



# The end of core:

*Should disruptive innovation in telecom invoke discontinuous regulatory response?*

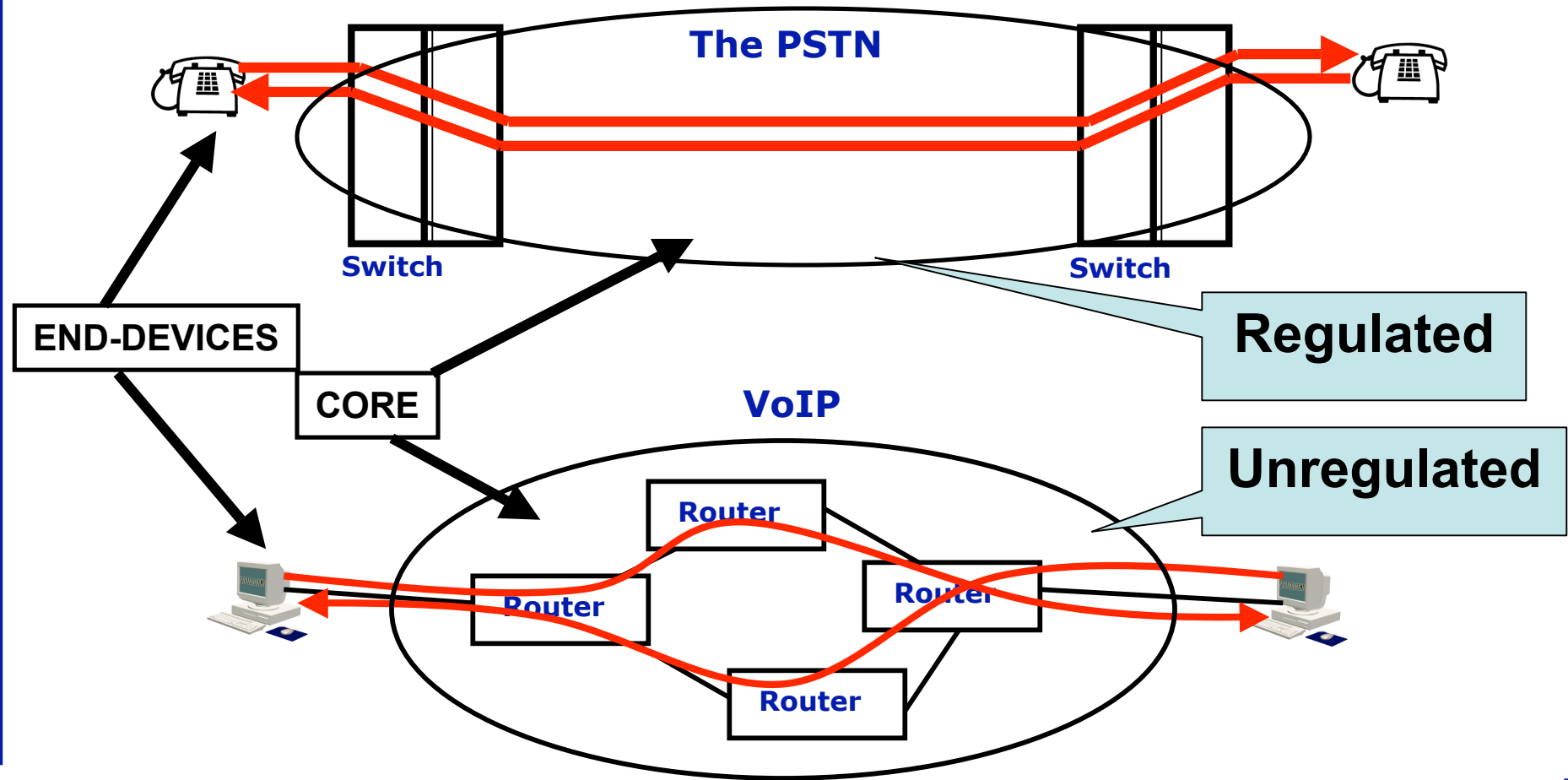
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# VoIP bridges PSTN and the Internet! Should we care?



**The broad regulatory question: Should VoIP be regulated like the PSTN, unregulated like the Internet or should there be a third approach?**



# What is the Current Regulatory Response to VoIP?

## US Telecom Regulation

Paradigm	Traditional Regulation	Objective
Social Regulation	911/E911	Public Safety
	Wiretapping (CALEA)	Law Enforcement Capability
Economic Regulation	Disability Access	Equal Opportunity
	Universal Service	Economic Development
	Access Charges	Competition

## Modes of VoIP

Mode	Service Example	Regulatory Term
Phone-to-Phone	VoCable, VoDSL, Vonage, 8x8	“interconnected” service (i.e. PSTN interconnection)
PC-to-Phone	SkypeOut, Net2Phone	“interconnected” service
PC-to-PC	Skype, Yahoo, IM, Google Chat	“unmanaged” service (i.e. no PSTN interconnection)

**“Light Touch” Regulation: Traditional 911/E911 and CALEA regulation extended only to “interconnected” VoIP services**



## Observation and Hypothesis

### Observation:

Telecommunications regulation assumed a network core that...

- could be engineered to fulfill regulatory objectives
- was controlled by an industry structure that could do the engineering

### Argument:

Disruptive trends such as VoIP erode assumed control in the core

### Hypothesis:

**With eroding control in the core meeting regulatory objectives will increasingly require regulatory responses discontinuous from the past**

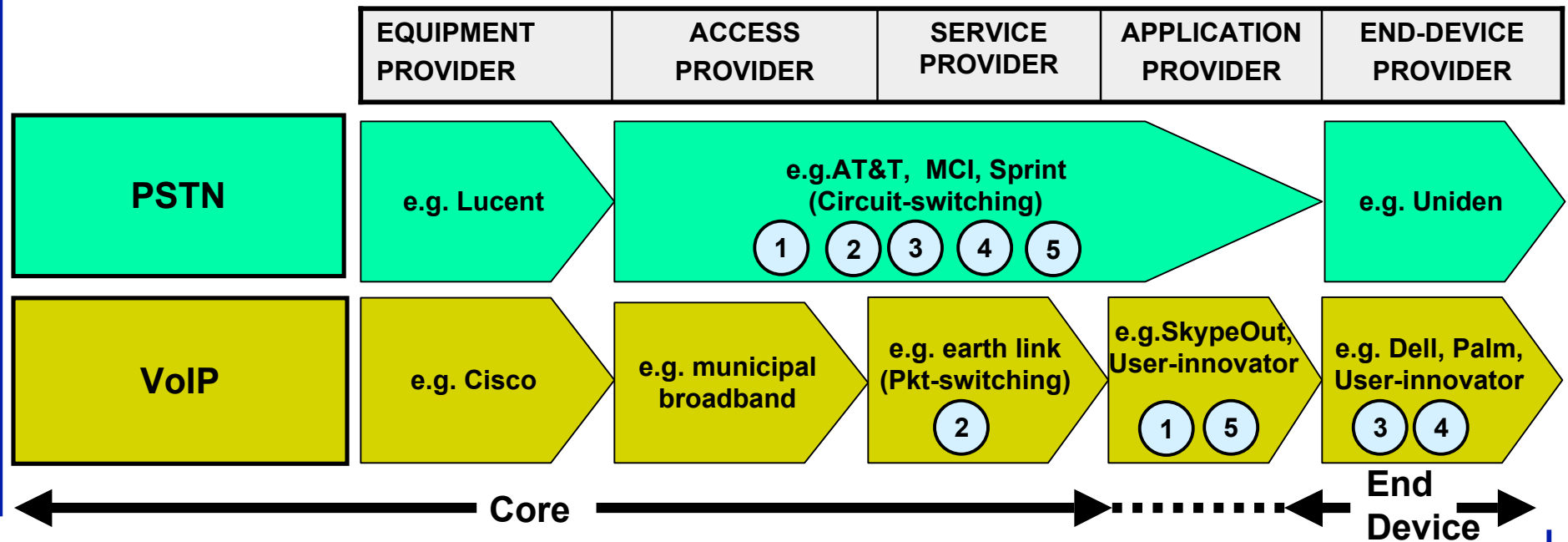


# Observing and Conceptualizing The End of Core

## Functions of a typical voice call

- ① Setup & terminate the call (call signaling)
- ② Voice transport (bit transport)
- ③ Secure the channel
- ④ Maintain user privacy
- ⑤ Billing for voice service

Communications Value Chain





## The End of Core

**Functionality is Dispersing to End-Device**

**+**

**The Ownership of the Core is Fragmenting**

**=**

**The End of Core**



# The implications of the End of Core for Regulation

## The End of Core can cause...

### **Regulatory misalignment (*Static Complexity*):**

Between those who must meet the regulatory requirements versus those who control the functionality necessary to meet them

### **Regulatory Misalignment can cause...**

- Inefficiency in achieving regulatory compliance
- Regulatory capture by new players

### **may require...**

Discontinuing access-centric regulatory thinking...and understanding the complexity of the value chain



# The implications of the End of Core for Regulation

## The End of Core can also cause...

### **Circum-innovation (*Dynamic Complexity*):**

By user-innovators (a customer with the necessary knowledge to innovate) who can introduce innovations that might, intentionally or otherwise, circumvent regulatory objectives

### **Circum-innovation can cause...**

- arms race between proponents of compliance and non-compliance


### **may require...**

Discontinuing command-and-control regulatory thinking...and understanding a collaborative model of regulation



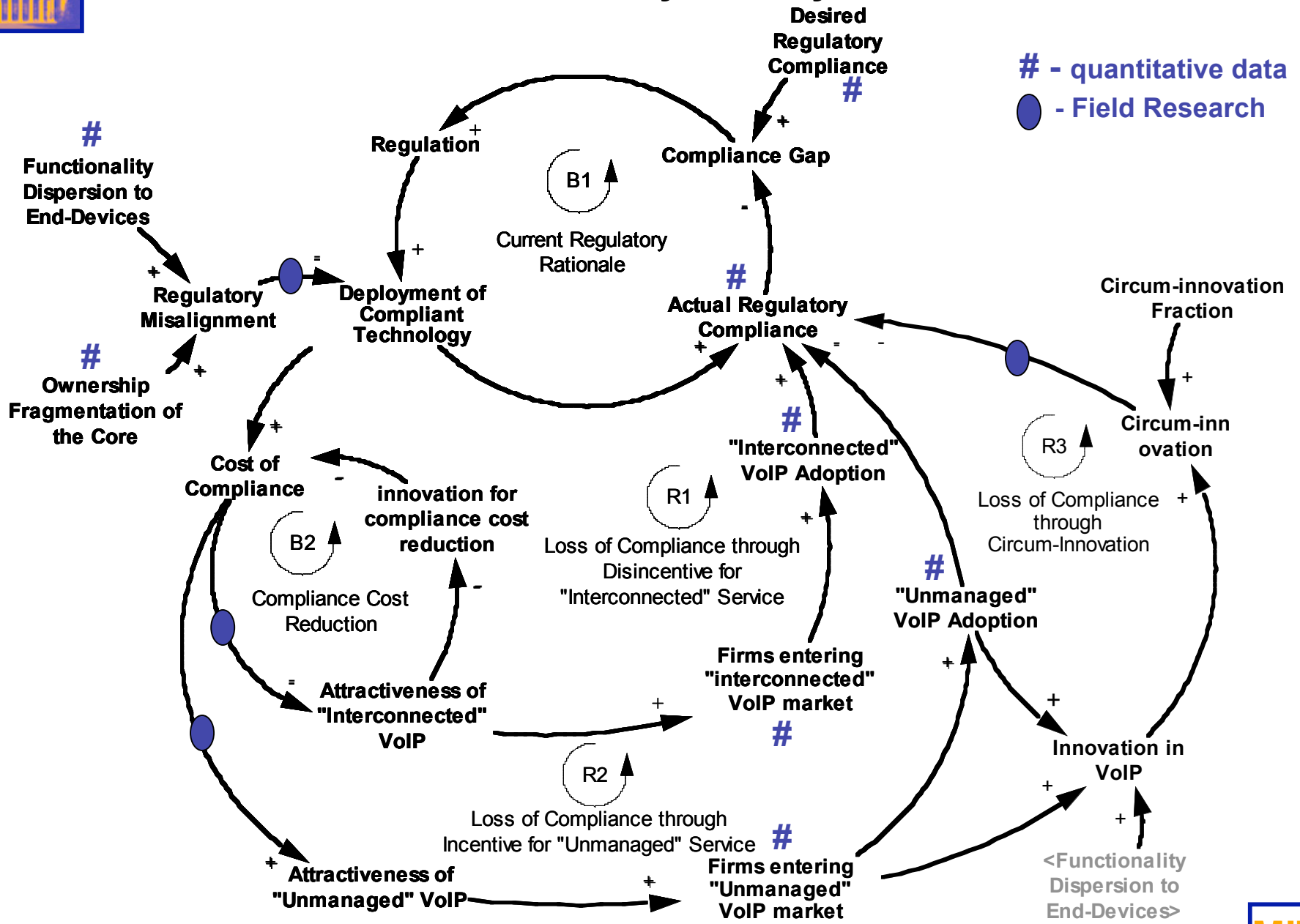
## Research Method

### System Dynamics Model and Field Research

- 
- Build a system dynamics model
  - Perform internal validity of the model using field research
  - Perform construct validity by calibrating the model with real-world data
  - Use the model and modeling insights to perform policy analysis



# Causal Structure of the System Dynamics Model





# Summary of Field Research

## Field Study 1

**Involving:** Firms offering “interconnected” and “unmanaged” VoIP service

**Investigate:**

1. How and why does the regulatory misalignment affect the deployment of compliant technology?
2. How and why does the compliance cost affect the choice of technology to develop?

## Field Study 2

**Involving:** Circum-innovations affecting 911/E911 and CALEA Compliance

**Investigate:**

1. How and why circum-innovations impact the regulatory compliance?



## Description of Data Collection

Quantitative data from FCC, industry reports and trade magazines

<b>Theoretical Construct</b>	<b>Proxy</b>	<b>Type</b>
<b>Functionality Dispersion</b>	% Voice Traffic that is PC-to-Phone + PC-to-PC VoIP	Time Series
<b>Ownership Fragmentation</b>	Market share of PC-to-Phone + PC-to-PC VoIP	Time Series
<b>Desired Regulatory Compliance</b>	Number of “interconnected” VoIP Firms	Time Series
<b>Actual Regulatory Compliance</b>	Number of 911 and CALEA compliant “interconnected” Firms	Quant.
<b>Level of Compliant VoIP Use</b>	% Voice Traffic that is “interconnected” VoIP	Time Series
<b>Innovation Rate</b>	TBD	Time Series
<b>Compliance Cost</b>	Average Cost of a PSTN Wiretap	Quant.



## Desired Contribution

### ESD / Telecom Policy

1. Explaining dynamic complexity involved in the regulation of VoIP
2. Increasing the ability to communicate risks and opportunities in regulating the emerging communications technologies from the perspective of socio-technical systems

### Innovation Theory Literature

3. A framing paper on the dynamics of regulation and innovation

### Internet Architecture Literature

4. Extending the “tussle in cyberspace” work by one step with a paper on “tussle for surveillance and its impact on the Internet architecture”

### System Dynamics Literature

5. A comprehensive paper on the system dynamics modeling of the communications industry



# Thank You!

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### **Committee:**

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