Connectivity as a resource for organizations
Small Cells World Summit 2019 Event Report

It is often said that 5G will enable mobile technology to reach far beyond the current boundaries of connectivity. In fact, it was abundantly clear, at the Small Cells World Summit in London, that there is no need to wait for next generation technology. Right now, small cells are the vehicle to extend mobile connectivity as a resource for a wealth of new deployers, new devices, new applications and new organizations.

There was plenty of lively debate among the speakers and delegates at Small Cell Forum’s well-attended conference. However, for all the variety of opinions and experiences, attendees were united by a central conviction – that the small cell ecosystem, brought together by the Forum, is propelling the mobile industry towards unprecedented reach and diversity of high quality connectivity.

The traditional cellular model – mobile network operators (MNOs) rolling out in exclusively licensed spectrum to support general purpose mobile broadband connectivity - will remain central. But to fulfil the potential of densification and future 5G, this model must be extended radically, complementing the MNO deployments with a second wave of deployers, harnessing multi-operator platforms and shared spectrum to support highly targeted connectivity and the digital transformation requirements of multiple industries.

Mobile operators cannot reach every location and every use case profitably, but neutral hosts and private network operators can fill those gaps and open up mission critical connectivity as a vital resource for many organizations, enabling new and business critical services. That, in turn, will drive adoption of new industrial and IoT applications, and provide the foundation for truly smart cities.

In summary, SCWS19 clarified the need for a secondary market in cellular connectivity driven by a diverse set of deployers armed with small cells. Neutral hosts took center stage as the pioneering group of deployers, already addressing enterprise needs in private indoor spaces as well as municipal needs in the public outdoor environment. Specialist system integrators are using private networks to address high-value mission-critical cases in healthcare, industry and emergency services.

The event represented a resounding call for action to drive this vision further forwards. Innovation in spectrum licensing, small cell architectures and network management will be essential to improve the economics of densification. The more cost-effective small cell deployment can become, the more organizations will benefit.

Now we must respond, as a community, to these demands, and build on the clear consensus that emerged from SCWS19.

The Forum’s work program for 2019-2020 focuses strongly on many of the key requirements which emerged from two days of intense debate and learning. The themes of the conference inform the work going forward, including neutral host models, indoor coverage, spectrum, policy and architecture innovation, and the needs of industrial, IoT and city organizations.

We must work together to address the challenges, and harness the considerable opportunities, of a hugely enlarged ecosystem for small cells, extending to a wide range of new service providers and organizations, and bringing the benefits of high quality mobile connectivity to a host of new users and applications.
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Attendees

450 delegates attended the event from the following companies:

47 speakers:

Event videos: [https://www.youtube.com/channel/UCcdY5lyj0-kroJuPSiSyY4Q](https://www.youtube.com/channel/UCcdY5lyj0-kroJuPSiSyY4Q)

Twitter activity summary: [https://wke.lt/w/s/NK1DE1](https://wke.lt/w/s/NK1DE1)

Slides: [https://www.smallcells.world/post-event/](https://www.smallcells.world/post-event/)
State of the Market 2019: Keynotes & Analyst Update

Speakers and slides

• David Orloff, Chair SCF, Director RAN product introduction, AT&T, “Network Densification in the 5G Era”. Virtualization, indoor strategy and neutral hosting, smart cities, edge computing, Open RAN & 5G roadmap.

• Gavin Jones, MD Mobile Operator, Media and Broadcast Divisions, BT Wholesale, “The Deployment of Small Cells for the Network of the Future”. The current state of play and areas of demand, types of small cells to meet these needs, future development based on improved deployment models.


• Caroline Gabriel, Research Director, Rethink Research and Content Director, SCF, “State of the Market for Densification”. Deployment forecasts for small cells to 2025, key trends and forecasts for each of the conference’s themes.

• Simon Fletcher, CTO, Real Wireless – panellist

• Dean Bubley, Disruptive Analysis – panellist

Panel Debate chaired by Julius Robson, Chief Strategy Officer, SCF

The three keynote presentations provided a fascinating snapshot of the diversity of the small cell operator landscape. AT&T is one of the powerhouses behind new and open architectures and David Orloff made a strong case for how open, virtualized platforms can drive the industry forward towards 5G. No one operator or alliance can achieve this by itself and he outlined how the “spirit of sharing” would transform the small cell market, aligning the work of SCF, on open specifications such as 5G FAPI, with other initiatives like the AT&T-initiated ORAN Alliance.

BT Wholesale’s Gavin Jones was focused on the practicalities of the here and now, and particularly how simpler, cheaper deployment processes are essential to make the neutral host model a reality and put small cell connectivity in every corner. He was clear that demand for small cells was no longer an issue – he has seen a 500% increase in demand in the past year in the UK. But that can only be met if the cost and complexity of roll-out is slashed. “It’s a myth that sites are a pot of gold – only 60% are profitable,” he said, and that needs to change.

And Turkcell, one of the industry’s leaders in extending the traditional MNO model into new services, illustrated how the business case is strengthened by diversity, with small cell roadmaps which span multiple spectrum bands, form factors, vendors and deployment environments.

Overall, the presentations and panel discussion may have represented different viewpoints, but they were united on some key ideas, which were taken up consistently by the later sessions. All agreed that there was a huge pent-up opportunity for small cells, especially in enterprise and indoor environments, which would be served only when it became significantly cheaper and easier to roll out small cells to every organization. According to BT Wholesale, to deploy the 770,000 small cells the UK is estimated to need using current one-by-one processes, would take 210,000 years.

That will depend on a range of emerging changes becoming mainstream – multi-operator and neutral host platforms; open RAN architectures and shared spectrum to drive flexibility and cost reduction; streamlined roll-out and approval processes.
According to SCF’s latest market forecasts, the result of the industry making a concerted effort to support these key enablers will translate into more than two million extra cells being deployed in 2025, compared to a situation where the current landscape remains little changed.

Particular environments where the demand is expected to intensify rapidly were identified as roads and railways; ports and airports; industrial and IoT applications with high reliability or mobility needs; city centers and tourist venues; and rural services.

These have in common a need for more than general purpose mobile broadband – their operations will be transformed if they can harness connectivity that is optimized for their individual requirements, whether those involve high availability, low latency, enhanced security or massive device density. Serving all these needs will require larger numbers of deployers, including those with specialized knowledge of the individual sector and its business.

**Recommended Industry Actions**

- Slash the time and cost of deploying small cells – streamlined, standardized processes; certification process for engineers; better arrangements with local authorities, landlords and other stakeholders.
- Reduce cost of operating dense networks with open architectures and automation tools.
- Make it practical to use all kinds of spectrum – licensed, shared, millimeter wave and so on – in flexible combinations to optimize cost:performance.
- Encourage neutral host models and private networks to accelerate deployment, especially for specialized environments, and lower barriers between MNOs and alternative deployers.
Indoor Solutions, 5G Readiness and mmWave

Speakers and slides

- Ki Seok Yang, Access Network Development, SK Telecom, “5G In-building Solution Commercialization”. New form factors to simplify indoor deployment, including SK Telecom’s new repeater.
- Puneet Sethi, Senior Director, Product Management, Qualcomm Atheros, “Breaking the Wireless Barriers to Mobilize 5GNR mmWave”. Co-siting 5GNR mmWave antennas with existing Wi-Fi deployments.
- Randy Cox, Senior Director, Product Management, Small Cells and mmWave, Nokia, “5G mmWave”. 5G small cells to complement 4G and 5G macro networks, use cases and challenges and typical mmWave solutions.
- Summer Chen Zhiping, Director of Wireless Solution, ZTE - panellist

Panel Debate chaired by Caroline Gabriel, Research Director, Rethink Research

Making a strong business case to deploy small cells deep inside buildings has been a tough challenge for many MNOs, yet many of the biggest commercial opportunities for mobile connectivity rely on high quality, reliable coverage in every corner of an organization.

This session sought to address that conundrum, and made a strong case that two developments would bridge the gap between enterprise needs, and MNO priorities – new architectures which would drive down cost and time to deploy; and complementary deployers, who would extend the MNO network deep indoors on a neutral host or private basis. According to operator surveys by Rethink, three factors would ease indoor roll-out to such an extent that an additional 2.4 million cells would be installed in a single year, in 2025. These factors were alternative deployers; frameworks to share cost and risk between enterprises and operators; and highly simplified installation procedures.

The speakers and a lively panel debate confirmed these priorities for the industry. There was considerable focus on the need for a wide variety of form factors to extend connectivity cost-effectively in different indoor environments, with SK Telecom’s innovative repeater as one example. Both Qualcomm and Nokia talked about the importance of new spectrum, including millimeter wave, to enable greater density and capacity as the industry shifts from addressing “high ceiling” locations such as stadiums, to bringing deep connectivity to every office, warehouse and factory.

This was a pragmatic session. Addressing cabling issues to create a common infrastructure, that can be upgraded to 5G without ripping out any wires, is more important now than visions of 5G-driven robots. Huawei’s Bruce Li argued strongly for a common physical architecture that would allow different radios and spectrum bands to be swapped in and out for a decade.

And there was strong recognition that enterprises are very diverse, so one platform and one channel to market will not serve them all. The need for private network operators or neutral hosts, which can deploy edge computing alongside connectivity and enable specialized use cases, was highlighted here, and taken up in far more detail in the session dedicated to these issues. Indeed, the crossover with later sessions in many areas, including new spectrum and virtualized architectures, made it clear that excellent indoor networks,
with a migration path to 5G, will depend on a combination of many enablers from standard cabling to flexible form factors to new deployment models.

**Recommended Industry Actions**

- Publish clear guidelines for supporting infrastructure to ensure indoor small cells can use the same cabling for many years, to improve future-proofing.
- Develop low-touch deployment and management processes to reduce cost of ownership.
- Encourage neutral host or enterprise-specific deployers to improve the business case for indoor connectivity while working alongside MNOs.
- Drive technologies to harness millimetre wave spectrum and virtualized architectures to enhance the cost:performance ratio.
- Draw up frameworks for interaction between landlords, enterprises, integrators and operators to improve cooperation and ease deployment.
Neutral Hosting

Speakers and slides

- **Kieron Osmotherly, CEO, TowerXchange**, “Market Update”. The rise of towercos and neutral hosts, and the balance between macro towers and urban infrastructure in the new mobile network.
- **Scott Coates, CEO, Wireless Infrastructure Group**, "Perspectives on Neutral Host Wireless Infrastructure in the UK”. Delivering the edge of the network for multiple MNOs.
- **Paul Coffey, Head of Strategy, DenseAir**, "Holistic Benefits of Deploying Neutral Host Small Cells in Wholesale Spectrum”. Wholesale neutral host small cell services.
- **Mark Gilmour, VP, Mobile Connectivity Solutions, Colt Technology Services**, "SDN Agile Transport for Neutral Hosting”. Cost-effective SLA-based fiber transport for neutral hosting.
- **Morten Tolstrup, Executive Director, Marcom & Learning Strategy, JMA Wireless**, "Neutral Hosting with Shared Virtualized RAN”. Distributed radio systems vs small cells.
- **Stuart Holyoak, Director, Small Cells Business Development Europe, Commscope** – panellist.

Panel debate Chaired by Julius Robson, Chief Strategy Officer, SCF

Perhaps the single most important theme that unified the conference attendees and speakers was the need for a secondary market in small cell deployment – one that would complement the MNOs’ networks and extend the reach of 4G and 5G into new locations, enterprises, spectrum bands and services.

In the past, mobile networks have only needed to support two core services, voice and mobile broadband data/Internet, but 4G expansion and 5G are being driven by the need for more specialized, sector-specific and mission-critical connectivity. An MNO model based on general purpose connectivity for the largest numbers of users does not adapt easily to the need for every enterprise to have its own tailored network. That is where private operators, or neutral host platforms supporting multiple enterprise MVNOs and integrators, come in.

Every session in the conference touched on these new models and how they would accelerate and diversify small cell deployment. In the double session devoted to the topic, it became clear how neutral host models can engage a wide variety of players in the ecosystem. Tower companies, pure-play small cell neutral hosts, fiber providers and telcos’ wholesale units were all represented, providing a good cross-section of this evolving landscape. This diversity is clearly necessary when a wide range of locations and enterprises need to be supported, from large sports venues to remote industrial plants. Some companies, such as Digital Colony, are taking a portfolio approach, with units devoted to many models from indoor networks to traditional towers to city specialists.

The different backgrounds of the companies on-stage resulted in a variety of perspectives, though a high level of overall consensus about the key opportunities and requirements. The towercos are looking to extend their macro model – about 60% of European towercos’ assets are now not masts but small cell or backhaul infrastructure, said TowerXchange’s Osmotherly. And the high market valuation of infrastructure companies means these players could bring welcome new capital into the small cell market.
Most neutral hosts do not regard themselves as an alternative to MNOs. They are focused on enhancing the MNO’s business case for densification by allowing them to share networks more easily and by reaching locations that are not cost-effective for mobile providers. The towercos were clear that, as in the macro business, they need MNOs as tenants in most cases. DenseAir talked about its AI-enabled tool to identify the locations that most require small cells and the improvements those cells would make to overall quality of service. The company then proactively approaches the MNOs to convince them of the case to share those sites.

However, the more shared, or industrial, spectrum is available, the more there is the opportunity to deploy networks which are not dependent on the MNOs for their airwaves, even if they are still seen as important tenants. Other sessions drilled into more detail of how combinations of shared spectrum, edge computing, and local core networks would support localized, specialized enterprise ‘sub-nets’ on which a wide variety of service providers could ride in order to serve a specific industry or location. This trend will enrich the neutral host model while lowering the barriers to small cell roll-out in environments that require multi-operator support, and are difficult for MNOs to address.

A question for all neutral hosts is the balance they draw between deploying passive and active infrastructure. A company like Wireless Infrastructure Group, and neutral hosts targeting indoor networks, provide the full service including the active equipment – and in DenseAir’s case, they even acquire the spectrum. Some conventional tower and fiber providers are more interested in deploying sites, backhaul and power and then partnering with a small cell provider. Not that this necessarily makes the job easier. Colt’s Gilmour explained how the ideal location for a small cell might be the hardest for fiber deployment, giving the example of a cell in the middle of a roundabout.

That highlighted a common theme of the session – that many shared assets are involved in a neutral host offering, not just the small cells themselves, and that means a high level of cooperation between different stakeholders, including the MNOs and the enterprises themselves, to deliver a high performance, easily shareable multi-operator platform. Success in doing this will, however, transform the small cell landscape and accelerate densification, especially for enterprises and cities.

**Recommended Industry Actions**

- Drive availability of multi-operator product sets to improve cost of neutral host deployment.
- Facilitate cooperation and understanding between MNOs, neutral hosts and enterprises to lower barriers to shared networks.
- Lobby regulators to earmark spectrum for shared or neutral host use.
- Target local authorities as important anchor tenants for neutral host networks.
- Support technology and define business cases for shared edge compute as a complement to small cells.
- Define frameworks for cooperation between owners of different assets, such as fiber and sites, to ensure an end-to-end neutral host platform and a single relationship for tenants.
5G Smart Cities & Policy to Enable Them

Speakers and slides

- **Burcu Kuzlak, City of Amsterdam**, "From Trials to Deployment: Europe’S 5G Cities". 5G pilots on crowd control, FWA and bodycams. Siting and fiber challenges. 5GPPP Trials for Euro2020.
- **Michael Guerin, Smart Docklands Dublin**, "Smart Docklands Dublin". An initiative of Dublin local authorities to engage with smart technology providers, researchers and citizens to solve challenges and improve city life.
- **Louise Lancaster, DCMS**, "Government Initiatives in Busting Barriers to 5G". Making it quicker and cheaper to deploy infrastructure, including small cells at scale.
- **Steven Bage, City of London Corp**, "Preparing For A 5G City - City Of London Wireless Concession". Mobile coverage and capacity is more valuable than site rental revenue.
- **Mark Lumley and Norm Steel, Royal Borough of Kingston**, "The Practicalities Of Building Smart Cities". A collaborative, connected and responsive city integrates digital technologies and uses city-wide data to respond to citizens’ needs.

Panel Debate chaired by William Webb, Webb Search

Lamp-posts were often cited as a critical resource for outdoor small cell deployment. However, they are also difficult to backhaul and access for multiple operators without undue clutter. Neutral hosting was recognised across the panel as a potential solution to these challenges.

The panellists also agreed that authorities need to understand better how digital infrastructure can improve outcomes for citizens and business rather than focussing on revenues from street assets. This requires understanding of user needs and THEN finding solutions through technology. Not the other way around.

Digital infrastructure deployment crosses multiple departments of local councils (suspension of parking, closing roads, use of assets, power, IT etc). Local councils need to appoint a senior councillor to act as a single point of contact and ensure digital policy is implemented and not blocked by individuals.

All authorities on the panel agreed that they had no desire to operate and maintain telecoms infrastructure. This had to be done by a third party - although not necessarily an MNO. Their preference was to work through a single point of contact such a neutral host. However, the panel felt that MNOs were not in favour of this approach, nor did current spectrum allocations support that model well.

Moving from tech trials to business-as-usual commercial activity is not a given. Successes have been achieved in Dublin with smart bins, bikes and buses as well as utilizing sensor networks. But funding models require close engagement with users to ensure they understand how the technology improves their outcomes. Authorities would like use of their assets to discount against cost of services, but independence is required to ensure that services can evolve with needs during the much longer lifetime of the asset.

Authorities felt their role was to ensure fair and equitable mobile service across their locality, and not just have service providers cherry-pick the most lucrative areas. The exclusivity of the concession model – dismissed as outdated and inappropriate by the neutral hosts – was considered as the lever to prevent such a digital divide. Whatever replaces it must work for local authorities too, avoiding excessive street clutter and ensuring equitable coverage. Furthermore, we need a holistic nationwide approach to this, rather than proceeding on a city-by-city basis.
Recommended Industry Actions

- Resolve the disconnect between operators’ technology deployments and local authorities’ actual needs, to improve outcomes for citizens by bringing together these groups in a room.
- Local authorities would like to see the SCF develop a portfolio of possible small cell form factors and mounting options. It would also be useful to understand how physical or siting constraints might impact resulting service delivery.

Disaggregated Architectures: Virtualization, Open Source and Transport/Sync

Speakers and slides

- Dr Prabhakar Chitrapu, SCF and AT&T, “Disaggregation Options Galore!”. Different splits and architectures for the disaggregated RAN.
- Vivek Jha, Reliance Jio and Radisys, "5G and the Shape of RANs to Come". Converging to intelligent edge, role of open source, how the stack can be plug-and-play, “re-aggregating the disaggregated”.
- Richard Mackenzie, BT Research and Telecom Infra Project. NGMN, TIP and other industry activities bringing consensus around disaggregation terminology, options and transport requirements. VRAN for neutral host.
- Anthony Magee and Gil Biran, ADVA Optical, "Transport Implications of the Disaggregated And Virtual Ran, Sync, Latency and High Speed Connectivity". Typical transport performance requirements.
- Clare Somerville, SCF and Intel, "SCF’s 5G PHY API for Small Cells". Update on the Forum”s 5G PHY API project.
- Mike Cronin, NodeH – panellist.

Panel Debate Chaired by Prabhakar Chitrapu, AT&T and Chair SCF Tech & 5G Group

AT&T summarized a key driver for disaggregation as being the need to foster a richer ecosystem to support both legacy and disruptive players. This would result in more flexible and agile networks and service creation, enabling MNOs to compete with webscale providers. Virtualization will then allow MNOs to leverage software-controlled networks for efficient and automated management, as well as introducing open source technologies.

A common theme from all speakers in this session was that progress has been made in consolidating the many proposed architecture options down to a few key ones. This is being helped by several developments - establishing a common terminology; the identification of transport and sync requirements; and the beginnings of apples-apples performance comparisons. The panel also helped decompose several key underlying concepts of disaggregation – outlining the separate issues related to functional split options (vs. ‘options’ for 5GNR deployment), the API for SoC silicon, and virtualization.

Transport and sync requirements featured strongly in the presentations and the debate around functional splits, as they significantly impact the cost of the approach. ‘Headline’ peak performance figures from the standards can make deployments look very expensive, so ‘real world’ performance and configurations now need to be understood. AVDA provided guideline figures for capacity and latency. Current backhaul requirements of up to 1Gbps are likely to move up to 10Gbps per site, or potentially 25Gbps to allow room for further expansion. BT Research’s work with the Telecom Infra Project (TIP) is also in having all the benefits of a LLS (Lower Layer Split) without paying for ideal transport. “Fiber is definitely NOT needed for all cell sites. Microwave is perfectly good in some situations”.

Splitting the RAN architecture into remote, distributed and centralized units (RU, DU, CU) potentially changes the locations where sync is needed. Initial deployments with co-located DU and CU will be far easier to engineer than when these components are split. Slicing options involving dynamic functional splits will also need to take account of the sync performance available at any given compute location.

Disaggregation of the hardware and software has been the basis in the small cell ecosystem for over a decade and was the subject of Clare Somerville’s presentation on Small Cell PHY API. The API was designed and is maintained by the small cell vendor community to enable interchangeability of parts for a competitive ecosystem. The L1/L2 interface is a pragmatic one, reflecting ow subsystems are designed separately by different experts, and them combined by a system vendor. Specs are maintained for 3G, LTE and now 5GNR, the latter due to be published in June. The PHY API applies to all functional split options, and may be contained within the CU or DU components. SCF has also developed a ‘networked’ version of the LTE PHY API to support the Option 6 functional split over non-ideal backhaul, and work on a 5GNR version will start soon.

The panel came to some consensus around how the different functional splits might be deployed. The 3GPP-defined Higher Layer Split (HLS) is the only mature one so far, and is not demanding for transport. ADVA saw separating the DU and CU as a significant step that would likely come later, and expects 5G architectures to be dominated by 4G legacy and to use an eCPRI approach for fronthaul. The ORAN (Open RAN) 7.x was cited as the best for higher capacity scenarios, with better support for co-ordination where cell overlap is significant.

BT cautioned that we don’t yet know the extent of these benefits in real deployment and these must be traded against the additional costs of meeting tougher transport requirements. Furthermore, there are challenges in implementing LLS for higher frequencies such as mmWave. Intel pointed out that ultra-reliability is very much a PHY responsibility, and can be addressed with multi-point transmission, which is better supported with 7.2x. Radisys sees SCF’s option 6 nFAPI as good as a low cost option, which is quick to develop for lower capacity scenarios indoors.

NodeH expressed concern that there were still too many options and that MNOs either didn’t know which one they wanted, or each wanted a different one. If we truly want a competitive ecosystem, we need the industry to coalesce around a practical and deliverable approach in a reasonable timeframe, they argued. BT responded that the right hardware platform should support all split options in software, to avoid the need to pick just one. This would help with future-proofing, but the panel debated whether it was economically viable to deploy 5G hardware that would not be monetized for 3-4 years. Compute components can flexibly support 4G and/or 5G, but radios are band-specific. 5G can be deployed in the same channel as 4G, as was pointed out in the earlier neutral host session, which allows for flexible migration. Transport deployment can be very expensive, so thinking ahead makes sense here.

**Recommended Industry Action**

Continue to coalesce around a practical and deliverable approach to disaggregation and virtualization, which can be cost-effectively implemented in a reasonable timeframe.
IOT & Critical Comms with Private LTE/5G & Edge Computing

Speakers and slides

- Harry Smeenk, TIA, “Connecting IoT Devices, Edge Data Centres & Private Networks to Create Smarter Buildings”. The fully integrated smart building network as the fourth utility.
- Nanda Menon, MulteFire Alliance Representative and Business Development for Athonet, “Reliable Wireless for Industrial IoT”. License-exempt LTE with MulteFire and XGP, critical comms in shared spectrum.

Panel Debate Chaired by Simon Fletcher, CTO, Real Wireless

This session took a different slant on many of the issues raised in other areas of the conference, including the need for shared spectrum to open up the market to a greater variety of deployers; and how an alternative deployment model can improve availability, cost and quality of connectivity for many enterprises, especially indoors.

The discussion focused on the most demanding of all those enterprise use cases, those which require critical communications, and/or massive IoT connectivity. In the past, mission-critical wireless services have had to rely on proprietary private networks, which are expensive and preclude access to many mainstream devices and applications. The panel debated whether it would ever be possible for mission-critical networks to be fully standardized and so tap into volume economics, but concluded there would always be integration and optimization required to support specific industries.

However, using standards-based equipment and devices, plus shared spectrum, will enhance the case considerably. A private network based on standard 4G and 5G technology, but with its reliability and security guaranteed to the highest level, is the way to transform the economics of critical comms, the panel agreed.

This is not a futuristic vision however, nor one that is tied to 5G. Druid presented a variety of case studies that are live today, using private 4G small cells, sometimes combined with edge computing. Lead use cases include smart factories, ship-to-shore, utilities and healthcare. Meanwhile, the TIA has a framework to support smart buildings which is deployable today, integrating edge computing and private local networks to support the IoT while remaining compatible with existing systems like DAS.

And as that IoT grows in scale, there will be many more services that require this level of criticality, often involving huge numbers of users or things. That, in turn, will broaden the ecosystem, but also intensify the TCO challenges. Current private network deployments are being driven by public safety needs in many markets, as demonstrated by Druid’s and Bence’s award-winning case study of a UK fire service private network.

However, while relatively large budgets can be justified for safety, especially if the agencies are transitioning from a proprietary system, other sectors will need different cost models to enable a move into large-scale critical IoT. The solution will often lie in shared spectrum, and the Multefire Alliance’s Menon outlined how the right technology can deliver just as high reliability in shared bands like the USA’s CBRS, as in licensed
airwaves, while also enabling interoperability with other cellular networks, and a high level of future-proofing.

**Recommended Industry Actions**

- Encourage the release of spectrum for shared use or earmarked for private networks.
- Drive work on global standards in form factors and devices, as far as is practical given the highly specialized requirements of many users.
- Facilitate communication and understanding between specialized private operators and the broader ecosystem to help enable the model to be extended to new verticals and IoT use cases.
- Prioritize issues of high availability, reliability and security in the Forum’s technical and deployment work.
Spectrum for 5G Era Applications and Services

Speakers and slides

- **Mark Reudink, CrownCastle and Chair SCF Business Group**, “Spectrum for 5G Applications and Services”. New spectrum models to encourage sharing, neutral host; move to higher bands helps indoor and small cells, plus FWA.

- **Anna Cartwright, Head of Mobile and Spectrum Policy – UK Department of Culture, Media and Sport**, “Coverage and Sharing Requirements for Spectrum in the UK”. Policies to encourage site access, spectrum sharing, examples of European auctions so far.

- **Armelle Boisset, Director of Spectrum Engineering, Ofcom**, “Making Spectrum Available to Support Innovation”. Proposals and consultations for upcoming auctions, sharing in 3.8-4.2 GHz, power levels and dynamic spectrum.

- **Peter Claydon, Director of 5G Research, DenseAir** – panellist.

- **Nanda Menon, MulteFire Alliance Representative and Business Development for Athonet** – panellist.

Panel debate chaired by Peter Curnow-Ford - UK Spectrum Policy Forum

Licensing spectrum to a few competing MNOs, plus some unlicensed spectrum, has built the conditions for national mobile voice and data, but a new model is needed for all the additional use cases envisaged for next generation, dense and indoor networks.

As the spectrum available for mobile connectivity diversifies, so should the use cases that can be supported. Many new applications will be enabled for the first time, or untethered from wireline links, because of higher band, high capacity spectrum. However, it is important that business cases are made first for the applications, and the use cases aligned closely with the different airwaves on offer.

In addition, to make best use of the plentiful midband and millimeter wave spectrum that will open up, it will be important to encourage systems of sharing, such as CBRS, which can support neutral host and multi-operator models efficiently, while providing higher levels of security and reliability than unlicensed bands. It will be important for regulators to ensure that spectrum is available for additional parties, beyond the MNOs, otherwise the ‘cartel’ of MNOs (as Claydon called them) will decide the vertical markets which get the best connectivity, while others will be left underserved.

There are many issues to address, and the FCC’s licensed shared access scheme in CBRS is being closely watched by European regulators making policy, including Ofcom’s recent innovation consultation on sharing or on spectrum earmarked for industrial use. Other important issues include the ability of listen-before-talk mechanisms to support heavy loading; in-country roaming between the MNOs and the specialized networks; and the need for higher power limits to cover large buildings more efficiently.

Given her previous work in the treasury, DCMS’ Anna Cartwright expressed surprise at the lack of a secondary market for spectrum in the UK. Although it might mean less initial auction revenue for the treasury, increased monetisation through, say, leasing could increase the utilisation and thus value of the asset, as well as incentivise more people to have more access to spectrum.

Regulation needs to be predictable to encourage investment, as DCMS pointed out, but 5G should be an opportunity to create greater variety of spectrum owners, allowing neutral hosts or private operators to run active as well as passive equipment. This could greatly accelerate small cell deployment in difficult environments including deep indoors.
SCF Small Cell Awards 2019

1. Excellence in Commercial Deployment (Urban) - Airspan and Sprint
AirStrand, the world’s fastest deployed outdoor small cell

2. Excellence in Commercial Deployment (Enterprise) - Nextivity
Cel-Fi QUATRA Supercell helps deliver great cellular service to the middleprise

3. Excellence in Commercial Deployment of Rural, Remote and Temporary Small Cells - Parallel Wireless
Parallel Wireless ALL G software-enabled Open RAN connects on six continents

4. Software and Services – Management, automation and orchestration - Bence Command, ip.access, Druid Software, CellAntenna Corporation, Tyne and Wear Fire and Rescue Service
Critical communications via portable LTE small cell network helps emergency services save lives and protect the environment

5. Development of new architecture providing a clear path to future networks - Nokia
Need for extreme capacity and the promise of 5G mmWave

6. Commercial Small Cell Design and Technology (Network & Xhaul) - SK Telecom
SK Telecom’s world-first 5GNR RF repeater - commercialization for 5G coverage extension

7. Outstanding Innovation in Small Cell Technology or Architecture - Qualcomm
mmWave coverage with 5G innovation supporting small, scalable and cost-effective infrastructure

8. Outstanding Innovation in Small Cell Business Case - Dense Air
Dense Air – Unlocking the economics of small cell deployment

9. Outstanding contribution to open RAN and core platforms and ecosystems - Benetel
Remote radio unit product supporting 7-2 VRAN fronthaul network

10. Social Impact – Promoting Small Cells for Social/Economic/Environmental Development Dense Air and Dublin City Council
Enabling neutral host small cells providing unrivalled benefits to the city, mobile operators and citizens

Judges’ Choice - Sprint and HARMAN
Beyond a connectivity solution, a fresh approach to driving value into the small cell offer

Individual Contribution to SCF Activities - Dr Clare Somerville, Intel and Dr Samel Celebi, Qualcomm
For their leadership and technical contributions

Chair’s Award - Graham Payne, Digital Colony
For his relentless promotion of the neutral host business model, especially in the context of connectivity for Enterprise

Awards photos: https://www.smallcellforum.org/winners-2019/
Conclusions and next steps for SCF

The SCF was delighted to be able to build this event around its workplan and welcome a wide range of speakers. Together they were able to expand our thinking and understanding of how we can do more to accelerate densification and enable connectivity as a resource.

We will be continuing the conversation in our regular meetings and events and encourage everyone who is not already to get more involved. Please get in touch to find out about our ongoing workplan and membership via our website www.smallcellforum.org.

We shall now be taking the conference’s recommended actions on board and integrating them into our workplan:

- Slash the time and cost of deploying small cells – streamlined, standardized processes; certification process for engineers; better arrangements with local authorities, landlords etc.
- Reduce cost of operating dense networks with open architectures and automation tools.
- Make it practical to use all kinds of spectrum – licensed, shared, millimeter wave and so on – in flexible combinations to optimize cost:performance.
- Encourage neutral host models and private networks to accelerate deployment, especially for specialized environments, and lower barriers between MNOs and alternative deployers.
- Publish clear guidelines for supporting infrastructure to ensure indoor small cells can use the same cabling for many years, to improve future-proofing.
- Develop low-touch deployment and management processes to reduce cost of ownership.
- Encourage neutral host or enterprise-specific deployers to improve the business case for indoor connectivity while working alongside MNOs.
- Drive technologies to harness millimeter wave spectrum and virtualized architectures to enhance the cost:performance ratio.
- Draw up frameworks for interaction between landlords, enterprises, integrators and operators to improve cooperation and ease deployment.
- Drive availability of multi-operator product sets to improve cost of neutral host deployment.
- Facilitate cooperation and understanding between MNOs, neutral hosts and enterprises to lower barriers to shared networks.
- Lobby regulators to earmark spectrum for shared or neutral host use.
- Target local authorities as important anchor tenants for neutral host networks.
- Support technology and define business cases for shared edge compute as a complement to small cells.
- Define frameworks for cooperation between the owners of different assets, such as fiber and sites, to ensure an end-to-end neutral host platform and a single relationship for tenants.
- Resolve the disconnect between operators’ technology deployments and local authorities’ actual needs to improve outcomes for citizens by bringing together these groups in a room.
- Develop a portfolio of possible small cell form factors and mounting options for use by local authorities. It should help asset owners understand how physical or siting constraints impact service delivery.
- Continue to coalesce around a practical and deliverable approach to disaggregation and virtualization which can be cost-effectively implemented in a reasonable timeframe.
- Encourage the release of spectrum for shared use or earmarked for private networks.
- Drive work on global standards in form factors and devices, as far as is practical given the highly specialized requirements of many users.
- Facilitate communication and understanding between specialized private operators and the broader ecosystem to help enable the model to be extended to new verticals and IoT use cases.
- Prioritize issues of high availability, reliability and security in the Forum’s technical and deployment work.