DE-CIX

German Internet Exchange

Building resilient and scalable Terabit Exchangepoints

PLNOG

Mazurkas Conference Center,
Warsaw, 2009-01-15

Agenda

- **Motivation**
- Design of infrastructure
- Implementation of infrastructure
- Scaling the infrastructure
- Summary

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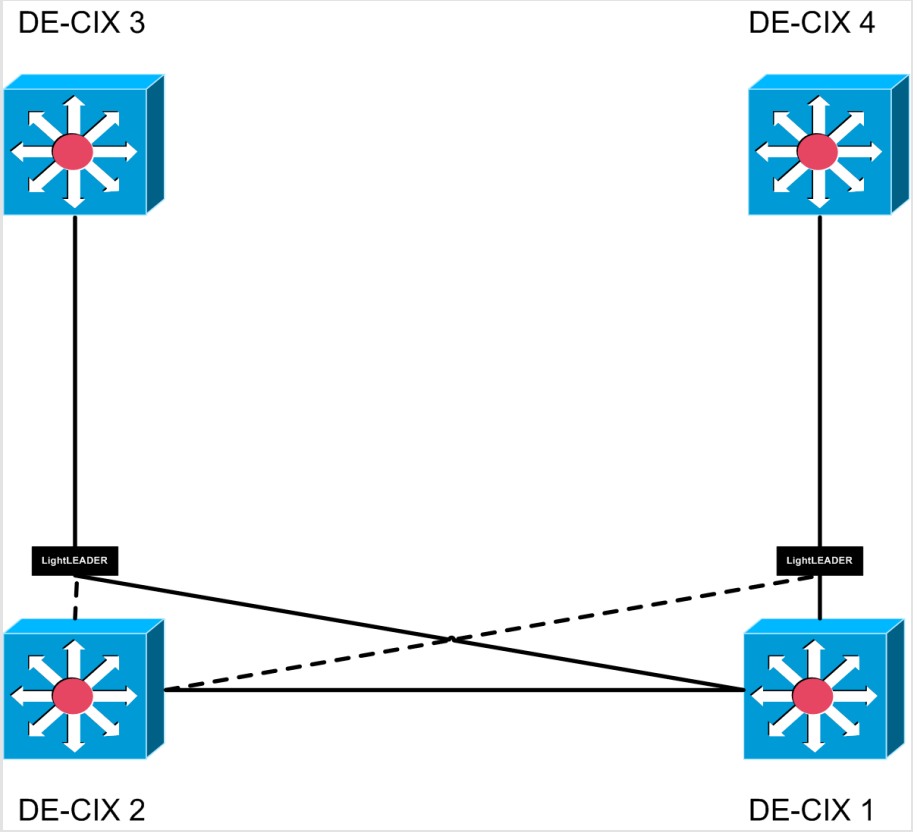
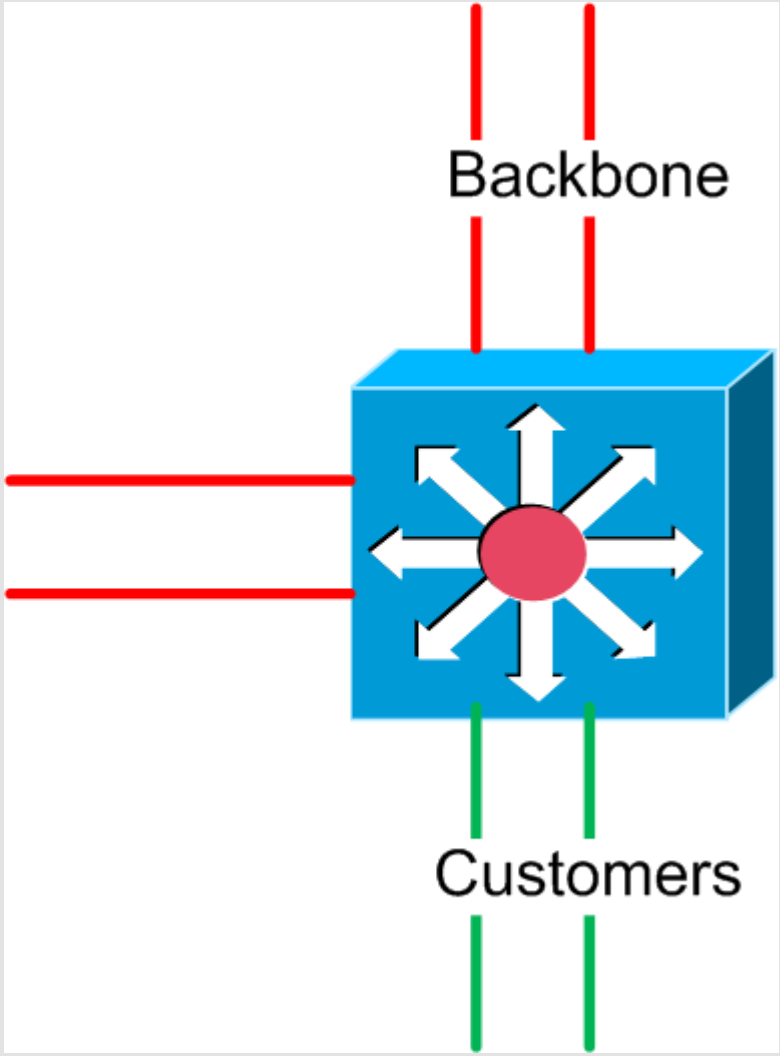
Locations

Topology until mid 2008

- DE-CIX1 and DE-CIX2 on the same campus, DE-CIX3 and DE-CIX4 in separate colocations
- combined edge and distribution in resilient star
- grown over time since 1995 from single switch, dual edge, STP resilience to fibre protection based resilience



- mix of edge and distribution
- hard to plan for growth in backbone bandwith and ports for customers
- outage of distribution switch also affects customers



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Design of new infrastructure

- which topology?
  - star
  - ring
- which technology for interconnects?
  - simple dark fibre
  - DWDM
- which technology for resilience?
  - STP
  - MRP (Metro Ring Protocol)
  - Layer 0

Design of new infrastructure

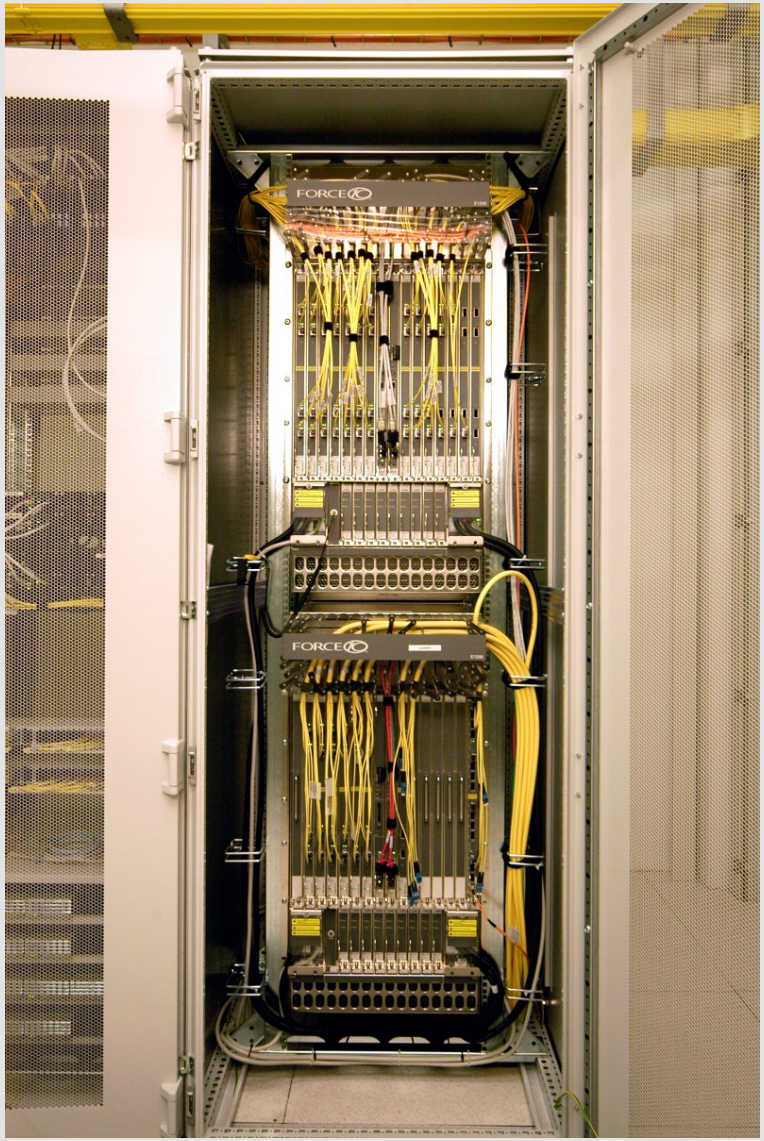
- star topology
- DWDM technology for interconnects
- Layer 0 technology for resilience
- other considerations
  - scalable, simple and robust
  - cost-efficient
  - easy migration

Building blocks

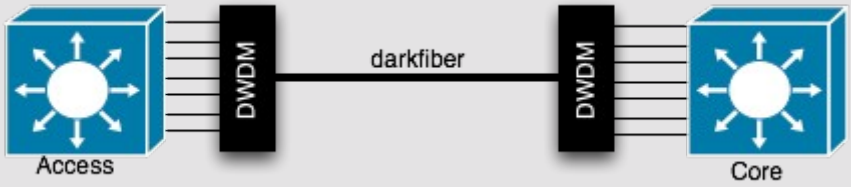
- core switches (star)
- DWDM de/muxes (interconnect)
- optical switches (resilience)

cores

- where to locate
  - new POP?
  - existing POP?
  - which POP?
- Take existing POP's
- Hardware is Force10 networks E1200



DWDM / dark fibre



- passive
- up to 16 channels
- diverse routes
- one pair per edge
- Cube Optics as a system partner

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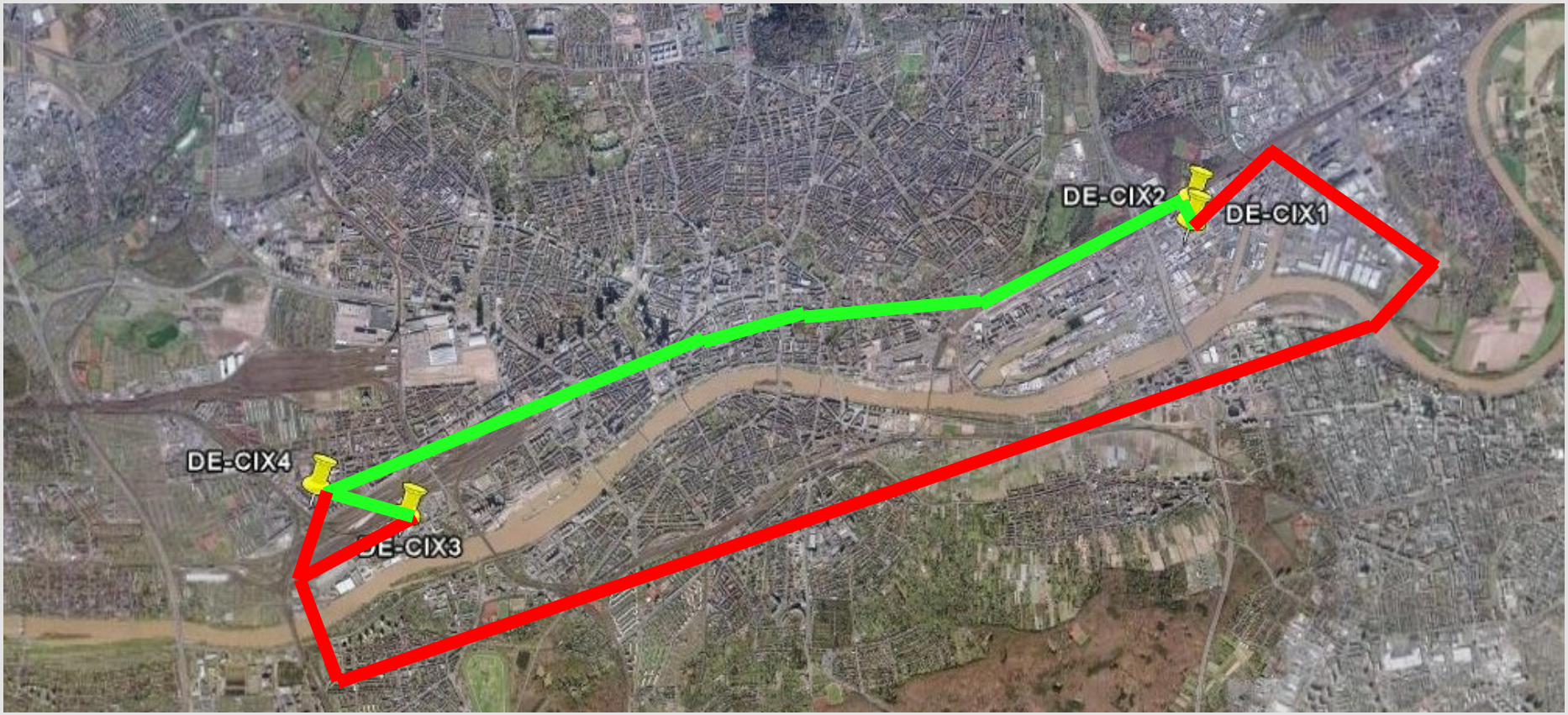
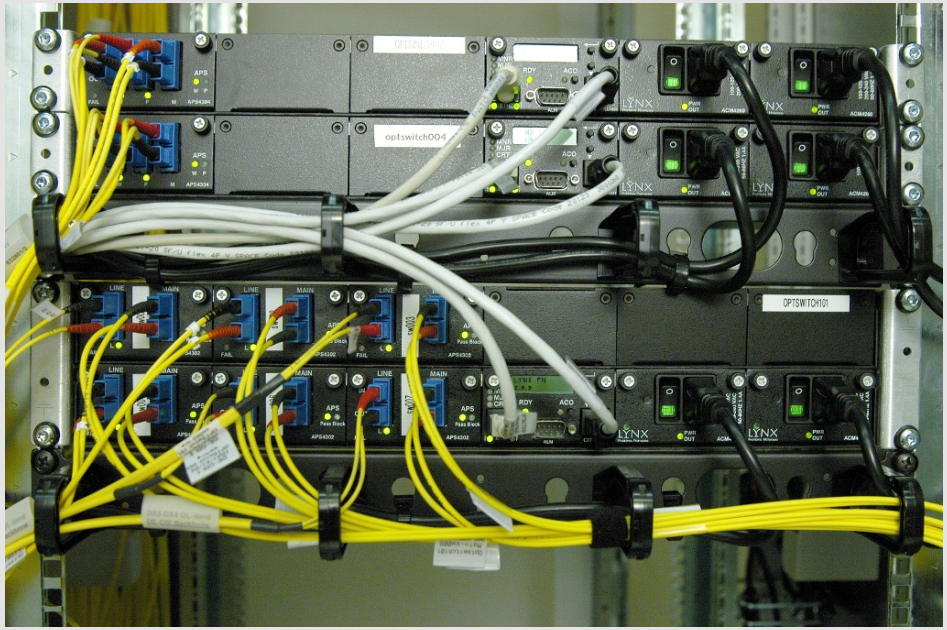
darkfiber routes



Resilience

- using simple fibre switches
- power is only needed to switch fibres
- primary and backup path going via diverse fibres
- master/slave
- Lynx networks Lightleader
- all optical switches synchronously switch over to standby core



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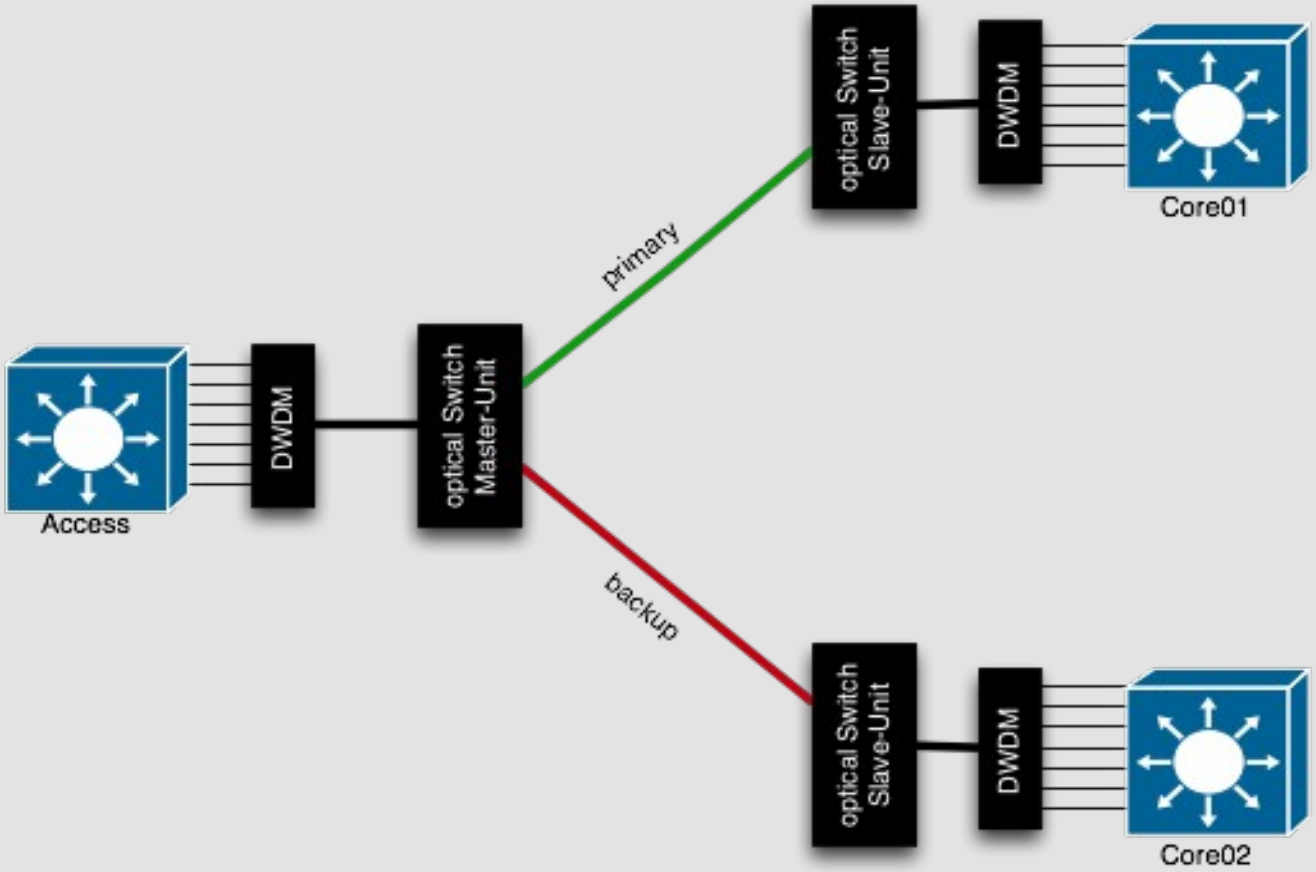
optical protection



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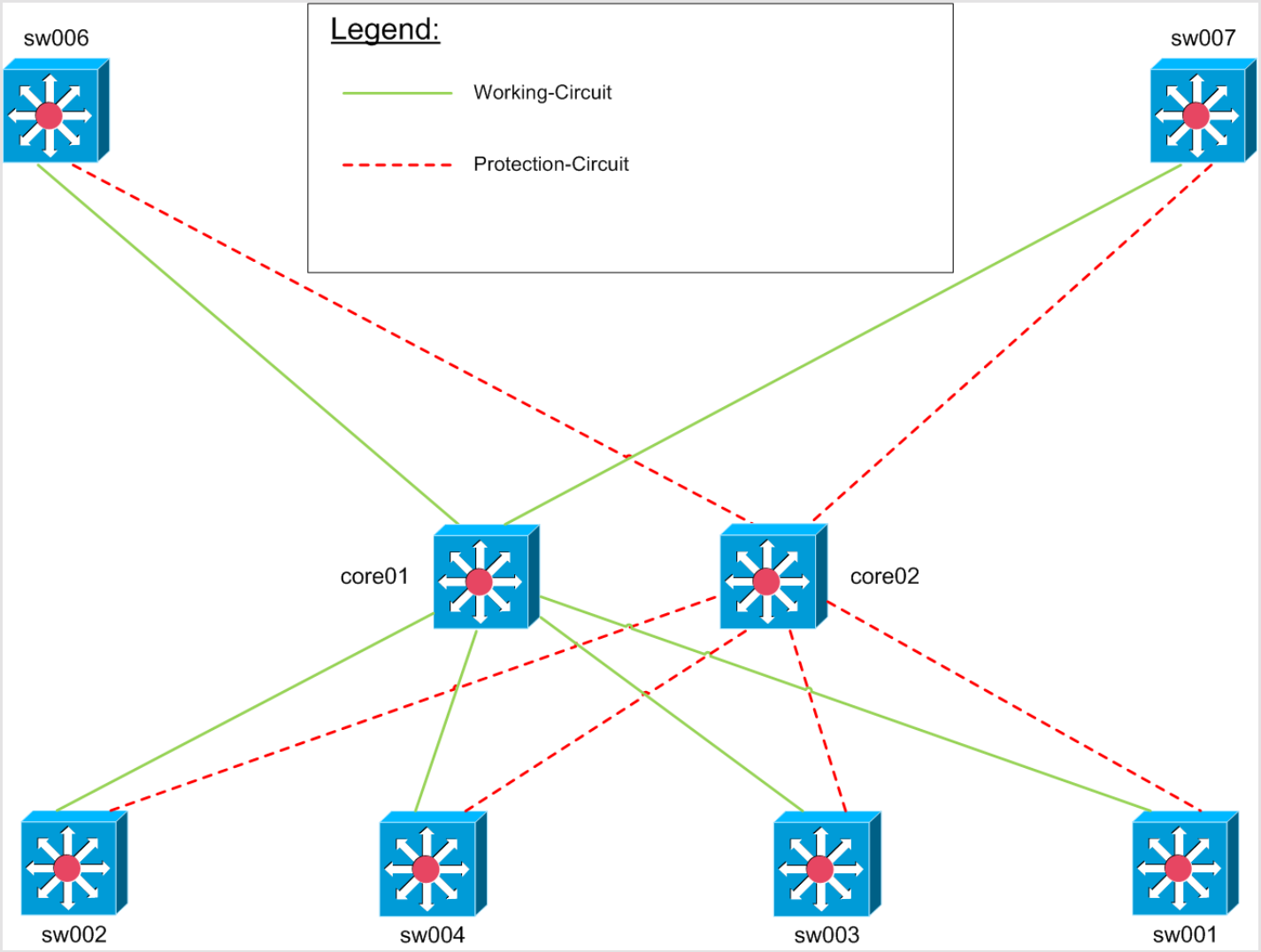
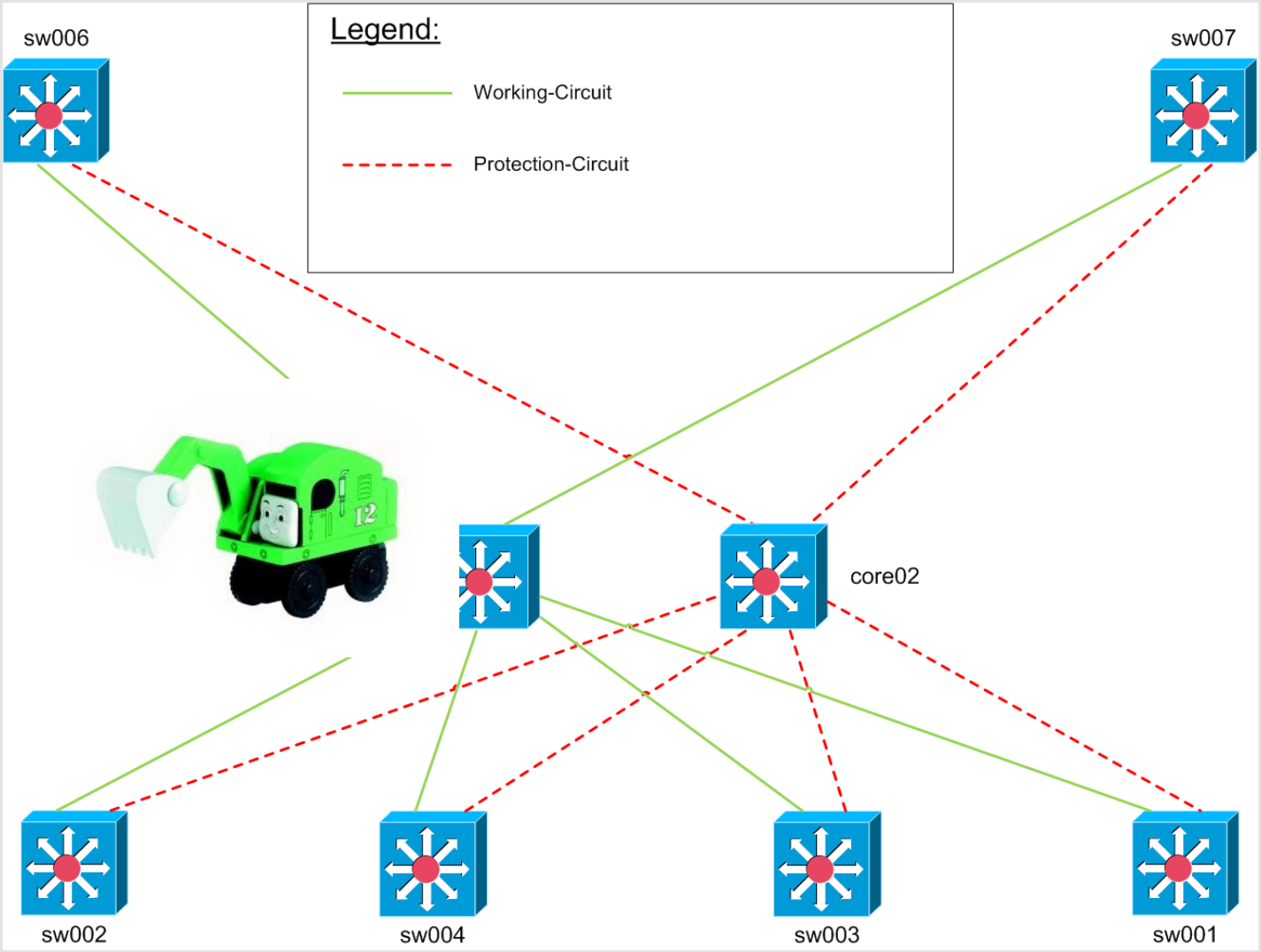
Normal operation mode ☺



Something went wrong ☹



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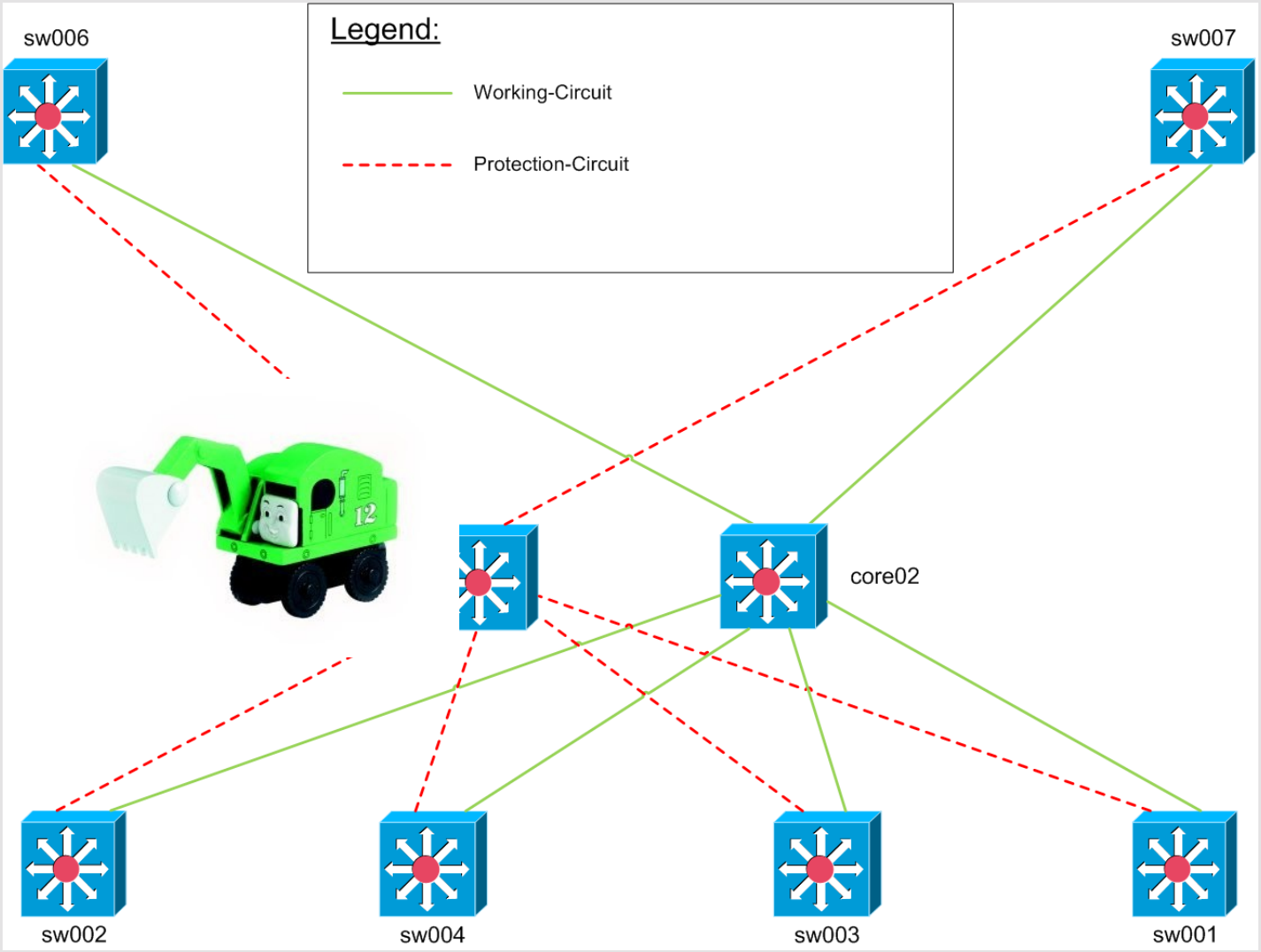
Protection operation mode 😐



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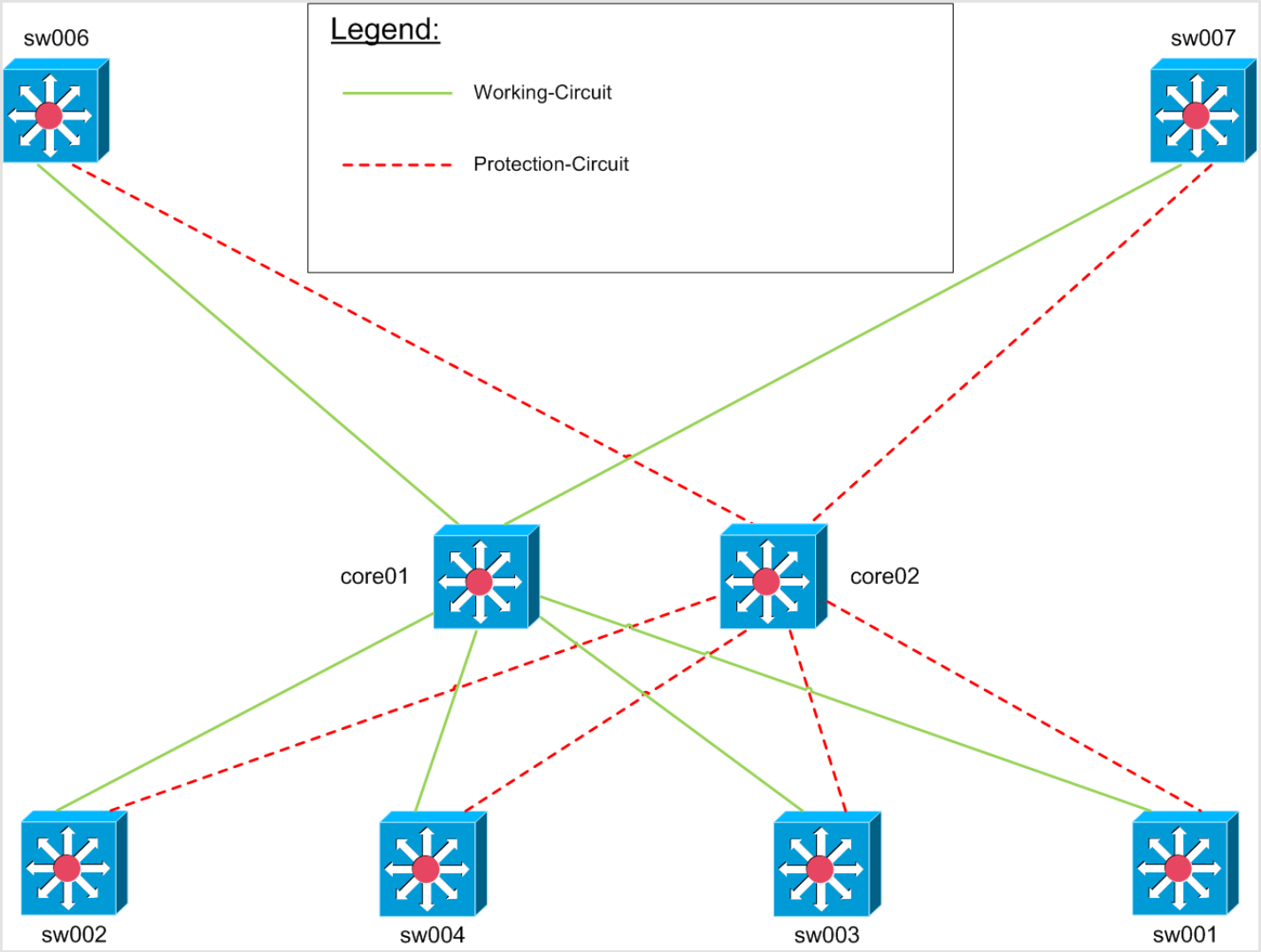
Problem fixed → Normal operation mode ☺



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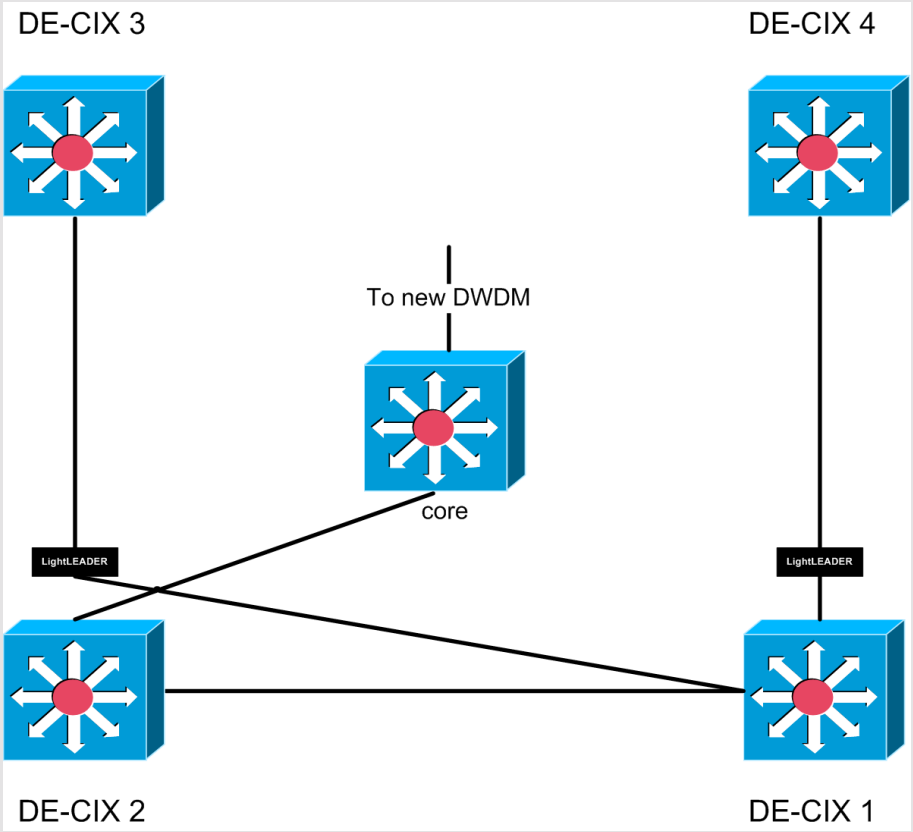
Implementation

- Order lines, DWDM transceivers (long leadtime), DWDM chassis, fibre switches and core switches
- Install and test everything
- connect core to existing infrastructure

Migration

- replace existing connections with DWDM/LL connections
- use old backup ports to interconnect new core
- during off peak hour replace existing interconnects (etherchannels) with new interconnect to core
- test failover scenario



Testing failover

- simulating fibre cut by re/plugging a cable
- doing a contolled failover
- while testing failover backup connection of one edge did not come up
- optical budget was not enough
- removing attenuator solved the problem
- failover will be done on a regular basis

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Edge

- simply add another switch
- more efficient to use bigger edges as well

#switches	local traffic
1	100%
2	50%
3	33%
4	25%
5	20%
6	17%
7	14%
8	13%
9	11%
10	10%

Core

- use bigger switches
- will upgrade core to Foundry MLX32 soon
- „stack“ core switches when you can't get bigger ones
- scales up to 32 core members (~41TBps)

Summary

- Building resilient, scalable highbandwidth IXP is possible

- Scaling is possible up to >40 Tbps which will safely take us to when 100Gbps ports are widely available

Thanks!

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