# Data Gathering in Optical Networks using the TL1 Toolkit

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# Hybrid Networks

- Many NRENs are operating hybrid networks
- Hybrid networks have two parts:
  - Packet switched routed internet part
  - Circuit switched “lightpath” part
- Lightpaths are high bandwidth circuits with deterministic Quality of Service
  - Used for point-to-point connections and VPNs
  - Typically 1 to 10 Gbps
  - Deterministic QoS, so very low jitter
  - Implemented at SDH or DWDM layer
  - Customers get Ethernet interface
  - Dedicated (no sharing with other users)
- Lightpaths are often used for large data streams
  - Routing would be too costly
  - You do not want to compete with other traffic


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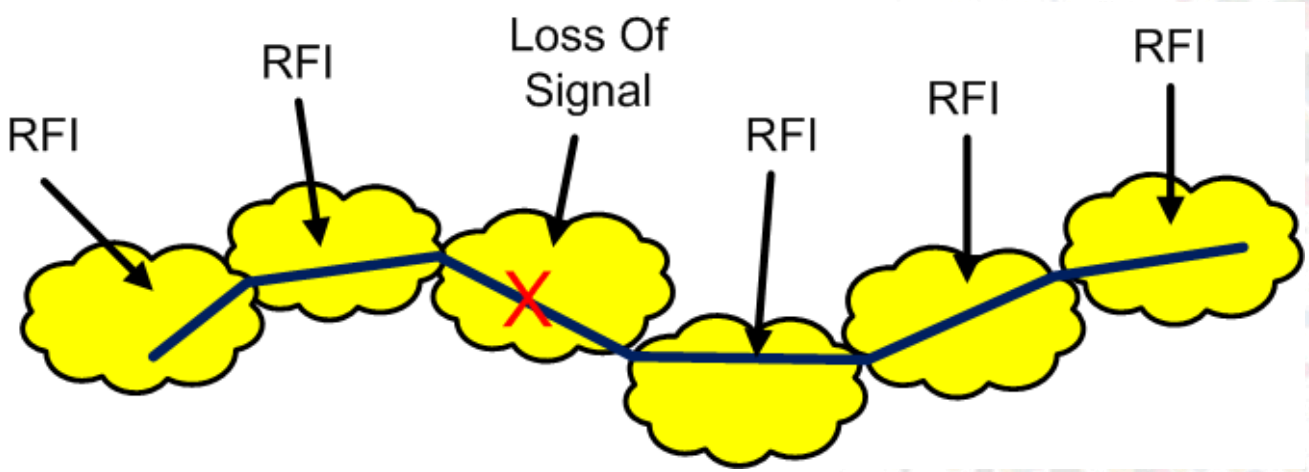
# Hybrid Network Challenges

- NRENs now also operate (DWDM and SDH) transport layer
  - Different from operating IP networks
- Many “lightpaths” cross multiple management domains
  - Alarm in one domain causes alarms in all other domains
  - Joint distributed operations
  - Need to have access to monitoring info of other domains





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# TL1 Toolkit

- Optical equipment uses TL1 as CLI, little SNMP support
- TL1 is a user unfriendly interface
- Terse commands with arguments separated by colons:
  - RTRV-OM-ETH::ETH-1-6-3:42::;
- TL1 Toolkit Perl module makes writing TL1 scripts easy
- Vendor independent
- Can be used to extract status and performance info
- In use by several organisations:
  - BCnet
  - Canarie
  - HEAnet
  - British Telecom
  - Neuf Cegetel/SFR
- Open source (Apache 2 license)
- http://nrg.sara.nl/TL1-Toolkit


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# TL1 Toolkit MRTG Script

```
use TL1Toolkit;

my $tl1 = TL1Toolkit->new(
        hostname => $hostname, username => $username, password => $password
);

# connect and login
if ($tl1->open() == 0) {
        print STDERR "$0 Could not connect to $hostname\n";
        exit 1;
}
my $inoctets =  $tl1->get_inoctets();
my $outoctets =  $tl1->get_outoctets();

# logout and disconnect
$tl1->close();

# generate MRTG output
print "$inoctets\n";
print "$outoctets\n";
print "Unknown\n";
print "$hostname\n";
```



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# Supported Functions

- open() – connect and login
- close() – logout and disconnect
- get_swversion() – get firmware release of equipment
- get_inoctets(slot, port) – get Ethernet inoctets
- get_outoctets(slot, port) – get Ethernet outoctets
- get_alarms() – get active alarms
- cmd(command) – execute any TL1 command


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# Lightpath Operational Status


| | Status | Local ID | Global ID |
|---|---|---|---|
| 1 | UP | 2111LE_Ut02-Asd01_SURFNET-FC(EXP-S15735) | |
| 2 | UP | 2161LE_Nh01-Asd01_SURFnet-UvA(NBD-HDPMnet) | netherlight.net:2161LE |
| 3 | UP | 5000LE_CNSHA-NLDGL(NBD-SHAO-JIVE) | netherlight.net:5000LE |
| 4 | UP | 5001LE_NLAMS-NOOSL(NBD-UiO-UvA-SNE) | |
| 5 | UP | 5002LE_TWHSZ-CZPRG_NL(NBD-TWAREN-CESNET) | |
| 6 | UP | 5003LE_INBOM-CHGVA(TIFR-CERN-LHCOPN) | |
| 7 | UP | 5004LE_CHGVA-CAVAN(TRIUMF-LHCOPN) | dante.net:CERN-TRIUMF-LHCOPN-001 |
| 8 | UP | 5005LE_CZPRG-USCHI(NBD-Brookhaven-BNL) | |
| 9 | UP | 5006LE_NOTRD-KRSEL(NBD-Trondheim-Korea) | |
| 10 | UP | 5007LE_CZPRG-USCHI(NBD-ViLab/VINI) | |
| 11 | UP | 5008LE_CZPRG-KRSEL(NBD-ASnet) | |
| 12 | UP | 5009LE_CZPRG-USCHI(NBD-IoP-FNAL) | |
| 13 | UP | 5010LE_NLAMS-DEFRA(SARA-Deisa) | dante.net:SARA-FRA-DEISA-001 |
| 14 | UP | 5011LE_NLAMS-CHGVA(LHCOPN-SARA-CERN) | dante.net:CERN-SARA-LHCOPN-001 |
| 15 | UP | 5012LE_USNYC-DKKTP(NBD-GLIF-PerfSonar) | canarie.ca:KISTI-UNINETT-GLIF-001 |
| 16 | UP | 5013LE_NLAMS-USCHI(NBD-IRNC-Ams-Chi) | netherlight.net:5013LE |
| 17 | UP | 5015LE_CAVAN-NLAMS(TRIUMF-SARA-LHC) | dante.net:SARA-TRIUMF-LHCOPN-001 |
| 18 | UP | 5018LE_AUSYD-NLDGL(NBD-ATNF-JIVE) | netherlight.net:5018LE |
| 19 | UP | 5019LE_CHGVA-CAVAN(MANLAN-TRIUMF-5G) | dante.net:CERN-TRIUMF-LHCOPN-002 |
| 20 | UP | 5020LE_NLAMS-GEJUE(NBD-Phosphorus-Viola) | |
| 21 | UP | 5021LE_NLAMS-ESBCN(NBD-Phosphorus-i2CAT) | |
| 22 | UP | 5025LE_USNYC-NLAMS(NBD-internet2-demo) | netherlight.net:5025LE |
| 23 | UP | 5026LE_CHGVA-NLAMS(Caltech USLHCnet) | dante.net:CERN-AMS-USLHCNET-001 |
| 24 | UP | 5027LE_USNYC-NLAMS(GEANT-I2Abilene-IRNC) | |
| 25 | UP | 5028LE_USNYC-NLAMS(SURFnet-MANLAN-IP) | netherlight.net:5028LE |
| 26 | UP | 5029LE_CAOTT-NLAMS(NBD-CRC-Phos) | netherlight.net:5029LE |
| 27 | UP | 5030LE_GBCOL-NLAMS(NBD-EssexU-Phos-GN2+) | |
| 28 | UP | 5031LE_PLPOZ-NLAMS(NBD-Phos-GN2+) | |
| 29 | UP | 5032LE_USCHI-ESBCN(NBD-IRNC-I2CAT-4K) | |
| 30 | UP | 5033LE_RUMOW-NLAMS(RIPN/Gloriad) | |
| 31 | UP | 5034LE_ESBCN-USCHI(NBD-HPDM-i2CAT) | netherlight.net:5034LE |
| 32 | DOWN | 5035LE_NLAMS-USCHI(EXP-HPDM-SARA) | |
| 33 | UP | 5036LE_NLAMS-USCHI(NBD-HPDM-UvA) | netherlight.net:5036LE |
| 34 | UP | 5040LE_Asd01-Gen01(NBD-LHCOPN-CERN-RIPN) | |
| 35 | UP | 5041LE_Asd01A-Asd01A(NBD RIPN-Terraflow) | |



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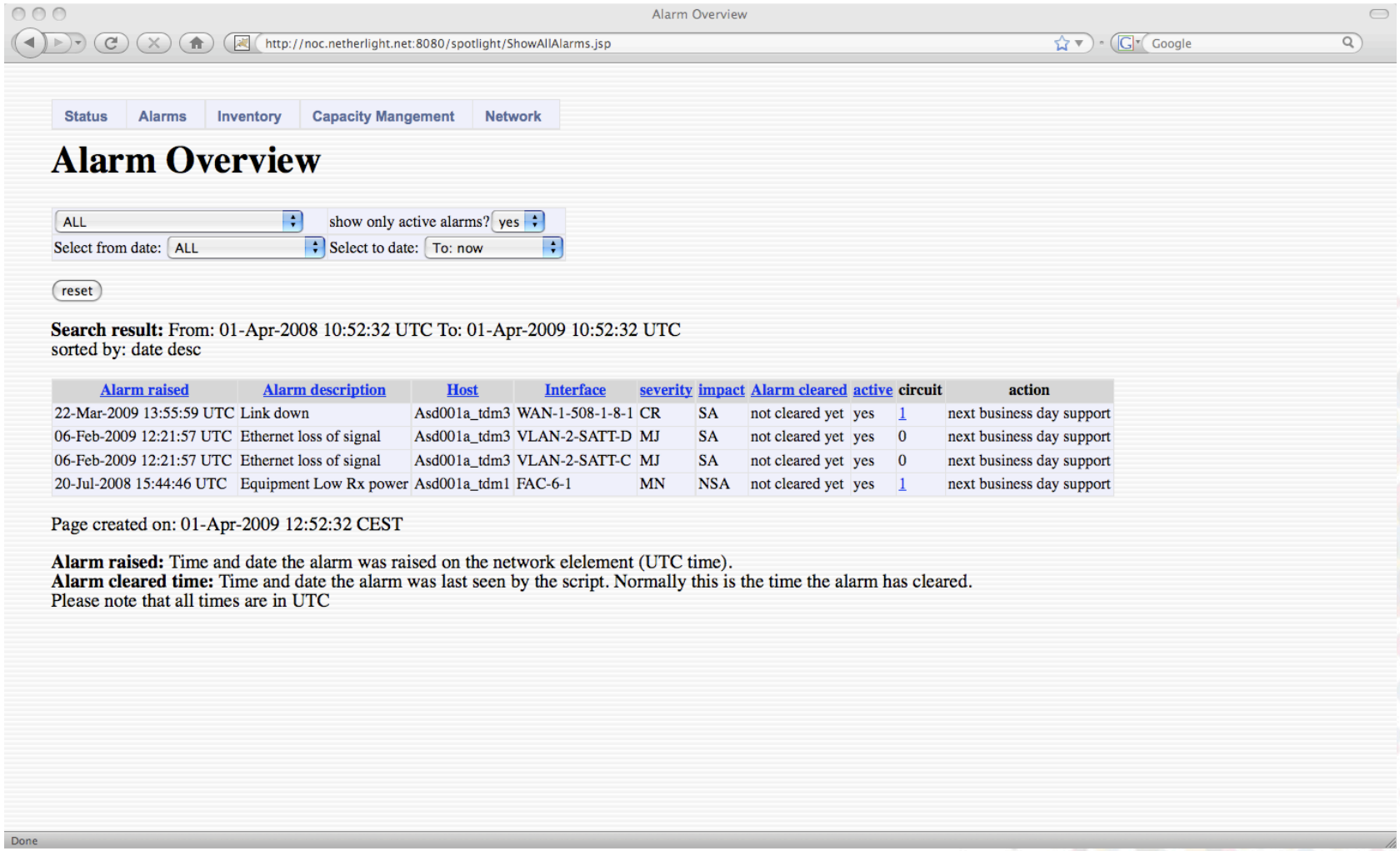
# Lightpath Active Alarms



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# Various Other Scripts

- Extract performance data, like
  - Ethernet statistics
  - SDH errored seconds
  - DWDM optical loss
- Extract optical network resource usage
  - Wavelengths in use
  - Timeslots in use
  - Slots/ports in use
- Extracting parameters from all equipment in the network
  - E.g. retrieve and compare settings


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# Thank You

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