InterConnect - on your wavelength

InterConnect Consultants Chase Borderland Signals

Radio waves have no respect for man-made constructs such as borders between nation- states. The inevitable result is overspill of signal in all areas of the spectrum between one nation-state and another. The International Telecommunications Union has developed recommendations for management of this overspill and yet uncertainty still remains. This uncertainty comes from the latitude that exists for nation-states to reach their own bi-lateral or multi-lateral agreements to fit local conditions. And so it was in the Middle East where overspill of 2G and 3G mobile services became the subject of a recent comprehensive study by InterConnect Communications.

There are three reasons for wanting to control overspill of signal. The first is interference between networks. To effect control of this, techniques such as preferential frequencies and codes need to be employed governing assignments to stations within 100km of the border. The second is the inadvertent roaming of citizens of one nation- state on foreign networks. Mostly they don't realise and only find that they have roamed when they see their high phone bill. The third is the issue of national security. If there is extensive coverage of a nation-state by a foreign cellular network then this can be used to escape the prying eyes of local security agencies for those involved in criminal activities at or near the border.

InterConnect consultants approached the project using both modelling and measurement to determine the degree of breach of a current 2G bi-lateral agreement and to re-craft this and postulate a 3G agreement that would be practical for cellular operators to meet whilst controlling the problem. Commented John Berry, Director of Spectrum Services at InterConnect "it's too easy to assume that either the operators will sort it out or that the ITU or ECC recommendations alone will control all issues. This is rarely so and local agreements are essential." As Jan Verduijn, the InterConnect survey project manager, commented, "This was an adventure of a lifetime. It's not often that spectrum engineers get the chance to drive 2,500km of beautiful borderlands in search of rogue signals!"

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Consulting in Communications Regulation and Strategy

InterConnect Communications
A Telcordia Technologies Company

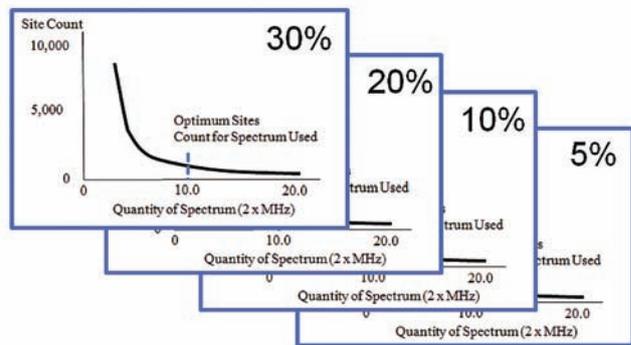# So just how much spectrum is needed for future cellular networks?

This is the very question that is on everyone's mind just now as NRAs consider re-farming the 900MHz and 1800MHz bands on which incumbent operators run 2G services. Some studies suggest that 3G services under the banner of IMT-2000 will need around 500MHz with those for IMT-Advanced needing about 2GHz and this explains recent allotment declarations as bands from 450MHz to 3.5GHz have been declared 'IMT',

NRAs have much decision making to do as they make regulatory plans to move from today's allotments to a state with more operators using more spectrum supporting more dense networks supplying a greater variety of services. To help make these decisions InterConnect consultants recently built a country-specific calculator for Jordan's Telecommunications Regulatory Commission that allowed the spectrum managers there to play 'what if' between existing and future MNO allotments to determine the cost penalty (measured in site count to meet different market penetrations) for every possible block size. The result was a cross-band decision tool for band re-farming.

As Mohammed Al Wathiq Shaqrah of Jordan's TRC commented "it gives us a unique ability to make plans considering future traffic and market projections out to 2020." The tool has been built using some of the principles from Recommendation ITU-R M.1390 and Report ITU-R M.2023 as well as from the current body of knowledge on 2G and 3G cell planning and uses MS Excel.

There are other spreadsheets as John Berry, Director of Spectrum Services at InterConnect noted "there's WINNER and SPECULATOR and they are extremely comprehensive but they don't answer the practical question: how much do I take away from X to give to give to Y, what's the effect on X and what do I give as compensation".

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Core algorithms: site count versus spectrum for varying market share

User interface: a 'what if input and graphical output'

Model engine: Cell dimensioning, services and traffic

About InterConnect

InterConnect Communications is a company based in the United Kingdom. Our business is consulting in communications regulation and strategy. InterConnect comprises two consulting practices: Networks and Spectrum & Wireless. In Spectrum & Wireless our customer base of national regulatory authorities and wireless network operators using the radio spectrum covers the World.

Consulting in Communications Regulation and Strategy

On Spectrum Policy

Much of the focus day to day for operators and regulators is on spectrum management within existing policy guidelines. Such policy, however, needs development. Spectrum policies that determine how spectrum users get spectrum access have their roots in national telecommunications law and other governmental thinking. Spectrum policies flow easily from well-crafted governmental policy. A good example is the flow from rural development policies into spectrum provision and coverage obligations for rural broadband. Spectrum access policy facilitates higher governmental aims.

To assemble spectrum policy, National Regulatory Authorities (NRAs) prepare plans. The ultimate aim is to maximise contribution of the spectrum to the Gross Domestic Product of the nation-state. Today, the central principle in mixed-market economies is the use of the economics 'law of demand' to determine access price thereby making allocation to users who value the spectrum most. Such plans will also say how governmental, military and civil spectrum will be managed in concert and what role auctions, trading and opportunity-cost will have in setting the market price for spectrum released. Most NRAs will also want to promote competition in their telecommunications markets. Most will want to embrace service and technology neutrality. And most will strive to expose their thinking through consultation.

InterConnect has aided two NRAs, one in the Middle East and the other in the Far East, over the past three months to prepare comprehensive policy across the spectrum culminating in Spectrum Master Plans. Multi-discipline teams of economists, lawyers, marketers and engineers have worked side by side in-country. This policy development work commenced with a comprehensive review of statutory instruments already in place in the nation-states. The projects then reviewed the needs of the markets, completing demand studies for various segments. They reviewed existing policy and best practice world-wide. And they culminated in the development of comprehensive reports setting out policy proposals. In several instances and for several market segments, consultation documents were delivered for later use by the NRAs prior to adopting the various plans. These consultations illustrated proposals for spectrum release, spectrum pricing and future regulatory methods including GSM re-farming. The cycle started with central government policy for such things as rural development, economic stimulus, broadcasting and national security and ended saying how spectrum policy would aid national goals.

On system specification

So all national regulatory authorities are the same? And doesn't the ITU mandate how spectrum management should be done? The answer is an emphatic 'no'! Each NRA is culturally unique. It has unique objectives and unique development aims. It has unique staff and unique commissioners. One size does not fit all and we don't have a World family of 192 clones.
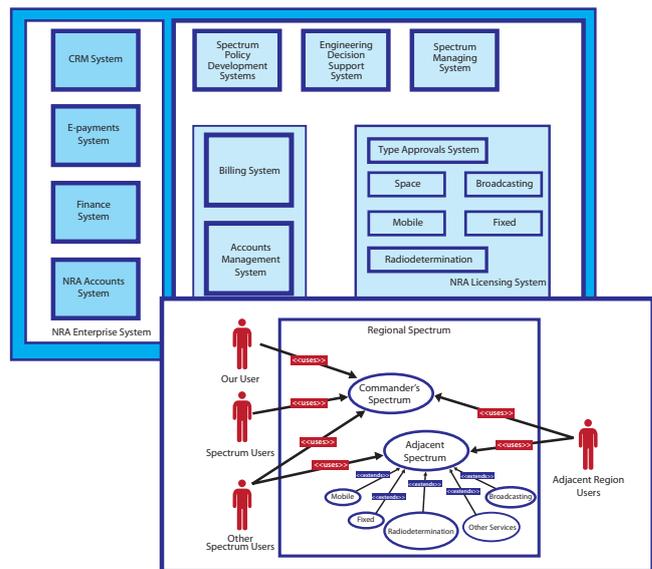
**Use of UML in system specification: system diagram and use case model**

This was the start point for a recent Spectrum Management System Specification project run by InterConnect Communications for a Middle Eastern National Regulatory Authority. As John Berry, Director of Spectrum Services commented, "Whilst the ITU does give good guidance, one has to start with the premise that requirements are special and need to be elicited and not just presumed." The InterConnect team developed a comprehensive specification covering traditional spectrum management, allotment and plan management, e-licencing, e-payments, information security, monitoring system interface, CRM system and accounting system. The project went on to include bid adjudication and vendor management. As John continued "A consulting team with balanced skills is essential. Today's systems span software engineering, business process and radiocommunications ."

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Multi Player Model

Often there is a requirement for analysis in the mobile sector to determine which of multiple possible regulatory and business solutions will contribute most to or even threaten investment return. Investors, NRAs and operators alike ask:

- How many MNO/MVNOs can the market sustain in the long run?
- How sensitive is the operator business model to auction result or licence fee?
- What are the implications of spectrum rights and trading on future business?
- How does industry structure affect evolution of retail prices for services?
- How will operators' financial returns be affected by universal service obligations?
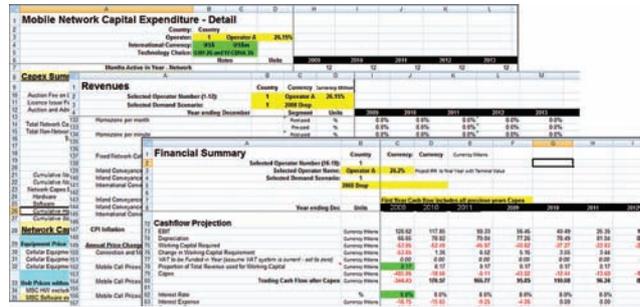
Multi-Player Model: ready to use, just add local data

InterConnect's Multi-Player Model (MPM) was designed with these very questions and issues in mind and produces financial results and forecasts for each Operator in a competitive market. The model takes into account the interactions between operators including response to retail price signals, inter-operator traffic flows and interconnect charges, inter-operator churn rates and changes in market shares. The MPM also incorporates a demand forecasting model to estimate the future size and value of the mobile services market as a whole. With the MPM ready to use, only market demand forecasts and data on the current market situation are required to enable a wide range of future scenarios to be fully modelled and properly tested. The tool has recently been used to inform important decisions about industry structure and licensing in NRAs in a number of countries.

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InterConnect's TRMC Master Classes

InterConnect has historically provided extensive levels of training related support to regulatory authorities and operators during the delivery of its major consulting assignments. In 2000, however, the company went one step further in creating the Regulatory Master Class, the first in what is now a series of training courses for professionals in the communications sector. The range of courses on offer now extends to Economic Regulation, Interconnection, Spectrum Management, Numbering, and Next Generation Networks.

Spectrum Master Class
The Spectrum Master Class is now in its sixth year. It is ideal for anyone requiring an intermediate-level overview of the whole business of spectrum management from development of policy through spectrum engineering and modeling to processes such as assignment and coordination. Tutors are regulatory consultants or engineers and policy-makers from NRAs. And towards the end of the week a senior figure from a regulator gives his view of the traditions and transformations in the vibrant world of spectrum.

Modern Wireless Networks
New for this year, InterConnect Communications builds on its existing Next Generation Networks by adding a course that explores modern wireless networks right from the business case, investment appraisal and network dimensioning through to roll out and optimisation. The emphasis is on the viability of future investment. The course is run by consultants with many years of experience in wireless network design and deployment.

For more information and dates and to book your place on either course go to **www.icc-uk.com** and navigate to 'TRMC & Training'.

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