## ··II·II·I CISCO

#### Cisco Embedded Automation Systems - EASy Overview



January 2010

## Why Embedded Automations?



#### Demand for Automation and Differentiation



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**Business Value/Revenue Potential** 

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## **An Analogy**





| Airplane       | Router                  |  |  |
|----------------|-------------------------|--|--|
| Instruments    | Embedded<br>Automations |  |  |
| 21,000 Sensors | OIDs in MIBs            |  |  |

With increasing scale, complexity, differentiation, and availability requirements, operators rely on embedded automations

#### From: Full Control by a Single Central Authority

#### To: Operating a System of Self-Managing Components

| Device Manageability Instrumentation  |  |   |  |
|---|--|---|--|
| Fault   | Configuration  | Performance   | Accounting   |
| <ul> <li>802.3ah—Link<br/>monitoring and remote<br/>fault indication</li> <li>802.1 ag—Continuity<br/>check,<br/>L2 ping, trace, AIS</li> <li>MPLS OAM—LSP<br/>ping, LSP trace, VCCV</li> <li>IP OAM—Ping, trace, BFD,<br/>ISG per session</li> </ul> | <ul> <li>E-LMI—(service parameter and status signaling)</li> <li>E-DI—(Enhanced Device Interface, CLI, Perl, IETF Netconf)</li> <li>EMM—Embedded Menu Manager</li> <li>NETCONF—(XML PI)</li> <li>CNS and WSMA</li> </ul> | <ul> <li>IP SLA—delay, jitter,<br/>packet loss, MPLS health<br/>monitoring, advanced<br/>object tracking</li> <li>CBQoS MIB—(class-based<br/>QoS)</li> <li>NBAR</li> <li>RMON</li> <li>EPC—Embedded<br/>Packet Capture</li> </ul> | <ul> <li>Flexible NetFlow—<br/>IETF IPFIX</li> <li>BGP policy accounting—<br/>includes AS information</li> <li>Periodic MIB bulk data<br/>collection and transfer</li> <li></li> </ul> |
| <ul> <li>EEM—Embedded<br/>Event Manager</li> </ul>  | <ul> <li>TR-069</li> <li>KRON—command</li> </ul>   | <ul> <li>ERM—Embedded<br/>Resource Manager</li> </ul>   | Security   |
| <ul> <li>EVENT-MIB—OID-based<br/>triggers, events, or SNMP<br/>Set, IETF DISMON</li> <li>EXPRESSION-MIB—OID<br/>expression-based triggers,<br/>IETF DISMON</li> <li></li> </ul>   | <ul> <li>scheduler</li> <li>Config change—logging<br/>and notifications</li> <li>Config replace and<br/>rollback</li> <li>Diff—context diff utility</li> <li>MIB persistence</li> <li></li> </ul>                        | <ul> <li>GOLD—Generic<br/>Online Diagnosis</li> <li>Smart Call Home</li> <li></li> </ul>  | <ul> <li>Auto Secure—one-touch<br/>device hardening</li> <li>LDP Auth—message<br/>authentication</li> <li>Routing Auth—MD5<br/>authentication, BGP, OSPF</li> <li></li> </ul>          |
| Device Manageability Instrumentation Has Evolved  |  |   |  |

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## **Questions During a Service Lifecycle**



#### What Are Embedded Automations?



## **Embedded Automation Systems (EASy)**

#### Combine...

A formerly reactive task outside the network

Based on your service lifecycle model

Real-life situations that are cumbersome or hard to solve

#### Device manageability instrumentation

To measure or trigger with the network

At the source in near real-time

Such as Flexible NetFlow, IP SLA, NBAR, MIBs, and many others

#### Embedded automation capability

To implement your custom logic

Such as Embedded Event Manager (EEM), Cisco IOS<sup>®</sup> Safe-Tcl scripting, and Embedded Menu Manager (EMM)

#### Types of Embedded Automation Systems

Type 1: Automation of manual operational tasks

Example: Low-TTL traffic monitoring

Example: NBAR/CBQoS effectiveness monitoring

Example: CPE-driven automated port reconfiguration

Type 2: Automation of previously unsolvable challenges
 Example: Packet capture based on NBAR ← → Flexible NetFlow correlation
 Example: Automated embedded diagnostics
 Example: Performance-based topology/policy changes

 Type 3: Use of automation to architect new solutions

Example: Highly available mobile access router (HAMAR)

Example: Resilient Layer 2 DC interconnect

Example: High-throughput geo-redundant FW clustering

## **Anatomy of an EASy Package**

The actual embedded automation itself

Useful embedded automation for real-life situations Can be type 1, 2, or 3 automation

A menu-guided installation

Making installation a simple and reliable experience Download the latest EASy Installer separately

Introduction slides

Illustrating the purpose and concept

A short video

Taking you through the installation and use

#### Example 1: NBAR Effectiveness Monitoring

- Problem: Application protocols as well as user behavior are changing; hence the traffic mix changes too; we need to permanently assess how effective the NBAR deployment is—especially when using CBQoS with match protocol
- Solution: Automate the comparison between "unknown" versus "total" traffic

| Router# show | ip nbar protocol-discover                                      | y top-n 5 Serial0/0   |              |
|--------------|--|---|--------------|
| Protocol     | Input<br>Packet Count<br>Byte Count<br>5 minute bit rate (bps) | Output<br>Packet Count<br>Byte Count<br>5 minute bit rate (by | 9 <b>8</b> ) |
| :            | :  | :   |              |
| unknown      | 205  |   | 204          |
|              | 14976  |   | 10404        |
|              | 0  |   | 0            |
| Total        | 41304  |   | 40944        |
|              | 2649809  |   | 2619839      |
|              | 3000   |   | 3000         |

 Upon low percentage of traffic recognized by NBAR, it's time to check for new PDLMs...

$$NBAR recognized(\%) = \frac{[(total - unknown) \times 100]}{[total]}$$

Available as an EASy package: <u>http://www.cisco.com/go/easy</u>

## **Example 2: Connectivity Verification**

- Problem: We need a failover from the primary to the secondary link—but with flexibility and custom notification beyond what a simple routing protocol based solution provides
- Solution: Automate based on IP SLA, EOT, and Embedded Event Manager



#### Available as an EASy package: <u>http://www.cisco.com/go/easy</u>

## **Example 3: Custom MIB Polling**

- Problem: Sometimes there is a show command but no MIB support; what if we still want to collect the information via SNMP?
- Solution: Automate Custom MIB polling via EEM and Expression-MIB or RFC2982-MIB, depending on the Cisco IOS<sup>®</sup> Software version



#### How Can I Engage?



#### Learn

1. Browse and download EASy packages:

www.cisco.com/go/easy

2. Make sure to also download EASy Installer

http://cisco.com/assets/prod/ios-nxos/easy-installer.tcl

3. Make sure to download EASy Installer Guide

http://cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6555/ps107 77/application\_note\_c27-574650.html

4. Browse other embedded automations:

www.cisco.com/go/ciscobeyond

5. Learn about the technology under the hood:

www.cisco.com/go/instrumentation

www.cisco.com/go/eem

www.cisco.com/go/pec

#### Share

- Share with your peers
- Get creative
- Discuss, ask questions, provide suggestions and answers:

supportforums.cisco.com

 Upload your own examples to Cisco<sup>®</sup> Beyond:

www.cisco.com/go/ciscobeyond

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| WAN. Routing and Switching<br>Network Abacagometer   | IP Telephony                                   | IT redues? - Borepole  |  |  |
| Network Management   |  |  |  |  |
| DRITCH PROPER  |  |  |  |  |
| DRITCH PROPER  | Unified Communications Applications            | YouTube (7%)   |  |  |
|  | Telapresance                                   | -  |  |  |
| Optical Networking<br>Deting Transducts LANs   | Digital Media Dystem<br>Contact Center         | Facebook (7%)  |  |  |
| Other Network Infrastructure Subjects  | Other Collaboration, Wrice and Video Subjects  | -  |  |  |
|  |  | LinkedIn (7 %)   |  |  |
| Security   | Data Center                                    | -  |  |  |
| VPN  | Application Networking                         | Teitter (2%)   |  |  |
| Network Management   | Server Networking                              | and the second sec |  |  |
| Firesaling   | Storage Networking                             |  |  |  |
| Intrusion Prevention Systems/105   | United Computing<br>Other Data Center Subjects | Delicious (U.%.)   |  |  |
| Physical Security  | uther Lata Genter Subjects                     |  |  |  |
| MAR \$   | Smill Business                                 | I rarely use social media (29%)  |  |  |
| MAR'S Package Starting   |  |  |  |  |
| Kon/Furt   | Challenges of Running a Small Business         | I never use social media (91%)   |  |  |
| Other Security Subjects  | Technologies for Small Businesses              | I never use poolal media (41%)   |  |  |
| Wireless - Mobility  | Career Certification                           | Votes 294 - Full Results   |  |  |

| CISCO   |                                  |   |                    |                             | Search            | worotek page i tegin ( Megner ) sourc   |
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| and constants   | Script Title                     | Summary   | Category           | Date Posted -               | Bating            | EMILS, COMA SACRAFT, FUR PURTUE TO COMPLET<br>SA MILE SCIENT, MATCHINE  |
|   | Teens. trues. JDS                | Tweet information from IOS using EDM<br>and Twitter's API   | Uper interface     | Nov 16,<br>2009.00 40am PST | ****              | Carlos CO diagnostic Toola in Contracting Of<br>The development of Article and the development<br>Manager Friedrichten  |
|   | NEAD Effectivement<br>Microsofte | Script combines an EEMpolicy based in<br>ED Timer and Expression-<br>MERIF C2002(13.6.1.4.1.9.10.22<br>//13.8.1.3.1.09) to subsolate the<br>Recognized traffic by NDAR feature. | Network Management | Oct 29,<br>2009,12:54am PST | ***               | C 2 00.000 EDB FORMERTAR<br>C 200.000 EDB FORMETAR BID IN<br>Helecites 2 004/2008 Classifier des 2/20<br>Predictor of C 100 Decord<br>C 24 Decordance and 200   |
|   | Crash TETP (Mes)                 | Simple porte to capture show tech info  | High Availability  | Oct 13,<br>2009;10:13am PST |                   |   |
|   | Scalag, & Email 811<br>Calif     | Generates a syslog & sends an email<br>when 911 is called   | Security           | Sep 11,<br>2009,12:42pm PST | ****              |   |
|   | TCP. focker. frame<br>Meritar    | This EDM policy detects, sends a syslog<br>message, and optionally cleans, TCP<br>sockets hung in certain states.   | Security           | Aug 04.<br>2009,11:23am PST |                   |   |
|   | stos2astvar.tol                  | Duick and eary show command output<br>into the server   | Network Management | Jul 14,<br>2009.02-Ham PST  |                   |   |
|   | CLL-2ML transform<br>specifie    | ell - and transformation spece on the bex   | User Interface     | Mary 28, 2009.03.40pm #ST   |                   |   |
|   | HTTP Janvar with COI<br>Excepts  | HTTP server with CGI support  | Network Management | Apr 92,<br>2009,10:58am PST |                   |   |
|   | inditurnal sector.               | automates ipv8 tunnel update with<br>dynamic ipv4 tunnel endpoint   | Resting            | Apr 01,<br>2009.10.40am PST |                   |   |

#### Contribute

- You've just built the smartest embedded automation on Planet Earth?
- You've got a really good use case?
- Or a great idea with a half-baked solution?
- Want to suggest additions to existing EASy packages?
- Or volunteer your scripting skills to improve an EASy package?

#### → Contact <u>ask-easy@cisco.com</u>

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