Session #1 - Emerging 6G Architecture Options
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6G RAN Architecture: Balancing Continuity and Innovation

by

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Presentation Outline

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Foundations for 6G RAN Evolution

2

New Drivers: AI, Sensing and Data

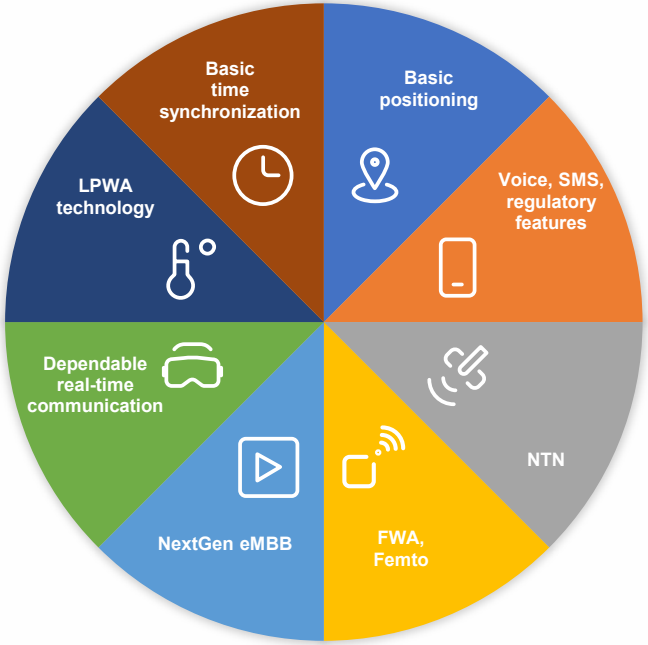
3

6G Architecture Options & Open Questions

6G Day One Services

Early market deployments expected by 2030

- **Build on successful 4G/5G services** including eMBB, FWA, voice, messaging, regulatory features, positioning, time critical communications and massive IoT.
- **Extend capabilities** for immersive communication like XR/gaming, Non-Terrestrial Networks (NTN).
- **Enable native support** for data-driven services and capabilities such as Integrated Sensing and Communication (ISAC) and AI/ML operations.



6G Day One builds on existing services while enabling enhanced capabilities

Maximizing the Value of 6G Standards

Design Principles

Avoid multiple options

Minimize fragmentation of both the ecosystem and specifications

Focus on the mainstream

Niche use cases are unlikely to justify major architecture redesign

First release sets the baseline

Key elements need to be supported in the initial 6G release

End-user visibility matters

Features with clear end-user benefits are more likely to reach the market

Successful 6G standards: Simplicity, Scale, Readiness, Market Relevance

6G RAN Architecture Drivers

Key considerations shaping 6G RAN evolution

Performance and operational efficiency

- Smooth migration from 5G
- Deployment flexibility
- Resilient and secure design
- Enhancing end user experience

Scalability and extensibility

- Lean and implementation friendly
- Enable new services (e.g., sensing)
- AI-powered network operation
- Data-driven design

6G RAN Architecture Evolution

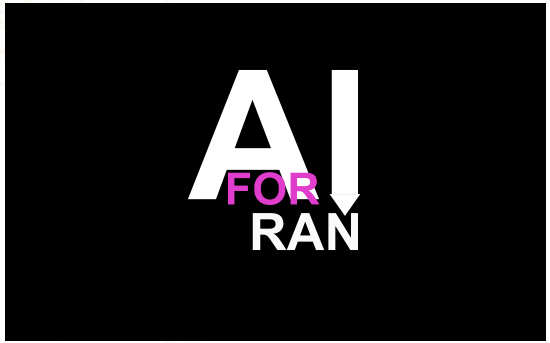
Balancing continuity and innovation

Native support of AI and data driven architecture	Cloud-native protocols	Integrated Sensing and Communication (ISAC)
Service characteristics awareness in RAN	Resilient architecture design	Non-terrestrial network (NTN) integration
Clear RAN-Core functional separation	Open multi-vendor interfaces	Point-to-point RAN interfaces

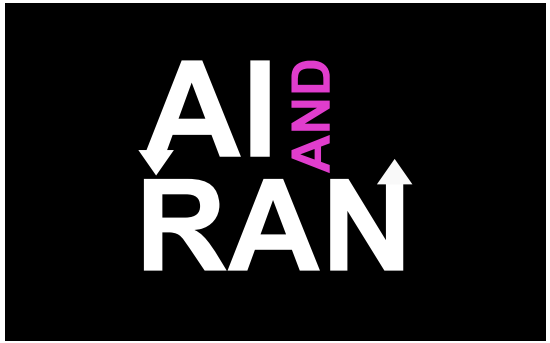
AI-RAN as a driver for 6G RAN evolution

Roles of AI in future RAN systems

RAN augmenting
AI-app performance



AI augmenting
RAN performance



Leveraging
synergies

AI is both a capability enabled by 6G networks and a tool to optimize network operation

Integrated Sensing and Communication (ISAC)

Extending 6G RAN capabilities beyond communication

- **Aim:** Converting communication infrastructure to sensing infrastructure.
- **Use cases:** Detection and/or tracking of passive objects like UAVs, human, vehicles and AGVs.
- **Supporting different sensing modes:**
  - 5G-Advanced Rel-20 enables initial sensing support, focusing on BS-based monostatic sensing with UAV-related use cases.
  - 6G studies will explore additional sensing modes, including UE-based and UE-assisted sensing, enabling broader sensing scenarios.

ISAC introduces new data sources for 6G networks

Data: 6G's foundational asset

Enabling network intelligence

Data-driven AI/ML across training, validation, testing, and inference

Enabling new services

Supporting advanced services through large-scale, diverse data

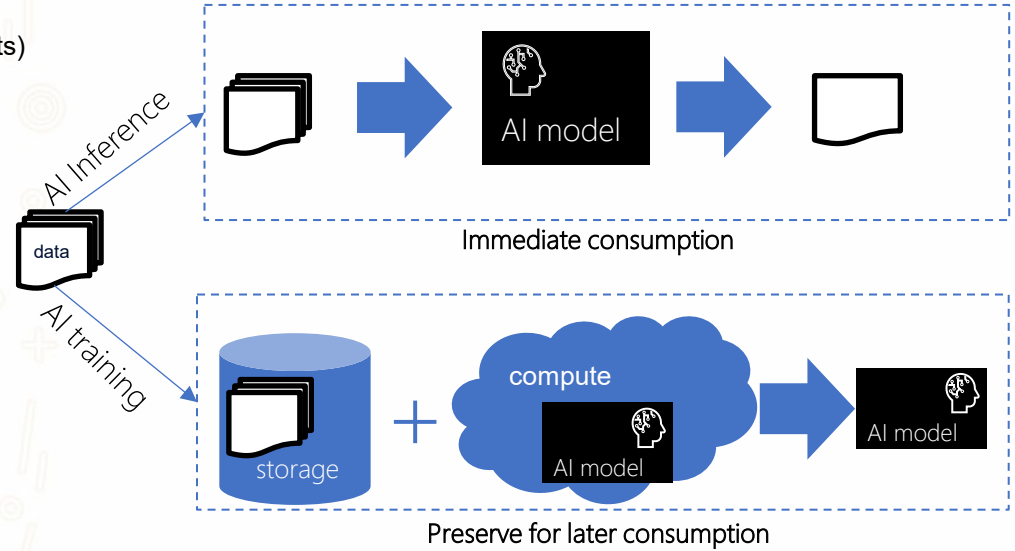
Enabling new value creation

Supporting data exposure, sharing and monetization opportunities

Data sources in 6G

Data to support AI and other services

- **UE-generated data**
  - UE measurements (including RAN L1/L2/L3 measurements)
  - Service-related data (sensing, processing workloads, etc.)
  - Application data
- **RAN-generated data**
  - gNB measurements
  - Sensing data
  - RAN AI/ML use-case data
- **Network Function (NF)-generated data**
  - Event exposure data
  - Analytics
  - AI model inputs/outputs



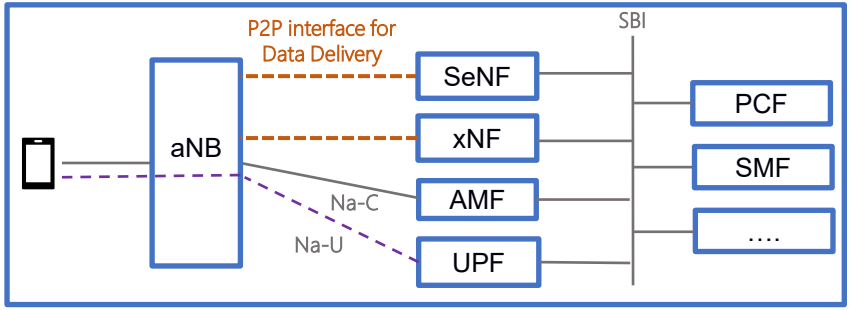
6G relies on diverse data sources and data types

P2P-based RAN-Core interaction

Architecture option emphasizing continuity and efficiency

Potential motivations:

- Reuse established 5G design principles to reduce implementation and interoperability complexity.
- Preserve a lean and deterministic procedure-based model for RAN-CN interaction.
- Maintain consistency with the P2P-based RAN-CN interaction adopted for 6G connectivity services, extending the same approach to other service types.
- Enable direct RAN-CN data transfer for large-volume and low-latency data flows.



Under study in 3GPP

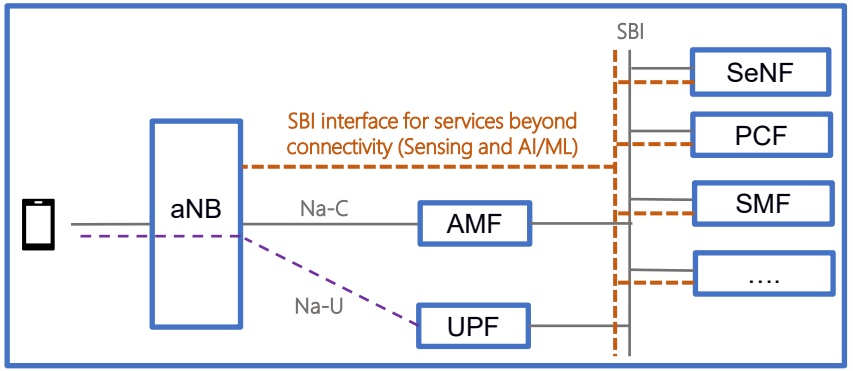
P2P builds on established RAN-CN interaction principles

SBI-based RAN-Core interaction

Architecture option emphasizing flexibility and service-based design

Potential motivations:

- Extend service-based architecture principles from the Core Network to RAN-CN interaction, enabling service-level interaction and evolution.
- Provide a common service-based framework for RAN-CN interactions beyond connectivity.
- Support cloud-native deployments, enabling application-layer routing and load balancing for flexible service interaction.



Under study in 3GPP

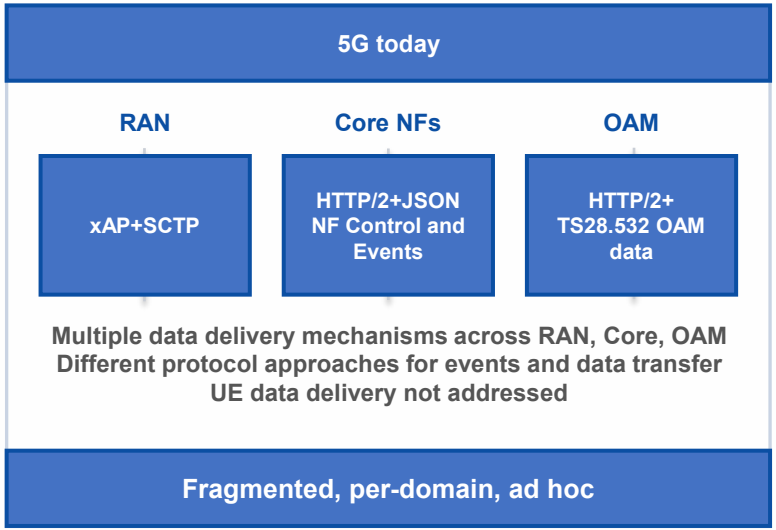
SBI extends service-based design principles to RAN-CN interaction

6G protocols for data delivery

Towards a common framework for diverse 6G data

Potential motivations:

- Avoid fragmented data delivery mechanisms across RAN, Core and OAM.
- Support diverse data transfer modes (notification, streaming, and file delivery) within a common framework.
- Enable a modern protocol stack optimized for cloud and performance.
- Avoid duplication of common protocol functions (e.g., security, load balancing) across layers.



Explore a unified protocol framework for 6G data delivery

6G RAN Architecture: Looking Ahead

RAN3 perspective on ongoing studies and open questions

RAN–CN interaction: options

Control plane design

- Procedure-based (P2P) vs service-based interaction models
- Trade-offs: determinism vs abstraction, efficiency vs flexibility, complexity vs extensibility

Data delivery and architectural implications

- Direct RAN–CN data delivery vs alternative models
- Need for native data exchange mechanisms
- Key factors: latency, scale, data volume, operational efficiency

Open questions for 6G architecture

- What is the right balance between direct and service-based interaction?
- How to balance continuity, flexibility, and deployment efficiency?

Takeaways

1

6G architecture evolution requires balancing continuity and innovation

2

Data is a foundational asset for 6G, enabling new capabilities and services

3

3GPP RAN3 continues to evaluate architectural options for 6G evolution

Thank You

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