



# Release Notes for Cisco Catalyst IR1101 Rugged Series Router – (Release 16.x)

The following release notes support the Cisco IR1101 router. These release notes are updated to describe new features, limitations, troubleshooting, recommended configurations, caveats, and provide information on how to obtain support and documentation.

## Overview

These combined release notes support the IR1101 router from Cisco IOS-XE Release 16.9.1, which was the initial software version for the IR1101, through the rest of the applicable releases for 16.x.x.

## Image Information and Supported Platforms

**Note:** You must have a Cisco.com account to download the software.

Cisco IOS-XE Release 16.9.1 includes the following Cisco images:

- ir1101-universalk9.16.09.01.SPA.bin

Cisco IOS-XE Release 16.10.1 and 16.11.1 includes the following Cisco images:

- ir1101-universalk9.16.10.01.SPA.bin
- ir1101-universalk9.16.11.01.SPA.bin

Cisco IOS-XE Release 16.12.1 includes the following Cisco images:

- ir1101-universalk9.16.12.01.SPA.bin
- ir1101-universal9\_npe.16.12.01.SPA.bin
- ir1101-ucmk9-XX for the SDWAN version of the OS.

Cisco IOS-XE Release 16.12.3 includes the following Cisco images:

- ir1101-universalk9.16.12.03.SPA.bin
- ir1101-universal9\_npe.16.12.03.SPA.bin
- ir1101-ucmk9-XX for the SDWAN version of the OS.

Cisco IOS-XE Release 16.12.4 includes the following Cisco images:

- ir1101-universalk9.16.12.04.SPA.bin
- ir1101-universal9\_npe.16.12.04.SPA.bin
- ir1101-ucmk9-XX for the SDWAN version of the OS.

## Known Limitations

Cisco IOS-XE Release 16.12.5 includes the following Cisco images:

- ir1101-universalk9.16.12.05.SPA.bin
- ir1101-universal9\_npe.16.12.05.SPA.bin
- ir1101-ucmk9-XX for the SDWAN version of the OS.

The latest software downloads for the IR1101 can be found at:

<https://software.cisco.com/download/navigator.html?mdfid=286287045&flowid=75322>

Click on the IR1101 link to take you to the specific software you are looking for.

## Known Limitations

Release 16.12.3 and 16.12.4 have the following limitations or deviations for expected behavior:

Downgrading from 16.12.x to 16.11.1

**Symptoms:** If an IR1101 with RJ45 Gig0/0/0 WAN is downgraded from 16.12.x to 16.11.1 or earlier, it will cause the Gig0/0/0 to fail to come up because its media-type is set to **media-type sfp**. The problem occurs because 16.12.x or later automatically selects the correct media-type of the Gig0/0/0 interface, while 16.11.1 and earlier does not have that capability.

**Workaround:** Specifically set the correct media-type for the Gig0/0/0 interface (e.g. media-type rj45) prior to any downgrade.

## Major Enhancements for Release 16.10.1

There are no major enhancements for this release.

## Major Enhancements for Release 16.11.1

The following features are included in the Cisco IOS-XE release 16.11.1:

## Support for the IR1100X-XP and IR1100X-P Expansion Modules

The IR1101 ISR has an expansion module that adds key capabilities such as an additional pluggable slot supporting LTE and mSATA SSD, SFP and Digital GPIO. These two expansion modules offer the following:

- 1 GE SFP
- 1 Pluggable slot
- 4 GPIO + 1 Return (Digital I/O)
- mSATA SSD slot

Cisco IOS-XE detects the existence of the expansion module at bootup and performs an anti-counterfeit check. If the check passes, the base IR1101 powers up the expansion module and adds the extra capabilities of the expansion module.

The IR1100X expansion modules will be available in the second half of Calendar year 2019. More information can be found in the product data sheet at:

<https://www.cisco.com/c/en/us/products/collateral/routers/1101-industrial-integrated-services-router/datasheet-c78-741709.html>

When the IR1100X expansion modules become available, installation and configuration details will be available here:

<https://www.cisco.com/c/en/us/support/routers/1101-industrial-integrated-services-router/model.html>

## Smart Licensing Support for Evaluation Expired Syslog after 365 Days

For the 16.11.1 release, evaluation expired syslog messages will be displayed after 365 days, and it is enabled by default. Customers will not see the evaluation period syslog messages for one year. There are no CLI or show command changes.

This feature changes only when the evaluation syslog messages are sent if the product instance is not registered, for example, the license usage is in Evaluation Mode. The actual 90-day evaluation period will not change. The only change is when these evaluation period syslog messages are sent, which is one year from the date the license has actually expired.

This one-year period will include the 90-day evaluation period, such that after the evaluation period expires, the smart agent will not send the evaluation mode syslog messages for another 275 calendar days.

The 90-day evaluation period will still trigger the following events:

- After 90 days of usage the evaluation period will expire.
- The **show usage** and **show status** CLI commands will show that the evaluation period has expired.

The following three evaluation period syslog messages are at issue. With the previous 90-day evaluation period, these are sent only if the product instance is not registered. However, with the evaluation expired syslog after 365-days in effect, none of these messages are logged in the syslog.

### %SMART\_LIC-3-EVAL\_EXPIRED

- Evaluation period just expired.
- Sent at the time the evaluation period expires

### %SMART\_LIC-4-EVAL\_WILL\_EXPIRE\_WARNING

- Evaluation period will expire soon.
- Currently sent prior to expiration on the following schedule.
  - 60 days before.
  - 30 days before.
  - Every week in the last month
  - Every day in the last week
  - Every hour on the last day.

### %SMART\_LIC-4-EVAL\_EXPIRED\_WARNING

- The evaluation period expired in the past.
- Sent once per week after the expiration. Includes the timestamp of the expiration.

## Licensing Event History Logging

In the 16.11.1 release, logging of the licensing event history has been enabled. This feature will always be on for continuous logging of events, and available across a reboot. These logs will be independent of btrace, and will contain:

- Boot log
- Registration & Renewal log
- Authorization log
- The regular log will contain all of the information.

This event history logging would be present across all the subsystems like smart agent, smart licensing infrastructure and platforms.

To display the licensing event history log, execute the **show license eventlog** CLI.

Sample output from the CLI:

```
Router# show license eventlog
**** Event Log ****

2019-01-15 19:06:59.454 UTC SAEVT_INIT_START version="4.6.3_rel/58"
2019-01-15 19:06:59.455 UTC SAEVT_INIT_CRYPT0 success="False" error="Crypto Initialization has not been
completed"
2019-01-15 19:06:59.455 UTC SAEVT_HA_EVENT eventType="SmartAgentEvtHarmfRegister"
2019-01-15 19:06:59.525 UTC SAEVT_EXPORT_FLAG exportAllowed="False"
2019-01-15 19:06:59.525 UTC SAEVT_STATE_EVAL_EXP expiredTime="2018-10-30 14:47:26.000 UTC"
2019-01-15 19:06:59.596 UTC SAEVT_LICENSE_USAGE count="1" type="total"
entitlementTag="regid.2018-04.com.cisco.IR1101_Network_Essentials,1.0_95814bcc-8788-4546-9dc1-524953f68
cbc"
2019-01-15 19:06:59.597 UTC SAEVT_STATE_EVAL_EXP expiredTime="2018-10-30 14:47:26.000 UTC"
2019-01-15 19:07:00.954 UTC SAEVT_READY
2019-01-15 19:07:00.955 UTC SAEVT_ENABLED
2019-01-15 19:07:00.955 UTC SAEVT_EXPORT_FLAG exportAllowed="False"
2019-01-15 19:07:03.920 UTC SAEVT_HA_EVENT eventType="SmartAgentEvtHarmfInitialize"
2019-01-15 19:07:03.925 UTC SAEVT_HA_CHASSIS_ROLE udi="PID:IR1101-K9,SN:FCW2213TH01"
2019-01-15 19:07:03.925 UTC SAEVT_HA_EVENT eventType="SmartAgentEvtHachkptRegister"
2019-01-15 19:07:04.267 UTC SAEVT_INIT_ROUTING_READY
2019-01-15 19:07:07.437 UTC SAEVT_HA_ROLE udi="PID:IR1101-K9,SN:FCW2213TH01" haRole="Active"
2019-01-15 19:07:07.439 UTC SAEVT_HA_ROLE udi="PID:IR1101-K9,SN:FCW2213TH01" haRole="Active"
2019-01-15 19:07:07.489 UTC SAEVT_HA_CHASSIS_ROLE udi="PID:IR1101-K9,SN:FCW2213TH01" haRole="Active"
2019-01-15 19:07:07.489 UTC SAEVT_HA_ROLE udi="PID:IR1101-K9,SN:FCW2213TH01" haRole="Active"
2019-01-15 19:07:07.654 UTC SAEVT_INIT_CONFIG_READ_BEGIN
2019-01-15 19:07:12.110 UTC SAEVT_HOSTNAME_CHANGE
2019-01-15 19:07:12.284 UTC SAEVT_INIT_CONFIG_READ_DONE
2019-01-15 19:07:12.614 UTC SAEVT_INIT_SYSTEM_INIT
2019-01-15 19:07:13.616 UTC SAEVT_INIT_CRYPT0 success="False" error="Crypto Initialization has not been
completed"
2019-01-15 19:07:43.615 UTC SAEVT_INIT_CRYPT0 success="True"
2019-01-15 19:07:43.615 UTC SAEVT_EXPORT_FLAG exportAllowed="False"
2019-01-15 19:07:43.615 UTC SAEVT_INIT_COMPLETE
```

## Support for sub-interface on GigabitEthernet0/0/0

The 16.11.1 release supports sub-interfaces and dot1q configuration on the g0/0/0 interface. For example:

```
Router(config)#interface g0/0/0.?
<1-4294967295> GigabitEthernet interface number

Router(config-subif)#encapsulation ?
```

## Major Enhancements for Release 16.11.1

dot1Q

IEEE 802.1Q Virtual LAN

## Serviceability Features

Cisco IOS-XE **show tech-support** functionality is extensively used by technical support for various platforms that run IOS-XE and comprises of a library of shell scripts that spawn various show commands to obtain the state of the device for debugging purposes. The tech-support output is very critical in debugging various problems in the system and has been a key component in debug infrastructure.

The **show tech-support** series of commands has been a part of the Cisco IOS and IOS-XE release since release 4.0(0)N1(1a). The IoT products follow the core IOS-XE software functionality.

The output from the **show tech-support** command is very long. To better manage this output, you can redirect the output to a file (for example, **show tech-support > filename**) in the local writable storage file system or the remote file system.

You can use one of the following redirection methods:

> *filename* – Redirects the output to a file.

>> *filename* – Redirects the output to a file in append mode.

### Examples

This example shows how to display technical support information:

```
device# show tech-support
```

This example shows how to redirect the technical support information to a file:

```
device# show tech-support > bootflash:TechSupport.txt
```

This example shows how to display the brief technical support information for the device:

```
device# show tech-support brief
```

This example shows how to display the technical support information for a specific feature:

```
device# show tech-support aaa
```

This example shows how to display the commands used to generate the technical support information:

```
device# show tech-support commands
```

For Cisco IOS-XE release 16.11.1, improvements were made to improve the monitoring capabilities of forwarding plane (QFP) using CLI and SNMP. **show platform resources** would display QFP details and an SNMP MIB walk would include all QFP objects including memory related MIB objects. **show inventory** and **show inventory oid** will display the related Forwarding processor and its OID information.

**show tech-support** is enhanced to include the following CLIs:

```
show platform hardware qfp active  infrastructure punt config cause
show platform hardware qfp active  infrastructure punt internal-interface
show platform hardware qfp active  interface if-name internal0/0/rp:0
show platform hardware qfp active  interface if-name internal0/0/recycle:0
show platform hardware qfp active  interface if-name internal0/0/crypto:0
show platform hardware qfp active  infrastructure uidb internal0/0/rp:0 input config
show platform hardware qfp active  infrastructure uidb internal0/0/recycle:0 input config
show platform hardware qfp active  infrastructure uidb internal0/0/crypto:0 input config
show platform hardware qfp active  infrastructure uidb internal0/0/rp:0 output config
show platform hardware qfp active  infrastructure uidb internal0/0/recycle:0 output config
```

## Major Enhancements for Release 16.12.1

```

show platform hardware qfp active infrastructure uidb internal0/0/crypto:0 output config
show platform hardware qfp active infrastructure punt statistics interface 1
show platform hardware qfp active infrastructure punt statistics interface 2
show platform hardware qfp active interface if-name internal0/0/rp:0 statistics
show platform hardware qfp active interface if-name internal0/0/recycle:0 statistics
show platform hardware qfp active interface if-name internal0/0/crypto:0 statistics
show platform hardware qfp active infrastructure punt statistics type per-cause
show platform hardware qfp active infrastructure punt statistics type global-drop
show platform hardware qfp active infrastructure punt statistics type punt-drop
show platform hardware qfp active infrastructure punt statistics type inject-drop
show platform hardware qfp active statistics drop
show platform hardware qfp active system state
show platform hardware qfp active system transactions
show platform hardware qfp active datapath infrastructure time basic
show platform hardware qfp active infrastructure exmem statistics
show platform hardware qfp active infrastructure exmem statistics user
show platform hardware qfp active infrastructure exmem resource
show platform hardware qfp active infrastructure exmem region
show platform hardware qfp active infrastructure exmem table
show platform hardware qfp active infrastructure bqs status
show platform hardware qfp active feature acl control
show platform hardware qfp active feature acl tree
show platform hardware qfp active feature tunnel state
show platform hardware qfp active feature erspan state
show platform hardware qfp active feature ess state
show platform hardware qfp active feature ipfrag global
show bootlog FP active
show bootlog RP active
show platform software diagnostic chassis-manager R0 cpld
show platform software diagnostic chassis-manager R0 status
show platform software ipc queue-based chassis-manager R0 connection
show platform software ipc stream-based ios RP active connection
show platform software ipc stream-based ios RP active manager
show platform software process environment ios rp active
show power
show license tech support
show license summary

```

New CLIs that have been added are:

```

show tech-support l2
show tech-support acl
show tech-support dhcp
show tech-support port-channel
show tech-support private-vlan
show tech-support vlan
show tech-support confidential

```

Detailed information on all of these commands can be found in the Catalyst 9500 Switches Command Reference:

[https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst9500/software/release/16-10/command\\_reference/b\\_1610\\_9500\\_cr/interface\\_and\\_hardware\\_commands.html#wp3848147936](https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst9500/software/release/16-10/command_reference/b_1610_9500_cr/interface_and_hardware_commands.html#wp3848147936)

## Major Enhancements for Release 16.12.1

The first supported IOS-XE release for the IR1101 was 16.10.1. This release, 16.12.1, is the first which supports the new Expansion Modules, as well as SDWAN capabilities. The minimum cEdge software version supporting SDWAN on the IR1101 is IOS-XE 16.12.1, the ir1101-ucmk9-XX image.

The Expansion Modules are the following SKUs:

- IRM-1100-SPMI

## Major Enhancements for Release 16.12.1

### ■ IRM-1100-SP

The IR1101 ISR also has an Expansion Module that adds key capabilities such as dual LTE Pluggables, mSATA SSD FRU, SFP, and Digital GPIO connections.

[Figure 2](#) shows the IR1101. [Figure 2](#) shows the IRM-1100-SPMI Expansion Module. [Figure 3](#) describes the details of the Expansion Module.

Note: Complete details on the IR1101 and both Expansion Modules can be found in the [IR1101 Industrial Integrated Services Router Hardware Installation Guide](#).

Major Enhancements for Release 16.12.1

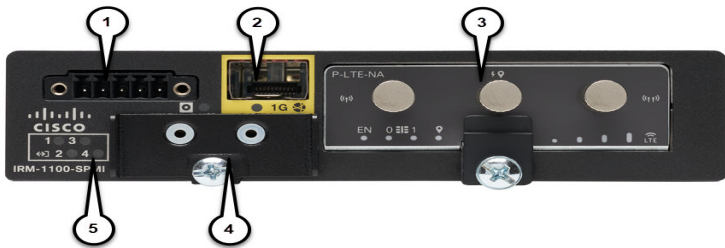
Figure 1 Cisco IR1101 Industrial Integrated Services Router



Figure 2 IRM-1100-SPMI Expansion Module



Figure 3 IRM-1100-SPMI Expansion Module Details



1	4 GPIO + 1 Return (Digital I/O)
2	SFP Connector
3	Pluggable Module
4	mSATA SSD Slot
5	Digital I/O LEDs



**Note:** The IR-1100-SP Expansion Module is the same as the IR-1100-SPMI module, without the Digital I/O and mSATA components.

## Interface Naming Conventions

With the addition of the new Expansion Modules, there are additional interfaces.

**Table 1 Hardware Interface Naming Convention**

Port	Naming Convention
Gigabit Ethernet combo port	Gigabitethernet 0/0/0
Gigabit Ethernet SFP port on Expansion Module	Gigabitethernet 0/0/5
Fast Ethernet ports	Fastethernet0/0/1–0/0/4
Cellular Interface on IR1101 Base	Cellular 0/1/0 and cellular 0/1/1
Cellular Interface on Expansion Module	Cellular 0/3/0 and 0/3/1
Asynchronous Serial Interface	Async 0/2/0
USB	usbflash0:
mSATA	msata
IR1101 Base Unit Alarm input	alarm contact 0
GPIO on Expansion Module	alarm contact 1–4

## Digital I/O

The IR1101 has two different Expansion Modules, the IRM-1100-SP and IRM-1100-SPMI. The IRM-1100-SPMI comes with a Digital I/O connector which has 4 GPIO connections plus 1 Return connection. Both Dry and Wet contacts up to 60Volts.

- Dry contact is isolated from a voltage source (or “No Volt”), with an embedded relay function (NPN transistor), usually used to indicate an event. For example: open/close, alarm.
- Wet contact is a contact with external power (+3.3V to +60V, max 150mA of current allowed at high voltage) applied, usually used to energize something. For example: solenoid, light.

Digital I/O is similar to the ALARM IN and ALARM OUT supported on the IR800 series routers. The differences are that on the IR800 series, ALARM IN is a dedicated input, the ALARM OUT is a dedicated output. With Digital I/O, it can be input or output. ALARM OUT includes a relay to provide the Normally Open (NO) or Normally Close (NC) terminals. Digital I/O does not include a relay.

More information on the Digital I/O hardware capabilities can be found in the [IR1101 Industrial Integrated Services Router Hardware Installation Guide](#).

## Configuration Commands

You can set the alarm severity to critical, major, minor, or none. The severity is included in the alarm message when the alarm is triggered.

To configure and show alarms on the IR1101, use the Command Line Interface (CLI). The first step in configuring the Digital I/O is to enable the alarm contact. Failure to enable the alarm contact and configuring either the severity, threshold or trigger first will return the error message "Alarm / Digital IO Port x is not enabled".

## Major Enhancements for Release 16.12.1

Command	Purpose
<b>configure terminal</b>	Enters global configuration mode.
<b>alarm contact</b> <i>contact-number</i> <b>enable</b>	<p>Enables the alarm contact number. o The contact-number value is from 0 to 4. &lt;0-4&gt; Alarm contact number (0: Alarm port, 1-4: Digital I/O).</p> <p>Alarm contact 0 is located in the base unit (pins 3 and 4) and always in Output Mode. Additional configurations for Alarm 0 include <i>severity</i>, <i>threshold</i> and <i>trigger</i>.</p> <p>Alarm contact 1-4 (pins 1-4) are located in the IRM-1100 Expansion Module and can be in Input or Output Mode. Pin 5 is for ground. Please refer to <a href="#">Figure 3</a>. Additional configurations for Alarms 1-4 include <i>application</i>, <i>output</i>, <i>severity</i>, <i>threshold</i> and <i>trigger</i>.</p>
<b>alarm contact</b> { <i>contact-number</i> { <b>application</b> {dry   wet}   <b>description</b>   <b>enable</b>   { <b>output</b> {1 for High   0 for Low}   <b>severity</b> {critical   major   minor   none}   <b>threshold</b> {1600-2700}   <b>trigger</b> {closed   open}}	<ul style="list-style-type: none"> <li>■ Enter a <i>contact number</i> (0-4) that you are configuring.</li> <li>■ The <b>description</b> string is up to 80 alphanumeric characters in length and is included in any generated system messages.</li> <li>■ For <b>application</b>, select dry (default) or wet. Only applicable for Digital I/O ports 1-4.</li> <li>■ <b>enable</b> is for enabling the alarm port. A no alarm contact contact-number x will disable the alarm port.</li> <li>■ The <b>output</b> is either 1 for High or 0 for Low. Only application for Digital I/O ports 1-4.</li> <li>■ For <b>severity</b>, enter <i>critical</i>, <i>major</i>, <i>minor</i> or <i>none</i>. If you do not configure a severity, the default is minor.</li> <li>■ For <b>threshold</b>, select a value between 1600-2700. The default value is 1600 mv.</li> <li>■ For <b>trigger</b>, enter <i>open</i> or <i>closed</i>. If you do not configure a trigger, the alarm is triggered when the circuit is closed.</li> </ul>
<b>end</b>	Returns to privileged EXEC mode.
<b>show alarm</b>	Shows the configured alarm contacts.
<b>copy running-config startup-config</b>	(Optional) Saves your entries in the configuration file.

## Configuration Examples

## Configure an alarm.

```

ir1101#conf term
Enter configuration commands, one per line.  End with CNTL/Z.
ir1101(config)#alarm contact 1 description  Your Descriptive Text Here
ir1101(config)#alarm contact 1 severity critical
ir1101(config)#alarm contact 1 trigger closed
ir1101#

```

## To show the alarm status:

```

ir1101#show alarm
ALARM CONTACT
  Status:      Not Asserted
  Description:  Test Input Alarm
  Severity:     Critical
  Trigger:      Closed

```

## Major Enhancements for Release 16.12.1

**Example of an alarm being generated:**

```
ir1101#!  
*Nov 27 14:54:52.573: %IR1101_ALARM_CONTACT-0-EXTERNAL_ALARM_CONTACT_ASSERT: External alarm asserted,  
Severity: Critical
```

**To show the alarm status during an event:**

```
ir1101#show alarm  
ALARM CONTACT  
Enabled: Yes  
Status: Asserted  
Application: Dry  
Description: test  
Severity: Critical  
Trigger: Open  
Threshold: 2000  
  
Digital I/O 1:  
Enabled: No  
Status: Not Asserted  
Application: Dry  
Description: External digital I/O port 1  
Severity: Minor  
Trigger: Closed  
Threshold: 1600  
  
Digital I/O 2:  
Enabled: No  
Status: Not Asserted  
Application: Dry  
Description: External digital I/O port 2  
Severity: Minor  
Trigger: Closed  
Threshold: 1600  
  
Digital I/O 3:  
Enabled: No  
Status: Not Asserted  
Application: Dry  
Description: External digital I/O port 3  
Severity: Minor  
Trigger: Closed  
Threshold: 1600  
  
Digital I/O 4:  
Enabled: Yes  
Status: Not Asserted  
Description: External digital I/O port 4  
Mode: Output  
  
Router#
```

**Example of an alarm being cleared:**

```
ir1101#!  
*Nov 27 14:55:02.573: %IR1101_ALARM_CONTACT-0-EXTERNAL_ALARM_CONTACT_CLEAR: External alarm cleared  
ir1101#
```

**Note:** There are no traps generated for alarms from the GPIO.

## Layer 2 Tunneling Protocol Version 3 (L2TPv3) on SVI Interfaces

SVI on the IR1101 router is also designed to provide basic Layer 3 functions for the Layer 2 switch ports that belong to a specific VLAN. To provide LAN extension between remote sites; SVI is used as the Layer 2 tunnel termination point. The SVI does not provide the same feature set and functions as the integrated Layer 3 Ethernet port of the routers and should not be used to entirely replace the Layer 3 Ethernet ports.

**Note:** L2TPv3 was already supported on Gigabit Ethernet 0/0/0 on release 16.10.1, and Gi0/0/0 sub-interfaces on release 16.11.1.

There will be no changes to existing CLIs. Below are the example CLIs used to configure the Ethernet vlan segment:

```
2tp-class Rlsignal
hello 10
password cisco
cookie size 8

pseudowire-class ether-pw
encapsulation l2tpv3
protocol l2tpv3 Rlsignal
ip local interface Loopback0

interface FastEthernet0/0/1
switchport access vlan 4

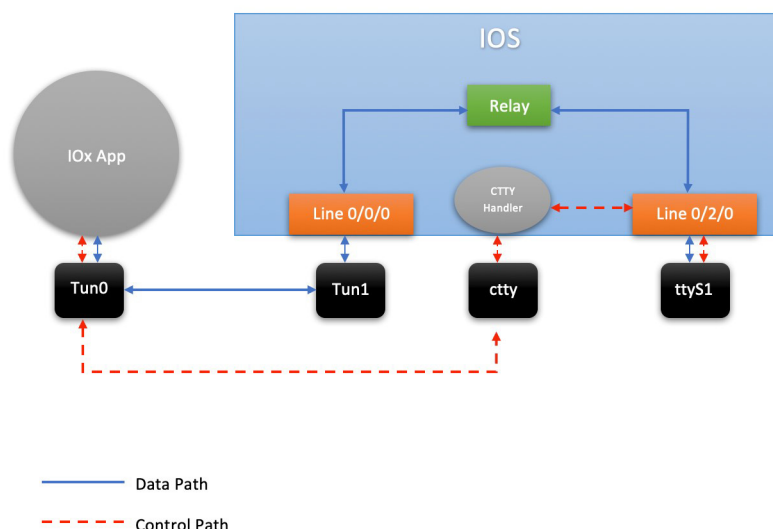
interface Vlan4
no ip address
xconnect 10.10.20.2 123 encapsulation l2tpv3 pw-class ether-pw
Existing features of L2TPv3 ethernet vlan will be same.
```

For complete information on L2TPv3, see the [Wide-Area Networking Configuration Guide: Layer 2 Services](#).

## Serial Relay

Serial Relay service on the IR1101 enables IOx apps to communicate with the Async Serial port (/dev/ttyS1 under IOS-XE). The configuration of Serial Relay service is similar to that of the IR800.

On the IR1101, IOS-XE has complete control over the data path and control path of the Async Serial port. This aspect is essential to other encapsulations supported on the Async port such as PPP, raw-socket, SCADA, etc. The IOx app is never allowed to exercise full control over the device. All data and configurations are passed through IOS-XE before going to the device. Instead of exposing the actual Serial port to IOx apps, the Serial relay service creates a software emulated serial tty device enumerated as /dev/ttyTun0 (shown below). The pair of devices /dev/ttyTun0 and /dev/ttyTun1 represent a data tunnel whose primary function is to act as a pass-through gateway during any data transfer. /dev/ttyTun1 is open by IOS-XE and all the ingress/egress data from IOS to the app uses this device during data transfer. Line 0/0/0 is used to communicate with /dev/ttyTun1. Serial relay service should be configured beforehand to allow the connection between two lines.

**Data Path:**

1. When the IOx app sends a character to `/dev/ttyTun0`, the tunnel driver automatically pushes the data to `/dev/ttyTun1`.
2. IOS reads the data which it then passes to the Serial relay service.
3. The Serial relay service retrieves information about the other end of the relay service (Line 0/2/0 in this case) and forwards the data to the Line's buffer.
4. The line driver actively pushes the data into the actual serial device (`/dev/ttyS1`) based on buffer availability.
5. The reverse path functions the same with the roles of `/dev/ttyS1` and `/dev/tun0` reversed.

**Control Path:**

1. When the IOx app performs `TCGETS` ioctl call on `/dev/ttyTun0`, the tunnel driver uses `/dev/cttyTun` to send request to the CTTY handler service running in IOS.
2. CTTY handler service and the kernel driver use a client-server architecture to communicate configuration objects.
3. Upon receiving the request about `TCGETS` from `/dev/cttyTun`, the CTTY handler examines the request and requests Line driver to populate the required data into control data structures.
4. Upon receiving the control data structures, CTTY handler sends out a response to `/dev/cttyTun` which eventually goes back to `/dev/ttyTun0`.
5. `/dev/ttyTun0` passes the control data to IOx app as requested.
6. Similar path can be extrapolated for `TCSETS` where the CTTY handler requests the Line driver to update the settings of the underneath `/dev/ttyS1` driver.
7. Line driver of Line 0/2/0 and driver config on `/dev/ttyTun0` are always in sync with each other. Any configuration changes such as baud rate modification is transparently propagated to the Line driver without any additional configuration overhead. This emulates the propagation feature of Serial relay on the IR800 series where the virtual serial port can configure the parameters of the real serial port.

**Configuration:**

```
IR1101#configure terminal
```

## Major Enhancements for Release 16.12.1

```

IR1101(config)#interface async 0/2/0
IR1101(config-if)#encapsulation relay-line
IR1101(config-if)#exit
IR1101(config)#relay line 0/2/0 0/0/0
IR1101(config)#exit
IR1101#

```

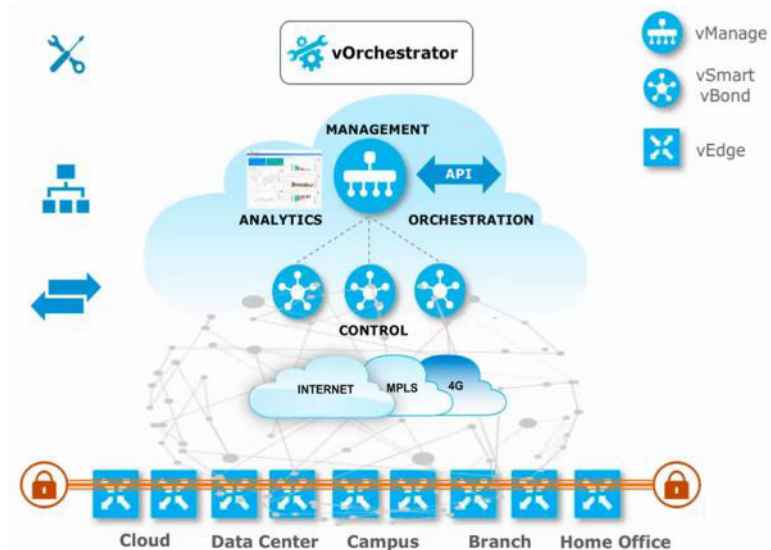
## Cisco SD-WAN Support

Cisco SD-WAN is a cloud-first architecture that separates data and control planes, managed through the Cisco vManage console. You can quickly establish an SD-WAN overlay fabric to connect data centers, branches, campuses, and co-location facilities to improve network speed, security, and efficiency.

Cisco SDWAN adopts a cloud based solution, it consists of vOrchestrator, vManage, vSmart and vEdge.

- vOrchestrator is responsible for launching all controllers VMs in the cloud.
- vManage is the management plane for the overall SDWAN solution. It uses netconf/YANG to talk to vEdge devices.
- vSmart is the control plane for the overall SDWAN solution. It talks to the vEdge device, acts as the route reflector, key reflector, and policy engine.
- vEdge is the data plane of the overall SDWAN solution. The IR1101 platform talks to vSmart, vManage, as part of the SDWAN network.

The follow diagram shows the high level architecture of SDWAN:



## Frequently Asked Questions

**Question:** What is the minimum cEdge software version supporting SDWAN on the IR1101?

**Answer:** The minimum cEdge software version supporting SDWAN on the IR1101 is IOS-XE 16.12.1, the ir1101-ucmk9-XX image.

**Question:** What is the minimum SDWAN controller software version supporting the IR1101?

**Answer:** The minimum SDWAN controller software version supporting the IR1101 is 19.2.

## Major Enhancements for Release 16.12.1

**Question:** Where can I find SDWAN documentation?

**Answer:** Cisco SDWAN documentation is available from

<https://www.cisco.com/c/en/us/support/routers/sd-wan/tsd-products-support-series-home.html>

[https://sdwan-docs.cisco.com/Product\\_Documentation/Software\\_Features](https://sdwan-docs.cisco.com/Product_Documentation/Software_Features)

**Question:** Can I use 2 LTE pluggables with SDWAN?

**Answer:** Cisco IOS-XE SDWAN version 16.12.1 does not support 2 LTE pluggable interfaces. Both the Base or Expansion Module can support 4G module, but still only one 4G module, in current May 2019 vManage and IOS XE 16.12.1 releases.

**Question:** Can I convert an IR1101 IOS-XE to a cEdge IR1101?

**Answer:** For migration from Cisco IOS-XE to cEdge image, please refer to

<https://www.cisco.com/c/dam/en/us/td/docs/routers/sdwan/migration-guide/SDWAN-migration-guide.pdf>

**Question:** Is IOx supported when running a cEdge image?

**Answer:** IOx is not supported on the IR1101 SDWAN 16.12.1 version.

All of the technical documentation for Cisco SD-WAN can be found here:

<https://www.cisco.com/c/en/us/support/routers/sd-wan/tsd-products-support-series-home.html>

## mSATA

Mini-SATA, or mSATA, is a low-profile interface connector that enables more effective Serial ATA (SATA) integration in small form-factor drives roughly the size of a business card, such as solid state disks (SSDs).

The IRM-1100-SPMI Expansion Module provides the capability for adding a 100GBmSATA SSD. The PID is IR1100-SSD-100G.

There is a single LED that provides status of the mSATA SSD:

- Off - Not powered on or no activity
- Flashing Green - mSATA being accessed

Highlights of the mSATA Pluggable Module are:

- Provides an additional 100GB of additional flash memory storage
- Main purpose is to provide space to store application data for IOx
- Field Replaceable unit, but is not hot-swappable.

## mSATA Partitioning

IOS-XE release 16.11.1 divided the mSATA SSD into 3 partitions. One partition used by IOS-XE and the other two for IOx. IOS-XE release 16.12.1 divides the mSATA SSD into 2 partitions. One for IOS-XE and the other for IOx. Examples used in this document are for release 16.12.1.

- Partition 1:
  - Used by IOS-XE
  - 34GB is allocated to IOS-XE

## Major Enhancements for Release 16.12.1

- Can be accessed using **dir msata**:
- Partition 2:
  - Used by IOx Applications
  - 64GB is allocated to IOx
  - Space allocated can be viewed from IOx CLI

**Note:** If the customer upgrades from release 16.10.1 or 16.11.1 to 16.12.1, applications should be re-installed due to the partition changes. All the application data will be lost along with the application.

Additional information about the mSATA use can be found in the [Cisco IR1101 Integrated Services Router Software Configuration Guide](#).

## New Cellular Pluggable Modules

Release 16.12.1 supports new pluggable modules/modems. The IR1101 with an Expansion Module supports DUAL LTE (Active/Active), DUAL SIM and DUAL Radio.

- Dual LTE (active/active or active/backup) is supported on the IR1101 equipped with an expansion module and two LTE pluggable interfaces. One on the base unit, the other on the expansion module.
- With DUAL SIM, the two SIMs operate in active/backup mode on the single LTE pluggable module. With DUAL Radio the two LTE pluggable modules operate in active/active mode with each of the two SIMs assigned to a specific cellular radio on the DUAL Radio.

See the following table for details on the new SKUs.

SKU ID	Modem Used	Description	Technology Supported
P-LTE-VZ	WP7601-G	U.S. (Verizon) Single Micro SIM	LTE CAT4: B4, B13
P-LTE-US	WP7603-G	North America (AT&T) Dual Micro SIM	LTE CAT4: B2, B4, B5, B12 HSPA+, UMTS: B2, B4, B5
P-LTE-GB	WP7607-G	Europe Dual Micro SIM	LTE CAT4: B3, B5, B8, B20, B28 HSPA+: B1, B5, B8 EDGE: 900/1800
P-LTEA-LA	EM7430	APAC	<b>LTE Bands:</b> B1, B3, B5, B7, B8, B18, B19, B21, B28, B38, B39, B40, B41. <b>Non-LTE Bands:</b> B87 - WCDMA (Europe, Japan, and China) 2100 band B91 - WCDMA US 850 band B92 - WCDMA Japan 800 band B114 - WCDMA Europe and Japan 900 band B115 - WCDMA Japan 1700 band B125 - WCDMA Japan 850 band
P-LTEA-EA	EM7455	USA, Canada, Europe, Latin America	<b>LTE bands:</b> Bands B2, B4, B5, B13 <b>Non-LTE bands:</b> B87 - WCDMA (Europe, Japan, and China) 2100 band B88 - WCDMA US PCS 1900 band B89 - WCDMA (Europe and China) DCS 1800 band B90 - WCDMA US 1700 band B91 - WCDMA US 850 band B114 - WCDMA Europe and Japan 900 band



## SFP Support

The SFP interface on the Expansion Module operates differently than on the Base unit. The SFP interface on the IR1101 base module is part of the combo port (SFP/RJ45) for GigabitEthernet0/0/0. It may be configured as Layer-3 (default) or Layer-2 interface.

The SFP interface on the Expansion Module is only an SFP interface. It is named GigabitEthernet0/0/5, and is a Layer-2 interface. For Layer-3 feature set, it must be assigned to a VLAN interface.

**Note:** On the Expansion Module, there is no need to explicitly configure the media-type for the SFP. When using the SFP combo interface on the Base, you **MUST** use the command to enable SFP on the Gi 0/0/0 interface. The command is **media type sfp**.

Details about the SFP Interface can be displayed using the **show interfaces transceiver detail** CLI, for example:

```
Router#show interfaces transceiver detail
```

```
IDPROM for transceiver GigabitEthernet0/0/0:
```

```

Description                = SFP or SFP+ optics (type 3)
Transceiver Type:          = GE T (26)
Product Identifier (PID)    = ABCU-5710RZ-CS4
Vendor Revision             =
Serial Number (SN)          = AGM151124J4
Vendor Name                 = CISCO-AVAGO
Vendor OUI (IEEE company ID) = 00.17.6A (5994)
CLEI code                   =
Cisco part number           =
Device State                = Enabled.
Date code (yy/mm/dd)        = 11/03/21
Connector type              = Unknown.
Encoding                    = 8B10B (1)
Nominal bitrate              = GE (1300 Mbits/s)
Minimum bit rate as % of nominal bit rate = not specified
Maximum bit rate as % of nominal bit rate = not specified

```

```
Socket Verification
```

```
SFP IDPROM Page 0xA0:
```

```

000: 03 04 00 08 00 00 00 00 00 00
010: 00 01 0D 00 00 00 00 00 64 00
020: 43 49 53 43 4F 2D 41 56 41 47
030: 4F 20 20 20 20 20 01 00 17 6A
040: 41 42 43 55 2D 35 37 31 30 52
050: 5A 2D 43 53 34 20 20 20 20 20
060: 41 0C C1 15 00 10 00 00 41 47
070: 4D 31 35 31 31 32 34 4A 34 20
080: 20 20 20 20 31 31 30 33 32 31
090: 20 20 00 00 00 99 00 00 06 17
100: C5 44 22 B7 DE 02 63 0F 59 73
110: 64 EC A5 37 19 00 00 00 00 00
120: 00 00 00 00 0F 2C 6D 22 FF FF
130: FF FF FF FF FF FF FF FF FF FF
140: FF FF FF FF FF FF FF FF FF FF
150: FF FF FF FF FF FF FF FF FF FF
160: FF FF FF FF FF FF FF FF FF FF
170: FF FF FF FF FF FF FF FF FF FF
180: FF FF FF FF FF FF FF FF FF FF
190: FF FF FF FF FF FF FF FF FF FF
200: FF FF FF FF FF FF FF FF FF FF
210: FF FF FF FF FF FF FF FF FF FF
220: FF FF FF FF

```

## Major Enhancements for Release 16.12.1

SFP IDPROM Page 0xA2:

```

000:      00 00 00 00 00 00 00 00 00 00 00
010:      00 00 00 00 00 00 00 00 00 00 00
020:      00 00 00 00 00 00 00 00 00 00 00
030:      00 00 00 00 00 00 00 00 00 00 00
040:      00 00 00 00 00 00 00 00 00 00 00
050:      00 00 00 00 00 00 00 00 00 00 00
060:      00 00 00 00 00 00 00 00 00 00 00
070:      00 00 00 00 00 00 00 00 00 00 00
080:      00 00 00 00 00 00 00 00 00 00 00
090:      00 00 00 00 00 00 00 00 00 00 00
100:      00 00 00 00 00 00 00 00 00 00 00
110:      00 00 00 00 00 00 00 00 00 00 00
120:      00 00 00 00 00 00 00 00 00 00 00
130:      00 00 00 00 00 00 00 00 00 00 00
140:      00 00 00 00 00 00 00 00 00 00 00
150:      00 00 00 00 00 00 00 00 00 00 00
160:      00 00 00 00 00 00 00 00 00 00 00
170:      00 00 00 00 00 00 00 00 00 00 00
180:      00 00 00 00 00 00 00 00 00 00 00
190:      00 00 00 00 00 00 00 00 00 00 00
200:      00 00 00 00 00 00 00 00 00 00 00
210:      00 00 00 00 00 00 00 00 00 00 00
220:      00 00 00 00 00 00 00 00 00 00 00
230:      00 00 00 00 00 00 00 00 00 00 00
240:      00 00 00 00 00 00 00 00 00 00 00
250:      00 00 00 00 00 00

```

```

Link reach for 9u fiber (km)          = SX(550/270m) (0)
                                       1xFC-MM(500/300m) (0)
                                       2xFC-MM(300/150m) (0)
                                       ESCON-MM(2km) (0)

Link reach for 9u fiber (m)           = SX(550/270m) (0)
                                       1xFC-MM(500/300m) (0)
                                       2xFC-MM(300/150m) (0)
                                       ESCON-MM(2km) (0)

Link reach for 50u fiber (m)          = SR(2km) (0)
                                       IR-1(15km) (0)
                                       IR-2(40km) (0)
                                       LR-1(40km) (0)
                                       LR-2(80km) (0)
                                       LR-3(80km) (0)
                                       DX(40KM) (0)
                                       HX(40km) (0)
                                       ZX(80km) (0)
                                       VX(100km) (0)
                                       1xFC, 2xFC-SM(10km) (0)
                                       ESCON-SM(20km) (0)

Link reach for 62.5u fiber (m)        = SR(2km) (0)
                                       IR-1(15km) (0)
                                       IR-2(40km) (0)
                                       LR-1(40km) (0)
                                       LR-2(80km) (0)
                                       LR-3(80km) (0)
                                       DX(40KM) (0)
                                       HX(40km) (0)
                                       ZX(80km) (0)
                                       VX(100km) (0)
                                       1xFC, 2xFC-SM(10km) (0)
                                       ESCON-SM(20km) (0)

Nominal laser wavelength              = 16652 nm.
DWDM wavelength fraction              = 16652.193 nm.
Supported options                     = Tx disable

```

You can find all of the supported SFP Interfaces in the [IR1101 Industrial Integrated Services Router Hardware Installation Guide](#)

## Serviceability features

With additional functionality added to the IR1101 with its Expansion Modules, there have been changes made to some of the CLIs.

- **show platform resources** displays QFP details and SNMP MIB walk includes all QFP objects including memory related MIB objects.
- **show inventory** and **show inventory oid** displays the related forwarding processor and its OID information.
- **show led** displays what the LED status is on the device.
- **show tech-support** is enhanced to include the following CLIs:

```
show platform hardware qfp active      infrastructure punt config cause
show platform hardware qfp active      infrastructure punt internal-interface
show platform hardware qfp active      interface if-name internal0/0/rp:0
show platform hardware qfp active      interface if-name internal0/0/recycle:0
show platform hardware qfp active      interface if-name internal0/0/crypto:0
show platform hardware qfp active      infrastructure uidb internal0/0/rp:0 input config
show platform hardware qfp active      infrastructure uidb internal0/0/recycle:0 input config
show platform hardware qfp active      infrastructure uidb internal0/0/crypto:0 input config
show platform hardware qfp active      infrastructure uidb internal0/0/rp:0 output config
show platform hardware qfp active      infrastructure uidb internal0/0/recycle:0 output config
show platform hardware qfp active      infrastructure uidb internal0/0/crypto:0 output config
show platform hardware qfp active      infrastructure punt statistics interface 1
show platform hardware qfp active      infrastructure punt statistics interface 2
show platform hardware qfp active      interface if-name internal0/0/rp:0 statistics
show platform hardware qfp active      interface if-name internal0/0/recycle:0 statistics
show platform hardware qfp active      interface if-name internal0/0/crypto:0 statistics
show platform hardware qfp active      infrastructure punt statistics type per-cause
show platform hardware qfp active      infrastructure punt statistics type global-drop
show platform hardware qfp active      infrastructure punt statistics type punt-drop
show platform hardware qfp active      infrastructure punt statistics type inject-drop
show platform hardware qfp active      statistics drop
show platform hardware qfp active      system state
show platform hardware qfp active      system transactions
show platform hardware qfp active      datapath infrastructure time basic
show platform hardware qfp active      infrastructure exmem statistics
show platform hardware qfp active      infrastructure exmem statistics user
show platform hardware qfp active      infrastructure exmem resource
show platform hardware qfp active      infrastructure exmem region
show platform hardware qfp active      infrastructure exmem table
show platform hardware qfp active      infrastructure bqs status
show platform hardware qfp active      feature acl control
show platform hardware qfp active      feature acl tree
show platform hardware qfp active      feature tunnel state
show platform hardware qfp active      feature erspan state
show platform hardware qfp active      feature ess state
show platform hardware qfp active      feature ipfrag global
show bootlog FP active
show bootlog RP active
show platform software diagnostic chassis-manager R0 cpld
show platform software diagnostic chassis-manager R0 status
show platform software ipc queue-based chassis-manager R0 connection
show platform software ipc stream-based ios RP active connection
show platform software ipc stream-based ios RP active manager
show platform software process environment ios rp active
```

## Major Enhancements for Release 16.12.3

```
show power
show license tech support
show license summary
```

## Major Enhancements for Release 16.12.3

There are no major enhancements for this release.

## Major Enhancements for Release 16.12.4

There are no major enhancements for this release.

## Major Enhancements for Release 16.12.5

There are no major enhancements for this release.

## Related Documentation

The following documentation is available:

- All of the Cisco IR1101 Industrial Integrated Services Router documentation can be found here:

<https://www.cisco.com/c/en/us/support/routers/1100-series-industrial-integrated-services-routers/tsd-products-support-series-home.html>

## Caveats

Caveats describe unexpected behavior in Cisco IOS releases. Caveats listed as open in a prior release are carried forward to the next release as either open or resolved.

**Note:** You must have a Cisco.com account to log in and access the Cisco Bug Search Tool. If you do not have one, you can [register for an account](#).

For more information about the Cisco Bug Search Tool, see the [Bug Search Tool Help & FAQ](#).

## Open Caveats for Release 16.9.1

### ■ CSCvk34807

SCEP authentication/enrollment fails when RA or CA hostname is resolved to an IPv6 address.

**Symptoms:** Release 16.9.1 only supports SCEP enrollment to RA-CA/IPv4, or RA-CA/hostname-to-ipv4, or RA-CA/IPv6.

**Conditions:** If the RA-CA hostname is resolved to IPv6 address, SCEP will always fail to resolve the configured RA-CA hostname to the actual IPv6 address, thus causing the SCEP authorization and enrollment to fail.

**Workaround:** There is no workaround.

### ■ CSCvj86161

raw-socket: encap raw-tcp default config line with packet-length 0

## Caveats

**Symptoms:** When you encapsulate raw-tcp to async 0/2/0, it automatically configures the line with raw-socket packet-length 0. This is out of range from <10-1400>.

**Workaround:** There is no workaround.

## Resolved Caveats for Release 16.9.1

There are no open issues at this time.

## Open Caveats for Release 16.10.1

There are no open issues at this time.

## Resolved Caveats for Release 16.10.1

### ■ CSCvk34807

SCEP authentication/enrollment fails when RA or CA hostname is resolved to an IPv6 address.

**Symptoms:** Release 16.9.1 only supports SCEP enrollment to RA-CA/IPv4, or RA-CA/hostname-to-ipv4, or RA-CA/IPv6.

**Conditions:** If the RA-CA hostname is resolved to IPv6 address, SCEP will always fail to resolve the configured RA-CA hostname to the actual IPv6 address, thus causing the SCEP authorization and enrollment to fail.

**Workaround:** There is no workaround.

### ■ CSCvj86161

raw-socket: encap raw-tcp default config line with packet-length 0

**Symptoms:** When you encapsulate raw-tcp to async 0/2/0, it automatically configures the line with raw-socket packet-length 0. This is out of range from <10-1400>.

**Workaround:** There is no workaround.

## Open Caveats for Release 16.11.1

There are no open issues with this release.

## Resolved Caveats for Release 16.11.1

There are no closed issues with this release.

## Open Caveats for Release 16.12.1

### ■ CSCvp18328

The speed range should only show 10 or 100 for FE ports in the IR1101 switchport template.

**Symptom:** The FE ports can only be set to 10 or 100 Mbps. The template allows the full range of 10/100/1000/10000.

**Workaround:** Only use the 10 or 100 Mbps selections.

## Caveats

■ **CSCvq13666**

On the IR1100 with the cEdge image, the upgrade fails due to insufficient disk space.

**Symptom:** Occurs with an image upgrade of cEdge devices using vManage and returns a failure of insufficient flash space.

**Workaround:** There are two options:

1. vManage checks required disk space before downloading the image and taking 40 min time and 4G bandwidth. First delete files to make room.
2. Limit tracelog on the flash to retain 2x 430MB (current image size) free space.

■ **CSCvp48383**

vManage: GPS enabling feature from vManage template fails.

**Symptom:** From AWS vManage, attempting to attach device-template, including a Cellular GPS feature-template, fails. Removing the GPS template allows the attach of template to progress to the next stage where it shows the configuration differences. With the GPS feature-template selected, it always shows as failed.

**Workaround:** Remove the GPS template.

■ **CSCvp36305**

vManage: CPU util shown by CLI doesn't match reported by vManage realtime.

**Symptom:** The CPU util doesn't match when comparing what was on IR1101 CLI **sh plat soft status control brief** with the realtime device CPU util on vManage. The vManage seems to be reporting CPU from **sh proc cpu** older IOS version CLI.

**Workaround:** Check each device using CLI commands

■ **CSCvp48578**

vManage: Allow cellular modem firmware image upload and upgrade via vManage.

**Symptom:** Currently, vManage doesn't have a device/feature template or Software Repository + Upgrade mechanism of cellular modem.

**Workaround:** There is no workaround, functionality to be added in a future release.

■ **CSCvp48578**

vManage: Allow cellular modem firmware image upload and upgrade via vManage.

**Symptom:** Currently, vManage doesn't have a device/feature template or Software Repository + Upgrade mechanism of cellular modem.

**Workaround:** There is no workaround, functionality to be added in a future release.

■ **CSCvq64265**

"Found no Snowfinch (MCU) on this system" message displayed at bootup.

**Symptom:** At boot, "Found no Snowfinch (MCU) on this system" is displayed in the completion text.

**Workaround:** There is no workaround, the text does not effect functionality and will be corrected in a future release.

## Caveats

### Resolved Caveats for Release 16.12.1

- **CSCvo24734**

Gig0/0/0 WAN port comes up administratively down by default, pnp failure.

### Open Caveats for Release 16.12.3

None for this release.

### Resolved Caveats for Release 16.12.3

- **CSCvq13666**

IR1100 cEdge: Image upgrade fails due to insufficient disk space.

- **CSCvs37437**

Changed the out of the box baud rate in rommon to be 9600 baud.

- **CSCvp31354**

VPN LED always ON even when the tunnel is down.

### Open Caveats for Release 16.12.4

None for this release.

### Resolved Caveats for Release 16.12.4

- **CSCvs73854**

SPAN capture in both directions is only capturing in one way.

**Symptoms:** SPAN capture in IR1101 is only capturing in one way even if it is configured to capture in both directions. Only the traffic that goes out of the monitored interface is captured.

### Open Caveats for Release 16.12.5

None for this release.

### Resolved Caveats for Release 16.12.5

- **CSCvu78908**

A debugging shell is started on the USB console.

**Symptoms:** This is a modification on the product to adopt new secure code best practices to enhance the security posture and resiliency of the product.

**Conditions:** Device running with the default configuration.

**Workaround:** Not available or not applicable.

- **CSCvw57687**

## Caveats

Multicast throughput is slower.

**Symptoms:** multicast had a different bandwidth (traffic rate) when there is a receiver on the same VLAN or not. Checked the packet number and it was not matched.

**Conditions:** When there is no receiver on the same VLAN with a source, the traffic rate is reduced by around 1M. Source traffic rate was 50M.