Trends in the Evolving Software Defined Radio (SDR) Market Landscape

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Software Defined Radio (SDR) has evolved from a conceptual solution for enabling multiple radio applications in mobile handsets to a practical solution for RAN infrastructure in commercial cellular networks. Although a great deal of attention is currently being placed on this technology there is still a lot of confusion within the industry as to the benefits obtained by operators and end users. Additionally, many vendors use the term to describe varying levels of software influenced solutions that are not truly software defined, thus furthering industry confusion. This article attempts to bring clarity to these discussions and provide some proof points as to the operator and end user benefits of SDR.

SDR Evolution

SDR allows a single wireless device to support a wide range of capabilities previously available only by integrating multiple radio components. The initial SDR industry focus was on the concept of a multi-purpose handset — taken to the extreme, a single SDR device could provide cellular connectivity, act as an AM/FM receiver, offer GPS position location services, connect to wireless data networks or even function as an HDTV receiver.

SDR offers the flexibility and upgradeability necessary to satisfy these user needs by enabling simultaneous operation of multiple standards on a single hardware device. Today, this technology enables software RAN solutions that allow a cellular operator to support multiple standards simultaneously on a single hardware platform, including shared RF equipment and backhaul transport.

Vanu, Inc's Anywave® base station is the first FCC-certified, commercially available SDR RAN solution, where a single reusable hardware platform can support multiple wireless services and standards simultaneously. Each wireless standard is entirely developed in high level languages that can run on high volume, high performance commercial off-the-shelf processors, allowing customers to choose the best and most cost-effective processor for their application.

Compared to traditional hardware-oriented approaches, such as DSP and FPGA-based solutions, a true SDR base station is highly modular and enables a high degree of software portability and reuse, minimizing the amount of code that has to be re-written to keep pace with advances in the underlying technology. Building SDR systems for general-purpose platforms and a full-featured operating system enables the use of advanced technologies such as virtualization, and allows operators to take advantage of the multitude of existing solutions for management, network integration and system security.

Other approaches labeled as SDR may include significant software elements but do not provide the same engineering benefits, thus reducing the advantage to operators.

Industry Challenges to Growth

Software RAN solutions enable operators to have the flexibility to design and offer differentiated solutions to their end customers. As the mobile industry evolves the challenges operators are faced with also evolve: ARPU continues to decline, so operators are struggling to remain competitive and offer new services without sacrificing their profitable revenue streams. In addition to deploying new services to gain a greater percentage of existing customers' wallet share, there is also a need to reach new customers — within their existing territories or through branching out to unserved and/or underserved markets.

Although reducing costs is always a priority, there are only so many opportunities to derive substantial impact. Creating new revenue streams is the key approach to helping offset declining ARPU and increasing market share. Software RAN solutions can address these market challenges by allowing for upgrades to the next generation of wireless standards through software downloads, as opposed to expensive truck rolls and forklift equipment upgrades. The ability to run multiple radio standards on a single network infrastructure allows for market expansion through lucrative roaming relationships with, or wholesale service provision for, neighboring competitors. Furthermore, green-field opportunities can be addressed through lower cost software-based solutions and the opportunity to share a single network across multiple operators.

How Operators Benefit From Software RAN Solutions

Operators are faced with business challenges on many different levels in today's changing economic times. Software RAN solutions are well positioned to address many of these needs, but SDR systems can go far beyond these obvious benefits by taking advantage of the unique flexibility of a software platform.

The *virtualized basestation* is one example of a new technology enabled by the SDR approach. The advantages of shared infrastructure, primarily reduced costs, are well understood, but numerous disadvantages have also been recognized: the need for cooperative management, lack of independent upgrades or competitive differentiation, etc. A virtualized basestation addresses these concerns by using virtualization technology to allow a single hardware platform to support multiple, independent basestation applications; each operator is allocated a share of the total processing capacity and has total control over their virtual basestation, including the ability to deploy different standards or software upgrades independently of other operators.

Similarly, *On-Demand Capacity* allows the total basestation processing capacity to be dynamically allocated to different virtual basestations according to instantaneous traffic

and associated system policies. Operators can thus only pay for the traffic they generate, and shared infrastructure can be provisioned more efficiently, thus reducing the overall capital investment required.

Vanu, Inc. – Thought Leadership for Industry Change

Vanu, Inc., provides of innovative wireless infrastructure solutions to enable operators to access new markets and new revenue streams. The company was founded in 1998 and grew out of ground-breaking research in software radio at the Massachusetts Institute of Technology (MIT). It is the developer of the Anywave® Base Station, the first U.S. Federal Communications Commission (FCC)-certified software radio for cellular usage. Anywave's SDR applications run on commercial off-the-shelf processors, rather than costly, proprietary hardware; it is the only Radio Access Network (RAN) product to simultaneously support multiple cellular waveform standards on the same hardware platform.

Vanu addresses the challenges discussed above with three solution sets – Multi-Standard products, Shared Active Infrastructure products, and Extended Reach products. The **Anywave Base Station** remains the only multi-standard architecture commercially deployed in live customer networks since 2007. The **MultiRAN** solution allows more then one operator to virtually share a single physical network through the use of virtualization. This not only provides an operator the cost benefit of a shared infrastructure but also the ability to maintain independent management control and offer differentiated services in support of the competitive landscape of their customer base. Vanu has the ability to reach beyond your existing RAN into access challenged locations – rural, indoor/outdoor, small form factor – via **Extended Reach** solutions. Where it doesn't make economic or logistical sense to expand the deployment of your existing RAN, Vanu can provide options to reach these markets.