



## Joint Fronthaul Load Balancing and Computation Resource Allocation in Cell-Free User-Centric Scalable Massive MIMO Networks

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We propose a framework for the joint optimization of the fronthaul load and the placement of edge computing resources in an ORAN-inspired wireless network formed by RUs, DUs, connected by a flexible routing-capable fronthaul. Main question for collaboration: how to expand the optimization framework to dynamic environments where the user-centric clusters evolve with time. This is related to modeling the migration of software-defined virtual network functions across the DUs.



A conceptual illustration of a cell-free user-centric network where UEs are associated with user-centric clusters of RUs, jointly processed at some DUs. Since the clusters are not defined a priori, but are usercentric, the RUs must be connected with the DUs via a flexible routing-capable fronthaul network.

## **KEY FINDINGS**

In our paper we have addressed the problem of joint load balancing in the fronthaul and placement of the cluster processors in the DUs. We show that the optimization problem can be expressed as a mixed-integer linear program (MILP) which can be easily solved. In practice, this can be implemented in a network orchestrator, that collects the statistics from the network nodes and optimizes the fronthaul routing and the placement of the PHY-layer cluster processors (implemented as software-defined virtual network functions) in the DUs. As a byproduct of our analysis, we also obtain interesting results on fronthaul compression and on the functional split between RUs and DU both for the uplink and for the downlink.

): Z. Li, F. Göttsch, S. Li, M. Chen and G. Caire, "Joint Fronthaul Load Balancing and Computation Resource Allocation in Cell-Free User-Centric Massive MIMO Networks," in IEEE Transactions on Wireless Communications, 2024