Megatrends
Internet of Things

The speed and scale of the changes affecting both business and society demand new thinking and new solutions. At Fujitsu, we are addressing these challenges in a responsible and sustainable way by exploiting new and emerging technology.

Contents

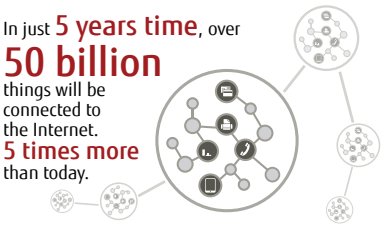
Headlines

- Connecting masses of intelligent devices together will create a new, smart environment that will change the way we live and work.
- The IT industry must make sure it delivers a coherent, usable and flexible Internet of Things that meets the expectations being set.
- Suppliers need to excel in the disciplines and technologies of security, network management and integration.
- Collaboration is needed as well as competition to ensure a viable, cost effective and high quality Internet of Things.

The rise of connectivity

Something big is happening. A system designed to provide data communications on behalf of users is morphing into a network where the principal traffic is between machines. Our new technological infrastructure is talking to itself – about us.

In 2003 there were fewer than a billion devices connected to the internet, and slightly fewer people with connections. Today there are around 9bn devices and 3bn people. These numbers are forecast to climb to 50bn devices and 6bn people by 2020[1] - seven times as many connected devices as connected people.



This 'hyperconnected' world has the potential to grow even bigger if we consider that these 50bn devices could each have 10 direct connections, combined with one connection hop would result is 5 trillion connections!

The name for this phenomenon is the Internet of Things (IoT). Computing and communications power continues to grow while prices drop. Connected sensors are appearing in mobile phones, tablets, vehicles and homes. They are also being embedded in bridges[2] and hung over drainage ditches[3]. They are appearing on tailored skins that can be wrapped around a human heart[4]. At Fujitsu, we make sensors you can swallow like a pill. Connected sensors are creating quiet revolutions in agriculture[5] and insurance[6]. They are turning our environment into an informed, actionable infrastructure that can host an infinite variety of applications.

Is this just the development of a technological trend or an enabler of fundamental change? We believe the IoT offers the opportunity to reimagine human lives, society and business structures. IoT enables greater control of the systems we rely on while creating a foundation for entirely new kinds of service.

In this paper, Solution Architect at Fujitsu, Iain Groves, contemplates whether the IoT is just the development of a technological trend or an enabler of fundamental change. In addition, we look at the opportunities that the IoT offer to reimagine human lives.

Laying the foundations – together

Today's IoT exists in two forms: an all-embracing but abstract vision and a disjointed collection of pilot and demonstrator projects. We believe the IT industry has a responsibility to ensure we realise the vision in its complete form, with an IoT that is open, scalable, interoperable, transferable and transformable. A fragmented landscape of networks and devices which can only cooperate in proprietary groups will impede market development and waste resources.

We need to collaborate on technical standards – especially communications protocols and service quality definitions – so that we can build viable and credible services. If we can agree the rules of the road, then we can journey separately or together as necessary – confident that we can reach our chosen destination.

Fujitsu is keen to play a role in standardisation. However, we believe governments have an important part to play here too. Government will be a significant user and enabler of the IoT. It is in all our interests that industry, commerce and government collaborate to create the technical standards, governance structures and commercial agreements that will enable the IoT to blossom fully – and to serve all members of society. The IoT will enable us to solve problems in unique and previously unimaginable ways. It will also create opportunities we can't envisage today. If we come together to create the necessary frameworks, we can lay the foundations for a more prosperous, inclusive and intelligent world.

Making sure we deliver

One of the unique features of the IoT is that it is an emergent phenomenon, rather than a directed industrial development. The IoT is being built from the ground up and the edges in as technology companies, applications and service providers, entrepreneurs and regulators make their own contributions to an evolving landscape. While the IoT will be ubiquitous and increasingly significant to our lives and businesses, it will be hard to say who owns it.

And while many organisations – including Fujitsu – are already taking leadership positions, the success of IoT will ultimately depend on collaboration as much as competition. We need to agree an array of technical standards to ensure the required highly heterogeneous and open environment. We also need to create governance structures that ensure access, security and quality criteria for every conceivable usage. The term ecosystem has been used loosely in the IT industry to refer to collaborative networks of suppliers, partners and customers. The IoT is the epitome of such an ecosystem: a planet-wide network of connected devices open to any and every application.

1 CISCO "Embracing the internet of everything to capture your share of $14.4 trillion", 2014

2 Michigan State University, "Self-powered sensors that communicate could warn of bridge, building defects"; http://msutoday.msu.edu/news/2015/self-powered-sensors-that-communicate-could-warn-of-bridge-building-defects/

3 Nominet, "Nominet and Love Hz use the Internet of Things for flood detection "; http://www.nominet.org.uk/news/latest/nominet-and-love-hz-use-internet-things-flood-detection

4 See eg Kyle G Fricke, Wireless Telemetry System for Implantable Sensors; http://ir.lib.uwo.ca/etd/966/

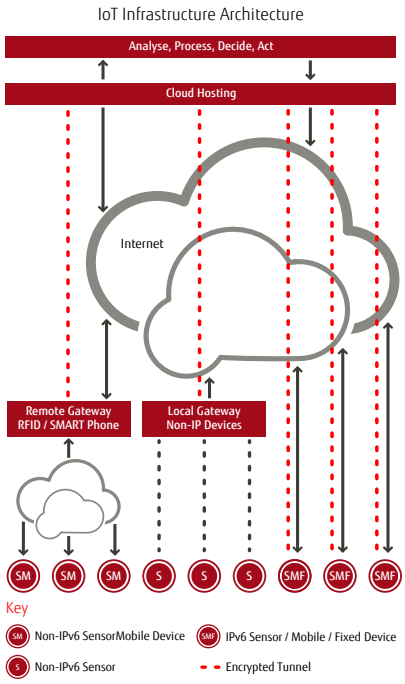
5 Venture Beat, "Surprise: Agriculture is doing more with IoT Innovation than most other industries"; http://venturebeat.com/2014/12/07/surprise-agriculture-is-doing-more-with-iot-innovation-than-most-other-industries/

6 Towers Watson, "The Internet of Things Is Transforming the Insurance Industry"; http://www.towerswatson.com/en-GB/Insights/Newsletters/Global/emphasis/2014/the-internet-of-things-is-transforming-the-insurance-industry

Getting there from here

The IoT will be a huge network, with billions of end user devices and sensors coupled to millions of applications and services. Traditional models in the telco and Managed Service Provider (MSP) supply chain are not currently geared towards the sheer volume associated with the delivery of IoT.

To deliver on the promise of IoT, no single delivery partner can meet all needs. An ecosystem of suppliers with a service integration overlay is the only supply model that can meet the projected demand. Therefore selecting the right partners will be key to ensuring the delivery of the ecosystem of information and associated fabric of control for business to realise their IoT ambitions. In order to be credible, each delivery partner will need to fully understand the fundamental structural aspects of IoT. These are Security, Network Management and Integration.



Security – building an intelligent environment we can all trust

The IoT will be a network of billions of devices that can be remotely controlled and which will be generating huge amounts of data. This brings unprecedented changes in both the nature and scale of threat profiles.

Primary security mechanisms such as firewalls, intrusion protection and prevention, and log monitoring and analysis systems will still be needed. But these established capabilities will not meet all the security needs of IoT.

We need a new approach based on tight integration between competing products. Standards in this area will solve some of the issues, but suppliers will still need credible security practices that can provide just-in-time security within and across domains either directly or indirectly.

Software Defined Networking (SDN) and Network Functions Virtualisation (NFV) will have a key role to play. These capabilities enable responsive network protection in reply to threats as they occur. Affected areas of the network can be immediately isolated from the rest of the IoT while remedial action is undertaken. It's a little like adding an immune system to the network: with the right monitoring and control systems in place, we can shut down and heal affected areas – and recognise the threats next time they occur.

> "Security, network management and integration are crucial disciplines for building the Internet of Things"

Encryption will provide a base level of security for IoT. IPv6 includes IP Security-based encryption which allows secure transmission of data between IPv6 connected endpoints. Those devices that use a gateway to connect to the IP-based world will need to connect to a device that can provide an IP stack. Application based encryption (SSL in the short term) is likely to be required in addition to secure end-to-end transmission and base level protection of data.

Sensors attached to the IoT may capture, process or exchange personal data – so there is a clear need to provide the strongest security and privacy controls. Suppliers which place privacy and data protection at the forefront of their IoT developments will be well placed to ensure their solutions respect the privacy of data subjects and abide by the growing body of privacy law.

The sheer volume of data being transmitted, collected and stored will require highly scalable compute capacity and immense storage systems. Today's approach to big data and the cloud will have to evolve rapidly to keep pace with the IoT's demands. A key component of any IoT based service will be close coupling of cloud and big data capabilities with the network and sensor environments – plus the ability to ensure regulatory compliance throughout.

At Fujitsu we are involved in early adopter projects in data protection for the IoT. We have also developed integrated Software Defined Networking (SDN) and Network Functions Virtualisation (NFV) features for platforms used by our defence clients. These implement event triggers which can isolate network components and operations such as automatic port enablement/disablement, Cyber ranges and traffic routing kill switches in order to provide just-in-time security.

Network Management – networks get dynamic

The size, complexity and fluidity of the IoT will quickly overwhelm traditional management systems, at both physical and logical levels, and within telcos as well as enterprises. Imagine a simple core network fibre break. Billions of devices could potentially send out alarms reporting loss of connectivity. In the first instance, the management systems will need to be able to receive these alerts, process them to determine the root cause failure and then suppress all the incidental alarms. Even traditional telco Operational Support Systems (OSS) which can do this today for millions of alarms will fail under the billions of events that could be generated in such a scenario.

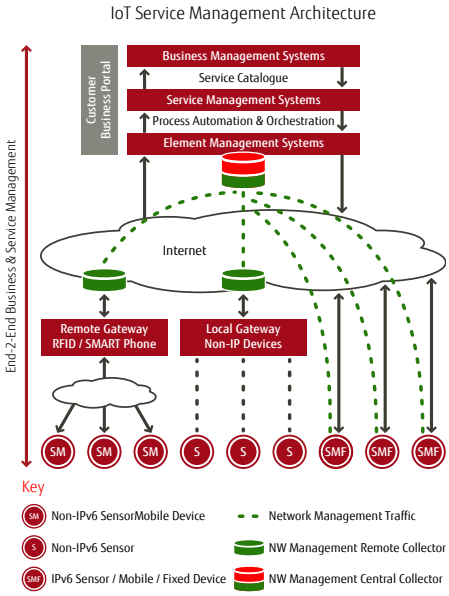
The next generation of network management solutions will need Automated Root Cause Analysis, Service Impact Assessment and Alarm Correlation capabilities. Suppliers will need to equip network aggregation points and gateways with intelligence to ensure they only propagate true root causes to centralised management while suppressing non-impacting or casual alerts.

A Fujitsu company, iMotion GlobeRanger, already provides a proven IoT platform which simplifies the development, deployment and management of RFID, mobile and sensor-based solutions. We see significant activity in this area.

Integration – putting the pieces together

Integration is fundamental to delivery of a cohesive IoT solution. Any IoT delivery partner must be able to integrate services from multiple suppliers, in each of the service towers (End User Devices, Network, Hosting and Applications).

As the IoT will be a supplier ecosystem, every participant will need a well defined service model and supporting architecture. Ideally these will be based on agreed standards that enable management of the infrastructure and applications in the context of the business services that consume them.



Another key consideration will be integration of cloud capabilities both from the IoT supplier and with other third party providers. Fujitsu is addressing this with its RunMyProcess service, which effectively provides an integration, orchestration and automation capability across multiple services and providers.

Conclusion: turning the vision into reality

IoT is both an opportunity and a threat to businesses. The possibilities are dazzling – but there are traps for the unwary. Neglecting the needs of security, network management and integration will lead to wasted investments and lost ground. Although some players may try to take a lead by using proprietary standards or privileged services, they are likely to lose out to vendors who take a longer-term view and who build for the future.

The way ahead involves a judicious and dynamic balancing of collaboration and competition. At Fujitsu we're delighted to be contributing some of the most promising technologies and deploying our strong transformation capability to turn the IoT into a reality that works for everyone.

> "Collaboration and competition are required to ensure a viable, cost effective and high quality Internet of Things"

Three things you can do today – to be a smart part of the Internet of Things

- Discuss how the IoT will impact your customers – and all the value chains in which your organisation acts
- Monitor advances in the IoT – and ask about sponsors' commitment to standards, security, network management and integration
- Make a pragmatic plan for exploiting the potential of the IoT, with achievable goals for the short, medium and long terms.

Fujitsu would be delighted to discuss the megatrend implications for your organisation. Please contact the author lain.Groves@uk.fujitsu.com

About megatrends

This paper is one in a series of megatrends papers written by Fujitsu to help inform organisations of the current and future trends impacting business and society. Highlighting how human centric innovation is responding to these global challenges, they aim to enable you to consider how you can contribute to a more prosperous and sustainable world.

Other papers tackle the challenges and opportunities of population growth, urban migration, an ageing population, healthcare and energy demand.

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