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**pCR Title: Pseudo-CR on Use Case on AI-driven Smart Factory with Computing Service**

**Draft Spec: 3GPP TR 22.870v0.3.1**

**Agenda item: 8.1.3**

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*Abstract: This pCR introduces a new use case on AI-driven smart factory with computing service.*

**1. Introduction**

The convergence of cyber-physical system in industry 4.0 demans intelligence, connectivity, and computational capabilities. This use case demonstrates how computing service and AI transform smart factories into self-optimizing ecoysystems.

**2. Reason for Change**

Introducing a new use case on AI-driven smart factory with computing service.

**3. Conclusions**

<Conclusion part (optional)>

**4. Proposal**

It is proposed to agree the following changes to 3GPP TR 22.870v0.3.1.

\* \* \* First Change \* \* \* \*(all new text)

## 6.X Use case on AI-driven Smart Factory with Computing Service

### 6.X.1 Description

In smart factory, equipment, such as Automated Guided Vehicles (AGVs), IoT sensors, industrial cameras and industrial robots, generates massive real-time data but suffers from severely limited on-device computing resource and computing capability.

The deep integration of computing service in AI-driven smart factories drives the paradigm-shifting operational improvements: zero-downtime production becomes achievable through edge-based anomaly detection, sustainable manufacturing in enabled via smart scheduling, and agile innovation accelerates the product line deployment.

Computing service is required due to the needs of low-latency inference for defect detection, heavy training for digital twin simulations, and edge-cloud collaborative training for predictively maintenance analytics. Collaborative AGV obstacle avoidance and anomaly monitoring require extreme End-to-End latency and there is unattainable for complex AI inference on local devices due to the limitation on devices. Besides, computing service could help with the data-intensive workloads in the factory with energy efficiency extending the battery life of those devices.

In order to protect the data security and data privacy,

This use case leverages the 6G computing service to enable intelligence and efficient AI-driven smart factory, where computing service helps with real-time perception, decision making, and evolution.

### 6.X.2 Pre-conditions

The factory is equipped with devices that can connect to the 6G system. There are industrial robots manufacturing the products. There are AGVs carrying the products to the next production line. There are sensors monitoring the temperature, humidity, and vibration, etc.

There is a service hosting environment AA near the factory that has pre-trained lightweight AI models deployed and some computing resource, which could support anomaly detection fulfilling the low latency requirement of the factory.

There is a service hosting environment BB that is far from the factory and has adequate computing resource for AI training and inference for predictively maintenance analytics and new production line design.

AI models for predictively maintenance and new production line design are splitted and stored in service hosting environment AA and BB.

### 6.X.3 Service Flows

1. Due to the limitation of the vibration sensors and cameras, they offload the computation task for anomaly detection to the 6G network. The 6G network evaluates that the latency requirement could be fulfilled when the task is offloaded to the service hosting environment AA.
2. The data from vibration sensors and cameras are transferred to the service hosting environment AA. Utilizing the AI models within AA, the faulty within the production line and safety within the factory are monitoring.
3. When it detects an anomaly, the network sends an alarm to the instructor’s UE so that the anomaly could be checked and fixed.
4. The smart factory would also like to monitor the manufacturing and predict the potential maintenance analytics with AI models. The smart factory would like to maintain the data security and privacy of its own manufacturing data. So that, the 6G network firstly offloads the task firstly to the service hosting environment AA for data cleansing and partial model training, then transfer the intermediate result to the service hosting environment BB for predictively maintenance analytics.

### 6.X.4 Post-conditions

Faulty and anomaly within the smart factory could be detected in time even though there is no human monitoring the production lines.

Based on the predictive maintenance analytics, maintenance could be carried out when necessary and shorten the downtime of the production lines.

### 6.X.5 Existing features partly or fully covering the use case functionality

There are requirements in TS 22.261[14] clause 6.5 on efficient user plane to meet localization requirement like low latency, low bandwidth pressure, and improve the user experience. Those requirements do not take the computing resource into consideration, and there is a lack of requirements to support data transferring between multiple service hosting environment endpoints.

There are requirements in TS 22.261[14] clause 6.40 on AI/ML model transfer in 5GS supporting AI/ML operation splitting between AI/ML endpoints, AI/ML model/data distribution and sharing over 5GS, and Distributed/Federated Learning over 5GS. It is supported to offload the computation-intensive, energy-intensive parts to the network endpoints, whereas leave the privacy-sensitive and delay-sensitive parts at the end device.

### 6.X.6 Potential New Requirements needed to support the use case

 [PR 6.X.6-1] Subject to operator policy and regulatory requirement, the 6G network shall be able to support the selection of multiple Service Hosting Environments for a computation task.

[PR 6.X.6-2] Subject to operator policy and regulatory requirement, the 6G network shall be able to support the coordination of multiple Service Hosting Environments for a computation task to train a distributed AI model in different Service Hosting Environments.

[PR 6.X.6-3] Subject to operator policy and regulatory requirement, the 6G network shall be able to support the distribution of AI models in Service Hosting Environments.

\* \* \* End of Change \* \* \*