

INTERVIEW

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INTRACOM
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INTERVIEW

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EXPANSION OF THE NATIONAL TELEMEDICINE NETWORK TO THE ISLANDS OF THE ATTICA REGION

Intracom Telecom and the OTE Group expanded the National Telemedicine Network - 2nd Health Region - to the islands of the Attica Region with the purpose of providing the inhabitants of these islands with equal access to health services from the National Healthcare System.

We, as the main subcontractor of the project, undertook the supply, installation, maintenance and configuration of the core telemedicine equipment, the configuration of the telemedicine spaces, as well as the configuration of the telemedicine software and digital medical devices.

The updated National Telemedicine Network (EDIT) has been incorporated eleven (11) new stations, in the islands of Antikythera, Agistri, Aegina, Poros, Spetses, Hydra, Galata, as well as in Korydallos and Avlona detention centers, along with a Medical Consultant Station at the Piraeus Health Center and a new station at the Polyclinic of the Hellenic Police, in order to provide services to its officers, who served in the islands of the jurisdiction of the Second Healthcare District. It was also planned to provide homecare health services, as ninety (90) monitoring systems consisting of tablets and digital medical devices for patients with chronic diseases will be offered.

The National Telemedicine Network (EDIT) of Greece provided the island residents with specialized and quality health services, without requiring them to travel, while reducing transportation and hospitalization costs. In addition, the medical and nursing staff located in them have accredited Continuous Medical Education courses and training allowing them to continue their professional development without leaving their posts.



INTRACOM TELECOM MODERNIZES AND CONSOLIDATES ONLINE CHARGING SYSTEMS OF MAJOR CSPS

Intracom Telecom, has been selected by major CSPs in South-Eastern Europe to support their journey beyond traditional charging models and enable them to effectively address hybrid networks challenges. NGINius-Charging™, the Company's powerful real-time platform, allows CSPs implement a fully convergent monetization strategy. Among the recent success stories, NGINius-Charging™ has been selected by "Vala Telecom Kosovo" for their Online Charging modernization. Besides this, Intracom Telecom recently completed the migration of legacy voice & data charging systems of Greece's Tier-1 Mobile Operator to NGINius-Charging™, including its smooth integration with the Operators' network and IT environments. NGINius-Charging™ is architected to effectively respond to the dynamic environment of hybrid 4/5G & Fixed networks, being agile enough to support existing technologies and business models with new ones.



PMP MMWAVE FWA DELIVERING GIGABIT SPEEDS

Intracom Telecom has further invested in the WiBAS™ G5 FWA product line with the addition of new technology neutral mmW radios (FDD/TDD) with MU-MIMO and beamforming capabilities. **WiBAS G5** EOLO, an Italian WISP, in 2017 selected WiBAS™ products for the ongoing deployment of the largest ultra-broadband mmW FWA network in the world. Similarly in 2019 Open-Fiber, an Italian fiber network provider, selected WiBAS™ G5 for wholesale FWA. EU decided for its Gigabit Society initiative that households should be connected with VHCN networks reaching 1 Gigabit/s. In 2022 the Italian government decided to promote investments in Gigabit networks to all residents by 2026. WiBAS™ G5 dual-BS, smart-BS radios and the new GigaConnect CPE make the Gigabit to the user with mmW FWA a reality.

HIGH PERFORMING E-BAND RADIOS SUPPORT 5G DEPLOYMENT IN INDIA



After the completion of the auctioning process and the allocation of 5G spectrum licenses in India last year, Indian mobile operators, which have already embarked in an aggressive deployment program of thousands of 5G base stations per month across the country, stand to benefit from the advanced features of the UltraLink™ radios. Intracom Telecom's portfolio of high performance E-Band radios, including the field proven, highest system gain, UltraLink™-GX80 10 Gbit/s full duplex radio as well as the new UltraLink™-GX80 Dual, a highly spectrally efficient fully outdoor Dual radio supporting up to 15 Gbit/s full duplex throughput using a 1000 MHz channel, are ideal for 5G RAN transport (xHaul) in cases where optical fiber is not available.

DIGITAL GREECE IN THE SPOTLIGHT

The Digital Economy Forum 2022 themed "Digital Greece in the spotlight" was organized by the Federation of Hellenic Information Technology & Communications Enterprises (SEPE) last December. Our Deputy General Manager of the Services Business Division, Ioannis Poulos, participated in "The role of smart cities & regions in innovation" panel discussion, during which he elaborated on how municipalities can utilize digital technologies to facilitate citizens' everyday life and analyzed the issues that need to be given greater attention by the cities in order to accelerate deployment.



INNOVATION & SUSTAINABILITY AWARD 2022



Intracom Telecom was honored with the InfoCom "Innovation & Sustainability 2022" award, recognizing the NFV-RI™ platform and our Company's collaboration with Intel® and Red Hat®, for building an innovative solution for energy saving & carbon emissions reduction, thus helping operators achieve their sustainability goals. The awarding was held during the Annual InfoCom World conference that took place in Athens, Greece, last November. During the event, our Marketing Director for Telco & Enterprise Software, Sotiris Bithas, gave a speech on "Delivering Sustainable, Environment-friendly Operations TODAY", presenting how an APAC Tier-1 operator managed to succeed in its sustainability goals, to achieve energy savings and reduce their carbon emissions.

APPOINTMENT OF A NEW DEPUTY GENERAL MANAGER

Ioannis Poulos was appointed as Deputy General Manager of the Services Business Division, in our company. Ioannis has held, over the past 15 years, high-ranking positions in the Intracom Telecom Group, contributing to the company's development in the Middle East, North and sub-Saharan Africa, and Southern Europe. Ioannis holds a degree in Electrical Engineering and Electronic Systems Engineering and a master's degree in Digital Communication Systems from Loughborough University, UK.



SOFTWARE DEVELOPMENT & IOT WORKSHOPS

An interesting workshop, entitled "Building an IoT platform: Technologies and use cases", took place on November 2022, in our premises. Our team welcomed the IEEE (Institute of Electrical and Electronics Engineers) students and showcased solutions and real case studies. Moreover, collaborating with the Board of European Students of Technology (BEST) Thessaloniki, our company organized the workshop, entitled "Software Development: Cloud Native" on December, at the Aristotle University's Research Dissemination Center. The young participants had the opportunity to gain access to invaluable professional experiences and learn more about our company's solutions.

THE INTEL® NETWORK BUILDERS WINNERS' CIRCLE FAMILY

Being part of the Intel® Network Builders Winners' Circle family, as a Gold Member, for a 3rd year in a row is as thrilling as it sounds! Looking forward to advancing the industry and bringing excellence to our customers, as part of the vibrant Intel Builders ecosystem.



INTRACOM TELECOM IN AFRICACOM

Intracom Telecom participated in a crowded AfricaCom show in Cape Town. This year the show was targeting to unite business & technology in order to create a better, more inclusive digital world. A large number of show participants visited Intracom Telecom's stand where our team presented Company's innovative wireless products & solutions for Ultra Broadband Wireless Access & Ultra-High Capacity Wireless Transport.

SPRINTER

Intracom Telecom has been developing own modem technology for ultra broadband millimeter wave wireless transport systems since 2014. The technology is embedded into the UltraLink™ product line transporting with speeds up to 30 Gbit/s in each direction. High capacities are in demand in cases of industrial networks. Our company is taking part in SPRINTER, an Innovation Action project in Horizon Europe. With our company's contribution the consortium of the project, comprising 5 academic/research



organizations, 2 SMEs and 5 large companies, will develop a set of groundbreaking photonics-enabled transceivers supporting wireless connectivity using free-space optical and mmWave channels. These technologies are fueling the evolution of Intracom Telecom's own wireless transport platforms.

➤ <https://horizon-de-sprinter.eu>

XGAIN

As a leader in Ultra Fast Fixed Wireless Access, we are developing own technology for rural last mile connectivity solutions since late 90s. This technology has been incorporated into the WiBAS™ product line connecting homes and business with Gigabit/s speeds. Our company participates in XGain, a Research and Innovation project in Horizon Europe, aiming at delivering a Knowledge Facilitation Tool that will aid business model development, supporting decision-making in the selection of connectivity and edge processing solutions. With our company's contribution the consortium of the project, comprising 17 partners from research / academia and industry, as well as governmental organizations, aims to increase systemic resilience and energy efficiency, contribute to climate mitigation and reduce the digital divides between different types of citizens, farms, sectors and regions.

➤ <https://xgain-project.eu>



6G-BRICKS



Intracom Telecom is taking part in 6G-BRICKS, a Research and Innovation project in the 6G Smart Networks and Services Joint Undertaking of Horizon Europe. It aims to deliver a new 6G facility, which builds on the baseline of mature "Smart Connectivity Beyond 5G" projects such as to bring to life breakthrough technologies, i.e., cell-free and RIS technologies, that will play a key role in beyond 5G networks. With Intracom Telecom's contribution on an UltraLink™-based disaggregated xHaul solution and the intelligent management of Cloud/Edge/Far Edge/IoT resources and services, the consortium of the project aims to explore novel unified control paradigms based on Explainable AI and Machine Reasoning. All enablers will be delivered in the form of reusable components with open APIs, termed "bricks". Finally, initial integrations with O-RAN will be performed, aiming for the future-proofing and interoperability of 6G-BRICKS outcomes.

➤ <https://6g-bricks.eu>

DEPUTY MINISTER OF DEVELOPMENT & INVESTMENTS VISITS INTRACOM TELECOM

The Deputy Minister of Development & Investments of Greece, Mr. Nikolaos Papathanasis, visited recently the premises of Intracom Telecom in Peania Athens, Greece. The Managing Director of Intracom Telecom, Mr. Kartlos Edilashvili, welcomed the Deputy Minister along with top management executives of the company. Mr. Papathanasis was briefed about the company's international activities, as well as the innovative solutions that are being developed in Greece. More specifically, he was informed about the Fixed Wireless Access technologies in the 5G frequency spectrum, which has recently been licensed by EETT (Hellenic Communications and Post Commission), for the deployment of very high capacity networks (VHCN) in areas, where the installation of optical fibre is unprofitable and time-consuming. The Deputy Minister also visited Intracom Telecom's Research and Development (R&D) facilities, as R&D is at the foundation of the company's business strategy with the company investing approximately 10% of its annual turnover. It is noted that the company currently has more than 1,650 employees, of which more than 1,200 are based in Greece, while the Company's exports reach 68% of its annual turnover.



TRADE SHOWS PARTICIPATION IN VEGAS

Intracom Telecom participated in MWC Las Vegas last year, a trade show focused on mobile operators in the North American market. The show was a great opportunity to showcase our innovative equipment in the mmWave FWA, RAN xHaul, NFV-R1™ and IPTV solutions. Particularly noteworthy, was the demonstration of the UltraLink™-XR80 as it highlighted the many advantages that the technology offers by upgrading E-Band link capacities to 30 Gbit/s+, a great solution for the trend of increased capacity demand operators are faced with. Attendees were also impressed by the unveiling of the WiBAS™ smart-BS, a FWA MIMO base station that is capable of supporting 3.2 Gbit/s aggregate capacity at the base station.

Immediately following MWC, Intracom Telecom participated at the Wispapalooza show, the defacto trade show for WISPs in the US market. Attendees got a chance to look at our 24/28 GHz PMP WiBAS™ portfolio offering the industry's only solution that delivers up to 700 Mbps to the user, interference free due to its licensed spectrum deployment characteristics. Attendees were also engaged with our E-Band PTP portfolio's Dual Band failover capabilities, a solution that allows WISPs to increase their congested MW links to 10 Gbps capacity by keeping their MW infrastructure intact. We also marketed promotion with our partner for the region Winncom Technologies.



INTERVIEW

DEVELOPING TECHNOLOGY FOR RELIABLE CONNECTIVITY & HIGH QUALITY OF SERVICE IN AFRICA

John Tenidis, Marketing Director of Intracom Telecom's Wireless Solutions Portfolio, and Trevor Burchell, Head of Intracom Telecom subsidiary in South Africa, talk about the Group's dynamic presence in the market and the wide variety of solutions and services that cater to the African continent.

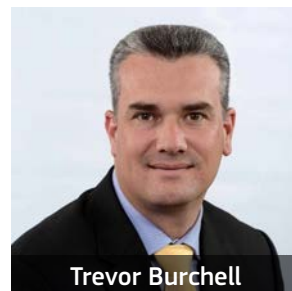
INTERVIEW » Great to have you here today gents, thank you! So, Mr. Burchell, what has it been like for your company in the African market over the last 12 months?

T. Burchell » Intracom Telecom is a global telecommunication systems and solutions vendor present in African market since 2010. The company is serving the telecom markets of the continent through its offices in Johannesburg and Dubai. The last 12 months have been period of transition from the sudden halt which was caused by the COVID-19 pandemic, and gradually returning to normal terms. Our company serves its African customers with support & maintenance for their networks and we now see new investments in expansion of these networks.

We supply networks for Fixed Wireless Access to ISPs and telcos, for wireless transmission to cellular operators, control & management networks for electricity companies, private networks for armed and police forces and for the mining industry. The COVID-19 pandemic despite the crisis and the devastation it caused, it also motivated our clients to think proactively about the capacity and expanse of their networks as well as addressing the demand for more "remote" than "physical" interaction in business and private lives. We see this in our booked business for the last 12 months and our forecast for the coming terms.

INTERVIEW » Assuming that the company's effort in transforming the continent, would be really challenging and demanding. Mr. Burchell, would you like to share the greatest challenge the company has to deal with?

T. Burchell » From the setting up of our existence in African telecom market, we took into consideration the diversity between the countries on the continent and the impact that this has on the ways of conducting business. To address the demands from customers coming from so many different countries means that we have to understand and embrace the different cultures and mindsets. With our local sales teams and network of partners in various countries



Trevor Burchell

We are bringing our experience gained from the global presence of our company, adapted for local use in Africa.

we manage to address this challenge. As we recover from the restrictions caused due to COVID-19 pandemic, it will be possible to spend more time, again, with our clients, listening to their problems and presenting solutions from our vast portfolio of telecommunication products. Having addressed adequately the challenges of the past we are now ready to face those of the future. Our customers have now a completely different mindset about the way they want to operate and expand their network. We are bringing our experience gained from the global presence of our company, adapted for local use in Africa. We bring mature, yet innovative solutions, based on international standards of the telecoms industry. In some cases we admit that our African customers were frontrunners in the adoption of technology, compared to ones in other parts of the world, and we had to learn from them while adjusting our products. Thinking globally and acting locally is not as easy as it sounds!

INTERVIEW » Talking about versatility and adaptability... have you spotted any trends or direction in the market? Mr. Burchell would you like to comment on that...

T. Burchell » Well, the pandemic taught everyone a big lesson, that of being connected with people and assets at any time. If physical presence is not possible then remote access has to be possible. This is causing a trend for the build-up of public as well as private networks. We see the increased demand for access to people, to services and functions which drives the expansion and the upgrade of networks. Although some will claim that quality does not matter when

reachability is the primary objective, we are trying to make our customers think proactively also for that part. Quality when designing a network for long reach, and reaching the digitally unserved and underserved parts of the population with quality of service. We see this trend in the two leading markets for our products in Africa, in South Africa and in Nigeria. We are developing new markets which are influenced by this trend and we will be able to announce more success stories in the coming 12 months.

INTERVIEW » Taking all these into account, Mr. Tenidis, do you see any emerging opportunities that you can build on?

J. Tenidis » We see a big opportunity in building networks for quality of service at their epicenter. The reason is simple; the quality pays back and increases the ARPU, the lack of quality causes frustration and subscriber churn. We are proposing to our clients solutions from our vast and mature product portfolio for their networks, whether this is for fixed wireless access connecting people together, or for wireless transport networks connecting machines to machines allowing human administrators to manage every part of their precious assets. Our portfolio of products, the WiBAS™ for multipoint access, the OmniBAS™ and the UltraLink™ for point to point connections and the uni|MS™ for network life-cycle management and automation have simple yet modular architectures to cater for so many different applications at the field of operation. We see demand from telcos and ISPs for fast and reliable connection to the internet, and on equal importance we cope with demand from utilities and enterprises to connect their assets for control and monitoring purpose. These two segments have our uninterrupted attention and this is what we expect to drive our growth in Africa for the next 12 months.

INTERVIEW » So, Intracom Telecom focuses on the quality of the network... Strategically, Mr. Tenidis, what or where will be your company focus going forward?

J. Tenidis » I would say that the company expects to significantly grow its PMP business throughout the African continent in order to address the constantly increasing bandwidth demand, the frequency spectrum congestion and the failure of the currently used unlicensed technology to meet the required quality of service. The company is a familiar brand for the Tier-1 operators and Wireless ISPs of the continent, and this is used as the foundation of the promotion strategy for the new generation of ultra-broadband products, such as the new series of WiBAS™ PMP systems and E-Band UltraLink™ radios.

Our solutions come to fill in the gap and we are striving to develop technologies which bring ultra-broadband connectivity to the populations of the great nations of Africa.



John Tenidis

INTERVIEW » And last but not least, Mr. Tenidis... Given the difficult times in recent years, how do you see the next twelve months developing and what is your view of the years coming?

J. Tenidis » We hope that the COVID-19 pandemic is behind us and will not create any further devastation from the loss of human lives, neither disruption of private and business routine. We firmly believe in Africa's huge potential to invest in modernizing and expanding telecommunication infrastructures. The vastness of the land, the diversity of the populations and the magnitude of nations on the continent has no similar on our planet, yet with one distinct characteristic; the wide gap between those who have connection and those who do not have connection to services and other people. We see a tremendous opportunity for our solutions enabling access communication networks, ones that provide real broadband and uncompromised quality to citizens no matter where they are. During the past years our industry focused very much in improving connectivity while on the move and neglected the cases where we are at fixed locations. Our solutions come to fill in the gap and we are striving to develop technologies which bring ultra-broadband connectivity to the populations of the great nations of Africa. ■



INNOVATIVE LOW ENERGY FOOTPRINT TECHNOLOGY FOR STABLE 5G SPEED WIRELESS ACCESS IN RURAL / SEMI-URBAN AREAS

PANTELIS TRAKAS

Senior Product Manager, Wireless Network Systems



INTRODUCTION

Leveraging 45 years of experience and investing significantly in R&D, Intracom Telecom develops technologies that apply in wireless access systems. A key feature of the latest G5 technology is the significant reduction of the energy footprint while providing ultra-high connection speeds to subscribers. More specifically, the G5 technology reduces energy costs for the telecommunications provider by two orders of magnitude compared to competing wireless technologies widely used internationally.

WiBAS™ G5 solution facilitates sustainable development of green networks by implementing innovative technologies leading to energy footprint reduction.

THE CHALLENGE

The exponential worldwide increase in demand for fixed ultra-high speed connections has created major challenges for telecommunications providers, who must offer this good both within the urban fabric and in remote rural areas. Optical fiber networks that can offer ultra-high speeds (Ultra-Broadband) of the order of hundreds of Mbps or even Gbit/s to the end user are not suitable for access to semi-urban or rural areas, because it is economically unprofitable for providers to extend fiber to these regions. Fixed wireless access networks follow a similar architecture to mobile telephony, wirelessly covering remote areas with a cellular pattern around the Base Stations. End users have Terminal Stations in their homes, which ensure the broadband connection.

According to connectivity providers and governmental objectives, all subscribers should have access to a 1 Gigabit per second connection quite soon, some say this can be

achieved by 2030. But the growing demand especially in wireless services has its toll, the increasing energy consumption and thus the carbon footprint of the specific sector. It has been estimated that the entire telecommunications sector represents approximately 1.5-2% of energy consumption in developed economies. Of this percentage, approximately 50-60% corresponds to the base stations of the networks in question.

How can we define a telecommunication solution "GREEN"? The reduction of energy consumption, the use of renewable energy sources and the strategy to reduce CO₂ emissions are the main three pillars that must coexist in order for a network to be labeled "GREEN".

In addition to minimizing the overall energy footprint of wireless telecommunications, there is also a strong economic component, which mainly concerns carriers. More specifically, the high requirements for connection speeds with the end subscribers that we mentioned above, leads to denser and wider networks with an increase in the number of base stations. Coupled with steadily increasing energy prices, it is becoming apparent that energy consumption is a critical factor in the operating expenses (OPEX) of the telecommunications fixed wireless access network providers.

THE SOLUTION

Intracom Telecom has developed the WiBAS™ fixed wireless access (FWA) product family which now encompasses the G5 technology, which achieves ultra-high connection speeds and up to 11 kilometers range from the hub (Base Station). In addition, the system in question has the ability to support up to 960 users per base station. These two features alone drastically reduce the need for dense wireless networks. Therefore, there is a significant reduction in overall energy needs for providers who choose the WiBAS™ G5 solution for their subscribers.

The WiBAS™ G5 solution adequately responds to the aforementioned challenges for sustainable development of green networks by implementing innovative techniques and using inherent features that can lead to the reduction of the energy footprint. This is proven in practice by a radio coverage study, implemented in Italy in the province of Cremona. We chose this area with low population coverage (1000 inhabitants per km²), because it perfectly matches the areas targeted by Fixed Wireless Access Networks. The coverage area is 40 km². Two wireless access technologies were compared. The WiBAS™ G5 solution and an alternative, which also uses millimeter frequency band (mmW). In Figure 1 we see the study with the WiBAS™ G5 solution achieving the coverage of the entire area with 3 base stations (cells). End users can access speeds in the order of Gigabit/s even at a distance of 3.9 km from the center of the cell.

The fixed access alternative seen in Figure 2, to ensure full coverage in the same area and at the same speeds as WiBAS™ G5, should limit the radius of cells to 500 m. This translates into a need to deploy 64 base stations, a number that is about 20 times larger. This significant difference translates into a huge environmental burden, multiple energy consumption and increased total cost of ownership (TCO). ■

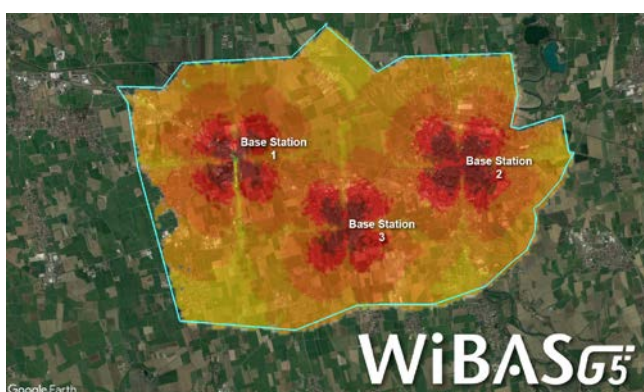
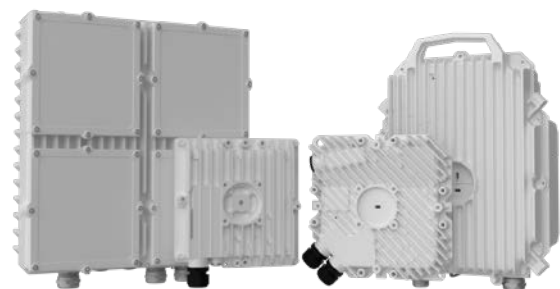


Figure 1

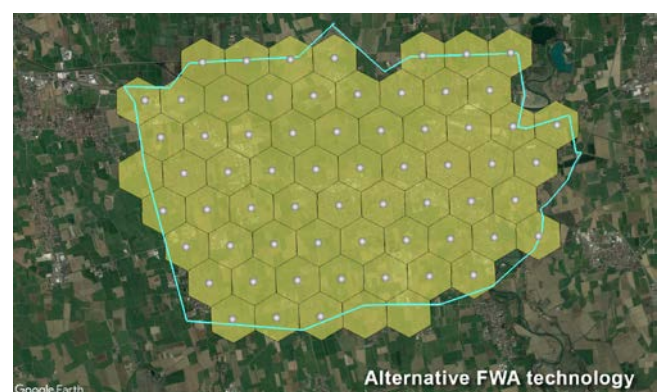


Figure 2



THE RISE OF INSIDER THREATS

SPYROS GIANNOPOULOS

Cloud, IT & Security Solutions Section Manager, ICT Services & Solutions

INTRODUCTION

An insider threat is a cyber security risk that comes from the internal network of an organization. It occurs when an employee (current or former, contractor or partner) with legitimate access misuses that access to damage the organization's network, systems or data. An insider may act intentionally or unintentionally. The result is compromised confidentiality, availability, and integrity of enterprise systems or data.

Most data breaches are caused by Insiders. Traditional cybersecurity policies often target on external threats, leaving the company vulnerable to attacks from inside. The insider already has authorization to systems, so it's difficult for Security Officers to identify malicious intent.

TYPES OF INSIDERS

» Malicious Insider

The goals of a malicious insider include intellectual property theft and fraud. They intentionally abuse the privileged access they have to leak information for malicious reasons.

» Negligent Employee

Negligent insiders act inadvertently. It is about human error or social engineering victims

» Outsiders

An outsider has gained insider access to the organization. They may be a vendor, partner, or contractor.



HOW TO COMBAT INSIDER THREATS BASED ON CONTINUOUS AUDITING

» Secure Critical Assets

Identify your organization's critical assets. These are networks, systems, data, facilities and people. Understand each critical asset, and rank them

» Baselining of Normal Behavior

There are many different systems that can analyze and alert on incidents from insider threats. These tools work by creating a baseline of normal behavior for entities, then deviations can be flagged and investigated.

» Increase Visibility

Security officers should deploy systems that monitor user activity and correlate information from multiple sources. This information would then be sent to other security solutions to identify and prevent the attack.

» Enforce Policies

Define the organization's security policies. Employees, contractors, vendors or partners should recognize their responsibility to not give privileged information to unauthorized parties.

» Culture Modification

Detecting insider threats is important. But educating users on Cyber and Information Security is more proactive and less expensive. Running a security-aware culture change and digital transformation is the key..

DETECTION

Most threat intelligence applications analyze the network, and application data checking the behavior of authorized persons who could misuse their access. To secure cyber against an insider threat, companies are analyzing anomalous behavioral and general network activity.

Behavioral & Digital Indicators:

- » A dissatisfied employee, contractor, or partner.
- » Working off-hours.
- » High abnormal volume of network traffic.
- » Violation of organizational policies.
- » Using USB drives.
- » Signing into applications at unusual times.
- » Resignation announced.
- » Emailing sensitive information to personal emails
- » Accessing HR or Finance data (not relevant for their day-to-day activities).

CONCLUSION

Mitigating insider threats requires a strategy that involves a wide range of stakeholders and operational areas. As the workplace became more complex and insider threats become more difficult to detect, the actions and techniques must be more comprehensive, smarter and capable of adjusting to the new threats. Having too many security controls is not the proposed solution. Insider threat programs should focus on the balance between defending from the threat and accomplishing the organization's business objectives. The goal is to detect anomalies as early as possible and investigate alerts in order to interrupt potential insider threats before assets or data are compromised. With a complete portfolio of advanced cybersecurity solutions and services, Intracom Telecom ensures the trustworthiness of information of every client proposing the right combination of products and services upon assessing your environment and identifying all potential insider threats. ■

SOLUTION BRIEF

KDDI AND INTRACOM TELECOM, COLLABORATE ON MORE EFFICIENT 5G NETWORK POWER USAGE SUPPORTING LOWER CO₂ EMISSIONS

KDDI CORPORATION

MASANORI HARADA, TOORU YAMAMOTO, HAJIME MIYAMOTO, HIDENORI ISHIMURA

INTRACOM TELECOM

NIKOS ANASTOPOULOS, EVANGELOS ANGELOU, CHRISTOS RIZOS

INTEL CORPORATION

WEI XIAN, EMMA COLLINS, TAKERU TSUCHIYA, MASATO HOTTA



Intracom Telecom's NFV-RI™ Machine Learning (ML) based solution, leveraging Intel server telemetry and insights, can optimize KDDI's 5G Network power efficiency, lowering energy consumption, and enabling reduced CO₂ emissions.

EXECUTIVE SUMMARY

KDDI Corporation (KDDI) is one of Japan's largest Tier-1 telecommunications operators. As a business entity, KDDI emits approximately one million tons of CO₂ annually through the consumption of energy such as electricity. For context, that's equivalent to the CO₂ emissions of approximately 500,000 households each year. By far, the largest portion of those emissions (98%) is due to the electricity consumed by mobile phone base stations, communication station premises, and data centers. Further increases are anticipated as the rollout of 5G continues and communications traffic volumes grow over time.

To move toward carbon neutrality, KDDI is firmly committed to reducing the power consumption of its mobile phone base stations and communications equipment and the use of renewable energy. To align with Japan's national Climate Action Plan, KDDI aims to achieve net zero CO₂ emissions from its business activities by fiscal 2030, ahead of the previous declaration. In addition, the entire KDDI Group aims to achieve net zero CO₂ emissions by fiscal year 2050.

To achieve this target, KDDI has several approaches to reducing emissions, including research into finding new ways to conserve energy in existing infrastructure.

Intracom Telecom is a global telecommunication systems and solutions vendor providing equipment and services to the industry for over 40 years. As virtualized infrastructures become increasingly critical in Communication Service Provider (CoSP) deployments, Intracom Telecom has developed solutions that employ Machine Learning (ML) to find the best power profile for optimizing power consumption. The Network Function Virtualization – Resource Intelligence (NFV-RI) solution can determine the ideal distribution and configuration of resources automatically, in closed-loop form, and dynamically, under any traffic.

KDDI, Intracom Telecom, and Intel partnered to explore possibilities for reducing power consumption for 5G core network workloads. The resulting Proof of Concept (PoC) is the subject of this paper.

The PoC demonstrates the ability to reduce power consumption by around 30 to 35W for a single data plane pod running on a single data plane server with a baseline power consumption of 360W, with possibilities to reduce power consumption further while maintaining service quality levels.

PROBLEM DESCRIPTION

The benefits of Network Functions Virtualization (NFV) are well understood by CoSPs and are a key enabler as 5G networks expand. By virtualizing functions in the two fundamental parts of a mobile network, namely 1) the mobile core and 2) the Radio Access Network (RAN), many CoSPs have reported a significant Total Cost of Ownership (TCO) reduction.

The 5G data plane constitutes a significant part of a 5G mobile core. To meet stringent Key Performance Indicators (KPIs) such as deterministic performance, low latency, and zero packet drops, the 5G data plane relies on the Data Plane Development Kit (DPDK), the de-facto framework for accelerated packet processing. The DPDK employs polling to meet these KPIs, which is however, by design, oblivious to the load level of the user planes. As a result, CPU cores are always at their highest utilization, even when a user plane is idle or receiving the lowest amount of traffic. As a result, data plane servers always consume the maximum possible power, resulting in a higher Operational Expense (OpEx).

Figure 1 illustrates the problem in a graph that shows the notional network load over a 24-hour period. CPU cores are always 100% busy due to the polling mechanism even when the traffic load is light. The green bars show opportunities for power savings where CPU frequency can be turned down and still support the traffic load without packet drops. Conversely, CPU frequency can be turned up to handle the high traffic load during busy periods.

Existing system software, such as the Linux operating system, include power management policies to dynamically manage power for CPUs when they are not busy. However, because the data planes running DPDK always appear to be at 100% CPU utilization (due to the polling scheme), the OS is unaware of their actual CPU demand at any given time.

Finding ways to leverage knowledge of the actual data plane demand facilitates the implementation of mechanisms to adapt CPU frequencies according to data plane load. Adjusting a CPU's frequency changes the power consumption leading to opportunities for power savings and consequently reduced CO₂ emissions.

SOLUTION DESCRIPTION

To improve the energy footprint of their 5G mobile network, KDDI teamed up with Intracom Telecom to develop a PoC evaluating Intracom Telecom's NFV-RI solution to reduce the power consumption of KDDI's 5G data plane servers. NFV-RI leverages Intel's telemetry and power management

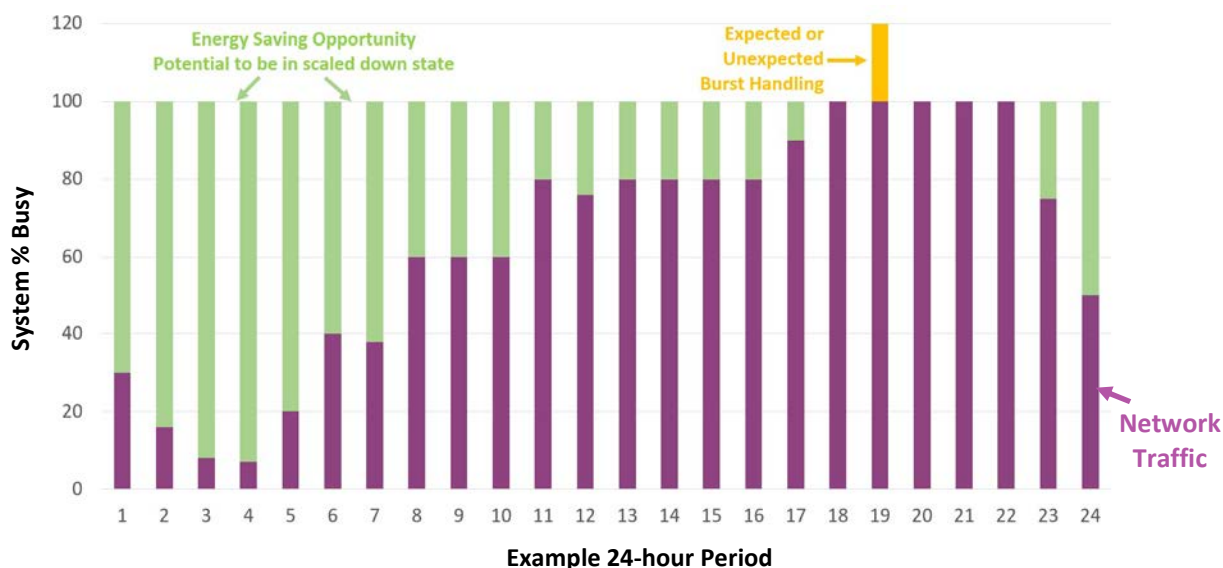


Figure 1: Notional Network Traffic Load Over a 24-Hour Period

SOLUTION BRIEF

technologies to retrieve the metrics necessary for network load determination and adjust CPU frequencies accordingly. The result can be significant energy savings.

High-Level Data Plane Structure

This PoC focuses on the 5G data plane that employs servers based on Intel's 2nd Generation Intel® Xeon Scalable processors.

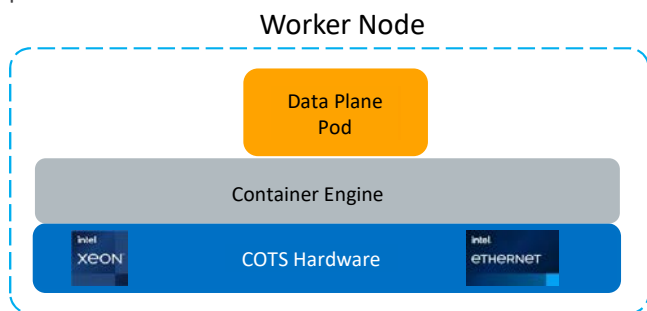


Figure 2: 5G Data Plane Setup

The setup for emulating the 5G core nodes around the 5G data plane server is the subject of the next section.

PoC Setup

The PoC setup comprises a traffic generator to simulate and handle traffic on the following 5G interfaces as shown in Figure 3:

- » N3 interface to a Radio Access Network (RAN), for example a radio base station (gNodeB) with connected User Equipment (UE) devices
- » N4 interface to the Session Management Function (SMF)
- » N6 interface to the Data Network that provides IP services

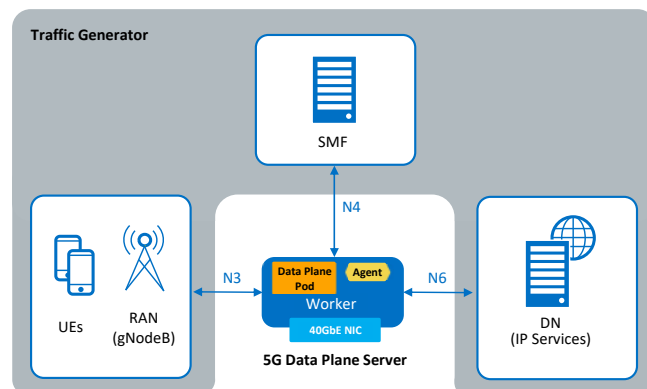


Figure 3: Data Plane Server in an Emulation Environment

The emulated 5G data plane server (Worker) has the following features:

- » CPU: Intel® Xeon Gold 6230N 2.30 GHz 20C/40T, two socket
- » Memory: 312 GB
- » Hard Disk Driver (HDD): 900 GB
- » Network Interface Card (NIC): 40 GbE

The software includes:

- » Kubernetes bare metal platform software (cloud platform software)
- » 5G data plane software
- » Intracom Telecom NFV-RI with Frequency Feedback Loop (FLL)

To facilitate CPU performance scaling on the Worker, the intel_pstate driver is enabled.

The server runs multiple instances of a commercial 5G data plane Network Function (NF), which consists of complex traffic accelerations including a DPDK distribution from a leading industry vendor, implemented as Cloud-native Network Functions (CNFs) for Kubernetes-based environments.

NFV-RI uses a Frequency Feedback Loop (FLL) workflow to predict a DPDK-based CNF's traffic levels and dynamically adjust its CPU cores' frequencies according to its incoming load, while promoting zero packet drops. The FLL uses Machine Learning (ML) to predict a CNF's behavior in upcoming traffic changes and adjust its CPU cores frequency accordingly, to enable reduced power usage during light or off-peak traffic periods, without compromising performance.

Figure 4 is a view of the setup from the Kubernetes perspective. The NFV-RI Agent pod describes the resource requirements of an NFV-RI Agent container, and the Data Plane pod describes the resource requirements of the 5G data plane server.

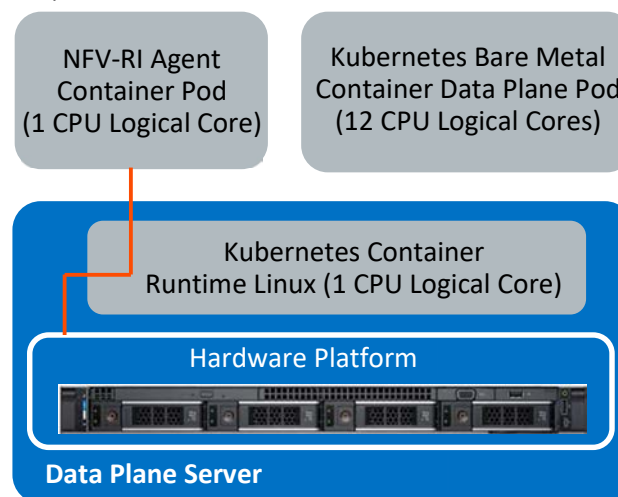


Figure 4: Kubernetes View

Emulated Traffic

Based on KDDI's own traffic model, we emulate the traffic load for a 24-hour period. This traffic is representative of typical data plane traffic, which has the lightest traffic load in the early hours of the morning (for example, 3 to 4 a.m.) and the heaviest traffic in the evening (for example, 6 to 8

p.m.) with varying traffic load levels in between. The maximum traffic load is set at six times the minimum traffic load.

Since by default, a DPDK application always utilizes its CPU cores at 100% due to polling, any time the traffic is not at its highest presents an opportunity to turn down the frequency (and consequently reduce power consumption). This is a key principle that the PoC leverages.

Server CPU Logical Core Allocation

In the PoC, only 12 of the available 80 CPU logical cores (40 per socket) are reserved (or pinned) for use by the 5G data plane. Intracom NFV-RI controls the frequencies of these 12 CPU logical cores. Figure 5 shows the CPU logical core allocations for the data plane in the PoC.

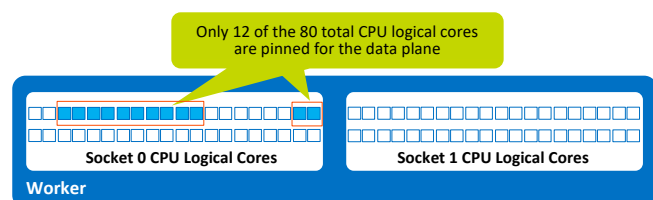


Figure 5: Server CPU Logical Core Allocation for 5G Data Plane

FLL Phases of Operation

The Intracom Telecom NFV-RI uses a Frequency Feedback Loop (FLL) workflow to predict CNF traffic levels and dynamically adjust the frequencies of each CPU core used by DPDK CNFs. The three phases of FLL operation are:

» **Configuration** - The user provides all the parameters needed for configuring FLL in its subsequent phases, like

the suitable data sources or the mapping of CNFs to FFL instances.

» **Training** - In the training phase, FFL is trained to find ideal frequencies for different traffic levels. The ideal CPU frequency for a certain traffic level is the minimum CPU frequency that yields zero packet drops. In general, at higher traffic levels, the more CPU frequency is required to keep packet drops at zero. In this phase, the user is initially asked to specify the maximum known capacity of the CNF (Cmax), that is, the maximum amount of traffic that the CNF can sustain in production without errors. Subsequently, FFL attempts to identify the ideal frequencies for a certain number (N) of traffic steps, uniformly distributed in the range between 0 and Cmax, asking the user to feed CNFs with the corresponding traffic rate in each step. The outcome of this phase is a trained model that can predict how traffic is going to vary in the subsequent short-term period and decide the best CPU frequency for the predicted level that avoids packet drops and maintains Service Level Agreements (SLAs).

» **Operation** - In the operation phase, the user launches one or more FFL instances on the machine, one for each different CNF the user wants to control, specifying which trained model should be used for each. This phase may run indefinitely. Each FFL instance dynamically detects changes in traffic load and decides automatically which CPU frequency should be applied to the CNFs as shown in Figure 6.

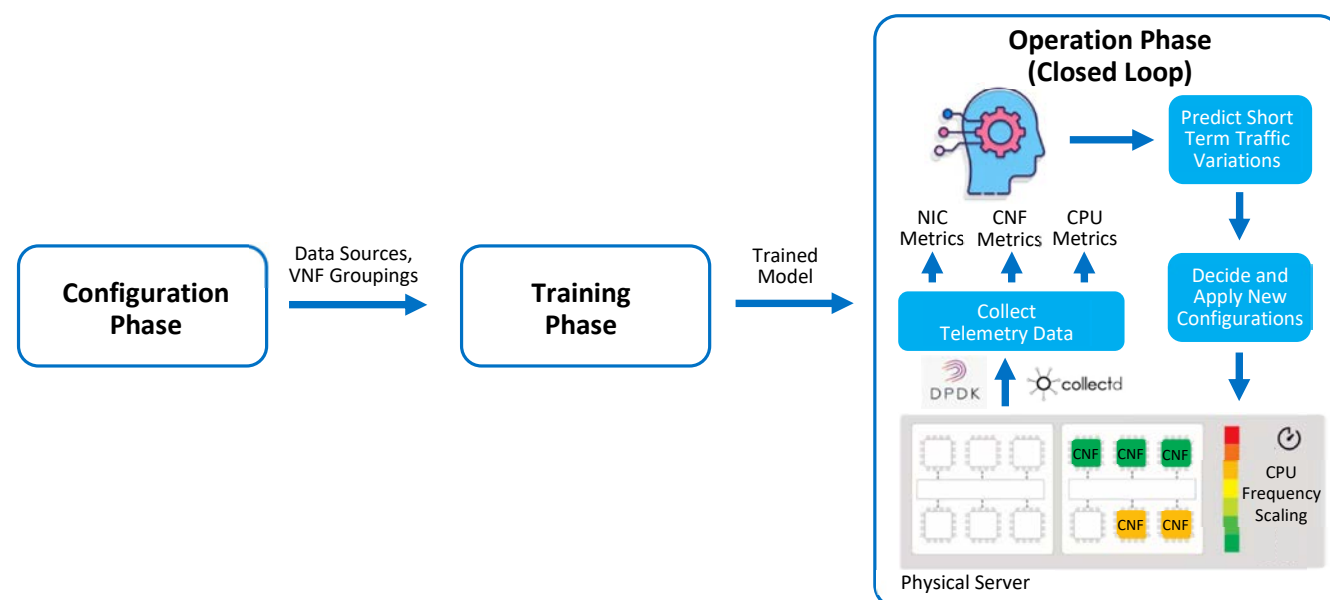


Figure 6: NFV-RI FFL Phases

SOLUTION BRIEF

NFV-RI FFL Agent

A key component in this PoC is the NFV-RI Agent. The Agent monitors:

- » Low-level Performance Monitoring Unit (PMU) metrics on each CPU core, which provide an indication of the actual traffic load handled by that CPU core
- » A packet drop counter from Prometheus running on the Kubernetes platform

The Agent uses this information to determine the P-state (and accordingly the frequency) to which the CPU core can be set while ensuring zero packet drops.

The Agent reads packet drop counts from Prometheus to close the loop as shown in Figure 7. Prometheus gathers packet drops either from the CNF directly, or from the NIC statistics. In our case, we have chosen to use the metric reported by the data plane itself. This closed-loop scheme ensures that the CPU core continually operates at the lowest possible frequency required to handle the predicted traffic load without incurring packet drops.

RESULTS

This PoC demonstrated initial savings of around 30 to 35W with 12 CPU logical cores. However, in a production environment, there are many variables that contribute to overall power consumption, for example:

- » **The High Availability (HA) and Cluster setup** - Greater power savings can be expected in such setups because the traffic load is shared across multiple Data Planes.

References

The following list provides links to information related to the technologies described in this solution brief.

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<https://www.intel.com/content/www/us/en/developer/articles/technical/intel-sdm.html>

- » **The Average Traffic or Data Plane Load** - The higher this value, the less savings can be achieved because there are fewer opportunities to reduce core frequencies.
- » **The number of vCPUs used by Data Plane and managed by NFV-RI** - The higher this number, the greater the power savings because the frequency/power optimization is applied to more vCPU cores.

CONCLUSION

Intracom Telecom's NFV-RI solution, leveraging Intel server telemetry and power management capabilities, provides significant opportunities for power consumption reduction in KDDI 5G network. This solution can contribute significantly to KDDI's quest to become carbon neutral and meet its CO₂ emission targets by 2030.

KDDI is encouraged by the potential for even greater savings and have expressed interest in exploring this solution further. For example, greater power savings can be expected if more than 12 CPU logical cores are allocated to the 5G data plane. It may also be possible to apply other power saving technologies to unused data plane cores, or unused control plane cores, or both, for even greater power consumption reductions. ■

The solution brief was originally published at <https://networkbuilders.intel.com/solutionslibrary/kddi-and-intracom-telecom-collaborate-on-more-efficient-5g-network-power-usage-supporting-lower-co2-emissions>



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