As demands for wireless broadband explode, we need to make more use of licence-exempt spectrum allocation and dynamic spectrum access, writes H Nwana. This will help to address the digital divide

True dynamic spectrum access will meet the thousand-fold spectrum challenge

H Nwana: There are trials of dynamic spectrum access under way in a number of countries

We need more licence-exempt and dynamic spectrum access in order to tackle the challenge of explosive bandwidth demands — the thousand-fold spectrum challenge.

Managing and meeting today's insatiable demand for mobile data can only be successful achieved through a combination of:

- more efficient technology, delivering more bits per megahertz;
- more mobile sites, including macrocells, femtocells and wifi;
- more spectrum — more megahertz;
- and, specifically, more low-frequency spectrum, under one gigahertz.

More bits per megahertz generally means more bandwidth is obtained from any spectrum; more macrocells, femtocells and wifi will increase capacity markedly.

Furthermore, access to frequencies under one gigahertz will be needed for more rural coverage, particularly for emerging market countries or continents such as Africa where more people live in sparsely populated rural areas.

While this seems straightforward enough, reassigning this additional spectrum for wireless broadband and allocating it in the usual exclusive licensed manner will not be optimal to meet the 1,000x spectrum challenge. We need more licence-exempt spectrum allocation as well as dynamic spectrum access.

Making dynamic access real

Dynamic spectrum access involves technologies that enable wireless users to share access to spectrum. It allows regulators to tailor the technical conditions at the place and time of sharing. Doing this maximises the efficiency of spectrum usage and in turn spurs innovation, while protecting incumbent services from harmful interference at the same time.

The global dynamic spectrum access movement continues to grow as dynamic spectrum policy thinking moves up the agenda for regulators and policy makers, especially as new areas such as the internet of things emerge.

More and more countries are looking to implement dynamic spectrum access regulations in 2015, adding to the US, Singapore, Ghana and Finland. This includes the UK, South Africa and Malawi, as well as a growing number of geographical database-based spectrum access pilots already underway in North America, Europe, South Africa, South Korea, the Philippines, Kenya, Tanzania, Namibia, Japan, Jamaica and Latin America — the first being in Uruguay.

Undoubtedly dynamic spectrum access is firmly coming of age, as witnessed by these trials and pilots, which are well and truly underway. The most recent country to allow for commercial dynamic spectrum access in the TV bands, ensuring TV white-spaces-based broadband, was Ghana in January 2015. This adds to dynamic spectrum access becoming more real.

More broadband

More broadband requires the industry to specifically address the need for more wifi, more spectrum and, most importantly, how the more spectrum is accessed.

The push for more wifi is on the back of a recent report from the European Broadcasting Union.

It is estimated that 71% of all wireless data to mobile devices in the EU was delivered using wifi. This means that the majority of broadband data ▶ 94

Dynamic spectrum access can help by allowing sharing of television spectrum to improve broadband coverage

66 ◀ delivered to mobile devices is now increasingly transmitted over wifi.

Globally, 45% of total mobile data traffic was offloaded on to the fixed network through wifi or femtocells in 2013.

Without offload, mobile data traffic would have grown 98% rather than 81% in 2013. Therefore, wifi and off-loading to wifi networks are a significant part of the solution to the mobile data problem.

At the same time, more spectrum for wifi is also critical, and spectrum sharing is just logical, pointing to the fact that most licence-exclusive spectrum is not being used in most of the places most of the time. Therefore, why not use the new dynamic access technologies that we have available in 2015? This spectrum could be used without interfering with existing licensed users.

More non-wifi spectrum is also needed, and particularly how the spectrum is allocated and assigned is crucial. The 1000x spectrum challenge will not be met from new spectrum allocations or assignments on licence-exclusive bases.

Therefore, the 1000x challenge must grapple too with how existing assigned spectrum is accessed.

It is vital for the industry to evolve with trends, and licence-exempt networks are required for the flurry of certain new devices.

Much of the growing capacity needs can be attributed to new licence-exempt devices that are produced and certified each year. Wifi devices are very well known, but Bluetooth, Zigbee and RFID have also experienced rapid growth over the last several years.

Licence-exempt access complements licensed access and this will drive demand for increased bandwidth particularly with new wifi technologies, including IEEE 802.11ac and 802.11af.

So, increasing the available licence-exempt wifi capacity is as important as provisioning additional capacity for networks using licensed spectrum access.

The ability to offload data from cellular networks to wifi is key. It has saved mobile network operators billions of dollars in network deployment costs and studies of wifi use make it clear that greater availability of licence-exempt spectrum increases both demand for, and the utility of licensed spectrum.

Wifi availability has enabled consumers to use their phones and tablets more intensively to access online content and services. Use and development of these online services in turn drives demand for licensed and licence-exempt network access, creating a virtuous cycle of investment in content, services and applications.

The dynamic use of spectrum can enable access even if other users such as broadcasters are not cleared from licensed bands.

Taking UHF as an example, dynamic spectrum access in the UHF band will enable valuable broadband coverage and capacity benefits to be gained even if digital terrestrial TV remains as an incumbent in the band.

If policymakers decided to clear broadcast services from the UHF bands, or broadcasters vacated, dynamic spectrum access would provide a seamless way to exploit any unused spectrum fragments that result. This can be achieved without the costs and delay entailed by clearance, as a precursor to an auction and exclusive-use licensing.

Even when parts of the UHF bands have been cleared and assigned, many rural areas are often left without coverage from new networks. Again, dynamic spectrum access can help by allowing sharing of unused, cleared spectrum, until the new licensee deploys infrastructure in these areas.

Mature technologies

Not only are these technologies available, but they are also increasingly mature. After several years of research and development, the first generation of commercial-grade TV white space equipment is being used in the first commercial deployments around the world.

MediaTek, a first-tier wifi chipset maker, has announced a roadmap to providing 802.11af chipsets, enabling wifi in TV bands. TV white space technology is already being widely deployed in projects occurring on five continents.

Action needs to be taken now to connect the next three to four billion broadband-unconnected. Great progress has already been made to kick-start regulations and policy making with regulators worldwide, engaging with regulators and government officials to promote the adoption of legal and regulatory frameworks that facilitate dynamic access to radio spectrum.

While there is much progress taking place, much more needs to be done. We need to continue to raise awareness of the critical need to best use the radio spectrum on a global scale and address the digital divide.

Many of these issues will be addressed at this year's Dynamic Spectrum Alliance global summit, which takes place in Manila in May. It will focus on the potential future offered by dynamic spectrum access technologies.

It will effectively encourage discussions towards creating regulatory guidelines and standards which act as a catalyst in building relationships and nurturing initiatives, whilst driving global dynamic spectrum access efforts to better the use of limited and scarce frequencies. ■

Professor H Nwana is executive director of the Dynamic Spectrum Alliance
http://www.dynamicspectrumalliance.org