

Both sides speak out on the IEEE SEP policy controversy

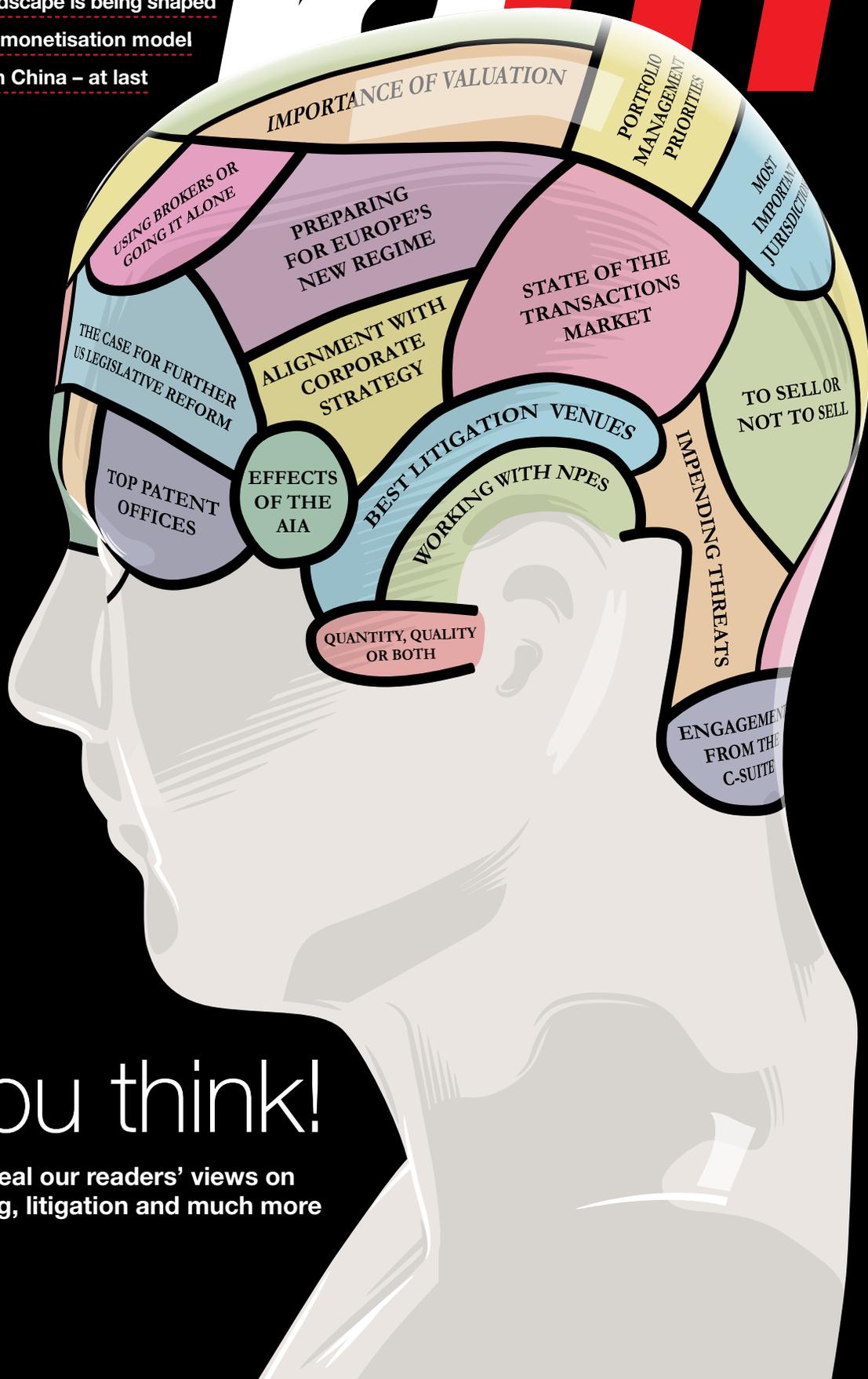
The 369 companies that own over 50% of all US patents

How the Internet of Things IP landscape is being shaped

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The IP of the IoT

Intellectual property will be at the core of tomorrow's hyper-connected world, where the Internet of Things will facilitate greater interaction between our homes, workplaces and vehicles. Here, we take a look at some of the likely key players

By **Julia Elvidge, Jim Morrison and Martin Bijman**

A lot of hype surrounds the Internet of Things (IoT); yet many, if not most, are confused by what IoT really is and what it means for their businesses. Understanding the market players and their patents is close to impossible. If you are a new player in the IoT market, you most likely will be filing patent applications for new innovations. However, since the IoT is being built on established technology, you need to be aware that there are hundreds of technology companies that may already own the seminal foundation patents. We talk first about the technology and market players, then later about the patents.

What is IoT?

We live in a natural world where everything around us is analogue. We sense, interpret and act, if necessary, based on what we sense happening all around us. Today, technology exists which brings this class of sensing to electronic devices and systems. For humans, it means that we can now sense virtually everything from almost anywhere. Advances in semiconductor process and design technology have enabled us to produce low-cost, ultra-low power and mixed signal semiconductor

system-on-a-chip (SoC) devices. A single 3 x 3 millimetre (mm) integrated circuit (Figure 1) has the potential to include sensors, an analogue-to-digital converter, processors, flash memory and on-board power management to minimise power consumption.

In the past two decades a trifecta of events has opened the door to the IoT. Diverse and advanced electronics became commodity items; the global Internet became pervasive; and technology became the norm in everyday life, with Wi-Fi and declining costs driving the number of smartphone users today to over 2 billion. The IoT basically connects any device with an on/off switch to the Internet or to other devices. By adding sensors to everything and employing analytics, it enables new levels of efficiency and business refinement.

This capability has fuelled applications that span virtually every part of life, from sensing the walking cadence and heart rate of an elderly person through his or her slippers to the remote wireless control of high-voltage electric power grids. Virtually everything can be sensed, and all at ultra-low cost.

IoT markets

In addition to changing how people live, work and play, these applications are driving market growth at healthy double-digit year-on-year compound annual growth rates (CAGRs). Today, the largest markets – which are driving billions of shipments per year in both silicon and devices – are medical, fitness wearables, industrial, automotive and smart homes.

The medical market has the ability to become as big as today's market for smartphones and tablets combined. IoT medical wearables are monitoring many of our vital statistics, sometimes using disposable patches. The penetration rate

Figure 1. Die photo and floorplan of SoC

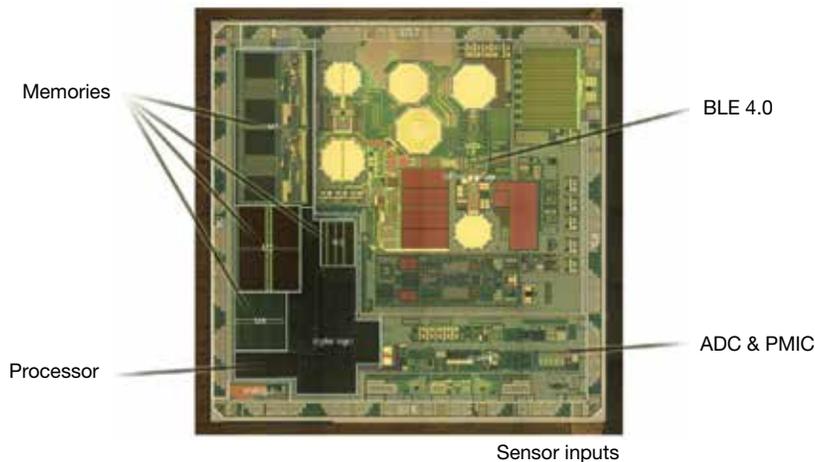


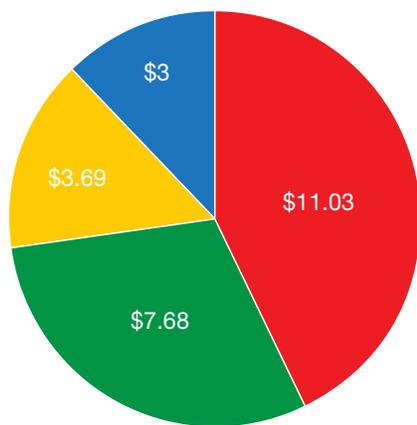
Figure 2. Apple Watch



Figure 3. Omron automatic wrist blood pressure monitor



Figure 4. Market data for wearables revenue 2015



- Bluetooth headsets 43%
- Smart watches 30%
- Smart glasses, HMD/cameras 15%
- Other 12%

Source: Gartner

for tablets in the average household is two to three units per household. IoT medical devices have the potential over time to reach penetration rates that could be double or triple that figure.

While fitness wearables are experiencing significant growth right now, analysts are talking about seeing high abandonment rates in the first three to six months. Abandonment occurs when users leave their fitness wearable in their drawer and never wear it again. This leaves the future of devices such as the Nike Fuel Band, FitBit and other wearables in question. Will this market ever take off and reach a point where annual volumes and revenue are measured in billions of dollars? Will Apple's new Apple Watch trigger another wave of change in consumer behaviour globally, such as we saw with the iPhone 3/3GS? Only time will tell.

Industry has been applying IoT for the past decade and the increasing use of sensors and robotics is common in all areas and types of manufacturing. Other examples include sensors deployed in remote locations throughout utility networks. Remote locations in mining installations consolidate sensors to cellular hubs that backhaul on satellite links. Numerous cities have evolved their infrastructure to become smart cities.

Intelligent, safe and connected automobiles are emerging. At the Consumer Electronics Show 2015, leading manufacturers such as Volkswagen, Mercedes, Toyota and Ford – to name a few – unveiled the future of safe smart cars. Much of what was demonstrated is already in our vehicles today and even more is promised for the future, including forward-looking infrared radar, gesture recognition, complete voice control, 5G connectivity and

intra-vehicle communications. The smart auto market, which employs IoT devices, is growing at nearly 20% annually and shows no signs of stopping.

Smart homes employ many IoT devices, ranging from heating, ventilation and air conditioning systems to smoke, fire and security systems, remote monitoring, white goods, door locks, entertainment systems, windows and blinds and communications. The smart home market will experience two types of growth. Existing homes will evolve over time rather than convert to IoT instantaneously. However, new homes will adopt new IoT technology as it becomes readily available. This should translate as slower but steadier growth.

Thinking of these top five markets, the two segments with the best chance for short and near-term growth are the medical and wearable markets. These break down into two major classes: devices prescribed by a physician and devices available for consumer purchase. The first category includes single-point solutions capable of tracking one type of data for a single medical condition. The consumer category includes fitness devices designed to be worn during workouts and smart wearables that are meant to be worn continuously. These devices can usually track multiple types of data (eg, sleep, steps taken and heart rate). Currently this market is worth approximately \$25 billion (see Figure 4). Some estimates put this market on track to be worth as much as \$50 billion by 2017.

Within the individual segments, the dominant players are:

- Samsung and Pebble for smart watches (although the entire landscape will change with the launch of the Apple Watch);
- Garmin and Polar for sports watches;

- Jawbone, Garmin and FitBit for fitness wristbands; and
- Plantronics, Jabra and Jawbone for Bluetooth headsets.

The rest of the applications are still too nascent to predict what will happen.

These markets are still in the early adopter phase; many applications are developed, competitors arise and many new products are launched each year, yet there is still uncertainty as to which segment will deliver the best overall revenue and total units per year. To emphasise this, we go on to examine the patent filings and awards by year within this segment, which demonstrate a steep ramp over the past four years. This is typical of emerging markets. We saw this in the early days of microelectromechanical systems sensors for consumer applications. An enormous amount of patent filing and award activity occurred in the years leading up to an explosion in the growth of these devices in smartphones and gaming systems. The wearables segments have a few years yet to go before one or two of these segments reach the 1 billion units per year mark. However, given the pace of new product releases and consumers' appetite for all things connected, this market could grow as fast as that for smartphones.

IoT technology

A typical IoT 'thing' has several key technology areas, as seen in Figure 5. Individual sensors use a variety of structures and materials to convert environmental conditions into electrical signals. Power, processor and wireless technologies are implemented in semiconductor devices and, for the most part, are established technologies. In the IoT domain, the power requirements are being driven to very low levels – those that can be maintained by a small battery for a decade or powered from the energy emitted by the human body. Systems are designed for the remaining areas. First, sensor systems combine several individual sensors with a microcontroller and converter to create proper digitisation over a range of environmental conditions. Second, sensor systems, power, processor and radio are combined to create a variety of products with features applicable to different applications.

To illustrate IoT technology better, consider the example of smart slippers. A complementary metal-oxide-semiconductor (CMOS) integrated circuit (IC) is sewn into each slipper. This IC can monitor motion changes in X, Y, Z, roll, pitch and yaw, as well as temperature, pressure, humidity and global

positioning system. All of these analogue signals are fed into a processor and the resulting data is passed on to an ultra-low-power Bluetooth device and then to a local gateway – for example, a smartphone or a smart hub within the home. The data is then sent to a cloud application via the home's internet service provider. A family member with the application on a smartphone or tablet can monitor and learn about his or her loved one's day, including when he or she is up and moving, the cadence of his or her steps, body temperature and even when he or she is sitting in an armchair watching television. This IoT solution has taken data from a pair of slippers, sent it by Bluetooth to a home router, then to a cloud-based server application and then back out over a phone service provider to a smartphone or to a Wi-Fi router – all so that you know a loved one is safe and watching television in the den.

Further, IoT can use analytics to observe trends among a large number of users with smart slippers. This aggregate analysis can provide a picture of the habits, health and wellbeing of all smart slipper users, and help to design individual services that these users may want or need from day to day, or community services that may be helpful for an ongoing period or emergency basis.

Any IoT device or appliance can deliver remote data anywhere and any time.

IoT technology segments

As a participant in the IoT world, it is important to have a high-level understanding of the five IoT technology segments (Figure 6) and their patent landscapes, as well as a deeper understanding of the patent landscape of things.

IoT has five technology segments: things, networking, computing and storage, services and analytics.

Things are sensors and actuators (a mechanical device that takes energy and

Figure 5. Key technology areas of an IoT thing

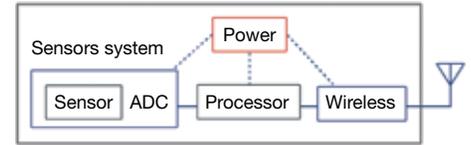
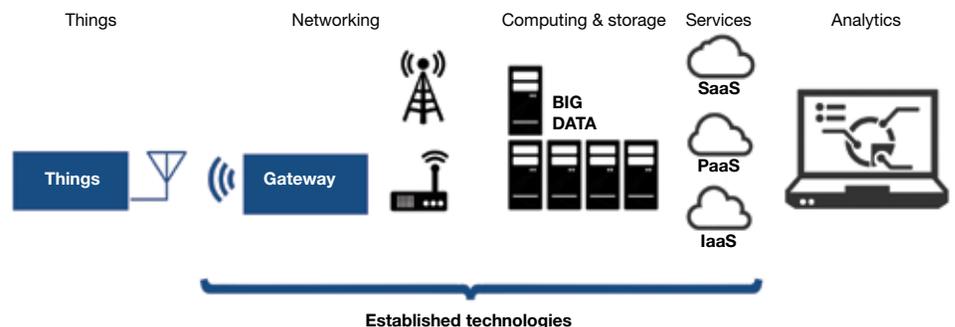


Figure 6. IoT technology segments



converts it into some type of motion). The primary focus of IoT hype today is on sensors. IoT sensors are inexpensive (less than \$5 each now and forecast to drop to \$0.50 in the coming years), very low power, wireless and either disposable or ‘install and forget’. They are intended to work well, but not perfectly, on aggregate data. Outlier data will be dropped. Sensors are asleep most of the time, but periodically wake up to transmit small bursts of data. The actuators may include automated controls, robots or humans.

Networking includes a gateway, wireless infrastructure and internet transportation of data to the cloud. The gateway depends on the application and range of communication of the things. The radio could be new long-range or use established technologies such as Bluetooth Low Energy, Wi-Fi or cellular. Gateways can be simple or smart. A smart gateway might be appropriate for a home IoT solution; in situations where the internet connection goes down, it can run autonomously. The network infrastructure today is very well established. Data pipes are larger in the downstream direction from cloud to gateways for high-bandwidth applications such as video. With IoT, the upstream pipe must become larger as well, so that it can carry data for the 500 million things forecast by 2020.

The remaining three technologies reside in the cloud.

Computing and storage of the full volume of sensor data are provided by big data systems. Some data compression may occur at the gateway. Big data computing and storage are well-established technologies which have been implemented widely in data centres, where data security is critical.

Services include infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS), and provide the means to deliver applications and services using the data for a particular client. These applications generate revenue and are mostly targeted at consumer applications and entertainment. For IoT, the goals of new applications will also include high reliability for medical, safety for automated cars, efficiency for manufacturing and security for homes.

Analytics of broad amounts of IoT data will help to identify IoT system refinements, using metrics and machine learning. This is a new area of technology, mostly software, where the goal is to look for operational or business metrics that allow a decision maker to make refinements and adjustments to each local IoT system. It also encompasses machine learning, where machines determine the relationships between the input and output data. This opens the door to a range of solutions, some of which may be new, perhaps unexpected, and potentially extremely advantageous to improving IoT systems.

IoT areas of innovation

The patents for these five technology areas differ in content and maturity (Figure 7). The bottom line is that the technologies at the beginning of this system, things, and at the end of this system, analytics, are the newest. The technologies in between – networking, computing and storage and services – are established, but will evolve and scale for IoT. It is in these in-between areas that we see the most dominance of mature companies such as IBM, Microsoft and Samsung. A company such as Nokia Solutions and Networks, with its new acquisition Alcatel-Lucent, is in a solid patent position with regard to networking

Figure 7. An overview of the IoT US granted patent and pending application landscape

Portfolio	IoT patents	Things patents	Networking patents	Big Data patents	IaaS, PaaS, SaaS patents	Analytics patents	% of corporate portfolio
IBM	12077	571	631	4744	7912	877	20%
Microsoft	10037	962	923	3370	6264	630	26%
Samsung	7317	400	3493	1692	3377	68	12%
Nokia/Alcatel-Lucent	6791	463	4302	1300	2146	130	25%
Google	5866	914	1892	1496	2461	273	27%
Intel	5777	475	1875	1712	2866	140	19%
Oracle	4209	46	243	1789	2937	188	30%
Apple	3608	858	1305	616	1434	66	21%
NEC	2494	109	1457	686	760	63	20%

Figure 8. Snapshot of technology granted patents and pending applications

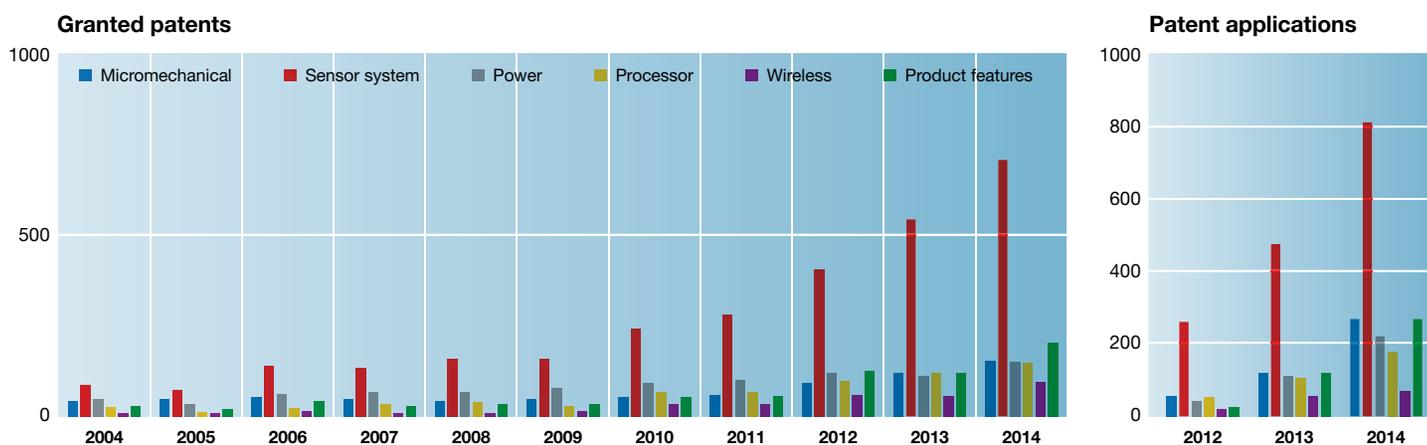
Portfolio	IoT wearable patents	Sensor patents	Sensor system patents	Power patents	Processor patents	Wireless patents	Product feature patents	% of total corporate portfolio
Microsoft	962	89	407	71	287	38	170	3%
Google	914	109	409	99	103	59	277	4%
Apple	858	210	483	45	159	15	42	5%
Qualcomm	752	173	359	209	62	44	57	3%
Medtronic	655	14	516	38	11	39	77	4%
Philips	596	17	425	32	31	38	83	5%
IBM	571	43	243	48	137	44	73	1%
Cardiac pacemakers	486	2	468	12	1	9	7	19%
Intel	475	70	224	128	40	48	32	2%
Nokia /Alcatel-Lucent	463	36	186	91	62	66	53	2%
Seiko	455	180	99	105	1	0	76	2%
BlackBerry	403	74	246	68	20	32	16	4%
Samsung	400	55	98	157	23	19	55	1%
Panasonic	360	61	105	132	28	3	34	1%
Siemens	341	28	187	57	34	17	23	1%
Nike	308	24	175	4	3	1	154	7%
AT&T	287	12	74	14	77	74	47	2%
LG Electronics	275	41	53	56	40	40	52	1%
Sony	268	29	109	44	48	4	39	1%
Canon	241	17	118	55	27	1	24	1%
Motorola	199	39	87	31	5	22	36	5%
Toshiba	182	11	78	59	19	4	12	1%
Gentex	137	57	92	0	1	1	0	21%
Lenovo	135	27	52	33	15	4	9	3%
Verizon	113	7	32	8	30	32	11	2%
NEC	109	6	40	45	7	0	13	1%
FitBit	94	3	82	0	2	0	25	60%
Nintendo	92	20	71	0	3	1	1	5%
Immersion	87	22	50	2	10	1	24	14%
Garmin	83	12	30	0	3	37	10	14%
Polar	69	0	58	0	2	1	15	45%
Casio	58	6	27	4	1	0	21	2%
Citizen Holdings	56	11	5	13	0	0	28	6%
Oracle	46	16	13	4	10	1	2	0%
Plantronics	12	1	4	0	0	1	8	3%

but also, surprisingly, in the things category.

Things represent the area where we can effectively look at new patents, created by diverse companies. Things also cover a very wide range of technologies, applied in industries, cars, homes and health and wellness. This area is so broad that

we decided to focus our analysis on the companies in the fitness and wellness markets, and their US patents. We examine their patent landscapes in the final sections of this article. Analytics is a new area. Here, statisticians will create new processes that invoke machine learning and measure

Figure 9. IoT wearables granted patents and applications by publication year



of business and operational activity. It is anticipated that the patents will be quite specialised.

The remaining technologies are much more established.

Networking is a combination of gateway, wireless infrastructure and internet transport. Chipworks blogged about the patent landscape in this area in September 2014 (“Intel Builds Wireless IP with Powerwave Patents”). These Powerwave patents fall into this networking area. The patents in this area tend to be mostly aligned with standards, with some product differentiation found in implementation patents.

Computing and storage and services are both broadly covered by cloud markets. Valuable patents in these two areas cover methods, as the flow of operations that interact with the cloud can be observed. The hardware of the cloud is a challenge to assert, as it is located in private data centres which cannot be accessed or inspected.

Focus on fitness and wearables market

Gartner lists six companies that share the majority of the revenue in this wearable market: Samsung, Nike, Garmin, FitBit, Sony and Google. To create patent analysis models, the technologies of the products made by these companies were considered, characterised and refined by applying a set of about 100 keyword phrases to the patent portfolios.

Next, these refined keywords were applied to all US patents to determine what other companies may have patents that are also applicable to these products and services. Over 300 companies were considered. The results for a selection of these companies are shown. The companies listed in bold are the

six leading companies; the companies listed in red are medical companies.

There are some interesting observations in this initial study. Near the top of the chart in Figure 8 are a number of older established companies (Microsoft, Apple, Qualcomm, Philips, IBM and Intel) which have diversified into wearables. The proportion of their portfolio that is applicable to wearable technologies is small – that is, they have many other patented innovations available to overwhelm a target company. The top six wearables companies range from diversifying companies such as Google, Samsung and Sony to a diverse apparel company, Nike, and focused wearable companies Garmin and particularly FitBit. The focused wearable companies tend to be at the bottom of the list, where a larger percentage of their portfolio applies to the wearable market. A number of medical companies have been implementing many of the solutions commercialised in wearables with strong portfolios, particularly Medtronic and Cardiac Pacemakers. Finally, the patents found for power, processor and radio are more about using and integrating these technologies than fundamentally building them.

How recent are the applications and patents found in the patent study?

Histograms of the age of these patents bear out further observations, as seen in Figure 9. Most clearly, the rate of innovation in sensor systems is growing – in terms of both applications and allowed patents. Sensor systems are not simply a clever micromechanical component that senses the environment. Increasingly today they are a sensor system that combines several

sensors for different environmental aspects with a microcontroller and analogue-to-digital converter to provide a meaningful digital output. Also, the next highest areas of innovation are wearable product features and the individual micromechanical sensors themselves.

What is the timeline for when licensing will begin for the wearables market?

In 2015, the wearables segment is dominated by smart watches, fitness bands, smart glasses and Bluetooth headsets. The total 2015 market for this segment is estimated at in excess of \$25 billion (and about 230 million units).

Typically, it will become economically attractive for companies to invest in licensing activities when the market becomes rich enough to get a return. The amount of time for a patent licensing market to establish itself is reflected by observing Chipworks' success in producing hits (claim charts) plotted by patent age: a typical assertable patent age is 12 years (Figure 10). The growth of innovation in sensor systems and the current level of market revenue suggest that we are still a year or two away from the first licensing cycle in the wearables market.

Semiconductor patents applicable to IoT things – including innovations in extremely low-power radios, sensors and power supplies – would encompass a vast array of companies and commonly used technology. In fact, the majority of devices used in IoT things are exceptionally attractive licensing targets, as their schematics, functionality and data streams are relatively simple (eg, in comparison to smartphones), their power consumption is limited and the size of their digital blocks is relatively modest.

Chipworks has recently analysed a dozen wearable products. The diversity of technology is reflected by the 149 socket wins found for 41 different companies, led by Texas Instruments (41), STMicro (11) and Qualcomm (seven). Sensor wins are led by STM, Samsung and nine others. Sensor systems are led by AKM, Texas Instruments (TI), Invensense and four others. TI, Maxim and 10 others lead in the use of power management devices. Processors are led by TI, STM and 13 others. Radios are led by Nordic, Broadcom, TI and six others. Other functions are delivered by 16 different companies.

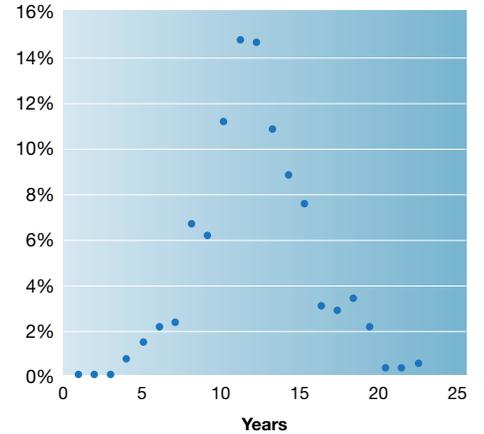
Given the diversity of technologies in IoT's things, the innovations in low power and analytics and the wealth of established technology that is being repurposed for this market, strong licensing positions will be

held by a wide assortment of well-established companies. Companies entering the market will have to prepare for licensing by driving their rate of patent applications, purchasing patents, taking licences or being acquired as part of a round of market consolidation.

Wearables company patent portfolios

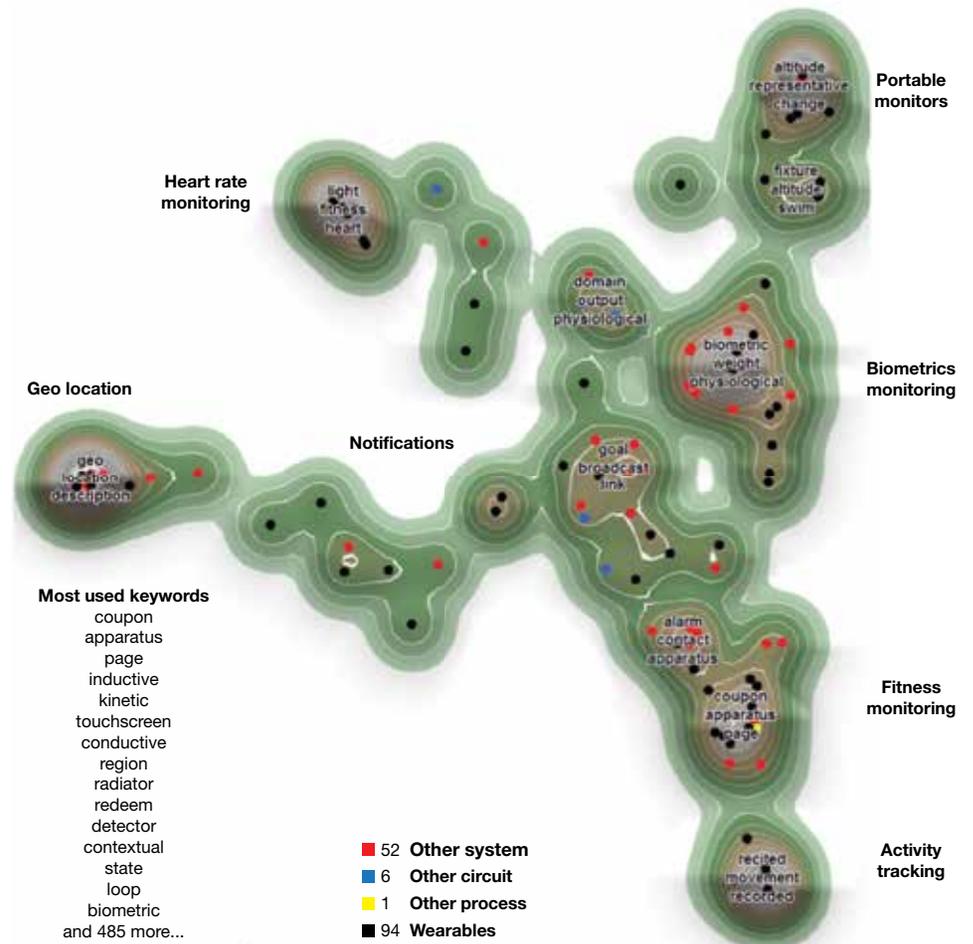
The companies examined in the initial patent study (Figure 8) fall into several groups with regard to their position in the market and licensing positions. There are new companies that are just starting to build their portfolios, some of which are successful in the wearables market, such as FitBit and Garmin. Some companies, such as Nike, are also successful in other markets and have diversified into the wearables market. Established companies in the medical, gaming and other markets have been creating products similar to wearables for some time (eg, Medtronics). And large mature technology conglomerates such as Microsoft dominate the infrastructure and

Figure 10. Age of technology patents asserted in licensing and litigation



Source: Chipworks

Figure 11. FitBit granted patent and pending application landscape



backbone technology patents.

Using Chipworks' Patent Analytics Solution powered by KMX, we can visualise the patent diversity for any group of patents. In these plots, each dot is a patent. A group of patents sharing similar keywords creates a peak in the landscape. Each peak indicates the top three keywords found in a patent cluster. Patent clusters that are significantly different are further apart and may be separated by white space.

As a part of basic triage of a portfolio, Chipworks has developed models that separate patents into four areas based on the type of analysis required to prove the claim: process (yellow), package (green), circuit (blue) or system (red). 'Process' refers to structure and materials, physical properties of the materials and mechanical aspects. 'Package' includes mechanical assemblies interfacing the physical and electrical domain. 'Circuit' refers to electronic schematics of printed circuit boards, packages or semiconductor dies,

and range from transistors to common circuits such as amplifiers, phase-locked loops, converters and digital logic. 'Systems' include the operation of products where several separated blocks are combined to deliver a feature or function, at either the electrical, data or software level.

Further analysis can be used to identify which patents are useful towards a goal, such as licensing technology applicable to the wearables market. In the following landscapes, patents applicable to wearables are painted black and are similar to one or more of our models for sensor, sensor systems, power, process, radio and product features.

Consider FitBit (Figure 11), a new wearables company with a modest portfolio applicable mostly to the wearables market (~60% of the portfolio was found in the wearables patent search of Figure 8). Its portfolio is relatively new, with 81 US applications, 69 recent granted patents and eight design patents. The structure of the portfolio appears to be centred on notifications, with four branches related to monitoring fitness and activity, geo-location, heart rate and biometrics.

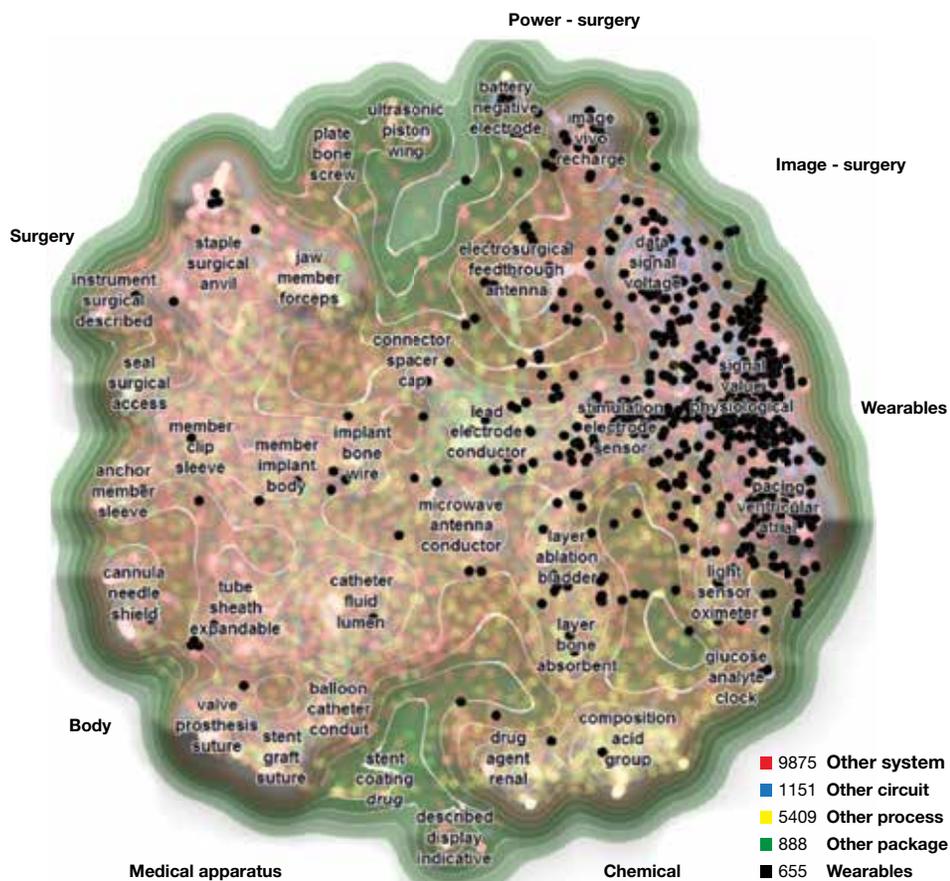
About 60% of the portfolio is found to be similar to our six models for wearables. This is a high percentage, suggesting that this is the primary market for FitBit. Most FitBit patents are systems related; perhaps only a handful are strongly circuit in nature. This implies that FitBit is an integrator, combining its own building blocks or those from other companies to create a higher-value end product.

FitBit may be in a good position for licensing negotiations, as its portfolio of recent sensor systems patents may patent high-level value features of the recent innovations marketed in this wave of wearable products.

Consider Medtronic (Figure 12), a successful medical company that has been making human body monitors for decades. It has three main areas in the patent landscape: surgery and body on the centre to left side of the landscape, chemical on the bottom right and electrical/data on the right.

About 4% or 655 of Medtronic's patents are similar to one or more of the six wearables models – these are nicely clustered in the right section of the landscape. The publication dates of these patents (Figure 13) include some early patents, as well as many more recent innovations. This suggests that focused solutions have been developed and patented by Medtronic that are similar to wearable products. Considering the volume

Figure 12. Medtronic US granted patents and pending applications



of patents and the product history of Medtronic, it appears that it has a strong position to leverage its portfolio with regard to the revenue of wearables, and that its patents may be more fundamental than those of companies now selling products in the wearables market.

Consider Microsoft, a highly successful and diverse company with a very rich patent portfolio and assertion history. Its US portfolio consists of 8,696 applications, 25,677 patents and 3,692 design patents. Its portfolio consists mostly of software patents, with about 300 patents that are circuit related and that are likely related to the Xbox gaming system, which includes Kinect and handheld peripherals. These peripherals are a lot like the IoT's things. They are wireless and often have inertial sensors and other sensors. Other companies that make gaming peripherals may also have interesting patents regarding wearables, such as Nintendo and Sony.

About 962 Microsoft patents are similar to the six wearables models in the initial study. Unlike Medtronic's patents, these patents – which are painted black in the full portfolio landscape plot on the bottom left of Figure 14 – are widely distributed. This suggests that the patents cover a broad range of technologies in wearables products.

Further, a landscape was created limited to the 962 patents found to be potentially applicable to wearables, shown in the right half of Figure 14. Interpreting this landscape, the top right area generally surrounding and above peak 'motion sensor virtual' is about sensors and sensor systems, and many of the product features of things. The left side around peak 'voice content application' combines sensor systems and processing. The bottom area, generally around and below peak 'message activity service', describes interactions of communication, wireless and power.

Considering that Microsoft also has a wide range of other technological innovations patented, it would have the best position leveraging the wearables market among all companies considered in this study. Microsoft has experience and success leveraging its patents with regard to Android, which would position it as a possible and perhaps probable company to leverage against wearables as well.

Rise of the machines

IoT will continue to evolve as we move from humans talking to machines to machines talking to machines. As a result, the IoT

Figure 13. Publication dates of Medtronic patents related to IoT wearables

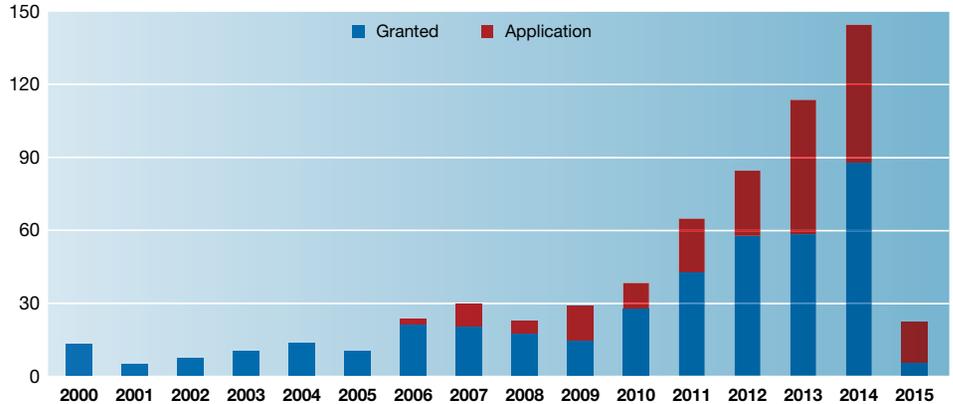
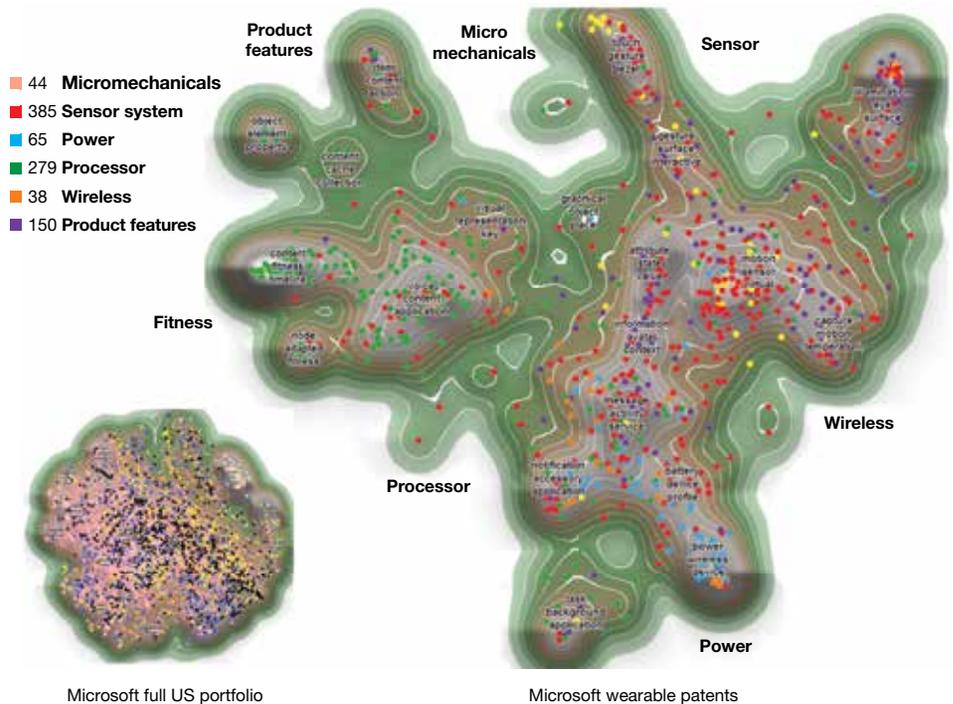


Figure 14. Microsoft granted patent and pending application landscapes



“ Considering that Microsoft also has a wide range of other technological innovations patented, it would have the best position leveraging the wearables market among all companies considered in this study ”

Action plan

A

In the increasingly interconnected world of the Internet of Things (IoT), there are a few key strategic steps that IP owners can take to make the most of the opportunities it presents:

- Understand your company's position in the IoT and identify patents that will be important from a competitive standpoint.
- Monitor growth in the key markets: medical, fitness and wearables,
- industrial, automotive and smartphones. Medical and wearable markets have the best chance for short-term growth, but the other markets are close behind.
- Map your competition's patents to better understand their position. Map their patents and patent applications by technology groups and over time to understand where they are focusing their innovation efforts.

patent landscape will also evolve. Already the medical, fitness wearables, industry, automotive and smart home markets are driving billions of shipments per year in silicon and devices. Many other markets are poised to jump on the IoT bandwagon as IoT permeates every facet of daily life. In addition to driving revenues – the health

and fitness wearables market alone is projected to reach \$25 billion in 2015 – the patent licensing landscape for these markets is on the verge of explosive growth.

Many companies new to the IoT market may have strong and expansive portfolio positions for assertion. Even so, understanding the market players, their experience and their patents in similar products is vital for creating a product and IP strategy that can deliver a high return in the IoT market. *iam*

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