Sustainability and Energy Efficiency was the name of the game at the Q2 Town Hall Innovation Series!

Building on the first inaugural Town Hall Innovation Series (THIS) sessions at the Q1 Broadband Forum meeting in Dallas, sustainability and energy efficiency was the subject matter focus of this meeting's session.

Thank you to all of our speakers!

The THIS sessions take place at our face-to-face meetings, and we are inviting speakers. The strategic theme for the upcoming Q4 meeting will be announced this Summer.

The topics presented at the THIS sessions align with BBF's strategic vision and industry trends. These topics are expected to stimulate future work for the Forum and act as a catalyst for new projects.

Please contact THIS@broadband-forum.org if you would like to present on a subject matter or suggest a new topic for discussion.

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Broadband energy consumption, how big it is and how to reduce it

The importance of broadband equipment complying with the EU Code of Conduct for Broadband Communication Equipment was outlined during an insightful presentation from **Paolo Bertoldi, Senior Expert at European Commission.**

Led by the European Commission Joint Research Centre, the European Union Broadband Code of Conduct is "a flexible mechanism to fill the policy vacuum till today." It creates an open and continuous dialogue on markets, technologies, efficiencies, and performance, so key issues and solutions to them can be identified. The ultimate goal is to raise awareness with decision makers and investors, develop a set of easy-to-understand set of metrics, and produce a common set of principles aligned with other international initiatives.

While it does not include STBs, TVs and computers, the Code of Conduct provides operators with power consumption information of their network equipment and end-users with broadband equipment that is energy efficient.

It is just one small aspect of Europe's sustainability efforts, which also include the EU Green Deal and the target to be climate neutral by 2050.

During his presentation, Bertoldi recognized the positive role that ICT and communication networks can play in reducing the environmental impact in other sectors, such as transport, and buildings. But, he said, more data is needed in the European Commission's studies to assess the energy consumption of broadband transmission networks and monitor network energy usage. So far, there is only some data readily available from studies in France, Belgium, and Finland.

Bertoldi asked Broadband Forum members to share any company studies or reports confidentiality to help the European Commission Joint Research Centre track and monitor the overall energy consumption as a limited number of studies currently provide estimates of consumption.

Bertoldi indicated that more telecommunications companies need to get involved and play their parts in achieving greater sustainability by committing to the Code of Conduct principles. To get involved, please reach out to paolo.bertoldi@ec.europa.eu.

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Energy Fingerprinting through standards can deliver energy cost savings

Collecting energy consumption information at the same time as identifying devices in a home network could deliver significant environmental benefits for the planet, cost savings for homeowners, and new revenue opportunities for broadband operators, according to **Gavin Young, Vodafone Head of Fixed Access Center of Excellence.**

Currently, connected devices in the home can be identified in real-time using network data. This is known as 'device fingerprinting'. By extending simple data models in device identification to include energy consumption characteristics, energy consumption of connected devices can be measured, and we can build on the progress of device fingerprinting to capture an energy fingerprint.
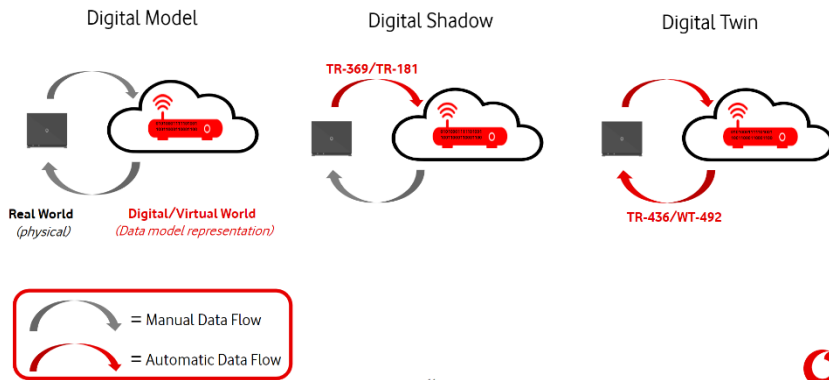
By building on the concept of digital twins, telemetry can be leveraged to create an 'energy digital shadow' in the cloud of a customer's home. The likes of machine learning, analytics, and closed loop automation can help learn device usage patterns, which devices consume

the most energy and propose energy reduction approaches without impacting the customer's normal activities.

Devices can be identified and modelled against set parameters, or measurements taken from a "virtual meter" from the Residential Gateway to the cloud. A dashboard can be constructed and provide information to customers, place devices in sleep mode, and advise what to turn off and when. The app can rank devices according to consumption, have a clear gauge of consumption readings (red, amber, green), and information on what time of day they are used, leading to dramatic cost savings.

Digital Shadow versus Digital Twin

Digital Model — Digital Shadow — Digital Twin

TR-369/TR-181

TR-436/WT-492

Real World (physical) — Digital/Virtual World (Data model representation)

= Manual Data Flow
= Automatic Data Flow

Young was quick to point out that turning off devices or putting them in sleep mode would achieve savings that are a small percentage of the overall household energy bill (compared to heating, cooking etc.). However, if this approach is adopted by a million customers or more then the planet will benefit immensely.

Once the digital shadow of a household has been developed and stored in the cloud, its data could be offered to third parties (only with prior user consent). This could be a newfound revenue opportunity as energy companies could pay operators for such granular data insights and offer more customized tariffs (potentially helping them better load balance the electricity grid too).

Young recognized that standardization was essential to make the concept of energy fingerprinting a reality. There is an opportunity for broadband operators, namely through leveraging TR-369/USP plus associated TR-181 data models, to have an accurate and granular insight of the home as the number of devices grows. By forging strong liaisons with other SDOs, such as Matter, a unified vision of energy fingerprinting can bring innumerable benefits in the years ahead.
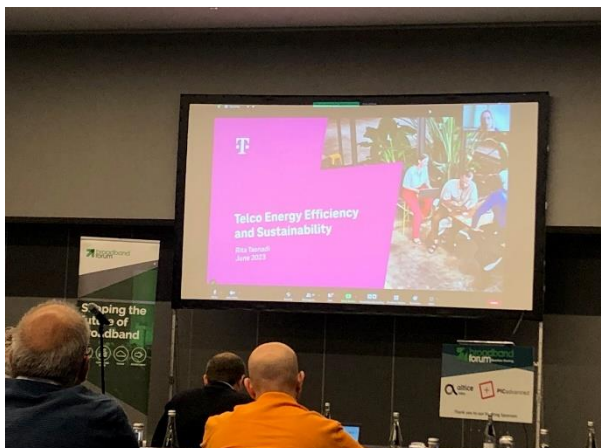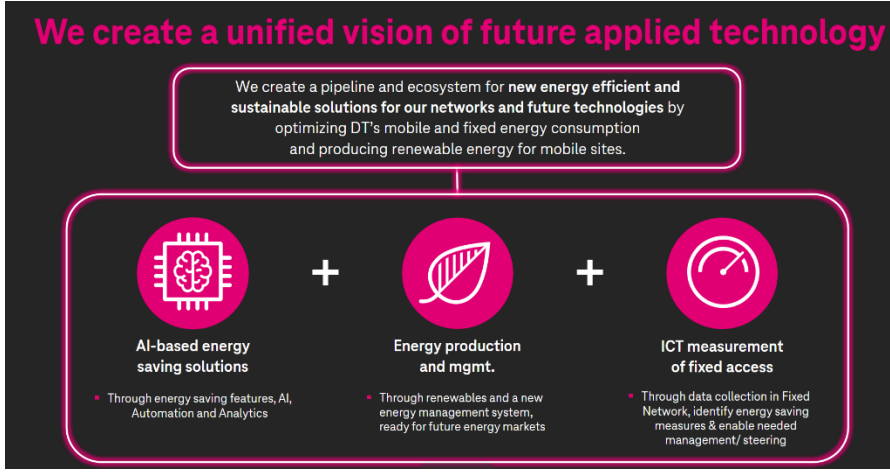
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"The best network is the sustainable network"

Rita Tasnadi, Vice President Telco Energy Efficiency and Sustainability at Deutsche Telekom (DT) called for telcos to work with standards development organizations to deliver more sustainable networks.

During the session, Tasnadi identified the challenges the industry currently faces, such as limited renewable energy availability with companies all going green at the same time, price volatility, fluctuation of supply and demand, and rising data volumes. This is why DT, like all other companies and industries, has had to rethink its way of operation.

At its most recent Capital Market Day, DT advised that it was aiming to double its energy efficiency by 2024 and is committing

We create a unified vision of future applied technology

We create a pipeline and ecosystem for **new energy efficient and sustainable solutions for our networks and future technologies** by optimizing DT's mobile and fixed energy consumption and producing renewable energy for mobile sites.

AI-based energy saving solutions
- Through energy saving features, AI, Automation and Analytics

Energy production and mgmt.
- Through renewables and a new energy management system, ready for future energy markets

ICT measurement of fixed access
- Through data collection in Fixed Network, identify energy saving measures & enable needed management/ steering

to further retiring legacy equipment. With energy at the top of most companies' agendas, innovation is key, Tasnadi advised.

By creating a unified vision of future applied technology, the ecosystem would be well placed to adopt new energy efficient solutions to optimize mobile and fixed consumption and produce renewable energy for mobile sites. Using AI-based energy saving solutions, energy production and intelligent management is key for future energy markets and ICT measurement of fixed access.

"The best network must be a sustainable network. As an industry, we must act responsibility and create energy efficient networks operation, and a lot of measures are needed as we need to continuously work to develop new innovations and cooperate with SDOs to tackle this challenge," Tasnadi stated. "We are all trialling this out, but no one has a best practice yet so undertaking this journey together is the way forward."

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Harnessing standards to improve the energy consumption of BNGs

Broadband Forum's work on disaggregation and Subscriber Session Steering can help enable a more energy efficient deployment for the BNG. This was the message delivered by **Jonathan Newton, Distinguished Technical Expert at Vodafone.**

Through BNG disaggregation, over-deployment will be avoided by simplifying the scaling of the system, greater resilience will be delivered, and different User Plane types can match the performance and efficiency requirements of certain services. Meanwhile, Subscriber Session Steering can enable a per subscriber choice of the User Plane, eliminate any 'on-path' resources constraints, and unlock on-demand scaling.
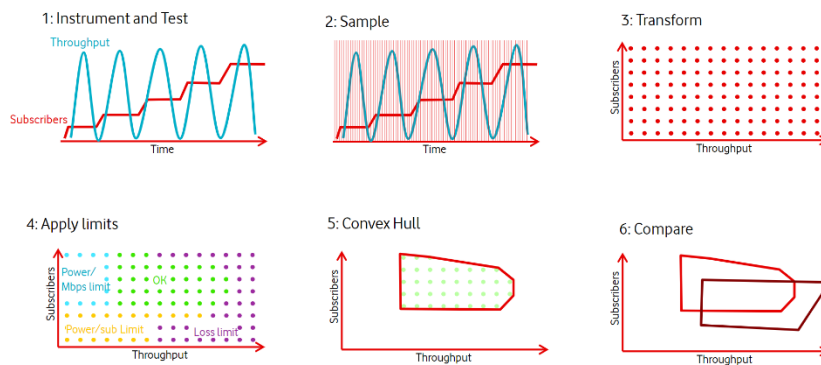
However, challenges for achieving greater energy efficiency in BNG deployments remain. These include the lack of value of headline power consumption, right-sizing deployments (as throughput, load, and subscribers continually change), the significant difference between average and peak loads, and quantifying the real benefit of new power saving techniques.

One approach to overcoming the challenges is to analyse and compare the performance of BNGs in a lab environment to validate peak performance and load. In the past, tests have highlighted how a BNG performs when maxed out, but that does not paint the full picture. Newton advised that it is more important to test how it operates over a full range across variation subscriber load, expected throughput, and latency. Limits can be applied such as maximum throughput, watts per subscriber, and latency and loss, allowing the efficient range of operation to be determined. These limits may vary by application such as added-value services, gaming, and enterprise services.

An approach to analyse and compare BNG

By characterizing and visualizing BNG performance, broadband operators can identify where it performs well and is most efficient.

Newton added: "As operators continue to seek better characterisation and comparison of the BNG before deployment, it is clear that disaggregation and Subscriber Session Steering will play a fundamental role."

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Unlocking the Sustainable Home Network

A sustainable home network is a key opportunity for broadband operators to seize, according to **Christian Gacon, Vice President Orange Labs Network at Orange**. Today, operators directly account for 15% of the home network's CO_2 emissions.

Gacon advised that a sustainable home network can be unlocked by lowering the energy requirements per device, improving product lifecycles, and using future-proof technologies for longer shelf lives. Encouraging circular economies by recycling materials and refurbishing devices can also help operators better manage the home network's environmental impact.

The Home Gateway's idle time power consumption of 90% was pinpointed as a key area to target to reduce energy. Better sleep modes are an obvious solution to improve this situation, Gacon pointed out. Nonetheless, if operators want them to be used, they need to consider what each costumer expects from their Home Gateway. For example, if Wi-Fi is used to connect security devices, it should not be

disabled when the customer is not at home. AI may help to activate sleep mode when possible.

Gacon warned that operators cannot do this alone. Chipset manufacturers need to improve their low energy features, optimize their manufacturing processes, and work with local manufacturers where possible. Improving CPE with features that lower consumption, helping subscribers reduce device numbers, and lowering the consumption of unnecessary devices (such as radio bands) are all additional tactics that operators can deploy.

In turn, Gacon said, improving the home network is not only beneficial for sustainability but can also encourage more people to take up remote working if there is traffic prioritization, such as video calls given precedence over gaming, improved cyber security, and enhanced Quality of Experience. An improved home network would also alleviate the load on the mobile network as customers would use Wi-Fi at home instead of their cellular radio network.

"If operators adopt equipment with sleep modes, migrate router functionality to the edge, educate consumers about digital sobriety, and cooperate with SDOs across the broadband ecosystem, the slice of the home network pie is there to be taken," he added.

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