Next-Generation Spectrum Management – A Layered Approach

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The demand for radio spectrum is ever increasing exponentially, particularly in countries like India with 96 percent mobile and four percent fixed connectivity. Planning for the future requires consideration of best and evolving spectrum management techniques and looking ahead at the task of universal broadband availability. Regulators and spectrum managers world over are grappling with the mission of performing the balancing act of meeting the demands of bandwidth-hungry service providers, emerging technologies, innovative applications, and movement toward de-licensing. When handled in isolation, spectrum demand for each stakeholder need a niche solution, which may be conflicting with others, resulting into mismanagement and sub-optimal utilization of this precious resource, which has started appearing scarce. One solution for this dichotomy appears to lying in the layered approach, which has been exploited by Internet and NGN to make the network, system, and utilization super-efficient. Going by the learning that *One Size Does not Fit All,* spectrum management can be done in a pyramid mode dividing the allocations in separate layers of exclusive allocation, dynamic need-based allotment, and license-exempt usage to get best of both the worlds.

Layered Approach

Spectrum allocation can be categorized in three distinct layers as follows:

Exclusive, dedicated allocation. This layer makes use of the conventional way of spectrum allocation, which is generally done through auction. This should be used for startup spectrum to an operator for providing QoS-based basic services wherein degraded quality as well as interference is not tolerated, e.g., 2G and 3G voice services. Any requirement of additional spectrum beyond startup spectrum by an operator should be met through dynamic allocations from pooled spectrum, which should be demand assigned. For this use, public switched spectrum pool (PSSP) could be made on dynamic allocation basis. Generally, a major chunk of popular spectrum at *sweet spots* in 800, 900, 1800, and 2100 MHz band amounting to around 300 MHz needs to be allocated through this mechanism, which is mostly the case. Major part of the upfront revenue requirement of the government can be met through this chunk, but optimum utilization of spectrum in this method is not ensured.

Dynamic spectrum exchange. The most efficient allocation and usage of radio spectrum for QOS-oriented services can be done through dynamic sharing basis by creating a common pool for add-on spectrum, allocated based on need and demand by existing operators and charged based on usage without any upfront payment. This method can be used for additional requirements of operators beyond startup spectrum. As the operators are made to pay per usage based, they are saved of *Winners Curse* which is countered in auctions, but eventually the government ends up earning more due to payments linked to usage, which becomes multiple times than the dedicated allocation. Any additional chunks of spectrum, being vacated fully or partially by public, state, and defense forces are the ideal candidates for this approach. This concept can be tried for about 100 MHz chunk coming out of *Digital Dividend* band in 700 MHz.

Licence-exempt spectrum usage. This is the top of pyramid and most efficient way of spectrum utilization, which is ideally suited for best-effort services like broadband (Wi-Fi). Though the government does not earn any upfront revenue from this, societal returns on its wide spread exploitation are immeasurable. In addition to last-meters broadband access powered by FTTx, this can also be used for data-offload and also the in-building solutions for voice through fixed mobile convergence. World over around 450 MHz of such spectrum in 2.4, 5.1, and 5.7 GHz is unlicensed for such applications but in India around 150 MHz in 2.4 and 5.8 GHz band only is made available under this and that also with a lot of technical restrictions. Consistent with what is happening around the world and the need of universal provision of all services to the entire populace, the pyramid should gradually become flat and then a reverse pyramid, wherein the de-licenced spectrum will be the norm and the dedicated spectrum will be an exception for niche applications.

Way Forward

The government needs to make more spectrum available unlicensed for Wi-Fi access based on best international practices. There is a need to establish a think-tank of sector experts to study and plan proof-of-concept project to test *Dynamic Spectrum Exchange* for spectrum sharing and pioneer it. ■