Frequency Dissemination Remote Management

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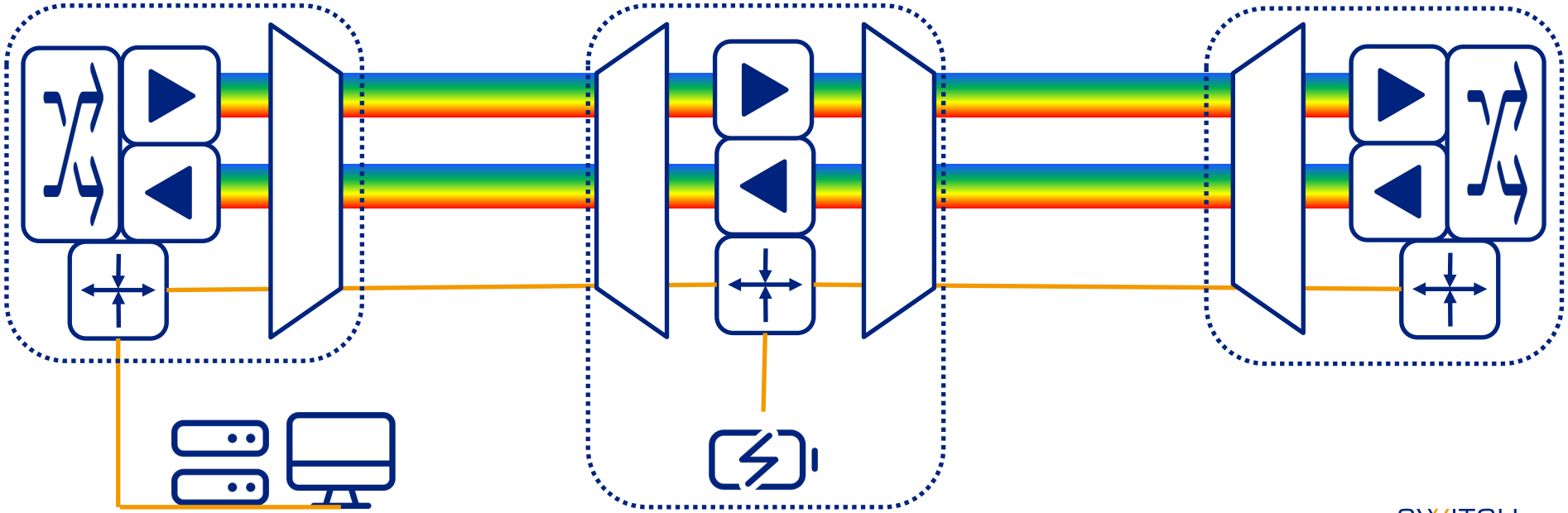
SWITCH

DWDM Management

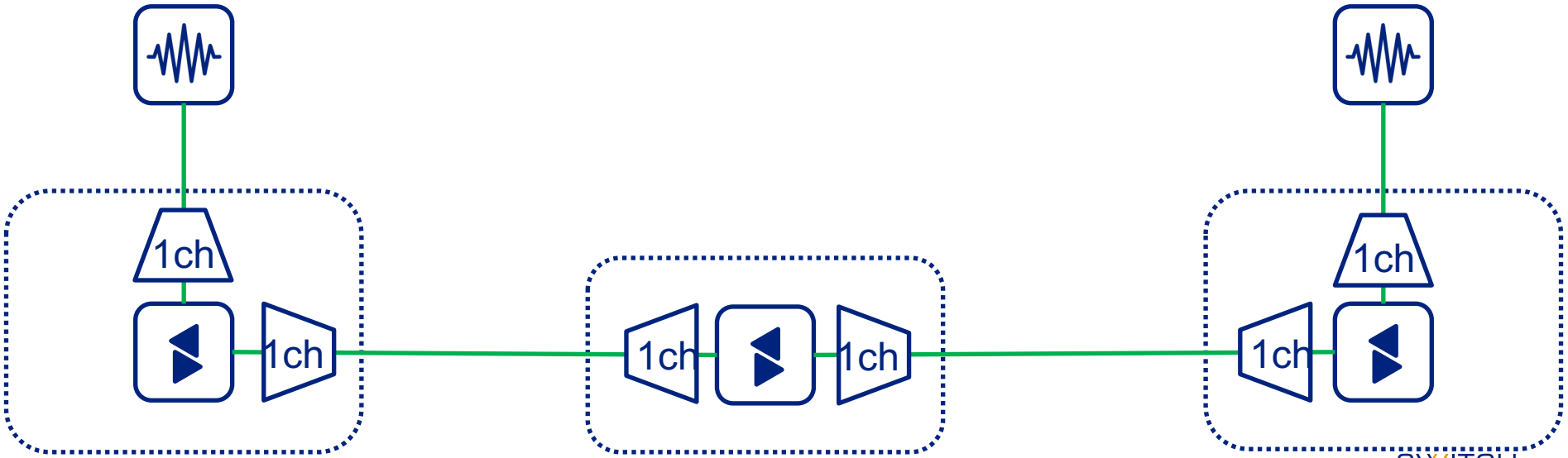
→ DWDM systems include IP based management network (DTN, OSC)
→ Transmitted on side-channel (1510nm, 1610nm) on same fiber, 100Mbit to 1000Mbit
→ Additional ethernet interface to connect other site equipment (user port, in-band port)



SWITCH

Frequency Dissemination

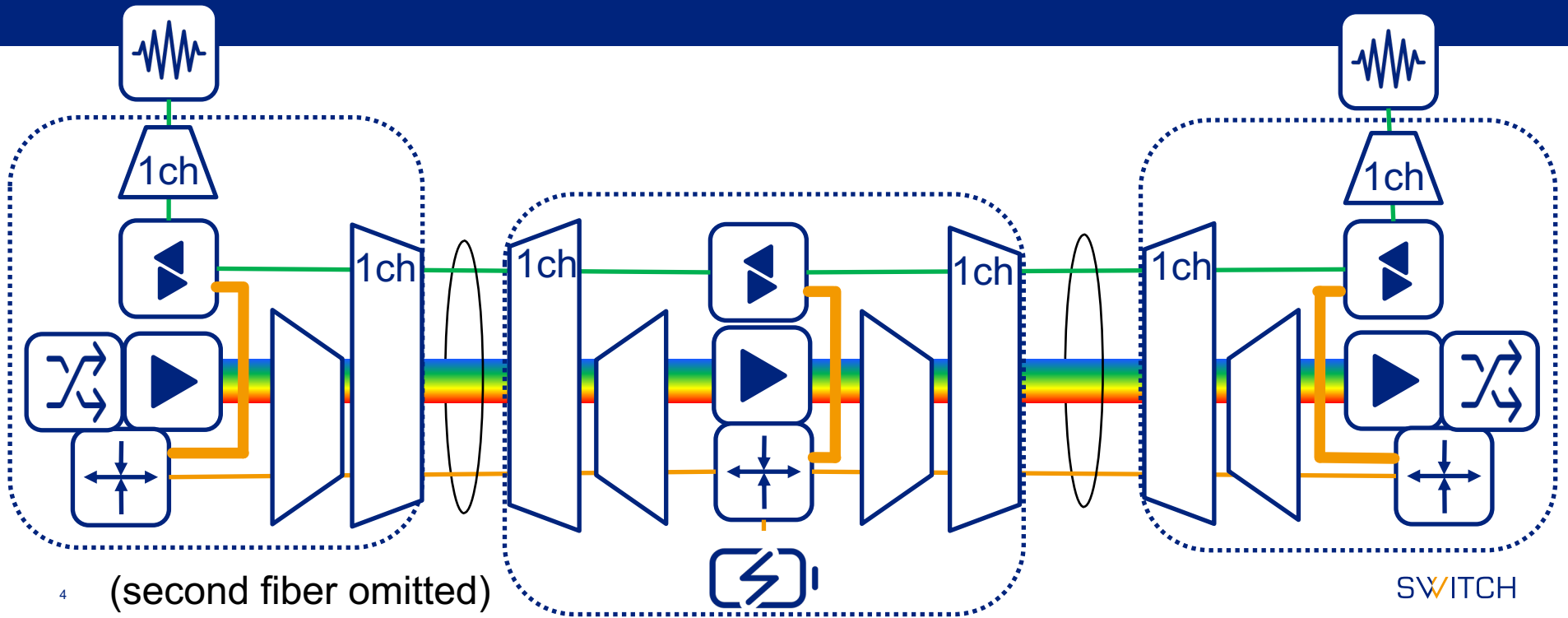
→ Single channel spectrum, single fiber, bidir amplifiers
→ No management channel, local management per site (more like early 2000’ DWDM)
→ End site / customer site need management too
→ Bidir amplifiers need narrow spectrum isolation (using single-channel DWDM OADMs)



SWITCH

Integrate Management

→ Integrate bidir amplifier management in existing DWDM management
→ Bidir spectrum isolation (DWDM OADMs) double as multiplexers
  → RAMAN amplifiers might use midstage extension port



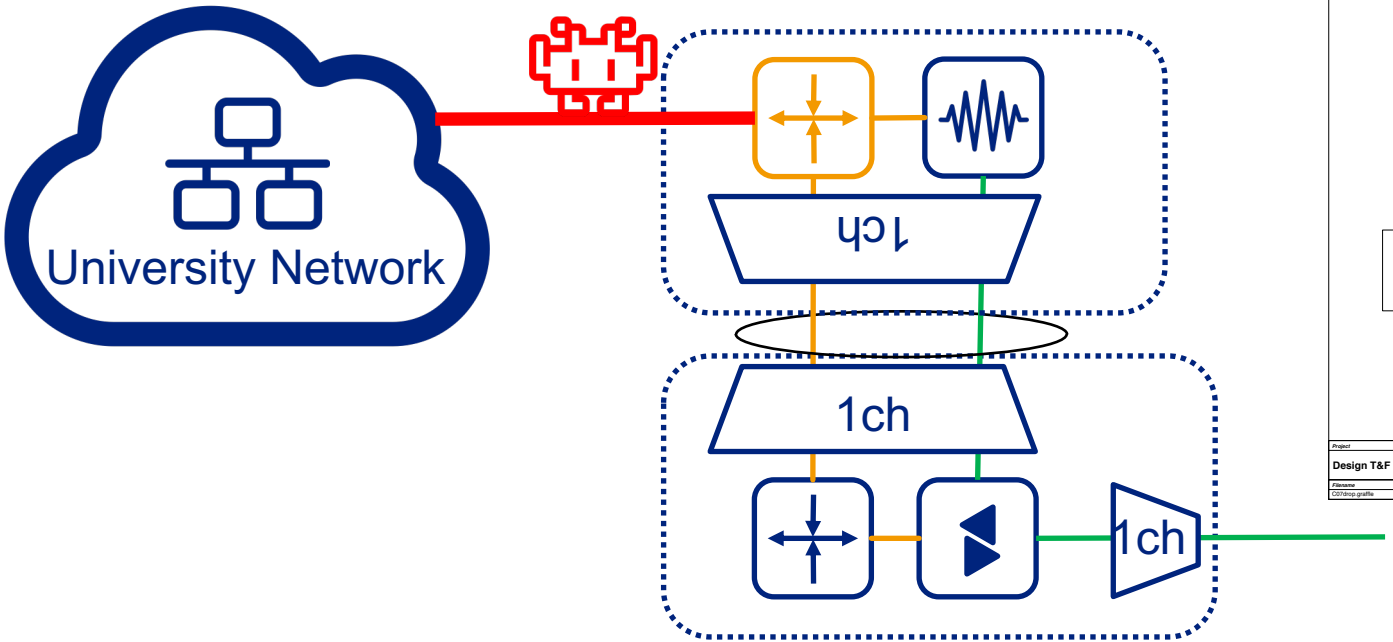
(second fiber omitted)

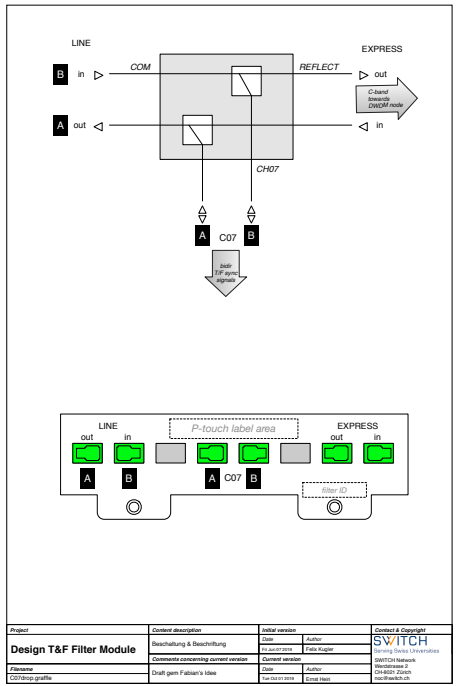
SWITCH

End-Site Management

→ Use same 1ch DWDM-OADM to multiplex management network
→ Add switch/router on end-site

→ Do **NOT** connect to university's network (local admin won't like you as a backdoor)

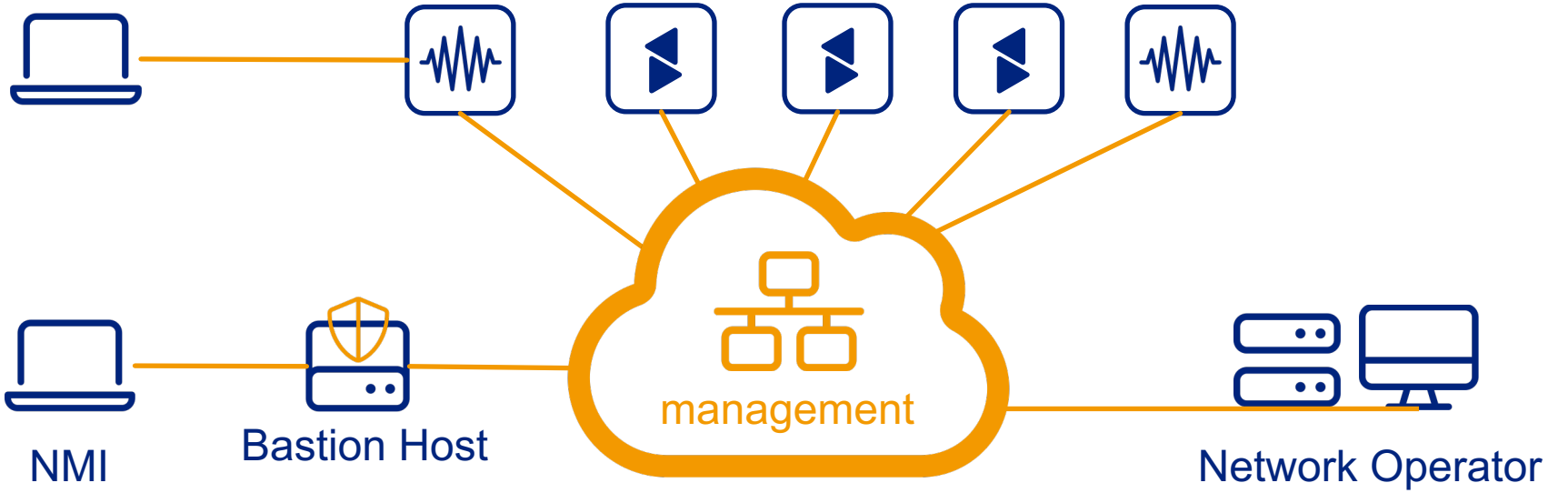




Remote Management

→ NMI personnel needs access (outside management network)

→ Some bastion host, proxy, vpn needed
→ e.g SSH Jumphost / SOCKS5 Proxy + NFtables rules include SSH user-id



SWITCH

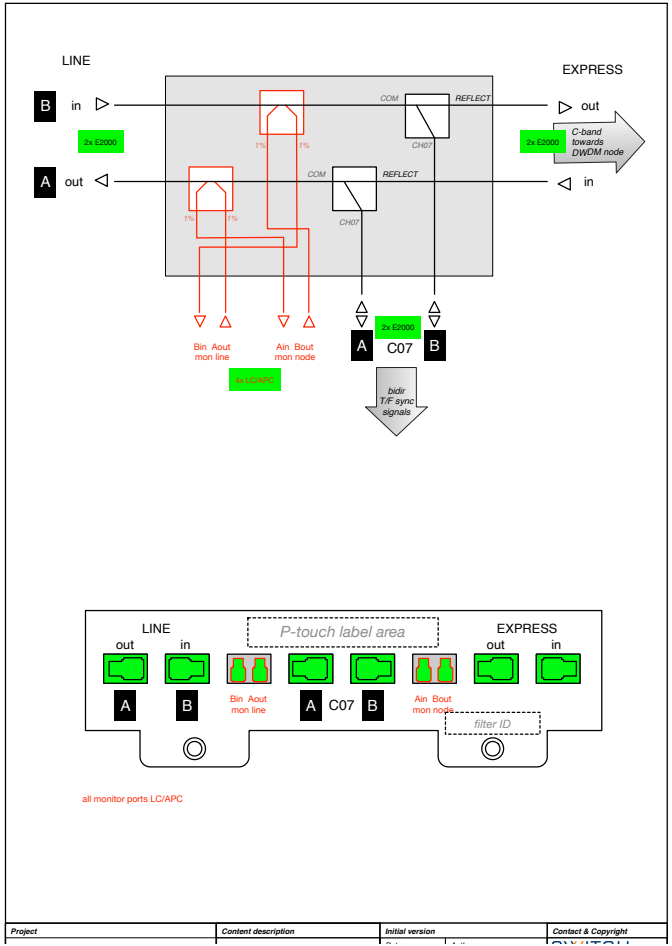
What we've learned

→ Amplifiers need little changes once link is established

→ NMI personnel mostly work directly from end-site (their lab)
→ Remote access works well enough

→ Integrate into NOC processes as spectrum service
  → not much insight besides light on/off
  → don't forget notifications when working on shared fiber

→ Taps on the OADM would be handy
  → debug spectrum (OSA) in-service
  → most DWDM equipment has them



SWITCH

Discussion

SWITCH

Bastion NFtables

```
#!/usr/sbin/nft -f

table inet filter {
 chain output {
  type filter hook output priority 0;
```

Log all connection attempts:

```
  ct state new log group 4 prefix "bastion new:" continue
```

Allow specific destination IP per user:

```
  ip addr <device-address> skuid <username> accept
```

Deny everything else and log it:

```
  log log group 4 prefix "bastion denied:" reject with
icmpx type admin-prohibited
 }
}
```

iptables equivalent:

```
-A OUTPUT -d <device-address> -m owner --uid-owner
<USERNAME> -j ACCEPT
```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