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
### Applications and Devices Matrix

Sample snapshot from the Applications & Devices Matrix

<table>
<thead>
<tr>
<th>Application Group</th>
<th>Applications</th>
<th>Description</th>
<th>Devices</th>
<th>Device Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command and Control</td>
<td>Command and Control (C&amp;C)</td>
<td>C&amp;C commands are sent as regular intervals from the ground station to the UAV. This includes telemetry, waypoint updates, etc. for autonomous UAV operations, route planning, identification, flight planning, flight authorisation, navigation database update, etc.</td>
<td>Moderate</td>
<td>Sensitive</td>
</tr>
<tr>
<td>Surveillance and monitoring</td>
<td>Surveillance UAVs</td>
<td>UAVs are used by many government organisations, such as police forces, environmental agencies (for detection and management of natural disasters) and defence agencies (for border monitoring and illegal immigration). UAVs may be used to monitor and patrol property boundaries, either looking for breaches or investigating breaches detected by other systems. They can also detect, and give early warning of, fires, floods, traffic accidents, oil spills and other accidents. Key benefits of using a UAV for surveillance are the ability to rapidly deploy and provide a &quot;breadth&quot; view of an area otherwise difficult to reach. 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 transmitted to the ground station via secure communications channel to a remote central location.</td>
<td>Moderate</td>
<td>Sensitive</td>
</tr>
<tr>
<td>Inspections and surveys</td>
<td>Inspections and surveys</td>
<td>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 in both directions of the structure that can be inspected using UAV's include: Wind turbines, power station chimneys and cooling towers, Transmission towers (for TV broadcast and mobile networks), Transport infrastructure (e.g. bridges and viaducts), Land mapping (e.g. agricultural fields, quarries)</td>
<td>Best effort</td>
<td>Sensitive</td>
</tr>
<tr>
<td>Goods delivery</td>
<td>Goods delivery</td>
<td>These use cases exploit an UAV's ability to travel quickly and easily between two points without being hindered, in general, based on obstacles. Some examples of infrastructure that can be inspected using UAV's include: Wind turbines, power station chimneys and cooling towers, Transmission towers (for TV broadcast and mobile networks), Transport infrastructure (e.g. bridges and viaducts), Land mapping (e.g. agricultural fields, quarries)</td>
<td>High</td>
<td>Not Sensitive</td>
</tr>
<tr>
<td>Emergency/Disaster Response/Search and Rescue</td>
<td>Emergency/Disaster</td>
<td>Emergency/Disaster Response and Search and Rescue</td>
<td>Moderate</td>
<td>Sensitive</td>
</tr>
<tr>
<td>Communications and Media</td>
<td>Communications and Media</td>
<td>Live cases in this category exploit a UAV's ability to overcome large areas above or below to its dynamically maneuver in response to events. In some high-risk use cases, the responsibility of a UAV can also be an important factor. UAVs also be used by rescue and documentary makers to film sequences more cost-effectively, and by broadcasters to cover news events. Ideally, the UAV will live stream the video or data it captures, particularly if the survival of the UAV itself is in doubt.</td>
<td>Moderate</td>
<td>Sensitive</td>
</tr>
</tbody>
</table>

**Device characteristics defined as basis for analysis**

- **Mode**: Data reporting mode
- **Direction**: Communication direction
- **Data rate**: Jitter
- **Availability**: Data reporting mode
- **Criticality**: Communication mode
- **Mobility**: Mobility type
- **Service continuity**: Service continuity
- **Device autonomy**: Power constrained

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

- **Unmanned Aerial Vehicles (UAV)**
- **Response/Search and Rescue**
- **Surveillance and monitoring**
- **Command and Control**
- **Inspections and surveys**
- **Goods delivery**
- **Emergency/Disaster Response/Search and Rescue**
- **Communications and Media**

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.