Cells: A philosophical excursion (Part 2)

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In Part 1 [1] of this two-part "philosophical excursion," I ventured out to explore how I think LTE Advanced (LTE-A) has changed the notion of a cell in cellular communications. My focus was with respect to features, namely, carrier aggregation (CA) and coordinated multi-points (CoMP), and what they mean to network operators and vendors alike. There is, however, yet another dimension to this, a shift in paradigm almost.

Without going into details, communication requires control information to be transmitted from the network to the user equipment. In LTE, this overhead is mainly cell-specific and static. For instance, all users connected to one cell receive the same control channel and reference signals. In LTE-A, however, much of this information has become user-specific and configurable and can thus be changed dynamically. Consequently, the cellular infrastructure of tomorrow will be heterogeneous, on-demand, "cloud-like" as well as able to quickly adapt to current traffic conditions and a plethora of applications ranging from tablets and smartphones to tens of thousands of connected devices in the Internet of Things.

One of the enabling technologies for tomorrow's "soft" networks are highly dense small cell deployments with greatly improved backhaul to facilitate enhanced intercell interference coordination techniques as well as self-organizing capabilities to control the operation and maintenance overhead. Parts of this next-generation mobile infrastructure will be decentralized, e.g., when small cells are deployed to boost capacity under the coverage umbrella of a macro base station. Yet other parts will be highly centralized, e.g., when multiple remote radio heads are controlled by one "cloud base station [2]."

This heterogeneous and on-demand nature makes these networks cost-effective and energy-efficient.

LTE-A enables on-demand user-specific performance by orchestrating a large amount of different network nodes from small cells to cloud base stations (all of which can be empowered by a single architecture like KeyStone). For the next

release of LTE-A, further small cell enhancements are being discussed together with hybrid network architectures that allow for improved interoperability with WiFi.

So what are your thoughts on the definition of a cell? It seems to be an ever-changing concept these days.

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