

INTERVIEW

INTRACOM TELECOM GROUP NEWSLETTER | ISSUE 39

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STAND 7B44

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INTERVIEW

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COMPLETION OF THE PSIM SYSTEM FOR ATHENS INTERNATIONAL AIRPORT

Intracom Telecom supplied SISC² with state-of-the-art surveillance, monitoring and threat prevention capabilities, accomplishing the synthesis of a common operational picture and awareness of the security and safety situation for the AIA critical infrastructure.

The core of the system is based on the command & control software with the distinct name SISC², a technological achievement developed by Intracom Telecom, which integrates-processes-analyzes kinematic data and tracks detected on the ground.

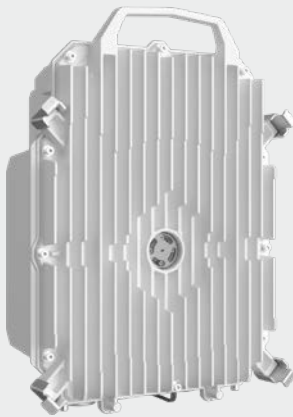
The sole purpose of the solution was the early intrusion detection and automated triggering of alarms and alerts in security operations centers with the objective of strengthening AIA prevention capabilities with regards to man-made threats and natural disasters.

Mr. Kostas Kardaras, Director of the Security & Integrated Systems of Intracom Telecom, said: *"The system was successfully completed and commissioned after intense parameterization - optimization - testing both in the field and in the security operations and administration centers of Athens International Airport, thanks to AIA executives, along with the high caliber engineers of the Intracom Telecom SIS department. We are honored to be trusted by AIA to provide our advanced technology for such a critical project."*



INTRACOM TELECOM PROUDLY PRESENTED TO EOLO THE ALL-STAR CLIENT AWARD FOR 2023

The two companies have a partnership since 2017, which resulted to the supply and deployment of the largest 28 GHz band FWA network in Europe and one of the largest ones worldwide. This prestigious award reflects Intracom Telecom's appreciation for the outstanding collaboration, innovation, and success we've achieved together with Eolo. Thrilled to see both CEOs Kartlos Edilashvili and Guido Garrone, capturing the excitement in a joint photo. We look forward to continuing this incredible journey with EOLO!



EXPERIENCE 15 GBIT/S WITH A 1+0 E-BAND LINK

Step into the future of telecommunications with Intracom Telecom's latest UltraLink™-GX80 Advanced. Meeting the evolving needs of both Mobile 5G and Fixed network operators, this high-performance E-Band radio redefines wireless transport benchmark. Experience the unparalleled throughput of 15 Gbit/s symmetrical in a 1+0 configuration, leveraging cutting-edge 512QAM modulation at 2000 MHz. Witness groundbreaking spectral efficiency, offering an impressive 50% more throughput than any other offering.

The UltraLink™-GX80 Advanced seamlessly integrates with Intracom Telecom or third-party microwave radios, enabling extended greenfield link-range or brownfield link capacity upgrades in a Dual-Band configuration. Explore the future with Intracom Telecom at stand 7B44 in Hall 7, enhancing network capabilities with the UltraLink™-GX80 Advanced in the evolving landscape of E-Band connectivity.

JOINING FORCES TO FOSTER INNOVATION AND LEARNING



The company and the National Technical University of Athens (NTUA) signed a memorandum of understanding (MoU) with the objective of utilizing both parties' capabilities and resources to create innovation and learning opportunities. Through this partnership, NTUA students and researchers will be having the opportunity to work closely with the Intracom Telecom's scientists to develop a common field of cooperation where learning and creativity can thrive. Sharing Knowledge, Hands-on Learning, Student ICT Research, Research Synergy and Supporting Graduates are the fields agreed by both parties.

Mr. Andreas G. Boudouvis, Rector of the National Technical University, stated: "NTUA's cooperation agreement with Intracom Telecom has a multifaceted educational and research scope which also draws from the company's distinguished position in the ICT industry. Internships for undergraduate students, research cooperation at doctoral and postdoctoral level and joint efforts in competitive research funding are key ingredients of our cooperation."



Mr. Kartlos Edilashvili, Acting CEO of Intracom Telecom, commented: "This strategic collaboration marks a significant moment, creating a dynamic framework for collaboration and knowledge exchange between academia and the ICT industry. Thus, we are creating a highly skilled scientific workforce to meet the needs of innovative product development."



TRANSFORMING NETWORKS WITH AI

Our very own Christos Rizos, Marketing Manager for Data Analytics, Artificial Intelligence & Orchestration, participated in the Product-Led Hub AI Summit held in Athens. He illuminated how AI is transforming our approach to Network Management from reactive to proactive. Our colleague showcased the significant progress Intracom Telecom is making in this domain, emphasizing that AI doesn't just wait around; it proactively ensures our networks are not just managed, but managed with finesse and innovation!

EXCELLENCE IN CUSTOMER EXPERIENCE



At Fortinet Security Day, Intracom Telecom, represented by Spyros Giannopoulos, Cloud, IT & Security Solutions Section Manager, received the prestigious "Excellence in Customer Experience 2022" award, that highlights our commitment to providing outstanding service to our clients. During the event, George Katsaounis, Senior Cyber Security Presales Engineer, presented the seamless security for converged IT/OT ecosystems enabled by Fortinet Security Fabric. We're honored to be a trusted partner, assisting in building resilient OT solutions.



FOSTERING INNOVATION

Company's first-ever Employee-Driven Innovation Day event was an absolute game-changer! The event that took place last November in Patras, Greece, aimed to foster Intracom Telecom's innovation culture, enabling individuals to present ideas, encourage collaboration, and recognize creativity.

Divided into stages like idea presentation, collaboration spaces, and voting, 22 engineers submitted ideas, with 15 presented and assessed. The physical interaction-driven atmosphere spurred fruitful conversations, emphasizing a forward-thinking mindset. Evaluation criteria included business value, feasibility, originality, and presentation. The awarded ideas, deemed by our company committee as visionary solutions, encompassed domains as Application Development Platform for Cloud Native Products, and Technologies & Processes. A sincere acknowledgment to all the innovators, who contributed to making this day truly memorable!



SHOWCASING WIRELESS PORTFOLIO AT AFRICACOM

Trevor Burchell, the CEO of Intratelecom in South Africa, and John Tenidis, Intracom Telecom's Marketing Director of Wireless Solutions Portfolio, engaged in an on-camera discussion at AfricaCom 2023. They provided insights into Intracom Telecom's groundbreaking wireless network technologies, specifically crafted to address the unique challenges of the African market. Our technological innovations are making significant advances in various sectors such as mining, telecommunications, and the ICT.

▶ www.intracom-telecom.com/misc/africacom-2023.mp4



MAKING U.S. WISPs BETTER



Intracom Telecom participated in WISPAPALOOZA, the premier Wireless Internet Service Providers event, where it showcased its E-Band and Green FWA mmWave technology. The company presented its groundbreaking technologies. Featured products include the WiBAS™ G5 series, a cutting-edge Green FWA mauve tech 24-28 GHz, the UltraLink™-GX80 at the forefront of E-Band radios, and the cost-effective, Full Outdoor MW transmission solution OmniBAS™-BX at 18 GHz. The company showcased its cutting-edge streaming TV solution, fc|cdn™ Anywhere, giving visitors the opportunity to explore the advantages of a future-proof IPTV & multi-play services platform.



CONTRIBUTING TO THE DIGITAL ECONOMIC FORUM

The digital economy forum 2023: Shaping Greece's Digital Future, where Intracom Telecom supported as a Gold Sponsor, was held last December at Athenaeum InterContinental Athens Hotel and posed new challenges and break new ground, since the digital technology evolves rapidly. Our company featured in session "Infrastructure - FTTH, Data Centers Change the Landscape in the Greek Market" with John Tenidis as our representative.

TECHNOLOGIES FOR GREECE

Intracom Telecom sponsored the 25th Infocom World conference that took place at the Divani Caravel Hotel in Athens. Company's Sotiris Bithas, Marketing Director Telco & Enterprise Software Solutions, and Charalambos Papanastasiou, Head of Access Radio Solutions, took the stage, sharing groundbreaking solutions and providing valuable insights into the digital future. More specifically, Sotiris participated in a discussion panel in the powerful thematic "Diginvest in A.I. Transformation" and Charalambos delivered a speech entitled "An integrated Giga Broadband-at-home strategy."



BUILD PROGRESS WITH BEST & INTRACOM TELECOM



Successfully completed our workshop entitled "Diving into 5G/Cloud Core Tech & Engineering" that was co-hosted with BEST Thessaloniki last December. Our team presented the latest updates in the field and discussed closely the opportunities we provide, for a dynamic career, full of exciting experiences and development opportunities! A huge thank you to all the attendees and their active involvement. The Board of European Students of Technology (BEST) is a constantly growing non-profit and non-political organisation. Since 1989, BEST has been providing communication, co-operation and exchange possibilities for students all over Europe.



BRINGING COLLEAGUES TOGETHER



Embracing our commitment to employee well-being, our company proudly announces its participation in the Men's Corporate Basketball Championship "Basketball Commercial League" for 2023-2024! This initiative, championing both sport and entertainment, reflects our dedication to fostering strong employee relations and enhancing the overall well-being of our workforce. The team has already secured several victories! We extend a huge thank you to all employees for showcasing their best talents, team spirit, and enthusiasm. With these qualities, we look forward to many more victories and achievements in the future. Cheers to the journey ahead!





DUAL BAND 15 GBIT/S RADIO LINKS WITH MAXIMUM SPECTRAL EFFICIENCY AND MINIMUM NUMBER OF RADIO UNITS

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Senior Product Manager,
Wireless Network Systems

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Wireless Network Systems

INTRODUCTION

The estimated transport capacity requirements of 5G Mobile Base station sites, which include co-located 2G/3G/4G/4G+ systems, will inevitably increase in the short to mid-term future to above 10 Gbit/s, given the progressive allocation of more spectrum to 5G systems and the gradual adoption of capacity-enhancing 5G-Advanced technology. Additionally, mmWave Fixed Wireless Access (FWA) systems, such as Intracom Telecom's WiBAS™, also require 10 Gbit/s or more for the backhaul needs of multi-sector FWA base station sites. These trends impose higher demands on the transport system links deployed between the access sites and the core network locations.

DEALING WITH THE EVER GROWING TRANSPORT CAPACITY CHALLENGE

Wireless transport systems are, and will continue to be, a key alternative and an indispensable complementing solution to the use of optical fiber links.

Wireless transport system manufacturers employ several ways to increase the capacity of their radio systems, such as introducing support for larger channel sizes per link or using multiple links, the capacity of which is seamlessly combined via link aggregation, as well as increasing the spectral efficiency of their radio systems.

Using larger channel sizes or aggregating multiple links correspond to using more spectrum. Increasing

spectral efficiency corresponds to using the spectrum more efficiently by squeezing more capacity out of it. Spectral efficiency is related to the capacity achieved by the radio system for a particular channel size and is a key counterbalancing trait to the "brute force" approach of the spectrum-hungry methods.

WHY RADIO SPECTRAL EFFICIENCY IS KEY

Regulators have responded to the market needs by increasing the channel size allocation applicable to the traditional fixed transport service-related microwave (MW) frequency bands, which typically occupy the spectrum up to 38 GHz. For example,

allowing 112 or 224 MHz channel sizes in MW bands where channel sizes up to only 56MHz channel sizes were allowed in the past. However, the need for higher spectral efficiency of transport wireless systems is inescapable, as the capacity requirements grow continuously, but the available overall useful spectrum remains the same, or can even be reduced by allocation of some MW spectrum bands to uses other than fixed service.

While extending the useful spectrum for transport applications to higher frequencies (above 80 GHz) is under research, still suffering from link-range/availability drawbacks, the currently “technologically mature” part of the spectrum is becoming highly contested by multiple Communication Service Providers (CSP), and as a result regulators are forced to allocate multiple channels or larger channel sizes more sparingly.

The operators enjoy an economic benefit when deploying high spectral efficiency technology, due to the smaller channel size and/or fewer channels they need to license. Furthermore, some regulators provide extra license fee-related incentives for operators that deploy technology with high spectral efficiency, such as XPIC configurations.

These trends place particular importance on increasing the radio spectral efficiency to obtain the maximum possible capacity performance with the minimum possible channel size. Ways to improve spectral efficiency include, higher-order modulation formats, use of XPIC, MIMO, use of low overhead error correction schemes, spectral shaping for maximization of a channel’s useful bandwidth, traffic compression, using higher Class, more directional, antennas and others.

For example, the XPIC technique enables utilizing simultaneously both the horizontal and vertical polarizations of the allocated frequency channel, effectively doubling throughput and spectral efficiency. There are various cost, system gain, hardware and other technology complexity trade-offs associated with the application of the spectral efficiency-enhancing techniques. The research and evolution in this field is continuous and intensive.

FINDING THE RIGHT BALANCE TO OPTIMALLY ACHIEVE HIGH-CAPACITY WIRELESS TRANSPORT

Given the optimum practically achievable level of spectral efficiency, it is still necessary that more spectrum has to be

employed to reach the desired link capacity levels. Using larger channel sizes is preferred to using multiple channel sizes if this also means that less HW/discrete radio units are required to be deployed. However, sometimes this is not an option since the maximum channel size in the band of operation may not offer enough capacity, so more than one channels have to be aggregated. One way to avoid the deployment of multiple radio HW/link instances is to integrate more than one transceiver/carrier within a single unit. This has installation space, speed and simplicity advantages as well as power consumption advantages.

When selecting larger or more channels in a particular band is not feasible or economically favorable, then combining links of radios operating in two or more different frequency bands, sometimes referred to as Dual Band or Multi-Band, can allow the cost-efficient use of more spectrum for the generation of the required transport capacity. Especially if one of these bands is the E-Band, this solution proves to be an excellent option, which can provide the simplest multilink configuration, since the largest part or all the required capacity can be contributed by a single E-Band link component, while the lower frequency microwave link(s) of the configuration provides a high availability, necessary capacity component. Since E-Band spectrum is usually priced by regulators very favorably compared to MW spectrum, an E-Band-based dual band transport solution can many times be the simplest and the most cost-effective solution for high-capacity wireless transport links^[1].

Finding the right balance between cost and complexity is key to the selection of the capacity-enhancing approach that can be applied in an optimum way for a particular transport link’s capacity, range, and availability requirements^[2].

INTRACOM TELECOM’S NEW MW AND MM-WAVE RADIOS LEAD IN SPECTRAL EFFICIENCY AND CAPACITY

Intracom Telecom’s MW and E-Band radios, already widely deployed in Mobile or Fixed CSP networks, are ideal for 5G-era transport / xHaul applications, as they are at the forefront of performance in terms of link range, spectral efficiency, and operational flexibility. Intracom Telecom presses on with the evolution of its leading series of UltraLink™-GX80 E-Band radios and OmniBAS™ MW radios by pushing the spectral efficiency barriers yet further.

ARTICLE

The new UltraLink™-GX80 Advanced is the highest-throughput single-transceiver E-Band radio in the market delivering up to 15 Gbit/s full duplex data traffic rate in 1+0 link configuration by employing 512-QAM modulation of in a single 2000 MHz channel. It builds and improves on the leading system gain of the field-proven UltraLink™-GX80 radio enabling longer and more stable high-capacity radio links.

UltraLink™-GX80 Dual is a high-performance dual-transceiver E-Band radio delivering up to 15 Gbit/s full duplex throughput with double the spectral efficiency of a single-transceiver E-Band radio. It achieves a particular multi-gigabit/s capacity using half the channel size employed by a single-transceiver E-Band radio, 1000 MHz for 15 Gbit/s, while having the same simple installation requirements, form-factor and weight as the UltraLink™-GX80 Advanced.

Both radios feature an embedded Ethernet Bridge that offers advanced Carrier Ethernet services over multiple 10GbE user interfaces and supports the highest accuracy packet-based synchronization protocols to fully address the requirements of 5G networks. Furthermore, they are SW upgradeable to support IP/MPLS functionality bringing the benefits of IP networking to the edge of the network without requiring additional dedicated CSRs.

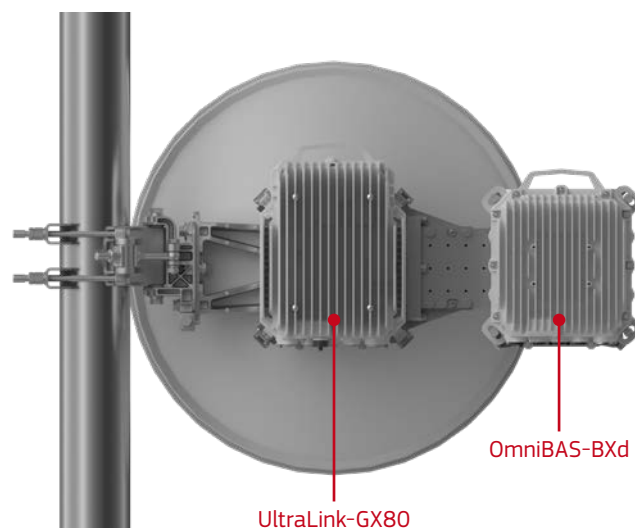
The UltraLink™-GX80 E-Band radios can be seamlessly combined, using L1-link aggregation, with the OmniBAS™ MW all-outdoor radios, OmniBAS™-BX or OmniBAS™-BXd, using a single Dual Band antenna to offer fully outdoor Dual Band configurations delivering up to 15 Gbit/s throughput and extended range.

OmniBAS™-BX, the well-established portfolio of all-outdoor radios of the OmniBAS™ Point-to-Point MW family, covers a wide range of MW frequencies from 11 GHz to 38 GHz. It supports market-leading modulations up to 4096-QAM and channel sizes up to 112 MHz per unit, to offer 1 Gbit/s or 2 Gbit/s using one or two units in XPIC 2+0 configuration.

OmniBAS™-BXd, the new generation of dual-transceiver all-outdoor radios features a novel design to support 2 x 112 MHz channels in a single compact unit at frequencies 13-38 GHz, while maintaining the high system gain required for long range/high availability links. It can be flexibly configured for 1+0, 1+1, 2+0 or XPIC 2+0 link operation offering MW radio capacity 2 Gbit/s using just one unit.

Both OmniBAS™-BX and OmniBAS™-BXd radios employ advanced radio and traffic processing functionality to deliver exceptional MW radio performance and constitute the perfect match to UltraLink™-GX80 Dual / Advanced in Dual Band configurations up to 15 Gbit/s full duplex throughput.

As an example, figure below depicts an indicative Dual Band link setup consisting of an UltraLink™-GX80 Dual and an OmniBAS™-BXd radio. As both radios support 2+0 XPIC/RLA operation in a single unit, they achieve the maximum spectral efficiency, while delivering multi-gigabit/s throughputs, with minimum hardware. Such a solution not only minimizes the number of radio units that need be installed on the pole but also reduces the spectrum fees that need be paid, thus facilitating substantial CAPEX and OPEX savings to CSPs.



CONCLUSION

As the requirements for transport capacity continue to grow, wireless technology evolves to satisfy it in an efficient way, ideally complementing optical fibre technology. The new Intracom Telecom MW and E-Band radios can deliver up to 50% improvement on throughput, while optimizing licensing costs and minimizing installation space and complexity. ■

[1] "High Gain E-Band Radios for Maximum Dual Band Link Performance", INTERVIEW Newsletter, Issue 35, p.9

[2] "Exploiting Advanced E-Band Technology for Replacing 26 GHz Band Links", INTERVIEW Newsletter, Issue 37, p.10

15 GBIT/S FULL DUPLEX

WHY SETTLE FOR LESS?



71-76/81-86 GHz
frequency band



15 Gbit/s
capacity

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UltraLink™-GX80 Advanced is the market's highest throughput single-transceiver E-Band radio ideal for the transport network needs of mobile and fixed network operators in the 5G-era. It offers up to 15 Gbit/s Full Duplex throughput in 1+0 radio link configuration, utilizing one unit and one single polarization antenna per link side, by employing an industry-leading 512QAM modulation in a 2000 MHz-wide channel. UltraLink™-GX80 Advanced supports 15 Gbit/s link ranges up to 5 km, while 10 Gbit/s link ranges exceed 10 km.

ULTRALINK™-GX80 ^{advanced}

All-Outdoor 15 Gbit/s E-Band Radio



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REVOLUTIONIZING TELCO INFRASTRUCTURE EFFICIENCY WITH DYNAMIC DATA CENTER SIZING

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INTRODUCTION

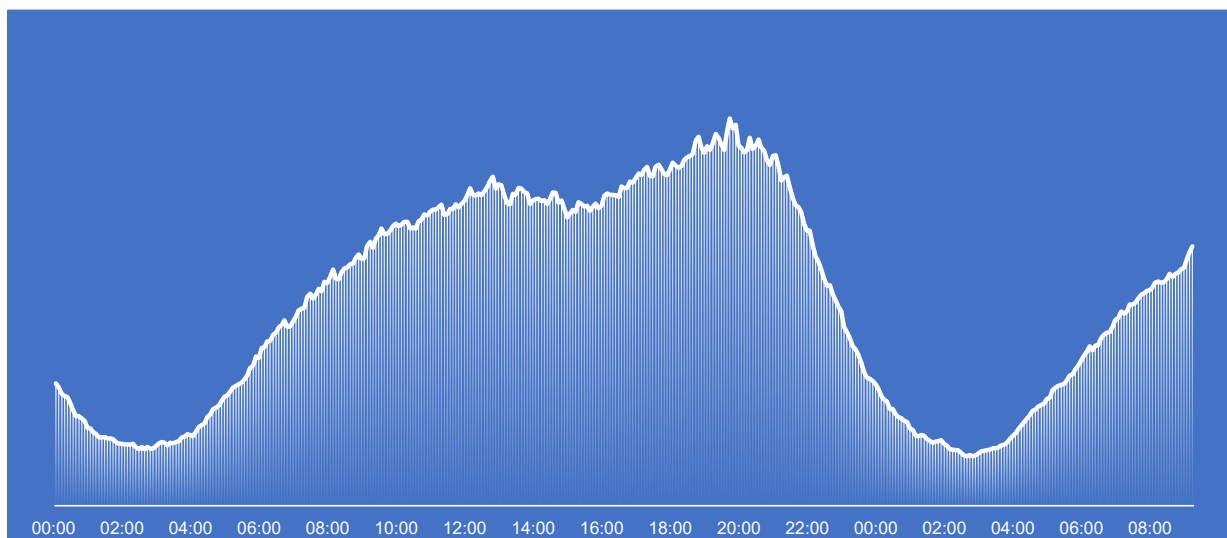
Telco infrastructures have experienced a transformative journey in recent years, aligning with the demands of the digital era. This evolution has been marked by the adoption of cutting-edge technologies, including Network Functions Virtualization (NFV), cloud computing, big data, artificial intelligence, and cloud-native architectures. In these advancements, the data center (DC) plays a pivotal role, serving as the hub where network functions, business platforms, cloud services, analytics workflows, and IT operations integrate into a converged infrastructure.

The services operating within the telco DC undergo load fluctuations throughout the day, driven directly or indirectly by the activities of the telco subscribers. Typically, there

is peak load during daytime hours when people are actively using their communication services and reduced load during nighttime (Figure 1).

In response to these load fluctuations, operators have started embracing auto-scaling strategies, a prominent capability enabled by modern cloud-native technologies such as Kubernetes. This approach involves automatically adjusting the number of service instances to align with the current load. For instance, during peak demand, the auto-scaling logic detects the increased load and deploys additional instances, while in periods of reduced demand, it efficiently scales down the instances to prevent resource waste.

Figure 1: Daily load variation in a subscriber-driven telco service



While operators embrace cloud-native principles for their services, the infrastructure supporting these services often lags behind. To optimize service performance, operators often provision DC servers for peak loads. Consequently, a substantial portion of servers remain underutilized during off-peak times, and even when they sit completely idle and are not actively processing loads, they lead to significant operational costs and energy waste.

DYNAMIC DATA CENTER SIZING: THE MISSING ELEMENT FOR CLOUD-NATIVE INFRASTRUCTURES

Dynamic Data Center Sizing (DDS) is a novel feature within Intracom Telecom's NFV-RI™ product that comes to address exactly this challenge: the disparity between the scalability of modern, cloud-native applications and the underlying infrastructure. DDS optimizes telco DCs by dynamically consolidating workloads and powering off idle servers during periods of extended inactivity. Unlike traditional static approaches, DDS leverages AI to accurately forecast resource needs and ensure proactive adjustments to timely meet fluctuating demand. This intelligent scaling capability allows operators to efficiently manage DC servers, avoiding overprovisioning during low-demand periods and preventing bottlenecks during peak times.

At its core, DDS provides a forecasting and a decision-making module (Figure 2). The forecasting module analyzes historical data corresponding to resource requests (CPU, memory, NICs, etc.) to predict resource demand across the entire DC for the next time step. Predictions are then fed to the decision-making module which determines when to power on or off servers, and which ones. When predictions indicate that server resources will be underutilized in the next time step, the module identifies the most appropriate servers to power off, and initiates their “draining” before shutting them down completely. During draining, attempts are made to migrate pods from the server to other servers in the cluster. Conversely, when predictions indicate a surge in demand, the module identifies the smallest subset of servers to power on, so that the expected load can be handled efficiently.

Both the draining/server power-off, and the server power-on process, are non-instantaneous and may take a considerable and sometimes unpredictable amount of time. Yet, DDS ensures that the decision to switch between server states accounts for these transition times. Moreover, it always guarantees that the servers scheduled to be

online at the next time step have the capacity to securely serve the predicted demand. In this way, service disruptions are prevented and overall DC efficiency is optimized.

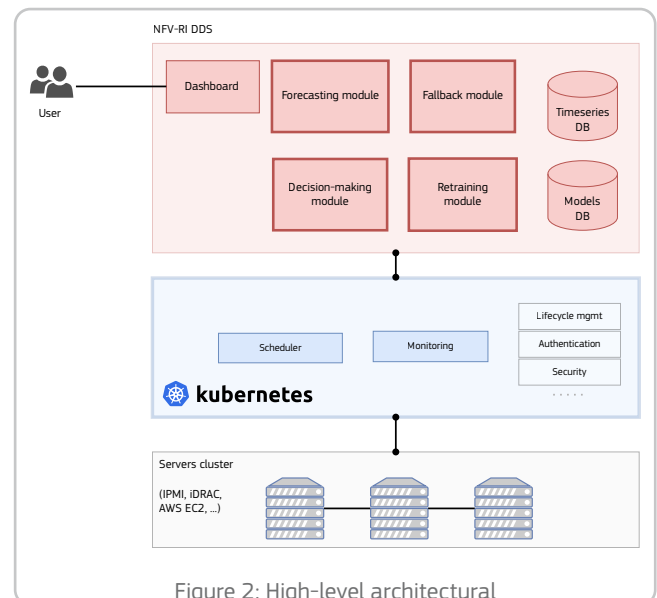


Figure 2: High-level architectural view of NFV-RI DDS feature

ENHANCED OPERATOR CONFIDENCE

Ensuring the safety and reliability of automated solutions in the face of mispredictions, unforeseen load spikes, and any other kind of uncertainty is paramount for telco operators. Apart from its highly accurate forecasting algorithms, DDS addresses this concern with a multitude of robustness mechanisms.

First of all, DDS features a fallback module which serves as a safety net in case of unexpected load increases. This module continuously monitors the Kubernetes scheduler queue, which is responsible for managing incoming requests, and forcibly powers on servers when congestion is detected. This approach effectively prevents any significant service disruptions when demand suddenly becomes greater than the previously available capacity.

In addition to this, DDS introduces various thresholds, including the overprediction and utilization threshold, both key mechanisms that empower users to act with a greater degree of caution and take a more conservative approach to dynamic resource allocation. For instance, the overprediction threshold enables users to consistently overprovision nodes beyond what is predicted (e.g. “always allocate a 10% surplus of nodes”). This essentially serves as a safety buffer to accommodate unexpected demand spikes, prioritizing service stability over optimal resource sizing.

Finally, to include new usage patterns, DDS features a retraining module which can make the system adapt to previously unseen patterns observed in the production environment. As new data becomes available, this module dynamically retrains its AI models in the background, and when finished it pushes them to the production for inference. In this way, decision-making accuracy is maintained or enhanced over time.

ENERGY SAVINGS AND COST EFFICIENCY

One of the standout benefits of NFV-RI's DDS is its impact on energy consumption and cost efficiency. By strategically powering off underutilized servers during periods of low demand, DDS not only reduces energy consumption but also minimizes operational costs. In a comprehensive evaluation of DDS on AWS, we conducted an extensive, multi-day assessment using

a Kubernetes cluster (EKS) comprising 34 virtual machine nodes of various EC2 instance types, collectively offering a total of 572 CPUs. We deployed a range of cloud-native workloads, strategically designed to auto-scale their number of pods to serve varying demand throughout the day.

To gauge DDS's potential, we simulated diverse load patterns (Figure 3), effectively mirroring various real-world cases. In a fluctuating load pattern ('dynamic' day), our evaluations demonstrated a reduction in the number of EC2 instances and associated cost savings of 31%, showcasing the tangible sustainability and financial benefits of incorporating DDS into telco DCs. This pattern emulated substantial load variations within a day, where the aggregate CPU demand fluctuated between 23% and 90% of the total DC capacity. Recognizing that many telco DCs may not exhibit such extremes yet, we also explored 'balanced' and 'static' days. Even in these less dynam-

While operators embrace cloud-native principles for their services, the infrastructure supporting these services lags behind. NFV-RI's DDS addresses exactly this challenge

ic scenarios, DDS showcased tangible benefits (15.4% and 6.3% savings, respectively), proving its adaptability and efficiency across a variety of realistic deployments.

CONCLUSION

NFV-RI's DDS offers a pragmatic approach to telco infrastructure efficiency, blending seamlessly with cloud-native technologies. By addressing the disparities between application scalability and infrastructure limitations, DDS provides telco operators with a reliable and adaptive solution for the challenges of modern DCs. Recognizing the diversity of telco environments, not only in terms of workload dynamics but also in terms of DC infrastructures, DDS seamlessly integrates with various setups, including both bare-metal and cloud-based DCs. This flexibility ensures that operators can easily deploy DDS in their existing infrastructure and start enjoying its benefits with zero integration and deployment effort. Its proven impact on energy savings, cost efficiency, and operator confidence, makes it an essential technology for telco operators seeking to accelerate their sustainability goals and reduce their costs. ■

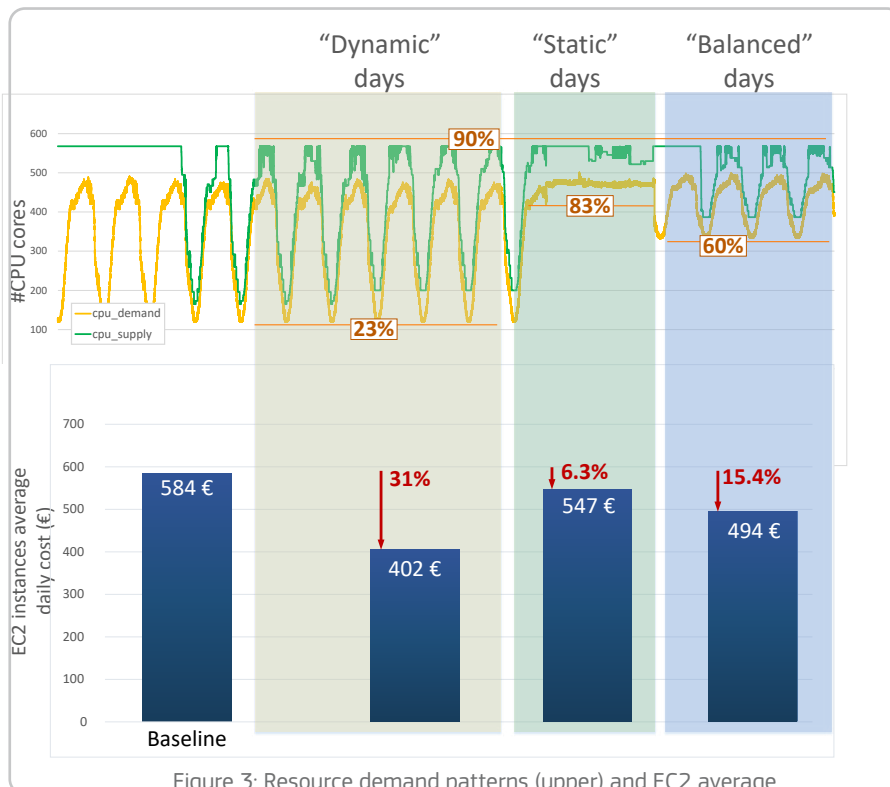


Figure 3: Resource demand patterns (upper) and EC2 average daily costs (lower) for the evaluation of NFV-RI's DDS on AWS



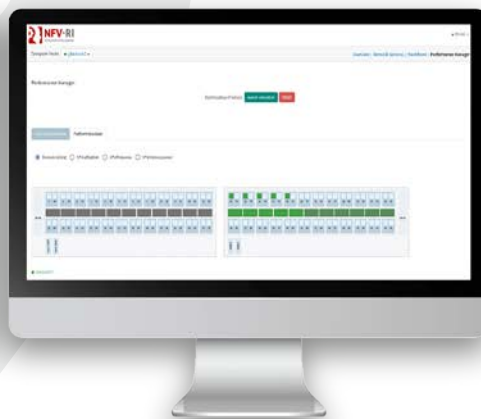
NFV-RI
RESOURCE INTELLIGENCE

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ENHANCING ENERGY & RESOURCE EFFICIENCY IN TELCO NETWORKS



Metrics dashboard displaying
system & application
telemetry in real time



Intuitive topology
diagram showing VNF
placement & resource
utilization



Different optimization
workflows supported by
the platform



**ENERGY
EFFICIENCY**



**HIGH
PERFORMANCE**



**PREDICTABLE
PERFORMANCE**



**HIGH INFRASTRUCTURE
UTILIZATION**

Intracom Telecom's NFV Resource Intelligence (NFV-RI™) embraces a holistic approach to address the energy and resource efficiency challenges across the major segments of the mobile network, promoting sustainability and cost-effectiveness in telco operations. NFV-RI™ leverages versatile and robust AI mechanisms to dynamically allocate resources at all levels -data center, server, CPU- in real-time, and in line with incoming demand. In this way, resource overprovisioning is avoided and energy consumption is reduced across centralized or regional data centers, and Mobile Core and virtualized RAN functions.



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ARTICLE

UNLOCKING GIGABIT TO THE HOME HARNESSING THE POWER OF 26.5-29.5 GHz BANDS IN FDD & TDD SPECTRUM

PANTELIS TRAKAS

Senior Product Manager, Wireless Network Systems

INTRODUCTION

In our fast-paced digital era, the demand for high-speed internet connectivity continues to surge, prompting the exploration of advanced technologies to meet this need. Especially the rural and semi-rural areas that are still experiencing low VHCN network penetration rates, will be challenged to meet the demanding objectives of European Unions' digital compass.

Gigabit to the home can be delivered from a "toolchest" of technologies allowing room for synergies between wired and wireless solutions to address the connectivity and service needs of the end users. When it comes to the Fixed Wireless Access, then the millimeter wave spectrum, by offering very large contiguous blocks of spectrum, has the potential to deliver significant benefits by enabling large increases in wireless data capacity and speeds.

More specifically the use of 26.5-29.5 GHz bands is gaining traction for Gigabit to the Home (Gtth) applications through both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) Fixed Wireless Access (FWA) systems. In this article we will present the capabilities of such FWA solutions that are able to overcome the challenges of mmW spectrum and deliver Gtth even at distances longer than 6 km from the hub site.

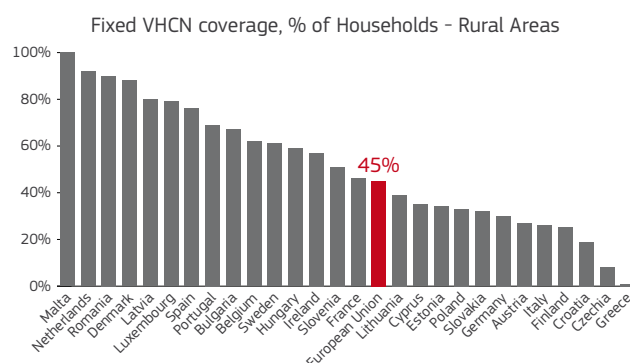
GIGABIT FOR ALL AND THE RURAL AREA CONNECTIVITY CHALLENGE

Globally, there has been a collaborative effort to bring about a new era of ultra-fast internet connectivity through Gigabit to the Home (Gtth) initiatives. In March 2021 the

European Commission proposed a path to the Digital Decade. This policy program is guided by the 2030 Digital Compass – a plan to achieve digital transformation of the EU economy and society. One of the four cardinal points of the Digital Compass is the secure and sustainable digital infrastructures that will be able to provide Gigabit connectivity for all by the year 2030.

One of the largest obstacles for achieving the EU's targets is the Urban-Rural divide in terms of Ultra-Broadband access penetration. The following figure shows the coverage of fixed VHCN (Very High-Capacity Networks) in rural areas as a percentage of households across the European Union countries.

We notice that the EU average is only 45% and there are still many countries that are well below this value. The low adoption of Very High-Capacity Networks (VHCN) in rural areas, as highlighted by the DESI index, underscores the pressing need for urgent attention and investment in purpose-built technologies that will be able to deliver Gigabit service to these remote areas.



FIXED WIRELESS ACCESS SYSTEMS USING FDD OR TDD MMW SPECTRUM

The 26.5-29.5 GHz frequency bands represent a portion of the millimeter-wave spectrum, characterized by its high frequency and short wavelength. While these frequencies were historically underutilized due to technical challenges in propagation, recent advancements in radio frequency engineering have opened doors to their exploitation for high-capacity long range Fixed Wireless Access communication systems operating in paired FDD or contiguous TDD spectrum.

FDD is a communication technique that uses separate frequencies for upstream and downstream transmissions. In the context of GttH, FDD offers enhanced stability and reliability by ensuring that the upstream and downstream signals do not interfere with each other. The implementation of FDD in the 26.5-29.5 GHz bands allows for efficient bidirectional communication without compromising the quality of service. **TDD**, on the other hand, is a method where the same frequency channel is alternately used for upstream and downstream com-

munication. The switching between transmission and reception occurs in rapid succession, with the timing managed by a synchronized protocol. TDD offers dynamic efficiency, adapting to the asymmetric nature of internet traffic, where download speeds often outweigh upload speeds. In the 26.5-29.5 GHz bands, TDD proves to be an excellent choice for FWA systems by maximizing spectrum utilization.

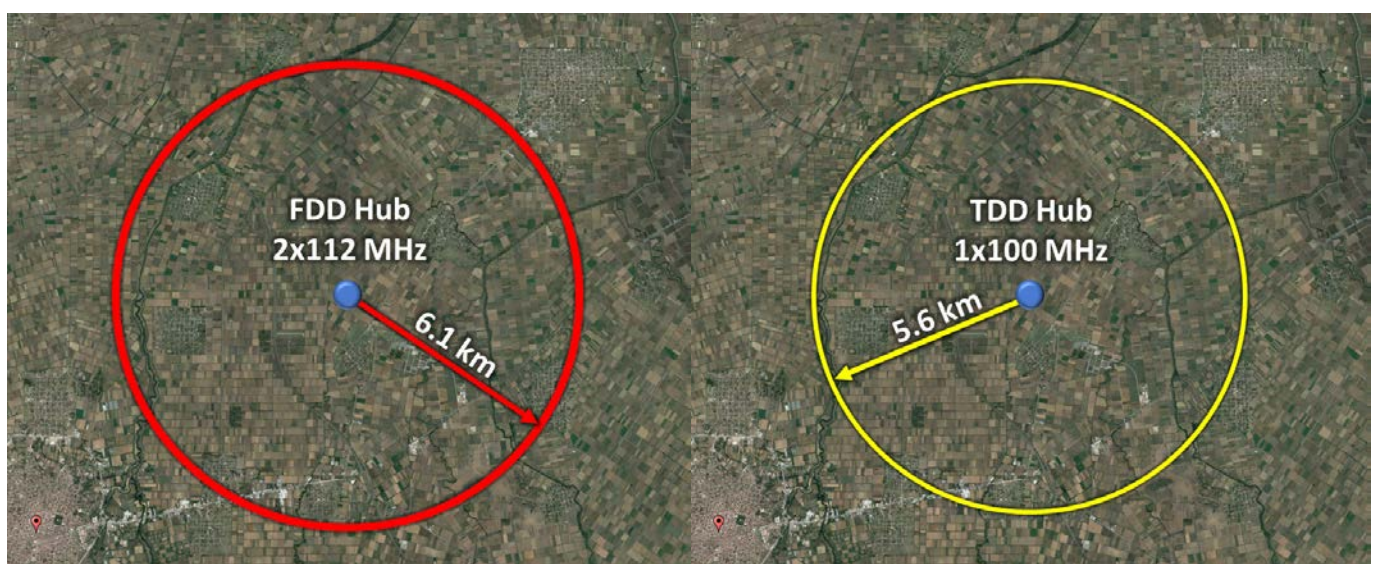
IMPROVING PERFORMANCE WITH ADVANCED ANTENNA TECHNOLOGIES

The successful deployment of FDD and TDD systems in the 26.5-29.5 GHz bands relies on overcoming traditional challenges associated with millimeter-wave frequencies, such as signal attenuation due to rain and atmospheric absorption. Advanced antenna technologies, including phased array antennas and beamforming, play a pivotal role in mitigating these challenges. Phased array antennas enable the electronic steering of beams, allowing for precise targeting of user locations. This capability minimizes signal losses due to atmospheric absorption and enhances the overall link quality. Beam-

forming further amplifies the signal strength in the desired direction, compensating for the inherent limitations of millimeter-wave propagation.

MMW PTMP PURPOSE-BUILT FWA SOLUTIONS - COMBINING SPEED WITH RANGE

Backed up by a multi-decade experience in the design and manufacturing of leading-edge telecommunications products, Intracom Telecom can offer Point-to-MultiPoint (PtMP) solutions operating in the 26.5-29.5 GHz licensed spectrum that are capable to address the EU's "Gigabit for all" target. The portfolio includes a range of FWA solutions, including the ultra-compact, all-outdoor WiBAS™ G5 dual-BS (FDD), WiBAS™ G5 smart-BS (TDD) base station radios and the WiBAS™ G5 GigaConnect and Connect+ terminal stations. The system uses MU-MIMO and beamforming technology to achieve higher spectrum efficiency, interference cancellation and long-range links. Both systems can deliver Gigabit downlink speeds to the user at distances over 5.5 km (FDD and TDD).



Achieving the Gigabit to the home milestone is not the only goal that needs to be reached by telecom operators. This target must be materialized in an efficient way and with minimum impact in the network complexity, power consumption and spectrum usage. As we see in the above systems by Intracom Telecom the Gigabit Downlink speeds in a base station sector are achieved with the use of a single 100MHz channel in the case of TDD deployment and one paired 112MHz channel in the case of FDD. 3GPP based FWA systems like 5G can also deliver Gigabit speeds to the subscriber using mmW spectrum. Unlike purpose built FWA systems, 5G employs carrier aggregation technique that allows the aggregation of multiple component carriers to enhance data rates and improve spectral efficiency. Despite the benefits of carrier aggregation, this technique adds complexity to the network and leads to expensive deployments. The reason for the cost ineffectiveness of such solutions are the a) increases of the power consumption of the hub and terminal equipment and b) requires a multitude of spectrum resources that usually come at a high price for the operator. Additionally, in areas with low data traffic (rural), the benefits of carrier aggregation may be less significant. The advantages are more pronounced in high-density areas with a high demand for data services. The adoption of network design techniques used for mobile networks, also creates an undue burden to the economics of FWA networks. For example, the range of a 5G FWA network would normally shrink with increasing subscriber density, requiring more hub sites to be created in order to address a particular service area.

The purpose built WiBAS™ G5 FWA system minimizes the need for vast spectrum resources and at the same time

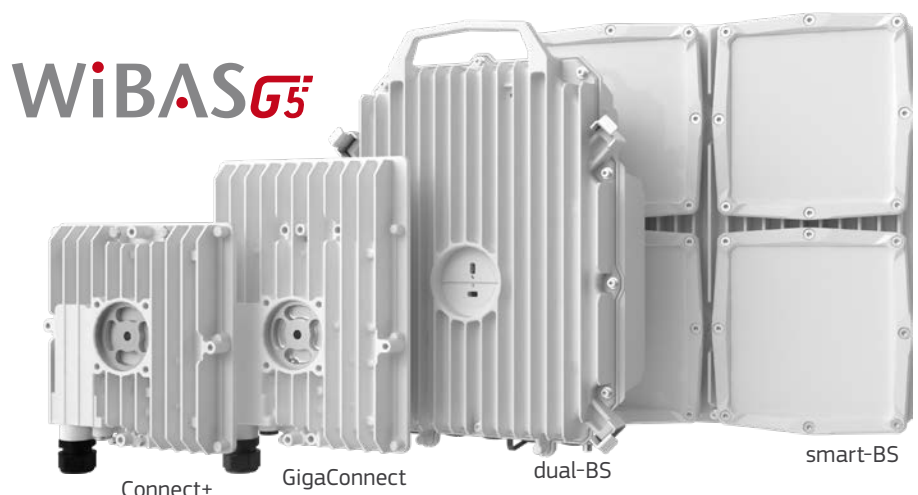
mmWave FWA must not be missed from the toolchest of solutions for Gigabit to the Home

maximizes the end user connection speeds even at long ranges which is the main requirement for Gigabit services in rural areas. Moreover, the low power consumption of the Intracom Telecom Base Station radios in combination with the high subscriber density (960 users per 4-sector cell) and long-range connections, constitute the solution environmentally friendly and GREEN when compared with its 3GPP based counterparts which require higher amounts of energy to cover similar service areas (more Base Stations). By reducing power consumption, the industry can significantly decrease its carbon footprint and help mitigate the impact of climate change paving the way for sustainable digital infrastructures. In addition to minimizing the overall energy footprint of the FWA deployments, there is also a strong economic component, which mainly concerns carriers and their Total Cost of Ownership (TCO) when building and operating their networks.

CONCLUSION

The utilization of millimeter-wave spectrum, particularly in the 26.5-29.5 GHz bands, presents a promising solution through Fixed Wireless Access (FWA) systems. Both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) systems offer distinct advantages in stability, reliability, and spectrum efficiency, strengthened further by advanced antenna technologies like phased array antennas and beamforming. Intracom Telecom's purpose-built PtMP solutions demonstrate remarkable potential in achieving Gigabit connectivity over long distances, with minimal spectrum usage and minimal carbon footprint.

By optimizing power consumption, enhancing spectral efficiency, and reducing network complexity, these solutions align with the imperative need for sustainable digital infrastructures while meeting the pressing demands for bridging the digital divide in rural areas. Ultimately, the convergence of innovative technologies and strategic deployment strategies will be instrumental in realizing the vision of Gigabit for all, ensuring equitable access to ultra-fast internet services across diverse landscapes. ■



POWERFUL BIG DATA ANALYTICS SOLUTIONS FOR ANY BUSINESS

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INTRODUCTION

The global Big Data Analytics software market size reached US\$ 181.1 Billion in 2022, expecting to reach US\$ 335.2 Billion by 2028, exhibiting a growth rate (CAGR) of 9.8% during 2023-2028. The Big Data industry is driven by a sharp increase in data volume. The global data consumption over telecom networks alone will nearly triple, from 3.4 million PB in 2022 to 9.7 million PB in 2027 (according to PwC & Omdia).

To make the most out of these data and their metadata, businesses leverage the functionalities of modern Data Analytics Solutions to gather, store and process huge volumes of information to further generate deep insights and proactively trigger intelligence-driven actions fast (preferably in real or near-real time). Despite all recent technological advancements that enable the operation of modern Data Analytics Solutions on larger volumes of data either in streaming and/or in batch processing mode, these frameworks pose significant business challenges to the stakeholders.

CHALLENGES

Nowadays, stakeholders face several challenges during the selection of a new complete commercial Data Analytics Solution, or the replacement of an existing one.

Indicative dilemmas affecting their final decision are illustrated below.

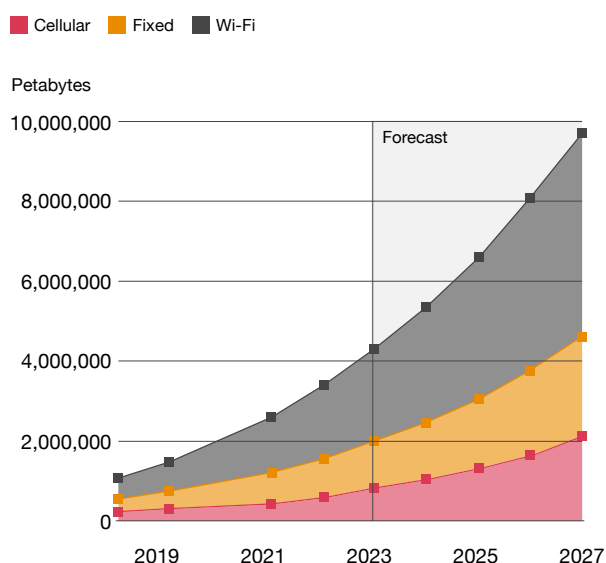
(Privacy) Cloud-based vs On-premises

Cloud-based solutions rely on third-party cloud service providers for infrastructure and services, but introduce concerns on privacy as data are stored on the cloud, and also their long-term cost is much more than on-premise solutions. In contrast, on-premises solutions are deployed within an organization's local infrastructure, providing control over hardware, software, and data storage. Control over these components, however, comes with increased responsibility for maintenance, updates, and security measures.

(Cost) Licensed vs. Open-source

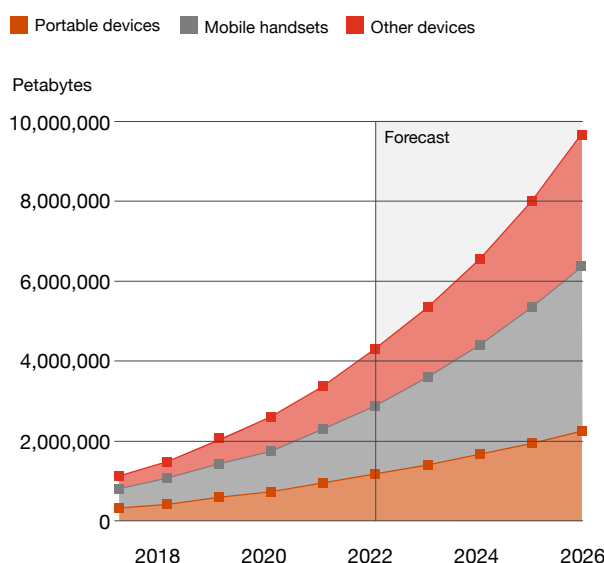
Licensed solutions, although fully supported by private companies, come at the expense of higher costs due to

Global total data consumption split by network, 2018-2027



Note: 2018-2022 are actual numbers.

Source: PwC's Global Telecom Outlook 2023-2027, Omdia



Despite the tremendous business benefits of a new Big Data Analytics Solution for an organization, selecting the right architecture can be a tough decision for the stakeholder

high license fees, limited customization options, lack of integration flexibility with third-party applications, and potential vendor lock-in. On the other hand, open-source solutions are built using publicly available source code, granting users the freedom to modify, redistribute, and contribute to the solutions' development. This collaborative approach often results in rapid innovation, new products from private entities with a vast support community, and reduced licensing costs.

(Scope) Vertical vs. Horizontal

Vertical solutions are tailored to address the specific needs of a particular industry or business domain. These specialized solutions provide industry-specific data models, analytics capabilities, and integrations, enabling organizations to derive insights relevant to their domain. This may introduce limitations due to this specialization, restricting usage in some use cases from different industries. In contrast, horizontal solutions are designed to be versatile and applicable across various industries.

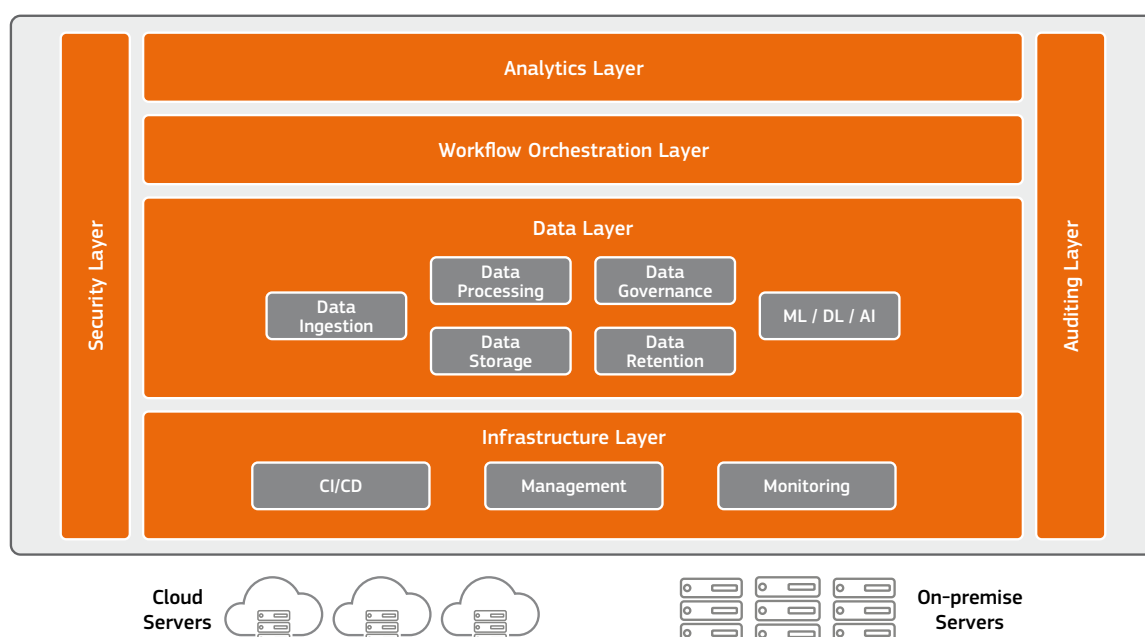
OUR BIG DATA ANALYTICS SOLUTIONS

Intracom Telecom addresses these challenges through a full suite of Big Data Analytics Solutions and its extensive knowledge on data engineering and data science, serving and guiding a variety of organizations for more than a decade. All these solutions, either built with open-source tools or licensed frameworks are horizontal and therefore cover different needs in all industries, while also satisfying divergent and vertical requisites for the development of any specialized application or data flow. In addition, they are designed to provide unmatched value with leading performance and scalability, but with minimum OPEX, for data on-premises and on the cloud, and for both batch and streaming processing applications.

Our solutions satisfy all principles of modern data architectures, such as:

- » **Data Warehouse:** where large amounts of data from disparate data sources are aggregated and then stored structured in a unified data repository to support efficient querying, analysis, and eventually data-driven business decisions.
- » **Data Lake:** where large amounts of structured and unstructured data in their raw, original, and unformatted form are stored in a centralized repository, leading an organization to advanced insight gains from unstructured data.

Figure 1: Big Data Analytics Solutions Architecture



- » **Data Virtualization:** where the applications retrieve and manipulate data without requiring technical details about the data, such as knowledge of the data format or the location where the data are physically located.
- » **Data Mesh:** where the data ownership is distributed among different data domains within an organization; facilitating and accelerating the value extraction from data by applying domain-specific business knowledge dispersed throughout an organization.
- » **Data Lakehouse:** where the best features from streaming and batch processing of both data warehouses and data lakes are efficiently combined, satisfying high performance and data integrity standards for advanced data analytics and machine learning workloads.

BENEFITS

Our comprehensive solutions empower businesses to harness the full potential of their data, make more informed decisions, and remain competitive in an increasingly data-driven world, by addressing the following critical aspects:

- » **Data integration and consolidation:** By enabling organizations to integrate and consolidate data from disparate sources, such as databases, APIs, IoT devices, and web or document scraping, businesses can create a unified, holistic view of their operations, making it easier to identify patterns, trends, and potential areas for improvement.
- » **Scalability and performance:** By handling the increasing volume, velocity, and variety of data generated by today's businesses with features like horizontal scaling, distributed



processing, and real-time analytics, our solutions can efficiently manage large datasets and deliver insights at the speed required for informed decision-making.

- » **Enhanced data analytics and insights:** By offering advanced analytics capabilities, including ML, DL and AI processing, organizations derive actionable insights from their data using models to identify trends, optimize operations, and uncover hidden relationships within the data.
- » **Improved collaboration and data sharing:** By centralizing or distributing data storage according to the organization's needs, our solutions facilitate collaboration and data sharing among different teams within an organization. This improved collaboration allows teams to work together on projects more efficiently, fosters a data-driven culture, and ensures that everyone has access to the most up-to-date and accurate data for decision-making.
- » **Data security and compliance:** By applying advanced built-in security measures, such as encryption, access control, and data loss prevention, to protect sensitive information

from unauthorized access and misuse, our tools for data governance and compliance, assist organizations managing their data in accordance with industry-specific regulations and guidelines.

INDICATIVE USE CASE

Our Big Data solutions connected with Intracom Telecom's **Cognitiva™ Enterprise-ready AI Application Suite** provide advanced analytics capabilities based on ML, DL and AI technologies to solve major business challenges, such as Customer Network Experience perception, leading to (2) maximized revenue through optimized network planning, and (2) minimized churn through proactive customer care.

Our specialized application for customer network experience, **Cognitiva™ Customer Experience Suite**, is designed as a unified framework on the grounds of satisfaction metrics that relates deterministic RAN performance to Customer Network Experience. Cognitiva™ allows operators to shift to a customer-centric paradigm that enables them not only foresee RAN disruptions with anomaly detection but also assess their impact on customer experience, identify their root cause and recommend resolution actions. This proactive framework is powered by Big Data to drastically reduce human intervention in RAN management, augment operational expenditure (OPEX) efficiency and optimize capital expenditure (CAPEX) network investments. ■



AI-POWERED UNIJMS™ INCREASES ENERGY SAVINGS FOR WIRELESS BACKHAUL

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INTRODUCTION

According to the International Energy Agency, data transmission networks consumed 260-360 terawatt-hours (TWh) in 2022, making up 1-1.5% of the world's total electricity usage. Looking ahead, there's an expected 160% increase in the energy consumption of Wireless networks up to 2030, despite 5G being more energy-efficient per unit of traffic compared to 4G. This rise is driven by the growing demands for data traffic, prompting Communications Service Providers (CSPs) to expand their networks' capacity through dense deployments, inevitably leading to higher energy consumption.

In response, the telecommunications industry is actively pursuing sustainability initiatives. These efforts include but not limited to enhancing the energy efficiency of network components, forming regulatory frameworks, and exploring renewable energy sources. Wireless backhaul is considered an environmentally friendly option among 5G backhauling technologies (e.g. fiber).

This article discusses the challenges posed by increasing energy consumption in this network segment and emphasizes the benefits of facilitating Artificial Intelligence (AI) to increase energy savings for sustainable growth.

Communication service providers (CSPs) should facilitate AI-based tools to efficiently manage their energy consumption

CHALLENGES FOR WIRELESS BACKHAUL ENERGY EFFICIENCY

In order to meet modern Wireless Backhaul demands including investment in infrastructure and enhance customer experience at the same time, CSPs will be struggling to balance rising OPEX and particularly energy consumption. The modern trend for Wireless Backhaul includes multi-band transport links, most often combining E-Band with MW ones. The CSPs are trying to balance at any time three key factors:

- » **Energy costs:** Imperative to optimize energy usage, creating the financial space for ongoing investments.
- » **Capacity Availability & Service Quality:** Assure additional capacity deploying modern radio links for enhanced link capacity and extended range with increased link availability.
- » **Sustainability:** Succeed in ESG reporting targets and regulatory compliance by reducing carbon emissions.

Energy consumption optimization for Wireless Backhaul poses challenges with respect to the complexity of establishing mechanisms for intelligent management, uninterrupted deep monitoring and continuous adaptation of network resources that satisfy both traffic demand and power saving.

- » **Manual approach** is inefficient, as it is not scalable and therefore centralized smart techniques should be utilized.
- » **Rule-based approach** is comparatively smart but limited to few dimensions such as predefined peak/off-peak hours or near-real time bandwidth utilization which are not fit for every CSP and do not provide care for the dynamic traffic variations.
- » **AI-based approach** can handle the complexities of modern networks with algorithms that correlate large volumes of data, including power consumption profiles, predicted traffic patterns, user behaviors, and environmental conditions.

CSPs should facilitate tools that serve their energy efficiency strategies, with continuous data analytics, KPI forecasting, and early events detection to autonomously make sophisticated decisions based on continuous learning.

INTELLIGENT “POWER SAVE”

Intracom Telecom's product portfolio has been adapted to satisfy CSPs energy efficiency strategies. The Wireless Backhaul products have been enhanced with Power Save mode functionality and uni|MS™ platform offering Network Lifecycle Management & Automation is under continuous evolution to orchestrate energy consumption optimization while peak traffic is being served.

Extending the NMS, Planning and SDN existing feature set with the brilliance of Artificial Intelligence (AI), to optimize Dual-Band radios energy consumption by up to 30% per physical link, it revolutionizes your Network Operations through a single User Interface.

The **Power Save mode** of the network elements allows the device to enter a low-power state, shutting down the radio transceiver and modem while still maintaining manageability through interfaces.

Similarly, link adaptation can enter an energy savings mode by limiting the selection of available modulations to the less power-intensive ones ensuring that the throughput demand is met.

Rule-based implementation

The prevailing automation implementations available in the market are based on programmable criteria for activation of the Power Save mode. This rule-based approach is using as input factors the peak traffic rate and bandwidth utilization or a fixed off-peak hour time window in which Power Save mode is activated. However, this way, is not fit for every CSP and does not provide care for the dynamic traffic variations.

AI-powered implementation

The uni|MS™ Energy Consumption Optimization App revolutionizes existing implementations with the introduction of an AI-powered traffic predictor used for the Power Save

mode decision making. It assures prediction accuracy of future bandwidth requirements by analyzing link availability and characteristics (e.g. modulation) per direction, both downlink and uplink, in real time. This in turn reduces the probability of erroneous sleep mode decisions and triggers available fallback mechanisms. Latest LAB implementation is based on a Long Short-Term Memory (LSTM) model; a type of Recurrent Neural Network (RNN) known for its ability to effectively manage multivariate time series (i.e., simultaneously observe multiple variables), capture long-term dependencies and understand complex dynamics in sequential data, leading to the following benefits.



-30%

ENERGY CONSUMPTION
PER PHYSICAL LINK
IN POWER SAVE MODE

TANGIBLE BENEFITS FROM AI

The uni|MS™ App exploits the network devices' Power Save mode and orchestrates energy consumption on a network-wide scale, by intelligently controlling resources utilization and retaining network performance efficiently. Energy consumption can be decreased by up to 30% per physical link in energy consumption Power Save mode.

The typical configuration scenarios presented below are indicative but non-exhaustive in terms of available options.

ARTICLE

Scenario 1:**2+0 XPIC & RLA UltraLink™-GX80, 10 Gbps**

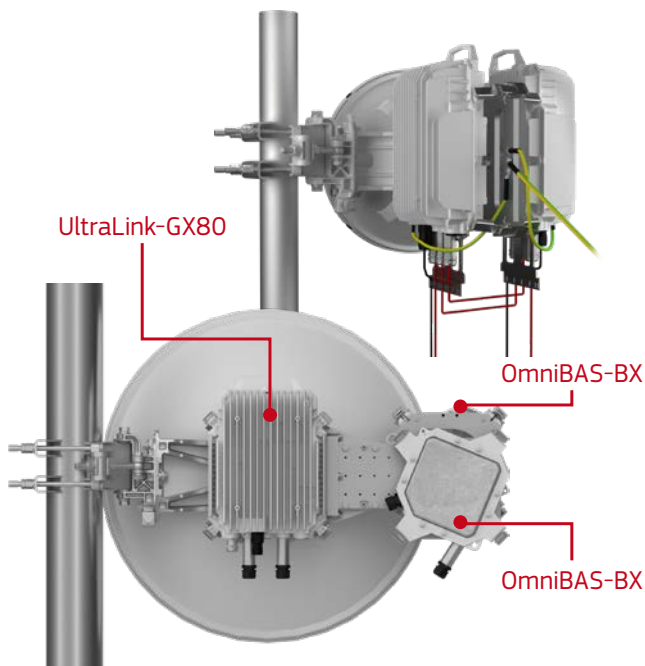
In this scenario one of the two physical UltraLink™-GX80 (E-Band) links form a single logical link out of the two parallel XPIC links providing higher reliability (one physical link acts as protection to the other link in the RLA) and higher link availability for a particular capacity or double the capacity for a particular channel size.

In a network with 160 such links and for the total of off-peak hours, a CSP can save up to 10 MWh per year.

Scenario 2:**Dual-Band configuration with 1x UltraLink™-GX80 + 2 x OmniBAS™ BX in XPIC & RLA, 2 Gbps**

In this scenario with a fully-outdoor Dual-Band configuration including one UltraLink™-GX80 (E-Band) and two OmniBAS™-BX (MW) radios, implementing Radio Link Aggregation (RLA)-based link bonding.

Dual-Band aggregation can be deployed in greenfield installations to enable the use of E-Band in extended-range links or can be provided as an upgrade to existing microwave links to enable the multiplication of their capacity.



Like scenario 1, more than a single physical link could be opportunistically enabled or disabled based on the current and predicted link requirements. Both MW devices can be set in Power Save mode more than 95% of the time (when the E-Band link is available). In a network with 320 such links a CSP can save up to 125 MWh per year.

In deployments where Dual-Band links are used for fiber connection backup, the saving will be further increased because even the E-Band link can run, most of the time, in low modulation.

Off-peak hours:

1-2 hours in the afternoon and
4-6 hours in the night, only at
working days, 15% per year.

E-Band link availability:

With 45 mm/hr rain rate, mean
E-Band link availability is more
than 99.5%.

BENEFITS**Energy Saving**

Conserving power without compromising network reliability

**Cost Reduction**

Reduced energy costs and improved network profitability and sustainability

**Improved Network Efficiency**

Balanced energy consumption while maintaining peak network performance

**Compliance with Regulations**

Follow energy efficiency standards/regulations set by governmental authorities

**Power Management**

Visibility into energy utilization and predictive analytics to identify opportunities for additional power savings

INVESTING IN ARTIFICIAL INTELLIGENCE

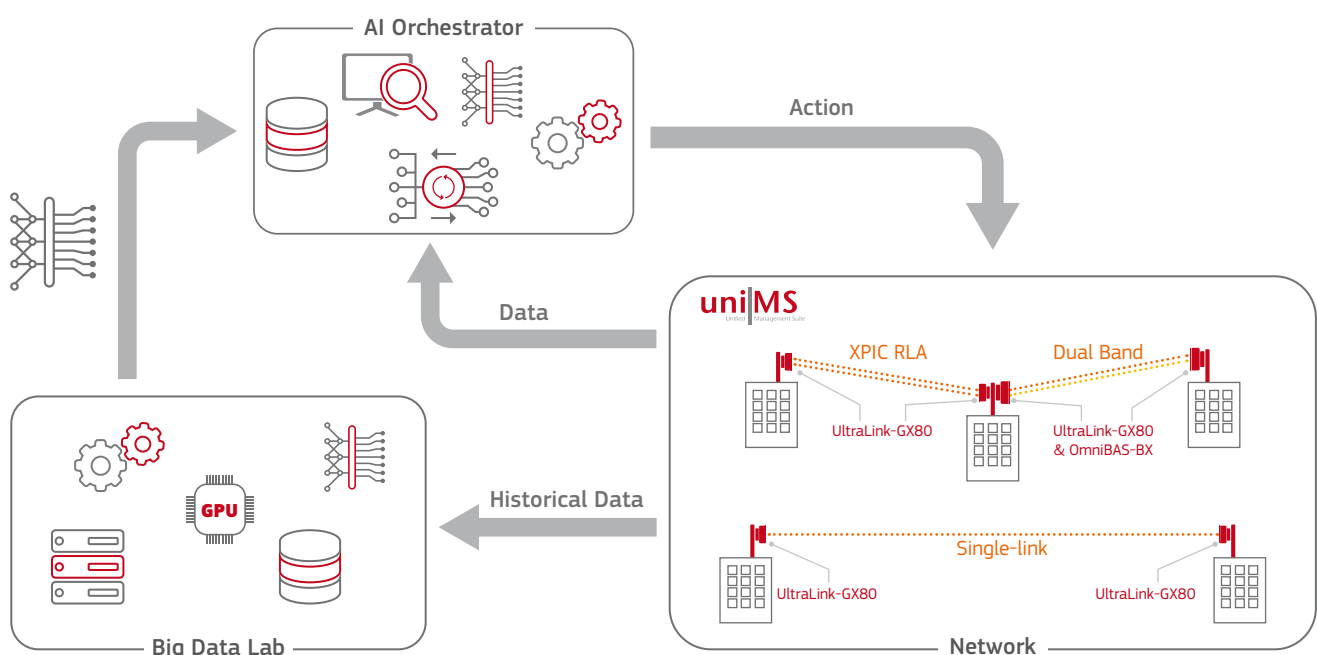
Future development plans will be targeting to improve the prediction accuracy and proactive capabilities of the App by considering more factors such as weather forecast, energy consumption and anomaly detection mechanism.

Detecting deviations from the normal traffic conditions may indicate a sharp increase of the network traffic in the near future, ingesting upcoming weather data might reveal coming fading conditions and energy consumption analytics could indicate relevant usage patterns or any other unexpected events that could proactively end the sleep mode of a backhaul link before the scheduled time in order to effectively serve the unforeseen situations that need to be handled on time.

To support the development, deployment, execution and maintenance of related AI-powered functionalities, Intra-com Telecom is working towards the implementation of an architecture for AI Lifecycle Management. Any AI-based use case is developed in our Big Data lab leveraging a High-Performance Computing (HPC) cluster and Graphical Processing Units (GPU) nodes to facilitate the parallel processing of large datasets and accelerate the training of complex neural networks. To ensure the highest possible generalization, model training and validation relies on a diverse dataset comprising of historical data collected from live networks as well as training samples from a network

simulator or Digital Twin, whenever applicable. Collecting data from different sources and conditions will eventually make the model more robust to variations, corner cases, etc. and eventually perform well on unseen data when deployed in the real world.

The offline trained AI model is then deployed to the AI orchestrator which resides closer to the network and is responsible for inference, continuous monitoring and local retraining. Live data coming from the network are used as input for executing model inference and generate a respective output (e.g., prediction, classification, etc.) which in turn is mapped to an informed action that is signaled back to the network (i.e., activate or deactivate the MW device). Given that hardware constraints can be met, inference may even be placed in the device enabling faster execution and decision making. The outcome of the AI decisions is continuously monitored, and local retraining is triggered when performance degradation is detected requiring model adaptation to the varying network conditions. Another option of model adjustment would be through a software update; nonetheless, in this case the existing AI model is replaced completely by a newer (and enhanced) version developed in the Big Data lab. ■



ARTICLE



ENERGY MONITORING OBSOLETE OR IMPERATIVE?

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KOSTAS TSIRBAS
Technical Director, Ether Applications S.A.



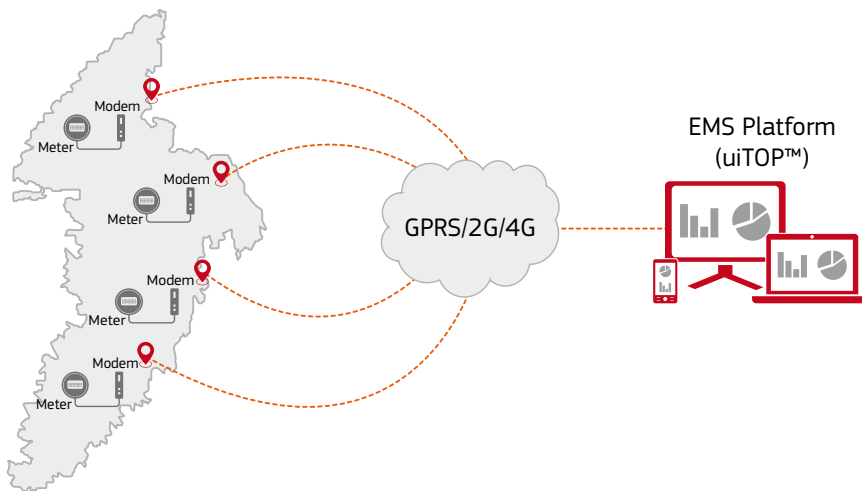
INTRODUCTION

With energy prices skyrocketing in recent years, monitoring of energy consumption is becoming imperative for many private businesses and public agencies. There are many cases, in which the installation of energy monitoring systems has helped many people to identify critical problems and take the right actions, which have had drastic results to the direction of reducing the overall energy consumption and consequently the costs.

To this direction, a bright example can be the energy monitoring solution, which was successfully installed on the island of Kythnos by the company Ether Applications S.A. within the framework of the "Kythnos Smart Island" project, on behalf of the non-profit organization DAFNI - Network of Sustainable Greek Islands. The offered solution covers the part of the collection of consumption data, the transmission, and the representation of them to the web platform for further analysis and processing, helping to identify high energy consumption points of the facilities and buildings.

THE PROBLEM

"Kythnos Smart Island" project is divided into several categories, depending on the nature of each problem. One of these categories was the energy assessment of the island's facilities and buildings by utilizing smart electricity metering and recording systems. Project directors and engineers were called to evaluate the island's facilities and buildings and propose specific solutions that would reduce consumption and increase energy efficiency at the same time. However, decision-making and interventions that would lead to this direction were not possible, as there was no clear picture of the energy consumption of these facilities. It is also a fact and has been proven in the past that in many buildings, high energy consumption devices may still be operating even when it is not required, wrong wiring connections affect the Power Factor negatively and faulty devices increase the total energy consumption, creating a puzzle with no solution for the facility managers and engineers.



THE SOLUTION

With the provided solution, Ether gave the project managers and engineers the opportunity to properly measure and record the energy consumption, in a friendly way that will help them make the right decisions and restrict unjustified consumption.

The solution consists of three (3) levels:

1. Energy Meter

The heart of the solution is the device that measures the energy consumption or production. The data of the measurements must have an almost zero error rate so that the conclusions can be drawn safely and reflect reality. For this reason, the installed meters were selected based on the product's compliance with the European MID (Measuring Instruments Directive). In addition, the meters offering a plethora of measuring quantities such as Incoming-Outgoing Power and Energy, Power Factor ($\cos(\phi)$), Voltages of all phases etc. All the previous quantities can be gathered and sent to the main platform with a frequency up to 1 second given that the communication infrastructure supports the appropriate speed.

2. Communication Module

The communication module may vary each time depending on the provided telecommunication infrastructure. Ethernet, Wi-Fi, GPRS/2G/4G are the most common options. In our case, knowing the wide coverage of the island by mobile network, 2G/4G modems with M2M SIM cards were selected.

3. Energy Monitoring Platform

Powered by uiTOP™, "Energy Monitoring Solution" (EMS) platform has been used with some adaptations on this project. EMS is a unique web-based platform that gives the user the convenience to access a user-friendly environment, from any browser, any device. During the implementation of the project many customizations and modifications were made to meet the challenges of the project, making the EMS a powerful tool in the hands of facility managers and engineers of the project.

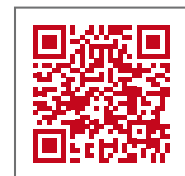
The most important features of the platform based on this project are:

- » Representation of the collected measurements through multiple charts;

- » Representation of multiple quantities (kWh/kW/V/A/PF etc.) through only one diagram. For example, Voltages, Currents and Power Factor can be combined on one axis vs time;
- » Historical values with 15 minutes resolution;
- » Data extraction for further analysis;
- » View metering points on map;
- » Grouping of metering points with simultaneous calculation of the individual consumptions.

CONCLUSION

Taking into account all the previous it is obvious the necessity of energy monitoring. Knowledge can be a benefit of troubleshooting and decision-making, while the lack of it can lead to higher consumptions and further mistakes in our attempt to solve the problems. ■



LONG RANGE FWA NETWORKS

DELIVERING GIGABIT CONNECTIVITY



24.25-29.50 GHz
frequency band



5 Gbit/s
capacity



Coreless
architecture

VISIT US IN HALL 7
STAND 7B44

MWC™

GSMA

Fira Gran Via, Barcelona
26 - 29 February 2024

The WiBAS™ G5 product line makes Ultra-Fast Broadband FWA a reality. The combination of the MU-MIMO **WiBAS™ G5 smart-BS** hub radio, capable of achieving up to 5 Gbit/s per sector with a single 200 MHz channel, and the **WiBAS™ G5 GigaConnect** MIMO terminal station enables the delivery of Gigabit services to the subscriber even at distances of 5.6 km from the base station.



GigaConnect

smart-BS

WiBAS[™] G5

Enabling Gigabit to the Home



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TELECOM