Reflections on Redundancy

Ruben van den Brink, CTO

Maxx Cherevko, Network Architect

amsix

About AMS-IX

AMS-IX Amsterdam in numbers

Connected Networks

Peak Internet Traffic

12 Tbps

Total traffic volume in 2023

Total port Capacity

57.12 Tbps

Global presence

- AMS-IX locations
- Powered by AMS-IX

17 internet Exchanges

1150+ connected networks

Our Mission

A better society through better Internet

amsix

Be the exchange you want to see in this world

- Neutrality and Independence
- Online Safety
- Sustainability

Innovation is key

For Internet Exchanges, we can identify two directions for innovation

- **Horizontal**
  Broaden your serviceportfolio with existing network services, like cloud access, transport, security (anti DDoS): might piss off customers
- **Vertical**
  develop new services that leverage the trusted position of an internet exchange, like time services, data exchange, quantum exchange: we offer neutrality and independence

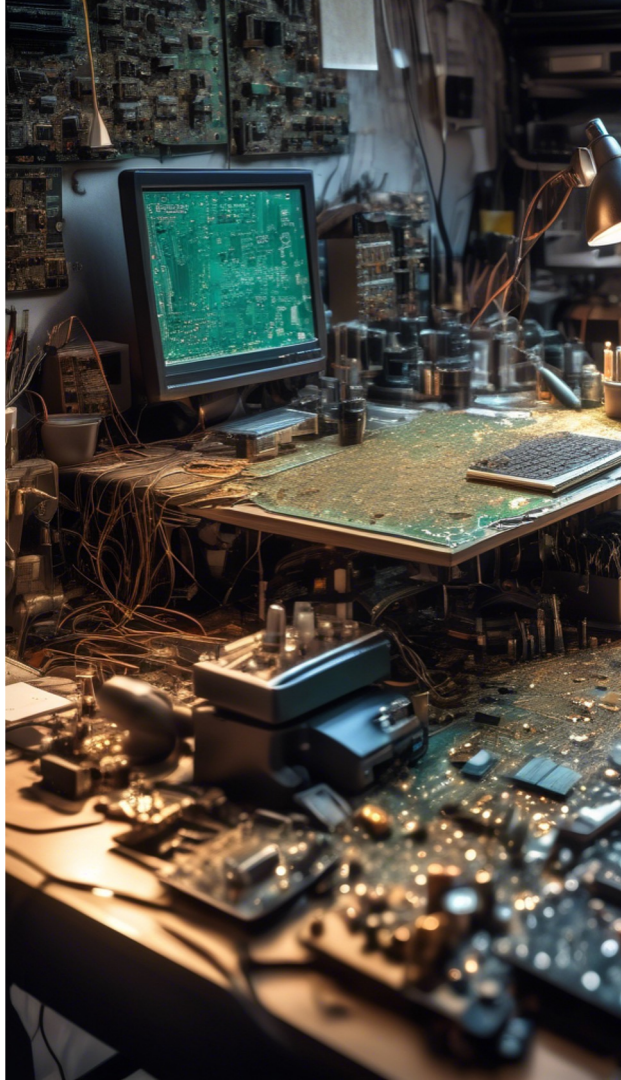
Innovation can be unexpected

Next, Maxx will tell us the AMS-IX story of photonic cross connects and the importance of redundancy in our platform.

It is about the historical pursuit of service availability, about a company that went out of business, about mirrors, and a raspberry pi.

In the unlikely event that you don’t care about any of these things, please remember this one takeaway:

Don’t underestimate the power of Friday afternoon projects…



Internet Exchange Designed for Redundancy

Topology after ring > 2003 double star with VSRP > 2006

Increased scalability:

- Easy expansion/Flexibility

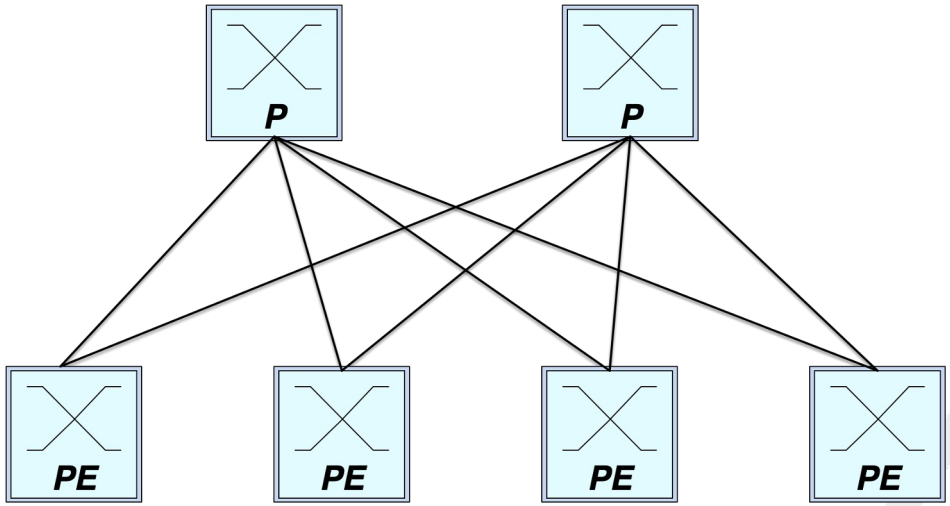
Enhanced redundancy:

- Multiple path
- Fast failover (ECMP, secondary LSP)

Other benefits:

- Cost-effective (pizzas vs chassis)
- Simpler management/troubleshooting

Spine-Leaf single PE



- High-port spines (should be dense)
- Cabling infrastructure (all PE to all P)
- **Potential vendor lock-in**

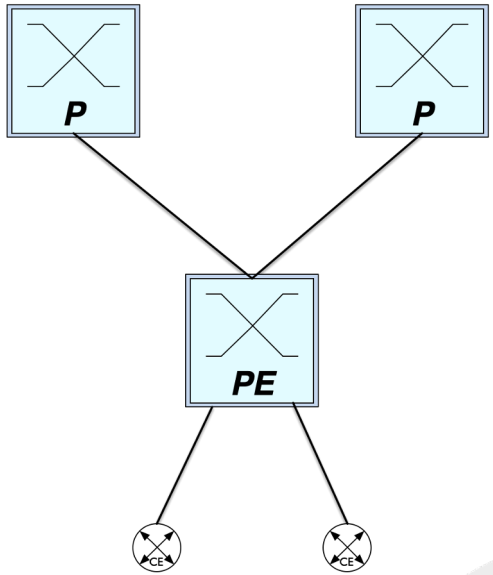
Issues with single PE design

Different operational incidents (time of resolution):

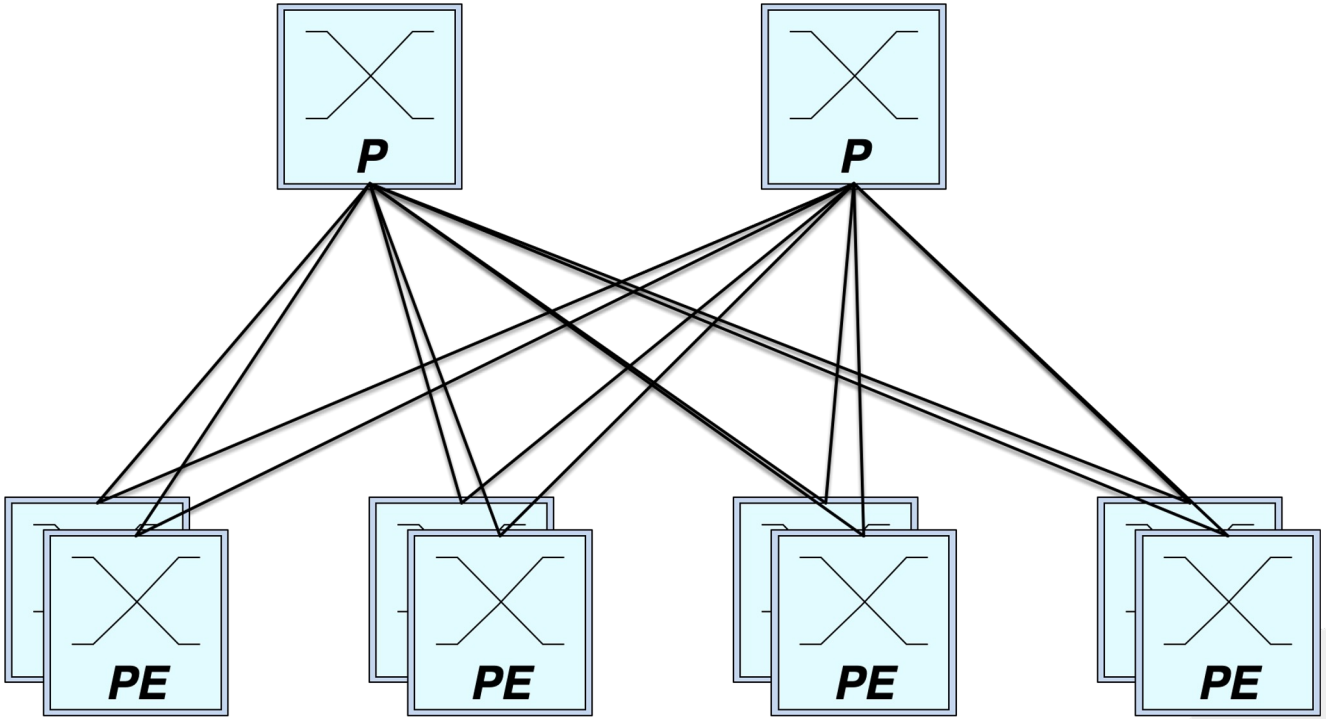
- CE facing optics died
- Line-card on PE HW issue
- Line-card/MM unexpected reboot (SW issue)
- Both backbone fiber-cut(unlikely but possible)
- MM CPU is overloaded with something!?!?
- Whole chassis "just died"
- and many others....

How to avoid long downtime?

Spine-Leaf single PE



Double PE topology



Problem solved?

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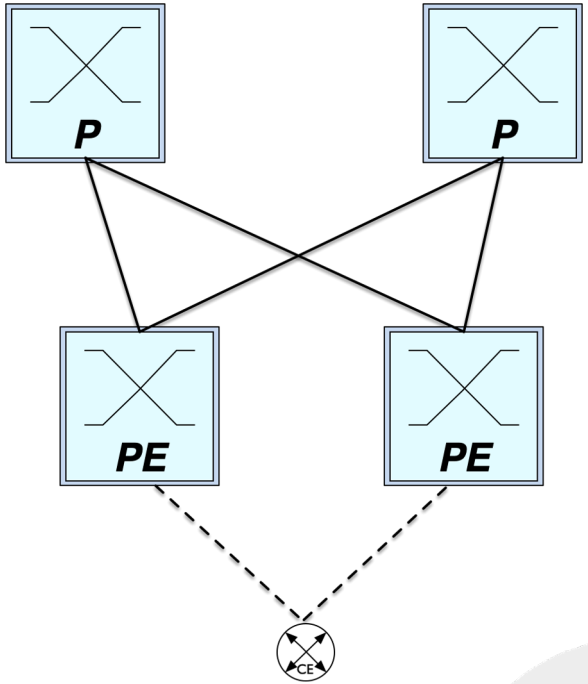
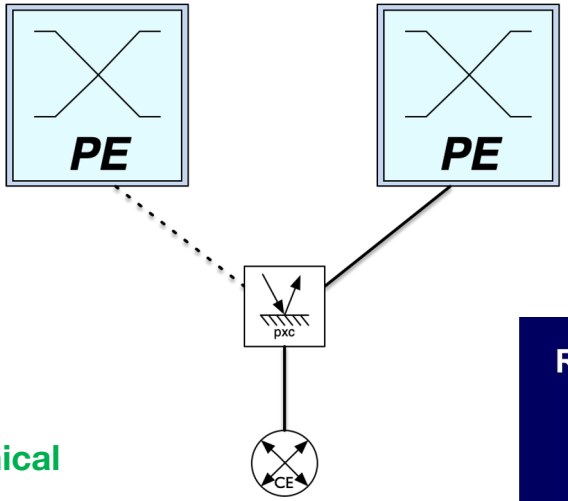
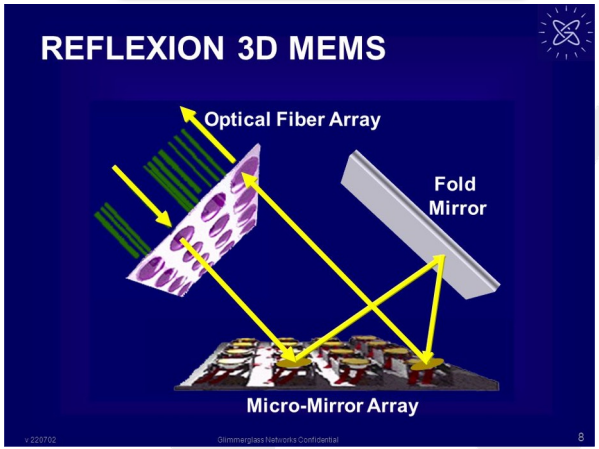


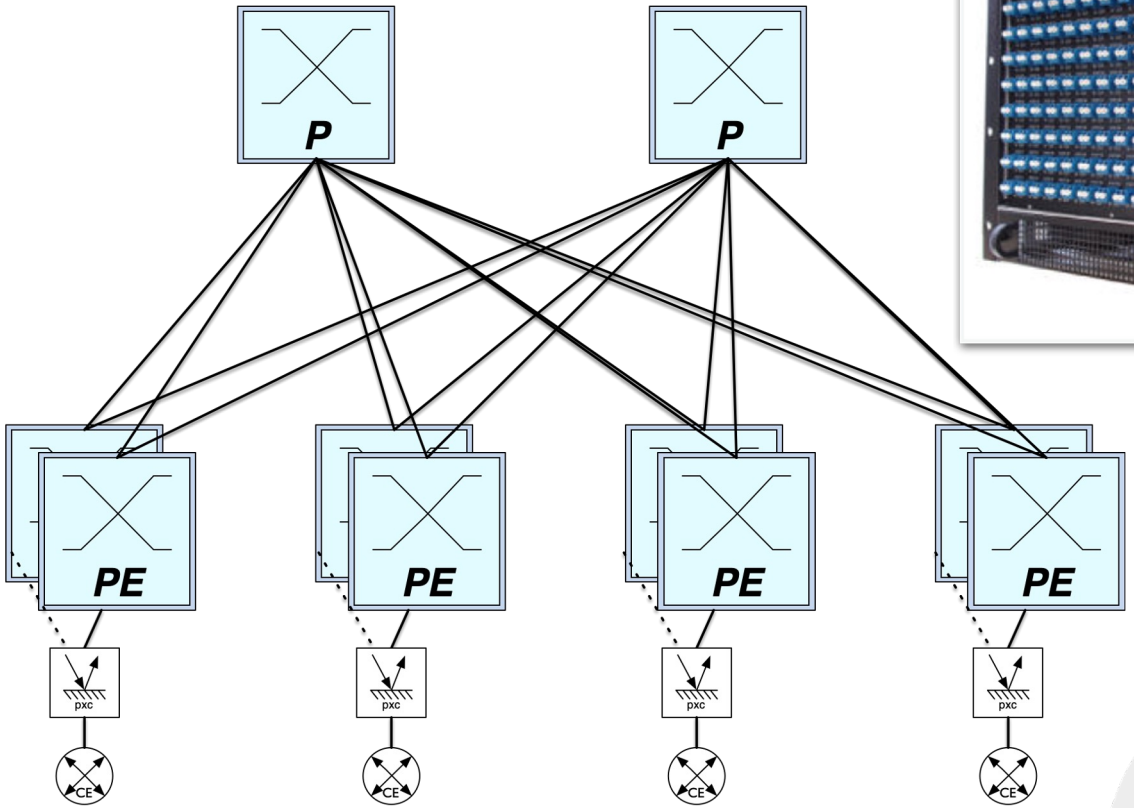
Active-passive L1 switch setup

- L1 Active-passive setup
- Photonic X-Connect (PXC)
- reliable devices
- able to map any-to-any
- measure light level
- detects Tx/Rx issues
- fast swap (<25ms)
- 3D-MEMS (**Microelectromechanical systems**)
- BGP timers 90s/30s (180/60)





Double PE topology



Autoswap and operational aspects

- LSP state monitoring
- 10x last year we had autoswaps (some due to HW/SW issues and some due to interop issues with multivendor network)
- Even L1 support line can solve 90% of issues with customers
- Field engineers have a lot of time to fix issues like optics, LC, BB etc.
- Replacing of unit is not service affecting
- Upgrade of the unit/reboot neither

```
# unexpected     reboot of LC1 on stub-eq3-344
2023-02-06T15:33:38+01:00 stub-eq3-344

# unexpected reboot of chassis
2023-05-09T11:37:05+02:00 stub-nik-341

# 20230516 maintenance load-balance customers niche
2023-05-16T00:13:59+02:00 stub-ix9-241

#????????
2023-07-19T09:50:42+02:00 stub-eq5-247

# unscheduled reboot for stub-nik-341
2023-10-01T08:56:49+02:00 stub-nik-341

#20231113 - Replacement of core-glo-205 with Juniper unit
2023-11-14T00:14:35+01:00 stub-nik-341/stub-ix9-241

#lacp issue
2023-11-22T19:06:25+01:00 stub-nik-341

#Unexpected reboot of MLX switches in AMS-IX network
2023-11-27T08:05:58+01:00 12x MLXe

#swaps before reboot due to memory leak
2024-01-10T03:48:35+01:00 1x switch

#Unscheduled swaps on multiple PEs at DR1, DG1, EQX1, EQX3, EQX7 OSPF
2024-01-09T00:58:32+01:00 5x switches
```

Glimmerglass has left the building

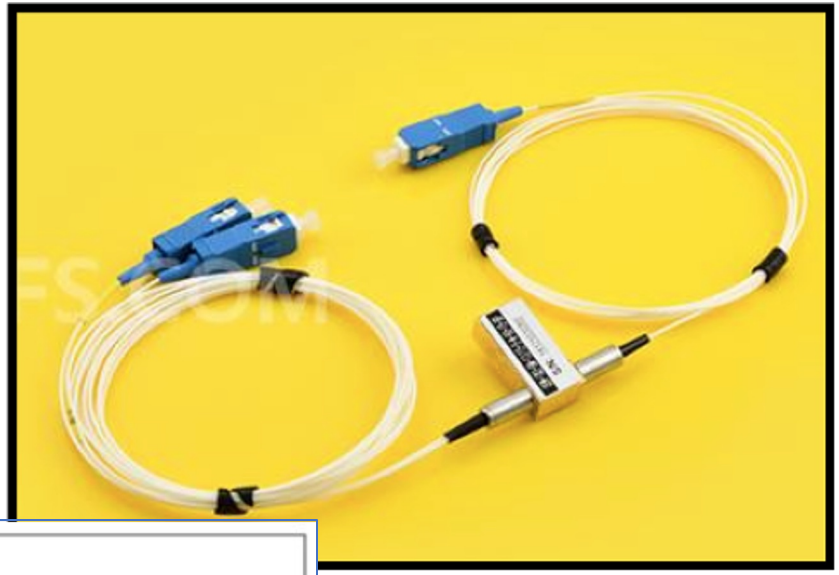
- Around 70 units in production @AMS-IX NL network
- Really stable devices but no one lasts forever
- Lack of 1U dense units for IXaaS
- Glimmerglass went out of business since 01-01-2019

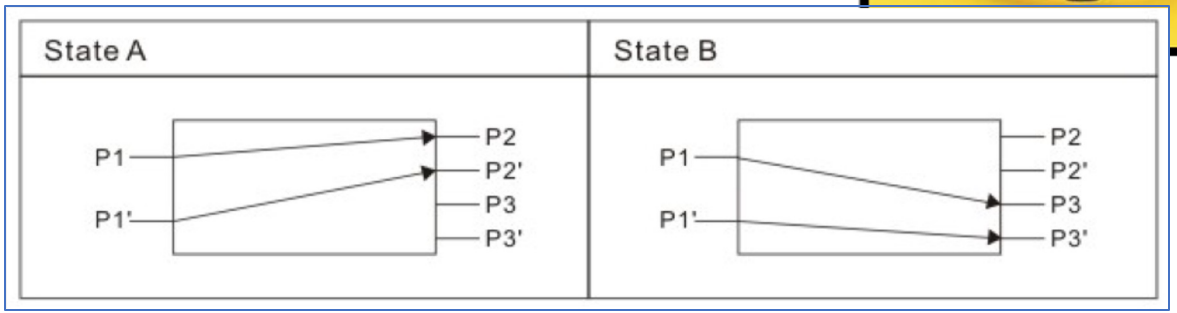
- Replacement?

Investigation
Design
Development
MVP

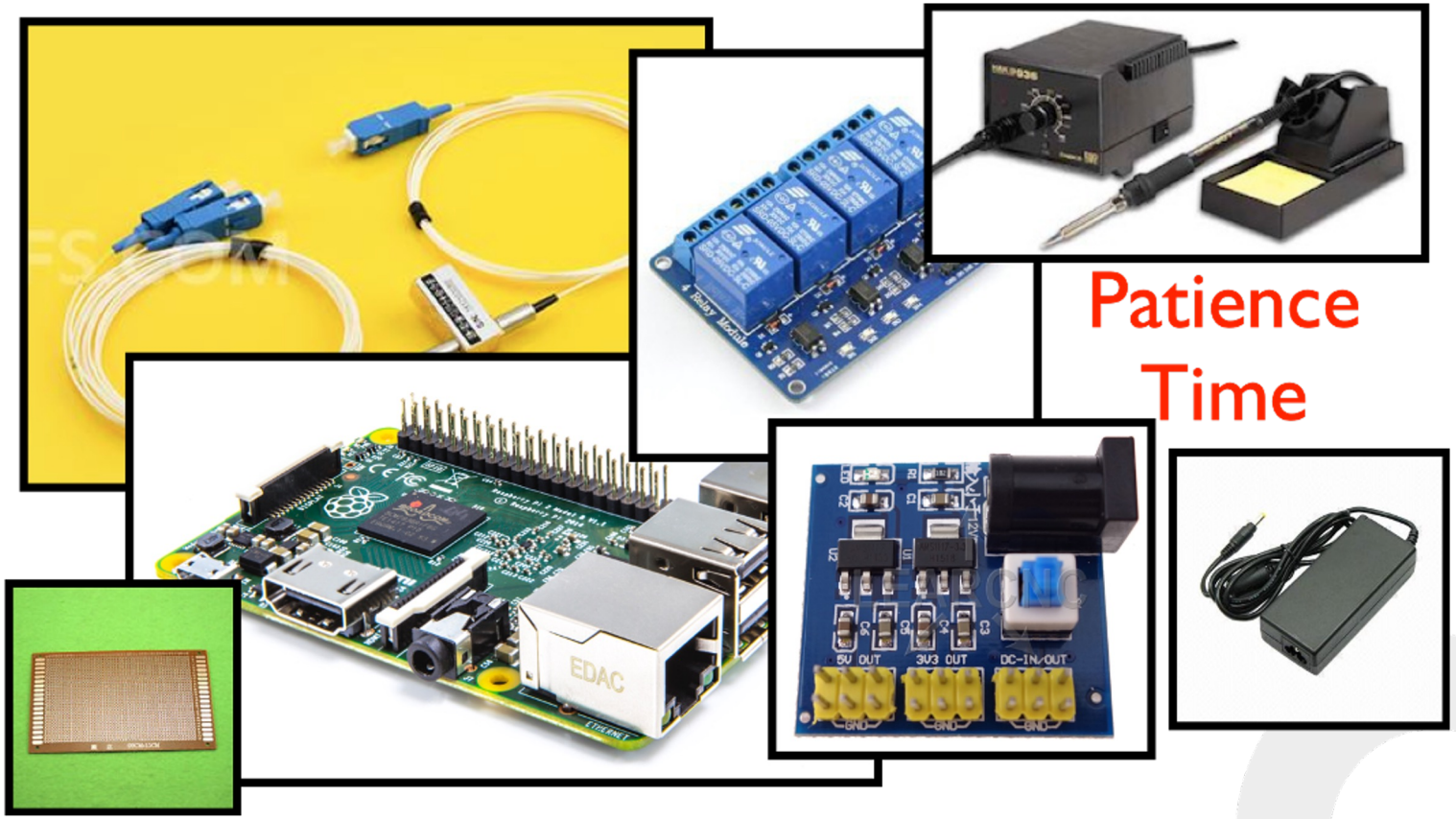
D1×2 Optical Switch

- Latching
- 1310-1650nm
- insertion loss: 0.6dB
- fast (<8ms)
- current (55mA)
- cheap





Building Proof of Concept (PoC)



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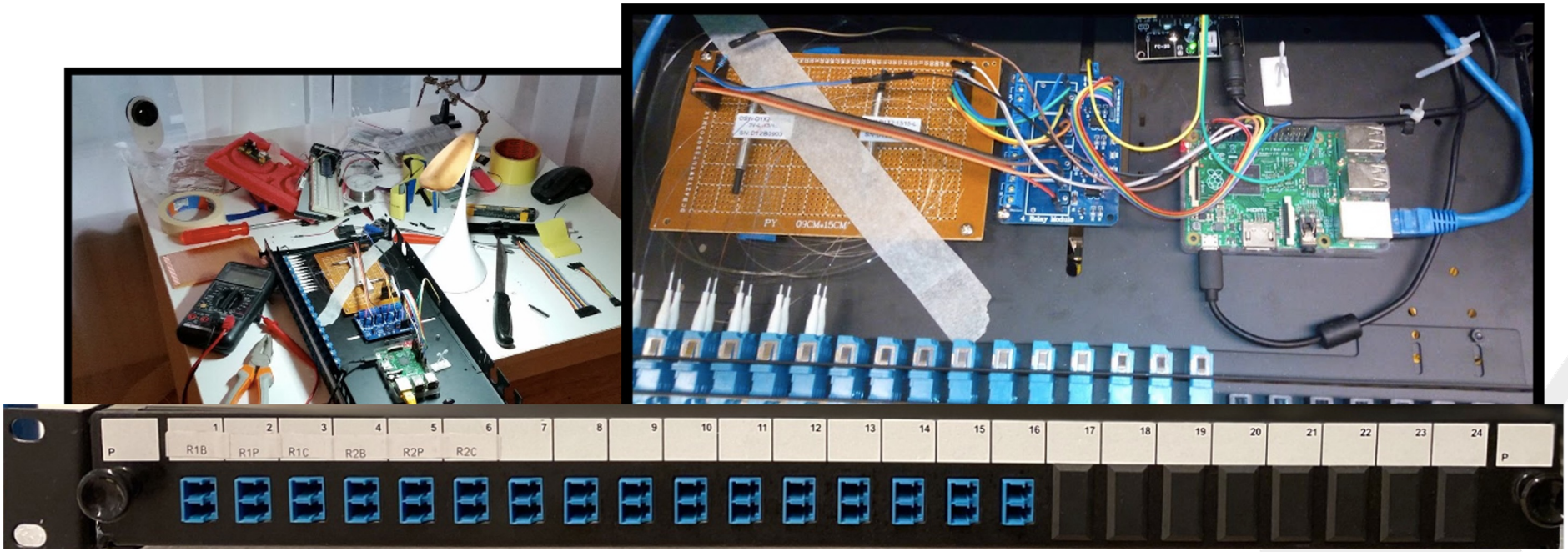
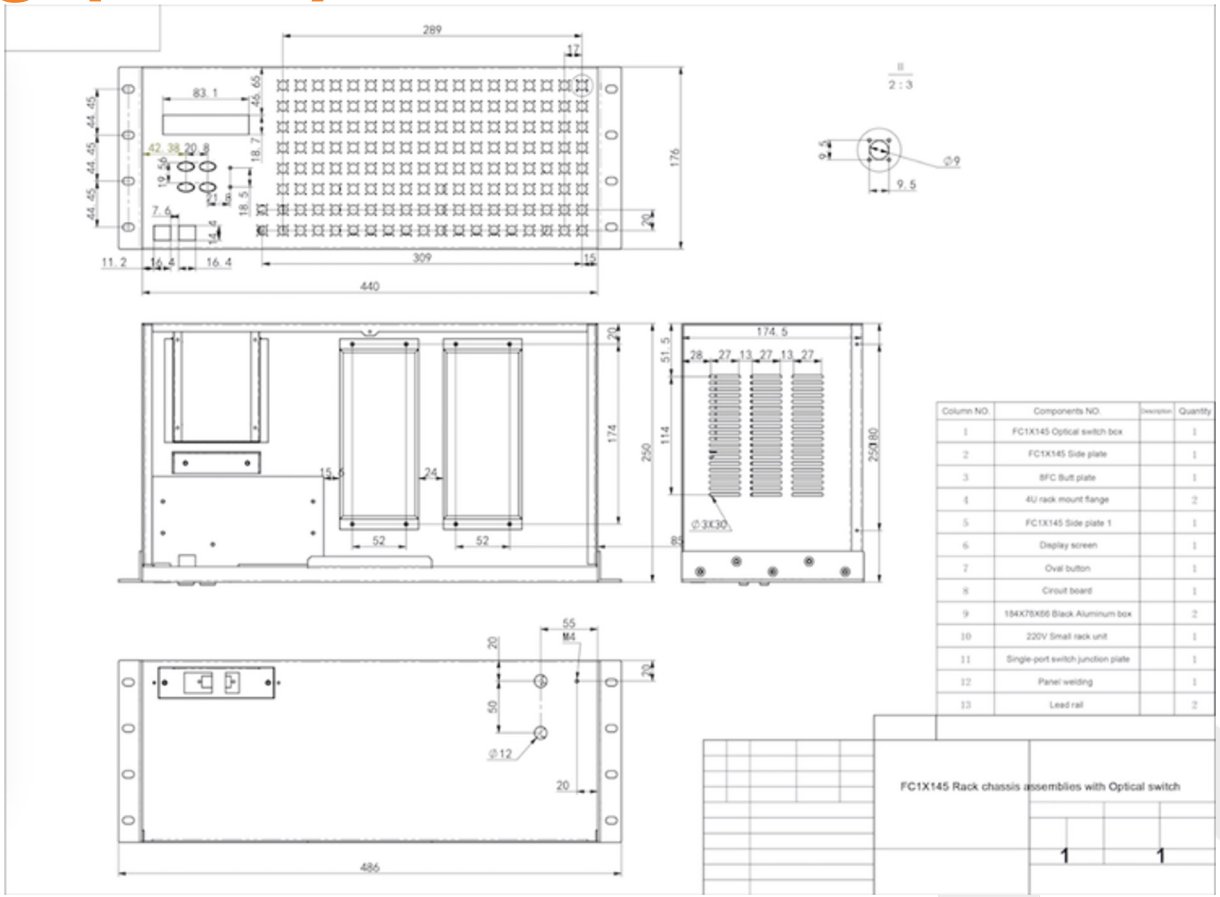
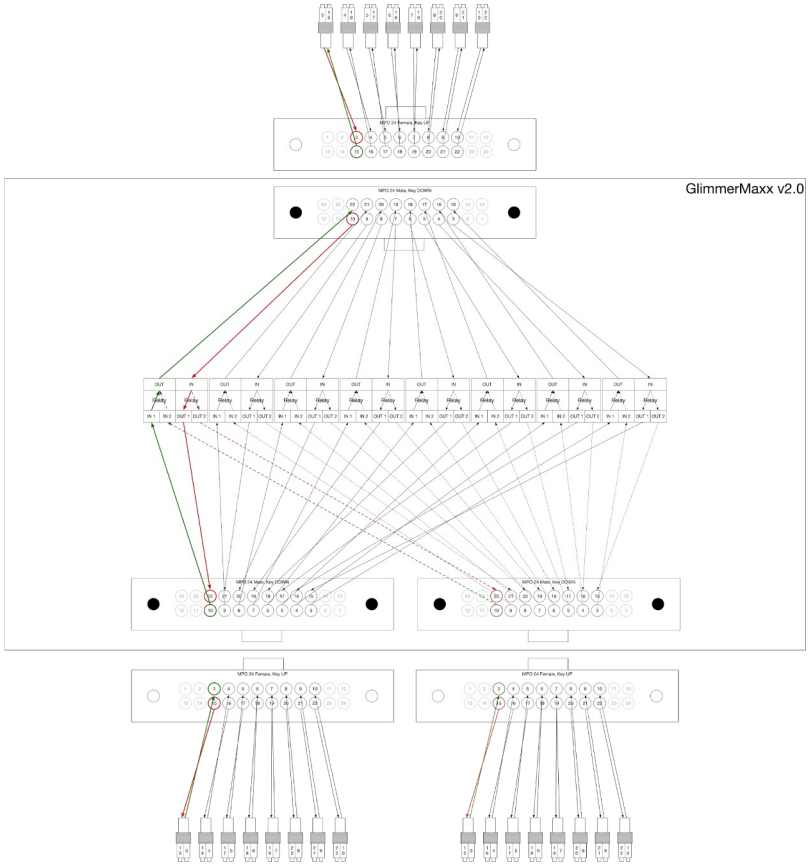


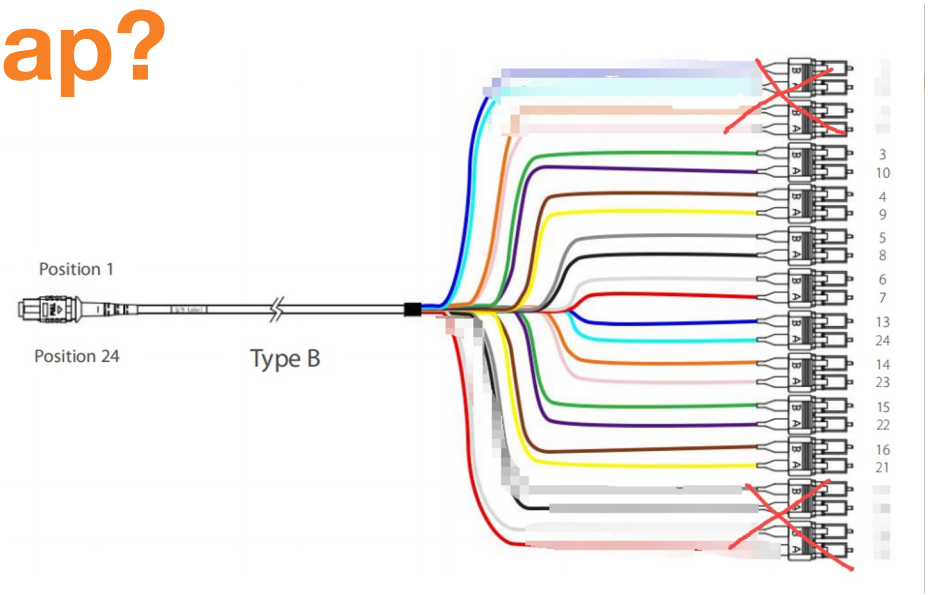
Designing (MVP) non-modular LC unit



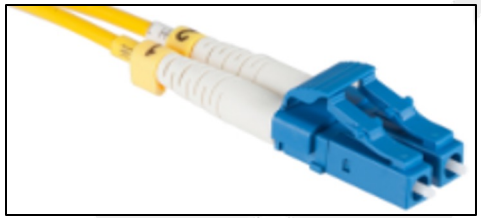
Column NO.	Components NO.	Description	Quantity
1	FC1X145 Optical switch box		1
2	FC1X145 Side plate		1
3	8FC Butt plate		1
4	4U rack mount flange		2
5	FC1X145 Side plate 1		1
6	Display screen		1
7	Oval button		1
8	Circuit board		1
9	184X78X66 Black Aluminum box		2
10	220V Small rack unit		1
11	Single-port switch junction plate		1
12	Panel welding		1
13	Lead rail		2

Is rackspace cheap?



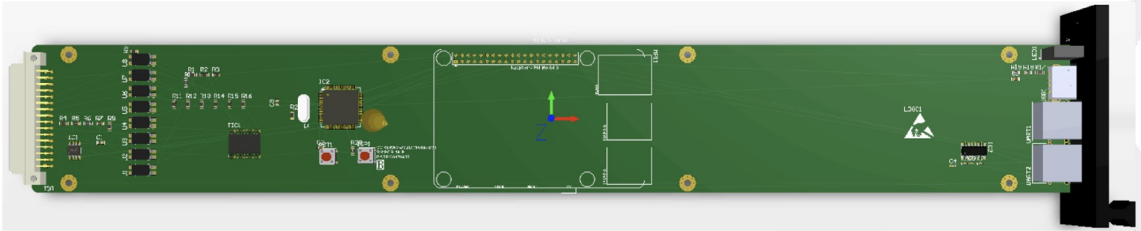


MPO/MTP24 to LC



Minimum viable product (MVP)

- 2 rack units
- 8x optical modules
- 1 module x 12 relays
- latching relays
- 1x redundant PSU
- 1x management module
- ALL modules+PSU+MM are hot swappable
- one chassis can serve 8x12 = 96 customer connections
- MM is Raspberry Pi 4 :-)

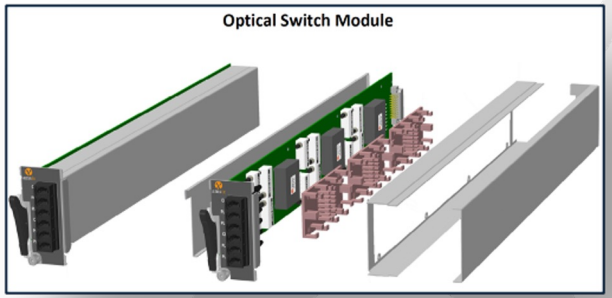


AMS-IX MXC v1

GM-64

&

GM-160

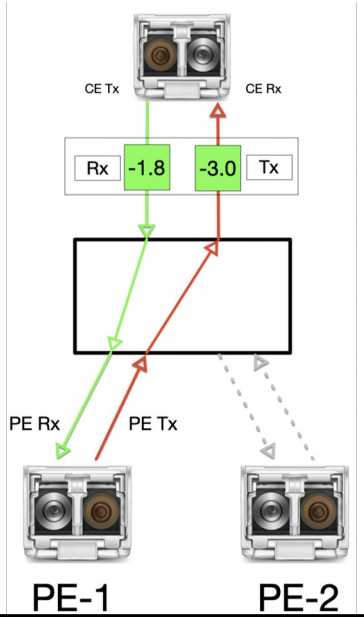


AMS-IX MXC (boring)internals :-)

- Two types of chassis 2U for "bigger" locations 1U for small(interchangable modules)
- Low insertion loss:
  - Pigtail < 0,3db * 2 (Senco)
  - Power reader 0,1db-0,2db (Santec)
  - Relay < 0,7db (Coreray)
  - Splicing 0,1db * 3
  - Total +/- 1.8db
- Latching relays
- NXP i.MX8 heart of MM
- Dual power supply
- Low power consumption(15-16w)
- Fast swaps(<8ms)

Web-UI & REST-API

- REST-API vs TL1
- Tx/Rx issues detecting



```
url='https://192.168.11.2:5000/api/mappings'
query={"mappings": [{"id": "1/1", "mapping": "b"}, {"id": "1/2", "mapping": "b"}]}
r = requests.patch(url, json=query, headers={'x-access-tokens':token}, verify=False)
print(r.text)
print(r.content)
```

MXC in (Virtual) Reality

MXC in Reality

- UAT testing in AMS-IX lab is ongoing
- Aim to place production order for the first batch before summer
- Initial deployment in 2024
- Several IX’s have shown interest in this technology

If the MXC is sufficiently tested in the field, we consider making it commercially available.

MXC in Virtual Reality

MXC in Virtual Reality

Questions?

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