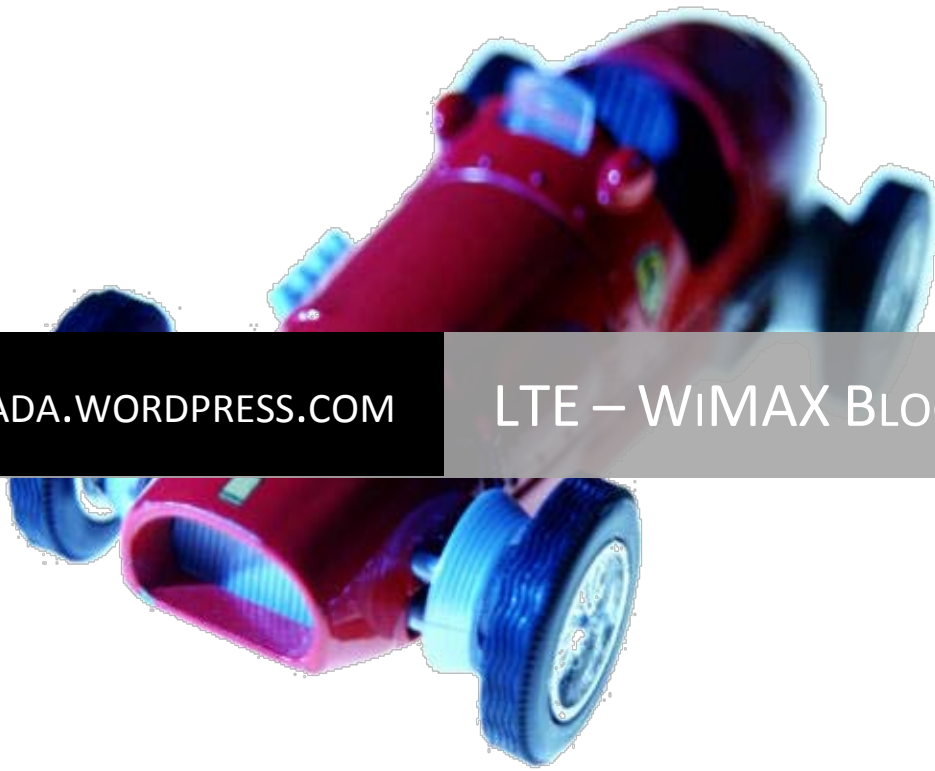


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LTE – WIMAX BLOG

SDR – A silent revolution | Harish Vadada

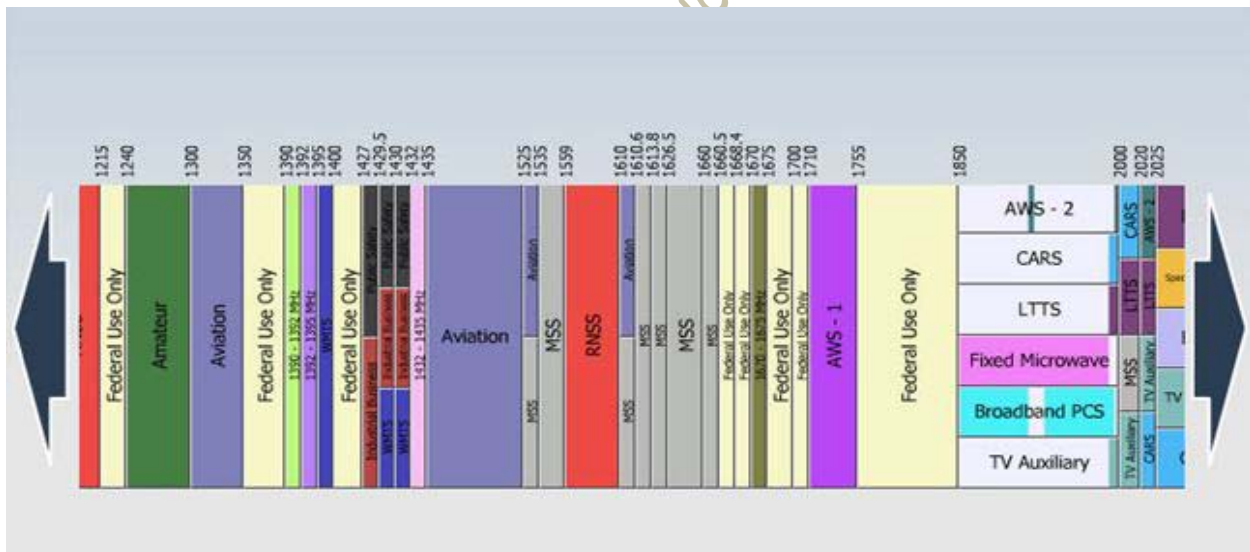
Software defined Radio, as an essential feature for radio base-stations has been adopted by most RAN infrastructure vendors to manufacture their Base Station equipment. With the proliferation of multiple RAN access standards – 2G/3G/4G and various flavors of technologies GERAN, UTRAN, WIMAX and LTE the need for cost savings and efficiency for a base-station holds true in a fast evolving ecosystem.

They go by many marketing names - Single RAN, Uni-BTS, Multi-RAN and Multi-standard Radio. But they all mean essentially the same thing - relatively simple upgrades that allow a single standard base station to support multiple technologies. The next few years will see a rapidly growing – although possibly short-lived – wave of such upgrades throughout both mature and developing markets. A single RAN with multi-standard base stations help an operator move quickly and cost-effectively between technologies and they can be used to support multiple radio technologies simultaneously from a single cabinet.

The proliferation of Cognitive Radio into RAN architecture can be attributed to these three main factors:

### Spectrum Re-farming

The biggest driver for SDR would be the spectrum re-farming efforts that will take place as the GSM technologies reach the twilight zone with the networks transitioning from GERAN to 3G/HSPA+ to LTE. Even though UMTS has offloaded most of the 2G networks, there are still pockets of the world where GSM/EDGE is still doing the bulk of the work by providing voice services and coverage. Refarming of 900 MHz GSM/UMTS is the best example of where multistandard base stations have been used.

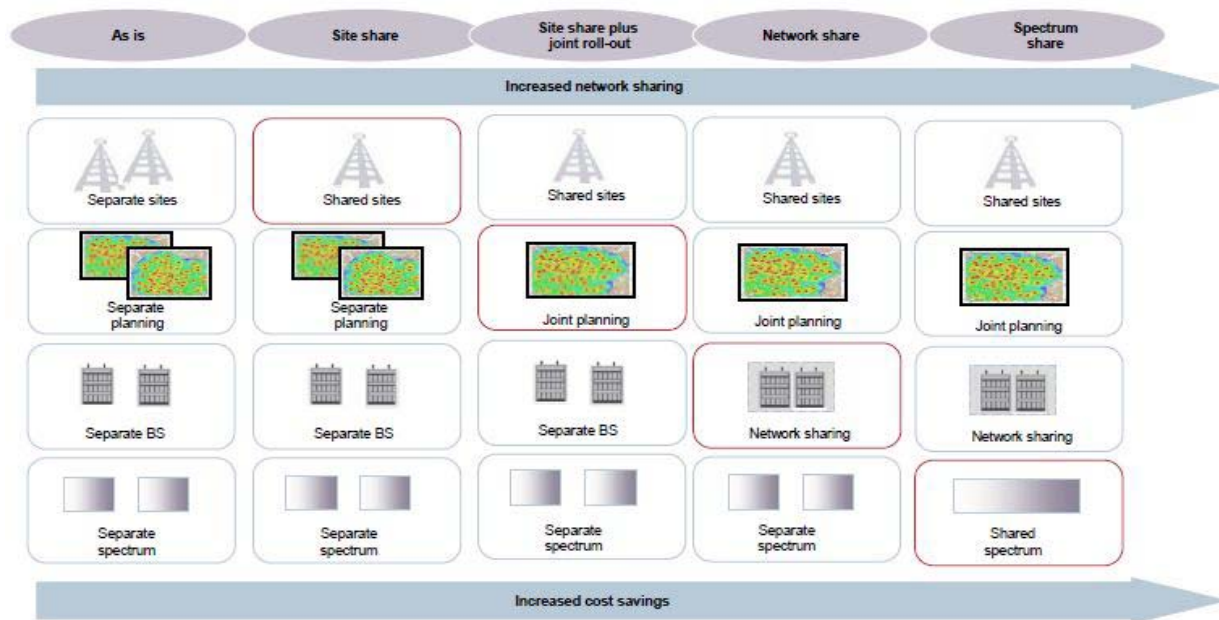


Spectrum refarming has taken place in Europe and will also be considered by FCC in future as we strive to reach mobile broadband milestones. As B3G networks become more spectrally efficient with OFDMA offering more gains for spectrum bands of 10MHz and above. Refarming has its advantages as spectrum is scarce and allowed to recapture lower frequencies. All other things being equal, the lower the frequency, the further a radio signal propagates, which meant that UMTS900 offers a significant improvement over UMTS2100 for cell range and coverage. This translated into fewer sites and cost savings for network build and opex, as well as faster network roll-out. Some other benefits include potential improvements in indoor coverage and better voice quality compared with older technologies.

A GSM operator could now deploy UTRAN/LTE with a single BTS/BBU hardware swap with a scope to do an upgrade when LTE-Advanced along with IMS/MBMS is launched.

## LTE – RAN Sharing across Het-Nets

The LTE architecture enables service providers to reduce the cost of owning and operating the network by allowing the service providers to have separate CN (MME, SGW, PDN GW) while the E-UTRAN (eNBs) is jointly shared by them. This is enabled by the S1-flex mechanism by enabling each eNB to be connected to multiple CN entities. When a UE attaches to the network, it is connected to the appropriate CN entities based on the identity of the service provider sent by the UE. This makes the UE to handover from LTE to non-3GPP access technologies.



RAN sharing as a concept has taken off with Orange and T-Mobile in the UK, as will become the path of choice for many operators as they migrate to 4G, due to various reasons. Operators in the past have paid high amounts for spectrum for 3G and 4G, and to realize their return on investment networks of the future will have to follow a network sharing model that suits their network needs. And an SDR based RAN upgrade would be profitable for migration path that can be easily upgraded in future.

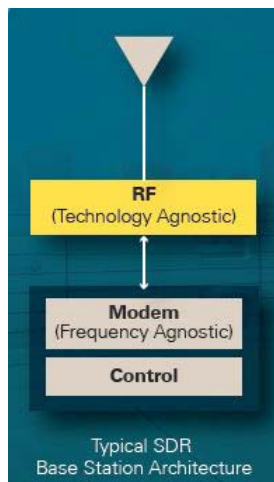
SRVCC (Single Radio Voice Call Continuity) and CSFB (Circuit Switch Fallback) are mechanisms for initial LTE deployment that will pave the way for operators who deploy LTE networks before a single industry approach for Voice/VOIP solution is adapted for 3GPP-LTE. Two initiatives currently undergoing standardization are the VOLGA and One Voice, and till that plays out an SDR solution would very much useful in deploying Het-nets (Heterogeneous Networks).

For Het-nets using CDMA and LTE technologies which use different frequency bands, such as 800MHz or 1900MHz for CDMA and 700MHz or 2.6GHz for LTE, there are no currently available mature RF modules that can simultaneously support two mutually remote frequency bands. However, the two networks can use the same baseband unit (BBU). This approach has two advantages: (1) A shared BBU reuses transmission equipment; (2) Different RF units and antenna feeder systems allow the CDMA and LTE networks to be independently optimized, especially the antenna and downtilt angles. This again is an

example where SDR would be the most economical solution.

## SDR – Mature Technology

SDR as a technology has matured and has come a long way in terms of deploy-ability on the field, with the RRU(Remote Radio Heads) and BBU(Baseband Units) being deployed heavily due to cost savings. Compact base-stations (BTSs) are the latest base station design to be introduced in the market and offer operators flexibility and cost savings while retaining the performance of macro BTSs as they can be installed in single-sector or multiple-sector configurations as alternatives to distributed BTSs with remote radio heads (RRHs). Compact BTSs do not require ground shelters and cooling equipment, and also support high-performance features such as multiple antennas per sector with multiple input, multiple outputs (MIMO) and beamforming.



Several operators are currently assessing the feasibility and cost savings that SDR can offer to them and are starting to include the new concepts in their networks. Vendors like ZTE, Motorola, NSN and Vanu have developed hardware with their Flexi-BTS platforms that have scaled across radio access technologies.

Network operators, including Vodafone Spain, Hong Kong CSL and others, are proving that SDR can increasingly save costs in the network and are acting as greenfield attempts for SDR. Although the majority of mobile operators are now deploying SDR for future upgradeability, Hong Kong CSL has consolidated hardware from several infrastructure vendors into a single platform and is now operating a much more cost effective and efficient network.

## Conclusion

According to ABI Research mobile networks practice director Aditya Kaul, "The first increase in multi-standard upgrades will come from developing markets, especially India, that are now deploying 3G networks. Further momentum will come from LTE rollouts in mature markets."

"One of the major drivers for this coming wave of upgrades is spectrum refarming," Kaul continues.

"Like many other 'natural resources', fresh spectrum is getting scarce. But there are significant amounts previously allocated that are now un- or under-utilized. Multistandard upgrades allow operators to put that spectrum to new uses. Upgrades for refarmed spectrum now account for just 10% of the total market, but their future is bright."

SDR as a ubiquitous technology is here to stay and upgrades involve adding a baseband line card or doing a simple software update to existing baseband cards. For example such an approach would allow a WCDMA base station to move to HSDPA, HSPA+ and possibly LTE standards. Latest advances in RF and SDR technology allow RF components to be reused if operation is in the same frequency band. These upgrades will start to gather steam in 2011 and will continue accelerating for several years before the tempo eases again around 2014-2015.