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Juan Pedro Fernández-Palacios received the MS in Telecommunications Engineering from Polytechnic University of Valencia in 2000. In Sept. of 2000 he joined Telefonica I+D where his research activities where focused on the design of new data and control plane architectures for IP over optical networks. He is author of 6 patents filled in Europe and US and more than 70 publications in conferences and journals. He was coordinator of two European research projects on optical transport networks (MAINS and IDEALIST) between 2011 and 2014. In 2013 he joined the Telefonica Global CTO office as Head of Transport. In 2016, he also took this position in Telefonica-O2 Germany. From June 2017 to March 2020 he was in charge of the Integrated Transport Centre, a global organization in Telefonica in charge of defining the strategic network planning for IP, DWDM, MW and satellite networks in Argentina, Chile, Peru, Colombia and Brazil. From 2019 he is responsible for Transport Technology in GCTIO and leading iFUSION project for common and vendor agnostic Transport SDN deployment in IP, optical and MW networks within Telefonica Group. Currently, he is co-chairing the MUST and TFS groups within the Telecom Infra Project and ETSI respectively.

Optical Technologies Enabling Responsible AI

ITU Workshop on “Future Optical Networks for IMT2030, AI, broadband and more“. Paris, France, 12 June 2025

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Measuring Responsibility

The term **"responsible AI"** is often used to refer to its application with special focus on ethical principles, societal well-being, and legal compliance

Responsibility is can also be extended on how the development, training and inference of AI models is done**.**

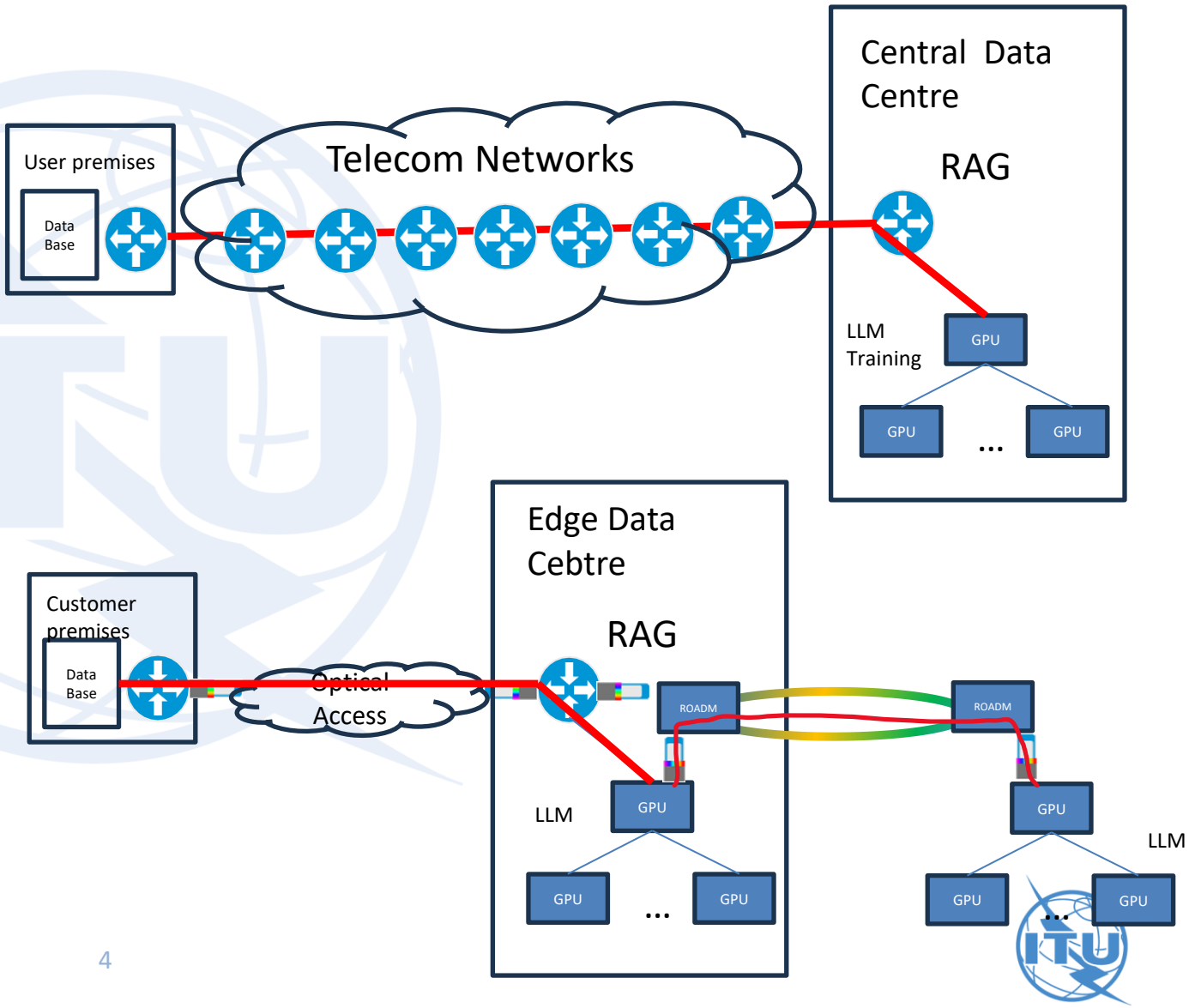
Four basic parameters might be used measure the responsibility of an AI model generation process:

1. **Data security, isolation, and inviolability.**
2. **Energy consumption.**
3. **Survivability, or resilience to catastrophic events.**
4. **Network resources consumption**

Centralized vs Distributed Computing

Centralized Model: AI training and inference in few large data centres connected to users via telecom networks (Internet).

Distributed Model: Multiple smaller data centres which could be connected to users via dedicated fibres or wavelengths and interconnected among them using optical switching technologies.



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Which one is more responsible?

	Centralized	Distributed
Security	Long path between user and GPU with multiple IP hops Encrypted Internet communication	Short path between user and GPU with physical channel isolation via Fiber or wavelength, optical encryption, quantum cryptography
Energy	Huge energy requirements in central locations Increased power consumption in transport networks due to new capacity and cooling demands in multiple IP hops	Energy consumption distribution in multiple locations Optimization techniques based on GPU sharing between telecom real time services and AI training
Survivability	Susceptible to catastrophic failures affecting large regions	Distributed computing systems are resilient to catastrophic failures
Telecom Resources	Huge impact in e2e packet and optical networks access, metro, backbone and international networks.	Minor impact on packet networks Significant traffic increase in optical networks Traffic matrix coul be defined by Telecom operator

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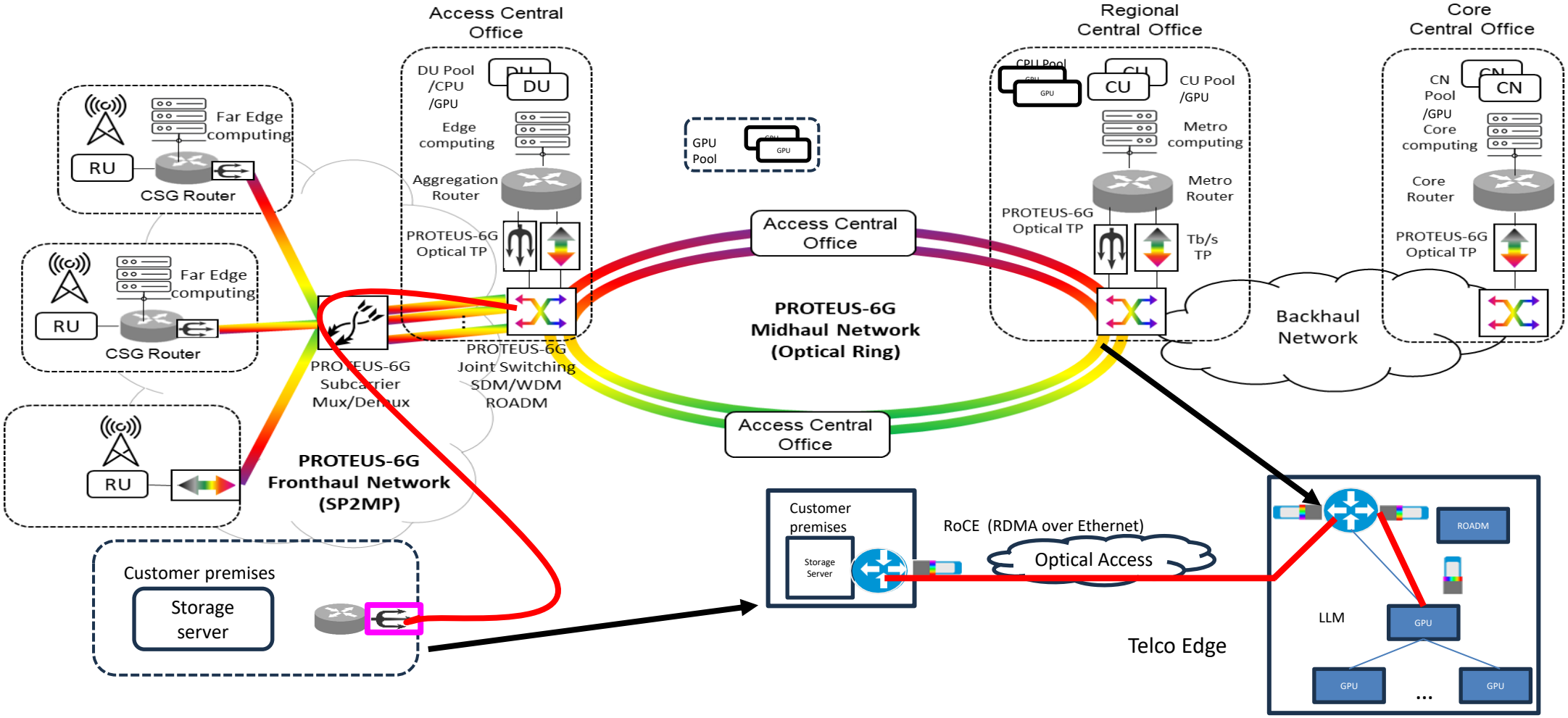
Are telecom Networks ready?

Current networks are not designed to handle the massive traffic that widespread use of **Customized LLMs** would generate.

The **distributed model could be better adapted** to these new services demands due to the availability of **fibre and photonic meshes** with ROADMs deployed by telecommunications operators.

Optical technologies such as **tunable optical transceivers** supporting speeds of 800G to 1.2Tbps, **multiband solutions** extending DWDM spectrum from the C-band to L-band and beyond further support the scalability of distributed architectures

Coherent Pluggable transceivers in Access and Metro networks



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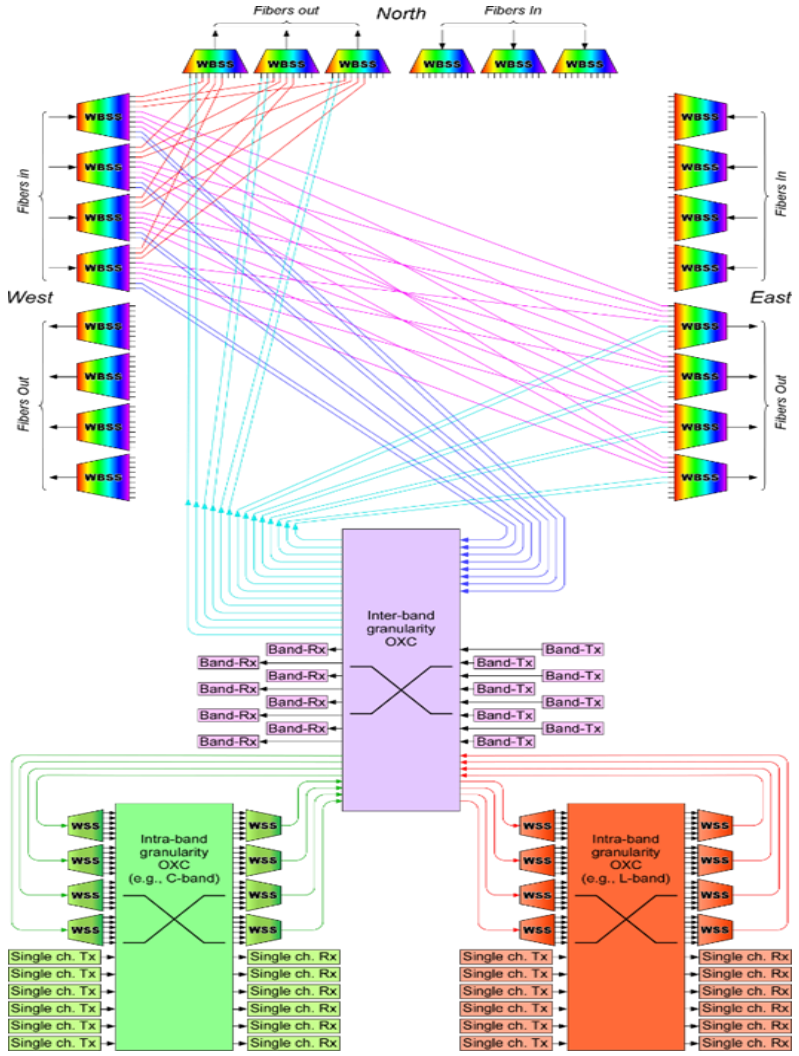
Multigranular Switching Nodes in Backbone

FLEX-SCALE

- **Fiber (Spatial level):**
  Enables scalable capacity through multiple fibers → supports distributed traffic and long-term growth.

- **Band (Waveband level / High-order):**
  Efficient routing of large spectral blocks without per-channel processing → optimizes resource utilization.

- **Wavelength (Channel level / Low-order):**
  Fine-grain processing for adding/dropping individual channels → ideal for detailed or legacy services.



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Conclusions

Current networks are not designed to handle the massive traffic that widespread use of **Customized LLMs** would generate.

Distributed AI training enabled could optimize key aspects such as **security, energy consumption, survivability** and **telecom resources consumption.**

Optical networking plays a key role providing high-capacity, low-latency, secured, reliable and energy-efficient connections, making them ideal for data-intensive AI tasks.

ACKNOWLEDGEMENTS

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Thank you !