RIEEW 2007 – Cisco meets TU Dresden

Device Manageability Instrumentation (DMI) Overview

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Device Manageability Instrumentation

Categories of DMI

Device Instrumentation
- Fault
- Configuration
- Accounting
- Performance
- Security

Mediation at Network Level
- Fault
- Configuration
- Accounting
- Performance
- Security

Active Network Abstraction
### Device Manageability Instrumentation

**Feature Richness is Huge: Example MPLS**

**Cisco Device Manageability Instrumentation (DMI)** – (only subset shown here, as relevant for MPLS)

<table>
<thead>
<tr>
<th>Fault</th>
<th>Configuration</th>
<th>Performance</th>
<th>Accounting</th>
<th>Security</th>
</tr>
</thead>
</table>
| • 802.3ah – Link monitoring & remote fault indication  
• 802.1 ag – Continuity Check L2 Ping, Trace, AIS  
• MPLS OAM – LSP Ping, LSP Trace, VCCV  
• IP OAM – Ping, Trace, BFD, ISG per Session  
• EEM – Embedded Event Manager  
• EVENT-MIB – OID based triggers, events or SNMP Set, IETF DISMON  
• EXPRESSION-MIB – OID expression based triggers, IETF DISMON  
• … | • E-LMI – (service parameter & status signaling)  
• E-DI – (Enhanced Device Interface, CLI, Perl, IETF Netconf)  
• KRON – command scheduler  
• Config Change – logging and notifications  
• Config Replace and Rollback  
• Diff – context diff utility  
• MIB Persistence  
• … | • IP SLA – delay, jitter, packet-loss, MPLS health-monitoring, and advanced object tracking  
• CBQoS MIB – (Class based QoS)  
• NBAR  
• RMON  
• ERM – Embedded Resource Manager  
• GOLD – Generic Online Diagnosis  
• … | • Flexible NetFlow – IETF IPFIX  
• BGP Policy Accounting – includes AS information  
• Periodic MIB Bulk Data Collection and Transfer  
• … | • Auto Secure – one-touch device hardening  
• LDP Auth – message authentication  
• Routing Auth – MD5 authentication, BGP, OSPF  
• … |

See: [www.cisco.com/go/instrumentation](http://www.cisco.com/go/instrumentation) (new white paper)
Device Manageability Instrumentation
Successful Examples

- Information Sources & Detection Mechanisms
  (RMON, Netflow, NBAR, IP SLA, BQM)

- Processing (Correlations, Thresholding, …)
  (Event-MIB, Expression-MIB, Embedded Event Manager, GOLD)

- Actions & Alarming/Escalation
  (Netconf, E-DI, Embedded Syslog Manager, Embedded Event Manager)

Example: IP SLA
Example: Diagnose MPLS
Example: BQM
Device Manageability Instrumentation Agenda

Device Instrumentation
- Fault
- Configuration
- Accounting
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Mediation at Network Level
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Active Network Abstraction
Event-MIB

- The EVENT MIB provides a superset of the capabilities of the RMON alarm and event
- The EVENT MIB calls “triggers”
  The RMON MIB calls “alarms,”
  but the concepts are the same
- More flexible test types with the EVENT-MIB
  Existence test: absent, present, changed
  Boolean test: <>, =, <, <=, >, >=
- Event MIB proposed by Cisco to IETF DISMON
  Working Group, accepted standard track RFC-2981
EXPRESSION-MIB

- Allows you to create new SNMP objects based upon existing MIB variables and formulas
- Interesting when combined with the EVENT-MIB
- EXPRESSION MIB proposed by Cisco to IETF DISMON Working Group, accepted standard track RFC-2982
  - Cisco implementation based on IETF draft, again in the DISMON Working Group, and numbered in Cisco’s namespace
- Only configuration support via SNMP so far: no CLI
  - Scriptable interface for adding command line support in 12.3(7)T
  - However “show management expression” exists
  - However “debug management expression mib” exists
Device Manageability Instrumentation

Agenda

Device Instrumentation
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Mediation at Network Level
- Fault
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Active Network Abstraction
Mediation at Network Level – Configuration
Why is it important? 1/2

- More Configuration Items due to changes rather than new roll-out

Source: Several Major MPLS Operators

- Which do you prefer for configuring your network?

| 62% Command Line Interface | 33% NMS Tools | 5% |

Source: Cisco Web Seminar 522 attendees
### Mediation at Network Level – Configuration

**Why is it important? 2/2**

- **Network Operations Failures by Cause**

<table>
<thead>
<tr>
<th>Network Operations Failure Types</th>
<th>Percent of respondents that ranked type as most frequent source of network operations failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration errors</td>
<td>39%</td>
</tr>
<tr>
<td>Upgrade errors</td>
<td>27%</td>
</tr>
<tr>
<td>Data entry errors</td>
<td>10%</td>
</tr>
<tr>
<td>Maintenance errors</td>
<td>10%</td>
</tr>
<tr>
<td>Errors in monitoring the network</td>
<td>7%</td>
</tr>
<tr>
<td>Version control errors</td>
<td>7%</td>
</tr>
</tbody>
</table>

  *Sage*

- **Network Outages Related to Human Configuration Errors**

  - 48% Human Config Error
  - 52% Other

  *Yankee Group*

- **Provisioning Efficiency of L3VPN Operators varies by a factor 15+ in terms of orders per HeadCount over time**

  *Cisco IBSG*
Mediation at Network Level – Configuration Focus Areas

- Enhanced CLI / Enhanced Programmatic Interface
  - Cisco Enhanced Device Interface (E-DI)

- Innovative Provisioning Workflows
  - Zero-Touch-Deployment (ZTD)

- Embedded Features and CLI Usability Improvements
  - Config Change Logging, Notification, Rollback, Diff Utility, ...

- Device-Capability-Model & Device-Driver Concept
  - Partially adopted by Applications (such as Cisco Active Network Abstraction, IP Solution Center, ...)
  - Internal to the Applications today
  - Standardizing & Opening up device-drivers still work-in-progress
Cisco Enhanced Device Interface – E-DI 2.1
Why E-DI?

- Improve Productivity & Quality for
  - device configuration
  - maintenance & troubleshooting
  - CatOS to IOS upgrades

- Single point of access to device configuration

- Unified interface across platforms & releases
  - enhanced CLI
  - Perl integration
  - XML API (IETF NETCONF draft 5 compliant)

- Complementary to EMS and NMS

- Support existing and new cisco devices

Enhanced Device Interface – E-DI

- IOS / CatOS Today
- others later
Cisco Enhanced Device Interface – E-DI 2.1
IOS-like Command Line Interface

- Real-time syntax validation & visual feedback
Cisco Enhanced Device Interface – E-DI 2.1
Example: Network Virtualization

Access Point
- RAM
- Flash0
- Radio-0
- Radio-1
- Eth-0

Switch
- RAM
- Flash0
- Eth-0/0
- Eth-0/1

Router
- RAM
- Flash0
- Radio-0
- Eth-0/0
- Eth-0/1

Engineer
Perl Script
NMS Application

E - CLI
Perl API
Netconf XML

Enhanced Device Interface – E-DI

Interfaces
- Radio-A0
- Radio-C0
- Eth-A0
- Eth-B0/0
- Eth-B0/1
- Eth-C0/0
- Eth-C0/1

FLASH
- A0
- B0
- C0
Cisco Enhanced Device Interface – E-DI 2.1
Main Features

- **OS Parser Emulation**
  - CLI syntax checking & command context validation
  - eliminates human errors

- **Device Grouping**
  - Definition of administrative domains
  - Access Control per administrative domain level
  - Simplifies Configuration and Administrative tasks.

- **Group least common denominator CLI**
  - Perform group operations without risk of generating unsupported command

- **Context – Based CLI**
  - Simultaneously apply changes to one or more devices by selecting the context
  - Single point for network configuration
Cisco Enhanced Device Interface – E-DI 2.1

Benefits

For Customers

- **Reduced** Network Operating Costs.
- **Increased** Operational Efficiency and Productivity.
- Reduced Training Costs – **No Additional Learning** for each new Technology or Platform.
- Extendable and **Customizable**.
- Complementary to Existing to Solutions.

Additionally, for Developers, Integrators, SPs

- Fast and Robust way to speed-up PoC, Pilot Deployments, Rapid Integration, Services to Early-Adopter Markets
Self-Managing Networks – A Reality Today?
References

Device Manageability Instrumentation (DMI) www.cisco.com/go/instrumentation
- NetFlow: www.cisco.com/go/netflow
- IPSLA (aka SAA, aka RTR): www.cisco.com/go/ipsla
- Embedded Event Manager: www.cisco.com/go/eem
- Bandwidth Quality Management (BQM): www.cisco.com/go/bqm
- Feature Navigator: www.cisco.com/go/fn
- MIB Locator: www.cisco.com/go/mibs

Monthly Newsletter
- Cisco Network Management Newsletter (email subscription possible):
  www.cisco.com/external/networkmanagement/cnm-newsletter/January07.htm
... thank you ...

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