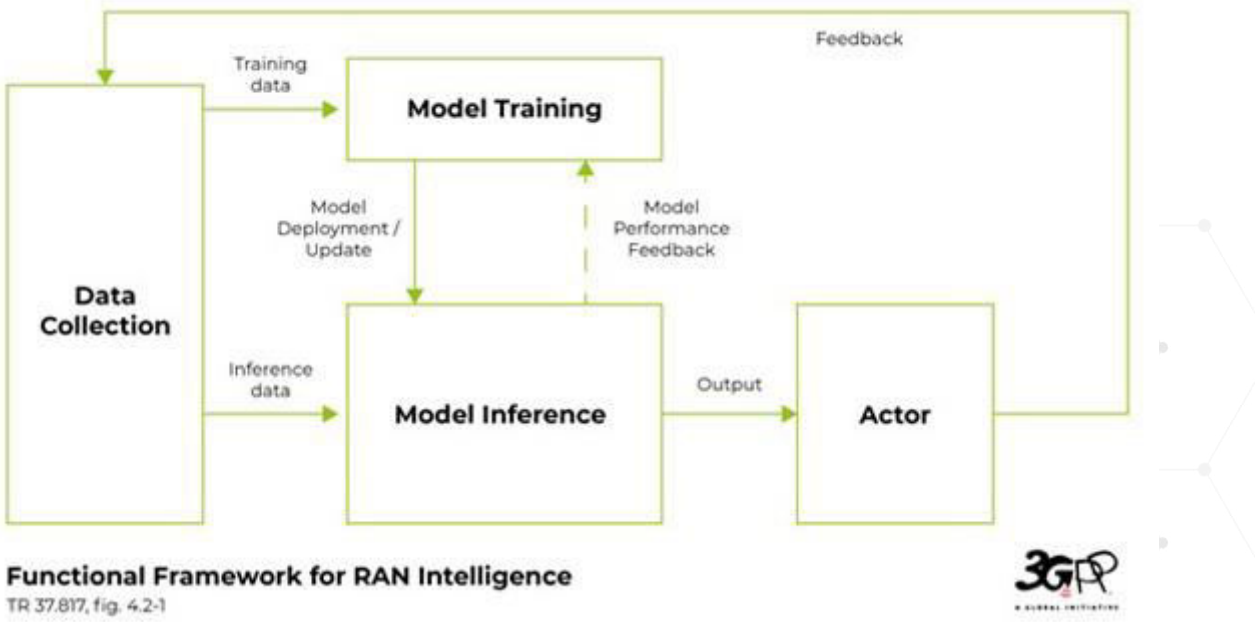
Title: 3GPP Release 18-19 RAN WG3 Contribution to 5G/6G AI/ML

Companies involved: Jio Reliance India, April 2023 - ongoing

Description

MCNS is a preferred and official sub-contractor representing and delegating Jio Reliance in 3GPP RAN3 meetings for Release 18 & 19 AI/ML standardization. 3GPP Releases 18 and 19 introduce significant advancements in AI/ML techniques within the RAN3 working group, focusing on how these technologies can be leveraged for network slicing, dynamic RAN algorithms, and end-to-end optimization. RAN3, responsible for architecture and protocols of interfaces within the RAN, is driving efforts to integrate AI/ML in a way that aligns with the broader 5G Advanced goals.



Source: https://www.3gpp.org/technologies/ran3-completes-ai-ml-support-study

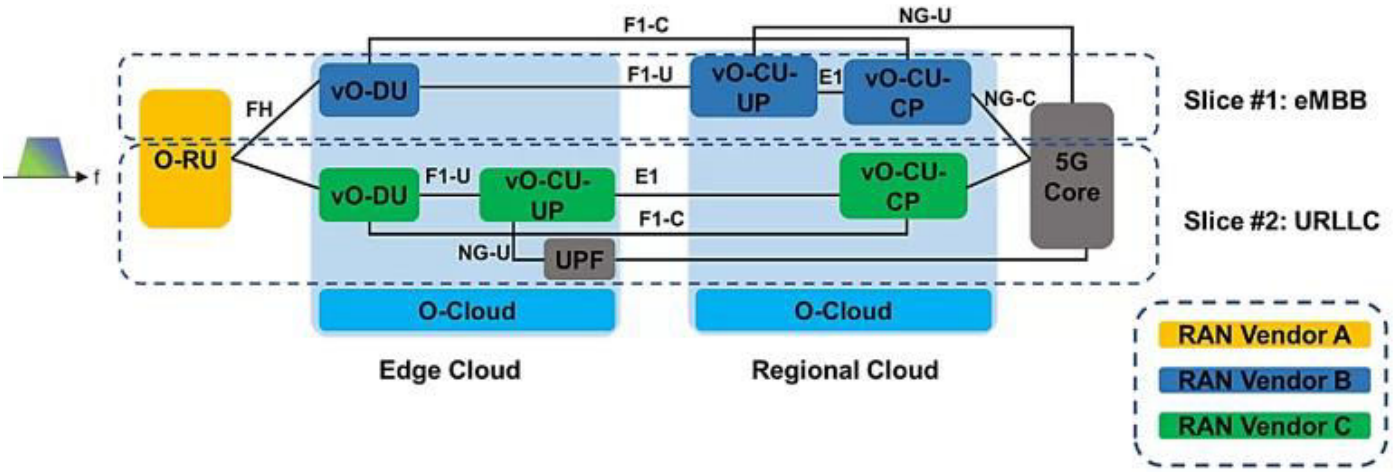
RAN3, responsible for overseeing interface protocols and architecture, is now emphasizing advanced AI/ML techniques to enhance network slicing, dynamic radio resource management, and predictive optimization across multiple network layers. These advances represent the next stage in 5G Advanced, targeting seamless integration of AI/ML to create a more autonomous, efficient, and user-responsive RAN.

In the 5G era, network slicing enables operators to partition a single physical network into multiple virtual networks or “slices” to cater to diverse applications with unique performance requirements. For example, high-definition streaming and IoT-based applications require vastly different service levels. AI/ML plays a crucial role in RAN3’s slicing by enabling:

Dynamic Resource Allocation: Traditional network slicing often used static allocation rules, which may not adapt well to real-time traffic variations. AI/ML enables predictive and adaptive resource allocation, where resources are adjusted dynamically based on real-time traffic demands, historical data, and forecasted demand surges. For instance, an AI model can preemptively allocate resources to slices serving a crowded stadium or downtown area based on expected user influx.

Predictive Slice Quality Assurance: To meet stringent Service Level Agreements (SLAs), RAN3 incorporates AI to forecast potential issues within slices. Machine learning models identify potential capacity constraints or congestion within slices before they occur, allowing the network to proactively adjust configurations or reallocate resources to maintain slice integrity.

Cross-Slice Coordination and Isolation: AI techniques enhance slice isolation by monitoring and dynamically adjusting inter-slice boundaries, which is essential to prevent interference among slices. This improves service reliability for mission-critical slices, such as those supporting emergency services, by ensuring that other slices cannot deplete shared resources during peak times.



Self-Organizing Networks (SON) have been essential in automating network configuration, optimization, and maintenance, but AI/ML unlocks new levels of intelligence and automation within SON, moving towards "self-learning" networks.

Automated Configuration Management: Traditional configuration management required manual adjustments and periodic recalibration. AI models can autonomously adjust network parameters based on real-time insights and self-learn from historical performance data. For example, an AI-enhanced SON can configure newly deployed cells based on the traffic patterns of surrounding cells, optimizing coverage and capacity without operator intervention.

Fault Detection and Automated Recovery: Faults such as hardware malfunctions or coverage gaps can degrade user experience and service reliability. AI/ML allows SON to identify patterns in network performance that precede faults, enabling proactive fault detection and, in some cases, self-recovery. For instance, AI can detect early signs of hardware degradation, alerting operators or triggering automated adjustments to minimize impact.

Energy-Efficient Operation: AI-based models in SON can optimize network energy usage by dynamically adjusting the power of individual cells based on real-time demand. During periods of low activity, such as late at night, AI algorithms can partially or fully deactivate underutilized cells, conserving energy while maintaining service for active users. AI also allows selective reactivation based on predicted demand, ensuring quick responsiveness when activity resumes.

Deliverables

Our project deliverables and proposals are perpetual in several different 3GPP specifications and documents.

Please refer to ***3GPP TR 37.817***, *"Study on enhancement for data collection for NR and EN-DC,"* , ,and to ***3GPP TR 22.874***, *"Study on traffic characteristics and performance requirements for AI/ML model transfer,"*, along with many Discussions, Decisions, TP to TR and Change Request (CR) documents in all subsequent RAN3 meetings.