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Final Paper

Price Competition and Rivalry in the Wireless Industry

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I. Overview

The wireless industry as of 2002 consisted of five major national carriers. To be considered a national carrier, one must be able to serve the airtime needs of customers coast to coast, with few exceptions. AT&T Wireless, Verizon Wireless, Cingular, T-Mobile, and Sprint PCS are the main players in this market.

These carriers are fighting for many of the same customers from city to city. And despite vast improvements in technology and service, prices in the wireless phone market, as well as the airtime minutes market, have become so cheap that many customers are making the transition to wireless as their primary or even only phone. This dependency however, makes value of service a priceless commodity. Carriers over the past five years have seen dramatic growth in demand for their service. And while any carrier would welcome demand, a small margin of excess capacity is somewhat important in this industry, as some providers are finding their value is shrinking as customers can hardly complete a call, due to overloaded networks.

Maintaining aggressive pricing, while trying to build up a decent ARPU (Average Revenue Per User) is also proving increasingly difficult. Most of the *new* demand is in the form of customers just getting into the game and buying bottom end plans, rather than going for more expensive, option filled plans. Carriers are also finding out that existing customers in *this* industry can be a chore to retain. Often these customers demand a new phone every six months or so. And while, to an outsider, this may seem like a great thing for the carrier, it can be very costly. Few customers realize that companies do not make *any* money, on average, from the sale of their phones. In many cases they are actually *subsidizing* the price that they pay to the manufacturer, in order to entice new customers to the service, and/or retain current members, which is where the real dollars come in.

This retention problem is precisely why providers feel that they need 1 year to 2 year contracts. Most obligate their customers, upon activating their new phone to choose between the 1 or 2 year contract, with some perk to go for the 2 year such as more minutes or a bigger rebate on the price of the phone. Generally, there is a buy out price of \$150 -\$200, in order to break a contract.

II. History

As the wireless industry approaches its third generation of products, many users are too young to remember the first in the early 1980's. It was a standard known as A.M.P.S. or Advanced Mobile Phone Service. Analog is the word most associated with this period. Calls were transmitted from one's mobile phone to the closest analog cell tower and back. While this marked a leap forward at the time, many consumers still questioned the benefits of such a service relative to the sky-high prices. It was most commonly used by the upper-middle to upper class, as a novelty or for urgent business related matters. This technology (referred to as 1G) covers the vast majority of the United States.

Next of course came the 2nd generation or 2G technologies, and the majority of today's current users. In the mid to late 90's customers began to see an array of realistic options in terms of pricing for airtime minutes, phones, and roaming and long distance services. (Roaming services generally refer to the ability to use one's phone outside one's home calling area.) These second generation technologies GSM (Global System for Mobile Communications), TDMA (Time Division Multiple Access), and CDMA (Code Division Multiple Access) are all digital, resulting in not only more secure calls, but also dramatically increased clarity and capacity in terms of the number of simultaneous callers that one tower can support. But this is also where the evolutionary path of the industry split. One technology, at least domestically, did not reign supreme over the others. Some carriers, such as AT&T Wireless and later Cingular, chose TDMA as their base technology, while others such as Sprint PCS and Verizon Wireless chose CDMA, with T-Mobile, previously Voicestream, choosing GSM.

The three technologies are different in their capacity, complexity, and time to market. TDMA and GSM are more similar to each other, and preceded CDMA. TDMA also known as USDC or US Digital Cellular in America, has roughly triple the capacity of a comparable analog system. It is able to achieve this by dividing the bandwidth into timeslots, 3 per 30Khz, allowing 3 people to utilize the same frequency, in the same cell, simultaneously. The timeslots are so small and quickly interchanged that people cannot even detect that they are sharing a channel.

GSM is similar in its approach but can only manage 8 time slots per 200Khz ($200/8 = 25\text{Khz}$ per caller). GSM however, can actually surpass the capacity of TDMA by using techniques such as better error management and frequency hopping. Just as walkie-talkies can interfere with one another if two sets are being used, on the same frequency, too closely to each other, cell towers using TDMA are only able to reuse frequencies every 7 cells without interference. (see exhibit 1) GSM uses the forementioned techniques to reduce that to every 5 cells, slightly surpassing TDMA, despite its less efficient time division.

CDMA, on the other hand, divides the callers by code rather than time slots. Each “channel” is 1.25Mhz wide and the digital signals from all of the users in the cell are spread across the spectrum and flow simultaneously. Although this does significantly add to the complexity, it also affords CDMA carriers with some notable advantages. Firstly, CDMA carriers can reuse frequencies in every cell, without fearing interference, because they are divided by code, referred to as a “frequency reuse of one.” (See exhibit 2) It is similar to a cocktail party where everyone is in the same room, but speaking a different language. Speaking partners can understand each other, but not other partners, so they can all talk simultaneously without interference. This gives CDMA networks significantly more capacity per cell than any other technology, somewhere around 3 times that of GSM. Secondly, CDMA evades the “near-far” problem by independently adjusting the power level at which each device transmits to the tower and vice versa, also increasing capacity. Thirdly, a device known as a “rake receiver” similar to having multiple receivers in one, allows for CDMA devices to detect the three strongest signals coming from any direction and combine them into a single stronger signal. Lastly, CDMA reduces the number of dropped calls relative to other technologies by relying on “soft handoffs.” A soft handoff means that before a caller is passed from one tower to another, the second tower begins transmitting and securing the call, something only possible on CDMA due to all of the towers sharing the same frequency and using rake receivers.

Why would carriers have adapted GSM or TDMA when CDMA offers such advantages? Essentially it was a matter of timing. GSM and TDMA came first and

were widely adopted, something that matters desperately as callers demand more and more coverage and compatibility. Furthermore, TDMA and GSM were time tested in European markets, which developed before the United States market. Whereas CDMA, pioneered by the armed forces, may have been “field tested,” but still remained an unproven technology when applied to the masses. Telecommunications Companies have dumped billions of dollars in to the TDMA and GSM standards and cannot afford to let it die, despite future capacity issues associated with spectrum availability and these technologies’ relatively inefficient use there of. This early popularity and subsequent adoption, not any technological superiority seems to be the biggest ally of the TDMA/GSM platforms.

III. Carrier Overview

Price Competition

Pricing in the wireless industry is confusing at best. With different coverage areas, technologies, phones, and definitions of roaming and long distance, it is little wonder that many consumers struggle to make sense of pricing materials found in stores. To get a sense of the value provided by a service, customers need to compare apples to apples, though they are rarely allowed to do so. A carrier’s sales force serves to “educate” the public. And the dilemma one faces when choosing a car, an appliance, and now a wireless service, remains the same. Highly skilled sales people can throw enough brochures one’s way to make them practically beg for higher rates or obsolete phones. Disinformation is a huge problem for consumers in this industry. It is precisely the overabundance of information, which is supposed to rescue the consumer that buries them in a sea of definitions and hidden charges. This allows carriers to charge somewhat higher prices, though it would be difficult to estimate the level of cushioning. Pricing and airtime minute allowances are also to some extent a reflection of a carrier’s network capacity. Though this will likely play a bigger role in the future of the industry for technological and spectrum scarcity reasons discussed later.

AT&T, T-Mobile, Cingular, and Verizon currently offer “local” calling plans that all allow callers to make domestic long distance calls, as long as they remain in

their respective home calling areas, which generally cover most of the major cities in the callers home state. AT&T also offers a “regional” calling option that expands a caller’s home calling area, within which they can travel and make calls, local or long distance. And of course, all of these carriers offer “national” calling plans. These are plans in which the caller can “roam” from market to market and incur no extra charges, with some limitations. Naturally, there are no long distance charges associated with these plans either. The idea is that the industry can price discriminate based on a callers needs or desires. However, there is, to some extent, a trend toward predominantly “national” pricing structures, which could simplify the service plans for customers and make prices even more competitive.

Generally, pricing changes are not overnight. Rather, they change quarterly, either when a carrier adjusts their standard rates or applies a confusing layer of promotional offers, which may or may not expire over the course of one’s contract. Carriers need this time to disseminate information about their newest promotion. Word of mouth is the biggest advertising tool when it comes to choosing a carrier based on service plans. This means that there can and do arise times when a carrier is running a slightly less competitive promotion unintentionally, conceding new customers to whomever has the hottest deal at the moment.

Marketing and Differentiation

Every carrier offers rebates to entice new customers and every carrier appeals to the customers’ sense of value. How carrier chooses to do this lies in their positioning strategy.

Some carriers such as Verizon and Sprint PCS, tend to offer customers more advanced phones and higher quality services as opposed to huge discounts and rebates. Services such as high speed wireless Internet, downloadable ringers, games, screen savers, and applications are just a few of the differentiating tools pioneered domestically by these providers. Other providers tend to follow suit with such services but lack the “techy” style and cutting edge designs. Verizon and Sprint PCS are willing to concede some, though not a large portion of customers, to other carriers in order to secure the high-end (at least in a technologically

demanding sense) clientele. Generally, the phones offer more features at a higher price point. Sprint PCS, specifically, is notoriously expensive when it comes to many of its phones, while at the same time remaining extremely popular for the option to dazzle one's friends with the latest color, camera enabled, gizmo. Furthermore, consumers wishing to take advantage of a large and well-maintained network are generally more likely to choose one of these providers for their industry leading coverage areas and capacity, rather than biting on huge one time phone discounts that have little to do with a providers overall value.

And then there are the “bargain basement” providers like Cingular and to some extent T-Mobil (although not at much so since scrapping the Voicestream brand). These providers have historically tried to attract customers with less sophisticated, lowbrow techniques such as interchangeable faceplates, “ping-pong” messaging, and free phones. Generally, these providers equip their customers with sorely outdated phones, considering the pace of the industry, and lock them into long contracts with very competitive airtimes rates. This approach often works well with customers who put a lot a stock in low start up cost, and cheap printed (though not always realistic) rates. AT&T lies somewhere in between the two extremes, offering a more limited high-speed data network, and historically cheaper phones than Sprint PCS, while positioning itself clearly above Cingular in terms of quality.

The providers' airtime rates fall into this rhythm as well. Sprint PCS specifically, prides itself on offering its customers ultimate flexibility and customization. It is currently the only provider that allows its new customers to avoid signing a contract, in exchange for a higher monthly rate, something that remains very attractive to industry new comers. Cingular on the other hand offers requires 2 year contracts from every new customer. Many other options exist with premium providers (Sprint PCS, Verizon, and AT&T for the most part), such as the ability to take advantage of new rate plans despite being in a contract, and monthly options such as Mobile-to-Mobile calling or wireless web, that are customizable from month to month. This strategy differentiates the Premium services from the others and offers customers a definition of value that emphasizes quality, technological leadership, and flexibility. Equally formidable though, is the

definition of value that highlights low start up cost (easy entry) and proven rather than cutting edge technology.

There is currently in the industry, great pressure on premium services to deliver on the alleged benefits and quality they claim, such as fewer dropped calls and expanding coverage area for their data services. Likewise customers demand that carriers such as Cingular have extreme discount promotions such as “rollover minutes” to give them an incentive to tolerate less developed capacity, coverage, and capabilities. It is hard to believe that one definition of quality will prevail, as their will always be people who “just want a phone.” And there will always be people looking to push the technological envelope with more options and capabilities than ever before.

Market Share, Churn Rates and the Future

In analyzing the future strategic position of domestic wireless providers, a carrier’s 2nd generation technology is by far the most important aspect, apart of course from some basic financial requirements necessary to remain in the business. GSM is by far the most popular technological standard in the world, but remains far from it domestically. TDMA shares a common technological thread with GSM and carriers utilizing it will likely share the same concerns as the industry evolves toward 3G. These carriers will undoubtedly face capital investment and spectrum/capacity challenges associated with their base technologies and subsequent evolutionary paths.

The evolutionary path for non-CDMA carriers has been set as follows: GSM/TDMA > GSM+GPRS > EDGE (Enhanced GPRS) > WCDMA (also known by less concessionary names). Specifically, AT&T and Cingular (assuming Cingular’s acquisition of T-Mobile goes ahead as planned) will hit a bottleneck as they try to convert customers from yet to come EDGE networks (a GSM based technology) to WCDMA (Wideband Code Division Multiple Access). The problem lies in the fact that while GSM/TDMA carriers can make a relatively inexpensive move early on to GSM+GPRS, this only increases their data transfer rates, not voice capacity (which is already behind CDMA carriers’), while using up ever more

spectrum. Then, after moving to EDGE, the next step, with the same limited voice capacity, these carriers must try to simultaneously launch an *entirely* different 3G WCDMA network that must occupy additional, extremely expensive spectrum, which they do not even know they can get. This is coupled with the fact that along every single step GSM/TDMA carriers must get their customers to buy all new phones, as nothing is backwards compatible along this path. So on the one hand, carriers can choose a 3G path with lower short to mid-term costs but uncertain long-term costs (the GSM/TDMA paths). Or they can choose a 3G path with higher short- to mid-term costs but apparently more certain and seemingly lower long-term costs (CDMA 2000 path)? (see exhibit 3)

The CDMA path is as follows: CDMAone > 1xRTT(CDMA20001x) > CDMA2000. This means that while the cost of going to 1xRTT is roughly 40% of a carrier's 2G investment (compared to 28% for GSM/TDMA carriers going to GSM+GPRS), it gets them to a *recognized* 3G standard with twice the voice capacity and data rates higher than that of GSM+GPRS. Furthermore the move from 1xRTT to CDMA2000, a superior and more flexible technology than WCDMA, requires only some software upgrades and switching some channel cards at the base stations, rather than the "forklift" overhauls needed when coming from non-CDMA based technologies. This means that while GSM/TDMA carriers spent 28% of their 2G investments going from GSM/TDMA > GSM+GPRS, plus either 142% going from GSM+GPRS > EDGE > WCDMA or 120% going straight from GSM+GPRS > WCDMA, totaling from 148 to 170% of 2G investments, CDMA carriers will have spent a mere 100% of their previous investments. And this is not even considering the need to buy more spectrum, which the GSM/TDMA carriers, but not the CDMA carriers, will have to consider. This means that while GSM/TDMA carriers will have to pass along the cost of additional spectrum and network capital to their customers, CDMA carriers will have a competitive cost advantage in the near future.

There were more than 120 million CDMA subscribers worldwide at the end of the first quarter of 2002. Of the 120 million, about 8 million were using CDMA2000 1X, the leading 3G technology. The number of CDMA subscribers has grown by 30 million people, or 33% in the past year. The largest CDMA base was in North America, where there were nearly 53 million users, making up more than 60% of the total number of subscribers in the region. Latin America now has more than 22 million subscribers, a 39% jump from the past year, and CDMA penetration in Asia has grown to nearly 44 million subscribers. CDMA2000 subscribers are growing at a rate of more than 1 million per month and, in March, they accounted for more than 98% of the total number of all 3G subscribers. With additional expansion planned this year, CDMA2000 will continue to lead in delivering 3G. (CDMA Development Group)

These numbers however, may not however be as important as the sheer number of GSM subscribers. And if it is to remain the dominant technology, that is, as it transitions to WCDMA and thereafter, it will be a product of a seemingly endless amount of R&D monies pouring in from carriers who feel they have no financial alternative to sticking out the less cost effective route in the long run. In other words, what the international wireless industry has is a battle between the superior, and minority evolutionary path, and the one most worldwide will take due to having been so heavily invested in an inferior technology. It could be assumed that the “Churn rates” (the rate at which a company loses customers) of GSM/TDMA carriers will suffer due to less competitive pricing overall, and more so if customers are not willing to frequently upgrade phones so as to relieve these carriers of having to maintain old networks simultaneously.

IV. Conclusion

Overall, the strategic positions of this industry’s players are determined by their base technology and their ability to provide a comparable service at a competitive price. By in large, the customer base remains uneducated about, and uninterested in, the technical benefits of one technology over another. And ultimately, what attracts customers is visible results. Having worldwide

compatibility, in order to be able to roam internationally is important to some, but not the majority of domestic customers. And while this capability would help carriers, by possibly creating a snowball effect as a technology slowly edges the other one out, it is not immediately crucial to the success of those in the US wireless market.

Prices are fairly competitive domestically, though they could be more so if rate plans underwent some simplification. This competitiveness will be challenged as GSM/TDMA carriers make some tough capital and technological decisions and face pressure to merge in order to gain capacity and customers. Also challenging the level playing field are advanced and premium services offered by some carriers such as high speed data capabilities for imaging, transmitting emails back and forth (with attachments), and in the future streaming audio and video to the handsets. These services will allow providers to differentiate and create temporary but sizeable profit margins in the future.

Seldom discussed is the role that customer service plays in this industry. This may be because the customer, ideally, can already do everything online necessary for maintaining his/her account. In reality however, qualified customer service and sales representatives are still the main source of information for the customer. And carriers do experience backlash when sales representatives systematically misinform customers about their own pricing, and that of others. This may seem like a short-term problem, but in lean years a bad reputation may snap whatever thread was keeping a carrier above water. Luckily for domestic wireless carriers, everyone's customer service seems to be equally bad, or good, depending on one's expectations. (see Exhibit 4)

In conclusion, the race to 3G is much like the arms race of the Reagan Era. The side that wins, if there is a winner, will likely be the one who outlasts and/or is in a position to outspend the other.

References

- www.cgd.org, The CDMA Development Group.
- www.qualcomm.com, Qualcomm's home site with training modules.
- www.yankeegroup.com, Consumer and Business Communication consulting.

Exhibit 1.

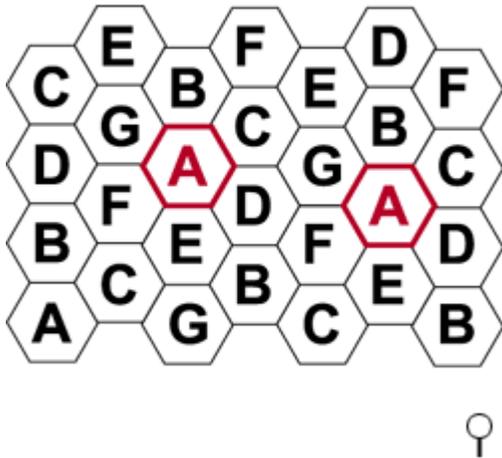
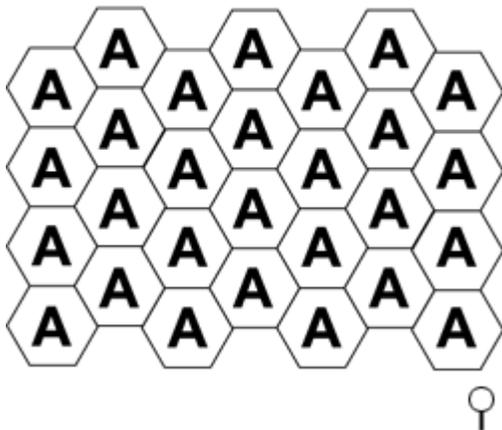


Exhibit 2.



Source: Qualcomm.com CDMA Modules

Exhibit 3.



- Voice
- Data up to 14.4 Kbps
- Voice
- Data up to 115 Kbps
- 2x increases in voice capacity
- Up to 307 kbps* packet data on a single (1.25 MHz) carrier
- First 3G system for any technology worldwide
- Optimized, very high-speed data (Phase 1)
- Up to 2.4Mbps* packet data on a single (1.25 MHz) carrier.
- Integrated voice and data (Phase 2); up to 3.09 Mbps

Source: wirelessdevnet.com (The Wireless Developer Network)

Source: The Yankee Group, 2000

Technology	2G	2.5G	2.5G	3G
TDMA and GSM	1x	GPRS .28x	EDGE .51x	WCDMA x 1.2x .90x
CDMA	1x	1XRTT .40x	—	cdma2000 .60x

In this chart, “GPRS .28x” means that it will cost TDMA and GSM carriers roughly 28% of their initial 2G investments to get to this step, and another 51% of that investment to get EDGE and so on.

Exhibit 4

Industry Ratings

Providers	Sprint PCS	AT&T	T-Mobile	Cingular	Verizon
Rating (1-5) Customer Satisfaction Avg 4.23	4.27	4.33	4.16	4.28	4.30
Rating (1-5) in-building coverage, outdoor coverage, voice/sound quality, value for the money, feature offerings, and customer service Avg 3.88	3.91	3.90	3.80	3.83	3.88

■ Top Rating

Source from the Yankee Group