

INTERVIEW

INTRACOM TELECOM GROUP NEWSLETTER | ISSUE 37

COST-EFFECTIVE DUAL-CORE ALL-OUTDOOR MW RADIOS ACCELERATE 5G DEPLOYMENT

> PAGE 6

EXPLOITING ADVANCED E-BAND TECHNOLOGY FOR REPLACING 26 GHz BAND LINKS

> PAGE 10

BUILDING AN ENERGY-HYBRID SMART CHARGING SOLUTION FOR ELECTRIC VEHICLES

> PAGE 14

AI-POWERED MOBILE CUSTOMER NETWORK EXPERIENCE (CNE)

> PAGE 18



INTRACOM
TELECOM



INTERVIEW

INTRACOM TELECOM GROUP NEWSLETTER

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INNOVATIVE ALL OUTDOOR DUAL-CORE MW RADIOS

We, at Intracom Telecom, launched our advanced dual-core all-outdoor radios, the OmniBAS™-BXd, the new generation of the OmniBAS™ Point-to-Point MW family, at MW frequency bands 13-38 GHz. The featured product was displayed during the MWC Barcelona 2023, 27 February – 2 March, giving the opportunity to operators to achieve substantial CAPEX and OPEX savings thanks to its system's cost-effective architecture and superior performance.

OmniBAS™-BXd addresses the operator need for cost-effective, all-outdoor multi-Gigabit IP transmission solutions for both 5G MW backhaul and for a wide range of enterprise wireless connectivity applications. Operators can also benefit from OmniBAS™-BXd advanced design and features to deploy fast and easily all-outdoor multi-Gigabit IP MW links by installing just one unit on pole instead of two, thus achieving substantial CAPEX and OPEX savings.

John Tenidis, Marketing Director of Intracom Telecom's wireless solutions portfolio, noted: *"OmniBAS™-BXd expands significantly the OmniBAS™-BX portfolio of all-outdoor MW radios, offering a comprehensive and advanced portfolio to 5G network providers and other operators who need to deploy quickly a reliable multi-Gigabit MW backhaul. In parallel, we have enriched the widely used family of OmniBAS™-BX radios to cover a broad range of MW frequencies from 13 to 38 GHz. The new products are the evolution of OmniBAS™ MW portfolio and come as the result of extensive technological research encompassing several innovations, which serve network operators around the world since 2010".*



PROJECT FOR THE COAST GUARD IN GREECE

The association of companies INTRACOM TELECOM - GRIVAS S.A. undertook the implementation of a project that uses specialized mobile devices connected to mobile phones and applications that are linked to international Law Enforcement Authorities in order to provide verification and authentication control of travel documents, verify fingerprints and other biometric data. The project was awarded to the association by the Hellenic Coast Guard after an international public tender and it is related to the supply of Intracom Telecom's innovative Command & Control SISC² software platform that will be customized specifically to the requirements of the Hellenic Coast Guard. The complex queries extension of the SISC² system offers the ability to display results on specialized mobile devices from complex searches performed in databases, applications and third-party systems. Kostas Kardaras, Director of the Security & Integrated Systems Division of Intracom Telecom, stated: *"I would like to express my deep appreciation to the Hellenic Coast Guard for trusting the technological solutions of the association INTRACOM TELECOM - GRIVAS S.A., as well as to thank all the members of the groups who participated in the process of preparing and submitting our offer".*



SDN-POWERED ULTRALINK™-GX80 & UNI|MS™ ENABLE WIRELESS TRANSPORT AUTOMATION

Intracom Telecom announced its successful participation in the 4th ETSI mWT SDN Plugtest™ with UltraLink™-GX80 E-Band radio, natively supporting SDN/NETCONF in the Equipment's Software for end-to-end Network/Service auto-discovery and L2 (E-LINE) Service Provisioning.

Building on its leading Radio Performance, UltraLink™-GX80 powered with SDN capabilities, allows Operators to efficiently transform their networks, deliver innovative services, improve operational efficiency, and provide superior customer experience, while uni|MS™ Network Lifecycle Automation (NLA) Platform has already incorporated SDN Domain Control automations for service provisioning, and together with Radio Planning & Network Management capabilities eliminate error-prone manual efforts and disengage network operators' experts from laborious repetition.

Michalis Kissas, Systems Software Development Department Manager of Wireless Network Systems Business Division, stated: *"Intracom Telecom's wireless product portfolio continuously adopts SDN (Protocols & Yang Data models) standards, leveraging our new and modern L2 & IP/MPLS Embedded Software Platform. Our active contribution throughout the entire series of mWT SDN Plugtests highlights our commitment in bridging SDN standardization with production networks".*



MMWAVE FWA GIGABIT TERMINAL STATION LAUNCHING

Intracom Telecom announced the launch of its new millimeter wave (mmWave) MU-MIMO Terminal Station, the WiBAS™ G5 GigaConnect. Our unique featured product was displayed during MWC Barcelona 2023. Operators can now offer high-end wireless Gigabit connectivity services to more homes in suburban and rural areas thanks to the improved modem technology of the system, while gaining higher channel bandwidth utilization and denser networks (PMP). The WiBAS™ G5 GigaConnect is ideal for service locations requiring cost-effective and rapidly-implemented FWA networks as it enables state-of-the-art IP connectivity in zero-footprint installations. This innovative terminal delivers download speeds of 1 Gbit/s, increased operational

convenience, reliable performance and power-saving features, while its MU-MIMO technology facilitates high spectrum utilization in parallel with fast and reliable connections.

Dimitrios Pantelopoulou, R&D Director of Intracom Telecom's Wireless Networks Solutions Division, added: *"We are capitalizing on the vast experience and accumulated knowledge of our R&D team gathered over the past 30 years to develop the most competitive and innovative products, to enable our customers to serve a much larger number of homes and businesses, upgrade their existing infrastructures and reduce their network TCO. The MU-MIMO WiBAS™ technology of the GigaConnect terminal enables maximum exploitation of the available spectrum and the provision of wide coverage of rural areas with 1 Gbps service".*



SHOWCASING SMART CITY SOLUTIONS

Our company participated as a Grand Sponsor in the Smart Cities Conference that took place on March 9 at the Riviera Coast in Voula. During the presentation "Empowering intelligent sustainable mobility" Zinovia Boulogiorgou, Senior IoT & Smart City Solutions Presales Engineer of Intracom Telecom, analyzed the integrated solutions for smart cities our company provides in order to promote the improvement of citizens' daily lives, reduce energy costs and minimize the footprint of urban pollutants.

TERRAMETA

Leveraging its advanced mmWave modem technology embedded into the UltraLink™ product line transporting with speeds up to 30 Gbit/s in each direction, Intracom Telecom is taking part in TERRAMETA, a Research and Innovation project in the 6G Smart Networks and Services Joint Undertaking. The project aims to develop new communications techniques for ultra-high data rate wireless networks, leveraging on THz Reconfigurable Intelligent Surfaces (RISs). With our company's participation, the consortium of the project, comprising 9 EU/UK Academic/Research Institutes and 5 EU/UK based companies, has the ambition to be the first in the world to demonstrate the application of THz RIS-assisted networks in real application scenarios, including industry edge and telecom cases.



TERA6G

Participating in TERA6G, a Research and Innovation project in the 6G Smart Networks and Services Joint Undertaking, our company collaborates to leverage state-of-the-art integrated Radiofrequency (RF) Photonics technology to deliver disruptive wireless transceiver modules unlocking the "Fiber-over-the-Air" concept. The concept uses independently steerable wireless pencil-beams with fiber data throughput capacity. With our contribution, the project sets as a goal to design, new agile, scalable and reconfigurable wireless transceivers for 6G networks.



GREEN BRAND AWARD DISTINCTION

Another significant achievement comes to showcase our commitment to bringing our world closer to a better and more sustainable future for all. We, at Intracom Telecom, are pleased to be distinguished at the Green Brand Awards 2023 with the Gold Award for the Fixed Wireless Access WiBAS™ G5 family of products in the R&D for Green Product Category. The key feature of our award-winning solution is the significant reduction of the energy footprint, while providing ultra-broadband connection speeds to the end users. More specifically, WiBAS™ G5 mmW FWA technology reduces the energy costs for Wireless ISPs

by two orders of magnitude compared to other competing wireless access technologies. This significant achievement aligns us with the European Union's target for Gigabit connectivity for all citizens by 2030 and also contributes to the collective effort for building green sustainable telecommunication networks.

PRESENTING THE OPERATION OF IoT NETWORK IN ATTICA

Intracom Telecom took part in the open event of the Municipality of Vari, Voulas, Vouliagmenis, in the context of the Athens Money Show, entitled "Technology in the Municipality of Vari, Voulas, Vouliagmenis at the Service of the Citizen - The creation of a truly smart city". Giorgos Agathos, Senior Account Manager Public Sector, participated in the session "Challenges and opportunities from the creation of an IoT network in the municipality of Vari, Voula, Vouliagmeni", presenting the project "Procurement, installation and operation of IoT network."



ARTICLE

COST-EFFECTIVE DUAL-CORE ALL-OUTDOOR MW RADIOS ACCELERATE 5G DEPLOYMENT

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INTRODUCTION

As we are moving further into the 5G era, the 5G mobile networks rollout is moving at full speed. To serve the ever-increasing 5G traffic, mobile operators continuously work at densifying networks in urban areas and expanding the 5G coverage in sub-urban and rural areas.

A critical factor for cost-effective acceleration of 5G networks rollout is the availability of economical 5G capable transport systems and in particular of wireless backhaul networks that connect the 5G base stations to the central sites. Fortunately, mobile operators can rely on novel Dual-Core Microwave (MW) backhaul solutions that facilitate a fast rollout, especially at tail sites, offer exceptional capacity and carrier-grade performance, while enabling CAPEX and OPEX optimization.

THE IMPORTANCE OF MW BACKHAUL SOLUTIONS IN GROWING 5G NETWORKS

Wireless transmission systems have been an important part in the transport network technology mix and are expected to continue to be in the foreseeable future. Microwave (MW) transmission remain the preferred solution for mobile backhaul networks in areas that have a challenging landscape, where fiber cannot be optimally deployed. Of course, the availability is not the sole criterion, MW technical features and capabilities are also evolving in line with mobile networks requirements.

Modern MW Point to Point (PtP) IP solutions in licensed frequency bands 6-42 GHz (like Intracom Telecom's OmniBAS™) have already become part of the 5G ecosystem by offering multi-Gigabit IP capacity. In parallel, advanced IP MW Long-Haul (LH) backhaul solutions at lower frequency bands (6-11 GHz), have enabled reliable wireless connection at longer ranges, usually 30 Km to 50 Km or more, and brought 5G to remote areas and islands.

Today 5G is continuing to grow at full speed. More than 250 operators have already launched commercial 5G networks worldwide serving more than a billion subscribers. It is seen that the 5G subscription uptake is faster than for 4G and is estimated that 5G users will reach 5 billion by 2028, resulting in explosive growth of 5G data traffic. Therefore, in the coming years the 5G networks deployment will continuously expand worldwide in order to extend coverage in broader areas and also densify networks in metropolitan cities.

MW backhaul networks will have an important role to help accelerating the diverse 5G rollout cases, which may be in different deployment phases for different markets and regions. Especially for 5G network expansions in under-served rural and sub-urban areas where the vast majority of the newly deployed 5G base stations will be tail sites, the MW technology is perfectly suited to provide the last-mile backhaul, from both technical and economical point of view. Noticeably, MW is the dominant backhaul technology in the last mile of 5G networks across rural and urban areas, at medium to long ranges, with more than 50% of all radio sites today connected via MW.

The desired technical capabilities of MW last-mile backhaul systems in growing 5G networks are analyzed in the following Section.

OmniBAS™ has been a pioneering platform of IP MW transport for contemporary mobile networks since 2010. It is an ecosystem of products which can support effectively and efficiently the modern networks, based on innovative technologies developed by Intracom Telecom

ESSENTIAL REQUIREMENTS OF LAST MILE MW BACKHAUL IN 5G NETWORKS

The essential requirements of modern MW radio systems for last mile 5G backhaul can be grouped in the following main categories:

1. Maximize backhaul capacity for 5G in a cost-effective manner

The backhaul capacity needed for 5G varies depending mainly on the spectrum available by different operators and their regional network deployment phases. Estimations regarding required 5G backhaul capacity per site (up to 2025) converge to the following throughputs:

- » Rural: 0.3-2 Gbps
- » Suburban: 1-5 Gbps
- » Urban: 5-20 Gbps

Therefore, the MW system must provide Gigabit capacity, easily scalable to Multi-Gigabit. To achieve Gigabit throughput, wide channels 112 MHz or more must be supported. To double this throughput a second channel need be used (If available). Doubling the capacity should not be realized by adding a second similar radio system in parallel, because this would double the cost of deployment. Ideally, the radio system must be ready to support two wide channels or a single wide channel in XPIC configuration in one unit, resulting in substantial CAPEX/OPEX reduction.

2. Exploit flexibly the MW spectrum with adaptable link configurations

MW spectrum especially in urban areas, is scarce and saturated. A flexible utilization of scattered bunches of MW spectrum that may be available within the range of a frequency band, in different or same polarization, would help to exploit optimally the available spectrum and increase capacity.

3. Enhance radio performance to maintain capacity

To maximize the RF performance and enable long-standing and high throughputs, MW systems need employ advanced radio techniques. As an example, aggregation of two radio channels over one logical transmission stream is an essential functionality, which when combined with a robust Adaptive Coding and Modulation (ACM) algorithm would boost the radio performance and increase link availability at higher modulations.

4. Facilitate fast and easy mass-deployment with zero-footprint units

New MW link deployments would be greatly simplified when using all-outdoor radios because there will be no need to reserve expensive space in a telecom room located in a private property. In addition, the number of units to be installed on the pole should be minimized. It is worthwhile mentioning that mobile operators have recognized the value of all-outdoor MW systems over the legacy split-mount ones and as consequence, their market share over split-mount systems is continuously increasing (Source: Independent Analysts & Intracom Telecom), as shown in Figure 1. Note that it is anticipated that the share of multicore modems and radios over the total radio shipments will continue to increase and reach 50% in 2025.

5. Improve energy efficiency

Reducing power consumption of new MW radios is a key requirement of mobile operators in their effort to lower operational costs and reach carbon footprint reduction goals.

6. Be interoperable in IP transport systems

MW backhaul solutions need be fully interoperable with 5G nodes and other transport systems to ensure a uniform handling of the various IP traffic flows across different 5G network segments.

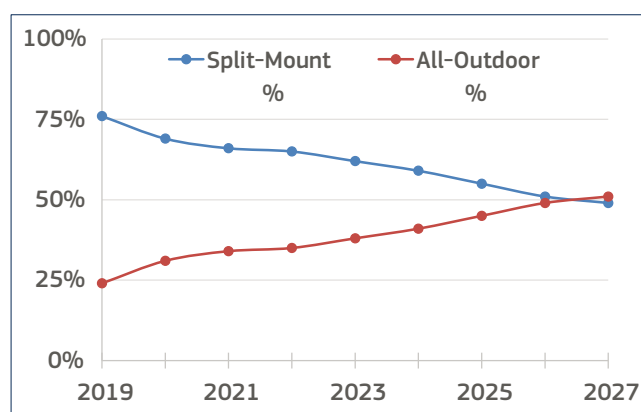


Figure 1: Worldwide Transceivers Share % by MW Architecture

7. Be managed by smart OSS systems

New MW links would ideally be managed by an advanced OSS system and/or SDN Controller that provides service automations and prompt corrective and optimization actions, therefore reducing the operator OPEX.

8. Minimize CAPEX/OPEX

All the essential requirements described in this section ultimately contribute to reducing the total costs for 5G operators, CAPEX and OPEX, which is fundamental for successful long-term business operation.

KEY ATTRIBUTES OF MW RADIOS FOR COST-EFFECTIVE LAST MILE 5G BACKHAUL

An ideal MW radio system for 5G last mile backhaul should have certain characteristics and technical capabilities that are outlined in this section.

All-Outdoor & Compact

First, it should be an all-outdoor compact unit. In an all-outdoor system, all the electronic circuits for the baseband and RF processing functions are enclosed in a weather proof outdoor unit. With zero footprint requirements, all the MW equipment is installed easily on the pole thus eliminating the need for expensive indoor space rental. Therefore, all-outdoor radios can accelerate the 5G rollout and facilitate both networks expansion and densification while optimizing the operator CAPEX and OPEX.

Dual Core 2x112 MHz and multi-Gigabit, in one unit

To enable higher throughputs required for last mile 5G backhaul, the MW all-outdoor unit should have a cutting-edge dual-core broadband architecture to support simultaneously 2 TX / RX RF signals of wide channels 112 MHz each. The CAPEX and OPEX optimization benefits of such a design are apparent. One unit instead of two needs be purchased, installed and maintained. It is anticipated that the cost of a dual-core unit would be significantly lower than the cost of two single-core units, resulting in clear CAPEX savings. Furthermore, a dual core radio will have simpler installation and require less cabling and other ancillary material.

The backhaul capacity supported by such a unit is 2.5 Gbit/s, which in most cases will be more than sufficient for last

With the brand new dual-core all-outdoor radios, OmniBAS™-BXd, operators can achieve substantial CAPEX & OPEX savings thanks to system's cost-effective architecture and superior performance

mile backhaul especially in rural and suburban areas. In areas where operators would need more capacity and the wireless hop length extends many km, MW dual core radio could be seamlessly combined with E-Band radios to support Dual-Band Links that can extend capacity and availability at longer ranges.

Spectrum efficient with Flexible link configurations

Efficient MW spectrum utilization by a dual-core radio is of paramount importance because spectrum is scarce and is usually available in fragments of various bandwidths in the same or different polarization. Therefore, the radio must be capable of allowing various carrier arrangements such as:

- » 2+0 (same polarization)
- » 2+0 (different polarization, example ACAP: adjacent channel alternative-polarization)
- » XPIC 2+0 or CCDP (co-channel dual polarized).

As depicted in Figure 2, a dual-core radio can exploit optimally the spectrum and support various link configurations by just fitting two types of compact integrated coupling units between the radio and the antenna. Such an integrat-

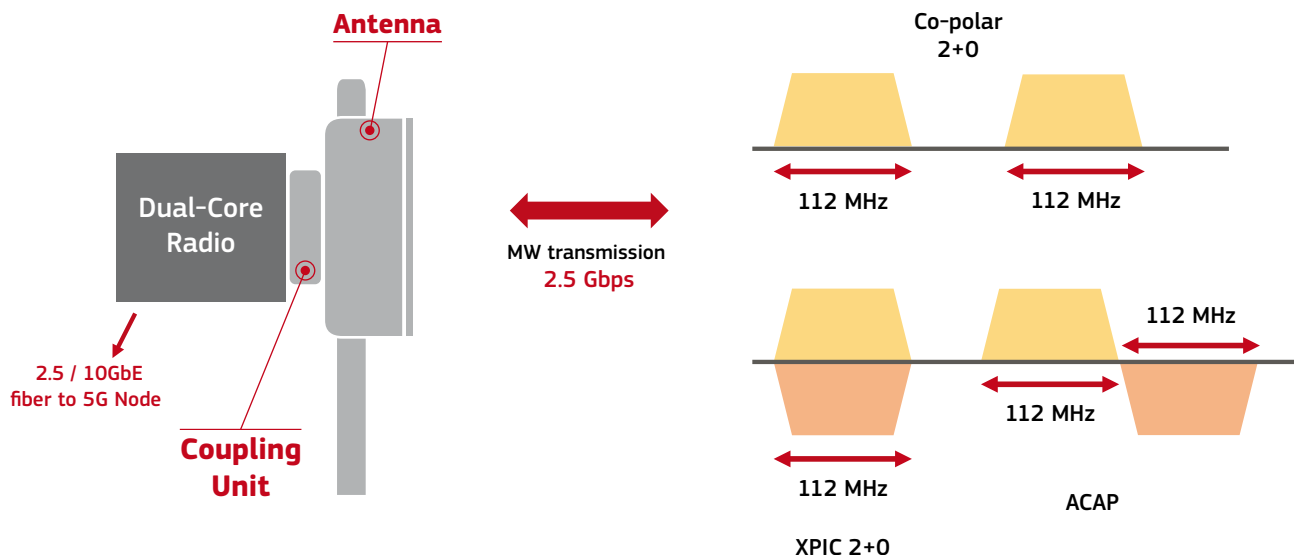


Figure 2: Flexible link configurations by a dual-core MW radio using 2x112 MHz channels

ed overall design would not only greatly simplify installation and slash operational costs but moreover offer better RF performance. In addition, it will be very valuable for operators if the dual-core radio could accommodate adaptable carrier allocations with replaceable RF band specific parts (duplexers).

Robust RF performance

Dual core MW radios at licensed frequency bands 13 GHz to 38 GHz are typically used in wireless links ranging from a few km up to 30 km or more. In all cases it is imperative that the MW system empowers Gigabit speeds with the best possible availability at higher modulations (4096-QAM). To achieve this goal, the dual-core radio must have a superior system gain and employ sophisticated signal processing algorithms, such as:

- » **Advanced Radio Link Aggregation (RLA)** to consolidate in the physical layer multiple transmissions over the same or different carrier with same or different bandwidths.
- » **Smart Radio Resource Control with Adaptive Coding and Modulation (ACM)** optimally utilizing link signal strength and quality parameters.

Energy efficient

Thanks to their dual-core optimized architecture and the use of state-of-the-art components, modern MW radios consume less power than legacy

MW systems, offering substantial OPEX savings to 5G operators. When a dual-core radio operates in one carrier, consumption can be reduced by 50%. Furthermore, the Automatic Transmit Power Control (ATPC) algorithm reduces TX power to the minimum needed to keep the link stable considering the varying propagation conditions, resulting in additional power savings up to 40%. As an additional improvement, traffic aware algorithms may deactivate the second carrier in the MW radio when 5G traffic is low, as an example during night hours, and ensure that the system absorbs just the right energy needed to serve the actual traffic.

Integral part of the IP networking ecosystem

MW backhaul systems already employ advanced L2 and L3 control mechanisms to handle effectively the IP traffic coming from the 5G base stations. Modern dual-core MW radios following the evolving IP/MPLS networking standards and adapting to new open architecture paradigms like SDN, with embedded NETCONF/YANG support, are future proof solutions with a long lifecycle, thus protecting the operator investments.

Managed by smart OSS systems

New dual-core MW links can be managed by powerful OSS systems that enable simple and efficient control

of devices and services and offer sophisticated tools through the entire MW system lifecycle, from planning to commissioning, day-to day operation, auditing and long-term optimization. In addition, embedded SDN support would allow SDN Controllers (Intracom Telecom's uni|MS™ Network Lifecycle Automation Platform and/or 3rd party) to directly manage services in an E2E fashion. Thanks to the smart automations supported, the network is always fine-tuned and the operators OPEX is minimized.

CAPEX/OPEX efficient

The technical attributes and capabilities of dual-core all-outdoor MW radios outlined in this section will decidedly contribute to minimizing the last mile backhaul CAPEX and OPEX, thus enabling operators to expand swiftly their 5G networks.

CONCLUSIONS

Novel dual-core MW radios address completely the communication service providers need for cost-effective, all-outdoor multi-Gigabit IP backhaul solution for 5G networks. Operators can achieve substantial CAPEX and OPEX savings thanks to system's cost-effective architecture and exceptional performance, while accelerating the 5G networks deployment and expansion. ■



ARTICLE



EXPLOITING ADVANCED E-BAND TECHNOLOGY FOR REPLACING 26 GHz BAND LINKS

DR. KONSTANTINOS DIMOPOULOS
Senior Product Manager, Wireless Network Systems

INTRODUCTION

Regulators around the world have decided on allocating the 26 GHz frequency band to 5G New Radio connectivity. As a result a large number of installed links, operating in this frequency band and providing fixed connectivity services, will have to be decommissioned and replaced by alternative technologies. The deadline for the decommissioning of the 26 GHz links, as determined by the respective Telecommunications Regulatory Authorities (TRA), varies on a per country basis, from immediate to as far as 15 years into the future, or may even still be undefined. Nevertheless, Communication Service Providers (CSP) have already started considering the options for replacement of their links operating in this band, even earlier than required. A reason is that, as Mobile 5G or ultra-high capacity broad-band Fixed Wireless Access (FWA) systems are introduced, it will be difficult to extract sufficient capacity from legacy 26 GHz radio systems for their current or near term transport needs.

According to the CEPT ECC Report 173 (2023 Revision, Draft) there are currently more than 70,000 Point-To-Point (PtP) links, as reported by regulators in the CEPT area only. The majority of these links are reported to be used for mobile

backhaul and broadcasting infrastructure. In the last 10 years mobile operators have deployed 26 GHz links in PtP or even Point-To-Multi-Point (PtMP) configurations, mainly, in order to provide backhaul for the 2G, 3G and 4G networks.

CSPs owning 26 GHz links have a number of options for their replacement. Some of these options are discussed below in terms of their advantages and disadvantages in relation to operational suitability considerations.

WIRELESS OPTIONS FOR REPLACING 26 GHz LINKS

Legacy 26 GHz links may be replaced by Microwave (MW) links in a nearby area of the frequency spectrum. CSPs and TRAs are considering the frequency bands of 18, 23, 28 and 32 GHz for existing 26 GHz-link replacement. Additionally, CSPs may consider new options that are available to them, such as the E-Band radio technology, operating in the mmWave frequency band of 71-76 / 81-86 GHz, and Dual Band radio technology combining an E-Band link with a MW frequency link. E-Band technology advantages include: The highest capacity in the simplest PtP link configuration possible, currently up to 10 Gbit/s in a 1+0 configuration (i.e.

one radio per link terminal), the lowest power consumption per Gbit/s of capacity and the lowest licensing cost per MHz w.r.t other frequency bands. CSP considerations, related to 26 GHz link replacement, include:

1. Current & future capacity needs

While existing 26 GHz links operating with, typically, 28 or 56 MHz channel sizes may satisfy transport capacity requirements of a few hundreds of Mbit/s, new Fixed or Mobile access system capacity is such that the corresponding backhaul capacity required is on the order of Gbit/s. The 26 GHz link replacement solution needs to be able to satisfy current needs, while still being able to scale, in a cost efficient and least operationally intrusive way, to cater for the future capacity needs. Note that new generation MW systems, featuring higher spectral efficiency (higher modulation formats), support for larger channel sizes as well as more than one transceivers (TxRx) in one unit, can provide significantly larger capacity than legacy MW links. Part of this capacity can be exploited immediately or be provisioned gradually in the future, without requiring additional site visits and installation of new units.

Nevertheless, in order to scale the capacity of a MW link from a few hundreds of Mbit/s to a few Gbit/s, more or/and larger channels or/and more complex link configurations will eventually be required. For example, starting from a 56 MHz channel capable of around 0.5 Gbit/s in 1+0 and 1 Gbit/s in 2+0 XPIC configurations, in order to reach a 2-3 Gbit/s of capacity the use of at least one 56 MHz channel of additional MW spectrum will be required. Spatial multiplexing using 2x2 MIMO techniques could potentially be adopted to double the capacity while conserving spectrum, however, this requires additional hardware units and significantly more pole space. Particularly, for the 18-32 GHz frequency bands, depending on the link range and frequency of operation, the distance of the two antennas per link end in a 2x2 MIMO configuration can range from 5 to 10 meters or more, which may not be practically possible to be accommodated in the deployment location.

On the other hand, fully outdoor E-Band radios may be used to achieve very high capacity with the simplest link configuration, i.e. 1+0, as well as compact form factor. For example, an E-Band link operating in 500, 1000, 2000 MHz-sized channels can offer 4, 8, 10 Gbit/s, respectively, in 1+0 configuration. For such capacities to be achieved by MW radio units a lot of expensive MW spectrum as well as additional radio units will be required.

Substituting narrow MW spectrum channels with wide E-Band spectrum channels leads to radio links with higher capacity and smaller spectrum fees

2. Link range as a function of required capacity and link availability

According to the ECC REPORT 173 (2023 Revision, Draft), as reported by the CEPT responding TRAs for existing 26 GHz links, short link lengths are up to 3 km, typical link lengths up to 9 km, while maximum link lengths may reach 20 km or more. In general, for carrier class operations, CSPs require high availability of 99.995% or even 99.999% for the minimum reference capacity value of the link (i.e. the capacity for which the maximum availability is required).

MW solutions can offer their maximum capacities by using very high spectral efficiency modulation formats, such as 4096-QAM. However, the capacity availability at these high modulation formats is relatively low. To achieve high capacity and high availability the designers need to use more spectrum and/or larger antennas. As a way to avoid or down-scale these costly resource upgrades, the planner may be allowed to design the link, so that the target availability operation is for a reference capacity that is smaller than the maximum possible capacity of the system. This is facilitated by the fact that traffic in modern networks is no longer of a constant magnitude TDM type, but variable multiservice packet traffic that comprises a significant "best effort" component.

Indicatively, for a reference capacity of 300 Mbit/s, using 56 MHz channel size and requiring availability 99.995%, the ranges achievable by an Intracom Telecom OmniBAS™ MW 1+0 radio link operating in the 15, 18, 23 and 32 GHz bands, using 60 cm antennas in ITU-R rain zone K, are 12, 9, 7.5, 5.5 km respectively. Of course using antennas of larger diameters will increase these ranges. On the other hand, requiring operational availability of 99.995% for at least 400 Mbit/s capacity of a high System Gain E-Band radio link, such as Intracom Telecom's UltraLink™-GX80, using 60cm antennas and operating in the ITU-R Rain zone K, can provide a link range of 3.5 to 4 km.

A Dual Band link configuration, performing a “seamless” aggregation of the capacities of E-Band and MW radio carriers, can provide an equivalent link with very high capacity for most of the time (indicatively 99.9% of the time) and high availability (indicatively for 99.995% of the time) for smaller reference capacities (please refer to October 2022 issue on p.9 at <https://www.intracom-telecom.com/newsletter>). Additionally, today there are commercially available Dual Band antenna solutions with 60 cm diameter, combining the signals of one or two MW radio units operating in a MW band, such as 15, 18 or 23 GHz, with one or two E-Band radios.

Indicatively, in the context of a Dual Band link, a high System Gain E-Band radio, such as the UltraLink™-GX80, can offer capacity of at least 2 Gbit/s with 99.9% availability for a range of 8, 9, 11 km for 500, 1000, 2000 MHz channel size respectively, using a 60 cm Dual Band antenna in ITU-R rain zone K.

It can be seen that there is scope for links of several kilometers by using a Dual Band configuration with a single antenna. Considering the above results, combining a MW radio operating in a 56 MHz channel, in either of the 15, 18, 23 GHz bands, with the UltraLink™-GX80, using 60 cm diameter Dual Band antenna can provide links of up to 11 km in an ITU-R Rain zone K area, assuming a requirement for 99.995% link availability of 300 Mbit/s capacity and 99.9% availability for a total Dual Band link capacity of 2.5-3 Gbit/s. In the near future there will be 90 cm E-Band and Dual band antenna options offering significant extension of the corresponding link ranges.

Consequently, a short 26 GHz link may be replaced by an E-Band link and a typical length 26 GHz link may be replaced by a Dual Band link.

Spectrum fees

One important contributor to operational expenditure for CSPs is spectrum fees. Microwave spectrum is considered premium spectrum and obtaining more of it impacts operating costs adversely. Usually, the lower the frequency band, the higher the yearly spectrum fee that TRAs charge. Microwave band spectrum fees for a year are comparable to the price of a radio unit. This is something that affects the cost of the link replacement configuration on day one, but also impacts future costs when capacity upgrade will be needed. As capacity demands grow, more spectrum will be required. Therefore, it is financially advantageous to use as little high-cost spectrum as possible.

E-Band spectrum is offered for the lowest licensing cost per MHz w.r.t. other frequency bands. For example, as a rule, a 56 MHz MW channel costs much more than 500 MHz and often more than a 2000 MHz channel of E-Band spectrum in many parts of the world. So, from financial standpoint it is preferable to obtain a 500, 1000 or even 2000 MHz channel to an existing link instead of obtaining an additional 56 MHz channel.

An E-Band link or a Dual Band link, using E-Band spectrum in combination with the minimum possible MW spectrum, will be operationally more cost effective than adding spectrum in multiples of 56 MHz channels. The minimum amount of MW spectrum to be used in a Dual Band link will be determined by the minimum capacity required at the target availability.

EXPLOITING E-BAND AND DUAL BAND TECHNOLOGY FOR REPLACING 26 GHz LINKS

From the points discussed so far it can be concluded that it is technically feasible, from a link range and availability viewpoint, and advantageous, from a capacity and economic viewpoint, for a significant proportion of the legacy 26 GHz links to be replaced by E-Band links or Dual Band links.

Intracom Telecom, being a global telecommunication systems and solutions vendor operating for 45 years in the market, offers a series of advanced radio systems for transport applications in 5G-era networks. Its leading system gain UltraLink™-GX80 10 Gbit/s E-Band radio can be used by itself or be seamlessly combined with a range of single and dual transceiver OmniBAS™ MW radios, or even third party MW radios, to provide multi-gigabit carrier class transport connectivity. ■

ENABLING HIGH QUALITY SECURITY OPERATIONS IN ONE OF TOLEDO PROVINCE'S BIGGEST MUNICIPALITIES

The local authority selected Intracom Telecom's broadband wireless licensed solution to improve public safety with wireless CCTV connectivity.

THE CUSTOMER

The Municipality is located in central Spain, in the province of Toledo. Despite the small area it covers, the town hosts two prisons, one of them being one of the biggest prisons in Spain, with the local authorities working very tight with European and worldwide security organizations to ensure compliance with safety measures. The local Police Force is one of the Municipality's main services with its mission being to ensure citizens' security.

THE CHALLENGE

The Municipal police department had been looking for a suitable solution to connect the municipal security IP cameras with the police operations/monitoring center. The security camera project was an important part of the effort to improve the police surveillance capabilities given that vandalism incidents were increasing in number during the recent years. Additionally, the police would benefit from being able to use the cameras' images to perform Optical Character Recognition (OCR) on vehicle

number plates at the Municipality area. As the equipment would be installed in street areas, cable-based transport for the cameras would be difficult and slow to implement and the cost of the civil works would be very high.

THE SOLUTION

Intracom Telecom's state-of-the-art solution combines WiBAS™ G5, a mmWave Ultra-fast Point-to-Multi-Point (PMP) radio operating in the frequency band of 28 GHz, along with UltraLink™-BX70, a high performance lightweight E-Band (71-76 GHz) TDD radio. The solution can support strict SLA conditions for surveillance networks, along with the superior transport capabilities offered by the Intracom Telecom products which were fully compliant with the customer requirements and particular circumstances. Using the licensed frequency spectrum at 28 GHz, which had been allocated to the Municipality, allowed uninterrupted wireless transport service of the IP cameras' high quality video streaming to the police monitoring center, avoiding all interference problems that occur from operation in ISM frequency bands (2.x and 5.x GHz). Thus, the use of licensed 28 GHz spectrum ensured a reliable framework for the specific service implementation.

WiBAS™ G5 PMP radio system is based on a fully outdoor Software-Defined Radio platform with sophisticated QoS features and robust performance that enables the delivery of personalized, customer-centric ultra-broadband Fixed

Wireless Access (FWA) to suburban and rural environments, allowing operators to deploy dense FWA networks, capable of serving up to 240 terminal stations (per hub). The advanced modem technology of the WiBAS™ system provides an aggregated capacity of up to 1 Gbps in distances of up to 8 km. On the terminal site, the new generation of terminals, WiBAS™ G5 Connect+, a lightweight compact fully outdoor radio, blend discreetly with the surrounding environment and offers superior quality Ultra-Broadband Services.

Intracom Telecom's E-Band portfolio, UltraLink™, comprises a series of outdoor Ethernet radio units that exploit the advantages of E-Band technology to offer exceptional data transport performance. UltraLink™-BX70 is a lightweight fully outdoor radio that offers up to 1.6 Gbit/s aggregate capacity, along with a complete set of Carrier Ethernet networking features at a most competitive TCO. Being a TDD radio it provides ideal transport in cases where the traffic load on the two directions is asymmetrical, as in the case of IP camera transport. UltraLink™-BX70 is the best fit for deployment on poles and lamp posts due to its small size and low power consumption. Moreover, its quick and easy installation facilitates the implementation of the roll-out plan. The installation and deployment of the solution was carried out by ITSA Seguridad, a local engineering company of a highly qualified personnel, assuring excellence in the integration of the CCTV systems and the wireless network. ■



ARTICLE



BUILDING AN ENERGY-HYBRID SMART CHARGING SOLUTION FOR ELECTRIC VEHICLES

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INTRODUCTION

Energy is a foundation of human activity, either as an input to the production process or as a final consumer good. Currently energy costs are affected by post-pandemic demand recovery as well as broader geopolitical changes. Dealing with rising energy costs (oil, natural gas, electricity) is a significant global challenge.

In addition, climate change due to the extensive use of fossil fuels and the effect of the transport sector on it, needs to

be addressed immediately. Urban areas consume 60-80% of the world's energy and are responsible for the release of 70% of carbon dioxide gases. In the EU, CO₂ emissions from road transport account for 20% of total CO₂ emissions, while passenger cars, which are used for an average of only 2 hours per day, account for over 60% of total road transport CO₂ emissions in the EU. At the same time, the transport sector is the only one in which carbon dioxide emissions have increased over the last three decades, by 33.5%. Europe's goal of reducing greenhouse gas emissions by 55% by 2030 (Fit for 55) is a cornerstone for the ultimate goal of making the EU the first climate-neutral continent by 2050.

In this context, the promotion of electric mobility (sustainable mobility) is extremely important. Fully electric or hybrid vehicles are an increasingly popular transport mode. Approximately 6M public EV chargers will be needed by 2030 at European level. Public and corporate policies need to encourage electric transport, exploiting renewable energy sources (solar radiation, wind power). This, combined with the intelligent use of the land, leads to the protection of the environment, contributing to the improvement of the health of the population.

Intracom Telecom contributes to addressing the above challenges by developing the Smart Carport solution which focuses indicatively but not restrictively in corporate users or Municipalities/governmental locations with available open parking spaces. Moreover, publicly accessible or controlled access areas like Commercial Hubs (shopping centers, supermarkets), Workplaces with Car parking lots, Hotels, Hospitals, Car Rental or Repair companies, Shared Charging on Multi-Dwell properties, Gas stations are potentially deployment domains for Smart Carport.

SOLUTION OVERVIEW

Intracom Telecom's Smart Carport expands the traditional use of a Carport into an energy-hybrid smart charging solution for electric vehicles, in which a PhotoVoltaic (PV) system is used as an additional energy source with optional battery storage capabilities.

Smart Carport can operate either as a Net Metering installation (using Energy Off-setting) or completely energy independent (off-grid), using the energy produced by the PV panels installed on the roof.

The electrical energy produced by the PV panels is stored in a battery array and supplies alternating current (AC), through inverters, to the locally installed electric vehicle chargers. The combination of solar panels and energy storage through batteries ensures optimal system performance, making it possible to save energy by charging even when there is insufficient or no sunlight (cloudy, evening).

Smart Carport is equipped with remote-controlled sensors (via LoRaWAN, nb-IoT) to automatically detect the occupancy of parking spaces within their marked boundaries. For lighting, remote-controlled LED lighting is used, which is activated depending on the car presence in combination with the light of the surrounding area. Local WiFi may be also included, so that the user can activate and control the charging process via Mobile Intracom app, instead of an authorization card. Finally, there is a digital smart energy meter installed, through which all electrical parameters of the system are remotely available at any time.

The management of the overall solution, which includes Chargers, Inverters, Batteries, Lighting Controllers, Park-

Why to select Smart Carport

1. Cost reduction of electric vehicle charging
2. Revenues increase through mobile app for optional management of payments
3. A sustainable and eco-friendlier parking solution
4. Sunlight protection for the company cars
5. Integration capability with other solutions (e.g. security cameras, environmental measurements)
6. Tax reduction or subsidization incentives to the companies
7. Overloading avoidance of the electricity grid
8. Health improvement by contributing to the transport decarbonization

ing Sensors, Energy Meter, is achieved remotely through Intracom Telecom's cloud-based Management Software Platform (powered by uiTOP™). It greatly simplifies the monitoring and management of the relevant infrastructure. Any available telecommunication interface network, wireless or wired, can be used for the interconnection of the installed equipment with the management platform.

Smart Carport is offered as a turn-key solution, independent of specific manufacturers and types of chargers (AC or DC), with minimal maintenance costs and full technical support. In addition to the above and depending on case-by-case needs, it is possible to integrate other vertical solutions offered by Intracom Telecom, such as the installation of security cameras or station(s) collecting environmental data and measuring ambient air quality.

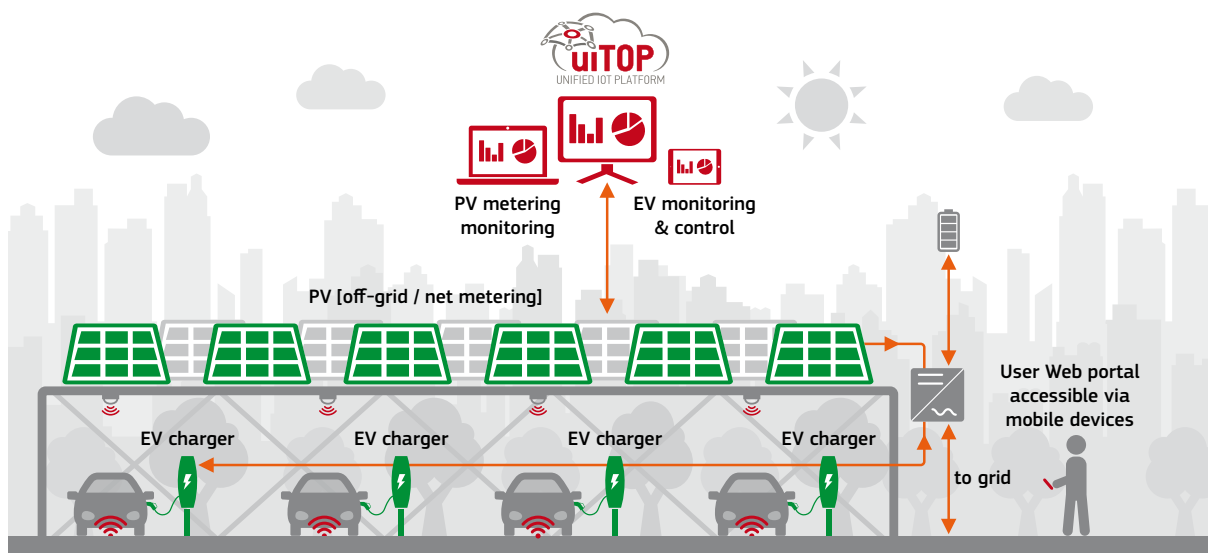
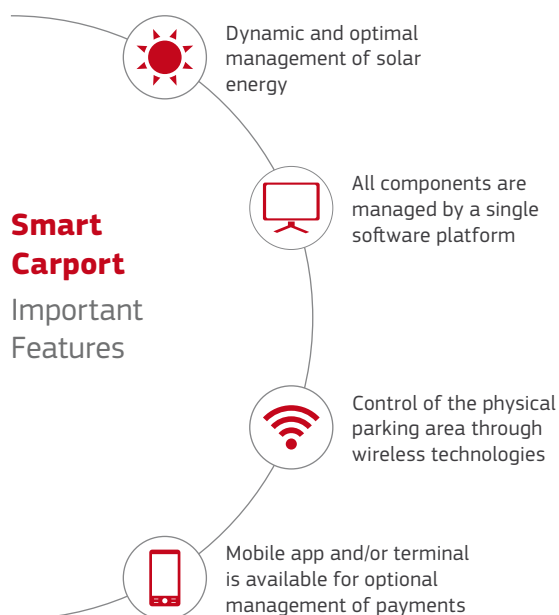


Figure 1: Smart Carport Architecture

EFFICIENT & SUSTAINABLE MOBILITY

Smart Carport can fully cover charging needs with up to zero emissions using smart management strategies:

1. In case there is an excess of generated energy, the batteries are automatically charged so that the stored energy can be used later, when there is increased demand in addition to the PV panels.
2. When the produced by the PV panels energy is not sufficient due to increased demand (EV charging), the need is automatically covered by the energy stored in the batteries, thus achieving the limitation of Utility network absorption to the absolute minimum.
3. In case of high demand, the energy from both the PV and the batteries is used at the same time.
4. In case of Net metering installation, when the demand exceeds the available energy (produced by the panels and stored in the batteries), the required excess energy will be absorbed from the Utility network and at a later stage offset with the energy injected into the Network when energy from PV and batteries exceeds the demanded one.
5. Optimization of the charging process and efficiency through load balancing (Load Balancing) to the chargers but also prioritization, if required, to specific EV charging users.



UNIFIED MANAGEMENT SOFTWARE

Our Smart Carport solution is powered by its own in-house advanced cloud-based platform that simplifies remote management of charging networks. It integrates with Carport infrastructure components (chargers, inverters, parking sensors, smart lights, energy meters, etc.) via open interfaces and standardized protocols (e.g. OCPP) and can also interface with external networks and customer systems through open APIs. The platform provides all the necessary functionality required to keep the Carport network in healthy shape and enables important operational flexibility by allowing customers to implement fine grained charging & power management policies and produce reports that are required in order to align with requirements posed by relevant legislation/laws.

Whether offered to Enterprises, Public organizations or Municipalities the platform can be tailored to fit a variety of business and network needs.

CONCLUSION

The Smart Hybrid Energy Solution for Electric Vehicle Charging (Smart Carport) of Intracom Telecom, contributes to addressing the challenges related to the high energy costs, the environmental footprint minimization and the promotion of electric mobility. By adopting innovative technologies in software and hardware it offers energy efficient, environmentally friendly, easy, safe and affordable electric charging to the end organization/user (Company, Municipality). ■

BUSINESS PARTNER GREECE CORD MAGAZINE

FACE TO FACE WITH EFTHIMIOS PARTSALIS ON ARTIFICIAL INTELLIGENCE

The EU has been working actively to promote the development and deployment of 5G networks across the region. Intracom Telecom has been part of this initiative from the outset, developing its wireless networks portfolio to support the high demand for broadband connectivity in 5G backbone multi gigabit networks. Efthimios Partsalis, CEO, Intracom Telecom subsidiary in Serbia, gave an interview at CorD Magazine talking about 5G era.



Mr. Efthimios Partsalis, CEO Intracom Telecom DOO Belgrade (right) with Mr. Vuk Dapcevic, Vice President of the Management Board of Hellenic Business Association (left)

CorD Magazine » Being fully aligned with the need to support sustainability – not only in telecoms networks, but in every aspect of people's lives – Intracom Telecom also focuses on providing a comprehensive portfolio of Smart Sustainable City & Enterprise solutions. That is our near future. As more devices become connected to the internet, the demand for fast, reliable connectivity will only continue to grow. What is Intracom Telecom developing in terms of network equipment?

E. Partsalis » All products that work in MW and mmW spectrum are now built to support 5G transport networks. Moreover, Intracom Telecom has in its portfolio WiBAS™, a complementary product to 5G for fixed broadband access, which can enable operators to provide broadband connectivity to their customers, especially in rural and semi-rural areas, where it is not economically viable to build 5G or optical networks.

CorD Magazine » Artificial Intelligence seems to be an important element of the digitalization process. Is

Intracom Telecom ready to address this challenge?

E. Partsalis » Yes, this is true. We see AI as being the differentiating factor topping every solution we build. We have succeeded in having a comprehensive offer, including modules for Big Data clusters that we developed on our own, like cluster Monitoring & CI/CD pipelines, as well as a multidisciplinary team of skilled experts, starting from systems administrators, developers and data engineers, to ML engineers and data scientists. With such a strong team, we develop AI-powered applications on top of our products, while we are also working hand-in-hand with our customers to build solutions for them, working closely with their business teams and IT experts.

CorD Magazine » How do you imagine the smart city of the future?

E. Partsalis » Smart cities have been a hot topic in the technology industry for several years, but there is still a long way to go before we can say that we have truly realized the full potential of smart cities. At its core, a smart city is a city that leverages data, technology and

infrastructure to improve the quality of life of its citizens, while also reducing its environmental impact and increasing economic efficiency. The same applies to enterprises, which need to monitor their assets, premises and power consumption in order to formulate and enforce their operational optimization and sustainability strategies.

Intracom Telecom, with its leading IoT orchestration platform uiTOP™, addresses demands for smart organizations, covering all vertical applications from smart lighting to environmental protection and energy management. The true benefits of a smart use case can be seen in a combination of leveraging IoT data and artificial intelligence, which is what Intracom Telecom did for the project in our region's largest city. In this case, our uiTOP™ platform was used in combination with our artificial intelligence Cognitiva™ platform to predict air pollution, bringing the city's authorities and citizens more actionable insights on the state of air pollution in their city and ultimately helping to protect health. ■

ARTICLE

AI-POWERED MOBILE CUSTOMER NETWORK EXPERIENCE (CNE)

Employing state-of-the-art ML techniques to improve proactive CNE provisioning with forecasting and real-time anomaly detection.

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INTRODUCTION

Given the continuously increasing expectations of modern mobile subscribers, customer network experience (CNE) has emerged as a key differentiator among communication service providers (CSP). In this context, radio access network (RAN) optimization for customer loyalty and churn reduction becomes of paramount importance, putting pressure on CSPs to effectively capture and proactively monitor CNE.

Nevertheless, the complex RAN architecture – where overwhelming data volumes are fragmented across multiple carriers and different radio access technologies (RAT) – as well as the intricate traffic and mobility dynamics make the extraction of actionable CNE insights a challenging task.

GENERIC CNE ANALYTICS FRAMEWORK

Shifting to a customer-centric paradigm implies that CSPs must be able to not only foresee RAN disruptions but also assess their impact on CNE; or, at least, provide a fast resolution to detected CNE degradation before becoming customer complaints. As shown in Figure 1, this calls for a unified framework built on the grounds of satisfaction metrics that relate deterministic RAN performance to CNE, net promoter scores (NPS) and machine learning (ML) algorithms to deliver accurate CNE predictions, derive actionable insights and trigger proactive actions accordingly.

All in all, such a CNE provisioning framework can drastically reduce human intervention in RAN management

and augment operational expenditure (OPEX) efficiency in several domains such as:

- » Loyalty-centric network planning and optimization
- » Anomaly detection and root cause analysis
- » Marketing campaign management for retention or upsell purposes.

INTRACOM TELECOM MOBILE CSI ANALYTICS SUITE

Mobile CSI Analytics Suite assists CSPs to monitor CNE by defining a Customer Satisfaction Index (CSI) in accordance with TM Forum standards. CSI is calculated based on RAN key performance indicators (KPI), it can be finetuned by means of ML and assesses multiple aspects of CNE.

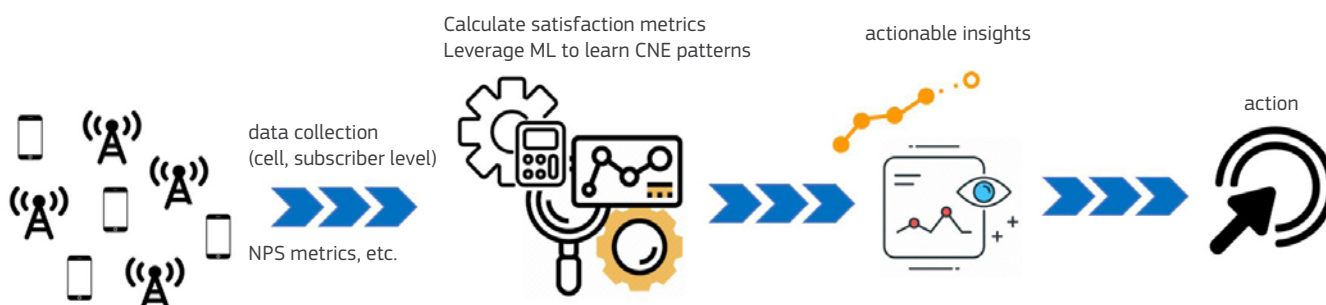


Figure 1: Customer Network Experience (CNE) Analytics Framework

Essentially, CSI complements NPS with a notion of RAN performance which allows to not only measure subscribers' overall perception of a CSP and predict customer loyalty but also to unveil potential RAN reasons that lead to customer dissatisfaction. To ensure a holistic performance evaluation, CSI calculations are based on heterogeneous KPIs coming from different RATs and are stored in one or more data lakes from where distributed processing takes places with suitable ML algorithms. The outcome of this processing is the visualization of CSI metrics in series of comprehensive, visually rich reports organized in highly interactive dashboards that track current and historical satisfaction with respect to various dimensions:

- » Individual subscriber, cell, and network-wide CSI
- » Voice, data, and overall service CSI
- » CSI per vendor equipment and geographical locations

An indicative example of different CSI visualizations is illustrated in Figure 2.

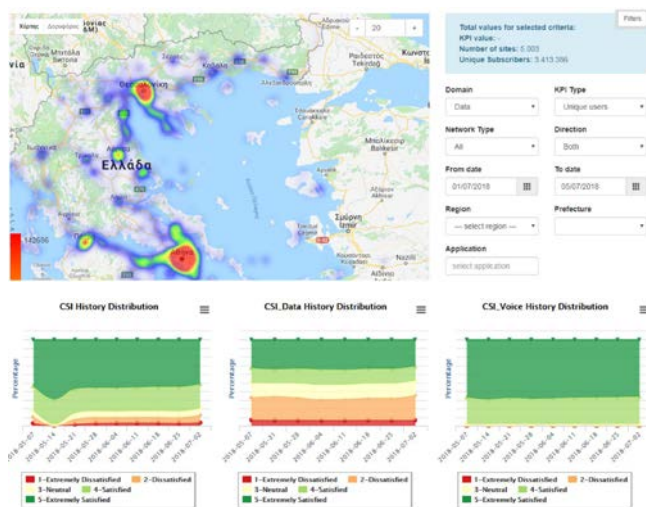


Figure 2: Example of different CSI visualizations

AI-POWERED MOBILE CSI

Leveraging state-of-art ML techniques for time series analysis and anomaly detection, AI-powered CSI supplements existing dashboards with new features for evolved CNE provisioning. Among others, the most notable CSI enhancements can be summarized as follows:

» Mobile CSI Forecasting

Predicting future CSI values is a natural Mobile CSI extension. Network-wide CSI forecasting can drive strategic future decision making by assisting CSPs to detect well ahead-of-time geographical regions that require system upgrades to continue maintaining a certain CNE level in the future. At a subscriber level, CSI

forecasting can be employed for the proactive care of VIP customers with stringent service level agreements (SLA) to prioritize actions based on customer importance.

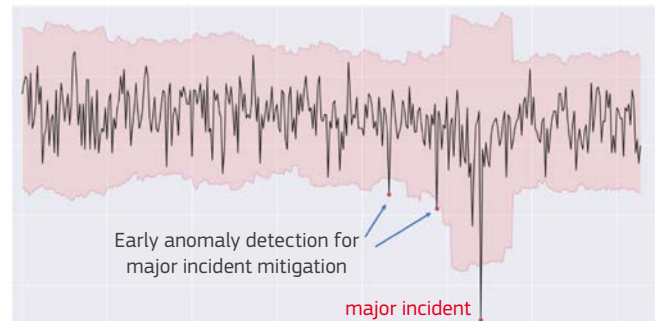


Figure 3: Detection of early anomalies as a sign of a future anomaly incident

» Mobile CSI Anomaly Detection

Historical CSI information can be used to learn normal metric behavior and train ML models capable of tracking CSI anomalies either at their infancy or even before occurring. It is worth mentioning that anomaly provisioning at CSI level can reduce the overhead of generated alerts by suppressing anomalies at RAN KPIs that hardly impact CNE. Nonetheless, it is still relevant to continue analyzing these events in the background as they may unveil useful information for the mitigation of future major incidents.

» Enhanced Mobile CSI correlation for root cause analysis

CSI correlation with RAN performance during anomaly detection instances can help CSPs learn the healthy range of their RAN KPIs. Out-of-bounds KPIs could provide valuable actionable insights regarding the underlying problem, steer troubleshooting to specific directions and eventually enable a faster and more efficient root cause analysis and recovery.

CONCLUSIONS

Intelligent CNE monitoring is a critical requirement that CSPs must meet to stay ahead of their competitors. Intracom Telecom's Mobile CSI suite and related AI-powered enhancements simplify proactive care by means of CNE forecasting and real-time anomaly detection. Such mechanisms enable loyalty-driven network optimization, accelerate response times to CNE degradation and eventually improve CSPs' customer retention. ■

» <https://www.intracom-telecom.com/cognitiva>

ENABLING GIGABIT SOCIETY



Wide channels, up to
200 MHz (TDD)



MU-MIMO access method
with interference
cancellation techniques



Dual-Carrier radio delivering
1 Gbps downlink capacity to
the subscriber



WiBAS^{G5}
GigaConnect

Intracom Telecom has further invested in the WiBAS™ G5 PtMP Fixed Wireless Access product line with the addition of new mmW radios with MU-MIMO capabilities. WiBAS™ G5 GigaConnect is the new terminal station of Intracom Telecom's PtMP portfolio. The offered solution is technology neutral since it can operate either in FDD or TDD licensed spectrum at the 24 / 26 / 27 / 28 GHz bands. European Union decided for its Gigabit Society initiative that households should be connected with VHCN networks capable to deliver up to 1 Gbit/s.

WiBAS™ G5 GigaConnect radios along with the new WiBAS™ G5 dual-BS and WiBAS™ G5 smart-BS hubs make the Gigabit to the user with mmW FWA a reality.



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