Digital Innovation and Efficiency Committee

Item No.

Report title:	**The Internet of Things and Associated Networks**
Date of meeting:	**11th July 2018**
Responsible Chief Officer:	**Executive Director, Finance and Commercial Services**
Strategic impact Networks of connected devices and associated systems provide new opportunities to achieve savings for the Council and improve outcomes in Norfolk.	

Executive summary

The Internet of Things (IOT) and associated networks, provides new opportunities for the Council to explore alternative ways of delivering services and achieving outcomes for the people of Norfolk.

These technologies present a significant opportunity to quickly trial new approaches and consider how they can transform the way services are delivered and achieve savings.

In addition, they present an opportunity for schools, colleges and universities to create, learn and experiment with the technology. Local small to medium enterprises and entrepreneurs will also be able to exploit the proposed Norwich based network in order to develop new solutions to old problems and thereby stimulate economic growth.

While researching this paper, an extensive soft market testing exercise was undertaken which involved many companies ranging from blue chip multinationals, such as Microsoft, IBM, Cisco, Amazon, Phillips and Huawei, through to local small to medium enterprises and local academia. Officers and members also attended several conferences and vendor events to ensure we are aware of all the latest technologies and use cases.

Recommendations:

1. **To approve the launch of the Norwich based LoRaWAN network in July 2018.**
2. **To approve the launch of a schools' competition in October 2018.**
3. **To approve the Hackathon proposals scheduled in October 2018.**
4. **To direct officers to develop and return to committee with specific business cases, to exploit sensors and networks in areas such as street lighting and social care.**

1. Background

1.1. The Internet of Things (IOT) refers to the concept of connecting a device (any device) with a sensor to the Internet to collect data to monitor, manage, control

or report. This includes everything from kettles, light bulbs, pollution monitors and flood warning sensors to almost anything else you can think of.

1.2. As Internet connectivity becomes more widely available, more connected devices are being created that have sensors built into them that use broadband, low-power wide area networks and mobile phone networks.

1.3. Smart doorbells, light bulbs, television controls, buttons, central heating controls, cameras and doorbells can already be purchased relatively cheaply by consumers: easily connected and controlled through home broadband, linked to products such as the Amazon Echo and Google Home, to enable voice capability and control.

2. Sensors

2.1. The function of a sensor is to collect information from the real world, then process it, send it over the internet or perform an action according to some rules.

Examples include:

- Detection if a kettle is turned on before 10am; if it is not, a member of a person's family is alerted to check on them.

- Highway sensors that dim or brighten lights, depending on detection of movement.

- Automatic opening of the correct compartment of a pill box to administer medications and detect if it has been taken.

- Tracking of herds of cattle, via a sensor that is swallowed, to reduce theft or detect illness.

- Detection if a bin is full and needs to be emptied, which notifies the bin collection service.

- Detection if parking spaces are all full and notifying traffic control systems to redirect traffic

2.2. In addition to consumer based technologies, sensors can also be designed, developed and tested by anyone using low cost computing devices such as Raspberry Pis or Arduinos (technology used in many schools), which enables rapid creation of sensors as they use simple connectivity of electronic components and can be programmed with some intelligence.

3. Associated Networks

3.1. Sensors send information to the internet or a specific destination, using a variety of networking technologies such as Bluetooth between devices, Wi-Fi often through home broadband, mobile phone networks using a mobile phone SIM card and through licenced or unlicensed low-power, long-range networks, such as LoRaWAN.

3.2. Broadband is ideal for sensors located in the home but would not be suitable for connection of sensors to be used outside over wide areas.

3.3. Mobile phone connectivity is good for outside sensors but not available

everywhere and requires payment per use.

3.4. LoRaWAN is a low-power, long-range network using mobile phone technology without the need for Wi-Fi or cellular (2G/3G/4G), designed to wirelessly connect battery operated 'things' to the internet.

3.5. We have chosen to deploy LoRaWAN as our trial network, over alternatives such as Sigfox because it is free to use and subscription free. Companies such as Microsoft are supporting innovation with the technology as are independent groups in Norwich and we can "try it" at very low cost.

3.6. Anyone can deploy a LoRaWAN gateway connected to the internet: they are relativity low cost and the range can extend 10km-15km outside; relatively small numbers of them could cover large areas.

3.7. This sort of connectivity is suitable for sensors that only need to send small amounts of data, perhaps only occasionally. This is also the type of network that the Council can deploy to rapidly test solutions and stimulate local educational institutions and companies.

4.   Service Transformation

4.1. The Internet of Things and associated networks, present a significant opportunity to trial new technology to understand how it could transform the way services are delivered and achieve savings, for example, it could be used to:

- Reduce electricity costs associated with street lighting, by dimming and brightening based on whether movement is detected by sensors.
- Detect if someone has fallen and then alert a family member or a trusted neighbour, via mobile phone text message.
- Detect if a person suffering from conditions such as dementia, has roamed outside a certain area and then alert a family member or carer.

4.2. It presents opportunities for schools, colleges and universities to create, learn and experiment with the technology.

4.3. It also presents opportunities for small to medium enterprises and entrepreneurs to identify new opportunities and develop new solutions.

5.   What are we doing?

5.1. We have been preparing to launch a LoRaWAN gateway on the Millennium Library in Norwich and another on County Hall; a third site is currently being identified. This will enable anyone to develop and use sensors with 'The Things Network' to rapidly prototype ideas and test if they work.

5.2. The 'Making It Real Group,' is a group made up of carers and people who use services, brought together to have a real say in the way services are shaped. We will be providing the group with a number of Amazon Echo Dots to experiment with, to see how they can help with everyday life and feedback examples of use.

5.3. We have provided the Assistive Technology Team (in Adults Social Care) with IoT buttons, which can be linked to other consumer technology, to experiment with how they can be used to help people stay living independently in their

homes longer.

5.4. We attended the Royal Norfolk Show in June 2018 to introduce 'The Things Network' and LoRaWAN as part of the Norfolk County Council stand, supported by Microsoft.

5.5. We propose launching Norfolk joining 'The Things Network' in July 2018, once the LoRaWAN gateway has been installed on the Millennium Library, announcing it is available for the use by SMEs, schools, colleges, universities, businesses and the public.

5.6. We propose the announcement of Norfolk's sponsorship of a schools' competition in October 2018. The Council would sponsor the competition, accessing its existing social value funding from large contracts by:

- Funding equipment for the competition.
- Setting competition challenges, e.g. monitoring air pollution in Norfolk.
- Providing the overall prize.

We propose to work with 'Step Into Tech,' a Norfolk social enterprise group that brings together parents, educators, employers and tech specialists, that have successfully run competitions previously.

5.7. We also propose to work in partnership with 'The Things Network' to conduct a Hackathon in October 2018, which sets a series of challenges for SMEs that benefit the people of Norfolk. These could include how can we use technology to:

- Monitor air pollution.
- Notify a trusted friend or neighbour if someone has fallen or is taken ill.
- Tackle dementia.
- Alert if a person's normal activities have not happened.
- Tackle loneliness and isolation.

6.   Evidence

6.1. We have researched numerous organisations which are demonstrating the 'art of the possible' using IoT devices and networks including the following.

6.2. The Dementia Buddy provides secure location finding for people living with dementia. Ensuring carers and emergency services can quickly locate lost individuals. The key fob sized device uses a city wide LoRaWAN network and a combination of technologies to send back, on authorised request, location data enabling the individual to be quickly found.

6.3. The Home Alone Guardian monitors home water usage to build a pattern of routine usage. Unusual water usage triggers a notification to registered family and friends, via email and text, to 'get in touch'. For example, excessive water usage may indicate illness or accident or just a leak, no water usage suggests the occupant may be incapacitated by illness or accident.

6.4. The Homecare Service Watchdog uses RFID cards to enable care givers to log their presence and delivery of service so that interested parties can be assured the service has been delivered and at an appropriate time. The recognised impact on urinary tract infections (UTI) in recipients of 'put to bed' services.

Recipients of the service typically stop drinking sometime before being put to bed, to avoid overnight bed wetting. When the put to bed service is delivered too early in the day, recipients of the service become dehydrated which can lead to a UTI. A UTI in the elderly is treated with a prolonged stay in hospital, at the end of which the individual may be determined by social services as unable to care for themselves, prematurely ending a person's independence simply because a home care service was poorly timed.

7.   Financial Implications

7.1.   The use of social value funding from the Council's existing Capita/Updata network contract and officer time, to develop, implement and organise.

8.   Issues, risks and innovation

8.1.   Significant innovation opportunities across all sectors, including Norfolk County Council's services.

8.2.   The future opportunity to extend the network to cover the whole county.

9.   Background

9.1.   The Things Network (TTN) https://www.thethingsnetwork.org/

9.2.   The Things Network is building a network for the Internet of Things by creating abundant data connectivity, so applications and businesses can flourish.

The technology used is called LoRaWAN and it allows 'things' to talk to the internet without cellular mobile or Wi-Fi networks.

It features low battery usage, long range and low bandwidth. No Wi-Fi codes and no mobile subscriptions.

9.3.   Digital Catapult

9.4.   Digital Catapult joins TTN for UK: https://thethingsnetwork.pr.co/166907-digital-catapult-joins-forces-with-the-things-network-expanding-uk-lorawan-coverage?reheat_cache=1

9.5.   LoRa Alliance(https://lora-alliance.org/):

9.6.   A non-profit worldwide association of more than 500 member companies, committed to enabling large scale deployment of Low Power Wide Area Networks (LPWAN) IoT through the development and promotion of the LoRaWAN open standard. Members benefit from a vibrant ecosystem of active contributors offering solutions, products & services, which create new and sustainable business opportunities.

9.7.   Google

9.8.   Google has joined the LoRa Alliance: https://lora-alliance.org/in-the-news/lora-alliancetm-announces-google-cloud-joins-sponsor-member

9.9.   Step Into Tech (http://stepintotech.org/)

9.10. Step Into Tech is a social enterprise founded to make sure we are doing all we can to help all our children reach their full tech potential. The group brings together parents, educators, employers and tech specialists.

Officer Contact

If you have any questions about matters contained in this paper or want to see copies of any assessments, eg equality impact assessment, please get in touch with:

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