

Title: Switched RoF: Toward Personalized Cell Mobile Front Haul Using Optical Switch

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Extended Abstracts:

In beyond 5G era, it is expected to faster, higher capacity, lower delay, and more secure communication. In order to achieve these targets, it is necessary to use high frequencies such as millimeter waves and tera-hertz waves. However, high frequencies have issues with straightness and attenuation of radio waves, thus microcells (i.e., cell radius is about 10 m) must be created by deploying a large number of antennas for ensuring coverage area. Toward the realization of microcells, we address some issues: deploying new optical fibers, the way of power supply to many radio units (RUs), and further high-speed signal processing in RUs. Therefore, we have proposed the switched radio over fiber (Switched RoF) with an optical switch between the small optical power feed antennas and the signal processing units in central units (CUs) or distributed units (DUs), aiming for a new mobile front haul (MFH) with analog radio over fiber (A-RoF) and power over fiber (PWoF) using hollow core fibers (HCFs) [1]. Since the cell radius is extremely small in the proposed architecture, the number of users in a microcell is expected to be zero or one. In addition, it leads to personalization of cells, thus Switched RoF using optical switch can achieve higher functionality as shown below.

- Power saving by (1) turning off the signal processing units in CUs/DUs connected to no users cells and (2) aggregating them into the same nodes as much as possible for turning off other nodes [2].
- High reliability by using $N + 1$ redundant signal processing units.
- Low-cost construction with $N < M$ (the number of signal processing units is N and the number of antennas is M).
- Cell tracking in response to user movement for handover acceleration, etc.

Because of providing the power saving function and cell tracking function, it is necessary to identify user's location. Hence, we utilize macro cells as a C-plane by means of a hierarchical cell structure and microcells are used as a U-Plane [3].

In this study, we used a Linux PC based Wi-Fi access point (Wi-Fi AP) as a base station (i.e., CU/DU), commercially available A-RoF modules, a micro electro mechanical system (MEMS) optical switch, and installed HCF cables in the experiment. We confirmed that the concept and effectiveness of the cell tracking function using optical switch in the Switched RoF.

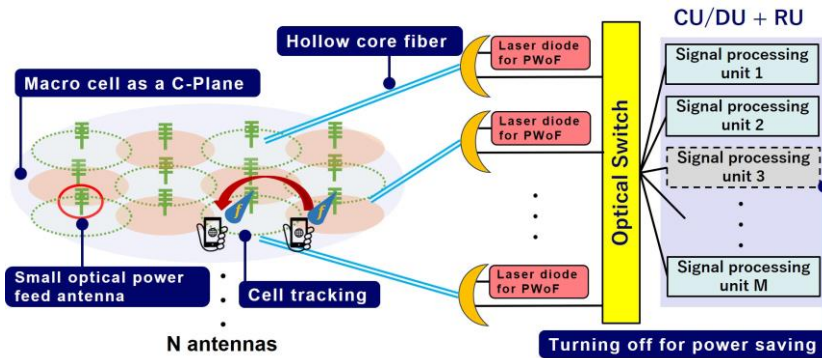


Fig 1. The overview of switched RoF architecture.

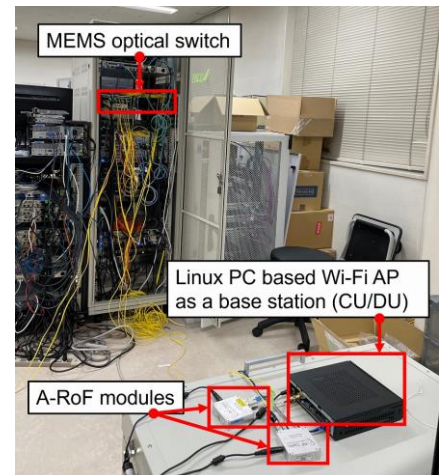


Fig 2. The devices used in the experiment.

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