



Enhanced Use Cases for Scaling Deterministic Networks

draft-zhao-detnet-enhanced-use-cases-03

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Updates from last versions

- Presented at IETF#118 , and comments at meetings and on the mailing list are appreciated from :
 - Jie Dong, Janos and Lou
- The updates from version-00 to -03 are like following:
 - add two co-authors, Muhammad Awais Jadoon from InterDigital and Luis M. Contreras from Telefonica
 - add new use cases "ISAC-Enabled Smart Factory", "Interconnection of Time Sensitive Domains" and "Intelligent Computing"
 - add sub-section "Requests to the IETF" to each use case
 - add section "Use Case Common Themes" to specify the new requirements with the enhanced use cases for DetNet
 - editorial revision

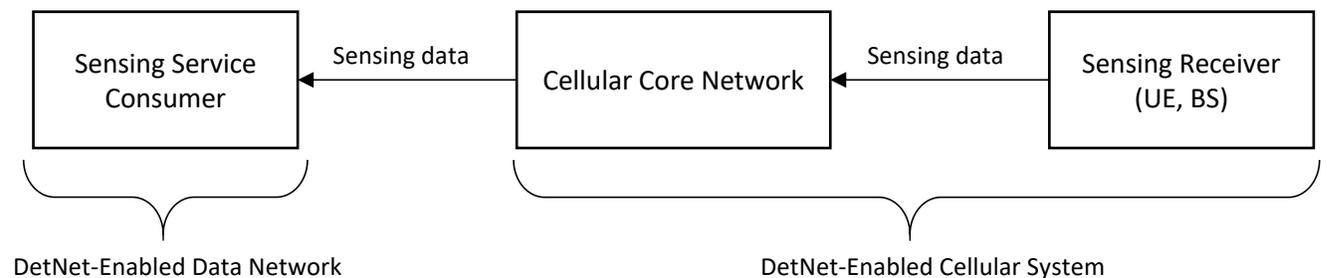
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Use case: ISAC-Enabled Smart Factory

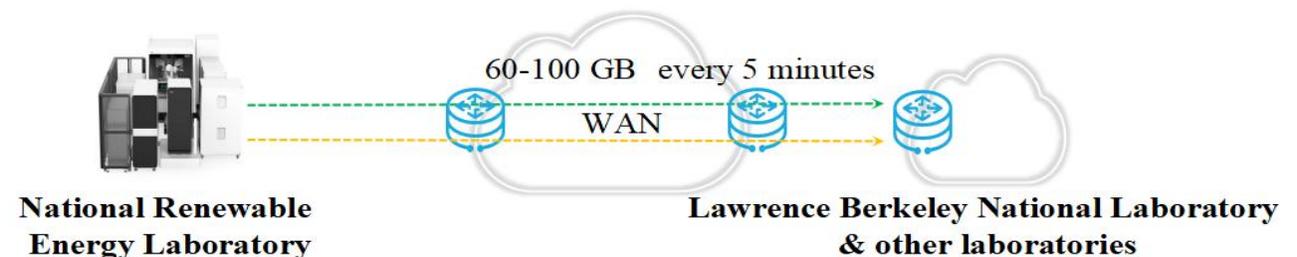
- Integrated Sensing and Communication (ISAC) enables RF-based sensing for real-time environment perception, object detection, and localization in Smart Factories.
- AGVs and robotic systems utilize ISAC to avoid collisions, optimize paths, and synchronize movements using wireless signals instead of dedicated sensors.
 - Sensing receivers in a smart factory produce sensing data from sensing signals. The sensing data is used to meet the KPI requirements from the sensing service consumer.
- DetNet to ensure low latency, bounded jitter, and high reliability for real-time sensing data transmission and decision-making for
 - Predictive maintenance
 - Real-time process optimization
 - Safety control and maintenance



e.g. Sensing Rx in the smart factory generating Sensing Data from the Sensing Signals and sending it to a cellular core network and Sensing Service Consumer for real-time decision making

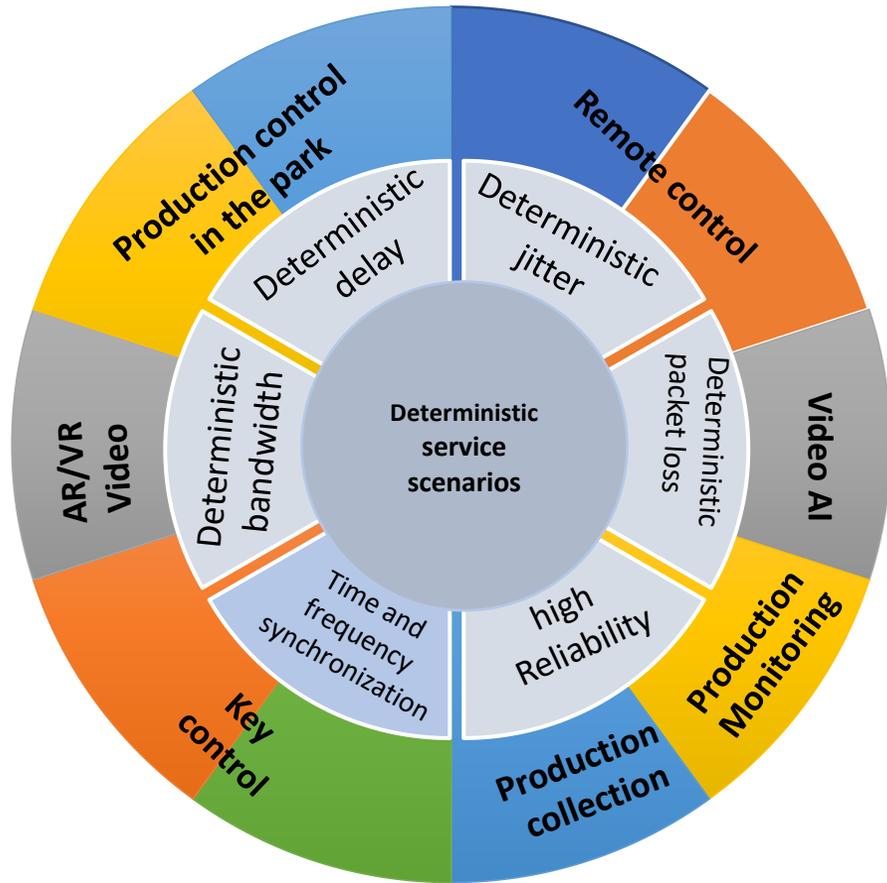
Use case: Intelligent Computing

- Intelligent computing refers to the integration of artificial intelligence (AI) techniques with computational methods to enhance the performance, efficiency, and capabilities of computing systems. It involves the use of algorithms, machine learning models, and other AI approaches to solve complex problems, analyze large datasets, and improve decision-making processes.
- Intelligent Computing has specific requirements for deterministic networks to ensure reliable and predictable performance such as predictable latency, low packet loss rate, high throughput and reliability.
- The typical scenarios involve applications such as
 - AI-based scientific research
 - autonomous vehicles



e.g. The collaboration across different geographic regions for HPC scientific research

Common Themes--Deterministic Classification



	Use Cases	Typical Applications	Differentiated Deterministic Requirements				
			Bandwidth	Delay	Jitter	Packet Loss	Availability
1	Industrial Internet	Machine Vision	Low	Low	N/A	N/A	Medium
		Remote Control	Low	Low	Ultra-low	N/A	High
		AGV Control	Low~High	Low~Medium	N/A	N/A	Ultra-high
		AR Assistance	Low	Low	Ultra-low	N/A	High
2	High Experience Video	Cloud VR and AR	Medium ~High	Low	N/A	Ultra-low or zero	N/A
		Cloud Games	Low	High	N/A	N/A	N/A
		Cloud Live Streaming	Medium	High	N/A	N/A	Medium
3	Intelligent Computing	Scientific Research	Ultra-high	Low	N/A	Ultra-low or zero	Ultra-high
		Autonomous Vehicles	Ultra-high	Low	N/A	Ultra-low or zero	Ultra-high

- The applications differ in the network ranges and SLAs requirements such as bounded latency, jitter, bandwidth, availability and packet loss.
- The classification should consider the characteristics such as traffic specification and service requirements.

Common Themes--Ultra-low or Zero Packet Loss

- Some applications such as intelligent computing requires high-throughput, low-latency data-intensive transmission. It demands ultra-low packet loss which is critical to ensure real-time data processing, maintain data integrity, optimize resource utilization, and support scalable and reliable operations.
- Some applications such as AR/VR do not fit as payload into a single IP packet and may be fragmented into multiple smaller chunks as discussed in [I-D.rc-detnet-data-unit-groups]. It demands zero packet loss for some chunks while a single packet loss can lead to the loss of the whole application.

Next Steps



- Ask for WG feedback and suggestions.
- Comments and discussions are very welcome!



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Thank You