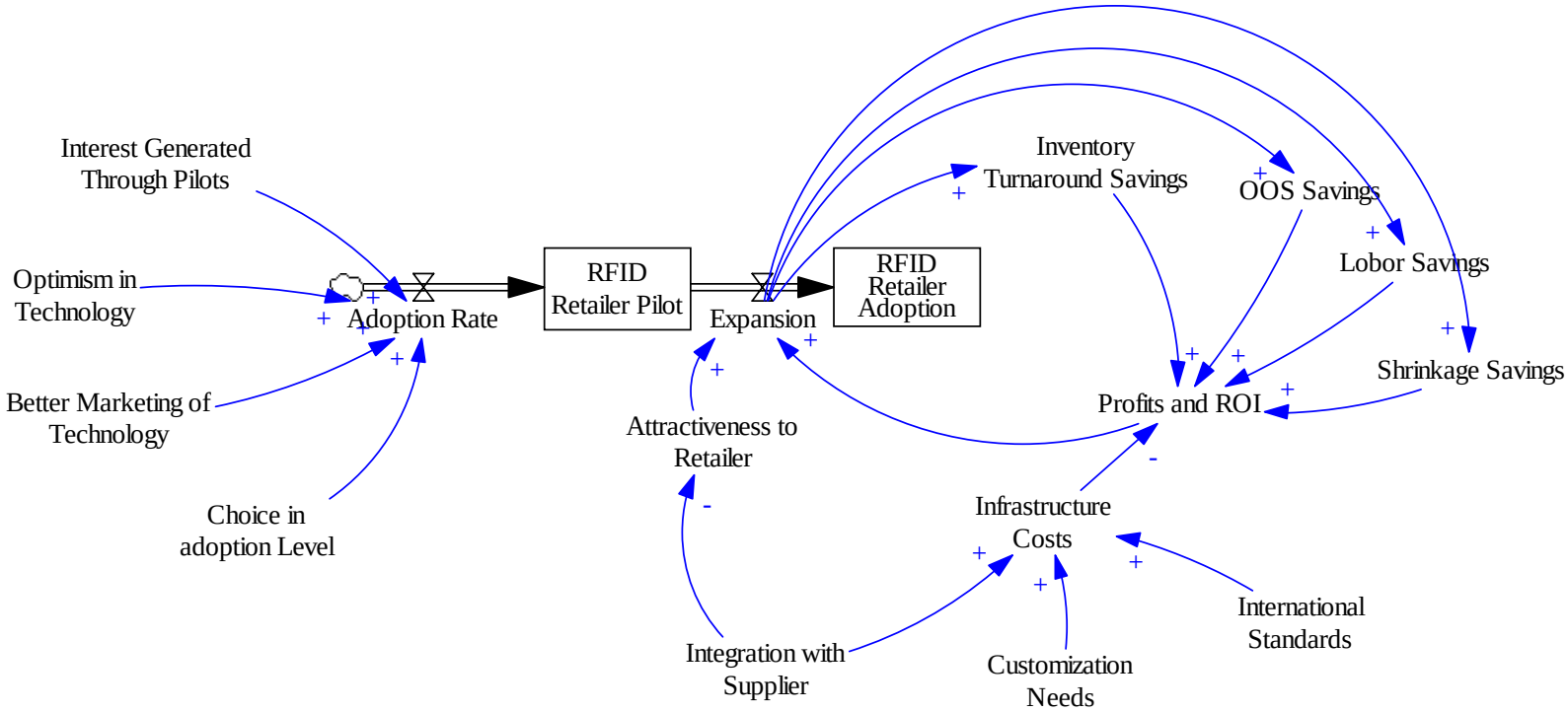
- Application:
  - Retail, Apparel
- Level of RFID usage:
  - Item Level
- Benefits sought:
  - Improved Customer Service, Improved Loyalty, Improved Sales, Less OOS
- Project Status:
  - Trials Completed
- Tags:
  - UHF 868 MHz (Not EPC)
- System:
  - Paxar, Intellident



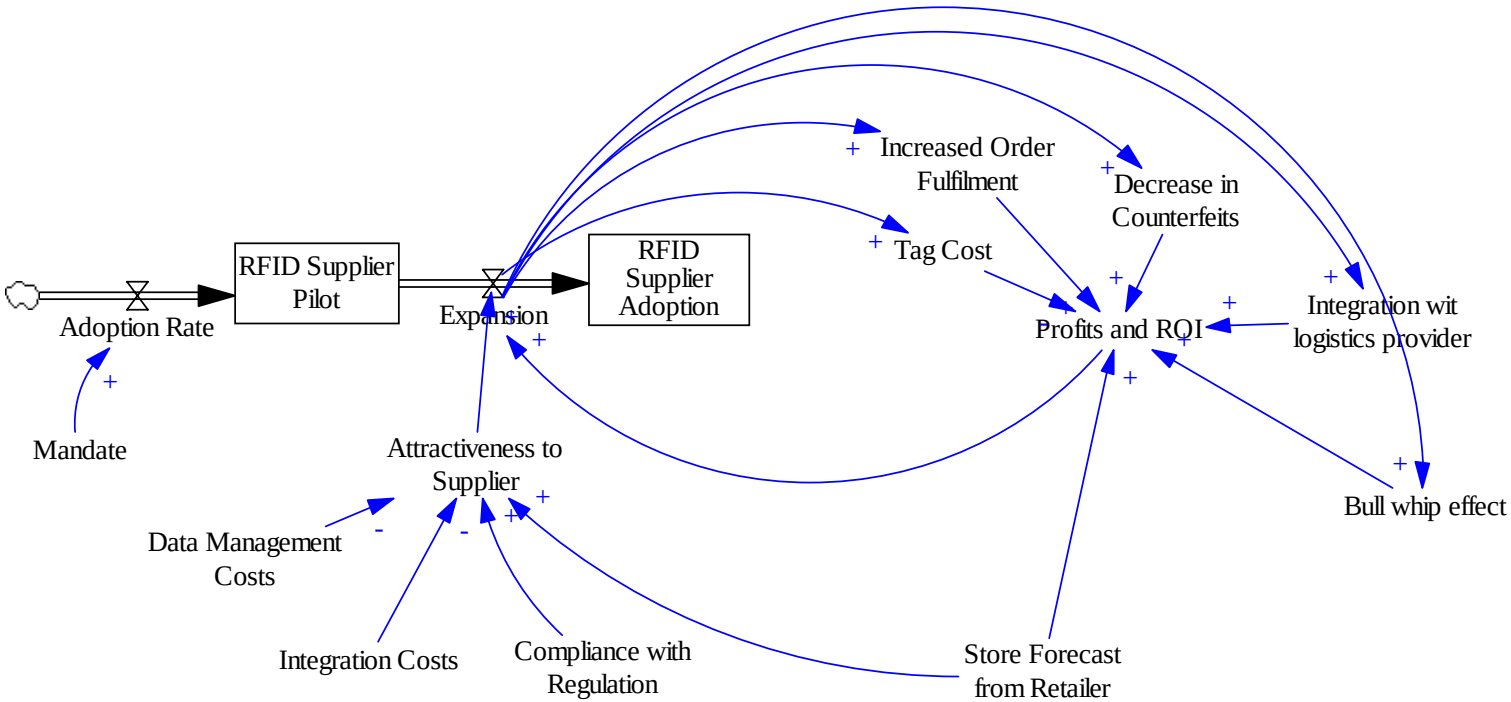
RFID at a Macro Level



Retailers Perspective



Suppliers Perspective



Summary

- Retailers have proven ROI and are pushing for RFID
  - More than 70% with $5B evaluating RFID
- Suppliers have yet to see a clear ROI and need to eat up all costs
- Complex infrastructure is needed to integrate both parties

Trend – Towards creating “Thinking Machines”

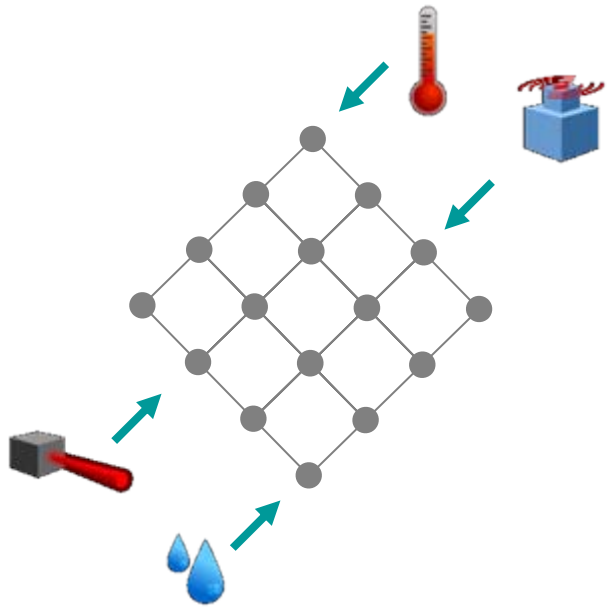
Internet

Linear Business Processes

- **Human Intervention Required**
- **Limited by Submit or Go Button**

Real Time

Web of Business Processes



- **Triggered by Physical Events in the Real World**
- **Many Starting Points**
- **Automated, Interdependent Processes**

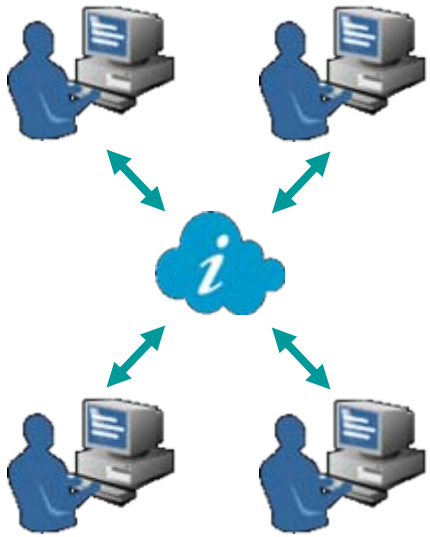
Trend: Towards Real-Time Enterprises

Data Processing

- Weeks
- Batch
- Megabytes
- Punch Cards
- Few People

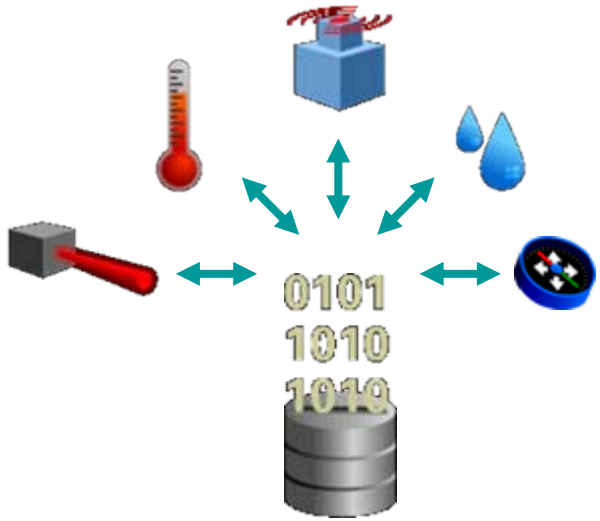
Internet

(Still Happening)



- Days
- Request/Reply
- Terabytes
- Human
- Many People

Real Time



- Minutes
- Automated
- Exabytes
- Event Driven
- Beyond People

Companies Studied

- Wal-Mart
- Tesco
- Metro
- Tyco
- Intermec
- Texas Instruments
- Bic Corporation
- Pratt and Whitney
- Carrier Corporation
- Sikorsky Helicopters

Next Steps

Cocktails and appetizers next door…

Broadbrand Working Group Meeting tomorrow

Room 298, Muckley Building
(Building E40) 1 Amherst Street