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Views on Rel-19 Ambient IoT

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Ambient IoT technology is important for verticals

- Digitalization capability is important to achieve efficient management for the end-to-end ecosystem. The vertical demands of timeliness, stability, low cost, productivity and value-added services have become critical.

- Ambient IoT would be a key enabler of E2E digitalization (from manufacturing to end consumer), which should provide:
  - ✓ Continuous coverage in desired area for verticals
  - ✓ Ultra-low cost and energy consumption devices, easy to be equipped (in small form-factor), and no need maintenance
  - ✓ Connectivity and others such as inventory, sensor, positioning etc.

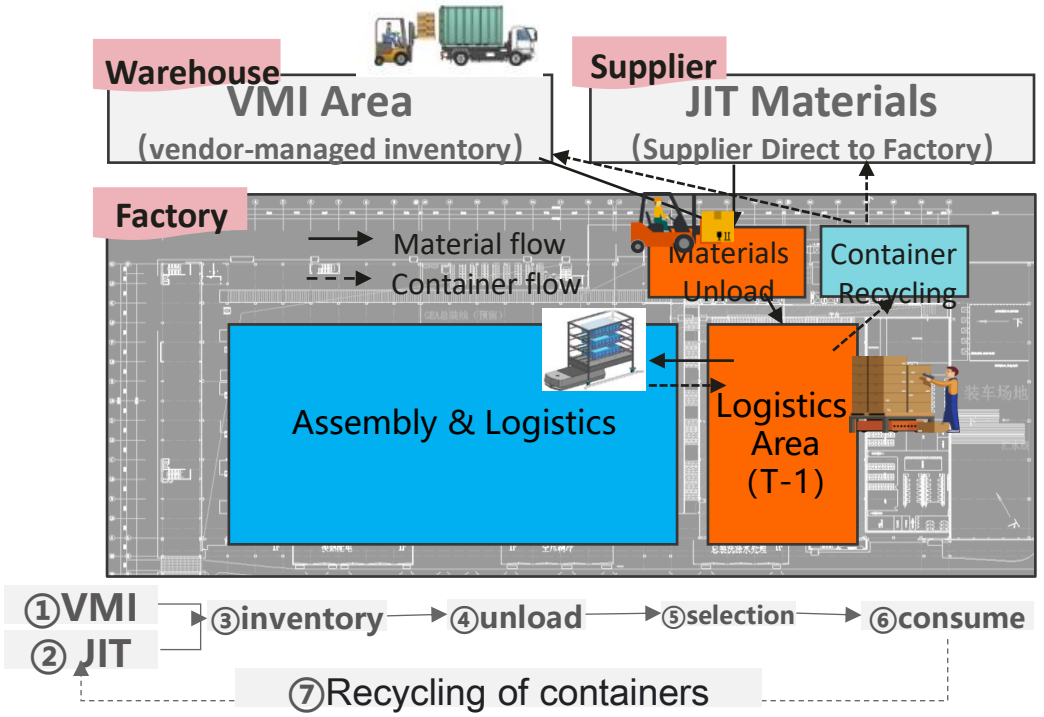
Use Case 1: Smart Clothing Management

- Smart home appliances are upgraded to provide intelligent functions. Ambient IoT technology can be combined with those smart home appliance application to further improving user experience, and achieve customized services.
- IoC（Internet of Clothing）ecology is the whole process ecology around giving users digital management solution for clothing. In the era of smart home, clothes washing, laundry care and wear management become more attractive.
- **Challenges:**
  - End users may not have a scientific enough approach for daily care of their clothes, especially for clothes made of special fabrics. It is desirable to select proper laundry procedure to different clothes autonomously, as well as detergent and care cycles. In addition, using mismatched washing procedure can easily cause damage to clothing. When there are many clothes, stacking them in different wardrobes can be difficult to find. This scenarios could be happen in every family in the daily handling of clothing.

- **Expected solutions:**
  1. Tags: Low-cost (a few to tens of cents), imperceptible to users.
  2. Communication channel: Cost-effective and wide-reaching.
  3. Positioning accuracy: Precisely locatable even within a wardrobe.

Use Case 2: Production material whole-process visible in the factory

- One factory produces 12,000 washing machines in more than 100 different types per day. Production materials turnover 1,450,000 times per day in the 9,000㎡ factory.
- **Challenges:** low efficiency of manual scanning, unknown location of stacked materials between manual scanning points, inability to detect if they are present in right place



- **Expected solutions:**

1. Ensuring the network coverage in a factory with lots of metal equipment;
2. High density, 3000+ level labels within 100 meters;
3. Parts positioning in the factory, positioning accuracy meter level;
4. Material tracking: continuous coverage of 100-meter network;
5. Inventory success rate: > 99.99%;
6. Equipment inventory: service life guaranteed 10 years.

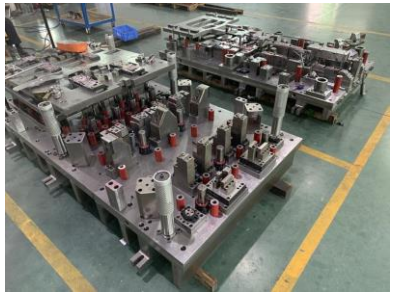
Proposal: It is recommended for 3GPP to have normative work (WI) on Ambient IoT in Rel-19 timely e.g. focus on factory use case

Use Case 3: Mold Management

- A company has many different kinds of molds, which are very important production tools. Molds need to be transported between factories and have a significant effect on the quality of product. So effective digital management tools are needed.

- **Challenges:**
  1. The signal of existing solutions is unstable and easily blocked by factory buildings and equipment.
  2. The power consumption increases due to the signal instability, which increases the manual maintenance cost in the later period
  3. The positioning accuracy and signal can not meet the demand of mold transportation between factories.

- **Expected solutions:** .
  1. The technology can ensure penetration and communication distance, which up to tens of meters or more in the plant and hundreds of meters or more outside the plant.
  2. The positioning accuracy of communication solution can reach the meter level at least in the plant
  3. Passive communication solution to meet the power consumption requirements of data collection and reporting for more than 10 years
  4. Large-scale and high-concurrency communication in the region



Use Case 4: Smart city

Internet of Things (IoT) technology plays a crucial role in constructing smart cities by connecting various devices and systems within the city. This facilitates functions such as urban governance, environmental monitoring, and city emergency responses, ultimately enhancing sustainable urban development and residents‘ quality of life. Ambient IoT is particularly significant in numerous outdoor scenarios, especially in situations affecting life safety, such as gas pipeline supervision, urban water supply and drainage monitoring, bridge surveillance, reservoir water level detection, and forest fire prevention. These scenarios involve outdoor, complex environments, high power replacement difficulty, and low fault tolerance, however, relevant scenarios encounter the following challenges when using existing technical equipment, we expect solutions can be come up with solutions for smart city scenarios.

Challenges and Issues:

1. Unstable signals, leading to easy packet loss in device communication, with high demands for device antenna selection.
2. Poor deep coverage, resulting in accelerated device battery consumption, especially under elevated bridges and within city manholes.
3. Low data concurrency capabilities, contributing to a low success rate for online device upgrades.

Expected Solutions:

1. Enhance signal coverage strength and module reception sensitivity, optimizing communication mechanisms to achieve reliable signal transmission.
2. Achieve not only deep coverage but also ensure good signal quality at shallow depths, such as half a meter inside covered manholes, while simultaneously improving technical indicators at a low cost.
3. Improve network data concurrency capabilities to support successful concurrent upgrades for thousands of devices.