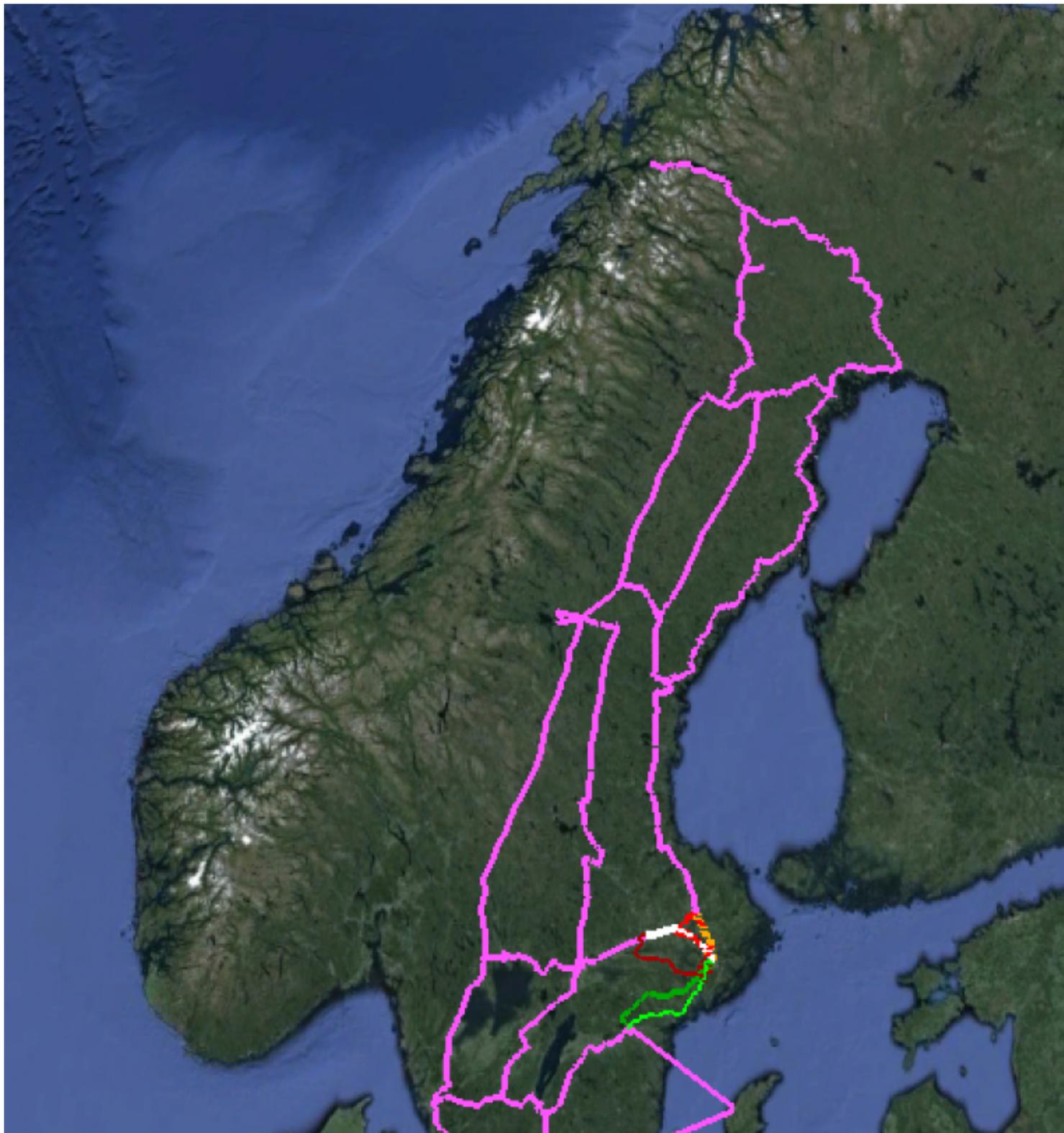


## THE NETWORK TOPOLOGY IN A NUTSHELL

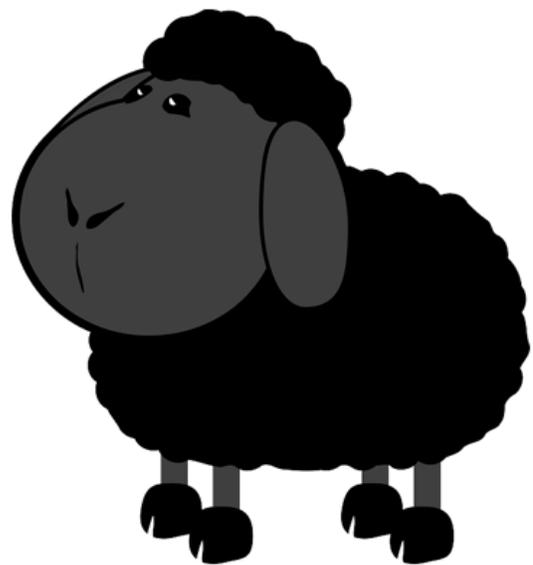
I looked through my older post and it seems I forgotten one of the very basic things, an overall look on what the new network will look like. A lot of the readers have probably seen the big-picture design documents on our various conferences but I realise people from outside the community has not. So let's start from the basic levels and work up in the hierarchy.





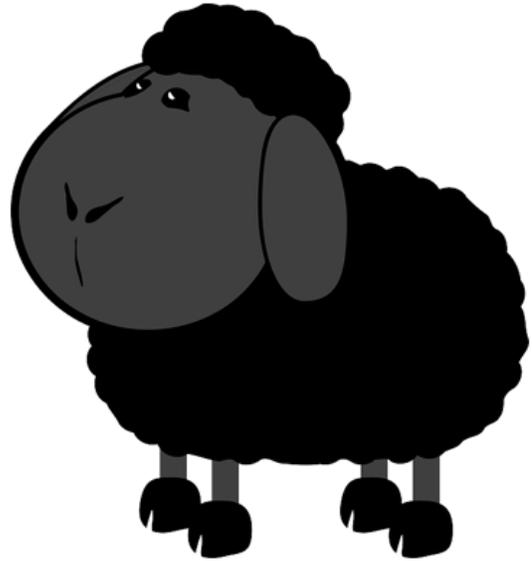
This is the high-level plan of the fiberplant we got through the tender last year, this is accurate map on where the actual cable is routed. Notice that the circuits to Gotland (the Island to the right of Sweden) has suspiciously straight fibre, this is because It's actually leased lines and not darkfibre as the rest of the network is. All in all this sums up to about 7381km of dark-fibre throughout Sweden.

# Fibre-maps removed due to security concerns from the darkfibre vendor.

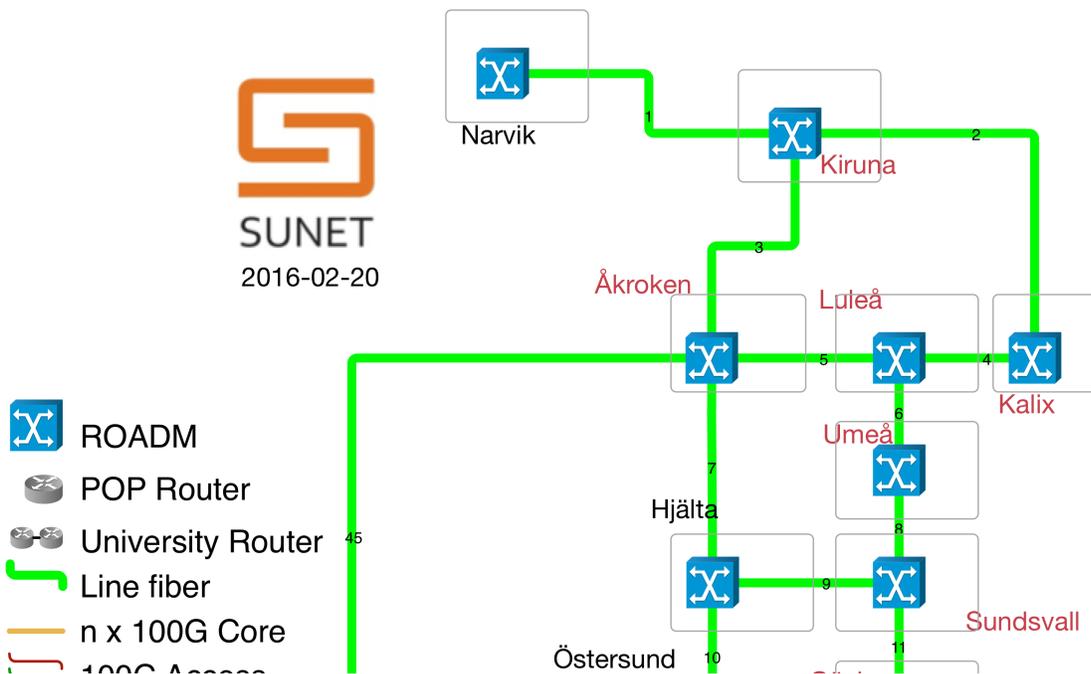


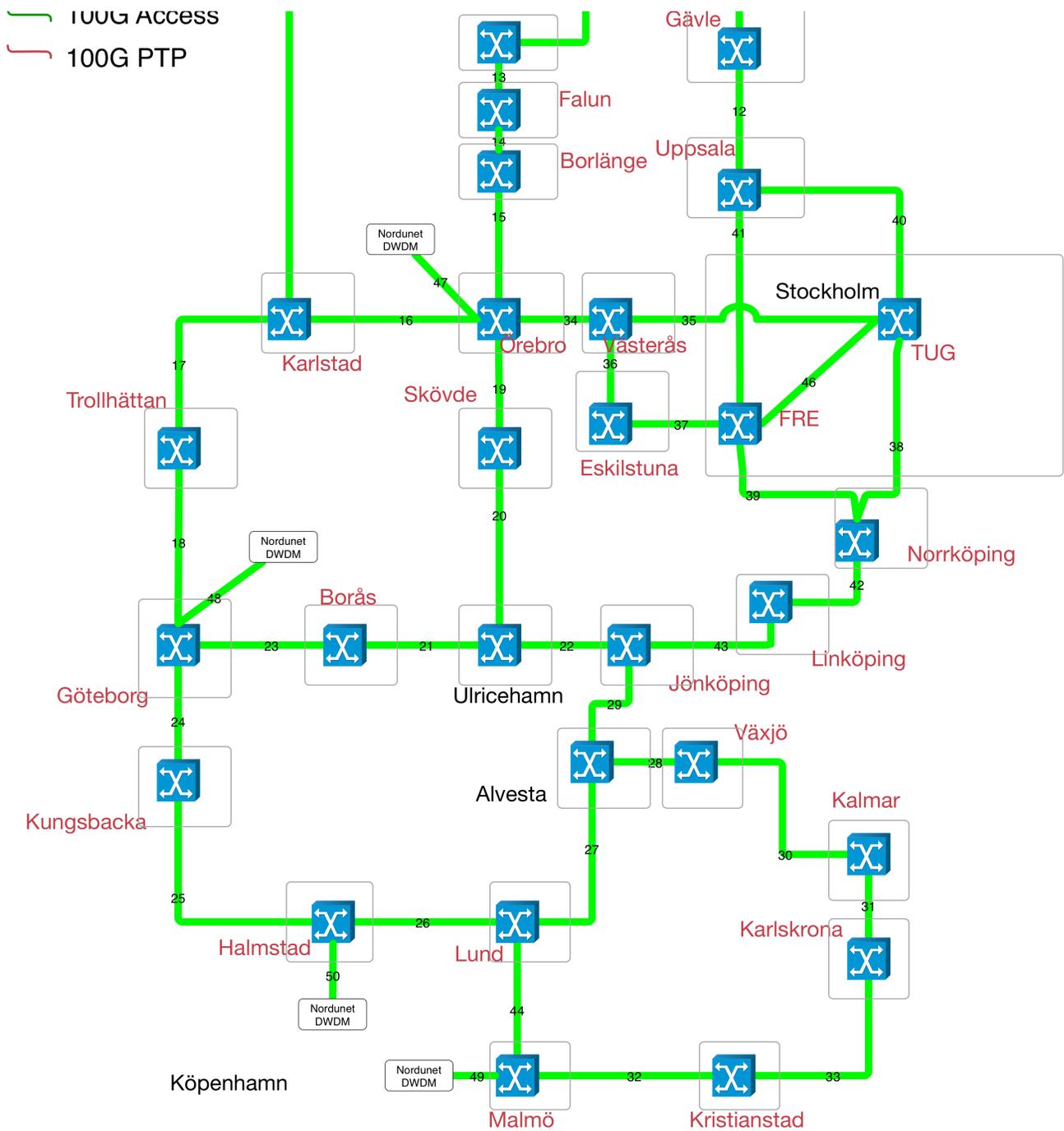
Here is a more detailed look on the middle and northern part of the infrastructure. We do have three paths going from south to north all the way through up to Luleå. The red boxes is Amplifier-sites and the green and yellow boxes is where we will have ROADMs, this means that we either have multiple paths available out from the site or we will drop wavelengths at the site. The site "Hjälta" north of Sundsvall is a ROADM-site because just north of it the optical paths will be divided into two directions, however no waves will be dropped there unless someone opens a institution in the middle of a very dense forest 😊

# Fibre-maps removed due to security concerns from the darkfibre vendor.

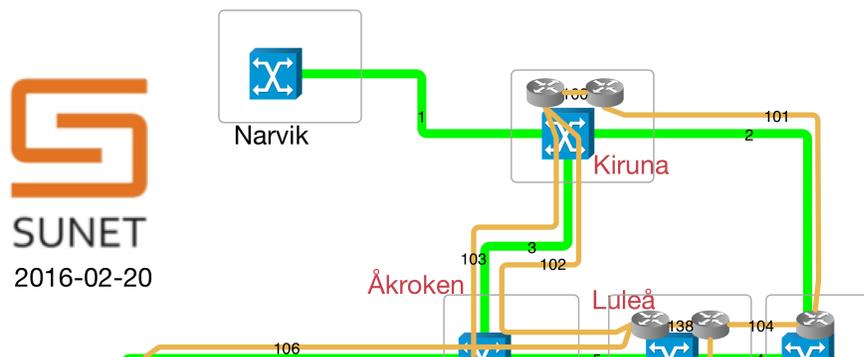


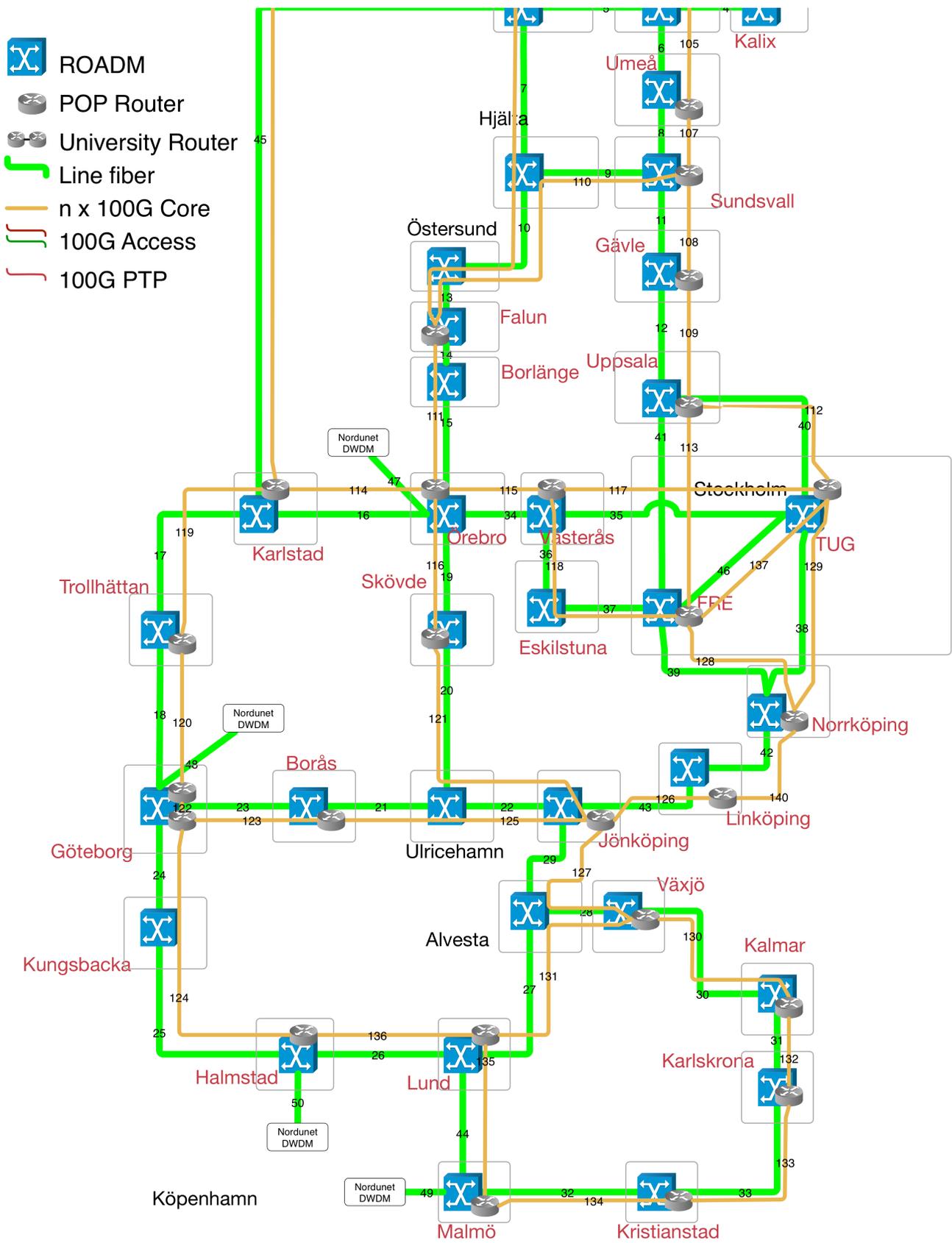
The southern part is a bit more dense with sites for obvious reasons. One thing to note is that if we ever have the need to convert a ILA-site (InLineAmplifier) to a ROADM to drop wavelengths, we can keep the actual amplifiers and put them in a bigger chassis where ROADM card could fit, they use the same type of modules as the 1RU amplifiers so converting ILA to a ROADM is just a chassis-swap away. Rack and power-distributions is overdimensioned slightly to make room for this kind of move.





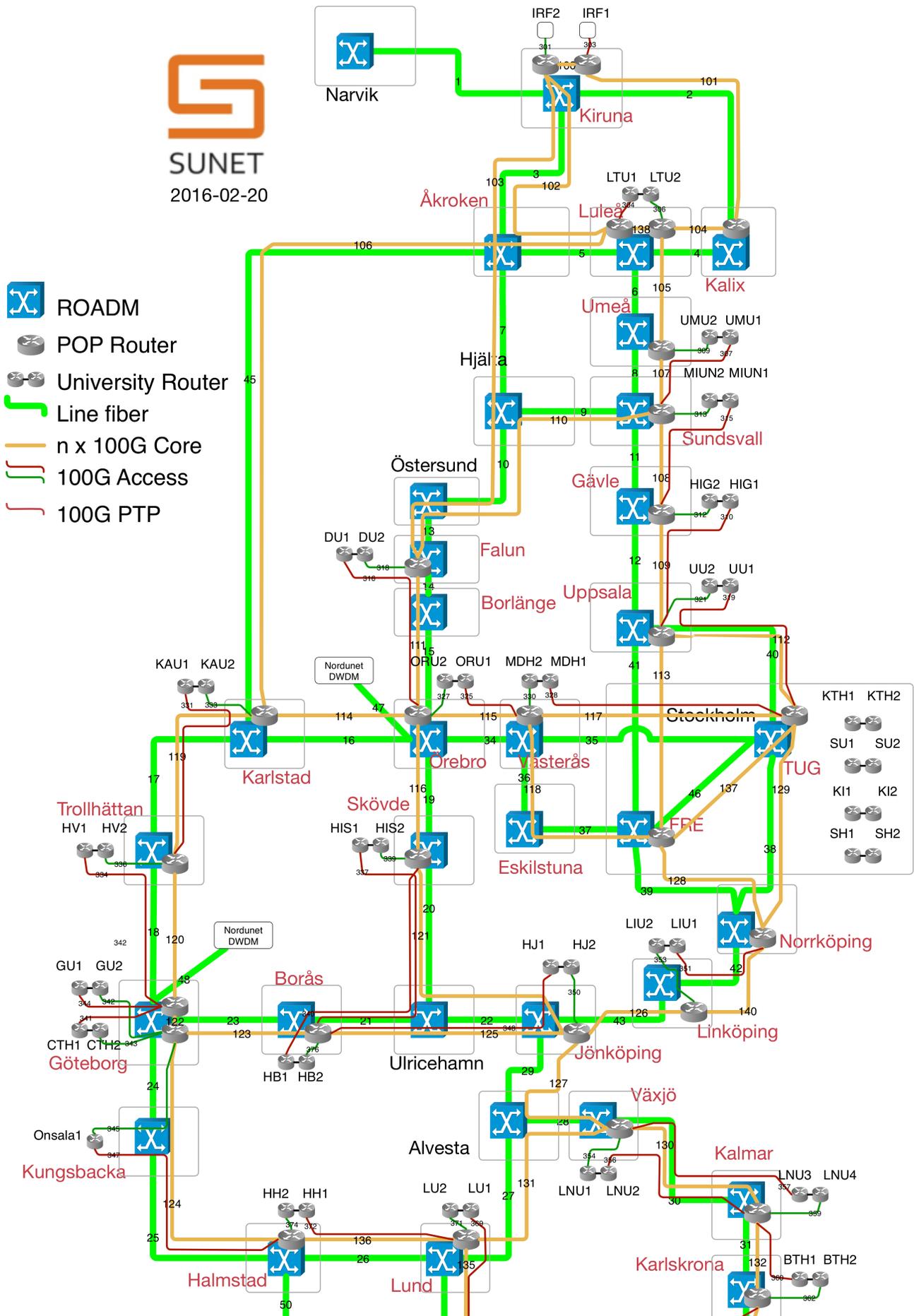
Breaking it down the optical layer will look something like above if we unclutter it and dont put out the amps. The blue boxes is the core ROADM-nodes where we can drop wavelengths, shown is also where SUNET has the possibility to meet the NORDUnet network to reach outside of Sweden and to reach the rest of the Internet. SUNET will obviously also meet NORDUnet in Stockholm as both networks have their core-routers in Stockholm just as we do today. But for the southernmost institutions a exit through Malmö into NORDUnet core in Copenhagen is a clear improvement of latency if heading down to Europe or crossing the Atlantic.

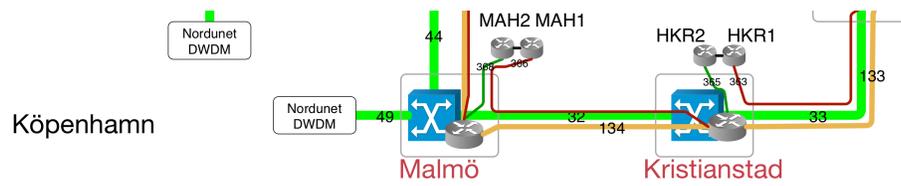




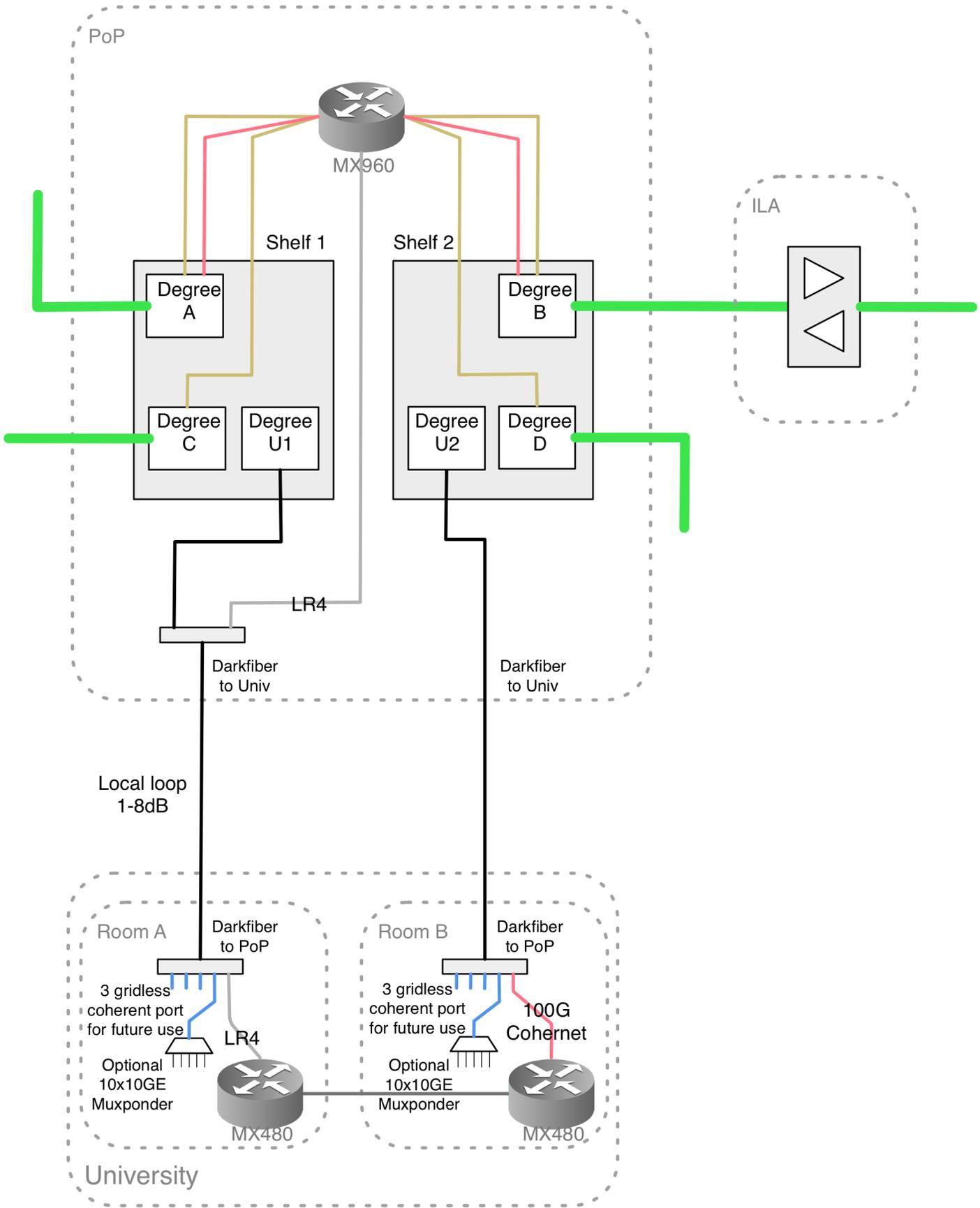
Now we add the core-routers into the picture. All dark-yellow links is going to be 100G OTU4 DWDM Coherent waves on the first day of operation, no sub-speeds at all in the core. Just pure 100G. These signals will as we have been mentioned before generated directly in the router with a tunable DWDM interface card and no transponder will be placed in the DWDM-shelves. This also means that we can at any time and place make a optical reroute and re-tune a wavelength if we are running short on capacity during a longer fibre-break, this can be done solely from remote seeing as we are not dependant on a field-technician to change a port in a MUX/DEMUX to be able to change wavelength and generate a new path through the network. Running with a gridless system gives

you this flexibility. Most of the routers in the corelayer will be Juniper MX960 and in the bigger cities we will use a mix of MX2020 and MX2010.





Now we add access and CPE's into the picture as well. The sharp eye can see that the two routers at the campus have their uplinks diversified, one link will go to the core-router in the same city as the institution and one link will go to the neighbouring city. The inter-city link will be realised through 100G LR4/ER4 regular Ethernet optics and the long-range link will be a integrated DWDM Coherent 100G link, same as the one we use in the core-layer to get longhaul capabilities. Having the core built with a single router in each city saves a lot of money and with coherent capabilities all the way out to the university we get a much more flexible solution. The CPE's will be Juniper MX480.



This is a more detailed breakdown of the optical handoff in the cities, here it is pictured as a 4 degree ROADM site but naturally this could of course be two aswell, or more than four. The red wave originating from the right MX480 at the university will go into the

line-system on the most fitting degree and be terminated in the neighbouring citys core-router, just as the other red waves are coming in from Degree A and B in this picture.

This was a short introduction to the general idea about the network topology, this week we will hopefully receive one of the core-routers for Stockholm as well as continue north and west from Stockholm with the optical rollout. Today the installation-team did Gävle and they have a tight schedule and is rolling alongside road E4 northbound and hopefully we can reach Sundsvall and hopefully all the way to Östersund by the end of this week.

Until next time, live long and prosper

/FK

Skriven av



**FREDRIK "HUGGE" KORSBÄCK**

Network architect and chaosmonkey for AS1653 and  
AS2603. Fluent in BGP [hugge@nordu.net](mailto:hugge@nordu.net)