# 為Cisco IOS XE 16.X平台配置NETCONF/YANG

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# 簡介

本檔案介紹如何在基於Cisco IOS® XE 16.x的平台上設定NETCONF/YANG。

### 必要條件

#### 需求

自Cisco IOS® XE 16.3.1軟體起,支援NETCONF/YANG。

S 註:使用本文檔之前不需要有NETCONF、YANG或Python指令碼編寫方面的經驗。

#### 採用元件

本文中的資訊係根據以下軟體和硬體版本:

在本例中,運行Cisco IOS XE 16.3.3的獨立WS-C3850-12X48U交換機用作NETCONF伺服器。這 是已配置的裝置,透過NETCONF/YANG從該裝置中收集資料(show命令輸出)。

筆記型電腦(執行macOS Sierra 10.12.2和Google Chrome瀏覽器的Apple MacBook Pro)用作 NETCONF使用者端。它充當集中管理平台,使用Yang Explorer應用程式。它是建立YANG格式請 求的裝置,這些請求透過NETCONF RPC(遠端過程呼叫)消息傳送到Catalyst 3850,以配置和收 集來自Catalyst 3850的資料。

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除(預設))的組態來啟動。如果您的網路運作中,請確保您瞭解任何指令可能造成的影響。

### 背景資訊

本文檔中的示例重點介紹使用Catalyst 3850進行的實驗室測試,但是,所提供的資訊也適用於其他 Cisco IOS XE 16.x平台,例如Cisco ASR 1000系列路由器。

#### 資料模型-基於程式設計和標準的配置和監控

資料模式提供另一種集中方式來設定思科裝置(而不是使用思科指令行介面(CLI)或簡易網路管理通訊 協定(SNMP)),以及從思科裝置收集作業資料(show指令)。由於資料模型是基於相同過程的標準 ,並且還可用於從非思科裝置配置或收集資料,因此非常適合支援多個供應商的客戶。集中管理平 台(例如筆記型電腦)可用於配置多個思科裝置或從多個思科裝置收集資料,並且資料模型架構允 許透過Python指令碼自動執行這些過程(另外兩項關鍵優勢)。

下一代資料建模語言(YANG) (RFC 6020)

YANG是基於標準的資料建模語言,用於建立裝置配置請求或運行(show命令)資料請求。它具有 類似於人類可讀電腦程式的結構化格式。有數個應用程式可以在集中管理平台(例如筆記型電腦 ) 上執行, 以建立這些組態和作業資料要求。

適用於所有供應商的標準(通用)YANG資料模型(例如,對於思科和非思科裝置,停用或關閉乙 太網介面的請求可以相同)以及便於配置或收集與專有供應商功能相關的運算元據的裝置(本地、 供應商特定)資料模型。

網路組態(NETCONF)通訊協定(RFC 6241)

NETCONF是一種基於標準的可擴展標籤語言(XML)編碼的協定,它提供傳輸功能,將YANG格式的 配置或運行資料請求從運行在集中管理平台上的應用程式(例如筆記型電腦)傳輸到使用者希望從 中配置或請求運行(show command)資料的思科裝置。它提供基於事務的服務,例如當配置請求的 一部分失敗時中止整個配置請求。NETCONF使用基於簡單遠端過程呼叫(RPF)的機制,促進客戶端 (集中管理平台指令碼或應用程式)與伺服器(Cisco交換機或路由器)之間的通訊。它使用安全外 殼(SSH)作為跨網路裝置的傳輸層。一些NETCONF操作包括get、get-config、edit-config和rpc。

### 設定

1. 運行Cisco XE 16.3.3軟體以支援NETCONF/YANG資料建模的Catalyst 3850的基本配置

3850-1# show running-config netconf-yang ------> Enable NETCONF/YANG globally. It may take up to 90 username cisco1 privilege 15 password 0 cisco1 ---> Username/password used for NETCONF-SSH access

注意:這是在Catalyst 3850上支援NETCONF/YANG資料建模所需的完整配置,但是它假定沒 有全局配置aaa新模型(預設值)。如果需要透過配置aaa new-model啟用AAA(身份驗證、 授權和記帳),則至少還需要此配置。您也可以將其擴展為對TACACS+或RADIUS配置使用 AAA,但這超出了此示例的範圍。

aaa new-model

aaa authorization exec default local -----> Required for NETCONF-SSH connectivity and edit-conf

#### 2. 允許NETCONF/YANG系統日誌和SNMP事件監控的其他(可選) 配置

必須存在這些snmp-server配置,才能為Syslog消息和任何配置的SNMP陷阱生成NETCONF通知 (RFC 5277 - <u>Tools 5277</u>),從而也生成NETCONF通知。



注意:雖然這是最低要求,但也可能出現額外的snmp-server enable條目。客戶端(集中管 理平台)註冊以從伺服器(Catalyst 3850)接收NETCONF通知流並傳送特定訂用RPC(請參 閱配置集中管理平台(筆記型電腦)的第3部分)。

#### 3850-1# show running-config

<pre>snmp-server community <string> RW&gt;</string></pre>	SNMP gateway in DMI requires communi
<pre>netconf-yang cisco-ia snmp-community-string <string>&gt;</string></pre>	Configure the same community string
<pre>snmp-server trap link ietf&gt;</pre>	enable traps for IETF link up/down
<pre>snmp-server enable traps snmp authentication linkdown linkup&gt;</pre>	enable traps for link up/down
<pre>snmp-server enable traps syslog&gt;</pre>	enable traps for Syslog so notificat
<pre>snmp-server manager&gt;</pre>	enable snmp-server

對於Syslog,當Catalyst 3850上的Ciscod生成Syslog消息時,必須存在此配置,Catalyst 3850上的 資料模型介面(DMI)才能生成RFC 5277中定義的NETCONF通知。 logging history debugging -----> required for the generation of any NETCONF notification messages fo logging snmp-trap emergencies ---> configure 1 or more of the following to control which levels of Sys logging snmp-trap alerts logging snmp-trap critical logging snmp-trap errors logging snmp-trap warnings logging snmp-trap notifications logging snmp-trap informational logging snmp-trap debugging

對於SNMP陷阱,生成NETCONF通知需要此配置。在Cisco XE 16.3.1軟體中,最多可以設定10個 SNMP陷阱來產生NETCONF通知,但此限制可在未來的版本中移除。預設情況下,SNMP陷阱的 通知生成處於啟用狀態。要停用生成SNMP陷阱通知,請使用此CLI,no netconf-yang cisco-ia snmp-trap-control global-forwarding。

netconf-yang cisco-ia snmp-trap-control trap-list 10.3.6.1.6.3.1.1.5.3 -----> LinkDown trap netconf-yang cisco-ia snmp-trap-control trap-list 10.3.6.1.6.3.1.1.5.4 -----> LinkUp trap netconf-yang cisco-ia snmp-trap-control trap-list 10.3.6.1.4.1.9.9.41.2.0.1 ---> Syslog generated noti

#### 3. 本示例中使用的Catalyst 3850的網路連線配置

3850-1# show running-config

在本例中,Catalyst 3850管理介面GigabitEthernet0/0用於連線到網路和集中管理平台(可以使用筆 記型電腦)。動態主機配置協定(DHCP)已用於將IP地址172.16.167.175分配給此介面。只要筆記型 電腦可以到達網路上的Catalyst 3850,備用配置就可以在Catalyst 3850上使用。

vrf definition Mgmt-vrf L address-family ipv4 exit-address-family ! address-family ipv6 exit-address-family interface GigabitEthernet0/0 vrf forwarding Mgmt-vrf ip address dhcp negotiation auto ip route vrf Mgmt-vrf 0.0.0.0 0.0.0.0 172.16.167.161 3850-1# show ip interface brief Interface IP-Address OK? Method Status Protocol YES NVRAM up Vlan1 10.1.1.1 up Vlan10 10.10.10.1 YES NVRAM up up Vlan20 10.20.20.1 YES NVRAM up up GigabitEthernet0/0 172.16.167.175 YES DHCP up up YES unset down Fo1/1/1 unassigned down Fo1/1/2 YES unset down unassigned down

unassigned	YES manual	up	up
unassigned	YES unset	up	up
unassigned	YES unset	down	down
unassigned	YES unset	down	down
unassigned	YES unset	down	down
	unassigned unassigned unassigned unassigned unassigned	unassigned YES manual unassigned YES unset unassigned YES unset unassigned YES unset unassigned YES unset	unassigned YES manual up unassigned YES unset up unassigned YES unset down unassigned YES unset down unassigned YES unset down

# 驗證Catalyst 3850上的NETCONF/YANG

1. 從Catalyst 3850的命令列介面(CLI),此命令可用於確保在配置netconf-yang後運行Catalyst 3850上支援資料模型介面(DMI)所需的軟體進程。

3850-1# show platform software yang-management process

confd : Running nesd : Running syncfd : Running ncsshd : Running dmiauthd : Running vtyserverutild : Running opdatamgrd : Running ngnix : Running

接下來的步驟是從集中管理平台執行的。在本例中,使用的筆記型電腦(運行macOS Sierra 10.12.2的Apple MacBook Pro)可以訪問Catalyst 3850網路。這些命令是從筆記型電腦上的終端提 示符發出的。目前筆記型電腦上並未載入任何特殊應用程式。

2. 確保集中管理平台(筆記型電腦)可以訪問網路上的Catalyst 3850 (172.16.167.175)。

#### <#root>

USER1-M-902T:~ USER1\$ ping 172.16.167.175

PING 172.16.167.175 (172.16.167.175): 56 data bytes 64 bytes from 172.16.167.175: icmp\_seq=0 ttl=247 time=3.912 ms 64 bytes from 172.16.167.175: icmp\_seq=1 ttl=247 time=6.917 ms 64 bytes from 172.16.167.175: icmp\_seq=2 ttl=247 time=4.063 ms 64 bytes from 172.16.167.175: icmp\_seq=3 ttl=247 time=4.371 ms

^C

3. 使用此Catalyst 3850配置中的使用者名稱和口令(cisco1/cisco1),驗證從集中管理平台(筆記型 電腦)到Catalyst 3850(本示例中為172.16.167.175)的SSH連線。響應可以是Catalyst 3850的 NETCONF功能的長清單,後跟Hello消息。TCP埠830 = netconf-ssh。



提示:如果此SSH測試不起作用,請確保筆記型電腦和Catalyst 3850之間的任何防火牆都允 許TCP埠830(請參閱RFC 4742:<u>工具4742</u>)。 USER1-M-902T:~ USER1\$ ssh -s cisco1@172.16.167.175 -p 830 netconf cisco1@172.16.167.175's password: cisco1

```
<?xml version="1.0" encoding="UTF-8"?>
<hello xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
<capabilities>
<capability>urn:ietf:params:netconf:base:1.0</capability>
<capability>urn:ietf:params:netconf:base:1.1</capability>
<capability>urn:ietf:params:netconf:capability:writable-running:1.0</capability>
<capability>urn:ietf:params:netconf:capability:xpath:1.0</capability>
<capability>urn:ietf:params:netconf:capability:validate:1.0</capability>
<capability>urn:ietf:params:netconf:capability:validate:1.0</capability>
<capability>urn:ietf:params:netconf:capability:validate:1.1</capability>
<capability>urn:ietf:params:netconf:capability:validate:1.1</capability>
<capability>urn:ietf:params:netconf:capability:rollback-on-error:1.0</capability
--snip--
</capabilities>
<session-id>2870</session-id></ hello>]]>]>
```

Use <  $\wedge C$  > to exit

## 配置集中管理平台(筆記型電腦)

1. 在筆記型電腦上安裝Yang Explorer應用程式

在本例中,Yang Explorer應用用於筆記型電腦(運行macOS Sierra 10.12.2的Apple MacBook Pro和Google Chrome瀏覽器)作為集中管理平台。Yang Explorer允許使用者執行以下操作:

·從使用者介面或命令列上傳/編譯YANG資料模型

- ·建置NETCONF RPC (遠端程式呼叫)
- · 針對真實的NETCONF伺服器(Catalyst 3850)執行RPC
- ·將建立的RPC儲存到集合以供以後使用
- ·瀏覽資料模型樹並檢查YANG屬性

💊 註:Linux系統也支援YANG Explore應用程式。

#### 2. 使用Yang Explorer應用程式

啟動Yang Explorer應用程式-在筆記型電腦上的終端提示符下,從yang-explorer目錄運行./start.sh和命令。

✤ 注意:保持此終端會話處於打開狀態,否則Yang Explorer應用程式會關閉並且必須重新啟動 。它還可以用作應用程式活動的控制檯日誌。

USER1-M-902T:~ USER1\$ cd yang-explorer

```
USER1-M-902T:yang-explorer USER1$ ./start.sh &
```

```
Starting YangExplorer server ..
```

Use http://localhost:8088/static/YangExplorer.html

Performing system checks...

System check identified no issues (0 silenced). January 19, 2017 - 23:12:20 Django version 1.8.3, using settings 'server.settings' Starting development server at http://localhost:8088/ Quit the server with CONTROL-C.

啟動Yang Explorer GUI -啟動Yang Explorer應用程式GUI,並作為訪客/訪客登入到應用程式GUI主 選單右上角的Yang Explorer應用程式GUI(請參閱螢幕截圖)。

從Catalyst 3850檢索功能。輸入Catalyst 3850的詳細資訊(IP地址、使用者名稱/口令、TCP埠830 for ssh-netconf),然後按一下Capabilities以從Catalyst 3850軟體檢索YANG操作功能清單。

### 提示:此測試還可用於確認NETCONF在集中管理平台(筆記型電腦)上的Yang Explorer應 用程式與Catalyst 3850之間的通訊是否有效。



載入Yang資料模型-可在「管理模型」下訂閱各種YANG資料模型。訂閱後,它們會顯示在左邊的「 總管」方塊中。這些YANG模型允許Yang Explorer應用程式建立YANG格式的NETCONF遠端過程 呼叫(RPC)消息(傳送到Catalyst 3850以對其進行配置或從中檢索資料),而無需具備深入的 YANG專業知識。下一節「基本NETCONF/YANG操作」中將介紹如何執行此操作

範例:

Ocalhost:8088/static/YangExp ×	Mike
$\leftrightarrow$ $\rightarrow$ C ( ) localhost:8088/static/YangExplorer.html	☆ 🖾 :
Yang Explorer 0.6.0 (Beta)	🔿 Help 🛛 😫 Admin 📿 Refresh 🔹 guest
Values OT Rietf-interfaces Select Al iana-if-sy ietf-interf ietf-interf ietf-interf ietf-yang- ietf-yang- ietf-yang- ietf-yang- ietf-select ietf-sele	Llector Manage Models Device Device Showing 5 models Filter  e@2014-01-15.yang pes.yang topes.yang types.yang bypes.yang bypes.yang types.yang types.yang types.yang bypes.yang

### 3. 訂閱NETCONF通知(可選)

客戶端(集中管理平台)透過傳送此YANG格式的NETCONF RPC消息來註冊以從伺服器(Catalyst 3850)接收NETCONF通知流。Catalyst 3850會以非同步方式將NETCONF通知傳送到訂閱的每個使用者端。完成此任務之前,請確保Catalyst 3850上的正確配置已到位,以支援NETCONF通知(請參閱第2部分)(在Catalyst 3850上配置NETCONF/YANG)。當系統中發生事件時,NETCONF伺服器(Catalyst 3850)開始將事件通知傳送到NETCONF使用者端(集中管理平台)。這些事件通知可以繼續傳送,直到NETCONF會話終止或訂閱因其他原因終止為止。有關訂閱選項<u>工具5277</u>的詳細資訊,請參閱RFC 5277。

要執行此操作,您需要將其剪下並貼上到Yang Explorer應用程式GUI中作為自定義RPC。

e e filocalhost:8088/st	tatic/YangExp ×		Mike
$\leftrightarrow$ $\rightarrow$ C (i) localhost:808	8/static/YangExplorer.html		☆ 🖾 🗄
Yang Explorer 0.6.0 (Beta)		(O)	Help 🛛 🚰 Admin  🤁 Refresh 🔹 guest
Explorer search	Values	Build Colections Manage Models	Property Value
► Rietf-interfaces		Operations Device Settings	Name statistics
		Create device profile	Node Type container
		Profile	Data Type
		Platform •	Access read-only
		Host 172.16.167.175 Port 830	Presence
		Username cisco1 Password cisco1	Key
			Mandatory
		NetConf      RestConf     Doc	Default
		Encoding Console	Path ietf-netconf-monitoring/
		<pre>************************************</pre>	Description Statistical data pertaining to the NETCONF server.Statistical data pertaining to the NETCONF server.None
Config Oper Status : Clear completed	+ Add - Delete	C Reset Custom RPC Run Save Clear C	Copy

接下來,選擇運行以透過NETCONF將自定義RPC消息傳送到Catalyst 3850。Catalyst 3850會以 ok訊息回覆,讓使用者知道作業已成功。

localhost:8088/static/Yan	gExp X				Mike
← → C () localhost:8088/statio	c/YangExplorer.html				☆ 🔛 🗄
Yang Explorer 0.6.0 (Beta)			O Help	😁 Admin	😋 Refresh 🛛 💄 guest
Explorer search	Values	Q. 7	Build Collections Manage Models	Property	Value
▶ Rietf-interfaces	21		Operations Device Settings	Name	statistics
			Create device profile	Node Type	container
			Protile	Data Type	
			Platform • •	Access	read-only
			Host 172.16.167.175 Port 830	Presence	
			Username cisco1 Password cisco1	Key	
				Mandatory	
			NetConf      RestConf     Contain      Contain	Default	
			Encoding Console	Path	ietf-netconf-monitoring/ netconf-state/statistics
			<pre><rprc-reply <ok="" message-id="urn:uuid:8a3329b6-e30a-4407-91f2-c094fba2a4db" tritef;parama:xml:ns:netconf:base11.0"="" wfins:no="urn"></rprc-reply> <ok></ok> </pre>	Description	Statistical data pertaining to the NETCONF server.Statistical data pertaining to the NETCONF server.None
O Config O Oper	+ Add - Delete C Res	set	Custom RPC Run Save Clear Copy	■	
Status : Recieved HTTP Result for request: run	-rpc				IETF 93

注意:本示例中使用的Yang Explorer的當前版本沒有檢視已接收的NETCONF通知的選項。 它們通常儲存在應用程式主選單的可點選通知日誌中。

# 基本NETCONF/YANG操作示例

現在,Catalyst 3850和集中管理平台已配置並開始通訊,讓我們看一些基本操作示例。

這些範例可示範從Centralized Management Platform (Laptop) Yang Explorer應用程式透過 NETCONF傳送到Catalyst 3850的YANG格式化NETCONF RPC訊息,已透過Catalyst 3850上的 confd軟體程式轉換成標準的Cisco IOS CLI。此外,Cisco IOS CLI資料(show command data)在 Catalyst 3850上透過confd軟體進程轉換為YANG格式的資料,然後再作為NETCONF RPC消息傳 送到集中管理平台(筆記型電腦) Yang Explorer應用程式。這意味著除使用NETCONF/YANG配置 交換機並收集show命令資料外,在Catalyst 3850上仍可使用常規CLI來配置交換機。

1. 資料檢索示例

從Catalyst 3850要求介面名稱清單

所需操作可從Yang Explorer應用程式GUI的左側Explorer部分中選擇。在這種情況下,介面名稱資料會從Catalyst 3850中擷取,因此在「interface name」下拉式清單中選取了Oper(針對操作)然後選取get-config。下一步選擇RPC,以生成需要透過NETCONF傳送到Catalyst 3850以從Catalyst 3850檢索此資料的YANG格式的(人類可讀) NETCONF RPC。

← → C () localhost:8088/static/Y	angExplorer.html				☆ 🕅
Yang Explorer 0.6.0 (Beta)			🙃 Help 🛛 🗳 Admin	2 Refresh	🐣 guest
Explorer Stoch	Values	Operation	Build Collections Manage Models	Property	Value
Rietf-interfaces			Operations Device Settings	Name	name
v 🔤 interfaces			Create device profile	Node Type	leaf
▼			Profile	Data Type	string
P name	<get-config></get-config>		Platform other -	Access	read-write
			Host 172.16.167.175 Port 830	Presence	
/ enabled			Harmond alcost	Key	true
🔎 link-up-down-trap-enable			Username Ciscol	Mandatory	true
▶ 🚰 interfaces-state			NetConf RestConf RPC Script Capabilities	Default	
			Encoding Console	Path	ietf.
			<pre><rpc message-id="101" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"></rpc></pre>		interfaces/ interfaces/ interface/ name
			<pre><interface></interface></pre>	Description	The name of the interface. A device
Config Oper	+ Add - Delete	C Reset	Custom RPC Run Save Clear Copy		MAY restrict the

生成YANG格式化的NETCONF RPC消息後,選擇Run將其傳送到Catalyst 3850。Catalyst 3850會 使用YANG格式的Catalyst 3850介面名稱(GigabitEthernet1/1/1、GigabitEthernet1/1/2等)清單 (人類可讀取)進行回覆。

$\leftrightarrow \Rightarrow c$	localhost:8088/static/Ya	ngExplorer.html			☆ 🕅		
Yang Exp	Yang Explorer 0.6.0 (Beta) 🔗 Help 🛛 😤 Admin 📿 Refresh 💦						
Explorer	search	Values	Operation	Build Collections Manage Models Property	Value		
Rietf-inte	rfaces			Operations Device Settings Name	name		
🔻 🚰 inter	faces			Node Type	leaf		
🔻 🚞 int	terface			Profile Create device profile	string		
P	name	<get-config></get-config>		Platform other	road unito		
-	description			172 1/ 1/7 175 Part 920	read-write		
-	type			Host 172.10.107.175 Port 830			
-	enabled			Username cisco1 Password cisco1 Key	true		
-	link-up-down-trap-enable			V Mandatory	true		
► 📅 inter	aces-state			NetConf RestConf RPC Script Capabilities     Default			
				Encoding Console	ietf-		
		_	<pre></pre>				
				<pre>           </pre>	The name of the interface.		
O Config	Oper	+ Add 🛛 — De	lete C Reset	Custom RPC Run Save Clear Copy	MAY restrict the		

### 2. 組態範例

關閉Catalyst 3850上的乙太網介面

所需的操作從Yang Explorer應用程式GUI的Explorer部分的左側選擇。在這種情況下,要在Catalyst 3850上配置介面(關閉介面),需要選擇Config(用於配置),然後是介面下拉選單下所需的操作 引數。下一步選擇RPC,以生成需要透過NETCONF傳送到Catalyst 3850以執行配置任務的 YANG格式的(人類可讀)NETCONF RPC。

localhost	×		Mik
← → C O localhost:8088/static/	YangExplorer.html		¥ 1
Yang Explorer 0.6.0 (Beta)			🕥 Help 🏾 🚰 Admin 😂 Refresh 🔹 guest
Explorer such	Values	Build Collections Manage Models	Property Value
Rietf-interfaces		Operations Device Settings	Name enabled
V interfaces		Profile Creste device profile	e Node Type leaf
▼		FIGURE	Data Type boolean
mame	GigabitEthernet1/0/16	Platform other	Access read-write
✓ description	ianaift:ethernetCsmacd	Host 172.16.167.175 Port 830	Presence
🔎 enabled	false	Username cisco1 Password cisco1	Key
link-up-down-trap-enable			▼ Mandatory
interfaces-state		NetConf      RestConf     RPC	Script Capabilities Default true
		Encoding Console	Path ietf-
		<rpre><rpc message-id="101" urn:ietf:params:xml:r<br="" xmlns="urn:ietf:params:xml:ns:netconf;base:1.0 &lt;edu-config&gt; &lt;target&gt; &lt;running/&gt; &lt;/target&gt; &lt;/config&gt;&lt;/race&lt;/td&gt;&lt;td&gt;I*&gt; interfaces/&lt;br&gt;interface/&lt;br&gt;enabled&lt;/td&gt;&lt;/tr&gt;&lt;tr&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;td&gt;&lt;pre&gt;&lt;interfaces xmlns=">interfaces"&gt;</rpc></rpre>	<pre>s:yang:ietf- Description This leaf contains the configured, desired</pre>
Config Oper	+ Add - Delete C R	Custom RPC Run Save	Clear Copy state of the

生成YANG格式化的NETCONF RPC消息後,選擇Run將其傳送到Catalyst 3850。Catalyst 3850會 以YANG格式(人類可讀取)的訊息回覆,指出組態作業成功(ok)。



為了確認更改是否發生,可以檢查配置。Catalyst 3850可能會使用get-config作業(Oper),回覆成介 面GigabitEthernet 1/0/16組態現在已啟用= false,這表示介面已關閉。 提示:通常,當不清楚在Yang Explorer應用程式的Explorer部分中的值可以採用什麼格式時,如圖所示,轉儲YANG格式的Catalyst 3850配置是在嘗試修改它們之前確定它們的好方法。 接下來的熒幕右邊會在「屬性」和「值」欄中提供這些值的描述和相依性。

← → C () localhost:8088/static/Yang	gExplorer.html				☆ 🕅
Yang Explorer 0.6.0 (Beta)			🔿 Help 🛛 😤 Admin	C Refresh	🔒 guest
Explorer search	Values	0	Build Collections Manage Models	Property	Value
Rietf-interfaces			Operations Device Settings	Name	interface
▼ Contentaces			Profile Create device profile	Node Type	list
• interface	<get-config></get-config>			Data Type	
<pre>// name</pre>	GigabitEthernet1/0/16		Platform other	Access	read-write
/ type	ianaift:ethernetCsmacd		Host 172.16.167.175 Port 830	Presence	
/ enabled			Username cisco1 Password cisco1	Key	
link-up-down-trap-enable				Mandatory	
interfaces-state			NetConf RestConf RPC Script Capabilities	Default	
			Encoding Console	Path	ietf-
			<pre><rpc message-id="101" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"></rpc></pre>		interfaces/ interfaces/ interface
			</td <td>Description</td> <td>The list of configured interfaces on the</td>	Description	The list of configured interfaces on the
					The

生成YANG格式化的NETCONF RPC消息後,選擇Run將其傳送到Catalyst 3850。Catalyst 3850以 YANG格式的消息作為回覆,該消息表明介面GigabitEthernet 1/0/16配置現在已啟用= false,這意 味著該介面已關閉。

$\leftrightarrow$ $\Rightarrow$ C (i) localhost:8088/static/	YangExplorer.html			☆ 🕅
Yang Explorer 0.6.0 (Beta)			🕜 Help 🦙 😤 Admin 🖉 Refresh	💄 guest
Explorer search	Values	0	Build Collections Manage Models Property	Value
Rietf-interfaces			Operations Device Settings Name	interface
🖲 interfaces			Node Type	list
🔻 🖵 interface	<get-config></get-config>		Profile Create device profile	
🎤 name	GigabitEthernet1/0/16		Platform other	read-write
description			Host 172.16.167.175 Port 830	read mile
type	ianaift:ethernetCsmacd			
			Username cisco1 Password cisco1	
▶ Tinterfaces-state			Mandatory	
			NetConf RestConf RPC Script Capabilities Default	
			Path           Encoding         Console <rpc-reply< td="">         message-id="urn:uuid:cd8460c3-7be3-447a-9940-8305113bf3cb"</rpc-reply<>	ietf- interfaces/
			<pre>xmlns - unitetipdrams.mml:ns:netcon:rodaet.ro xmlns:no="unitefipdrams:rml:ns:netconf:base:1.0"&gt; <data> <interfaces xmlns="unitefipdrams:xml:ns:vand:ietf-interfaces"></interfaces></data></pre>	interfaces/ interface
			<pre><interface></interface></pre>	The list of configured interfaces on the device.
Config Oper	+ Add - Delete C R	eset	Custom RPC Run Save Clear Copy	The operationa

Catalyst 3850 CLI在上一個NETCONF/YANG配置更改之前和之後顯示介面配置

在上次Yang Explorer配置更改操作時,該命令是從Catalyst 3850的CLI中輸出的。在收到 NETCONF RPC消息之前,GigabitEthernet 1/0/16介面處於預設的no shutdown狀態,如Catalyst 3850上的日誌消息中所示。收到包含關閉介面的YANG格式化請求的NETCONF RPC消息後,操作 完成,介面關閉,並且運行配置被修改以反映這一點。此部分還演示了Catalyst 3850上的confd軟體 進程如何將收到的YANG格式的NETCONF RPC消息轉換為標準Cisco IOS CLI。這意味著使用者除 了使用NETCONF/YANG來修改配置和執行顯示命令外,還可以使用常規Cisco IOS CLI來修改配置

3850-1# show running-config interface gigabitEthernet 1/0/16 □ Building configuration...

Current configuration : 39 bytes ! interface GigabitEthernet1/0/16 end

3850-1# show startup-config | begin 1/0/16 □interface GigabitEthernet1/0/16 □ !

\*Jan 5 17:05:55.345: %DMI-5-CONFIG\_I:Switch 1 R0/0: nesd: Configured from NETCONF/RESTCONF by cisco1, t \*Jan 5 17:05:57.335: %LINK-5-CHANGED: Interface GigabitEthernet1/0/16, changed state to administrativel

3850-1# show running-config interface gigabitEthernet 1/0/16 □Building configuration...

Current configuration : 49 bytes  $\hfill\square$ 

!
Dinterface GigabitEthernet1/0/16 D
shutdown -----> the interface is shutdown now
Dend

3850-1#



```
3850-1# show startup-config | begin 1/0/16
interface GigabitEthernet1/0/16
!
```

儲存Catalyst 3850上的組態

運行配置可以儲存到Catalyst 3850上的啟動配置中,方法是透過NETCONF將此YANG格式的 NETCONF RPC消息傳送到Catalyst 3850。

當您將其剪下並貼上到Yang Explorer應用程式作為自定義RPC時,即可完成此操作。

Iocalhost:8088/static/Yang	gExp 🗙				Mike
$\leftarrow$ $\rightarrow$ C ( ) localhost:8088/static	/YangExplorer.html				☆ 🛙 :
Yang Explorer 0.6.0 (Beta)			O Help	嶜 Admin	🔁 Refresh 🔒 guest
Explorer search	Values	0.7	Build Collections Manage Models	Property	Value
▼ Rietf-interfaces	/	10	Operations Device Settings	Name	enabled
🔻 🚰 interfaces				Node Type	leaf
V 💭 interface			Profile Create device profile	Data Type	boolean
i name €			Platform other 👻	Access	read-write
description			172 1/ 1/7 1/5 Port 920	Prosonce	1000 11110
type			Host 172.10.107.175 For 830	rresence	
			Username cisco1 Password cisco1	Key	
Fink-up-down-trap-enable				Mandatory	
Interfaces-state				Default	true
- wiet-netcon-monitoring			NetCont RestCont RPC Script Capabilitie     Encoding Common     (?xml version="1.0" encoding="utf-8"?>	Path	ietf-interfaces/ interfaces/interface/ enabled
			<pre><rpc message-id="" xmlns="urn:letf:params:xml:ns:netconf:base:1.0"> <cisco-ia:save-config xmlns:cisco-ia="http://cisco.com/yang/cisco-ia"></cisco-ia:save-config> </rpc></pre>	Description	This leaf contains the configured, desired state of the interface.
					Systems that implement the IF-MIB use the value of this leaf in the 'running'
Config Oper	+ Add - Delete C F	Reset	Custom RPC Run Save Clear Copy		datastore to set IF-MIB.ifAdminStatus to

### 選擇Run以透過NETCONF將自定義RPC消息傳送到Catalyst 3850。Catalyst 3850以成功訊息回覆

Iocalhost:8088/static/Yang	gExp 🗙 💭			M
$\leftrightarrow$ $\rightarrow$ C 🛈 localhost:8088/static,	/YangExplorer.html			* 🕅
Yang Explorer 0.6.0 (Beta)			🔉 Help 🛛 🍲 Admin	😂 Refresh 🛛 💄 guest
Explorer search	Values	0.7	Build Collections Manage Models Property	Value
Rietf-interfaces			Operations Device Settings Name	enabled
🔻 🛅 interfaces			Node Typ	a leaf
🔻 🚍 interface			Profile Create device profile Data Type	boolean
🔎 name			Platform other	read units
description			Access	read-write
/ type			Host 172.16.167.175 Port 830 Presence	
/ enabled			Username cisco1 Password cisco1 Key	
link-up-down-trap-enable			Mandatory	
► interfaces-state			Default	true
* Kietf-netconf-monitoring			NetConf     RPC     Script     Capabilities       Encoding     Console <rp><rp><rp>reprint     rp</rp></rp></rp>	ietf-interfaces/ interfaces/interface/ enabled
		<	<pre>xmlns="urnietf:paramatxmline.netconf:hame11.0" xmlns="urnietf:paramatxmline.netconf:hame11.0"&gt; <cesult xmlns="http://cisco.com/yang/cisco-ia">Save running-config xccessful(/result&gt; </cesult></pre>	This leaf contains the configured, desired state of the interface.
				Systems that implement the IF-MIB use the value of this leaf in the 'running'
O Config O Oper		-		datastore to set

# Catalyst 3850 CLI顯示上次NETCONF/YANG配置儲存操作後儲存的啟動配置

啟動配置現在與運行配置相匹配:

```
3850-1# show running-config interface gigabitEthernet 1/0/16
Building configuration...
Current configuration : 49 bytes
!
interface GigabitEthernet1/0/16
shutdown
end
3850-1# show startup-config | begin 1/0/16
interface GigabitEthernet1/0/16
shutdown
!
```

#### 從CLI配置Catalyst 3850

如前所述,除使用NETCONF/YANG進行配置和收集show命令資料外,常規Catalyst 3850 CLI仍可 用於配置交換機。使用Catalyst 3850 CLI而不是NETCONF/YANG來設定交換器時,新的runningconfig會透過syncfd軟體程式與Catalyst 3850上的資料模型介面(DMI)同步。

3850-1# show running-config interface gigabitEthernet 1/0/16 Building configuration... Current configuration : 49 bytes interface GigabitEthernet1/0/16 shutdown end 3850-1# config t Enter configuration commands, one per line. End with CNTL/Z. 3850-1(config)# interface gigabitEthernet 1/0/16 3850-1(config-if)#no shutdown 3850-1(config-if)# exit 3850-1(config)# exit 3850-1# \*Jan 24 16:39:09.968: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/16, changed state to down \*Jan 24 16:39:13.479: %SYS-5-CONFIG\_I: Configured from console by console \*Jan 24 16:39:15.208: %DMI-5-SYNC\_START:Switch 1 R0/0: syncfd: External change to running configuratio \*Jan 24 16:39:43.290: %DMI-5-SYNC\_COMPLETE:Switch 1 R0/0: syncfd: The running configuration has been s 3850-1#

下次在CLI更改後,Yang Explorer應用程式請求介面配置副本時,更改會正確反映在YANG輸出中 。

← → C ① localhost:8088	/static/YangExplorer	html			\$ 11
Yang Explorer 0.6.0 (Beta)			🖸 🔿 Help 👔 👹 Adm	in 📿 Refre	sh 🛔 guest
Explorer (search	Values	Operation	Build Collections Manage Models	Property	Value
Rietf-interfaces		~	Operations Device Settings	Name	interface
* Dinterfaces				Node Type	list
* Interface	<get-config></get-config>		Profile Create device profile	Data Type	
P name	GigabitEthemet1/0	/16	Platform other 🔫	Access	read-write
# type		/	Host 172.16.167.171 Port 830	Presence	
enabled			numerical and a second	Key	
Ink-up-down-trap-en			Username CISCO1	Mandatory	
► 🚰 interfaces-state			NetConf      RestConf     RestConf     Capabilities	Default	
Rietf-netconf-monitoring			Encoding Console	Park	latt.interfaces/
			<pre><rpc message-id="101" xmlns="urn:ietfips:ams:xml:ns:netconf:base:1.0"></rpc></pre>	1.001	interfaces/
			<pre><get-config> <automatical< a=""></automatical<></get-config></pre>		interface
		_	<running></running>	Description	The list of
			<filter> <interfaces mine="urn:letf:params:ml:ns:yang:letf-interfaces"></interfaces></filter>		configured
			<interface> <name>OigabitEthernet1/0/16</name></interface>		interfaces on
					the device.
					The
-			¢/mc>		operational
()					state of an
) Confue 💽 Oper	+ Add - 0	C Reset	Custom RPC Run Save Clear Copy		interface is

選擇Run以透過NETCONF將GigabitEthernet1/0/16的RPC get-config消息傳送到Catalyst 3850。 Catalyst 3850會使用GigabitEthernet1/0/16介面組態回覆,顯示enabled = true。

$\leftrightarrow$ $\rightarrow$ C ( localhost:8088/static/Yang	gExplorer.html					\$
Yang Explorer 0.6.0 (Beta)			0	Help	🐏 Admin	🔁 Refresh 💦 🛔 guest
Explorer search	Values	Oner 1	Onerstines Duries Satisma	A	Property	Value
Rcisco-process-cpu		4	Operations Device Settings	— П	Name	interface
Rcisco-process-memory			Profile Create device profile		Node Type	list
► 🕏 cisco-pw					Data Tupe	
Rcisco-self-mgmt			Platform •		Data Type	
▶ 🥵 cisco-table-map			Hest 172.16.167.178 Port 830		Access	read-write
R cisco-virtual-service					Presence	
R common-mpls-static			Username cisco1 Password cisco1		Key	
Rietf-diffserv-classifier		-			Mandatory	
▶ 🕏 ietf-diffserv-policy					Defects	
Rietf-interfaces			NetConf RestConf RPC Script	Capabilities	Default	
▼ 🚰 interfaces			Encoding Console	=	Path	ietf-interfaces/
▼ <del>□</del> interface	<get-config></get-config>		<pre><rpc-reply <="" message-id="urn:uuid:832c3b3c-71fe-4e63-8bf4-6ec96&lt;/pre&gt;&lt;/td&gt;&lt;td&gt;1131991" td=""><td></td><td>interfaces/interface</td></rpc-reply></pre>		interfaces/interface	
🔎 name	GigabitEthernet1/0/16	-	<pre>xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"&gt;</pre>		Description	The list of configured
description			<data> <interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-inter&lt;/td&gt;&lt;td&gt;faces"></interfaces></data>		interfaces on the	
🔎 type			<interface> GigabitEthernes1/0/16</interface>			device.
🔎 enabled		0	<type xmlns:ianaift="urn:10 f:params:xml:ns:yang:iana&lt;br&gt;type">ianaift:ethernetCsmacd</type>	-if-		The operational state of
link-up-down-trap-enable			<pre><enabled>false</enabled> </pre> <pre></pre>			an interface is available
► 🚰 interfaces-state			<pre><ipv6 xmlns="urn:ietf:params:xml:ns:yang:ietf-ip"></ipv6> </pre>			in the
Rietf-key-chain						/interfaces-state/
Rietf-netconf-monitoring			 			interface list. If the
► Reietf-routing						configuration of a
-			Custom RPC Run Save Clear	Сору		system-controlled

Status : Recieved HTTP Result for request: run-rpc

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### 3. 檢查哪些SNMP MIB運算元據可透過GET請求操作獲得

使用者無法配置可與NETCONF GET操作一起返回的SNMP MIB資料。所有支援的SNMP MIB若轉 換成由YANG資料模型定義的結構化資料,均屬於Catalyst 3850上的Cisco XE軟體。要瞭解GET請 求中有哪些MIB資料可用,可列出三個選項。所有支援的MIB都可以在功能回應中包含smiv2。

選項 1. 在Yang Explorer應用程式GUI中可以選擇Capabilities按鈕。Catalyst 3850會回覆其包含 smiv2 MIB條目的功能清單。

localhost:8088/st	tatic/YangExp ×				Mike
← → C U localnost:808	B/static/rangExplorer.n	tmi			* 111 :
Yang Explorer 0.6.0 (Beta)			O Help	😁 Admin	😋 Refresh 🛛 🔒 guest
Explorer search	Values	Operation	Build Collections Manage Models	Property	Value
► Rietf-interfaces			Operations Device Settings	Name	name
			Create device evelin	Node Type	leaf
			Profile	Data Type	netconf-datastore-type
			Platform other	Access	read-only
			Host 172.16.167.175 Port 830	Presence	
			Hermone Ciscol	Key	true
			Username CISCOL	Mandatory	true
				Default	
			NetConf RestConf RPC Script Capabilities     Encoding Console     User left finanzame style transmission (2) SNMP-FRAMEWORK-MTR2module=SNMP-FRA	Path	ietf-netconf-monitoring/ netconf-state/datastores/ datastore/name
			MIB4amp:revision=2002-10-14 urn:letf:params:xml:ns:yang:smlv2:SNMP-PROXY-MIB?module=SNMP-PROXY- MIB4amp:revision=2002-10-14 urn:letf:params:xml:ns:yang:smlv2:SNMP-TARGET-MIB?module=SNMP-TARGET- MIB4amp:revision=3002-10-14 urn:letf:params:xml:ns:yang:smlv2:SNMPv2-MIB3module=SNMPv2- MIB4amp:revision=2002-10-16 urn:letf:params:xml:ns:yang:smlv2:SNMPv2-TC?module=SNMPv2-TC urn:letf:params:xml:ns:yang:smlv2:TCP-MIB3module=TCP- MIB4amp:revision=2005-02-18 urn:letf:params:xml:ns:yang:smlv2:TCP-MIB7module=TUNNEL- MIB4amp:revision=2005-02-16 urn:letf:params:xml:ns:yang:smlv2:TCP-MIB7module=TUNNEL- MIB4amp:revision=2005-02-10 urn:letf:params:xml:ns:yang:smlv2:VDP-MIB7module=UPP- MIB4amp:revision=2005-11-15	Description	Name of the datastore associated with this list entry.Name of the datastore associated with this list entry.None
Config O Oper	+ Add	- Delete C Reset	Custom RPC Run Save Clear Copy		
Status : Recieved HTTP Result for req	quest: get-cap				IETF 93

### 選項 2. 此YANG格式的NETCONF RPC消息可以透過NETCONF傳送到Catalyst 3850,以便檢索包 括可用smiv2 MIB模型的功能清單。

```
<?rml version="1.0" encoding="utf-8"?>
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="">
<get>
<filter type="subtree">
<ncm:netconf-state xmlns:ncm="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
<ncm:capabilities/>
</ncm:netconf-state>
</filter>
</get>
</rpc>
```

當您將Yang Explorer應用程式剪下並貼上為自訂RPC時,即可完成此操作。

	localhost:8088/static/	YangExp ×			Mike
€ → G	localnost:8088/st	atic/rangexplorer.nti	mi		¥ M :
Yang Exp	blorer 0.6.0 (Beta)			() Help 🔮 Admin 🕃	Refresh 🔮 guest
Explorer	search	Values	Operation	Build Collections Manage Models Property	Value
► 😤 ietf-inter	rfaces			Operations Device Settings Name	name
				Create device profile	leaf
				Data Type	netconf-datastore-type
				Platform other  Access	read-only
				Host 172.16.167.175 Port 830 Presence	
				Key	true
				Mandatory	true
				Default	
				NetConf RestConf RPC Script Capabilities     Path     Forming Console	ietf-netconf-monitoring/
				xml version="1.0" encoding="utf-8"?>	datastore/name
				<pre><rpre><rpre><rpre></rpre></rpre></rpre></pre> <pre> </pre> <pre>Consistence on f = state = state</pre>	Name of the datastore associated with this list entry.Name of the datastore associated with this list entry.None
				Vipc>	
O Config	O Oper	+ Add	- Delete C Reset	Custom RPC Run Save Clear Copy	
Status - Clear	completed				IFTE 93

Status : Clear completed

選擇Run以透過NETCONF將自定義RPC消息傳送到Catalyst 3850。Catalyst 3850會回覆包含所支 援smiv2 MIB的功能清單。

Yang Explorer 0.6.0 (Beta)			O Help	🔄 Admin	🖰 Refresh 💦 💄 guest
Explorer search	Values	Operation	Build Collections Manage Models	Property	Value
Rietf-interfaces			Operations Device Settings	Name	name
			Create device profile	Node Type	leaf
			Profile	Data Type	netconf-datastore-type
			Platform •	Access	read-only
			Host 172.16.167.175 Port 830	Presence	
			Usersame cisco1 Password cisco1	Кеу	true
				Mandatory	true
				Default	
			Recommendation     Recommen	Path	ietf-netconf-monitoring/ netconf-state/datastores/ datastore/name
		MIB6amp;revision=1994-05-05 MIB6amp;revision=1994-05-05 (capability> capability> capabilit	Description	Name of the datastore associated with this list entry.Name of the datastore associated with this list entry.None	

選項3:可用MIB型號的清單可在Catalyst 3850為響應來自集中管理平台(筆記型電腦)的SSH連線 而返回的NETCONF功能和Hello消息中檢視。

```
USER1-M-902T:~ USER1$ ssh -s cisco1@172.16.167.175 -p 830 netconf
cisco1@172.16.167.175's password: cisco1
<?xml version="1.0" encoding="UTF-8"?>
<hello xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
<capabilities>
<capability>urn:ietf:params:netconf:base:1.0</capability>
<capability>urn:ietf:params:netconf:base:1.1</capability>
<capability>urn:ietf:params:netconf:capability:writable-running:1.0</capability>
<capability>urn:ietf:params:netconf:capability:xpath:1.0</capability>
<capability>urn:ietf:params:netconf:capability:validate:1.0</capability>
<capability>urn:ietf:params:netconf:capability:validate:1.1</capability>
<capability>urn:ietf:params:netconf:capability:rollback-on-error:1.0</capability
--snip--
<capability>urn:ietf:params:xml:ns:yang:smiv2:CISCO-CONFIG-MAN-MIB?module=CISCO-CONFIG-MAN-MIB&amp;revi
<capability>urn:ietf:params:xml:ns:yang:smiv2:CISCO-CONTEXT-MAPPING-MIB?module=CISCO-CONTEXT-MAPPING-MI
<capability>urn:ietf:params:xml:ns:yang:smiv2:CISCO-DATA-COLLECTION-MIB?module=CISCO-DATA-COLLECTION-MI
--snip--
</capabilities>
<session-id>2870</session-id></ hello >]]>]]>
```

```
Use < \wedgeC > to exit
```

# 載入其他YANG資料模型

此連結包含其他YANG資料模型檔案。這些檔案允許透過NETCONF/YANG執行與其他Catalyst 3850功能相關的其他操作,例如配置IPv4單播路由、QoS等。

#### <u>GitHub Yang型號</u>

透過選擇standard、ietf、rfc,可以找到適用於所有供應商的標準(通用、網際網路工程任務組 (IETF)模型。這提供了基於IETF標準機構從RFC出版物中提取的YANG資料模型。

#### GitHub Yang模型樹主標準

透過選擇vendor, cisco, xe, 1632可以找到思科本地(裝置、供應商特定)型號。這為Catalyst 3850的Cisco IOS XE軟體版本16.3.2提供專有YANG資料模型。

GitHub Yang建模楊樹大師級供應商

. (US) https://github.com/YangModels/yang/tree/ma	ster/vendor/cisco/xe/1632	cisco yang models → ☆ 自 ♥ ♣
Code 🕕 Issues 11 🕅 Pull requ	ests 1 🗏 Projects 0 🔸 Pulse 🔟 Graphs	
Branch: master - yang / vendor / cisco	/ xe / 1632 /	Create new file Find file History
gohite Cisco IOS XE 16.3.2 Pelease Yang	Models	Latest commit 55bd294 on Nov 28, 2016
MIBS	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
README.md	Cisco IOS XE 16.3.2 Release Yang Models	a month ago
Cat3k-netconf-capability.xml	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Check-models.sh	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Cisco-acl-oper.yang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Cisco-bfd-state.yang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Cisco-bgp-state.yang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Cisco-bridge-common.yang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Cisco-bridge-domain.yang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Cisco-cfm-stats-dev.yang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
Cisco-cfm-stats.yang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago
cisco-checkpoint-archive.vang	Cisco IOS XE 16.3.2 Release Yang Models	2 months ago

+ etc...

這些檔案可以下載到集中管理平台(筆記型電腦),然後載入到Yang Explorer應用程式。有兩種方 法可以做到這一點。第一種是在各種YANG資料模型檔案中個別載入,第二種是大量載入所有檔案 。

#### 1. 個別載入各種YANG資料模型檔案

提示:從Github下載檔案可能需要<u>rawgit</u>。要從github下載檔案,請選擇與YANG檔案關聯的 Raw按鈕。如果提供URL而不是檔案下載選項,則可以將URL貼上到<u>rawgit</u>中,然後由其提供 生產URL。將此新的生產URL貼到瀏覽器中,它可提供檔案下載選項。

在本例中,cisco-ethernet.yang已經從github下載到集中管理平台(筆記型電腦)。以下步驟可將檔 案載入到Yang Explorer應用程式GUI中,然後選擇預訂,以便將其載入到工具的Explorer部分。

→ 提示:NETCONF功能可用於確定Catalyst 3850軟體支援哪些資料模型。請參閱設定集中管理 平台(膝上型電腦)的第2節。

$\leftarrow \rightarrow \mathbb{C}$ (i) localhost:8088/st	atic/YangExplorer.html				☆ 🔛
Yang Explorer 0.6.0 (Beta)			Q Help	😁 Admin	🕄 Refresh 💦 💄 guest
Explorer Search Rietf-interfaces	Values	Operation	Build       Collection       Manage Models         Workspace       Device         Select All       Showing 5 models         iana-if-type@2014-01-15.yang       ietf-interfaces@2013-12-23.yang       ietf-interfaces@2013-12-23.yang         ietf-interfaces@2010-10-04.yang       ietf-yang-types.yang       ietf-yang-types.yang         ietf-yang-types.yang       ietf-yang-types.yang       ietf-yang-types.yang	Property Name Node Type Data Type Access Presence Key Mandatory Default Path Description	Value

City Contracts: Display: static; Mangbepterer. Method     City So doward, hold to see history     City So doward, hold to see history     Name     Statius     Name     Statius     Display: City So doward, hold to see history     Name     Statius     Browney     Upload     City So doward, hold to see history     Statius     Browney     Upload     City So doward, hold to see history	Iocalhost:8088/static/Y	fangExp ×						Mike
	$\leftrightarrow$ $\rightarrow$ C (i) localhost:8088/sta	tic/YangExplorer.htm	1					☆ 🖬 :
Marine Marine Marine Marine Marine Marine Marine	Click to go forward, hold to see history	2				O <sup>treip</sup>	(C)2223) (	9120at ( - Charait - )
Marked and a base								
<ul> <li>Ander AM</li> <li>Beau of agreed and the agreed</li> <li>Beau of agreed and the agreed</li> <li>Beau of agreed and the agreed</li> <li>Beau of agreed agreed and the agreed</li> <li>Beau of agreed agreed</li></ul>								
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And and a second								
Name Status     Name Status     Name Status     Name Status     Clear Status     Browse Upload     Browse Upload     Clear Status     Status Status        Status Status                                       <								
Vpload Yang X Nme Status Browse Upload Clear Browse Upload Cl								
Name Status     Ame				Upload Yang		*		
Default Def				Name	St	atus		
Park Addressed by the sub- Browse Upload Clear								
<ul> <li>Browse</li> <li>Upload</li> <li>Clear</li> <li>Browse</li> <li>Upload</li> <li>Clear</li> <li>Browse</li> <li>Browse</li> <li>Upload</li> <li>Clear</li> <li>Browse</li> <li>Browse</li></ul>								
Browse Upload Clear Clea								
Description of package Browse Upload Clear								
Browse Upload Clear which we not be able to								
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addressed to a multicast or broadcast and and addressed to a multicast or broadcast a					Browse	pload Clear		

O Calhost:8088/static/YangEx; X			Mike
← → C ③ localhost:8088/static/YangExplorer.html		\$	1
Yang Explorer 0.6.0 (Beta)	替 Admin	😷 Refresh 💦 💧 gu	Jest
Explorer       Sarch       Values       Operation       Build       Collection       Manage Models         Rietf-interfaces       Select All       Showing 6 models       Filter         2       clsco-athernet@2014-05-10.yang       Item=1000000000000000000000000000000000000	Property Name Node Type Data Type Access Presence Key Mandatory Default Path Description	Value	

### 2. 一次大量載入所有YANG資料模型檔案

第5.2.2節(此處:<u>github</u>)中也提到了這一過程。

在集中管理平台(筆記型電腦-運行macOS Sierra 10.12.2的Apple MacBook Pro)上的終端提示符 處:

```
USER1-M-902T:~ USER1$ cd yang-explorer □
USER1-M-902T:yang-explorer USER1$ cd server 

USER1-M-902T:server USER1$ python manage.py bulkupload --user guest --git https://github.com/YangModels
Git upload .. □
Cloning into '/Users/USER1/yang-explorer/server/data/session/tmpk7V406'...
□remote: Counting objects: 5610, done. □
remote: Total 5610 (delta 0), reused 0 (delta 0), pack-reused 5610 🗆
Receiving objects: 100% (5610/5610), 11.80 MiB | 2.34 MiB/s, done. □
Resolving deltas: 100% (3159/3159), done. 🗆
Checking out files: 100% (3529/3529), done.
□Cleaning up /Users/USER1/yang-explorer/server/data/session/tmpk7V406 □
Compiling : user: guest, file: /Users/USER1/yang-explorer/server/data/session/tmpHTAEP3/cisco-acl-oper.
DEBUG:root:Compiling session dependency ...
□//anaconda/bin/pyang □
DEBUG:root:Rebuilding dependencies for user guest
□--snip--
```

所有Yang資料模型現在都可在Yang Explorer應用程式GUI中看到。按一下Subscribe即可選擇與所 關注功能相關的檔案,然後將其增加到工具的Explorer部分。 提示:NETCONF功能可用於確定Catalyst軟體支援哪些資料模型。請參閱設定集中管理平台
 (膝上型電腦)的第2節。

Ocalhost:8088/static/YangEx	× \							Mike
$\leftarrow$ $\rightarrow$ C (i) localhost:8088/static/Ya	ngExplorer.html							☆ :
Yang Explorer 0.6.0 (Beta)				O Help		Admin	C Refresh	💄 guest
Explorer search	Values	Operation		Build Collections Manage Models		Property	Value	
				Wardspace Device		Name		
			1		_	Node Tupe		
				Showing /v modes Inter	닊	Node Type		
			Ъ	✓ cisco-acl-oper.yang	-	Data Type		
				Cisco-bfd-state.yang		Access		
			Т	Cisco-bgp-state.yang	=	Presence		
				V cisco-bridge-common.yang		Key		
				✓ cisco-cfm-stats-dev.yang	-	Mandatory		
				✓ cisco-cfm-stats.yang		Default		
				✓ cisco-checkpoint-archive.yang		Delaur		
				✓ cisco-efp-stats.yang		Path		
			1	✓ cisco-environment.yang		Description		
				✓ cisco-ethernet.yang				
				✓ cisco-flow-monitor.yang				
				Cisco-la.yang				
				V cisco-ip-sia-stats-dev.yang				
				✓ cisco-Ildp-state.yang				
			1	✓ cisco-memory-stats.yang				
				✓ cisco-mpls-fwd.yang				
			d.	✓ cisco-odm.yang				
				I cien real days war	Ŧ			
localhost:8088/static/YangEx								Mike
Yang Explorer 0.6.0 (Beta)	ngExplorer.ntml			C Halo		at Admin	C Refrech	H :
Tang Explorer 0.0.0 (Beta)			_				C Refresh	a guest
Explorer search	Values	Operation	_	Build Collections Manage Models	_	Property	Value	
▶ 🕏 cisco-bfd-state			4	Workspace Device	_	Name		
▶ K cisco-bgp-state			Н	Select All Showing 79 models filter		Node Type		
Kcisco-bridge-domain			Ш	cisco-acl-oper.vang		Data Type		
<ul> <li>Recisco-cfm-stats</li> </ul>			Н	cisco-bfd-state.yang [subscribed]		Access		
▶ K cisco-checkpoint-archive			Н	cisco-bgp-state.yang [subscribed]	-	Presence		
Theisco-efp-stats			Н	cisco-bridge-common.yang	-	Presence		
Kcisco-environment			=	cisco-bridge-domain.yang [subscribed]		Key		
K cisco-flow-monitor				cisco-cfm-stats-dev.yang		Mandatory		
			Ц	cisco-cfm-stats.yang [subscreed]		Default		
Reisco-Ildo-state				cisco-checkpoint-archive.kang (subscribed)		Path		
			Ш	cisco-environment-vang (subscribed)		Description		
▶ K cisco-mpls-fwd				cisco-ethernet.yang				
▶				cisco-flow-monitor.yang [subscribed]				
▶ 🕏 cisco-process-cpu				cisco-ia.yang [subscribed]				
▶ K cisco-process-memory				cisco-ip-sla-stats-dev.yang				
▶ K cisco-pw				cisco-ip-sla-stats.yang [subscribed]				
▶ Kcisco-self-mgmt				cisco-Ildp-state.yang [subscribed]				
▶ 🕏 cisco-table-map				cisco-memory-stats.yang (subscribed)				
▶ 🕏 cisco-virtual-service				cisco-odm.vang				
Rcommon-mpls-static				Circa and down your	Ŧ			

Status : Received HTTP Result for module request

+ Add - Delete C Reset

O Config O Oper

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其他任務現在可以完成,例如生成在Catalyst 3850上儲存配置所需的NETCONF/YANG RPC。當您 在Yang Explorer應用程式左側的Explorer部分中選擇save-conf RPC時,即可完成此操作。然後

📤 Add Subscribe Un-Subscribe

,選擇RPC以生成YANG格式化的NETCONF RPC,該RPC可以透過NETCONF傳送到Catalyst 3850以儲存Catalyst 3850上的配置。

localhost:8088/static/Y	angExp x G how to che	ck "netconf notifica x								M
← → C (i) localhost:8088/sta	tic/YangExplorer.html									Ŕ
Yang Explorer 0.6.0 (Beta)							<b>ဂ</b>	Help	😁 Admin	🔁 Refresh 💦 🛔 guest
Explorer search	Values	Operation	Build	Collections	Manage Mode	s			Property	Value
Rcisco-bfd-state		A	Operations	Device Settin	ngs				Name	save-config
🖻 🕏 cisco-bgp-state				_					Node Type	rpc
🕈 🕏 cisco-bridge-domain			Profile		•	Create device profile			Data Type	
Cisco-cfm-stats			Platform	other	-				but type	
Rcisco-checkpoint-archive									Access	write
• 🥵 cisco-efp-stats		=	Host	172.16.1	167.178	Port 830			Presence	
Cisco-environment			lleernam	cisco1		Password cisco1			Key	
R cisco-flow monitor			Caernan	- ciscor	]	ciscor			Mandatory	
Rcisco-ia									Default	
Perc-from			<ol> <li>NetC</li> </ol>	onf 🔿 Res	tConf	( 📻	tPC Script (	Capabilities	Dendort	
▶ 🚰 save-config	<rpc></rpc>		Encoding	Console					Path	cisco-ia/save-config
► Checkpoint			circosing	control d- #10	1. mlne-fu		unch confight could fill		Description	Copy the running-config
► 🏧 revert			<rpc mess<br=""><save-c< td=""><td>onfig xmln</td><td>s="http://c</td><td>isco.com/yang/cisco-i</td><td>a"/&gt;</td><td>&gt;</td><td></td><td>to</td></save-c<></rpc>	onfig xmln	s="http://c	isco.com/yang/cisco-i	a"/>	>		to
▶ 🚰 rollback										startup-config on the
► 🚰 reset										Network
🕯 🕏 cisco-ip-sla-stats										running-config to
Rcisco-Ildp-state										startup-config on the
K cisco-memory-stats										Network
Rcisco-mpls-fwd										Element.None
Cisco-platform-software										
Rcisco-process-cpu		Ŧ								
Config Oper	+ Add - Del	ete C Reset	Custo	om RPC		Run Save	Clear	Сору	1	
Status : Recieved HTTP Result for request to	ype rpc									IETF

### Run被選中以透過NETCONF將自定義RPC消息傳送到Catalyst 3850。Catalyst 3850以成功訊息回 覆。

$\leftarrow \rightarrow \mathbb{C}$ (i) localhost:8088/stat	ic/YangExplorer.html				☆ :
Yang Explorer 0.6.0 (Beta)			O Help	🚰 Admin	🔁 Refresh 🛛 🚨 guest
Explorer search	Values	Operation	Build Collections Manage Models	Property	Value
▶ 🔒 cisco-bfd-state		-	Operations Device Settings	Name	save-config
Rcisco-bgp-state				Node Type	rpc
🕨 😤 cisco-bridge-domain			Profile Create device profile	Data Tupo	
Rcisco-cfm-stats			Platform other -	Data Type	
Rcisco-checkpoint-archive				Access	write
► 🕏 cisco-efp-stats			Host 172.16.167.178 Port 830	Presence	
Rcisco-environment			Il and Research	Key	
▲ cisco-flow-monitor			Username CISCOI	Mandatory	
🔻 🥵 cisco-ia				Default	
► 🏧 sync-from			NetConf RestConf RPC Script Capab	lities	
▶ 🚰 save-config	<rpc></rpc>		Feedlag County	Path	cisco-ia/save-config
🎙 🚰 checkpoint				Description	Copy the running-config
▶ 🚰 revert			<pre>crpc-reply message-id="urn:uuld:df9a8485-e635-406e-899f-052cl5615ad7" xmlns="urn:ietf:params:xml:ns:netconf:base:l.0"</pre>		to
▶ 🛅 rollback			<pre>xmlns:nc="wrn:ietf:params:xml:ns:netconf:base:1.0"&gt;     <result xmlns="http://cisco.com/yang/cisco-ia">Save running-config</result></pre>		startup-config on the
▶ 🚰 reset			successful 		Network
🕨 🕵 cisco-ip-sla-stats					Element.Copy the
▶ 🕏 cisco-lldp-state					startup-config on the
Rcisco-memory-stats					Network
▶ 🤻 cisco-mpls-fwd					Element.None
🕨 🕵 cisco-platform-software					
► 🔒 cisco-process-cpu					

Status : Recieved HTTP Result for request: run-rpc

# 值得關注的YANG資料模型

cisco-ia.yang資料模型

以下是cisco-ia.yang資料模型的一些RPC示例。值得注意的是,它們牽涉到如下作業:儲存Catalyst 3850組態、將Catalyst 3850執行組態同步到本機資料模型介面(DMI)資料儲存,以及重設Catalyst 3850上的DMI介面。

第一步是訂閱cisco-ia.yang資料模型,以便其顯示在YANG Explorer應用程式GUI左側的Explorer部 分中。

/ang Explorer 0.6.0 (Beta)			O Help	Admin C	Refresh A guest
stores (south	Values	Operation	Build Collections Manage Models	Property	Value
cisco-la			Workspace Device	Name	id
tert incortaces			Select All Showing 79 models	Node Type	leaf
erf-netconf-monitoring			cisco-art-oper vano	* Data Type	uint16
			□ ciaco-bfd-state.yang	Access	read-write
			Cisco-bgp-state.yang	E Prosence	
			🖸 cisco-bridge-common.yang	reserve	
			Cisco-bridge-domain.yang	_ Key	true
			Cisco-cfm-stats-dev.yang	Mandatory	true
			cisco-cfm-stats.yang	Default	
		1	Cisco-checkpoint-archive.yang	Path	ned/native/router/
		1	cisco-empistality and	1	ospt/id
			cisco-ethernet.yang	Description	
		/	cisco-flow-mogiteryagg	1.	
			2 cisco-laying (scherobed)		
			Cisco-ip-sla-stats-dav yang		
			Cisco-Ip-sla-stats.yang		
			Cisco-Ildp-state.yang		
			Cisco-memory-stats.yang		
			Cisco-mpls-fwd.yang	*	

在YANG Explorer應用GUI左側的Explorer部分中展開cisco-ia資料模型後,即可看到各種操作選項 。例如,要使用其中一個可用的cisco-ia.yang資料模型選項,將會選擇save-config操作,並且會在 您選擇RPC按鈕時生成關聯的RPC。

← → C (① localhost:8088/sta	tic/YangExplorer.html			\$
Yang Explorer 0.6.0 (Beta)		O Help	· Admin	😷 Refresh 🛛 💄 guest
Explorer search	Values Operatio	Build Collections Manage Models	Property	Value
Rcisco-bfd-state		Operations Device Settings	Name	save-config
▶ 🕏 cisco-bgp-state			Node Type	rpc
🗠 🥵 cisco-bridge-domain		Profile Create device profile	Data Turne	
Rcisco-cfm-stats		Platform other -	bata type	
R cisco-checkpoint-archive			Access	write
* 🥵 cisco-efp-stats		E Host 172.16.167.178 Port 830	Presence	
Rcisco-environment		Username cisco1 Password cisco1	Key	
Cisco-flow monitor			Mandatory	
Rcisco-ia			Default	
► monte-from		NetConf RestConf RPC Script Capabilities	Deale	day between the
▶ 🚰 save-config	<rpc></rpc>	I Encoding Console	Path	cisco-ia/save-config
► 🚛 checkpoint		<pre><ru></ru></pre>	Description	Copy the running-config
▶ 🚰 revert	(	<pre><save-config xmlns="http://cisco.com/yang/cisco-ia"></save-config> </pre>		to
rollback		1 April		Network
▶ 🚰 reset				Element.Copy the
* 🥵 cisco-ip-sla-stats				running-config to
Rcisco-Ildp-state				startup-config on the
R cisco-memory-stats				Network
R cisco-mpls-fwd				Element.None
Rcisco-platform-software				
Rcisco-process-cpu				
Config Oper	+ Add - Delete C R	set Custom RPC Run Save Clear Copy		
Status : Recieved HTTP Result for request to	VDR FDC		1	IFTE Q

### 接下來,選擇運行以透過NETCONF將RPC消息傳送到Catalyst 3850。Catalyst 3850會回覆成功訊 息,讓使用者知道作業已成功。

Clasc-bid Cetating     Clasc-bidge-domain      Clasc-bidge-domain      Clasc-bidge-domain      Clasc-bidge-domain      Clasc-directpoint-archive      Clasc	Explorer search	Values	Operation		Build Collections Manage Models	Property	Value
Aciso-bg-state Image: Second Se	► 🕏 cisco-bfd-state		_		Operations Device Settings	Name	save-config
Relace-bridge-domain       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-christata       Image: Create dovice profile       Image: Create dovice profile         Relace-flow-monitor       Image: Create dovice profile       Image: Create dovice profile         Relace-flow-monitor       Image: Create dovice profile       Image: Create dovice profile         Relace-flow-monitor       Image: Create dovice profile       Image: Create dovice profile         Relace-flow-monitor       Image: Create dovice profile       Image: Create dovice profile         Relace-flow-monitor       Image: Create dovice profile       Image: Create dovice profile         Relace-profile       Image: Create dovice	Rcisco-bgp-state					Node Type	rpc
Relation-offmittatistic       Image: Second se	Rcisco-bridge-domain				Profile Create device profile	Data Turan	
R cisco-checkpoint-archive       Image: cisco figure and set of the cisco	eisco-cfm-stats				Platform other -	Data Type	
Image: State Stat	Rcisco-checkpoint-archive					Access	write
R cisco-environment       Username       Cisco1       Password       Cisco1       Madatory       Red         R cisco-flow-monitor       Image: Cisco1       Password       Cisco1       Cisco1       Madatory       Default	Rcisco-efp-stats			=	Host 172.16.167.178 Port 830	Presence	
Ricsco-flow-monitor       Image: Cisco-insection       Mandatory         Ricsco-ins       Image: Cisco-insection       Image: Cisco-insection         Figure state       Image: Cisco-insection       Image: Cisco-insection         Figure state       Image: Cisco-insection       Image: Cisco-insection         Ricsco-ip-sla-stats       Image: Cisco-insection       Image: Cisco-insection         Ricsco-plasform-software       Image: Cisco-insection       Image: Cisco-insection         Ricsco-process-cpu       Image: Cisco-insection       Image: Cisco-insection	k cisco-environment				Hanna cisco1 Password cisco1	Key	
Ricisco-ia       Image: Construction of the second of the se	k cisco-flow-monitor				Username CISCOI	Mandatory	
> async-from <td>名 cisco-ia</td> <td></td> <td></td> <td></td> <td></td> <td>Default</td> <td></td>	名 cisco-ia					Default	
* 2: save-config         Path       cisco-is/save-config         * 2: checkpoint	► 🏧 sync-from				NetConf RestConf RPC Script Capabilities	Default	
> Include	🕨 🚰 save-config	<rpc></rpc>		Цŀ	Encorting Console	Path	cisco-ia/save-config
* Trevert       c	► 🚰 checkpoint					Description	Copy the running-conf
* Toront       ************************************	▶ 🏧 revert				<rp><rp>-reply message-id="urn:uuid:df9a8485-e655-406e-899f-052c15615ad/" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"</rp></rp>		to
* Treset     successful     Network       * Acisco-ip-sla-stats         * Acisco-lldp-state         * Acisco-menory-stats         * Acisco-pla-form-software         * Acisco-process-cpu	▶ 🚰 rollback			$\mathcal{A}$	<pre>xmlns:nc="rn:ietf:params:xml:ns:netconf:base:1.0"&gt;</pre>		startup-config on the
Reisco-ip-sla-stats     Element.Copy the       Reisco-lidp-state     running-config to       Reisco-menory-stats     Network       Reisco-platform-software     Element.None       Reisco-process-cpu     Element.None	► 🛅 reset			Ų.	successful 		Network
Reisco-Ildp-state     Image: Constraint of the status constraint of th	Rcisco-ip-sla-stats						Liement.Copy the
Reisco-memory-stats     Network       Reisco-mpis-fwd     Element.None       Reisco-platform-software     Image: Compile of the software       Reisco-process-cpu     Image: Compile of the software	Rcisco-Ildp-state						startup-config on the
& cisco-mpis-fwd     Element.None       & cisco-platform-software        & cisco-process-cpu	Rcisco-memory-stats						Network
Rcisco-platform-software	Rcisco-mpls-fwd						Element.None
R cisco-process-cpu	Rcisco-platform-software						
	Rcisco-process-cpu						

#### 所有各種cisco-ia.yang資料模型操作都如下所述:

sync-from -此RPC使Catalyst 3850上的NETCONF介面將裝置運行配置的NETCONF資料儲存表示 與裝置上的運行配置同步。兩者都存在於Catalyst 3850本身上。

此RPC的預設行為是執行不帶預設設定的同步,這將導致傳送到裝置的show running-config命令的 輸出與NETCONF資料儲存同步。如果存在sync-defaults ,則NETCONF介面還會讀取功能代碼提 供的預設配置資訊。在大多數情況下,不使用此選項。通常,只有在NETCONF介面使用者希望使 用NETCONF replace命令替換裝置配置的全部部分時,才使用該命令。

save-config -此RPC執行寫入記憶體(copy running-config startup-config)命令,以將當前裝置運行配 置儲存到裝置啟動配置。

```
<?xml version="1.0" encoding="utf-8"?>
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="">
<cisco-ia:save-config xmlns:cisco-ia
</rpc>
```

檢查點-此RPC使NETCONF介面使用Cisco IOSd內建配置存檔功能將運行配置儲存到非易失性儲存。

```
<?xml version="1.0" encoding="utf-8"?>
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="">
<cisco-ia:checkpoint xmlns:cisco-ia
</rpc>
```

回滾-此RPC導致NETCONF介面將裝置的運行配置回滾到與檢查點RPC一起儲存的運行配置或裝置 上儲存的任何其他有效運行配置。

target-urlstring (name of the saved checkpoint file)verbose?Boolean (show detail during rollback process)nolock?Boolean (lock configuration)revert-on-error?Empty (if error occurs during rollback, leave running unchanged)revert-timer?int16 (time in seconds before revets to the original configuration)

```
<?xml version="1.0" encoding="utf-8"?>
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="">
  <cisco-ia:rollback xmlns:cisco-ia=
     <cisco-ia:target-url>saved-config</cisco-ia:target-url>
     <cisco-ia:verbose>true</cisco-ia:verbose>
    <cisco-ia:nolock>true</cisco-ia:nolock>
     <cisco-ia:revert-on-error></cisco-ia:revert-on-error>
     <cisco-ia:revert-timer>10</cisco-ia:revert-timer>
   </cisco-ia:rollback>
</rpc>
```

```
還原-此RPC會使NETCONF介面從倒回RPC變更還原計時器。這將取消定時回滾並立即觸發回滾
,或者重置定時回滾的引數。
```

now? empty timer? int16 idle? int16

```
<?xml version="1.0" encoding="utf-8"?>
 <rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="">
   <cisco-ia:revert xmlns:cisco-ia
     <cisco-ia:now/>
     <cisco-ia:timer>10</cisco-ia:timer>
     <cisco-ia:idle>60</cisco-ia:idle>
   </cisco-ia:revert>
 </rpc>
```

重置-可以使用此RPC重新啟動NETCONF介面。如果reinitialize為true ,則NETCONF介面將清除可 寫運行的資料儲存中存在的所有狀態資訊。如果為false(預設值),則會保留NETCONF配置 datastore狀態資訊。

```
<?xml version="1.0" encoding="utf-8"?>
<rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="">
  <cisco-ia:reset xmlns:cisco-ia
     <cisco-ia:reinitialize>true</cisco-ia:reinitialize>
   </cisco-ia:reset>
</rpc>
```

💊 注意:某些Cisco平台或Cisco IOS軟體版本目前無法支援所有給定功能。例如,將上一次重置 傳送到運行IOS 16.3.3的Catalyst 3850時, Catalyst 3850會將「不支援重置」錯誤作為 RPC應答返回給集中管理平台(筆記型電腦)。

```
<nc:rpc-error xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
    <nc:error-type>application</nc:error-type>
    <nc:error-tag>operation-failed</nc:error-tag>
    <nc:error-severity>error</nc:error-severity>
    <nc:error-path xmlns:cisco-ia
    <nc:error-message lang="en" xmlns="https://www.w3.org/XML/1998/namespace">Reset not supported</nc:er
    <nc:error-info>
        <nc:error-info>
        <nc:bad-element>reset</nc:bad-element>
        </nc:error-info>
        </nc>
```

ned.yang資料模型

就思科裝置(Catalyst 3850)配置而言,網元驅動程式(NED)資料模型(如ned.yang)提供的最大功率。以下是一些演示此過程的螢幕截圖。

第一步是訂閱ned.yang資料模型,以便其顯示在YANG Explorer應用程式GUI左側的「瀏覽器」部 分中。

Explorer         Values         Operation         Build         Collections         Manage Models           * & deti-interfaces         Build         Collections         Manage Models         Workspace         Device           * & deti-interfaces         Select All         Showing 79 models         There		
Red     molicetconf-monitoring     moli-ldp.yang     med-asr1k.yang     med-asr1k.ya	Property Name Node Type Data Type Access Presence Key Mandatory Default Path Description	Value ospf list read-write ned/native/rout Open Shortest I Finst (OSPF)Op Shortest Path Fi (OSPF)None

在YANG Explorer應用程式左側Explorer區段中捲動可用選項時,GUI會在ned.yang資料模型中顯示 一個長長的可設定Catalyst 3850功能清單。

Yang Explorer 0.6.0 (Beta)			O Help	Admin 🕄	Refresh 🔒 guest
Explorer Jacob	Values	Queration	Build Collections Manage Models	Property	Value
Rcisco-la		A	Operations Device Settings	Name	native
Rietf-interfaces				Node Type	container
Ried ontconf-monitoring			Profile Create device profile	Data Tuna	
Rned			Nation other -	Dem type	
*Enative				Access	read-write
Gevice-model-version			Heet 172.16.167.174 Port 830	Presence	
/ version			Iterest Parment circot	Key	
boot-start-marker				Mandatory	
▶ 🔁 boot				Deducts	
Boot-end-marker		•	The series Control Resolutions	Detent.	
▶ Call-home			Encoding Console	Path	ned/native
* arvice-list				Description	
* Commony					
▶ Cocation					
▶ 🔁 hw-module					
* 🕾 cisp				-	
• E module					
* Comain					
▶ 😂 parser					
* Eservice		*			

例如,這些螢幕截圖演示了在首先向下滾動YANG Explorer應用程式GUI左側Explorer部分中可用 ned.yang資料模型配置選項清單後,如何顯示Catalyst 3850的OSPF路由配置。ospf子選項位於 router選項內部。當您選擇RPC按鈕時,將生成關聯的get-config RPC。

/ang Explorer 0.6.0 (Beta)			Онир	Admin 🕃	Refresh guest
plorer	Values	One cation	Build Collections Manage Models	Property	Value
► 🔐 esmc			Operations Device Settings	Name	ospf
* 🔁 setup				Node Type	8 st
* Ctod-clock			Profile Create device profile	Data Type	
* Pretwork-clock			Platform other 💌	Arres	read-write
▶ È i2vpn			470 44 447 474 Brd ( 000	Piccess	The state of the
Config-I2vpn			Host 172.10.167.174	Presence	
* 🖻 l3vpn			Username cisco1 Password cisco1	Key	
mpla				Mendatory	
* C router			NetConf () RestConf     RestConf     RestConf     RestConf	Default	
bgp			Encoding Conscie	Path	ned/native/router/os
	(get configs)		<pre>crpc message-id="101" xmlns="urniletf:parama:xmlins:netconf:base:1.0"&gt;</pre>	Description	Open Shortest Path First (OSPF)Open Shortest Path First (OSPF)None
► Dibfd			Crack		

接下來,選擇運行以透過NETCONF將RPC消息傳送到Catalyst 3850。Catalyst 3850以其OSPF路 由配置作出回覆。

Yang Explorer 0.6.0 (Beta)			O Help	Admin 🕃	Refresh 👗 guest
Explorer Search	Values	Queration	Build Collections Manage Models	Property	Value
► esmc		4	Operations Device Settings	Name	ospf
* 🗗 setup				Norie Tune	Est
► Tod-clock			Profile Create device profile	inde type	
► Contwork-clock			Nation other	Data Type	
► Di2vpn				Access	read-write
► Config-I2vpn			Heat 172.16.167.174 Port 830	Presence	
+ ₽ I3vpn				Key	
► 🗗 mpls			Username CISCO1 Password CISCO1	Mandatory	
* 🗗 router				in the second	
▶ 🔐 bgp			NetConf () RestConf     RPC Script Capabilities	Default	
► aspfv3		-	Encoding Console	Path	ned/native/router/or
* capí	<get-config></get-config>		<pre>Erpc-reply message-id="urn:uuid:0e2c04cf-9119-4e6a-8c05-238ee7f25208"</pre>	Description	Open Shortest Path
Pid			<pre>kmins="urn:letf:parama:xml:ns:netconf:base:1.0" kmins:nc="urn:letf:parama:xml:ns:netconf:base:1.0"&gt;</pre>		First (OSPF)Open
Pvrl			<pre><data>     <native mlns="http://cisco.com/ns/yang/med/ics">     </native></data></pre>		Shortest Path First
* address-family			<pre><router> <roopf></roopf></router></pre>		(OSPF)None
* 🔤 area		-	<1d>100 1d		
* auto-cost			<pre></pre>		
* avent-log			<pre><mibneta></mibneta> </pre>		
▶ 🖻 bld			«/connected>		
* Dinterface-id		*			

以下是Catalyst 3850為響應get-config RPC操作而返回的OSPF路由配置的擴展。

```
<rpc-reply message-id="urn:uuid:0e2c04cf-9119-4e6a-8c05-238ee7f25208" xmlns="urn:ietf:params:xml:ns:net</pre>
  <data>
    <native xmlns>
      <router>
        <ospf>
          <id>100</id>
          <redistribute>
            <connected>
              <redist-options>
                <subnets/>
              </redist-options>
            </connected>
          </redistribute>
          <network>
            <ip>10.10.0.0</ip>
            <mask>0.0.255.255</mask>
            <area>0</area>
          </network>
          <network>
            <ip>10.20.0.0</ip>
            <mask>0.0.255.255</mask>
            <area>0</area>
          </network>
          <network>
            <ip>10.100.0.0</ip>
            <mask>0.0.255.255</mask>
            <area>0</area>
          </network>
        </ospf>
      </router>
    </native>
  </data>
```

透過NETCONF從Catalyst 3850檢索的YANG格式的OSPF路由配置是人類可讀的,它匹配透過 Catalyst 3850的CLI檢視Catalyst 3850配置時看到的內容。

#### <#root>

3850-1#

show running-config | section ospf

router ospf 100 redistribute connected subnets network 10.10.0.0 0.0.255.255 area 0 network 10.20.0.0 0.0.255.255 area 0 network 10.100.0.0 0.0.255.255 area 0 3850-1#

如果需要,ned.yang資料模型也可用於修改OSPF路由配置。在本示例中,新網路引數將增加到 Catalyst 3850上的現有OSPF路由配置中,方法是:首先在左側的Yang Explorer應用程式GUI的 Explorer部分輸入所需的引數(也輸入了OSPF路由器ID 100,但由於瀏覽器螢幕滾動而無法看到 ),然後生成相關的YANG格式的RPC並點選RPC按鈕。

fang Explorer 0.6.0 (Beta)					O Help	👹 Admin	🕃 Refresh 🛛 🛔 gues
ploner (search	Values	Oneration		ulid	Collections Manage Models	Property	Value
domain-tag		ter ter and the set	* Op	rational	Device Settings	Name	ы
* E fast-reroute						Node Type	e loaf
* graceful-restart			11.2	rofile	Create device profile	Data Tana	
* Elignore			Ш.,	latform	other 👻	Deta Type	uncio
₩ isp!						Access	read-write
* 🖻 ämit			11	ost	172.16.167.174 Pert 830	Presence	
* Dical-rib-criteria			1		Colours Binness Colours	Key	true
* 🚰 microloop			11.1	sernam	Chc01 Chc01	Mandatory	true
► 🖻 mpis						Data de	
* Delightbor	-		0	NetCo	RestCore RPC Script Capat	Liberarus .	
T network			1 Inc	sding	Console	I Path	ned/native/router/
Plp	30.30.30.0		<2p	ness.	ge-id="101" wmlns="urnitetfiparams:xmlins:netconfibaseil.0"		ospeva
Prask	0.0.255.255			<tarp< td=""><td>t&gt;</td><td>Description</td><td>NC:</td></tarp<>	t>	Description	NC:
Parea	0			<td>65&gt;</td> <td></td> <td></td>	65>		
* lit rol				<conf: <nat< td=""><td>g&gt; ive xmlna="http://cleco.com/na/yacg/med/loa*&gt;</td><td></td><td></td></nat<></conf: 	g> ive xmlna="http://cleco.com/na/yacg/med/loa*>		
▶ Prefix-priority		~		: 4	outer> <opr></opr>		
P prefix-suppression			+		<ld><ld><ld><ld><ld><ld><ld><ld><ld><ld></ld></ld></ld></ld></ld></ld></ld></ld></ld></ld>		
P priority					<ip>30.30.30.0</ip> <mask>0.0.255.255</mask>		
* Process-min-time					<area/> G 		
# shutdown			*				

接下來,選擇運行以透過NETCONF將RPC消息傳送到Catalyst 3850。Catalyst 3850會以ok訊息回 覆,讓使用者知道作業已成功。

Yang Explorer 0.6.0 (Beta)			O Help	Admin 🖸	Refresh 🛔 guest
xplorer (search	Values	Oneration	Build Collections Manage Models	Property	Value
domain-tag	_	4	Operations Device Settings	Name	ы
► Tast-reroute				Node Type	laaf
* Craceful-restart			Profile Create device profile		
* 🗈 ignore			Parton other	Data Type	uint10
# ispl				Access	read-write
* Et limit			Heat 172.16.167.174 Port 830	Presence	
P Docal-rib-criteria				Key	true
* 🚰 microloop			Username CISCO1 Pessword CISCO1	Mandaton	171.00
* 🖻 mpis				mandadory	0.00
▶ 🔤 neighbor			NetConf RestConf Rpc Script Capabilities	Default	
* = network			Encoding Cansole	Path	ned/native/router/
Plp	30.30.30.0		<rp><rpc-reply <="" message-id="urn:uuid:cb43b46e-2e77-4808-8fd5-4d58128d3485" p=""></rpc-reply></rp>	1	ospf/id
₽ mask	0.0.255.255		<pre>knina="urn:ietf:parama:xml:na:netconf:base:1.0" kmina:nc="urn:ietf:parama:xml:na:netconf:base:1.0"&gt;</pre>	Description	
P area	0		<pre><qx></qx></pre>		
* at rat					
► C prefix-priority					
P prefix-suppression					
P priority					
• C process-min-time					
# shutdown					

透過ned.yang資料模型修改OSPF路由配置的此NETCONF/YANG RPC操作反映在Catalyst 3850配置中,透過Catalyst 3850的CLI可以看到該配置。Catalyst 3850上也有一條系統日誌訊息,指出已透過NETCONF進行組態變更。

3850-1#

\*Jan 30 14:13:41.659: %DMI-5-CONFIG\_I:Switch 1 R0/0: nesd: Configured from NETCONF/RESTCONF by cisco1,

3850-1# show running-config | section ospf
router ospf 100
redistribute connected subnets
network 10.10.0.0 0.0.255.255 area 0
network 10.20.0.0 0.0.255.255 area 0
network 10.30.0.0 0.0.255.255 area 0 -----> new line added to OSPF configuration
network 10.100.0.0 0.0.255.255 area 0
3850-1#

有關如何透過NETCONF/YANG將running-config儲存到Catalyst 3850上的啟動配置的詳細資訊,請 參閱上一節cisco-ia.yang資料模型中提到的儲存配置操作。

# Python指令碼

從Yang Explorer應用程式GUI生成Python指令碼

Yang Explore應用程式GUI也可用於為指定的NETCONF/YANG作業產生Python指令碼。Python指 令碼編寫的一個主要好處是它允許協調和自動化NETCONF/YANG操作。 在此範例中,在集中管理平台(膝上型電腦)上Yang Explorer應用程式GUI左側的Explorer視窗中 選取儲存組態作業。接下來,選擇Script按鈕以生成Python指令碼。然後,可以選擇複製按鈕複製 指令碼,以便將其貼上到可儲存在中央管理平台(筆記型電腦)上、副檔名為Python .py的檔案中 。在本示例中,(未顯示)此檔名為example.py。

✤ 注意:在下一個示例中,在GUI中使用Platform type other時,運行Python指令碼時出錯。因此,「平台型別已變更為csr,因為Cisco CSR路由器也像Catalyst 3850一樣執行Cisco IOS XE軟體。這樣避免了錯誤。

Values       Operation       Ruidi       Collection       Manage Models       Property       Value         Resonance       Ruidi       Collection       Resonance       Ruidi       <	← = C ① localhost:8088/i	tatic/YangExplorer.html				☆ [1]
Explorer       Values       Operations       Build       Collection       Manage Models       Property       Value         Rescording       Operations       Device Settings       Operations       Device Settings       Name       save-config         * Structure       * Structure       * Device Settings       Create device profile       Name       save-config         * Structure       * Structure       * Device Settings       Create device profile       Name       save-config         * Structure       * Structure       * Structure       * Structure       * Structure       Create device profile       Name       save-config         * Structure       * Structure       * Structure       * Structure       * Structure       Create device profile       Name       Save-config         * Structure       * Structure<	Yang Explorer 0.6.0 (Beta)			🖸 🖸 Help 🛛 👹 Ad	min 😥 Refre	ish 👗 guest
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• Mined       Encoding       Console       Path       Coscolar/ave- config         ***       Setcooff       python example by yang-explorer (https://github.com/ CiscolevMet/yang-explorer)       *       *       Description       Copy the running-config         ***       Testalling python dependencies: > pip installinki ecclient       *       *       *       Description       Copy the running-config         ***       * <td>• Ried-routing</td> <td></td> <td></td> <td>RPC Script Cloublities</td> <td>- Charlen</td> <td>/ HEALTHEALTHEALTHEALTHEALTHEALTHEALTHEALT</td>	• Ried-routing			RPC Script Cloublities	- Charlen	/ HEALTHEALTHEALTHEALTHEALTHEALTHEALTHEALT
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from modilent.operations import RPCError starup-config on the Netwo				Seconf python example by yang-explorer (https://github.com/ CiscoDevMet/yang-explorer) Installing python dependencies: > pip install ixml noclient Nunning script: (save as example.py) > python example.py -a 172.16.167.174 -u ciscol -p ciscolport 33 import ixml.stree as ET from argparse import ArgumentParser from noclient.sport AngumentParser from noclient.sport AngumentParser from noclient.sport AngumentParser from noclient.sport AngumentParser from noclient.sport AngumentParser	Description	Copy the running-config to startup-config on the Network Element.Copy the running- config to startup-config on the Network

下面是對Python指令碼的擴展,該指令碼在集中管理平台(筆記型電腦)上生成,然後複製並貼上 到名為example.py的檔案中。

✤ 注意:由Yang Explorer應用程式GUI生成的example.py檔案開頭的註釋包括運行Python指令 碼所需的步驟。負載包括指令碼可以執行的NETCONF/YANG操作。在此範例中,這是儲存組 態作業。

....

from argparse import ArgumentParser 🗆

```
Netconf python example by yang-explorer (https://github.com/CiscoDevNet/yang-explorer)
Installing python dependencies: 
> pip install lxml ncclient
Running script: (save as example.py) 
> python example.py -a 172.16.167.174 -u ciscol -p ciscol --port 830 □
"""
import lxml.etree as ET □
```

from ncclient import manager □from ncclient.operations import RPCError payload = """ □<save-config xmlns</pre> **""** if \_\_name\_\_ == '\_\_main\_\_': parser = ArgumentParser(description='Usage:') # script arguments □ parser.add\_argument('-a', '--host', type=str, required=True, □ help="Device IP address or Hostname") parser.add\_argument('-u', '--username', type=str, required=True, □ help="Device Username (netconf agent username)") □ parser.add\_argument('-p', '--password', type=str, required=True, □ help="Device Password (netconf agent password)") 🗆 parser.add\_argument('--port', type=int, default=830, help="Netconf agent port") □ args = parser.parse\_args() # connect to netconf agent  $\Box$ with manager.connect(host=args.host, port=args.port, □ username=args.username, □ password=args.password, □ timeout=90, □ hostkey\_verify=False, □ device\_params={'name': 'csr'}) as m: # execute netconf operation □try: □ response = m.dispatch(ET.fromstring(payload)).xml data = ET.fromstring(response) except RPCError as e: □ data = e.\_raw # beautify output □print(ET.tostring(data, pretty\_print=True))

### 從集中管理平台(筆記型電腦)運行Python指令碼

以下是運行Python指令碼example.py之前的Catalyst 3850 CLI檢查,該指令碼可將運行配置儲存到 啟動配置。此時,shutdown命令位於running-config,但不位於GigabitEthernet1/0/10介面的啟動配 置中。

3850-1# show running-config interface gigabitEthernet 1/0/10
Building configuration...
Current configuration : 49 bytes
!
interface GigabitEthernet1/0/10
shutdown
end
3850-1# show startup-config | begin 1/0/10
interface GigabitEthernet1/0/10
!
interface GigabitEthernet1/0/11

```
!
interface GigabitEthernet1/0/12
!
interface GigabitEthernet1/0/13
!
```

在集中管理平台(筆記型電腦)上的常規終端提示符處,由Yang Explorer應用程式GUI生成的 Python檔案example.py首先被複製到筆記型電腦上的yang-explore目錄。

USER1-M-902T:~ USER1\$ pwd /Users/USER1 USER1-M-902T:~ USER1\$ cp /Users/USER1/Desktop/example.py /Users/USER1/yang-explorer USER1-M-902T:~ USER1\$ cd yang-explorer USER1-M-902T:yang-explorer USER1\$ ls -1 total 112 -rw-r--r-- 1 USER1 staff 11358 Jan 4 17:59 LICENSE -rw-r--r-- 1 USER1 staff 13635 Jan 4 17:59 README.md drwxr-xr-x 12 USER1 staff 408 Jan 4 17:59 YangExplorer drwxr-xr-x 7 USER1 staff 238 Jan 4 17:59 default-models drwxr-xr-x 3 USER1 staff 102 Jan 4 17:59 docs -rw-r--r-- 1 USER1 staff 72 Jan 4 17:59 env.sh -rw-r--r-@ 1 USER1 staff 1990 Jan 30 17:50 example.py -rw-r--r- 1 USER1 staff 207 Jan 4 17:59 requirements.txt drwxr-xr-x 11 USER1 staff 374 Jan 5 14:37 server -rwxr-xr-x 1 USER1 staff 4038 Jan 4 17:59 setup.sh -rwxr-xr-x 1 USER1 staff 640 Jan 4 17:59 start.sh drwxr-xr-x 5 USER1 staff 170 Jan 4 18:00 v USER1-M-902T:yang-explorer USER1\$

接下來,從集中管理平台(laptop)上的常規終端提示中,執行這兩個命令,這兩個命令在yang Explorer應用程式GUI生成的example.py檔案開頭的comment部分中提供(請參閱上一節「從Yang Explorer應用程式GUI生成Python指令碼」)。

USER1-M-902T:yang-explorer USER1\$ pip install lxml ncclient Collecting lxml Downloading lxml-3.7.2.tar.gz (3.8MB) 3.8MB 328kB/s 100% | Collecting ncclient Downloading ncclient-0.5.3.tar.gz (63kB) 100% | 71kB 3.5MB/s Requirement already satisfied: setuptools>0.6 in /Library/Frameworks/Python.framework/Versions/2.7/lib Collecting paramiko>=1.15.0 (from ncclient) Downloading paramiko-2.1.1-py2.py3-none-any.whl (172kB) 100% | | 174kB 3.1MB/s Collecting six (from ncclient) Using cached six-1.10.0-py2.py3-none-any.whl Collecting cryptography>=1.1 (from paramiko>=1.15.0->ncclient) Using cached cryptography-1.7.2-cp27-cp27m-macosx\_10\_6\_intel.whl Collecting pyasn1>=0.1.7 (from paramiko>=1.15.0->ncclient) Using cached pyasn1-0.1.9-py2.py3-none-any.whl Collecting cffi>=1.4.1 (from cryptography>=1.1->paramiko>=1.15.0->ncclient)

Using cached cffi-1.9.1-cp27-cp27m-macosx\_10\_10\_intel.whl Collecting enum34 (from cryptography>=1.1->paramiko>=1.15.0->ncclient) Using cached enum34-1.1.6-py2-none-any.whl Collecting ipaddress (from cryptography>=1.1->paramiko>=1.15.0->ncclient) Using cached ipaddress-1.0.18-py2-none-any.whl Collecting idna>=2.0 (from cryptography>=1.1->paramiko>=1.15.0->ncclient) Using cached idna-2.2-py2.py3-none-any.wh1 Collecting pycparser (from cffi>=1.4.1->cryptography>=1.1->paramiko>=1.15.0->ncclient) Downloading pycparser-2.17.tar.gz (231kB) 100% | 235kB 2.6MB/s Installing collected packages: lxml, six, pycparser, cffi, pyasn1, enum34, ipaddress, idna, cryptograp Running setup.py install for lxml ... done Running setup.py install for pycparser ... done Running setup.py install for ncclient ... done Successfully installed cffi-1.9.1 cryptography-1.7.2 enum34-1.1.6 idna-2.2 ipaddress-1.0.18 lxml-3.7.2 USER1-M-902T:yang-explorer USER1\$

第2個命令透過TCP埠830 (netconf-ssh)對位於IP地址172.16.167.174且使用者名稱/口令 cisco1/cisco1的Catalyst 3850運行Python指令碼example.py。Catalyst 3850將RPC回覆傳送回儲存 配置操作成功的集中管理平台(筆記型電腦)。

```
USER1-M-902T:yang-explorer USER1$ python example.py -a 172.16.167.174 -u cisco1 -p cisco1 --port 830
```

```
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" xmlns:nc="urn:ietf:params:xml:ns:netconf:bas
</result>
</rpc-reply>
```

```
USER1-M-902T:yang-explorer USER1
```

以下是運行Python指令碼example.py後Catalyst 3850 CLI檢查,該指令碼將運行配置儲存到啟動配 置。由於save-config NETCONF/YANG操作成功,介面GigabitEthernet1/0/10的running-config和 startup-config中現在都存在shutdown命令。

```
3850-1# show running-config interface gigabitEthernet 1/0/10
Building configuration...
Current configuration : 49 bytes
!
interface GigabitEthernet1/0/10
shutdown
end
3850-1# show startup-config | begin 1/0/10
interface GigabitEthernet1/0/10
shutdown
!
interface GigabitEthernet1/0/11
!
interface GigabitEthernet1/0/12
!
interface GigabitEthernet1/0/13
```

### 疑難排解

!

本節提供的資訊可用於對組態進行疑難排解。

NETCONF錯誤消息

NETCONF通訊協定定義了一組作業和訊息,可在NETCONF使用者端(集中管理平台(膝上型電腦))和伺服器裝置上的NETCONF實作(Catalyst 3850)之間交換。常用的NETCONF操作包括:

<get>、<get-config>、<edit-config>和<rpc>

NETCONF消息內容的格式和其他約束由YANG資料模型定義。NETCONF客戶端和伺服器透過傳送 RPC進行互動。

如果NETCONF消息的格式存在錯誤,或者消息的內容與裝置實施的YANG資料模型中的定義不匹 配,則裝置上的NETCONF伺服器可能會返回RPC錯誤。

<error-type>application</error-type>

這些RPC錯誤不表示NETCONF介面不工作,這些錯誤表明客戶端正在嘗試執行伺服器裝置上實施 的YANG資料模型不支援的操作。使用者必須檢視在伺服器裝置上實施的YANG資料模型,以確定 並解決這些錯誤的原因。

RPC錯誤示例

在此範例中,使用了不正確的介面型別ianift:fastEtherFX來產生YANG格式化的<edit-config> NETCONF RPC訊息,以透過NETCONF傳送至Catalyst 3850。

← ○ C O localhost:8088/static/Yang	Explorer.html				<b>†</b>
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Rcisco-table-map				Access	read-write
Rcisco-virtual-service			Hest 172.16.167.178 Port 830	Presence	
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Rietf-diffserv-classifier		-		Mandatory	
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📕 туре	(ianailt:fastEtherFX)		 <ponfig></ponfig>		state of the
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Rief-key-chain					the IF-MIB use the
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Rietf-routing					leaf in the 'running'
	and the second second second second	-		41	datastore to set

### 選擇Run以將RPC消息傳送到Catalyst 3850後, Catalyst 3850將以錯誤消息進行回覆。

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Prano	GigabitEthernet1/0/16		toretror	-type application	iletfiparans: n4/nc:error=t	<pre>wmlinsinetconfibasei1.0*&gt; ype&gt;</pre>			enabled
description		1	Knoterror	r-tag>operation-f	ailed/nc:error-aev	or-tag> writy>	- 11	Description	This leaf contains the
🖉 type	ianalfcfastEtherFX		interfaces"	-path walns:if-" >/pec/edit-confi	urniietfipara g/conflg/ifii	naixmlins/yangiletf- nterfaces/lfilnterface	- 11		configured, desired
# enabled	false		fitrease o	luabitEthernet1/	0/16*]/lfityp	e pi//www.wi.org/XML/1998/			interface
link-up-down-trap-enable			namespace*)	/interfaces/inte	rface[name='G	agabitEthernet1/0/16*]/ty	pei		anterna car.
* Tinterfaces-state			neierror-me	issage>					Systems that implement
Kietf-key-chain			<nc:bad< td=""><td>i-element&gt;type<td>crbad-element</td><td>s</td><td>- 11</td><td></td><td>the IF-MIB use the</td></td></nc:bad<>	i-element>type <td>crbad-element</td> <td>s</td> <td>- 11</td> <td></td> <td>the IF-MIB use the</td>	crbad-element	s	- 11		the IF-MIB use the
Rietf-netconf-manitoring			<td>&lt;01/1/1/2012</td> <td></td> <td></td> <td></td> <td></td> <td>value of this</td>	<01/1/1/2012					value of this
Rietf-routing									leaf in the 'running'
					1		1		datastore to set

以下是Catalyst 3850傳回的錯誤。請注意,它包含錯誤標籤「operation-failed」,並包含與錯誤相 關的更多詳細資訊,如「Unsupported - value must be ethernetCsmacd or softwareLoopback」 </nc : error-message>。

<#root>

```
<nc:rpc-error xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0">
   <nc:error-type>application</nc:error-type>
  <nc:error-tag>operation-failed</nc:error-tag>
   <nc:error-severity>error</nc:error-severity>
   <nc:error-path xmlns:if="urn:ietf:params:xml:ns:yang:ietf-interfaces">/rpc/edit-config/config/if:int
   <nc:error-message lang="en" xmlns="https://www.w3.org/XML/1998/namespace">/interfaces/interface[name
```

"Unsupported - value must be ethernetCsmacd or softwareLoopback"</nc:error-message>

```
<nc:error-info>
    <nc:bad-element>type</nc:bad-element>
  </nc:error-info>
</nc:rpc-error>
```

#### 接下來,讓我們修正錯誤並在傳送到Catalyst 3850的RPC訊息中指定正確的介面型別 ianift:ethernetCsmacd,以便Catalyst 3850以ok訊息而不是錯誤來回應。



這一次,一旦選擇Run將RPC消息傳送到Catalyst 3850,Catalyst 3850就會使用ok消息作為回覆 ,表示操作成功。

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Ried-diffserv-classifier			Username	CISCOI	Cisco1		Key	
Ried-diffserv-policy							Mandatory	true
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🖉 type	lanailt ethemetCamacd	(	<td>42</td> <td></td> <td></td> <td>Description</td> <td>The type of the</td>	42			Description	The type of the
enabled	false		$\sim$	/				incertace.
Fink-up-down-trap-enable								When an interface entry
* 🚔 interfaces-state								is created, a server
Ried-key-chain								MAY
Ried netconf-monitoring								initialize the type leaf
Ried-routing		-						with a valid value, e.g.,
Oconfig () Oper	+ And - Delaus	C Reset	Custon	n RPC Run	Save Clear	Copy		if it is possible to derive the

提示:如果不確定正確的Explorer Values格式為何,可在嘗試更改其引數之前檢視存在的配置。這可以透過get-config操作(Oper)完成,如下所示。

<ul> <li>C (i) localhost:8088/static/Yang</li> </ul>	Explorer.html				弁
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選擇Run以將RPC消息傳送到Catalyst 3850後,Catalyst 3850會使用YANG格式的介面配置進行回 覆,該配置顯示介面型別為ianift:ethernetCsmacd。

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其他RPC錯誤型別範例

1.「使用中」(配置鎖定) RPC錯誤回覆消息

這是對<edit-config>請求的NETCONF錯誤響應。<error-tag>表示「使用中」。回應指出執行資料 儲存庫的伺服器裝置(Catalyst 3850) NETCONF目前被鎖定,且此時無法執行NETCONF <editconfig>作業。這並不表示NETCONF介面實作中有錯誤。如果NETCONF客戶端在資料儲存正在使 用時嘗試向運行資料儲存的NETCONF寫入資料,則客戶端會收到此RPC響應。NETCONF客戶端 可以重試NETCONF編輯配置消息。當裝置執行從裝置同步內部操作以將NETCONF運行資料儲存 與裝置IOSd配置同步時,可以收到此響應。

從伺服器(Catalyst 3850)到客戶端(集中管理平台(筆記型電腦))的NETCONF響應。

在本示例中,為未配置的環回介面向Catalyst 3850傳送了<edit-config> RPC。由於您無法配置不存 在於Catalyst 3850上的介面,因此返回錯誤。

```
<?xml version="1.0" encoding="utf-8"?>
<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="3">
<rpc-error>
<rpc-error>
<rpc-error>
<error-type>application</error-type>
<error-tag>data-missing</error-tag>
<error-severity>error</error-severity>
<error-path xmlns:if="urn:ietf:params:xml:ns:yang:ietf-interfaces">/rpc/edit-config/config/if:inte
<error-message xml:lang="en">/interfaces/interface[name='Loopback1111']/type is not configured</er
</error-info>
</error-info>
</rpc-error>
</rpc-error>
</rpc-reply>
```

#### 3. 「缺少資料模型」RPC錯誤回覆消息

如果對不存在於Catalyst 3850上的資料模型發出請求,或者對未實現於資料模型中的枝葉發出請求 ,伺服器(Catalyst 3850)以空資料響應進行響應。這是預期行為。

提示:使用NETCONF功能確定Catalyst軟體支援哪些資料模型。請參閱設定集中管理平台 (膝上型電腦)的第2節。

```
<?xml version="1.0" encoding="utf-8"?>
<data xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"/>
```

#### 4. 「Invalid-value」 RPC 錯誤回覆消息

在某些情況下,根據YANG資料模型,NETCONF消息可能包含有效的內容,但是,裝置(Catalyst 3850)無法實現請求的內容。當Catalyst 3850上的NETCONF介面向IOSd傳送無法成功應用的配置時,特定RPC錯誤響應將返回到NETCONF客戶端。

在本示例中,在RPC消息中向Catalyst 3850傳送了無效的日誌記錄緩衝值False。來自Catalyst 3850的回覆中的錯誤標籤指示無效值。錯誤消息表明Catalyst 3850 IOS分析程式無法將日誌記錄緩 衝的嚴重性級別配置為假的,因為這不是一個有效值。

```
<?xml version="1.0" encoding="utf-8"?>
  <rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="6">
    <rpc-error>
        <error-type>application</error-type>
        <error-type>application</error-type>
        <error-tag>invalid-value</error-tag>
        <error-severity>error</error-severity>
        <error-message xml:lang="en">inconsistent value: Device refused command "logging buffered bogus" a
    </rpc-error>
```

</rpc-reply>

#### 關於此翻譯

思科已使用電腦和人工技術翻譯本文件,讓全世界的使用者能夠以自己的語言理解支援內容。請注 意,即使是最佳機器翻譯,也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準 確度概不負責,並建議一律查看原始英文文件(提供連結)。