

2015 Edition

Connected Things

Exploring the rapid growth of Internet of Things in the Nordics and how it is impacting businesses and people across the region



The Internet of things (IoT) is growing rapidly in the Nordics, where the number of connected things has already surpassed the total population. This revolution, of which we have just seen the beginning, is transforming society, industries and the way we live. Benefits range from managing on-demand buses in downtown Helsinki, to optimizing energy consumption in Stavanger, to improving healthcare accessibility in Sweden and Denmark through remote care. By 2018, innovative mobility projects in Sweden and Finland will enable some of the most advanced transportation systems in the world. At the same time, Norway will have the largest share of connected homes in Europe and Denmark will have one of the world's most comprehensive platforms for connected medical devices.

In this year's Connected Things report, TeliaSonera and Arthur D. Little have teamed up to draw insight from the IoT development in the Nordic region, highlighting significant benefits to individuals as well as substantial opportunities for private and public organizations. We deep dive into three segments that will have a profound impact on the way we live in the Nordics: Connected Vehicle, Connected Building and Connected People.



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The Internet of Things continues to transform society, industries and the way people live

As an increasing number of devices, sensors and physical objects are being connected, the Internet of Things (IoT) creates value for customers, device manufacturers and application developers. IoT also allows third party businesses to leverage the information from thousands of connected devices to launch new innovative services. While core concepts of the IoT, such as machine-to-machine communication, have been around for about a decade it is not until the last few years that IoT development has really taken off.

There are several reasons for this. First, advances in wireless technology, including 4G and NFC, enable cost efficient and ubiquitous connectivity. Second, businesses are increasingly realizing the IoT opportunities in product and service innovation, improved customer insights and customer relevancy, and in creating more efficient, real-time operations. Third, consumers increasingly expect to be able to access all aspects of their lives anytime, anywhere, on any device, with customer demand for interactivity

and control far exceeding supply. For example, a recent survey by Ericsson Consumer Lab showed that close to 70 percent of smartphone owners today want interactivity and control for utilities, transportation and health care services.

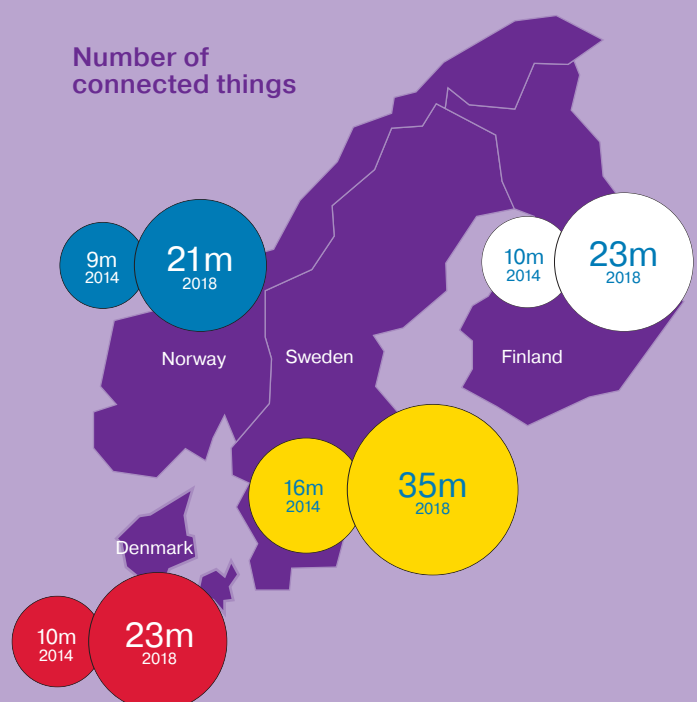
Analysts' predictions vary, but there is broad consensus that the IoT is the next major step in the digital revolution, transforming businesses, the lives of people and society. Cisco estimates that the IoT could increase global GDP with USD 19 trillion cumulatively by 2020, roughly equivalent to the annual GDP of the United States (USD 17 trillion), while MGI estimates an economic impact between three and six USD trillion annually by 2025. The rapid growth is reflected in the approximately 50 billion connected devices Ericsson expects to be deployed by 2020.¹ This would for example correspond to up to 25 connected things for every active social network user in the world as of today.

The Nordic region, with four times as many connected things per person as the rest of the

The Nordic region is at the forefront of the IoT revolution

The market size for IoT solutions² in the Nordics was EUR 4 billion in 2014 and is expected to grow at 23 percent per year until 2018, reaching EUR 9.1 billion

- Sweden is the largest market (EUR 1.3 billion in 2014) reaching a market size of EUR 3.1 billion in 2018
- Finland, with a total estimated market size of EUR 0.8 billion in 2014, is the smallest market, and will reach a market size of EUR 1.9 billion in 2018
- Norway is expected to grow from EUR 0.9 billion in revenue 2014 to EUR 2.0 billion in 2018
- Denmark's market size was estimated at EUR 0.9 billion in 2014 reaching EUR 2.1 billion in 2018



Source: Machina Research, Arthur D. Little analysis

world, is at the forefront of the IoT revolution. The Nordics have historically been a leading region for adopting new technological advancements. Good infrastructure, a high penetration of fixed broadband, 3G and 4G, coupled with consumers known to be early adopters of new trends, have created a hotbed for the IoT. Consequently, the number of connected things in the Nordics is estimated to have reached 45 million (or 1.7 per person) in 2014, and is expected to exceed 100 million in 2018.³

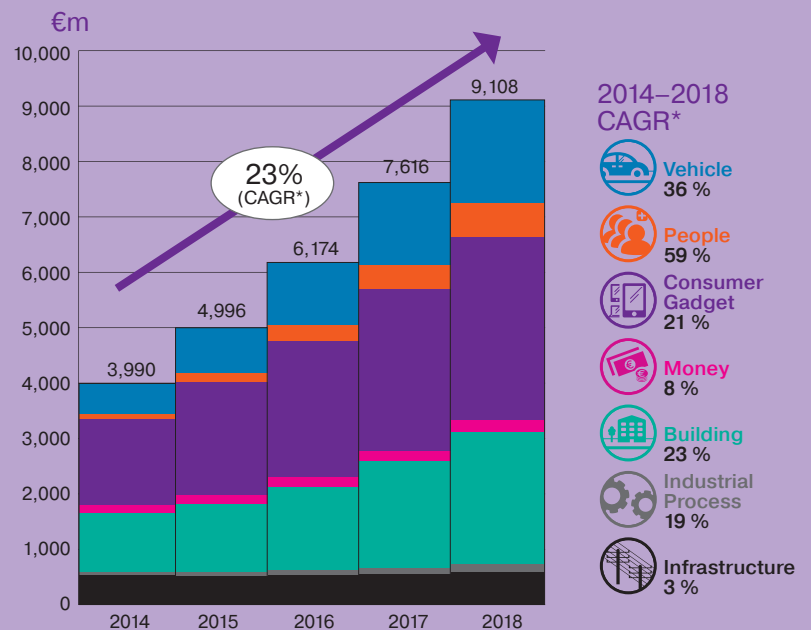
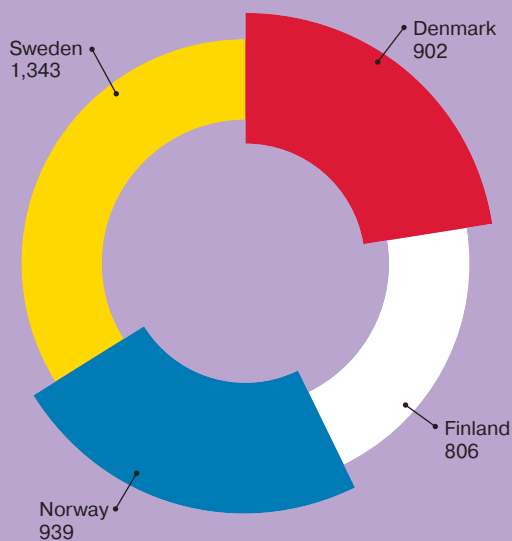
17 percent of all connected things in the Nordic region are connected to mobile networks including 2G, 3G and 4G. This is significantly higher than the nine percent in the rest of the world. The share of mobile based connectivity for connected things is expected to continue to increase to 20 percent by 2018 in the Nordic region, compared to 13 percent in the world. One reason for this expected increase is that traditional mobile technology solves data-access issues, protecting information from third-party access.

For example, it is easier and more flexible for a waste disposal company to deploy connected trash cans and containers using their own mobile based connectivity than configuring access through the customers' wireless LAN. Going forward, the number of things using multiple forms of connectivity is expected to increase, enabling connected devices to seamlessly roam between Bluetooth, broadband connected WiFi and mobile data connections.

Businesses are responding to address these new opportunities. Every month, hundreds of hopeful new IoT-related projects are developed and funded. For example, in 2013, the Pebble smart watch broke Kickstarter's old funding record by raising more than USD 10 million during its month-long campaign. In late 2014, Pebble had sold its millionth smart watch. Another landmark for the IoT in 2014 was autonomous vehicles, with Google's self-driving cars reaching a milestone 700,000 driven miles without incidents in April. Apple's inclusion of a health/fitness app in iOS 8 further demonstrates how leading innovative

Market size and growth

Total revenue
2014 €m

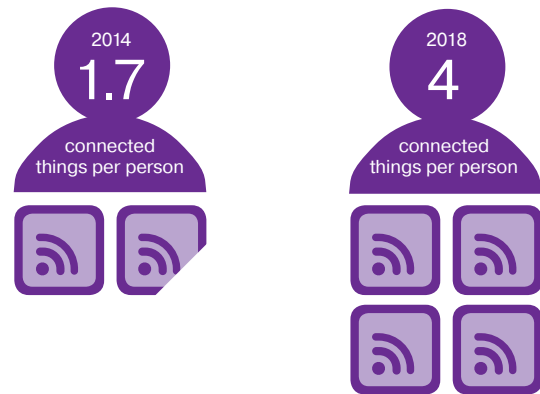


Source: Machina Research, Arthur D. Little analysis

companies develop devices and applications to connect more aspects of everyday life. In the Connected Building segment, Google's acquisition of smart homes company Nest Labs has been initially successful. For example, Nest Labs recently signed a major deal with Irish energy producer Electric Ireland. To secure future innovation power there is also an increasing trend towards forming regional innovation hubs for IoT innovations such as Mobile Heights (MHC) in Sweden, bringing together industry, academia and public sector institutions. MHC recently attracted Apple when locating their new development center in Lund.

To seize the IoT opportunities, significant business innovation in IoT services are taking place in companies in all industries. A recent study by Vodafone estimated that more than 20 percent of executives already had IoT-related offerings in place, and close to 60 percent planned to have so within the next two years. Third parties are also realizing opportunities in developing new services through using data from connected devices. In the US market user-based car insurances (UBI) are becoming more common. For example AT&T and Verizon have recently added UBI as an add-ons to their existing offers.

In the Nordics the number of connected things per person will more than double between 2014 and 2018



What is a *connected thing*? When physical objects can communicate with the outside world, they are said to be connected things or smart objects: One can interact with them remotely, query how they are doing and change their state as required. In the report, laptops, tablets, desktop computers, ICT infrastructure and mobile phones are excluded from connected things market figures.



Connected Vehicle includes machines (regardless of modus, i.e. road, air, rail, water), that transport passengers or cargo



Connected Building includes physical structures used as homes, office or a public facility



Connected People includes humans or living animals, e.g. tracking of people's geographical position, activity and measurement of bio markers



Connected Industrial Process is defined as part of a larger commercial process e.g. machinery



Connected Consumer Gadget includes electronic equipment intended for entertainment, communications and/or leisure, e.g. cameras, TVs, white goods, consumer wearables



Connected Infrastructure includes physical objects optimized for public needs or regulatory demands, e.g. energy optimization



Connected Money includes devices for payment and related services, e.g. vending machines, points-of-sale

Innovating the IoT ecosystem for growth

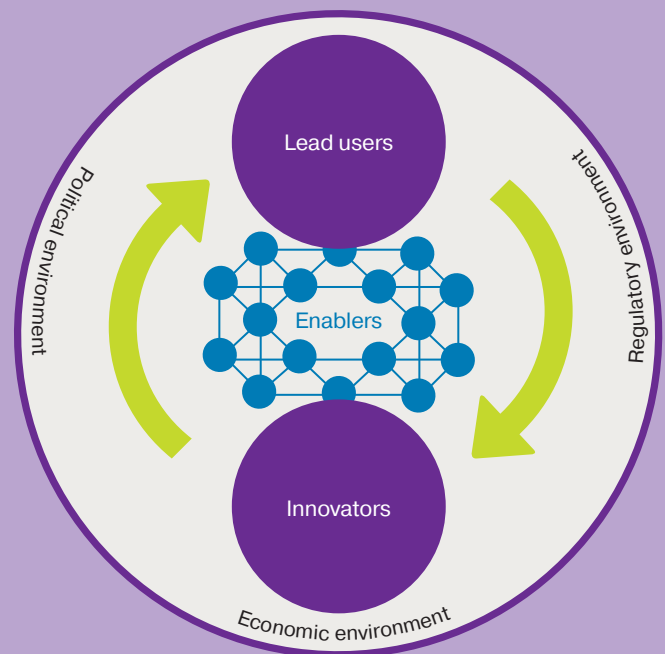
Growth in the IoT ecosystem is dependent on the interaction between lead users, enablers and innovators along with regulatory, political and economic preconditions.

Lead users are the customers that adopt new technology before others, leading the way in their respective industry. Lead users are driving demand, both by buying the services themselves and by inspiring others to do so. For example, new hospitals and county councils in the Nordics are pushing IoT innovations, increasingly demanding interoperability of medical technology solutions and digital services.

Enablers are companies that ensure provisioning, installation, security and connectivity for IoT services. Enablers can be telecom operators, platform providers and system integrators for example, and often a collaboration or partnership with several enablers is necessary in order to successfully launch a new set of applications or services to the market. One example of this is collaborations between regional telecom operators to ensure cross-border functionality necessary for service development in for example the connected car market.

Innovators are entrepreneurs and technology focused companies that develop new IoT applications and devices. These companies push the technology and application boundaries and explore business opportunities. To ensure end to end security and service level commitments, innovators require collaboration with one or more enablers. New services and applications can be seen in both innovative start-ups and leading listed companies in all sectors, from smart consumer products for finding that lost key, or monitoring health and fitness to IoT-based industrial solutions for optimized productivity.

Regulatory, Political, and Economic preconditions are forces that play an important role for the IoT market development. This is evident from for example Swedish and Finnish smart meter regulation, as well as from electric vehicle subsidies in Norway that have boosted connected car uptake.



**Key roles
in the Internet of Things
eco-system**

Interoperability is key to realizing the potential of IoT

The trend towards deployment of new and more advanced IoT services is expected to continue through 2018 and beyond. This development is taking place in three waves. In the first wave, the IoT enables remote control of devices, such as checking that the front door is locked or retrieving the position of moving objects. In the second wave, the IoT will enable new innovative services and improved productivity when large amounts of data are collected and processed. For example, the IoT and big data analytics will enable more efficient clinical research for pharmaceutical companies and insurance companies can offer individualized premiums to their customer with user based insurance. Still on the horizon is a third wave, in which the IoT will become increasingly vital and seamlessly integrated into the most critical systems of society; for instance in health care the IoT enable new advanced remote treatments and predictive care, as well as autonomous personal transportation.

In parallel to the development of more advanced IoT solutions, there is another trend which will intensify in coming years is the convergence of previously separated ecosystems of connected things. Enabling connected things to exchange and comprehend each others' data regardless of place, manufacturer or format, is key to realizing the full potential of IoT. When different types of connected things start to interact, connected cars transform into Intelligent Transportation Systems (ITS), connected medical devices into digital health and connected homes into smart cities.

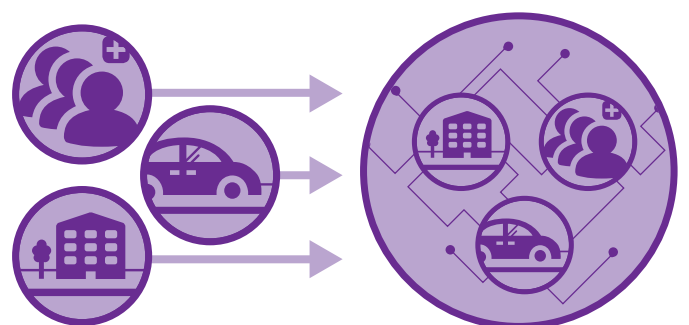
This trend towards convergence of IoT solutions means that players from previously different industries will increasingly see each other

as potential partners and/or competitors. As critical functions to everyday life are becoming connected, the role of enablers is expected to become more crucial. Enablers have an opportunity to ensure interoperability of connected devices, integrity and security of the information generated by those devices, as well as quality of service from back end systems to end user applications.

Yet, the reality is that the market landscape remains fragmented, with focus on connecting single applications or customer use cases such as controlling a car by remote. Many of the connected things currently being launched have unique interfaces and limited or no capability to share information with other connected things. The sheer number of suppliers, technologies and types of protocols used within each smart group poses a significant challenge to achieving interoperability. Whilst both telecom operators and the likes of Microsoft, Apple and Google are racing to address this opportunity, both through creating open ecosystems and by vertical integration (such as Google's Nest Lab acquisition), the successful way forward remains to be proven. Moreover, governments and regulators also play a key role to set the frameworks for unlocking growth, while ensuring reliability and security.

In the next section, an in-depth view is provided for three connected groups that have a significant transformational potential for people and businesses, being "mission critical" to everyday life, personal well-being and safety: buildings and homes (Connected Building), means of personal transportation and workplace commuting (Connected Vehicle) and health (Connected People).

Previously separated ecosystems are converging into a fully integrated system – the connected society



Sweden and Finland lead the way in mobility with autonomous vehicles and Intelligent Transportation Systems

The connectivity of cars is expected to increase, along with communication between cars, other services and infrastructure. In the next couple of years connectivity will become a key purchase criterion for buying a car. Security and convenience are expected to be key growth drivers between 2014 and 2018. With a strong automotive sector and progressive city and traffic authorities, the Nordic region is expected to take the lead in driving the development of autonomous vehicles and ITS.





Connected car is a growing trend in the Nordic region; in 2018, close to 50 percent of cars will be connected to the Internet, contributing to fewer traffic jams and accidents

as well as making parking spots visible on smartphone maps. The average spend per capita on Connected Vehicle devices will be close to EUR 70 per year in 2018, with very small variations between the countries.

This expected development in the Nordics is mainly driven by subsidies for electric cars, a strong automotive industry and innovative ITS projects. For example, the Tesla Model S remained the bestselling car in Norway in 2014. In Sweden, Volvo Cars is leading the way with a connectivity option for virtually all new models and the large-scale automated car project "DriveMe" in Gothenburg.

Considering new services, stolen vehicle recovery and eCall⁴ systems are expected to push the market forward, accounting for close to half of

the growth in revenue between 2014 and 2018 in this group. Third party services are also emerging, like new types of car insurance, so-called usage-based insurance (UBI) and proactive car maintenance.

Besides the publicity about automated cars, the transition from single Connected Vehicles toward intelligent transport systems (ITS) is equally profound. ITS is what will revolutionize the Connected Vehicles segment in the coming five to 10 years. Even though automated cars will start to benefit customers within this period, it is not until cars start to communicate with each other, street lamps, traffic signs and even the road itself, that true potential of Connected Vehicle will be reached.

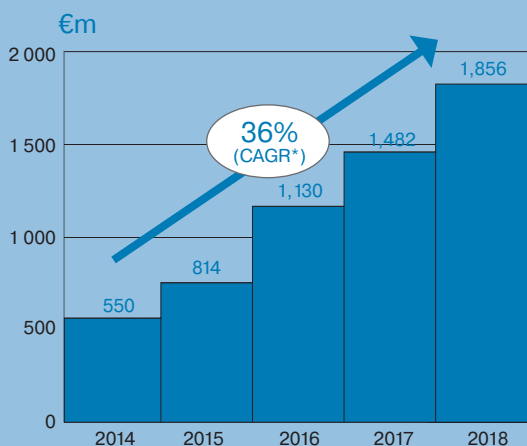
With connected cars, behavioral data about how the car is driven can be collected and used to set the insurance premium based on actual driving behavior. This trend is growing in the United States, both AT&T and Verizon are marketing UBI services in partnership with insurance companies, with similar ongoing development in the UK. UBI has potential to improve economic efficiency for

What is a Connected Vehicle? A single machine or fleet of machines that transports passengers or cargo with a special connected platform which enables a wide array of solutions. The driver of a single vehicle can access navigation systems, entertainment systems and eCall/emergency notification, and use security applications such as stolen vehicle location. Fleet owners can manage their fleets of vehicles and access remote diagnostics of engines and manufacturer data.

Key applications

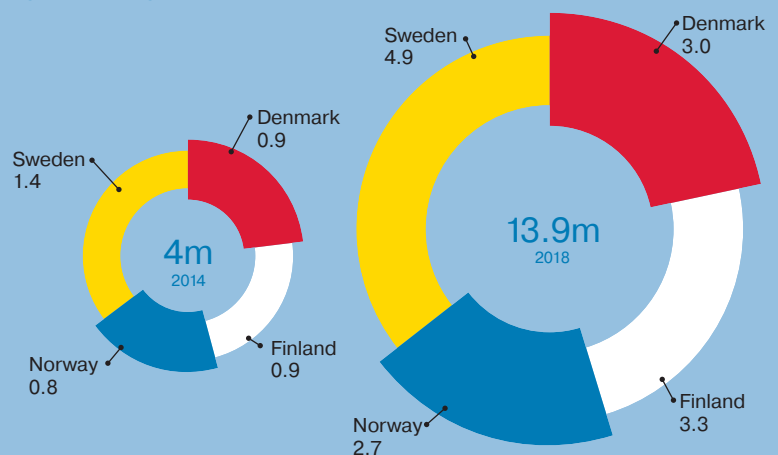
- Vehicle platform
- eCall
- Stolen vehicle recovery
- Usage based insurance
- Vehicle navigation

Segment revenue



Source: Machina Research, Arthur D. Little analysis

Total number of connected vehicles by country (millions)



insurance premiums, lower premiums for young drivers and create incentives to drive safely. A recent study by UK insurance company AGEAS estimated that a tax cut on UBI could eliminate over 2,500 personal injury crashes year-by-year and over 25,000 damage crashes. Similarly, the Finnish government has been discussing an overhaul of the road tax system to a pay-as-you-drive system, which if implemented could pave the way for insurance companies to use similar business models in the Nordics. One key opportunity also lies in the after-market. So called retrofit solutions enable older cars to become connected vehicles. The aftermarket potential is significant and analysts expect it to grow around 50 percent per year.

The eCall regulation is an example of when a regulatory initiative for creating a safer driving environment has pushed demand for connected products. Furthermore, connected cars also give an opportunity for information sharing between the car and repair shops, letting the repair shops know when the car is in need of service and why. The information from the cars also provide drivers with more insight about the cars' health and offer opportunities for new services such as proactive maintenance.

However, there are challenges that need to be overcome for the connected car to fulfill its potential. Recently, leading car manufacturer BMW had to fix a security flaw that could have allowed hackers to unlock the doors of 2.2 million vehicles. These kinds of issues or even the perception of an issue can slow down market uptake, and stresses the need for end to end security. Similarly, UBI is

a disruptive concept in so far that it increases the transparency of insurance premium pricing. While this enables "challengers" in the market to attract new customers, leading players need to plan for similar offerings to remain competitive.

Successful companies will be those that bring these services together; this requires OEMs, telecom operators, insurance companies and repair shops alike to each understand and master their roles. This will require significant change. For example, proactive service provisioning will require new competencies for repair shops to become outbound-oriented and proactive in service engagements.

Data about how the car is driven can be used to set insurance premiums – this is a fundamental shift for car insurance

Autonomous car pilots in Gothenburg

One of the world's first large-scale pilot studies of autonomous vehicles was launched in 2014 in Gothenburg, Sweden. The project, called "Drive Me", is a collaboration between several players – Volvo Car Corporation and the Swedish Transport Administration, among others. The autonomous cars will travel around on 50 kilometers of densely trafficked streets in the city. Up to a 100 cars are planned to be in traffic by 2017. Cars will have switches to activate the self-driving function and for the driver to resume control at any time.

This project is a major leap towards commercially available automated cars. Volvo Cars plans to have these

cars on the market by 2020. The pilot can help answer important questions about autonomous vehicles like what infrastructure around the car will be required, appropriate traffic conditions and how customers will react once in the driver's seat.

Collaboration between private and public entities is a vital part of this venture, and another example of the importance of interaction between different players within the ecosystem to drive the IoT forward.

Gaining consumer trust will be essential to trigger fast adoption in the market. Therein also lies a risk: the impact of one

severe accident will greatly damage the reputation of autonomous vehicles – even if they are proven to be safer than human drivers. Another challenge is that technological advancements may not be fast enough. As stated above, currently the driver needs to supervise the vehicle during autopilot. This issue must be resolved first for autonomous cars to have full impact on everyday life.

Mobility-as-a-service in Helsinki

In Helsinki, Finland, new possibilities are arising from a project referred to publicly as "Traffic Lab". The project spans 2014 and 2015 and is a collaboration between public and private entities.

The Finnish ministry of transport and communication launched the project with the aim of transforming mobility into a service, or, quoting the ministry of transport: "The goal is that the Finnish transport system will be one of the most advanced in the world."

In order to accomplish a true multi-modal transportation system, it is beneficial, if not necessary, to provide a common interface for different types of transport. Another goal of the project is

to ignite the consumer market for traffic applications by pushing out these applications on a large scale. By doing so, the project can provide a testing ground for innovative ideas. Resulting analysis on consumer impact can be used to decide the next move.

As the Traffic Lab project is concluding in 2015, it is yet hard to assess the full impact. But examples of new applications that are a result of the project includes an automatic driving diary, parking slot booking services and a remote maintenance and repair services.

Alongside Traffic Lab, another Helsinki initiative, launched by Helsinki Region

Transport, is transforming mobility as well. Kutsuplus is an on-demand minibus service operating in central Helsinki.

Users summon a minibus to a virtual bus stop by selecting a time and destination. As the buses can take up to nine passengers, an algorithm calculates the most direct route for the buses to pick up and drop off its passengers. The trip is paid for using a virtual wallet that can be shared among family members or co-workers. This is a great complement to expensive taxis or inflexible buses, and it has the potential to revolutionize mobility in Helsinki.

From smart homes to smart cities in Norway

The IoT will fundamentally change the way people utilize their homes. Driven mainly by increased demand for security and convenience, the number of connected home devices per person in the Nordic region is expected to double between 2014 and 2018. TAs the number of Connected Building applications increase, there will be a shift from single smart home applications to intelligent houses and smart cities, Stavanger in Norway is a world leading example.





The value of the Connected Building segment in the Nordics is expected to grow at 23 percent annually until 2018. It is estimated that there will be, on average, three

Connected Building devices per household in the Nordics in 2018. This means that the average household will spend, on average, around EUR 200 on Connected Building applications per year, more than double today's EUR 90. Norway is expected to have the highest spending per household (EUR 235) in Europe 2018, with Sweden and Finland close behind (EUR 176 and EUR 180 spend per household, respectively).

Demand for smart home appliances is expected to be driven partly by potential savings on energy costs with building automation, but also safety and convenience. Other applications, such as building automation, are still nascent. Advances in technology, as well as more attractive bundling of services, will drive the rapid growth in these application types.

Regulation and new government policies could trigger even higher growth than is currently expected in this connected group. Historically, smart meter regulation has ensured rapid uptake of such devices. High environmental ambitions in the Nordic region, for example the Swedish government's environmental targets for 2020 are pushing for lower energy consumption. Subsidies and or tax discounts could further increase the adoption of energy saving IoT services.

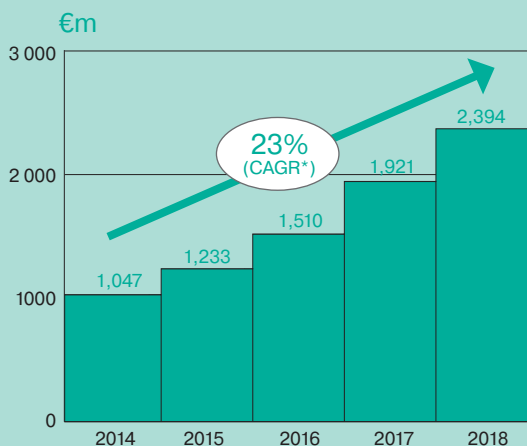
Among the Nordic countries, Norway is leading the Connected Building group. Stavanger will become the EU's new "laboratory" for smart cities. The project is sponsored by the EU's Horizon 2020 program (the world's largest research and innovation program, with a budget of EUR 80 billion over 2014-2020). The Stavanger project has been awarded EUR 200 million from the program. The concept of a consortium of players in the ecosystem collaborating to experiment with smart cities has been done previously, e.g., in Santander (Spain) as well as the Stockholm Royal Seaport (Sweden), yet at a

What is a Connected Building? A home or office equipped with a connected platform that enables its occupants to remotely control and program multiple automated connected devices. When the home or office becomes "intelligent", it offers a wide array of new applications, such as security, automation, optimization of HVAC (heating, ventilation and air conditioning), and connected office appliances.

Key applications

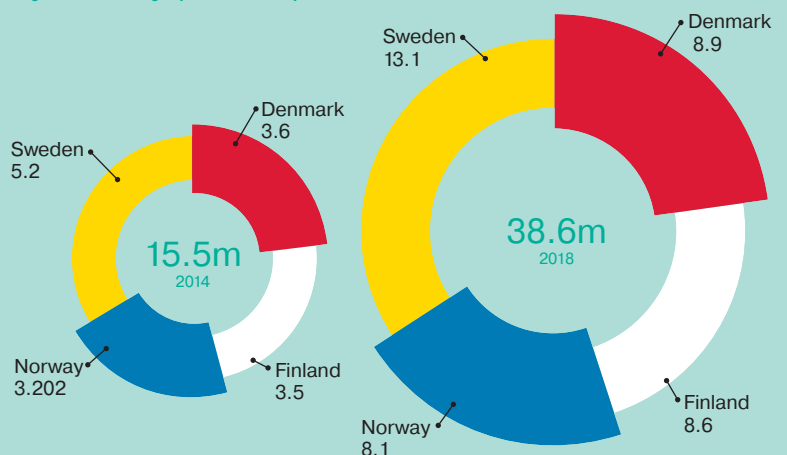
- Building security
- Building automation
- Office equipment

Segment revenue



Source: Machina Research, Arthur D. Little analysis

Total number of connected buildings by country (millions)



smaller scale. Stavanger is already more advanced than most other cities; it has the highest penetration of electric cars in Europe, as well as a highly developed fiber optic network to ensure that the vast amounts of data generated from the project can be exchanged at high speeds. The Stavanger project clearly illustrates the way the Nordic region is taking lead in moving from single connected appliances in homes toward intelligent houses and smart cities.

There will be three connected building devices per household by 2018

Use cases

Connected Norwegian homes

The Norwegian Water Resources and Energy Directorate has decided that all electricity meters should be replaced with smart meters by 2019. Norwegian utility provider Lyse saw this decision as an opportunity to offer something extra to make the installment of a smart meter more attractive to their customers. The result was the 2013 launch of connected smart home appliances under the brand Smartly.

Together with smart meters, the Smartly product line enables Lyse customers to save time and reduce costs, for example by keeping heating

to a minimum while away from the house. Entertainment and triple play are also integrated parts of the offering, which improves its attractiveness and convenience to customers.

With the Smartly product range, Lyse has expanded into new segments of the market. The product offering now includes home security applications like smoke and fire detectors as well as security alarms. Lyse has recently formed a partnership with Danish NorDan to provide a series of smart doors and windows that customers can lock remotely, as well as setting

up standards for other companies to have their products “Smartly-certified”, ensuring interoperability.

With a significantly higher proportion of smart home appliances installed, heating control alone allows consumers to reduce their energy consumption by up to 20 percent according to Lyse. The new smart home products will also make life more convenient by enabling new types of IoT based services including checking that appliances are functioning, that the water and heating is turned off/down when away, or ensuring that the kids have gone to bed properly.

Changing the game for home security with social safety networks

With new and innovative thinking in the home security market, Norwegian security company Sfty is capturing the increasing demand of connected security. The company, which was founded in 2012, focuses on the emerging market for multiple dwelling unit (MDU) security solutions. It is estimated that only 1-3 percent of MDU has alarms. Offering an all-in-one product called Sfty Sense, which features smoke detector, burglar alarm, thermometer and humidity meter, the company saw

rapidly increasing sales during 2014. The product is cheaper than normal alarms and installation is plug-and-play.

Based on an idea of a social safety network, the Sfty device alerts not only the authorities, but also friends, family and neighbors, in case of an alarm. Quick response is key to solving most situations, and in less serious situations, where authorities may not prioritize a fast response, these persons people with close proximity to the home and

family can be relied upon when less serious situations arise is important to mitigate the situation, while authorities may not prioritize a fast response. They can also help the police or fire department out with vital information in life-or-death situations. This social safety network is a new connected take on the old neighborhood watch concept, and has the potential to transform the view on home security.

Denmark and Sweden are seizing the digital health opportunity

The Internet of Things has the opportunity to develop health care towards being more accessible and preventive. This will improve patient care quality and outcomes as well as reduce costs. Due to its vertically integrated health care systems with mainly public funding and governance, the Nordics are well positioned to rapidly and decisively take this leap, leveraging common frameworks for digital health solutions and leveraging strong medical technology hubs combined with ICT innovations.





Connected People is one of the fastest growing connected groups in the Nordics, with an expected annual revenue growth of 59 percent between 2014 and 2018, which will

exceed estimates from last year's report of 48 percent. Growth in number of units is even higher, at 76 percent, and in 2018 there will be one connected people device for every fifth person in the Nordics region. This is more than twice as many as in the rest of the world.

In 2018, wearable devices and activity sensors, in addition to smartphones and tablets, will be commonplace in Nordic households. New IoT services leveraging this development are making it possible to provide new types of care and fitness services for citizens, tracking of people's fitness and provision of intelligent advice for a healthier lifestyle, as well as support managing chronic diseases such as diabetes, and enabling a longer independent lifestyle for senior citizens. In addition, early diagnosis and monitoring of risk factors enables a shift from treatment-focused

care to prevention-focused care. Solutions for outpatient care are especially beneficial for the Nordic region since it has such a low population density. This could significantly reduce healthcare costs. For example it is estimated that Stockholm county council could save up to EUR 200 million annually through reducing type 2 diabetes incidence by equipping patients in high risk groups with connected sensors for remote monitoring and prevention.

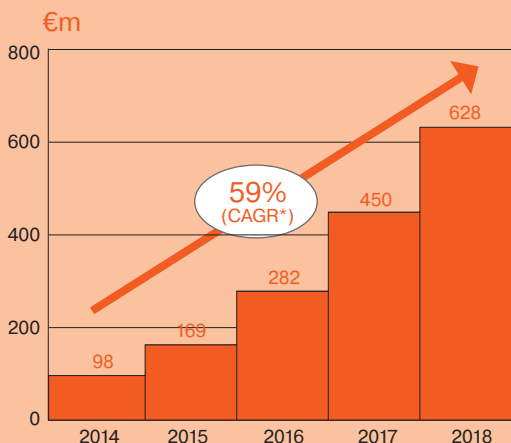
It is expected that clinical and personal remote monitoring will be one of the major drivers of the accelerated adoption of Connected People applications. The Nordics are facing several major pressures on the health care system with demographic change and an aging population, and increased prevalence of chronic diseases. Increasing healthcare expenses will result in that chronic and long-term conditions account for up to 75 percent of all health care expenses. These kinds of patients are well suited for remote treatment, as scheduled appointments often are just to check up on certain values, which now can be done without a physical meeting.

What is Connected People? A human or living animal that is connected, enabling tracking of geographical position, activity and access measurement data of bio markers. By connecting People a wide array of solutions could be offered, such as clinical remote monitoring, first-responder connectivity, telemedicine and personal monitoring.

Key applications

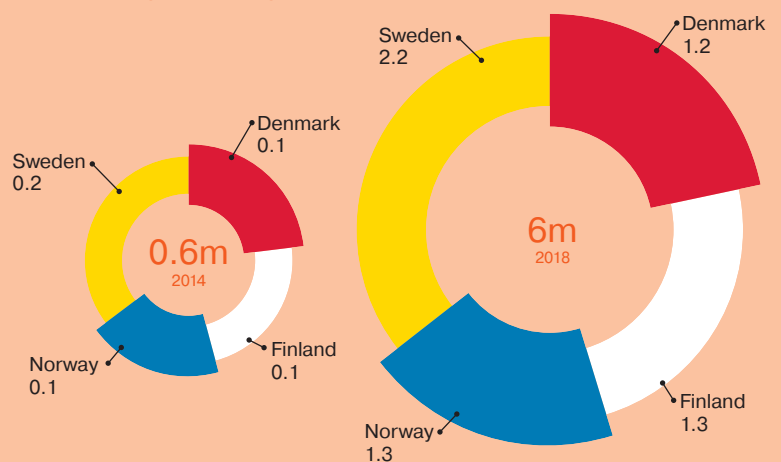
- Personal monitoring
- Remote monitoring
- Assisted living
- Tracking applications
- Connected medical environments

Segment revenue



Source: Machina Research, Arthur D. Little analysis

Total number of connected people devices by country (millions)



Furthermore, the conditions for Connected People advancements are favourable in the Nordic countries, which already have the highest IT-penetration in the world within healthcare. For example over 95 percent of information management within primary care is digitalized, and there is a comprehensive digital documentation within hospital care. Furthermore, the region is world-leading in electronic prescriptions and digitalized citizen services such as health-care advice and information.

With strong and similar healthcare systems and regulation, the Nordic countries are on their way to securing their leading position in deploying IoT-based health solutions. The future success of this development depends on a number of factors, including funding for mainstreaming, an integrated governance model, stakeholder engagement and a strong set of legal and clinical standards. In this process, stakeholders such as the health care professionals play a vital role.

Clear standards need to be set from the start, as this is important to enable interoperability between devices and ensure security and patient safety. Interoperability ensures both ease of use, freedom of choice, scalability and improved cost efficiency in both development and deployment of Connected People services. With common technical guidelines and standards, patients in any part of the country, using any device or platform, will have secure, simple and convenient access to

valuable health data and support from their health-care providers from the comfort and convenience of their home.

There are challenges to this development. For example, in healthcare, slow-acting public administrative regions inhibit fast adoption of new innovations. Moreover, laws and regulations that are in place to ensure patient safety and privacy have not been updated at the same pace as technology has progressed. There is a need to secure personal information from unauthorized access and control of medical equipment or medical records. This will be even more crucial as ecosystems become increasingly interconnected, creating an increased vulnerability. At the same time, this is an opportunity for players in the ecosystem to innovate services to take responsibility for security, privacy and communication.

Revenue of Connected People is expected to grow by 59% annually between 2014 and 2018

Innovative solutions are giving Swedes access to care anywhere

Today there are close to 15 million visits to physicians per year in the primary care system in Sweden. In many of these cases, physical examination is unnecessary. For example, disorders such as fever, urinary tract infections and many kinds of return visits can be attended to remotely.

Thinking along these lines is Swedish healthcare entrepreneur Kry, which will open one of Sweden's first online primary care units in early 2015. The patients are identified electronically, describe their symptoms, make appointments or stand in the drop-in queue, pay their fees and then meet their physicians via the computer screen. Kry estimates that up to 20 percent of healthcare encounters will be able to be conducted

remotely in five years. Pending successful piloting, this has the potential of allowing these services to be provided on multiple devices, interacting with personal gadgets to remotely report patient health values, such as weight, blood pressure and pulse.

In 2014, Uppsala county council and TeliaSonera initiated a partnership to launch Sweden's first connected health service for the home. With the service, planned to launch in 2015, individuals can have everything from blood pressure and ECG weight and lung capacity measured from the comfort of their homes. The information is automatically and securely forwarded to a personal health account. If the person chooses, health data can be sent to a primary

care unit, a hospital or a relative, but the information on the account is owned by the individual.

Both Kry and remote patient care in Uppsala County Council highlight how combining access to connected things with high speed and quality connectivity enables more advanced services and applications. For Swedes, this will create the possibility of contacting a doctor without having to leave home or work, ill or elderly citizens can have a significant part of the patient monitoring capabilities of a care unit right in their home. In the Nordics, where geographical distances are an everyday fact to millions of citizens, this is a significant benefit.

Denmark is leading the way with national standards for connected things in digital health

In 2013, Denmark adopted a new national action plan for digital health (telemedicine). The plan contains national standards on how to enable seamless and secure collection and communication of personal health data from connected things in patients' homes to healthcare providers across the country, as well as storage of that data once it has been submitted to the providers. The action plan is built on guidelines created by non-profit organization Continua.⁵ With the adoption of the action plan, Denmark is the first country in the world to establish national standards for interoperability of connected things and applications for personal health. The initiative enables a common technical framework for the creation of end-to-end, plug-and-play connectivity for personal health devices and services. Other Nordic

and European countries are following the Danish path. For example, the Norwegian Helsedirektoratet (national health board) is advocating for Continua to be implemented from 2016, with similar discussions ongoing in Sweden. A key success factor for this case is that all relevant stakeholders, including not least the healthcare profession, have been encouraged to participate in a clear model of governance, at regional and national level.

Moreover, in 2014 Denmark finalized its largest national telemedicine project ever, a two-year, 2,000-patient study involving 10 municipalities, four hospitals and a number of health care providers. The study is focused on five patient groups receiving home-based treatment on a national scale – patients with Chronic Obstructive Pulmonary

Disease (COPD), diabetes and inflammatory bowel diseases (IBD), and pregnant women with and without complications. Another case in point in Denmark is the monitoring of arrhythmia patients in their own homes using an ECG ePatch, conducted by the Odense University Hospital Svendborg. Clinical trials have found substantial savings can be realized by treating patients in their homes. Both of these projects are being carried forward as a part of the Patient@home project, Denmark's largest welfare-technological innovation initiative. The focus is on new technologies and services aimed especially at rehabilitation and monitoring activities within the Danish public health sector. This is being conducted as an integrated project with care providers, patient groups, private enterprises and entrepreneurs, and academic partners.

5. Continua is a non-profit, open industry organization of healthcare and technology companies collaborating to improve the quality of personal healthcare. It involves more than 200 member companies around the world, within electronics, telecommunications, IT, and medical technology.

Nordics in pole position to capture IoT opportunities – driving business innovation and improving quality of life

The Nordics continue to be at the forefront of the IoT revolution. Development in the number of connected things in the Nordics has been in line with, or even exceeded, what was predicted in last year's report. Looking ahead to 2018, it is expected that there will be close to four connected devices per person, totaling 102 million connected things in the region. From a peoples' perspective this development will generate benefits like improved home safety, more efficient and convenient transportation systems and better healthcare outcomes. It will also create opportunities for Nordic companies to launch new innovative products and services, improve customer insights and make operations more efficient.

Services are developing gradually within each type of connected group, with, for example, Connected Consumer Gadgets experiencing rapid uptake. This is driven by accessible prices for devices and an explosion of easy-to-use services and applications, enabled by the prevalence of smartphones and high-speed mobile connectivity in the Nordics. In the Connected People category, the potential to save lives and reduce costs of health care are driving innovation, despite regulatory challenges and a lack of common standards.

IoT services that remotely control and monitor connected things are increasingly common. At the same time, more companies are asking themselves how to best make use of the vast amounts of data these devices generate to enable intelligent decision-making, research and development, and predictive services. A recent Nordic example is PostNord, whose connected fleets of post-distribution vehicles not only allow for tracking and controlling of vehicles

remotely, but also create potential value for city authorities from the data generated, as road quality and temperature can be evaluated continuously. On the horizon are autonomous connected things, such as the driverless cars, which will place entirely new demands on regulation, security and quality of service of connectivity.

In parallel to this development, connected things are expected to increasingly communicate with each other; improved interoperability will enable even more advanced IoT services. For Connected Vehicles, a transformation of mobility through intelligent transport systems can be observed. Connected Buildings, like smart homes are gradually changing to smart cities; Stavanger is a leading example. For Connected People this means establishing patient centric care process across providers and levels of care.

As the IoT revolution continues, Nordic companies across industries are adapting their competencies, product and service portfolios and business models. "Head of digital" – job-titles have become commonplace for corporate recruitments, and digital transformation and IoT strategies are high on the agenda of executives.

We believe that the IoT will continue to disrupt old value chains and service models. Seizing the opportunity will be key to ensure future competitiveness in all industries.

About TeliaSonera Global M2M Services

TeliaSonera provides network access and telecommunication services in the Nordic and Baltic countries, the emerging markets of Eurasia, including Russia and Turkey, and in Spain. TeliaSonera Global M2M Services is a global unit in the TeliaSonera group and a founding operator of the Global M2M Association, responsible for business-critical M2M solutions. With extensive mobile networks across

its markets, dedicated M2M services, including technology and support, as well as an expert network of industry and operator partners, TeliaSonera deliver comprehensive M2M Solutions with seamless quality throughout Europe. TeliaSonera believes that M2M and IoT has the power to transform the way companies do business as well as how people live their lives. Read more on www.teliasonera.com/m2m

About Arthur D. Little

Arthur D. Little, founded in 1886, is a global leader in management consultancy, linking strategy, innovation and technology with deep industry knowledge. We offer our clients sustainable solutions to their most complex business problems. Arthur D. Little has a collaborative

client engagement style, exceptional people and a firm-wide commitment to quality and integrity. The firm has over 30 offices worldwide. Arthur D. Little is proud to serve many of the Fortune 100 companies globally, in addition to many other leading firms and public sector organizations.

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