

Faster network processing and throughput with C-RAN

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Video traffic from a myriad of devices, including smart phones, tablets, laptops and other devices, is overloading today's networks. What's more, the increased traffic must co-exist with legacy 2G and 3G protocols and anticipated new standards as the industry moves forward to 4G and beyond.

Cellular service providers are looking for cost-effective, scalable ways to manage their networks profitably. In the network core itself, software-defined networking (SDN), which abstracts functionality from network devices into virtual services, gives service providers the ability to minimize the cost of data traffic management by using ubiquitous hardware. Network function virtualization (NFV) will help service providers leverage previous capital investments in hardware by virtualizing it into server farms. Small cells, which distribute the baseband processing, is one approach that many service providers are deploying to manage data in dense urban environments (however, interference is one of several issues with this approach).

Cloud Radio Access Network (C-RAN) technology is gaining traction from service providers as a means of processing network wireless signaling by virtualizing baseband processing onto large server farms. This approach can provide significant advantages in terms of capital and operational expenditures (CAPEX and OPEX). The challenge is that general-purpose microprocessors in C-RAN are an impractical solution for handling the data path processing and the very high data rates required of 4G systems. Also, general-purpose microprocessors are not optimal platforms for these operations in terms of power consumption. To be cost-effective, next-generation C-RAN design must offer fast access to 2G, 3G, and 4G protocols, and easy, system-wide upgrades as new protocols inevitably emerge.

C-RAN, when combined with SDN and NFV, provides service providers with reduced equipment costs and power consumption. When massive amounts of data pulse through the network in the coming years, C-RAN can leverage the ample resources of the data center to handle the substantial load.

A novel approach to C-RAN that incorporates a co-processor in the servers in the data center to handle multiple communications protocols - without any compromise of the virtualization feature - will significantly increase network throughput.

Why C-RAN is crucial

The C-RAN approach, in which service providers delegate all RAN processing to the cloud and implement it in remote datacenters, has been gaining interest from cellular operators, cellular infrastructure vendors and integrated circuit (IC) vendors as of late. In a C-RAN paradigm, general-purpose servers handle the entire processing chain, from baseband processing to packet processing, including a large number of baseband Units (BBUs) that handle the RAN processing.

The C-RAN approach provides significant CAPEX and OPEX advantages and facilitates advanced processing techniques. However, implementing the entire RAN in the datacenter and particularly over CPUs is challenging. Some critical operations, such as channel decoding (especially turbo decoding) and de-multiplexing are extremely difficult to implement on a CPU. For the very high rates required in 4G systems, exceeding 100Mb/s/sector turbo decoding becomes impractical to implement on a CPU.

In addition, CPUs are not the optimal platform for these operations in terms of power consumption. A domain-specific co-processor, designed specifically for processing the tasks associated with wireless modems, can perform the critical and computationally intensive tasks, alleviating real-time issues and reducing power consumption.

A novel approach to C-RAN

By using a novel Modem Processing Unit (MPU) as a co-processor to the general-purpose computers in the telecommunications data center, service providers can offload complex communications protocols and other heavy computations from the general-purpose computers there. The general-purpose host processors in the cloud, such as Intel x86 processors, are free to handle the intensive, but general-purpose tasks such as detection, estimation and decision making.

An MPU can support a wide range of cellular standards, and can be programmed to support various processing topologies. New programs can be developed after the system is in operation - writing new firmware for the MPU is no more complex than writing a well optimized CPU function. MPU firmware can be loaded dynamically according to the current traffic types. The programmer uses a Modem Processing Language (MPL), a C-compliant API, to create the MPU solution the way he or she envisions.

The MPU/MPL approach offers a 10X power consumption advantage relative to the CPU. Besides offering virtualization, an MPU also enables scalable base station architectures, from small through macro to super cell.

Conclusion

By using an MPU in C-RAN, multiple communications protocols are offloaded from the general-purpose services, reducing power consumption, increasing CPU-to-

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accelerator throughput and overall network throughput. This approach reduces CAPEX and OPEX for service providers by offloading tasks from older base stations that are expensive to operate.

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