THE ROAD TO OPEN RAN PRODUCTIZATION

ABIresearch | TELECOM INFRA PROJECT

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INTRODUCTION AND MARKET OVERVIEW

The past and current years, 2020 to 2021, have provided a turbulent environment for teleco operators, with COVID-19 and supply chain restrictions accelerating new market dynamics and forcing the market to recreate established relationships that were in place for decades. These very same challenges underscored the importance of connectivity and proved that fixed and mobile telecom networks should be considered as key components of national infrastructure, while current 4G and 5G networks are connecting home workers and have shown the need to be reliable, with adequate capacity, and able to connect a home-based workforce.

Mobile operators are experiencing new market trends in 2021, somewhat different from the types of challenges they faced in the previous decade. These can be summarized in terms of commercial and technology trends.

COMMERCIAL TRENDS

In terms of the operator business, critical trends can be summarized as follows:

- In the consumer market, telecom operators in densely populated areas of the developed world are experiencing saturation in terms of subscriber penetration, while 5G network rollouts are taking a steady and staged approach instead of nationwide aggressive deployments.

- In the enterprise domain, private cellular is creating a new market for mobile infrastructure where mobile operators, telecom vendors, system integrators, and new entrants are competing to provide reliable, low latency, and high-quality networking for many enterprise verticals. The dust has not settled in this domain as it is a completely different market with new dynamics, but everyone agrees it is the biggest new opportunity.

These new trends necessitate new technology developments, which are, in fact, accelerating much faster than previous generations.

TECHNOLOGY TRENDS

These market developments are proving that the telecoms domain is ripe for innovation and, in fact, needs it. 5G technology is advancing, but is mainly driven by large infrastructure vendors, especially in the Massive Multiple Input, Multiple Output (mMIMO) domain, whereas mobile operators are finding that both supplier diversity and innovation democratization are vital components of a successful future strategy.

Open Radio Access Network (RAN) is an answer to these challenges by disaggregating software from hardware, opening interfaces, adding vendor diversity, and providing new platforms to manage the network. This will allow infrastructure to evolve from a limited number of vendors promoting proprietary "end-to-end" solutions to an open market of "best of breed" system designs offered by a much broader supply chain. This has already allowed the entry of new vendors in the relatively closed mobile infrastructure supply chain with companies like Altiostar, Mavenir, and Parallel Wireless creating new types of equipment.

Several operators are now issuing Request for Proposal (RFPs) for Open RAN. Greenfield operators, such as DISH, Rakuten, and Germany's 1and1, as well as existing operators such as Telefónica and Vodafone, have announced either plans to deploy Open RAN network or initial deployments for new 4G and 5G networks. In Europe, a group of five leading Tier One operators (DT, Orange, Telefónica, TIM, and Vodafone) have signed a Memorandum of Understanding (MoU), expressing their commitment to the development and implementation of Open RAN technologies and networks. The group has also developed and published a technical priorities document[1].

However, in order to understand how this will affect the mobile market, it is important to understand the evolution of mobile network technology from the time it is being discussed until it is fully commercialized.

CELLULAR NETWORKS, FROM CONCEPT TO COMMERCIALIZATION

The telecoms supply chain is a rapid innovation environment, having created the telecom networks everyone relies on in a matter of 30 years. The first 2G network was switched on in 1991, and today most of the developed world is blanketed with 4G, allowing for reliable data access and new types of services. Since the early 1990s, the mobile supply chain has ideated, created, developed, deployed, and commercialized four generations of network infrastructure, all of which reached economies of scale. This is a monumental feat, but does not mean that the supply chain cannot be further optimized with open and disaggregated networks, in the very same way the IT industry has evolved. Open and disaggregated networks is one of the most important trends in the telecoms market, that aim to increase innovation and accelerate the development of new products that address operator requirements in a more agile manner.

[1] https://telecominfraproject.com/openran-mou-group/

LEGACY SUPPLY CHAIN

The telecoms supply chain is currently a closed environment, where a handful of vendors dominate cellular infrastructure research, field trials, and commercial deployments. This is not without reason, because the development of carrier-grade networks requires heavy upfront investment, years of R&D efforts, and a proven track record of delivering secure and trusted solutions, especially because these networks carry 911 and other emergency calls. In addition, as these networks will form the backbone of the next industrial revolution, they are considered national infrastructure assets on which governments are not willing to compromise. These have conditioned the market to follow specific development trends:

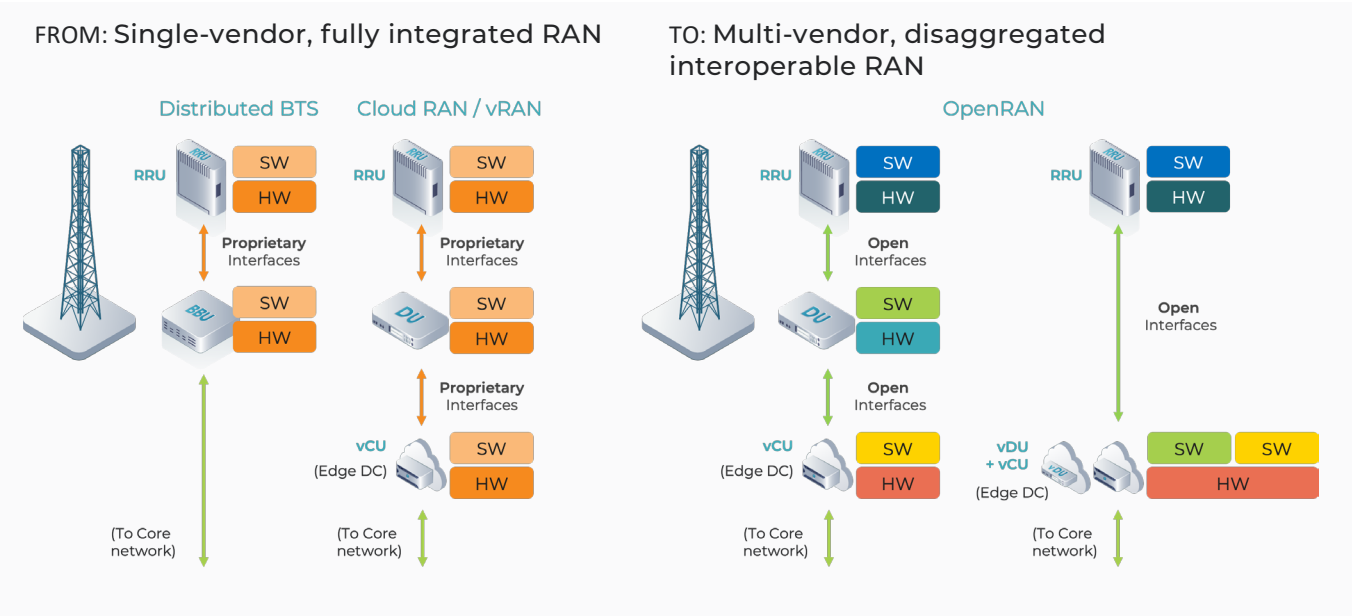
- Mobile operators now need to depend on a handful of vendors for the network rollouts.
- This leaves little room for innovation outside of these few vendors. Smaller vendors and innovators have very high barriers of entry in standards discussions and product commercialization.
- Deployment models are organically restricted according to large vendor priorities. For example, enterprise verticals have not yet been the biggest focus of large infrastructure vendors that profit most from nationwide macro-cellular deployments.
- New types of services and functionality are restricted and need vendor involvement to implement. End-to-end systems also restrict the entry of innovative products and solutions, even in the case of security.

The R&D efforts and commercial activities of these few vendors should not be discounted; indeed, they have developed cutting-edge equipment. However, the supply chain now needs to diversify to introduce new types of innovation, but also allow mobile operators and national policy makers to have more choice.

OPEN AND DISAGGREGATED NETWORKS

Open and disaggregated networks are driven by open interfaces, which in turn allow operators to select any vendor they choose for any network domain. For example, open fronthaul interfaces are being standardized to allow operators to select different baseband and radio vendors. Figure 1 illustrates a comparison between legacy and open/disaggregated interfaces for radio cellular networks.

Figure 1: Comparison of Vertically Integrated with Open and Disaggregated Radio Networks

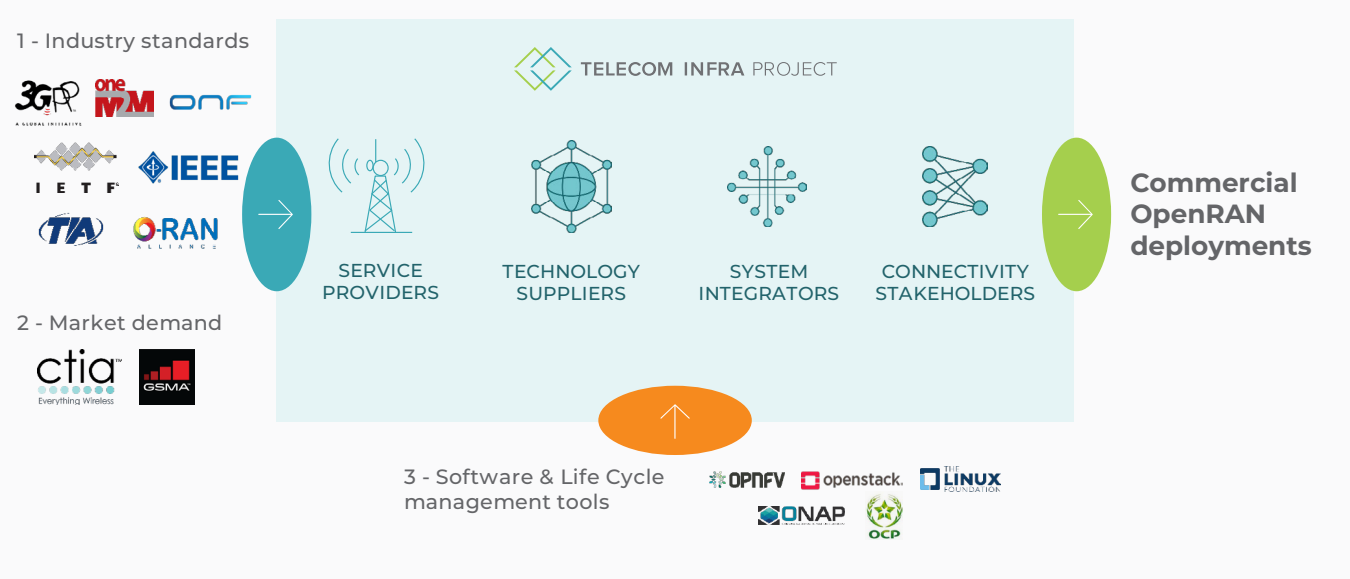


The evolution from traditional to fully open and disaggregated networks will be a transition that needs careful planning for operators that have networks that provide carrier-grade services today. Nevertheless, the Open RAN supply chain is advancing rapidly, creating new companies and products to address this space.

OPEN RAN SUPPLY CHAIN

The new supply chain is rapidly expanding, aiming to provide much more vendor choice to mobile operators globally. Figure 2 illustrates a cellular product journey from design to commercialization, in the context of Open RAN networks and also highlights how TIP is addressing the productization aspect of this journey.

Figure 2: Cellular Infrastructure, from Design to Commercialization



THE ROLE AND ACTIVITIES OF TIP OPENRAN PROJECT GROUP

The Telecom Infra Project (TIP) is a global community of diverse companies encompassing service providers, technology providers, system integrators, and other connectivity stakeholders, working together to accelerate the development and deployment of open and disaggregated network infrastructure. To do so, TIP includes multiple Project Groups (PG), focused on product, solutions, and software, covering different network domains (access, transport, and core, notably), as well as end-to-end solutions.

TIP's aim is to accelerate commercial solutions of open and disaggregated products and solutions from when a standard is finished to when it gets commercially deployed into networks, focusing on the productization aspect.

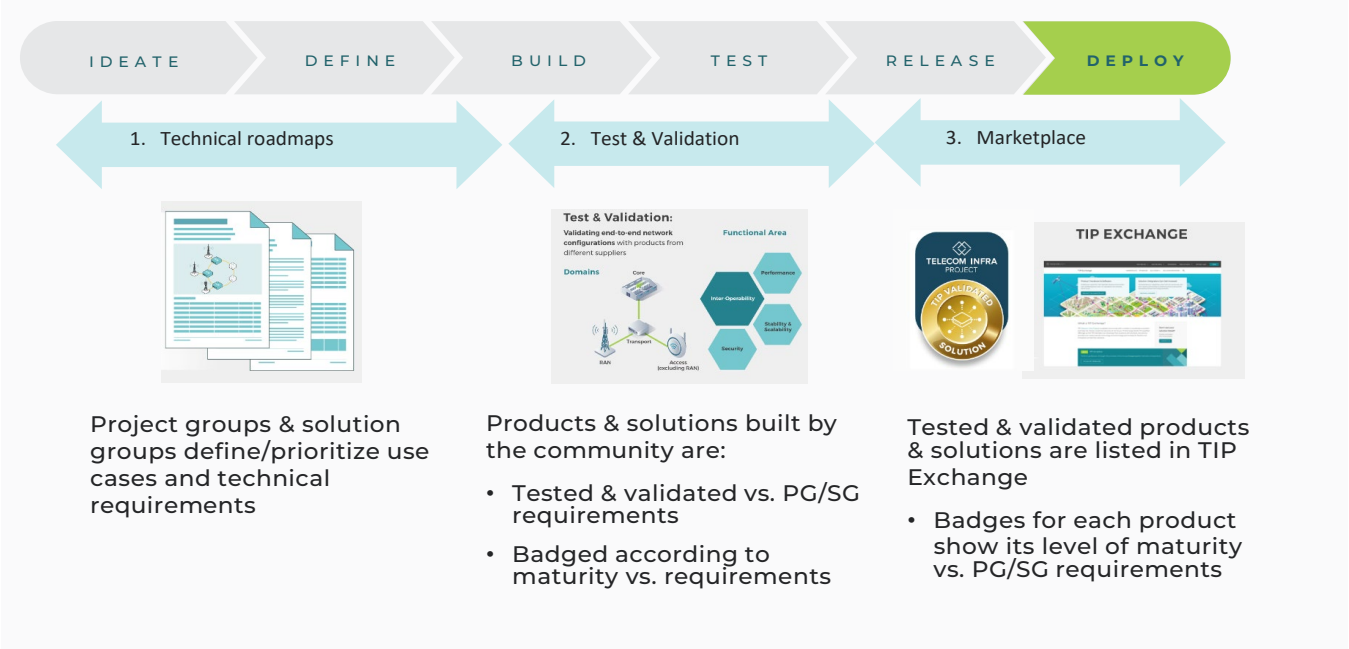
TIP OPENRAN PG STRUCTURE

The focus of the TIP OpenRAN PG is to produce open and disaggregated products and solutions, which will offer vendor diversity to network service providers, provide new platforms to manage the network, and, over time, significant operational cost reductions compared to traditional radio access networks. The group, in cooperation with leading operators, vendors, systems integrators, and other stakeholders throughout the world, seeks to harmonize requirements for Radio Units (RUs), Distributed Units (DUs), Centralized Units (CUs), and many other components of OpenRAN networks. Similarly to the rest of the TIP PGs, the OpenRAN PG emphasizes building, testing, and validating open and disaggregated RAN network products at scale.

TIP OPENRAN PG WORKING PROCESS AND RELEASES

TIP's process encompasses technical roadmaps, test and validation activities, and the resulting listing of a range of deliverables in TIP Exchange, its marketplace, including blueprints. This flow consists of three major stages as shown in Figure 3 and discussed in the following section.

Figure 3: TIP Process

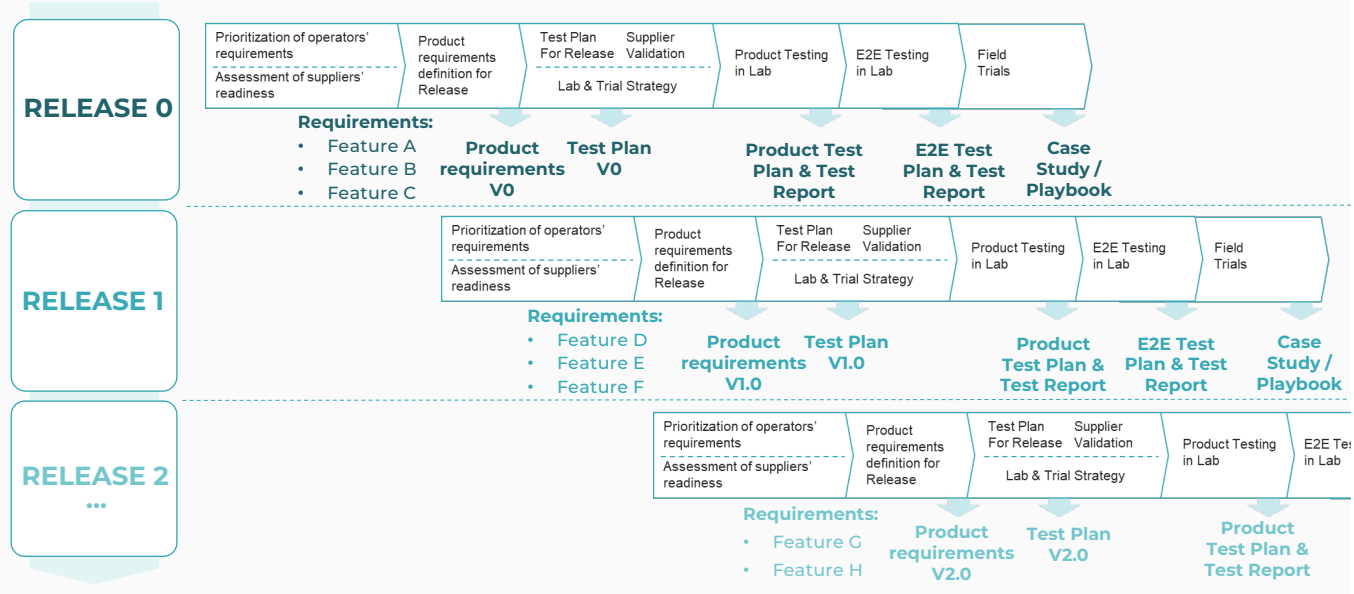


- Technical roadmaps are initially defined in the "ideate" and "define" steps, where operator requirements, commercial priorities, and use cases are identified and translated to definitions and feedback loop with participating vendors, ensuring that all inputs from the industry are accounted for.
- Test and validation with the "build", "test", and "release" steps comes next. This process ensures that components integrated for the solution can operate as a complete telecommunication system and be deployed in a live network.
- Marketplace is the last step, where blueprints, badged products, and solutions are published in the TIP Exchange[2].

The TIP process is iterative, reflecting continuous release management, so that the output is continuously improved. An example of this is illustrated in Figure 4.

[2] https://exchange.telecominfraproject.com/

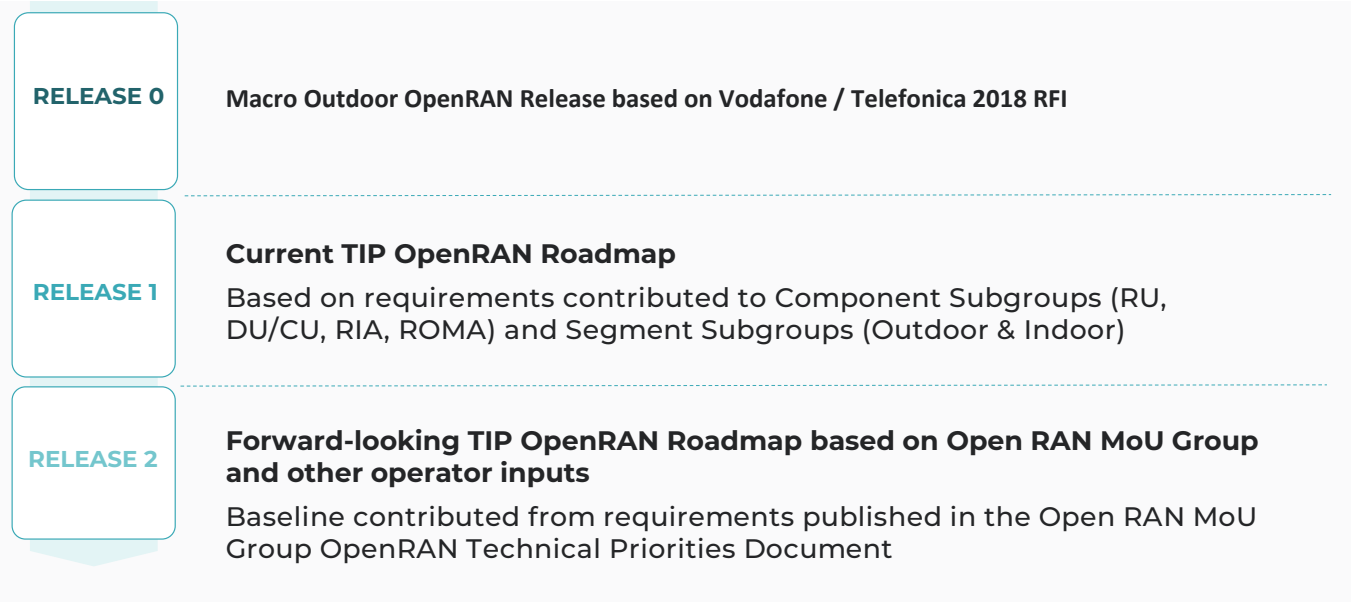
Figure 4: TIP's End-to-End Process with Defined Product Releases



RELEASES

Releases are a key aspect on how the TIP process is achieved for all TIP PGs and for the TIP OpenRAN PG specifically, improving the group's work and output using existing findings and learnings. This process is triggered by aggregating input from operators and technology suppliers to determine what needs to be prioritized and what can then be delivered within a release time frame. This translates into release-based blueprint deliverables that are finalized every year, while a new release is kicked-off every 6 months during the test and validation stage of the previous release. Figure 5 summarizes releases for OpenRAN PG, that follow distinct activities, within the technical roadmaps and the test and validation phases, detailed later in the TIP process section.

Figure 5: TIP OpenRAN Current Release Plan



RELEASE 0: MACRO OUTDOOR OPENRAN

The OpenRAN Project Group started as an initiative to define and build 2G, 3G, 4G, and 5G RAN solutions based on general-purpose vendor-neutral hardware and software-defined technology. Their first release (Release 0) consisted of a Technical Requirements document, based on the OpenRAN requirements document created by Vodafone and Telefónica in a Request for Information (RFI) process in 2018. This release is now complete, with badged products from validated vendors listed on TIP Exchange.

Based on this RFI, Vodafone alongside Parallel Wireless ran a commercial macro-outdoor network extension trial in Turkey, the result of which was published in the OpenRAN Turkey Trials playbook[3], summarizing findings, such as operational and technical Key Performance Indicators (KPIs) that were learned in this trial deployment where brownfield sites in Turkey were swapped with OpenRAN solutions for 2G/3G/4G. This release focused on macro-outdoor units and was the first public document outlining operational issues and processes when deploying Open RAN equipment in the field.

The playbook helps the OpenRAN community participants, RAN solution providers, network operators, and system integrators take an informed approach to the selection of technology and the planning of Open RAN deployments.

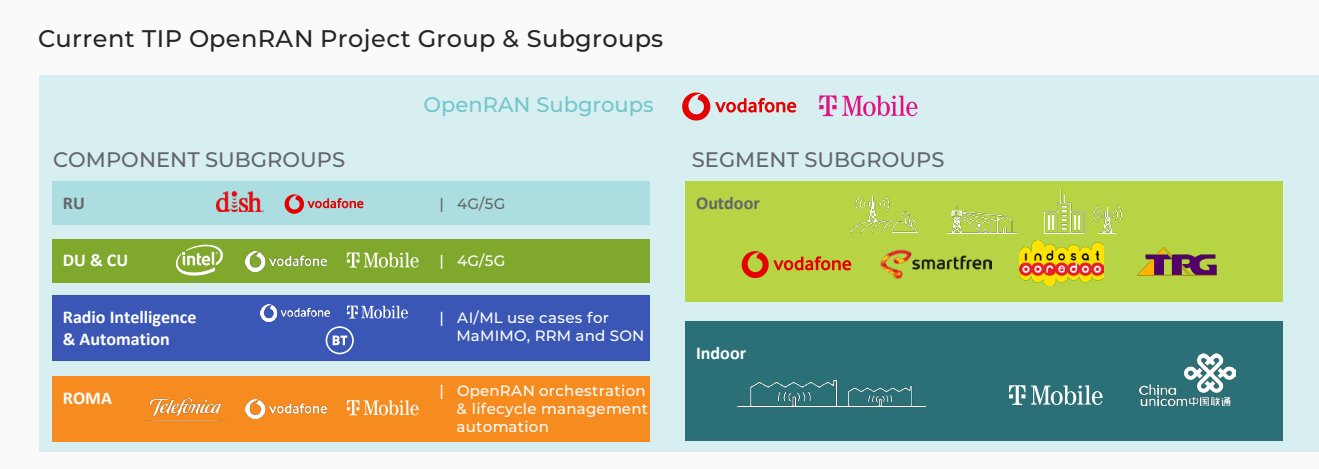
RELEASE 1: CURRENT TIP OPENRAN ROADMAP

Since its streamlining last year[4], the OpenRAN PG has structured itself into two major work streams as shown in Figure 6 and constituting the current ongoing Release 1:

1. Component subgroups, focused on improving the performance of individual OpenRAN technology components – software and hardware: RU, DU/CU, Radio Intelligence Automation (RIA), and OpenRAN Orchestration and Management Automation (ROMA)

2. Segment subgroups, focused on integrated RAN solutions for specific network use cases to improve deployment scenarios, (Outdoor and Indoor)

Figure 6: TIP OpenRAN Project Group Activities and Subgroups



[3] https://cdn.brandfolder.io/D8DI15S7/as/c5tx5crm45cch6w3nrz39s/OpenRAN_VF_TK_Playbook_FINAL.pdf
[4] https://telecominfraproject.com/tip-openran-project-group-is-streamlined-to-accelerate-development-and-deployments/

Release 1 covers a broader set of components, including RUs, DUs, CUs, RIA, and ROMA, split between outdoor and indoor use cases. Release 1 covers a much broader aspect compared to Release 0 (that focused mostly on outdoor macro), indicating the iterative process the OpenRAN PG follows. Product requirement documents have already been published within each subgroup and more outcomes of this release are illustrated in the live trials, including[5]:

- Indosat Ooredoo running 4G trials in rural Indonesia
- Vodacom in Democratic Republic of Congo making progress toward a live trial
- Telefónica Argentina launching a Proof of Concept for 80,000 rural inhabitants
- Vivo Brazil launching two Open RAN pilots
- Algar Telecom also in Brazil starting to test Open RAN technology
- Tigo Colombia started to deploy Open RAN solutions for rural areas

RELEASE 2: FORWARD-LOOKING OPENRAN ROADMAP

Release 2 is a forward-looking step, adding the requirements of the Open RAN MoU that five major European operators signed: DT, Orange, Telefónica, TIM, and Vodafone. The group recently published a Technical Priorities document[6] to outline their prioritized requirements for Open RAN, which include main scenarios and radio configurations, and hardware and software requirements for each Open RAN building block. These requirements, along with additional input from other operators, will be used in the development process for Release 2, which aims to generate as much scale globally as possible.

TIP PROCESS

TIP's goal is to speed up the process to get open, disaggregated network products to the right maturity stage, through a rigorous and efficient test and validation framework that makes it possible for a diversity of operators, technology suppliers, and system integrators to work together and reduce the time to market for these solutions.

The cadence and scope of each of the releases described in the previous section illustrate how TIP OpenRAN PG meets that goal and expands with each wave.

TECHNICAL ROADMAPS

The TIP process starts with community discussions with operator requirements, where commercial priorities drive the technical roadmap. This informs other operators, as well as technology providers, which can use it for their own internal product roadmaps. This deliverable includes use cases, definitions, and, most importantly, which industry standards and specifications will be used. For example, a specific operator requirement may necessitate the use of specific 3GPP standards specifications, as well as O-RAN Alliance interfaces.

TESTING AND VALIDATION

The next step, and the most important one, will be to build a system that answers the product requirements outlined in the previous step. This phase includes testing products from different suppliers while ensuring interoperability, security, stability, scalability, and carrier-grade performance.

The common test plan for each release is going to be based on what features and requirements can be defined and delivered within that release. That enables technology suppliers to do initial validation of their products and ultimately list them on the TIP Exchange, badged according to maturity *versus* requirements.

[5] https://telecominfraproject.com/openran-project-group-accelerates-development-validation-deployment-openran-solutions/
[6] https://telecominfraproject.com/openran-mou-group/

The test and validation strategy, including both lab and field testing, is meant to be a progressive testing, from individual product tested by the solution provider, to testing a combination of product in labs—such as a TIP Community Lab, to integration of a set of products into a solution that is ready for field deployment. This process does provide feedback, meaning that subsequent releases produce additional improvements based on operator inputs.

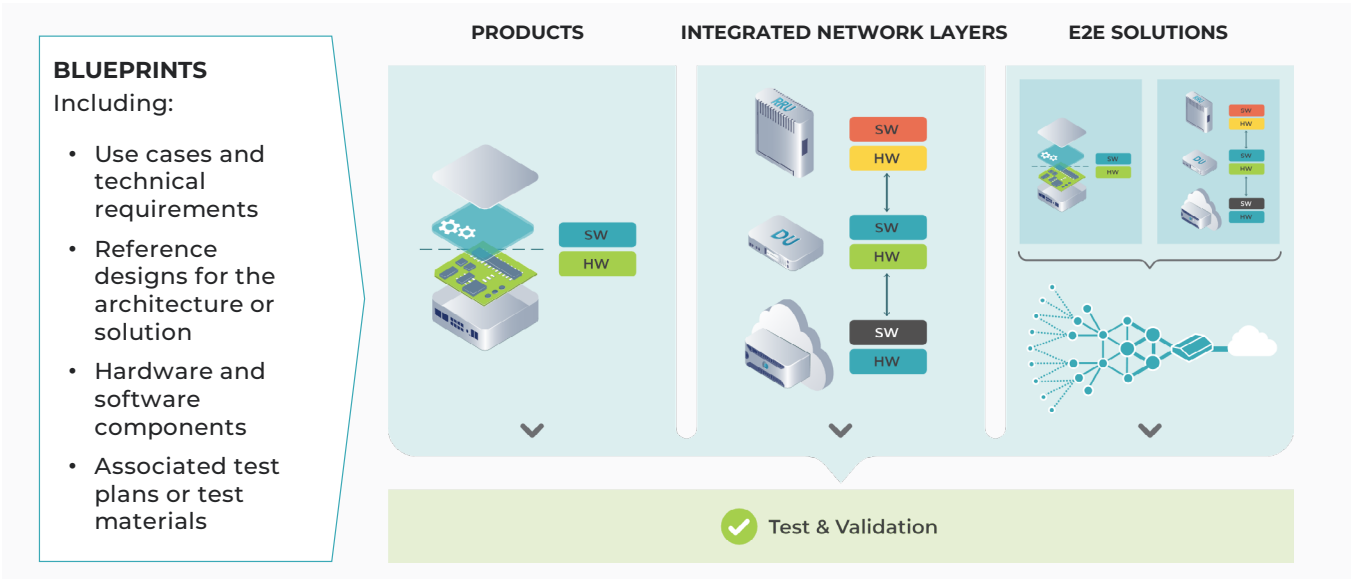
BLUEPRINTS AND TIP EXCHANGE

The final phase of the TIP process is to publish on TIP Exchange the products, solutions, and blueprints that have been tested and validated. OpenRAN includes product releases and blueprints that encapsulate all learnings from the previous phase into a format that can be used by other operators (and the rest of the ecosystem stakeholders) globally. There are three parts to this phase:

1) Products are listed on TIP Exchange, with their technical specification and their level of maturity through the badges they have earned. In the context of OpenRAN, such products would be primarily RU, DU, or CU.
2) Product blueprints highlight sets of products that have been integrated and tested together, and for which requirements, configurations, and similar documents are available to help deployment. In the context of OpenRAN, a typical product blueprint would be a RU, a DU, and a CU tested together as an integrated network layer.
3) Solution blueprints also consider sets of products that have been integrated and tested together, but within an end-to-end setup. In the context of OpenRAN, this may include multiple RUs, multiple DUs, multiple CUs, and transport nodes between them and interfaces to other network nodes, such as Operation and Maintenance (OAM). The output of this phase provides everything an operator needs to deploy this solution.

Blueprints are a vital output component of the TIP OpenRAN Project Group and range from products to integrated network layers and end-to-end solutions and is the final piece of the TIP OpenRAN PG process, as highlighted in Figure 7.

Figure 7: TIP OpenRAN PG Blueprints



Key elements of these blueprints are pre-integration of key network elements and functions, focusing on specific deployment scenarios that will be described by test, validation, and build guidelines. This aims to provide common processes and operations for deploying OpenRAN networks, as well as best practices learned throughout the TIP process.

The TIP Exchange distills findings from the TIP workflow for suppliers to showcase their capabilities and for operators to be able to assess products and solutions in a consistent manner. The TIP Exchange is a vital component of the TIP community, where operators can review and assess products, solutions, and blueprints, and solution providers can demonstrate their capabilities.

CONCLUSIONS AND RECOMMENDATIONS

TIP takes a practical and unique community-based approach to the productization of telecom network technology and facilitates the development, testing, and validation of commercial-grade products and solutions based on specifications and standards defined by industry organizations. In the current state of the open and disaggregated networks' market, this is a vital and important step to foster innovation and allow the supply chain to become more diverse. The implementation, coordination, performance testing, validation, and blueprint creation are all necessary steps in the open networks process and will be key to accelerate the large-scale evolution of these new concepts.

Open RAN, and open and disaggregated networks in general, promise more vendor choice and the ability to mix and match best-of-breed network components rather than rely on a single vendor for an end-to-end system. Open RAN technologies and concepts are evolving rapidly, but several of these have yet to be productized and fully tested in the market for interoperability and carrier-grade performance. The existence of TIP is vital to ensure that interoperable solutions are promoted and developed as the golden standard for open network deployments. ABI Research would advise any stakeholder that is associated with the productization or implementation of Open RAN systems to join TIP to help further drive the evolution of open and disaggregated networks.

Published August 2021

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