Intel Corporation (UK) Ltd Response

Ofcom - Promoting investment and innovation in the Internet of Things

Intel welcomes the opportunity to respond to Ofcom's consultation for "promoting investment and innovation in the Internet of Things". Intel has responded to parts of the consultation and therefore offer our response below.

1.3.1 *It is clear that radio spectrum will play an important role in enabling the IoT, given the need to support a potentially significant number of wireless connections. We are seeking input on the scale and nature of demand for spectrum, including how much additional spectrum may be required to support the IoT, if any; which frequency bands may be suitable; and whether an approach based on licensed or licence exempt access to spectrum is more appropriate;*

Intel Response:

With the IDC predicting 50 billion devices will be connected to the Internet by 2020 it is imperative to achieve connectivity to realise the full power of the IoT. Networking systems of intelligent devices (often called "systems of systems") must be achieved to seize the maximum potential of the transformational IoT opportunities.

However, as more than 85 percent of existing devices worldwide are based on unconnected legacy systems, it is critical that the industry focuses on the development and deployment of solutions needed to address connectivity and interoperability of legacy devices as an interim step to avoid replacing all existing infrastructure and still realise the benefits IoT can deliver to this legacy environment.

To address this connectivity and interoperability, the UK policy framework should contemplate intelligent gateway solutions that can connect legacy systems and provide common interfaces and seamless communication between devices and the cloud.

This approach to connecting legacy systems will accelerate the impact of the IoT by allowing data from existing infrastructure to be captured and utilised to immediately deliver value, while enabling legacy devices to seamlessly interact with each other and existing infrastructure as well as new devices and infrastructure that are later added to the IoT ecosystem.

Spectrum is an essential building block for IoT device connectivity. Ubiquitous, affordable, high-speed broadband connections over licensed and licence exempt spectrum are critical to enable consumers and the public and private sectors throughout the IoT ecosystem.

1.3.2 *Aside from spectrum, we recognise that the IoT has the potential to raise a number of other policy issues in which we have a role. Some IoT applications will require highly robust and reliable networks and we are therefore interested in understanding more about issues relating to network resilience and security. A specific and important aspect of network security is privacy of personal or commercially sensitive data; there will likely be a number of privacy issues and the IoT will only flourish if these are addressed;*

Intel Response:

Privacy and security are critical building blocks for the IoT ecosystem – and capabilities that must be designed into IoT systems from the outset using the best known Privacy-by-Design methodologies. Therefore, to maximise the potential of the UK's IoT opportunity the policy framework must have a clear and implementable privacy and security strategy.

This strategy must contemplate the range of purposes and risks among the various market applications, sectors, and domains, and create a logical and implementable framework that encourages industry innovation for appropriate solutions.

For trusted data exchange in an IoT ecosystem, data generated by devices and existing infrastructure must be able to be shared between the cloud, the network, and intelligent devices for analysis – enabling users to aggregate, filter, and share data from the edge to the cloud with robust protection.

Moreover, data must be accurate to be beneficial. So the policy framework must promote the importance of accuracy and integrity of data in all market sectors, but especially in the industrial domain where the safeguarding of critical infrastructure can be vital to economic and social stability.

The UK's policy framework also would also need to evoke consumer and industry trust through hardened privacy and security solutions in order to motivate adoption and participation in the IoT marketplace.

The IoT presents new challenges for traditional privacy principles. Consumer notice and consent will continue to be important, however other privacy principles must also be emphasised to ensure consumer privacy is adequately protected. For example, focusing on accountability for the appropriate collection, use, and protection of the consumer's data.

Optimal privacy and security methods must be developed as required for different IoT solutions. Use cases should be used to proactively identify privacy and security risks and to develop robust strategies to mitigate those risks.

1.3.4 *Finally, and more broadly, we are interested in stakeholders' views on the nature of Ofcom's role. Generally, our view is that industry is best placed to drive the development, standardisation and commercialisation of new technology. However, given the potential for significant benefits from the development of the IoT across a range of industry sectors, we are interested in views on whether we should be more proactive; for example, in identifying and making available key frequency bands, or in helping to drive technical standards.*

Intel Response:

Intel agrees with the view that industry is in the best position to lead and develop technological standards and solutions to address global IoT ecosystem opportunities and challenges, with government/Ofcom as a key participant where interested.

1.43 *In addition to views on how we might undertake our duties differently in order to support the development of the IoT, we are also interested in views on whether there is anything new we need to do. One example is in relation to so-called "big data". The IoT will involve the generation of a considerable amount of data from diverse sources. There are expected to be significant benefits from IoT service providers and third parties having access to this data, so that they can offer a range of innovative new services. We would be interested in stakeholders' views on potential barriers to the exploitation of "big data" to the benefit of citizens and consumers, and on whether Ofcom needs to take a role in removing these barriers.*

Intel Response:

Data availability: IoT cuts across a number of sectors. Examples are personalised healthcare, smart buildings, energy, retail, manufacturing and public sector. The ability to analyse the data will depend to the extent to which those sectors agree on common vocabularies. Here, the public sector can lead by example by making public sector information available for re-use in standardized formats.

Data protection and security: Not all Big Data is personal data. But the use of Big Data requires individuals to trust that data relating to them will be protected and used appropriately. Single data elements may not relate to an identifiable individual, but when aggregated with other data sets, organisations may then have the ability to identify an individual or a specific device. As organisations apply analytics to the data, the resulting inferences may allow for profiling of the individual or even determinations of the propensity of the individual to act in a certain way in the future. Therefore privacy and security are fundamental to developing trust in engaging the digital society and the use of new technologies. That is why a strong but balanced data protection framework, awareness and education, are key components to shape any relation with data. Education as always has been essential for the understanding and protection of fundamental rights. Supervisory authorities should

work together with other stakeholders in raising such awareness about the risks from privacy invasions, and how to protect oneself, exercise rights, or lodge claims. More consistent investment in coordinated programs is required, as well as additional focus on educating individuals and those processing personal data.

Education and skills: Data science is an emerging field. Demand is high, and finding skilled personnel is one of the major challenges associated with Big Data analytics. A data scientist may reside in IT or business- but either way, he or she is essential for planning and implementing Big Data analytics projects. The OECD has warned about the upcoming shortage in data scientist and Big Data related skills in its annual OECD Skills Strategy Report of 2012. Government, for example, could engage with academia and the ICT sector to develop data scientist curricula.

1.48.2 *Degree of openness: IoT services could be deployed over entirely open networks, i.e. any manufacturer's device conforming to a particular technical standard can be connected; or over a closed network, in which the operator controls which devices can access the network. We are interested in views on which of these (or similar) approaches might develop, whether particular services are suited to an approach and what the implications might be for the development of the IoT. We are also interested in views on the role of open versus proprietary standards.*

Intel Response:

Open participation standards will play an important role in building successful IoT ecosystems and increasing end-user choice for market solutions. In the emerging IoT economy, voluntary open global standards can accelerate adoption, drive competition and enable cost-effective introduction of new technologies. Furthermore, open standards which facilitate interoperability across the IoT ecosystem will stimulate industry innovation and technology evolution roadmaps.

1.54 *Data analysis and exploitation: The capture, analysis and exploitation of "big data" from multiple devices and applications to provide new, innovative services. We are interested in views on whether there will likely be demand for such services, on the nature of the services and whether there are any barriers to their development.*

Intel Response:

The response to 1.43 provides a response to the barriers foreseen.

Analysts forecasts point out that IOT's transformational opportunities will significantly impact the entire marketplace across numerous sectors from manufacturing and transportation to utilities and healthcare – fueling GDP, creating new jobs, and bolstering the EU economy. McKinsey Global Institute identifies the IoT as one of the most under-hyped technologies with great economic

potential – on the scale of $2.7 to $6.2 trillion of estimated global economic impact in 2025. (http://www.mckinsey.com/insights/business_technology/disruptive_technologies) IDATE Research projects that Europe will be the most valuable region in a global machine-to-machine (M2M) market worth €40 billion in 2017 (http://www.eurocomms.com/industry-news/49-online-press/9558-europe-to-be-most-valuable-m2m-market-claimsresearch), and Frost & Sullivan forecasts the European M2M market to increase at a 33 percent compound annual growth rate (CAGR) through 2016. (http://www.frost.com/prod/servlet/press-release.pag?docid=278342488) GE similarly estimates huge economic benefits from connecting machines and the Internet to drive a "productivity revolution" in Europe, predicting that the IoT could add €2.2 trillion to European GDP by 2030. (http://www.ge.com/europe/downloads/IndustrialInternet_AEuropeanPerspective.pdf)

Any IoT policy framework must recognise that analytics and the insights it provides will be the driving force to deliver IoT productivity and efficiency improvements, as well as new business/service opportunities, across both the public and private sectors.

A successful IoT ecosystem will be designed by industry to unlock data intelligence from the device through the network to the cloud – enabling the government and businesses to provide better products and services and enriched consumer experiences.

Intel's IoT vision includes the development of horizontal building blocks for end-to-end analytics, as well as distributed analytics solutions for edge systems and the data centre, which enable governments, businesses, and consumers to turn big data into actionable information. With this enormous volume of new data generated and shared across intelligent devices and systems that can now be analysed, a wealth of untapped value can be extracted to increase economic efficiency and productivity across the UK.

1.55 *International developments: In the longer term, IoT equipment is likely to be developed for a regional or global market; this will be necessary to drive down device costs and achieve economies of scale. We welcome views on relevant international activities, such as the development of common technical standards, trials and commercial deployments.*

Intel Response:

The Open Interconnect Consortium (http://www.openinterconnect.org/) is an industry effort focused on specifications. Specifically for improving device connectivity and interoperability of IoT ecosystems enabling an open source implementation and delivering a certification scheme for wirelessly connecting billions of devices.

Another example of an industry effort is the industry internet Consortium (http://www.iiconsortium.org/) which aims to accelerate innovation and deployment of IoT solutions for industrial applications.

Intel is one member of a consortium with UCL and Imperial College London and created ICRI sustainable connected Cities (http://www.cities.io/) and is concerned with how to enable future cities to be more connected and sustainable.

Our approach is interdisciplinary, combining methods from computer science, the social sciences, interaction design and architecture to improve how cities are managed and maintained in order to ensure and enhance citizen well-being.

There are many fundamental technical, social and urban challenges and opportunities that need to be addressed to accomplish this.

This will entail investigating, developing and deploying adaptive technologies that can optimize resource efficiency, and enable new services that support and enhance the quality of life of urban inhabitants and city visitors.