

An Optic's Life

by Thomas Weible



flexOptix
project initiator

Title: Total Solar eclipse 1999 in France, Author: Luc Viatour, Source: http://de.wikipedia.org/wiki/Datei:Solar_eclips_1999_4.jpg

Welcome – enjoy reading my notes here for the project introduction of „an optic's life“

Thomas Weible @ SwiNOG #21 – Co Founder of Flexoptix GmbH – 4. November 2010. In cooperation with Marcus Stoegbauer from man-da GmbH Darmstadt. In terms of scripting and Phyton, he is the expert.

Lighter Example of the analogue world:

- you don't know how long a lighter with regular housing will last! A failure always happens when you don't expect it

Solution:

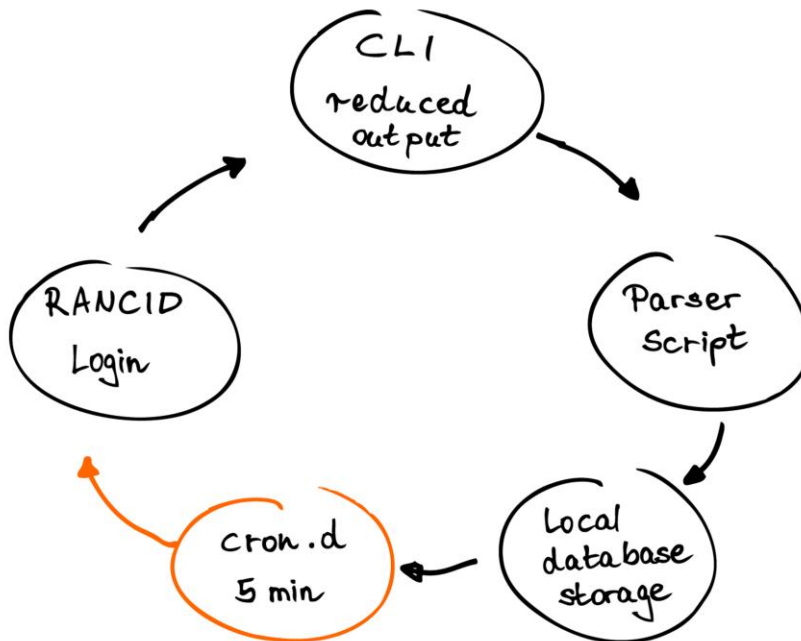
1. smokers know from their EXPERIENCE that a lighter will last e.g. for 1 month
2. smart people use lighters with transparent housing to see the amount of liquid gas.

The transparent housing is a metric which can be useful. The same applies for optics with DMI / DDM. You get more insight to them.

The goal of the project “An optic's life” is, to predict the time when a transceiver will reach its real end-of-life-time based on the actual setup in the datacenter / colocation.

Collection

```
#clogin -c 'show interfaces t0/2/0 | i packets  
input|packets output|input errors; show int...'  
myCiscoBox | poll.py cisco
```



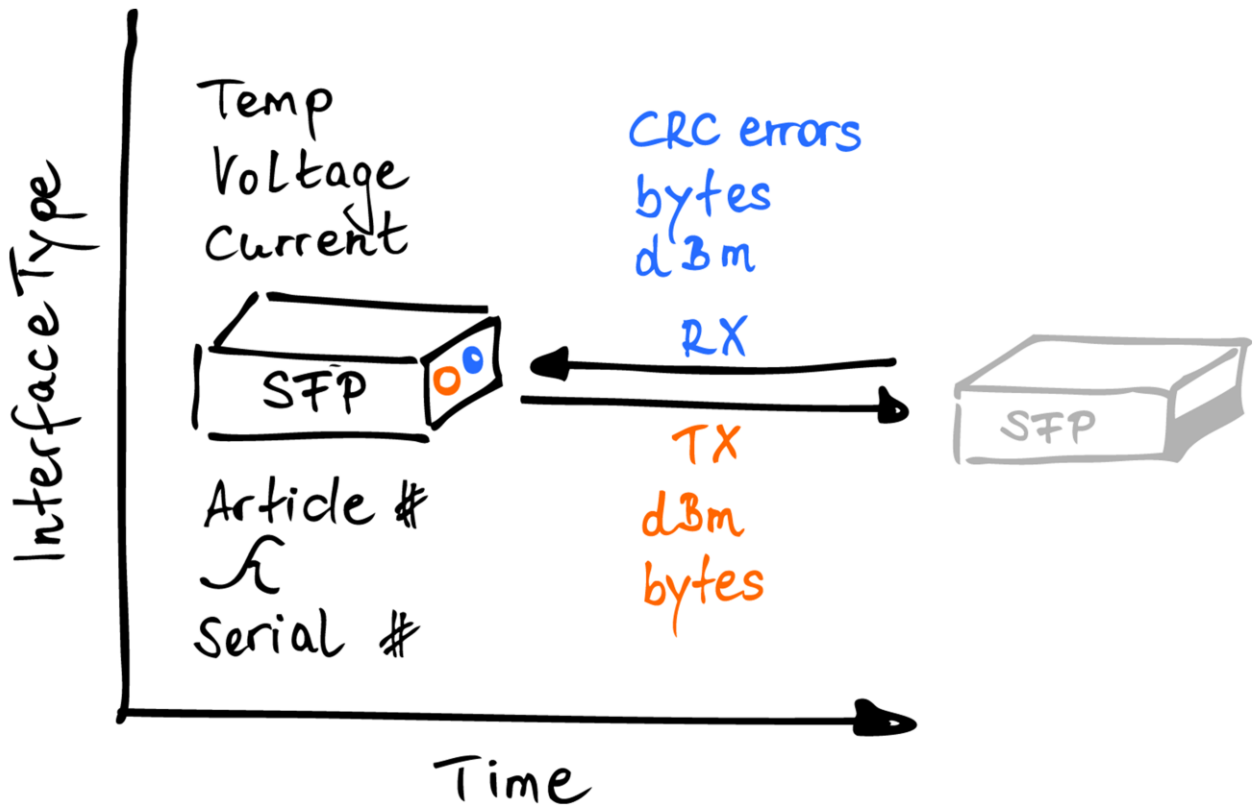
1. Cron job every 5 minutes to run script
2. RANCID to log into each single network device. No use of SVN feature of RANCID. We need RANCID because some vendors (e.g. Cisco) do need a password for the login process (no SSH keys possible). One login per node to get all interfaces (avoid consuming high load of CPU for login process)
3. OS specific CLI command with reduced output for an easier / simpler post-provcess
4. Parser script (poll.py) is based on regular expressions. It is writting in Phython.
5. Storage of gathered data in local SQL Lite database. This will make post-processing easier.

not on this slide:

Before we can run the code above we have to collect the information of interfaces with active transceivers. This collection is done once a day to see the changes on the network interfaces.

```
#clogin -c 'show hw-module subslot 0/2 transceiver 0 status' myCiscoBox | collect.py cisco
```

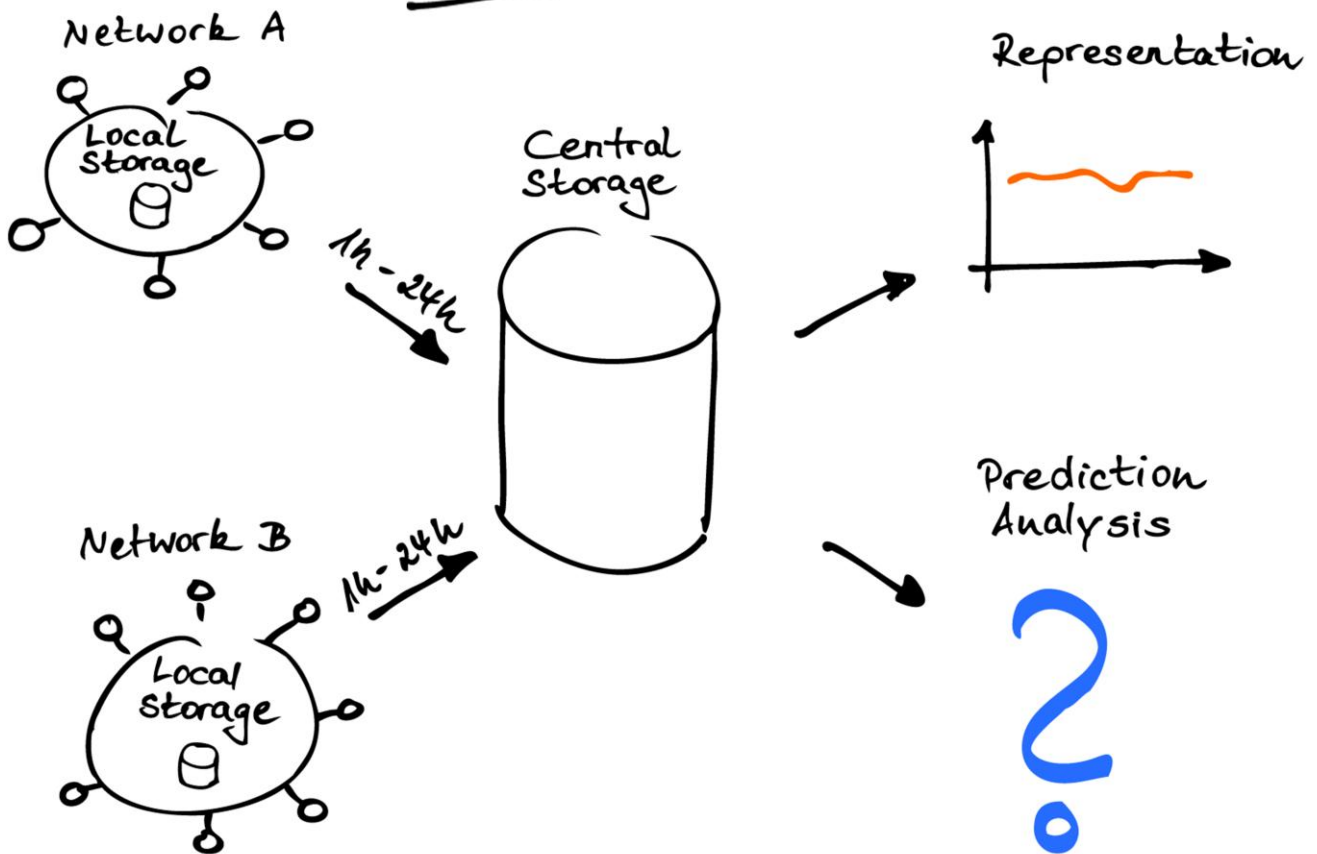
Metrics



we need 11 metrics in total!

- Interface metric (amount of TX und RX bytes) is needed to identify the peer interface. When we know the peer interfaces TX powerlevel value (dBm) we can do a better scoring on the RX powerlevel of the analysed transceiver.
- RX & TX powerlevel, Temperature, Current and Voltage are the transceivers own values. These values will play a main role in the prediction process
- The Serial# of each transceiver helps us to identify the transceiver within the network. An optic might be swapped within its operational lifetime with on other transceiver
- The Article# is very helpful to get parameters like the wavelength or the transceiver's supported distance. These values might have an impact on the prediction algorithm (still to be defined)
- CRC errors on the interface are a very good indicator for a corrupt transmission (either the sending instance mixed it up, the fibre or the receiver). The more optics with CRC erros we can identify for training set the better we can adjust the prediction algorithm later on.
- All 10 metrics will change over time. These differentiated timelines while end up in a transceiver type specific pattern.

Architecture



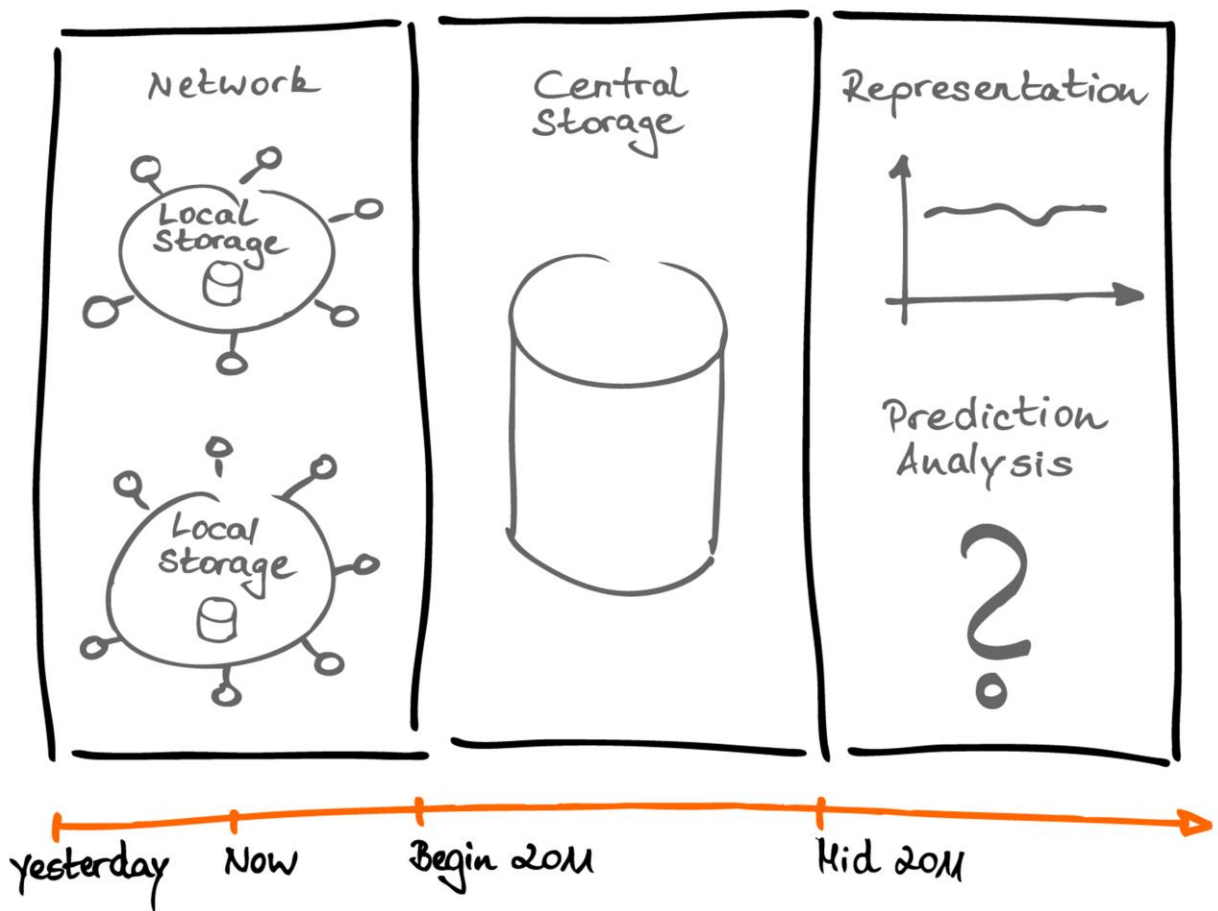
Local collection (network A and B): the data collection is done locally at each members network with scripts provided by the project members.

Central Storage collection: done daily, weekly or monthly. Depending on the amount of nodes and links. It might be necessary that we do a daily collection for an realtime presentation of the current transceiver monitoring values.

Representation: making use of the logging framework „log4free / logDirector“. This tool will be available for all participating networks to get a live view of the optical parameters of each interface.

Prediction: at the first stage we are searching for algorithms / methods which can handle the intensive mass of data. In the next step we have to generate several training sets to do a first analysis of the collected values. For both steps it is necessary that the collected data is NOT aggregated otherwise the result won't be accurate. Finally we can run the live data against the training sets to perform a fast analysis and prediction.

Timeline



Local Collector: will be coordinated from Marcus Stoegbauer and Thomas Weible. The software will be designed modular to add vendor specific CLI commands to it.

Version 0: Prototype for DENOG 2

Version 1: simple implementation for Cisco & Juniper -> mainly for RANCID user

Version 2:

- Modular programm for local network to add easily new devices, e.g. Force10
- TACACS / RADIUS authentication for network devices. TACACS also allows to define which command a user can apply.
- Furthermore we will do some analysis with parallel processes to improve the speed in big networks (> 500 nodes)

Version 1 will be published asap. At the stage other members can start adding vendor specific CLI modules to the project. At this stage the collected data has to be stored locally at the members facility. We assume approx. 2G of data for 1000 interfaces within 3 month (100K for 1 interface in 7 days). Hopefully after this time the central storage & collector is in production.

Central Storage Collector: this part is still in the planning phase. We are loooking for someone how has experience in collection a lot amount of data in a distributed manner (I prefer someone without google-background)

Representation: we are planing to have a cooperation with the guys from „logDirector“. This is database oriented log framework with very nice presentation & aggregation features.

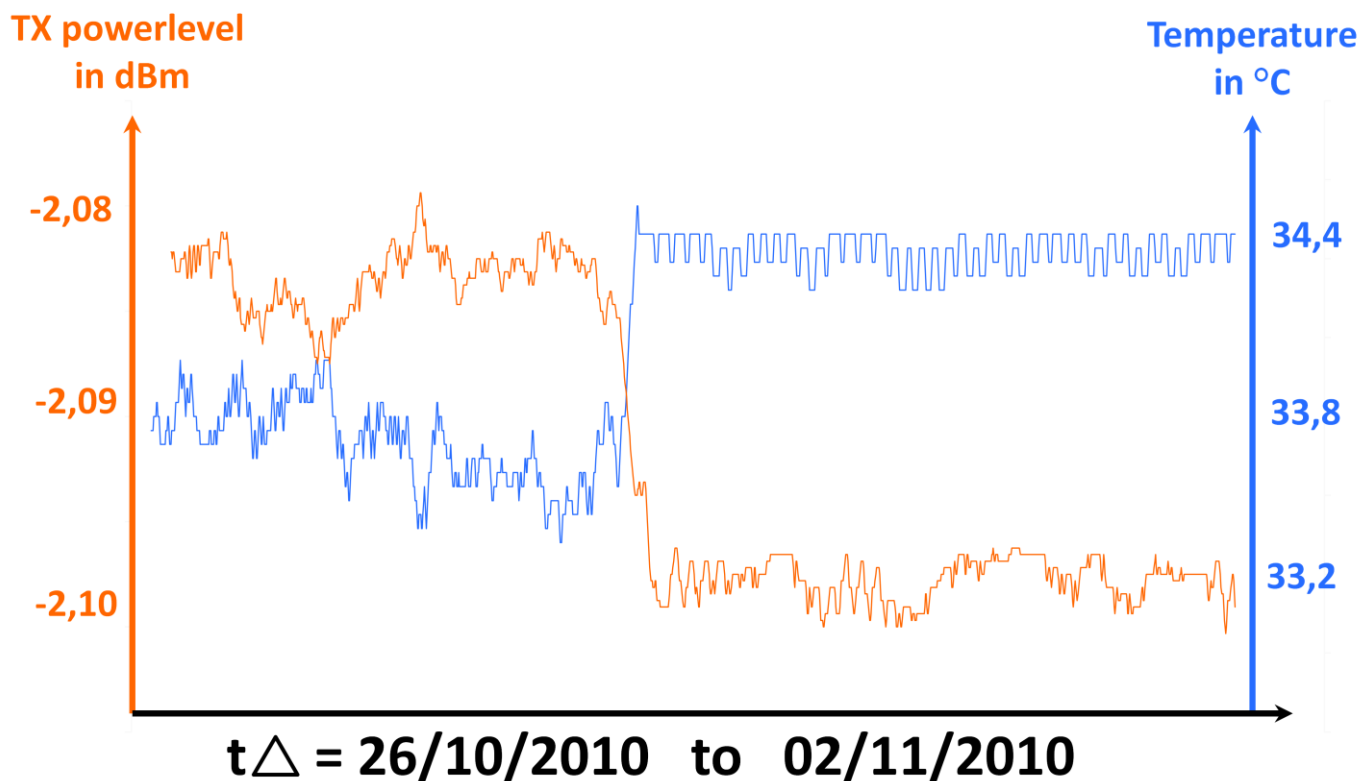
Prediction Analysis: this is based on the machine learing experience from Flexpotix GmbH. In 2010 we put a lot of effort into this field and gonna be much more wise in Mid 2011



~~Theory~~ Practice

At the end of October 2010 we, Marcus Stoegebauer and Thomas Weible, started implementing the first script to gather the needed data. The prototype is collecting data since this time on two 10G interfaces.

First Result



collected data from one 10Gig Ethernet SR interface @ man-da

This snapshot consists of approx. 2000 datapoints gathered from a 10G interface at the core network of man-da GmbH within one week of life traffic / operations in their datacenter. The optic itself is a XFP SR running in a Juniper box. The diagram shows the TX powervalue in comparsion to the XFPs temperature. You can see an increase of the modules temperature of 0,6°C which decreased the transmit power of 0,1dBm.

This is just a rudemental analysis but it shows the basic idea behind the project „an optics life“. There are correlations between the measured values. q.e.d

not in this Graph:

In parallel we collected also the data of the counterpart interface to this 10G interface. The counterpart interface was also a 10G SR XFP in a Cisco box. When we compared the amount of data of RX and TX on both interfaces and calculated the variance between the corresponding values (TX interface Juniper to RX interface Cisco, RX interface Juniper to TX interface Cisco) we were able to calculate a pattern to identify two counterpart interface partners within a 24h trace (or 360 datapoints / source). q.e.d

Issues

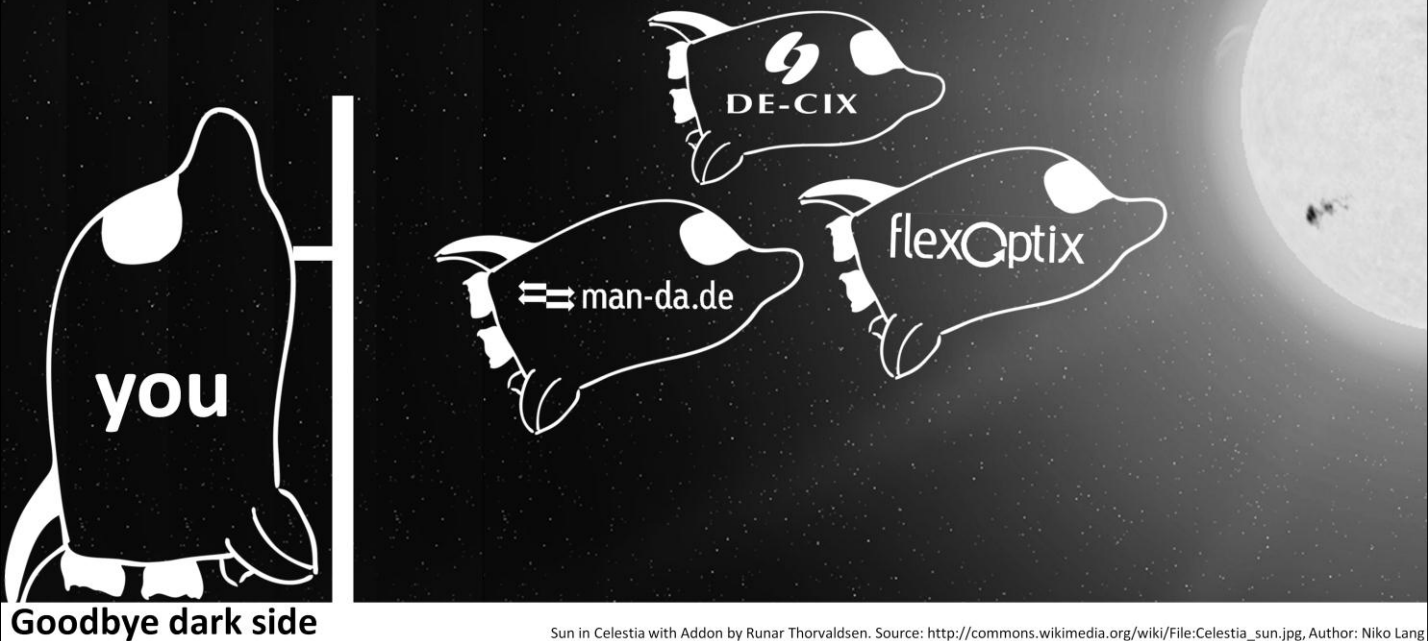
- **SNMP jungle for metrics**
- **rounded values (1,15 -> 1,00 dBm)**
- **lack of broken transceivers**

Followers !

- Our analysis of Cisco SNMP MIBs ended in a nightmare. Some of them had the transceiver DMI values integrated but only partial (TX & RX powerlevel only)
- Cisco ASR cuts off decimal value of digital monitoring information
- Digital Diagnostic Management of transceivers is in SNMP only partial implemented (varies on the platform and vendor)
-> the CLI never lies and with the CLI it is like WYSIWYG. This make testing and implementing of new modules way easier and simpler.
- we need the time based data of broken transceivers to identify patterns for a good prediction ratio.
- The more people / networks join this project the better the prediction will be

where to participate ?

anopticslife@flexoptix.net



Become a member of the project and you will get

1. an easy access to your live diagnostic data of your transceiver
2. an early-warning system to detect a transceiver failure before it will acutal happen when the project is successful.

Goodbye - See you at SwiNOG #22 next year.