Economics of a Standards War: An Analysis of the Current Industry for Wireless Broadband Internet

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1 Introduction

When a new product begins to take hold of the marketplace, it rarely finds itself unchallenged. Customers must often times choose between two or three different products that offer similar—if not identical—features. In most cases, customers can simply read reviews of the various products and decide which product satisfies their needs the best. Yet in some cases there is much more that needs to be considered. If the product is based on a new technology, it's possible that the technology will become

obsolete in the future. The buyer has to predict which of the technologies will win out and continue to improve, while the other falls by the wayside. In the market where the average person does not understand the technical specifications behind the technology, it is impossible to foresee which product will still be around within two years.

Looking beyond the individual consumer, small and large business alike must make these decisions all the time. In order to obtain a competitive advantage, businesses may choose to adopt a technology that can weed out inefficiencies in their business model. When the business decides to purchase the technology, there is usually a contract with the supplier to maintain the technology as it evolves in order to sustain the competitive advantage. Because this is usually a substantial investment, if the supplier of the technology fails to succeed in the marketplace and is no longer able to provide technical support, this can be catastrophic for the business.

The decisions that both consumers and businesses face in the technology driven marketplace are the most visible aspects of modern day standards wars. Companies that own the intellectual property to the technology are often the principal players in the biggest battle fought behind the scenes; they are the companies that have the most to gain or the most to lose. Because there is usually a large amount of money for the taking, firms pursue many different strategies in order to get as much of the pie as possible. There are other cases though, where multiple technologies are fighting in the market but there is no firm that owns the intellectual property. These cases are often referred to as a standards war between *unsponsored* technologies—there is no firm that has economic incentives to push this technology to market. In the case of unsponsored standards wars, the market is usually free to adopt a technology without any incentives to choose one

standard over the other. The decisions made are not clouded by promotional pricing or firm reputation backing a certain standard—rather as Victor Stango said, "demand-side decisions by consumers are the sole driver of adoption.[1]" There is little to analyze when it comes to these cases, as usually it follows that the superior technology will win out. Only when firms have economic incentives to push their own standard to the market do things really start to get exciting.

2 Sponsored Technologies in Standards Wars

When sponsored standards are trying to gain momentum to enter the marketplace, it is not uncommon for an organization to form –consisting of representatives from competing companies—that has the goal of creating an industry standard. Rather than flooding the market with too many different choices, industry standards bodies are often created. Firms realize that the costs of a price war to get their products adopted would be too great. Therefore they might agree to join along with competitors to bring a unified front to the market.

As discussed by Stanley Besen in Standard, Innovation, and Competitiveness, sponsored standards wars can fall into five distinct categories[2]. In the first scenario, the various sponsors have similar compatible technologies and each would benefit from agreeing on one set standard to attract the market. The companies quickly set up a formalization process and will officially standardize the new technology in a quick and painless manner. Another scenario is sponsors have incompatible technologies but what

[1] Stango, Victor
[2] Besen, Stanley

a unified front when approaching the marketplace. Each individual firm would prefer its own standard, but would much rather get a set standard to market rather than go through a long drawn out process to make sure their standard becomes the dominant technology in the market. The relationships between the firms is solid and there is a clear understanding that intellectual property will be shared so that firms can enter the marketplace with the new standard created. In a yet a different scenario, sponsoring firms have the incentive to try to force their standard to market over their competitors. In these cases, the market revenue for the firm with the winning standard is significantly higher than that of a licensing firm. Because of this, firms will either try to slow down the standards body while gaining an installed base in the market or not join the standards body from the beginning and start the standards war. By doing this, they attempt to become either the monopoly or dominant firm in the market and reap the profits that come along with that status. In another scenario, there is already a dominant firm in the industry that has its own standard. Although the smaller firms would prefer to have their standard make it to market, they realize they could not stay in business if they underwent a big battle with the dominant firm. Therefore fairly early on, companies decide to license the technology from the dominant firm. Finally, in the last case firms realize that the market in which they are working prefers variety; compatibility of products is not as important. Therefore, firms have the incentive to go after niche markets rather than the market as a whole. In this case, firms would not enter a standards body nor would there be a large battle in the marketplace.

Within this framework of identifying standards wars, the final outcome is often characterized as either a *de jure* or a *de facto* standard. When the scenario involves a

standards body proclaiming an industry standard via a consensus of the participating firms, it is said to be a de jure standard. On the other hand, in the cases where multiple standards come to the market for an all out standards war, the winner is said to be the de facto standard.

3 Academic Literature on Standards Wars

Upon reading the literature, it is difficult to ignore the relation of network effects, or network *externalities*, to the standardization of an industry. Network effects are added values to a product created through complementary relationships of adopters of a specific standard[3]. The fax machine is an example of a product with network effects because as more users purchase fax machines it allows those who own a fax machine to communicate with more individuals. Additionally, the AOL Instant Messenger protocol has strong network effects for the same reason. Firms that recognize that their products will be subject to network externalities will try to get an installed base of users before their competitors get their product into the market, due to the potential monopoly profits.

Lock-in

In cases where firms realize that their own technology might be inferior to their competitors' and not well suited for the mass market, rather than losing money on development the firm will attempt to get consumers to purchase their product early on—possibly at a loss. Those initial buyers take on risk when purchasing the technology, because as the market matures and eventually accepts a technology those first buyers

[3] Stango, Victor

might get "stranded" or "orphaned." If in fact the inferior technology wins out, the industry will often get "locked-in" to that technology because of the network externalities. Even if consumers realize that there is a significant increase in utility after a switch to the superior technology, the investment required to switch standards likely would exceed the incremental benefits thereby ensuring a lock-in to the inferior technology.

Preannouncements

In order to affect the adoption habits of consumers, especially in cases were there is an upgrade from an older standard, firms often compete by using "preannouncements." Farrell and Saloner (1986) examine cases where the sponsors of a new standard announce the impending arrival of a new superior standard before it actually will be available for purchase on the market. Interestingly enough, the social welfare in these situations is actually diminished because of the induced stranding of customers in the older technology. Customers who would have joined the network decide to hold off until the new unreleased technology is available, thereby choosing to not join the network that previous adopters have joined. In their paper analyzing the DVD-DIVX standard war in 2003, Dranove and Gandal measure the adoption rates of the DVD standard before and after the preannouncements from the DIVX standard community. In their case, Dranove and Gandal found that preannouncement of DIVX did in fact slow the adoption of DVD, but due to easy communication between consumers identifying the pros and cons of DVD vs. DIVX, consumers were able to move past the temptation of the different standard and adopt DVD rather than DIVX.

Waiting

Cabral and Dezso (2006) discuss the option of the consumers to wait when it comes to technology adoption. They find that the buyers choose the leading technology design as soon as the discounted payoff from that design is positive. Though this seems fairly intuitive, the common belief beforehand was that the option to wait might be more valuable from the individual consumers side rather than jumping in to a technology before it was obvious who would win. Cabral and Dezso find that the option to wait is often times counteracted by the higher licensing fees charged by the "winner." For example, while HD DVD and Blue-Ray are fighting for superiority in the market, it might be seen that it is better to go ahead and pick a side early on while the technologies are fighting to build their camps. After the lines have been crossed and it is obvious which technology will win out, producers of BlueRay/HD DVD players would see significantly higher fees after it was decided which technology would win because they would not be absorbing any risk (which decreases the price).

Additionally, Cabral and Dezso found that consumers are better off in situations where there are three technologies competing for the standard in the market place. Usually in the case of two providers, the expected price wars will likely lead to the adoption of an incorrect standard just because one is cheaper than the other. By introducing the third competitor, it makes it significantly more likely that at least two of the standards will continue to increase while one falls by the wayside. This induces the buyer to wait a bit longer before adoption until the new strong technologies fight it out-rather than just a strong and a weak company fighting for position. Cabral and Dezso

argue that as these standard wars become more like a two-stage game between the three companies, the social welfare would significantly increase due to the diminished chances of consumers picking a bad technology. During the first stage, the top-two companies improve tremendously leaving the third in the dust. As the second stage comes around, the consumers are left to choose between two technologies that have already proven that they can continue to improve; therefore it becomes less likely the that winning technology will stop improving after the sides are chosen.

Coordination

In the case where early adoption on a common standard is key to the overall success of the budding market, it is also common to see coordination among rival players in creating a common standard early on in the standards war. Shapiro and Varian (1999) discuss the cooperation between bitter Internet rivals Netscape and Microsoft in the development of the *Secure Electronic Transaction* standard over the Internet. This standard focused on the method with which credit card numbers were encrypted over the Internet in online purchases. Both companies understood that there was more to gain by jointly creating this standard and creating a common trust-worthy experience for consumers purchasing via the Internet than for there to two different methods that would not be as stable. If consumers found early on that their information was not as secure because the quality of the technology was not great due to focusing resources on competition, the adoption of this method of shopping might not have caught on so well.

4 The Wireless Broadband Internet

The Retail Side

When looking at this market, it is important to understand all of the different sides involved. Over the past ten years, individuals have grown accustomed to being connected to the Internet at all times at high speeds. Whether they are at home or in the office, consumers demand access to their email, news, business data and anything else under the sun. An even more recent phenomenon is the ability to connect to the Internet while outside of the home—whether at coffee shops like Starbucks or while waiting at the airport. The number of these mobile Internet hot spots has increased tremendously over the past five years with the increase from 2005 to 2006 close to 90%.[4] As both the demand increases for these services, but also as the types of devices capable of connecting increases, the fight to provide service to as many people has become a fight with enormous economic proportions.

In recent years, the explosion of cable/DSL connectivity has taken over the residential/home business market. Major Telecoms have used their existing fiber optics cables to provide access to the Internet while the user is stationary. At the same time, with the advent of the popular Blackberry from RIM, users have also grown accustomed to Internet connectivity while moving from place to place via wireless connectivity. Cell phone companies like Sprint, Verizon, and AT&T now include basic web browsers on their cell phones that are capable of browsing the Internet or event downloading brief video clips. Additionally, as laptop users are becoming more prevalent, there has been a growth in always-connected mobile PC cards that can ensure Internet service wherever

[4] http://www.jiwire.com/business/news/press-100k-hotspots.htm

the user is located. Though this service has traditionally serviced only the elite business customers, ordinary home users are starting to adopt as prices have decreased.

Keeping all this in mind, the major telecoms currently providing mobile broadband Internet to cell phone users have started to invest in technology which would allow them to reach the traditional home and business users at the same time. Since there is already the possibility of connecting to the Internet from anywhere that Verizon has cell phone coverage, Verizon is looking to get the home user to drop his DSL or cable modem and use Verizon's service.

Currently though, home computers cannot uniformly connect to the wireless standard that the cellular providers use. Each service provider—whether Sprint, Verizon or AT&T—uses different technologies to provide Internet to their customers. Both Sprint and Verizon currently uses the first generation EV-DO standard, while Cingular/AT&T uses the HSDPA/EDGE standard. To further complicate matters, Sprint announced during the Summer 2006 that they will be moving to a new standard—WiMAX—as soon as the $3B infrastructure is in place.

With all of these different standards in the marketplace, there seems no real clear-cut answer to which technology will win out. Technologically speaking, each standard touts high-speed connectivity over long distances, but WiMAX seems to have the longest range (theoretically 30 miles from one station with the ability to have hundreds of computers connected at one time).[5] But possibly the main differentiator is that the future upgrades to EV-DO and HSDPA are going to be more incrementally based on the infrastructure side (minimal upgrading of current towers) whereas the move to WiMAX

[5] Green, Jeff

is going to require significant investments on the provider side. At the same time though, arguably the more important factor is the upgrade costs on the user side rather than the provider side. For example, though it might be relatively cheaper for Verizon to upgrade its EV-DO technology, the users have a larger upgrade cost relative to WiMAX. Once customers make the initial investment in WiMAX, they will only have small incremental costs to upgrade to newer standards in the future while EV-DO/HSDPA customers must buy new equipment each time. The essential question becomes, which technology are users going to prefer? Holding technological specs somewhat constant, Shane Greenstein notes that history tends to "give an edge to those that are easy on the consumer side."[6] This leads me to conclude that there could be a slight edge in that regard to WiMAX moving in as the universal accepted standard in the future—especially since Sprint has already devoted $3B to develop the technology and roll it out as early as Q4 2007.

The Supply Side

Though this seems to be complicated already, there is much more going on behind the scenes. Though Sprint/Verizon/AT&T are all fighting on one front, the owners of the technologies are the players who really have the most to gain (or lose) depending on which standard takes the cake. Traditional chip manufacturer Intel is the main sponsor of the WiMAX standard while Qualcomm holds the patents on EV-DO and HSDPA. If Verizon determines that WiMAX also better suits the needs of their customers, Qualcomm will find a significant portion of its licensing revenues missing. Though Intel does not actually own the WiMAX technology, they do have a vested interest in its success. If WiMAX proves to be the next universal standard for wireless Internet (like

[6] Email with Shane Greenstein 8/22/2006

Wi-Fi is now) there will be a strong demand for Intel chips in new laptops as well as other hand-held gadgets capable of connecting to the Internet. The potential revenues for either Qualcomm or Intel are so large that this battle actually has been the subject of front-page news in the Wall Street Journal.[7]

Historical Findings Related to Current Market

On the surface, it seems like this battle is going to be decided in the markets. But the question arises: How can these companies influence the eventual choices by the consumer? Can Qualcomm convince the phone providers that the small royalties paid to Qualcomm will easily be covered by the windfall of profits stemming from data packages on new cell phone plans? Or will the long distance WiMAX provide carriers with enough range to attract rural users to purchase home computer Internet along with cell phone service?

Historically speaking, the WiMAX camp also has a few things to their advantage. Rather than waiting until the standard was completely ratified, the WiMAX forum has made pre-announcements explaining the technology and expected availability and applications. Instead of keeping everything under wraps, they provided information to technology officers and CEOs so that they could hold off on their upgrade investments until this technology was completely ready for market.

Most importantly, the WiMAX group has the biggest inroad already when it comes to pushing wireless standards to market. Before the Wi-Fi standard had become accepted, Intel found itself in a similar standard war trying to get their standard to

[7] Sharma, Amol

universal acceptance. Because they had the advantage of reaching the customers directly, Intel was able to build their standard into their processor chips—which were already being purchased by consumers—thereby forcing their way on to the scene. Consumers already had the technology they needed in their laptops to connect wirelessly, so suppliers of wireless equipment knew consumers would not go out and buy other wireless cards. Intel currently finds itself in a very similar position and they have already been talking about building in WiMAX support into new chips coming to the market.

Though all of these factors seem to give WiMAX the victory, there are still some factors against them. Intel has talked about building WiMAX support into the chips, but we have still not seen anything come to market. Intel originally announced that WiMAX would be released with the new Santa Rosa chip in Q2 2007, but it has been delayed likely until 2008. This leads one to think that there are problems introducing this technology onto their chips—what incentives do they have to wait? As Sprint is expected to begin its rollout of their WiMAX network later this year, it only makes sense to have the technology present in the newest laptops.

On that note, another potential downfall to the success of WiMAX lies with having Sprint as the cellular partner. When it comes to overall growth, Sprint currently is experiencing the lowest growth rates of the big three at 10% (up to 53.6M subscribers) compared to 14.5% growth (60.7M) for Verizon and 11.2% growth (62.2M) for AT&T.[8] At the same time, it is important to note that though overall subscriber numbers are not growing at the same pace as either Verizon or AT&T, Sprint is seeing an increase in revenue from their data services. In a market where margins are continuously dropping

[8] Lawson, Stephen

for voice revenue, Sprint is making big gains while at the same time expecting further gains with the upgrade to WiMAX.

5 Conclusions

In this battle for dominance in the wireless broadband Internet market, at this stage in the game the favorite seems to be Intel's WiMAX technology. There is quite a bit of momentum for Intel moving forward with their revenue growth along with the large group of companies who are board members of the WiMAX forum (Motorola, Samsung, Alcatel-Lucent to name a few). Qualcomm has been very quiet in terms of their upgrades to EV-DO while WiMAX networks are already beginning in Texas as part of the initial roll out for Sprint.[9] If growth can continue for Sprint in their data network with the introduction of WiMAX, we could very likely start to see more investments in this technology.

[9] Nath, Niladri

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