Modeling Coreness using System Dynamics

The Voice over Internet Protocol (VoIP) Model

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Outline

- **History (using VoIP example)**
  - **Basic Elements (VoIP Control Points)**
  - **Coreness of Control Points**
  - **Coreness over Time (The Coreness Tunnel)**

- **System Dynamics (SD) Modeling**
  - **What is Systems Dynamics?**
  - **The Goal (How do we plan to use SD?**
  - **Process Steps**

- **Model Building (Discussion)**
  - **Variables**
  - **Reference Modes and Rough Hypotheses**
  - **Illustrative Causal Loops**

History

History

Basic Elements (VoIP Control Points)

- Local Access
- National Backbone
- International Backbone
- Bit Transport (Voice Quality)
- Call Signaling
- PSTN Gateway
- Features
- End Device/Software
- Name Space

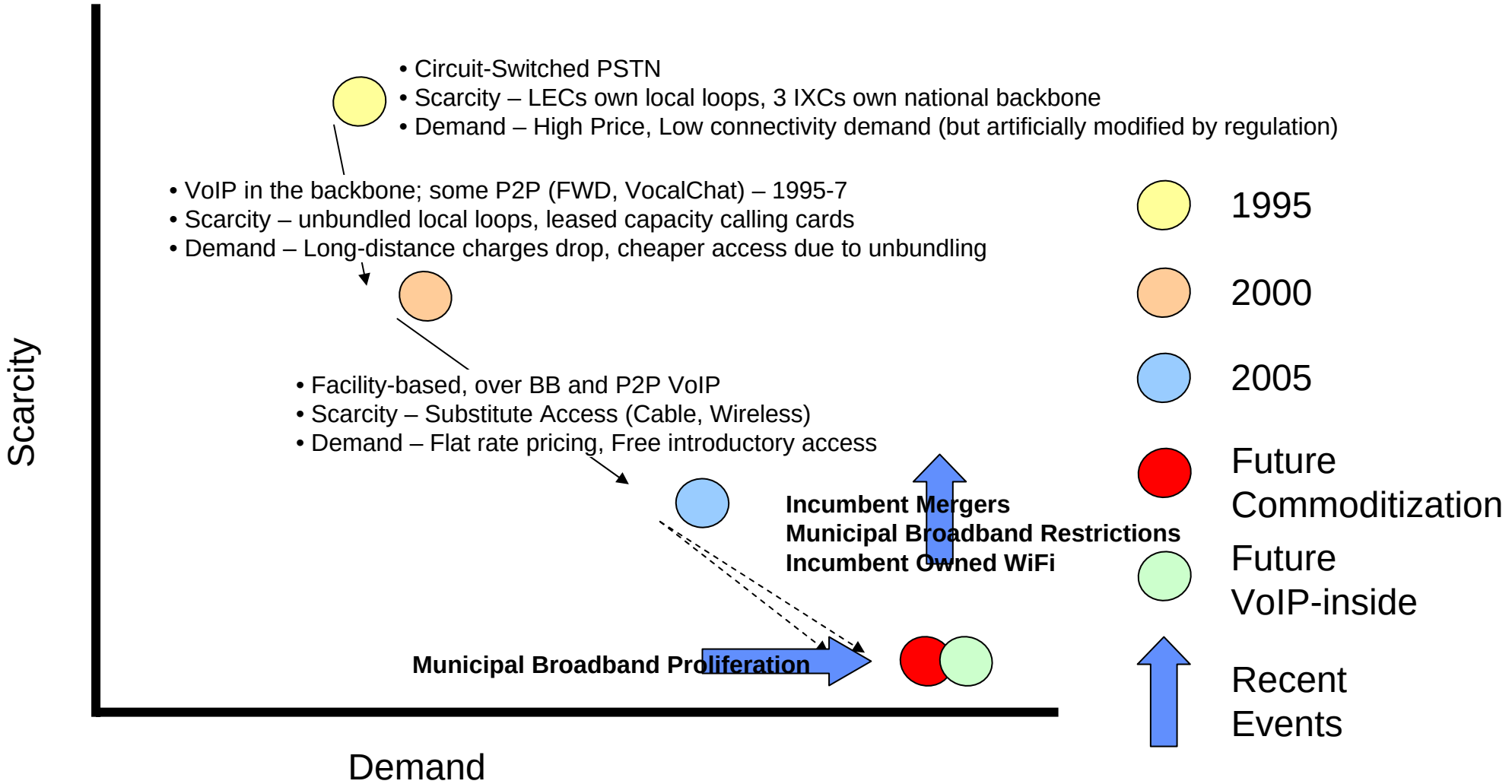
} Access

Other case studies are: digital music, LBS, SIP

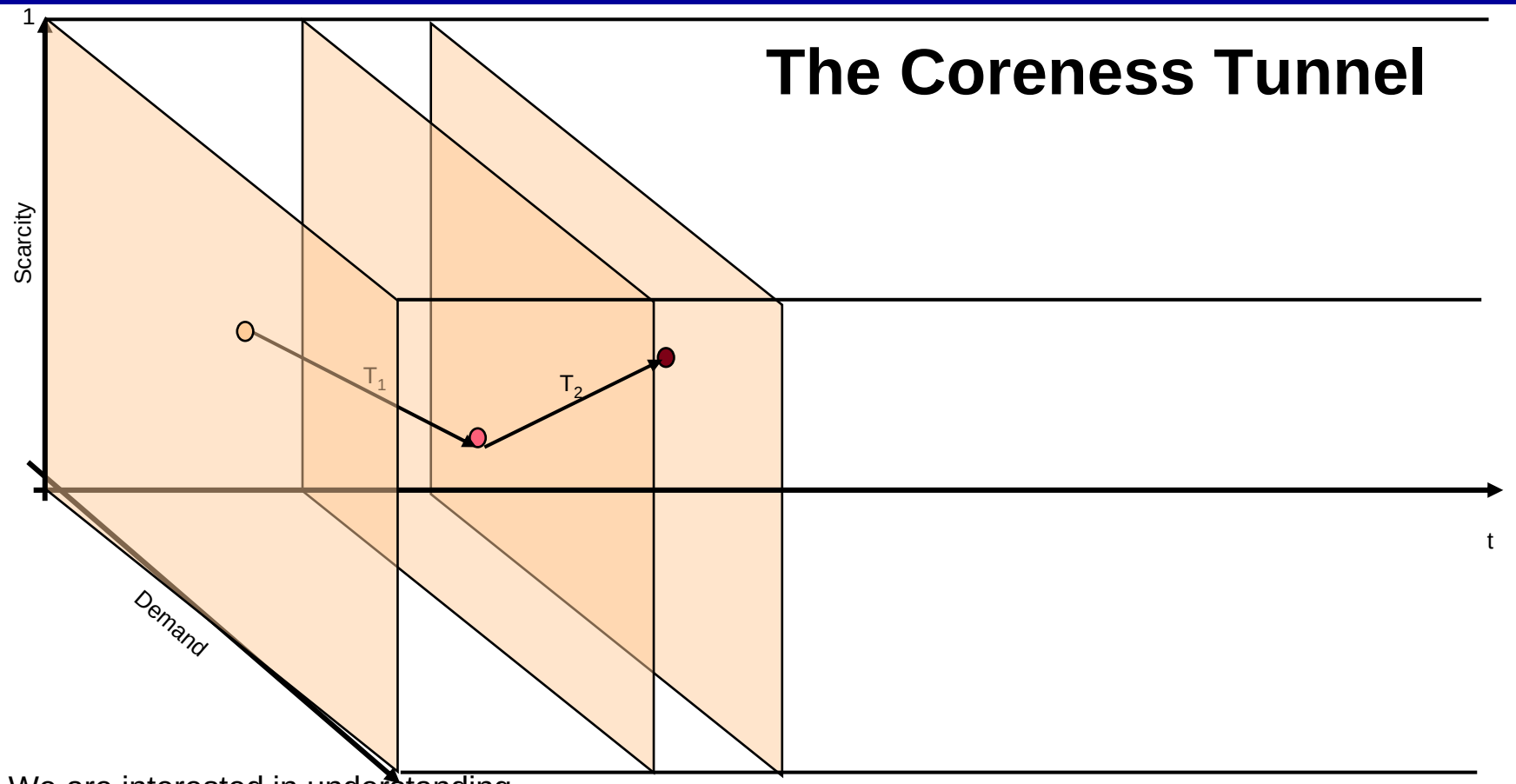
History

Evolving Coreness of Access

(this exercise was carried out for each control point)



History



We are interested in understanding…

- What happens to the demand and scarcity (i.e. the coreness) of a certain technology offer over time.
- What triggers a change in demand and scarcity?
- Can we construct a business model that will control the triggers to drive coreness of an offer to the desired region on the plane?

System Dynamics Modeling

System Dynamics Modeling

What is System Dynamics?

- 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.

System Dynamics Modeling

The Goal **(How do we plan to use SD?)**

We are developing an SD model of the coreness tunnel for VoIP services to…

1. Understand what triggers a change in the demand and scarcity of VoIP offers over time.
2. Understand which triggers are strong and which are not.
3. Abstract the learning from VoIP to a macro gear-teeth model (revisited next).
4. Validate the core-edge taxonomy we have developed and used in the past for characterizing different technologies and services.

System Dynamics Modeling

Modeling Steps

1. Problem definition
2. List of variables
3. Reference modes and rough hypotheses
6. Dynamic hypotheses (i.e. causal loops)
7. Model first loop
8. Analyze first loop
9. Model second loop
10. Analyze second loop
11. …

Most of the learning is in the process of building the model itself…

The VoIP Model (in progress)

The VoIP Model (in progress)

Step 1 – The Problem Statement

Statement:

To model the VoIP coreness tunnel to understand changes in service demand and scarcity.

Challenges:

1. At what level of abstraction?
   - Control Points Level vs. Service Level
   - Start with one big model vs. a separate model for demand and scarcity (and then combine them)

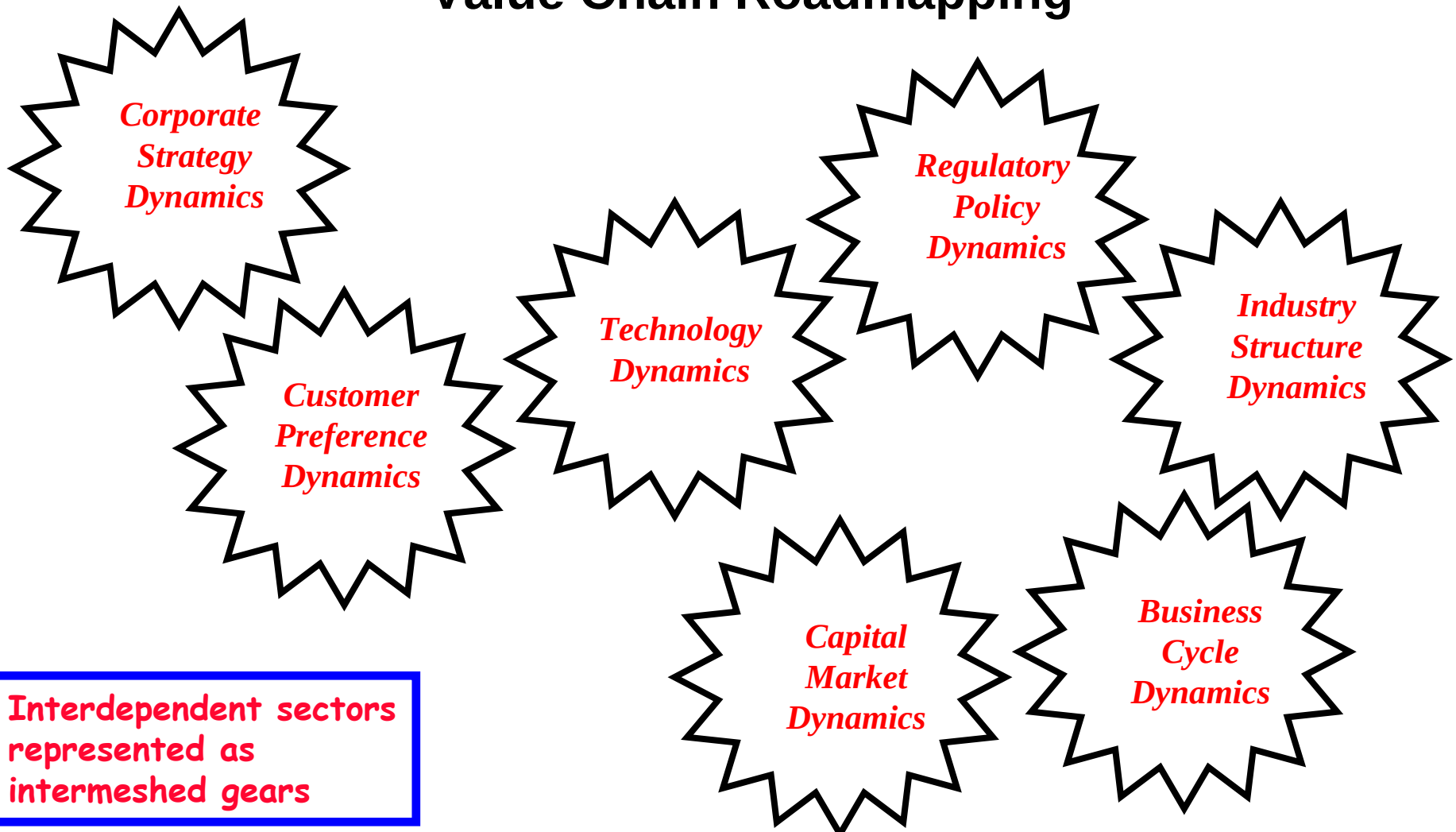
   Resolution: *Model demand and scarcity separately at the service level.*

2. How to abstract learning from the VoIP model to a macro level dynamics?

   Resolution: *Under discussion.*

The VoIP Model (in progress)

The "Gear Model" for Value Chain Roadmapping



Interdependent sectors represented as intermeshed gears

The VoIP Model (in progress)

Step 2 – Variables in the system

Technology Dynamics

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

Regulatory Policy Dynamics

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 Dynamics

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 Preference Dynamics

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 personells

Corporate Strategy Dynamics

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

Capital Market Dynamics

VoIP Hype
capital available
attractiveness to wall street
wall street expectation
capital performance
attractiveness of internet technology

Business Cycle Dynamics

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

80 variables

The VoIP Model (in progress)

Variables (contd.)

Challenge:

Do these variables affect demand, scarcity or both?

Variable Name	Affects
Voice Quality	**Demand**
New Features	**Demand**
PSTN Interconnection	**Demand**
Broadband deployment	**Scarcity**
WiFi Hotspots	**Scarcity**
Convergence	**Both**
VoIP Enabled Devices	**Both**

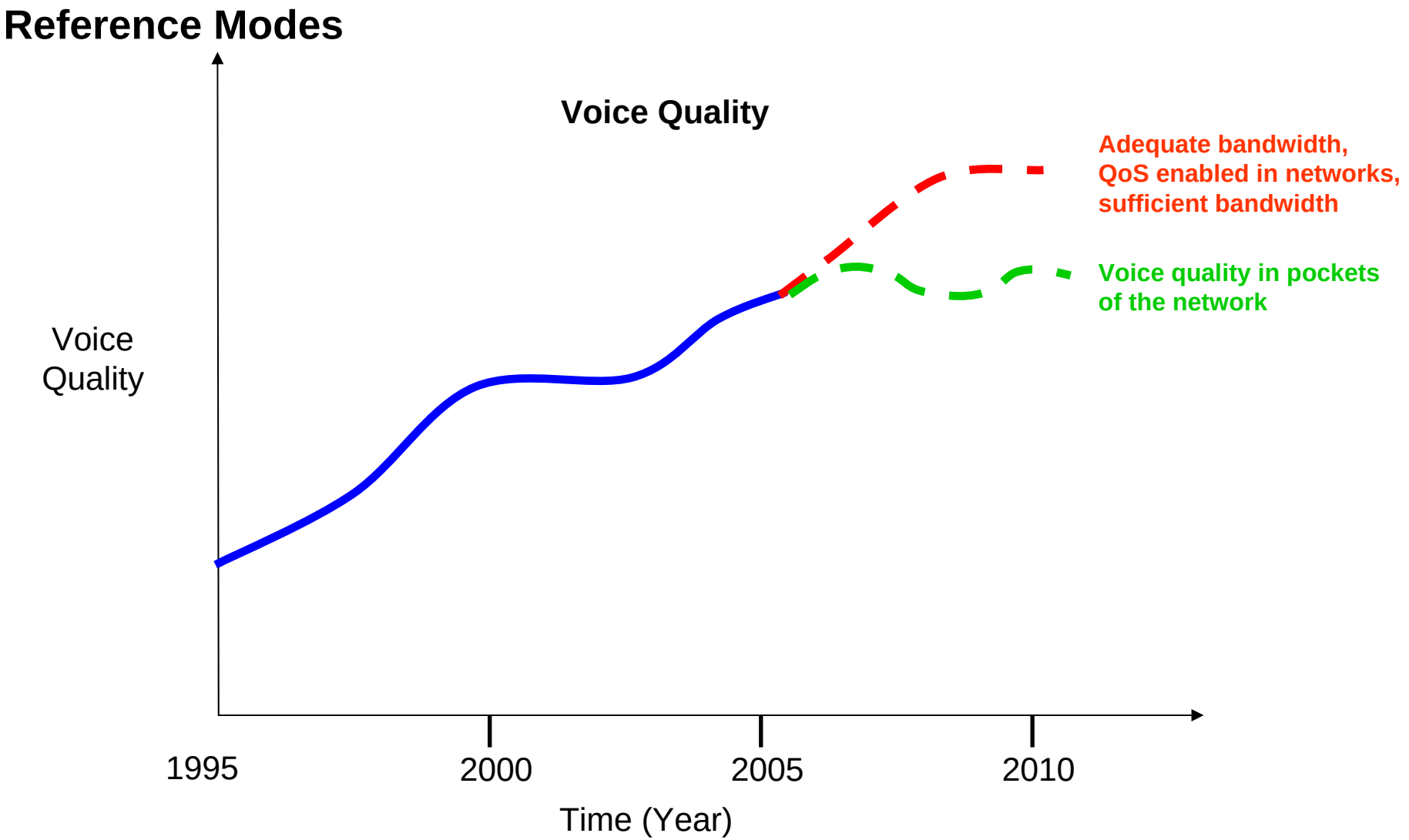
Think about how the variable impacts demand/scarcity keeping everything else in the system constant.

The VoIP Model (in progress)

Important Variables for Modeling Demand

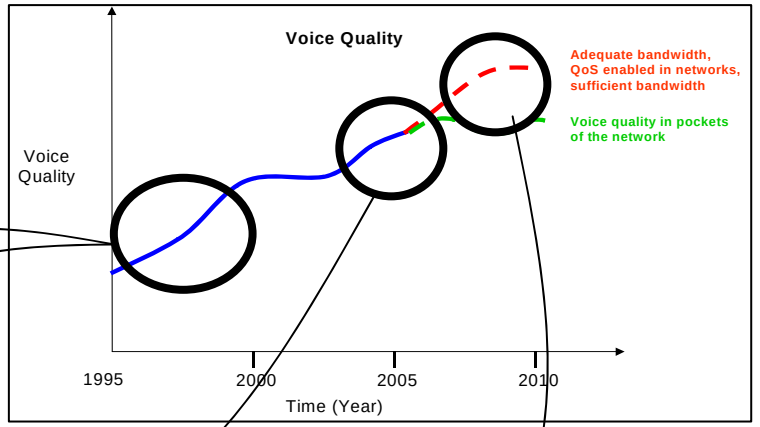
1. Voice quality
2. Price
3. Perceived coolness (as perceived by consumer)
4. New VoIP-enabled features
5. No. of developers
6. Service mobility (across devices)
7. Price bundling

The VoIP Model (in progress)



The VoIP Model (in progress)

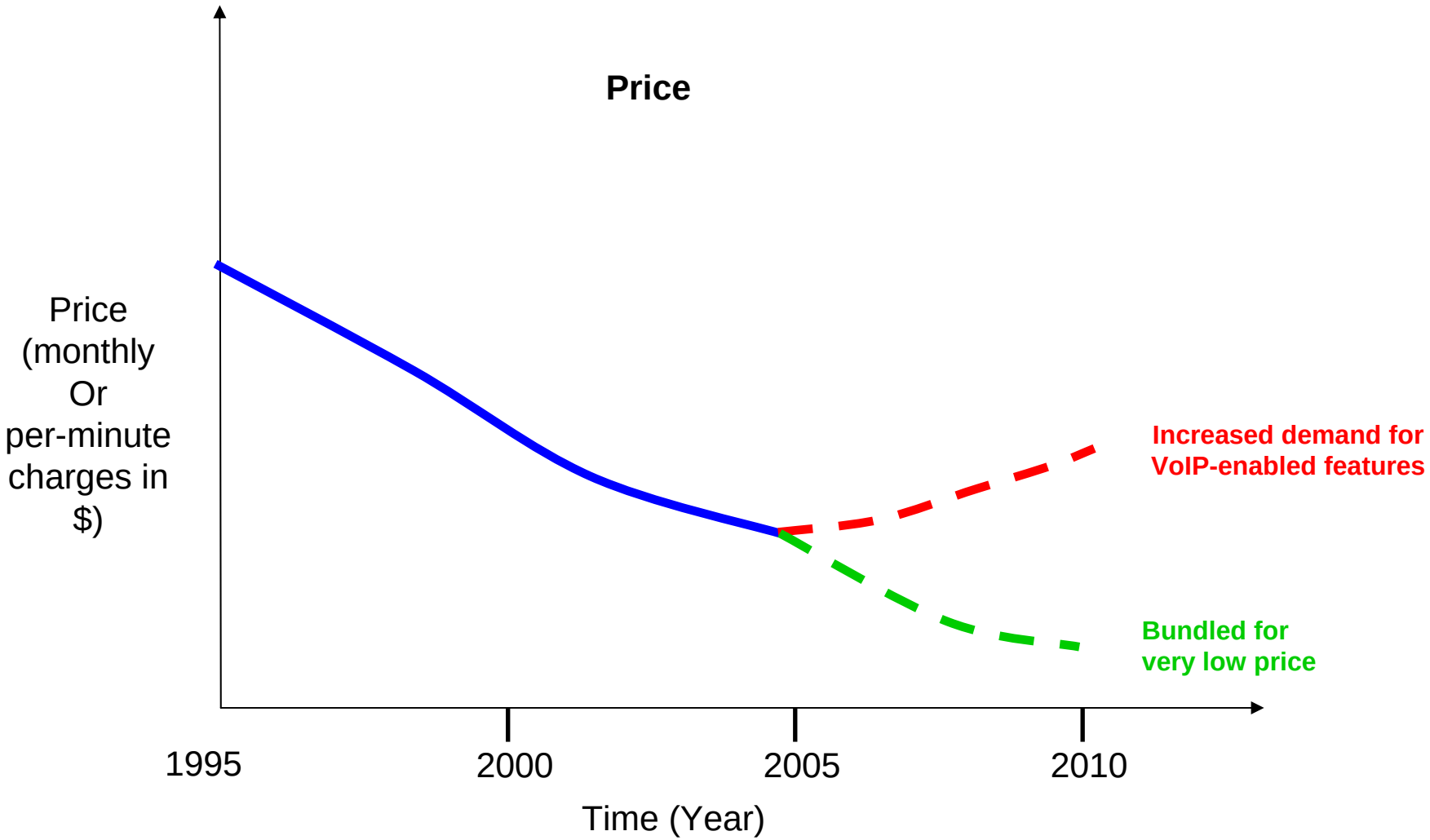
Dynamic Hypotheses and Causal Loops



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

The VoIP Model (in progress)

Reference Modes (Contd.)



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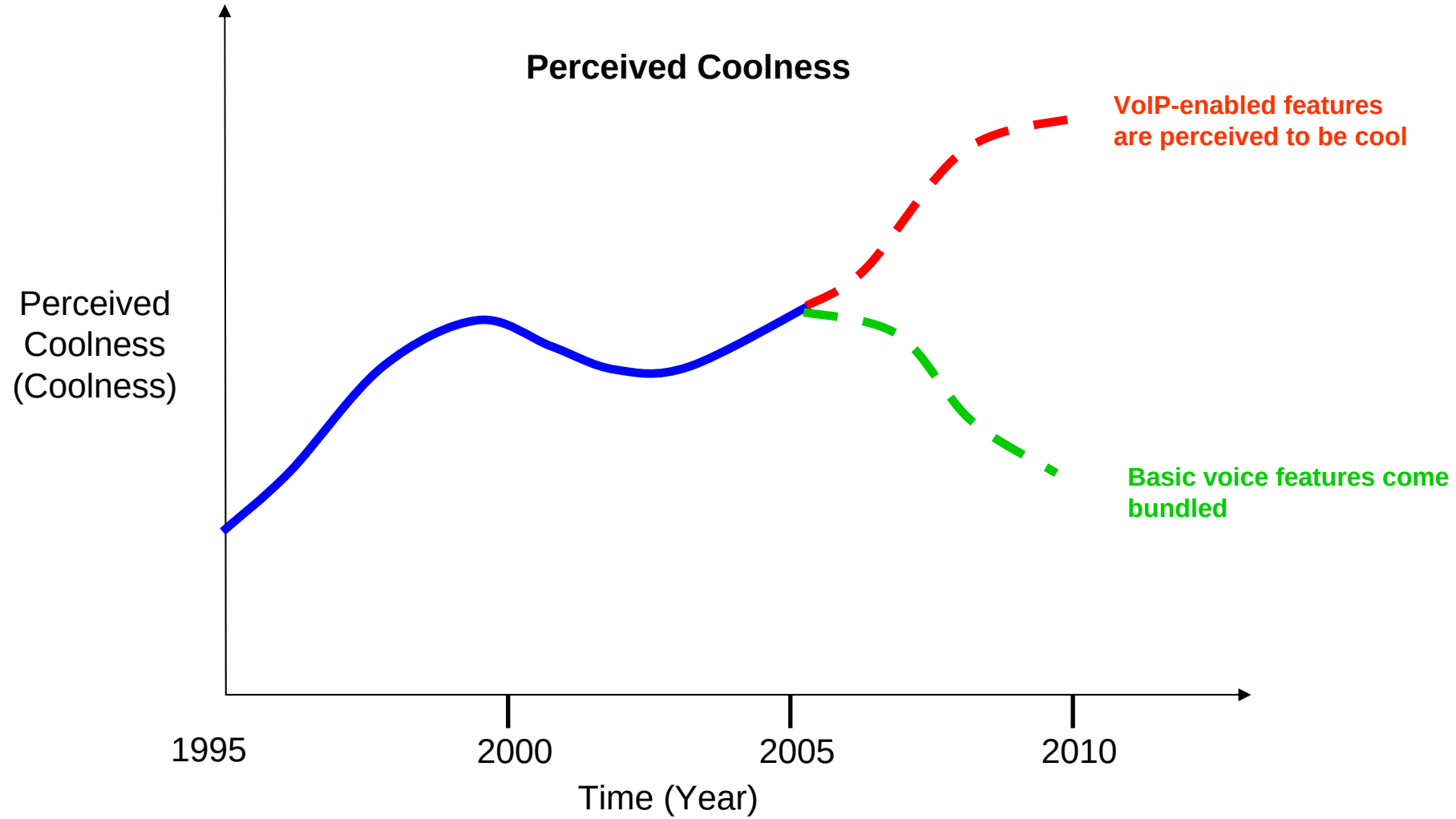

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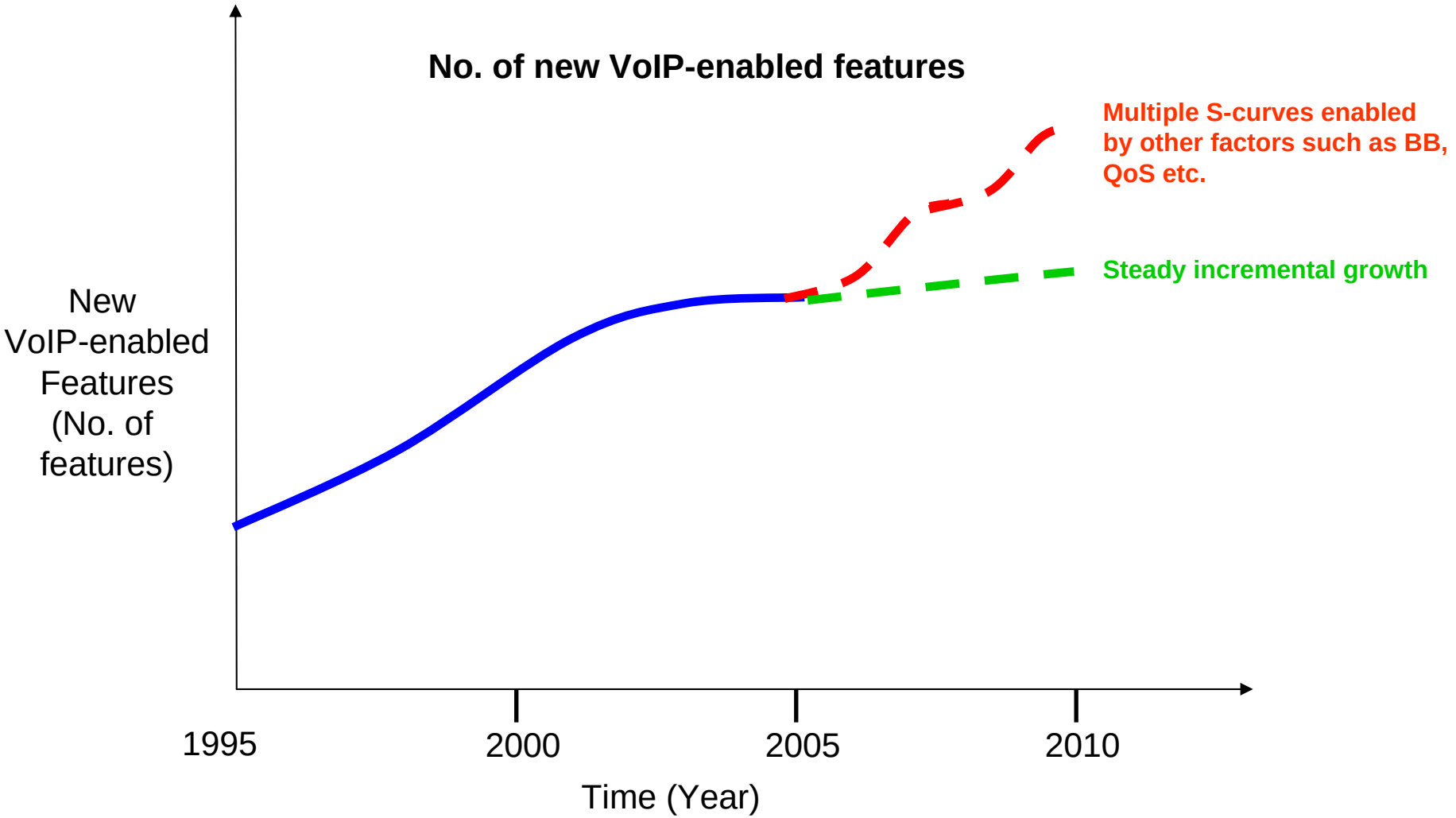

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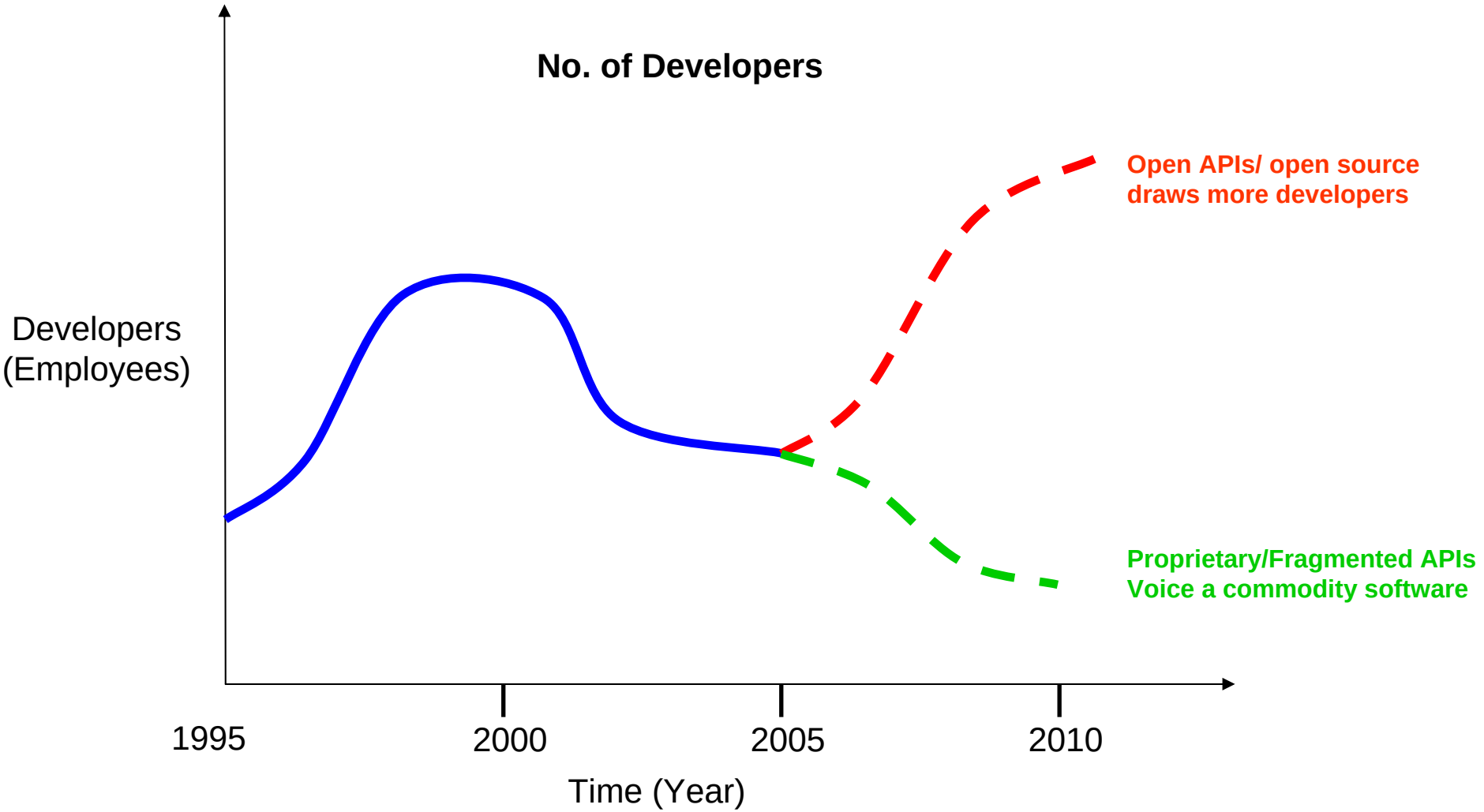

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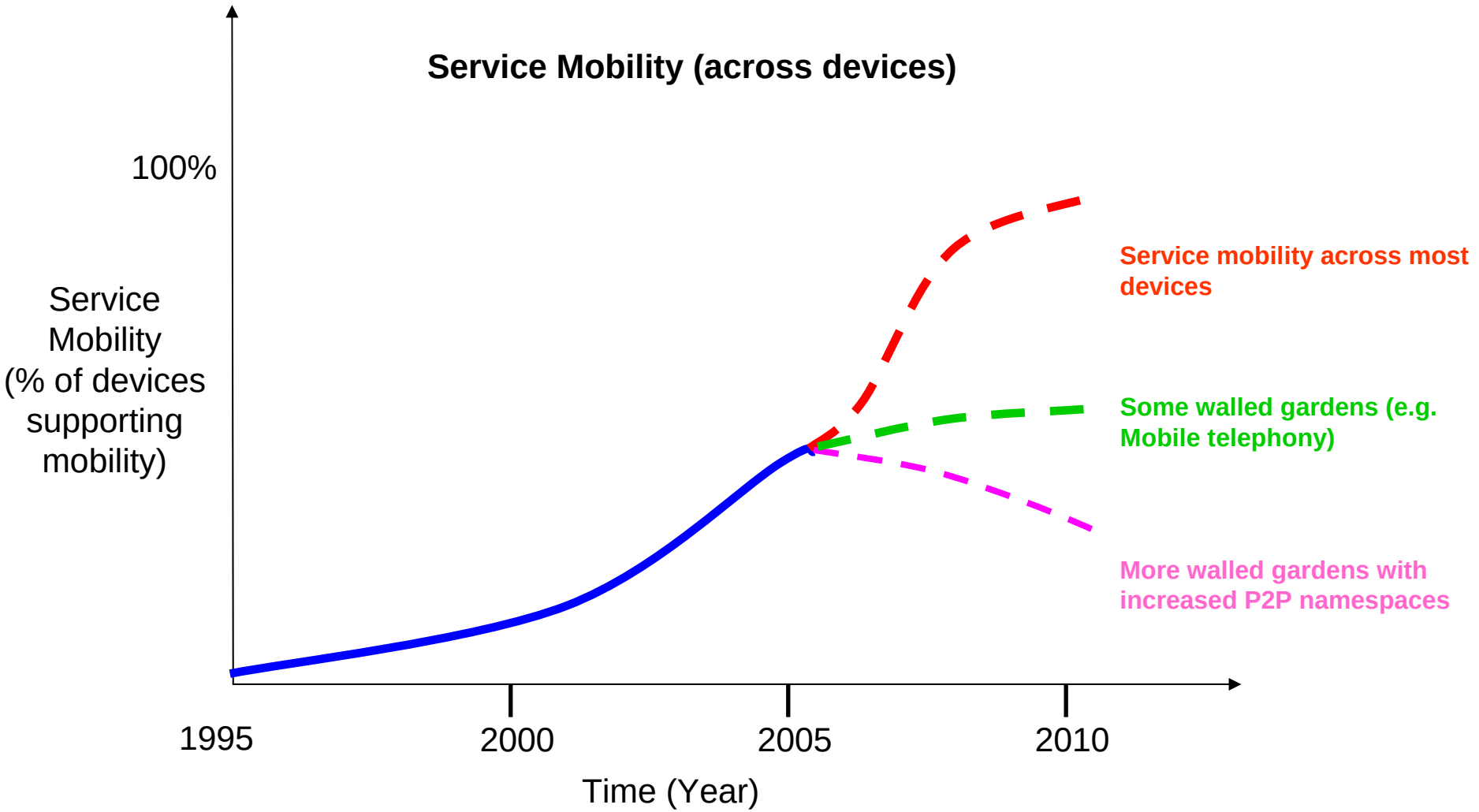

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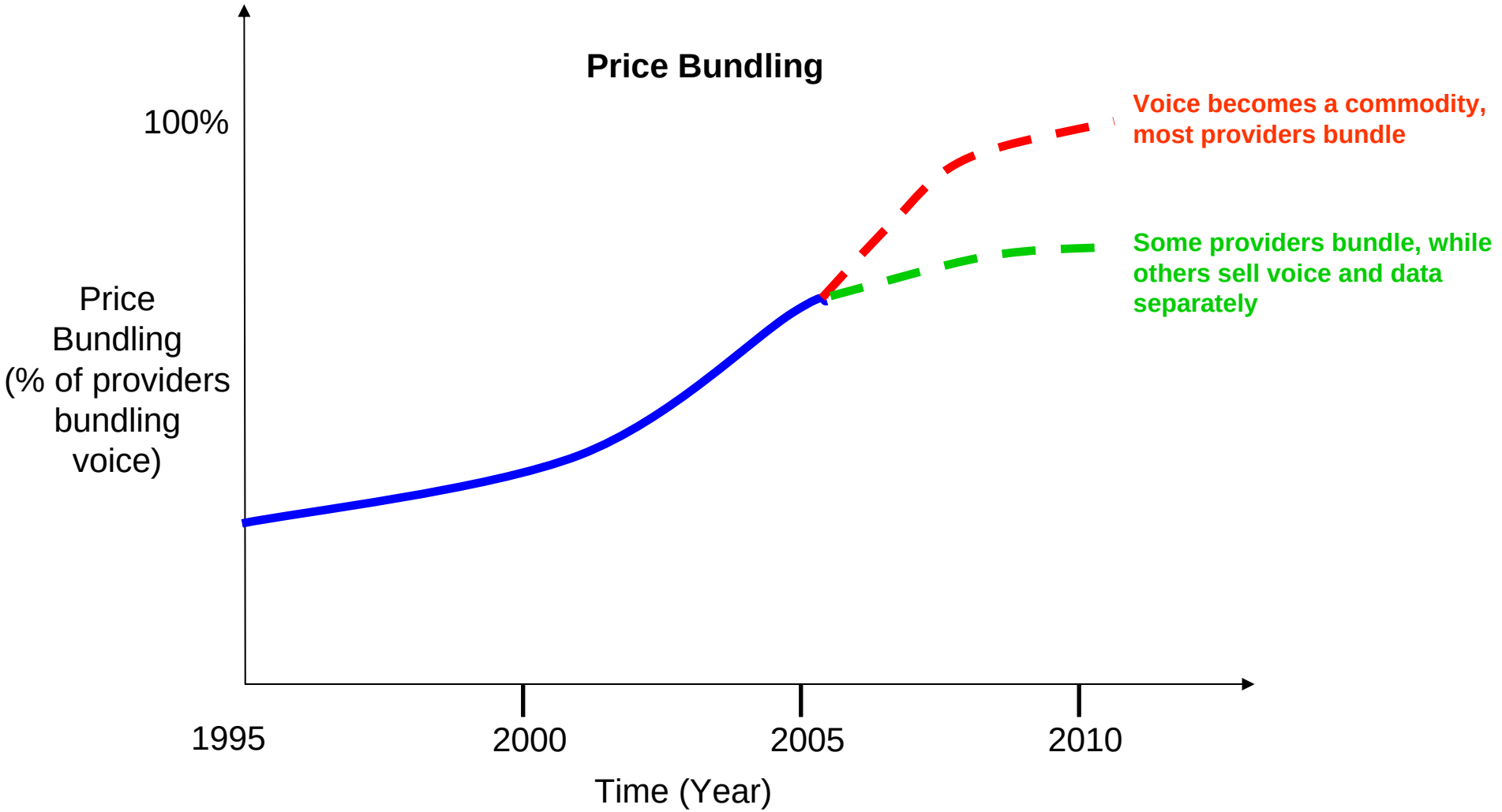

The VoIP Model (in progress)

Next Steps…

1. Complete causal loops for the demand side and aggregate them.
2. Pick important variables for the scarcity side and create a causal loops.
3. Combine causal loops in 1 and 2 with variables that affect both.
4. Build stock and flow model.
5. Calibrate the model.
6. Carry out desired analysis…