WHY 400G FTTH

WHY2025's uplink

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Who, Why, What?

Who?

- Nicola von Thadden, aka nicoduck, works at PFALZKOM, involved in NOC at various events
- Arjan Koopen, aka AK, works at i3D.net, lead of Team:NOC at WHY2025, EventInfra

Why?

- It's fun and hackers need internet

What?

- WHY2025 is this year's Dutch multi-day non-profit outdoor hacker festival/camp
- With a team of volunteers we built a decent scale temporary ISP with its own AS and IP-space, on-site fibre infrastructure, 60 datenklo's, etc. Also see last years NLNOG hacker festival/event networking talk.

Dutch hacker camp uplink history

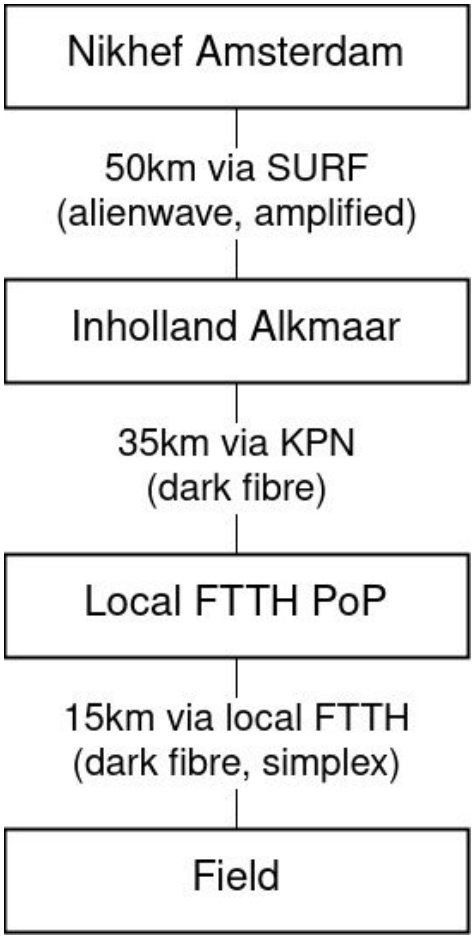
- **HAR2009**: Vierhouten to DC2 Amsterdam. 10G over dark fibre, install 800m of fibre ourselves to KPN PoP
- **OHM2013**: Geestmerambacht to Nikhef. 10G wave via UPC/Ziggo, install 3km of fibre ourselves to Jeroen's house
- **SHA2017**: Zeewolde to Nikhef. 100G coherent with Juniper gear, Eurofiber on-net, 60km of dark-fibre
- **MCH2022**: Zeewolde to Nikhef 200G coherent with ADVA gear via Eurofiber on-net. 30km of dark-fibre from Zeewolde to Almere. Almere to Nikhef via SURF alien-wave
- **WHY2025**: we are back at Geestmerambacht, but this time we have FTTH on-net and we can use it as dark-fibre. However, it is only simplex...

OHM2013 path

Getting to Nikhef from the field

- For MCH2022 we had a nice cooperation with SURF so we wanted to work with them again
- SURF offered an alien-wave (100GHz DWDM channel). With that we could build a 400G link from Nikhef to Inholland in Alkmaar.
- From there dark-fibre was rented at KPN (duplex) and a friendly local FTTH provider (simplex), for the 2nd 400G.

EventInfra AS64404 equipment at Nikhef



400G over simplex, how hard can it be?

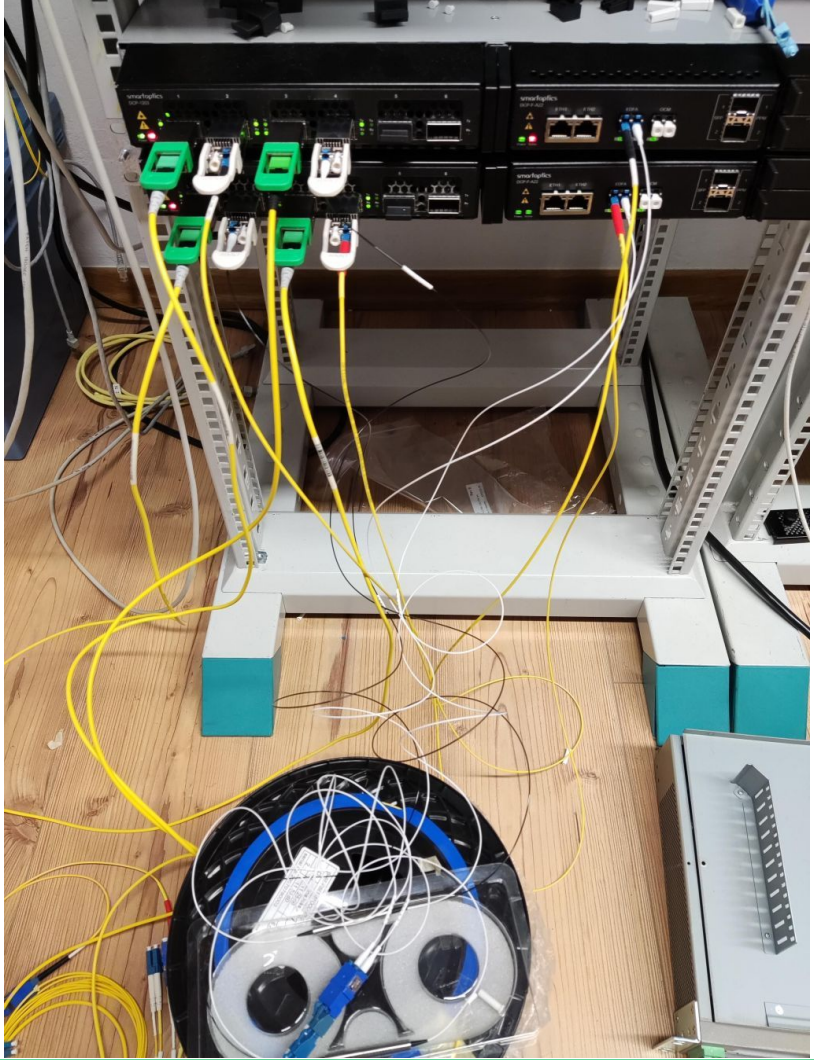
- Needs to be DWDM due to distance/loss [50km, and KPN fibre performed as 80km in terms of loss]
- EMF2024 did 4x 10G over simplex using DWDM (using 8 channels) [see picture]
- Initial tests with ADVA coherent 400G were not successful (RX on channel A, TX on channel B).
- Mailed ADVA, but apparently you need another product for this.
- Learned that with current coherent technology RX and TX frequency always needs to be the same
- Then ask around on IRC #nlnog
- Suggestions given for optical circulators (RX and TX can be the same) [Arendje]
    - Downside with this solution are reflections and loss (KPN fibre probably would've had too many of that)
- And then Nico came up with a somewhat cursed idea :)

Cursed idea

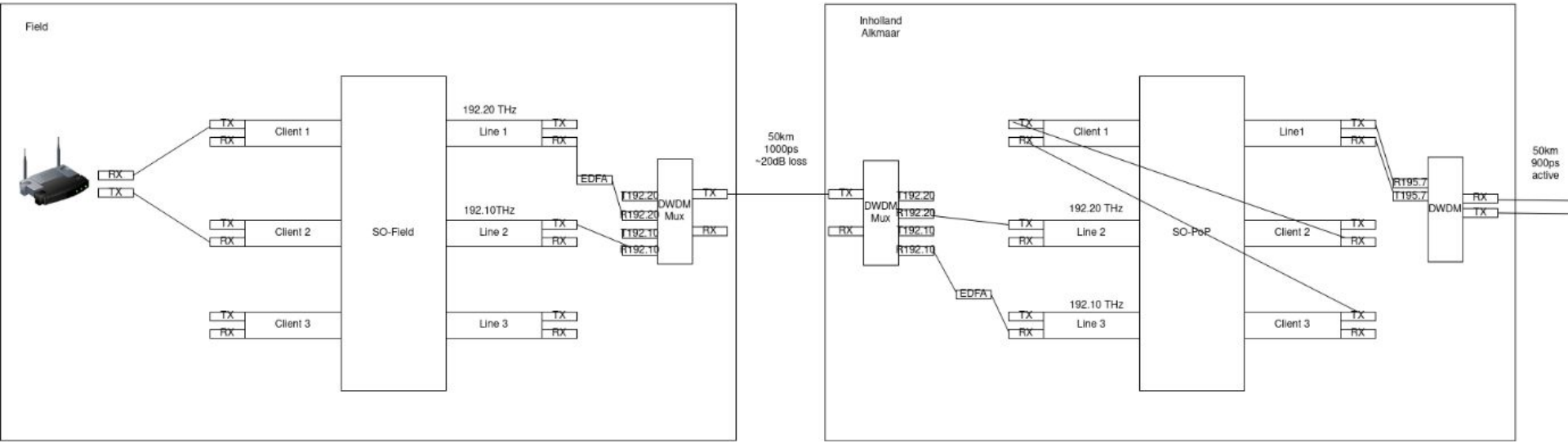
- If the optic can't have two different channels, why not use more optics
- One only doing TX on one channel, another one for RX on another channel
- Problem
  - Ethernet devices have a link state
  - Link don't like to be split across multiple ports
  - => active DWDM equipment to the rescue
- DWDM equipment sometimes doesn't care about link state, "it's a cable"
- OpenZR+ with Smartoptics Transponders do not care about unidirectional links
- Use either circulator or DWDM Mux as a BiDi mux
- Local fiber had a surprise: ~20dB of loss on 50km

Circulator test

- Works as expected
- Higher attenuation than mux



400G ZR+ as BiDi



https://dashboard.eventinfra.org/dashboard/snapshot/cUj7OvtPv6hguxpO310QqSp6kRikU2lj?orgId=1

Uplink

Questions?