MU-MIMO Efficiency Requires Accurate Channel Knowledge
MU-MIMO is a technology that communications service providers (CSPs) are adopting to improve RAN performance without changes to devices or radios. However, in order to beamform efficiently, MU-MIMO requires accurate knowledge of the channel between the user and the base station. Current channel estimation techniques fail to incorporate user mobility and evolution of the RF environment into their calculations, resulting in inaccurate estimates that eliminate the advantage of MU-MIMO.

Aira’s Uplink Channel Prediction xApp
Aira’s High Fidelity Channel Estimation and Prediction xApp can allow operators with existing networks to achieve more than double the throughput and gain up to 3dB of Signal to Interference Noise Ratio (SINR). This excess throughput can either service more subscribers or furnish existing ones with higher levels of data rates for high-fidelity applications like VR and gaming, helping operators improve topline revenue.

With these gains in SINR, operators can extend cell ranges and plan new network deployments with fewer base stations, which can reduce TCO, CapEx, and OpEx.

Channel Estimation is a key processing block in the Distributed Unit (DU) of the radio access network (RAN) software stack. In traditional implementations, the algorithm used for channel estimation relies solely on the reference signals (such as SRS and DMRS) defined by 3GPP. Aira, however, uses a more custom approach. Aira’s machine learning (ML) module uses the reference signals to establish and continuously update a network profile and user profile. These profiles accurately

Reliable and efficient MU-MIMO with Aira

FIGURE 1: The Aira Technologies xApp works with VMware RIC to deliver efficient MU-MIMO.
estimate and classify various network parameters and user characteristics. A different machine learning block then uses these profiles to hyper-localize the channel estimation and prediction algorithm to the network and user scenario. Aira calls this data-driven process “fingerprinting.” This process allows Aira’s xApp to predict the evolution of a channel more accurately than current state-of-art algorithms deployed in the DU.

How it Works
Cellular networks behave differently depending on whether you are in a city, suburb or rural area, and are a function of what the users in those areas are doing at a point in time. The characteristics of the serving network and user behavior are finger-printed by Aria using proprietary machine learning algorithms that can predict future changes in the channels between a user and their serving network. Aria’s Channel Prediction xApp uses available L1 reference signals (SRS, DMRS, etc.) to first estimate and classify the user status, including their speed and distance from the base station, and the network environment, especially the most likely channel model and multipath delays. The xApp then uses this information with the reference signals to predict the evolution of the user channel. This process increases the effectiveness of MU-MIMO compared to simple channel estimation, and it can result in huge SINR gains.

Details of the xApp
The xApp is composed of:
• An ML-powered fingerprinting module that uses the existing reference signals in the network to accurately generate two profiles.
• A User Profile that estimates characteristics like the speed of the user and distance from base station on a per-user basis.

Network Profile estimates that classify characteristics like number of reflectors in the network and rural versus urban network setting. These profiles, along with the standard reference signals, are then processed by an ML-powered channel prediction module that accurately predicts the evolution of the channel. Accurate prediction of the channel has uses beyond the primary use case of MU-MIMO beamforming. It can improve rate adaptation, scheduling, and reduce the overall energy consumption of the base station.

Benefits
The Aira Channel Prediction xApp supported by VMware Distributed RIC provides network operators with a range of options to increase throughput, expand their cell coverage and reduce power consumption. These options drive OpEx and CapEx reductions, bringing real value to a CSP’s business.
VMWARE RIC AT A GLANCE
VMware RIC lets you programmatically manage and control your radio access network (RAN). The RAN intelligent controllers from VMware enable third-party application developers to tap into network data, process it, and use it to modify RAN behavior.

VMware Distributed RIC hosts near-real-time applications (xApps), and VMware Centralized RIC runs non-real-time applications (rApps). These apps introduce new use cases — automation, optimization, and service customization — that fuel innovation across a telecommunications network.

KEY BENEFITS
• Multi-vendor interoperability and a vibrant partner ecosystem — use a vendor- and technology-agnostic platform and tap pioneering solutions.
• Network optimization — gain network-wide observability and automate optimization with AI/ML.
• Efficiency — reduce energy consumption and improve spectrum utilization by using applications from various partners.

RIC SDK PARTNER PROGRAM
A rich developer ecosystem is critical to the successful adoption of open RAN technology. The VMware RIC SDK Partner Program expands access to and simplifies the development of RIC applications. The program gives partners access to RIC SDKs as well as training videos and application developer support. To find out more, visit https://techpartnerhub.vmware.com/programs/vmware-ric

LEARN MORE
For more information about the VMware Telco Cloud or VMware RIC, call 1-877-VMWARE (outside North America, dial +1-650-427-5000) or visit https://telco.vmware.com/

VMware and the Path to a Disaggregated, Programmable RAN
For the past five years, VMware has been methodically introducing new telco cloud solutions and changing expectations in the service provider industry about modernization. With an established footprint in telco cloud deployments globally, VMware has been expanding its capabilities to address the challenges in the disaggregation of the RAN.

With a horizontal platform that enables workload consistency from the core and the RAN to the public cloud, we’ve revealed what is possible—simplicity, speed, agility, and far-reaching automation. The objective is to enable our customers to modernize their entire networks, simplify their operations with end-to-end consistency, and further disaggregate their RAN.

FIGURE 3: The high-level architecture of the Aira xApp running on VMware Distributed RIC.