

Dynamic Spectrum Exchange- Making Scarce Resource deliver More

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It is a well known fact that the radio spectrum is a scarce resource and the regulators world over are struggling to counter the crunch and ever increasing demand for this from operators who are trying to meet the ever increasing aspiration for high bandwidth consuming applications on their mobiles.

Actually, the radio spectrum is not really scarce, but finite and highly mismanaged and grossly underutilized. In fact, this wonderful natural resource though finite but has enormous capacity to carry information. This is depicted by the famous Shannon's Theorem which mathematically estimates the limit of information Carrying capacity of a radio channel.

As an analogy, spectrum can be equated to the real estate, which may be finite, but through multistoried sky scrapers, the capacity of buildup area can really be enormous. It is only constrained by the regulation (FSI) and the technology and construction material used. Same way by use of Multi- level modulation techniques, Multi-model multiplexing and efficient encoding processes, a single Hertz (Cycle per Second) of spectrum can be made to carry tens of Bits, hence increasing the information carrying capacity many folds.

As far as options to enhance the capacity is concerned, their niche role is required to be played by each key stake holders ie. Govts., Operators and Network providers. Option available with operators is to make use of frequency re-use techniques as a tradeoff between spectrum required and no. of Towers, to serve a particular Subscriber's base/ data carrying requirement. This option is hardly exploited due to obvious high capex implications. On the part of vendors, they are required to embrace the next generation technologies based on packet switching in Access network also, which is very efficient. Of course more and work is already happening in this direction and Vendors and R &D persons are

not resting. The main discussion in this paper is that for the spectrum manager to learn from innovations in management of finite resources.

The role of spectrum managers, either the govt. or regulators, whichever is the case in increasing the efficiency of radio spectrum is of paramount importance as being the custodian they are the first and most significant stakeholders in this value chain. To meet the objective they need to innovate in management of spectrum and learn from the various advancements in similar fields. One case in point is emergence of packetisation techniques, to improve the utilization of a resource or media. This has been exploited fully by internet and now moving to Telco domain through NGN, wherein efficient Connection-less channels are giving way to dedicated but in-efficient Connection-oriented channels. Also learnings are to be taken from the trunking techniques wherein the same resource is shared among multiple users in time-domain. Also the old age, proven concept of DAMA-Demand Assigned Multiple Access, very well used in Satellite communication has some ideas to emulate.

In addition, many regulators and operators has made use of Time-slot interchange and packet- switching techniques to improve the utilization many fold. Examples are Internet Exchanges, which helps in efficient utilization of precious International Connectivity, Interconnect- Exchanges or Teleco-hotels for efficient interconnection among multiple operators and lately, the Power-Exchanges to help in distribution of pooled power to the most needy entity at a given time.

Therefore, there is a life-time opportunity knocking the doors of spectrum managers to come out of the stigma of gross mismanagement of spectrum, by bringing efficiency not only in the utilization of spectrum but also in its Allocation. Unfortunately, charity has to begin at home as the most In-efficient usage of radio spectrum is prevalent in the strategic and state entities. Defence forces are still using spectrum through outdated technologies and also in a fraction of the geography, in which they have been allocated spectrum. Same way state broadcasters are still embracing spectrum guzzling analogue technologies, though there is a strong movement towards “Digital Dividend”.

Also, not many public sector utilities are known to be efficient users of spectrum.

In the developing nations specially, US and Europe, there is pragmatic political move towards “Authorised Shared Access” and “Pooled Spectrum”, wherein taking cognisance of interference- tolerant technological developments through SDR (Software Defined Radio) and Cognitive Radio (CR), Govt. is discussing the possibility of sharing the strategic spectrum with the public operators, with a condition of First-right and Zero-interference to the Defence usage. This is likely to work in 95% of geography, where defence forces though have exclusive allocations but no operations. For rest, Public users will be allowed to use only if and whatever the spectrum is idling and without any interference to the original allottee ie. the defence forces. This appears to be good beginning but not enough.

The innovative, forward looking approach for efficient spectrum allocation has to take best of learnings from past, present and some out-of –box thinking to Make- it –Happen. One solution in this direction can be establishment of “ Dynamic Spectrum Exchange for dynamically allocating the spectrum chunks from “Public Switched Spectrum Pool (PSSP)” to the most needy one and temporarily withdrawing from the allottee who is not using it at the moment. This will work as a Spectrum Highway or a Clearinghouse, wherein Spectrum Usage Charge (SUC) will be paid based on the usage and not upfront. This process will also save the spectrum-hungry operators from the “Winners Curse” as they will “pay-as-you-eat”.

To start with, to take it forward, Govt. needs to setup an Expert group of top brains of the country from all relevant segments and come out with a White Paper and action plan. Then a Proof- of –Concept project needs to be created to test it with about 100 Mhz spectrum, wherever idling (like digital dividend band) or some some strategic spectrum at a non-strategic location far away from security forces activity centres. This can prove to be the “Nirvana” for all our man-made spectrum woes.
