



Funet 2020

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13.3.2018 @SIG-Marcomms



CSC – Finnish research, education and public administration ICT knowledge centre

Funet

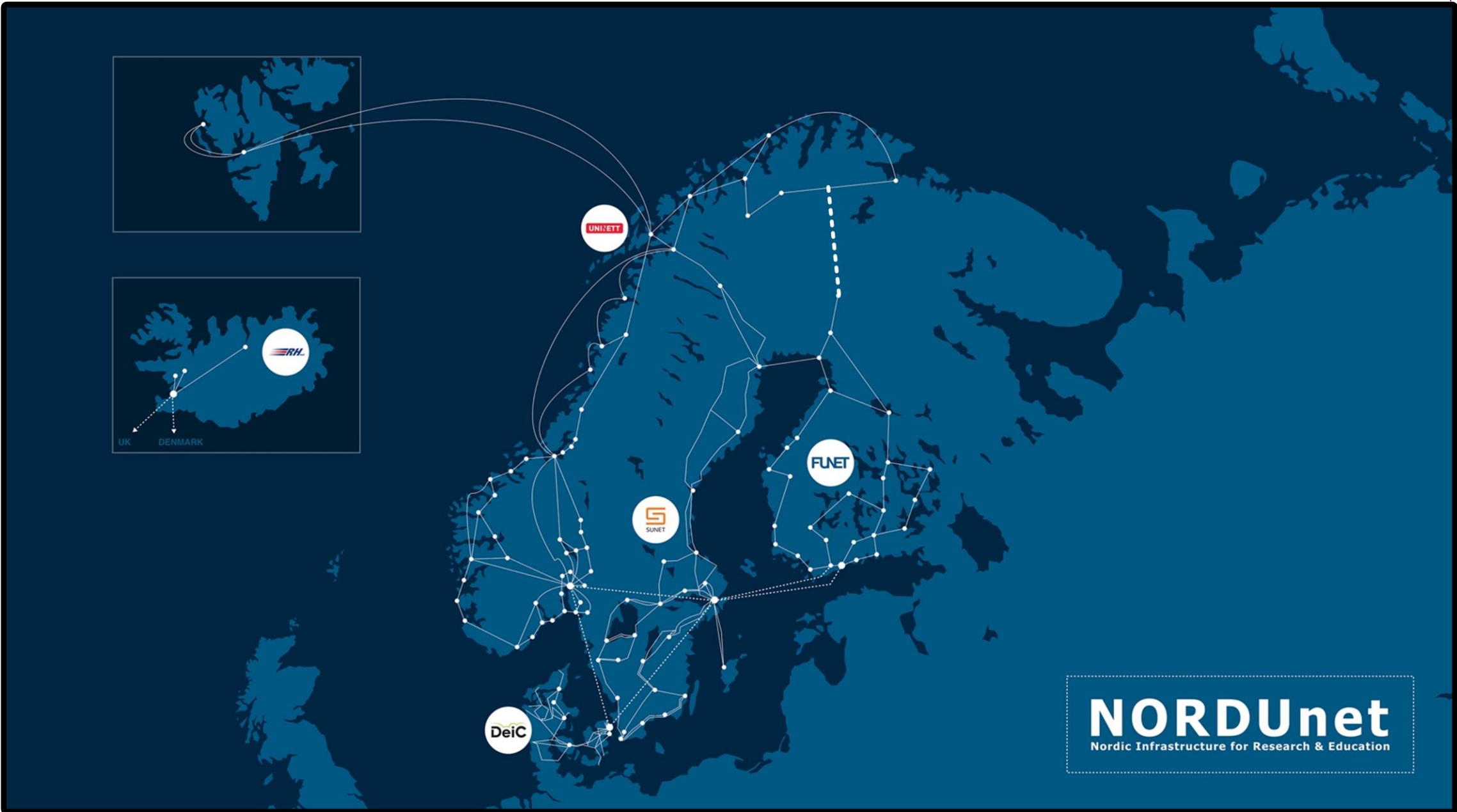
- The Finnish National Research and Education Network
- Used by 75 organisations
 - Universities, polytechnics
 - Research organisations
 - University hospitals
 - Student dormitories
 - Organisations in public administration
- About 370 000 users
- With other Nordic NRENs, was among the first networks outside United States to connect to the Internet.



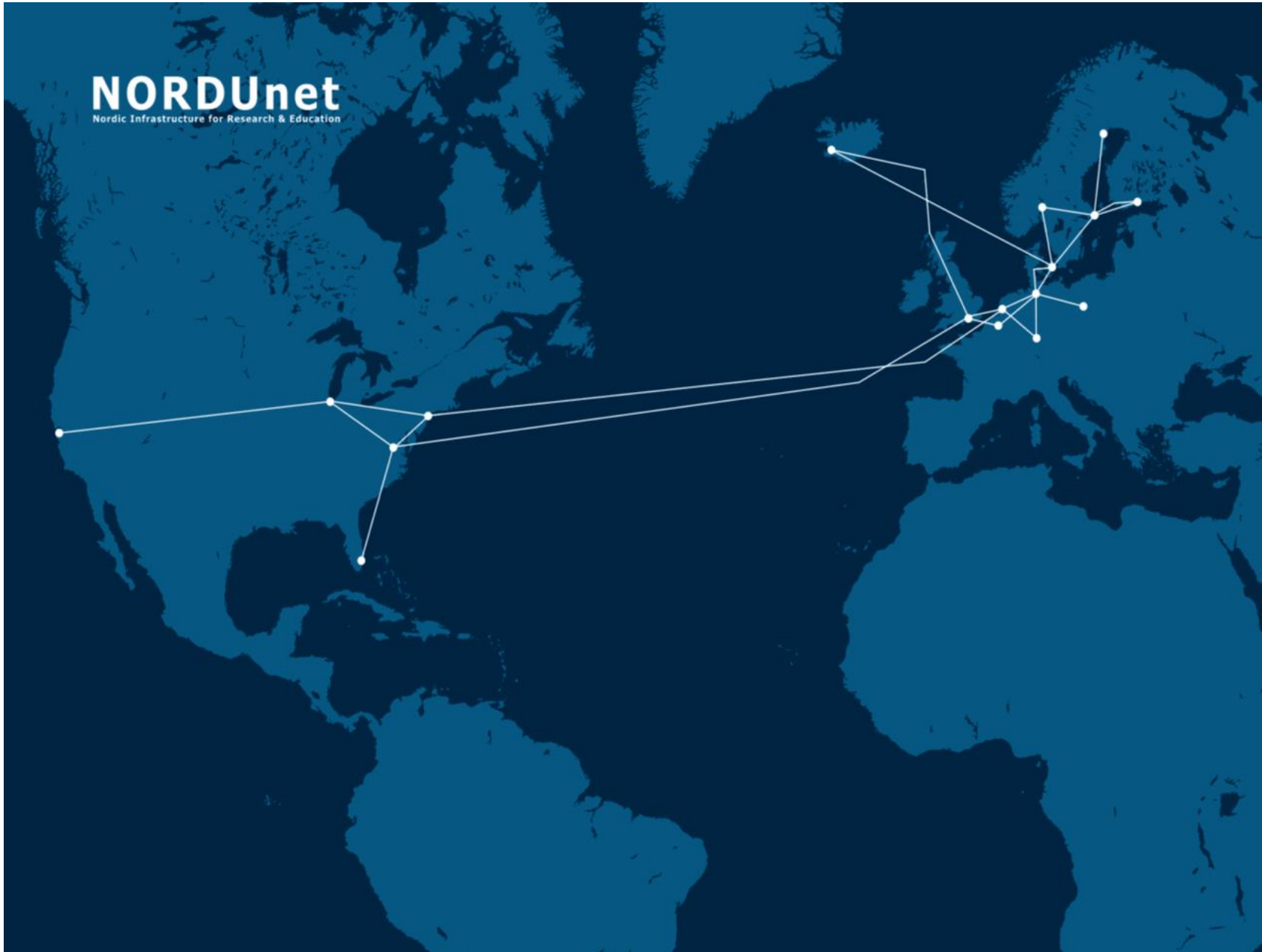
Capacity growth

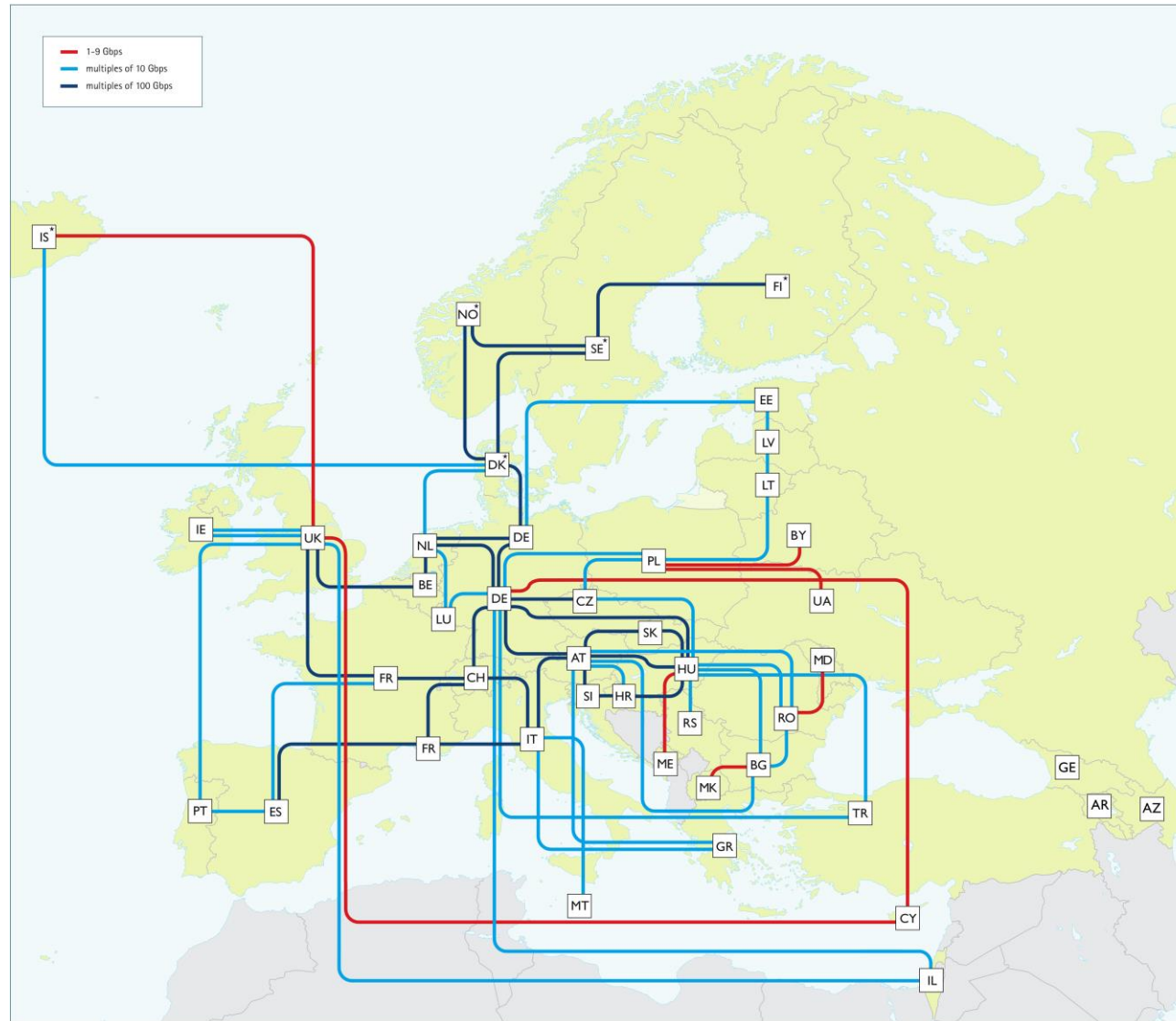
- 29.12.1983: Funet established, 4,8 kbit/s
- 1986: 64 kbit/s
- 1992: 2 Mbit/s
- 1993: 34 Mbit/s
- 1997: 155 Mbit/s
- 2001: 2,5 Gbps
- 2005: 10 Gbit/s
- **2015: 100 Gbit/s**





NORDUnet
Nordic Infrastructure for Research & Education





Funet 2020?

- By 2022 the current “Funet 2007” network has been in operation for quite a long time.
 - The contracts for our backbone fibre infrastructure will end in phases, starting this year.
- Preparations for the next-generation Funet network started in Spring 2016.
 - The target was to plan the required development steps for Funet network in 2018-2022.

Timeline and implementation

- Funet 2020 has been implemented as a series of projects
 - 2016: Funet 2020 planning project
 - 2017: Funet 2020 procurement project
 - 2018-2022: Funet 2020 implementation/transition project
- The work has been done in tight collaboration with the network users
 - For example: universities and research institutions

Funet 2020 Planning: Requirements and Services



Funet 2020 planning

– in tight collaboration with the network users

1. Specifying the Funet 2020 connectivity services based on concrete future needs of organisations using Funet
2. Planning and comparison of different technical and administrative solutions
 - How the required connectivity services could be implemented?
 - Are there any new methods or technologies to implement the services?
3. Justified solution to implement Funet 2020 and its services. Preliminary planning of target architecture and roadmap.
 - Both technically and financially the ideal solutions to implement the services required by Funet organisations.
 - Approved by Funet customer steering group.

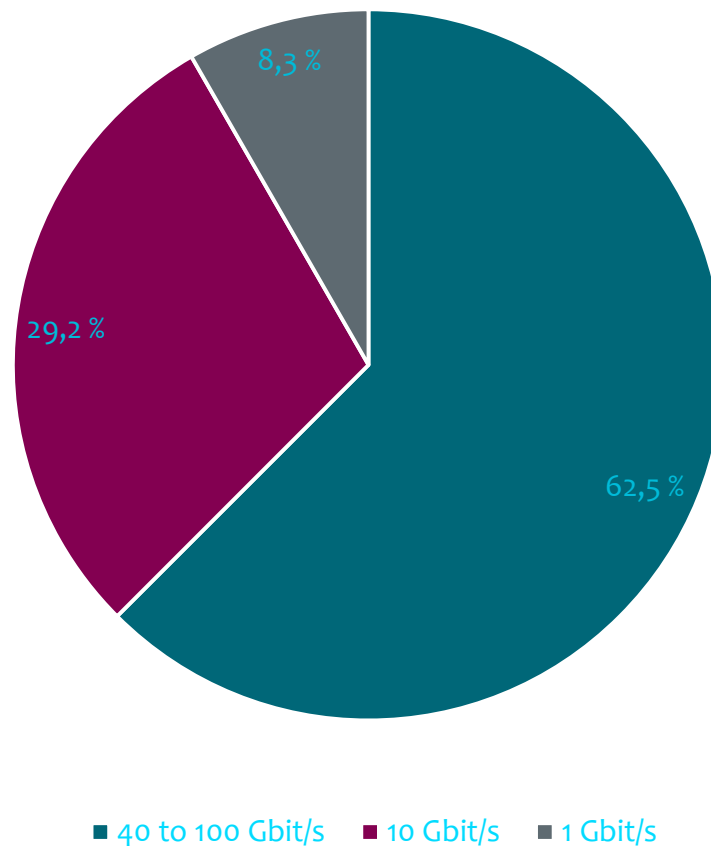
Collecting the future needs of our users

- We collected the needs of organisations connected to Funet in two separate tracks
 - Technical track
 - Management/administrative track
- Funet 2020 planning was a major topic of our annual Funet member organisation meeting (Funet technical days) in June 2016.
 - The work continued in AccessFunet collaboration group in autumn 2016 and January 2017. We also published a web-based user questionnaire to get further information.
- There was a separate working group that focused on Funet 2020 administrative issues.

Some results and feedback from Funet organisations

- The reliability of network connections is critical.
 - The importance of network is significant, and the importance is increasing in the future.
 - Reliability of network connections is more important than dedicated capacity or the used underlying technologies.
- Network latencies are important
 - Especially the availability of short(er) backup routes during fibre cuts
- Good connectivity to service and content providers is valued.

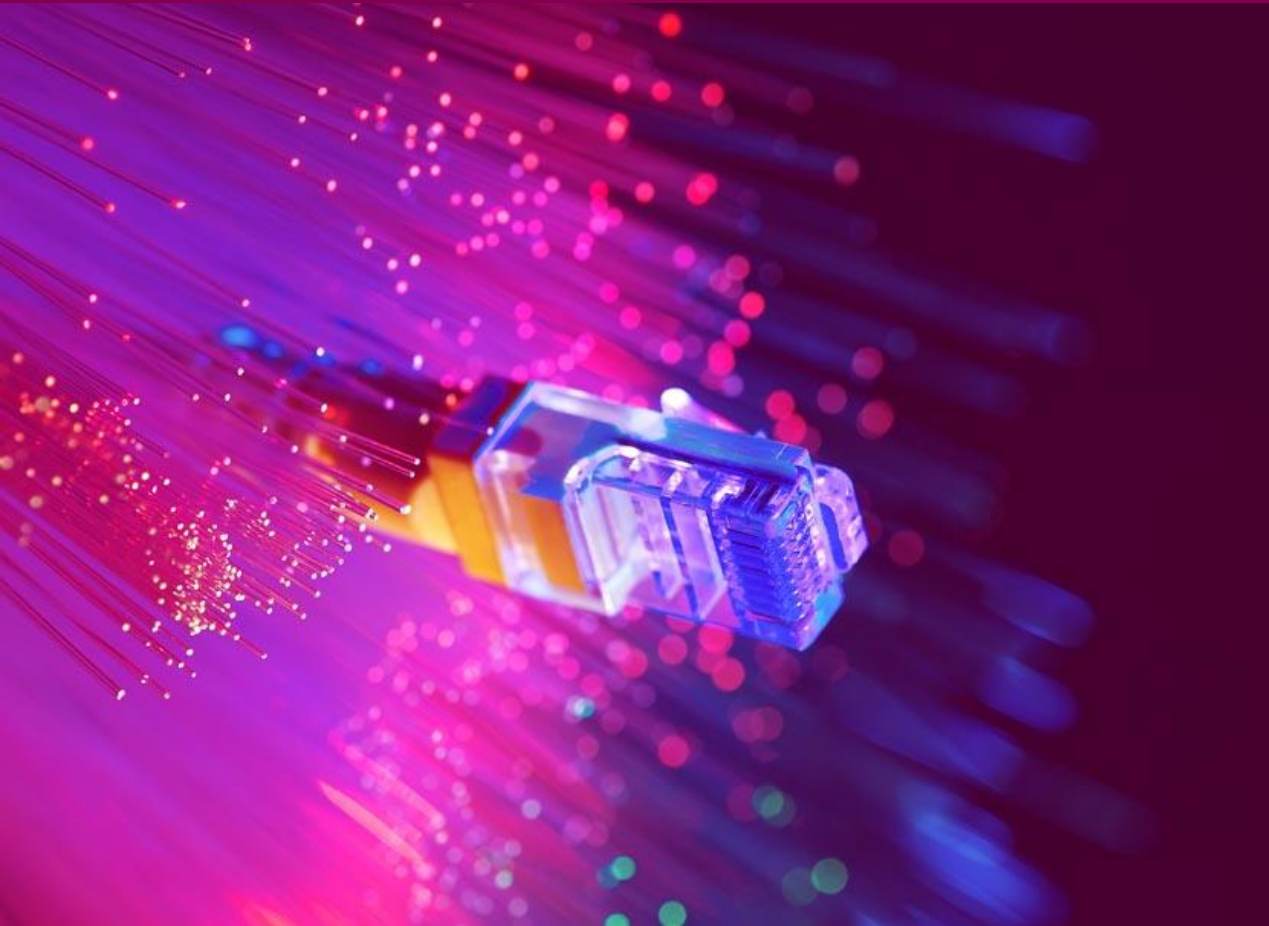
Future bandwidth requirements of Funet organisations (year 2020-)



Possible Funet 2020 connectivity services (draft)

- Funet Connections
 - Either IP uplink or private L2/L3 connection
- Encrypted Funet Connection *New!*
 - End-to-end encrypted connectivity
- DDoS Protection Service *New!*
- Funet CPE Router Service
- Funet Light CPE Service *New!*
- Funet Campus Firewall Service *New!*

Funet 2020 Planning: The New Network Architecture



The chosen solution for Funet 2020: IP/MPLS-based network with a simple coherent open-line DWDM system

- Pros

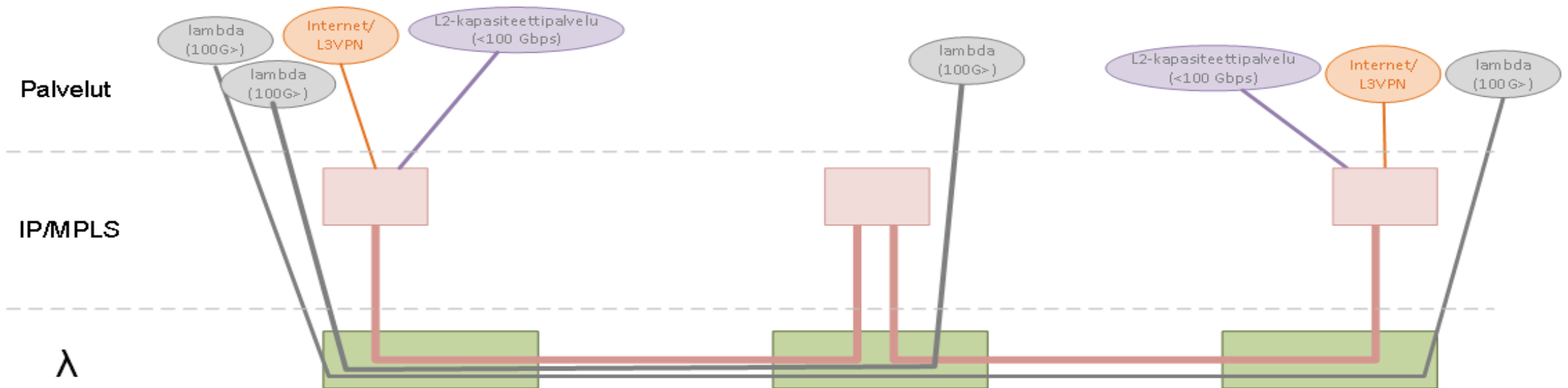
- The most cost-efficient way to implement the required connectivity
- Flexible connectivity services which enable collaboration between organisations connected to Funet
- Provides cost-efficient ways to provide (virtually) dedicated connectivity to cloud and service providers.
- All connections get redundancy against backbone fibre breaks.
- The campus network capacity can be upgraded as needed.
- Smaller and more consistent latencies, as local routing calculates minimal backup routes.

- Cons

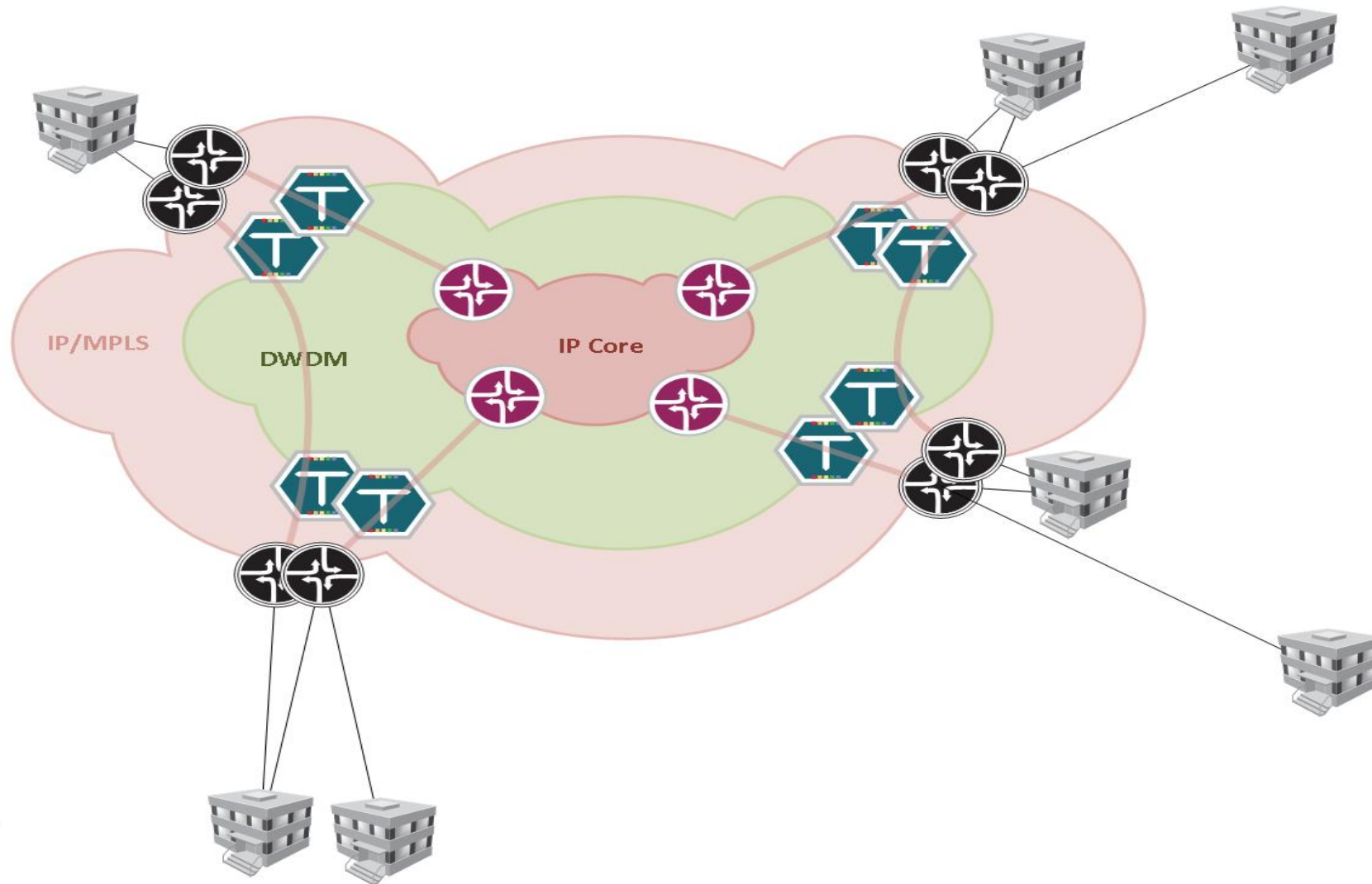
- Implementing some special connectivity services may require extra steps.
- Minimising the transition costs leads to comparatively tight deployment schedule.

The IP/MPLS solution

- Technical components
 - Dark fibres and open-line DWDM transmission system
 - Flexible rate DCI transponders
 - IP/MPLS PE routers in each PoP

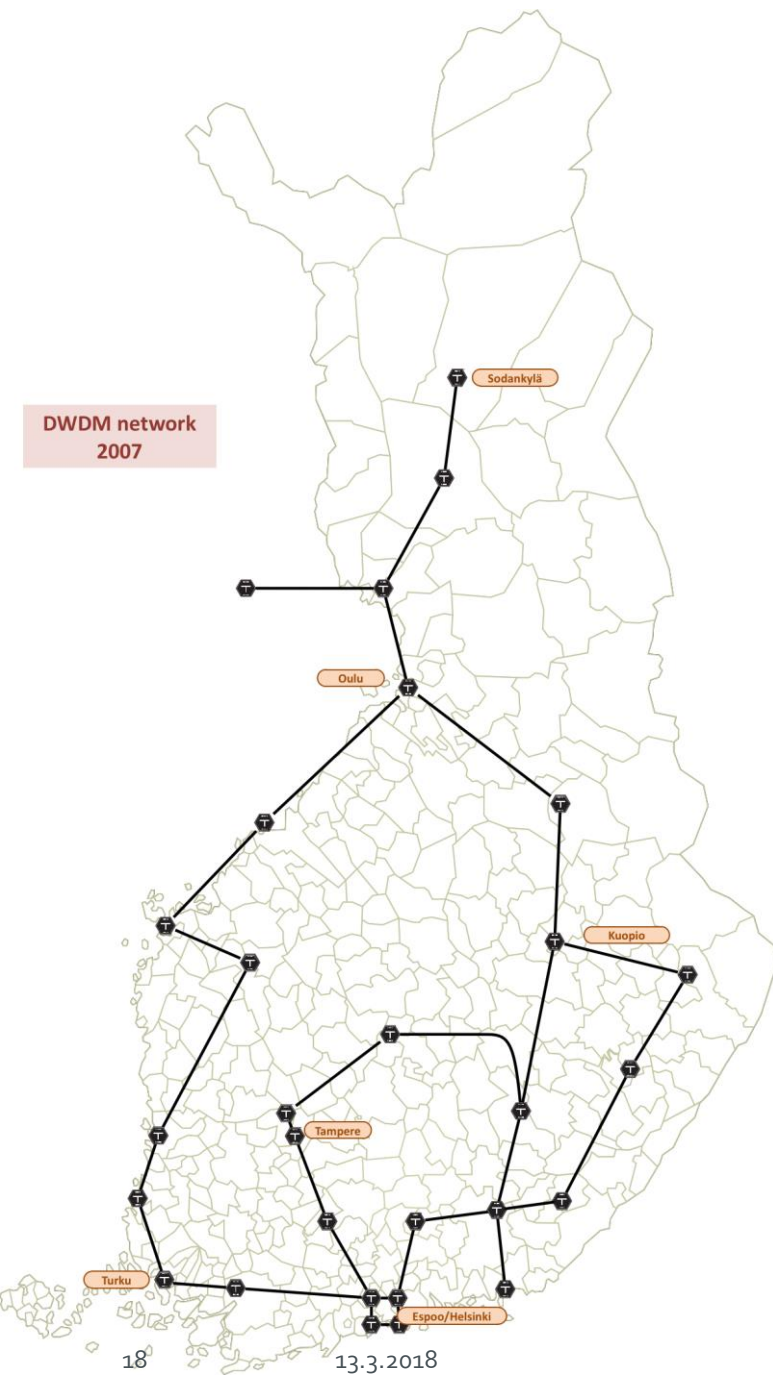


~All access connections are terminated to IP/MPLS routers

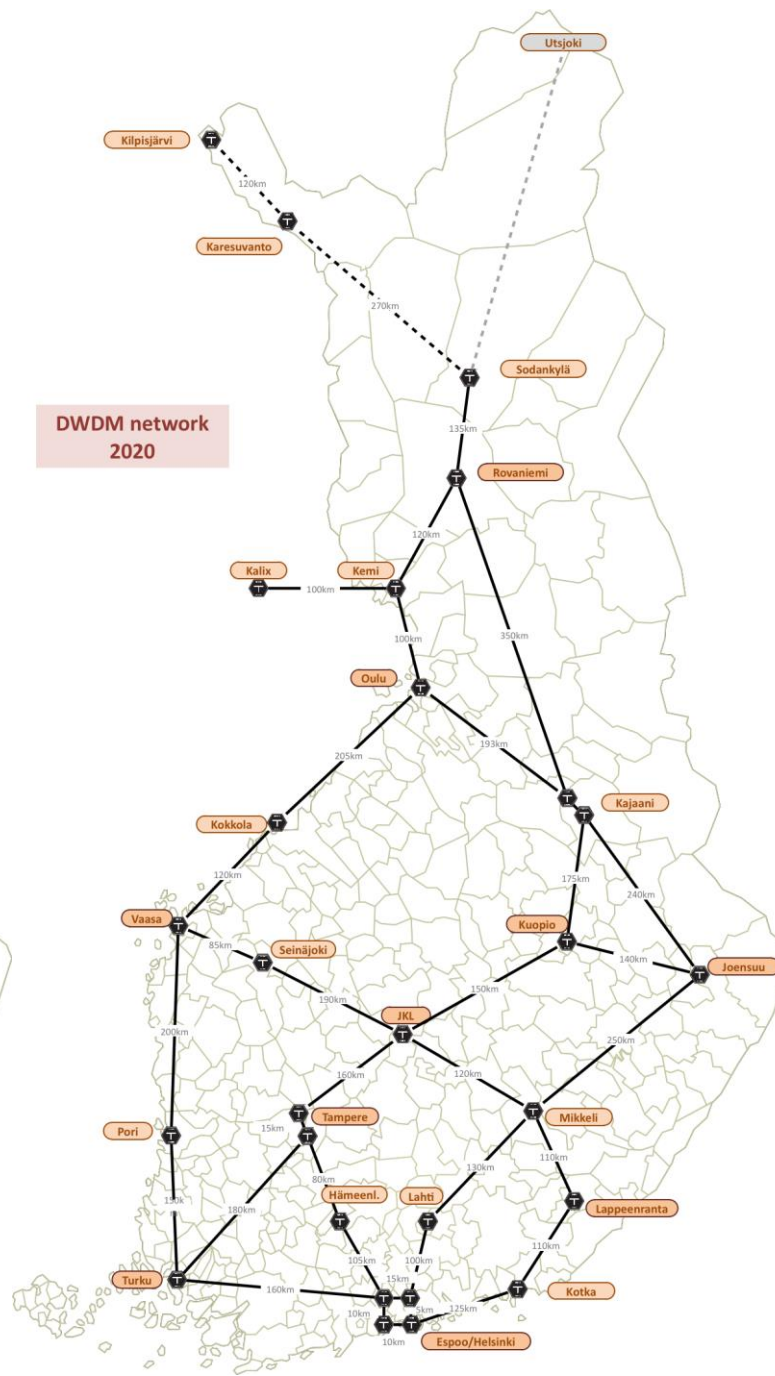


-  DWDM ROADM
-  IP/MPLS runkoreitin
-  IP/MPLS PoP-reitin

DWDM network 2007

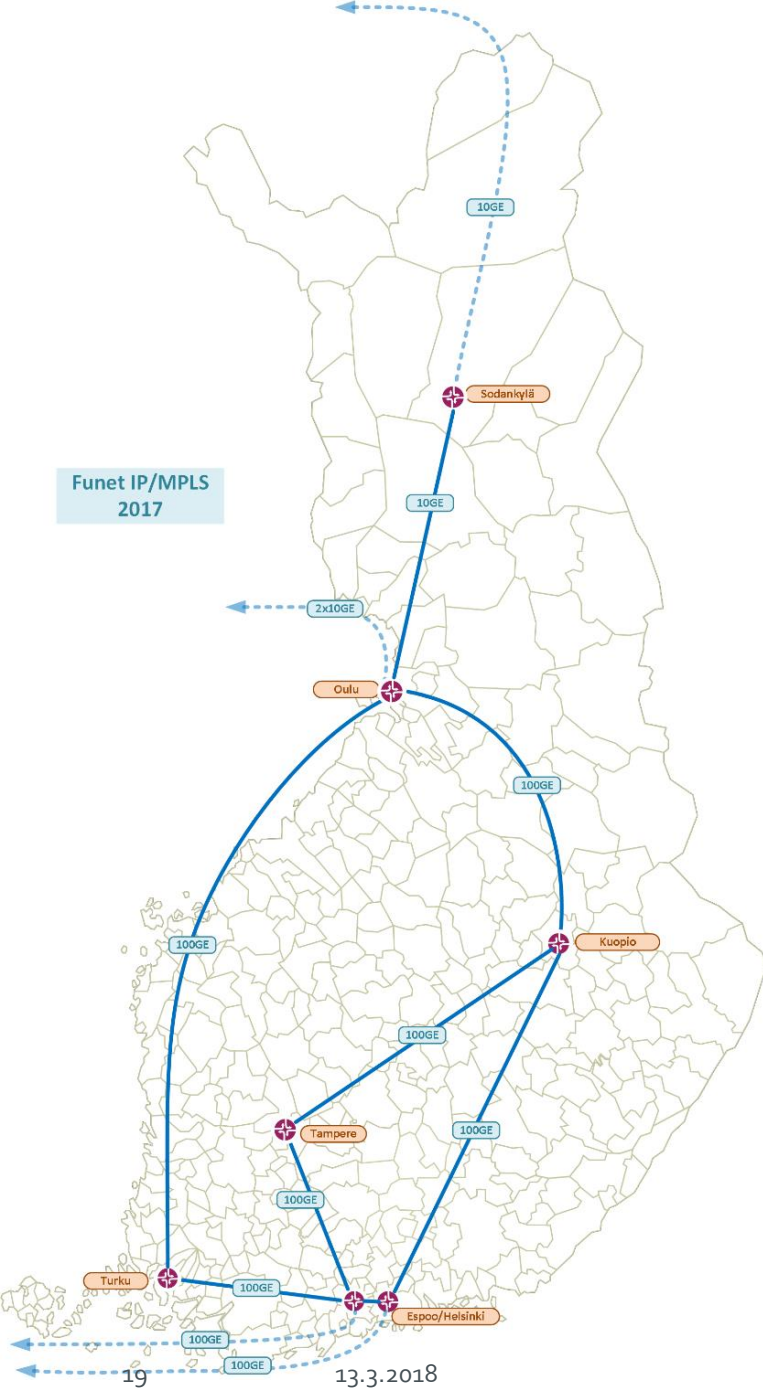


DWDM network 2020

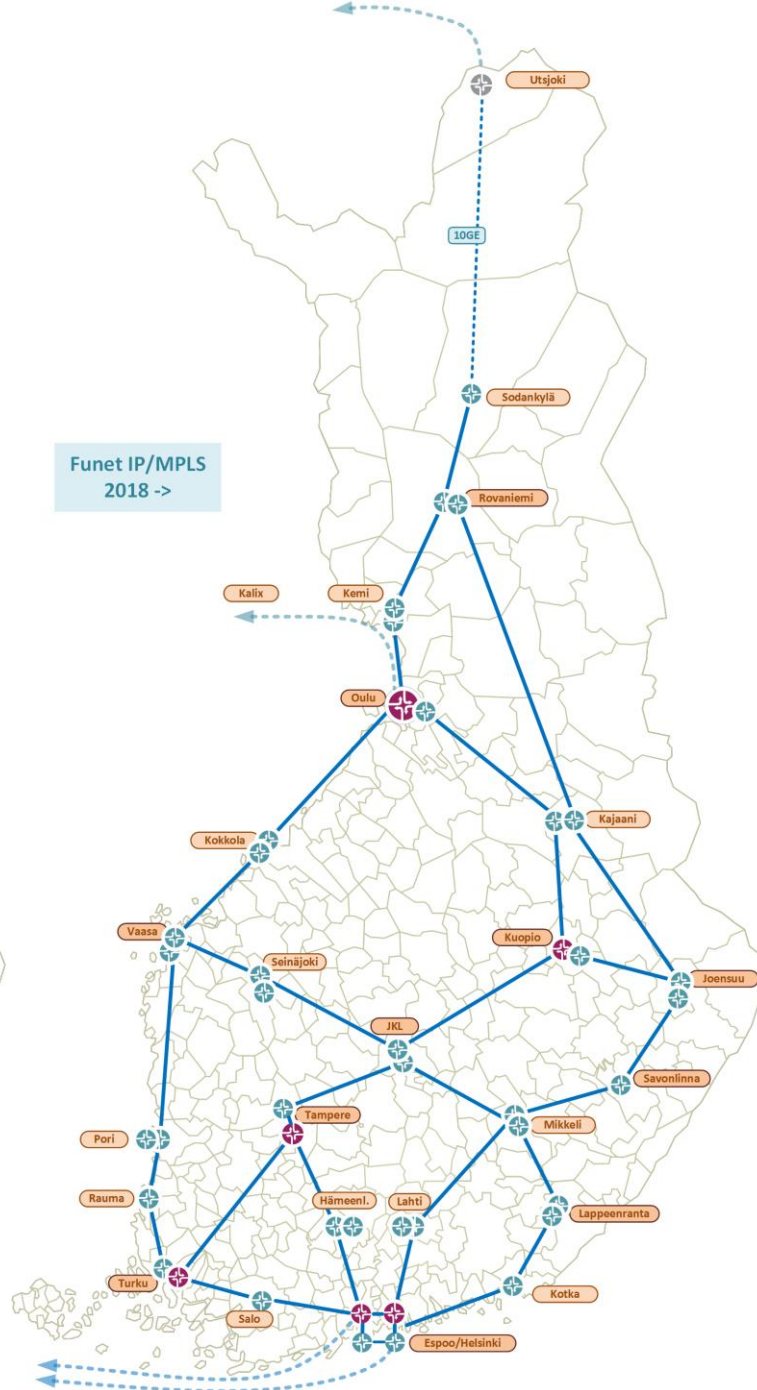


- Funet 2020 has much denser fibre topology compared to current network

Funet IP/MPLS
2017



Funet IP/MPLS
2018 ->



- Funet 2020 has IP/MPLS routers in all PoPs

Transition to Funet 2020

- Public procurement of fibre, optical DWDM transmission and IP/MPLS successfully done in 2017.
- The new network will be deployed in phases, during 2018-2022
 - New parts of network will be deployed as current fixed-time fibre contracts end.
- Goals
 - Minimise service disruptions
 - Minimise costs of transition
- Feedback



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Funet Network



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