ATIS TOPS Council
IoT Categorization Focus Group

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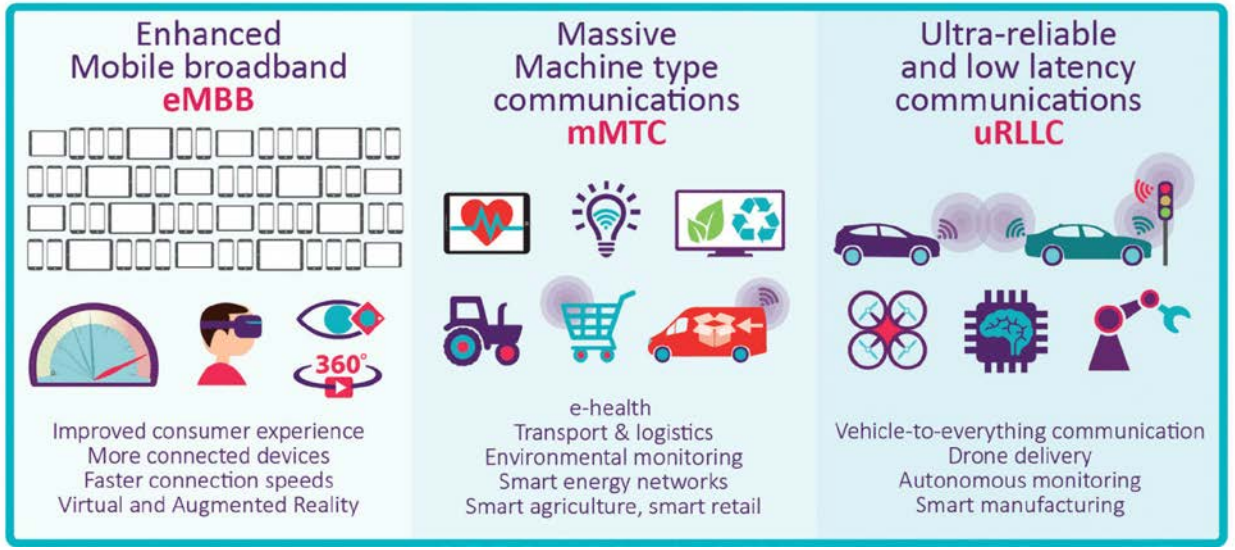
Advancing ICT Industry Transformation

Background

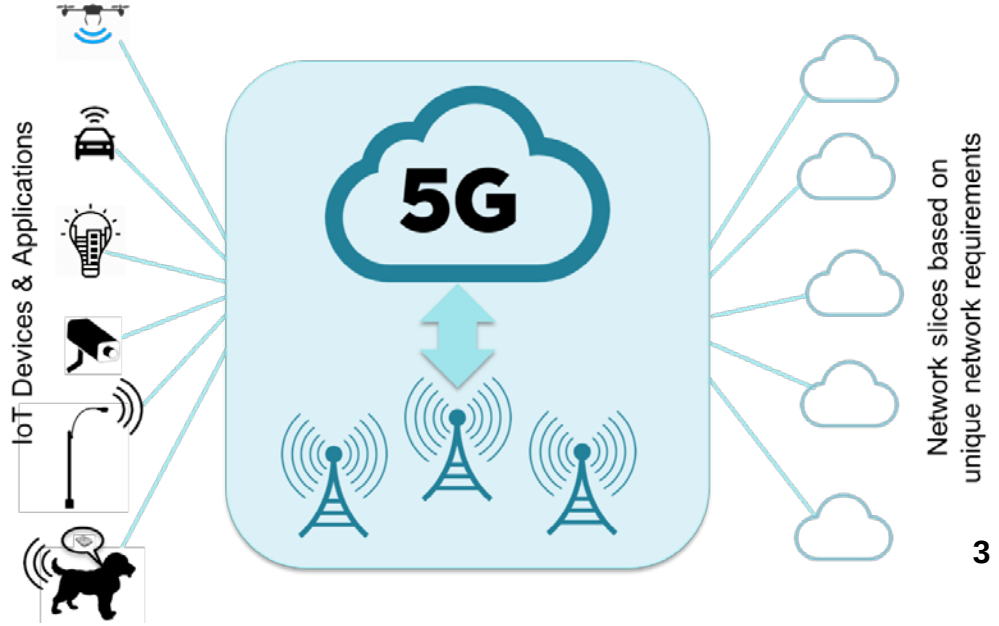
- Launched in November 2017, the IoT Categorization Focus Group was tasked with identifying a way to embrace and “organize” a view of the IoT market that would enable the identification of network requirements as a “platform for IoT,” including the development of network connectivity features
- Existing IoT initiatives take an application-centric approach, often from perspective of a single application or industry vertical.
- IoT Categorization initiative is examining IoT from a *network-centric* perspective to determine an effective way to categorize IoT into a small number of meaningful categories:
  - Based on device types, applications, services, or a combination of these
  - Business, technology and regulatory implications
- Use categories as basis to identify specific network capabilities, enhancements and requirements to support a robust IoT network platform.

Objectives

- Initial standards define only three *slice types:*
  - Ultra-reliable low-latency communications (uRRLC)
  - Massive machine-type communications (mMTC)
  - Enhanced mobile broadband (eMBB)
- Objective:
  - Define other potential slices for standardization
  - Identify areas of commonality amongst slices that will guarantee the same service characteristics across operators keeping service quality consistent for a given IoT device used across different operators



" Enabling 5G in the UK", Ofcom



Applications and Devices Matrix

Device characteristics defined as basis for analysis

Sample snapshot from the Applications & Devices Matrix

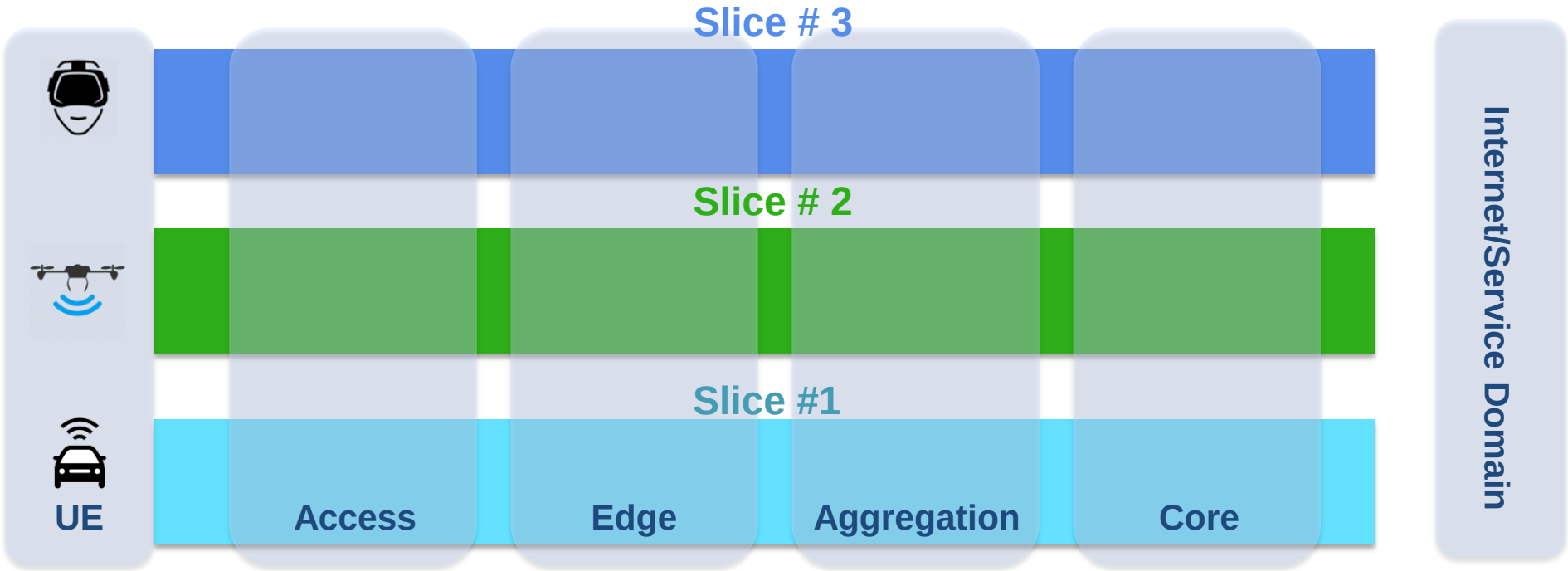
Major IoT Application groups identified and decomposed into further use cases along with the devices used

Application Group	Applications	Description	Devices	Device Characteristics										
				E2E Latency	Jitter	Data Rate	Availability	Criticality	Communication Direction	Common Communication Mode	Data reporting mode	Mobility (type/speed)	Service Continuity	Device Autonomy: Power Constrained
Unmanned Aerial Vehicles (UAV)	Command and Control	Command and Control (C&C) commands are sent on regular intervals from the ground station to the UAVs, This includes telemetry, waypoint update for autonomous UAV operation, real time piloting, identity, flight authorization, navigation database update, etc.	Drones equipped with mobile communication link for C&C between the vehicle and a ground control station	Moderate	Sensitive	Very Low	High	Mission critical and safety critical for UAV operation.	Two-way	Unicast	Continuous-Based	High speed vehicular	Required	Yes
	Surveillance and monitoring	Surveillance UAV's are used by many government organisations, such as police forces, environment agencies (for detection and management of natural events and threats) and border agencies (to detect smuggling and illegal immigrants). UA may be used to monitor and patrol a property boundary, either looking for breaches or investigating breaches detected by other alarms. They can also detect, and give early warning of, fires, floods, traffic accidents, oil spills and other incidents. Key benefits of using a UAV for surveillance are the ability to rapidly deploy and provide a "bird's eye" view of an area otherwise difficult to reach, along with the UAV's ability to follow a moving object on the ground.	Depending on the application, different types of cameras are used for surveillance. Visual cameras are used for capturing images during daylight, while a thermal camera may be used for night vision, seeing through smoke or fog, vegetation monitoring, fire and heat detection using infrared patterns, etc. Data may be streamed directly from the UAV via a secure communications channel to a remote central location.	Moderate	Sensitive	Low	Low	Mission critical and safety critical	Two-way	Unicast	Continuous-Based	High speed vehicular	Required	Yes
	Inspections and surveys	Many industries need to inspect assets that are remote or difficult to reach using a vehicle or are inaccessible because of safety hazards. This may be because they are tall structures, stretch over long distances with no parallel roads or both. Examples of infrastructure that can be inspected using UAV's include: Wind turbines,Power station chimneys and cooling towers, Transmitter sites (for TV broadcast and mobile networks), Transport infrastructure (e.g. bridges and viaducts), Land mapping (e.g. agricultural fields, quarries)	UAV generally carries a video camera and other sensors such as laser scanner, GPS, gyroscope,accelerometer, and barometer. Streaming the video and other sensor data to a remote location for instant storage, verification and analysis allows the survey team to gauge whether additional data needs to be collected.	Best effort	Sensitive	Low	Low	Mission critical	Two-way	Unicast	Continuous-Based	Pedestrian to low Vehicular. Location of devices above ground level needs to be considered.	Required	Yes
	Goods delivery	These use cases exploits an UAV's ability to travel quickly and easily between two points without being hindered, in general, by obstacles on the ground, except in no-fly zones. UAV can carry a cargo or payload between these two points for delivery. Can also be used in agriculture for crop planting and spraying, where the "delivery" is over a large area that is otherwise difficult to reach.		High	Not Sensitive	Low	Medium	Mission critical	Two-way	Unicast	Continuous-Based	Pedestrian to Vehicular. Location of devices above ground level needs to be considered.	Required	Yes
	Emergency/Disaster Response/Search and Rescue	Natural disasters, such as storms, heavy snow, floods, earthquakes, tsunamis and volcanic eruptions, can make land routes and waterways temporarily inaccessible by terrestrial or marine means. Such events might also interrupt the communication infrastructure, leaving the affected area isolated. UAV's can be deployed to collect real-time data about the scale of the damage caused by the disastrous event and relay information about the disaster zone in real time to the disaster coordination base. Having prompt and correct information helps first responder agencies to distribute aid suppliers effectively and to the places most in need.	If a speaker has been installed in the UAV, voice messages from the disaster coordination base can be delivered to disaster victims via the cellular network, while the voice of victims can be picked up using the microphone mounted on the UA, and relayed back to the disaster coordination base.	Moderate	Sensitive	Low	Medium	Mission critical and safety critical	Two-way					
	Communications and Media	Use cases in this category exploit a UAV's ability to oversee large areas from above and to dynamically manoeuvre in response to events. In some high-risk use cases, the expendability of a UAV can also be an important factor. UAV also used by movie and documentary makers to film sequences more cost effectively, and by broadcasters to cover news events. Ideally, the UAV will live stream the data or video it captures, particularly if the survival of the UAV itself is in doubt.		Moderate	Sensitive	Low	Best Effort	Mission critical.	Two-					Yes

Identify "categories" with unique network requirements

Using Classification to Define Network Slices

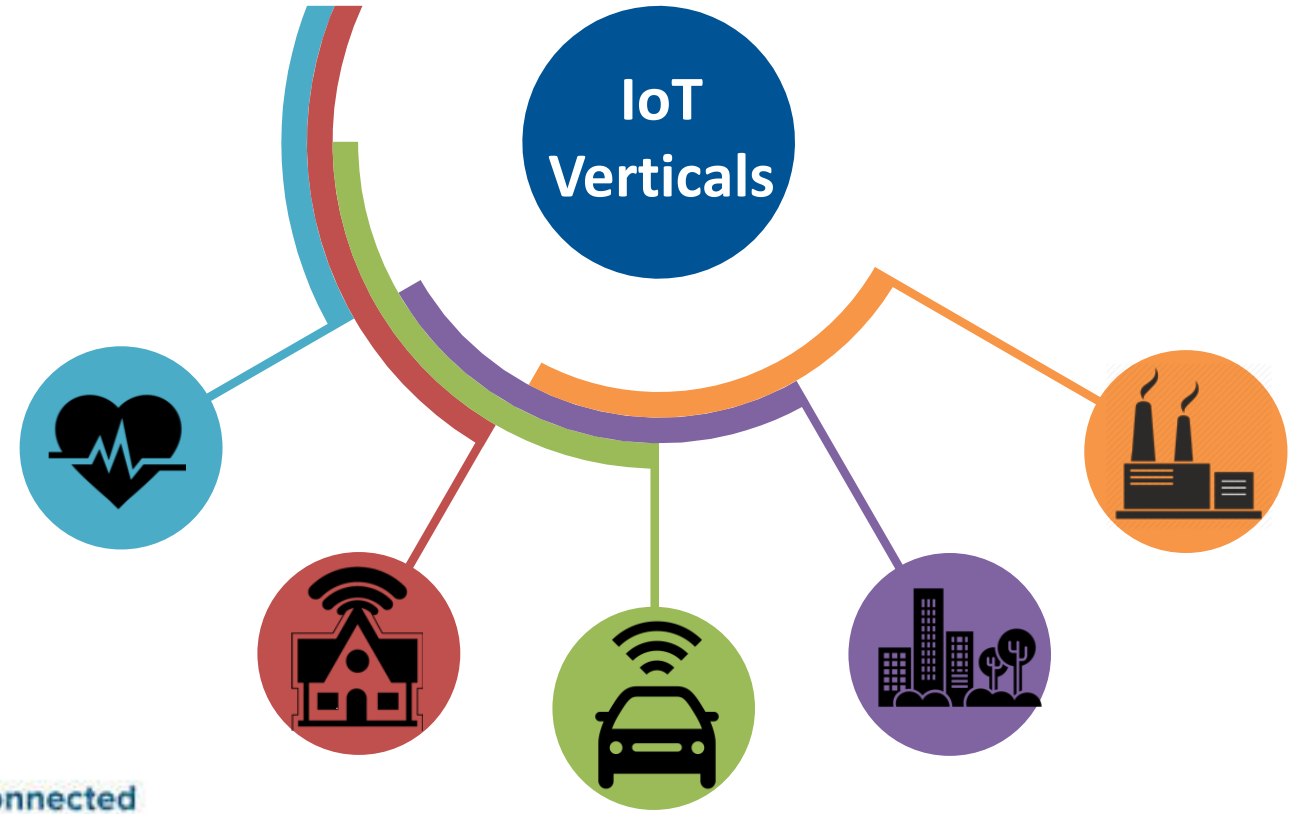
Use categories to define network slice based on unique network requirements



Functions such as speed, capacity, connectivity and coverage will be allocated to meet the particular demands of each category

Outreach to Industry Verticals

- An important step in the characterization analysis is to validate requirements from key vertical markets targeted by 5G networks.
- Outreach planned to vertical industry groups as characteristics are identified for the different network slices.



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