Premeeting on Ambient power-enabled IoT

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Outline

Definition of Ambient IoT

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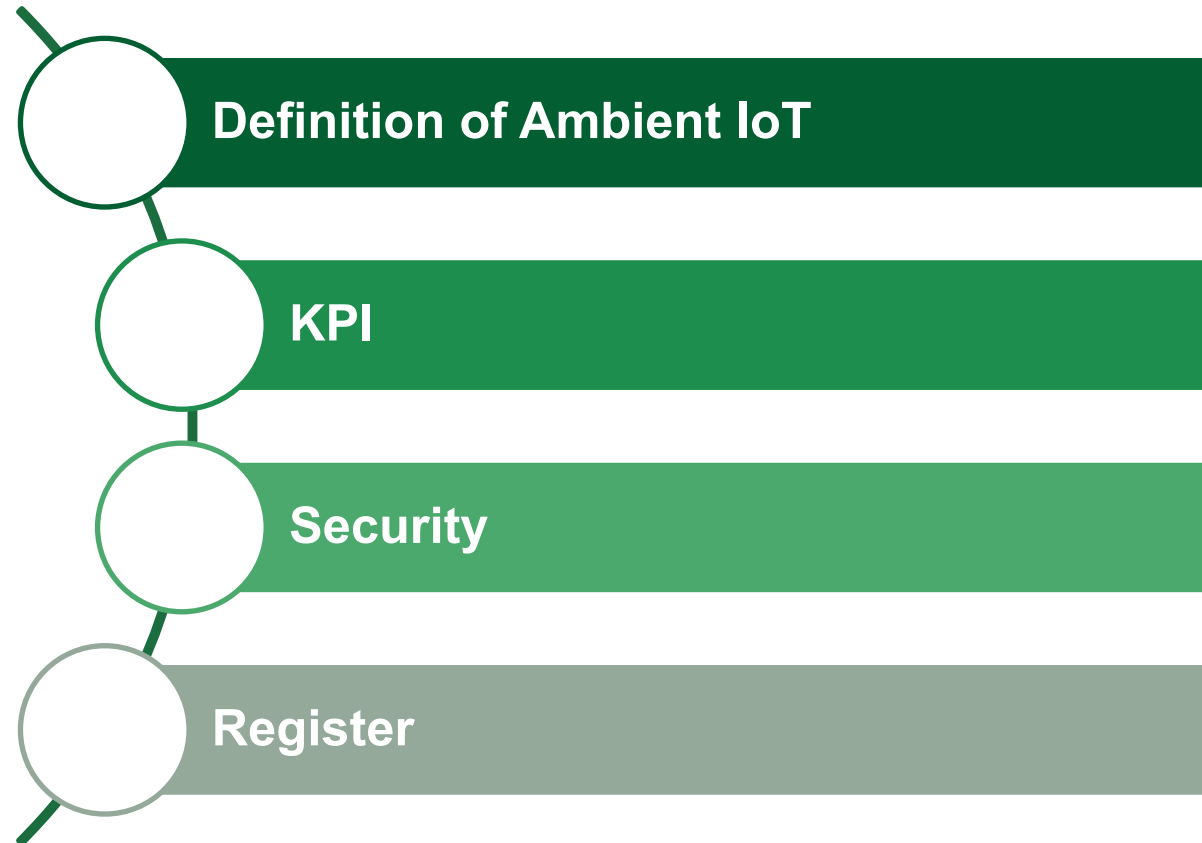
❑Definition of ambient IoT

During the discussion on the scope in SA1#98, there has been proposal but not approved:

Ambient power-enabled Internet of Things (Ambient power-enabled IoT) device is an IoT device powered by energy harvesting, being either battery-less or with limited energy storage capability (i.e., using a capacitor). Ambient IoT device is with low complexity, small size, maintenance free and long life span.

 Editor's note：The maximum instantaneous power consumption of Ambient power-enabled IoT device is FFS.

❑ **The following can be taken into account for the definition**

- **Energy harvesting, battery-less or not using conventional battery**

- **Low complexity, small size**

- **Maintenance free**

- **(ultra-) low power consumption or constraint in power consumption**

- **Be able to adapt to non-stable and small amount of harvested power**

- **Meet the unmet service requirement with existing 3GPP IoT devices (e.g.,)**

- **Lower capability than existing 3GPP IoT devices, e.g., NB-IoT**

- **USIM-free**

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Examples of definitions

IoT device: a type of UE which is dedicated for a set of specific use cases or services and which is allowed to make use of certain features restricted to this type of UEs.

NOTE 5: An IoT device may be optimized for the specific needs of services and application being executed (e.g. smart home/city, smart utilities, e-Health and smart wearables). Some IoT devices are not intended for human type communications.

❑Which KPIs are needed？

The following KPIs can be considered:

- Communication Service Availability/Ambient IoT service availability
- Max. allowed end-to-end latency/Ambient IoT service latency
- Ambient IoT positioning availability
- Max. instantaneous device power consumption
- Service bit rate: user-experienced data rate
- Message Size
- Communication range
- Device density
- Devices per base station
- Service area dimension
- Horizontal Positioning Accuracy
- Inventory rate
- Moving speed/Velocity

☐ **Example KPI table**

| Scenario	Max. allowed end-to-end latency	Max. instantaneous device power consumption	Service bit rate: user-experienced data rate	Message Size	Device density	Communication Range (meters)	Service area dimension
Remote monitoring of transmission and distribution networks in smart grids	[1 s]	[500] µW (note 4)	[< 1kbit/s]	Typically [< 100 bytes] (note 1)	[< 10,000 /km^2] (note 3)	Outdoor: [> 50]	[several km^2 up to 100 000 km^2] (note 2)
NOTE 1: Electronic Product Code standard [5], this size is the payload size. NOTE 2: The service are refers to the overall size of transmission and distribution networks. Typically, the size of the individual substations varies from 100m x 200m to 500m x 600m. NOTE 3: The device density is calculated based on an individual substation, where typically several hundreds of Ambient IoT devices are required to monitor the environmental parameters. NOTE 4: The power consumption takes into account of the power needed for communication and sensor functions.							

Security

- How to specify the security aspects, e.g., authentication, authorization, integrity protection? The impacts from different stakeholder models?
- In order to resolve the potential uplink and downlink threat, the following may be needed.
  - **Authentication**: e.g., The 5G system shall support the security mechanism to enable the Ambient IoT device to authenticate the information collection request sent by network/UE and enable the network to authenticate Ambient IoT devices

  - **Authorization** : e.g., The 5G system shall support requesting an information collection from a specific Ambient IoT device while avoiding other irrelevant Ambient IoT devices to be exposed.

  - Trust mode: 3rd party credential?

- Will the device have legacy USIM?
  - Light weight security: where to store the credential and how to perform key deviation?
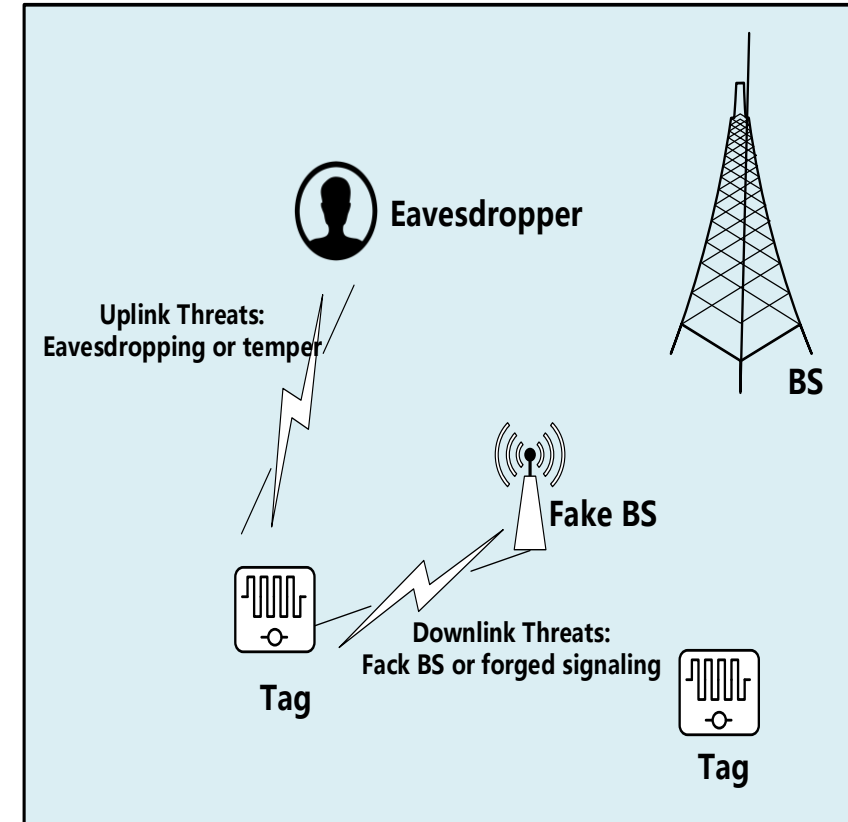
Register

- Whether and How the device do register to the network?

The harvested power is unstable, the reachability can't be guaranteed. It is hardly to perform location updating.

- Purpose of the register---aware of the existence/activation/deactivation of the device