Software-defined orchestration

The next generation of RAN

Huawei’s SoftMobile solution supports software-based adjustment/customization of radio frequencies, basebands, and network controllers, eliminating equipment bottlenecks and enabling a broader pipe. With its dual-layer coordination architecture based on cloud baseband (Cloud BB) and single radio controller (SRC) technologies, SoftMobile can coordinate multiple modes, frequency bands, layers, and cells, all to the betterment of the next generation of radio access networking (RAN).

By Xu Dezhi
Over the past 20 years, mobile communication has become indispensable to our daily lives. According to a World Bank report from 2012, approximately three quarters of the world’s inhabitants now have access to a mobile phone, accounting for a significant portion of the over six billion mobile subscriptions now in existence.

Over the next ten years, mobile networks will become more than just a simple medium for communication, but a vital strand in the very fabric of our lives, as they increasingly evolve to encompass office functionality, health care, vehicle connection/control, and security assurance.

Huawei’s SoftMobile solution redefines MBB networking. On an equipment level, SoftMobile redefines the design framework of MBB network gear and adopts the concepts of modular design and software customization to achieve software-based networking and flexible capacity deployment and expansion. It eliminates equipment bottlenecks, making traffic flow smooth and efficient. It also redefines MBB network topology to facilitate centralized cloud-based network control and efficient coordination of overall network resources.

**Modular design and software-based customization**

Traditional telco network reconstruction and upgrade are siloed and cannot accommodate rapid changes in services and applications. As such, software-based customization that supports modification, configuration, and expansion is essential to any next-gen RAN, and these capabilities must extend to the frequencies, basebands, and network controllers.

**Software-defined RF**

In the MBB era, multi-band and multi-mode networks are key to operator adaptation to the robust growth seen with data services. Sites in Europe that support two or more frequency bands are expected to exceed 70% of the total by 2016. With the introduction of new spectrum, wireless frequency band combinations will grow increasingly complex, leading to a tremendous increase in RF module number, site complexity, and needed space for sites. This will drive up the costs of site deployment and operation & maintenance (O&M), and Huawei offers a solution in the form of its blade remote radio unit (RRU).

The Huawei blade RRU complies with 3GPP Multi-Service Ring (MSR) standards and supports mode transition through software configuration to achieve optimal coverage, capacity, modality, and frequency allocation. A single blade RRU is only 12L in volume and weighs 14kg. Installation is also very simple; only five minutes are needed to assemble three units.

Thanks to Huawei’s uniform blade design, multiple units supporting different frequency bands, modes, and sectors can be flexibly combined and seamlessly assembled, greatly reducing the site’s footprint and meeting the requirements for network capacity and services for different network deployment phases.

For hotspots where site acquisition is difficult, active antenna units (AAUs) that integrate multi-band RF modules and antennas can be employed. Currently, an AAU supports a maximum of three frequency bands simultaneously, including two active bands, with each frequency band supporting multiple modes.

An antenna for a single AAU can support three modes and five frequency bands, but there is a slight tradeoff in terms of its dimensions. However, thanks to its modular design, an AAU only needs to be installed once and new modules can be inserted for expansion or replacement, reducing the number of site visits.

AAUs also support the splitting of horizontal beamforming, turning three sectors into six, and increasing network capacity by 50%. With user-level beamforming and four-uplink reception diversity, network capacity and user experience are greatly improved.

**Software-defined baseband**

The air-interface traffic that carries most mobile services is also a strain on baseband capability; improvements in processing and coordination are needed here that eliminate interference and improve spectrum efficiency.

As an integral part of software-defined RAN, Huawei baseband units (BBUs) are far more integrated than what came before. Our industry-leading four-mode BBU (supporting GSM, UMTS, LTE FDD, and LTE TDD) is designed to share the main control board and baseband board between multiple modes, with smooth evolution.
enabled via software.

To address the signaling impact of smart devices, Huawei BBU features a signal processing capacity of up to 1500 CNBAP/s and a secure transmission rate reaching 4Gbps, based on Huawei’s proprietary chipset. In addition, Huawei’s Cloud BB solution, based on this BBU, can bring dozens or even hundreds of BBUs together, facilitating dynamic sharing of converged baseband resources and increasing resource utilization, while reducing O&M costs.

Software-defined network control

Huawei SRC supports multi-mode controller evolution, multi-network convergence, and flexible deployment of MBB services. The hardware supports a throughput of 120Gbps and terabyte-level capacity evolution, while real-time virtualization technology supports converged processing boards and modes on the control and user planes (greatly streamlining hardware management) and resource sharing between boards maximizes system processing efficiency.

Under real-world network load, SRC can dynamically adjust spectrum and power resources among different modes to optimize the efficiency/utilization of both. It can also accurately select a suitable mode, frequency band, and macro or micro network, so that communication is carried over an optimized pipe.

Centralized network orchestration

RANs are quite complex, as multiple frequency bands, cells, layers, and modes must coexist for several years’ time. To eliminate interference between modes, balance the service load between networks, reduce mobile switchover times and delays, and ensure a consistent user experience during network interoperation, Huawei has developed a dual-layer coordination architecture, based on our Cloud BB and SRC solutions.

Cloud BB for base station coordination

As user experience demands and site requirements increase, centralized and cloud-based baseband processing capability must come into being. As sites increasingly rely on optical fiber, Cloud BB grows that much more viable.

Huawei Cloud BB is a groundbreaking networking solution that consists of multiple BBUs and universal switching units (USUs). It allows BBUs to be deployed in a centralized manner in dense urban areas and connected via fiber, greatly improving the capacity for an individual site and alleviating the difficulties of site acquisition.

With Cloud BB, baseband resources can be centrally deployed, with macro-macro and macro-micro coordination facilitating intra-frequency interference reduction, spectrum efficiency improvement, and network capacity expansion. In an ideal scenario, macro-macro coordination can increase the downlink capacity by 50%, while intra-frequency macro-micro and micro-micro coordination can increase the downlink capacity 4.7 fold.

SRC for network coordination

As the unified super controller for GSM, UMTS, LTE, and WLAN, SRC manages all radio resources by controlling and converging multi-mode and multi-band resources, while providing functionality that includes load balancing, dynamic spectrum management, seamless switchover, and coordination of multiple radio access technologies (RATs).

In a complex wireless environment, multi-mode and multi-layer network coordination and network optimization are crucial, with the SRC’s eCoordinator functioning as a wireless network co-processor that provides a centralized self-organizing network (SON) platform for automatic control of multi-mode and multi-layer networks to their coordination.

By collecting and analyzing call history records (CHR)s and measurement reports (MR)s, the eCoordinator supports automatic optimization neighbor relations, adaptation of inter-cell interference coordination (ICIC), and scrambling code self-optimization based on the data, including that for configuration, performance, and alarms from various network elements in different modes.

For LTE networks with decreased throughput at the cell edge (caused by intra-frequency interference), the eCoordinator supports self-optimization, ensuring that users there enjoy the same user experience as they would at any other point within coverage.

Editor: Xu Shenglan xushenglan@huawei.com