16TH ITU ACADEMIC CONFERENCE

ITU KALEIDOSCOPE
GENEVA2026

AI and frontier technologies for good

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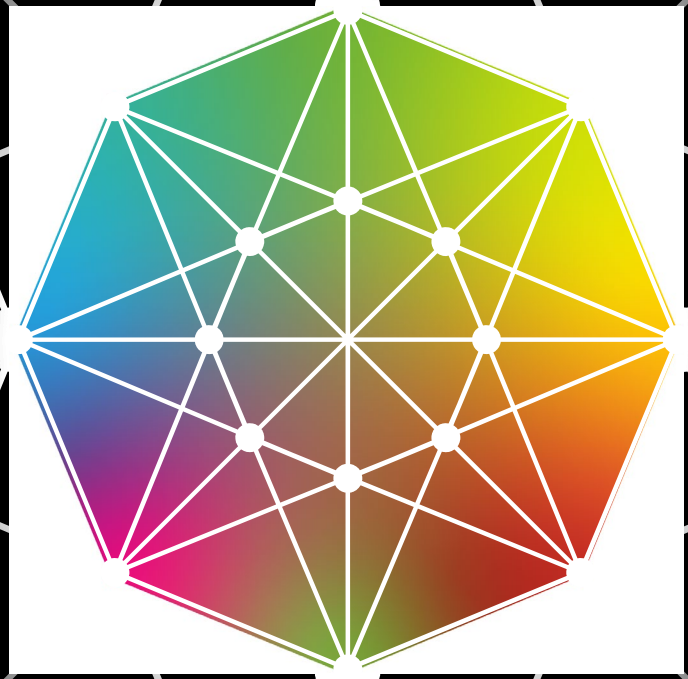
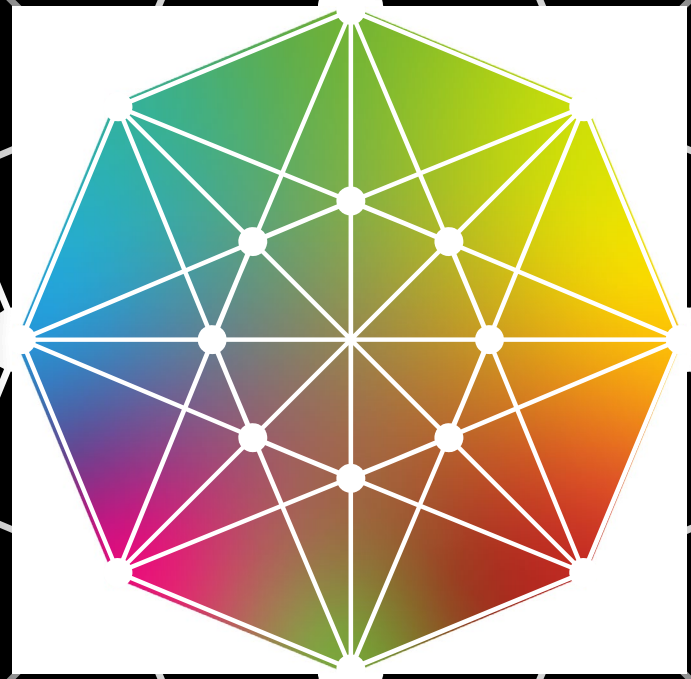
Hosted by AI for Good Global Summit



Toward Deployable Semantic Communication in 6G

SKMF-Enabled Wide Coupling for Deployable Semantic Communication in 6G

9 July 2026



Name of presenter

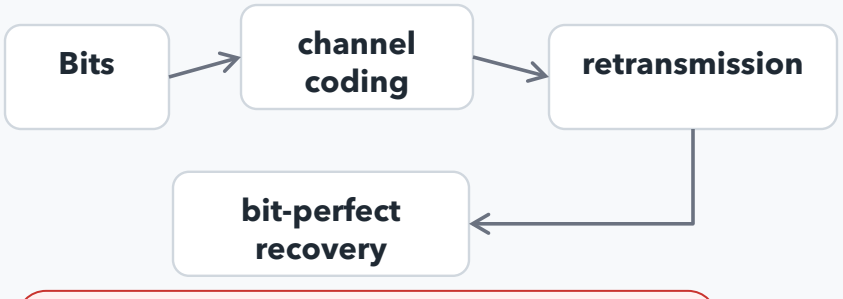
Zhe Zheng

Session #S6.2

Do we always need bit-perfect delivery?

Traditional link

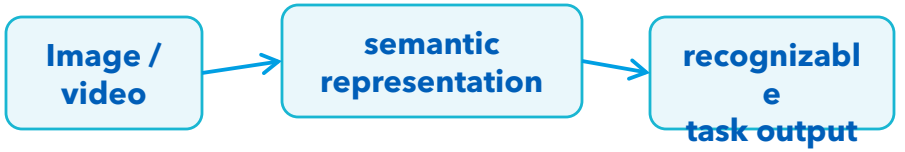
Designed to recover correct bits.



Poor channels often mean more latency, bandwidth, and energy.

Semantic task

Designed to keep meaning useful for the task.



A degraded output can still be recognizable.

For some applications, success means meeting a task-quality threshold.

Semantic communication helps - but deployment creates a dilemma

Graceful degradation instead of cliff effect

More semantic-index errors make the image fuzzier; the task output can remain recognizable.

Prototype success is not enough

The key question is where semantic functions should sit in a commercial network architecture.

Placement becomes the problem.

App

Source exposure
Plaintext semantics or features enter the network

Architecture boundary

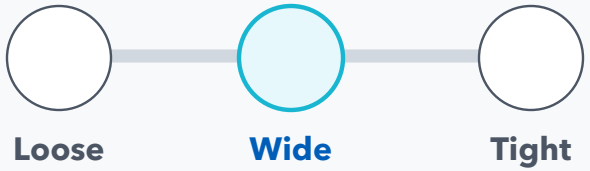
Network

Channel exposure
Raw CSI or PHY state enters the application

The problem is not whether semantic communication works; it is deployable placement.

Wide coupling: controlled knowledge exchange via SKMF

Coupling spectrum



Wide coupling is the middle path.

SKMF

Controlled knowledge exchange

SKB | **CKB** | **TKB**

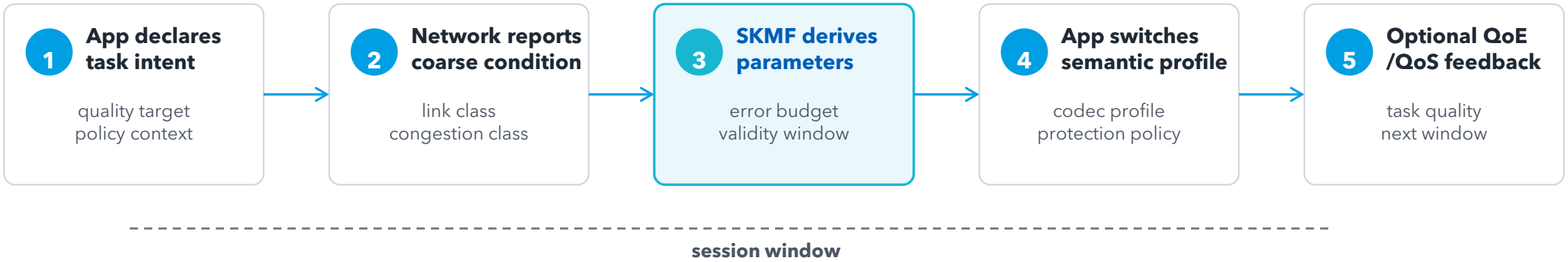
SKMF acts like a policy-bounded broker: it translates intent and coarse network knowledge into safe adaptation hints.

Returned to the application

- **Link class**
- **Semantic error budget**
- **Mode/profile ID**
- **Validity window**

The network assists the application without seeing plaintext content or exposing raw PHY state.

Session-level adaptation: what is exchanged, and what is not



Exchanged

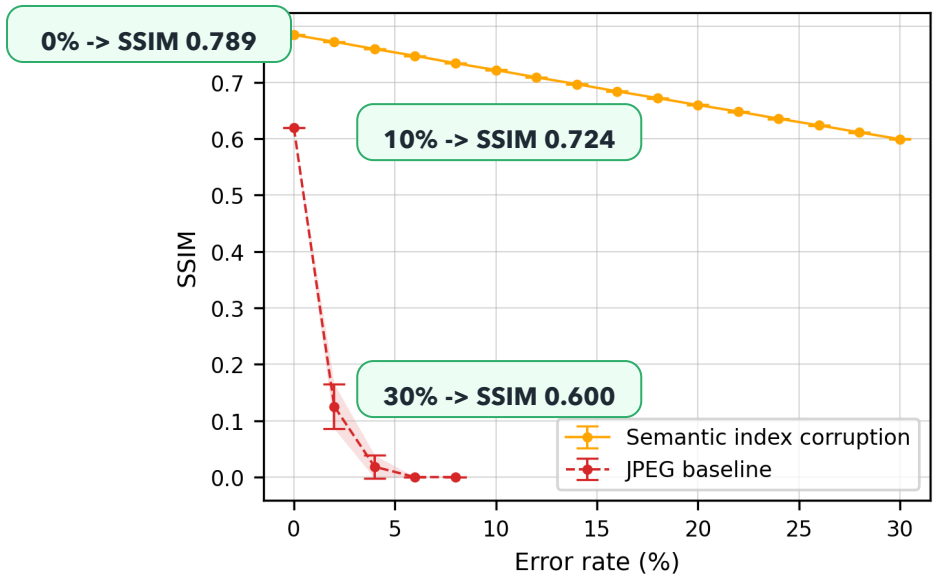
- Link class
- Error budget
- Profile ID
- Validity window

Not exposed

- Plaintext content
- Raw semantic tokens
- Raw CSI
- Scheduler internals

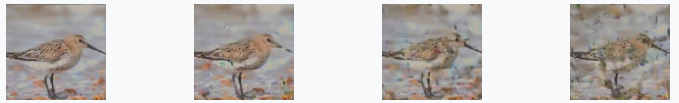
Only low-dimensional hints cross the boundary: periodic profile selection, not real-time PHY control.

Graceful degradation enables relaxed reliability



SSIM versus semantic-index error rate

Quality examples



0% 10% 20% 30%

Experiment setup

VQGAN-LC
1024 indices x 17 bits
17,408-bit payload
1000 trials | 95% CI
JPEG + polar baseline

Relaxed reliability means meeting a task-quality threshold, not accepting uncontrolled errors.

Semantic feature error rate is a representation-domain proxy, not raw PHY BER.

Toward deployable semantic communication

1. Architectural middle ground

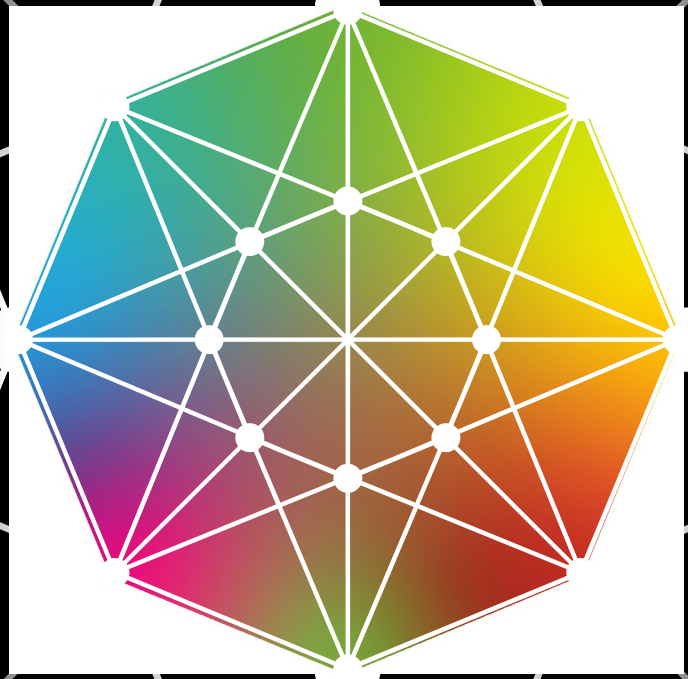
Semantic encoding and decoding remain in the application domain.

2. Controlled knowledge exchange

SKMF provides policy-bounded parameters without plaintext content or raw CSI.

3. Threshold-based semantic reliability

Graceful degradation enables periodic profile selection.



Future work

PHY-to-error-budget calibration · Link-conditioned training · Importance-aware protection · Task-level evaluation

Thank you – Questions?