Smartphone

A smartphone is a mobile phone built on a mobile operating system, with more advanced computing capability and connectivity than a feature phone. The first smartphones combined the functions of a personal digital assistant (PDA) with a mobile phone. Later models added the functionality of portable media players, low-end compact digital cameras, pocket video cameras, and GPS navigation units to form one multi-use device. Many modern smartphones also include high-resolution touchscreens and web browsers that display standard web pages as well as mobile-optimized sites. High-speed data access is provided by Wi-Fi and mobile broadband. In recent years, the rapid development of mobile app markets and of mobile commerce have been drivers of smartphone adoption.

The mobile operating systems (OS) used by modern smartphones include Google's Android, Apple's iOS, Nokia's Symbian, RIM's BlackBerry OS, Samsung's Bada, Microsoft's Windows Phone, Hewlett-Packard's webOS, and embedded Linux distributions such as Maemo and MeeGo. Such operating systems can be installed on many different phone models, and typically each device can receive multiple OS software updates over its lifetime. A few other upcoming operating systems are Mozilla's Firefox OS and Canonical Ltd.'s Ubuntu Phone.

History

IBM Simon and charging base (int. August 16, 1994)
Origin of the term

Although devices combining telephony and computing were conceptualized as early as 1973 and were offered for sale beginning in 1994, the term "smartphone" did not appear until 1997, when Ericsson described its GS 88 "Penelope" concept as a "Smart Phone". The distinction between smartphones and feature phones can be vague, and there is no official definition for what constitutes the difference between them. One of the most significant differences is that the advanced application programming interfaces (APIs) on smartphones for running third-party applications can allow those applications to have better integration with the phone's OS and hardware than is typical with feature phones. In comparison, feature phones more commonly run on proprietary firmware, with third-party software support through platforms such as Java ME or BREW. An additional complication in distinguishing between smartphones and feature phones is that over time the capabilities of new models of feature phones can increase to exceed those of phones that had been promoted as smartphones in the past.

Some manufacturers and providers use the term "superphone" for their high end phones with unusually large screens and other expensive features. Other commentators prefer "phablet" in recognition of their convergence with low-end tablet computers.

Early years

In 1973, Theodore George “Ted” Paraskevakos patented the concepts of combining intelligence, data processing and visual display screens with telephones, outlining the now commonplace activities of banking and paying utility bills via telephone.

The first cellular phone to incorporate PDA features was an IBM prototype developed in 1992 and demonstrated that year at the COMDEX computer industry trade show. A refined version of the product was marketed to consumers on 16 August 1994 by BellSouth under the name Simon Personal Communicator. The Simon was the first device that can be properly referred to as a "smartphone", even though that term was not yet coined. In addition to its ability to make and receive cellular phone calls, Simon was also able to send and receive facsimiles, e-mails and pages through its touch screen display. Simon included many applications including an address book, calendar, appointment scheduler, calculator, world time clock, games, electronic note pad, handwritten annotations and standard and predictive touchscreen keyboards.

In 1996, Nokia released the Nokia 9000, part of the Nokia Communicator line which became their best-selling phone of that time. It was a palmtop computer-style phone combined with a PDA from HP. In early prototypes, the two devices were fixed together via a hinge in what came to be described as a clamshell design. When opened, the display of 640x200 pixels was on the inside top surface and with a physical QWERTY keyboard on the bottom. Email and text-based web browsing was provided via their GEOS V3.0 operating system.

In the late 1990s though, the vast majority of mobile phones had only basic phone features so many people also carried a separate dedicated PDA device, running early
versions of operating systems such as Palm OS, BlackBerry OS or Windows CE/Pocket PC.[1] These operating systems would later evolve into mobile operating systems and power some of the high-end smartphones.

In early 2001, Palm, Inc. introduced the Kyocera 6035, the first smartphone in the United States. This device combined a PDA with a mobile phone and operated on the Verizon Wireless network. It also supported limited web browsing.[15] The device was not adopted widely outside North America.[16]

In 2004, HP released the iPaq h6315, a device that combined their previous PDA, the HP 2215 with cellular capability.[17]

**Operating systems**

**Symbian**

The Nokia N8 smartphone is the first device to run on the Symbian^3 mobile operating system and the first smartphone to feature a 12 megapixel autofocus lens.

Symbian is a mobile operating system designed for smartphones originally developed by Symbian Ltd. but currently maintained by Accenture.[18] The Symbian platform is the successor to Symbian OS and Nokia Series 60. The latest version, Symbian^3, was officially released in Q4 2010 and first used in the Nokia N8.[19]

The first Symbian phone, the touchscreen Ericsson R380 Smartphone, was released in 2000,[20][21], and was the first device to be marketed as a 'smartphone'.[22] It combined a PDA with a mobile phone.[23]

Later in 2000, the Nokia 9210 communicator was released, also with Symbian. The later 9500 was Nokia's first camera phone and first Wi-Fi phone. The 9300 was smaller, and the E90 Communicator included GPS. In 2007, Nokia launched the Nokia N95 which integrated various multimedia features: GPS, a 5 megapixel camera with
autofocus and LED flash, 3G and Wi-Fi connectivity and TV-out. In the next few years these features would become standard on high-end smartphones. The Nokia 6110 Navigator was a Symbian based dedicated GPS phone introduced in June 2007.

In 2010, Nokia released the Nokia N8 smartphone with a stylus-free capacitive touchscreen, the first device to use the new Symbian^3 OS. Its megapixel camera able to record HD video in 720p. It also featured a front-facing VGA camera for videoconferencing.

Some estimates indicate that the number of mobile devices shipped with the Symbian OS up to the end of Q2 2010 is 385 million. Symbian was the number one smartphone platform by market share from 1996 until 2011 when it dropped to second place behind Google's Android OS.

In February 2011, Nokia announced that it would replace Symbian with Windows Phone as the operating system on all of its future smartphones. This transition was completed in October 2011, when Nokia announced its first line of Windows Phone 7.5 smartphones, Nokia Lumia 710 and Nokia Lumia 800. Nokia committed to support its Symbian based smartphones until 2016, by releasing further OS improvements, like Nokia Belle and Nokia Belle FP1, and new devices, like the Nokia 808 PureView.

**BlackBerry**

In 1999, RIM released its first BlackBerry devices, making secure real-time push-email communications possible on wireless devices. The introduction of Blackberry devices with voice, data, browser, messaging and organizer applications in 2002 marked the first true smartphone. Services such as BlackBerry Messenger and the integration of all communications into a single inbox allowed users to access, create, share and act upon information instantly. There are 80 million active BlackBerry service subscribers (BIS/BES) and the 200 millionth BlackBerry smartphone was shipped in September 2012 (twice the number since June 2010). Popular models include the BlackBerry Bold, BlackBerry Torch (slider and all-touch) and BlackBerry Curve.
Android

Galaxy Nexus Android 4.0 smartphone

Main article: Android (operating system)

Android is an open-source platform founded in October 2003 by Andy Rubin and backed by Google, along with major hardware and software developers (such as Intel, HTC, ARM, Motorola and Samsung, to name a few), that form the Open Handset Alliance.[31] The first phone to use Android was the HTC Dream, branded for distribution by T-Mobile as the G1. The software suite included on the phone consists of integration with Google's proprietary applications, such as Maps, Calendar, and GMail, and a full HTML web browser. Android supports the execution of native applications and a preemptive multitasking capability (in the form of services). Third-party free and paid apps are available via Google Play, which launched in October 2008 as Android Market.

In January 2010, Google launched the Nexus One smartphone using its Android OS. Although Android has multi-touch abilities, Google initially removed that feature from the Nexus One,[32] but it was added through a firmware update on February 2, 2010.[33]

On June 24, 2011, the HTC EVO 3D was released by the HTC Corporation, a smartphone which can produce stereoscopic 3D effects and take 3D stereoscopic photos for viewing on its screen. Samsung Galaxy S III sales hit 18 million in the third quarter of 2012.[34] In November 13, 2012 Google and LG released the Nexus 4 with Qualcomm's Snapdragon S4 Pro processor.
In 2007, Apple Inc. introduced the original iPhone, one of the first mobile phones to use a multi-touch interface. The iPhone was notable for its use of a large touchscreen for direct finger input as its main means of interaction, instead of a stylus, keyboard, and/or keypad as typical for smartphones at the time. It initially lacked the capability to install native applications, meaning some did not regard it as a smartphone. However in June 2007 Apple announced that the iPhone would support third-party "web 2.0 applications" running in its web browser that share the look and feel of the iPhone interface. A process called jailbreaking emerged quickly to provide unofficial third-party native applications to replace the built-in functions (such as a GPS unit, kitchen timer, radio, map book, calendar, notepad, and many others).

In July 2008, Apple introduced its second generation iPhone with a much lower list price and 3G support. Simultaneously, the App Store was introduced which allowed any iPhone to install third party native applications (both free and paid) over a Wi-Fi or cellular network, without requiring a PC for installation. Applications could additionally be browsed through and downloaded directly via the iTunes software client. Featuring over 500 applications at launch, the App Store was very popular and achieved over one billion downloads in the first year, and 15 billion by 2011.

In June 2010, Apple introduced iOS 4, which included APIs to allow third-party applications to multitask and the iPhone 4, with an improved display and back-facing camera, a front-facing camera for videoconferencing, and other improvements. In early 2011 the iPhone 4 allowed the handset's 3G connection to be used as a wireless Wi-Fi hotspot.

The iPhone 4S was announced on October 4, 2011, improving upon the iPhone 4 with a dual core A5 processor, an 8 megapixel camera capable of recording 1080p video at 30 frames per second, World phone capability allowing it to work on both GSM & CDMA networks, and the Siri automated voice assistant. On October 10, Apple announced that over one million iPhone 4Ss had been pre-ordered within the first 24 hours of it being on sale, beating the 600,000 device record set by the iPhone 4.
Along with the iPhone 4S Apple also released iOS 5 and iCloud, untethered device activation, backup, and synchronization,[48] along with additional features.[49]

Windows Phone

Main article: Windows Phone

A Windows Phone device produced by Nokia, the Lumia 800

On February 15, 2010, Microsoft unveiled its next-generation mobile OS, Windows Phone 7. Microsoft's mobile OS includes a completely over-hauled UI inspired by Microsoft's "Metro Design Language". It includes full integration of Microsoft services such as Microsoft SkyDrive and Office, Xbox Music, Xbox Video, Xbox Live games and Bing, but also integrates with many other non-Microsoft services such as Facebook, Twitter and Google accounts. The new software platform has received some positive reception from the technology press and has been praised for its uniqueness.[50][51][52]

Palm OS

In early 2002, Handspring released the Palm OS Treo smartphone, utilizing both a touch screen and a full keyboard that combined wireless web browsing, email, calendar, and contact organizer with mobile third-party applications that could be downloaded or synced with a computer.[53]

Bada

The Bada operating system for smartphones was announced by Samsung on 10 November 2009.[54][55] The first Bada-based phone was the Samsung Wave S8500, released on June 1, 2010,[56][57] which sold one million handsets in its first 4 weeks on the market.[58]

Samsung shipped 3.5 million phones running Bada in Q1 of 2011.[59] This rose to 4.5 million phones in Q2 of 2011.[60]

Open-source development
The open-source culture has penetrated the smartphone market in several ways. There have been attempts to create open source hardware and software for smartphones.

In February 2010, Nokia made Symbian open source. Thus, most commercial smartphones were based on open-source operating systems. These include those based on Linux, such as Google's Android, Nokia's Maemo, Hewlett-Packard's webOS, and those based on BSD, such as the Darwin-based Apple iOS. Maemo was later merged with Intel's project Moblin to form MeeGo.[61][62]

Features and applications

Display

See also: List of mobile phones with HD display

Screens on smartphones vary largely in both display size and display resolution. The most common screen sizes range from 3 inches to over 5 inches (measured diagonally). Some 6 inch screen devices exist that run on mobile OSes and have the ability to make phone calls, such as Huawei Ascend Mate. Ergonomics arguments have been made that increasing screen sizes start to negatively impact usability. [citation needed]

Common resolutions for smartphone screens vary from 240×320 (QVGA) pixels to 1080×1920 (Full HD), with flagship Android phones commonly sporting displays at or above 1280×720 (720p HD) and the iPhone 5 at 640×1136.

As of late-2012 and early 2013, an industry trend has emerged to move towards full HD 1080p smartphone screens for the highest-end handsets, with some of the models as follows:

- HTC Butterfly/Droid DNA
- Sharp SH930W
- Sony Xperia Z/ZL
- OPPO Find 5
- Huawei Ascend D2
- LG Optimus G Pro
- Lenovo K900
- ZTE Grand S
- Panasonic ELUGA X
- Fujitsu ARROWS X
- Pantech Vega No.6

With the passing of the years, Pixel density of smartphone screen is getting higher. Apple branded high-density display as Retina.

<table>
<thead>
<tr>
<th>Android[63]</th>
<th>iPhone</th>
<th>Windows Phone[64]</th>
<th>note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ldpi (120dpi, Android 1.6 or later)</td>
<td></td>
<td>Windows Phone 7 96dpi</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows Phone 7 131dpi</td>
<td></td>
</tr>
</tbody>
</table>
### Popular applications

According to a ComScore report released on May 12, 2011, nearly one in five smartphone users are tapping into check-in services like Foursquare and Gowalla. A total of 16.7 million mobile-phone subscribers used location-based services on their phones in March 2011.\(^{[65]}\)

Some smartphones allow watching television\(^{[66]}\) and provide a second screen for media multitasking.\(^{[67]}\)

Some applications allow the user to protect their privacy, such as preventing unwanted calls from telemarketers and do not disturb services. The demand for these apps has increased, as a result of the *National Do Not Call Registry*.\(^{[68]}\)

### Application stores

<table>
<thead>
<tr>
<th>Store</th>
<th>2009 (millions U.S.)</th>
<th>2010 (millions U.S.)</th>
<th>(^{[69]})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple App Store</td>
<td>$769</td>
<td>$1782</td>
<td></td>
</tr>
<tr>
<td>Blackberry App World</td>
<td>$36</td>
<td>$165</td>
<td></td>
</tr>
<tr>
<td>Nokia Ovi Store</td>
<td>$13</td>
<td>$105</td>
<td></td>
</tr>
<tr>
<td>Google Play</td>
<td>$11</td>
<td>$102</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$828</strong></td>
<td><strong>$2155</strong></td>
<td></td>
</tr>
</tbody>
</table>
The introduction of Apple's App Store for the iPhone and iPod Touch in July 2008 popularized manufacturer-hosted online distribution for third-party applications focused on a single platform. Before this, smartphone application distribution was largely dependent on third-party sources providing applications for multiple platforms, such as GetJar, Handango, Handmark, PocketGear, and others.

The iPhone's platform is officially restricted to installing apps through the App Store, through "B2B" deployment, and on an "Ad Hoc" basis on up to 100 iPhones. Through jailbreaking it can install apps from other sources. Other platforms may allow application distribution through additional sources outside of their manufacturer-provided app stores, such as third-party app stores and downloads from individual websites.


The relatively high revenue of U.S. $5782 million in 2012 for Apple's App Store compared to competitor's stores can be attributed to a combination of factors. In large part this can be attributed to having the largest number of apps available and the highest download volume of any mobile app store in 2010, but besides that only 28% of the apps in Apple's App Store were free apps, compared to over 57% in the Android Market. Similarly, Nokia's Ovi Store and the BlackBerry App World both had only 26% of their apps available for free, but both generated higher revenues than the Android Market despite having much lower download volumes.
Market share

Smartphone usage

For several years, the demand for smartphones has outpaced the rest of the mobile phone market.\(^7^2\) According to a 2012 survey, around half of the U.S. mobile consumers own smartphones and could account around 70% of all U.S. mobile devices by 2013.\(^7^3\) In the 25–34 age range smartphone ownership is reported to be at 62%.\(^7^4\) NPD Group reports that the share of handset sales that were smartphones in Q3, 2011 reached 59% for consumers 18 and over in the U.S.\(^7^5\)

The European mobile market, as measured by active subscribers of the top 50 networks is 860 million.\(^7^6\) According to an Olswang report in early 2011, the rate of smartphone adoption is accelerating: as of March 2011 22% of UK consumers had a smartphone, with this percentage rising to 31% amongst 24- to 35-year-olds.\(^7^7\)

In China, smartphones represented more than half (51%) of handset shipments in the second quarter of 2012.\(^7^8\)

In profit share, worldwide smartphones far exceeds the share of non-smartphones. According to a November 2011 research note from Canaccord Genuity, Apple Inc. holds 52% of the total mobile industry's operating profits, while only holding 4.2% of the global handset market. HTC and RIM similarly only make smartphones and their worldwide profit shares are at 9% and 7%, respectively. Samsung, in second place after Apple at 29%, makes both smartphones and feature phones but doesn't report a breakdown separating their profits between the two kinds of devices.\(^7^9\)

Up to the end of November 2011, camera-equipped smartphones took 27% of photos, a significant increase from 17% in 2010. For many people, smartphones have replaced Point-and-shoot cameras.\(^8^0\)
A study conducted in September 2012 concluded that 4 of 5 smartphone owners (85.9M U.S. users) are actually using the device to shop.¹⁸¹

**By Manufacturer**

<table>
<thead>
<tr>
<th>Smartphone by J.D. Power and Associates</th>
<th>Customer Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>Score</td>
</tr>
<tr>
<td>Apple 2010</td>
<td>810</td>
</tr>
<tr>
<td>Apple 2011</td>
<td>838</td>
</tr>
<tr>
<td>HTC 2010</td>
<td>727</td>
</tr>
<tr>
<td>HTC 2011</td>
<td>801</td>
</tr>
<tr>
<td>Industry Average 2010</td>
<td>753</td>
</tr>
<tr>
<td>Industry Average 2011</td>
<td>788</td>
</tr>
<tr>
<td>Samsung 2010</td>
<td>724</td>
</tr>
<tr>
<td>Samsung 2011</td>
<td>777</td>
</tr>
<tr>
<td>Motorola 2010</td>
<td>N/A</td>
</tr>
<tr>
<td>Motorola 2011</td>
<td>775</td>
</tr>
<tr>
<td>RIM 2010</td>
<td>741</td>
</tr>
<tr>
<td>RIM 2011</td>
<td>762</td>
</tr>
<tr>
<td>LG 2010</td>
<td>N/A</td>
</tr>
<tr>
<td>LG 2011</td>
<td>760</td>
</tr>
<tr>
<td>HP/Palm 2010</td>
<td>712</td>
</tr>
<tr>
<td>HP/Palm 2011</td>
<td>733</td>
</tr>
<tr>
<td>Nokia 2010</td>
<td>720</td>
</tr>
<tr>
<td>Nokia 2011</td>
<td>721</td>
</tr>
</tbody>
</table>

Rankings are based on a possible top score of 1000

From the launch of their Communicator model in 1996 until 2011 Nokia was dominant in the smartphone market, though has more recently been joined by other competitors in the market. Based on a report by Strategy Analytics, Samsung overtook Nokia in smartphone shipments with an estimated 27.8 million units shipped in Q3 2011¹⁸² (Samsung does not publicly disclose the numbers of their smartphone shipments and sales).

Apple surpassed Nokia worldwide by revenue and profit for the first time in Q2 2011, with Apple's profit share of the total worldwide smartphone market increasing to 66.3% while Nokia reported a loss.¹⁸³

Between Q2 2010 and Q2 2011 Nokia's worldwide Symbian smartphone sales dropped significantly from 38.1% to 15.2%, while Samsung smartphone sales increased significantly worldwide from 5% to 17.5%.¹⁸⁴ As of Q1 2011, Nokia had already announced plans to switch to Windows Phone. Samsung smartphones use a diverse portfolio of operating systems, including their own Bada operating system along with Android and Windows Mobile.¹⁸⁵
Market share among smartphone manufacturers does not equate to OS market share since some OSes are available only to one manufacturer and others are licensed across multiple manufacturers. Apple's iPhone, Nokia's Symbian, and RIM's BlackBerry smartphones are currently only available from single manufacturers. Google's Android OS and Microsoft's mobile OSes are platforms that are licensed and used by a variety of manufacturers. As a result, manufacturers of smartphones using licensed OSes all split the total market share of that OS between them, while the total share for a single-manufacturer OS is held by that manufacturer alone. Nokia's Symbian OS was previously available from several manufacturers under a licensed model, then later predominantly only by Nokia itself.

In Q1 2012, after 14 years in the market, Samsung surpassed Nokia in units sold. Samsung also taking pole position in smartphones with 44.5 million smartphones sold or 30.6% market share, while 35.1 million iPhones sold or 24.1% market share.\[86\]

Currently the vast majority of smartphones are manufactured in China, Taiwan and Mexico, for companies based in the U.S. (Apple, HP, Motorola), South Korea (LG, Samsung), Canada (RIM), Finland (Nokia), Taiwan (HTC) and the U.K. (Sony Ericsson).

By Operating system

*Main article: Mobile operating system*

2010 saw the rapid rise of the Google Android operating system from 4% of new deployments in 2009 to 33% at the beginning of 2011 making it share the top position with the since long dominating Symbian OS. The smaller rivals include Blackberry OS, iOS, Samsung's recently introduced Bada, HP's heir of Palm webOS and the Microsoft Windows Phone OS which is now supported by Nokia. In the UK, which currently has one of the highest penetrations of smartphones in the World, Android achieved 50% market share in October 2011.[87] As of December 2012, the worldwide smartphone market had Android as its top operating system, counting on 68.3% of market share, followed by iOS with 18.8% and Blackberry with 4.7%. Forecasts show that by 2016 Windows Phone will overtake the third place, with 11.4% market share, while Android and iOS will remain in its previous positions, with 63.8% and 19.1% respectively. [88]

**Historical sales figures**

![World Wide Smartphone Sales (%)](image.png)
Figures in millions.

<table>
<thead>
<tr>
<th>Year</th>
<th>Android (Google)</th>
<th>BlackBerry (RIM)</th>
<th>iPhone (Apple)</th>
<th>Linux</th>
<th>Palm/WebOS (Palm/HP)</th>
<th>Symbian (Nokia)</th>
<th>Asha Full Touch (Nokia)</th>
<th>Windows Mobile/Phone (Microsoft)</th>
<th>Bada (Samsung)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>11.77</td>
<td>3.3</td>
<td>11.76</td>
<td>1.76</td>
<td>77.68</td>
<td>14.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>23.15</td>
<td>11.42</td>
<td>11.26</td>
<td>2.51</td>
<td>72.93</td>
<td>16.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>6.8</td>
<td>34.35</td>
<td>24.89</td>
<td>8.13</td>
<td>80.88</td>
<td>15.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>67.22</td>
<td>47.45</td>
<td>46.6</td>
<td>111.58</td>
<td>12.38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>219.52</td>
<td>51.54</td>
<td>89.26</td>
<td>93.41</td>
<td>8.77</td>
<td>14.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012-Q1</td>
<td>81.07</td>
<td>9.94</td>
<td>33.12</td>
<td>12.47</td>
<td>2.71</td>
<td>3.84</td>
<td></td>
<td></td>
<td>1.24</td>
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</tr>
<tr>
<td>2012-Q2</td>
<td>104.8</td>
<td>7.4</td>
<td>26.0</td>
<td>6.8</td>
<td>5.4</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012-Q3</td>
<td>122.5</td>
<td>9.0</td>
<td>23.6</td>
<td>4.4</td>
<td>6.5[95]</td>
<td>4.1</td>
<td></td>
<td></td>
<td>5.1</td>
<td>0.7</td>
</tr>
</tbody>
</table>

**Enterprise share by operating system**

In a worldwide study of 2,300 workers at 1,100 businesses by iPass it was reported that Apple's iPhones have displaced RIM's BlackBerry devices in enterprise adoption in 2011.[96] The share for iPhones increased to 45% from 31.1% in 2010, while the Blackberry share dropped to 32.2% from 34.5% in the previous year. Android phones also increased in share, to 21.3% from 11.3% in 2010, exceeding Symbian for the first time, which dropped to 7.4% from 12.4%. Windows Mobile and all other smartphone OSes also dropped in 2011 compared to 2010.[97]

**Customer loyalty by operating system**

According to a survey of more than 6,000 smartphone users through 2010 by mobile analytics firm Zokem, the top five loyalty scores for smartphone platforms are the iPhone at 73%, followed by Google's Android at 40%, Samsung's Bada at 33%, RIM's BlackBerry at 30%, and Symbian S60 at 23%. Windows Mobile and Palm follow at 10% each. Customer loyalty gauges the likelihood that the user of a smartphone platform whose contract has expired or who has broken or lost their phone will repurchase another one that uses that same platform.[98][99]

**Malicious software attacks**

*Main articles: Mobile security, Malware, and Mobile virus*

As smartphone adoption increases, these devices become more appealing to attackers who try to infect them with malicious software (malware).[100][101] Smartphone security
literature suggests that smartphone malware can be written even by average developers.[102]

Smartphone malware is more easily distributed through application stores that have minimal or no security mechanisms, such as app kill switch (aka remote app removal), review process for their content, etc.[103][104] Often malware is hidden in pirated versions of legitimate apps, which are then distributed through 3rd party app stores.[105][106] Malware risk also comes from what's known as an "update attack," where a legitimate application is later changed to include a malware component, which users then install when they are notified that the app has been updated. Additionally, the ability to acquire software directly from links on the web results in a distribution vector called "malvertizing," where users are directed to click on links, such as on ads that look legitimate, which then open in the device's web browser and cause malware to be downloaded and installed automatically.[107]

Typical smartphone malware leverages platform vulnerabilities that allow it to gain root access on the device in the background. Using this access the malware installs additional software to target communications, location, or other personal identifying information. A common form of malware on mobile phones is the SMS trojan, which sends premium SMS messages, possibly while unknowingly running in the background of a legitimate application. These premium SMS messages run up charges on the owner's phone bill which cannot be recovered.

In August 2010, Kaspersky Lab reported detection of the first malicious program for smartphones running on Google's Android operating system, named Trojan-SMS.AndroidOS.FakePlayer.a, an SMS trojan which had already infected a number of devices using that OS.[108] Over the spring of 2011 Android malware increased 76%, according to McAfee.[100][109] A report from Juniper Global Threat Center notes that malware on the Android platform increased 400% from 2009 to the summer of 2010, and then saw a 472% increase between July and November 2011.[103] The Juniper report indicates that 55% of Android malware acts as spyware, and 44% are SMS trojans.

While there have been and continue to be potential security flaws in iOS,[110] as of at least August 2011 there were no known malware or spyware apps in Apple's App Store, according to security firm Lookout. There are however commercial spyware applications available, outside the App Store, for jailbroken iOS devices.[107] In June 2011 Symantec's 23-page report "A Window Into Mobile Device Security" characterized (non-jailbroken) devices running iOS as having "full protection" against malware attacks.[111]

Symbian and older versions Windows Mobile have had to contend with a degree of malware in the past, but as legacy systems it is believed that the people who previously targeted them have shifted their focus to Android.[103] There were also a few Palm OS viruses.

The only mobile platform other than Apple's iOS without reports of malware so far is HP's (formerly Palm's) webOS, but this may be explained by its relatively low adoption rate.[109]
The best way to reduce a device's vulnerability to malware attacks is to install the most recent versions of operating systems which include security patches. This can be complicated by long delays in software updates for many devices which have had their software modified with custom "skins," services, or promotional on-deck apps by their manufacturer or mobile carrier. In some cases a device may no longer be receiving updates from its manufacturer or carrier, leaving it vulnerable to exploits that have been patched in an OS version that's more recent than the device's last supported one.

**Social impact**

A University of Southern California study found that the unprotected adolescent sexual activity was more common amongst possessors of smartphones. There are numerous smartphone applications that have positive social and environmental benefits. For example, smartphones have been shown to be a useful tool for encouraging energy conservation by assisting crowd source building energy audits.

**Patent licensing and litigation**

*Main article: Smartphone wars*

*See also: Apple Inc. litigation, Apple Inc. v. Samsung Electronics Co., Ltd., and Motorola Mobility v. Apple Inc.*

The rate of lawsuits, trade complaints, and countersuits and complaints based on patents and designs, in the markets for smartphones and devices based on smartphone OSes such as Android and iOS, increased greatly in 2010 as companies engaged in patent wars. A smartphone war between Samsung and Apple started when Apple claimed that the original Galaxy S Android phone copied its iOS in terms of interface and possibly the hardware of iPhone 3GS.