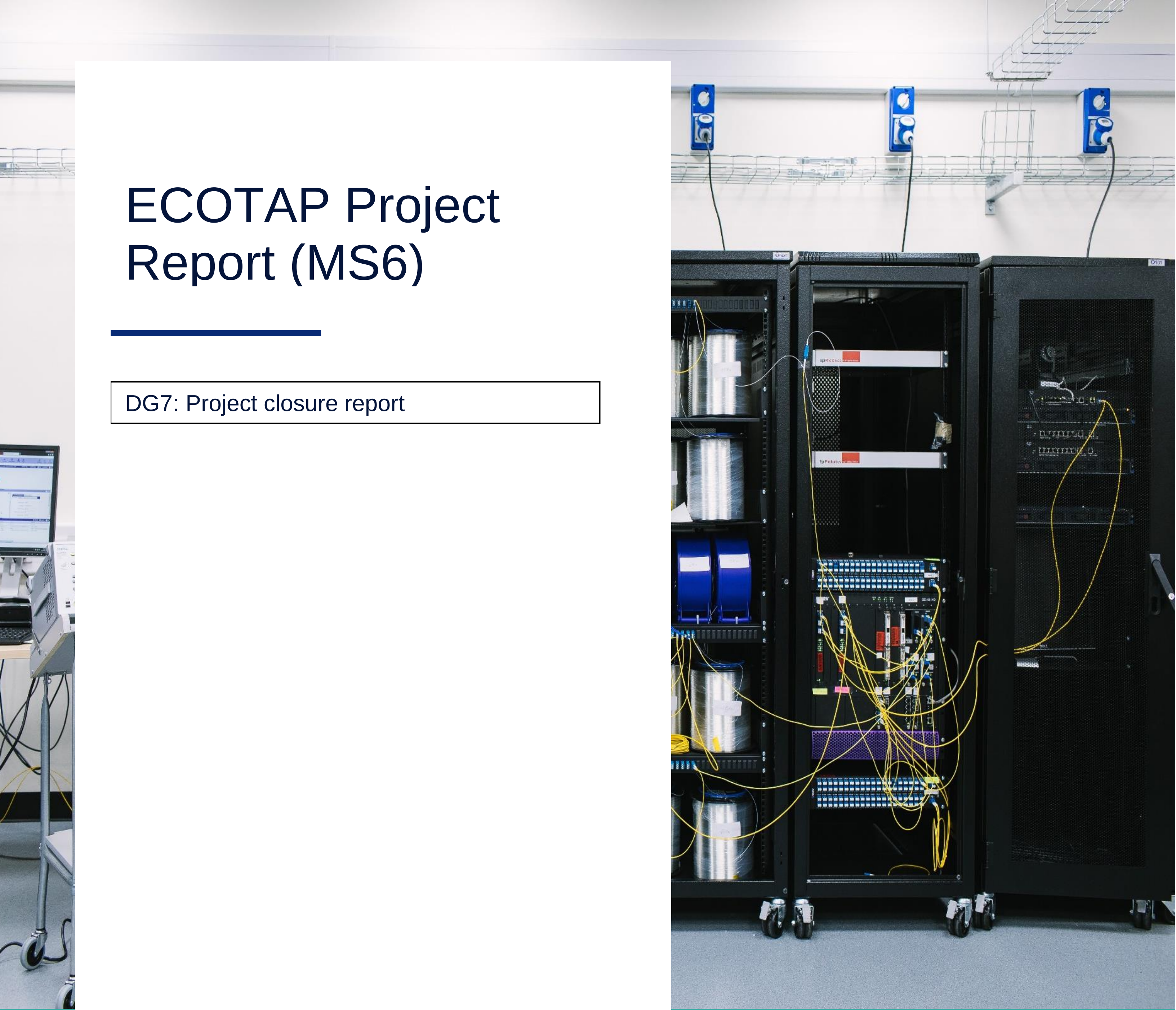

ECOTAP Project Report (MS6)

DG7: Project closure report

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ULTRACELL NETWORKS

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1 ECOTAP Project Review

The growing demand for data and applications such as deep learning has led to a surge in network traffic and energy consumption. Traditional server architectures are inefficient, driving up costs and energy use. The ECO-TAP project tackles this by using server disaggregation, where servers are dynamically assembled from essential components. This increases resource efficiency, reduces energy consumption, and lowers costs. The project also introduces a Hybrid Cellular-Switched Topology to improve server connections' energy efficiency and performance.

This project review aims to provide a comprehensive evaluation of ECOTAP project's R&D efforts. We will assess the project's success against its intended scope, aims, and benefits, and identify key lessons learned. This review will offer valuable insights to inform and enhance future projects.

1.1 Project Aim and Objectives

The ECO-TAP project aims to develop energy-efficient and flexible data centre network architectures optimised for the disaggregation of servers. By breaking away from traditional rigid server designs, the project envisions a system where CPUs, memory modules, and network interface cards (NICs) are housed in separate racks and dynamically assembled on demand. This approach improves server resource utilisation and significantly enhances energy efficiency. To achieve this, the project designed novel algorithms that efficiently manage the composition and disintegration of these disaggregated servers, ensuring that energy efficiency remains a primary driver in the process.

A key innovation of the project is the introduction of the Hybrid Cellular-Switched Topology, which merges concepts from both cellular and switched networks. This topology takes advantage of the multidimensional nature of optical networks, where routing can occur across time, wavelength, and space domains. This novel approach allows for dynamic interconnects between disaggregated resources, ensuring rapid adaptation to varying workloads while optimising overall performance.

The objectives of the ECO-TAP project are centred around three key innovations. First, it aims to develop novel data centre network architectures specifically designed to optimise the energy efficiency of server disaggregation. Second, it creates advanced algorithms for the composition and disintegration of disaggregated servers, with a primary focus on minimising energy consumption. Lastly, the project employs a modelling tool to analyse and visualise practical scenarios to demonstrate the benefits of ECO-TAP architecture in real-time for dynamic resource allocation and reduced energy consumption.

1.2 Project Achievements

The ECOTAP project has reached its successful closure, delivering on several critical objectives that have substantially advanced the energy-efficient of server disaggregation. Over the course of the project, several key objectives were met, concluding in notable technical achievements.

The objectives of the technical development activities of the ECOTAP project are the development of energy-efficient data centre network architectures for server disaggregation, advanced algorithms for the composition and disintegration of disaggregated servers, and the development of a modelling tool.

2 Project Challenges and Lessons Learned

Over the course of the ECOTAP project some challenges were encountered and mitigated. Several lessons were also learned during the ECOTAP which would inform and direct the development of the technology to higher TRLs.

2.1 Challenges

The completion of all tasks and deliverables in the ECOTAP project is not without challenges. However, the team of engineers on the project were able to mitigate the challenges to ensure successful completion of the ECOTAP project. Some notable challenges are discussed as follows:

- **Delays in Signing GFA:** The Grant Funding Agreement (GFA) signing was delayed by approximately two months due to the due diligence process required to ensure all annex documents were agreed upon. To mitigate this, Ultracell Networks assigned team members to manage the delay, ensuring the project's progress was not significantly affected.
- **Recruitment Delays**: Recruitment delays occurred as a result of the GFA signing delay, affecting resource allocation. To address this, Ultracell Networks advertised roles to fill the gaps, and the project PI stepped in to cover the labour shortfall, ensuring key project milestones continued as planned.

- **Supply Chain Challenges**: The global chip shortage led to delays in obtaining servers and cards, posing a risk to project timelines. To mitigate this, Ultracell Networks secured equipment loan agreements with suppliers to bridge the gap and adjusted the project plan by prioritising mathematical optimisation and software development in the initial quarters, reducing immediate reliance on hardware.

- **Increased Component Prices:** Rising component costs at the start of FY 24/25 created budgetary pressure. Ultracell Networks mitigated this by leveraging strong supplier relationships to negotiate better prices and secure early commitments on key components.

2.2 Lessons Learned

The ECOTAP project has provided several critical insights into both management and technical aspects. These lessons not only shaped our approach but also enhanced our project's overall execution and outcomes. Below is a detailed summary of these lessons, their implications, and their value to the project.

1. Management lessons learned:

- **Commercial GFA Process Improvement:** The GFA process should be reviewed to ensure timelines align with project start dates. Allowing more time for the GFA process before projects begin would reduce delays. Earlier notification of competition winners by DSIT would also provide sufficient time for due diligence, improving overall project planning.

- **Improved Project Planning and Resource Allocation:** Delays in recruitment highlighted the need for better contingency planning. Assigning backup staff or securing temporary resources in advance can help mitigate risks. Establishing clearer timelines for GFA completion and initiating recruitment as early as possible are essential improvements.

- **Proactive Supplier Engagement:** Rising hardware costs and supply chain delays emphasise the importance of maintaining strong supplier relationships. Securing early commitments on key components, along with negotiated guarantees for timely delivery or cancellation options, can mitigate risks.

- **Enhanced Financial Management:** Costs and supporting evidence should be provided by all project partners no later than one week after milestone submissions to ensure claims are processed without delays. Improved internal processes for tracking expenditure and ensuring alignment with financial forecasts are essential.

- **University Partnership Strategy:** Companies collaborating with universities should establish contingency plans to manage potential administrative delays. Engaging dedicated advisors or project coordinators to guide through university processes can improve communication and ensure smoother collaboration.

2. Technical Lessons learned:

- **Supply Chain Risk Mitigation:** The global chip shortage highlighted the need for proactive supply chain strategies. Placing orders as early as possible, establishing equipment loan agreements with suppliers, and securing guarantees for delivery timelines or order cancellations can significantly reduce the impact of hardware delays.
- **Flexible Project Design:** The project's decision to prioritise mathematical optimisation and software development in the initial stages proved effective in minimising the impact of hardware delays. Structuring project plans to focus on software-based tasks early on can improve flexibility when facing supply chain issues.