
The Future of Optical Communications

Using Systems Dynamics to Assess the
Opto-Electronics Industry

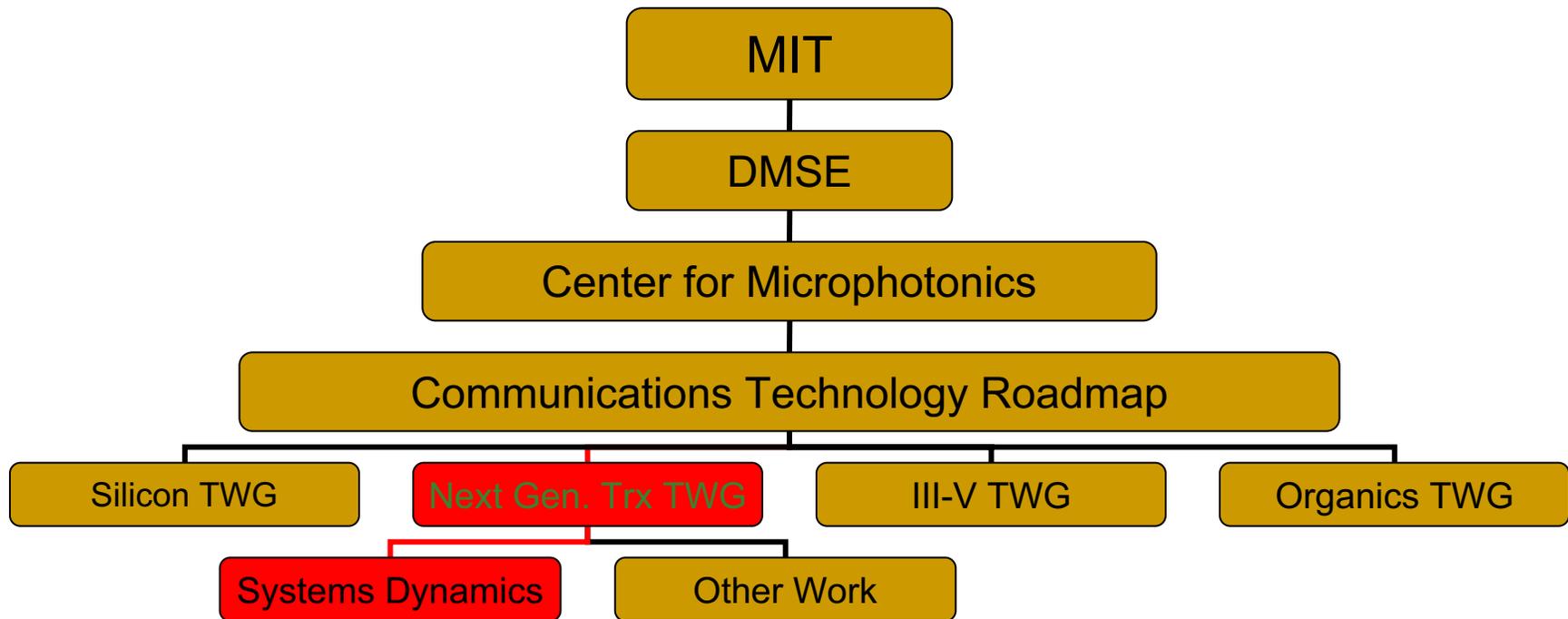
Michael Speerschneider

May 14, 2004

Agenda

- Overview of the Problem
 - Some Results in an Industry Setting
 - Future Directions
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Background

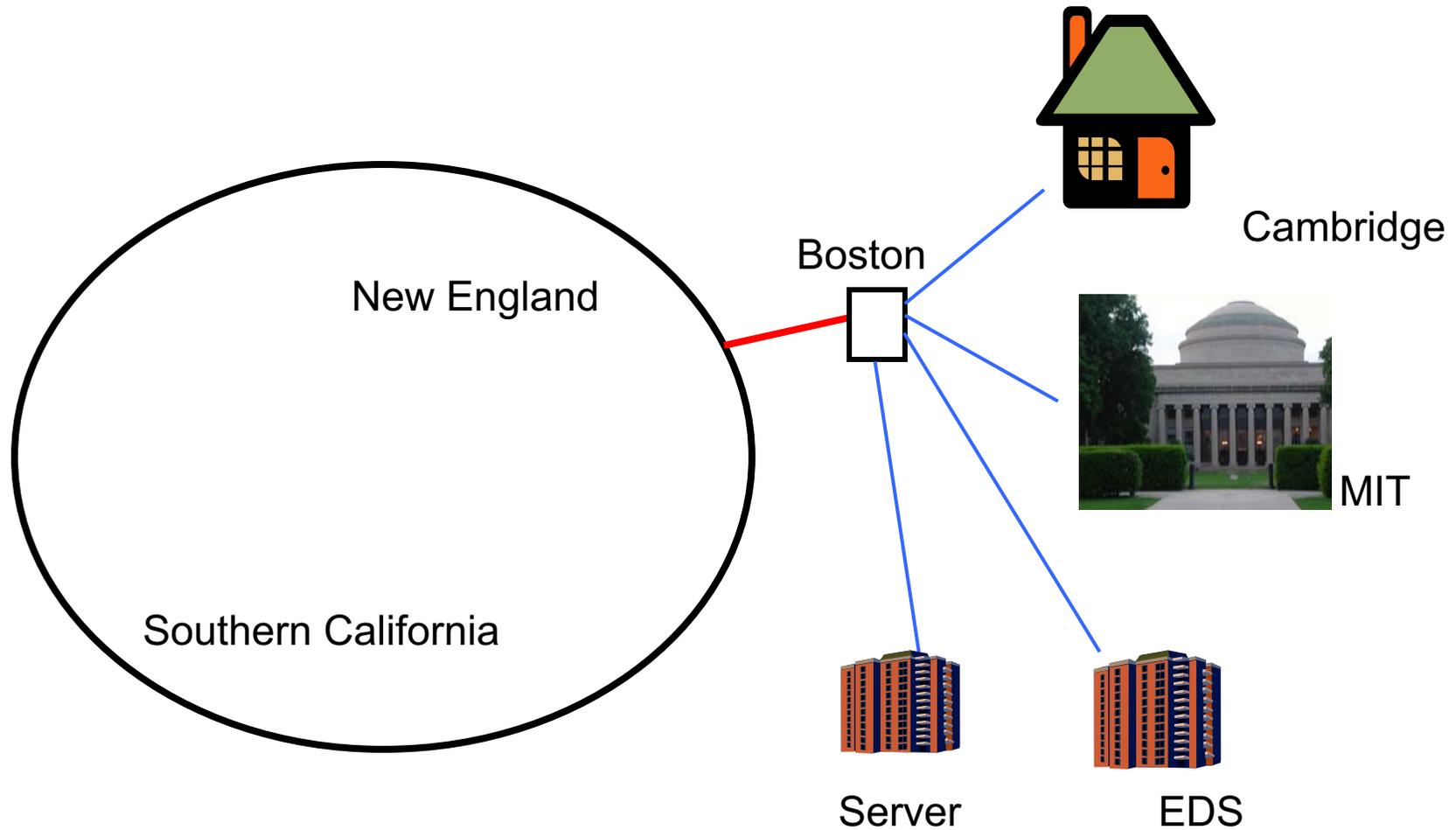


The Problem:

No Network Effect

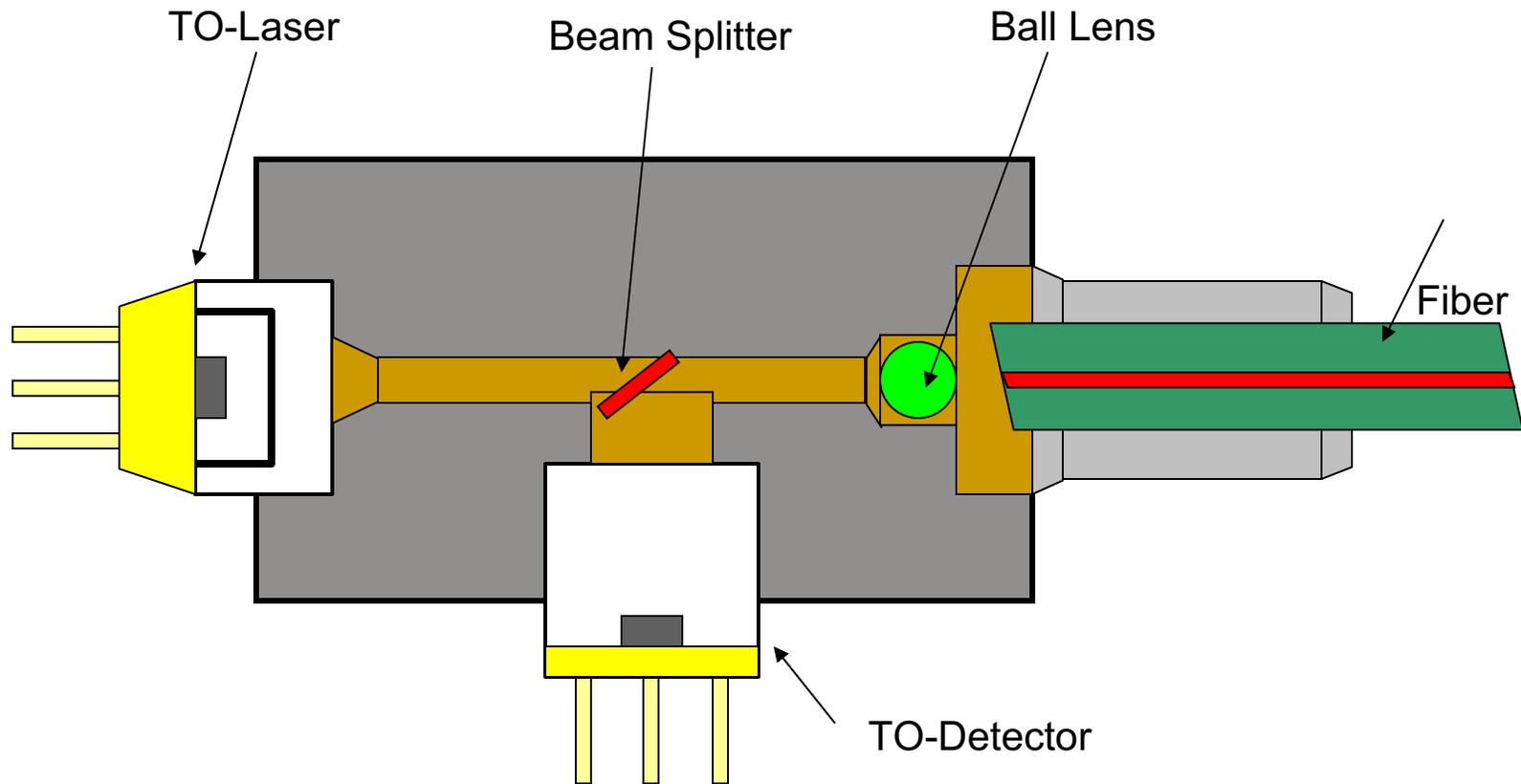
- In the heyday, Supplier had plenty of business, there was little competition
 - After crash, overbuild meant few new builds, and left a varied architecture.
 - That is, no way to consolidate and cut costs.
 - High competition – all fighting for market share
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The Problem: No Network Effect – Opto-Electronic Components



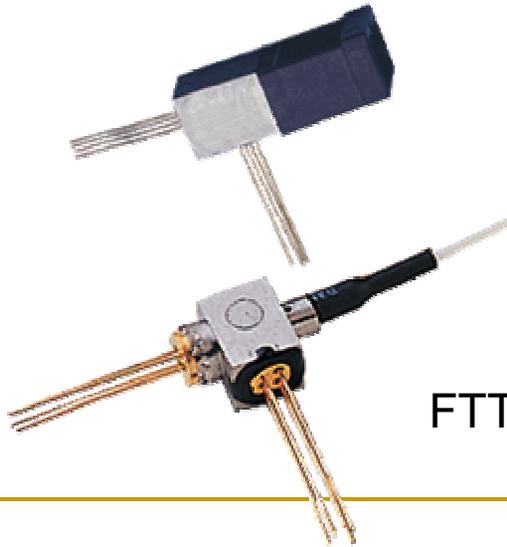
The Problem:

Example of a Transceiver



The Problem:

Example of a Transceiver



FTTH



The Problem:

Proliferation of Transceiver Flavors

3 Application: SAN, LAN, WAN/MAN

5 Bit Rate:
.155 Gb/s, .622 Gb/s, 1 Gb/s, 2.5 Gb/s, 10 Gb/s

3 Wavelength:
850 nm, 1310 nm, 1550 nm

4 Reach: SR, IR-1, IR-2, LR

x 6 Form Factor:
SFF, SFP, GBIC, XFP, MSA, Other

1080

~500

580

Approximate number of logical exclusions

The Problem:

In a Nutshell

- The Opto-electronics industry is looking at standardization to spur growth
- But, need volume
 - Chicken and egg
- Optical has enormous potential

Why Does that Potential Not Materialize???

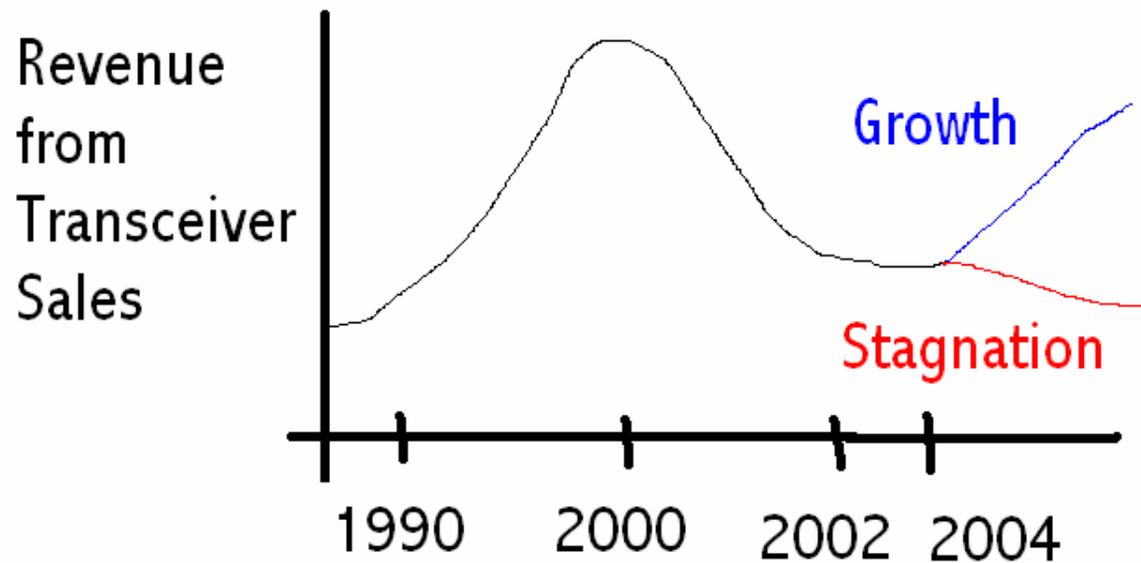
Industry Conference

- What: Photonics and Roadmapping Spring Conference
 - When: May 4, 2004
 - Why: Discussion on the opto-electronics industry and future paths
 - Why do you Care: I donno, maybe it would be interesting to talk about presenting this stuff in the “real world”
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Industry Conference

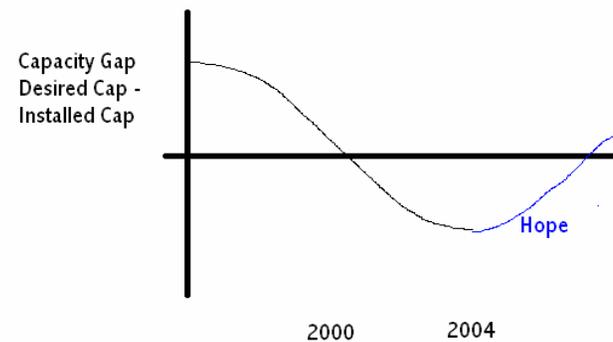
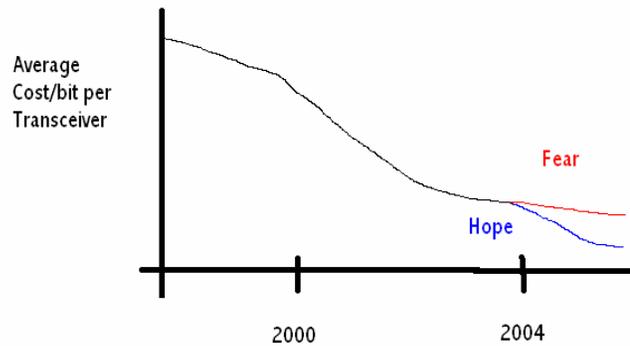
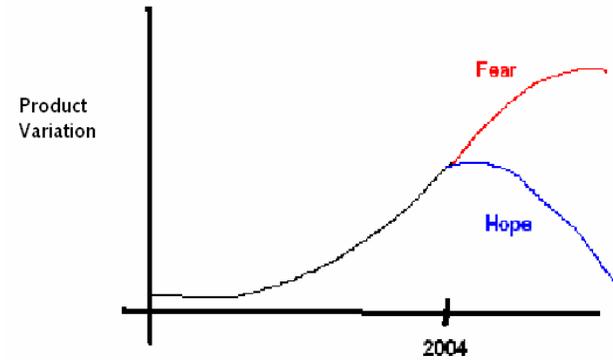
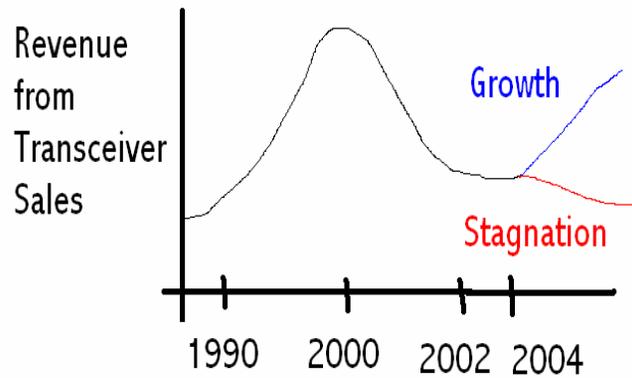
Industry Conference:

Define Problem: Identify Strategies for Growth



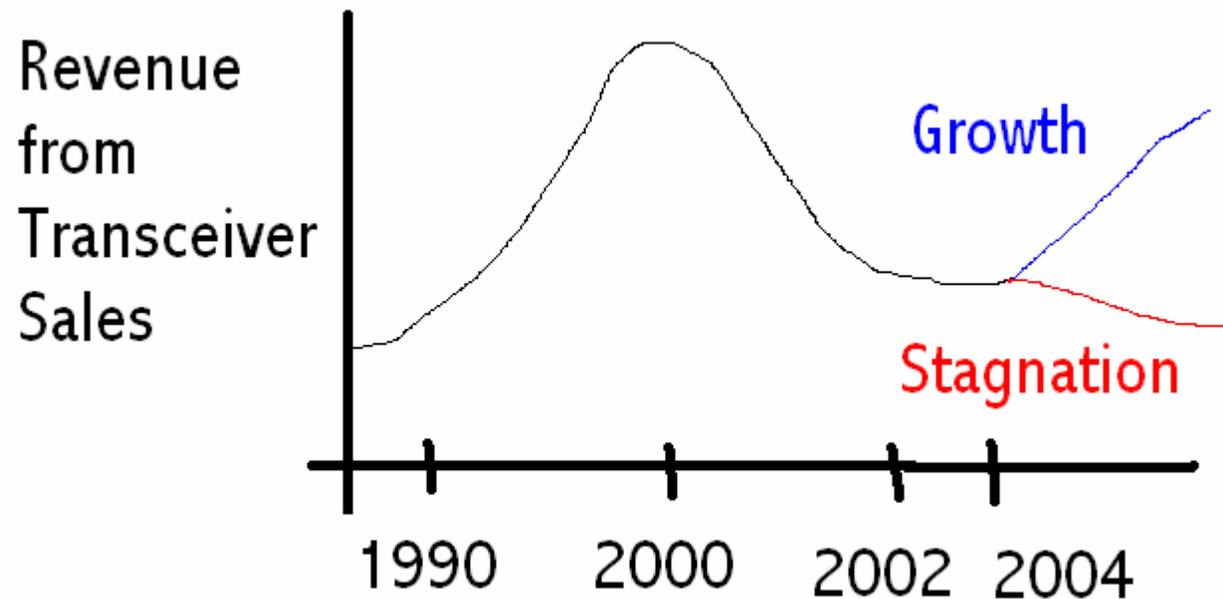
- How might standardization of optical components play a role?
 - Convergence vs Divergence
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Industry Conference: Patterns of Behavior

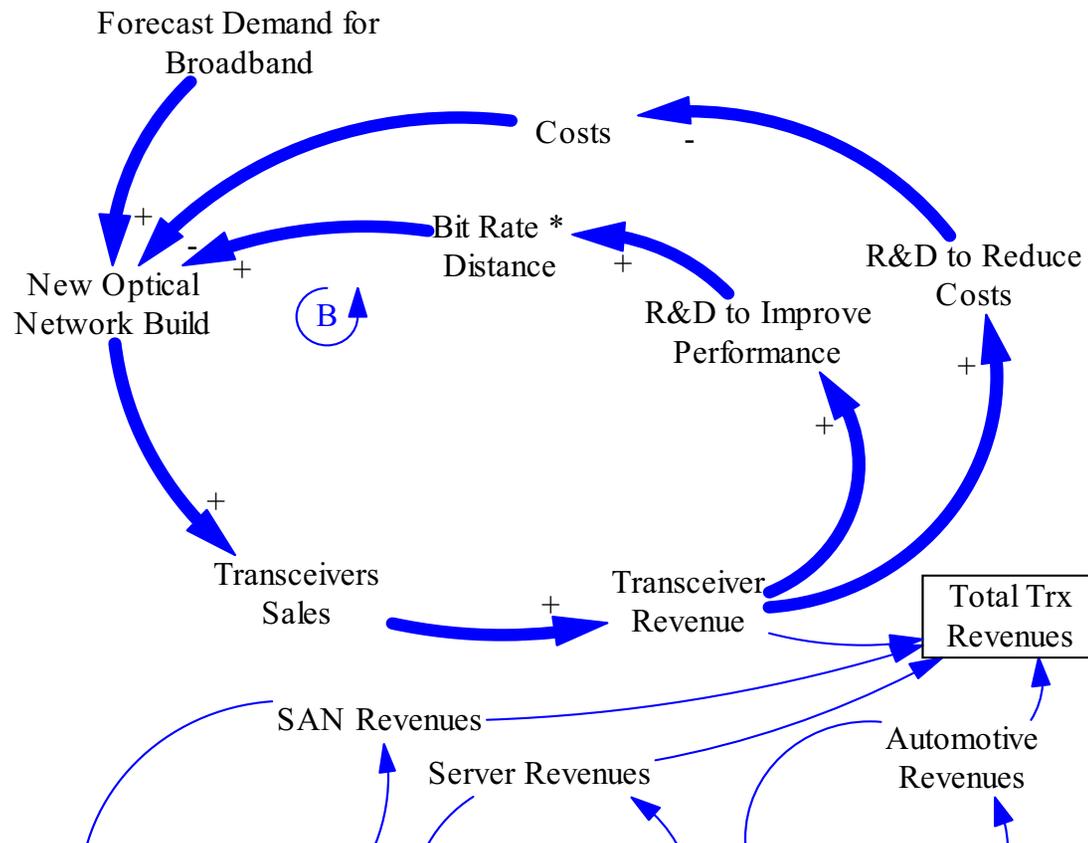


Industry Conference:

The Problem - Revenues From Transceiver Sales



Industry Conference: Revenues From Transceiver Sales



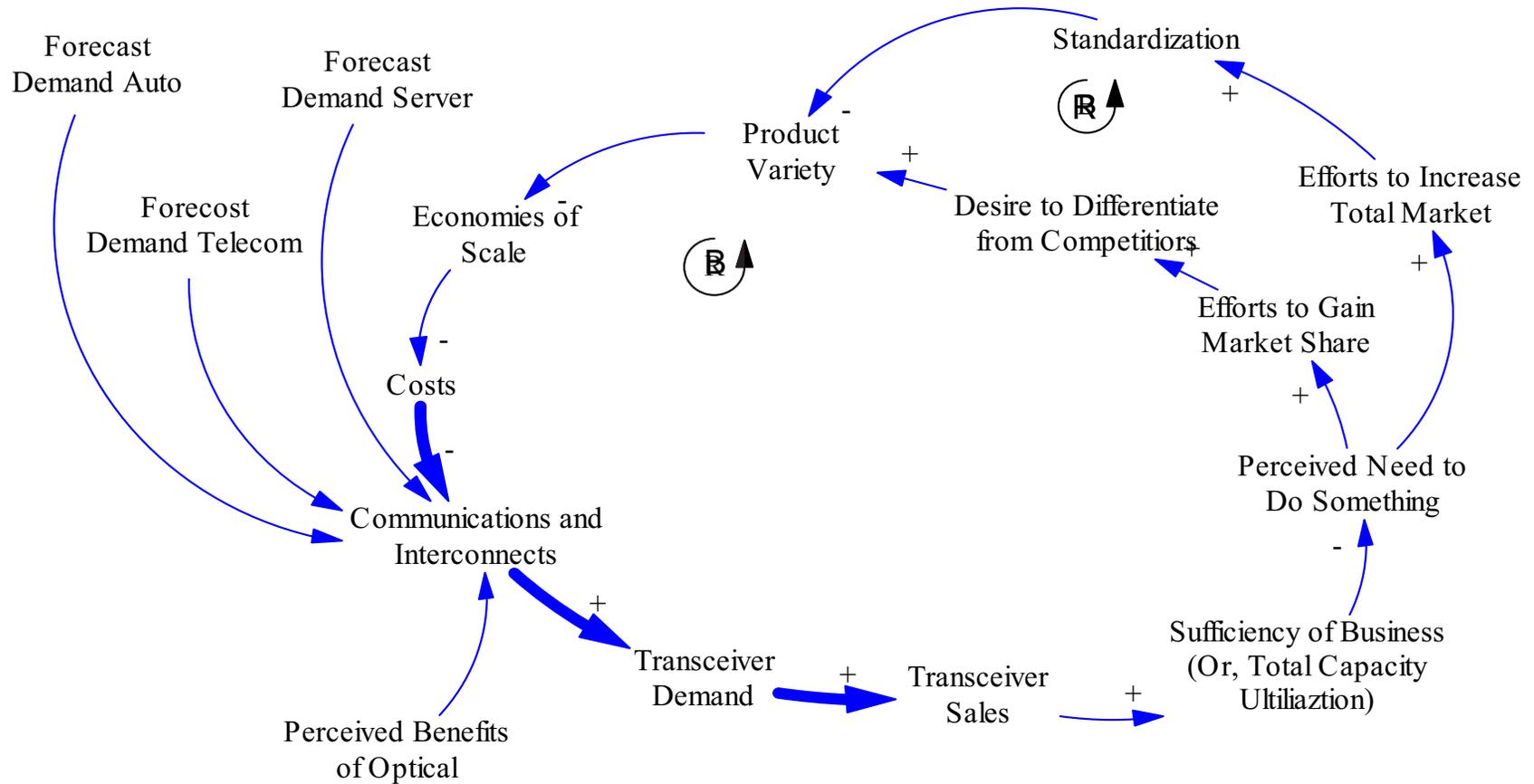
Industry Conference:

Revenues From Transceiver Sales

- Once Trx technology is “good enough” competition and innovation move somewhere else in the value chain.
 - If further BR*D improvement is doesn't matter, there is price competition and cost reduction
 - If Trx/System is small, no effect on new build
 - So, what is the other way to increase revenue?
Demand
-

Industry Conference:

Convergence - Standardization Across Market Segments



Industry Conference:

Convergence - Standardization Across Market Segments

- Insight: Lack of standardization during the boom years created the conditions for current state of the industry.
 - There was a smaller perceived need to do anything, so standardization might have been easier when business was good.
 - $\text{Pie} * \text{Market Share} = \$\$$: at what point does it make sense to expand the total pie versus increase market share
 - Look at standardization as a way to expand the pie and increase \$\$, rather than wait for service providers to come up with the “killer app”
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Industry Conference:

Convergence - Standardization Across Market Segments

- Insight: The drive to divergence is from firms acting in individual interest, not for interest of the industry
 - Desire to gain market share dominates the reinforcing loop in bad times
 - Insight: By focusing on increasing market share through differentiation, the industry can get stuck in negative sales growth loop.
 - Right now, Capacity Utilization is very low, and the effect of pushing standardization depends on the strength of the balancing loop.
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Industry Conference:

Main Points for Consideration – Revenue Loop

- Not much interest here, and to be honest I can't see much in the way of valuable “ah ha's” here either.
 - Maybe something will come out as modeling advances.
 - SD issues: Interestingly, the causal model is easy and simple, but putting that into a model is incredible difficult and abstract.
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Industry Conference:

Main Points for Consideration – Revenue Loop

- Costs points for market convergence?
 - What is convergence? At what level do you standardize? What does that mean for these loops?
 - In considering the increase in effective demand (or the capture of new markets), margins are of critical importance – firms must and will consider margins
 - Costs saving in manufacturing or in development?
 - How many firms? What drives the elimination of firms?
 - OR, what is to stop this industry from involving into a case where there are more sales and more profits, but too many firms, and thus everybody is the same as they were pre-standardization?
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Conclusions

- Cost reduction is not enough
 - Need to think about how to increase total optical demand – develop applications, etc
 - The current industry focus on winning market share assures further industry troubles
 - The transition is the hard part. How can we get from high margins, low volume to low margins, high volume?
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What's Next

- Continue into summer
 - Finish analysis of revenue and convergence loop
 - But, system dynamics is not the bulk of the project
 - Some work toward identifying the key design rules for an standardized transceiver
 - But first, assess the client's thoughts on the usefulness of SD
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Acknowledgements

- Thanks to the “client” group
 - Professor Lionel Kimerling – MIT (DMSE)
 - Elizabeth Bruce – Communications Technology Roadmap
 - Michael Schabel – Lucent Technologies
 - Professor Jim Hines – MIT (Sloan School)
 - Jeroen Struben – MIT (Aramis group leader)
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System Dynamics Modeling Difficulties

- Working by myself
 - Progress is slower, less confidence, different “eyes”
 - No real client
 - Working for an industry seems difficult for the standard method
 - Much of the value is in the process. What if the client, i.e. an industry cannot experience that?
 - In conference, not enough time to draw in – hard to convey value
 - This makes formulating policy difficult
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