METRO-HAUL Year 1 Newsletter

August 2018

YEAR 1 IN REVIEW

Recent estimates suggest that by the year 2025 over 1.4 billion users will be using 5G mobile connections to access high bandwidth services such as 4K video streaming, enhanced reality, and massive multi-player mobile gaming. This will put a lot of pressure on the network infrastructure.

In 2017 our METRO-HAUL consortium was awarded €7.7 million by the European Commission to fund ambitious research into the application of scalable optical networks to future 5G wireless technology and services.

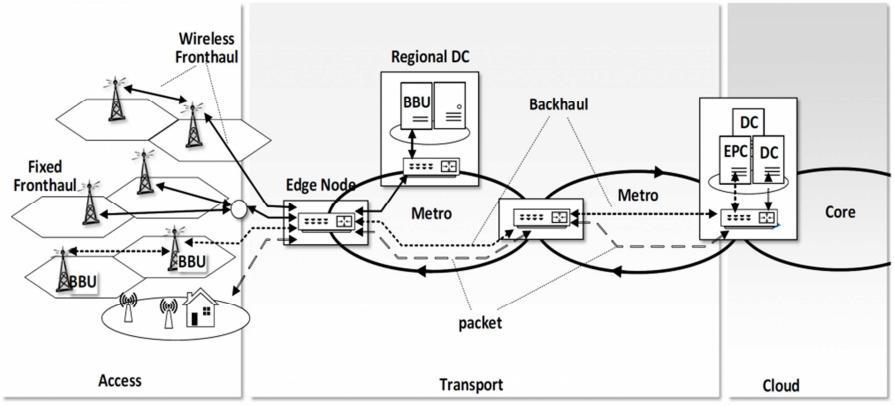
The objective of the METRO-HAUL project was to architect and design cost-effective, energy-efficient, agile, and programmable metro networks that are scalable for 5G access supporting next generation Internet services, while capable of fulfilling future requirements.

BT leads the project of more than 20 partners, with a planned duration of 36 months of activities. It started in June 2017 and will run until May 2020.

Our Year 1 work has encompassed the design of all-optical metro nodes that will include full compute and storage capabilities that will interface with both 5G access and multi-Tbit/s core networks capable of elastic dimensioning.

We developed real 5G use cases and outlined their requirements, with ongoing techno-economic analysis of those use cases. These use cases include video security for Smart Cities, and Crowdsourced video streaming.

The METRO-HAUL presence at leading optical and networking events has been very impressive in the first year of the project, including a strong representation at OFC in San Diego, Optical Network Design and Modeling (ONDM) in Dublin, and the International Conference on Transparent Optical Networks (ICTON) in Bucharest. In total the METRO-HAUL team has published more than 50 articles in peer-reviewed journals, and attended more than 20 leading International conferences, workshops, and Standards meetings.



TO SLICE OR NOT TO SLICE, THAT IS THE QUESTION

One of the questions exercising the partners in the METRO-HAUL project is "What is a network slice?"

There are several base definitions that can be drawn upon, although many of these are specific to layers in the network, to the technologies in use, and to the services being delivered. This focus on environment-specific details leads to definitions and interpretations that do not translate well to generic applications and environments.

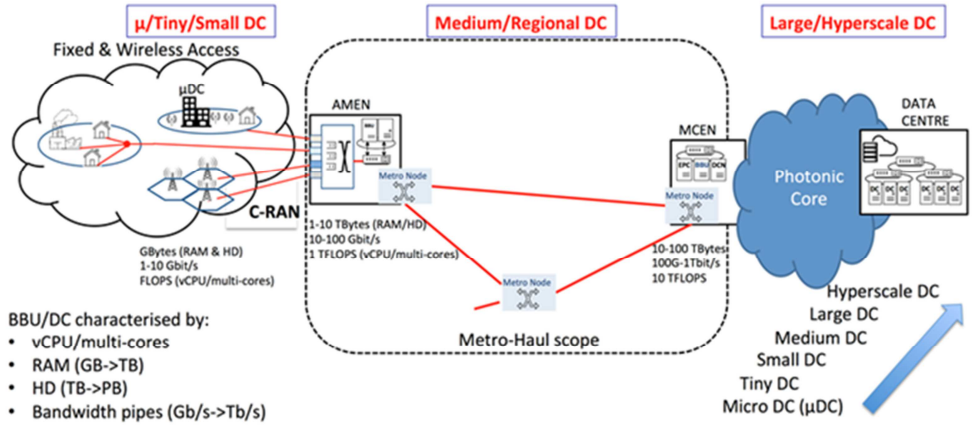
Furthermore, this approach can lead to attempts to consider complete end-to-end and top-to-bottom slicing solutions that would result in optical equipment being sliced dependent on (and to support) individual user-to-user 5G calls.

TECHNOLOGY TRENDS AND MARKET OUTLOOK

One of the main reasons METRO-HAUL is already so successful relates to the timeliness of its main theme: how optical networks should evolve to handle future 5G services. 5G is clearly a huge global development unlocking many applications that require, not just high bandwidth, but potentially low latency, edge-compute/storage functions, and many end points for IoT-related applications.

Within the first year, the project adopted a general "high-level" perspective, considering trends emerging in recent technology and market outlook surveys. Several use cases were defined and characterized in high detail, and their impact on METRO-HAUL was quantitatively evaluated. The project assumes 5G as the main access technology and the work analyzes the possible 5G transport architectures and how they can be mapped onto the METRO-HAUL architecture.

Transmission distances range between 50km and 200km. To meet the METRO-HAUL objectives, both storage and computing resources are necessary in both Access Network Nodes (AMEN) and the Metro Core Network Nodes (MCEN). These resources may be used to host one or more controllers and/or network monitoring functions, all of which have open interfaces capable of connecting to the various network components and nodes in the optical transport layer.



SDN-Based Control and Monitoring

Control and monitoring functions are required and play an integral role within METRO-HAUL. An SDN-based platform has been designed to control the assignment of both computing and transmission resources within the network. The SDN controllers interact with the data plane via the monitoring system. Network functions will be instantiated and hosted using NFV-enabled platforms. The project has published several key deliverables in year 1 outlining these capabilities including:

- Deliverable 3.1 : Selection of Metro Node Architectures & Optical Technology options – June 2018.
- Deliverable 4.1 : Control & Management Requirements Framework – June 2018.

Much of this network slicing conversation is reminiscent of the old "bandwidth on demand" discussions that we had more than 15 years ago. At that time a lot of people talked past each other, but it was clear that no operator wanted to turn up a high-capacity optical path to support a micro flow in their IP network.

To advance the discussion of network slicing more meaningfully, we need to settle on a simple, generic, and abstract definition. Once we have that in place we can consider the applicability of different aspects of network slicing to different layers of the network, to different applications and use cases, and to different network technologies.

And then we can look at the hierarchy of network slicing that spans networks, crosses network administrations, and can be applied to a number of technologies. In this hierarchy, there will be a need for technological and administrative interfaces, and multiple software packages will need to be integrated to build a full-function system.

This presents yet another impact opportunity for METRO-HAUL.

DISSEMINATION THROUGH SOCIAL NETWORKING

Communicating the status and developments of the METRO-HAUL project is a really important outcome for the project. For that reason, the project is actively engaged in a range of dissemination activities beyond the large number of conference appearances and journal papers.

- The METRO-HAUL account at ResearchGate (https://www.researchgate.net/project/Metro-Haul) allows partners to publicise their papers and articles to a wider readership. This is an important resource for other researchers and helps METRO-HAUL participants to share their work and make it publically available
- Twitter is, of course, a key way to let the world know what is going on. The METRO-HAUL twitter account (https://twitter.com/MetroHaul) is used to let everyone know about new work, papers, conference talks, and related developments. The Twitter feed applies not only to the many followers of the project, but is also valuable within the project to help the partners keep in touch.
- There is a new METRO-HAUL channel on the video content provider YouTube (https://www.youtube.com/channel/UCnxS679kyoHgtWNLv1_4eLA) is going to be built up to carry project tutorials and presentations from conferences. Currently the channel contains presentations from OFC 2018 and from Layer123's SDN/NFV conference.
- The professional business community's social networking and contact site is LinkedIn. METRO-HAUL has a group (https://www.linkedin.com/groups/13543287) has been set up to see whether we can attract more interest and connection and thereby promote dissemination more widely.
- As well as these publically hosted outlets, METRO-HAUL also runs a blog where we report major events and results, and debate issues relevant to the project (https://metro-haul.eu/media-corner/blog/).

News Coverage

In order to attract attention for the project and increase effective dissemination, the project issues Press Releases for key events. Each PR is archived on the project web site on the "Latest News" page (https://metro-haul.eu/media-corner/latest-news/) and is circulated to a long list of media outlets by the project and by the press offices of some of the partners. We also track some of the press hits on the project wiki just so we know how effective we have been.

Plenary Meetings and Project Gatherings

METRO-HAUL has held three plenary meetings: in Ipswich, UK hosted by BT; in Castelldefels, Catalonia/Spain hosted by CTTS; and in Lisbon, Portugal hosted by Coriant. These meetings are essential for project coordination, but they also facilitate rapid advances in project work through face-to-face discussions and heated debate among project partners: there is no substitute for sitting in a room together with a whiteboard.

Of course, these plenary meetings also allow the project partners to get to know each other socially. And that pays great dividends as the project work advances because it is a lot easier to do collaborative work with remote partners when you have a personal relationship with your collaborators.

YEAR 1 : GOLDEN NUGGETS

A major issue with metro networks supporting future 5G function with the 5G requirements of low latency, high bandwidth, and very dynamic services, is the need for huge optical resources which, given current technology, will be prohibitively expensive.

The METRO-HAUL project is therefore proposing a new, cost effective optical architecture, which uses either Photonic Integrated Circuit (PIC)-based optical filters or simple passive optical splitters to considerably reduce the cost of the optical layer. In addition, the work also explores the use of low-cost, low-complexity sliceable bitrate variable transceiver technologies (e.g. using DSPs) to exploit the shorter total fibre length of metro networking.

After one year of work in the Metro-Haul project, we can already describe the following three Golden Nuggets of achievements and results, to highlight the technical progress of the project:

Demonstrating a Dynamic, Intelligent Control Architecture

Our 5G slices to be provisioned E2E, taking account of their individual KPIs, in scenarios involving multiple network segments and layers, spanning multiple geographical Data Centre (DC) locations and addressing resource heterogeneity including, notably, the optical transport.

Without this architecture and Control Plane technology, network resources supporting future 5G services would require enormous over provisioning, of both optical transport capacity across metro and core networks, and edge DC resources such as compute and storage.

Multilayer Disaggregated and Open Transport Networks

We demonstrated the benefits of applying a systematic and unified approach based on model driven development for the SDN control of multilayer disaggregated and open transport networks.

This facilitates flexibility in deployment choices, extensibility for the integration of new technologies and agility in migration processes without vendor lock-in.

Telemetry Framework for Monitoring & Performance Analysis

The project has implemented a telemetry/monitoring framework which provides a global, real-time view of the E2E 5G network performance without requiring a huge data communications channel bandwidth or storage requirements.

This new technology will enable 5G services to be set up and then maintained reliably, whilst providing pro-active early warning of reliability issues. Machine Learning within the decision engine allows this new Metro-Haul technology to continually learn and improve as real network data is collected.

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