(Extra) ISAC Support in OAI

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AI RAN Alliance Annual Meeting
June 23rd 2026

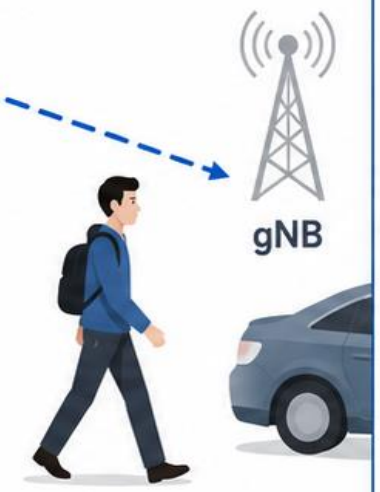
ISAC (gNB perspective)

- Use the 3GPP RAN to detect
  - **Presence:** Is something there?
  - **Location:** Where is it positioned?
  - **Size and shape:** What are its approximate physical dimensions?
  - **Velocity:** Is it moving, and how fast?
  - **Direction:** Where is it heading?
  - **Identification:** What IMSI are we “seeing”?

Illustrative example: UE detects blockage before gNB KPIs degrade

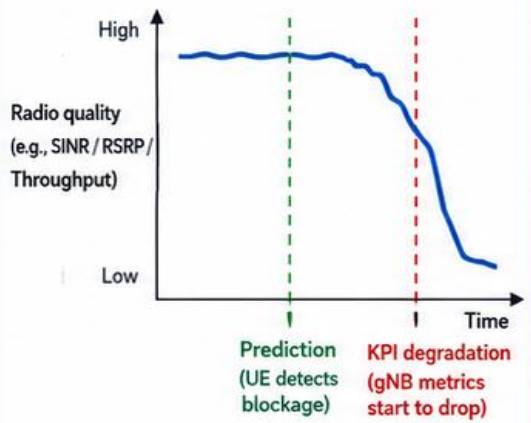
AI/ISAC-enabled UE provides proactive information to RAN policy

1 UE local sensing + AI → 2 Blockage detected before gNB KPIs degrade → 3 3GPP signaling to gNB (two parallel mechanisms) → 4 RAN policy / AI controller takes proactive actions



Predicts imminent blockage

Prediction happens before KPI degradation



Detection before degradation

Fast 3GPP path
L1/L2 assistance: beam / CSI / measurement indication
For extremely low-latency reaction
3GPP mechanisms

3GPP policy path
RRC / UE assistance information / measurement report
For RAN policy adaptation
3GPP mechanisms

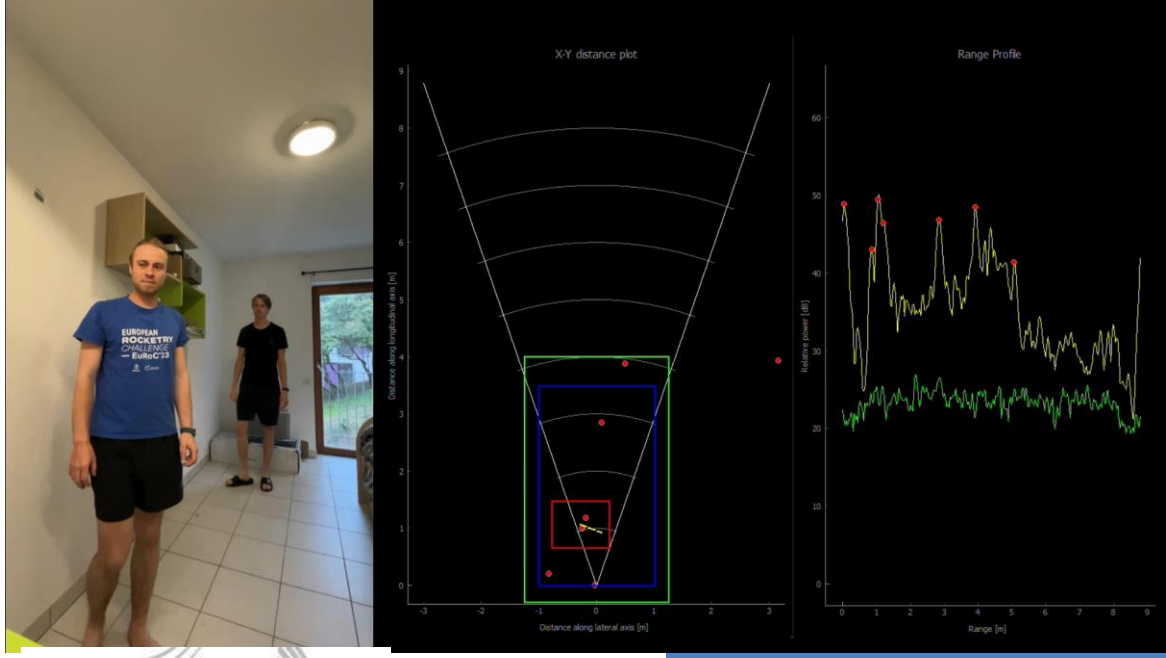
gNB

RAN policy / AI controller
(Near-RT control)

- Pre-emptive beam switch
- Handover preparation
- Resource adaptation
- ISAC-aware scheduling

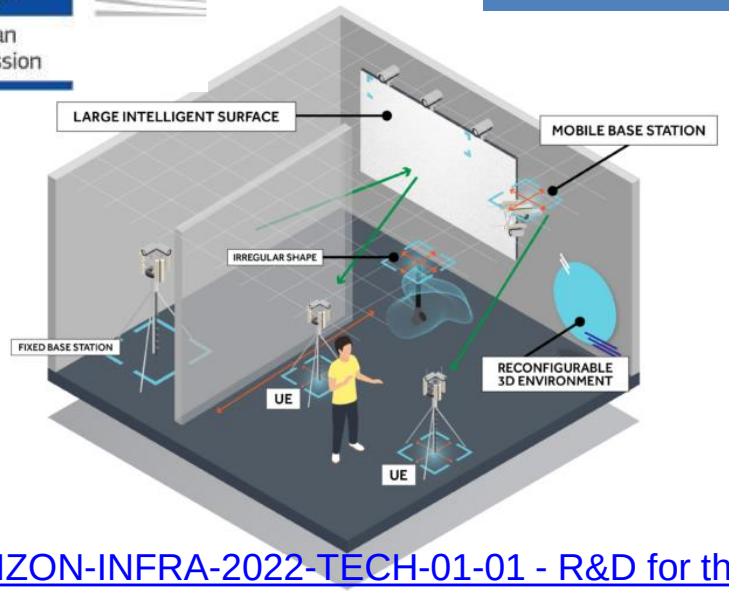
Fusion of non-3GPP and 3GPP mechanisms (gNB side)

- Example here, (cheap) mmWave chirp-based radar
- Joint processing at the edge with co-located 3GPP RAN
  - SRS/PRS FR1/FR2
- Integration of work from CONVERGE Horizon Europe project
  - Fusion of SRS and real-time camera measurements (RGB or infra-red)
  - Contrallable RIS reflections (FR2) and synchronized feedback



European Commission

CONVERGE
view-to-communicate and communicate-to-view



HORIZON-INFRA-2022-TECH-01-01 - R&D for the next generation of scientific instrumentation, tools and methods

(Extra) ISAC Support in OAI

- OAI/DURANTA would like to
  - Enhance support for existing 3GPP physical channels and L2/L3 support for ISAC within current 5G framework (SRS, PRS, NRPPa, etc.)
    - See Albesmart demo!
  - Enhance T-tracer support for ISAC (real-time IQ streaming, input from CONVERGE Horizon Europe project)
  - O-RAN/AI-RAN extensions (E3/dApps)
  - Support integration of additional sensing technologies on top of 3GPP/O-RAN/AI-RAN signaling
- Support the development of nextgen UE platform
  - 6G bandwidths and carrier frequencies, AI-capable compute alongside

Current and envisaged for 3GPP/non-3GPP Signaling Work in OAI Community

3GPP

SRS

- aperiodic scheduling pull/193)
- PRACH/PUSCH-DMRS multi-beam TDoA measurements

PRS

add support for DL TDOA reporting (NRPPa/LPP)

-3GPP TS 38.305: Stage 2 functional specification of UE positioning in NR.

-3GPP TS 37.355: LPP for LTE and NR positioning procedures and information elements.

-3GPP TS 38.455: NRPPa procedures between LMF and NG-RAN nodes for positioning.

Following 3GPP/ETSI 5G/6G Study items for prototyping purposes (Rel19 38.765, Rel 20 SeNF)

Non-3GPP

E3 / dApps

-recent PRs from NEU (pull/204)

Enhancements to T for real-time IQ streaming (SRS)

- built on top of NI's 2025 contribution for PUSCH
- AI Training data models

RIC/xApp

- control of sensing data (inputs CONVERGE HE project)

Platform : deterministic radio engine + AI-capable UE processor

Real-time boundary

JESD204C
TDD timing
timestamping
buffering/DMA
deterministic reset/control
GPSDO

AI/ISAC boundary

inference on RF features
Integration with sensors (video, radar)
dataset capture
sensor fusion
policy/control experiments
visualization

System boundary

OAI / OCUDU/ O-RAN/ AI-RAN demos
RIC/xApp/dApp integration
edge/cloud workload placement
experiment orchestration

Targets for UE

- Mobile UE device (tablet size with battery and screen)
  - Blockage detection in the field (earlier scenario)
  - Drone mountable
- Fixed ground station UE for ISAC support in 3GPP network
  - Detection of objects (Albesmart demo) and estimation of physical parameters (speed/direction, size/shape, identity)