

XML-based Network Management Tools BOF

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NANOG 28 - Salt Lake City

June 2nd, 2003

Agenda

- Where is XML applicable?
- Examples of deployed tools
- XML interfaces to network devices
- Standards
- Discussion

Where Is XML Applicable?

- Back-end systems
 - Stitching together multiple databases
 - Transforming data for display
- Communication with devices
 - Configuration and operational data encoded as XML
 - Replace CLI as configuration protocol for programmatic access

Why XML?

- Parse
 - Off the shelf parsers
- Translate
 - It's malleable
 - XSLT
- Debug
 - It's text
- Connect
 - It's glue
 - To databases, OSS/BSS systems, etc...

Translate

- To HTML

| Interface Name | Oper State | Admin State | Description |
|--------------------------------|------------|-------------|-----------------|
| at-0/0/0 | Up | Up | |
| at-0/0/0.0 | Up | Up | |
| | ccc | | |
| at-0/0/0.1 | Up | Up | |
| | ccc | | |
| at-0/0/0.32767 | Up | Up | |
| ge-0/3/0 | Down | Up | |
| so-1/0/0 | Up | Up | |
| so-1/0/0.0 | Up | Up | |
| | inet | Address | 10.0.1.1/24 |
| | mpls | | |
| dsc | Up | Up | |
| fxp0 | Up | Up | |
| fxp0.0 | Up | Up | |
| | inet | Address | 192.168.72.2/21 |

Transform interface XML into HTML

```
<xsl:stylesheet version="1.0"
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
<xsl:template match="physical-interface">
  <tr>
    <td class="label">
      <a><xsl:value-of select="name"/></a>
    </td>
    <td class="value">
      <xsl:call-template name="up-down-box">
        <xsl:with-param name="state">
          <xsl:value-of select="oper-status"/>
        </xsl:with-param>
      </xsl:call-template>
    </td>
    <td class="value">
      <xsl:call-template name="up-down-box">
        <xsl:with-param name="state">
          <xsl:value-of select="admin-status"/>
        </xsl:with-param>
      </xsl:call-template>
    </td>
  </tr>
</xsl:template>
```

Translate

- To Text

```
Interface: so-0/0/0 State: down, Admin State: up
```

```
Logical Interface: so-0/0/0.0
```

```
inet::
```

```
Local: 10.0.0.1 Destination: 10.0.0.2
```

```
Interface: so-0/0/1 State: down, Admin State: up
```

```
Logical Interface: so-0/0/1.0
```

```
inet::
```

```
Local: 10.0.1.1 Destination: 10.0.1.2
```

```
Interface: fxp0 State: up, Admin State: up
```

```
Logical Interface: fxp0.0
```

```
inet::
```

```
Local: 192.168.4.130 Destination: 192.168.4/24
```

```

<xsl:stylesheet version="1.0"
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
  <xsl:output method="text"/>

  <xsl:template match="physical-interface">
    <xsl:text>Interface: </xsl:text>
    <xsl:value-of select="name"/>
    <xsl:text> State: </xsl:text>
    <xsl:value-of select="oper-status"/>
    <xsl:text>, Admin State: </xsl:text>
    <xsl:value-of select="admin-status"/>
    <xsl:text>&#10;</xsl:text>
    <xsl:apply-templates select="logical-interface"/>
  </xsl:template>

  <xsl:template match="logical-interface">
    <xsl:text> Logical Interface: </xsl:text>
    <xsl:value-of select="name"/>
    <xsl:text>&#10;</xsl:text>
    <xsl:apply-templates select="address-family"/>
  </xsl:template>

  ...
</xsl:stylesheet>

```

Transform interface
XML into text

Some Deployed Tools Using XML

Abilene - Visible Backbone

<http://loadrunner.uits.iu.edu/~gcbrowni/Abilene/>

- Set of web pages providing a view into the Abilene backbone routers
- Current and historical operational data
- Plans to make raw XML data available

Abilene – Visible Backbone

| Analysis - Multiple Data Sets | | |
|--|---|------------|
| Gigapop Technology Support | "BGP,Interfaces,PIM,MTU,IPv6,Multicast" | XML |
| ISIS - Monitoring of the Abilene Backbone IGP | | |
| ISIS SPF Calculation Details | "show isis spf log" | XML |
| ISIS Hostnames | "show isis hostname" | XML |
| ISIS Adjacencies | "show isis adjacency" | XML |
| ISIS Interface Support | "show isis interface" | XML |
| ISIS Statistics | "show isis statistics" | XML |
| ISIS Routes | "show isis routes" | XML |
| BGP - Monitoring of the External Routing Protocol | | |
| BGP Summary Statistics | "show bgp summary" | XML |
| Interfaces - Monitoring of the Physical Interfaces | | |
| Interface Link-Layer Attributes | "show interfaces" | |
| Interface Addresses | "show interfaces" | XML |

Abilene – Visible Backbone

Slot 0 Route Engine

| | ching | dnvng | hstng | iplng | kscyng | kscy-m5 | losang |
|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------|---------------------|
| Current Status | backup | backup | master | master | master | N/A | master |
| Election Priority | master (default) | master (default) | master (default) | master (default) | master (default) | N/A | master (default) |
| Temperature/C | 28 | 29 | 29 | 34 | 31 | 26 | 33 |
| DRAM | 2048 | 2048 | 2048 | 2048 | 2048 | 256 | 2048 |
| Memory Util | 7 | 7 | 11 | 13 | 12 | 37 | 10 |
| CPU/User | 0 | 0 | 7 | 15 | 15 | 3 | 6 |
| CPU/Background | 0 | 0 | 0 | 5 | 4 | 0 | 1 |
| CPU/Kernel | 0 | 0 | 6 | 6 | 5 | 1 | 4 |
| CPU/Interrupt | 0 | 0 | 2 | 1 | 1 | 1 | 0 |
| CPU/Idle | 100 | 100 | 84 | 72 | 75 | 95 | 89 |
| Model | RE-3.0 | RE-3.0 | RE-3.0 | RE-3.0 | RE-3.0 | RE-2.0 | RE-3.0 |
| Load Avg/1m | N/A | N/A | 0.27 | 0.19 | 0.08 | 0.20 | 0.01 |
| Load Avg/5m: | N/A | N/A | 0.18 | 0.20 | 0.14 | 0.07 | 0.06 |
| Load Avg/15m: | N/A | N/A | 0.12 | 0.18 | 0.10 | 0.01 | 0.04 |

Abilene – Visible Backbone

- Data is gathered periodically in XML format...
- Post-processed by a number of perl programs...
- Which ultimately generate web pages.

Abilene – Visible Backbone

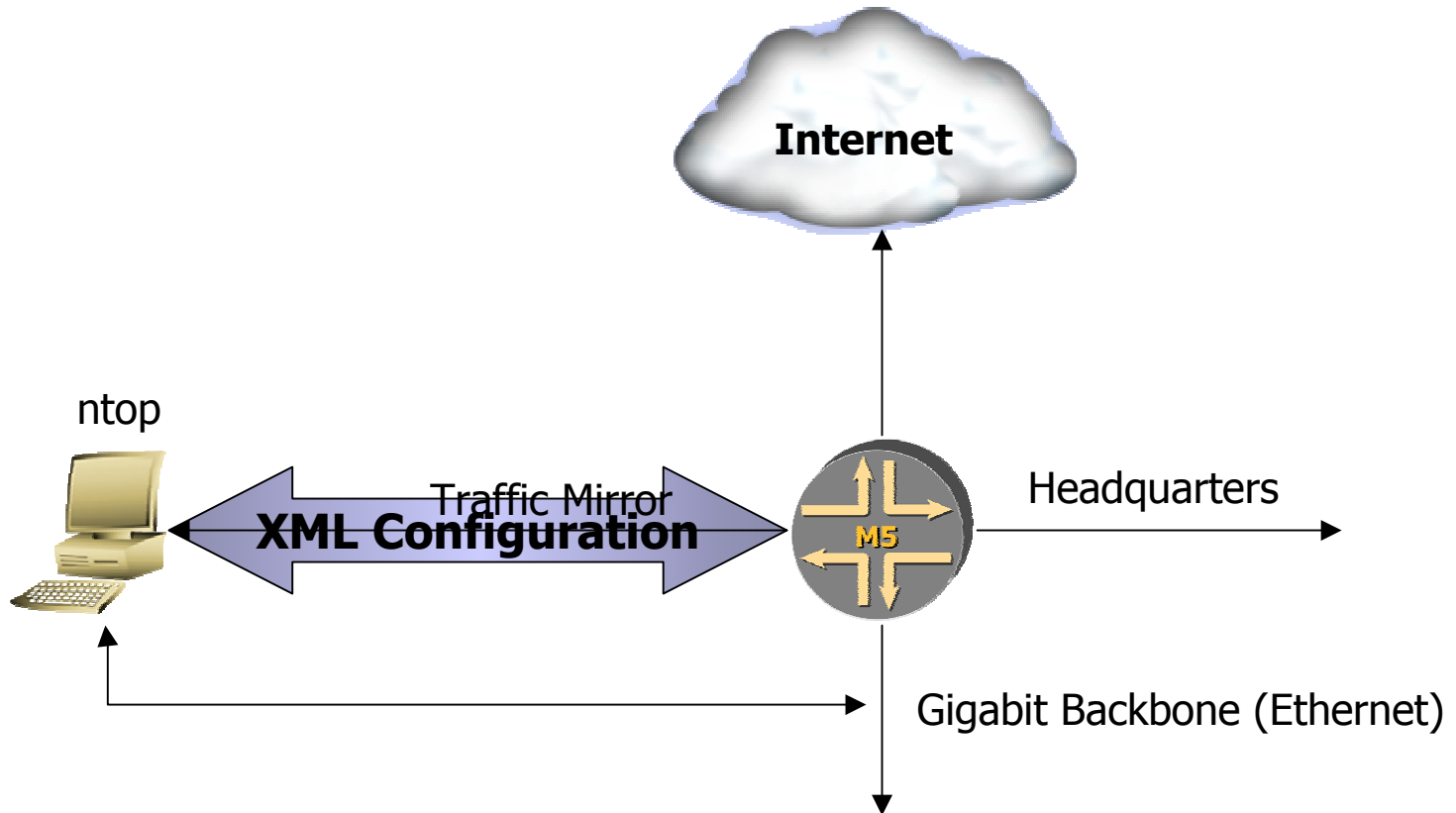
- Issues with XML?
 - Updating scripts from expect-based parsing to XML-based as JUNOS content is converted to XML
 - Size of complete route table in XML
 - ~7000 routes exhausts workstation memory
 - Using SAX instead of DOM should help

Passive Monitoring

- Gigabit speed passive monitoring
 - Luca Deri, University of Pisa

<http://luca.ntop.org/PAM2003.pdf>
- A modified libpcap controls a Juniper M5 via JUNOScript
- More detail at <http://www.ntop.org>

Passive Monitoring



Welcome to ntop! - Mozilla {Build ID: 2002052918} <2>

File Edit View Go Bookmarks Tools Window Help

http://jabber:3000/

Home Bookmarks Red Hat Network Support Products Training snark.ntop_ord...

About Data Rcvd Data Sent Stats IP Traffic IP Protos Admin

Nw Interface Type Ethernet [iprb0]

Local Domain Name tecsiel.it

Sampling Since Tue Jul 9 19:19:03 2002 [1:28]

Statistics

- Multicast
- Traffic
- Hosts
- Network Load
- Domain
- Plugins

| | |
|------------------|-----------|
| Total | 1,180 |
| Unicast | 51.6% 609 |
| Broadcast | 33.7% 398 |
| Multicast | 14.7% 173 |

Packets

| | |
|-----------------------|-------------|
| Shortest | 38 bytes |
| Average Size | 134 bytes |
| Longest | 1,514 bytes |
| < 64 bytes | 46.0% 543 |
| < 128 bytes | 36.4% 429 |
| < 256 bytes | 7.8% 92 |

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Netopeer (CESNET)

- Vendor independent router configuration tool
- Internal data format is XML
- Uses a vendor independent schema for configuration data – currently expressed as an XML DTD
- More detail at <http://www.cesnet.cz/doc/techzpravy/2003/netopeer-dtd/>

Sample configuration using Netopeer DTD

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE configuration SYSTEM "netopeer.dtd">
<configuration version="0.1">
  <system hostname="burcak" multicast-routing="on">
    <banner>Welcome to burcak!</banner>
    <dns>
      <dns-server address="2001:718:1:1::2"/>
      <search>
        <domain-suffix suffix="cesnet.cz"/>
        <domain-suffix suffix="muni.cz"/>
      </search>
    </dns>
  </system>
  <interfaces>
    <network-devices>
      <device duplex="full" name="FastEthernet0/0" id="i00">
        <description>VLAN trunk</description>
      </device>
      <device name="FastEthernet0/1" id="i01">
        <description>Library</description>
      </device>
      <device disable="yes" name="FastEthernet0/2" id="i02">
        <description>Lab</description>
      </device>
    </network-devices>
  </interfaces>
  ...
</configuration>
```

XML Interfaces to Network Devices

Juniper Networks

- JUNOScript: XML API to JUNOS
- RPC to router encoded in XML
- More at <http://www.juniper.net/support/junoscript>

JUNOScript Example: Change the hostname

```
<?xml version="1.0"?>
<junoscript version="1.0">

<rpc>
  <load-configuration>
    <configuration>
      <system>
        <host-name>seabiscuit</host-name>
      </system>
    </configuration>
  </load-configuration>
</rpc>

</junoscript>
```

2wire

- DSL Provisioning of 2wire devices
- XMLRPC over SSL
- Submitted to DSL Forum
- More at <http://www.2wire.com>

Cisco Systems

- CNS
 - XML-tagged configuration changes
 - Northbound XML interface for OSS/BSS integration
- CiscoWorks Data Extracting Engine (DEE)
 - Exports CIM-like inventory in XML format
- IP phones & call manager
 - Speak XML

NextHop Technologies

- XML API to GateD (version 10.0)
- RPC to router encoded in XML
- More at <http://www.nexthop.com>

Standards rule OK

NETCONF

- draft-enns-xmlconf-spec-00.txt
- IETF working group to be created
 - Andy Bierman, Simon Leinen will co-chair
- Mailing list is netconf@ops.ietf.org
 - Subscribe majordomo@ops.ietf.org

Discussion