
CASE STUDY OF THE COMPETITIVE BEHAVIOR OF COMPANIES IN RESPONSE TO DISRUPTIVE TECHNOLOGIES IN THE DYNAMIC ENVIRONMENT OF CHANGING USER NEEDS

by

Sergey A. Naumov

M.S. Mechanical Engineering (1995)

Submitted to the System Design and Management Program
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Engineering and Management

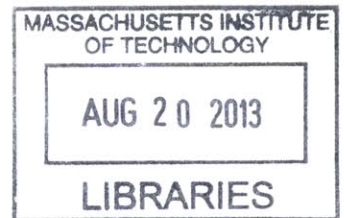
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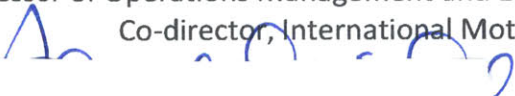
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ABSTRACT

Innovations are part of everyday reality in the business life of many companies. While for startups, success in business largely depends on success of innovations as they are trying to enter the market, for large monopolistic companies the influx of innovations is a crucial part of strategic decision-making. In a fast clockspeed high technology market, innovations are being introduced every day and have to be evaluated to identify potential threat to existing technology and market share of an incumbent. It is extremely difficult to understand if this new technology is something relevant to the market and will be adopted fast by customers, or it is merely one of many attempts, that will prove unsuccessful.

Overarching questions for this work is “Why does the same technology become dominant in some cases while failing in others?”

This work focuses on considering several real life examples with different outcomes through the lens of the Incumbent’s Dilemma framework. The goal is to identify patterns of dynamics for several typical innovation scenarios and provide explanations that might be useful for product managers as well as top management of any company who want to understand how to use innovations to improve business performance and gain market share.

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Cambridge, MA, USA

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INTRODUCTION

Why do some new technologies become dominant while others fail or coexist with the old? Numerous studies of technological innovations and organizational behavior have been asking questions how and why incumbent corporations lose market share when new entrants attack with “disruptive” innovations. While these studies certainly provide rich perspective on disruptive innovations, there is no comprehensive framework exploring all the possible outcomes. In some instances, large companies fail to adopt new technologies and lose market share. However, this is not a definitive outcome. For any given clash, there are three distinct outcomes possible: new entrant wins and incumbent loses its market, new entrant loses and incumbent retains the market, or both new entrant and incumbent share the market. The outcomes are agnostic to the type of environment (be it high tech or not) and can occur in virtually every market as the underlying dynamics of drivers are the same. It is the combination of firms’ ability to understand their product, company and market requirements (i.e. user needs) and to make right strategic decisions, that defines which outcome becomes more likely and why. In this work, we will identify specific patterns of dynamics and show why fast adoption of new technology in some cases squeezes out the incumbents, while in other cases where the initial conditions seem similar, new technology fails to gain sufficient traction, and incumbent retains its market position (or at least shares it with a new entrant).

PRIMARY RESEARCH OBJECTIVES

Dr. Chintan Vaishnav and Prof. Charles H. Fine from the Value Chain Dynamics Working Group of the Communications Futures Program at MIT have developed a System Dynamics model (Vaishnav, 2010) to understand how incumbents and entrants compete on:

- product level features such as price, quality, and innovations, and switching costs
- firm level features such as resources to innovation vs. resources to quality
- environment features such as sensitivity to innovation and quality and network externalities.

The model considers the environment (or the market) as the battlefield where users constantly filter different products and services and choose among them using set of preferences or sensitivities to certain product features. Products have several dimensions or features that appeal to customers: quality, or the reflection of maturity of the learning curve of the technology, innovation, or the new level of performance that has not been offered before, price, and network externality, or the reinforcement of product or service utility due to the installed base of same or complementary products. The firms are characterized by available resources, strategic decisions of when and how to allocate these resources and the level of modularity or how much of the product or service is produced in cooperation with partners or what part of the value chain is captured by the company. In addition, the companies' structure is constantly (albeit sometimes quite slow) changing between integral and modular as described by C. Fine in "Clockspeed" (Fine, 1999). By performing sensitivity analysis of the model and calibrating it appropriately, Vaishnav and Fine have theoretically explained how various outcomes arise in the face of an attacking innovation.

However, the ultimate purpose of such a model, which is to help the companies select appropriate strategy to compete better, requires better correlation of the theoretical data with the empirical findings from the existing and new industry cases. The result of any entrant-incumbent clash is defined not only by engineering features of a product (such as quality and technological innovation), but also (and may be largely) by the dynamic response of the management adjusting the resources and priorities of the organization. We suggest that the environment or user preferences serve as a main filtering mechanism that assigns lesser or greater leverage to these factors, thus defining the outcome. This study will attempt to identify the patterns of such filtering for several typical scenarios and provide practical insights that might be useful for product managers as well as top management of a company.

Chapter 1. THEORETICAL BASE AND SYSTEM DYNAMICS MODEL

In this chapter, a previous theoretical work discussing adoption challenges and opportunities of new technologies is reviewed first. Then, we consider potential outcomes of clashes between new entrant introducing disruptive technology and incumbent perfecting existing technology, and define the scope of our framework. Next, we introduce the Incumbent's Dilemma framework and discuss theoretical predictions using the System Dynamics model based on it.

HISTORICAL RETROSPECT

The literature on innovations is extensive, and offers rich material, where seminal works complement and challenge each other over the course of last decades. Dosi compared the natures of technologies and science and considered technological paradigms similar to scientific paradigms. He differentiated between continuous changes and discontinuities in technological innovations and offered a framework to understand the process of selection of new technological paradigm. He also studied cumulativeness of technical advances as well as uncertainty associated with technological shifts, and how the innovative process is shaped by economic and institutional factors (Dosi, 1982). Teece considered boundaries of the firms and the ownership of complementary assets as being crucial in capturing value from innovations. He argued that in some cases innovating firms have to establish a prior position in manufacturing and related capacities to be successful, and considered necessary trade and economic policy implications (Teece, 1986). Tushman and Anderson talked about differentiation between incremental changes and technological discontinuities that might increase environmental uncertainty. They expanded the concept of innovation by introducing

competence-destroying and competence-enhancing discontinuities that are initiated by new or existing firms accordingly, and affect the industrial order (Tushman & Anderson, 1986). Henderson and Clark challenged the traditional categorization of innovations as either incremental or radical, and introduced the idea of architectural innovation that destroys the usefulness of existing knowledge of established firms and offers new firms opportunity to gain significant advantage over incumbents (Henderson & Clark, 1990). The concept of disruptive technology was first introduced by Bower and Christensen in 1995 (Bower & Christensen, 1995) and further explored by Christensen in (Christensen, 1997), who described how large companies typically ignore new technologies, as they often sacrifice traditional performance, and thus are perceived as unattractive for mainstream customers. However, in time new entrants become proficient in producing quality products alongside with new dimension of performance (innovation) and eventually displace incumbents. Sood and Tellis used the data from four different markets to challenge traditional S-shaped technology diffusion curve and suggest that technological evolution follows a step function, where periods of sharp improvements in performance are followed by long periods of no improvements. They showed that new technologies might enter above or below the existing technologies and their paths rarely cross just once. They also argued that new technologies come as much from new entrant as from large incumbents (Sood & Tellis, 2005). These and other works (see Bibliography for full list of references) have covered substantial part of the innovations landscape, however, no comprehensive framework exploring all the possible factors and outcomes of innovative clashes between incumbent and entrant has been thoroughly considered and theoretically studied. This work attempts to fill the gap using empirical data and the Incumbent's Dilemma framework.

POTENTIAL OUTCOMES WHEN NEW TECHNOLOGY ENTERS THE MARKET

When considering buzzword “disruption,” one must clearly understand what constitutes disruption, and what the two different dimensions along which a disruption occurs are. Most of the time, people understand disruption as the outcome when old company and old technology is pushed out by a new company with new technology. However, this is only one possible scenario where no differentiation between industrial disruption and technological disruption is made.

All cases of disruption can be categorized using three main outcomes (disruption, co-existence, and no disruption) along two main dimensions – industrial order (or the players on the market) and technology:

New technology loses (New entrant abandons it)

- New entrant quits the market, Incumbent retains market share
- New entrant adopts old technology, Coexistence of companies who share the same market
- New entrant adopts old technology and wins, Incumbent loses market share

Coexistence of technologies

- New entrant uses new technology, Incumbent uses old technology
- Incumbent uses new technology, new entrant uses old technology (hardly possible)

New technology wins (Incumbent abandons old technology)

- Incumbent quits the market, New entrant wins market share
- Incumbent adopts new technology, Coexistence of companies who share the same market
- Incumbent adopts new technology and wins, New entrant loses market share

All possible combinations of cases populated along these two dimensions – industrial and technological disruption – are shown in Table 1-1.

		TECHNOLOGY		
		Disruption New technology wins (Incumbent abandons old technology) (TD)	Coexistence Both technologies exist on the market (TC)	No Disruption New technology loses (New entrant abandons it) (TN)
INDUSTRY	Disruption Incumbent leaves the market (ID)	<i>Incumbent</i> quits the market, <i>New entrant</i> wins market share	N/A	<i>New entrant</i> adopts old technology and wins, <i>Incumbent</i> loses market share
	Coexistence Both New entrant and Incumbent are on the market (IC)	<i>Incumbent</i> adopts new technology, Coexistence of companies, share the same market	1) <i>New entrant</i> uses new technology, <i>Incumbent</i> uses old technology 2) <i>Incumbent</i> uses new technology, <i>New entrant</i> uses old technology	<i>New entrant</i> adopts old technology, Coexistence of companies, share the same market
	No Disruption New entrant cannot enter the market (IN)	<i>Incumbent</i> adopts new technology and wins, <i>New entrant</i> loses market share	N/A	<i>New entrant</i> quits the market, <i>Incumbent</i> retains market share

Table 1-1. Matrix of possible disruption scenarios

It is clear from the table that there are seven distinct outcomes possible. Two scenarios, TCID and TCIN, are infeasible, as coexistence requires two companies (and two technologies), but both ID and IN rows assume that one of the company leaves the market and it is hardly possible that the remaining player starts using both technologies at the same time. Of the seven

scenarios that are left, TNID seems to be controversial, as it assumes that new company quickly realizes immaturity of its new technology, abandons it, and adopts old technology. Moreover, new entrant does it so well, that it perfects and uses old technology better than existing companies do, which leads to the expelling of the existing companies from the market. However unrealistic this might seem, in real life this is quite possible scenario, specifically keeping in mind that new company might have a different complementary assets to the old technology effectively improving value proposition of old technology to customers. Scenario TNIC is much more likely, as here two companies coexist on the market. Very interesting ongoing true real life example pertaining to these two scenarios is the new company Numecent¹ that is offering a technology called now “cloudpaging,” which is the optimized for mobile application version of old client-server technology. The outcome of adoption of this technology is hard to predict so far, but this would be very interesting case to analyze in the future research.

Scenarios TDIC and TDIN are more typical as they support the notion of the ultimate superiority of a new technology and it is just the question of strategic action of the companies that define whether there will be coexistence of companies or new entrant will quit the market.

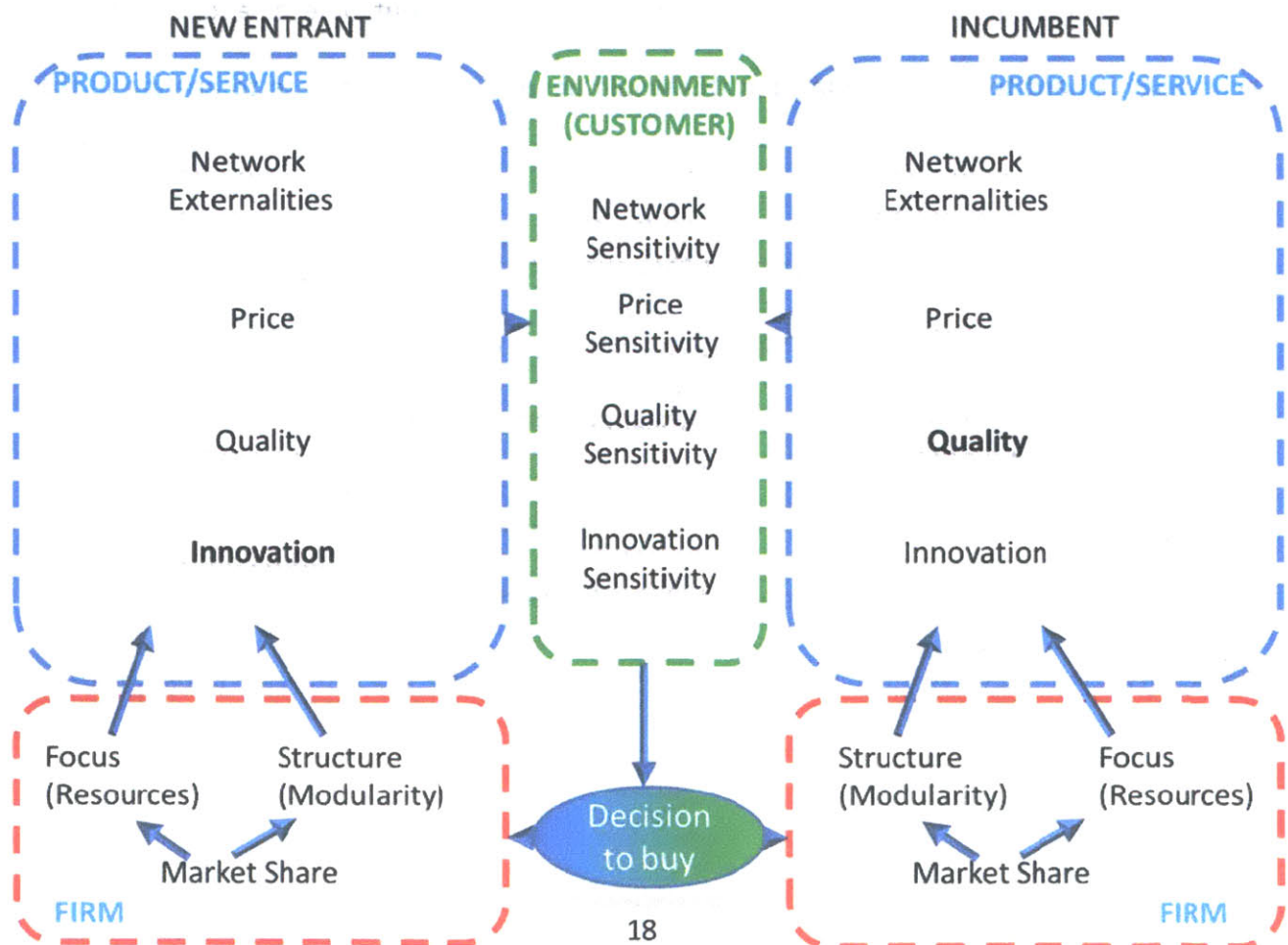
The diagonal of the matrix, scenarios TDID, TCIC, TNIN are classical ones and this is what the literature on innovation and disruption has been focused on. For the purposes of our case studies, we tried to select the cases that fit the diagonal to keep the consistency with classical

¹ <http://numecent.com>

interpretation of disruption. It is worth mentioning though, that other four scenarios are equally important in current fast clock speed technology, as companies are looking for any possibility to attract customers who eventually transform their loyalty into the market dominance of well-informed player.

INCUMBENT'S DILEMMA FRAMEWORK

Having defined all the possible outcomes of a clash between new and existing technology, we are now ready to go one step further and talk about how we can predict the outcome and what are the most influential factors and dynamics affecting it. The Incumbent's Dilemma framework consists of two players, incumbent and new entrant, competing for the same customers by



offering different features of a product/service. Typically, new entrant has more emphasis on Innovation (or new dimensions of performance), while incumbent improves Quality (perfects existing dimensions of performance, or features).

The variables of the framework are split in two main parts. Current positions describe static factors, reflecting the actual positions of the players. Dynamic behavior is the reflection of players' strategic decisions.

NEW ENTRANT		ENVIRONMENTAL FACTORS	INCUMBENT	
Firm-level Factors	Product-level Factors		Product-level Factors	Firm-level Factors
CURRENT POSITIONS				
Fixed Costs	Price	Price Sensitivity (SoA to Price)	Price	Fixed Costs
1	6	11	17	22
Marginal Costs	Quality	Quality Sensitivity (SoA to Quality)	Quality	Marginal Costs
2	7	12	18	23
Resources to Quality	Innovation	Innovation Sensitivity (SoA to Innovation)	Innovation	Resources to Quality
3	8	13	19	24
Resources to Innovation	Network Effect	SoA to Installed Base	Network Effect	Resources to Innovation
4	9	14	20	25
Modularity	Switching Costs	Contact Rate	Switching Costs	Modularity
5	10	15	21	26
		Word of Mouth		
		16		
DYNAMIC BEHAVIOR (RESPONSE to COMPETITION)				
Time to Develop Quality / Complementary Assets			Time to Develop Quality / Complementary Assets	
27			32 N/A	
Time to Innovate			Time to Innovate	
28 N/A			33	
Resource Reorientation Time			Resource Reorientation Time	
29			34	
Rate of Modularization/Contracting			Rate of Modularization/Contracting	
30			35	
Rate of Integration/Mergers			Rate of Integration/Mergers	
31			36	

Table 1-3. Incumbent's dilemma framework variables

CURRENT POSITIONS

NEW ENTRANT F-level factors

- 1) *Fixed Costs*: Costs of setting up the manufacturing of the product regardless of the number of units produced. The business expenses, which are not dependent on the level of goods or services produced by the business.
- 2) *Marginal Costs*: Costs of manufacturing of every additional unit of the product. The change in total cost that arises when the quantity produced changes by one unit.
- 3) *Resources to Quality*: Available resources to create quality product (current manufacturing base, supply chain, employees).
- 4) *Resources to Innovation*: Available resources to create an innovative product and maintain innovation level (R&D, Patents).
- 5) *Modularity*: Degree of modularity of the product architecture and its ownership.

NEW ENTRANT P-level factors

- 6) *Price*: Price of the product on the market.
- 7) *Quality*: Quality of the product. Ability of the product/service to perform or deliver primary functions.
- 8) *Innovation*: Level of innovation offered by the product. Ability of the product/service to perform or deliver ancillary functions.
- 9) *Network Effect*: Cumulative product potential to create direct or indirect network effect (utility function based). Direct network effect is the degree, at which the utility of the product depends on the similar products installed and working. Indirect

network effect is the degree at which the utility of the product can be created due to complementary products installed and working.

- 10) *Switching Costs*: How costly it is to walk away from new product. May be due to unique features of the product as well as due to contractual obligations.

ENVIRONMENTAL FACTORS (Market analysis)

- 11) *Price Sensitivity (SoA to Price)*: How important for the users is the price level of the product.
- 12) *Quality Sensitivity (SoA to Quality)*: How important for the users is the quality of the product.
- 13) *Innovation Sensitivity (SoA to Innovation)*: How important for the users is the level of innovation, offered by the product. In other words, how much do users want the innovation?
- 14) *SoA to Installed Base*: Degree, at which customers care about the network effect (will they want to use its benefits?).
- 15) *Contact Rate*: How frequently users interact with each other.
- 16) *Word of Mouth*: Degree of influence of other users' opinions on buyers' decision.

INCUMBENT P-level factors

- 17) *Price*: Price of the product on the market.
- 18) *Quality*: Quality of the product.
- 19) *Innovation*: Level of innovation offered by the product.

- 20) *Network Effect*: Cumulative product potential to create direct or indirect network effect (utility function based). Direct network effect is the degree, at which the utility of the product depends on the similar products installed and working. Indirect network effect is the degree at which the utility of the product can be created due to complementary products installed and working.
- 21) *Switching Costs*: How costly it is to walk away from current product. May be due to unique features of the product as well as due to contractual obligations.

INCUMBENT F-level factors

- 22) *Fixed Costs*: Costs of setting up the manufacturing of the product regardless of the number of units produced.
- 23) *Marginal Costs*: Costs of manufacturing of every additional unit of the product.
- 24) *Resources to Quality*: Available resources to create quality product (current manufacturing base, supply chain, employees).
- 25) *Resources to Innovation*: Available resources to create innovative product (R&D, Patents).
- 26) *Modularity*: Degree of modularity of the product architecture and its ownership.

DYNAMIC BEHAVIOR (RESPONSE to COMPETITION)

NEW ENTRANT

- 27) *Time to Develop Quality/Complementary Assets*: Time required by new entrants to develop the quality, currently offered by incumbents.

- 28) *Time to Innovate*: Not applicable to new entrants in the beginning, as it is the time required by incumbent to develop innovation that new entrant offers from the beginning. When new entrant matures and becomes incumbent, this factor becomes relevant.
- 29) *Resource Reorientation Time*: Time required to re-allocate firm's resources from focusing on pure innovation to delivering high quality.
- 30) *Rate of Modularization/Contracting*: Rate of increase in reliance on outsourcing.
- 31) *Rate of Integration/Mergers*: Rate of increase in reliance on own resources.

INCUMBENT

- 32) *Time to Develop Quality/Complementary Assets*: Not applicable to incumbents in the beginning, as this the time required by new entrants to develop the quality, currently offered by incumbents. When incumbent creates a new technology and effectively becomes a new entrant, this factor becomes relevant.
- 33) *Time to Innovate*: Time required by incumbent to develop the innovation that new entrant offers from the beginning.
- 34) *Resource Reorientation Time*: Time required to re-allocate firm's resources from focusing on quality with old product to innovation.
- 35) *Rate of Modularization/Contracting*: Rate of increase in reliance on outsourcing.
- 36) *Rate of Integration/Mergers*: Rate of increase in reliance on own resources

Factors 27-28, 32-33 are possible to estimate based on common sense and knowledge of the technology.

Factors 29-31, 34-36 reflect strategic behavior of the company and managerial response, hence they are impossible to estimate beforehand.

Although we can almost correctly define factors 5 and 26 (snapshot data), factors 29-31 and 34-36 (time and rates of change) are very much hidden from the outside observer as we can only use publicly available data, which rarely contain this information treated by many companies as private. In rare cases, we can try to speculate, but the accurate measurements are only possible if firm is willing to cooperate and disclose its internal processes. They are used to model the dynamic behavior of the players once the new entrants come to the market field.

Factors 17 and 18 are separated, although in the model more complex equation based on Quality per Price is utilized.

Exact data of factors 1-2, 22-23 is also internal, but it can be reliably evaluated or otherwise derived from the common knowledge of the technology.

THEORETICAL PREDICTIONS FROM SYSTEM DYNAMICS MODEL

The sensitivity analysis of the model (Vaishnav, 2010) predicts certain outcomes without even talking about concrete cases. Table 1-4 summarizes prediction of outcomes for different “standard” scenarios based on model assumptions and dynamics.

The most straightforward interpretation of these results for an actual case is when all of the factors (firm, product, and environment) are in the same column. For example, consider column one when an entrant company has superior cost structure, its product has high innovation features, and consumers care about high level of innovation and are willing to ignore some quality gap in the beginning. This is definitive disruption scenario and one can reasonably expect to have it confirmed by data and market. This is not to say, however, that an incumbent cannot regroup and offer better deal to customers or that another technology cannot emerge and displace the winner, which is very often the case in high clockspeed markets.

Things become more complicated though, when some of the factors are suggesting disruption, while others lean towards the no-disruption column. The outcome of such cases depends largely on the dynamic response of the players to the actions of each other. In order to analyze such a case, one would need to gather all the data required for the model and make intelligent assumptions whenever the data is hard to quantify.

	Disruption	Co-existence	No disruption
Firm Factors	<ul style="list-style-type: none"> • Entrants have far superior cost structure 	<ul style="list-style-type: none"> • Incumbents innovate, restructure while maintaining quality • Entrants struggle to offer quality due to lack of complementary assets or market power 	<ul style="list-style-type: none"> • Incumbents have far superior cost structure
Product/Service Factors	<ul style="list-style-type: none"> • Weak Network Effect • High Innovation and Quality 	<ul style="list-style-type: none"> • No Network Effect • Incumbents can affect switching behavior heavily 	<ul style="list-style-type: none"> • Strong Network Effect
Environment Factors	<ul style="list-style-type: none"> • Consumers highly price sensitive and willing to adopt innovations with low quality and compatibility • (Alternatively) consumers value quality, but entrants introduce a product with strong network effect 	<ul style="list-style-type: none"> • Consumers value availability over quality/innovation, or are willing to tradeoff quality and innovation 	<ul style="list-style-type: none"> • Consumers value quality and compatibility over innovation and low price • (Alternatively) consumers value innovation, but incumbent's product has strong network effect

Table 1-4. Theoretical Lessons from the System Dynamics Model

Another dimension that has to be considered when applying the model is to separate the technology disruption from industry disruption (see discussion earlier in this chapter). To summarize, technology disruption means that a new technology substitutes the old technology

and users get new dimensions of quality and innovation with new product or service. Industry disruption means the incumbent company exits the market and the new entrant takes over the customers. Theoretical literature and our framework have been focusing on the cases where a technology and industry disruption happens at the same time. However, it can be easily possible that an incumbent reacts quickly and adopts innovation abandoning old technology, thus becoming new supplier of innovative product or provider of innovative service. Such cases mostly require incumbents cannibalizing their own products and need accurate data in order to properly accommodate them for our framework and system dynamics model.

Chapter 2. CASE STUDIES

In this chapter, we describe the research method we are using in our analysis. We then show how our framework can be applied using limited number of publicly available information and illustrate it with two examples. Next, we describe our approach to the selection of case studies used in this work, and finally, we analyze seven case studies (two pairs of historical cases and three case studies that are more recent and were selected and analyzed in cooperation with Communications Futures Program at MIT).

RESEARCH METHODS & APPROACHES

There are number of research methods available for a researcher who wants to understand complex phenomena or to test a theory – case study, experiment, survey, archival records, history, etc. Among them, the case study is one of the most challenging methods. As Yin points out, “the case study method allows investigators to retain the holistic and meaningful characteristics of real-life events – such as individual life cycles, organizational and managerial processes, neighborhood change, international relations, and the maturation of industries” (Yin, 2009). Many researchers consider hierarchical approach to methods, where the case study serves as the preliminary strategy that cannot be used to test or describe the phenomena. In other words, the case study is often considered as only exploratory strategy, while for the descriptive and explanatory strategy other methods are preferred. However, more holistic, inclusive approach is advantageous. It considers all the strategies as mutually complementing, and suggests that purpose of the research and questions that need to be answered define the appropriate research strategy.

The conditions that affect the choice of the research method are:

- Type of research questions
- Ability to control the events
- Degree of focus on historical vs. contemporary events

Summary of these conditions and appropriate research strategies are shown below in Table 2-1 (adapted from (Yin, 2009)).

Strategy	Form of Research Question	Requires Control of Behavioral Events?	Focuses on Contemporary Events?
Experiment	how, why?	Yes	Yes
Survey	who, what, where, how many, how much?	No	Yes
Archival analysis	who, what, where, how many, how much?	No	Yes/No
History	how, why?	No	No
Case study	how, why?	No	Yes

Table 2-1. Research Strategies

As can be seen from the table, research strategies are not mutually exclusive, but there are certain distinct advantages of the case study. As a research method, it is mostly beneficial when a researcher is looking for answers to questions “how” and “why,” and is focusing on contemporary events, over which a researcher has little or no control, but where data is readily available, or where direct observation and interviews are possible to complement missing data (Yin, 2009).

Since the goal of this work is to understand the dynamics and various factors affecting the outcomes, or the links of the events in time that lead to certain outcomes, we are trying to answer the questions “how” and “why” that are explanatory, and this is exactly why we are choosing the case study as opposed to experiment or survey. The following is the list of questions that we are trying to answer in our case studies:

1. Why new technologies not always substitute old ones and sometimes there is a coexistence of technologies?
2. Why some new entrants win, while others fail, and incumbent retains leading position?
3. How can we predict the outcome of the interplay between innovation and quality?
4. How user needs are changing in time, and how can companies capture this change and reflect in their strategy?

To collect the data, we will define the comprehensive list of study questions. The case study will be designed as Multiple-case with multiple units of analysis. The Static part of the cases will consider Firm-level factors, Product-level factors and Environment factors as defined in the Incumbent’s Dilemma framework. The Dynamic response part will consider Firm-level factors and Environmental factors in form of changing user needs. Each case must be carefully selected to predict either similar results (literal replication) or contrasting results for anticipatable reasons (theoretical replication) (Yin, 2009).

To ensure quality of our research, we will challenge our Research Design against

- Construct validity, by using multiple sources of evidence, chain of evidence
- Internal validity, by using pattern matching, explanation building, rival explanations, logic models

- External validity, by applying theory and replication logic (for multiple-case studies)
- Reliability, by maintaining case study protocol, case study database

The reports of the case studies would serve as the empirical evidences of the validity of the framework and help us to identify its flaws and methods of their mitigation. Conclusions and results of this work would be instrumental for any manager of the company (large or small) seeking to understand how to respond to new technologies to defend its market share and remain competitive, or what should be the new product/service features in order to challenge the incumbents.

FRAMEWORK APPLICATION FOR PUBLICLY AVAILABLE INFORMATION

To validate the framework, we first have analyzed several cases that were mentioned in The New York Times over the period from 1999 to 2008. The analysis was based solely on the information mentioned in the articles and the data available at the date of publications. Full list of analyzed cases and two detailed examples are shown below. As can be clearly seen, in many cases the information is rather scarce and does not mention the emergence of viable commercial technology, but describes the scientific discovery that might be far from the industrial diffusion.

Potentially Disruptive Technology	Industry	Year	Incumbent (market share)
Organic LED	Electronic Equipment Manufacturers <i>LCD/TFT Screens</i>	1999	Samsung (14.5%), Sharp (13.9%), Philips (12.7%)
Nano science in chip manufacturing	Semiconductor Equipment	1999	Intel (\$26bn) NEC (\$9bn) Toshiba (\$7.6bn) Samsung (\$7.1bn) Texas Instruments (\$7.1bn) Motorola (\$6.4bn)

Potentially Disruptive Technology	Industry	Year	Incumbent (market share)
Open Source Software	Computers: Systems Software <i>IP protected software</i>	2000	Microsoft
Online Book Stores	Retail, Internet Services <i>Book sales</i>	2000	Bertelsmann (Random House) Rupert Murdoch's News Corp, Time Warner, Disney, Viacom/CBS
e-Port (Internet-based Advertising)	Advertising, Internet Services <i>Traditional Media</i>	2000	TV, Newspapers, Magazines
Digital Photography	Photographic Products	2000	Kodak, Fujifilm, Polaroid
Gigabit Ethernet	Communications Equipment	2000	Cisco, 3Com
Online Investment Firms	Investment Banking and Brokerage <i>Traditional Mutual Funds</i>	2000	Vanguard (<i>mentioned in the article</i>)
Online Journals	Publishing <i>Traditional subscription & Archives</i>	2001	Random House: \$2.1 billion worldwide Penguin Group: \$1.3 billion HarperCollins: \$1.1 billion Simon & Schuster: \$690 million AOL/Time Warner: \$415 million
WiFi Mesh Networks	Wireless Telecommunications Services	2002	AT&T , Verizon, Sprint, T-Mobile, Cingular, Nextel
Segway Scooter	Automobile Manufacturer <i>Internal Combustion Engine</i>	2002	GM, Ford, Chrysler
Alternative Energy - Solar, Biomass, Wind, Hydrogen	Oil and Gas Exploration and Services, Electrical Utilities	2003	Exxon-Mobil, BP, Chevron
P2P Service Providers	Telecommunications Service <i>Long Distance Calls</i>	2004	AT&T-Cingular, Verizon, Sprint

Potentially Disruptive Technology	Industry	Year	Incumbent (market share)
P2P File Sharing	Movies and Home Entertainment	2005	Warner Bros, Buena Vista, Columbia, Universal, Fox, Paramount, MGM
Online Shopping	Retail	2005	Wal-Mart (<i>mentioned in the article</i>)
Online Book Content	Publishing <i>Libraries</i>	2006	Reed Elsevier, Pearson, Thomson, Bertelsmann, Wolters Kluer, McGraw-Hill Education
Online Commodity Futures Exchange	Commodity Futures Exchange	2006	NYMEX – New York Mercantile Exchange (<i>mentioned in the article</i>)
YouTube (Political Advertising)	Advertising	2006	TV, Newspapers, Magazines
YouTube (Video Content Distribution)	Movies and Entertainment, Publishing	2006	<i>The same</i>
Paint Films	Auto Parts and Equipment <i>Lacquer Paint</i>	2007	AkzoNobel, PPG Industries, DuPont
Advertising using Social Networks	Advertising	2008	TV, Newspapers, Magazines

Table 2-2. List of Publicly Available Cases

Data and rankings used in the analysis are based on the following sources:

- <http://www.telecompaper.com/news/samsung-holds-145-of-tft-lcd-market-in-1999>
- http://en.wikipedia.org/wiki/Semiconductor_sales_leaders_by_year#Ranking_for_year_1999
- <http://www.parapublishing.com/sites/para/resources/statistics.cfm>
- http://en.wikipedia.org/wiki/Photographic_film
- <http://business.highbeam.com/industry-reports/equipment/photographic-equipment-supplies>
- http://www.wintergreenresearch.com/reports/Wireless_Services.htm
- http://www.iab.net/media/file/resources_pdf_ADR_021028.pdf
- <http://ncseonline.org/NLE/CRSreports/05apr/RL32883.pdf>
- <http://www.localenergy.org/pdfs/Document%20Library/Exxon%20Future%20of%20Oil%20and%20Gas.pdf>
- http://www.petrostrategies.org/Links/Worlds_Largest_Oil_and_Gas_Companies_Sites.htm

http://www.skillset.org/film/knowledge/article_5082_1.asp
http://www.pcimag.com/HTML/BNP_GUID_9-5-2006_A_1000000000000375750
<http://en.wikipedia.org/wiki/Samsung>
http://en.wikipedia.org/wiki/Intel_4004
http://en.wikipedia.org/wiki/Intel_Corporation
<http://en.wikipedia.org/wiki/Microsoft>
http://en.wikipedia.org/wiki/AT%26T_Wireless_Services
http://en.wikipedia.org/wiki/AT%26T_Corp

The complete list of detailed analysis for each case is available upon request at snaumov@sloan.mit.edu

Organic LED, 1999²

Industry: Electronic Equipment Manufacturers (Computer screens, mobile devices)

Incumbent: TFT LCD - Samsung, Market share 14.5% of global TFT LCD market in 1999³

New Entrant: Philips Electronics⁴

NEW ENTRANT		ENVIRONMENTAL FACTORS	INCUMBENT	
Firm-level Factors	Product-level Factors		Product-level Factors	Firm-level Factors
CURRENT POSITIONS				
Fixed Costs	Price	Price Sensitivity (SoA to Price)	Price	Fixed Costs
High	Low	High	High	High
Marginal Costs	Quality	Quality Sensitivity (SoA to Quality)	Quality	Marginal Costs
Low	Low	High	Medium	Low
Resources to Quality	Innovation	Innovation Sensitivity (SoA to Innovation)	Innovation	Resources to Quality
High	Very High	High	High	High
Resources to Innovation	Network Effect	SoA to Installed Base	Network Effect	Resources to Innovation
High	Medium	High	Low	High
Modularity	Switching Costs	Contact Rate	Switching Costs	Modularity
Low	Low	Medium	Low	Low
		Word of Mouth		
		Low		

DYNAMIC BEHAVIOR (RESPONSE to COMPETITION)

Time to Develop Quality / Complementary Assets	3-5 years	Time to Develop Quality / Complementary Assets	N/A
Time to Innovate	N/A	Time to Innovate	2-3 years
Resource Reorientation Time		Resource Reorientation Time	
Rate of Modularization/Contracting	Low	Rate of Modularization/Contracting	Low
Rate of Integration/Mergers	High	Rate of Integration/Mergers	High

² All the tables in this and all other cases are based on the data available at the date of the case indicated. No later information was used to correct the factors

³ Samsung holds 14.5% of TFT LCD market in 1999, 18 July 2000, Telecompaper, <http://www.telecompaper.com/news/samsung-holds-145-of-tft-lcd-market-in-1999>, Accessed 2013

⁴ Vivid Colors in the Palm of Your Hand, Anne Eisenberg, August 5, 1999, The New York Times

CURRENT POSITIONS

NEW ENTRANT F-level

Fixed Costs: *High*, Large spending on R&D.

Marginal Costs: *Low*, Economies of scale after ramp up.

Resources to Quality: *High*, Alliances created with research groups. Uniax licensed a technology for using light-emitting polymers for flat panel displays to Philips.

Resources to Innovation: *High*, 16.3% of total sales are spent on R&D⁵.

Modularity: *Low*, Large corporation with a lot of integrated activities.

NEW ENTRANT P-level

Price: *Low*, Easy to manufacture and require fewer components.

Quality: *Low*, Initial quality is low, only for displays with little information, problems with plastic base, permeable to oxygen and water vapor.

Innovation: *Very High*, Ability to shape into any form, *flexible*, robust, easy to manufacture, do not require a light source as they emit color light.

Network Effect: *Medium*, No direct network effect. Medium indirect network effect: larger customer base will force developers of applications and content providers to start using new features of the product (colors, resolution etc.) and the experience of the customers will be much better.

Switching Costs: *Low*, Initially, new entrants' product will be forced to have the same interface to ensure easier switching TO this product. However, later new versions might offer some features, requiring new proprietary interface. If the market share will be big, then switching costs might be high. Another possible source of switching costs is content providers, who might be locked to the particular feature. However, this should not be considered as a strong factor, as content providers are typically flexible and are willing to upgrade their content to keep up with new technologies and capture new sales (example HD vs. SD TV).

ENVIRONMENTAL FACTORS

Price Sensitivity (SoA to Price): *High*, Prices must remain low to capture mobile phones market (OEM). This is also true for end customers (computer monitors).

⁵ Philips Annual report 1999, http://www.philips.com/shared/assets/Downloadablefile/ManagementReport_AR99-12931.pdf, Accessed 2013

Quality Sensitivity (SoA to Quality): *High*, Quality color screens demanded for new generation of mobile devices and advertising as well as PCs.

Innovation Sensitivity (SoA to Innovation): *High*, New technologies are requested by high tech devices.

SoA to Installed Base: *High*, Customers care a lot about the content and apps to maximize their experience.

Contact Rate: *Medium*, Everyday casual contacts schedule.

Word of Mouth: *High*, Ability to produce vivid colors and flexibility will attract new customers and they will share their opinion with others.

INCUMBENT P-level

Price: *High*, TFT LCD screens are still in the very early phase and marketing still positions them as superior elite screens (as opposed to CRT). Costs of manufacturing are high, and the learning curve is not yet developed.

Quality: *Medium*, Technology offers outstanding features such as improved image quality, but colors are far worse than CRT. Designers do not use TFT screens. TFT displays require a light source.

Innovation: *High*, *Lightweight and flat, low power consumption (might start as ancillary, but is moving to become one of the primary performance factors).*

Network Effect: *Low*, No direct or indirect network effect.

Switching Costs: *Low*, Initially used for advertising screens, later for TV and computer screens. The same interface, therefore no disruption in standards and low switching costs.

INCUMBENT F-level

Fixed Costs: *High*, Large spending on R&D.

Marginal Costs: *Low*, Economies of scale.

Resources to Quality: *High*, Great manufacturing base and production standards, partnerships⁶.

Resources to Innovation: *High*, R&D spending 6.1% of sales in 1999⁷.

Modularity: *Low*, Large corporation with a lot of integrated activities.

⁶ http://en.wikipedia.org/wiki/Samsung_Corning_Precision_Glass, Accessed 2013

⁷ Samsung Annual report 1999,

http://www.samsung.com/us/aboutsamsung/corporateprofile/download/all_1999.pdf, Accessed 2013

DYNAMIC BEHAVIOR (RESPONSE to COMPETITION)

NEW ENTRANT

Time to Develop Quality/Complementary Assets: 3-5 years to laptop screens, longer (not specified) for wall-screens.

Rate of Modularization/Contracting: *Low*, IP issues prevent reliance on outsourcing, trend to consolidate activities.

Rate of Integration/Mergers: *High*, M&A strategy.

INCUMBENT

Time to Innovate: 2-3 years given large R&D base. Established LCD panel R&D Line in Kiheung⁸.

Rate of Modularization/Contracting: *Low*, Large international corporation with the trend to consolidate activities.

Rate of Integration/Mergers: *High*, M&A strategy.

Predicted outcome: Co-existence of technologies and industrial order (TCIC) with possibility for technology disruption (TDxx), depending on the speed of achieving necessary quality.

⁸ http://www.samsung.com/global/business/lcdpanel/aboutus/AboutUs_1999-1991.html, Accessed 2012

P2P Service Providers, 2004

Industry: Telecommunications Service. Long Distance Calls, PSTN

Incumbent: AT&T-Cingular⁹

New Entrant: Skype¹⁰

NEW ENTRANT		ENVIRONMENTAL FACTORS	INCUMBENT	
Firm-level Factors	Product-level Factors		Product-level Factors	Firm-level Factors
CURRENT POSITIONS				
Fixed Costs	Price	Price Sensitivity (SoA to Price)	Price	Fixed Costs
Low	Very Low	High	High	High
Marginal Costs	Quality	Quality Sensitivity (SoA to Quality)	Quality	Marginal Costs
Low	Medium	Medium	Medium	Very Low
Resources to Quality	Innovation	Innovation Sensitivity (SoA to Innovation)	Innovation	Resources to Quality
Low	High	High	High	High
Resources to Innovation	Network Effect	SoA to Installed Base	Network Effect	Resources to Innovation
Low	High	High	High	High
Modularity	Switching Costs	Contact Rate	Switching Costs	Modularity
Low	Low	Medium	Medium	Low
		Word of Mouth		
		High		
DYNAMIC BEHAVIOR (RESPONSE to COMPETITION)				
Time to Develop Quality / Complementary Assets				Time to Develop Quality / Complementary Assets
Depends on the Internet infrastructure				N/A
Time to Innovate				Time to Innovate
N/A				1 year
Resource Reorientation Time				Resource Reorientation Time
N/A				
Rate of Modularization/Contracting				Rate of Modularization/Contracting
Medium				Low
Rate of Integration/Mergers				Rate of Integration/Mergers
Low				High

⁹ http://www.wintergreenresearch.com/reports/Wireless_Services.htm, Accessed 2013

¹⁰ In Internet Calling, Skype Is Living Up to the Hype, James Fallows, The New York Times, September 5, 2004

CURRENT POSITIONS

NEW ENTRANT F-level

Fixed Costs: *Low*, P2P network does not require large CAPEX.

Marginal Costs: *Low*, P2P networks are easily scalable by adding few control servers/sites.

Resources to Quality: *Low*, Start-up company founded in 2003¹¹.

Resources to Innovation: *Low*, Start-up company.

Modularity: *Low*, Start-up company.

NEW ENTRANT P-level

Price: *Very Low*, PC to PC calls are free, SkypeOut (to a phone) is very low priced.

Quality: *Medium*, Largely depends on the bandwidth of Internet connection between two peers.

Innovation: *High*, Completely new type of communication (VoIP).

Network Effect: *High*, Medium direct network effect. High indirect network effect. If all calling parties have Skype accounts, they can establish free video calls, which increases customer experience.

Switching Costs: *Low*, It does not take a lot of time to switch to new technology.

ENVIRONMENTAL FACTORS

Price Sensitivity (SoA to Price): *High*, As people tend to travel more, cheap long distance calls are very important.

Quality Sensitivity (SoA to Quality): *Medium*, Voice quality is generally enough (in worst cases it is comparable to PSTN). Quality requirements rise though when it comes to businesses, which require reliable and lag-free teleconferencing.

Innovation Sensitivity (SoA to Innovation): *High*, There is a constant need to improve communication among people and serve international businesses.

SoA to Installed Base: *High*, Everybody loves to have free video calls.

Contact Rate: *Medium*, Everyday casual contacts schedule.

Word of Mouth: *High*, Very high role of WOM and strong incentive to use Skype as customer base is growing and people's contacts migrate to Skype.

INCUMBENT P-level

Price: *High*, Prior to VoIP there was no alternative publicly available mean of connecting people, so the prices for long distance calls were very high.

Quality: *Medium*, Depending on the regions. To some countries long distance calls were very bad. US was generally high quality.

¹¹ <http://en.wikipedia.org/wiki/Skype>, Accessed 2013

Innovation: *High*, Initial phone invention was great innovation, PSTN solved problem of speed of connection -- long distance connections between major cities could take up to seven minutes prior to PSTN¹².

Network Effect: *High*, High direct and indirect network effect. There must be a network of phone lines in order to make calls. Customers benefit from more phone users -- can call anybody and solve anything.

Switching Costs: *Medium*, Customers are bound by contractual obligations.

INCUMBENT F-level

Fixed Costs: *High*, large spending on R&D.

Marginal Costs: *Very Low*, Once network was built, costs per additional line were low within the capacity of the line.

Resources to Quality: *High*, Large company with a long history and almost a monopoly in the phone calls. New company was founded in 1983 because of anti-trust suit¹³.

Resources to Innovation: *High*, SBC Laboratories (AT&T Labs) perform R&D¹⁴.

Modularity: *Low*, Large corporation with a lot of integrated activities.

DYNAMIC BEHAVIOR (RESPONSE to COMPETITION)

NEW ENTRANT

Time to Develop Quality/Complementary Assets: Depends on the Internet infrastructure. Speed and complementary features depend on the bandwidth/availability of the Internet connection and the activity of other players.

Rate of Modularization/Contracting: *Medium*, Reliance on own development team. Tendency toward cooperation with social networks and other sites to incorporate Skype features in web sites to make calls easier.

Rate of Integration/Mergers: *Low*, Start-up company with no sufficient funds to compete alone.

INCUMBENT

Time to Innovate: The technology is simple. Can be done very quickly provided company's desire to do so.

Rate of Modularization/Contracting: *Low*, Company tries to control everything -- cables, switching network and customer's database.

Rate of Integration/Mergers: *High*, series of mergers and acquisitions throughout the history.

¹² http://en.wikipedia.org/wiki/PSTN_network_topology, Accessed 2013

¹³ <http://en.wikipedia.org/wiki/AT%26T>, Accessed 2013

¹⁴ <http://www.corp.att.com/atlabs/about/>, Accessed 2013

Comment: Infrastructure of the Internet is an enabler and developed much faster without any efforts from Skype. This allowed new technology to become widely used. Many long-distance companies are using VoIP technology to lower the cost of their service.

Predicted outcome: Potential disruption of technology, potential disruption of industrial order (TDID).

CASE STUDY SELECTION

We have further continued to work on the Incumbent's dilemma framework by exploring and researching in details two pairs of empirical cases (Table 2-3) that had happened in the past and for which the outcome is known and not debatable. We use case studies to show why in some situations incumbents retain market share, while in others new entrants drive them out. We show how a single firm flourishes with an old technology but struggles in the face of a radical new technology; how a single technology disrupts one market environment, but struggles to disrupt another; and how a single environment reacts differently to an old vs. a new technology.

The reason for studying cases in pairs is to eliminate some of the difficulties discussed above and related to the data that is not readily and indisputably quantifiable. In addition, when studying cases in pairs, we get better understanding of the drivers working in each of the case. By picking two cases with one similar set of drivers, but with different outcomes, we can eliminate the effect of this one set of factors and look at two others sets of factors to see which one defines the outcome of the case (disruption, coexistence, or no disruption).

For example, In Linux vs. Windows case, we have the **same firms** and virtually the **same product**, but the rate of adoption, and dynamics, are different, and so is the outcome of the potential disruption.

Selection Logic	Case	Entrant vs. Incumbent
Same Product / Same Firm	1. Linux in desktop market (compared to) Windows in desktop market	Linux vs. Windows (desktop OS)
	2. Linux in server market (compared to) Windows in server market	Linux vs. Windows (server OS)
Same Environment	1. Mobile handset market (basic phones)	Nokia vs. Motorola
	2. Mobile handset market (Smartphones)	Apple/Android vs. Nokia/Motorola

Table 2-3. Pairs of Historical Cases

As a next step, we have decided to apply the framework to most recent cases. By doing so, we were hoping to explore the predictive potential of the model. Although empirical cases are great source of data for validation of the model, because the outcome of such a case is known, there are very interesting questions that can be answered only when studying ongoing cases. When studying historical cases, our goal was to analyze and improve the model, whereas our objectives for ongoing cases were different, as we wanted to explore the challenges of defining the cases and working within the boundaries of real time data that can be obtained by looking at the problem from daily manager’s perspective. In other words, in this exercise, we put ourselves in manager’s chair and attempted to predict the outcome of the case using the data that we have.

We chose to work with cases that are for the most interest for CFP members to make sure they receive some benefits from this work in forms of better understanding of the situation or at least looking at it through the lens of our model. We asked CFP members to provide us with the short description of disruptive scenarios they have encountered. To further investigate necessary details of the case, we have decided to create a survey that would help elicit information about each of the factors without having to explain the nature of the interaction among the factors simulated in the model (see Appendix A. The Incumbent’s Dilemma: Case Study Survey). In this chapter, we present three cases that resulted from such work (Table 2-4). First case of digital music strictly speaking may fall in the category of empirical cases from the past with known outcome. However, due to a lot of uncertainty in data and ongoing “digitalization” of the industry as a whole (i.e. video content case which is presented in (Klym, 2013)), it is better aligned with two ongoing cases, which we present next, telecom providers and wireless vs. wireline data.

Type	Case
Historical/impact on ongoing adjacent cases	Digital Music
Ongoing	Telecom Providers
Ongoing	Wireless vs. Wireline Data

Table 2-4. CFP Cases

Full mapping of the cases to the landscape of possible disruption scenarios is shown in Table 2-5 below. As we initially decided, we cover mostly the diagonal of the table, as this is what

innovation literature has been mostly discussing in the past and thus we can better validate our findings.

		TECHNOLOGY		
		Disruption New technology wins (Incumbent abandons old technology) (TD)	Coexistence Both technologies exist on the market (TC)	No Disruption New technology loses (New entrant abandons it) (TN)
INDUSTRY	Disruption Incumbent leaves the market (ID)	Nokia vs. Motorola Apple/Android vs. Nokia/Motorola Telecom Providers	N/A	
	Coexistence Both New entrant and Incumbent are on the market (IC)	Digital Music	Linux vs. Windows (server OS) Wireless vs. Wireline Data	
	No Disruption New entrant cannot enter the market (IN)		N/A	Linux vs. Windows (desktop OS)

Table 2-5. Mapping of Cases to Disruption Scenarios

OPERATING SYSTEMS, LINUX VS. WINDOWS

Operating systems market is one of the rarest markets where virtually the same product (or at least technology) of the same firms can be analyzed in two different environments – desktop OS and server OS – where the outcome was completely different. In fact, the outcome is so overwhelmingly clear, without any boundary conditions, that it is extremely good case for analysis of dynamics and factors of these clashes. We will see that the main difference was due to different sensitivities of the users, i.e. different set of values that users apply to evaluate the product and make a buy decision. We will first consider desktop market.

DESKTOP OPERATING SYSTEM

The incumbent in our first case is straightforward. **Microsoft Corporation** is the only developer of Windows Operating System. The entrant situation is slightly more complex. There are more than 30 Linux-based distributions of desktop OS with top 10 most widely used¹⁵. Ubuntu is by far the most popular desktop distribution, while Fedora is one of the most innovative distributions available today. Hence, two companies manufacturing these distributions, **Canonical Ltd. / Ubuntu Foundation** and **Red Hat, Inc.** are jointly considered as an entrant.

Reasonable starting point for this case is 2004. Although Windows XP was released far ahead of this time (2001), first releases of Ubuntu and Fedora appeared in 2004, and Windows XP had substantial improvement in functionality with SP2 released in 2004.

¹⁵ http://en.wikipedia.org/wiki/Comparison_of_Linux_distributions, Accessed 2013,
<http://distrowatch.com/dwres.php?resource=major>, Accessed 2013

According to ComScore,¹⁶ in 2010 the average American spent 32 hours per month on the Internet, and ages 45-54 had spent more than 39 hours online each month. Therefore, the statistics of client OS based on the information supplied to web servers by web browsers, seems to be sufficiently reliable. Although there are some critique to this method, accusing it first of all of over or under estimation due to the behavior of some browsers or short revisits by users or caching at browsers' sites, the Table 2-6 shows pretty good convergence for Windows with extremes at 74.20% and 92.23%. The data for Linux is more dispersed, with two extremes at 0.71% and 5.03%. Interestingly, the median for Linux is farther from the mean in comparison to Windows case. This means the extreme high numbers for Linux are probably outliers and not typically present in the sample. This gives us the reason to be more conservative in our estimates of true market share of Linux.

¹⁶ <http://www.comscore.com/2011/01/average-time-spent-online-per-u-s-visitor-in-2010/>, Accessed 2013

Source	Date	Windows Family	Linux Family
StatCounter ¹⁷	March, 2012	89.21%	0.82%
W3Schools ¹⁸	January, 2012	83.90%	4.90%
Wikimedia ¹⁹	January, 2012	74.20%	4.44%
W3Counter ²⁰	October, 2011	80.11%	1.65%
StatOwl ²¹	January, 2012	83.39%	0.71%
GetClicky ²²	March, 2012	84.32%	1.12%
Chitika ²³	February, 2012	83.65%	5.03%
AT Internet ²⁴	November, 2011	86.20%	0.90%
NetMarketShare ²⁵	November, 2011	92.23%	1.31%
	Median	83.90%	1.31%
	Mean	84.13%	2.32%
	Standard Deviation	4.85%	1.77%

Table 2-6. Market Share by Browser Usage

Below we have analyzed the data provided by <http://www.netmarketshare.com>, <http://www.statcounter.com> and <http://www.w3schools.com> in more details and found them sufficiently consistent. The variation between first two sources is in the range of less than +/-1% and can, therefore be considered as significantly reliable. Third source provides consistent data for Windows market share, but gives higher share for Linux based OSs, about 4.8%. It is worth noting, that this is the highest number found on the Internet, and this is the exception

¹⁷ <http://gs.statcounter.com/#os-ww-monthly-200807-201203>, Accessed 2013

¹⁸ http://www.w3schools.com/browsers/browsers_os.asp, Accessed 2013

¹⁹ http://stats.wikimedia.org/archive/squid_reports/2011-12/SquidReportOperatingSystems.htm, Accessed 2013

²⁰ <http://www.w3counter.com/globalstats.php?year=2011&month=10>, Accessed 2013

²¹ [http://statowl.com/operating_system_market_share_by_os_version.php?timeframe=last_6&interval=month&chart_id=4&fltr_br=&fltr_os=&fltr_se=&fltr_cn=&limit\[\]=windows&limit\[\]=mac&limit\[\]=linux&x=95&y=38](http://statowl.com/operating_system_market_share_by_os_version.php?timeframe=last_6&interval=month&chart_id=4&fltr_br=&fltr_os=&fltr_se=&fltr_cn=&limit[]=windows&limit[]=mac&limit[]=linux&x=95&y=38), Accessed 2013

²² <http://getclicky.com/marketshare/global/operating-systems/>, Accessed 2013

²³ <http://insights.chitika.com/2012/operating-system-report-february-2012-update/>, Accessed 2013

²⁴ <http://www.atinternet.com/en/Documents/ios-continues-its-growth-in-europe/>, Accessed 2013

²⁵ <http://www.netmarketshare.com/operating-system-market-share.aspx?qprid=9&qpcustomb=0&qptimeframe=M&qpsp=130&qpnp=25>, Accessed 2013

confirming the rule. Even this number is too small for more than 10-year-old operating system and cannot be supported by any trend. The trend indicated by first two sources shows steady hovering around 85% for Windows and 1.0% for Linux. Third graph shows slight decline of Windows, but still fluctuating around 85%, while Linux failed to break 5% level and is quite steady.

Data derived from <http://www.netmarketshare.com/operating-system-market-share.aspx?qprid=9&qpcustomb=0&qptimeframe=M&qpsp=130&qnp=25>

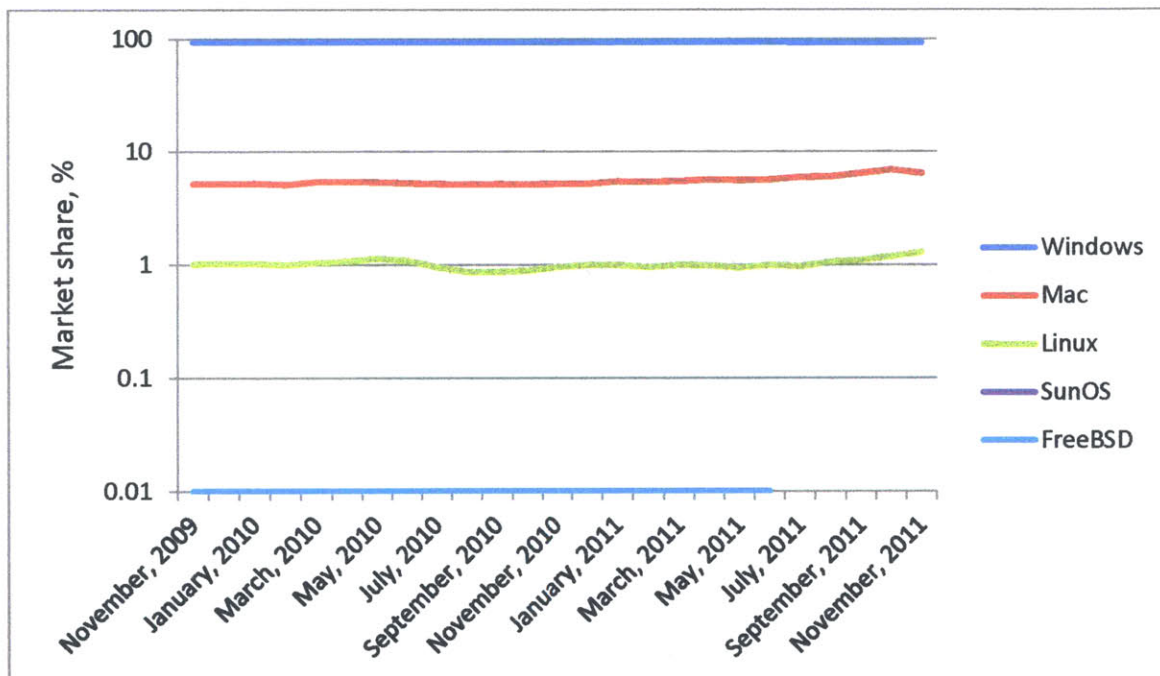


Figure 2-1. Desktop Top Operating Systems Market Share (on a logarithmic scale)

Data derived from <http://gs.statcounter.com/#os-ww-monthly-200807-201203>

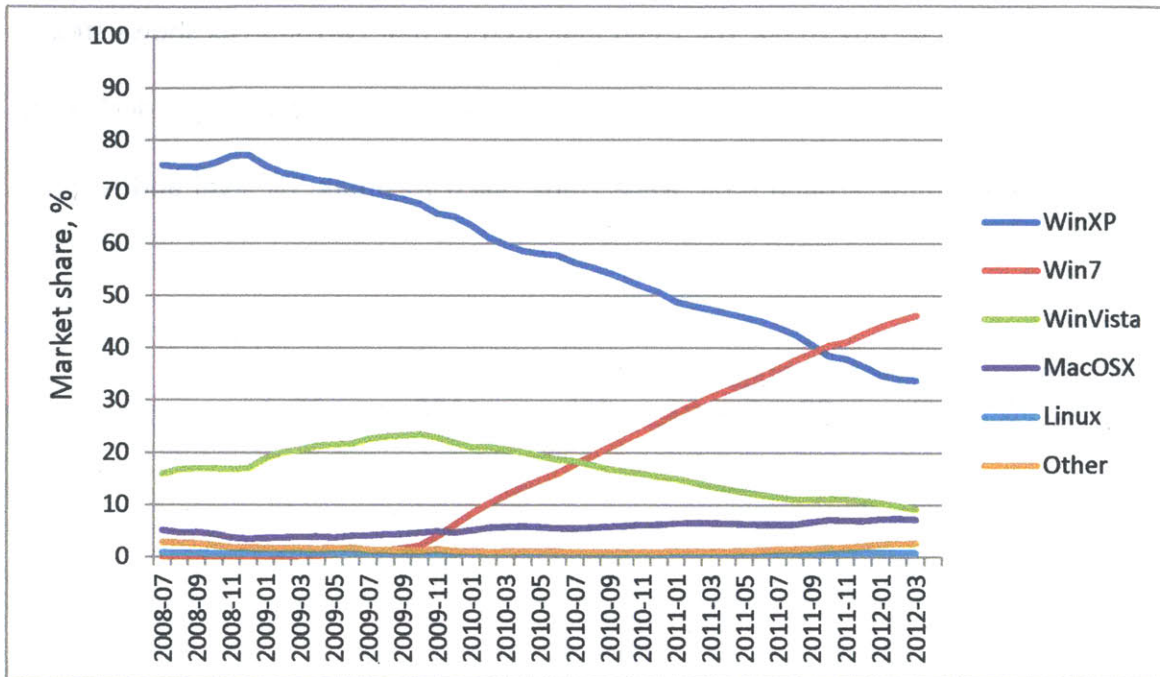


Figure 2-2. Top Five Operating Systems Worldwide

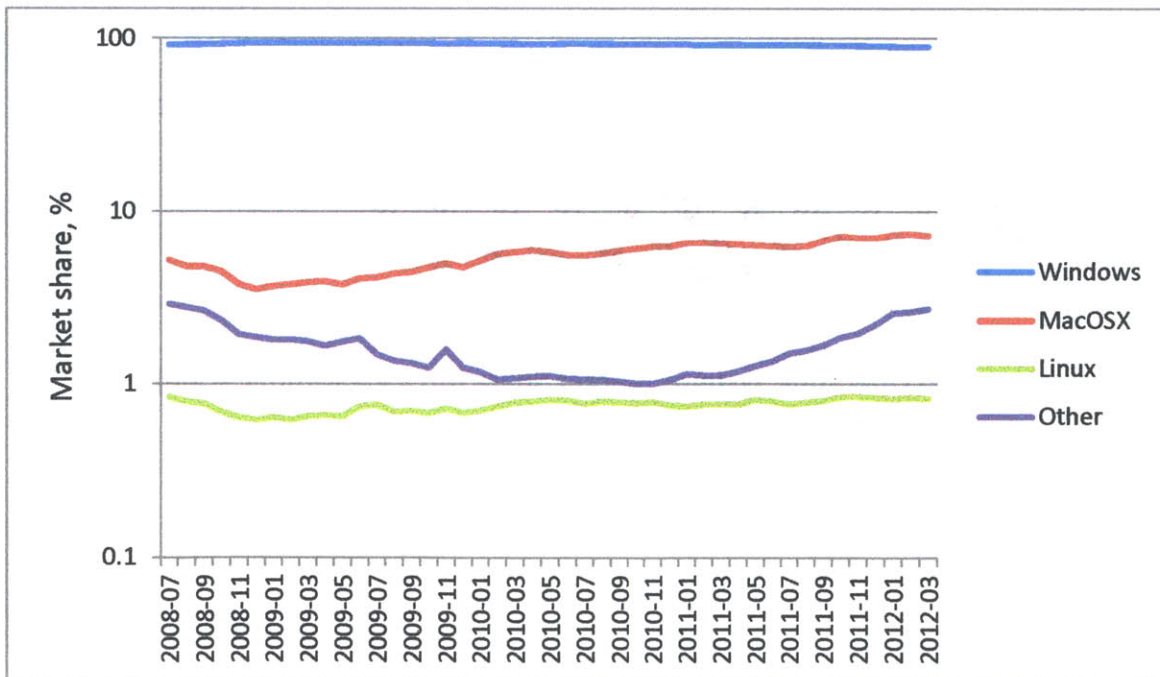


Figure 2-3. Windows vs. Linux Worldwide (on a logarithmic scale)

Data derived from http://www.w3schools.com/browsers/browsers_os.asp

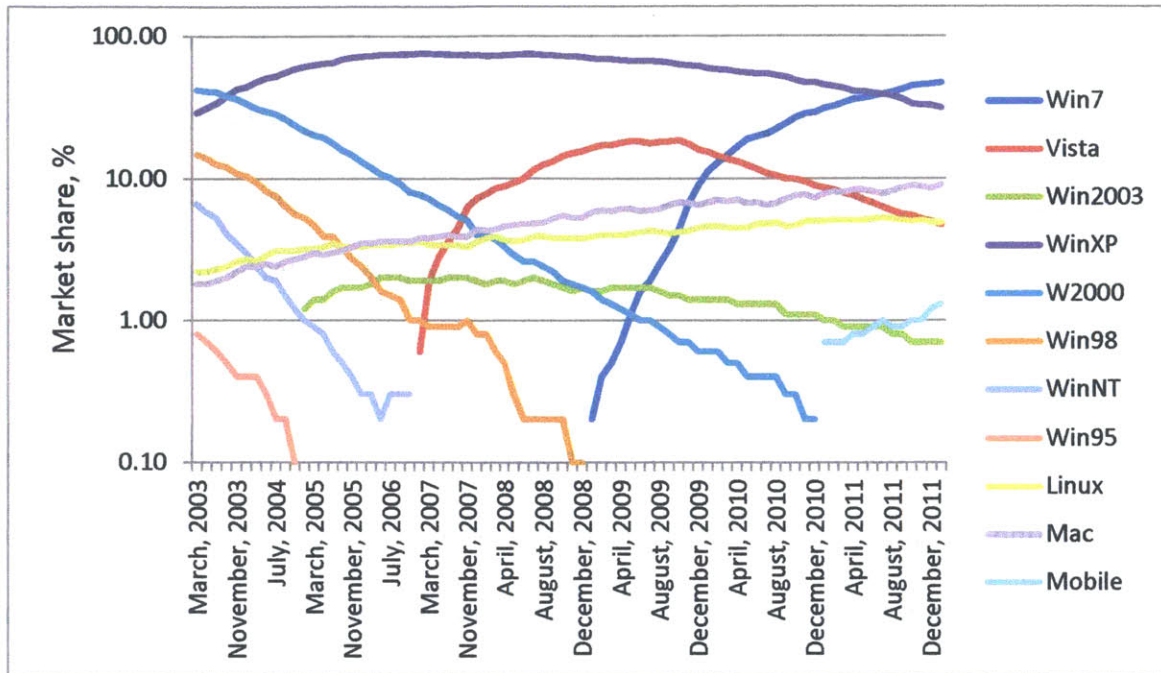


Figure 2-4. OS Platform Statistics (on a logarithmic scale)

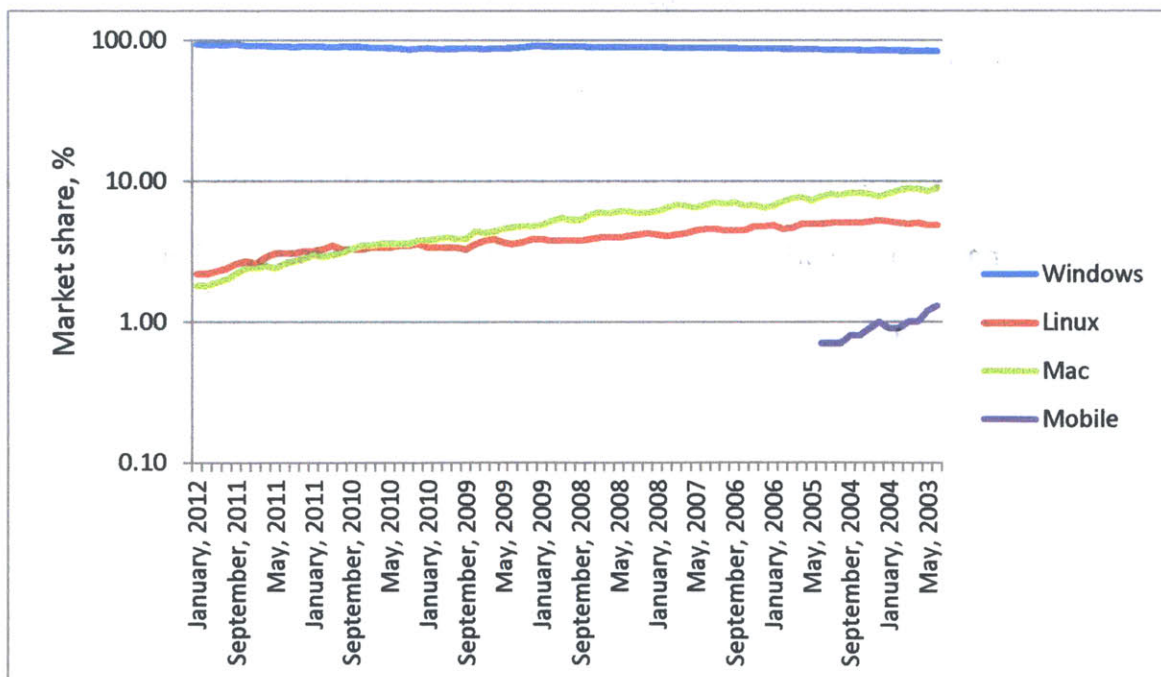


Figure 2-5. OS Platform Statistics, Windows Combined (on a logarithmic scale)

In summary, the market share estimated by web server statistics for Linux in the desktop OS market ranges from less than 1% to 4.8%. In comparison, Microsoft operating systems combined (Windows 7, Vista, and XP) hold more than 80%. Interesting is that the all-time peak of Linux usage was registered in July 2011 (5.3%) and has since dropped to 4.9% (Jan 2012). Windows 7 share has been growing steadily in the a.m. period from 39.1% in July 2011 to 47.1% in Jan 2012.

We can conclusively say that the case can be considered as being over. The Linux distributions have been around for about 10 years now and they failed to gain any significant market share, hovering below 5% mark at the very optimistic estimations. Windows, on the other hand, has managed to retain significant market share of more than 80% for the whole duration of the case. The outcome, therefore is non-ambiguous, the entrant (Linux) failed to enter the market of desktop OS and failed to disrupt the incumbent (Windows).

Windows OS has always been priced at the average level of \$200 for the basic version. Below is the table with summary of full pricing of different Windows editions (assumed no upgrade) for the time horizon of our case study.

Date	Windows XP	Windows Vista	Windows 7
2004	Home edition: \$199 ²⁶		
	Professional: \$299 ²⁷		
2007		Home Basic: \$188.90 - \$228.96 ²⁸	
		Home Premium: \$217.98 - \$267.53 ²⁹	
		Ultimate: \$184.13 - \$409.99 ³⁰	
			Home Premium: \$199.99
2009			Professional: \$299.99
			Ultimate: \$319.99 ³¹

Table 2-7. Official Prices of Windows OS

Linux distributions are free due to the nature of open-source copyright license (GNU General Public license or GPL)³².

For the core component of the computer that allows running applications, OS is quite different from a typical tangible product. Quality for OS is the ability to maintain functionality of a computer without crashing. In addition, quality is the ease of use and maintenance. Given the

²⁶ <http://web.archive.org/web/20031002031945/>

<http://www.microsoft.com/windowsxp/home/howtobuy/pricing.asp>, Accessed 2013

²⁷ <http://web.archive.org/web/20031204221225/>

<http://www.microsoft.com/windowsxp/pro/howtobuy/pricingretail.asp>, Accessed 2013

²⁸ <http://web.archive.org/web/20070217180703/>

<http://www.windowsmarketplace.com/category.aspx?bcatid=1008&tabid=2>, Accessed 2013

²⁹ <http://web.archive.org/web/20070227103229/>

<http://www.windowsmarketplace.com/category.aspx?bcatid=1010&tabid=2>, Accessed 2013

³⁰ <http://web.archive.org/web/20070910121025/>

<http://www.windowsmarketplace.com/category.aspx?bcatid=1001&tabid=2>, Accessed 2013

³¹ <http://web.archive.org/web/20091208101145/http://www.microsoft.com/Windows/buy/default.aspx?>,

Accessed 2013

³² http://en.wikipedia.org/wiki/GNU_General_Public_License, Accessed 2013

inherent nature of the software releases schedule, there are always a lot of bugs that need to be fixed in order to make sure the computer is running and is not compromised by hacking attacks from the Internet. Patches are one of the most important features of the support and maintenance period that ensure constant fixing of bugs. Hence, the process of checking for, obtaining, and applying patches is the most important one for users. Not the actual number of patches, but the ease and efficiency of patching process is the big differentiator. Microsoft used an update model known as "Patch Tuesday"³³ where patches and updates are issued usually on the second Tuesday of a month unless there are critical updates that needs to be released earlier. This model is different from various Linux update models.

Another factor that was actively discussed by users in the early days of Linux was the ability to run on older hardware. Many were accusing Microsoft of pushing up the requirements for hardware thus effectively forcing users to buy newer hardware if they wanted to use the latest Windows OS.

Our market in this case is mostly inexperienced computer users (home, office desktops etc.). They are very sensitive to network externalities, price, and quality, while being moderately sensitive to innovations.

If we look at what incumbent has to offer to them, we notice that incumbent has

- Very high Network Externalities. Network externalities here are applications that are working on OS. Tons of applications are written for Windows as opposed to very few

³³ http://en.wikipedia.org/wiki/Patch_Tuesday, Accessed 2013

applications for Linux, especially heavy 3D games and fancy photo and video editing software, which is very important for this market segment.

- Higher Quality. Quality here means ease of installation, ease of maintenance (upgrade, technical support), and reliability. Windows is easier to install (and most of the time it comes preinstalled on a new PC), it is easier to navigate (it has only one flavor as opposed to command line interface or several GUI packages available for Linux), easier to update (at least initially). All this translates into higher positive experience for consumers, or quality of the product for this market.

On the other side, new entrant has

- Much higher Price attractiveness, as users have to buy Windows, while Linux is free
- Higher Innovation. New dimension of performance introduced by Linux is the ability to create custom packages or distributions in order to be able to fine-tune them to specific narrow tasks, optimized performance of the kernel, fewer bugs. Even though Windows has different flavors that are supposed to be tuned to specific tasks and segments of users as well, they are mostly used for marketing purposes to justify different price levels.

Magnitude of the effect of features on the decision to buy follows AND logic, where both sensitivity to a feature set and the feature itself (such as price, innovation, quality, or network effect), have to be multiplied to identify the end effect on consumer behavior. Using this AND logic, we can see that not all the superior features of the product are demanded by the environment, example being innovation of Linux. This translates into higher influence on the

decision to buy Windows, and as the result, the influence on the market share of the incumbent is much higher than that of new entrant. The result of this case is clear disruption.

SERVER OPERATING SYSTEM

Now, let us see what the differences for Server Operating system case are. Market in the case of Server OS case is mostly corporate IT admins. As opposed to home users, they are much less sensitive to Price (companies are ready to pay for reliable IT solutions), hence we see that Linux Price influence on the decision to buy is weaker now (remember AND logic).

Users care about quality as strongly as they did in desktop market. Quality here means ease of maintenance (upgrade, technical support), and enormous amount of reliability and availability. Linux has offered a way for this market to get Quality. Being an open source product with very diverse and rich community Linux offers IT users the necessary level of quality by leveraging innovative feature of Linux – ability to customize and fine-tune distributions. In addition, many optimized distributions are offered by the community for major tasks such as Web-server, Data centers etc. Hence, we have higher influence on the decision to buy from Quality.

This market has higher Innovation sensitivity due to the ability of users to leverage innovation and better perform their jobs by creating custom packages or distributions, fine-tune them, optimize, and achieve higher quality. Even though Windows has much better diversity in server product line than in desktops, Linux has clear advantage here and we have strong influence on the decision to buy.

We can see that these changes in customer preferences translate into higher influence on the decision to buy for Linux in Server market than it was in Desktop market and as the result, the

influence on the market share of Linux is stronger. Linux Server OS market share has shown steady increase since 2007 from 19.6% to 26.3% forecast in 2013³⁴

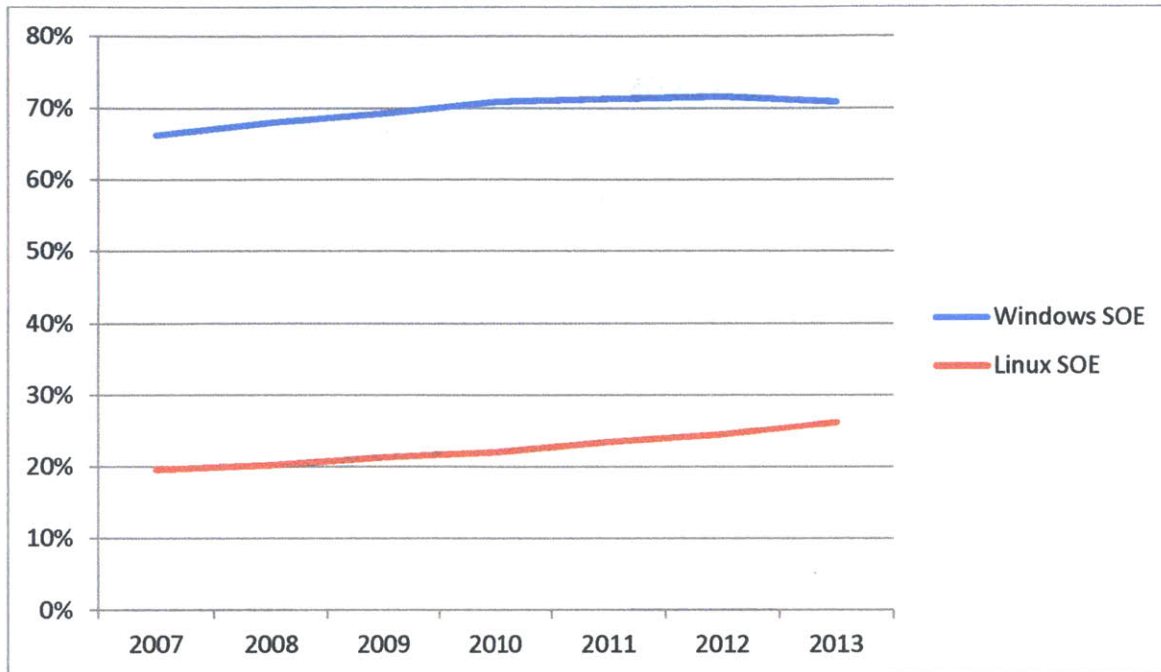


Figure 2-6. Worldwide Server OS Installed Base. Source: IDC

The numbers vary as it is much more difficult to evaluate server market share for free distributions of Linux, but even conservative reports from IDC show that Linux has about 25% server OS market share, while windows has about 70%. Therefore, this is clear case of coexistence and the result is different from desktop market solely due to the different customer preferences.

³⁴ Worldwide Client and Server Operating Environments 2012–2016 Forecast The Changing Dynamics and Demographics, Al Gillen, Iris Feng, IDC, 2012

	Disruption	Co-existence	No disruption
Firm Factors		<p>SERVER OS</p> <ul style="list-style-type: none"> • Incumbents innovate, restructure while maintaining quality 	
Product/Service Factors			<p>DESKTOP OS</p> <ul style="list-style-type: none"> • Strong Network Effect of Incumbent product
Environment Factors		<p>SERVER OS</p> <ul style="list-style-type: none"> • Consumers are willing to tradeoff quality and innovation 	<p>DESKTOP OS</p> <ul style="list-style-type: none"> • Consumers value quality and compatibility over innovation and low price • Consumers value innovation, but incumbent's product has strong network effect

Table 2-8. Desktop and Server Operating Systems Case Analysis

MOBILE WORLD: ANDROID, APPLE, NOKIA, MOTOROLA

NOKIA VS. MOTOROLA (BASIC PHONES)

The mobile phones were first presented by Bell Labs in the middle of 20th century, on June 17, 1946 in St. Louis, Missouri, but early technology featured phones for cars, as they were heavy and bulky, and required a lot of power. The network was capable of handling only few simultaneous calls at that time and it was not until 1970s when the technology matured enough to introduce working handheld device. Motorola and Bell Labs were racing with each other to introduce handheld phone first, and on April 3, 1973 Motorola executive made first mobile phone call from a handheld phone calling Bell Labs executive to declare the victory. The weight of the device was 2.5 pounds and it was quite large with 9 x 5 x 1.75 inches dimensions. In 1983, Motorola had received the approval from FCC for the first commercial handheld phone. At approximately the same time, Bell Labs introduced first commercial Advanced Mobile Phone System (AMPS) mobile phone network. First generation networks in the US and Europe were analog, but in 1990 new digital network, GSM (Global System for Mobile Communications), was introduced in Europe and in 1991 the first digital phone call was made. Since that time, GSM became ubiquitous standard in Europe supported by the governments and EU regulations. However, in the US, unlike Europe, adoption of digital network was not imposed by government and US market remained fragmented for a long time after GSM populated Europe and the world.

Capitalizing on the first mover advantage, Motorola was the largest mobile phone manufacturer with 60% of the US market share in 1994 and average revenue growth 27% a year

between 1993 and 1995³⁵. Motorola overall sales in 1994 increased 31% to \$22.2bn with Communication Segment reported 19% increase in sales to \$5.8bn and orders rising at 7%.³⁶

At the same time, Nokia in 1990s was struggling with falling sales, and the company financial results were far off since the demise of the Soviet Union (that was a significant source of trade and revenue). Attempts to restructure the company failed to bring desired profitability and Siemens saw Nokia as an attractive takeover target. Between 1984 and 1989, the average annual growth of Nokia's common stock was just 1%. Basic industrial units of Nokia were sold. However, the telecommunications, mobile phones, and data communications units were left as pillars for recovery. By early 1990s, the company has found itself in the worst Finland's recession since 1930s, due to the economic shift from the Cold War era to European integration. In 1992, new CEO, Jorma Ollila, was appointed and Nokia made an important strategic decision to focus on mobile communications (Steinbock, 2001).

In 1994, the US carriers began switching to digital technology, which promised many benefits for consumers, such as Caller ID, messaging and better call quality, and Motorola, enjoying the laurels of first mover and leader of the market, refused to follow the trend. Robert Weisshappel, cell-phone chief of Motorola, believed that most consumers wanted better analog phones, small and stylish, not the new digital phone that has to be bulky and ugly as the technology was immature. He said, "forty three million analog customers can't be wrong" at

³⁵ BusinessWeek. 05/04/98, Issue 3576, p140-148

³⁶ Motorola Annual Report, 1994

the executive meeting of cellular group³⁷, and in 1996 Motorola announced StarTAC, the ultra-sleek analog phone. It had been in development for the last two years and cost millions of dollars in R&D, and Motorola tried to recruit as many customers as possible by leveraging switching cost thru wireless providers. Motorola decided to allow StarTAC sales only to those carriers who had bought about 75% of their phones from Motorola and had a dedicated promotion campaign for its phones. This infuriated many wireless carriers and turned out to be complete failure as several of them refused to agree to these terms.

Another mistake that cost Motorola leading position was an attempt to develop its own digital chip, competing with rival chip from Qualcomm. The development took two years, but was unsuccessful and by the time the US wireless carriers were placing orders for digital phones, Motorola had nothing to offer.

When Motorola management has decided to make digital phones, it was difficult due to competing standards in the US. There were TDMA (promising three times the capacity of the analog network), CDMA (offering six times the capacity), and GSM (two to three times the capacity). Motorola had developed GSM phones first, and became big supplier to Europe and GSM carriers in the US, but it failed to quickly manufacture phones for other two wireless standards in the US. This and several other managerial mistakes including those when engineering efforts were focused on one standard ignoring others, cost Motorola time and market share, and are summarized in the Table 2-9.

³⁷ BusinessWeek. 05/04/98, Issue 3576, p140-148

Customer	Issue
PRIMECO PERSONAL COMMUNICATIONS	Equipment problems in 1997-98 resulted in PrimeCo network shutting down between 30 min and up to two hours. PrimeCo identified the problem is in Motorola's equipment, but Motorola could not fix the problem for several months. PrimeCo dropped Motorola's equipment and turned to Lucent.
BELL ATLANTIC	In early 1996, the carrier asked both Lucent and Motorola for equipment to help prevent fraud. Lucent provided the technology within three months. Motorola took a year and Bell Atlantic still was not completely satisfied with its product.
AMERITECH	In 1995, Ameritech told Motorola that it wanted to move to digital equipment. When Ameritech launched its digital network in Spring 1997, Motorola did not have products ready. Ameritech turned to Qualcomm and Sony.
U.S. CELLULAR	The carrier was forced to test four batches of Motorola's digital wireless phones over a six-month span before they finally worked. Meanwhile, similar phones—all used in its Tulsa (Okla.) market—have been supplied by rival Nokia for two years.

Table 2-9. Summary of Motorola Issues. Source: BusinessWeek

These mistakes became apparent already by 1998, when the market share in the US slid to 30%³⁸. In 1997, the company's revenue growth slowed to 5% from 27% few years ago and profits plummeted 33%³⁹ with shareholders return about 1% in 1997 from 75% in 1993. By 1999, Motorola has lost the mobile phone war to Nokia and had to focus on other communication markets.

³⁸ Gartner Dataquest

³⁹ BusinessWeek. 05/04/98, Issue 3576, p140-148

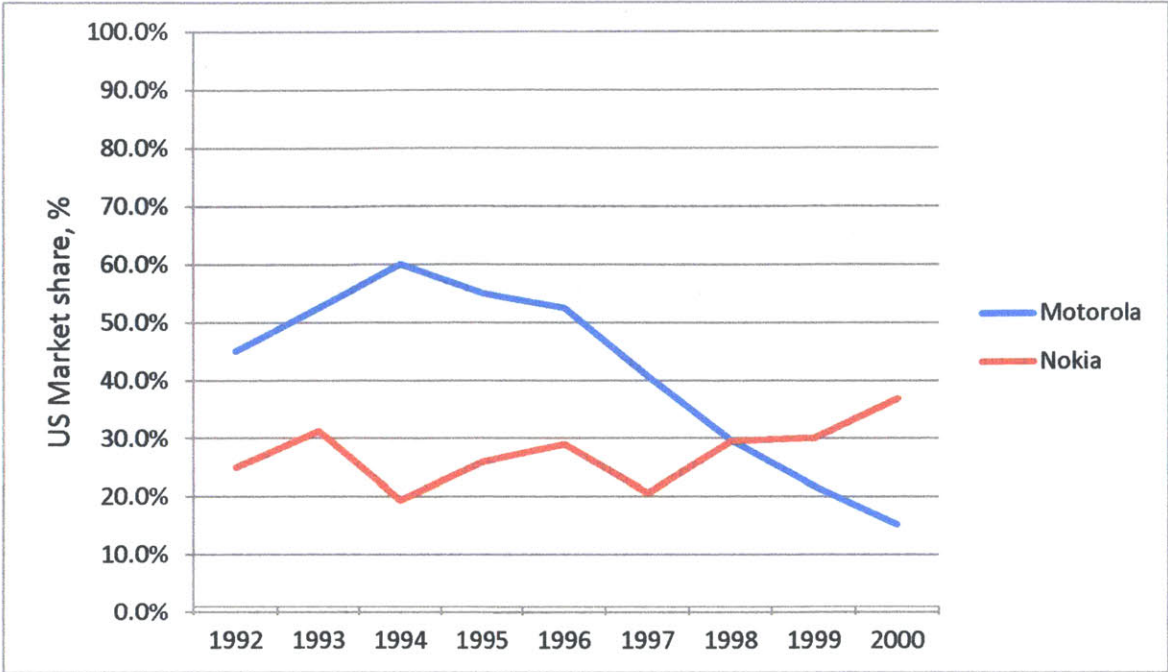


Figure 2-7. US Mobile Phones Market Share

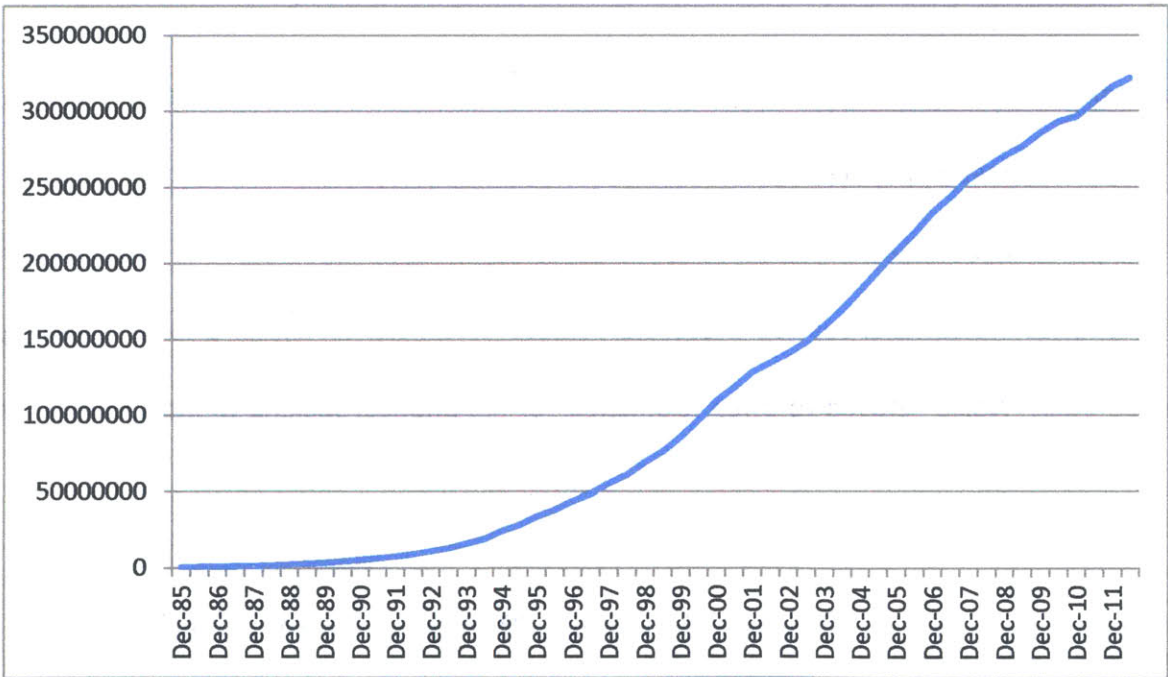


Figure 2-8. Total Subscriber Connections in the US

Data in Figure 2-7 and Figure 2-8 is from sources ^{40 41 42 43 44 45}.

ANDROID/APPLE VS. NOKIA/MOTOROLA (SMARTPHONES)

As much as Nokia has enjoyed its dominance after defeating Motorola in 1990s, it has made the whole lot of mistakes in the US market. In early 2000s, Nokia was taken over by its archrival Motorola before both ceded to new players such as Apple and Android.

Between 1998 and early 2000s, Nokia was a global leader of the world \$100bn mobile market with more than 30% market share. In the US, Motorola was defeated and Nokia enjoyed the growth of the subscribers. However, in the early 2000s, market forces began to change and Nokia had lost most of its momentum and market share. In Europe, where Nokia used to have a monopoly, the market share went from 51% in 2002 to 32.6% in 2004⁴⁶.

The mistakes made by Nokia were in part similar to those that Motorola made just a decade ago. First and most important mistake was almost completely identical – Nokia refused to adjust its phones to the US customers' requirements and instead insisted on the features it had for the phones worldwide. Just as Motorola refused to switch to digital phone, claiming it would be bulky, Nokia refused to offer "clamshell" or flip phones, sticking to mono-block form

⁴⁰ Nokia Mobile Phones Tops One Million in Unit Sales, 17 May 1993, Mobile Phone News Phillips Business Information, Inc., Vol. 11, No. 19

⁴¹ Nokia knocks on U.S. door; Nordic cellphone maker moves swiftly into number-two market share spot, 10 February 1992, HFD-The Weekly Home Furnishings Newspaper

⁴² Nokia gains mobile market share – paper, 6 February 1996, Reuters News

⁴³ BusinessWeek. 05/04/98, Issue 3576, p140-148

⁴⁴ U.S. handset sales grow while revenues lag, 12 February 1996, Mobile Phone News

⁴⁵ Gartner Dataquest

⁴⁶ Has Nokia Lost It?, January 24, 2005, FORTUNE Magazine, http://money.cnn.com/magazines/fortune/fortune_archive/2005/01/24/8234055/, Accessed 2013

factor to save manufacturing cost. “Nokia, at the height of its success, decided not to adapt its phones for the U.S. market. That was a mistake,” said Ari Hakkarainen, a Nokia business development executive from 1999 to 2007. “They are still trying to recover from this.”⁴⁷ In addition, Nokia refused to play by the rules of US wireless carriers, who wanted to control user experience and branding. They wanted to put their logo on the phone and customize the content. Nokia refused, mistakenly thinking that the situation is similar to Europe, where there are few hundreds of independent providers and the competition is fierce. In contrast, there are few carriers in the US, and Nokia underestimated the bargaining power. The major mistake was also the overlook of CDMA technology that is used by Verizon and Sprint, which led to automatic loss of half of the US subscribers. When eventually, Nokia decided to manufacture CDMA phones, it fell to the same mistake as Motorola before. Unwilling to pay to Qualcomm who was the monopolist on the market of CDMA chips, Nokia decided to manufacture the chips in house. After few years, Nokia had formed a joint venture with Sanyo to manufacture chips and had subcontracted the production of CDMA phones to Asia before finally admitting the failure and signing the deal with Qualcomm in 2006.

The iPhone introduced in 2007, made Nokia phones even less attractive and clumsier in terms of the interface. Since 2000s, accusations of patent infringing became increasingly more frequent, and the case of Nokia vs. Apple (considered in details in Chapter 3) was one of the

⁴⁷ Nokia Tries to Undo Blunders in U.S., October 18, 2009, The New York Times, <http://www.nytimes.com/2009/10/19/technology/companies/19nokia.html>, Accessed 2013

most interesting that took years and cost billions of dollars that could have been used for innovation instead.

By 2011, Nokia had less than 5% of mobile phones market share in the U.S., and Motorola was going down at mere 10% market share. At the same time, smartphones of Apple (about 20% market share) and Samsung (more than 20% market share) enjoyed increasing consumer preferences.

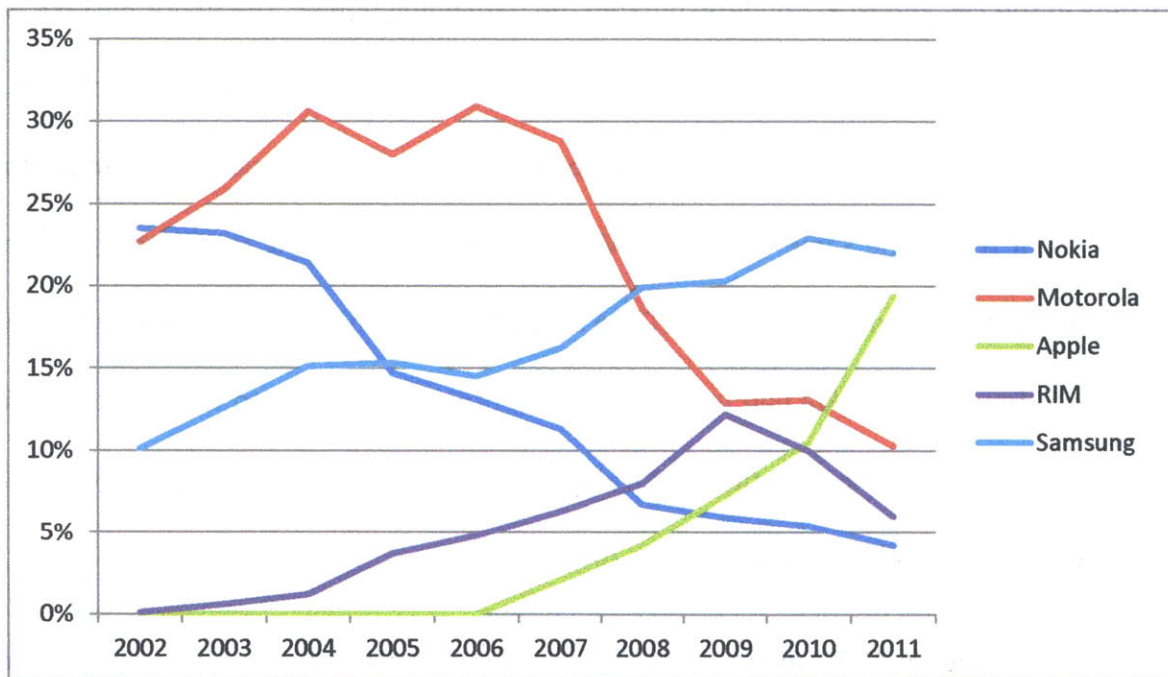


Figure 2-9. Company Shares in the US, Retail Volume. Source: Euromonitor

Both cases of disruption clearly show the influence of Firm factors as the main driver behind the outcome. Mistakes by Motorola in first case were replicated by Nokia in the second case, and led to the same outcome.

	Disruption	Co-existence	No disruption
Firm Factors	<p>BASIC PHONES / SMARTPHONES</p> <ul style="list-style-type: none"> • Inability to reorient resources to satisfy customer preferences (including that of providers) • Wrong focus on old technology (quality) as opposed to innovation 		
Product/Service Factors	<ul style="list-style-type: none"> • No network effect at play • High Innovation and Quality 		
Environment Factors	<ul style="list-style-type: none"> • Customers valued new features of digital phones and smartphones more than elegant look of older technologies 		

Table 2-10. Mobile Phones Case Analysis

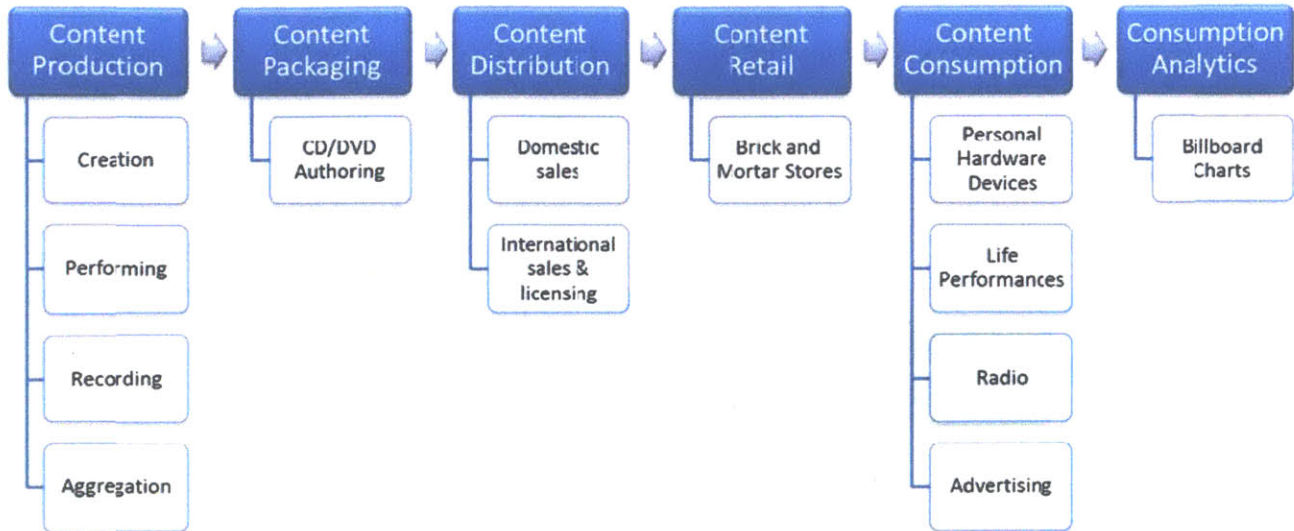
DIGITAL MUSIC

Based on interview with John Cate (TuneCore, eMusic)

The word “digital” in relation to content is oftentimes used to refer to different concepts. Fundamentally, it is important to differentiate between actual digitalization of the music that has been commercially introduced in 1982 when the CD became available, and MP3 files that emerged as a phenomenon in the early 1990s, but did not become really popular until high speed Internet had reached certain penetration of the market. Initially, MP3 was mostly used to rip the content of a CD for a personal use on a digital player, but eventually the Internet file sharing services such as Napster made the MP3 extremely popular and gave rise to the completely new industry and the mode of content consumption. It is this latter version of the word “digital” that will be used in this case. We are going to look at two players –TuneCore and eMusic that were reshaping traditional music value chain with new disruptive product – digital audio content.

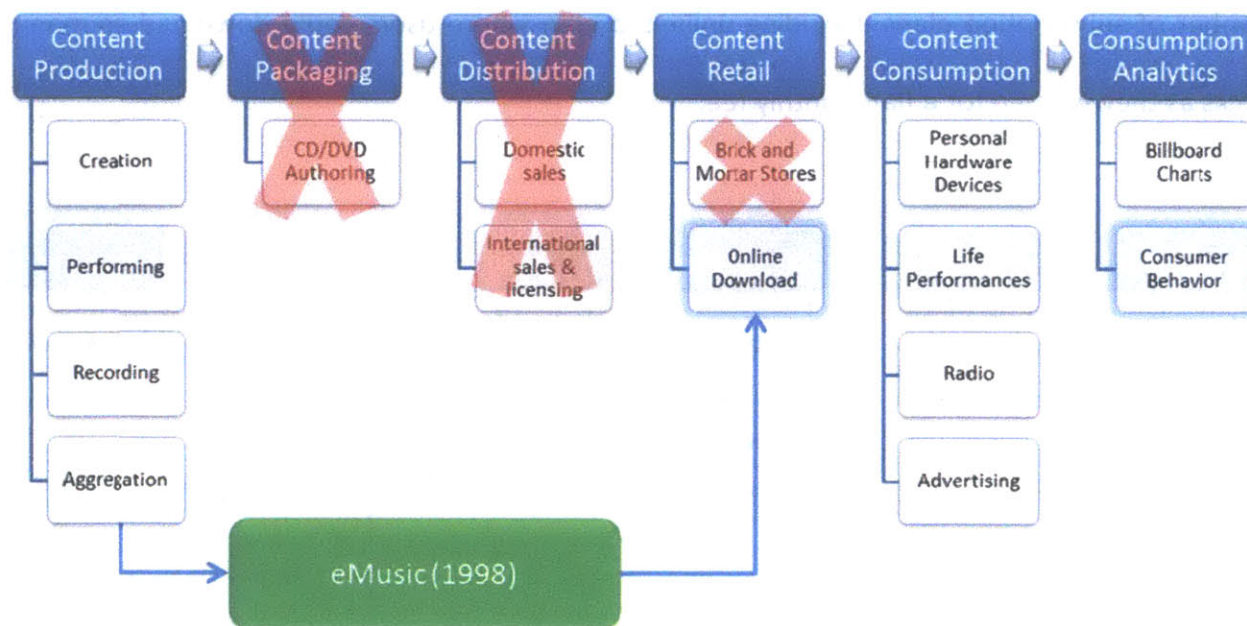
At the same time as MP3 was gaining popularity, one of the first players who wanted to capture the value from new product, was online music store eMusic established in 1998 by Bob Kohn (legal affairs) and Gene Hoffman (Pretty Good Privacy, PGP). Initial piracy concerns and implications were not clear and the company’s decision was to ignore all the encryption, as Gene Hoffman coming from the encryption company was sure that it could be broken anyway. The model that was offered by eMusic was the only one available at that time, but that is quite rare nowadays – download to own. Streaming was far away back then and the technology limitations (bandwidth and traffic caps) were effectively making it useless. eMusic offered a

number of subscription plans, including unlimited plan where users could download as many tracks as they wanted for a flat monthly fee.



The diagram above (Figure 2-10) shows the value chain in music production, distribution and retail sales in a world of physical media, such as CDs. In this standard value chain, all the content production was effectively aligned with physical steps necessary to get the content delivered to a consumer. Each of the links was very well occupied and served by well-established companies that were using the same business processes for years. The same value chain was used for LPs, and CDs did not alter the value chain, as the properties of the product remained the same – physical object with encoded music (analog encoding for LPs vs. digital encoding for CDs).

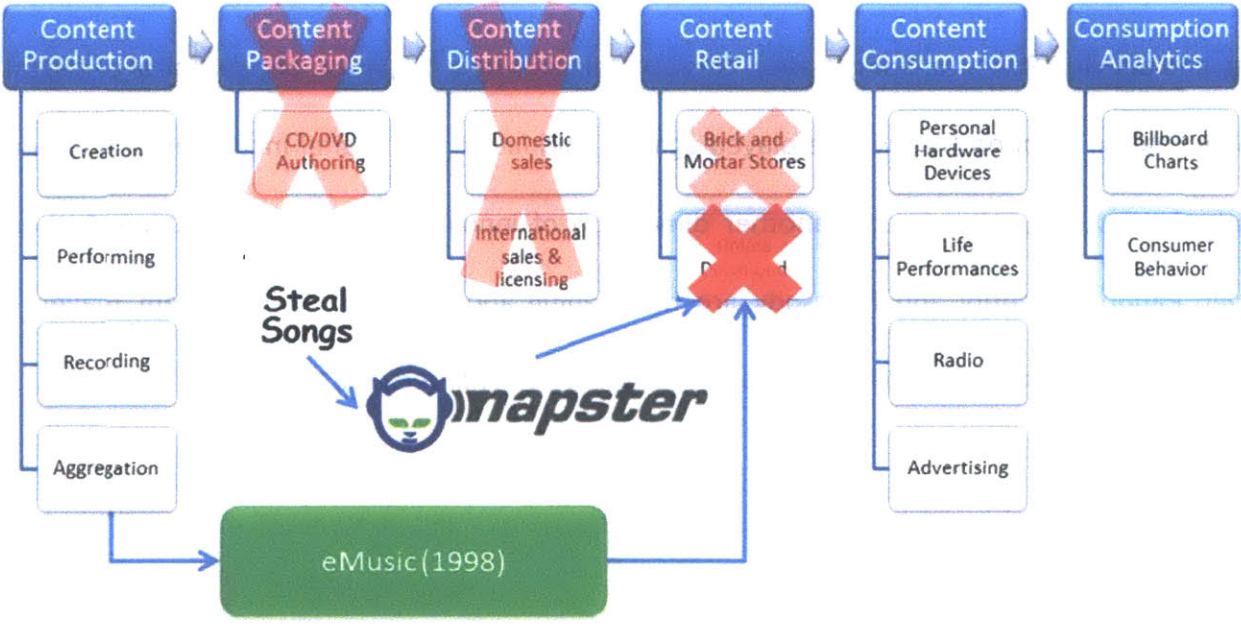
When the digital distribution was introduced, it changed the picture significantly. Figure 2-11 shows new “shortcut” that was enabled by emerging properties of new digital content.



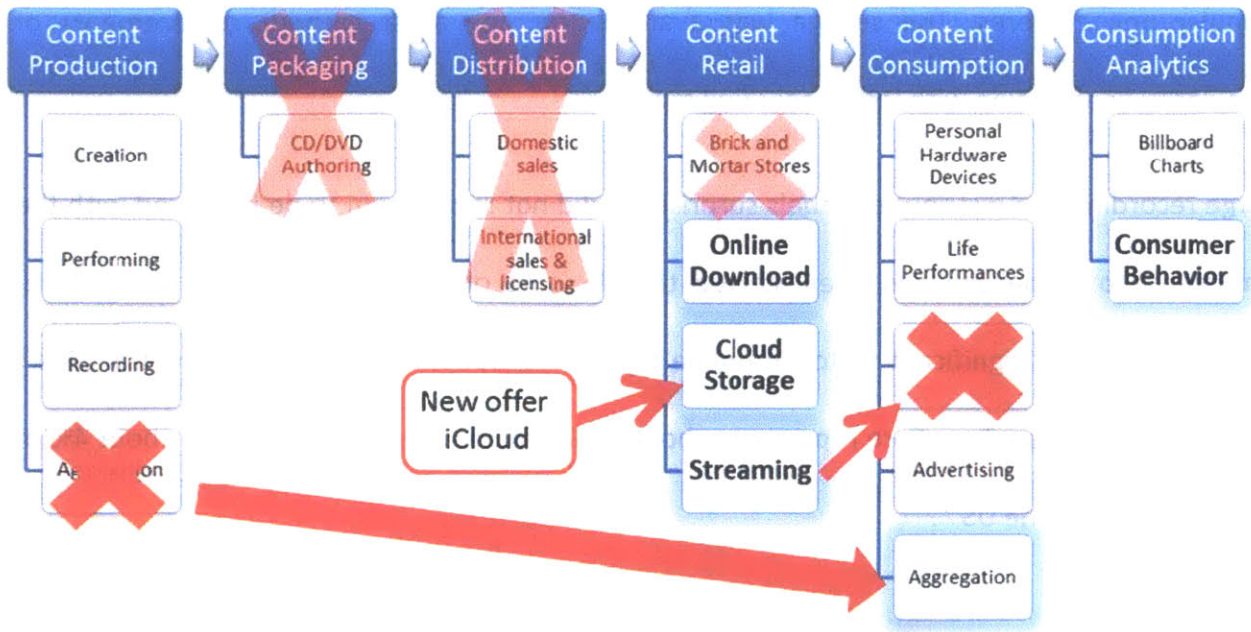
Content Packaging, Distribution, and Retail were disrupted in the new digital value chain by online stores, such as eMusic, iTunes, and later Amazon, Spotify, Rhapsody etc. The single step that became important after content production was “download,” which eliminated the need for multiple players along old traditional value chain. As an additional “complementary” value, new distribution mode allowed for better collection of consumption data and its further analysis that was previously done by third party agencies based on surveys and indirect data. Now, it became possible to get exact understanding of the consumption patterns of different customer groups. In short, eMusic was a Value Chain innovation based on new digital Value Chain architecture.

Popularity of MP3 and excessive demand for new innovative digital content spurred number of alternative attempts to disrupt traditional value chain, with Napster being one of them. In a

sense, this could be considered as a separate case, where eMusic would be an incumbent and Napster an entrant disrupting it. However, in our opinion, Napster was an environmental change (or change in the market preferences) that capitalized on consumer’s sensitivity to price. Napster dropped the price of the content to zero. Therefore, we believe Napster was not an entrant in the traditional sense, but it promoted a new class of entrants by dramatically reducing the cost of redistribution. Such redistribution of media was always possible with photocopying (for print media), cassette/CD copying (for music and video), but distribution of such activity was limited to physical contact. Napster overcame this limitation. Figure 2-12 shows how the content download was eliminated from the value capture by offering the content at no cost.



After Napster and other file sharing services started to threaten the revenue stream of artists and labels, Recording Industry Association of America (RIAA) attempted to fight Napster by suing and taking down the service. As the result of number of litigations, Napster and similar services were shut down. These and other similar actions led to a number of legislative initiatives (such as Digital Millennium Copyright Act or DMCA) aimed at preventing piracy and attempting to establish new ways to control the revenue stream in the new value chain. When iTunes decided to recapture the value of digital content, it managed to revitalize customers desire to pay by offering very convenient way of making a purchase from the mobile device, and different price structure. Today, an interesting new trend emerges, which takes on the content production domain, i.e. customers are taking on the Aggregation role by creating their own personalized playlists and adjusting the stations to their habits, mood, and the time of the day and activity (Pandora, Songza etc.). This can certainly be a beginning of new spiral of digital value chain disruption that will be played against “old-fashioned” digital incumbents. Coupled with cloud storage, it presents another dimension of innovation at the content production level. Pandora, Spotify and Rhapsody are threatening another classical incumbent player -- radio stations, by offering various forms of streaming personalized content.

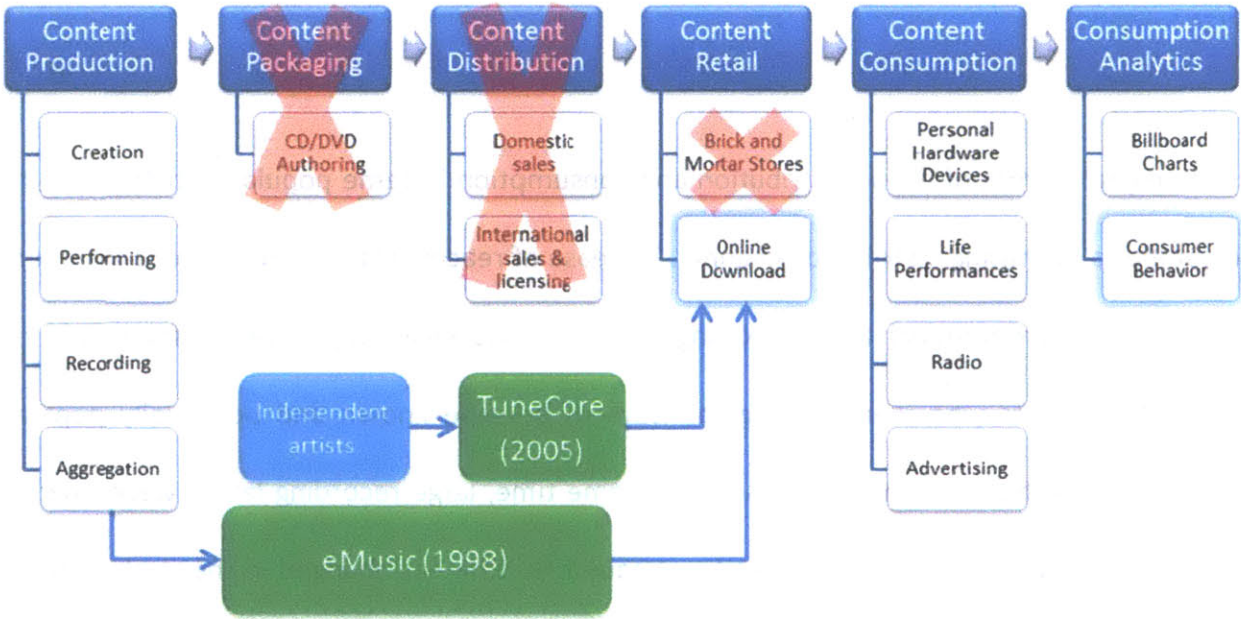


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As the digital format of music distribution and consumption became popular, artists began to look at it as a promising distribution channel. The ease of reaching large audience of consumers without costly promotional and marketing expenses was especially lucrative for young or independent artists who were looking for ways to become known and potentially popular among music enthusiasts and listeners. At the same time, large recording labels were slow at adopting these new features of MP3 and consequently, little has changed in their value chain. In this fertile environment, a new company called TuneCore was established by Peter Wells and Gary Burke in 2005. Before TuneCore, independent artists did not have a chance to sell their music to the majority of customers through popular retail channels. Distribution companies just would not deal with them claiming that it is too much work for too little return. When TuneCore was created in 2005, the company came up with the idea to have flat fee for an album (\$50) or a single (\$9.99) per year for putting the songs on iTunes, Amazon, and other

popular online stores. The service was available for any artist without requirements of popularity or affiliation with large recording studio.

Large recording and distribution labels surprisingly did not really seem to be bothered with the emergence of TuneCore and even started to sell some of the music through it. By 2008, TuneCore became significant factor in online music distribution and in 2009, Universal Music invested in it. Today, TuneCore represents about 10% of iTunes song and is behind about 4% of all digital sales in the US⁴⁸.



⁴⁸ Out to Shake Up Music, Often With Sharp Words, May 6, 2012, The New York Times, <http://www.nytimes.com/2012/05/07/business/tunecore-chief-shakes-up-music-with-his-own-words.html?hp& r=0>, Accessed 2013

As opposed to eMusic, TuneCore was a business model innovation, not Value Chain innovation.

It used digital value chain to offer independent content creator the access to customers.

Case Analysis

Core Innovation – Digital Music Value Chain

	Disruption	Co-existence	No disruption
Firm Factors		<ul style="list-style-type: none"> eMusic/TuneCore facilitated the inclusion of long tail of content production, and were welcomed by the incumbents (e.g., Universal, iTunes). As a result, they did not invoke competitive response from the incumbent 	
Product/Service Factors	<ul style="list-style-type: none"> CDs had very weak network externalities since a user does not benefit from other users having CDs. This is why CDs were easily disrupted by MP3 files 		
Environment Factors	<ul style="list-style-type: none"> Consumers highly price sensitive and willing to adopt innovations with low quality and compatibility 	<ul style="list-style-type: none"> Consumers value availability over quality/innovation, or are willing to tradeoff quality and innovation 	

Table 2-11. MP3 vs. CD Case Analysis

	Disruption	Co-existence	No disruption
Firm Factors	<ul style="list-style-type: none"> • Entrants have far superior cost structure 		
Product/Service Factors	<ul style="list-style-type: none"> • Napster introduced strong direct network effects, where one user's music collection became far more valuable to other users 		
Environment Factors	<ul style="list-style-type: none"> • Napster was an environmental change that created new class of distributors, and dramatically dropped value of traditional distribution channels (a critical complementary asset for traditional content incumbents). It exposed consumer's high price sensitivity and low quality sensitivity that were always present, , thus displacing many entrants until the next value proposition was found by iTunes etc. 		

Table 2-12. Napster vs. Paid MP3 Case Analysis

Case Discussion

Both eMusic and TuneCore used new digital value chain to provide service to customers and both were quite successful. In both cases, we can clearly observe technological disruption with local equilibrium as of now with CDs and DVDs as music content media, with no industry disruption potentially attributable to the availability of corporate resources and abilities to strike good deals with content production.

Here it is important to elaborate on the concept of equilibrium. Inarguably, in the double helix environment where all the advantages are temporary (Fine, 1999), the definition of equilibrium

is largely dependent on the time horizon chosen for analysis. We can speak about equilibrium when the case leads to customer segmentation (each segment with different sets of preferences), but even seemingly stable equilibrium is still temporary, as new entrant might still displace the incumbent by luring out the incumbent's customers to the other segment. However, it is not direct competition per se, but more of a discovering and satisfying latent needs and separating previously unified customers.

There are rarely cases, when innovation does not create such customer segmentation. When the mechanical typewriters were substituted with electrical ones, they clearly offered better user experience; however, one can argue that there were still customers who needed to use them where there is no access to power, hence leaving some market share for the incumbents. Another example is dot-matrix printers that rarely anyone uses now at home, but that are still being used by some airlines to print tickets and other documents using carbon copy paper. These examples illustrate the fact that there is always local equilibrium in the disruption or no disruption scenario, but its duration depends on the actual customer preferences and the magnitude of split introduced by new product or service features. Local equilibrium should not be confused with actual co-existence when there is persistent customer segmentation of customer preferences (such as business travelers and homemakers), which respond to different product features.

TELECOM PROVIDERS

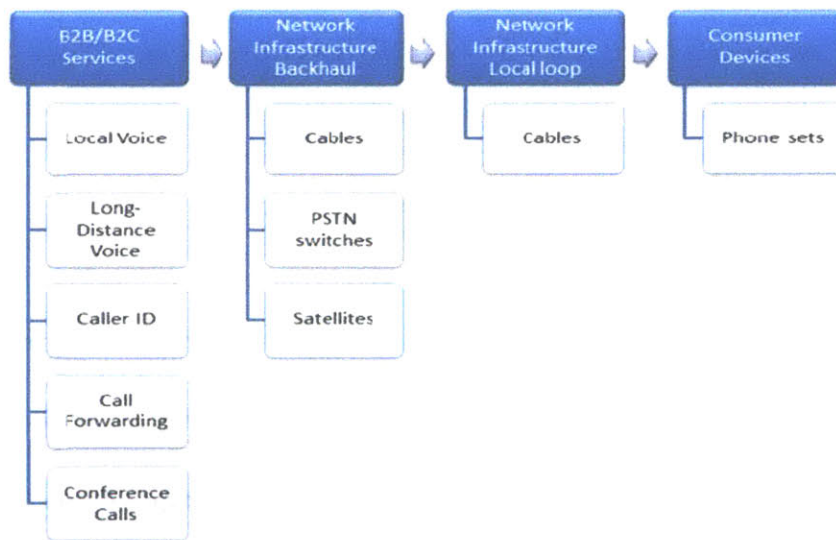
Based on interview with Roberto Saracco (Telecom Italia)

All telecom providers are now facing disruption of their traditional business model that has been based on offering services to the customer over the network. The competition forced telecom providers to cut prices, while regulatory actions decreased roaming charges and forced telecom companies to unbundle the loop (last mile) and make it available to other players, thus destroying main competitive advantage – customer base. The main disruption in telecom industry today is that the service has shifted from being offered by the network to being delivered by third parties over the same network. This very interesting case reveals some peculiar business dynamic. In addition to major financial losses occurring due to the loss of traditional services that were offered by telecom companies (such as call forwarding, long-distance calls, and multi-party conference calls) to various third party providers including Skype et al., investments in new infrastructure with higher bandwidth and capacity offer less ROI than ever. New innovative features such as video content delivery had failed to deliver financial benefits. Telecom companies had initially planned to use broadband data channels to deliver more paid services to the customers. However, it turned out that the services were not appealing enough to win the majority of the market or compete with content owners, who can sell their own content through data channels built by telecom companies.

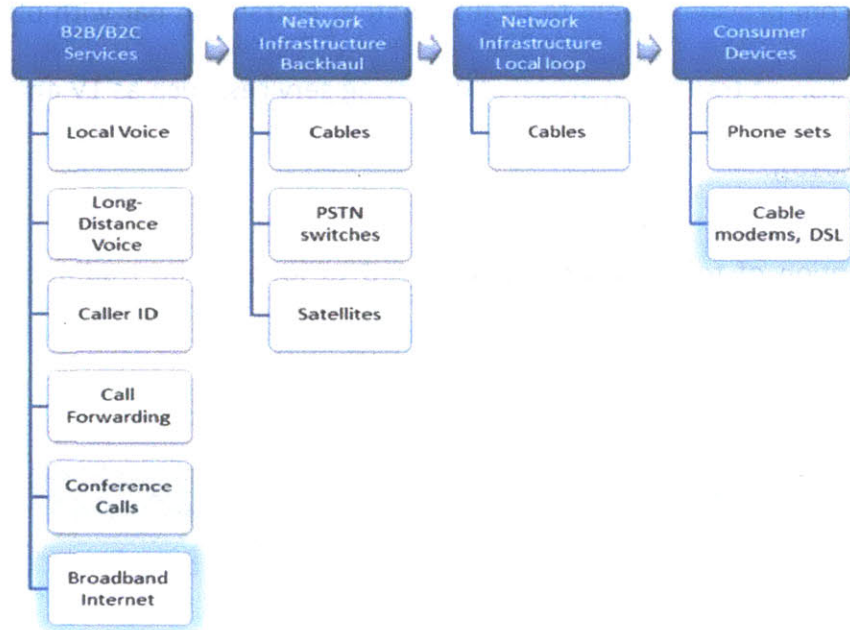
On a closer observation, we can see that this case can be split into few separate cases. In case of traditional telecom services, it is clear that telecom providers are being disrupted by new entrants such as Skype and others. However, in case of complementary services (such as video

distribution), telecom providers seem to be just another entrant on par with other companies that are trying to disrupt traditional model of delivering services, such as TV and movies (more on that in (Klym, 2013)).

Considering disruption of telecom services, we need to look at the traditional analog PSTN Value Chain (Figure 2-15).

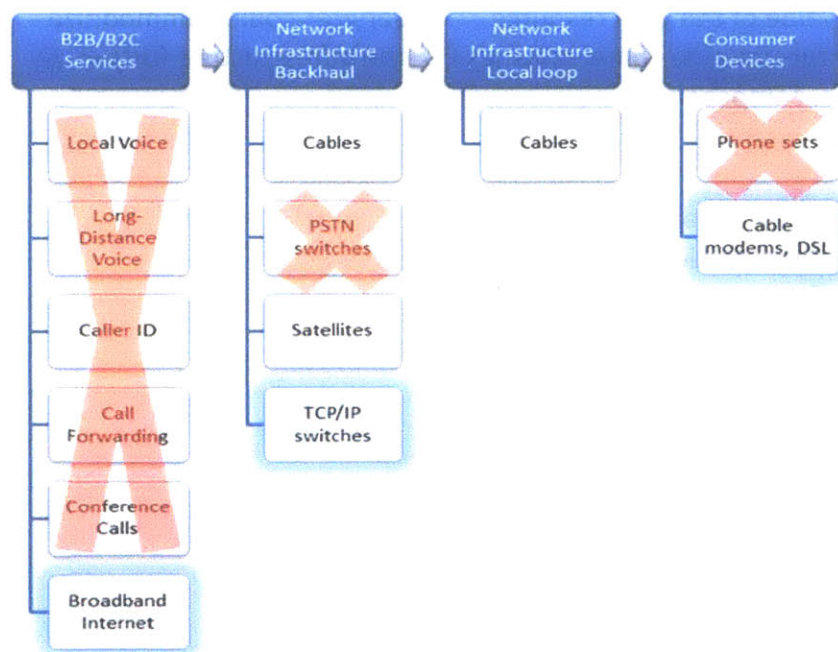


In this value chain, services were tightly coupled with the network that controlled the transport and user experience. Later, when some digital equipment was introduced (Figure 2-16), nothing really changed in the value chain (as in the first case of digital music, little has changed in the value chain when the CDs were introduced instead of LPs).



The picture was completely different when TCP/IP value chain started to become dominant. As shown in Figure 2-17, the whole domain of services and customer experience disappeared because of new communication principle offered by IP technology where interconnectivity between various segments of the network was key design requirement. There is an opinion that the shift of computing power to the edges of the network, or increasing power of the terminals (user devices) that are now capable of offering services previously requiring tight integration with the infrastructure, is largely responsible for diminishing returns of telecom providers. While this is certainly true and we do observe significant increase in the intelligence and computing power of the terminals, the mere improvement in the computing power would hardly change the existing telecom value chain where services were tightly coupled with the network. Sufficiently powerful computers were already on the market in the 1990s, but with the absence of the Internet, they had to rely upon modems to convert digital signal to voice in

order to transmit it over providers' proprietary networks and connect to other computers. The online games emerged early, but with the absence of reliable connectivity offered by the Internet, they could not get traction. When the Internet emerged, it uncoupled the service from transport, and it became reasonable to further increase the power of terminals. The Internet created different value chain and enabled the evolution of new services decoupled from providers' networks.



Core Innovation -- TCP/IP Providers Value Chain

	Disruption	Co-existence	No disruption
Firm Factors	<ul style="list-style-type: none"> • Rising costs from race to invest in capacity • Dropping value of the core resource (infrastructure) due to complex issues (regulation, competition) 	<ul style="list-style-type: none"> • Incumbent's reorienting resources to over-the-top services could commoditize the infrastructure further 	
Product/Service Factors	<ul style="list-style-type: none"> • Majority of traditional services are offered by third parties for zero price and it is difficult to compete with Price equal to zero. This becomes possible because the traffic is cheap and advertisers see a lot of value • Elimination of Network effect due to interoperability (e.g. SkypeOut feature that destroyed the network effect of PSTN networks) 		
Environment Factors	<ul style="list-style-type: none"> • The environment is characterized by High sensitivity to Prices and Innovation. At the same time, users have Lower sensitivity to Quality willing to cope with some loss of quality if the innovation features are offered 		

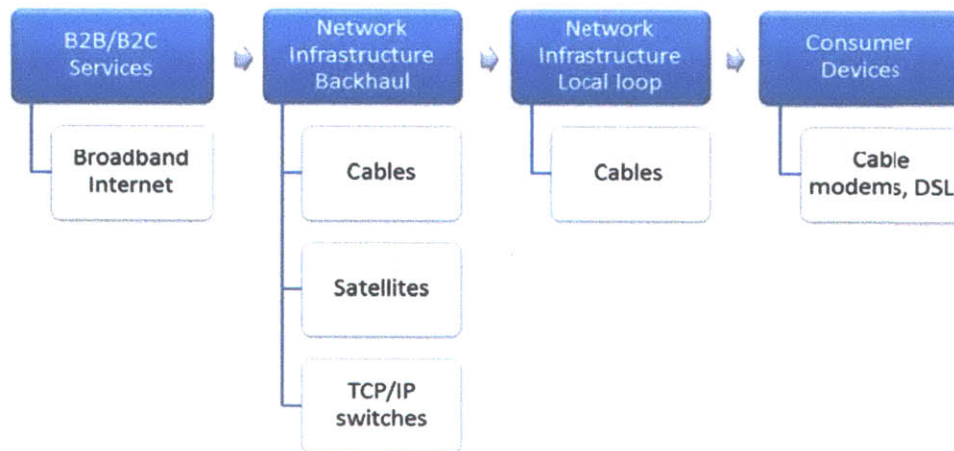
Table 2-13. Telecom Providers Case Analysis

With transport separating from service, the cost remains with the operators, but their revenues are shared. Despite investing money each year to double the capacity of their Internet channels, telecom providers sell less service and lose revenue and customers to third party service providers. Telecom companies are requested to provide more and more transport service and being distanced from offering complementary service to the customers with more peer to peer (or direct) connections established between end users. The service range has increased substantially and customers' needs evolved thanks to the Internet technologies. Eventually, conventional telecom companies could become simple network providers enabling other service companies to earn money from doing direct business with customers over the network.

WIRELESS VS. WIRELINE DATA

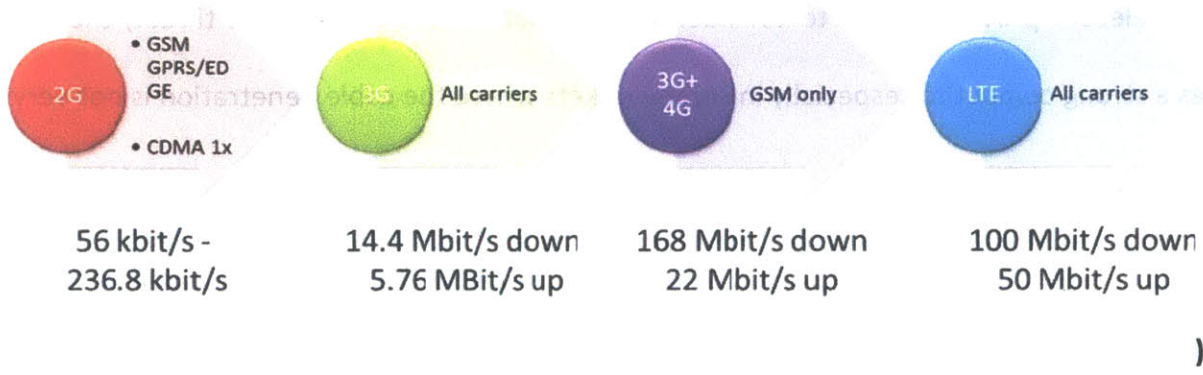
Based on interview with Tony Tauber (Comcast)

This case is looking at the potential disruption of wireline data services offered by cable companies such as Comcast, by LTE technology offered by Verizon and other wireless companies. For the data transmission, quality is high bandwidth and high reliability (in form of low latency, low jitter) and innovation is mobility (or coverage). Well-established Wireline Data value chain has been successfully beefing up quality by integrating various cable components when the main value proposition (data transmission) has always been using cable (to the end user device) owned by cable providers.

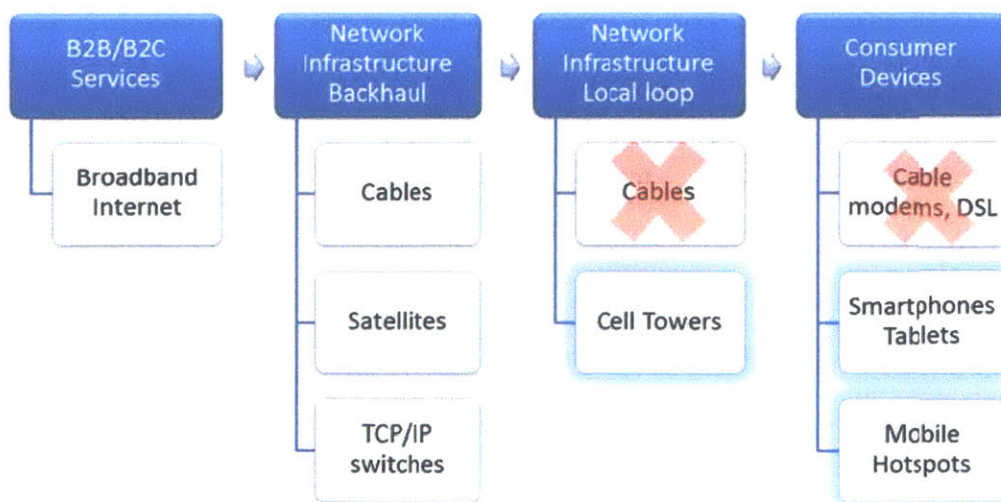


The data service offered by wireless carriers was always very slow and even though there was substantial push from the third parties offering various services on the go and also strong pull from certain segments of customers, such as business travelers and others valuing just-in-time information, the adoption had never been high up until the LTE technology emerged.

Figure 2-19 shows how the theoretical speed has changed in the last 20 years from very slow 2G networks to the latest LTE evolution that threatens to disrupt traditional cable services.

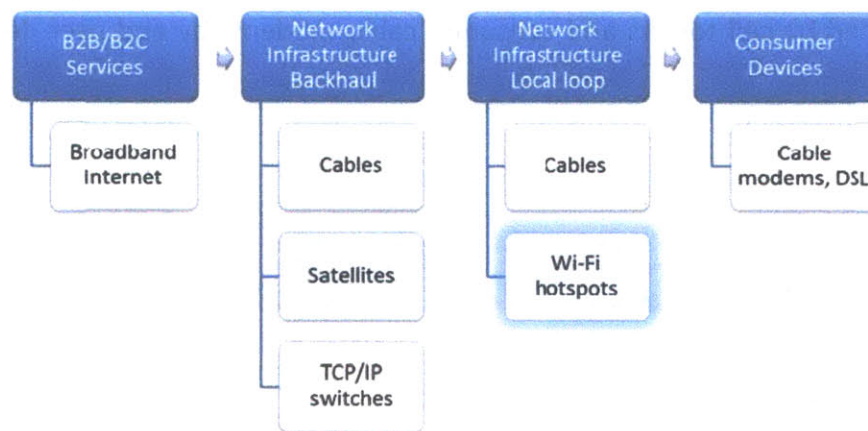


Since the introduction of wireless voice communication, wireless data was always a complementary feature, although with a very limited use due to the lack of quality. The Wireless Data value chain (Figure 2-20) looks very similar to the Wireline Data value chain with local loop displaced by cell towers and consumer cable modems by end user devices such as tablets etc.



For many years, cable companies could safely ignore wireless service as the competitor, as the speed effectively prohibited the adoption of the technology. However, with the evolution of data speed and commercial introduction of LTE in about 2011, it became increasingly clear that wireline telecom providers have to consider wireless data if not as a serious threat, then at least as a strong competitor especially in some markets where the cable penetration is not very high.

In response, cable companies are starting to introduce mobility features to remain competitive. This brings interesting dynamic of cable companies illustrating incumbent's product innovation. As an example, Comcast has recently introduced public Wi-Fi coverage for some customers. In the value chain, Wi-Fi hotspots are directly competing with cell towers as a local loop alternative (Figure 2-21).



Core Innovation – Wireless Data Value Chain

	Disruption	Co-existence	No disruption
Firm Factors	<ul style="list-style-type: none"> • The start of LTE constitutes the improvement in quality by new entrant – something that model suggests as “reorientation of resources to quality,” necessary step for entrant to defeat the incumbent 	<ul style="list-style-type: none"> • The Wi-Fi hotspots represent a competitive response from the incumbent in form of “reorientation of resources to innovation” 	
Product/Service Factors	<ul style="list-style-type: none"> • Entrant’s product has certainly evolved its quality • Switching costs from incumbent are very weak, consisting primarily of the email accounts associated with cable subscription. However, with more and more people switching their email over to Google or Yahoo, switching costs went to very low amount, consisting mainly of contractual obligations 	<ul style="list-style-type: none"> • Initial deficiency of quality in new entrant’s product (low bandwidth) with very distinctive innovative feature – mobility. If the wireless product would be able to increase quality and make it comparable, it would be clear case of disruption. However, there is technological limit to increasing quality of wireless service in terms of capacity • Quality and Reliability of incumbent’s product has increased about 10 times • Incumbent product has not changed the price: (\$40-\$50 per month for broadband for the last 12-13 years) while entrant’s price has increased substantially 	
Environment Factors		<ul style="list-style-type: none"> • Customers are not very sensitive to Network Effect, but are very fragmented in other three dimensions of Price, Quality, and Innovation and cannot be easily identifiable 	

Table 2-14. Wireless vs. Wireline Data Case Analysis

The network effect in this case is weak and is present on the new entrant side in an indirect form as user apps using high-speed data connection on mobile devices. Further analysis shows that users are very fragmented in the dimensions of price, quality, and innovation and cannot be easily identifiable. There is constant process of tradeoffs that customers have to make in order to represent their usage patterns. We suggest considering customer sensitivities in form of a rhombus using Price, Quality, Innovation, and Network Effect as the vertices whose distance from the center indicates strength of the sensitivity.

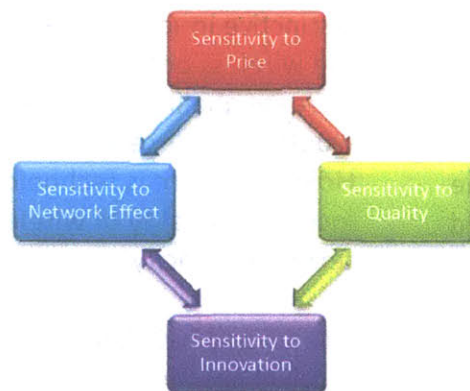
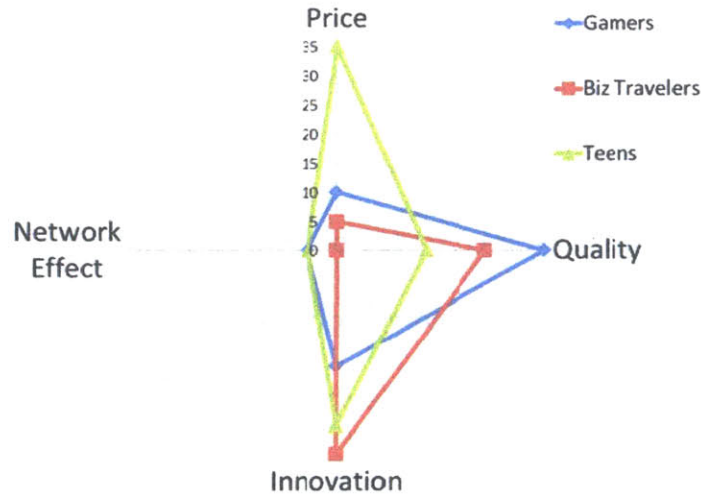


Figure 2-22. Customer Preferences

Consequently, customers can be divided in several macro groups that reflect major usage patterns. Hard core gamers, for example, would be less concerned with Price and Innovation (mobility), but more with Quality (speed and reliability). Business travelers would be more responsive to Innovation (mobility) ignoring Price and Quality (speed and reliability) to a major extent. In other words, the whole palette of possible combinations can be divided in areas

capturing characteristic behavior of certain groups of users. Diagram below (Figure 2-23) illustrates possible patterns behavior using empirical observations.



This ongoing case will keep unfolding for substantial amount of time, as the entrant has just started to offer good speed and capacity. However, capacity is very limited for wireless service. In the end, this could be a case of co-existence, as some of the customers would still need to use cables for most of their data consumption (i.e. given the adoption rate of online video content).

Chapter 3. IP PROTECTION COMPARISON IN DIFFERENT CLOCKSPEED

MARKETS

IP protection in general is a unique feature of the law landscape that aims at incentivizing innovations and keeping people and companies motivated to invest in new technologies, processes, and business models. The core idea of IP protection is to give companies strong incentive to invest in maturing a new technology, but also (and probably even in the first place) to ensure the technological progress of the society. If one company invents something, it enjoys protection for a certain amount of time, after which the invention enters public domain where others are free to use it. The length of this protection is from 20 (14 for design patents) to 70+ years depending on whether it is a patent or copyright protection. Generally, it works very well. People and corporations enjoy protection granted by the society in return for either disclosing their innovations (patents) or just publishing the forms or expressions (copyright). However, we will argue that these tools were very handy and applicable in the old type of industries that usually were quite slow and where inventions happened not very often and time to market was very long. In other words, copyright protection works very well in the slow clockspeed industries (or the industries that evolve at slow rate as defined by Charles Fine (Fine, 1999)) such as aircraft, automotive, semiconductors.

In slow clockspeed market, users benefit from copyright or patent law in terms of both quality and innovation. Incumbent firms enjoy long period of sustainable demand while entrant firms are trying to invent completely new technology as current one is protected and can only be

either bought or licensed. Current players compete for customers by increasing quality of the product. Disruptive innovations occur when new company brings in new technology that is appealing to certain portion of customers, who value innovation more than quality. In such scenario, users are free to choose between old product that has a lot of quality and new product that has new features that might still be not really perfected. Majority of users are able to choose either old product and enjoy it for a long time, or innovative products that are offered by new companies at slow pace. The market share is defined by user preferences and their sensitivity to quality and innovation. If there were no copyright protection in this market, companies would have no incentives to innovate as they could as well just copy existing technology. New entrants would be eaten by large corporations who would immediately imitate their innovations as soon as they see a potential. Moreover, firms would be fiercely fighting to win the market share and do not have time to innovate at all. Here the length of the protection offered by the society is synchronized with the clockspeed of the market.

In fast clockspeed industry, where companies, products, and processes evolve very fast, the picture is quite different and IP protection becomes an inhibitor of both quality and innovation. 70+ or even 14 years of protection is quite lengthy period for fast clockspeed industries. The technology changes rapidly, and companies tend to introduce new features as soon as possible, patenting everything and using patents to exploit general inefficiencies of the copyright legislation and vagaries of the patent claims to pursue injunctions against other companies by claiming the rights to the pieces of technology that are crucial for customers to have full and complete experience. The fear of economic consequences of any litigation (that is about \$5MM on the average) threatens any small to mid-size company, and forces it to use resources to find

workarounds about patents or copyrights, and thus effectively limits the innovations that would improve the final product. In other words, IP protection creates huge redundancy in fast clockspeed markets when multiple companies are effectively trying to invent the bicycle to circumvent patents of other companies. It also leads to the dilution of quality, as companies are forced to keep reducing time to market sacrificing quality of the product and sticking to “good enough” concept that is very vaguely defined.

We do not blame the IP protection per se. It is necessary and always worked and still works in slow clockspeed industries. However, fast clockspeed industries suffer from the length of the protection offered by law that was created for slow clockspeed markets. In fast clockspeed market, if there were no IP protection or it was more agile (i.e. offering less protection time), the companies would be able to use older inventions (with no or expired protection) and complement them with own innovations delivering much better and richer product and improving overall user experience. These fast iterations could go back and forth allowing companies to improve their own products based on work of others. Open source movement clearly demonstrates the viability of this approach in super-fast clockspeed software market. Of course, the most criticism goes around the fact that companies are afraid of not being compensated enough for innovating and improving. However, the business model could be developed around the idea of customizations of the product or improving specific product features depending on the particular market segment by developing core competency and effectively becoming renowned authority. This model has been successfully used by many companies working with open source software.

SPECIFICS OF MOBILE MARKET LITIGATIONS

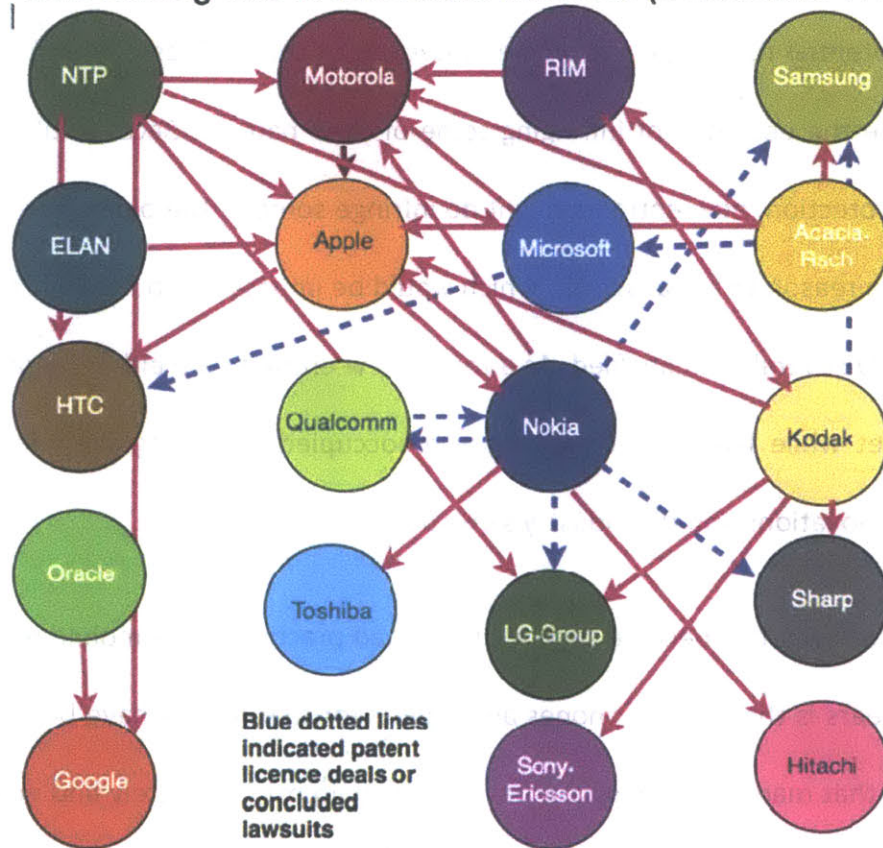
Of course, mobile business, being very fast clockspeed industry where scale of technology changes is incredible, reveals very interesting dynamics in response to existing IP protection. Copyright litigations in the mobile business turned into fierce battles over who is controlling the customers. Since it became so obvious that as soon as a cool feature is introduced in the mobile space, it has potential to change the whole landscape of the business, incumbent companies are trying to sue the entrants for infringing some of their patents. Because of the substantial length of the protection, new entrants might do infringe some of the older patents, or at least there might be a reason to file a lawsuit, which would be impossible to fund for any entrant let alone if there are several lawsuits filed. As a result, new entrants are either bought or expelled from the market while larger incumbents are preoccupied defending their fences, and the clockspeed of innovations and the industry slows down.

The partial reason why this became such a widespread practice in the mobile market over the last couple of years is that mobile phones and tablets for that matter have become a new hot market shifters that managed to displace basic phones almost completely and now threaten to significantly reduce desktop PC market. Of course, PC will be there for many other applications, but even the best stronghold of desktop PCs is now under fire as some companies are beginning to consider buying tablets instead of PCs⁴⁹. As these two markets merge to

⁴⁹ As PCs Wane, Companies Look to Tablets, August 19, 2011 , The New York Times, Available at: <http://www.nytimes.com/2011/08/20/technology/as-pcs-wane-companies-look-to-tablets.html?pagewanted=all>, Accessed 2013

smartphones/tablets market that is so lucrative for newcomers and incumbents, consumers start to feel waves of court decisions erupting from hot litigation volcano virtually every day. Here and there, injunctions are issued by the courts and the products are either blocked from import or removed from the stores in different parts of the world^{50 51}.

Who's suing who in the mobile business (8 Oct 2010 11.20)



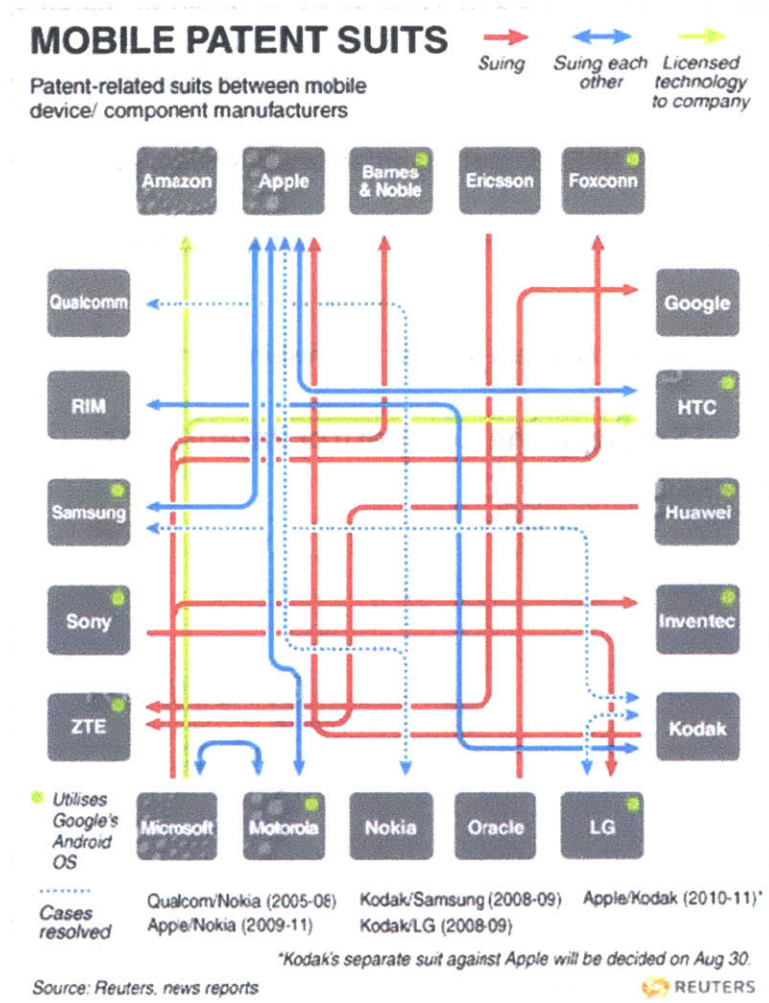
pleted

⁵⁰ Motorola wins iCloud injunction; iPhone, iPad temporarily pulled from online store, February 3, 2012, ZDNet, Available at: <http://www.zdnet.com/blog/london/motorola-wins-icloud-injunction-iphone-ipad-temporarily-pulled-from-online-store/2856>, Accessed 2013

⁵¹ Who Are The Real Losers In Patent Lawsuits?, August 31, 2011, InformationWeek, Available at: <http://www.informationweek.com/news/mobility/business/231600529>, Accessed 2013

The mobile market is full of clashes surrounding main players – Android and iOS. Mind-boggling infographics below illustrates snapshots of the litigations in the mobile space, Figure 3-1⁵², Figure 3-2⁵³, Figure 3-3⁵⁴, Figure 3-4 and Figure 3-5⁵⁵.

Apple has de facto become a center for the lawsuits as they have been trying to drive many products off the market and many companies replied with counter litigations. Role of Apple



⁵² <http://www.guardian.co.uk/technology/2010/oct/04/microsoft-motorola-android-patent-lawsuit>

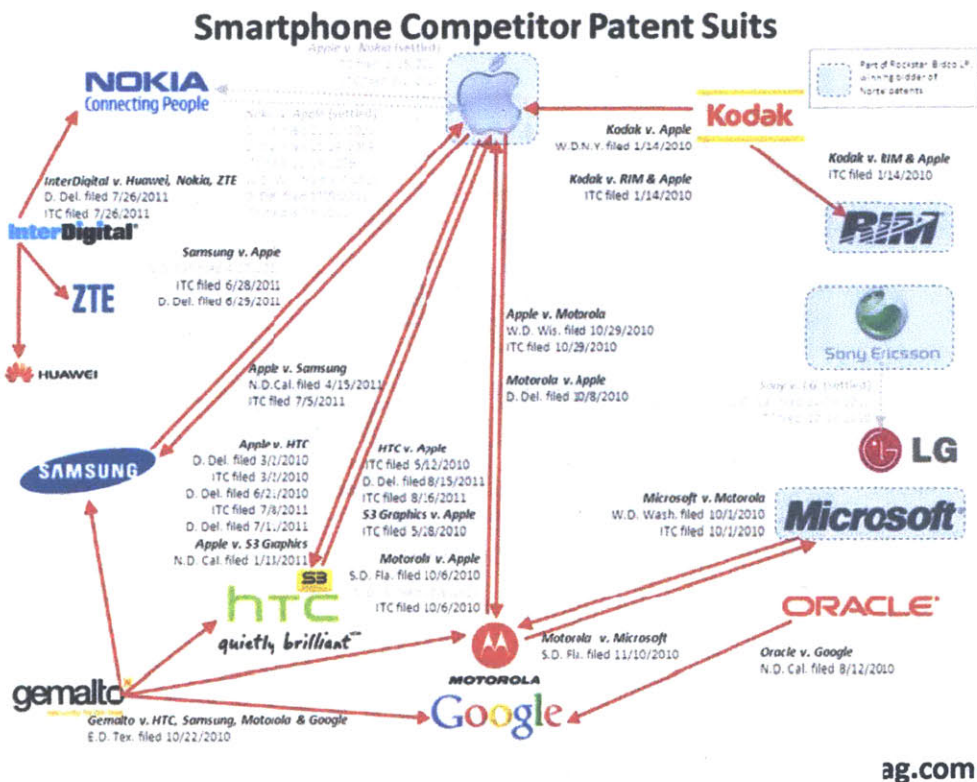
⁵³ <http://blog.thomsonreuters.com/index.php/mobile-patent-suits-graphic-of-the-day/>

⁵⁴ <http://www.fiercewireless.com/pages/chart-smartphone-patent-lawsuits>

⁵⁵ <http://www.pcmag.com/article2/0,2817,2399098,00.asp>

could be even more substantial if the fact that Apple has sold its patents to NPE (non-practicing entity or “patent troll”) Digitude Innovations⁵⁶ would be proven. This company has filed several suits with International Trade Commission alleging patent infringements by RIM, HTC, LG, Motorola, Samsung, Sony, Amazon, and Nokia. If these claims are confirmed, it can seriously affect the sales of the products of the a.m. companies on different markets. The only defense for many companies involved in litigations is to countersue the plaintiffs attempting to threaten their own products. However, NPEs do not manufacture anything, so it is impossible to defend against them by countersuing. The only settlement they accept is money or injunction.

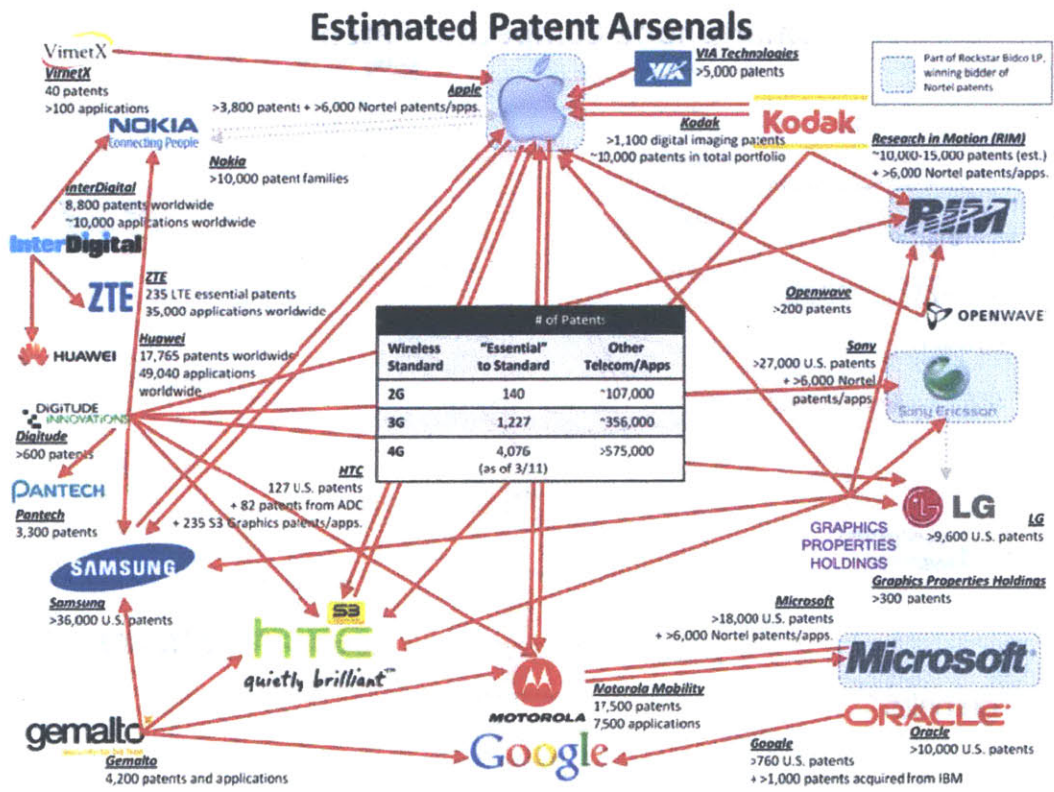
The two charts in Figure 3-3 and Figure 3-4 show astonishing dynamic of litigations documented



⁵⁶ Apple Made A Deal With The Devil (No, Worse: A Patent Troll), December 9th, 2011, TechCrunch, Available at: <http://techcrunch.com/2011/12/09/apple-made-a-deal-with-the-devil-no-worse-a-patent-troll/>, Accessed 2013

strategy, or at least not the only one. Litigations became centerpiece of the market strategy where technology is being pushed from the role of satisfying customer needs by improved performance or quality to a much less prestigious role of being mere servant of lawyers in the attempts to squeeze out royalties or destroy another company.

The acquisitions for many companies are now aimed not at improving competitive advantage on the market by acquiring new technology, but rather at improving patent portfolio to increase armor and stamina in litigation battles. The chart on Figure 3-5 shows how many patents are held by each of the main players in mobile space. One interesting fact from this chart can be derived about recent acquisition of Motorola by Google. It is obvious, that given all the facts about litigations and the countermeasures in form of counter suing, Google has very



small defense power having only 1760 patents. Motorola, on the other hand, has more than 17500 patents and 7500 applications. Expanding portfolio of patents would certainly give Google substantial boost in its counter suing capability.

These facts clearly demonstrate how the companies are adopting obsolete IP protection system to the new fast clockspeed market and using it to maximize their profits not by utilizing their core competency and perfecting it by collaborating with other players, but by employing questionable practice of slowing down the clockspeed of the industry through litigations and squeezing out the competitors. Although it might seem appropriate for the single business entity that cares about maximizing its revenue, it should be treated as unacceptable as cartel agreements from the perspective of the regulators.

APPLE VS. NOKIA CASE STUDY

The above-mentioned dynamics of litigating is well illustrated by the case of Apple vs. Nokia. Two leading mobile phones companies at the time fought about portfolio of patents that were allegedly infringed by both parties.

Step 1

The case started by Nokia that sued Apple on 10/22/2009 in United States District Court in Delaware claiming the infringement on 10 patents related to GSM, UMTS.(3G) and Wi-Fi (IEEE

802.11) technologies⁵⁷. The patents in questions were U.S. Patent Nos. 5,802,465, 5,862,178, 5,946,651, 6,359,904, 6,694,135, 6,775,548, 6,882,727, 7,009,940, 7,092,672, and 7,403,621. Nokia mentioned that prior to filing the suit it had licensed its technologies to 40 other companies while Apple refused to negotiate the appropriate license fee⁵⁸. Actual Nokia complaint⁵⁹ cites Nokia's argument to license its patents under FRAND terms (i.e. fair, reasonable, and non-discriminatory). These patents were obtained by Nokia while working on the GSM, UMTS, and Wi-Fi standards and, since they are necessary for any company to use any of these three technologies and since iPhone uses all of them, Apple should pay for licensing the patents.

This is Nokia's side of the story. However, in order to understand if this claim is substantial enough, in other words, if the patents are essential for the GSM, UMTS, and Wi-Fi technologies, it is necessary to evaluate them. The GSM and UMTS standards have been developed by the European Telecommunications Standards Institute (ETSI) and Wi-Fi was created under IEEE. Under the terms of the standard development procedure, all members have to disclose if they have the patents that are essential for the new standard. However, there is no verification process if the patents claimed by a company are really "must have" for the implementation. The drawback is that every company is trying to claim that it has essential patents hoping to get royalty payments from anyone who wants to use the standard. Research firm called Fairfield

⁵⁷ In Lawsuit, Nokia Says iPhone Infringes Its Patents, October 22, 2009 , The New York Times, Available at: <http://www.nytimes.com/2009/10/23/technology/companies/23nokia.html>, Accessed 2013

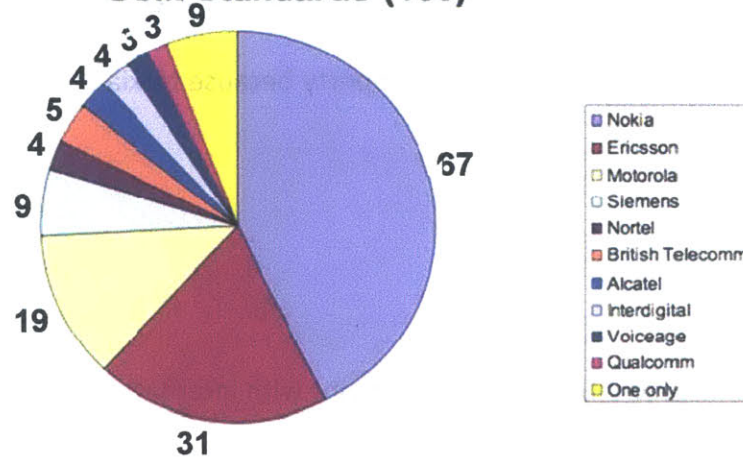
⁵⁸ Nokia sues Apple, says iPhone infringes ten patents, October 22, 2009, Engadget, <http://www.engadget.com/2009/10/22/nokia-sues-apple-says-iphone-infringes-ten-patents/>, Accessed 2013

⁵⁹ Available at: <http://podcasts.aolcdn.com/engadget/files/21458614-Nokia-vs-Apple-Complaint.pdf>, Accessed 2013

Resource International⁶⁰ has evaluated all of the patents for GSM standards and found that Nokia does indeed hold a majority of these patents, Figure 3-6. The independent expert judgments are consistent for UMTS and Wi-Fi as well.

The potential implications for Nokia might have been enormous. The wholesale price of iPhone to carriers was \$600 and even 2% royalty would be \$12 per each phone sold. With 34 million iPhones sold as of the date of the filing of the suit, it would represent about \$.4bn. Nokia claimed it has invested more than \$60bn over the last 20 years in the development of GSM and UMTS technologies.

Patent Families Judged as Essential to GSM Standards (158)



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⁶⁰ Analysis of Patents Declared as Essential to GSM as of June 6, 2007, December 31, 2007, Fairfield Resources International, Available at: http://frlicense.com/GSM_FINAL.pdf, Accessed 2013

Step 2

On 12/11/2009, Apple countersued Nokia in United States District Court in Delaware. Apple denied the infringement on all the patents and claimed that Nokia attempted to copy the iPhone and infringed 13 patents of Apple. The infringing Nokia models were S60, E71 and 5310. Apple asked for a dismissal of Nokia's complaint and wanted Nokia to pay damages for infringements. Patents in questions were⁶¹ 5,634,074, 6,343,263, 5,915,131, 5,555,369, 6,239,795, 5,315,703, 6,189,034, 7,469,381, RE 39,486, 5,455,854, 7,383,453, 5,848,105, and 5,379,431.

The counterclaim text⁶² accuses Nokia of seeking "to gain an unjust competitive advantage over Apple by charging unwarranted fees to use patents that allegedly cover industry compatibility standards and by seeking to obtain access to Apple's intellectual property." It also claims, "Nokia needs access to Apple's intellectual property because Nokia has copied and is now using that patented technology."

Step 3

On 12/29/2009, Nokia filed infringement complaint with International Trade Commission (ITC)⁶³ claiming Apple is infringing on seven Nokia patents involving iPhone, computers, and iPods. The patents in questions include United States Patents 6,834,181, 6,895,256, 6,518,957, 6,073,036,

⁶¹ Apple Countersues Nokia for Copying iPhone (Plus Disputed Patents and Full Text of Counterclaim), December 11, 2009 , AllThingsD, Available at: <http://allthingsd.com/20091211/apple-countersues-nokia/>, Accessed 2013

⁶² Available at: http://i.i.com.com/cnwk.1d/i/ne/pdfs/AAPL_NOKCountersuit.pdf, Accessed 2013

⁶³ Letter to Marilyn R, Abbott, Secretary, USITC, December 29,2009, http://stadium.weblogsinc.com/engadget/files/nokia_apple_itc.pdf, Accessed 2013

6,262,735, 6,924,789, 6,714,091 and covered user interface (touch screen), camera, antenna, and power management technologies. Paul Melin, General Manager of patent licensing at Nokia said,⁶⁴ "Nokia has been the leading developer of many key technologies in small electronic devices. This action is about protecting the results of such pioneering development. While our litigation in Delaware is about Apple's attempt to free-ride on the back of Nokia investment in wireless standards, the ITC case filed today is about Apple's practice of building its business on Nokia's proprietary innovation." Nokia claimed that iPhone infringes on the patents that cover a "programmable voltage controlled oscillator," a way to combine speaker and antenna assemblies, a contextual linking of data from an "electronic message" that causes another app to open in order to handle that data (clicking a phone number in an e-mail to make a call). Nokia also claimed that the click-wheel on most iPods violates a patent on combining multiple inputs in one interface and that every Apple device with a built-in camera (including the MacBook) violates a patent on combining camera functions into a single chip⁶⁵. Nokia asked the ITC to ban imports of Apple mobile products such as MacBook, iPhone and iPod.

⁶⁴ Nokia files ITC complaint against Apple over patents, December 29, 2009, MarketWatch, Available at: http://articles.marketwatch.com/2009-12-29/industries/30682796_1_nokia-corp-itc-complaint-apple, Accessed 2013

⁶⁵ Nokia adds additional lawsuit in patent catfight with Apple, January 4, 2010, ArsTechnica, Available at: <http://arstechnica.com/apple/news/2010/01/nokia-adds-additional-lawsuit-in-patent-catfight-with-apple.ars>, Accessed 2013

Step 4

On 1/15/2010, Apple responded to Nokia by filing counter complaint with ITC⁶⁶ asking to block Nokia phones from entering the U.S. market. Apple claimed Nokia products infringed nine of its patents. Four of them were included in the initial filing with Delaware court in 2009, and five new were added: 5,455,599, 5,519,867, 5,920,726, 5,969,705, and 6,424,354.

Step 5

On 2/19/2010, Apple drops four patents that were included in ITC filing from its original claim in Delaware.

Step 6

On 2/24/2010, Apple files second lawsuit in Delaware confirming Nokia's infringement on nine patents, including four that were dropped five days earlier thus bringing this lawsuit in accordance to its ITC claim.

Step 7

On 3/3/2010, a federal judge in Delaware put two patent-infringement claims between Nokia and Apple on hold while the U.S. International Trade Commission tries to resolve the dispute.

⁶⁶ Letter to Marilyn R, Abbott, Secretary, USITC, January 15, 2010, Available at: <http://info.usitc.gov/sec/dockets.nsf/9398c30a938aa5ad85256f19007790c3/0cac5b094e812852852576ac0075ce9b>, Accessed 2013

Step 8

On 4/9/2010, court in Delaware splits the main case into three trials, which will begin in 2012.

Step 9

On 5/7/2010, Nokia filed a lawsuit against Apple filed in the Federal District Court in the Western District of Wisconsin arguing that iPhone and iPad infringe on five Nokia patents 6,317,083, 6,348,894, 6,373,345, 6,603,431, and 7,558,696. In a statement, Nokia mentioned, "The patents in question relate to technologies for enhanced speech and data transmission, using positioning data in applications and innovations in antenna configurations that improve performance and save space, allowing smaller and more compact devices. These patented innovations are important to Nokia's success as they allow improved product performance and design."⁶⁷

Step 10

On 6/28/2010, Apple files counterclaim in the Federal District Court in the Western District of Wisconsin claiming infringement of seven patents 5,946,647, 5,612,719, 7,710,290, 7,380,116, 7,054,981, 5,379,430, and 7,355,905.

⁶⁷ Nokia expands patent-infringement feud with Apple, May 7, 2010, FierceWireless, Available at: <http://www.fiercewireless.com/story/nokia-expands-patent-infringement-fued-apple/2010-05-07>, Accessed 2013

Step 11

On 7/21/2010, Nokia drops its 6,262,735 patent about link functions and applications on a mobile phone from ITC case⁶⁸.

Step 12

On 8/16/2010, Apple amends its counterclaim in Wisconsin and replaces patent 7,355,905 with the new one 5,946,647 that was granted three weeks before.

Step 13

On 9/17/2010, Nokia amends its claim in Wisconsin and adds two more patents 7,532,680 and 5,752,172 to the original 5 patents.

Step 14

On 9/27/2010, Apple files a lawsuit in London claiming infringement on nine UK patents and a lawsuit in Dusseldorf, Germany claiming infringement on nine German patents, the same European patents as in UK suit.

⁶⁸ United States International Trade Commission Order No. 23, July 21, 2010, Available at: [www.itc337update.com/uploads/file/PDF_072110-1\[1\].pdf](http://www.itc337update.com/uploads/file/PDF_072110-1[1].pdf), Accessed 2013

Step 15

On 9/30/2010, Nokia files counterclaim in Dusseldorf, Germany over infringement of four German patents. On 10/12/2010, Nokia adds 3 more patents to Dusseldorf case. On 10/25/2010, Nokia adds 5 more patents in a new lawsuit in Mannheim, Germany.

Step 16

On 10/28/2010, Apple drops three patents 5,519,867, 5,929,852, and 5,915,131 from its ITC claim.

Step 17

On 12/3/2010, Nokia makes counterclaim in London over four UK patents. Apple countersues Nokia in Mannheim, Germany over one patent and two utility models (i.e. fast track patent with less rigorous examination). Nokia Also files a lawsuit in The Hague, Netherlands over two patents infringements.

Step 18

On 12/6/2010, Nokia drops patent 6,073,036 from its ITC claim.

Step 19

On 12/15/2010, Nokia questions the validity of Apple patents in Dusseldorf case in Federal Patent Court of Germany. On 12/22/2010, Apple questions the validity of Nokia patents in Dusseldorf case in Federal Patent Court of Germany.

Step 20

On 1/6/2011, Wisconsin cases are transferred to Delaware.

Step 21

On 1/18/2011, Apple files to invalidate one Nokia patent in London case.

Step 22

On 2/22/2011, Apple drops patent 5,969,705 from its ITC case.

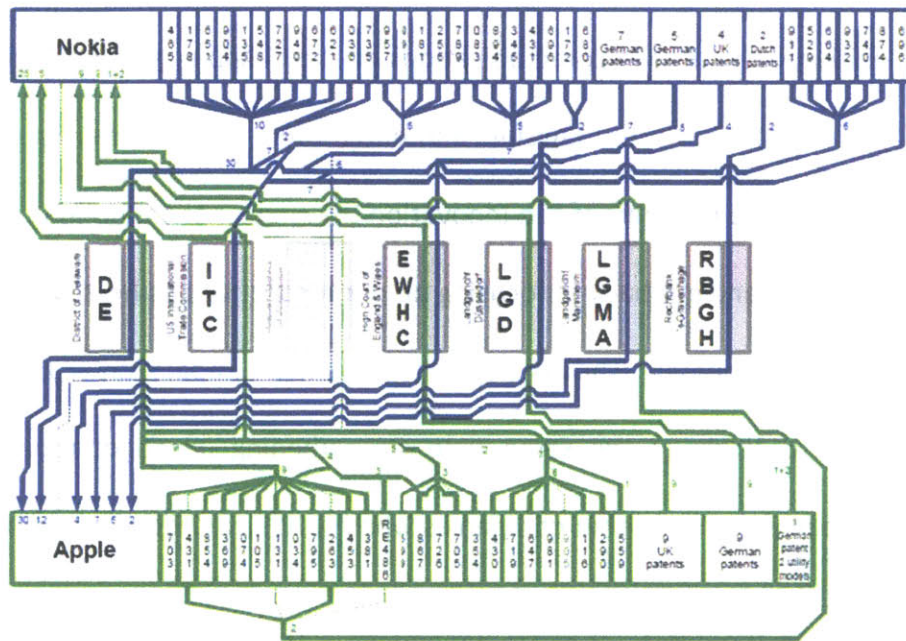
Step 23

On 3/25/2011, Administrative Law Judge makes a final decision and finds Apple as not infringing any of Nokia's five patents.

Step 24

On 3/28/2011, Nokia files second ITC claim over seven patents 7,209,911, 6,212,529, 6,141,664, 7,558,696, 6,445,932, 5,898,740, and 7,319,874. Six of these patents (all seven except 7,558,696) are used to file a new lawsuit in Delaware court.

Final layout of all the patents filed in Apple vs. Nokia clash is depicted below by the infographics from Florian Mueller at FOSS Patents⁶⁹.



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Step 25

On 6/14/2011, Nokia and Apple settle their litigations. The financial structure of the agreement consists of a one-time payment payable by Apple and on-going royalties to be paid by Apple to Nokia for the term of the agreement. The specific terms of the contract are confidential.^{70 71} The settlement ended the litigations at ITC, Delaware, Wisconsin, Germany, UK, and

⁶⁹ <http://www.fosspatents.com>

⁷⁰ Nokia enters into patent license agreement with Apple, June 14, 2011, Nokia, Available at: <http://press.nokia.com/2011/06/14/nokia-enters-into-patent-license-agreement-with-apple/>, Accessed 2013

⁷¹ Nokia Wins Apple Patent-License Deal Cash, Settles Lawsuits, Jun 14, 2011, Bloomberg, Available at: <http://www.bloomberg.com/news/2011-06-14/nokia-apple-payments-to-nokia-settle-all-litigation.html>, Accessed 2013

Netherlands. Stephen Elop, president and chief executive officer of Nokia said, "We are very pleased to have Apple join the growing number of Nokia licensees. This settlement demonstrates Nokia's industry leading patent portfolio and enables us to focus on further licensing opportunities in the mobile communications market." Apple stated, "Apple and Nokia have agreed to drop all of our current lawsuits and enter into a license covering some of each other's patents, but not the majority of the innovation that makes the iPhone unique. We are glad to put this behind us and get back to focusing on our respective businesses." Analysts have agreed that while the settlement should have little financial impact on Apple, it includes substantial payment to Nokia at the same time strengthening its negotiating position for further licensing agreements from other companies who might have refused them before.⁷²

This case is one among thousands of cases happening in the mobile market and other fast clockspeed industries where companies are clearly wasting tons of resources struggling with the IP protection system adjusted to slow clockspeed markets. While every public company strives to maximize its profits, litigations around IP certainly divert companies' focus and resources from their core business to jeopardy of litigations. However effective it might seem for some of the dinosaurs of business, it puts small to medium size companies out of play if they cannot afford to litigate around patents portfolios accumulated by their larger competitors. This effectively eliminates free competition and undermines the spirit of entrepreneurship underpinning the founding principles of U.S. economy. It is obvious that old

⁷² Nokia Settles 2-Year Fight with Apple on Patents, June 14, 2011, The New York Times, Available at: <http://www.nytimes.com/2011/06/15/technology/15nokia.html? r=2>, Accessed 2013.

single dimension IP protection cannot be universally applied for all industries. Regulatory actions are necessary to adjust IP protection system and synchronize it with the clockspeed of different markets to ensure effective competition among players of all sizes and stimulate inventions and innovations that benefit the society.

Chapter 4. DISCUSSION AND CONCLUSIONS

We have shown how application of Incumbent's Dilemma framework to different case studies allows for better understanding of the innovation adoption dynamics, considering three distinct factors

- product level features (price, quality, innovations, and switching costs)
- firm level features (resources to innovation vs. resources to quality, modularity etc.)
- environment features (sensitivity to innovation, quality, price, and network externalities)

In cases of Linux vs. Windows, we have seen different environment factors responsible for no disruption outcome in the desktop OS market, while commanding co-existence in the server OS market. In basic phones vs. smartphones cases we have shown how similar dynamic behavior of firms failing to offer features of product demanded by the market, was responsible for displacing first Motorola, and later, previous winner Nokia. In digital music and telecom provider cases, we could observe how consumers' high sensitivity to price resulted in clear disruption of the value chain of traditional players. Wireless vs. wireline data case revealed very interesting direction for future work, articulating possibility of change of the outcome due to customer segmentation. This potential case of co-existence relates to earlier discussion about local equilibrium vs. true customer segmentation. As this case moves along, it might provide additional data that could be used to expand the framework.

When dealing with an empirical case that had happened in the past and where there are no questions about the outcome the only challenge for a researcher is to find credible source of information in order to be able to parameterize it and feed the data into the model. Although there are challenges associated with this process as well, the general structure of the research

is clear and straightforward. For example, in Windows vs. Linux case in server and desktop markets, the outcomes are obvious (in server market there is a coexistence of both players, while in desktop market Windows has won) and the supporting data is quite abundant. The product or service as well as players themselves are easy to define and separate.

When switching over to ongoing cases, the challenges are much greater. Sometimes, large incumbent companies are entering new markets, but they claim themselves as incumbents when asked to describe the case. In other situations, it is hard to define what the product in question is, i.e. a company might be looking at overall business performance of the enterprise that is a function of multiple services and products and attempt to analyze its overall corporate strategy as one case. This is especially true for large corporations that have huge variety of products and/or services oftentimes interdependent, but still separate from each other. In addition, sometimes a new product or service attempts to displace multiple products or services from the perspective of customers. Therefore, even if the company is the same, there might be several cases because the competing product/service is different.

These challenges are not very obvious for most managers responsible for making strategic decisions. Without a framework in mind, the above-mentioned issues are piled up in a big intertwined problem, which has very little structure and is almost impossible to analyze. Even when informed about the Incumbent's Dilemma framework, managers tend to struggle answering structured questions, as the information they have is not related directly to the framework structure and careful consideration of all the underlying dynamics and factors is needed in order to shape the case that is possible to analyze.

If the data or the assumptions about the missing data are correct, the framework should be instrumental in predicting the likelihood of a winning for either new entrant or incumbent. The tricky part is consistency of customers' expectations and needs. Oftentimes, companies' activities might change the set of customer preferences and overall user experience. Our current version of the framework does not work with such situations and we have to make sure that case parameters (i.e. set of consumer sensitivities) remain unchanged; otherwise a new case needs to be defined and analyzed. Making consumer sensitivities endogenous, i.e. dependent on other variables, is a major extension of the current framework and we will have to approach it in our future work.

Three CFP cases also taught us few important lessons about the applicability of theoretical framework to the analysis of real time cases. The main challenges here are to identify whether the company is an incumbent or an entrant, accurately describe what is the product or service, and what is the quality and innovation in the case. The most difficult questions for our interviewees were those that asked about firm dealing with its resources.

Responses of the CFP members helped us refine the survey, addressing the most challenging issues when answering the questions. As a result, we have split the survey in two parts (basic, and detailed), we have also organized it differently to help readers better understand and convey the core drivers of dynamics of the case. The data from this study will be used to perform deeper empirical investigation aimed at more quantitative evaluation of lessons from our model.

Further dimension that can be considered in the future research is differentiation between Platform and Product. Platform is defined when a technology has a set of features or functions that can be used by other firms thus creating stronger (indirect) network effect. Multiple firms are working on the same platform help to promote market share. At the same time, while we do have Modularity as a firm factor in our current framework, we assume that it is reflected in the product as well. More modularity means more parts of the product are produced outside of the firm. Combining these two parameters, we can get better understanding of the outcome of a clash. We hypothesize that when there is no platform (we have pure product), firms with higher modularity have more chances to win, whereas when a platform exists (in form of API or open architecture) the influence of Modularity diminishes. This remains to be answered in the future work, which should take into account this and other relevant attributes to expand the scope of the framework and improve its robustness and applicability.

APPENDIX A. THE INCUMBENT'S DILEMMA: CASE STUDY SURVEY

The purpose of this survey is to help CFP members describe their experiences with disruption. By providing a set of simple questions, we aim to capture and understand the main drivers of the case and identify the underlying dynamics. If you are not sure of the answer to a particular question, please give your best estimation.

The survey is divided into 2 parts: Part 1 is a short set of general questions that can be answered fairly quickly. Part 2 is a longer set of detailed questions for those who have time to dig deeper into the case. We are happy to provide assistance with Part 2.

We suggest you work in "DRAFT" view mode when filling this out.

YOUR NAME AND CONTACT INFO:

PART 1: General questions

1. Briefly describe the case study, e.g., "disruption of the music industry by online distribution."
2. Who are the Incumbent and Entrant firms?
 - a. Incumbent firms:
 - b. Entrant firms
3. Describe the Incumbent's and Entrant's product/service
 - a. Incumbent product/service:
 - b. Entrant product/service:

4. What constitutes *Quality* and *Innovation* of the product/service in this case?
Quality refers to the basic features perfected by Incumbent technology. Innovation refers to new features based on new technology. For example, in the case of PSTN vs. VoIP, Quality constitutes voice quality and reliability, whereas Innovation constitutes voice, video, and data convergence.

- a. Describe the basic features of the product/service:
- b. Describe the innovative features of the product/service:

5. What is a reasonable starting point for this case?
When did the potentially disruptive product/service enter the market? This could be the specific date of a product release or official announcement, a particular quarter when sales reached a certain point, or even a decade.

6. What was the outcome of this case?
Can you conclusively say whether the Incumbent won, lost, or shares the market with the Entrant? If you think that an Incumbent company lost but there is still a chance it can come back again, or a new cycle has begun where former Entrants are now the Incumbents, this case is considered as over, and the process of return or the new cycle is the next case.

Please describe what happened if the case is over (Incumbent was disrupted and left the market, Entrant failed to enter the market, Incumbent and Entrant share the market). If the case is ongoing, please describe what you think might happen.

- ❖ Incumbents won:
- ❖ Incumbents lost:
- ❖ Incumbents shared market with Entrants:
- ❖ Ongoing (Please provide the description of the outcome):

If you want to stop here, please email the survey back to SERGEY snaumov@sloan.mit.edu

PART 2: Detailed questions
Incumbent: product/service questions
<p>7. What has happened to the Incumbent product/service's PRICE from the beginning of the case until the end (or until now)? <i>Please attempt to quantify if possible.</i></p>
<p>8. What has happened to the Incumbent product/service's QUALITY from the beginning of the case till the end (or till now)? <i>Please describe how the quality has changed.</i></p>
<p>9. What has happened to the Incumbent product/service's INNOVATION from the beginning of the case till the end (or till now)? <i>Please describe how the innovation has changed.</i></p>
<p>10. Are there direct network effects for the Incumbent's product/service? <i>Direct network effects exist when the utility of the product depends on the size of the user base, i.e., its value increases with its use by other consumers.</i></p>
<p>11. Are there indirect network effect (platform features) of the Incumbent's product/service? <i>Indirect effect is the degree at which the utility of the product depends on the size of the user base of complementary products. When other firms can use a technology's features, the technology functions as a platform, thus strengthening the indirect network effect. Multiple firms are working on the same platform help to promote market share.</i></p>
<p>12. What constitutes switching costs for the Incumbent's product/service? <i>Switching costs may be due to unique features of the product or contractual obligations.</i></p>
<p>13. What has happened to the network effect of the Incumbent's product over time?</p>
<p>14. What has happened to the switching costs of the Incumbent's product over time?</p>

Incumbent: Firm Questions

15. What has happened to the Incumbent's market share?

Possible answers include increased, decreased, reduced substantially, exit the market, market dominance etc.

16. What happened to the market share of technology? (e.g., of PSTN vs. VoIP)

17. What happened to the market share of firms?

18. What do you believe were the important resources for the Incumbent?

I.e. technologies, patents, manufacturing base, supply chain, sales and marketing etc.

19. Did the Incumbent produce the whole product or rely upon a third party?

Please describe what fraction of the product was produced in-house vs. outsourced. For example, fully vertically integrated company is making 100% in-house, while fully horizontal is making 10% in-house and outsources the rest.

Entrant: product/service questions
<p>20. What has happened to the Entrant product/service's PRICE from the beginning of the case until the end (or until now)? <i>Please attempt to quantify if possible.</i></p>
<p>21. What has happened to the Entrant product/service's QUALITY from the beginning of the case till the end (or till now)? <i>Please describe how the quality has changed.</i></p>
<p>22. What has happened to the Entrant product/service's INNOVATION from the beginning of the case till the end (or till now)? <i>Please describe how the innovation has changed.</i></p>
<p>23. Are there direct network effects for the Entrant's product/service? <i>Direct network effect exists when the utility of the product for a consumer increases with its use by other consumers.</i></p>
<p>24. Are there indirect network effect (platform features) of the Entrant's product/service? <i>Indirect effect is the degree at which the utility of the product depends on the size of the user base of complementary products. A platform results when a technology has a set of features or functions that can be used by other firms thus creating stronger (indirect) network effect. Multiple firms are working on the same platform help to promote market share.</i></p>
<p>25. What constitutes switching costs for the Entrant's product/service? <i>Switching costs may be due to unique features of the product or contractual obligations.</i></p>
<p>26. What has happened to the network effect of Entrant's product over time?</p>
<p>27. What has happened to the switching costs of Entrant's product over time?</p>

Entrant: Firm Questions

28. What has happened to the Entrants' market share?

Possible answers include increased, exit the market, market dominance etc.

29. What happened to the market share of technology? (e.g., of PSTN vs. VoIP)

30. What happened to the market share of firms?

31. What do you believe were the important resources for the Entrant?

I.e. technologies, patents, manufacturing base, supply chain, sales and marketing etc.

32. Did the Entrant produce the whole product or rely upon a third party?

Please describe to the extent possible what fraction of the product was produced in-house vs. outsourced. For example, fully vertically integrated company is making 100% in-house, while fully horizontal is making 10% in-house and outsources the rest.

Environment questions

Sensitivity means how important for the users is the price and quality level of the product. How important is the level of innovation, offered by the product? In other words, how much do users want the innovation? It is degree at which customers care about network effect (will they want to use its benefits?).

Please describe below the nature of sensitivity to given feature, and why you believe it was so.

33. Price

34. Quality

35. Innovation

36. Network Effect

Please email the survey back to SERGEY snaumov@sloan.mit.edu

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