Next Generation Spectrum Management- A Layered Approach

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"The technology for more dynamic spectrum access has come of age without being exploited fully. At the same time, consumer demand for services has exposed the limitations of current arrangements. It is now upto regulators and policy makers to provide the means to unleash the innovative potential of dynamic spectrum access and, in doing so, play an important part in tackling spectrum crunch."- Chief Executive, OFCOM, March,2012"
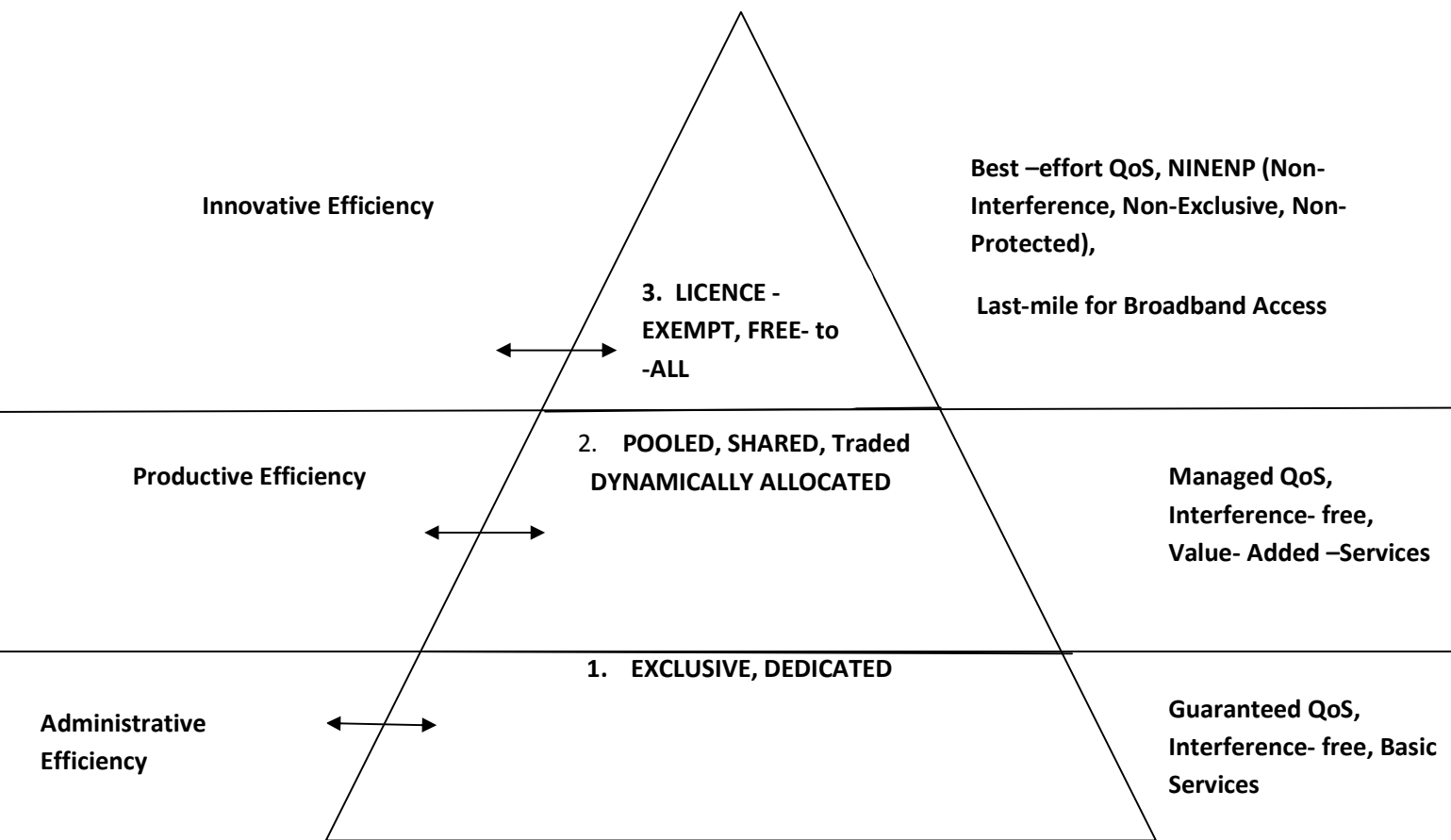
Need for Efficient Spectrum Management

The demand for radio spectrum is ever increasing exponentially, particularly in countries like India with 96% mobile and 4% fixed connectivity. Planning for the future requires consideration of best & evolving spectrum management techniques and looking ahead at the task of universal broadband availability. Some experts say that Spectrum Management is not a Science but an Art and hence needs dexterous handing. Regulators and spectrum managers world over are groppling with the mission of performing the balancing act of meeting the demands of bandwidth-hungry service providers, emerging technologies, innovative applications and movement towards de-licencing .

When handled in isolation spectrum demands for each stakeholder need a niche solution, which may be conflicting with the other, resulting into mismanagement and sub-optimal utilization of this precious resource which has started appearing scarce. One solution for this dichotamy appears to lying in the Layered approach (Divide and Control) 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" the spectrum management can be done in a Pyramid mode dividing the allocations in separate layers of Exclusive Allocation, Dynamic need-based Allotment and Licence- Exempt usage to get best of both the worlds. This can result in meeting the QOS requirement of Basic services and super- efficient usage for value-added services including Broadband and emerging innovative applications.

Such a conceptual approach, whose time has come specially in India, is depicted below:

Layered Approach for Spectrum Allocation

Innovative Efficiency

Best –effort QoS, NINENP (Non-Interference, Non-Exclusive, Non-Protected),

Last-mile for Broadband Access

3. LICENCE - EXEMPT, FREE- to -ALL

2. POOLED, SHARED, Traded DYNAMICALLY ALLOCATED

Productive Efficiency

Managed QoS, Interference- free, Value- Added –Services

1. EXCLUSIVE, DEDICATED

Administrative Efficiency

Guaranteed QoS, Interference- free, Basic Services

As per the above structure the spectrum allocation can be categarised in 3 distinct layers as following;

1. **Exclusive, Dedicated Allocation- This layer makes use of 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 allocation from Pooled spectrum which should be demand assigned (remember DAMA, Demand-Assigned Multiple Access, used in space communications). For this use of 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, 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 Govt. can be met through this chunk, but the optimum utilization of spectrum in this method is not ensured.

2. **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 of Add-on spectrum, allocated based on need and demand for Add-on spectrum 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 Govt. ends up earning more due to payment linked to usage which becomes multiple time 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 approach is already under POC (Proof of Concept) level in US and EU under the ASA (Authorised Shared Access) initiative. To start with this concept can be tried for about 100Mhz 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. It is ideally suited for "Best-Effort" services like Broadband (Wi-fi). Though Govt. does not earn any upfront revenue from this, but the societal returns on its wide spread exploitation are immeasurable. As per a study for US senate, the efficiency of usage in this mechanism is of the order of 1000 times over the conventional approach. In addition to last-meters broadband access powered by FTTX, this can also be used for Data-offload (to spare the dedicated spectrum for Voice) and also the In-Building Solutions for Voice through FMC (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 150Mhz in 2.4 and 5.8 GHz band only is made available under this and that also with lot of technical restrictions. We also have to remember that consistent with what is happening around the world, and also consistent with 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:-

1. Make more spectrum available unlicensed for wi.fi access based on best international practices.

2. Establish a Think-Tank of sector experts to study and plan Proof-of-Concept project to test "Dynamic Spectrum Exchange" for spectrum Trading and pioneer it.

3. Have a timeframe- earlier the better as Time is Essence.