

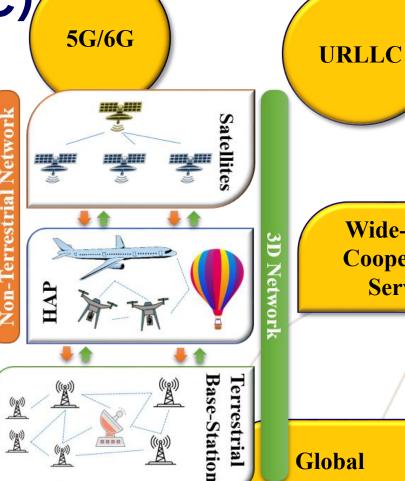






Safety and Mission-Critical (SMC) System with Wide-Range

Coperative Services Cloud Laver **Use-Cases** More reliable Comm. Accident. **BVLOS Piloting** Ctritical Safer operations of **Patient SMC** system Recommender system



Wide-range Cooperative **Service**

Global **Connectivity**

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Challenges of Safety Operation Extract Meaning meaning (meaning Goal/Task-based using Traditional Communication Message Physical channel Challenge 2: 10110....01...0100 111001...0100 Reliable Communication Network Challenge 1: Challenge 4: -- meaning-based message Error correction or **Message Priority** Communication req. By 3GPP Communication prioriterization + resource message re-transmission **Based on Semantics** One-way latency: $\leq 1 \text{ ms}$ Resource Management allocaiton due to bit error Error rate: $(10^{-5}, 10^{-3})$ **Costly Error** Correction **Priority Based on** Excess Priority Bit in High latency Source, Destination, Message Header Packet, QoS Req. Bit Error Service Req. 10110....0100 Sender Header Body + 10110....01...0100 111001...0100 Header Body

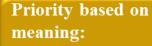
Challenge 3:Agent-to-**Agent Communication** Understand O-RAN: Open - Radio Access



Semantic Communication: A Solution for SMC Systems

Only meaning are sent over repetitive status observation data >
Reliable Communication

URLLC Req.



- Critical message > Status update
- Lean communication

Insightful exchange:
-- Goal/Task-oriented meaning

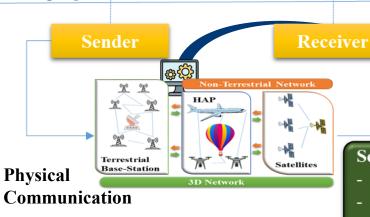
Encoder

Extract

meaning 🕻

- -- Goal/Task-oriented meaning extracted from messages
- -- Meaning over bits
- -- Example:
 - -- Obstracle Ahead

Meaning are transmitted when ever necessary → High channel avalability



Semantic

⊈ Understand

meaning (

Decoder

O-RAN

Semantic Layer

No retransmit/ erropr correction due to bit error

- Assured communication

Semantics with O-RAN:

- O-Ran Intelligent controller + Semantic components
- Better resource management based on meaning/intent of task

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- •What are the challenges:
 - •SMC systems require **real-time and reliable communication for** safe operation in Coperative SMC systems
- •Suitable Solution: Semantic Communication sends only the relevant meaning
- •SC is a promising tool for ensuring safer SMC systems with lean, assured, and reliable communication



Thank

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