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
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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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";
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

### Lightpath Overview

<table>
<thead>
<tr>
<th>Status</th>
<th>Local ID</th>
<th>Global ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP</td>
<td>1111E_UP02_Aad1_SGANET (PS-EXP-S15735)</td>
<td>nethe_lightnet:2640LE</td>
</tr>
<tr>
<td>UP</td>
<td>2111E_UP02_Aad1_SGANET (PS-EXP-S15735)</td>
<td>nethe_lightnet:2640LE</td>
</tr>
<tr>
<td>UP</td>
<td>3011E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
<tr>
<td>UP</td>
<td>4011E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
<tr>
<td>UP</td>
<td>5011E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
<tr>
<td>UP</td>
<td>6011E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
<tr>
<td>UP</td>
<td>7011E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
<tr>
<td>UP</td>
<td>8011E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
<tr>
<td>UP</td>
<td>9011E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
<tr>
<td>UP</td>
<td>1001E_NLAMS-SGAM (SGAM-DB)</td>
<td>nethe_lightnet:560LE</td>
</tr>
</tbody>
</table>

### Legend

- **UP**: The status of this lightpath is up.
- **DOWN**: The status of this production lightpath is down.
- **DOWN**: The status of this experimental lightpath is down.

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# Lightpath Active Alarms

![Alarm Overview](http://noc.netherlight.net:8089/spotlight/ShowAllAlarms.jsp)

**Alarm Overview**

- Status: [on]
- Alarms: show only active alarms? yes:
- Select from date: ALL
- Select to date: To: now

**Search result:** From: 01-Apr-2008 10:52:32 UTC To: 01-Apr-2009 10:52:32 UTC

<table>
<thead>
<tr>
<th>Alarm raised</th>
<th>Alarm description</th>
<th>Host</th>
<th>Interface</th>
<th>severity</th>
<th>impact</th>
<th>Alarm cleared</th>
<th>active</th>
<th>circuit</th>
<th>action</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-Mar-2009 13:55:59 UTC</td>
<td>Link down</td>
<td>Asd001a_tdm3</td>
<td>WAN-1-S08-1-8-1 CR</td>
<td>SA</td>
<td>not cleared yet</td>
<td>yes</td>
<td>1</td>
<td>next business day support</td>
<td></td>
</tr>
<tr>
<td>06-Feb-2009 12:21:57 UTC</td>
<td>Ethernet loss of signal</td>
<td>Asd001a_tdm3</td>
<td>VLAN-2-SATT-D MJ</td>
<td>SA</td>
<td>not cleared yet</td>
<td>yes</td>
<td>0</td>
<td>next business day support</td>
<td></td>
</tr>
<tr>
<td>06-Feb-2009 12:21:57 UTC</td>
<td>Ethernet loss of signal</td>
<td>Asd001a_tdm3</td>
<td>VLAN-2-SATT-C MJ</td>
<td>SA</td>
<td>not cleared yet</td>
<td>yes</td>
<td>0</td>
<td>next business day support</td>
<td></td>
</tr>
<tr>
<td>20-Jul-2008 15:44:46 UTC</td>
<td>Equipment Low Rx power</td>
<td>Asd001a_tdm1</td>
<td>FAC-6-1</td>
<td>MN</td>
<td>NSA</td>
<td>not cleared yet</td>
<td>yes</td>
<td>1</td>
<td>next business day support</td>
</tr>
</tbody>
</table>

*Page created on: 01-Apr-2009 12:52:32 CEST*

**Alarm raised:** Time and date the alarm was raised on the network element (UTC time).
**Alarm cleared:** Time and date the alarm was last seen by the script. Normally this is the time the alarm has cleared.

Please note that all times are in UTC.
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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