LTE: The Insatiable Need for Bandwidth Drives Architectural Change

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The baseband processing function represents a key area of product differentiation for Telecommunications Equipment Manufacturers (TEMs). However, the advent of 3.9/4G systems poses a difficult challenge to TEMs, as they struggle to evolve traditional DSP-centric channel cards to meet a new set of technical and commercial challenges.

In particular, Long Term Evolution (LTE) is acting as a catalyst for change, by driving increased datarates, reduced end-to-end latency and the use of more processing intensive advanced algorithms such as MIMO (multiple input multiple output). In addition, fierce competitive pressure means that basestation manufacturers need to show dramatic and sustained reductions in both CAPEX and OPEX. With LTE-Advanced on the horizon, the challenges outlined will only intensify. However, as in any period of change, challenge also represents an opportunity for innovation.

FPGAs can provide not only the required performance to process these higher bandwidths in less time, but also provide the reconfigurability necessary to future proof the design and accommodate evolutions in the air interfaces or applications being offered.

Furthermore, the inclusion of processor cores in FPGAs, both hard and soft, brings together the best of both worlds: the high performance and power efficiency of the FPGA fabric, with the easier development and control plane efficiency of a processor. By taking advantage of these capabilities, it is now possible to develop single-chip reconfigurable LTE PHY SoCs that can meet the technical challenge of higher bandwidth, lower latency, and advanced algorithms, as well as being more cost and power effective.

Another huge advantage to this approach is the ability to readily scale the architecture to meet different capacity requirements in a cost effective manner. Since there are families of FPGAs, such as Xilinx’s Virtex® family, it is possible to scale a reconfigurable LTE PHY SoC from a three sector macrocell to an enterprise, or even residential, femtocell. Fixed solutions, such as ASICs, generally don’t scale, and reprogrammable DSPs can’t scale in a cost effective way to meet the

computational complexity at the high end.

Another trend in the market that can greatly benefit from LTE PHY SoCs based on FPGAs, is the continued move to multi-mode, or Software Defined Radio, basestations. Due to the plethora of requirements in the wireless industry, from different air interfaces, bandwidths and frequencies, it is extremely time consuming and expensive to maintain multiple fixed platforms to support these requirements. It is also a very risky strategy as these requirements can change significantly over time.

The most effective approach is to leverage the aforementioned reconfigurable and scalable advantages of FPGAs to develop a common platform that can address the multitude of requirements through different bitstreams and/or software loads, or even smaller or large FPGAs.

In summary, baseband processing is an area of continuing change as bandwidths continue to increase. This introduces challenges and risks, but also the ability to capture value through differentiation, and reduce costs through new architectures. Reconfigurable LTE PHY SoCs based on FPGAs can provide a competitive advantage by meeting the technical requirements in a scalable fashion, while also reducing cost, power, form factor and risk.

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http://www.wirelessdesignmag.com/articles/2010/02/lte-insatiable-need-bandwidth-drives-architectural-change