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Problem statements and requirements of Deterministic CATS on the Industrial Internet

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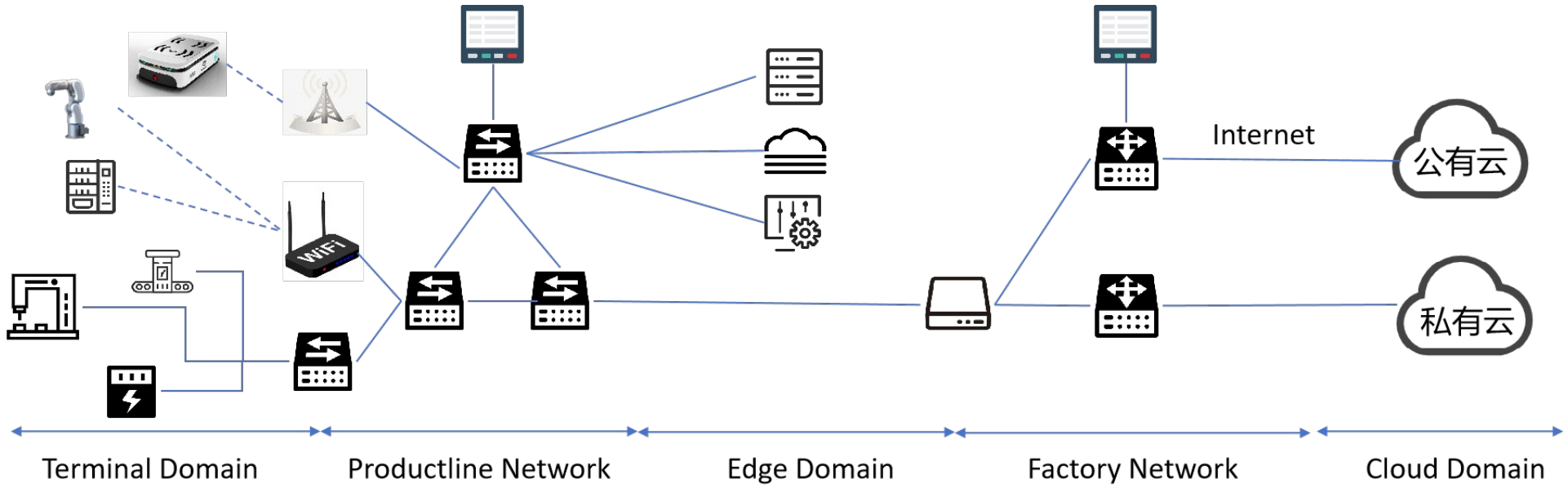
2024.7

CATS and Industrial Internet

The Industrial Internet is a new infrastructure, application mode and industrial ecology with the deep integration among the new information technology, communication technology and the industrial economy.



Industrial production tasks are time-sensitive, which put forward high requirements on networks and applications, and need to meet the deterministic requirements interms of delay, jitter, reliability, etc.

Problem Statement of Industrial CATS

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Industrial production service

Application services are dynamically adapted to industrial scenarios, tasks, and resources. The computation that devices participate in evolves from simple control logic to complex big data decision-making.In the application layer of industrial Internet,deterministic service is the combination of network communication process and calculation process. It refers to a closed loop formed by one or more application communication links and control links.

Deterministic Industrial Production Service

In order to satisfy the requirements of time-sensitive industrial production services, it is necessary to realize the deterministic management of computing power and network resources based on CATS. The concurrent processing of multiple services must ensure the strict requirements of delay, jitter, sequence, and reliability.

Deterministic CATS

Deterministic CATS is adjusting network forwarding configurations according to the computing requirements.
The traditional network can only control the round-trip transmission process. If the edge side blocks the task due to multiple services, the processing delay of the computing processes will increase.Deterministic CATS manages both the communication process and the calculation process, accurately ensuring the indicators of the entire visual inspection process from the perspective of an industrial activity.

Use Cases-Computing-Aware Industrial robots

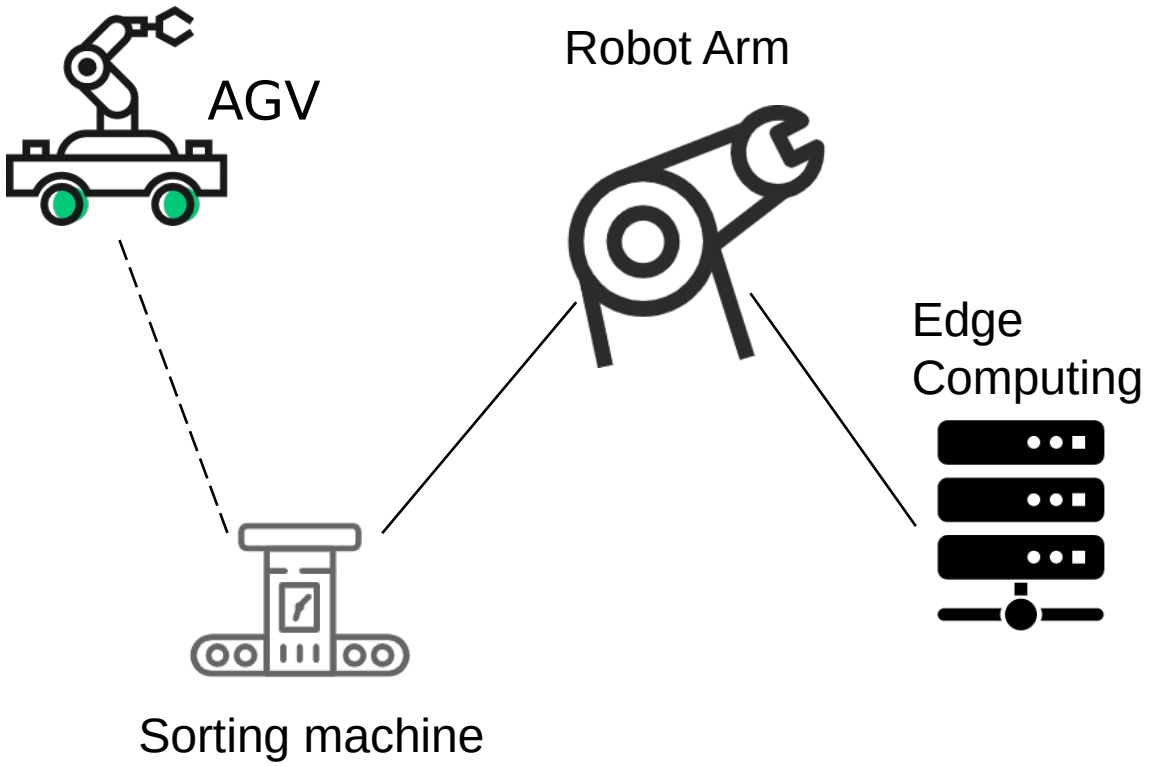
- The automatic manufacturing of soft materials has always been a difficult problem in industrial digitization. For the sake of unpredictable deformation of materials, it brings difficulties to the traditional equipments, unless it can recognize real-time states of the deformation for producets.Furthermore, productlines need to accurately perform operations and correct the negative effects of the deformation.
- The execution of complex assembly tasks in intelligent manufacturing requires the cooperation of multiple robots.
- The total time is mainly limited by the recognition accuracy and recognition delay.
- If the computing power resources are enabled through edge computing, and the certainty of network edge communication, self-learning and image recognition is ensured through application-oriented deterministic control, the processing complexity, folding speed and accuracy of flexible objects can be further improved.
- With the continuous optimization of intelligent algorithms, the tightness of operations can be further enhanced to achieve progress from substitution to transcendence.

Use Cases-Computing-Aware vCloud terminial

- Cloud services are control functions migrated from physical devices to Industril cloud, datacenter or edge, dramatically reducing production line costs. Traditional networks do not have the capability of application-oriented certainty assurance, usually directly by the engineer to estimate the processing and calculation time, subtract the estimated time with the control cycle, and finally determine the network certainty requirements, and the calculation part of the certainty is actually inaccurate or overreserved estimates. It will cause a waste of network or computing resources. The deterministic requirements of network cooperation are proposed to reflect the exact requirements from end to end at the application level, so as to realize the deterministic remote closed-loop control between control and execution. Meet the application's high performance requirements such as communication delay, bandwidth, and cloud computing power. Typical scenarios for cloud X services include on-site production line equipment control, robot control, automatic guided vehicle control, 5G PLC, etc. It has the characteristics of multi_x0002_network integration, broadening the acquisition channel, industrial equipment reusability, and improving the robustness of production network. PLC logic control has a fixed control cycle, assuming that the application needs to complete an IO data reading, processing and writing operations within a 10ms cycle. Motion control is a precision control business involving robots, servo motors and other equipment, which requires high deterministic capability of delay and jitter, with end-to-end delay to be controlled within 10ms and jitter less than 100us.

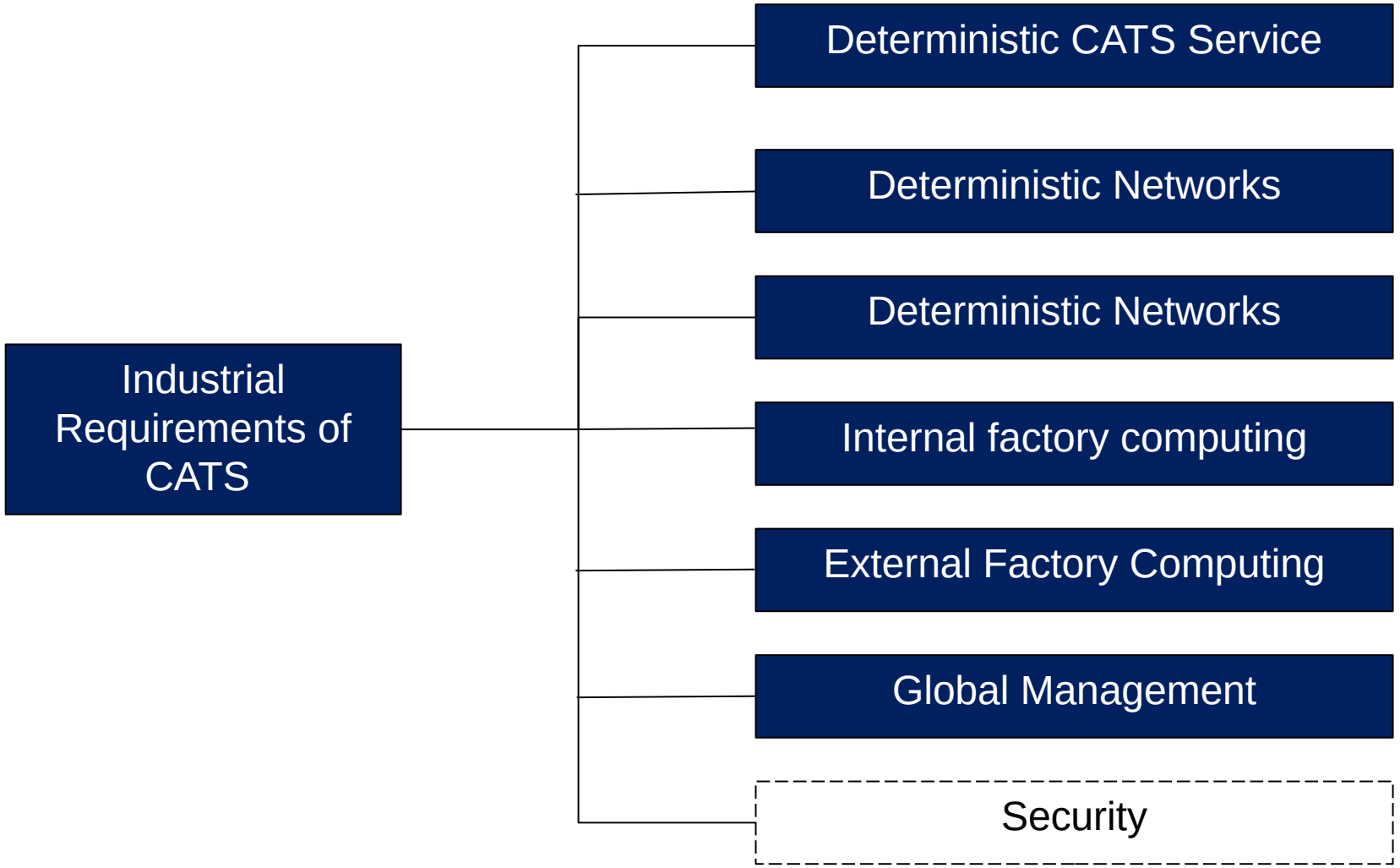
Use Cases-Computing-Aware Multi-Application collaboration

The combination of machine learning, big data and other technologies with the production line is mainly direct deployment and simple interconnection, and the role of advanced algorithms in resource optimization allocation in the life cycle of industrial production is still not fully reflected. If the network with high certainty accuracy is equipped with IT services that try their best to deal with IT, it is not enough. There is a risk that some links will time out, making it difficult to accurately guarantee the complex production tasks of multi-equipment collaboration.



- Deterministic CATS can solve this problem through multi-application global scheduling. In order to ensure the certainty of the entire production business, it is necessary to globally manage a series of applications and network transmission according to deterministic constraints to ensure that the overall service quality meets the needs of users. The deterministic global scheduling of multi-application collaboration needs to support the information interconnection between various systems at the data application level of the whole network, and regulate the real-time and reliability capabilities of all devices, so as to strictly meet the deterministic requirements of various applications. The certainty between applications actually includes logic, computing,network transmission and other links, and it is difficult to achieve the overall certainty guarantee by using only one level of certainty guarantee technology.

Requirements



Next plan

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Enrich and improve the use cases

Supplement the requirements

Explore CATS technology in the Industrial Internet

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Thank you

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