ambercite
Next Generation Patent Mapping

GRIFFITH HACK
PATENTS
TRADE MARKS
IP LAW

The Smartphone Patent Wars

This report casts an independent and unique perspective on a rapidly developing technology that we use every day.

By Mike Lloyd, Doris Spielthenner and George Mokdsi

March 2011

Contents

Who has the leading patents with smartphones?

In this report, Network Patent Analysis (NPA) is applied to the world of smartphone patents to answer questions such as:

- **Which technology areas are attracting the most litigation?**
- **Who has the best patents? Apple, Google, Nokia, or others?**
- **Who might be at risk of infringing whose patents?**

STOP PRESS:

Nokia/Microsoft join forces to create a new 'ecosystem' to take on Apple and Android.

See page 29 to read the full story.

Who can benefit from this report?

1. Smartphone users

Who are the smartest developers of smartphones? Patents are used by companies to protect their innovations, and so this independent review of the leading patents in this report can help tell you who the smartest companies are, and which parts of the smartphone they have helped to develop.

2. Technology enthusiasts

What exactly is a smartphone? What technologies needed to be developed to make a smartphone work? Important areas of technical development tend to attract a lot of attention from companies and even solo inventors, and they compete to file the leading patents in these areas.

Since smartphones are such an increasing valuable area of activity, this has to led to increasing patent litigation, with patent owners litigating in order to claim or defend ownership of valuable technologies. This report casts an independent and unique perspective on a rapidly developing technology that we all use every day.

3. Patent specialists, managers, owners and litigators

How can a large and complex set of patents be efficiently and objectively analysed? This report applies the wealth of information in patent citation data to gain new insights about a tightly contested patent field.

The newly developed Network Patent Analysis (NPA) technique is used to show the leading areas of litigation in the smartphone area, along with the leading patent owners and patents in these areas, and present these complex results in an intuitive and easy to understand visualisation and report.

Besides showing which companies have the leading smartphone patents, NPA is used to review a current patent dispute between Apple and Motorola, and to compare the relative positions of these two companies in this dispute.

Prior to NPA, this type of analysis was performed subjectively, using costly manual processes to review thousands of patent documents, or using analytical techniques that cannot simultaneously group and rank patents in an easy to understand manner.

In an earlier study NPA successfully predicted litigation and its outcome in the hybrid car area.

4. IT specialists and engineers

Where are the R&D and patent litigation dollars being invested in the smartphone industry? This report provides an overview of the key technologies being litigated in the smartphone area.

IT specialists can identify the smartphone technologies that have seen the most patent filing activity. These areas are most likely to be the leading areas of innovation and to be high value areas.

Companies wishing to innovate in these high value areas may benefit from reviewing the patents filed in these areas, and who is filing them, so as to help understand the current state of development and technology ownership.

IT specialists can also use these results to identify the ‘white spaces’ between these areas of activity, as well as patents that may link these areas together and so provide a technology brokering role.

The Network Patent Analysis method

The battle rages

Smartphones are rapidly becoming essential to our way of life and, in the process, are creating enormous value for both phone companies and their technology suppliers. The intense commercial competition between smartphone companies is also driving large volumes of complex and often multi-jurisdictional patent litigation. Patent litigation has been a common feature of the mobile phone industry for many years. Historically this litigation tended to focus on the core technologies involved in providing traditional mobile voice telephony services such as radio transmission, network management and speech compression technologies. More recently, the aggressive convergence of cellphone and mobile computing technology in smartphones has seen the focus of this litigation broaden across a wider range of technologies. The likes of Apple, Motorola, Nokia and others are suing each other over a range of patented smartphone technologies.

Who will be next to take a hit in the smartphone patent wars? Who has the leading patents, especially in the fastest moving and most commercial smartphone technologies (touch screens and mobile data transmission)?

The newly developed Network Patent Analysis (NPA) method has indicated that Apple has the leading patent portfolio in the smartphone patent dataset, slightly ahead of Microsoft and IBM (Apple owns 16 out of the top 20 patents according to NPA).

NPA also reveals that the majority of litigated smartphone patents fall into 16 distinctive clusters of related inventions. The largest of these technology clusters relates to mobile data access, followed by touch screens and mobile data transmission, with each cluster having a different dominant patent portfolio. Research in Motion (RIM), the maker of BlackBerry, dominates the mobile data access cluster while Apple, maker of the iPhone and iPad, dominates the touch screen cluster.

NPA has also been used to study a patent assertion by Motorola against Apple for a screen technology to reveal that, while Motorola has a case, the differences between the main Apple touch screen and the asserted Motorola patent are reasonably large. Instead, it is Synaptics, supplier of touch screens to many of Apple's competitors (and thought to be a supplier to Apple) that has filed patents for inventions most similar to Apple's key touch screen patents.

Who will be next to take a hit in the smartphone patent wars?

Who has the leading patents in the fastest moving and most commercial smartphone technologies (touch screens and mobile data transmission)?

The rise and rise of smartphones

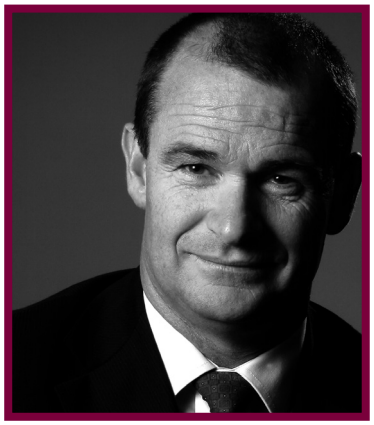
Smartphones are becoming very popular, with more than 80 million sold in the third quarter of 2010 alone (equivalent to 320 million phones a year).

Smartphones have changed the way we live, work, play, communicate and share information. Considering that a smartphone can combine a phone, electronic diary, computer, internet access, video and MP3 player, camera, GPS, video camera, notepad and gaming console into one compact and mobile device, it is not surprising that smartphone sales have grown 96% in the last 12 months[(1)].

Smartphones are also changing in scope, with Apple's iPad and its competitors bridging the gap between smartphones and computers and bringing many smartphone features (such as touch screens and location sensing applications) to mobile computing.

The role of patents in smartphone technologies

Companies and inventors file patents to protect their investment in research and development (R&D). A patent, once it has been examined and granted, provides >



"NPA is an exciting new way of visualising a technology landscape, and as a keen smartphone user I was curious to see what NPA would tell us about them"
Mike Lloyd, Griffith Hack

its owner or licensee with a monopoly to practice the patented invention for up to 20 years. Patents provide inventors and the companies that employ them with an incentive to invest in the expensive and risky business of bringing new technology out of the research lab and into the market. Patents are now a big business in their own right, with more than 1.9 million patent applications published each year.

Smartphone companies are protecting their investments with a multitude of patent applications, and this has recently led to an explosion in patent litigation[2][3]. Patent litigation[4][5] predominates in the US market, where patent damages for a single lawsuit can exceed $1 billion.

Well-known heavyweight technology firms including Apple, Kodak, Nokia, Google, HTC, Qualcomm, Microsoft, Xerox, Motorola, HTC, Samsung, and RIM are all in the midst of patent battles relating to smartphone technologies. But who has the leading patents? Which companies might be infringing which patents owned by other companies?

Traditionally, the answers to these questions have involved a long and detailed analysis of the patent literature by highly qualified legal experts, and long and expensive court cases, in which teams of experts argue in front of judges and juries. There is now an easier way of conducting much of this analysis; ironically using a method that draws inspiration from one of the key features of smartphones themselves.

The link between patents and social networks

A key benefit of smartphones is that they make it easier to communicate and share content with the various 'contacts' of a smartphone user. Together with the rise of social networking platforms such as Facebook, LinkedIn and MySpace, this has led to a growing awareness of the importance of social networks, and a better sense of the various direct and indirect links between members of a social network.

The idea of linkages has been exploited in the internet space, and constitutes the basis for modern search engines such as Google, which considers links between websites as part of the mathematical process they use to determine which websites are ranked highly during searching. Similar processes are also used by social networking platforms, some of which are able to predict who your 'friends' might be, by analysing your already nominated contacts.

Patents connect to each other by citations

These networking principles can also be applied to patents. While patents do not have 'friends' per se, they are connected to other patents via patent citations. In general, a patent is only granted when it is determined by a patent examiner to be 'novel' and 'inventive'; the question is, novel and inventive compared to what?

In practice, patent examiners tend to examine new patent applications in comparison to the closest and earlier patent applications[6], referred to as 'prior art', which may have been published anywhere in the world. Patent examiners find these patents after a careful patent search. Additionally, patent applicants in a number of countries (especially in the US) must supply the examiner with a list of known potential prior art patents. A number of countries (in particular the US) publish this list of earlier patent publications (known as 'reverse citations' or sometimes 'backward citations') in publicly accessible databases.

>

What can citations tell us about possible copying?

The role of citations has long fascinated technology analysts, since they can be used to identify patents (or inventions) that have been cited by a large number of other patents (known as 'forward citations'), which suggests that the earlier patent has served as a source of inspiration for a number of new developments. 'Imitation is the sincerest form of flattery'[7].

There remains an open question – whether these later citations arose because the later inventor knew of the earlier invention and worked to improve on it, or whether the later invention arose entirely independently of the earlier invention (for example, because the time had come for the later invention). Later inventors often like to claim that they independently developed their later inventions, as this can help avoid claims of deliberate copying.

At the same time, many leading technology companies carefully watch new patent publications of their competitors. Whether due to coincidental or deliberate 'improving' by later inventors, highly valued/valuable patents tend to have larger numbers of forward citations. For example, the US WiFi patent owned by the Australian R&D agency CSIRO, and successfully asserted in the US, has 77 forward citations in the US alone, an unusually high number of forward citations for just one patent.

An analytical tool is born!

While the number of forward citations is one useful measure of patent or invention quality, there is considerable scope to expand this measure. Further, measuring the worth of a patent by just the number of forward citations is akin to judging the strength of a person's social network based entirely on the number of people who have listed this person as a friend. Such an assessment would not take into the account the number of friends the person themselves thinks they know, but also who those friends know, and so on.

A more sophisticated analysis would also consider friends of friends – who exactly do these people know? And how important are the people that they know? And do they know or are they related in some way to the first person? And so on. These linked-data principles are behind the newly developed and world leading Network Patent Analysis (NPA), which is being commercialised by IP law firm Griffith Hack in association with technology developer Ambercite.

Ambercite, working together with Griffith Hack, has developed a set of analytical and visualisation tools that use citation links to both group patents of similar technologies and rank patents. Large numbers of patents can be analysed to ensure statistical reliability, with up to 250,000 patents and one million citation linkages being analysed in some studies. NPA has already been applied by a number of companies to efficiently reduce complex and diverse patent datasets into knowledge that is concise and manageable.

In an earlier study[8][9], Griffith Hack and Ambercite applied NPA to the world of hybrid cars. This study found the highest ranking hybrid car patents belonged to a small technology developer named Paice Corporation, and suggested that the likes of Toyota and Ford may risk infringing a highly rated Paice patent. These predictions were confirmed, with both Toyota and recently Ford executing settlement agreements with Paice Corporation.

"Using citations we can tell the story of the smartphone trajectory, and we can literally show how the technologies needed to make a call are interconnected"
Doris Spielthenner, Ambercite

"The power of associative patent searching allows me to draw on the collective expertise of many examiners and searchers"
George Mokdsi, Griffith Hack

How to determine relevant smartphone patents

The old method had many imperfections

As part of the NPA analysis, we also applied a new patent searching method known as 'associative searching', another development of NPA. Associative searching is the process of starting with a set of known patents, and adding all patents that are linked by citation linkages to this set of known patents.

Patent searching has traditionally been performed in the same way as a simple search on an internet search engine, namely, through the use of keywords, such as 'touch screen' or 'object-oriented', but also in combination with selected 'International Patent Classes' (IPC), which is a coding system for allocating different patents to different technical areas – or classes – in the same way that libraries use the Dewey system for classifying their non-fiction books. While skilled patent searchers will often find the key patents they are looking for using such methods, in practice a lot of irrelevant patents are produced and need to be reviewed and discarded in a time-consuming, manual process.

Also, no matter how carefully chosen, individual keywords are typically imprecise, for example, a search for patents related to 'screens' can locate patents for television or computer screens as well as smartphone screens. And different patent applicants can use different terms for the same concept, for example, the words 'phone', 'handset', 'mobile device' have all been used in patent documents in place of 'cellphone'. Further complications arise where patents are filed in different languages and are then translated for searching, often inconsistently. Patent examiners are used to compensating for such imprecision and, when performing their searches, will recognise for example, that a 'phone' can be a 'cellphone', which can be a 'mobile device', and that a television screen patent may not be relevant to smartphones.

The major advantage of associative searching is that it compensates for imperfections in the way the initial patents are chosen, and also how reverse citations are selected by patent examiners. Individual patent examiners are human, and may miss key prior art patents when examining patents.

Associative searching can quickly produce a data set with thousands of patents, and so in effect combine the search expertise of what might be hundreds of patents examiners. All key patents are likely to be cited by at least one of these hundreds (or more) of patent examiners. Associative searching is illustrated in Figure 1 on page 8.

Application of associative searching to smartphone patents

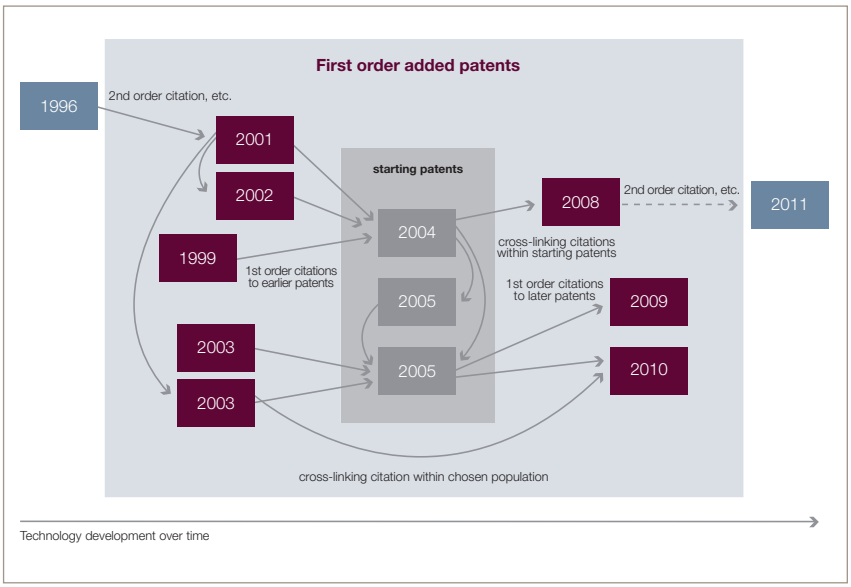
In our study we focused on smartphone patents being litigated. We searched for patents in the Thomson Innovation platform provided by Thomson Reuters for each of the following patentees: RIM, Motorola, Samsung, Microsoft, Apple, Qualcomm, Nokia, Sharp, LG, Hitachi, Sony Ericsson, Google, Toshiba, Oracle, HTC and Elan Microelectronics. Altogether about 250 patents were found. An expert patent searcher then manually reviewed these patents, and removed the patents that were not relevant to some aspect of mobile phone technology. This left 129 patents in total. Using the principle of associative searching, we added in the first order citations to these selected 129 patents. As a result, this data set grew to 7093 patents, with about 90,000 citations linking these patents together. Of these 7093 patents, 298 patents had been litigated (some of the first order citations were litigated patents as well).

The patents had publication dates starting from 1965, and grew steadily from 77 patents filed in 1990 to 565 patents filed in 2010, as seen in Figure 2 (page 8). >

In a nutshell

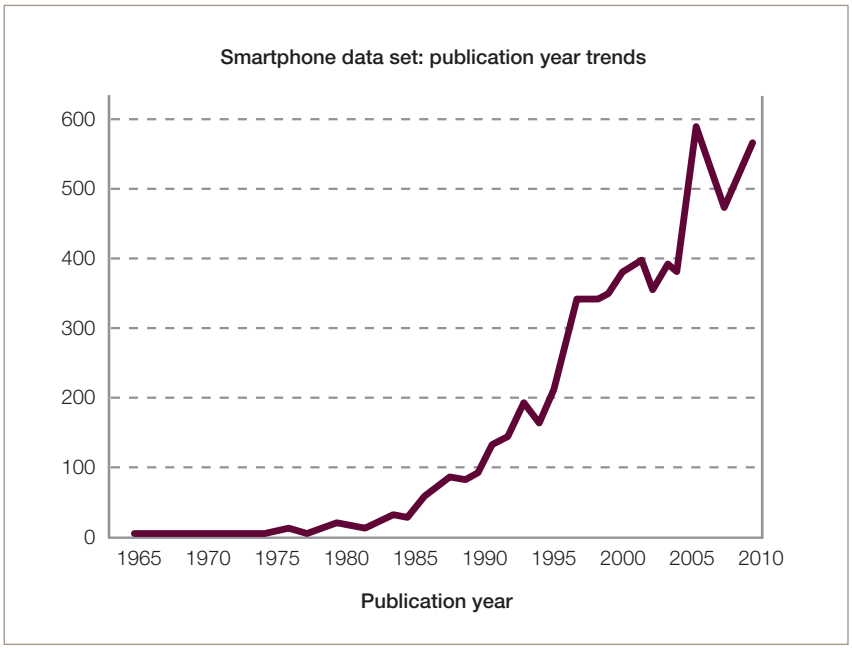
Associative searching, or the searching of patents related via patent citation links to a starting set of patents, has been used to strengthen the NPA analysis of a group of litigated patents belonging to leading smartphone manufacturers. This grew the number of patents in the initial dataset from 129 patents to 7093 patents.

Figure 1: Concept of associative searching.



The major advantage of associative searching is that it compensates for imperfections in the way the initial patents are chosen, and also how reverse citations are selected by patent examiners.

Figure 2: Publication years for the 7093 smartphone patents in our patent data set.



The patents had publication dates starting from 1965, and grew steadily from 77 patents filed in 1990 to 565 patents filed in 2010, as seen in Figure 2.

Results of Network Patent Analysis (NPA)

Whose patents were being litigated the most?

In the 298 litigated patents of this study, Motorola was asserting the most patents, against Apple and RIM. In terms of the number of patents asserted, Table 1, Qualcomm, Apple and Helferich Patent Licensing (hereafter 'Helferich', which describes itself as a 'patent management and licensing company specialising in the licensing of multimedia delivery technology') were also active litigants.

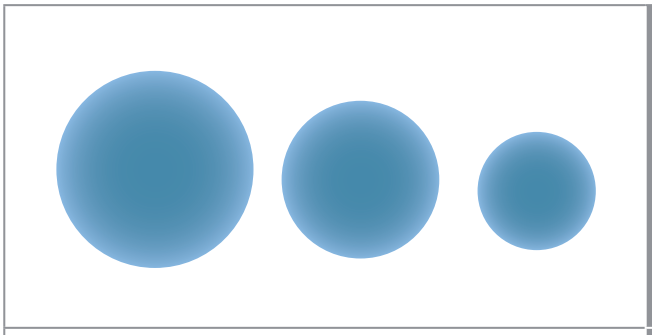
On the other side of the ledger, Apple was defending itself the most against patent assertion, a long way ahead of the defendants Nokia, HTC and RIM. These results are shown in Table 1. >

Motorola was asserting the most patents, against Apple and RIM. In terms of the number of patents asserted, Qualcomm, Apple and Helferich Patent Licensing were also active litigants

Table 1: Companies asserting and defending the most patents.

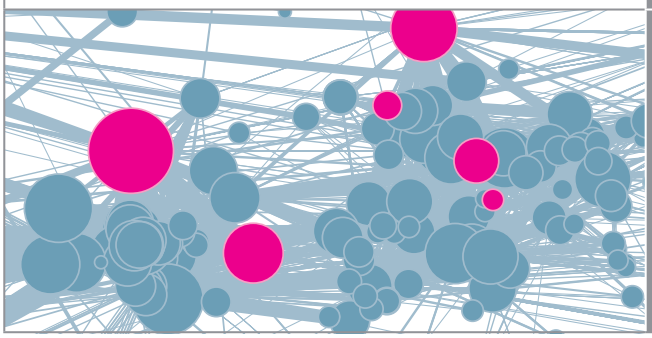
Plaintiffs asserting the most patents in data set	Number of patents asserted	Defendants having the most numbers of patent assertions in data set	Number of patents asserted against
Motorola Inc	41	Apple Inc.	50
Qualcomm Incorporated	24	Nokia Corporation	21
Apple Inc.	20	New York Times Co.	20
Helferich Patent Licensing, LLC.	20	High Tech Computer Corp (HTC)	15
Nokia Corporation	14	Research In Motion Limited, et al	14
Microsoft Corporation	10	Motorola, Inc.	13
Eastman Kodak	8	Samsung Electronics Co, Ltd, et al	12
Oracle America, Inc.	7	Motorola Inc	9
Pumatech Inc.	7	Google Inc.	8
Research in Motion Limited	6	Microsoft Corporation	7
WiAV Solutions LLC	6		

How to read a NPA patent map



Each node (or dot) on the map represents a patent. The size of a patent node reflects patent dominance and quality. The larger the node, the more dominant the patent is, and the higher its value.

A line between patent A and B indicates that A and B are linked with each other through a citation relationship. A thicker line means that the two patents have more mutual citations, for example, other patents which connect to both A and B.



A group of patents (10 to 200) that are more strongly and densely connected to one another relative to their environment are grouped into ‘clusters’. All patents of a cluster are likely to share a similar subject matter.

Which smartphone technology areas attracted the most litigation?

NPA was used to draw patent landscape maps to show the leading patents in a technology area, and how the inventions group and link together via citation linkages.

Figure 3 shows a diagram of the litigated 298 patents in the smartphone area, along with the 2859 patents that have the strongest relationships to the 298 litigated patents. The 298 litigated patents are shown as coloured nodes (other than grey), while the remaining 2859 patents are represented by light grey nodes.

While there is much information in Figure 3, initially we can note the following:

- The litigated patents form into 16 clusters (the numbers show the relative size of the clusters, number 1 being the largest cluster), that are made up of patents that are densely inter-connected[10]. Each cluster represents a group of similar patents, or a technology focus area, and is assigned a title based on the subject matter of the patents in the cluster, for example, 'mobile data transmission', or 'touch screens'. Each cluster, which is made up of patents owned by a number of different technology owners, is likely to represent a commercially valuable aspect of technology.
- The three largest clusters of litigated patents are in the area of mobile data access, touch screen technology, and mobile data transmission. The remaining clusters are listed in Table 2 (page 12), together with some details of these clusters.
- Coloured circles are drawn around the three largest clusters. Each circle represents the approximate size of the litigated patent cluster. Note that the circles for touch screen technology and mobile data access overlap; this indicates that some of the patents fall into both clusters. This can be regarded as analogous to how a surveyor might name adjacent mountains in a mountain range; there might be a ridge between these mountains that can be allocated to both mountain ranges.
- The key disputed technology areas are all connected through citation relationships between patents within these clusters. This shows the interdependence of these technologies and innovations.

Many of the litigated patents (coloured nodes) are positioned at the core of these clusters, which tends to suggest that they are more important than most other patents.

>

Figure 3: Disputed smartphone technologies – patent landscape analysis. Visualisation of the most disputed technology areas (coloured and ranked) and their internal relationship, and patent dominance of litigated patents (node size).

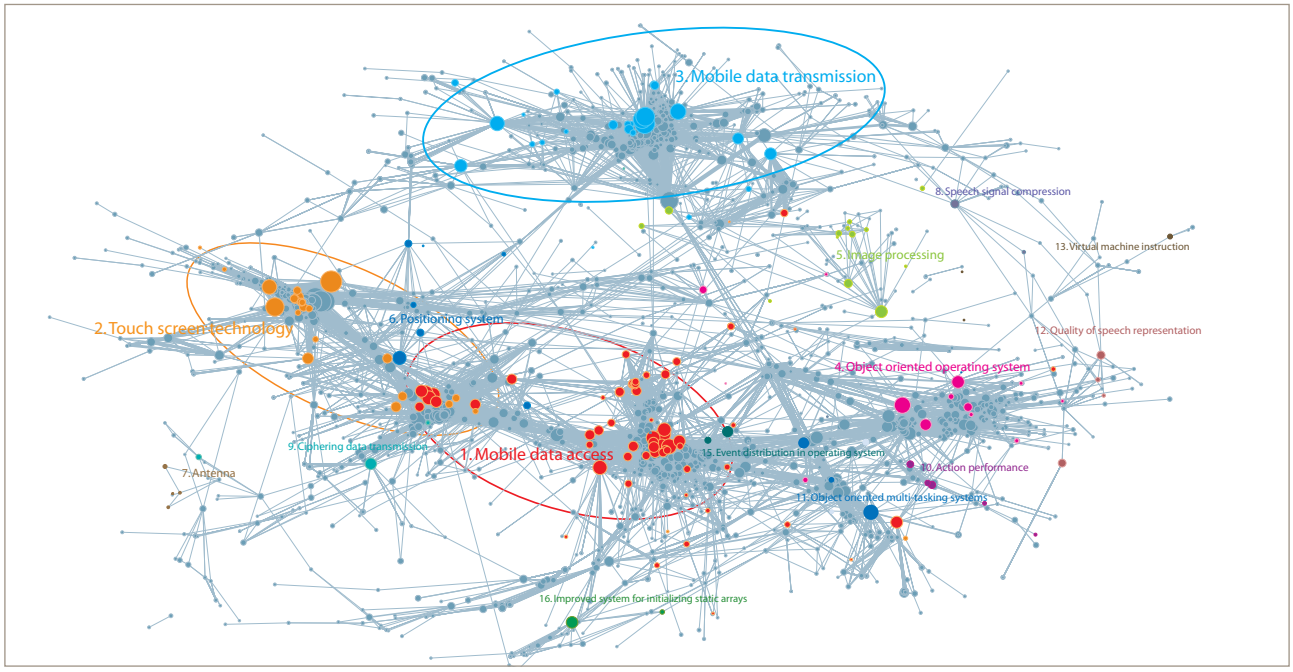


Table 2: Details of disputed technology clusters.

Cluster number	Cluster description	Number of patents in litigation group	Average publication year	Highest ranked patent in patent cluster (calculated using NPA)
1	Mobile data access	75 (25% of litigated patents)	2002	US 6,708,221 – Visto Corp (1998 publication year). System for using a workspace data manager to access, manipulate and synchronise network data.
2	Touch screen technology	27 (9.1%)	2001	US 7,663,607 – Apple (2005). Multipoint touchscreen.
3	Mobile data transmission	25 (8.4%)	1999	US 5,638,412 – Qualcomm (1995). Method for providing service and rate negotiation in a mobile communication system.
4	Object oriented operating system	17 (5.4%)	1999	US 6,424,354 –Motorola (1994). Object-oriented event notification system with listener registration of both interests and methods.
5	Image processing	13 (4.4%)	1998	US 5,493,335 – Eastman Kodak (1995). Single sensor color camera with user selectable image record size.
6	Positioning System	8 (2.7%)	2004	US 6,677,894 – Qualcomm (1997). Method and apparatus for providing location-based information via a computer network.
7	Antenna	6 (2.0%)	2006	US 6,317,083 – Nokia (1998). Antenna having a feed and a shorting post connected between reference plane and planar conductor interacting to form a transmission line.
8	Speech signal compression	5 (1.7%)	2002	US 5,778,338 – Qualcomm (1992). Variable rate vocoder.
9	Method of ciphering data transmission in a radio system	5 (1.7%	2002	US 6,882,727 – Nokia (1999). Method of ciphering data transmission in a radio system.
10	Object oriented multi-tasking systems	5 (1.7%	2000	US 6,832,223 – Sun Microsystems (1997). Method and system for facilitating access to a lookup service.
11	Data structures	5 (1.7%)	2005	US 5,946,647 – Apple (1999). System and method for performing an action on a structure in computer-generated data.
12	Quality of speech representation	4 (1.3%)	1999	US 6,385,573 – WiAV Solutions (2000). Adaptive tilt compensation for synthesised speech residual.
13	Virtual machine instructions	3 (1.0%)	2001	US 5,845,298 – Sun Microsystems (1998). Write barrier system and method for trapping garbage collection page boundary crossing pointer stores.
14	System for transporting information objects	3 (1.0%)	1999	US 6,125,388 – Reisman (1995). System for transporting information objects between a user station and multiple remote sources based upon user modifiable object manifest stored in the user station.
15	Event distribution in operating system	2 (0.7%)	2001	US 5,566,337 – Apple (1995). Method and apparatus for distributing events in an operating system.
16	Improved system for initialising static arrays	2 (0.7%)	2000	US 5,966,702 – Sun Microsystems (1999). Method and apparatus for pre-processing and packaging class files.
0	Not in cluster	93 (31%)	2001	US 5,664,133 – Microsoft (1997). Context sensitive menu system/ menu behaviour.

The publication year trends of the patents in these clusters, along with the next two leading clusters, are shown in Figure 4 (opposite top). While the mobile data access cluster had the most patents filed, the number of patents filed in the area of touch screen technology is increasing.

Highest ranked patents owners

Figure 5 (opposite below) shows the 10 leading patent owners (assignees), ranked according to NPA. While the number of patents in a company's portfolio can be indicative of the portfolio's overall ranking, Apple and RIM were in first and fourth positions respectively with a significantly smaller portfolio size. The reason for Apple's strong position is that Apple owned many of the most central or highest ranked patents, including 16 out of the top 20 patents. Apple also owns leading patents in other relevant areas such as mobile data access or object oriented multi-tasking system.

The portfolios of Microsoft and IBM include patents in the areas of object oriented operating system, object oriented multi-tasking system, as well as mobile data access. IBM also own key technology in the touch screen cluster. RIM comes in at fourth position because of its dominance in the mobile data access cluster, a key area for smartphone technology in that it accesses and synchronises messages, calendar entries, phone logs and files across disparate databases. Other companies not in the top 10 included Palm (11th), Phillips (21st), Samsung (60th), and LG (148th). We also looked at the leading patents in the full dataset for leading litigated patents and non-litigated patents, Table 3 (page 15). Four out of the five highest-ranked litigated patents are relevant to touch-screen technology which shows how relevant this technology is, equally viewed by companies other than Apple. >

Figure 4: Publication year trends for litigated patents in leading smartphone patent clusters.

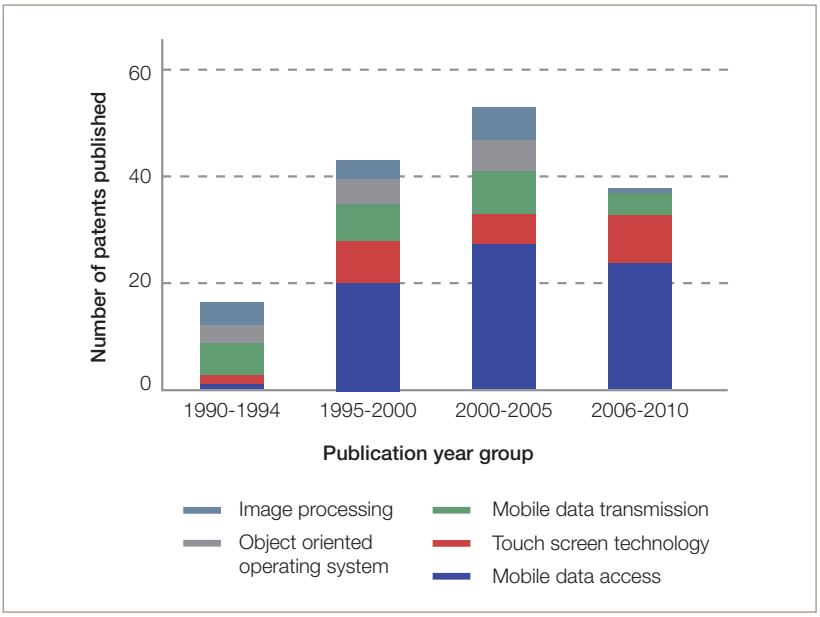


Figure 5: Highest ranked patent owners in full patent dataset.

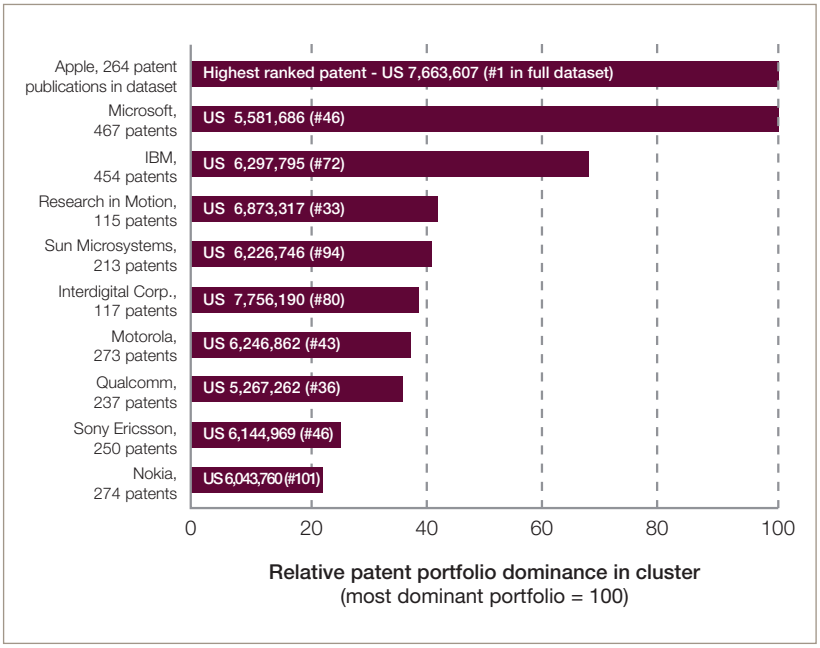
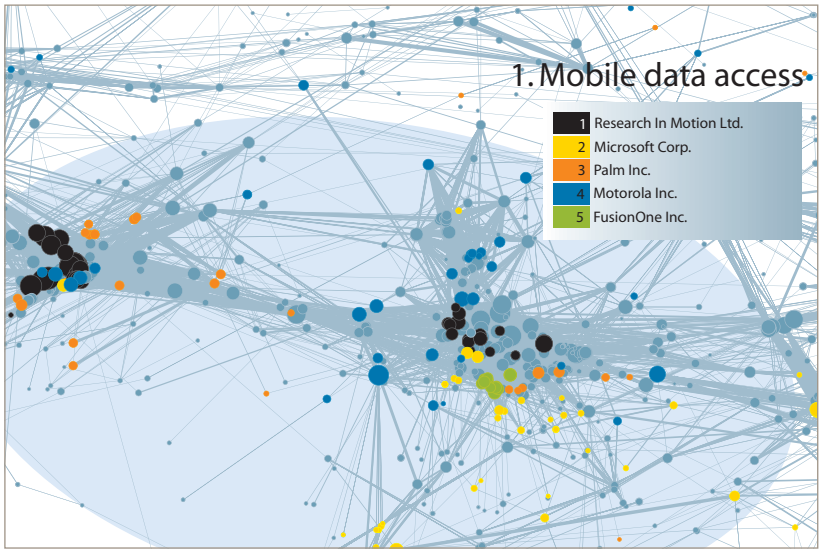


Table 3: Highest ranked litigated and non-litigated patents in full data set.

Patent number	Rank within full data set	Listed patent owner	Publication year	Patent title	Known to be litigated? If so, who?
Litigated patents					
US 7,663,607	1	Apple	2010	Multipoint touchscreen	Apple vs Motorola
US 5,825,352	8	Elantech Devices Corp.	1998	Multiple fingers contact sensing method for emulating mouse buttons and mouse operations on a touch sensor pad	Elan Microelectronic vs Pixcir Microelectronics
US 7,812,828	9	Apple	2010	Ellipse fitting for multi-touch surfaces	Apple vs Motorola
US 5,206,951	14	Eastman Kodak	1993	Integration of data between typed objects by mutual, direct invocation between object managers corresponding to object types	Eastman Kodak vs Sun Laboratories
US 5,880,411	25	Synaptics	1999	Object position detector with edge motion feature and gesture recognition	Synaptics vs Averatec
Patents not litigated					
US 7,653,883	2	Apple	2010	Proximity detector in handheld device	
US 7,339,580	3	Apple	2008	Method and apparatus for integrating manual input	
US 7,764,274	4=	Apple	2010	Capacitive sensing arrangement	
US 7,782,307	4=	Apple	2010	Multi-touch contact motion extraction	
US 7,614,008	6	Apple	2009	Operation of a computer with touch screen interface	

Figure 6: NPA patent landscape map of the mobile data access cluster, with patents owned by five leading patent owners in this cluster colour coded.



The mobile data access cluster is shown in Figure 6, with the five leading patent owners in this cluster having their patents colour coded

While there were a number of interesting technology clusters, in this report we focus in on the top 3 clusters, providing detailed patent maps and analytics.

Leading patents and owners in the Mobile Data Access cluster

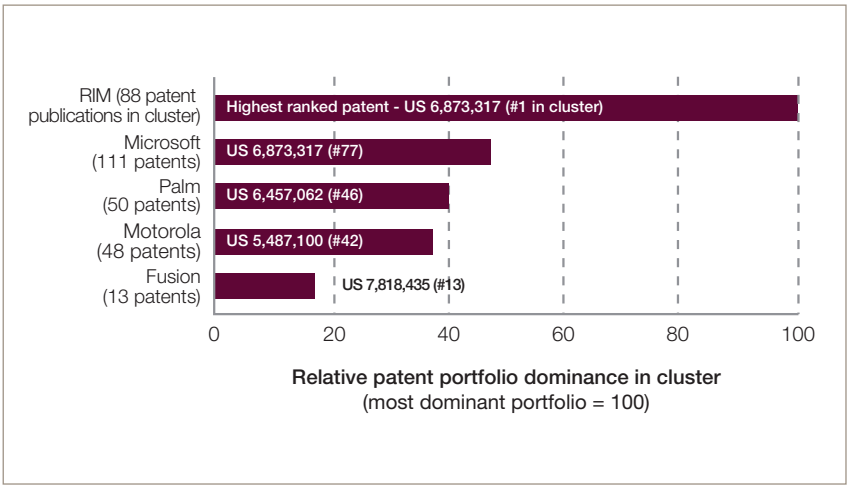
The largest cluster of litigated patents was in the area of mobile data access. The mobile data access cluster is shown in Figure 6 (above), with the five leading patent owners in this cluster having their patents colour coded. Note that patents shown include a mixture of litigated patents, and the patents directly connected to these patents, using the principle of associative searching shown in Figure 1 on page 8.

This cluster includes patents that help synchronise mobile email and other forms of remote data access, from both a hardware perspective (group of patents to the left) and a software perspective (group of patents to the right). Patents owned by RIM fell into both groups. The left hand group contained RIM's leading patents, such as US patent 6,873,317 'Hand-held electronic device with a keyboard optimised for use with the thumbs'.

Many of these patents connected with part of the touch screen cluster. The group of patents to the right of the cluster were more concerned with the software side of synchronisation, such as another leading RIM patent, US patent 6,701,378 'System and method for pushing information from a host system to a mobile data communication device'.

Microsoft was the second most dominant patent owner after RIM, with its patents found in and around the software group of patents. Microsoft's patent portfolio is more dispersed than say for example the RIM patents, and often has citation connections to patents in other >

Figure 7: Leading patent owners in the mobile data access cluster. This analysis includes both litigated patents, and patents linked by patent citations to the litigated patents.



technology clusters (further to the right – not shown in Figure 6) such as object oriented multi-tasking system and object oriented operating system.

It is interesting to compare the spread of the Microsoft patents to the concentration of the RIM patents. RIM has filed many patents, and often highly ranked patents in two relatively focused areas, while Microsoft has filed patents over a broader range of technologies, but only one patent for each invention. These are two distinctive patent strategies, and it is worth noting that RIM has a strong market position in smartphones, whereas smartphones using Microsoft software are not as common.

Palm and Motorola have patents in both groups, with many of their patents linking the software and the hardware component of mobile data access as well as beyond, to clusters such as ciphering data transmission and touch screen technology. The NPA map further suggests that Palm's patents seem concentrated on a smaller number of inventions, whereas Motorola's patents appear much more spread out. FusionOne owns a narrowly positioned group of patents concerned with data transfer and synchronisation systems.

The leading patents filed by these five companies are shown in Figure 7 (above). RIM's patent portfolio dominance was calculated as being more than twice as strong at the next strongest portfolio in this area, owned by Microsoft, even though RIM has less than half the number of patents.

The top five competitors in the mobile data access cluster are followed, in order, by Visto Corporation, (6th), Terahop Networks (7th), IBM (8th), Richard Helferich (9th) and Eric Morgan Dowling (10th). The dominance of RIM in this area can be seen in a listing of the highest ranked litigated and non-litigated patents. RIM owns several of the highest ranked litigated, along with non-litigated patents, in that cluster.

Table 4 (page 17) lists the top three of each litigated and non-litigated patents. >

RIM's patent portfolio dominance was calculated as being more than twice as strong at the next strongest portfolio in this area, owned by Microsoft

Table 4: Highest ranked patents in the mobile data access cluster.

Patent number	Rank within full data set	Listed patent owner	Publication year	Patent title	Litigated? If so, who?
US 6,873,317	1	RIM	2005	Hand-held electronic device with a keyboard optimised for use with the thumbs	
US 6,867,763	2	RIM	2005	Hand-held electronic device with a keyboard optimised for use with the thumbs	
US 5,961,590	3	Visto Corp.	1999	System and method for synchronising electronic mail between a client site and a central site	Visto Corp. vs Infowave Software
US 6,611,254	4	RIM	2003	Hand-held electronic device with a keyboard optimised for use with the thumbs	RIM vs Motorola
US 6,919,879	=4	RIM	2005	Hand-held electronic device with a keyboard optimised for use with the thumbs	RIM vs Motorola

Table 4 lists the top three of each litigated and non-litigated patents.

Leading patents and owners in the Touch Screen Technology cluster

The second largest cluster of litigated patents we explored was in the area of touch screens. Just like the previous cluster, this cluster covers two technology blocks, reflecting the technology development over time. This cluster is shown in Figure 8 (opposite top).

The younger, yet main component on the top left relates to gesture recognition and multi-touch point technology, whereas the block on the bottom right is instead focused on the hardware component, such as the compact integration of touch-panels into a handheld device or earlier touch technology using a pen. At this end, it overlaps with the hardware technology of the mobile data access cluster.

The touch screen cluster is shown in Figure 8, with the five leading patent owners in this cluster having their patents colour coded. Patents filed by Apple dominate the multi-touch technology area of the cluster, ahead of a group of high-ranking patents filed by Synaptics and Smart Technologies.

Third-ranked IBM features a number of high value patents ranging from inventions that put a device to sleep when not held or touched by a hand, to virtual pointing devices. In contrast, the majority of patents filed by fourth-ranked Palm tend to sit more towards the bottom right, and are more concerned with touch screen technology and hardware assembly.

Apple shows a strong lead once the individual patent scores are accumulated across its touch screen portfolio, with the next highest patent portfolio owned by Synaptics, or similarly ranked IBM, having a calculated strength of less than 20% of the Apple portfolio, Figure 9 (opposite below).

>

Figure 8: NPA patent landscape map of the touch screen cluster, with patents owned by five leading patent owners in this cluster colour coded.

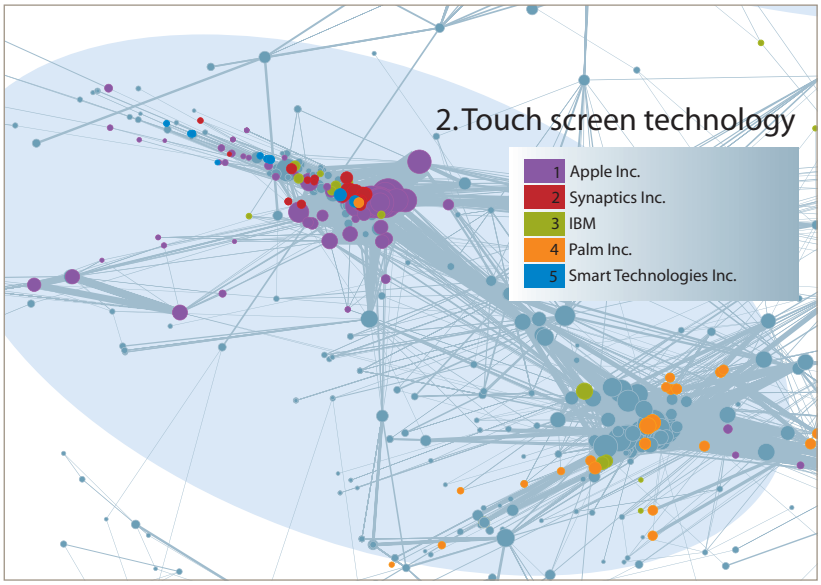


Figure 9: Leading patent owners in the touch screen technology cluster[11].

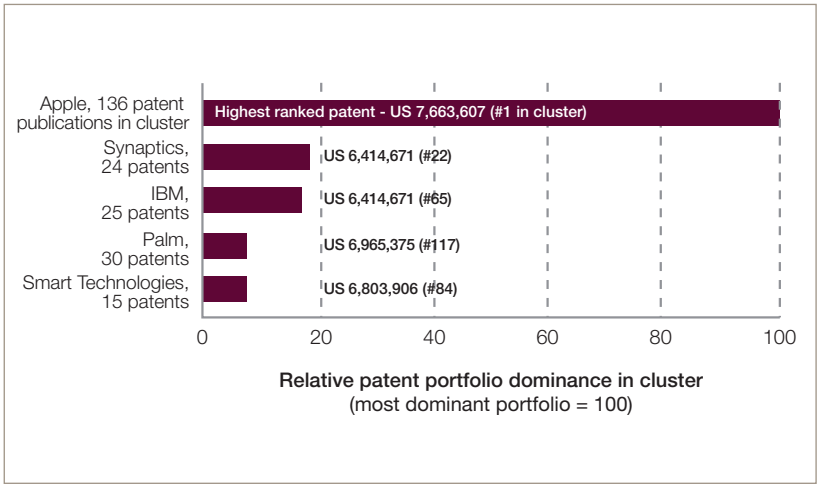
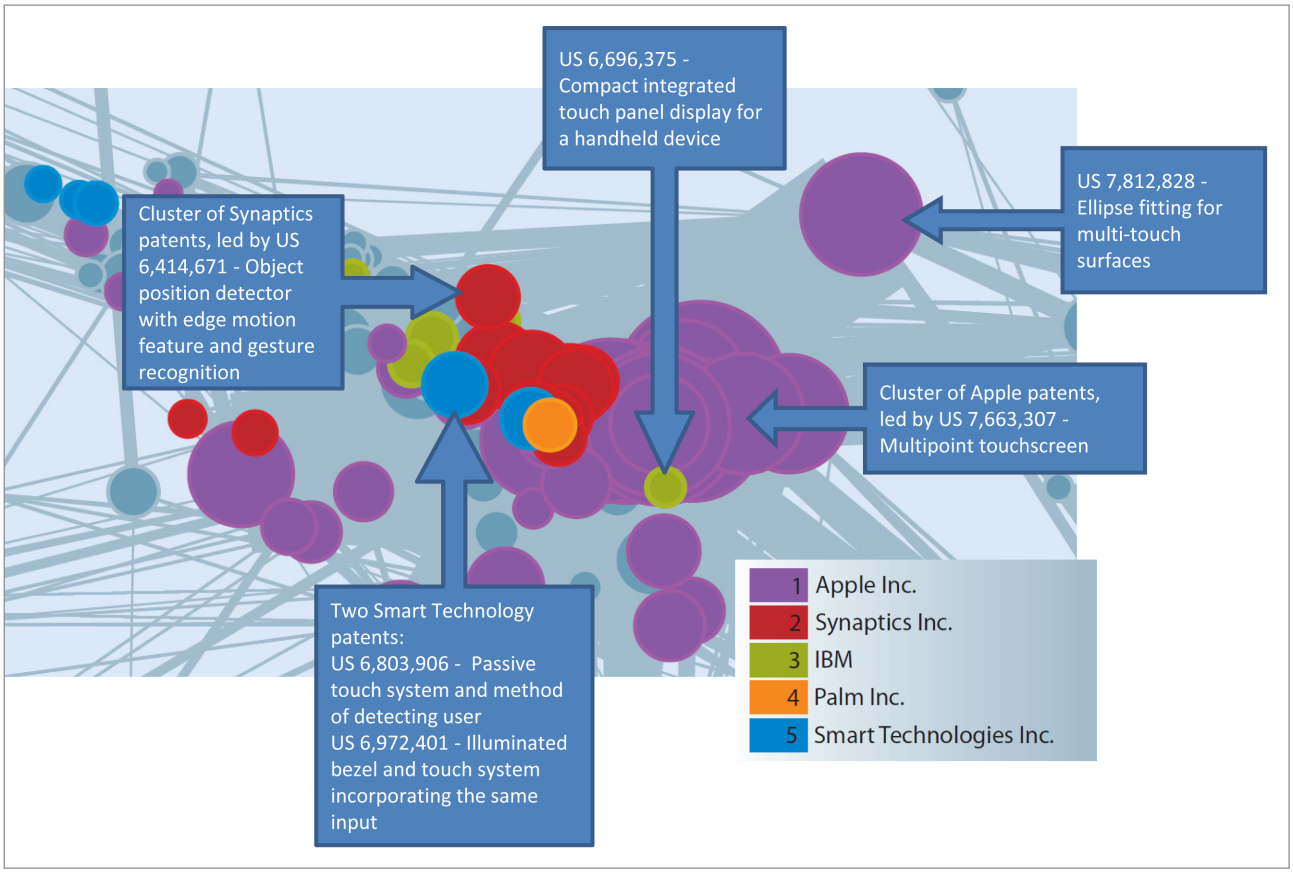


Figure 10: Details of key patents at the heart of the touch screen patent cluster.



The top five companies are followed by Phillipp Harald (6th), Philips (7th), Motorola (8th), Logitech (9th) and Nokia (10th).

When zooming in to the centre of the multi-touch screen cluster (see Figure 10 above) we can explore the interesting relationship between first-ranked Apple and its competitors, including details of key technology, such as the Apple owned US 7,812,828 'Ellipse fitting' patent (top right), which is currently being asserted against Motorola.

Figure 10 shows that, besides the large group of dominating Apple patents, a group of highly ranked Synaptics patents is nested right into the centre of gesture recognition and multi-touch technology. Synaptics, which is ranked in second place by NPA, supplies touchscreens used by some of Apple's competitors, yet is not thought to supply the touchscreens used in Apple iPhones[12].

Synaptics is thought[13] to be a supplier of other components to Apple, and such supply arrangement may assist Synaptics and Apple avoid litigation in this area.

Given Apple's leading position in the touch screen cluster it does not come as a surprise that Apple is involved in six out of the 27 disputes in this area, half of them against Motorola.

While the highest ranked litigated and also non-litigated patents are owned by known key players such as Apple and Motorola (see Table 5, page 21), about half of all patent assertions in this cluster are being made by niche technology companies that act as suppliers to the well known smartphone companies. This may be explained by the fact that, Apple's competitors (much more than Apple itself) are heavily dependent on suppliers and licensing agreements for one or more components.

>

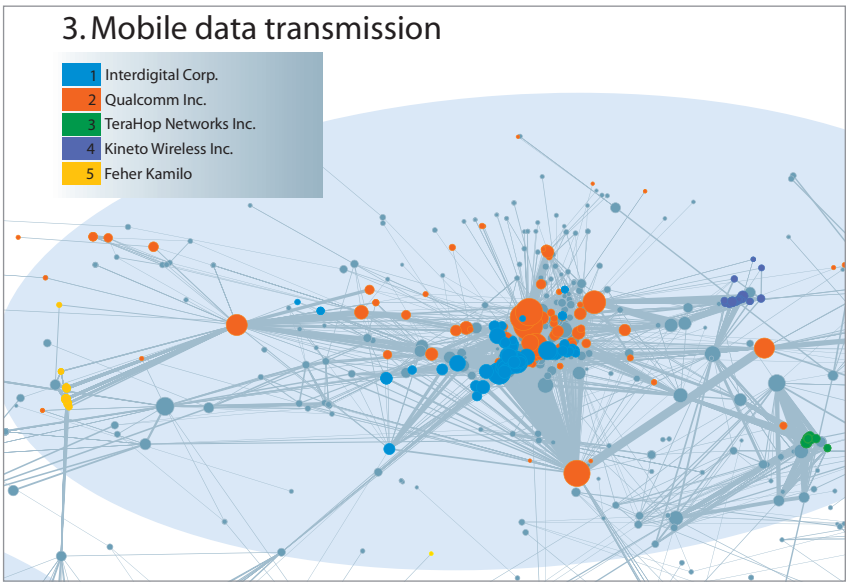
Table 5: Highest ranked patents in the touch screen technology cluster.

Patent number	Rank within subject matter	Assignee	Publication year	Patent title	Litigated? If so, who?
US 7,663,607	1	Apple	2010	Multipoint touchscreen	Apple vs Motorola
US 7,339,580	2	Apple	2008	Method and apparatus for integrating manual input	
US 7,782,307	3	Apple	2010	Multi-touch contact motion extraction	
US 7,653,883	4	Apple	2010	Proximity detector in handheld device	
US 7,812,828	5	Apple	2010	Ellipse fitting for multi-touch surfaces	Apple vs Motorola

To stay competitive, Apple's competitors (much more than Apple itself) are heavily dependent on suppliers and licensing agreements for one or more components

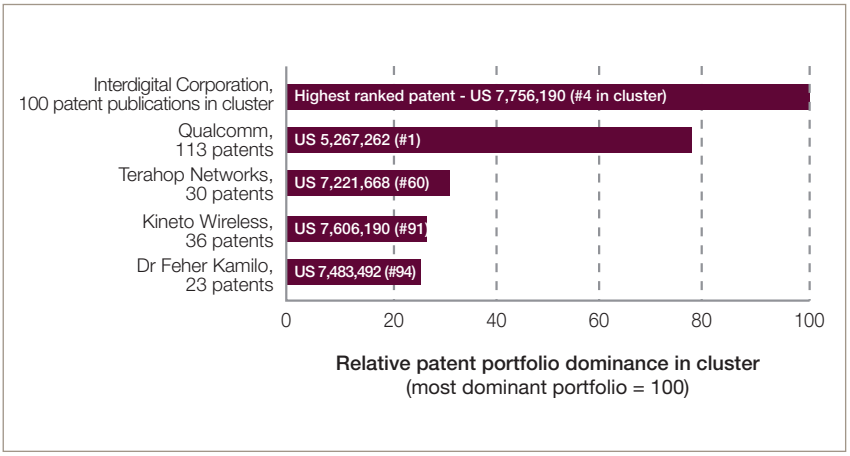
Leading patents and owners in the Mobile Data Transmission cluster

Figure 11: NPA patent landscape map of the mobile data transmission patent cluster, with this cluster's five leading patent owners (patents are colour coded).



According to our NPA algorithms, Interdigital Corporation, who develop and sell wireless technologies, owns the leading patents in the mobile data transmission cluster, along with Qualcomm, see Figure 11. Qualcomm's patents appear to be more dispersed, suggesting a broader spread of technologies, compared to patents filed by Interdigital, who dominate the core of this cluster.

Figure 12: Leading patent owners in the mobile data transmission cluster[14].



While Interdigital has the leading portfolio in this cluster, Figure 12. Qualcomm owns the top three patents, all of which are being asserted (Table 6, page 22). These top five owners are followed by Omnipoint (6th), Alcatel Lucent (7th), Sony Ericsson (8th), Motorola (9th) and Golden Bridge Technology (10th).

Table 6: Highest ranked patents in the mobile data transmission cluster.

Patent number	Rank within subject matter	Assignee	Publication year	Patent title	Litigated? If so, who?
US 5,267,262	1	Qualcomm	1993	Transmitter power control system	Qualcomm vs Conexant Systems
US 5,257,283	2	Qualcomm	1993	Spread spectrum transmitter power control method and system	Qualcomm vs Broadcom
US 5,056,109	3	Qualcomm	1991	Method and apparatus for controlling transmission power in a CDMA cellular mobile telephone system	Americans For Fair Patent Use, LLC vs Sprint Nextel
US 7,756,190	4	Interdigital Corp.	2010	Transferring voice and non-voice data	
US 6,574,211	5	Qualcomm	2003	Method and apparatus for high rate packet data transmission	Qualcomm vs Nokia

In a nutshell

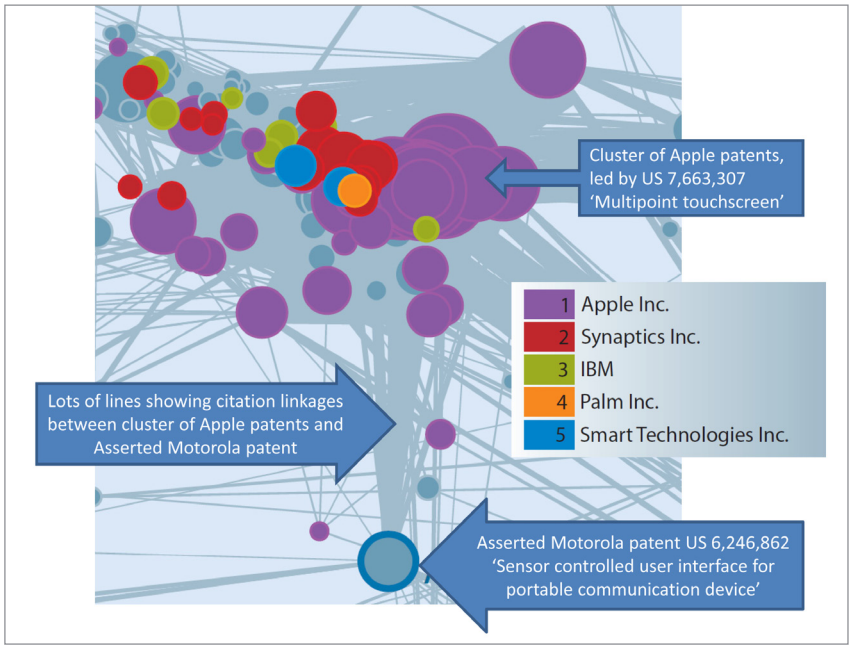
NPA has been used to review a set of 298 litigated patents in the smartphone area, and patents related by citation linkage to the 298 patents (7093 patents in total). The litigated patents formed into 16 clusters, with the three leading clusters being in the areas of mobile data access, touch screen technology and mobile data transmission.

The leading patent owner overall was Apple with 264 patents in the patent dataset, followed by Microsoft and IBM. Microsoft and IBM actually had more patents overall than Apple, with 467 and 454 patents respectively, but their patents were not as highly ranked as the Apple patents.

Apple also dominated the touch screen cluster, but Research in Motion dominated the mobile data access cluster, and Interdigital led the mobile data transmission cluster.

Visualisation of a smartphone patent dispute

Figure 13: NPA patent landscape map of the touch screen patent cluster, with patents colour coded in correspondence to the five leading patent owners. A thicker line or arrow implies a stronger relationship and possibly more similar technology.



Motorola vs. Apple

NPA can also illuminate the details of individual patent disputes. To demonstrate, we selected one of the current patent disputes in the smartphone space. Motorola is suing[15] Apple over a number of smartphone patents, including US patent 6,246,862, (hereafter the '862' patent) for a 'Sensor controlled user interface for portable communication device', filed in February 1999.

The 862 patent claims the concept of a user interface, such as keypad or touch screen on a smartphone, which detects when the smartphone 'is positioned in close proximity to a user, thereby, preventing inadvertent actuation of the touch sensitive input device'. In other words, a user can hold a smartphone close to the ear when making a telephone call, and the smartphone will automatically detect the user is doing so and disable the keypad or touch screen so that the user doesn't accidentally hit the off button, etc.

We have analysed this dispute in a number of ways. Firstly, the relationship between the key Apple patents in the touch screen cluster and the Motorola patents were visualised in Figure 13 (above). Figure 13 shows that, while there are a lot of citation linkages between the major cluster of Apple patents within the touch screen cluster and the 862 patent, the 862 patent sits away from the centre of the cluster. This suggests that the 862 patent is reasonably different from the main Apple patents that the 862 patent is linked to. >

We have analysed this dispute in a number of ways. Firstly, the relationship between the key Apple patents in the touch screen cluster and the Motorola patents were visualised in Figure 13

Table 7: Comparison of the most apparently similar (and later) patents to the 862 patent.

Patent number	Patent owner	Filing date	Cluster ranking	Title	Subject matter
US 6,246,862	Motorola	Jun 2001	51	Sensor controlled user interface for portable communication device	Controls operation of device after detecting proximity of user using an infrared sensor
US 7,339,580	Apple	Dec 2004	2	Method and apparatus for integrating manual input	Apparatus and methods … for simultaneously tracking multiple finger and palm contacts as hands approach, touch, and slide across a proximity-sensing, ... surface; 'A sensing device that is sensitive to changes in self-capacitance brought about by changes in proximity of a touch device to the sensing device'
US 7,663,607	Apple	May 2004	1	Multipoint touchscreen	A touch panel having a transparent capacitive sensing medium configured to detect multiple touches or near touches
US 7,614,008	Apple	May 2006	9=	Operation of a computer with touch screen interface	The virtual input device comprises a plurality of virtual keys. It is detected that a user has touched the touch screen to nominally activate at least one virtual key

A review of the subject matter shows there are differences between the inventions claimed in the Apple patents and the Motorola patent, as seen in Table 7. As one such difference, the Motorola patent uses infrared sensing technology, whereas the Apple patents use capacitive sensing.

The Motorola patent uses infrared sensing technology, whereas the Apple patents use capacitive sensing

Figure 14: NPA patent citation map showing citation linkages between the 862 Motorola patent (blue) and the patents it is linked to, including 26 Apple patents (purple). The arrow points from the earlier patents to the later patents. The reference next to each patent refers to its NPA ranking within the cluster and publication year, for example, 'Apple: 2 (2005)' means the second highest ranked Apple patent in the cluster, with a publication year of 2005.

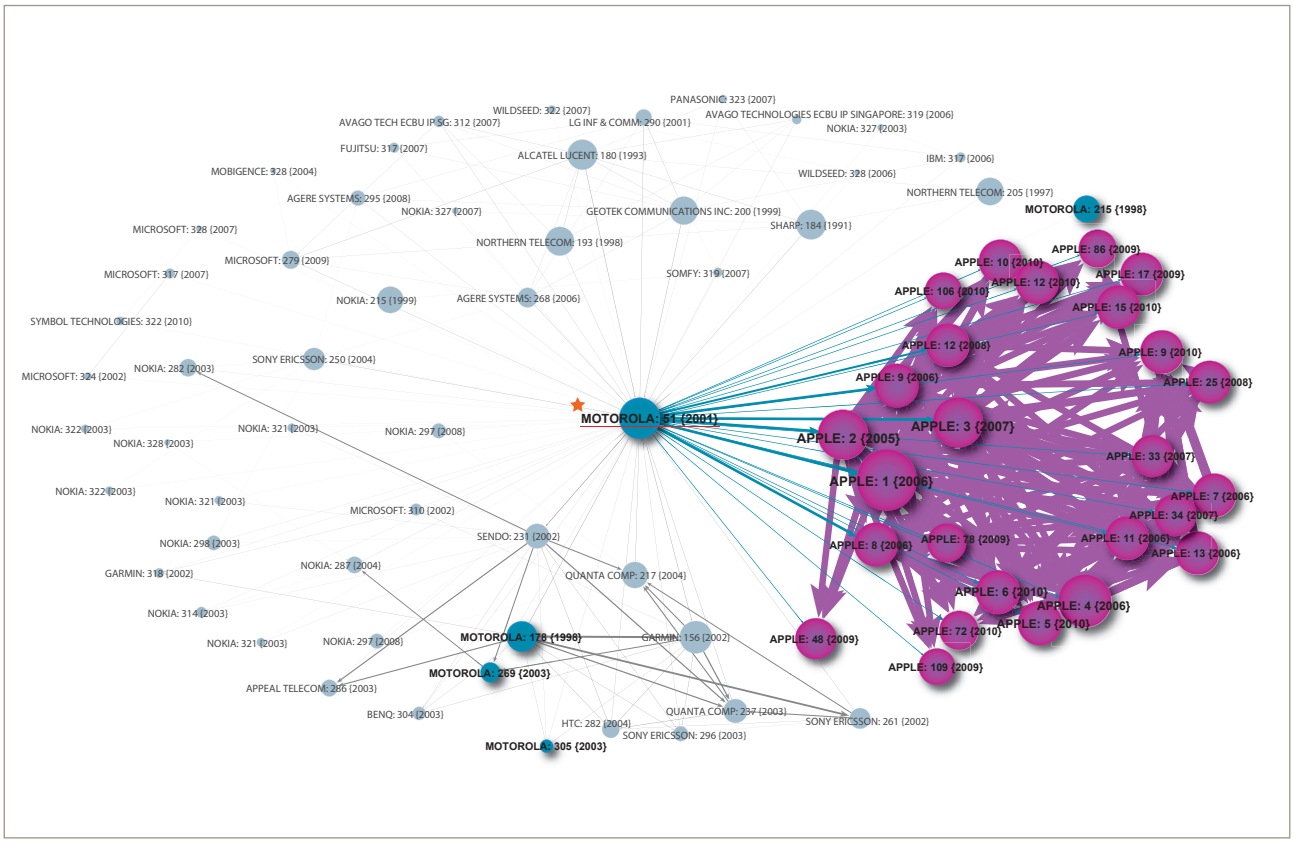


Figure 14 shows the citation linkages between the 862 Motorola patent and the patents it is connected to, to reveal that while the 862 patent is connected to the many of the Apple patents, the inter-relationships between those Apple patents are a lot stronger than the relationships between the 862 patent and the Apple patents.

Also there are no indirect relationships going from the disputed Motorola patent to Apple via a third party, suggesting that Apple did not adopt any similar technologies from third parties linked to Motorola. Figure 13 further confirms the differences between the 862 patent and the Apple patents.

Technology flow in the Motorola vs. Apple Dispute

It is also possible to examine this litigation using the concept of apparent 'technology flows'. Many innovators will recognise that the process of invention does not happen in a vacuum and, instead, inventors learn from earlier inventions, whether filed by the inventor, their employer, or by other companies. Similarly, breakthrough inventions often inspire later inventions, whether filed by the same or other companies.

Since the patent literature can be regarded as a record of inventions, it is possible to use NPA to review the patent literature to determine where inventions might have come from, and where they went (flowed to, for example, the invention or technology flow).

It should be noted that this analysis, while suggestive of similarity in the patents (and hence underlying inventions) filed by different companies, and hence of apparent technology flows, is not able to prove such flows. In practice, it may be impossible to prove that Company A learnt from Company B, no matter how strongly the patent data suggests this. Nevertheless, technology flow analysis may suggest where to look for ideas that may have been transferred from one company to another. Technology flows can also be used as a tool to understand potential infringement risks. Each patent filed by a company claims an invention and, if a company applies this invention, they may be at risk of infringing earlier and very similar patents filed by other companies.

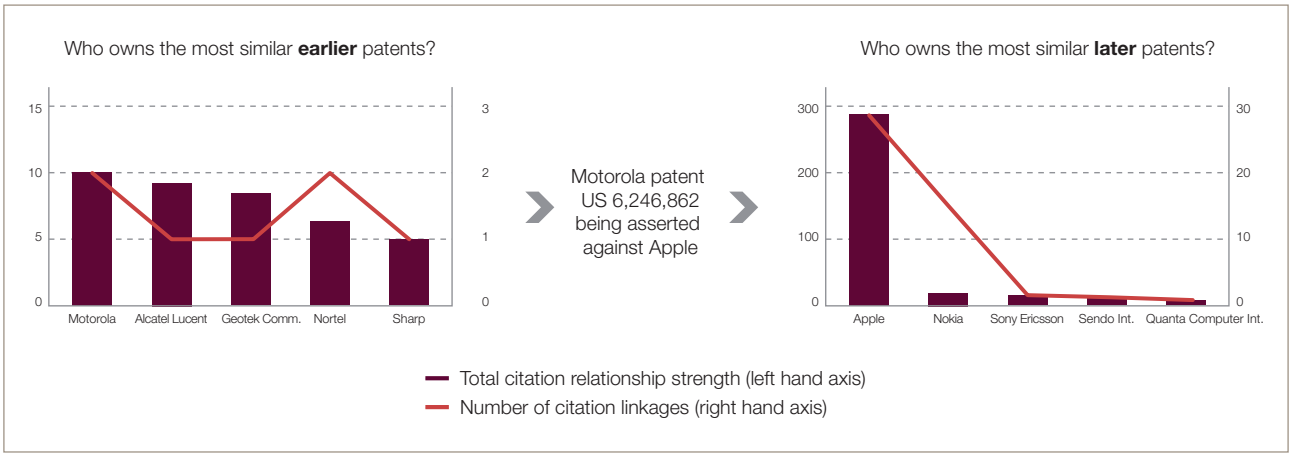
These similarities can be implied by a technology flow diagram. While the final opinion of whether a patent is infringed will be for the courts to decide, technology flow maps may indicate to patent owners and users where to look for potential infringements.

This concept is best shown by way of illustration. In this analysis, NPA was used to perform the following analysis for the 862 patent:

a) All direct citations (forward and reverse) to the 862 patent were determined.
b) The strength of these citation linkages were determined from the number of mutual citations between the top patents and their citations.
c) The above data was used to suggest which companies had the strongest influence on the 862 patent.

Technology flow analysis may suggest where to look for ideas that may have been transferred from one company to another

Figure 15: Apparent technology flows in relation to the 862 patent.



The result is shown in Figure 15, which shows that:

- The 862 patent was most heavily influenced by two earlier Motorola patents, along with one or two patents from each of Alcatel Lucent, Geotek Communications, Nortel and Sharp.
- Twenty-six later Apple patents or patent applications appear to be similar to the 862 patent, along with patents from Nokia, Sony Ericsson, Sendo International and Quanta Computer.

This shows that Motorola may indeed have a valid reason for investigating whether Apple has infringed its 862 patent.

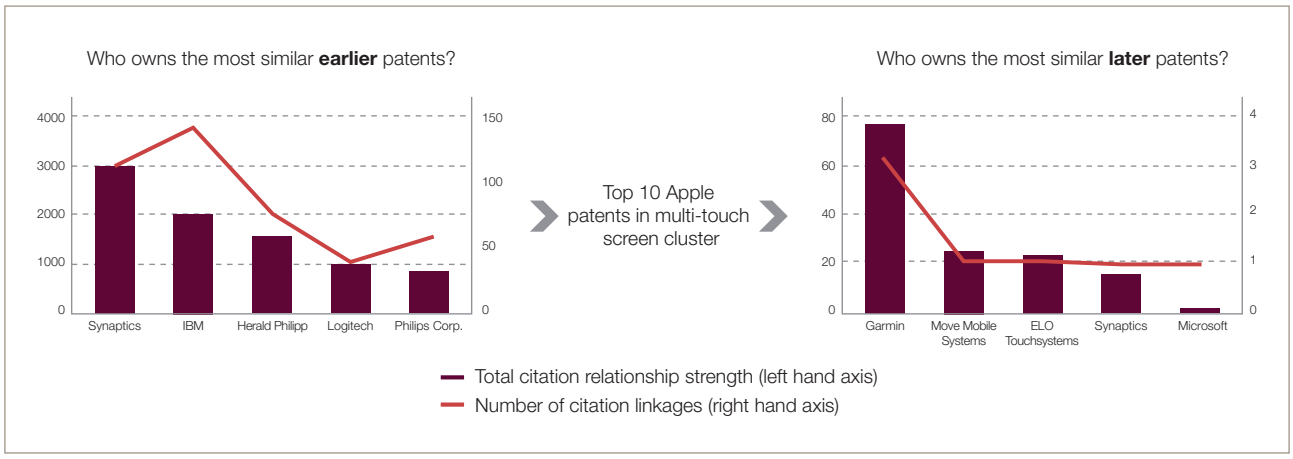
It is also possible to look at this dispute by considering what might have inspired Apple's technology, for example, in-house R&D, or from knowledge of technology or patents developed by Motorola or other parties.

For this reason, we prepared a technology flow map for the top ten patents filed by Apple in the touch screen cluster. All of these patents were found to be connected to the 862 Motorola Patent, with Apple patents ranked Number 1, 2, 3, 8, and 9 being the most strongly connected.

Self citations (for example, patents filed by Apple) make up the highest group by far, suggesting that Apple has a strong in-house reliance on its R&D development. These self citations have been excluded from the visual graph below so as to >

Self citations make up the highest group by far, suggesting that Apple has a strong in-house reliance on its R&D development

Figure 16: Apparent technology flows in relation to the top 10 Apple touch screen patents.



concentrate on third party influence, be it from Motorola or somebody else.

Figure 16 (above) shows that the leading earlier external influences on the top 10 Apple touch screen patents are Synaptics, ahead of IBM.

The companies that have filed later patents for inventions most similar to these top 10 Apple patents include Garmin, Synaptics and Microsoft. Motorola does not feature in either of these lists. Given the identified differences between the 862 patents and the most prominent Apple patents in this areas, we wonder how likely it will be for Motorola to win this dispute, and await the outcome of the dispute with interest.

In a nutshell

NPA was used to review a patent assertion of a Motorola patent ('862 patent') against Apple. NPA confirmed that Motorola has good reason to investigate whether Apple might be infringing its 862 patent. NPA also showed that the 862 patent is quite different to the inventions in the patents filed by Apple. It will be interesting to see if the courts decide that these differences are enough for any technology being sold by Apple (and based on these Apple patents) to avoid infringement of the Motorola 862 patent.

Conclusion

The value of NPA

Network Patent Analysis has been used to objectively analyse and visualise the smartphone patent dataset. While other means of reviewing and visualising patent data are known (for example, themescape maps or by subjectively reviewing the subject matter of thousands of patents), NPA can efficiently group and rank patents in a fully objective manner.

The 'associative searching' function of NPA can eliminate problems arising from keyword searching and patent classification. While NPA does not remove the need for patent attorneys or patent lawyers to subjectively review individual patents and disputes, NPA can help to focus in on the patents and patent owners that need to be investigated, and save countless hours and money required to manually review thousands of patents.

NPA may also reveal technology flows, which may predict where future patent litigation lies or how current litigation might unfold.

Need to know more?

Please visit www.griffithhack.com/networkpatentanalysis or www.ambercite.com to learn more about NPA in general. If you are interested in a more detailed discussion of this complex set of results, please contact the authors.

STOP PRESS: Nokia/Microsoft join forces to create a new 'ecosystem' to take on Apple and Android

In February 2011, shortly before this paper was due to be published, Nokia and Microsoft announced a partnership in the smartphone area.

"The game has changed from a battle of devices to a war of ecosystems," announced Nokia's CEO Stephen Elop.

But how has the Microsoft/Nokia partnership changed their relative position in the smartphone patent wars? Within the full patent dataset, the combined Microsoft/Nokia portfolio now comfortably claims first position with their 741 combined patents, ahead of the 264 Apple patents that are forced into second place. Despite their considerably smaller portfolio, Apple's relative patent portfolio dominance score only falls to 83%, reflecting the high NPA scores of many of their patents.

In terms of the three clusters considered in detail in this report, the Microsoft/Nokia portfolio would continue to sit in second place in the mobile data access cluster, as did the respective Microsoft portfolio by itself. Yet, the partnership's relative portfolio dominance score goes up to 57% from 47%, compared to RIM.

In the touch screen technology cluster, the partnership would claim 6th place, with 6.1% of the relative Apple dominance from the combined 41 patents in our cluster group. However, the partnership would not improve on its 11th place in the mobile data transmission cluster claimed by the 27 patents of Nokia, as Microsoft did not have any patents in this cluster.

The reason why the Microsoft/Nokia patent portfolio leads the full patent dataset, but not any of the three leading patent clusters, is because the patents owned by both companies are spread over a range of technologies across the overall patent map. In this light, the reference by the two companies to a smartphone 'ecosystem' rings true.

A likely driver for the partnership is the growing market for tablets that converges smartphone and computer technologies. These include operating systems provided by a range of companies including Apple, Nokia, Microsoft and the Android software provided by Google.

Google patents did not feature highly in this study, with only six patents in the full dataset. However, the operating system is only one part of a smartphone. Google does not manufacture smartphones, but instead offers its software to smartphone companies, such as Motorola, Samsung and HTC, which combine the Google operating system software with their own software and other technology needed to make a smartphone work.

References

1. 'Gartner Says Worldwide Mobile Phone Sales Grew 35 Percent in Third Quarter 2010; Smartphone Sales Increased 96 Percent'. (Gartner.com, found at http://tiny.cc/za424 on 17 January 2011.)
2. 'The great patent battle'. (Economist.com, 21 October 2010, found at http://tiny.cc/e9d3f on 17 January 2010.)
3. Arthur, C.; 'Mobile giant's billions at stake in smartphone patent battles'. (*The Age*, 20 November 2010, found at http://tiny.cc/z1sld on 17th January 2010.)
4. Florian, M., 'Visualisation of Apple's patent dispute with Android phone makers Motorola and HTC'. (Fosspatents.blogspot.com, found at http://tinyurl.com/39xx3ok on 17 January 2010.)
5. Humpries, M., 'Your guide to who is suing who in mobile'. (Geek.com, 5 October 2010, found at http://tinyurl.com/38tm24d on 17 January 2010.)
6. Patent examiners, especially but not limited to those working in the chemical sciences, also look for such 'prior art' in scientific publications as well but, in general, the dominant source of prior art is earlier patent applications.
7. Colton, C.C., Lacon Vol 1 (1820), see http://tinyurl.com/4jy78n2.
8. Lloyd, M., and Spielthenner, D., 'Hybrid car technologies – what can an advanced patent analysis method such as Network Patent Analysis (NPA) tell us about the leading companies and patents?' (Ambercite White Paper 2010_1, December 2010, found at www.ambercite.com on 17 January 2010.)
9. Lloyd, M., and Blows, J., 'Who holds the power? Lessons from hybrid car innovation for clean technologies'. (Griffith Hack White Paper, October 2009, found at http://tinyurl.com/6yzxlrn on 17 January 2011.)
10. Proprietary algorithms are used to automatically distinguish patents into the different clusters, which can also generally be recognised by eye.
11. As with the results shown in Figure 7, this analysis includes both litigated patents, and patents linked by patent citations to the litigated patents.
12. Hesseldahl, A, 'Apple IPhone 4 Parts Cost About $188'. (*Bloomberg Businessweek*, 28 June 2010, found at http://tinyurl.com/2addvcr at 28 January 2011.)
13. 'Apple supplier: Synaptics adds proximity sensing solution to product line'. (iphonenews@desinformado.com, 3 June 2008, found at http://tinyurl.com/4fkoer8 at 28 January 2011.)
14. As with the results shown in Figure 7, this analysis includes both litigated patents, and patents linked by patent citations to the litigated patents.
15. Florian, M., 'Visualization of Apple's patent dispute with Android phone makers Motorola and HTC'. (Fosspatents.blogspot.com, found at http://tinyurl.com/39xx3ok on 17 January 2010.)

About Griffith Hack and Ambercite

The Griffith Hack Group includes Griffith Hack Patent and Trade Mark Attorneys and Griffith Hack Lawyers, who specialise in intellectual property and information technology law.
www.griffithhack.com.au

Ambercite is the owner and developer of a state-of-the-art patent analysis tool known as Network Patent Analysis (NPA).
www.ambercite.com