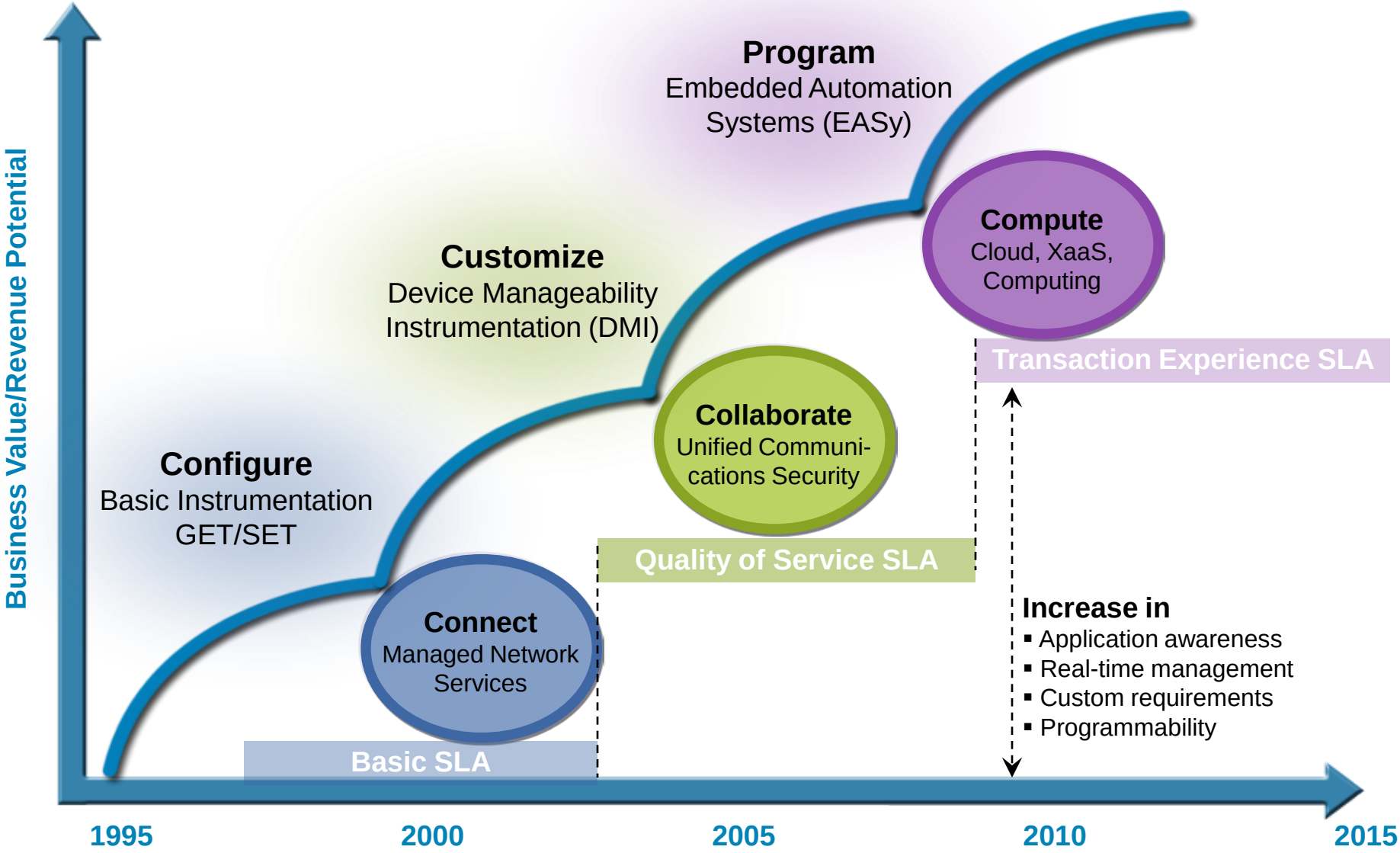
Cisco Embedded Automation Systems - EASy Overview

January 2010

Why Embedded Automations?

Demand for Automation and Differentiation



An Analogy

Airplane	Router
Instruments	Embedded 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

Cisco IOS® Device Manageability Instrumentation (DMI)

Fault

- **802.3ah**—Link monitoring and 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
- …

Configuration

- **E-LMI**—(service parameter and status signaling)
- **E-DI**—(Enhanced Device Interface, CLI, Perl, IETF Netconf)
- **EMM**—Embedded Menu Manager
- **NETCONF**—(XML PI)
- **CNS** and **WSMA**
- **TR-069**
- **KRON**—command scheduler
- **Config change**—logging and notifications
- **Config replace and rollback**
- **Diff**—context diff utility
- **MIB persistence**
- …

Performance

- **IP SLA**—delay, jitter, packet loss, MPLS health monitoring, advanced object tracking
- **CBQoS MIB**—(class-based QoS)
- **NBAR**
- **RMON**
- **EPC**—Embedded Packet Capture
- **ERM**—Embedded Resource Manager
- **GOLD**—Generic Online Diagnosis
- **Smart Call Home**
- …

Accounting

- **Flexible NetFlow—** IETF IPFIX
- **BGP policy accounting**—includes AS information
- **Periodic MIB bulk data collection and transfer**
- …

Security

- **Auto Secure**—one-touch device hardening
- **LDP Auth**—message authentication
- **Routing Auth**—MD5 authentication, BGP, OSPF
- …

Device Manageability Instrumentation Has Evolved

Questions During a Service Lifecycle

Is there room for yet another service?

- How do we perform today?
- Are there existing issues?
- Will we meet specs?
- Resource consumption?
- What is my current traffic?
- ...

How to configure?

- One or many nodes?
- CLI, scripts, automation?
- Can we afford downtime?
- Quality and security?
- ...

Is it working as specified?

- Configuration?
- Control plane?
- Data plane?
- Were my design assumptions right?
- ...

- How to be prepared?
- How to diagnose?
- Make use of smart services?
- Could we offer even tighter SLAs?
- Automate remedy and mitigation?
- ...

What if something goes wrong?

- Will we breach any SLAs?
- What is our performance?
- How to identify applications?
- ...

Are we meeting SLA?

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® 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-discovery top-n 5 Serial0/0

                Input                     Output
  Protocol      Packet Count              Packet Count
                Byte Count                Byte Count
                5 minute bit rate (bps)   5 minute bit rate (bps)
  ---------- ------------------------ ------------------------
    :               :                         :
  unknown                205                               204
                         14976                             10404
                         0                                 0
  Total                  41304                             40944
                         2649809                           2619839
                         3000                              3000
```

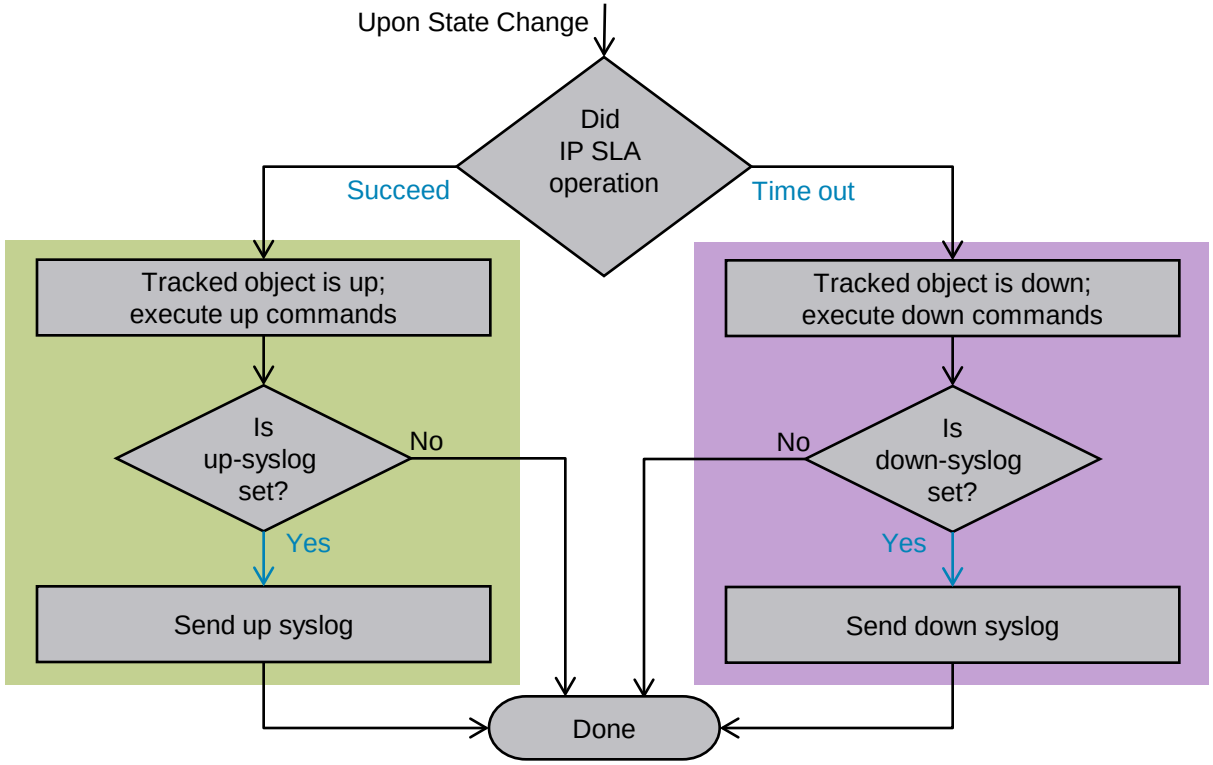
- Upon low percentage of traffic recognized by NBAR, it’s time to check for new PDLMs…

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

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

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



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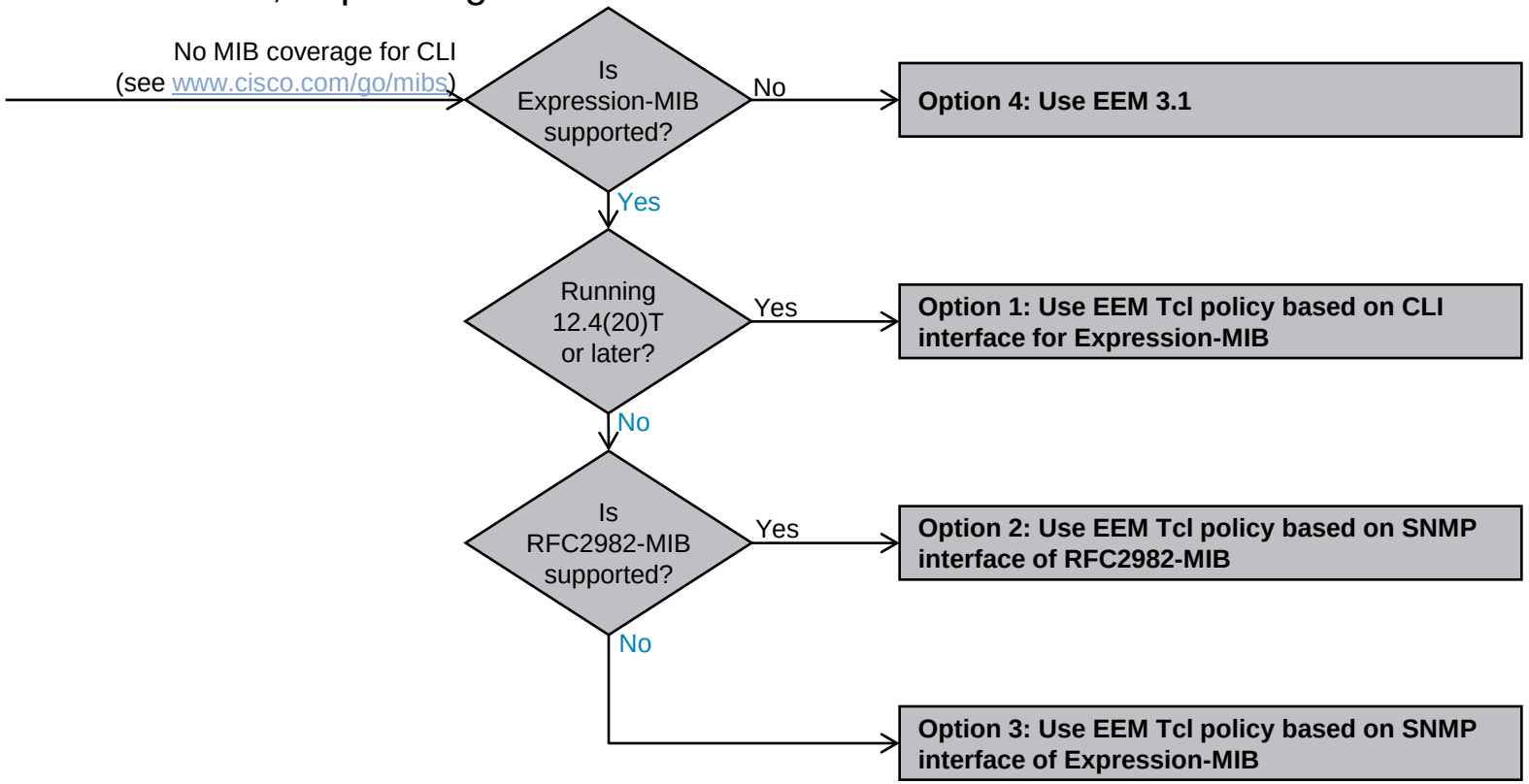
Example 3: Custom MIB Polling

- **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® Software version



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

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/ps10777/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® Beyond:

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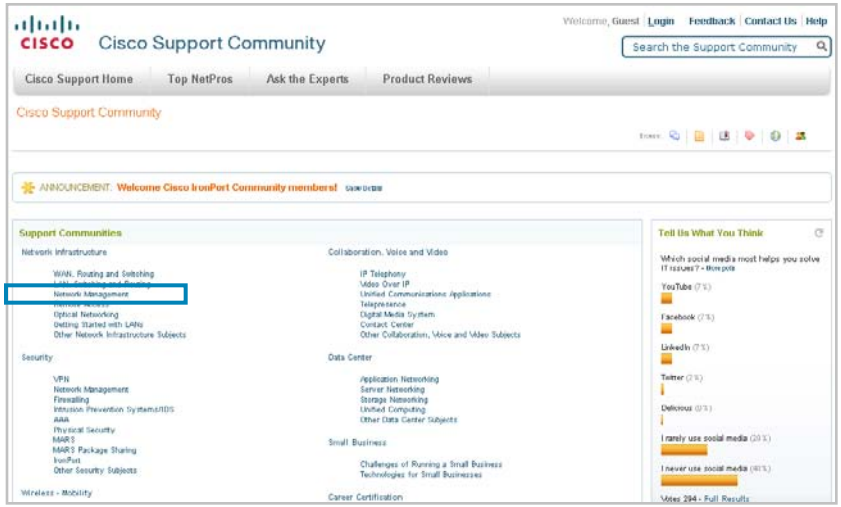

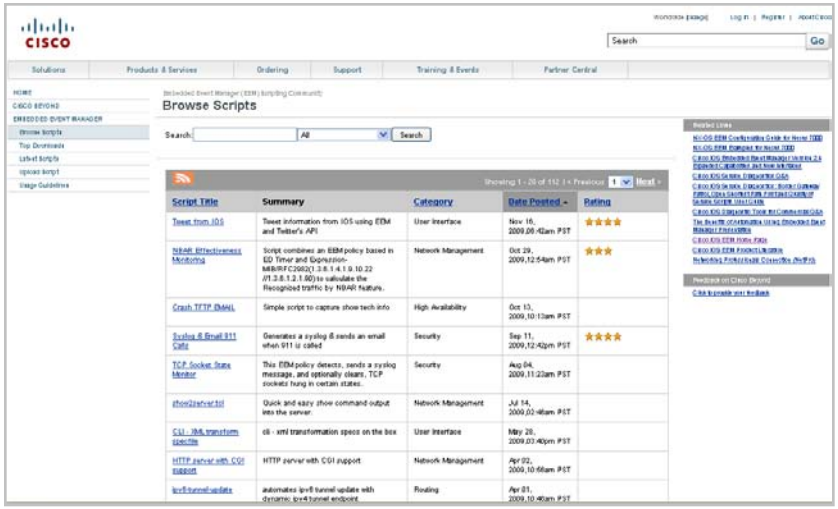

Contribute

- 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 ask-easy@cisco.com