

Development and Trial of Low-latency Optical Access Technology that Operates in Coordination with a 5G Mobile System—Achieving Efficient Accommodation and Operation of Base Stations

1. Introduction

NTT has developed low-latency optical access technology that helps to reduce the number of optical fibers needed to accommodate base stations, especially during the period when the fifth and subsequent generation mobile systems are being introduced. NTT has also conducted a feasibility trial in which the optical access system operated in coordination with a mobile system.

This technology reduces data transmission latency, which is an issue when applying optical access systems to a mobile system. It is achieved by making optical line terminals (OLTs) and base station aggregation units that are deployed in telecommunications carriers' central offices operate in coordination with the signal control.

Applying optical access systems with this technology to a mobile system makes it possible to efficiently use optical fibers between a central office and the base stations. This reduces both the number of optical fibers required and the ports of the base station aggregation unit, enabling efficient operation of base stations. Detailed discussions on this technology have been initiated by ITU-T (International Telecommunication Union - Telecommunication Standardization Sector), a standardization organization.

NTT is committed to ongoing research and development (R&D) to assist mobile operators with efficient construction of their networks.

2. Background

The fifth generation (5G) mobile system is being developed to achieve a high-speed, high-capacity, and low-latency mobile service. In the existing mobile system, optical fibers are used to connect the base station aggregation unit installed in a central office to base stations installed on towers or on top of buildings.

To achieve high-speed, high-capacity wireless communication, the 5G mobile system uses new radio frequency bands. This will require installation of more base stations than before, resulting in an increase in the number of optical fibers used to connect the base stations to the base station aggregation unit and in the number of ports for the base station aggregation unit. These increases are expected to complicate network operations, including fault recovery and maintenance. Therefore, it is essential that base stations can be connected and operated efficiently, especially during the period when the 5G system is expanding, which will require the installation of numerous base stations.

3. Research results

An optical access system is employed to connect optical network units (ONUs), which set up connections to user terminals, to OLTs in a central office in an FTTH (fiber-to-the-home) service. NTT has developed low-latency optical access technology to enable

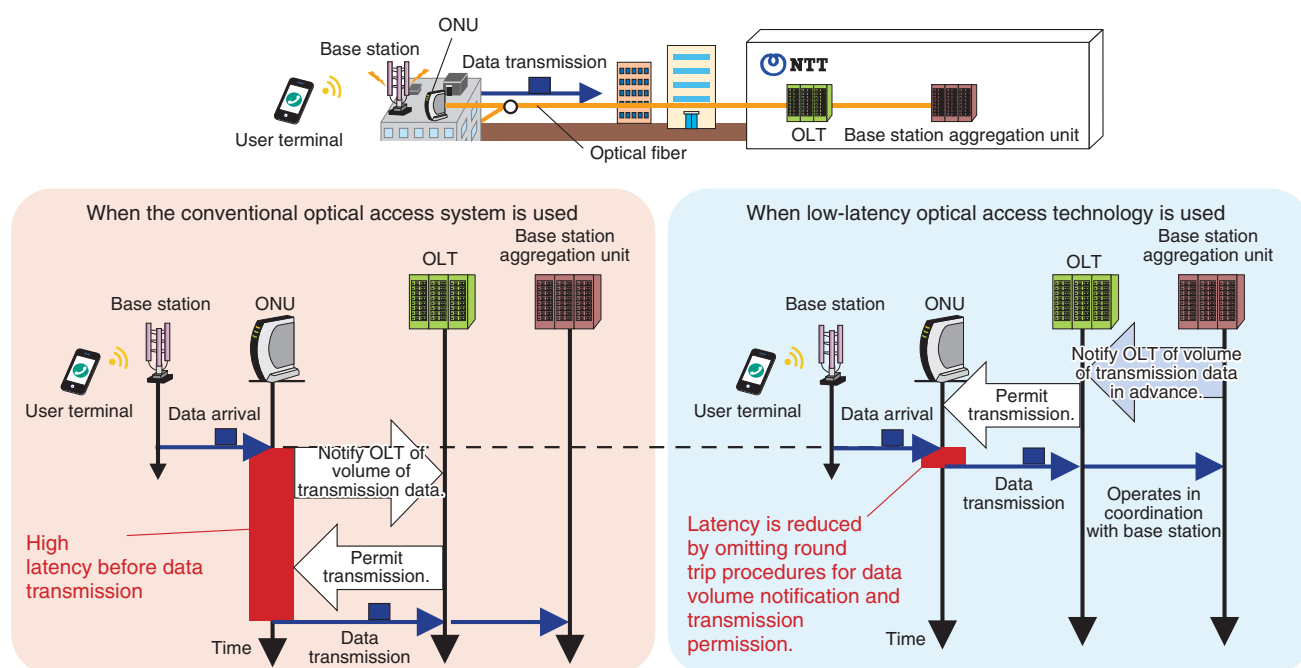


Fig. 1. Low-latency optical access technology.

use of the optical access system in a mobile system.

The conventional optical access system cannot satisfy the low latency requirement demanded by the mobile system. The new optical access technology reduces this latency by making OLTs in the optical access system operate in coordination with the signal control by the base station aggregation unit.

In cases where the conventional optical access system is used, when an ONU receives data from a user terminal, it notifies the OLT of the volume of data that it will transmit. It sends data to the OLT only after it has received permission to transmit data. This causes high latency before the ONU transmits data, which is why the conventional access system cannot satisfy the mobile system's requirement for low latency.

In contrast, when the new low-latency optical access technology is applied, the base station aggregation unit provides advance notification to the OLT of the volume of data that will be sent by the user terminal. This is possible because the base station aggregation unit has been notified by the user terminal in advance of the volume of data that will be sent

by the user terminal. Making the optical access system operate in coordination with the mobile system in this way makes it possible to omit the round trip procedures used in the conventional optical access system for notification of the amount of transmission data and for transmission permission, thereby achieving low-latency optical access (Fig. 1).

4. Future plan

NTT will continue pursuing R&D to assist mobile operators with efficient construction of their networks. It will also promote standardization by conducting global discussions with telecommunications carriers and vendors and studies on coordinated operation of the mobile system and the optical access system.

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<http://www.ntt.co.jp/news2018/1802e/180214a.html>