
The Big Question: Why Do We Need More Cell Sites?

A White paper

Prepared for:

Municipal Governments

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August 16, 2011

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O U T L O O K



PREFACE

Andrew Seybold's Outlook 4Mobility is an affiliation of closely held companies founded by wireless and mobility expert Andrew Seybold. Together with his consulting partners and a team of strategic partners, Andrew Seybold's Outlook 4Mobility offers unparalleled analyses of technologies and trends impacting the international convergence of wireless, mobility and the Internet.

Known for their ability to cut through the hype and mitigate risk, Seybold and partners guide technology startups, industry players, investors and enterprises up the road to profitability with a comprehensive array of information, education and strategic consulting services targeted to and about the mobile and wireless technology industries.

Seybold and partners each bring more than 30 years of personal computing, mobile data and wireless technology expertise to the firm and all its engagements and information products. This real-world market experience is *the* differentiator that sets them apart. Their world-class, hands-on approach nets their clients the most intuitive, insightful counsel available.

As one of the most sought-after consultancies in the market, Andrew Seybold and partners have led the industry with their ability to accurately visualize and articulate trends in technologies, services, devices and applications way ahead of the information curve.

DISCLAIMER

This white paper is being provided free of charge to any and all city, county and other governmental agencies that might be interested in its content. The intent of the paper is to impart an understanding of what is required to provide the level of cellular wireless service the public is demanding.

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Outlook 4Mobility's consulting arm, Andrew Seybold Group, LLC, has provided consulting services to most if not all of the commercial wireless network providers in the United States as well as a number of wireless operators throughout the world. However, none of the consulting

services provided have influenced the contents of this paper, and none of the assignments dealt with cell site locations or deployments.

The views expressed in this paper are those of the author and do not reflect the views of any other person or company nor have they been influenced by any other person or company.

Comments and questions are welcomed by the author who may be reached at the address, phone and email addresses listed on the cover page of this document.

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EXECUTIVE SUMMARY

The telecommunications industry has undergone many changes over the last few years. Services are now provided to customers over telephone wires, TV cables, fiber optics, satellite systems and wireless technologies. The number of wired telephones in the United States and in the rest of the world is shrinking due to the introduction of cellular voice and data networks starting in the early 1980s and continuing today.

As of the end of May 2005, there were more than 190 million cellular phones users in the United States (about 60% of the population) and this number is expected to continue to climb over the next few years. To put this in perspective, in both Europe and Asia the percentage of the population making use of cellular phones is at 90% or above, and in some places (such as in the state of North Carolina) there are now more cellular phones in use than wired phones.

In the early days when cellular phones were expensive to own and use, they were primarily used for business. Prices came down and today they are used by millions of consumers as well. This shift in usage and the resultant demand for cellular coverage into areas where there was none before requires the addition of cell sites to provide this coverage.

Further, as the number of customers on a given wireless network increases, there is a need to increase capacity on the network in order to provide instant service for emergency calls as well as normal business and personal calls.

All telecommunications services providers have had to increase their plant facilities to provide consistent levels of service as they acquired more customers. When wired telephone companies need additional capacity beyond the wires that were originally placed on telephone poles and equipment housed in their buildings, they pull cables with more pairs of wires in them and add more equipment within their existing buildings. When cable companies need to add capacity (as with Cox Cable in Santa Barbara County), they do so by decreasing the number of houses served by a given hub. In the case of satellite network providers, a new satellite is launched to provide additional programming and/or two-way Internet access. None of this activity is observed by the general public.

This is not true for wireless network operators. Their activities to increase capacity are visible to the general public and the agencies that govern them.

When wireless network providers need to add more capacity (and they all do as wireless continues to grow), they have only one choice – build more cell sites that are closer together. As an added benefit, when these new cell sites are approved and installed, they improve the coverage into near-by homes and business, thus providing both capacity gains and better coverage.

Today, more than 20% of the cellular phone population uses their wireless phone exclusively and no longer have wired phones in their homes. This makes it even more critical for the wireless networks to be able to handle the influx of customers. If wireless networks cannot expand their coverage, customers often must wait until someone else hangs up before they are able to place a call. Therefore, it is of utmost importance to increase capacity and coverage so there will be no delay for emergency calls from these homes without wired phones as well as from public places such as streets, shopping centers and recreational facilities.

Wireless network operators are the only telecommunications providers that must seek approval to increase capacity and coverage. This is because cell sites are visible to the public. Other telecommunications companies simply increase capacity when there is a need.

The trend in the United States and the rest of the world is toward a more mobile community making use of a wider variety of wireless services. Today these services include voice, email and data, with mobile TV, steaming audio (music) and other services coming soon. Wireless network providers are making major investments in new technologies and additions to their networks in order to deliver these and other services still in the planning stages to as many customers as possible.

Further, unlike the wired and cable operators who enjoy monopoly status in most of the United States, wireless network operators must compete with 5-7 other wireless network providers. One of the benefits of this competition is that the cost of a long distance call from California to the east coast of the United States has fallen from \$0.25 per minute when AT&T held the monopoly to less than \$0.03 per minute today.

Competition is good for the telecommunications industry and good for customers. But in order to remain competitive as demand increases, wireless network operators must be permitted and encouraged to add capacity and coverage to their networks. They are all willing and able to spend the money to make these improvements and should be allowed to do so without spending years and thousands of extra dollars in the process.

CELL SITES: WHY WE NEED MORE

For many years we had 6 nationwide networks in the United States. After the Cingular/AT&T Wireless merger there were 5 nationwide networks and dozens of regional and/or local wireless networks. After the Sprint/Nextel merger is approved sometime during 2005, there will be only 4 nationwide networks.

In addition to the companies that own the physical equipment (cell sites and back-end equipment) there is a new breed of wireless operators known as MVNOs or Mobile Virtual Network Operators. MVNOs buy capacity from companies that own the networks and resell time to their own customers. The best example of this today is Virgin Wireless, which caters to the youth market in the United States. However, we are seeing a trend to add more MVNOs. ESPN is the latest company to announce its own MVNO and Disney is not far behind.

So while we will have only 4 wireless operators that own all the equipment, we will have an increasing number of companies competing for customers in the wireless market. This is important because it means that all of the wireless networks – national and regional/local – will have to accommodate new customers signed up by MNVOs. All of them will need to increase their capacity.

If you look back in history to the advent of the cellular phone in the United States in the early 1980s, you will see a growth to 60 million cellular customers over a 14-year period. The next growth spurt occurred during the next three years when the average monthly bill dropped below \$50 per month. In this 3-year period, the number of cellular subscribers doubled to 120 million! And this happened when we only had 2 wireless network providers per region. Now we have 5 (down from 6) and are heading for 4 with the Sprint/Nextel merger.

The reason we have more than 2 wireless network operators today is that the Federal Communications Commission (the FCC) opened up new spectrum (called the PCS band) and auctioned this new spectrum to both incumbent and new network operators.

Some areas today have 8 or more wireless network operators. Santa Barbara County has seven at the moment – 5 nationwide networks (Cingular Wireless, Nextel, Sprint, T-Mobile, and Verizon Wireless) and 2 regional players (Alpine Communications and Entertainment Unlimited). After the Nextel/Sprint merger we will have 4 nationwide and 2 regional players. While this number of wireless network operators is good for competition, it also places demands for more cell sites on the county and city governments in the area.

Both the city and county have tried to encourage these network operators to work together and develop joint cell sites as one way to minimize the number of sites required to cover this area. In many cases this works well, but since these wireless network operators are in competition with each other, they are all looking for advantages in their markets and each may have a different set of priorities. For example, Nextel is primarily interested in blue-collar workers who need push-to-talk services while the other networks want to appeal to business and consumer customers. Oftentimes, this means the wireless network operators have different priorities for cell site locations. Getting two or more wireless network operators to agree on the same site location at the same time within varying budget cycles can be a daunting task.

I am often asked why network operators cannot share more than a cell site. Why must each have their own equipment and antennas? Until the merger of Cingular and AT&T, Cingular and T-Mobile were sharing a common network in California and Nevada. Once the merger was announced, the FCC and the Department of Justice required Cingular and T-Mobile to part ways and T-Mobile is now in control of the combined network with Cingular having to move its customer base to the existing AT&T network.

Beyond that, there are a number of reasons antennas and equipment cannot be shared among and between wireless network operators. The first is that they may operate in different portions of the spectrum, which means their equipment is not compatible. Second, they may deploy technologies that are not compatible.

For example, today, Cingular supports 4 different voice and 3 different data technologies on 2 different portions of the spectrum. Verizon Wireless supports 2 different voice technologies and a common data technology, again on 2 different portions of the spectrum. T-Mobile and Sprint are on the same portion of spectrum but are using different voice and data technologies. So in reality, the idea of sharing antennas and other equipment at cell sites is not practical.

How Networks Are Built

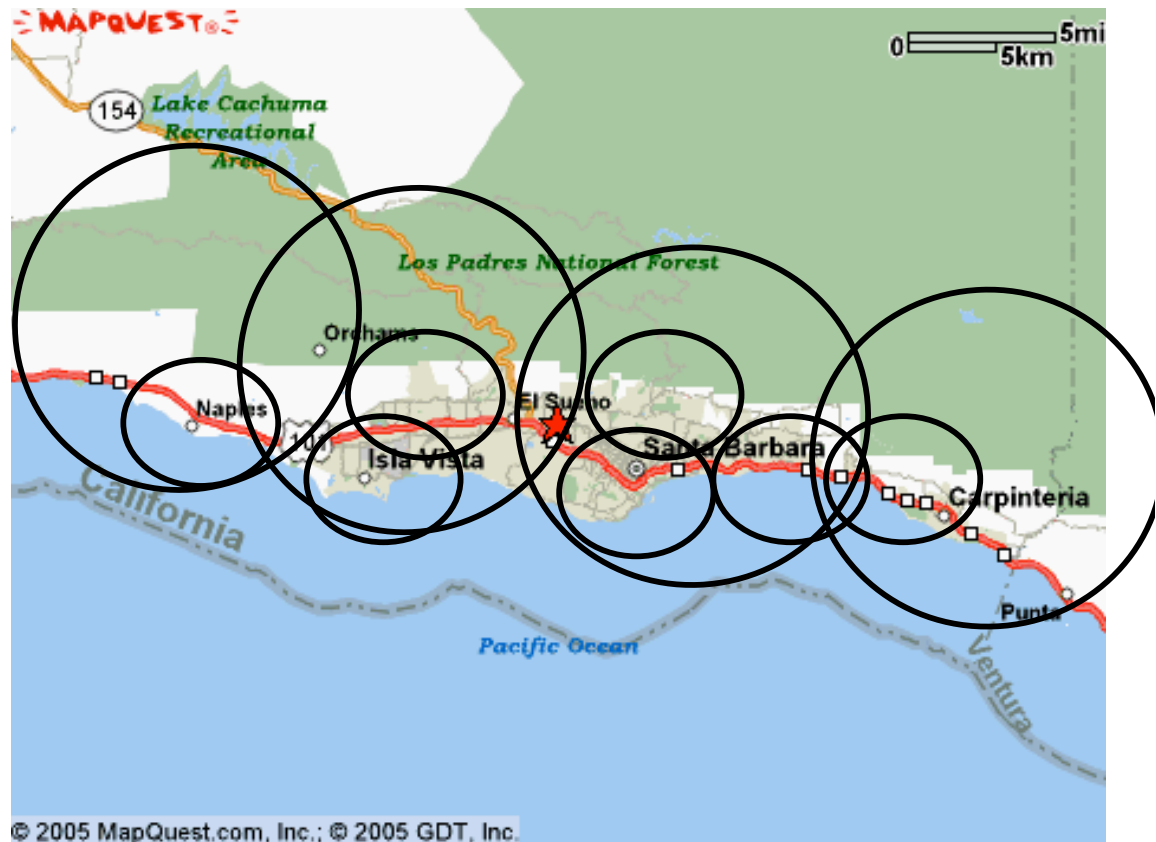
When the FCC grants a license for a given region to a wireless network operator, the operator has a finite time to get its network up and running. The rules are somewhat lax in this area so it is easy for most operators to build a few cell sites and meet the FCC requirements. Usually, the wireless network operator will go back into each area and add cell sites to provide better coverage and increased capacity to its prime customers, the business community. Therefore, most of the early cell sites were high-level (mountain or high tower) sites that covered the business population and the nation's freeway system.

Figure 1: A new wireless system covers a large area with a few cell sites.



As the price of wireless service continued to decline, more consumers began buying and using cellular phones. This meant that the network operators needed to provide coverage to housing developments, recreation areas, shopping centers, and surface streets in addition to major highways in a given region. They also needed to beef up the capacity of their networks. Wireless network operators can't pull more wires down a street. They have to build more cell sites that are closer together, thus lowering the number of customers simultaneously using any one cell site and providing better access to the wireless network.

Figure 2: As demand for wireless service increases new, smaller cells need to be built.

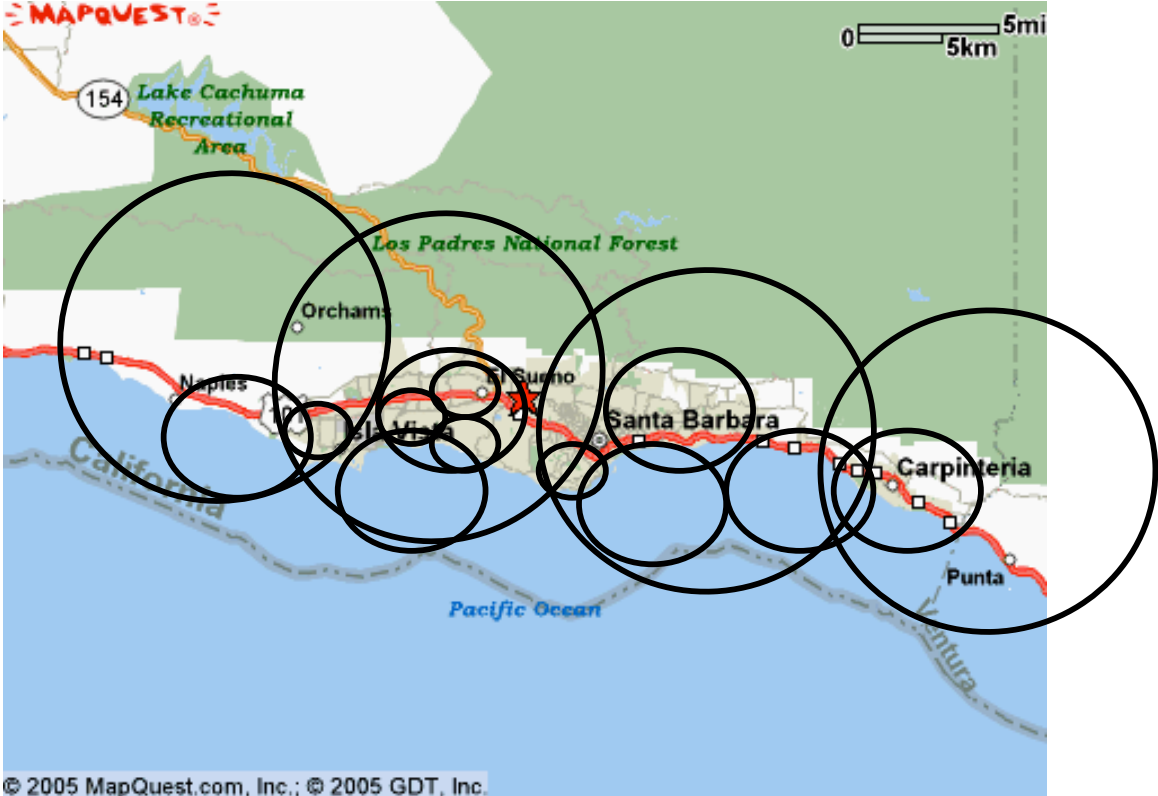


Each cell site is capable of handling a finite number of simultaneous calls. As cellular calls increase, so does the need to increase capacity across the network. The premise of cellular wireless is based on this concept. Start with large cell coverage areas then, as traffic increases, reduce the size of the cells (by adding new cells) to provide more capacity to customers. An example might be an area that is served by cell sites that provide service over a 10-mile area. Once the amount of cellular phone traffic grows, cell sites are added so each site covers a 5-mile radius, thus doubling the capacity of the system.

When the level of calls creates congestion and dropped calls, the size of the cell is divided again, this time going down to 2.5 miles between cell sites and it keeps repeating. In an area of extreme density, cell sites might be located within a quarter of a mile or less from each other in order to be able to handle the number of calls during peak loading periods. It is important to note that with the advent of “free night and week-end minutes,” peak calling times, which were morning and

evening commute times, have been lengthened to include nights and week-ends.

Figure 3: As demand for wireless services continues to increase, new cell sites that are smaller and closer together need to be built.



WIRELESS NETWORKS NEED TO BE MISSION CRITICAL

AT&T and other phone companies built their wired networks to withstand adverse conditions and to handle additional capacity as the demand for wired telephone service increased. Likewise, wireless network operators built their networks to high standards. This includes providing alternate power for times when public power is not available, redundant back-end services to ensure the best possible operation and tracking of the load on the networks to ensure that as demand for voice and data services increases in an area they can meet that demand and not subject their customers to dropped or uncompleted calls.

There is no way to provide this level of service without building additional cell sites that are closer together. This is especially important when wireless networks need to be able to provide access to emergency services. A single accident on a major freeway may prompt hundreds of calls to 911 emergency centers. Often, this volume of calls can clog a network reducing its capability to handle other calls, including calls placed by emergency responders.

Since each wireless cell site is limited and handles a finite number of calls, the only way to provide additional capacity is to build additional cell sites. The location of these new cells sites is a science of its own. The wireless network operator must first determine where there is congestion or high demand for services on its network and then try to find suitable locations for sites that will be able to take over some of this demand.

This search is not easy. It is a long, involved process that takes time and money. Most wireless network operators today are fully aware of a county or city's requirements for new cell sites and they factor this into their search for new sites. Whenever possible, they try to find a location that may already have a cell site that is providing service for another wireless network operator and propose a co-location on this site.

In many cases, however, this is not possible so a new location must be found, new wireless coverage surveys must be conducted and site design begun. Wireless network operators try to identify a site that meets their needs for capacity increases and coverage gains while being aware of the environment and aesthetics of any proposed cell site. They must also contend with regulations imposed by the Federal Communications Commission as well as by state and local government agencies.

In the early days of commercial wireless communications, new cell sites meant towers and other structures several hundred feet tall, usually made of steel and erected near freeways, industrial and business areas. Over the years, wireless network operators have become experts at blending their sites into the surrounding environment using a variety of creative ways to minimize the visual impact of the site. This includes but is not limited to mounting the antennas on a building and painting them to blend in with the building or providing a “monopine” mast that resembles a tree that blends in with other vegetation. Antennas can also be built into business signs and even within a structure on top of a church that then becomes a cross or other symbol.

In California, the expansion of wireless networks has been done with a minimum of visual impact. In other parts of the country, especially the mid-west, as you drive along the highways it is not unusual to see cell site antenna structures all along the way. In Santa Barbara County, driving along Highway 101, for example, unless you know where to look and what to look for, you will not see any signs of cell sites. This is a tribute to both the wireless network operators and the county and city planners.

More cell sites are needed today, and more will be needed in the future. For this reason, there needs to be a balance between the demands for wireless network coverage and city and county planning department requirements. The wireless network operators are attuned to the requirements of the cities and the counties with which they interact, but it appears that city and county planners are not fully aware of why new cell sites must be constructed or why, in some cases, they cannot be shared with other wireless network operators, and the fact that need for new cell sites will increase over time.

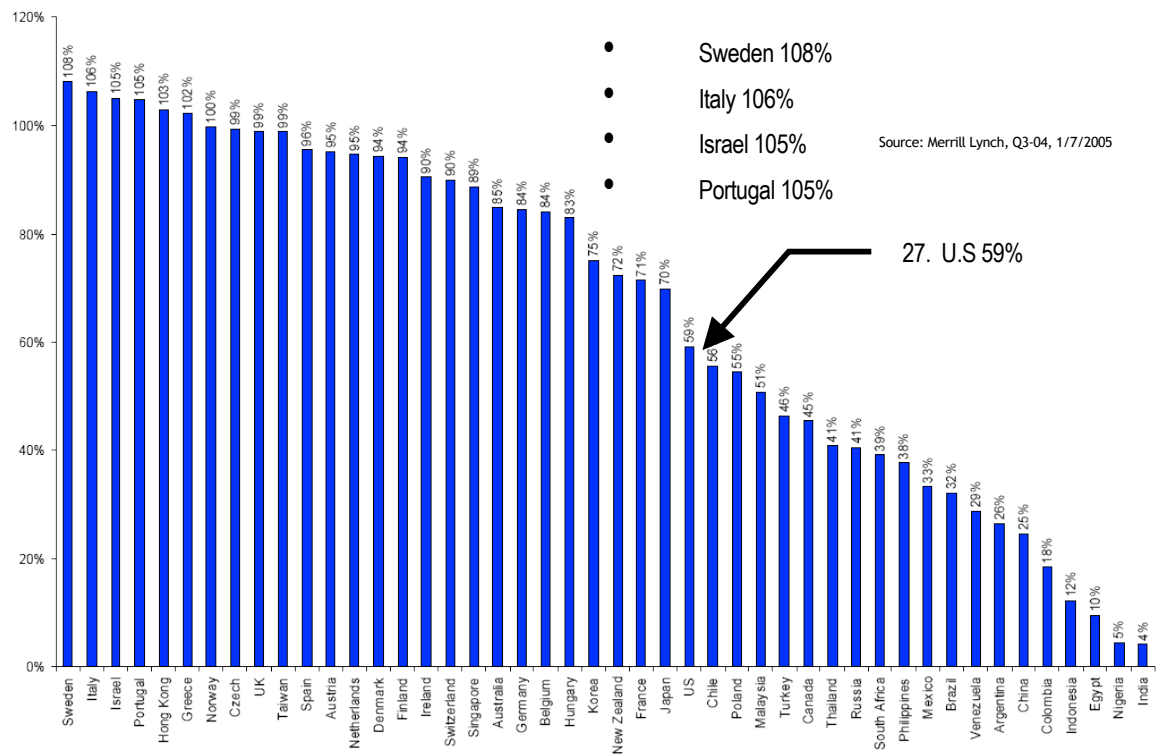
The demand for wireless services is on the rise. Projections are that while only 60% of the U.S. population today uses wireless voice and/or data services today, this percentage will grow to match what is happening in the rest of the world. This means that in a few years, more than 90% of the U.S. population will be using cellular communications services as their only form of communications or as an adjunct to one or more other types of voice and data access.

Cities and counties need to understand that as demand for wireless services increases, wireless network operators will need to build more cell sites in order to increase capacity on their networks as well as to increase network coverage into housing and recreational areas. This growth can best be handled when those providing the demanded services (the wireless network operators) and those charged with the planning and permitting processes within city and county governments understand each other’s needs and work together.

THE FUTURE DEMAND FOR WIRELESS SERVICES

Wireless service demand is at an all-time high within the United States and around the world. It is the fastest-growing segment of the telecommunications industry and in many places cellular devices are displacing traditional wired phone and data services.

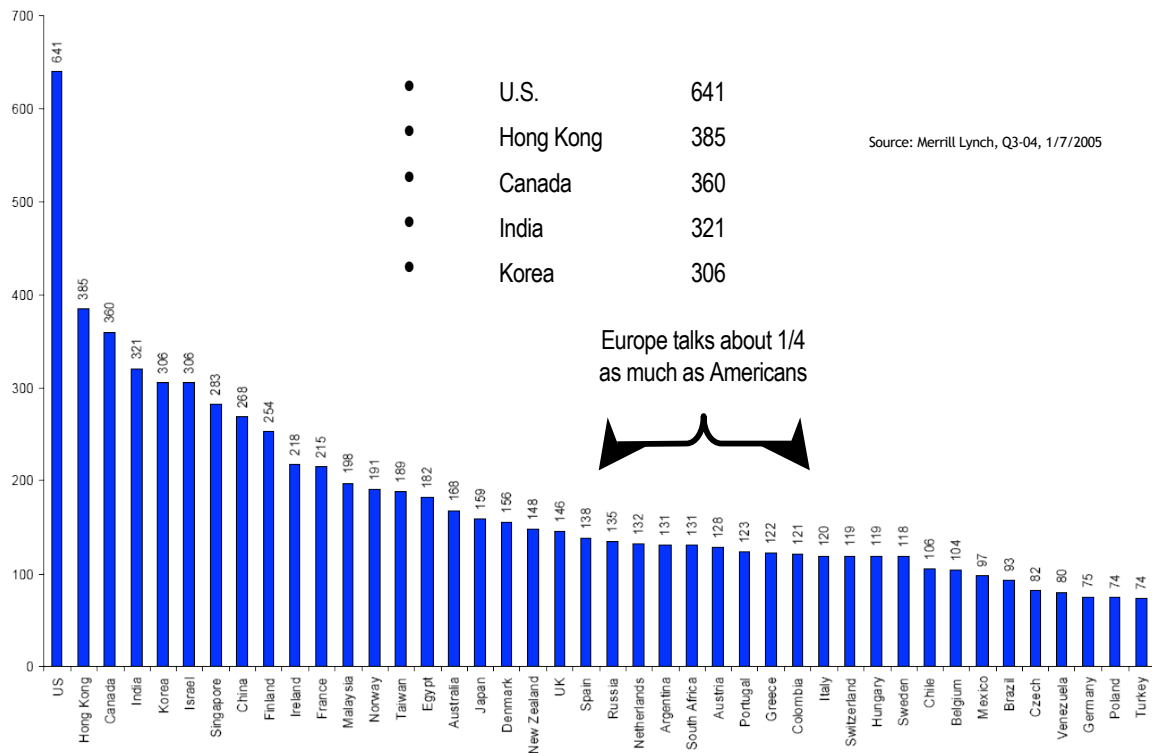
In Figure 3 you will see penetration rates for many countries as reported by Merrill Lynch for the last two quarters of 2004. In this graph you will see that the United States ranks number 27 in the world with 59% of the U.S. population using cellular wireless devices. You will also note that in many countries, mostly where wireless services have been available for a longer time, penetration rates are over 80% and in some cases over 100%.



Another predictor of the demand for wireless services within the United States is that the number of minutes of use for wireless services by U.S. consumers is the highest in the world by a wide margin. Because of the attractive pricing structure, the inclusion of both roaming and long-distance charges and free week-end and evening minutes, the average

U.S. wireless customer consumes more than 600 minutes of wireless services each month.

Figure 4: Wireless minutes of use compared with other countries.



While these figures are based on the number of voice minutes used in the various countries, another trend needs to be considered when planning for wireless growth: New third-generation systems are capable of data services as well as voice. These services include access to corporate email, calendar and other applications that enable mobile workers to access their corporate information.

Applications intended for wireless consumers include taking and sending photos and downloading games, ring tones and other information. The latest wave of applications includes viewing video or TV clips on your phone, recording and forwarding video clips to others and even playing interactive 3D games using a cell phone over the wireless network.

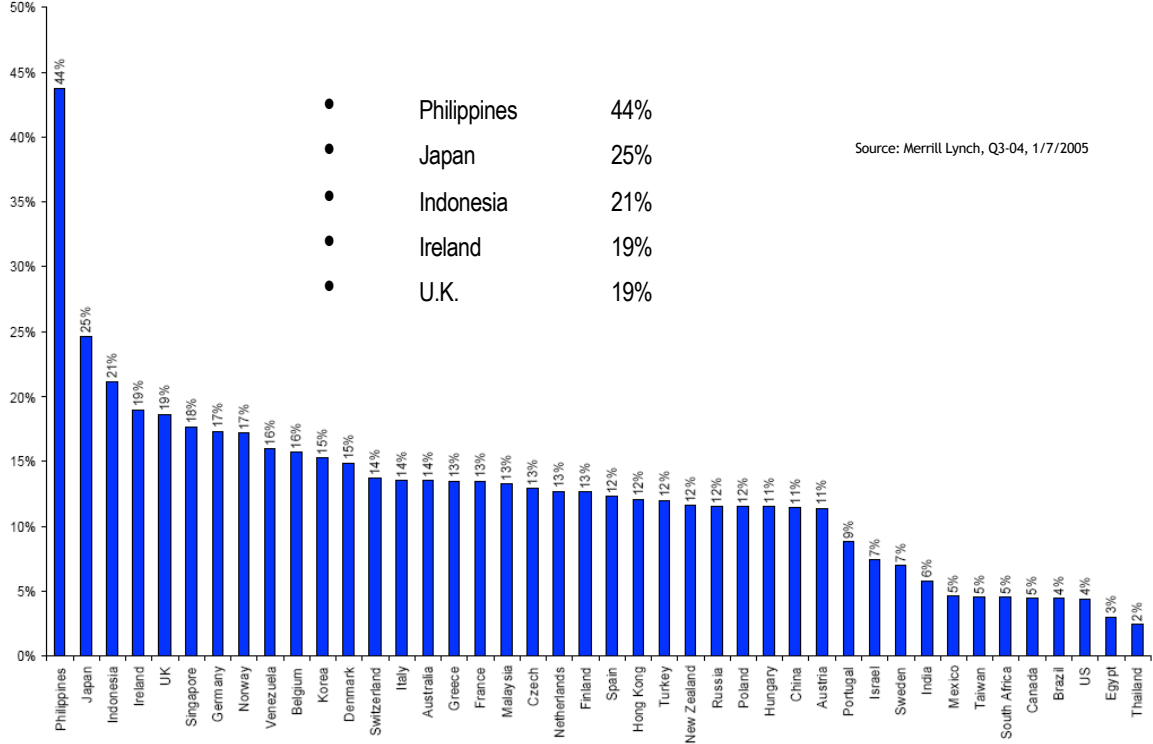
Soon, a new wave of applications and services will be available over the wireless networks. These applications will be based on a new technology developed for E911 location services for emergencies and they are being referred to as location-based services. With these services we will be able to receive turn-by-turn directions and real-time traffic reporting on

our cell phones, locations of the nearest ATMs, theaters or other points of interest and much more.

All of these new data services will create an even greater demand for wireless services over the next few years. This will, of course, necessitate further increases in network capacity. Again, the only way for wireless network operators to provide added capacity is to add cell sites.

As can be seen from Figure 5, the United States is only beginning to experience a demand for data services. If you look at some of the other countries listed in the figure, you will see that today in Japan, for example, 25% of all wireless revenue is derived from data services. In the United States, this number is much lower (4% in this chart) but growing rapidly. This growth in data services will put a further demand for capacity on the shoulders of the wireless network operators.

Figure 5: Wireless data leaders in the world. Data in this chart is represented as a portion of the total monthly revenue per country.



CONCLUSIONS

Wired telecommunications providers have increased capacity by adding more wires along our streets and upgrading equipment in their central offices. Cable TV and data providers have added more capacity by splitting the number of hubs and serving fewer customers per hub. Neither method for adding capacity is visible to the general public.

The only way for wireless network operators to add capacity today is to add cell sites, each covering a smaller area. These cell sites are visible to the general public. As mandated by the Federal Communications Commission, there are between 5 and 7 wireless network operators in a given area, but only a single telephone and cable company. This places an additional burden on city and county planners and wireless network operators. The operators must increase their network capacity and coverage to meet the growing demand for wireless services while cities and counties must balance their mandate to serve their citizens who are demanding more wireless access with their desire for orderly growth.

The trends that can be seen around the world hold true for the United States. The demand for wireless services will grow and capacity must be increased to satisfy this demand. And as new services are rolled out there will be even more demands on the networks as each of us use our wireless devices for longer periods of time each day.

Santa Barbara County has been wrestling with these issues for a number of years. On February 25, 1997, the Santa Barbara County Telecommunications Task Force delivered a report to the County Board of Supervisors that contained a number of recommendations. This report, it turns out, was correct in many aspects of what the future of telecommunications services in the county will entail.

One of the recommendations was that the county should “consider aggressive marketing and leasing of certain county property for use as cell sites which will provide the County with ongoing revenue over at least the next twenty years.” It went on to recommend that the County hire a qualified consultant to act as an agent on behalf of the County or that the County should conduct marketing and lease arrangements using County Staff.

Many of the recommendations made in this report, had they been implemented, would have provided the County of Santa Barbara with significant revenue from the wireless network operators and would have provided for additional wireless communications facilities as part of a

master lease agreement. Those who completed this study and prepared this report were forward thinking in their ideas and vision for the future of wireless communications.

Perhaps it is time to review this report, update it and put together a master plan that will benefit the County and its residents and provide wireless network operators with a level playing field when it comes to upgrading their networks as more capacity and better coverage is demanded, as it will be for the next decade or more.

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