

## MARIA HÄLL: WE ARE AT THE FOREFRONT!

After three years of hard labour, SunetC is finally in place, in a power grid pylon near you. Fiber Fever spoke to Sunet's manager Maria Häll about how things are and how everything is expected to work out in the future.



Maria making magic: The little crystal ball in front of her symbolises all transmission glass in the whole of SunetC, a total of 0.7 litres of pure Silicon dioxide, lit by the magic shine of 128 lasers, totalling 0.1 watts.

*SunetC is up and running. Did everything turn out as you expected?*

– Sure it did! Building a new network is a lengthy process, needing lots of preparation and meticulous planning at every step, such as dimensioning and procurement. The process began back in 2013. With such a long preparation time, you would assume things to turn out as expected. It has actually gone much better than expected. The project management people were really accomplished. One IT manager I met recently, meant that we had actually “replaced our own heart during operation” or built the ship while navigating. No one has really noticed that we changed the network. I can only congratulate everyone involved.

*The next obvious question is: How was the trip?*

– I haven't been directly involved in the technical details, but according to the reports I have received everything has gone incredibly well. You can fall over backwards on smaller projects than this one, but it didn't happen. Everything, however, has not been all sunshine. We have had discussions on the fiber quality. SunetC is composed of fibre from several fibre owners

and we have had to ask some of them to clean their fibre connectors. We also handed out fibre cleaners to a few of them. A symbolic gesture perhaps, but necessary.

*One never thought that would be an issue??!?*

– Well, it was a bit of a provocation to do it. Börje Josefsson (Sunet COO) and I have repeatedly spoken at various meetings about the importance of having clean fibre, good documentation, and keeping track of all the other quality parameters. I always stress that the city networks are part of the global research network. City network operators aren't generally aware that they are part of hauling data from e.g. the ALMA telescope in Chile to researchers at the Royal Institute of Technology (KTH) in Stockholm.

*I guess the smooth process was mostly due to great technicians, wasn't it? Who did what?*

– We began by drawing on napkins back in 2013. Initially, it was Per Nihlén and Börje Josefsson, later joined by all the technicians at NORDUnet. The people at Sunet are a tightly knit group who actually know what they are doing.



The Facilitatorz! The sharpened minds that conceived, planned, procured and implemented SunetC have gathered for a group photo at the Sunet Gathering (Sunetdagarna) in Halmstad in 2017. Here they describe their merits and superpowers, starting from the left:

**Fredrik Personal Jonhed:** I managed the procurement of SunetC. **Superpower:** I can see through the Public Procurement Act.

**Stefan Liström:** I was project manager of the build-out. **Superpower:** To get people to do things.

**Maria Häll:** I'm the boss. **Superpower:** Can do magic.

**Fredrik Korsbäck** (partly obscured): I invent new stuff. **Superpower:** Changing light bulbs and drawing on whiteboards.

**Börje Josefsson:** I am good at sketching on napkins. **Superpower:** The ability to say no.

**Magnus Bergroth:** Good at tightening screws. **Superpower:** Handles a Phillips screw driver.

**Per Nihlén:** I made the initial draft. **Superpower:** The ability to say yes.

Despite the humorous, casual appearance, this is a small group of highly specialized technicians who have designed and implemented a project that has turned Sweden into one of the world leaders of high-speed national research networks. Maria practises "management by smiling" and makes groundbreaking things happen without really having to ask for it. This might actually be something for others to follow.

*Has the intended service level been achieved, and if so, how much?*

– We always aim as close to 100 percent uptime as possible, but the two redundant "red" and "green" connections in the previous OptoSunet network were not sufficient to achieve this. This was demonstrated by the unhappy incident in Västerås, where redundancy was consumed by having both fibres simultaneously cut by a digger. We felt that it was a necessary step to introduce three redundant connections on all the main routes. The network should never go down.

*What are the future plans for Sunet? New, faster connections, for example?*

– It's not so much about faster connections. Instead we see a growing need for data storage. Large amounts of data are being transported around today, but the amounts will increase. Our learning management systems are now based entirely on streaming media. The ESS neutron science laboratory will become operative, as will Max IV and other large projects. We need a network designed for the peak loads occurring when scientists send data back and forth. Unlike the commercial networks that can be designed for a medium load scenario, we need to consider constantly increasing peak traffic.

Of course there are plans to increase the capacity from the current 100 Gbps, as the need arises. What do we need to do, to increase to 400 Gbps? There are no such transceivers available on the shelf today, but our network is prepared for it and the road ahead is clear. You just have to find good products and ensure that the manufacturers can deliver. Today, they can't do it, but we have ongoing contacts with suppliers.

*Sunet have proven to be very good at high availability, high security and excellent procurement arrangements. Will this rub off on other Government agencies?*

– Hopefully Sunet will be able to demonstrate how to make proper procurement, how to prepare and above all, acquire good procurement skills. Our expertise will definitely rub off on our own host agency, the Swedish Research Council.

*eduroam seems to be steaming ahead? Will there be any more places connected?*

– Our cooperation with The Cloud network provider means that as they build out their network, eduroam tags along. We have had a presence at the Wayne's Coffee and Bishop's Arms for along time, as well as at many Swedish railway stations and airports, at various hotel chains and so on. eduroam is now also offered by The School Federation (aimed at primary and secondary schools). But we also have clients who, for various reasons, do not use eduroam and we know that we have to help them.

*Which new services are in the pipeline to customers?*

– Mainly our cloud services, including Backup-as-a-Service, Storage-as-a-Service and virtual servers. Many of our customers are interested in cloud services for precisely the reason that they are operated by Sunet in Sweden. Cloud services will become increasingly popular, which is why we must have a good strategy for peering with NORDUnet. Procurement of our next-generation video service, a learning management system with e.g. streamed lectures, is almost finished. The younger student generation literally requires this development.

*What does the future hold for optical networks in Europe as a whole?*

– We are at the forefront here in the Nordic countries, for several reasons. Our country is long and we have a tradition of fibre networks that began with city networks. At the same time, we have an enthusiasm for good, fast connections. Let's call it fibre-awareness. Unfortunately, this awareness doesn't exist in all parts of Europe. We need a much closer collaboration between the European research networks, mainly so those involved will not have to build their own networks, creating unnecessary layers of networks.

The Nordic research networks cooperate very well within the NORDUnet, but we could do more. The same is true for Europe. You might think that the GÉANT network is a complete European network solution, but it is not. There is a variety of other special networks around. This old-fashioned thinking is, unfortunately, rewarded with EU money. Should we succeed in better coordination there are money to be saved. I see this as a challenge for Europe.

*Would Brexit cripple the European networking community?*

– We do not know that yet. Everything depends on whether it is possible to work together even though someone breaks out of the EU. If it means they will pull out of the network cooperation as well, we do not know. If they pull out, there may be some cost implications.

*Which are the big data-cannons right now and what can we expect in the near future?*

– CERN is a big data-cannon today (20 Gbps to Sweden), the Max III and Max IV labs as well, just like the Onsala Space Observatory (soon to produce 30-50 Gbps). GÉANT provides NORDUnet with 30-40 Gbps continuously. In the year 2020 the ESS will start up, and probably EISCAT 3D at the northern top of the Finnmark as well. More will come, such as the ALMA telescope in Chile and the SKA telescope antennas in South Africa and Australia.

Sweden is ship-shape in this respect, but the other member states need to modernize their networks, too. And remember that CERN is not the only nuclear research institution in the world. There are plenty of other equally large data-cannons, such as the Fermilab in the U.S.

*In the last interview you stressed that "Everything becomes researchable" Do you have any new hobbyhorse?*

– Global cooperation is the new big thing. Sunet is a part of the global research network, now more than ever before. We build great high-speed connections in Sweden, but we need even more connections to the rest of the world. The Karolinska Institutet medical university has started a branch in Hong Kong and we have been asked to arrange a connection to them. We will acquire more peering points in the world, in addition to those we already have in Europe and the United States, to keep the price of the data transfer down. We are already discussing how to handle the increased traffic to Asia. Our peering strategy is very important.

## FUNNY FACTS

### Total capacity

It is impossible to calculate the full capacity of the Internet, because you can't decide where and how to measure. Regarding Sunet we have all the facts and are able to calculate Sunet's full capacity.

As the network has 64 DWDM stretches at 112 Gbps (including FEC) and they can all be used independently, we end up with **7.2 Tbps** bidirectional capacity. The scientists will finish that in a jiffy, so the network will have to be upgraded with several new wavelengths. Fully developed with 96 wavelengths that can be independently utilized, we end up with **688 Tbps**.

As the network will never be utilized in that way, the above calculation is hypothetical. If you include triple redundancy in the picture, the capacity drops dramatically, but introducing a few planned stretches of 200 and 400 Gbps brings it back up to some **107 Tbps**. So what? "640 kB ought to be enough for anybody" (B. Gates, 1981)

### Feature films

Feature films are a popular unit of measurement today. If you recalculate Sunet's fully developed capacity in the number of movies that could be streamed simultaneously at 7 Mbps, that would be equal to **97.8 million** concurrent movies. Netflix' servers would glow and smoulder.

### Volume and weight



The backbone fibre core consists of Silicon dioxide, 8 micrometers in diameter. All the core on the 8000 kilometre network, times two as the network is bidirectional, adds up to a volume of no more than **0.7 litres**, or a small ball **11 centimetres** in diameter, weighing some **2 kilos**. Presently, this ball is lit by some 128 magically shining lasers.

– 688 terabits per second, that’s a lot! Or, that’s what we think now. Ten years ago we hadn’t even been able to imagine 100 gigabits per second. At the time it would have seemed astronomical. That’s why we need to be at the forefront, Maria says, while waving her wand and lighting the room with a magic blue flash.

## FURTHER READING

Mostly in Swedish, but some in English.

Previous interview, in September 2015: <https://www.sunet.se/blogg/sunet-nu-annu-battare/>

The design of a fibre: <https://www.sunet.se/blogg/sa-tillverkas-optisk-fiber/>

How to design a fibre optic network: <https://www.sunet.se/blogg/sa-designar-man-ett-fiberoptiskt-nat/>

Cleanliness is a virtue (in English): <https://www.sunet.se/blogg/long-read-cleanliness-is-a-virtue/>

Géant: <https://www.sunet.se/blogg/geant-och-nordunet-basta-kompisar/>

Sunet’s cloud services: <https://www.sunet.se/blogg/sunet-in-i-molnet-det-har-far-du/>

One of the really big data-cannons: <https://www.sunet.se/blogg/cern-krossen-som-slar-sonder-materiens-minsta-byggstenar/>

Capacity peaks, speculations: <https://www.sunet.se/blogg/nocen-spekulerar-1-hog-belastning/>

Peering to lower overall costs: <https://www.sunet.se/blogg/peering-sunets-ekonomiska-ryggrad/>

Skriven av



**JÖRGEN STÄDJE**

Jag heter Jörgen Städje och har skrivit om teknik  
och vetenskap sedan 1984. Friskt kopplat, hälften  
brunnet!