Connected vehicles: Internet governance and autonomous transport

While policy makers and regulators have long taken a keen interest in convergence between fixed and mobile networks or between telecommunications and broadcasting, the Internet of Things (IoT) represents convergence between ICTs and the economy on a grand scale. Nowhere is this more applicable in the convergence between the Internet and autonomous vehicles such as driverless cars or drones. The emerging issues around the Internet of things need to be further developed in the multi-stakeholder and multi-disciplinary environment of the IGF.

The term IoT signifies that almost every device and object could over time be connected to the Internet’s network of networks. Some of the other terms used to describe this process are the Internet of Everything, Industrial Internet and Machine-to-Machine communication (M2M). In some ways, the term Internet of Everything is the most accurate, as the Internet-connected sensors and actuators are not just linked to things, but also monitor health, location and activities of people and animals, monitor the state of the natural environment, the quality of food and much else that would not be considered a thing per se. In addition the IoT is not limited to just communications, but includes big data analysis, cloud computing and new sensors and actuators, that in combination could learn to run autonomous machines and intelligent systems. Here the term IoT is applied to the whole width and breadth, because it is more widely used than the alternatives. The IoT will be a major focus of the upcoming OECD Digital Economy Outlook 2015 (June 2015) and the full document will be available for IGF participants.

Main elements of the IoT

The IoT is not, of course, happening in isolation from other ICT developments. There are several developments in recent years that enable the IoT. Four main trends can be seen as underpinning the development of the IoT – big data, cloud, M2M communication and sensors (Figure 1). The combination of cloud computing and big data analytics leads to improved machine learning applications, operating at a new level of artificial intelligence. Combined, these also lead to additional developments in machine learning and remote control. In the case of remote control, human interaction is still needed, but the machine takes care of all the main operational functions and the human interaction is limited to very specific actions. The combination of remote controlled machines and systems, and machine learning will lead to autonomous machines and intelligent systems, including in particular robotic machines, such as autonomous vehicles.

Figure 1. Main enablers of the Internet of Things
**Autonomous machines and the IoT**

The IoT will affect remote controlled machines, machine learning and autonomous machines. Some of the main implications are related to employment and to the growth of autonomous machines. Furthermore, current regulations especially in transport assume human control of vehicles, which is not the case with remote controlled and autonomous vehicles. Therefore, there is little regulation that explicitly allows the use of remote controlled and autonomous machines and/or regulates their use.

While there are different views on the implications of technological change for employment, IoT promises to increase their scale and reach. Brynjolfsson and McAfee, for example, point to the introduction of mechanisation at the start of the 20th century, which led to an almost complete replacement of the use of horses in only two decades. In many ways, the world is today at the dawn of machine learning similar to where it was in 1994 with respect to the Internet. Practical commercial examples are now available, but much is still to be learned. Technology has moved quickly and the integration of low cost electronics, large scale processing power and ubiquitous networking has allowed new generations of autonomous and semi-autonomous machines.

Autonomous and remote controlled machines are currently mainly used in controlled environments but are going to be a major part of the IoT. Regulation in controlled environments mostly consists of adequate health and safety measures, which often translates by way of example into a switch that turns a robot off when an employee enters an area. This will change with the newest generation of autonomous machines where humans and machines will interact and co-operate. The legal context of these machines will as a result change, dramatically.

There are a number of countries and companies actively testing driverless cars on public roads. Google in the United States is a well-known example but every major automobile manufacturer has some prototype programme that deals with autonomous vehicles. For the near future companies are focussing on near-autonomous vehicles. The first applications are in driver assisted systems, some of which are already available, for example to allow autonomous driving in low speed traffic jam environments or to allow automatic parking. These applications will expand over time to allow automatic cruising on highways. Some automobile manufacturers, however, expect to bring their first near or fully autonomous vehicle on the market between 2017 and 2020.

The legality of the use of automated vehicles, be they airborne or on the road, is much more complex. Existing international treaties as well as national and local regulations were never written with autonomous or remote controlled vehicles in mind let alone connected to the Internet. International treaties that many, though not all, OECD countries are signatories to are the 1949 Geneva Convention on Road Traffic and the 1968 Vienna Convention on Road Traffic. These require a driver to be present. Some countries disagree on the definition of "driver" and on whether an automated function would fit the treaty definition.

In the United States, some states, for example California, Florida and Nevada have now enacted legislation that allows the use of autonomous vehicles. These laws do not resolve all legal issues surrounding the use of autonomous vehicles. However, they do explicitly recognise the existence of autonomous vehicles and authorise their use in the State. Some areas that will need attention are, according to the analysis of Stanford University, vehicle standards, general tort liability, insurance, data collection, transportation planning and environmental impact assessment.

The United Kingdom held a consultation in 2014, with a first trial to be conducted in 2015 in Greenwich. Its government said it will publish a Code of Practice in spring 2015 for those who want to test driverless vehicles on the roads of the United Kingdom. Officials said they want "a light touch/non-regulatory approach" to testing self-driving cars in order to get such automobiles on the road faster. "A Code of Practice will be quicker to establish, more flexible and less onerous for those wishing to engage in testing
than the regulatory approach being followed in other countries.” In the Netherlands the government has stated that it wants to become a test-bed for the use of autonomous vehicles and has approved the use of autonomous vehicles on the road. In Korea, however, despite research at national research institutes, the Road Traffic Act requires a driver to be present in the vehicle.

(Light) unmanned remote piloted aircraft systems (RPAS), also known as Unmanned Aerial Vehicles (UAV) or drones, are allowed in some OECD countries. One example comes from Japan, where remote controlled helicopters spray 40% of the rice crop. A roadmap for RPAS prepared for the European Commission mentions that currently the Czech Republic, France, Ireland, Italy, Sweden, Switzerland and the UK have national rules and regulations in place, and national regulations are being prepared in Belgium, Denmark, the Netherlands, Norway and Spain. In Korea, RPAS above 150 kilograms are forbidden, whereas for those under 150 kilograms are to file 18 documents seven days prior to a flight. Only RPAS under 12 kilograms are exempt from these rules. In the United States the FAA is working on regulations. However, at this moment commercial use of RPAS is restricted. Autonomous piloted aircraft systems are not yet in the roadmaps of regulators because the International Civil Aviation Authority is currently limiting itself to RPAS. RPAS are also used in many military applications and as a result are listed on the export control list of the Wassenaar Arrangement countries, to which many OECD countries adhere (category 9.A.12). This means that farmers in Australia cannot buy the remote controlled helicopters from Japan, but have to hire them as a service from the manufacturer, complete with a pilot.

Discussion at the IGF could further examine possible reform of regulation in this area. Evaluating issues associated with autonomous vehicles, requires a multi-disciplinary view, and could therefore benefit from an interactive discussion at the IGF. This IGF panel aims at exploring questions regarding:

- **Empowerment:** autonomous or semi-autonomous vehicles provide the potential for people to undertake transport goals that they may not otherwise be able to accomplish.
- **Privacy:** The capabilities for the collection of data through the use of in-vehicle or public cameras and sensors will increase, raising issues around privacy and surveillance.
- **Data as a public good:** the public and private data generated by vehicles can be of use for public safety, accountability of authorities or commercial provision in maintenance and investment in highways/roads and in better aligning insurance rates. Such data can also assist in the improvement of autonomous vehicles.
- **Public safety:** Aspects related to self-driving and flying vehicles
- **Competition:** Some suggest that the future may involve many hardware manufacturers but few software providers.
- **Employment:** Some jobs may be eliminated via self-driving vehicles such as with trucks or taxis while others may be created through greater use of transport.
- **Regulation:** Self-driving cars can now be tested in some countries, however fully autonomous vehicles on either the road or in the air are still illegal everywhere. Regulatory authorities will have to evaluate a large number of rules to see whether they still fit this new world.

As a result of this discussion it is expected that key players bring different perspectives on these issues, conveying what they consider to be the main barriers and recommendations regarding Internet governance and autonomous transport.