mobile multichannel one-way video programming services.[747] Verizon Wireless and AT&T have announced plans to deploy 4G broadband networks in the 700 MHz paired spectrum blocks in the coming years.[748]

277. *Spectrum Holdings Above 1 GHz.* All four nationwide providers hold spectrum above 1 GHz. Verizon Wireless, AT&T, and T-Mobile each hold a substantial number of PCS and AWS licenses, while Sprint Nextel holds significant amounts of PCS spectrum. Of the PCS and AWS spectrum held by nationwide providers, again based on MHz-POPs, Verizon Wireless holds approximately 15.3 percent of the PCS and 15 percent of the AWS spectrum, AT&T holds around 25.9 percent of the PCS and 11.2 percent of the AWS spectrum, Sprint Nextel approximately 26.8 percent of the PCS and none of the AWS, and T-Mobile approximately 19.7 percent of the PCS and nearly 28 percent of the AWS. US Cellular, MetroPCS, and Leap each hold some PCS and a somewhat higher percentage of the more recently auctioned AWS spectrum. Finally, other smaller providers hold approximately 5.5 percent of the PCS spectrum and nearly 30 percent of the AWS spectrum. Each of the nationwide providers, along with many others, offers mobile broadband and data services on 3G networks using some of this spectrum. MetroPCS also has announced plans to deploy 4G services using its AWS spectrum.[749]

278. Finally, as noted above, Clearwire holds substantial amounts of 2.5 GHz spectrum, comprised of BRS and EBS spectrum. It has been offering 4G broadband data services, using WiMAX technology, in markets across the country. None of the nationwide providers hold BRS/EBS spectrum, although Sprint Nextel has a majority ownership interest in Clearwire. Several smaller providers, including Xanadoo and Digital Bridge, are, like Clearwire, deploying WiMAX in their BRS and EBS spectrum holdings.[750]

279. *Relative Distribution of Spectrum Holdings Below and Above 1 GHz.* Chart 41 shows the spectrum holdings of nationwide wireless providers by frequency – licensees' holdings under 1 GHz versus licensees' holdings above 1 GHz. It provides a side-by-side comparison of each licensee's holdings, in terms of total population-weighted average megahertz under 1 GHz and above 1 GHz.

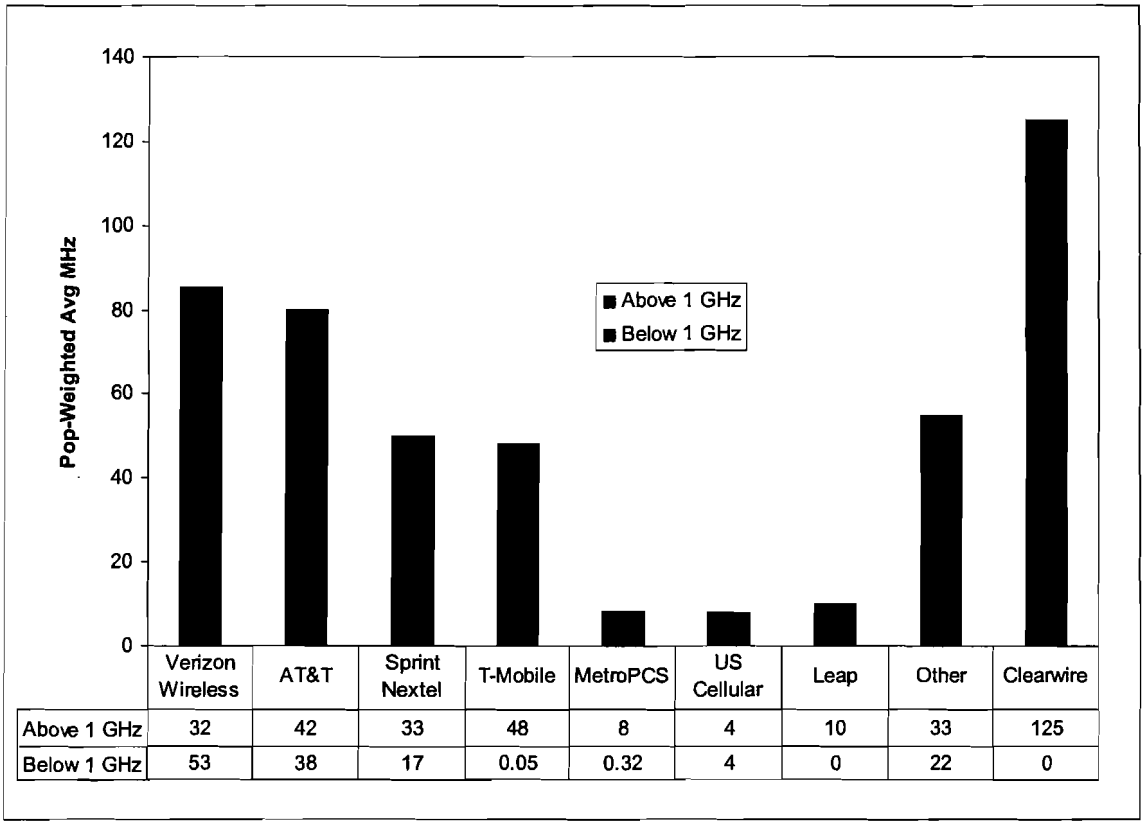
[747] *See, e.g.*, MediaFLO, *Enabling the Wireless Ecosystem*, http://www.mediaflo.com/about_us.html (visited Apr. 29, 2010).

[748] *See* Section IV.B.1.a, Service Provider Technology Deployments, *supra*.

[749] *Id.*

[750] Digital Bridge Communications, *About DBC: Bringing Broadband to Underserved or Rural Communities Nationwide*, http://www.digitalbridgecommunications.com/AboutDBC/tabid/84/Default.aspx (visited Apr. 29, 2010); Xanadoo Company, *About Xanadoo*, http://www.xanadoo.com/about.html (visited Apr. 29, 2010).

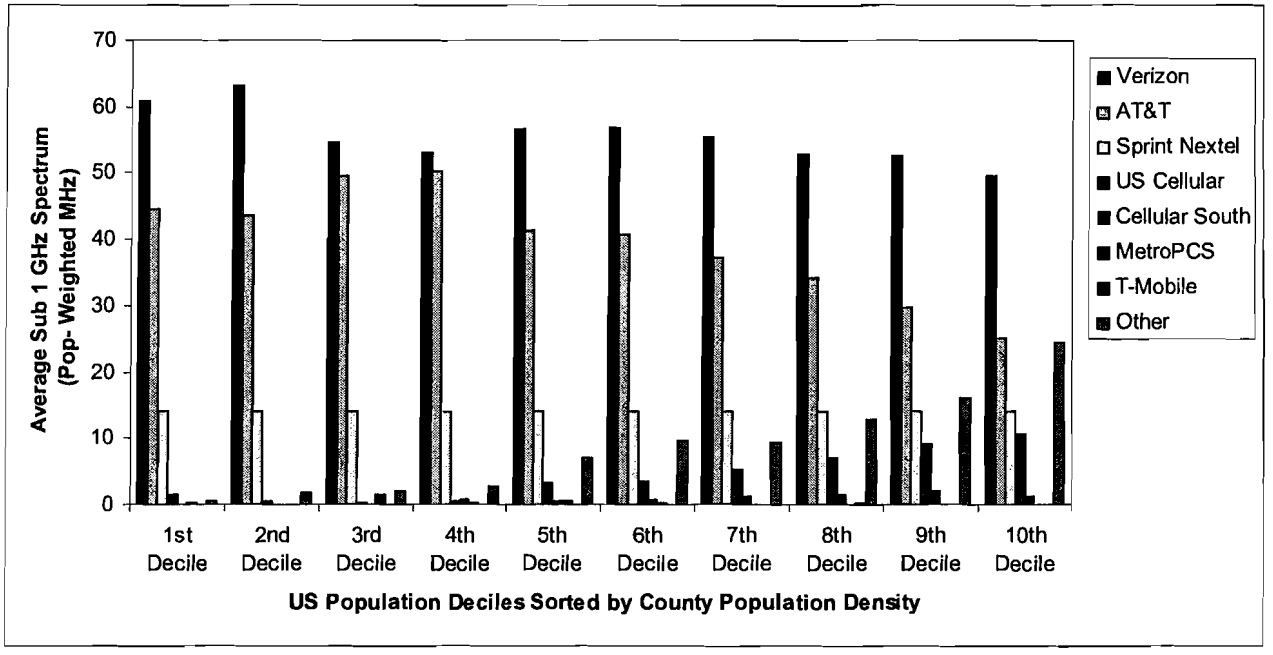
Chart 41
Population-Weighted Average Megahertz Under/Over 1 GHz (Licensed Spectrum Only)



	Verizon Wireless	AT&T	Sprint Nextel	T-Mobile	MetroPCS	US Cellular	Leap	Other	Clearwire
Above 1 GHz	32	42	33	48	8	4	10	33	125
Below 1 GHz	53	38	17	0.05	0.32	4	0	22	0

280. *Distribution of Spectrum by Population Density.* Chart 42 below shows how spectrum is nationally distributed by population density. Generally, as the population density decreases, the sub-1 GHz spectrum holdings of the large providers decrease, and those of regional and smaller companies increase.

Chart 42
Average Sub-1GHz Spectrum by Population Density Deciles



d. Competitive Effects of Spectrum Holdings

281. The Commission's competition policies with respect to spectrum holdings have been designed to preserve competitive opportunities in the mobile wireless marketplace and retain incentives for efficiency and innovation. Its policies have evolved over the years as more and more spectrum has been made available for mobile services. These policies have also changed as the marketplace changes and technology evolves.

282. The mobile CMRS marketplace for mobile telephone services in 1995, when the *First Report* was issued, was very different from today's marketplace. Until 2007, the Commission's competition policies concerning the spectrum input market for mobile services focused on spectrum associated with three frequency bands – Cellular, SMR, and broadband PCS. These were the specific frequency bands that, until that time, the Commission had determined to be spectrum "suitable" for the provision of mobile services in the relevant product market, which the Commission had defined as the product market for "mobile telephony" services.[751] For purposes of its competitive analysis, the Commission has evaluated whether particular spectrum bands are "suitable" for mobile wireless services by determining whether the spectrum is capable of supporting mobile services given its physical properties and the state of the equipment technology, whether the spectrum is licensed with a mobile allocation and corresponding service rules, and whether the spectrum is committed to another use that effectively precludes its uses for mobile telephony.[752] Since the Commission first began applying a "spectrum screen" as part of its competitive analysis, the Commission has determined that additional spectrum should be part of its spectrum input analysis – including 700 MHz,[753] AWS, and BRS

[751] *See AT&T-Dobson Order*, 22 FCC Rcd at 20311-312 ¶¶ 26-27 (2007).

[752] *Id.* at ¶ 26.

[753] *Id.* at ¶ 31.

spectrum[754] – and has continued to modify the spectrum screen as more spectrum has become available.[755] The Commission also has recognized that the mobile services marketplace – including the product market – has evolved. In 2008, the Commission revised its competition policies, no longer limiting its competitive analysis to examination of the mobile telephony product market. Given the increasing prevalence of mobile broadband services, the Commission began examining a combined product market for both mobile telephony services and mobile broadband services.[756]

283. As discussed above, spectrum resources in different frequency bands have distinguishing features that can make some frequency bands more valuable or better suited for particular purposes. For instance, given the superior propagation characteristics of spectrum under 1 GHz, particularly for providing coverage in rural areas and for penetrating buildings, providers whose spectrum assets include a greater amount of spectrum below 1 GHz spectrum may possess certain competitive advantages for providing robust coverage when compared to licensees whose portfolio is exclusively or primarily comprised of higher frequency spectrum. As discussed above, holding a mix of frequency ranges may be optimal from the perspective of providing the greatest service quality at low cost.

2. Infrastructure Facilities

a. Background

284. Infrastructure facilities are a major input into the provision of mobile wireless service. These facilities are comprised largely of cellular base stations and towers or other structures on which the base stations are situated. A base station generally consists of radio transceivers, antennas, coaxial cable, a regular and backup power supply, and other associated electronics. These base stations are generally placed atop a purpose-built communications tower, or on a tall building, water tower, or other structure providing sufficient height above the surrounding area.[757] The number of cell sites in use by wireless providers continues to grow in order to satisfy the increased demand created by new subscribers, accommodate additional airtime usage per subscriber largely caused by increased use of data services including broadband wireless and mobile Internet, expand geographic service area coverage and to improve coverage in existing service areas, and accommodate newer technologies. According to CTIA, the total number of cell sites in use by CTIA's members was 245,912 as of June 30, 2009.[758] This represents an increase in the number of cell sites of 1.6 percent since December 31, 2008, 41 percent since June 30, 2004, and 66.5 percent since June 30, 2003.[759] According to company reports, 204,817 of these cell sites, or 83 percent, were associated with the four major wireless providers.[760] For the four major wireless service providers, the percentage increase in the number of cell sites in use between the

[754] *Sprint Nextel-Clearwire Order*, 23 FCC Rcd at 17596-17600, ¶¶ 61-73. As discussed above, in reviewing proposed merger transactions that involve spectrum aggregation, the Commission examines market participants' holdings of suitable spectrum to ensure that there is sufficient spectrum available to competitors.

[755] *See id.*

[756] *See id.* at 17596 ¶ 61; *Verizon Wireless-ALLTEL Order*, 23 FCC Rcd at 17469-470, ¶¶ 45-47.

[757] An alternative to the use of tall structures for cell sites is distributed antenna systems (DAS). DAS are comprised of a relatively large network of small cells that are connected by fiber optic cable and can be placed on such locations as utility poles, buildings, or traffic signal poles, in geographic areas where either constructing towers is not feasible, or where wireless traffic demands are too great to be met with fewer, large cells. Because DAS sites are unobtrusive, they are particularly desirable in areas with stringent zoning regulations, such as historic districts. Two major providers of such networks are ADC Telecommunications (http://www.adc.com/us/en/), and NextG Networks (http://www.nextgnetworks.net/).

[758] *See CTIA Mid-Year 2009 Wireless Indices Report*, at 28; CTIA NOI Comments at 34-35.

[759] *Id.*

[760] AT&T reported 51,470 cell sites, Sprint 66,250, T-Mobile 45,397, and Verizon Wireless 45,397, as of June 30, 2009. *US Wireless 411 3Q09*, at 50.

end of the September 2008 and the end of September 2009 has been as follows: AT&T (5.5 percent), Sprint Nextel (0.8 percent), T-Mobile (6.6 percent), and Verizon Wireless (39.5 percent).[761]

b. Communications Tower Industry

285. The most visible cell sites are those that are situated on relatively tall communications towers. As noted above, cell sites may also be located on buildings, municipal water towers, and church steeples, and some cell sites are located inside buildings to fill indoor coverage gaps. In addition, cell sites may be located at the lower levels of taller towers built to support other communications services, such as broadcast or public safety. With the growth of cell sites required to meet the needs of wireless service providers and their subscribers, a communications tower industry has evolved. A typical communications tower can accommodate five to six tenants, though the industry average of wireless tenants per tower is currently approximately 2 to 2.5.[762] This industry includes companies that own large numbers of towers on which they lease space to wireless service providers. In addition, there are a number of companies that help wireless service providers identify available tower or building space in needed geographic areas or, alternatively, arrange to construct towers where no appropriate facilities exist. The five largest independent tower companies are American Tower Corporation (American Tower), Crown Castle International (Crown Castle), Global Tower Partners, SBA Communications (SBA), and TowerCo.[763] Additionally, the major wireless service providers own or lease a large number of cell sites.[764]

286. Analyst reports about the communications tower industry indicate that the financial health of this industry is dependent to a large extent on the wireless service providers and whether or not they have the capital resources to expand service to new geographic areas or to enhance the quality of service in current service areas. Analysts seem to be optimistic that the expansion of new wireless providers, such as Clearwire, into new markets,[765] together with the deployment of newer technologies by existing wireless service providers to, bodes well for growth of the tower industry. Clearwire is reportedly planning to deploy approximately 19,000 cell sites by the end of 2010, while Verizon Wireless indicates it will need to have in place a total of between 60,000 and 70,000 cell sites in order to accommodate its current needs and the deployment of its LTE network,[766] a projected increase of between 18,000 and 28,000 cell sites from June 30, 2009.[767] This growth potential, together with low churn – due to the high cost to wireless service providers of switching towers – and the annuity-like revenue stream from long-term leases, which include standard annual price escalators of 3-5 percent, contribute to a

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[761] *US Wireless 411 3Q09*, at 50. The significant increase in the number of Verizon Wireless cell sites is due largely to its acquisition of Alltel in January 2009.

[762] *SBA Communications*, Bank of America/Merrill Lynch, Mar. 27, 2009, at 10.

[763] The companies are listed in order of size based on the number of towers owned. American Tower is the largest and TowerCo is the fifth largest. American Tower, Crown Castle, and SBA Communications are public companies, while Global Tower and TowerCo are privately held. According to Verizon Wireless, no single tower company owns more than 21 percent of all towers nationwide. *See* Verizon Wireless NOI Comments at 102.

[764] Sprint sold many of its company-owned cell site structures in the past few years and then leased space on them, most recently selling approximately 3,000 towers to TowerCo. *TowerCo Completes Acquisition Of 3,080 Towers From Sprint Nextel For $670 Million,* Press Release, TowerCo, Sept. 24, 2008. It is not possible to determine from publicly-available information the number of cell sites still owned by Sprint Nextel or any of the wireless service providers.

[765] *Wireline & Wireless Telecom Services*, Bank of America/Merrill Lynch, Sept. 24, 2009, at 4.

[766] Presentation by Nadine Manjaro, ABI Research, *PCIA Wireless Infrastructure Show Debrief*, at 2009 Wireless Infrastructure Show, Oct. 1, 2009, *available at* http://www.rcrwireless.com/assets/pdf/PCIA_Wireless2009_Debrief.pdf.

[767] *US Wireless 411 3Q09*, at 50.

favorable financial outlook for the tower industry.[768] For example, American Tower reported that its revenue increased 8.5 percent between the third quarter of 2008 and the third quarter of 2009, and 9.7 percent between the fourth quarter of 2008 and the fourth quarter of 2009;[769] Crown Castle reported that its revenue increased 13 percent between the third quarter of 2008 and the third quarter of 2009, and 12 percent between the fourth quarter of 2008 and the fourth quarter of 2009;[770] and SBA reported that its revenue increased 17.4 percent between the third quarter of 2008 and the third quarter of 2009, and 7.9 percent between the fourth quarter of 2008 and the fourth quarter of 2009.[771]

c. Barriers to Cell Site Deployment

287. Two significant constraints faced by wireless services providers that need to add or modify cell sites are obtaining the funds needed to finance the capital expenditure, and obtaining the necessary regulatory and zoning approvals from state and local authorities.[772]

288. Co-locating base station equipment on an existing structure is often the most efficient and economical solution for existing and new wireless service providers that need new cell sites. Co-location is also commonly encouraged by zoning authorities to reduce the number of new communications towers.[773] Due to the high cost to construct new towers, and the often considerable delay to obtain approvals from state and local authorities, wireless service providers will typically look first for existing towers or other suitable structures for new cell sites. Co-location is particularly useful in areas in which it is difficult to find locations to construct new towers.

289. The issue of excessive delays in the zoning approval process was the subject of a Petition for Declaratory Ruling filed by CTIA in 2008. CTIA sought Commission assistance to alleviate unnecessary delays in the process of obtaining approval to construct a new cell site, or to modify an existing site.[774] The Commission solicited comments on the CTIA petition and developed a full and robust record. Based on the evidence in that record, the Commission agreed that the lack of timely action on a significant number of cell site applications was impeding the ability of wireless providers to improve and expand their service offerings. On November 18, 2009, the Commission adopted a Declaratory

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[768] *SBA Communications,* Bank of America/Merrill Lynch, Mar. 27, 2009, at 8.

[769] *American Tower Corporation Reports Third Quarter 2009 Financial Results*, Press Release, American Tower, Nov. 3, 2009, *available at* http://phx.corporate-ir.net/phoenix.zhtml?c=98586&p=irol-newsArticle_Print&ID=1349946&highlight; *American Tower Corporation Reports Fourth Quarter and Full Year 2009 Financial Results*, Press Release, American Tower, Feb. 24, 2009, *available at* http://phx.corporate-ir.net/phoenix.zhtml?c=98586&p=irol-newsArticle_Print&ID=1394632&highlight.

[770] *Crown Castle International Reports Third Quarter 2009 Results; Provides 2010 Outlook*, Press Release, Crown Castle, Nov. 3, 2009, *available at* http://investor.crowncastle.com/phoenix.zhtml?c=107530&p=irol-newsArticle&ID=1350357&highlight; *Crown Castle International Reports Fourth Quarter And Full Year 2009 Results*, Press Release, Crown Castle, Jan. 27, 2010, *available at* http://investor.crowncastle.com/phoenix.zhtml?c=107530&p=irol-news&nyo=0.

[771] *SBA Communications Corporation Reports 3rd Quarter 2009 Results*, Press Release, SBA, Oct. 29, 2009, *available at* http://ir.sbasite.com/releasedetail.cfm?ReleaseID=420018; *SBA Communications Corporation Reports 3rd Quarter 2009 Results*, Press Release, SBA, Feb. 25, 2010, *available at* http://ir.sbasite.com/releasedetail.cfm?ReleaseID=447344.

[772] There is no evidence that shortages of transmission equipment, including antennas, to install at cell sites, act as a barrier to cell site deployment.

[773] *See, e.g.,* Guilford County, NC, *Development Ordinance on Cellular Tower Placement*, www.co.guilford.nc.us/planning_cms (visited Jan. 25, 2010).

[774] Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review and to Preempt under Section 253 State and Local Ordinances that Classify All Wireless Siting Proposals as Requiring a Variance, WT Docket No. 08-165, *Petition for Declaratory Ruling*, filed July 11, 2008.

Ruling which, among other things, defined presumptively reasonable time parameters for state or local zoning authorities to decide whether or not to approve a cell site application.[775]

d. Competitive Effects of Infrastructure Costs and the Independent Communications Tower Industry

290. Infrastructure capital expenses for a new entrant can be higher than those for existing service providers. Infrastructure capital expenses per cell site vary depending primarily on whether the infrastructure is to be added to an existing cell site or entails building a completely new cell site. Additionally, a new entrant would need to construct a core network that includes such components as switches to connect its cell sites, gateways to access other networks, authentication capabilities, and back-office capabilities such as billing and customer service. The infrastructure operating expenses should be quite similar regardless of whether they are associated with an existing or new cell site for an existing wireless service provider, or a new cell site for a new wireless service provider.

291. When communications towers are owned by independent companies rather than wireless service providers, it may increase efficiency in the industry, ease entry, and enhance wireless service competition. Unlike wireless service providers that may have an economic incentive to forestall competition in a given area by restricting or delaying competitors' access to towers or antenna structures that they own, tower companies independent of wireless service providers have an incentive to maximize revenues by leasing space to as many service providers as possible. Therefore, it may be easier for wireless service providers to add cell sites on independently-owned towers in order to expand their geographic coverage area or to enhance service within a current coverage area. In addition, the ability of wireless service providers to lease space for new cell sites on established towers can ease and speed their entry into new geographic areas by eliminating the need to build a new tower. The use of existing towers also reduces the capital requirements for both new entrants and existing wireless service providers because they only need to finance the purchase and installation of the transmission equipment to be used at the cell site.

292. However, we note that, in many geographic areas, the most desirable positions for antennas on communication towers are occupied by existing tenants, leaving subsequent tenants with a choice of antenna positions that may not be optimal for their needs. Even with the reduced entry costs associated with an independent tower industry, tower siting costs and scarcity of desirable antenna position may constitute significant entry barriers to new providers.

3. Backhaul Facilities

a. Background

293. Backhaul connections are an integral component of a wireless service provider's network. Backhaul facilities link mobile providers' cell sites to wireline networks, carrying wireless voice and data traffic for routing and onward transmission. As wireless data services increase as a percentage of a mobile wireless provider's overall traffic, consuming vastly greater bandwidth, existing backhaul solutions are increasingly strained. Wireless providers must have access to sufficient backhaul, in terms of capacity and speed, to avoid creating a communications bottleneck.[776] As discussed above, estimates of average monthly backhaul costs range from hundreds of dollars (for a T1 line) to several thousand

[775] Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review and to Preempt Under Section 253 State and Local Ordinances that Classify All Wireless Siting Proposals as Requiring a Variance, *Declaratory Ruling*, WT Docket No. 08-165, 24 FCC Rcd 13994, 14021 ¶ 71 (2009), *petition for recon. pending, petition for review pending*, City of Arlington v. FCC, No. 10-60039 (5th Cir., filed Jan. 12, 2010).

[776] Service providers must provide backhaul for increasing numbers of cell sites and ensure that the backhaul solutions they employ provide sufficient capacity to support increasing use of wireless data services.

dollars per month.[777] Cell site backhaul capacity is forecast to increase fourfold between 2007 and 2011.[778]

294. There currently are three major technologies for backhaul transmission: copper lines, microwave (fixed wireless), and optical fiber.[779] Historically, copper circuits have been the predominant choice for backhaul traffic. The heavy reliance on copper transmission is diminishing. For example, one study estimated that 70.9 percent of backhaul traffic in 2009 would be carried via copper, 16.8 percent via fiber, and 12.3 percent via fixed wireless (including microwave).[780] In comparison, in 2005, 85.5 percent of backhaul traffic was carried via copper, 5.8 percent by fiber, and 8.7 percent by fixed wireless.[781] In other words, the incidence of copper as the medium for backhaul transmission is estimated to have decreased by nearly 15 percent over four years.

b. Competitive Landscape

295. Providers of backhaul services include incumbent local exchange carriers, independent wireline companies, cable providers, and independent wireless operators. Wireless providers may purchase special access services,[782] including DS1s and DS3s, from third parties for backhaul. Wireless providers that are unaffiliated with a wireline provider often purchase special access services from the incumbent local exchange carriers against whose wireless affiliates they compete.[783] One wireless service provider has claimed that over 98 percent of all DS1 circuits are purchased from incumbent local exchange carriers (LECs), as are the vast majority of DS3 connections.[784]

296. Backhaul costs currently constitute a significant portion of a mobile wireless operator's network operating expense, and the demand for backhaul capacity is increasing.[785] Wireless providers unaffiliated with a wireline provider often must rely on their competitors' affiliates for access. The Commission is examining the current state of competition for special access services to ensure that rates for these services are just and reasonable.[786] In light of the growing need for backhaul, cost-efficient access to adequate backhaul will be a key factor in promoting robust competition in the wireless marketplace.

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[777] *See MSV 700 MHz Comments* (hundreds of a dollars for a T1 line to $2,000 for a DS3 connection); Space Data Corporation Comments, WT Docket No. 06-150, PS Docket No. 06-229, Exhibit A (filed June 20, 2008) (backhaul cost ranging from $2,500 to $6,000). *See* Section III.D, Entry and Exit Conditions, *supra.*

[778] SNL Kagan, Communications Industry News, June 26, 2008, at 1 (citing Infonetics Research Analyst, Michael Howard).

[779] Different protocols for data transmission (*e.g.*, TDM , Ethernet) can run over each type of physical facility.

[780] *Wireless Backhaul Market Study*, New Paradigm Resources, Oct. 2008.

[781] *Id.* This study estimated that as of mid-2009, there were about 530,000 backhaul lines, for 230,000 cell sites in the United States. *Id.*

[782] Special access services do not use local switches; instead they employ dedicated facilities that run directly between two designated locations. *See* Special Access Rates for Price Cap Local Exchange Carriers, WC Docket No. 05-25, RM-10593, *Order and Notice of Proposed Rulemaking*, 20 FCC Rcd 1994, 1997, ¶ 7 (2005) (*Special Access NPRM*).

[783] Other options, including higher bandwidth Ethernet services, are currently unavailable in a number of markets.

[784] Sprint Nextel Comments, WC Docket No. 05-25 (filed Jan. 19, 2010), at ii.

[785] Verizon Wireless NOI Comments at 95-96 (citing a study by Raymond James which estimates that the size of the backhaul market will grow from $3 billion annually to $8 to $10 billion in the next three to fixe years, driven in large part by increases in wireless data traffic).

[786] *See* "Parties Asked to Comment on Analytical Framework Necessary to Resolve Issues in the Special Access NPRM," *Public Notice*, 24 FCC Rcd 13638 (2009) (referring to the *Special Access NPRM*).

c. The Growing Need for Backhaul Solutions and Alternatives

297. Several recent trends in the mobile wireless market have led to the increased demands on backhaul capacity, making access to sufficient backhaul an increasingly central component of a mobile wireless provider's overall performance. First, the increased adoption of Internet-connected mobile computing devices, incorporating such advanced functionalities as video and Internet browsing, is consuming greater amounts of bandwidth. As the smartphone penetration rate increases, bandwidth-consuming data services are becoming an increasing percentage of a mobile wireless provider's overall traffic. As discussed above, it is estimated that global mobile data traffic grew 157 percent, from 33 terabytes in 2008 to 85 terabytes in 2009.[787] Second, the proliferation of fixed-rate mobile Internet access plans enables subscribers to consume more services and greater bandwidth. As noted earlier, AT&T reported its network has seen an 18-fold increase in data traffic since the iPhone was introduced, with mobile data traffic increasing by over four times during the June 2008 to June 2009 period alone.[788] Third, mobile wireless network data speeds have increased as technology has evolved, with the forthcoming 4G WiMAX and LTE technologies supporting even higher data throughput rates and lower latencies.

298. In light of the foregoing factors, identifying solutions to satisfy the growing demand for mobile backhaul is taking on increasing importance. The special access proceeding affects services generally provided over copper or fiber by wireline carriers regulated under price caps.[789] Many wireless providers also use point-to-point microwave transmission. We note that the recently released National Broadband Plan recommends that the Commission take action to ensure that sufficient microwave spectrum is available to meet current and future demand for wireless backhaul, especially in the bands below 12 GHz.[790] The National Broadband Plan also recommends that the Commission take further actions to enhance the flexibility and speed with which companies can obtain access to spectrum to use for wireless backhaul, which is critical to the deployment of wireless broadband and other wireless services.[791] The National Broadband Plan also includes several recommendations to facilitate the more efficient and economic installation of fiber facilities that may be used to meet the rapidly increasing demand for additional wireless backhaul capacity.[792]

B. Downstream Segments

1. Mobile Wireless Handsets/Devices and Operating Systems

299. Handsets and devices are becoming increasingly central to the dynamics of the overall wireless market. Recent studies show handsets playing an increasingly important role for consumers as a basis for choosing providers, although these studies differ as to the level of importance of handsets to consumers. For example, a recent report from Consumers Union provides data that suggests that many consumers switched to new wireless service providers in order to obtain a particular handset. Specifically, the report states that during the two-year period of 2008 through 2009, 38 percent of respondents who had switched providers did so because it was the only way to obtain the handset that

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[787] *See* Section V.D.3, Mobile Data Traffic (Non-Messaging), *infra*; *Cisco Visual Networking Index: Global Mobile Traffic Forecast Update*, Cisco, Jan. 29, 2009, at 6.

[788] *MobileData: Traffic Jam Ahead?*, Bank of America/Merrill Lynch, Feb. 2, 2010.

[789] We note that carriers are increasingly interested in transitioning from TDM to Ethernet and other packet based services, and that existing facilities – including copper and fiber facilities – may often be transitioned from TDM to IP to address increased demand at particular sites. In addition, evolving technologies may provide wireless carriers with more alternatives to using special access services, including deploying their own facilities.

[790] *National Broadband Plan*, at 93.

[791] *Id.*

[792] *Id.* at 130 and 132-3.

they wanted.[793] The same report also indicates that 27 percent of all respondents had a specific wireless handset in mind when they went shopping for a new handset.[794] A first quarter 2009 survey by Nielsen Company shows handsets were the seventh most important reason consumers chose their existing wireless provider, although handset choice increased in importance to 6.4 percent from 2.9 percent in the third quarter of 2006.[795] Recent analyst reports also identify access to handsets as an increasing challenge faced by mid-sized and small providers.[796] An examination of the handsets/devices and operating systems segments reveals their importance to mobile wireless consumers and service providers.

a. Handsets/Devices

300. *Number of Manufacturers.* From 2006 to 2009 the number of mobile wireless handset manufacturers that distribute in the U.S. market has increased from eight to sixteen (Table 27).[797] In June 2009, there were sixteen handset manufacturers offering a total of 260 handset models to mobile wireless service providers in the United States.[798] Nine of these handset manufacturers each offered at least ten handset models.

Table 27
Handset Manufacturers and Handset Models Offered, U.S., 2006-2009

	2006 (Nov.)	2007 (Nov.)	2008 (Dec.)	2009 (June)
Total Number of Reporting Handset Manufacturers	8	12	12	16
Total Number of Reporting Handset Manufacturers Offering Ten or More Handset Models	5	8	8	9
Total Number of Handset Models Offered by Reporting Handset Manufacturers	124	168	346	260

301. *Innovation.* Over the past two years handset manufacturers have introduced a growing number of smartphones with the following features: an HTML browser that allows easy access to the Internet, an operating system that provides a standardized interface and platform for application

[793] *Best Cell Phone Service*, CONSUMER REPORTS, Jan. 2010.

[794] *Id.*

[795] Roger Entner, *When Choosing A Carrier Does the iPhone Really Matter?*, NIELSEN WIRE, Aug. 10, 2009.

[796] *See, e.g., USM/TDS, 4Q09 Preview: Wireless Remains Challenging*, Morgan Stanley, Feb. 23, 2010; *Company Update, Cincinnati Bell, Inc. (CCB)*, Goldman Sachs, Feb. 11, 2010)

[797] These figures based on data from hearing aid compatibility reports filed by handset manufacturers from 2006 to 2009. For reports prior to July 2009, see FCC Docket 07-250; for reports after July 2009, see the FCC Hearing Aid Compatibility status reporting site at http://wireless.fcc.gov/hac/index.htm?job=home. These reports include information (such as handset maker, model name, starting available date and end available date) for each handset model offered by the handset manufacturer during the reporting period.

[798] Handset manufacturers filed their hearing aid compatibility status reports by July 15, 2009, for the reporting period from January 1 to June 30, 2009. Starting in July 2010, handset manufacturers are required to file their hearing aid compatibility status reports annually on July 15 for the twelve month reporting period from July 1st of the prior year to June 30th of the reporting year. *See also* http://wireless.fcc.gov/hac/index.htm?job=home for more details on these reports. 47 C.F.R. § 20.19.

developers, and a larger screen size than a traditional handset.[799] In contrast to traditional handsets with applications that include voice and messaging, smartphones have more user-friendly interfaces that facilitate access to the Internet and software applications. Ten handset manufacturers offered a total of 56 smartphones in June 2009.[800] Table 28 lists the top five smartphone and handset manufacturers, by number of models offered, that distributed in the United States in June 2009. RIM, HTC and Samsung offered the most smartphone models, while Samsung, Motorola and LG offered the most handset models in June 2009.[801]

Table 28
Smartphone Manufacturers Offering Largest Number of Smartphone Models (U.S., June 2009)

Top Five Smartphone Manufacturers	Number of Smartphone Models
RIM	13
HTC	11
Samsung	10
LG	5
Palm	4
Total	**38**

Table 29
Handset Manufacturers Offering Largest Number of Handset Models (U.S., June 2009)

Top Five Handset Manufacturers	Number of Handset Models
Samsung	72
Motorola	52
LG	31
Sony Ericsson	22
Nokia	21
Total	**177**

302. Since Apple entered the handset business in June 2007 with the touchscreen *iPhone,* many handset manufacturers have responded with their own touchscreen smartphones. For example, Sony Ericsson launched its first touchscreen smartphone, *XPERIA™ X1,* based on the Window Mobile 6.1 platform, in February 2008.[802] HTC introduced the smartphone *G1,* powered by the Android operating system, in September 2008.[803] Nokia unveiled its touchscreen smartphone *5800 XpressMusic*

[799] See Section IV.B.3, Differentiation in Mobile Wireless Handsets/Devices, *supra* (defining smartphone for purposes of this report).

[800] Based on data from hearing aid compatibility status reports filed by handset manufacturers in July 2009, *available at* http://wireless.fcc.gov/hac/index.htm?job=home.

[801] Based on data from hearing aid compatibility status reports filed by handset manufacturers in July 2009, *available at* http://wireless.fcc.gov/hac/index.htm?job=home.

[802] *See Sony Ericsson Launches the New Brand XPERIA with the Unveiling of XPERIA X1*, Press Release, Sony Ericsson, Feb. 10, 2008, *available at* http://www.sonyericsson.com/cws/companyandpress/pressreleases/pressrelease/pressreleaseoverview/xperiax1us-20080210?cc=us&lc=en.

[803] *See T-Mobile Unveils the T-Mobile G1 – the First Phone Powered by Android*, Press Release, T-Mobile, Sept. 23, 2008, *available at* http://www.t-
(continued....)

based on the Symbian operating system in October 2008.[804] Palm launched its touchscreen smartphone *Pre,* based on the Palm webOS platform, in June 2009.[805] Motorola announced its touchscreen smartphone DROID based on the Android 2.0 platform in October 2009.[806] Garmin, a leading Global Positioning System (GPS) device provider, entered the smartphone business with its touchscreen *Nuviphone G60* in October 2009.[807] Huawei introduced its touchscreen smartphone *Tap* in October 2009.[808] Google recently started selling its own smartphone *Nexus One* (manufactured by HTC) in its online store.[809] LG offers at least 17 touchscreen smartphones[810] and Nokia offers at least six.[811]

303. With the convergence of mobile wireless handsets and portable computing technologies, other traditional computer manufacturers (besides Apple) have entered the handset/device business and are offering touchscreen smartphones. Acer, a computer manufacturer, entered the handset/device business when it unveiled multiple models at the World Mobile Congress trade show in Barcelona in January 2010.[812] Dell announced it will soon offer its first Android-based smartphone, *Mini 3,* for AT&T.[813] Lenovo, another computer manufacturer, introduced its first Android-based smartphone, *LePhone,* in January 2010.[814]

304. *Share of Mobile Devices.* According to comScore, a marketing information company, in December 2009, the top five handset manufacturers in the United States accounted for 82.8 percent of mobile devices currently in use, and all other manufacturers accounted for the remaining 17.2 percent (Table 30).[815]

(Continued from previous page)
mobile.com/company/PressReleases_Article.aspx?assetName=Prs_Prs_20080923&title=T-Mobile%20Unveils%20the%20T-Mobile%20G1%20–%20the%20First%20Phone%20Powered%20by%20Android.

[804] *See Nokia Amps Up Music Offering with New Nokia 5800 XpressMusic*, Press Release, Nokia, Oct. 2, 2008, *available at* http://www.nokia.com/press/press-releases/archive/archiveshowpressrelease?newsid=1256590.

[805] *See Sprint to Offer Palm Pre Nationwide on June 6*, Press Release, Sprint Nextel, May 19, 2009, *available at* http://newsreleases.sprint.com/phoenix.zhtml?c=127149&p=irol-newsArticle_newsroom&ID=1289761&highlight.

[806] *See Hello Humans: DROID by Motorola Arrives Next Week*, Press Release, Motorola, Oct. 28, 2009, *available at* http://mediacenter.motorola.com/content/detail.aspx?ReleaseID=12058&NewsAreaID=2.

[807] *See AT&T and Garmin Announce a New Mobile Navigation Era with Nuvifone, the Navigation Phone,* Press Release, AT&T, Sept. 29, 2009, *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27177&mapcode.

[808] *See* Brian James Kirk, *T-Mobile Tap - a new affordable touchscreen handset*, MOBILE BURN, Oct. 7, 2009 at http://www.mobileburn.com/news.jsp?Id=7976.

[809] *See Google Offers New Model for Consumers to Buy a Mobile Phone*, Press Release, Google, Jan. 5, 2010, *available at* http://www.google.com/intl/en/press/pressrel/20100105_phone.html.

[810] LG, *All LG Phones*, http://www.lg.com/au/mobile-phones/all-lg-phones/index.jsp (visited Apr. 29, 2010).

[811] Nokia USA, *Compare Phones*, http://www.nokiausa.com/find-products (visited Apr. 29, 2010).

[812] *See Acer Enters the Smartphone Market*, PCMAG.COM, Feb. 17, 2009, at http://www.pcmag.com/article2/0,2817,2341176,00.asp. *See also* ACER, *Smartphone Series*, http://www.acer.com/smartphone/ (visited on Jan. 12, 2010).

[813] *See At CES Dell Unveils First All Powerful Ultra Mobile Gaming System, Next Generation Smart Phones, Tablet Concepts and a New Line of Design Inspired Laptops*, Press Release, Dell, Jan. 7, 2010, *available at* http://content.dell.com/us/en/corp/d/press-releases/2010-01-07-dell-at-ces-2010.aspx.

[814] *See* Gabriel Madway, *Lenovo Enters Smartphone Fracas with "LePhone,"* REUTERS, Jan. 6, 2010, at http://www.reuters.com/article/idUSTRE6060JF20100107.

[815] *See comScore Reports December 2009 U.S. Mobile Subscriber Market Share*, Press Release, comScore, Feb. 8, 2010, *available at*
(continued....)

Table 30
Share of Mobile Devices in Use, U.S., 2009

Handset Manufacturer	Share of Mobile Devices in Use
Motorola	23.5%
LG	21.9%
Samsung	21.2%
Nokia	9.2%
RIM	7.0%
All Others	17.2%

305. *Technological Standards.* Handsets are manufactured for each of the commonly used wireless families of air interface standards, including the CDMA family (including 1xRTT and EV-DO), the GSM/WCDMA family (including GSM, GPRS, EDGE, WCDMA, HSDPA, and HSUPA), and iDEN. As the technical standards within each of these families progress, handsets are often built to support multiple air interfaces common to that family. This facilitates backwards compatibility with older technologies and migration to more efficient air interfaces over time. Handsets that are manufactured for one air interface family usually do not function on competing families of standards, although some handsets are designed to operate over more than one family. As of June 2009, handset variety was greatest for the GSM/WCDMA family, followed by the CDMA 1xRTT/EV-DO family. The iDEN standard has a comparatively small number of handsets.

Table 31
Handset Models Offered by Air Interface, U.S., 2006-2009

	Total Handset Models Offered by Reporting Handset Manufacturers			
Air Interface	**2006 (Nov.)**	**2007 (Nov.)**	**2008 (Dec.)**	**2009 (June)**
CDMA/1xRTT/ EV-DO[816]	81	118	146	115
GSM/WCDMA[817]	40	42	177	129
GSM/CDMA	0	0	0	2
iDEN	11	8	21	14
Total	**124**	**168**	**346**	**260**

(Continued from previous page)
http://www.comscore.com/Press_Events/Press_Releases/2010/2/comScore_Reports_December_2009_U.S._Mobile_Subscriber_Market_Share.

[816] Our data currently cannot separate 1xRTT with EV-DO handsets from 1xRTT only handsets.

[817] The number of handset models with WCDMA was 50 in June 2009, 52 in December 2008, 9 in November 2007, and 3 in November 2006.

Table 32
Smartphone Models Offered by Handset Manufacturers by Air Interface, U.S., June 2009

Air Interface Type	Estimated Smartphone Models, June 2009
CDMA/1xRTT/ EV-DO	19
GSM/WCDMA[818]	35
GSM/CDMA	1
iDEN	1
Total	**56**

306. *Operating Systems.* The operating system of a smartphone is one of the major factors that determine the smartphone's ability to support mobile applications and Internet-based services. Applications and services may not be available for all operating systems, and applications that work with one operating system may not be readily transferable to another operating system. Smartphone operating systems are discussed more extensively in the section on mobile applications. Table 33 states that 96.2 percent of smartphones in use in December 2009 have an operating system from a top-five mobile operating system provider, while the remaining 3.8 percent of smartphones in use have other operating systems.[819]

Table 33
Share of Smartphones in Use by Operating System, U.S., December 2009

Operating System	Share of Smartphones in Use
RIM	41.6%
Apple	25.3%
Microsoft	18.0%
Palm	6.1%
Google	5.2%
All Others	3.8%

307. The prevailing model for the distribution of handsets to U.S. consumers is a provider-as-retailer model in which manufacturers sell handsets in bulk quantities to service providers and then service providers sell them to consumers in handset-service bundles, either in pre-paid service plans or post-paid subscription service plans. Generally, handset manufacturers make their handsets available to many service providers and consumers have a wide choice of handsets from different service providers. However, there are two types of contractual arrangements that affect the distribution of handsets. The first is bundling contracts, which are contracts between a service provider and a consumer for a handset-service subscription bundle; the second is exclusive handset arrangements, where handset manufacturers grant exclusive distribution territories to providers. Both of these types of contracts potentially affect outcomes in the handset/device and mobile wireless services businesses and are discussed below.[820]

308. Service providers carry diverse handset portfolios and offer their customers a wide selection of handsets. As shown in Table 34, the average number of handset models offered by the eight

[818] The number of smartphone models with WCDMA was 25 in June 2009.

[819] *See comScore Reports December 2009 U.S. Mobile Subscriber Market Share*, Press Release, comScore, Feb. 8, 2010, *available at* http://www.comscore.com/Press_Events/Press_Releases/2010/2/comScore_Reports_December_2009_U.S._Mobile_Subscriber_Market_Share.

[820] *See* Section VII.B.1.b, Key Factors Affecting Mobile Wireless Competition, *infra.*

largest facilities-based mobile wireless service providers[821] increased from 28 in November 2006 to 43 in December 2009. The average number of handset models offered by non-top eight service providers increased from 10 in November 2006 to 23 in December 2009.[822] Chart 43 shows the number of handset models and smartphone models offered by each of the top eight facilities-based service providers.[823] All of the top eight providers sell at least one smartphone, except Leap, which, according to industry press reports, will begin offering its first 3G smartphone in 2010.[824] Table 35 shows the number of service providers (including resellers) offering a particular manufacturer's smartphone models.

Table 34
Average Number of Handset Models Offered by Mobile Wireless Service Providers

	2006 (Nov.)	2007 (Nov.)	2008 (Dec.)	2009 (Dec.)
Average Number of Handset Models Offered by Top Eight Service Providers	28	30	46	43
Average Number of Handset Models Offered by Non-Top Eight Service Providers	10	12	20	23

[821] The top eight facilities-based providers include AT&T, Verizon Wireless, Sprint Nextel, T-Mobile, Alltel (merged with Verizon Wireless on January 9, 2009), US Cellular, MetroPCS, and Leap Wireless. Tracphone, the fifth largest service provider in the U.S., is not facilities-based.

[822] These figures are based on data from hearing aid compatibility status reports filed by service providers from 2006 to 2009, *available at* http://wireless.fcc.gov/hac/index.htm?job=home.

[823] These figures are based on data from hearing aid compatibility status reports filed by service providers in January 2010.

[824] *Wireless*, COMMUNICATIONS DAILY, Mar. 1, 2010, at 7.

Chart 43
Total Handset and Smartphone Models Offered by the Top Eight Facilities-Based Service Providers, Dec. 2009

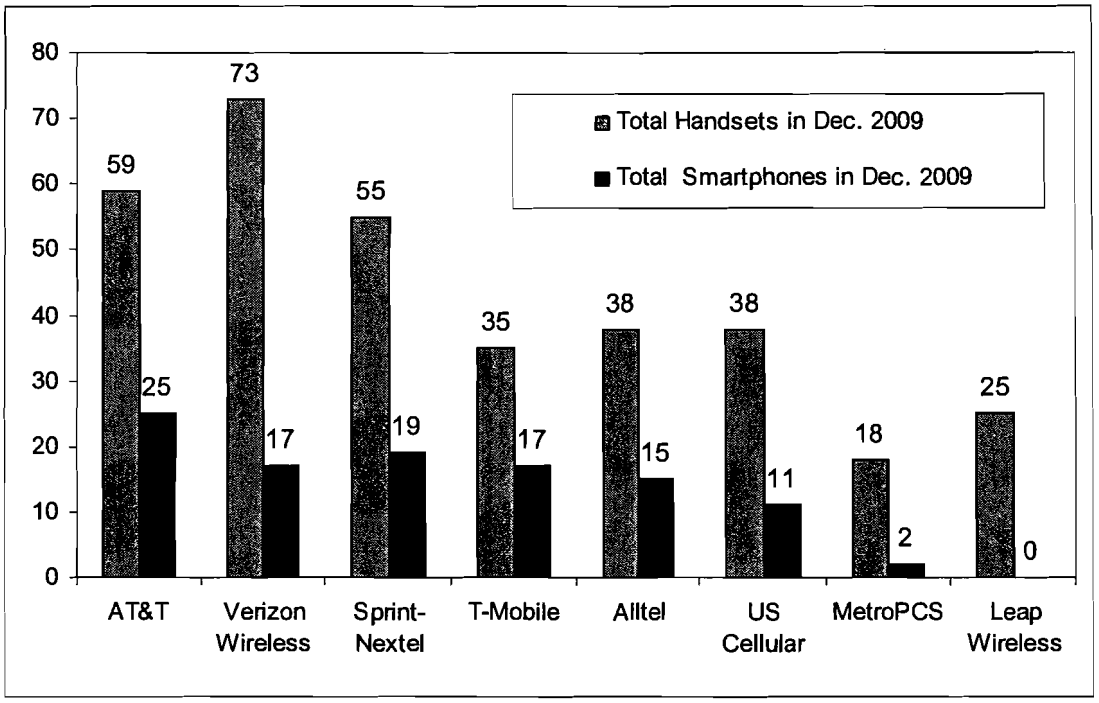


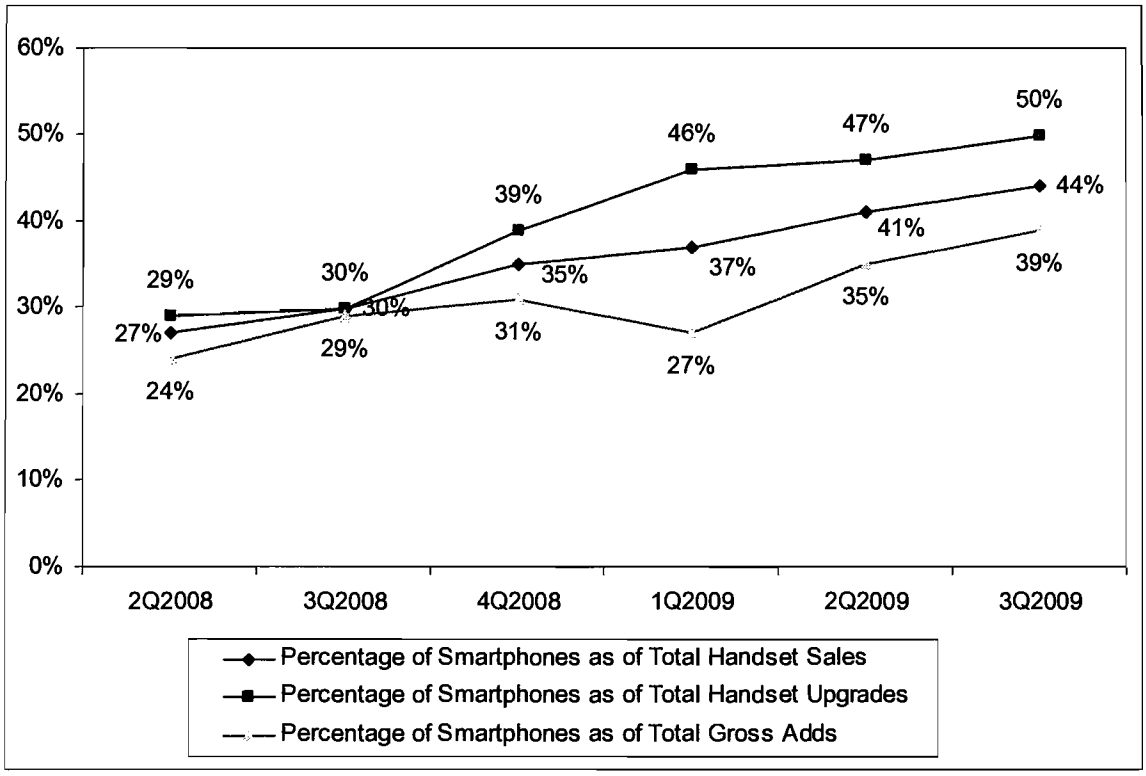
Table 35
Number of Service Providers (including Resellers) Offering a Manufacturer's Smartphones, Dec. 2009[825]

Manufacturer	Number of Service Providers (including Resellers)
HTC	128
RIM	116
Pantech	66
Samsung	66
Palm	55
Nokia	44
LG	40
Hewlett Packard	27
Motorola	14
Apple	5
Garmin	4
Sony Ericsson	3
Acer	1
Sharp	1

[825] Hearing aid compatibility annual status reports filed by Jan. 15, 2010. 220 service providers offered at least one handset model in December 2009.

309. Smartphone sales and adoption rates have increased in recent years, as shown in Chart 44. Smartphones as a percentage of total handset sales increased from 27 percent in the second quarter of 2008 to 44 percent in the third quarter of 2009. Fifty percent of total handset upgrades were smartphones in the third quarter of 2009, up from 29 percent in the second quarter of 2008; and 39 percent of gross additions were smartphone users in the third quarter of 2009, up from 24 percent in the second quarter of 2008.[826] Another analyst reports that smartphone sales increased from 9 million units in 2006 to 37 million units in 2008.[827]

Chart 44
Smartphone Adoption Rates in the United States 2008-2009[828]



310. According to one analyst, the average retail prices for all handsets and the smartphone subset, net of provider subsidies, decreased between 2006 and 2009. Chart 45 shows that the average price of smartphones after discounts decreased from $220 in the fourth quarter of 2006 to $120 in the fourth quarter of 2009, while the average price of all handsets after discounts decreased from $85 in the fourth quarter of 2006 to $50 in the fourth quarter in 2009.[829] This analyst also estimates that the average discount offered on the original price (the advertised price before contract-related discounts) of available handsets was 80 percent for the U.S. wireless industry in the last quarter of 2009, up from an average discount of 60 percent in late 2006.[830]

[826] *Smartphone Adoption Steadily Rising*, at 3.

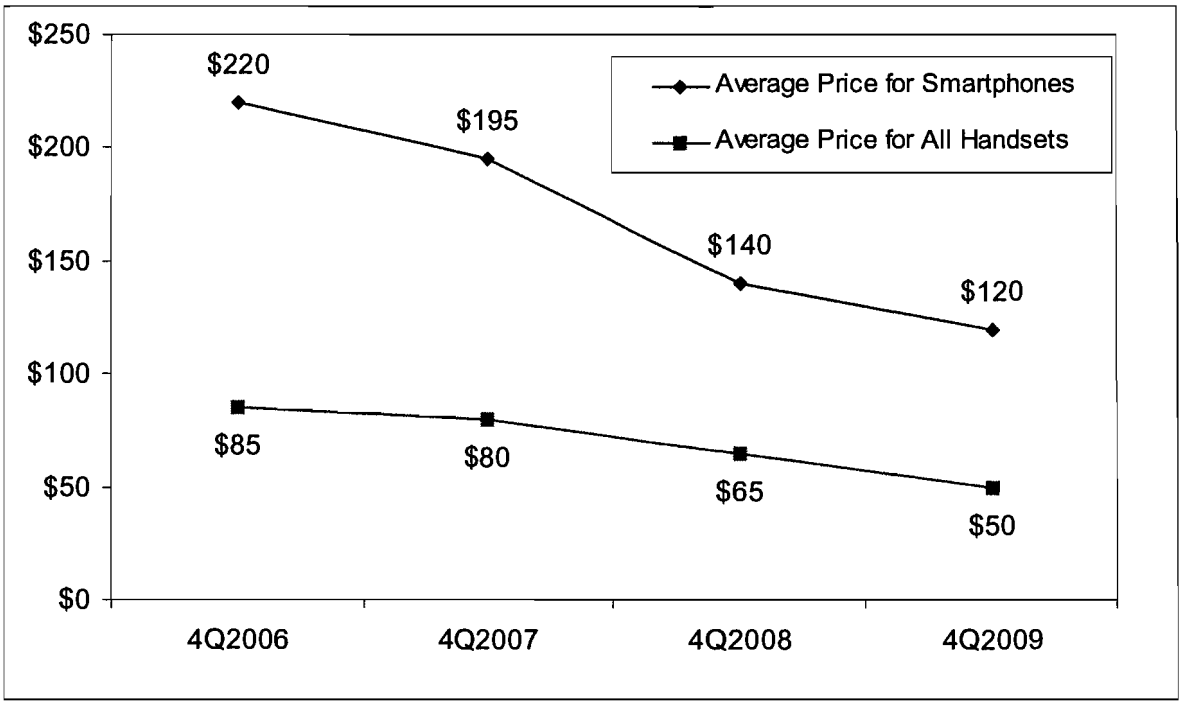
[827] *Finding Value in Smartphones*, at 6.

[828] *Smartphone Adoption Steadily Rising*, at 3.

[829] *Wireless Service & Handset Pricing – Tick Tock*, at 8.

[830] *Id.* at 7.

Chart 45
Average Price After Discount for PDAs/Smartphones and All Handsets[831]



b. Key Factors Affecting Mobile Wireless Competition

311. Competition among the mobile wireless handset manufacturers (discussed above) affects competitive outcomes in the mobile wireless service market through price and non-price competition by handset manufacturers and it is also shaped by the provider-as-retailer model of handset distribution. Bundling contracts and exclusive handset arrangements are firm conduct that occurs frequently in the provider-as-retailer model of handset distribution.[832] Bundling is discussed first, then exclusive handset arrangements.

(i) Bundling of Wireless Service Subscriptions with the Purchase of Handsets

312. In a bundling contract a provider conditions the sale of a handset upon the consumer's agreement to purchase a multi-month wireless service subscription, typically for a minimum of one or two years.[833] In a bundling contract, the wireless handset and wireless service plan are effectively sold as a single bundled product, with the price distributed over the length of the subscription. Service providers typically enforce these contracts by "locking" subsidized devices, so that they cannot be easily ported to a competitor's network, and by charging early termination fees for subscribers who break the contract early.

313. These bundles have both disadvantages and advantages for consumers. Some of the disadvantages of buying a handset-service subscription bundle are "buyer's remorse" at having entered a

[831] *Wireless Service & Handset Pricing – Tick Tock*, at 8.

[832] *See* FTC, *An FTC Guide to Dealings in the Supply Chain*, http://www.ftc.gov/bc/antitrust/factsheets/antitrustlawsguide.pdf, at 17-22 (*FTC*).

[833] *See Antitrust Law and Economics*, at 326 ("Under a tying arrangement, the seller of a product conditions the sale of one product upon the buyer's agreement to purchase a second product"). In particular, the sale of the handset is conditioned on the subsequent purchase of the multi-month wireless service subscription.

multiyear contract after the commitment was made, opaqueness surrounding how the handset price and the monthly subscription price are aggregated to obtain the price of the bundle, and monthly subscription prices that are seemingly independent of how long the customer has been paying off the initial discount on the handset price.[834] Some of the advantages of buying a handset-service subscription bundle are the conveniences of one-stop shopping, access to better technical support for handsets supported by the provider vis-à-vis handsets that are not in the provider's handset portfolio, obtaining a discount on the price of the handset, and distributing the price of expensive handsets over the course of the subscription.

314. Wireless service plans are generally available without bundled contracts, but most postpaid plans consumers have strong incentives to buy a subsidized device. Most providers allow customers to use a compatible unlocked handset with a postpaid network service plan.[835] Unlocked devices, while not widely distributed through the major retail channels, are available in some specialty stores and through some manufacturer websites (*e.g.*, Motorola and Nokia).[836] However, when customers bring an unlocked device to a postpaid plan, they generally do not receive a device subsidy from the provider nor do they typically receive a lower-priced service plan that would reflect the fact that the provider does not have to recoup the cost of the subsidy. Therefore, most customers have incentives to purchase subsidized devices from the provider and, indeed, this is the overwhelming U.S. industry practice.

315. For pre-paid and pay-as-you-go service plans, the incentives are slightly different, and indeed, at least one provider (T-Mobile) has begun to emphasize this fact. Prepaid plans also typically involve handset subsidies, although they may be smaller since providers expect prepaid plans to have higher churn than postpaid plans. In 2009, T-Mobile introduced its "Even More Plus" plan that offers a lower monthly service price for customers that use unsubsidized handsets.[837] This appears to be the first attempt by a national provider to change the incentives associated with device subsidies and service plan rates in a way to encourage mass market customers to use an unsubsidized device.

(ii) Exclusive Handset Arrangements

316. An exclusive handset arrangement (EHA) is an arrangement in which a handset manufacturer or vendor agrees to sell a particular handset model to only one wireless service provider, usually for a specified period of time. EHAs fall within a class of contractual arrangements known as territorial restraints or exclusive territory agreements.[838] EHAs may also involve sharing financial commitments and sharing market risks, with the manufacturer typically assuming some research and development commitments and the provider typically assuming some marketing and minimum volume commitments. Territorial restraints between manufacturers and their distributors are not per se illegal,[839] although they raise competitive issues.

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[834] *See, e.g.*, David Pogue, *The Irksome Cell Phone Industry*, THE NEW YORK TIMES, July 22, 2009, at B1.

[835] T-Mobile, for example, offers SIM cards that can be inserted into any unlocked GSM phone, a common practice in Europe.

[836] *See, e.g.*, the online stores of handset manufacturers Motorola and Nokia at http://www.motorola.com/Consumers/US-EN/Home and http://www.nokiausa.com/, respectively. The unbundled model of handset manufacturers distributing unlocked handsets has not yet been widely embraced by U.S. consumers even though some handset manufacturers directly sell unlocked handsets in their Internet shops and through non-provider retailers.

[837] *See* T-Mobile, *Plans*, http://www.t-mobile.com/shop/plans/Cell-Phone-Plans-Overview.aspx?WT.z_HP=shop_plans_DL (visited Feb. 22, 1010).

[838] *Territorial restraints* involve manufacture-dealer relationships. They are distinct from *exclusive dealing* where the manufacturer requires the distributor not to distribute products of competing manufacturers. *See Antitrust Law and Economics*, at 308, 345. *See FTC* at 17. *See also, Competition Policy*, at 301.

[839] *See FTC* at 17.

317. There is some data available on the prevalence and duration of EHAs, although confidentiality clauses in EHAs have restricted the availability of certain data. First, EHAs are often employed in the market launch of innovative handsets that are on the technological frontier, *e.g.*, smartphones. Second, the duration of EHAs, although typically private contractual information, appears to have ranged from six months or less[840] to a few years or more.[841] Third, many handset manufacturers use EHAs to distribute some, but not all, of their smartphones. EHAs apply to particular handset models; they do not prevent a manufacturer or vendor from selling other handset models to other providers, and they do not block a provider from selling handsets made by other manufacturers or vendors.[842] For instance, inspection of providers' online stores reveals that many handset manufacturers and vendors – including RIM, HTC, LG, Palm, Samsung, Motorola, and Nokia – sell many of the same smartphone models, or variants, to multiple U.S. service providers, including non-nationwide service providers.[843] In contrast, Apple and Garmin, both relatively recent entrants to the handset business, distribute their handsets at present only through AT&T (and its affiliates).[844] Fourth, handset manufacturers generally employ EHAs with providers that have larger customer bases and extensive network penetration. For instance, all nationwide providers have some EHAs, while non-nationwide service providers typically do not have EHAs. Table C-5 in Appendix C lists 67 selected smartphone launches that occurred in 2008 and 2009. Of the 67 smartphones listed, 32 were subject to EHAs at launch, including some of the most popular (*e.g.*, Apple iPhone, Motorola DROID, Palm Pre), while 35 were not subject to EHAs.

2. Mobile Applications

318. A range of different communication functionalities is now available to mobile wireless consumers, depending on the capabilities of the device they use and the network to which they connect. These functionalities include both voice and data services, with devices increasingly being used for data services. Morgan Stanley estimates that, in 2008, the average mobile wireless subscriber spent 70 percent of his/her time on a mobile device making voice calls and 30 percent using a data application, with half of

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[840] *See* Verizon Wireless, Written Ex Parte Presentation, RM-11497, July 17, 2009 (stating that, applicable to small wireless carriers (those with 500,000 customers or less), any new exclusivity arrangement it enters with handset makers will last no longer than six months – for all manufacturers and all devices). *See also* T-Mobile Reply Comments, RM-11497, Feb. 20, 2009, at 6-7 (stating that most of T-Mobile's exclusive agreements last less than a year and some are as short as 90 days). In October 2008, the Commission sought comment on a petition for rulemaking, filed by the Rural Cellular Association, regarding exclusivity arrangements between commercial wireless service providers and handset manufacturers. *See* "Wireless Telecommunications Bureau Seeks Comment on Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and Handset Manufacturers," RM-11497, *Public Notice*, 23 FCC Rcd 14873 (WTB 2008).

[841] The original iPhone was released in June 2007. *See* Apple Inc., SEC Form 10-K, for fiscal year 2008, filed Nov. 5, 2008, at 5. The third generation iPhone, called iPhone 3GS, was released in June 2009. Apple reports that the iPhone 3GS is sold in the United States through an exclusive arrangement. *See* Apple Inc., SEC Form 10-K, for fiscal year 2009, filed Oct. 27, 2009, at 4, 20.

[842] Hence, EHAs do not involve exclusive dealing where the distributor is prohibited from carrying products of competing manufacturers.

[843] For example, on February 5, 2010, the HTC Touch smartphone (or a variant with similar capabilities) was carried by at least Cellular One, Cellular 29 Plus (Chatmobility), Cellular South, T-Mobile, Copper Valley Wireless, Golden State Cellular, Verizon Wireless, Cellcom, Illinois Valley Cellular, Alaska Digitel, Inland Cellular, AT&T, Iowa Wireless Services, Nex-Tech Wireless, North Eastern Pennsylvania Wireless, Northwest Missouri Cellular, Sprint Nextel, Appalachian Wireless, Carolina West Wireless (HTC Hero arriving soon), Panhandle Telecommunications Systems, Alaska Communications Systems, Leaco, Nemont Telephone Cooperative (Sagebrush Cellular), US Cellular, Bluegrass Cellular, Strata Wireless, Thumb Cellular, United Wireless, and West Central Wireless. This data was collected directly from the websites of these providers.

[844] *See* Apple, *Apple Store – iPhone 3G*, http://store.apple.com/us/browse/home/shop_iphone?mco=OTY2ODQyMQ (visited May 14, 2010); Garmin, *Garminfone*, https://buy.garmin.com/shop/shop.do?cID=138&pID=30018 (visited May 14, 2010).

the data time spent on text messaging and the remaining time on a combination of e-mail, Internet access, games, music, and other applications.[845] Data use is higher among the growing segment of smartphone users in general and iPhone users in particular. In 2008, the estimated usage pattern of the average iPhone subscriber was 45 percent voice and 55 percent data.[846]

319. Mobile data functionalities include text and multimedia messaging, which typically do not require a highly sophisticated device or high mobile network speed, as well as e-mail access, web browsing, and mobile applications, which typically require a smartphone device and a mobile broadband network connection. Thousands of different mobile applications – software programs that can be used on a mobile device[847] – are now available to consumers through various channels. They may be accessed through web browsers, operating system application stores, or service provider-branded platforms.[848] In addition, certain applications may be native to, or pre-loaded on, a device, or may be side-loaded from a PC.

320. Both the number of mobile applications launched and the number of applications downloaded by consumers has grown significantly over the past two years. For example, there were over 100,000 applications available from the Apple App Store as of December 2009, and the number of applications downloaded from Apple's App Store grew from 100,000 in 2008 to over 2 billion in 2009.[849] In addition, Morgan Stanley has estimated that, as of December 2009, the Android Market had 15,000 available applications and 40 million downloads; and the Nokia Ovi Store had 6,000 available applications and 50 million downloads.[850]

321. Many different types of mobile applications, developed by a range of different third-party developers, are available through mobile application stores and web browsers. The major categories of applications include: web searching, news and information, e-mail and messaging, games, social networking, location-based services, photo sharing, music and video streaming, and VoIP. Thousands of niche applications, each serving a unique purpose, have been designed for specific uses, hobbies, interests, and industries by various third-party application developers.

322. Certain applications require a mobile Internet connection in order to be downloaded on a mobile device, but then may not rely on an Internet connection when used thereafter on the device. One example of such an application would be a non-networked game that is played only by the individual user on his or her device. Many other applications require a mobile Internet connection in order to function on a device. These would include applications related to specific web sites or web-based content, such as news and information content, mapping and location-based applications, and social networking sites. Moreover, certain applications – such as VoIP and video conferencing applications – may require a low-latency Internet connection in order to function properly.

323. In order to provide an overview of the structure of the mobile applications segment, we provide below data on the adoption and usage of different types of mobile applications across the entire

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[845] *Morgan Stanley Mobile Internet Report*, at 92. Morgan Stanley estimated the percentage of time spent each day on a mobile device on each type of activity. The estimates are based on data from CTIA, which estimated that the average voice call time per day is 27 minutes, and iSuppli, which estimated the total time spent on a mobile handset each day is 40 minutes. *Id.*

[846] *Id.*

[847] *Id.* at 134.

[848] CTIA NOI Comments at 28.

[849] *Morgan Stanley Mobile Internet Report*, at 134, 136.

[850] *Id.* at 157. CTIA reports that in the year following the launch of the Apple App Store, more than 100,000 applications were made available through the six different application download platforms from Apple, Google, Pocketgear, Blackberry, Palm, Samsung, and Sony Ericsson. CTIA NOI Comments at 25-27.

U.S. market, regardless of the device or operating system used. In addition, because certain devices are designed to facilitate the use of mobile applications, we provide data on mobile application use and adoption by type of device as well.

324. Adoption rates for mobile data services vary significantly by type of application. According to comScore, 63.1 percent of U.S. mobile subscribers used text messaging on their mobile devices in December 2009 (see Table 36).[851] In contrast, browsers were used by only 27.5 percent of U.S. mobile subscribers, while 21.6 percent of subscribers played mobile games and 15.9 percent accessed a social networking site or blog.[852] Nielsen Mobile estimates that, in May 2008, 40.4 million Americans had used the mobile Internet at least once in the past month, up from 22.4 million in July 2006.[853]

Table 36
Mobile Content Adoption Rates by Type of Application[854]

	Share (%) of U.S. Mobile Subscribers	
	September 2009	December 2009
Sent text message to another phone	61.0%	63.1%
Used browser	26.0%	27.5%
Played games	21.4%	21.6%
Used downloaded apps	16.7%	17.8%
Accessed social networking site or blog	13.8%	15.9%
Listened to music on mobile phone	11.7%	12.1%

325. Survey research also shows that mobile Internet usage is growing and that accessing the Internet via a mobile device is becoming a more frequent activity for many subscribers. According to comScore, the number of mobile subscribers who used their mobile devices to access news and information on the Internet rose to nearly 63.2 million in January 2009, up 71 percent from January 2008.[855] In addition, among those subscribers who accessed news and information via their mobile devices in January 2009, comScore estimates that nearly 22.4 million, or 35 percent, did so daily, more than double the number of daily users in January 2008.[856]

326. ComScore found that the use of mobile search applications grew 68 percent in the United States between the second quarter of 2007 and the second quarter of 2008, from 5.8 percent to 9.2 percent

[851] *comScore Reports December 2009 U.S. Mobile Subscriber Market Share*, Press Release, comScore, Feb. 8, 2010.

[852] *Id.*

[853] *Critical Mass: the Worldwide State of the Mobile Web*, Nielsen Mobile, July 2008, *available at* http://www.nielsenmobile.com/documents/CriticalMass.pdf; CTIA PN Comments, Attach. A, at 16.

[854] *comScore Reports December 2009 U.S. Mobile Subscriber Market Share*, Press Release, comScore, Feb. 8, 2010.

[855] *comScore: Mobile Internet Becoming a Daily Activity For Many*, Press Release, comScore, Mar. 16, 2009. *See also*, CTIA NOI Comments at 59.

[856] *comScore: Mobile Internet Becoming a Daily Activity For Many*, Press Release, comScore, Mar. 16, 2009.

of all mobile wireless subscribers.[857] And, according to comScore, 6.5 million Americans, or approximately two percent of all mobile wireless subscribers, watched video on a mobile device during August 2008. On-demand video was the most popular form of video content, with 3.6 million viewers.[858]

327. Analysts believe that one of the major applications driving mobile data usage is social networking.[859] Social networking saw the largest growth rate from August 2007 to August 2008 in comScore's survey, growing 8.8 percent to 14.9 million users, or 6.6 percent of all mobile wireless subscribers, during this period. The major social networking sites include Facebook, MySpace, Twitter, LinkedIn, and Foursquare. Facebook is the segment leader with 430 million users worldwide as of October 2009, compared to 110 million for MySpace and 58 million for Twitter.[860] Facebook and MySpace are popular on the mobile Internet as well as on the wired Internet. Facebook and MySpace rank #4 and #9, respectively, among top web domains accessed on desktop computers in the United States, but rank #2 and #4, respectively, among top web domains accessed on mobile devices.[861] Foursquare is a social networking site and that combines GPS and location functionalities, allowing users to see where their friends are located at any time.[862]

328. Certain mobile applications are available for download through mobile web browsers and/or through one or multiple mobile application stores, such as the Apple App Store, the Android Market, or the Blackberry App World. Users can access these application stores on mobile devices that run the operating system that supports them. The application stores are specific to particular operating systems, and, in many cases, the application stores may be available only on devices running a certain, more recent version of an operating system or on devices with certain hardware features. For instance, the Blackberry App World is available on Blackberry smartphones running BlackBerry Device Software v4.2 or higher with a trackball, trackpad, or touch screen.[863]

329. Mobile data application usage varies among iPhone users, smartphone users, and average mobile wireless subscribers, with iPhone user adoption rates leading average smartphone user adoption rates in every category.[864] The most popular paid applications downloaded from the Apple App store are games, while the most popular free applications are social networking applications.[865]

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[857] *comScore M:Metrics Reports Mobile Search Grew 68 Percent in the U.S. and 38 Percent in Western Europe During Past Year,* Press Release, comScore, Sept. 15, 2008.

[858] *comScore Reports 6.5 Million Americans Watched Mobile Video in August*, Press Release, comScore, Oct. 31, 2008.

[859] *Morgan Stanley Mobile Internet Report*, at 185-221.

[860] *Id.* at 188.

[861] *Id.* at 212.

[862] *Id.* at 204.

[863] BlackBerry, *BlackBerry App World Vendor Support - Frequently Asked Questions*, http://na.blackberry.com/eng/developers/appworld/faq.jsp (visited Mar. 1, 2010).

[864] *Morgan Stanley Mobile Internet Report*, at 92.

[865] *Id.* at 136.

Table 37
Mobile Application Adoption Rates by Device

	iPhone	Smartphone	Average Mobile User
Music	65%	35%	12%
Games	61%	48%	21%
Social Networking	58%	43%	14%
Web Search	52%	40%	12%
Instant Messaging	48%	42%	15%
News	40%	31%	9%
Video	23%	16%	4%
Personal Banking	22%	16%	4%
Restaurant Guides	18%	14%	4%
Online Shopping	14%	9%	2%

Source: Morgan Stanley Mobile Internet Report

330. In order to provide an application through an application store, third-party application developers must design their products in accordance with the specifications of a particular application store and operating system, and must abide by the conditions of the operating system and, in some cases, the mobile wireless service provider. As discussed below, the conditions set by the operating system developers and their level of control over the applications available through their application stores vary from provider to provider.

331. Aside from the parameters placed on third-party applications by operating system developers, the emergence of mobile web browsers and a handful of mobile operating systems in recent years has brought greater efficiency and standardization to the mobile application segment, to the benefit of both third-party developers and consumers. Under the typical mobile application distribution model of previous years, an application developer seeking to provide a product to mobile consumers often had to design an application differently for each handset on each mobile network, and the launch of an application required the approval of the wireless service provider, which acted as a gatekeeper for its "walled garden" content. As discussed above, mobile wireless service providers have to some degree opened their networks to smartphone devices with web browsers and application stores.[866] With the emergence of applications stores, developers can design their products for each application store, rather than each device. While the application development system has become more accessible and less fragmented than in previous years,[867] some mobile wireless service providers and application stores act as gatekeepers, deciding which applications are allowed to run on particular devices or networks, and approval processes are not always transparent or predictable.[868]

332. Mobile applications are a downstream segment within the mobile wireless ecosystem.

[866] The Commission recently opened a proceeding to explore whether certain core principles could be applied to ensure greater openness that would allow for broadband innovation. That proceeding includes an examination of devices, applications and network management practices of wireless broadband Internet access providers. *See Preserving the Open Internet,* GN Docket No. 09-191, *Broadband Industry Practices,* WC Docket No. 07-52, Notice of Proposed Rulemaking, 24 FCC Rcd 13064 (2009).

[867] *Morgan Stanley Mobile Internet Report*, at 135.

[868] *See, e.g.*, Jeffrey Glueck, Perspective of a Mobile Application Developer & Entrepreneur, Presentation at FCC Workshop on Innovation, Investment and the Open Internet, Jan. 13, 2010), at 4-6, *available at* http://www.openinternet.gov/workshops/innovation-investment-and-the-open-internet.html (discussing the challenges that service provider and/or application store gatekeepers present to mobile application developers); *iPhone Facebook App Developer Quits over Apple Process*, Daily Tech, Nov. 12, 2009, *available at* http://www.dailytech.com/IPhone+Facebook+App+Developer+Quits+Over+Apple+Policies/article16805.htm.

Factors influencing the development of mobile applications – such as the ways in which consumers can access applications, technological innovations, and the barriers to entry faced by application developers – are, for the most part, common across all applications. However, the entire mobile application segment is also fragmented into many different types of applications, and the applications themselves may be part of separate product markets. For instance, mobile mapping applications may compete with GPS devices and even printed maps in the larger market for road navigation. And mobile gaming applications may compete with portable and fixed gaming platforms as part of the larger gaming market.

3. Mobile Commerce

333. Mobile commerce refers to commercial transactions made using a mobile wireless device. It can include online banking and shopping via the mobile web, applications designed to enable mobile commerce, mobile advertising, mobile coupons, and using a mobile device to make payments as a substitute for credit cards and cash.

334. With consumers using mobile devices to browse the web and access application stores, rather than only for simpler functionalities such as texting, there is a greater potential for these devices to be used for mobile commerce.[869] Mobile commerce is just emerging but is expected to grow quickly. Estimates of mobile commerce spending in 2009 range from $500 million to $1.3 billion in 2009 to $12 billion in 2013.[870] Data from comScore shows that 10 percent of smartphones and 12 percent of iPhones have been used to access online retail sites, as compared to only one percent of traditional handsets.[871] According to Morgan Stanley, mobile devices have distinct attributes that will enable them to expand electronic commerce beyond fixed devices.[872] For example, mobile devices can be used for location-based services which enable real-time physical retail and service opportunities.[873] Certain mobile applications provide better, more transparent information on pricing by, for example, allowing consumers to compare instantly local and online prices.[874] Mobile devices can also offer instant gratification with immediate digital product and content delivery regardless of where a consumer is located.[875] Finally, mobile devices allow consumers to take advantage of time-based selective Internet sales more easily.[876]

335. Certain applications available from mobile browsers or mobile application stores are designed to enable various mobile commerce functionalities, including making online purchases from a mobile device, providing transparent pricing information, coupons, and mobile banking. For example, eBay offers an application for the iPhone which allows consumers to buy and sell products through its website and which generated $380 million in gross merchandise value during the first nine months of 2009.[877] ShopSavvy and Amazon.com offer applications that allow users to scan a bar code using their device cameras and compare the price of a product in the physical store with its price online.[878] The Coupon Sherpa application allows consumers to scan a barcode with a smartphone camera and receive a

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[869] *Finding Value in Smartphones*, at 30.

[870] *Id.* at 33.

[871] *Id.* at 30.

[872] *Morgan Stanley Mobile Internet Report*, at 218.

[873] *Id.*

[874] *Id.*

[875] *Id.*

[876] *Id.*

[877] *Finding Value in Smartphones*, at 31-32.

[878] *Morgan Stanley Mobile Internet Report*, at 218; Amazon, *Amazon App for Android*, http://www.amazon.com/gp/anywhere/sms/android (visited Apr. 28, 2010).

discount at checkout.[879] In addition, Bank of America and Wells Fargo both offer banking applications for the iPhone.[880]

336. Using mobile wireless handsets and devices to replace credit cards or cash, by making on-the-spot, contactless payments via a short-range wireless link from the device, is another functionality that is emerging, largely in Japan and South Korea, although not yet widely available in the United States.[881] In order for mobile payment applications to be successful, analysts argue that they must offer greater functionality than simple credit card replacement.[882] According to a study by the Information Technology & Innovation Foundation (ITIF), mobile payment applications could be used to pay for taxis, movie tickets, parking meters, parking garages, vending machines, and subway rides.[883] They could also potentially be used for hotel and airport check-in, taking attendance at school, and entry into health clubs or apartment buildings.[884]

337. The widespread use of mobile payment applications requires investment, buy-in, and coordination from several stakeholders – including mobile wireless service providers, device manufacturers, third-party application developers, financial institutions, merchants, public transit authorities, government agencies, and consumers – in order to deploy both devices that are capable of making contactless mobile payments and terminals that can accept such payments.[885]

338. Over 500,000 contactless credit card terminals have been deployed in the United States by 140,000 merchants, and contactless credit cards have been issued to more than 100 million Americans. MasterCard has begun running pilot programs that allow mobile devices, linked to a customer's account, to make contactless mobile payments at MasterCard's PayPass terminals.[886]

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[879] *Id.*

[880] *Finding Value in Smartphones*, at 45.

[881] In Japan, 73 percent of mobile phones have a mobile payment capability, and 17 million people make contactless mobile payments from their mobile phones. In South Korea, 12 million mobile phones have mobile payment capability, and 4 million people use their mobile phones to make payments. A limited number of mobile payment trials have been conducted in a few U.S. cities. Stephen Ezell, *Contactless Mobile Payments*, The Information Technology & Innovation Foundation, Nov. 2009, at 2-3, 26.

[882] Stephen Ezell, *Contactless Mobile Payments*, The Information Technology & Innovation Foundation, November 2009, at 2.

[883] *Id.* at 11.

[884] *Id.*

[885] *Id.*, at 2.

[886] *Finding Value in Smartphones*, at 45-46.