TELECOM INFRA PROJECT

Response to 'Emerging Technologies and Their Potential Impact on the Communications Industry' Consultation

Executive Summary

We are pleased to be able to respond to Ofcom's call for evidence on *Emerging technologies and their potential impact on the communications industry.*

We wish to direct our submission to a range of technologies that enable network disaggregation - separating the complex components that comprise modern mobile networks. The Telecom Infra Project believes disaggregation can change the way the telecom equipment market works, ushering a new generation of vendors and providing additional flexibility to procure best-in-class equipment. By taking advantage of a more dynamic, innovative market, TIP members want to change how people connect and satisfy Ofcom's objectives of broadening access, increasing network performance, lowering barriers to entry in the market, and increasing resilience.

The technologies we address here are:

- OpenRAN

- Open Wi-Fi

- Open Optical and Packet Transport Technologies

- Open Core Networks

Per the request in the call for evidence, we have provided a technology description, information on current state of deployment and their potential impact. We also include next steps and some policy considerations.
In concluding, we provide recommendations below about how policymakers can support these trends.

About Telecom Infra Project

With UK mobile network operators such as BT, Vodafone, and Telefónica (O2) at its heart, TIP is taking an innovative approach to building and deploying the technology that improves global connectivity. A community of manufacturers, software makers, network operators, integrators, and connectivity stakeholders work to make the telecom supply chain more diverse, innovative, and open, so that future digital infrastructure is brought more quickly to market for everyone.

We are an engineering-led organisation focused on technological solutions and providing alternative and complementary options for connectivity. One of the central components of our organisation is our TIP Community Labs - physical spaces that enable collaboration between member companies to develop new solutions. We host two TIP community labs in the UK: one in Ipswich, sponsored by BT, and another in London, sponsored by Facebook.

Impact of Disaggregation

TIP believes open, disaggregated networks address the challenges of a consolidated ecosystem by providing network operators more choice and flexibility to improve networks at

a pace that keeps up with rising demand.

Disaggregation — separating complex technologies into small pieces that can be combined in different ways — will allow for more flexible networks that let operators develop and upgrade individual components, selecting the best technology available at any point in time for each piece of a telecom network. They can choose from a wide range of software and hardware options that interoperate seamlessly, instead of having to source integrated infrastructure solutions from a very limited set of suppliers.

Separating out complex technologies and ensuring interoperability also means more companies, including SMEs, can compete in different parts of the technology stack, incentivising innovation and giving network operators more choice among both incumbent and emerging solutions. This can make the process of upgrading networks — either partially or totally — easier, faster, and more cost-efficient.

This method of development also has benefits for security by changing the development culture. Network security is best achieved from open scrutiny of development practices. Security is also enhanced by a more diverse market, as it provides greater incentives to compete on security and trust, as well as greater flexibility to mobile network operators.

OpenRAN/RAN AI

Technology Description

OpenRAN is an innovative, disaggregated way of designing radio access networks, which traditionally comprise 70% of network costs (Accenture 2019, below). Today, there is a high level of vendor concentration in the RAN market, with figures[1] from industry analysts Analysys Mason suggesting the top three vendors held around 75% of the market in 2018.

OpenRAN describes a new way of structuring the RAN, implementing an open interface between components (eg, radio unit, centralised unit, and distributed unit – RU, CU, DU) using hardware- and software-defined functions. It has multiple architecture options: integrated RAN with disaggregation at hardware and software levels; a split RAN with RU, BBU (DU/CU); and a split RAN with RU, DU and CU. This enables a diverse ecosystem for operators to choose best-of-breed options for 2G, 3G, 4G and 5G networks. Solutions can be implemented on virtualised, containerised, or bare-metal platforms.

Within TIP's OpenRAN project, members are developing a 5G NR whitebox gNB device based on an open and disaggregated architecture for 5G Mobile Infrastructure as per the requirements published in TIP; they are also exploring the use of AI/ML to increase performance and efficiency for Radio Access Networks, while lowering costs.

State of Development

One third of Tier-1 MNOs across the world and over half of Tier-2 have begun, or are expected to begin, roll-out of OpenRAN in their networks by 2023 (Gabriel, 2020, below).

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[1] Analysys Mason (2019):
https://www.analysysmason.com/Research/Content/Reports/RAN_market_share_RMA18

Japan's Rakuten Mobile launched the world's largest vRAN network covering 4,000 cell sites in April this year and is reportedly [planning to expand](#) to approximately 45,000 4G basestations and 35,000 5G ones by the time the network is fully up and running.

To date, Vodafone has launched the first live OpenRAN site in the UK, with trial deployments in Turkey, Ireland, Mozambique and the Democratic Republic of the Congo. Telefónica has launched OpenRAN trials for 4G and 5G in the UK, Germany, Spain and Brazil this year. Etisalat has completed its first deployment in the UAE and will now start trials of OpenRAN solutions in other regions. Meanwhile in Malaysia, Edotco, the tower arm of Axiata group, is collaborating with Celcom Axiata in conducting lab trials with a path to field trials. In Indonesia, Indosat Ooredoo and Smartfren are conducting the first OpenRAN field trials.

TIP's UK members are leading efforts to accelerate OpenRAN. The TIP community lab at Adastral Park Ipswich is sponsored by BT and operated together with Tech Mahindra. Further work is currently being planned to investigate the use of machine learning to optimise and improve the radio efficiency, exploiting OpenRAN interfaces.

Next Steps to Reach Full Potential

Technologically, OpenRAN is maturing and leading operators view it as the natural direction of the industry. However, this move — and the ensuing benefits to consumers — can be accelerated by policies that encourage open, interoperable, and disaggregated technology solutions and support a more diverse supply chain.

We have provided some policy recommendations below that are applicable to disaggregation across the supply chain.

References to Key Publications and Working Groups

Organisations

- [Telecom Infra Project](#)
- [O-RAN Alliance](#)
- [Small Cell Forum](#)

Publications

The Telecom Infra Project has commissioned two studies summarising developments in OpenRAN:

- Brown, Gabriel (May 2020): *TIP OpenRAN: Toward Disaggregated Mobile Networking*, available from: https://cdn.brandfolder.io/D8DI15S7/as/qc19tk-54bsw-305pae/TIP_OpenRAN_-Heavy_Reading_May_2020-_White_Paper.pdf

- Accenture (2019): OpenRAN: The Next Generation of Radio Access Networks, available from: https://telecominfraproject.com/wp-content/uploads/OpenRAN-v11082019-vFinal.pdf.

Open Optical and Packet Transport

Technology Description

TIP's Open Optical and Packet Transport (OOPT) Project Group works on the definition of open technologies, architectures and interfaces in Optical and IP Networking, including optical transponders, line systems, IP access devices, open APIs and network simulation and planning tools.

The OOPT Project Group supports various technology solutions, each focusing on a different part of the stack:

- Disaggregated Cell Site Gateways (DCSG)

- Physical Simulation Environment (PSE)

- Converged Architectures for Network Disaggregation and Integration (CANDI)

- Controls, Information Models and APIs (CIMA)

- Disaggregated Optical Systems (DOS)

- Network Operating Systems (OOPT-NOS)

- Disaggregated Open Routers (DOR)

Working to define open technologies, architectures, and interfaces in Optical and IP Networking, the OOPT Project Group is driving innovation and flexibility across the whole network to avoid lock-in and reduce costs.

State of Development (Key Technologies)

- **Disaggregated Cell Site Gateways (DCSG) —** DCSG is an open whitebox Cell Site Gateway device that operators can deploy for their upcoming 5G roll outs and any other new greenfield 4G/3G/2G deployments. DCSG is seeing increasing commercial adoption. In November 2019, Telefónica announced deployments in Ecuador and Germany and more announcements are expected by year's end. Field trials include Deutsche Telekom in Germany, Airtel in India, Vodacom in South Africa, and Africell in the Democratic Republic of the Congo. In August, Asia Pacific Telecom (APT) announced plans to work with TIP members IP Infusion and UfiSpace to deliver a comprehensive disaggregated solution based on DCSG technical requirements and open architecture principles for the deployment of their 5G mobile network in Taiwan.

- **Cassini** – Cassini, a disaggregated and modular packet/optical transponder contributed by Edge-core, is enjoying growing demand from industry. Mundo Pacífico announced in July that it has deployed HyperNET, a software-defined IP network, based on Cassini — reporting this allowed them to increase network capacity to meet surges in demand across cities in Central Chile during the COVID-19 pandemic. Also in July, VTS, Edgecore, and IP Infusion deployed Cassini on a +300km fibre link from Ghanaian border to the capital of Burkina Faso - Ouagadougou.

- **Disaggregated Open Routers** — As a part of the Disaggregated Open Routers initiative, TIP will publish technical requirements, including regulatory requirements, for the **Open and Disaggregated Broadband Network Gateway (OpenBNG)** device, which is a solution that seeks to overcome many of the issues operators are facing when deploying access services for fixed customers – including increased traffic growth which can affect performance.

- **Phoenix** – TIP has published the technical requirements for [Phoenix](#) — a high capacity, disaggregated, and open optical transponder. The initiative is being led by Deutsche Telekom, NTT Communications, Telefónica, Telia Company, and Vodafone. The group plans to have specification-compliant solutions ready for commercial deployments in the first half of 2021.

- **Voyager** – The industry's first open and disaggregated converged packet/optical transponder, originally designed by Facebook, is now being evolved and taken to market by Adva Optical, running software from Cumulus Networks.

Next Steps to Reach Full Potential

We have provided some policy recommendations to facilitate the development of OOPT technologies below.

References to Key Publications and Working Groups

Working groups:

- [Telecom Infra Project](#)

Publications:

- [The Open Optical and Packet Transport Project Group Expands Its Scope, Partners, and Solutions in 2020](#)

- [Orange steps towards open optical networks with GNPy (2020)](#)

- [Phoenix Technical Requirements (2019)](#)

- [Disaggregated Cell Site Gateway Technical Specification (2019)](#)

- OpenBNG Tech Requirement (forthcoming)

Open Wi-Fi

Technology Description

Wi-Fi is currently experienced as a "best-effort" service by consumers. However, as consumers depend more on Wi-Fi-enabled devices and with more spectrum becoming available for its use, operators are looking to offload traffic to Wi-Fi.

The TIP Open Wi-Fi project group is among those driving Wi-Fi to improve internet connectivity and make deploying Wi-Fi networks for carrier-grade services economical.

State of Deployment

Having launched this effort in February 2019, focus remains on defining and building the necessary solutions.

Next Steps to Reach Full Potential

We have included some policy considerations to facilitate the development of this technology below.

References to Key Publications and Working Groups

Organisations

- [Wi-Fi Alliance](#)

- [Wireless Broadband Alliance](#)

- [Broadband Forum](#)

- IEEE

Open Core Network

Technology Description

The Open Core Network (OCN) project group is developing cloud-native and converged core solutions supporting 4G, 5G, and Wi-Fi services. The goal of the project is to innovate on core network technologies enabling operators to deploy connectivity services with flexibility and to improve network performance and operational efficiency. Open Core solutions support seamless migration from 4G to 5G, and the use cases being considered span mobile broadband and fixed wireless access, as well as private networks, carrier Wi-Fi, and industrial IoT.

State of Deployment

The OCN project group launched in February 2020 and is currently working on developing a set of technical requirements for 5G use cases, microservices implementation of core network functions, API specifications, standardized hardware blueprints, and automation tools.

Rakuten Mobile, Vodafone, Orange, Amdocs, Facebook, Wavelabs, Mirantis, FreedomFi, and CPQD are actively leading TIP's OCN and the group is organized in 3 work streams:

- **Applications and Services** – The goal of this work-stream is to design and deliver a set of production-grade microservices implementing 3GPP 4G/LTE, 5G, shared spectrum and Wi-Fi core network functions and APIs between functions, as well as RAN elements or Network Management Systems.

- **Orchestration** – Aims to design, develop and deliver an orchestration framework for integrating, deploying and managing open core network microservices.

- **Automation** – This work-stream focuses on infrastructure and test automation for OCN microservices.

Next Steps to Reach Full Potential

Next steps include operator led lab trials in TIP Community Labs and end-to-end interoperability PlugFests before launching field trials in 2021.

We have included some policy considerations to facilitate the development of this technology below.

References to Key Publications and Working Groups

Working Groups

- Telecom Infra Project

Publications

- Introduction to Open Core Network (webinar recording)

- Project group charter

Policy Recommendations

Work is ongoing in the communications industry to facilitate a more diverse, disaggregated supply chain. This effort, led by British mobile network operators, will ultimately be able to provide more cost-effective connectivity to more consumers.

As the UK considers its telecom vendor diversification strategy, pro-active policies and Ofcom's key role in ensuring the optimal regulatory environment can accelerate these trends:

- Ofcom should consider ways to structure an ongoing dialogue with emerging vendors to ensure the regulatory regime continues to anticipate new technologies.

- Ofcom should consider ways to make it easier for new technologies to go from trial stage to more advanced testing. Policymakers should, for example, consider frameworks for access to street furniture and public-sector estates to make it more predictable for those at different stages of trial.

- Ofcom should consider ways to incentivise mobile network operators' procurement from outside the established vendors. Having the right environment for this market to flourish is indispensable to gaining the advantages inherent in that diverse marketplace.