



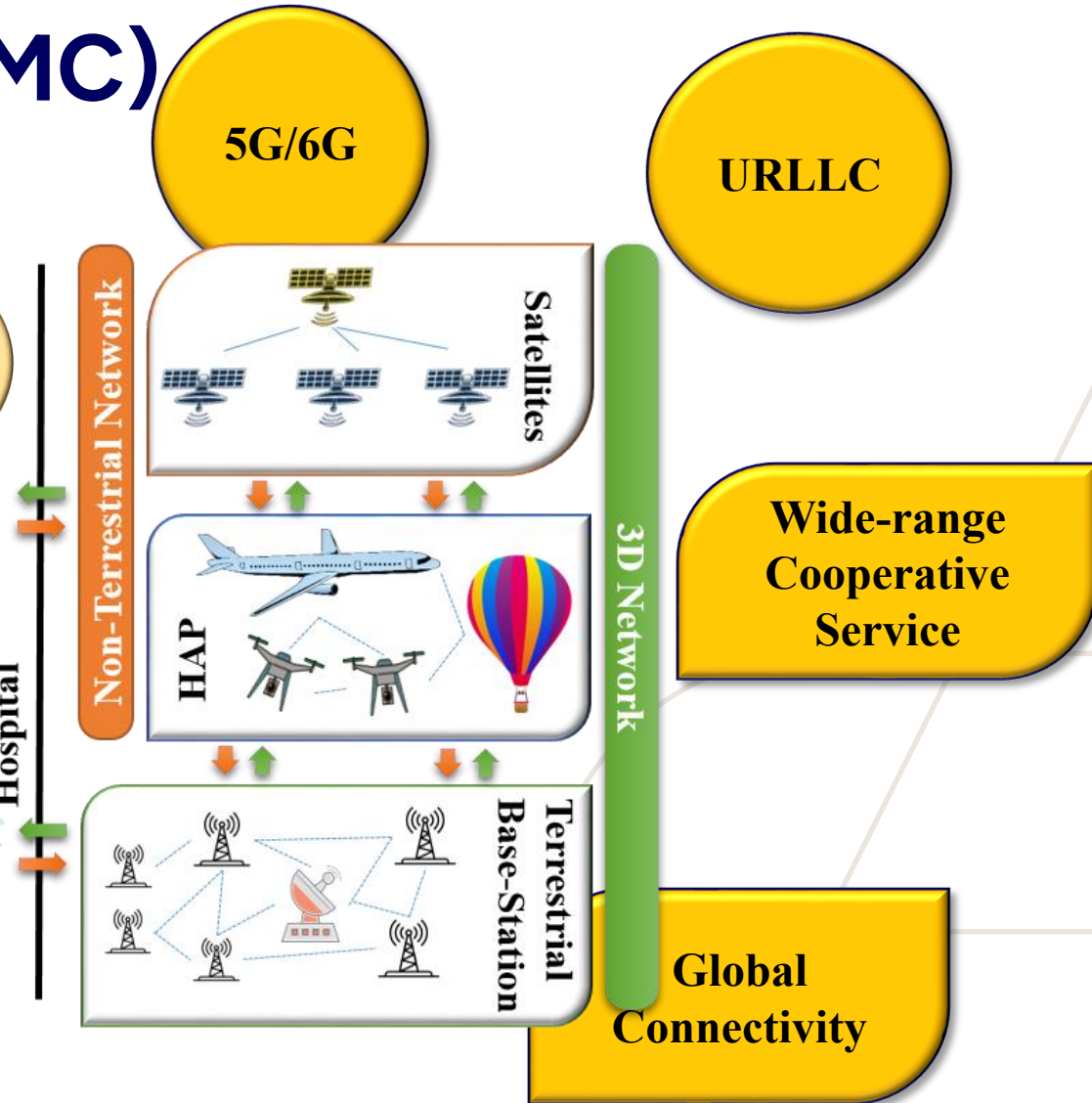
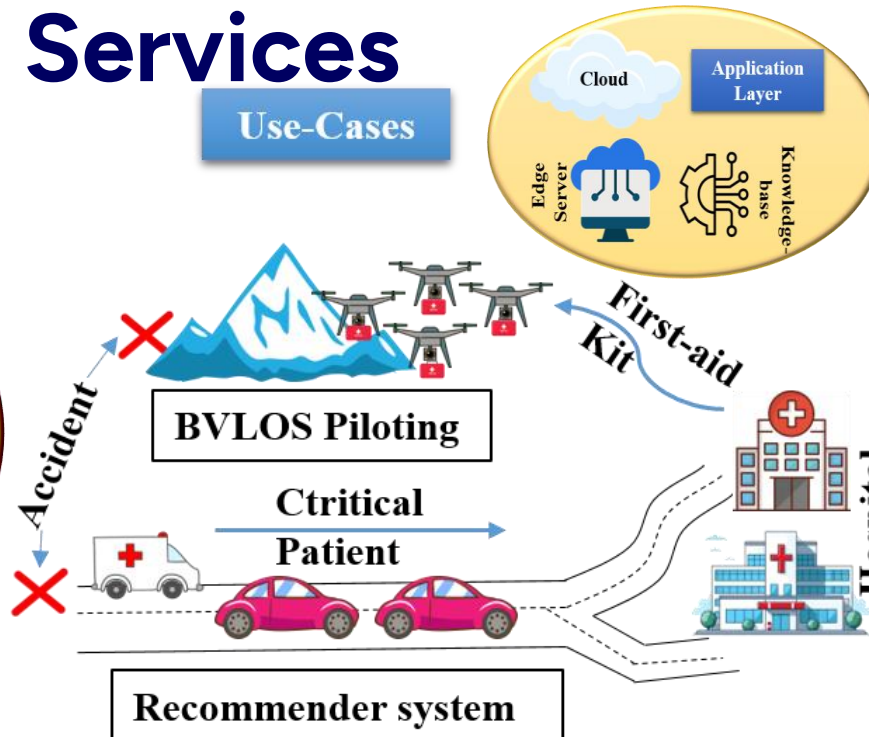
# Semantic Communications - Necessary for Future Safety- and Mission-Critical Connected Systems

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



# Challenges of Safety Operation using Traditional Communication

## Challenge 2: Reliable Communication

### Challenge 1: Message Priority Based on Semantics

Priority Based on Source, Destination, Packet, QoS Req.

Excess Priority Bit in Message Header

Service Req.

Sender

Receiver

10110.....01...0100

111001...0100

Header

Body

Communication req. By 3GPP  
1. One-way latency:  $\leq 1$  ms  
2. Error rate:  $(10^{-5}, 10^{-3})$

Error correction or message re-transmission due to bit error

Costly Error Correction

Sender

Receiver

High latency Re-transmission

Bit Error

10110....01...0100

111001...0100

Header

Body

## Challenge 3: Agent-to-Agent Communication

Extract meaning

Agent



Meaning -full Message  
Goal/Task-based

Understand meaning

Agent



Physical channel

10110....01...0100

111001...0100

## Challenge 4: Communication Resource Management

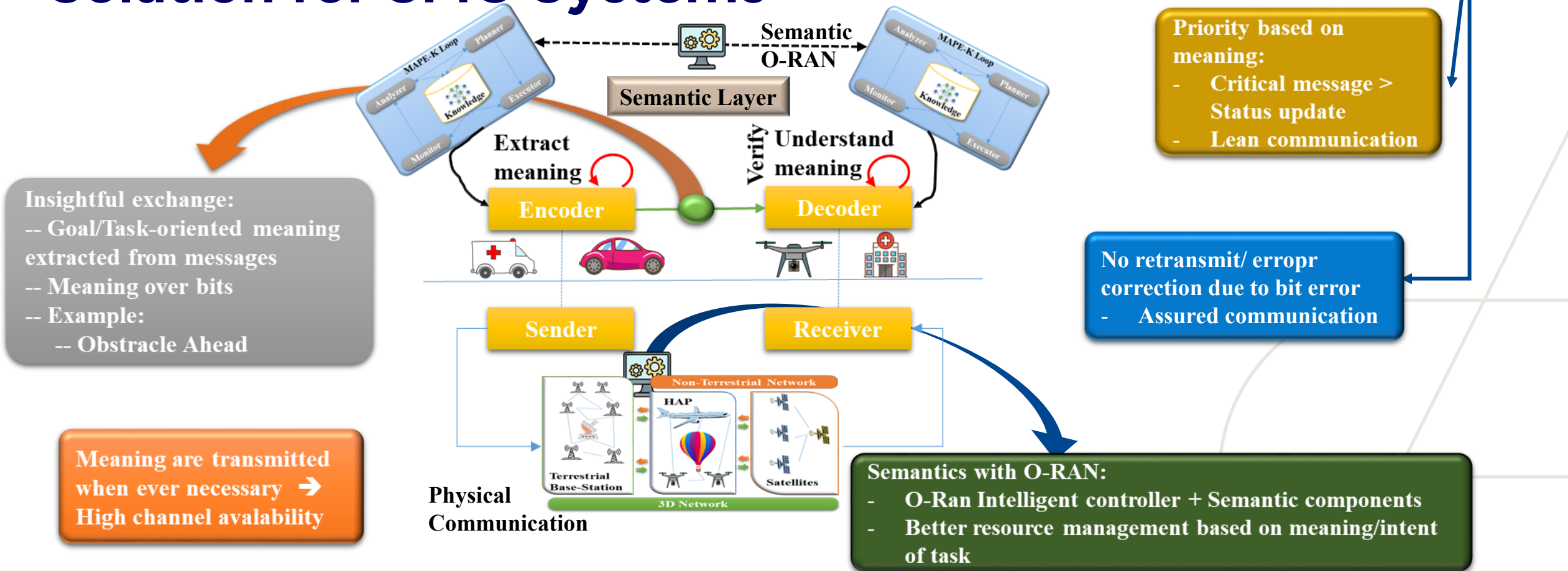
O-RAN: Open - Radio Access Network  
-- meaning-based message prioritization + resource allocation

Sender

Receiver



# Semantic Communication: A Solution for SMC Systems



- **What are the challenges:**

- SMC systems require **real-time and reliable communication** for safe operation in Cooperative 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**



TECOSA

*Thank  
You*

SafeComp2025