



# Cisco Embedded Automation Systems - EASy Overview

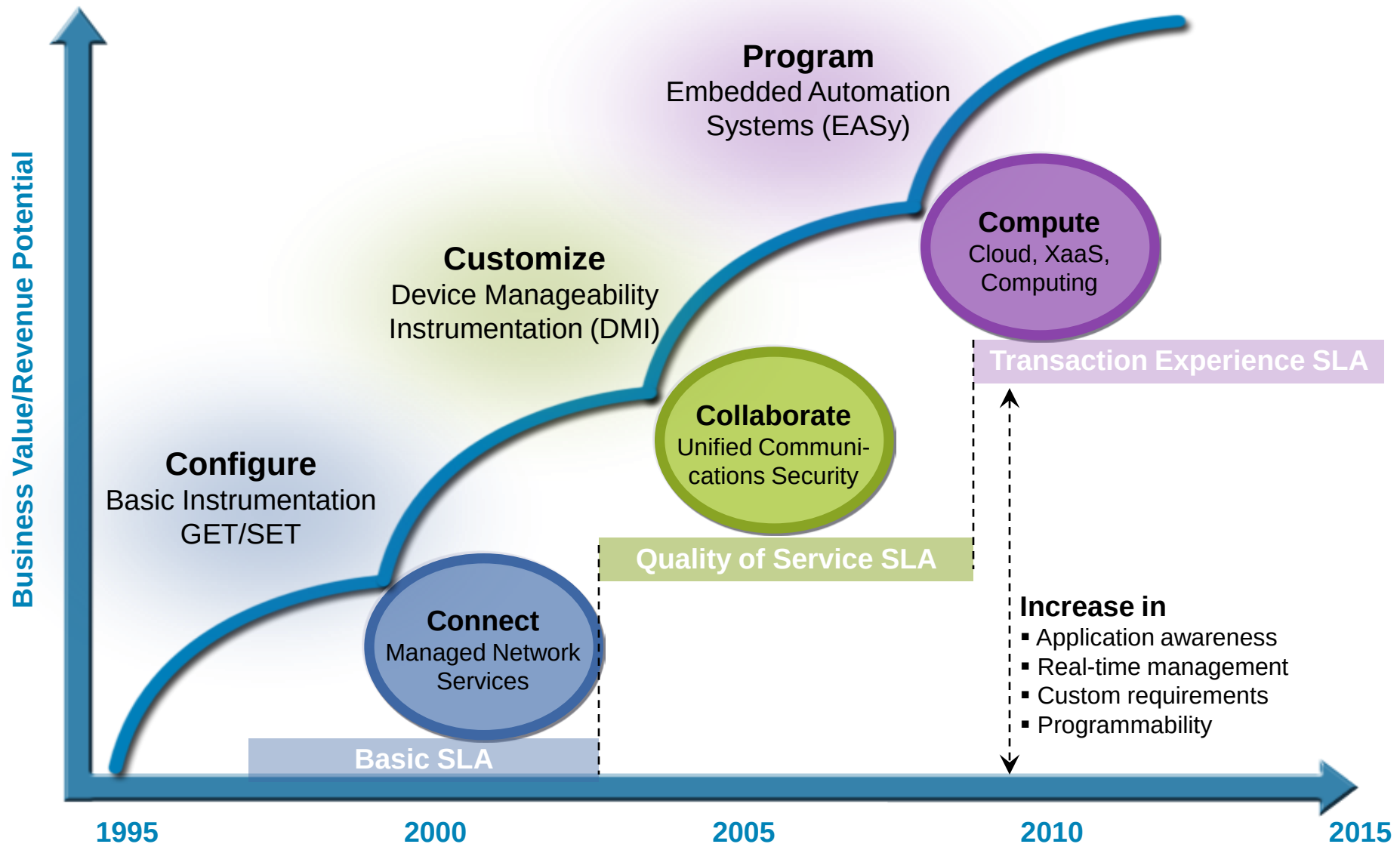


**January 2010**

# 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



## 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

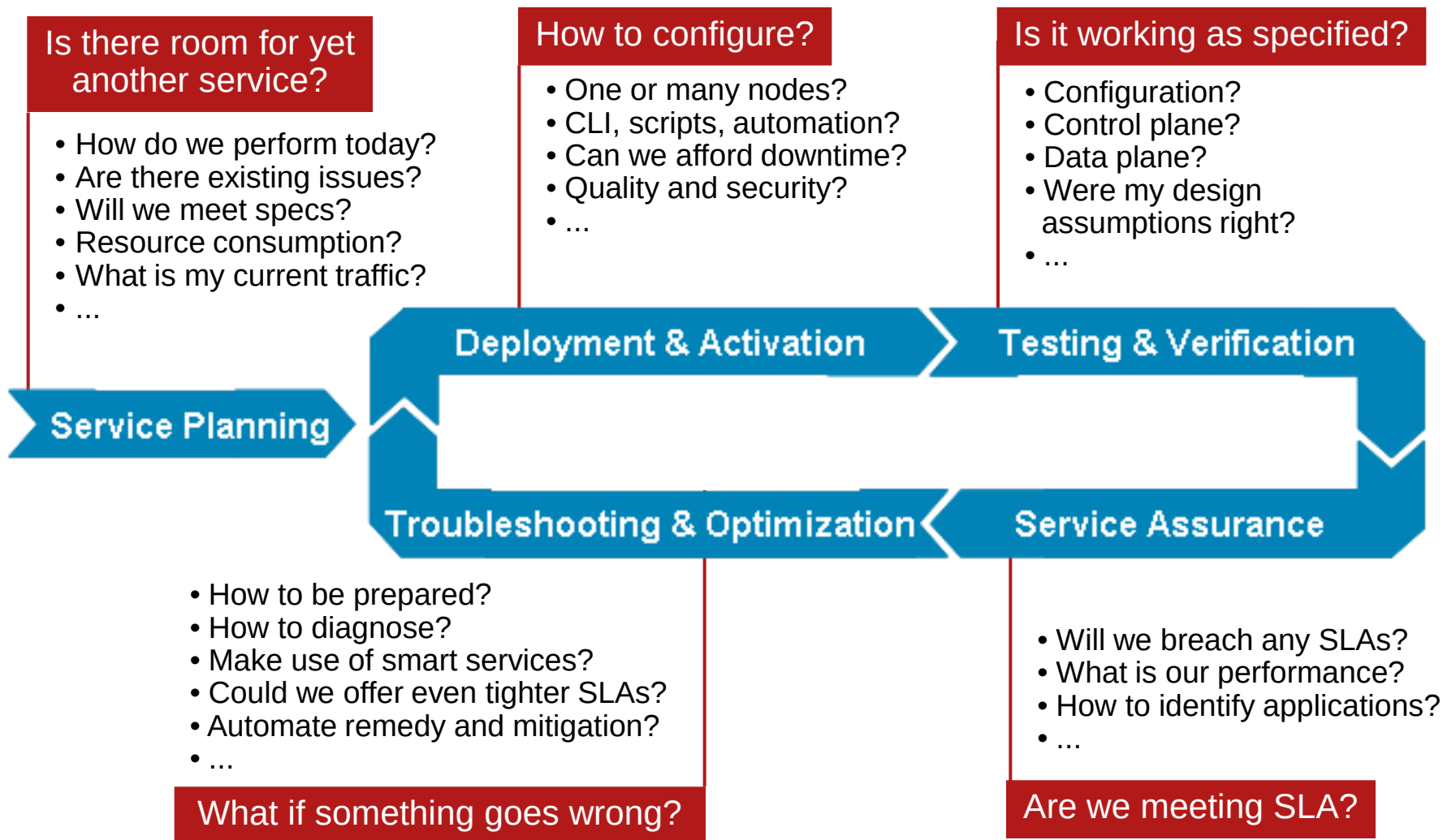
- **Flexible NetFlow**—IETF IPFIX
- **BGP policy accounting**—includes AS information
- **Periodic MIB bulk data collection and transfer**
- ...

## 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





# 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  $\leftrightarrow$  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
```

| 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 (bps) |
|----------|----------------------------------------------------------------|-----------------------------------------------------------------|
| -----    | -----                                                          | -----                                                           |
| :        | :                                                              | :                                                               |
| unknown  | 205<br>14976<br>0                                              | 204<br>10404<br>0                                               |
| Total    | 41304<br>2649809<br>3000                                       | 40944<br>2619839<br>3000                                        |

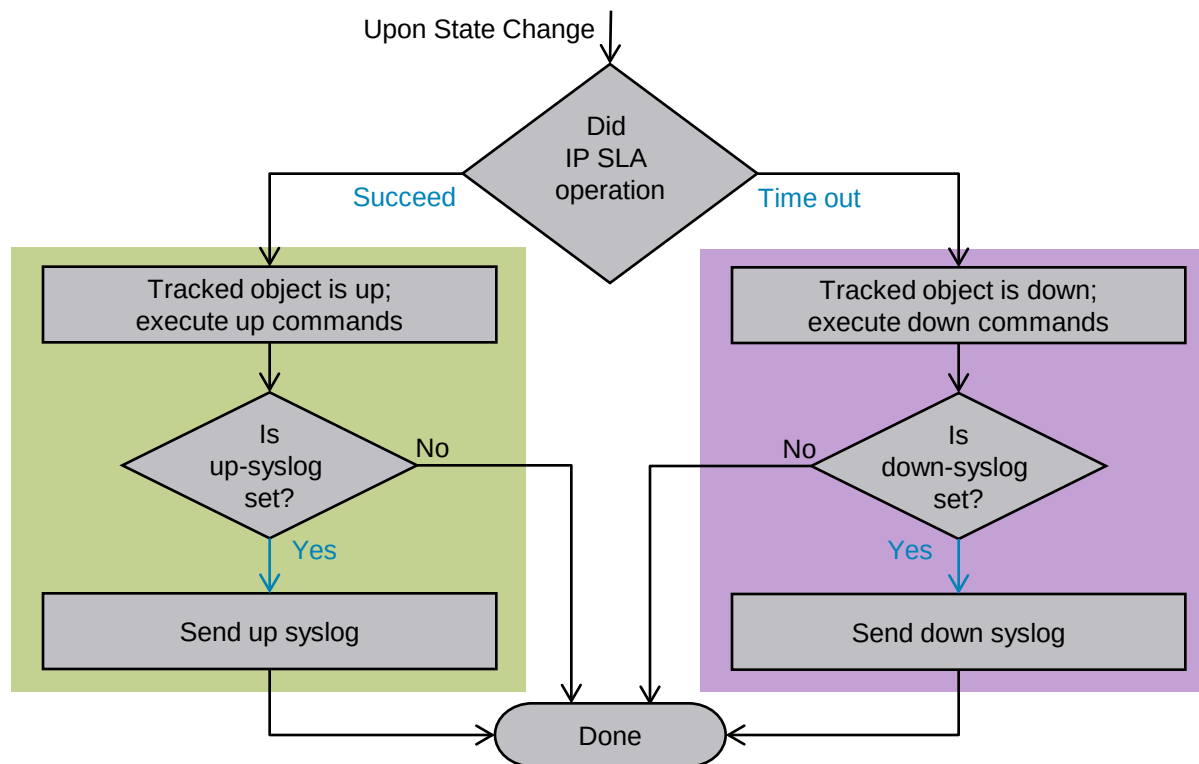
- Upon low percentage of traffic recognized by NBAR, it's time to check for new PDLMS...

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

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

# Example 2: Connectivity Verification

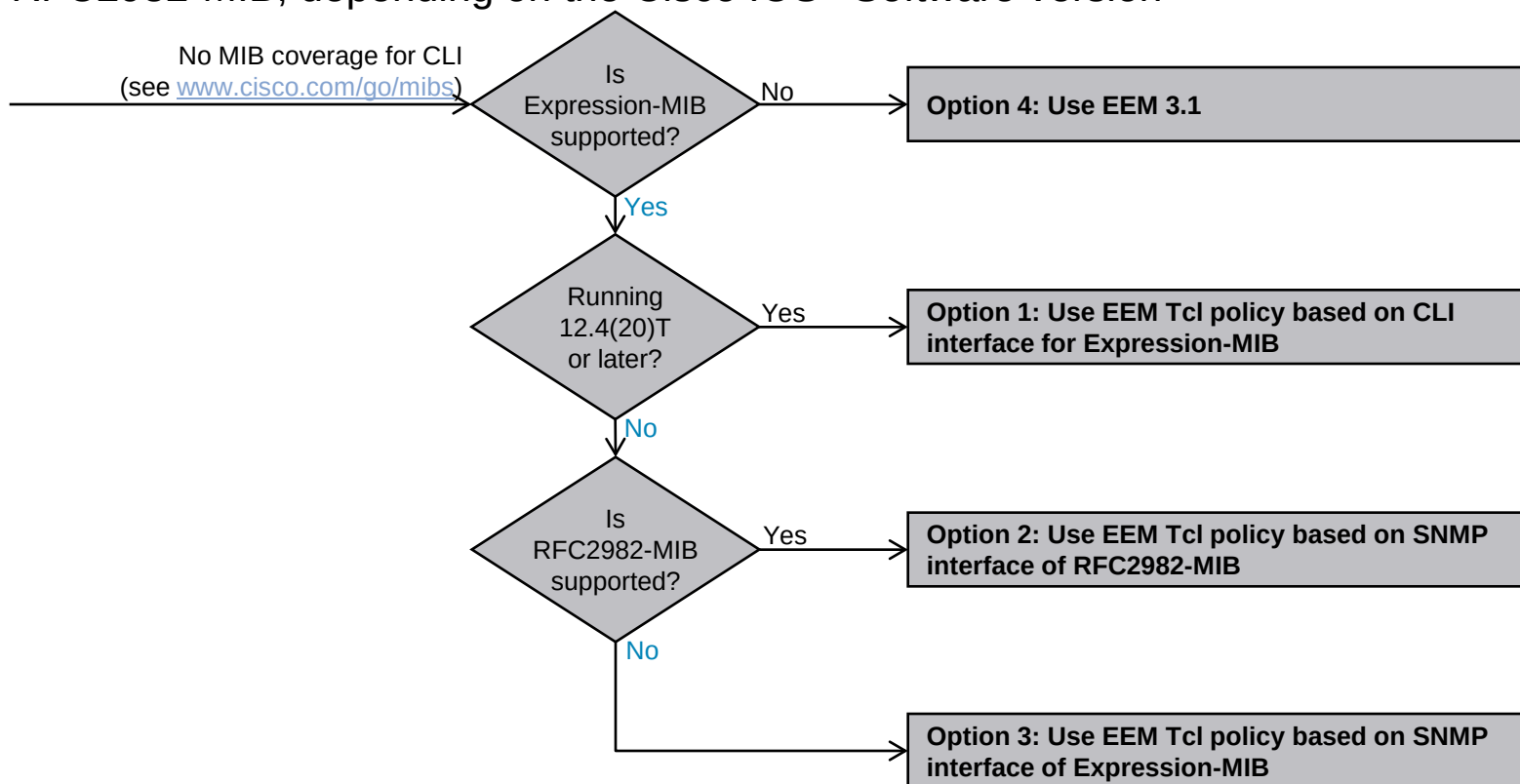
- **Problem:** We need a failover from the primary to the secondary link—but with flexibility and custom notification beyond what a simple routing protocol based solution provides
- **Solution:** Automate based on IP SLA, EOT, and Embedded Event Manager



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

# 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](http://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](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](http://www.cisco.com/go/ciscobeyond)

5. Learn about the technology under the hood:

[www.cisco.com/go/instrumentation](http://www.cisco.com/go/instrumentation)

[www.cisco.com/go/eem](http://www.cisco.com/go/eem)

[www.cisco.com/go/pec](http://www.cisco.com/go/pec)



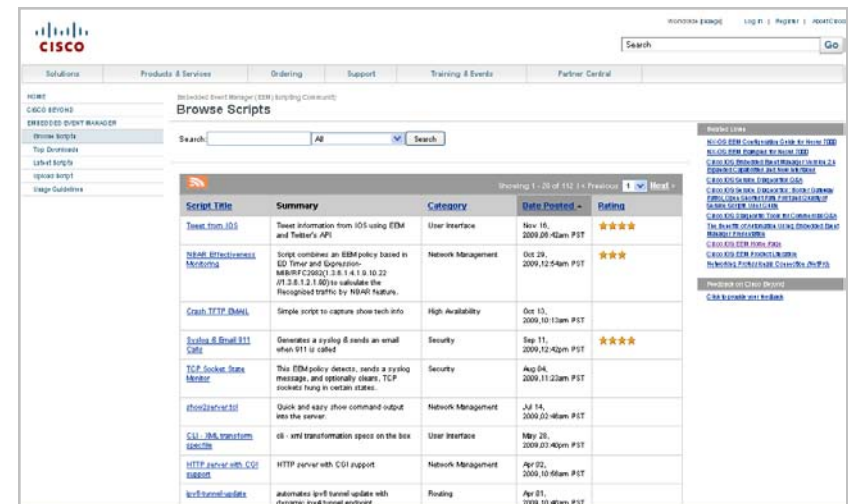
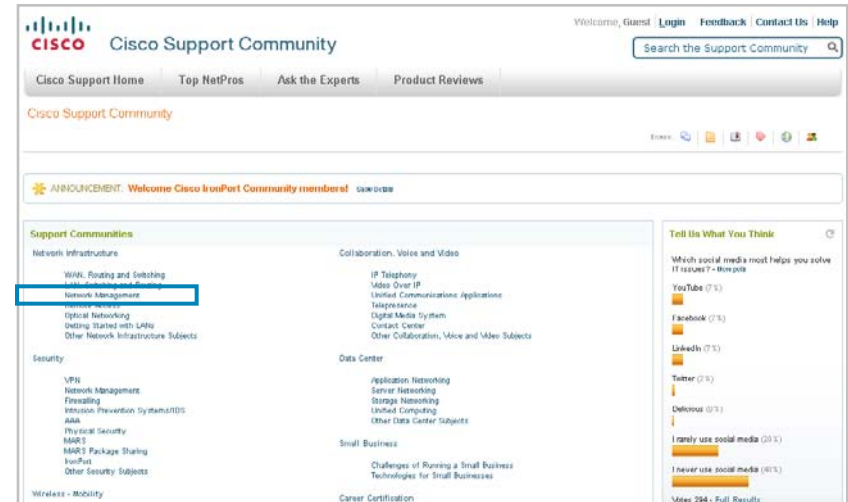
# Share

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

[supportforums.cisco.com](https://supportforums.cisco.com)

- Upload your own examples to Cisco® Beyond:

[www.cisco.com/go/ciscobeyond](http://www.cisco.com/go/ciscobeyond)



# 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](mailto:ask-easy@cisco.com)



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