CANONICAL

Internet of Things Certified Hardware Coverage

Contents

Introduction

This document lists the coverage for certification of Internet of Things (IoT) devices with Ubuntu images. IoT devices can be certified with the following image types:

- Ubuntu Core 22
- Ubuntu Server 22.04
- Ubuntu Desktop 22.04

The guide applies to devices submitted to Canonical through one of the following programmes:

- IoT Devices Enablement Programme with Certification
- IoT ODM Partner Programme

The following test categories are specified:

Blocking

Features that are required for certification. If any of the tests in the required category fails, the certification will fail.

Non-blocking

Features that are tested, but that don't block certification. If any of the tests under the optional category fail, a note will be added to the certificate to warn the potential customer or user.

Untested

The items in the Untested category are just reference items. Anything not explicitly called out in the Blocking or Non-blocking categories can be considered part of the Untested category. We will consider adding more tests as needed.

Note: only categories of hardware are tested and not specific types of hardware. For example, tests are run to verify USB controllers work, but the type of peripheral(s) used during those tests are not specified. Coverage is flexible based on customer requirements (for example, if a device's use cases don't require LEDs, then LEDs can be untested)

Full test descriptions can be found in Canonical certification site for partners:

http://certification.canonical.com

Blocking

Audio

Output needs to be undistorted between 0%-100%. Output lines tested:

- Internal speakers
- 3.5mm headphones
- HDMI audio output
- DisplayPort audio output

Input needs to be recorded undistorted between 0%-100%. Input lines tested:

- Internal microphone
- 3.5mm microphone

Plug detection: when a new audio line input or output is plugged in the system, it needs to be recognized.

Bluetooth

Bluetooth LE (Smart and Smart Ready) is tested for device scanning and pairing. Apart from pairing, several profiles are specifically tested and required:

- Eddystone Beacon
- HID Over GATT Profile (HOGP), Low-Energy keyboard or mouse with basic functionality

CPU

x86_64 and ARM processors are tested to ensure proper functionality. We will test specific features as:

- CPU's performance states (frequency up and down in runtime)
- CPU's sleep states (cpu on and off in runtime)
- Running CPU at its maximum frequency

We will also include a general stress test performed for 120 minutes to verify that the system can handle a sustained high load for a period of time. This test uses the tool "stress-ng" available in the Universe repositories.

For Intel CPU's, the IPDT (Intel Processor Diagnostic Tool) test suite will be run. The diagnostic checks for brand identification, verifies the processor operating frequency, tests specific processor features, and performs a stress test on the processor.

Ethernet

Connections are tested for functionality, but not for performance.

Firmware

The Ubuntu image must be installed using the factory default bootloader firmware (for example BIOS, UEFI or uboot as applicable) and with the default options (including SecureBoot, if that's the default setting). Firmware needs to be compliant with Canonical Firmware Test Suite (FWTS).

It is recommended that after running Canonical fwts with the list of tests defined in the Appendix A, ideally, no CRITICAL or HIGH failures should be reported, but those are not automatically certification blockers.

GPIO

We test the functionality of individual GPIO lines when the associated controller driver in the kernel implements a GPIO Sysfs Interface via the gpiolib implementers framework. In such cases, the GPIO system may be tested in two ways:

- Direct:
  - GPIO controllers are exposed through sysfs
  - GPIO lines are accessible by the user
- Indirect:
  - Communication with device connected via GPIO

I2C

All devices attached to the I2C bus must be detectable. This includes:

- Temperature sensors
- Humidity sensors
- Accelerometers

LEDs

When LEDs exist, they will be tested by following some basic expectations here. The actual behavior may vary depending on the hardware design. To ensure that the behavior is working as expected, please be sure to test against specifications obtained from OEM, as each OEM may have different defined behavior for LEDs. The following LEDs are tested:

- Power
- Serial Port LEDs (indicating activity)

Media Card readers

Media Card readers are tested for read and write for the following type of cards:

- CF
- MMC
- MS
- MSP
- SD
- SDHC
- SDXC
- XD

Memory

Proper detection of the amount of memory installed is required (the amount of memory installed is the memory seen by the OS).

Monitors

Each of the available external video ports (supported ports are HDMI, DisplayPort, DVI) are tested one by one. Output to the display must work i.e. a console is presented.

Power Management

Warm reboot is tested such that the system must be able to perform the reboot command and services must be restarted such that systemctl does not identify a failed state.

Cold reboot is performed where an RTC is available (see next section). The wakealarm is used to reboot the system after a period of rest and services must be restarted such that systemctl does not identify a failed state.

Real-Time Clock (RTC)

If present on the device, the device must have a working real-time clock. This will be tested by scheduling a wake alarm to bring the system up after a halt.

Serial Ports

Tests are carried out on ports that provide access via the Linux tty layer. The exact tests performed depend on the physical characteristics of the driver/receiver hardware. The possible tests include:

- Ensure expected number of devices are available
- Looped tests:
  - RS232 Ports: perform loopback test to ensure RX/TX
  - RS422/485 Ports: connect together to ensure RX/TX
- Machine to Machine tests: confirm that a connection can be made to another PC device and RX/TX is operational

Internal Storage

All internal storage devices are tested to be properly detected. An in-house performance test is run on all disks with read performance of 15MB/s required to pass.

USB controllers

USB 2.0

USB storage devices must work on all available USB ports. USB Human Interface Devices (HID), specifically keyboard or mouse, should be working properly on any USB port.

USB 3.0

USB storage devices must work on all available USB ports. USB Human Interface Devices (HID), specifically keyboard or mouse, should be working properly on any USB port.

USB Type C (USB 3.1)

USB Type C (USB 3.1) supports various types of devices (e.g. Video, Power) through the use of adapters or peripherals. The following adapters/peripherals should work:

- Storage devices
- Keyboard or mouse (basic functionality)
- When DisplayPort over USB Type-C is advertised:
  - Display hot plugging and the following display are required to work: mirrored, extended, internal only, external only.
  - Audio output needs to be undistorted over this port.

Wireless Networking

Wi-Fi interfaces are tested for connection to access points configured for 802.11 b/g/n/ac/ax protocols.

Wireless Wide Area Network

WWAN interfaces are tested for connection to 3G/4G/LTE services.

Thunderbolt

Thunderbolt featues tested:

- Audio output must be undistorted over this port.
- Storage devices with hot plugging capability should work when BIOS is set to “No security” option.
- Monitor hot plugging including different modes (mirrored, extended, internal only, external only) are required to work.
- Daisy-chaining devices should work with a storage device and a monitor chained together.

TPM

On Intel and AMD x86 platforms that include TPM 2.0 compliant modules, it is required that all commands necessary to support Ubuntu's Full Disk Encryption functionality are supported.

Non-blocking

CANBus

Devices that support the SocketCAN standard are tested to ensure that the adapter is present and can be communicated with via CANBus configuration commands.

Power Management

Suspend/Resume

For x86 devices, a 30 cycle suspend/resume stress test is performed using the FWTS. The suspend mode (e.g. S3, S2Idle) used during the test will be the default for the system under test. The test is passed if all 30 cycles complete without failure. Any errors reported in the fwts log for the 30 cycle suspend/resume stress test are informational only and do not affect the outcome of the test, however, we do recommend examining and fixing any failures noted, as they indicate firmware non-compliance with standards.

In addition a single suspend is performed across which the following features and devices are tested:

- CPU
- Memory
- Networking (Wifi, Ethernet)
- Audio
- Bluetooth
- USB controllers
- Input devices
- Mediacards

Watchdog Timer

A test will be performed to verify that any kernel modules needed for watchdog timers are loaded and working as expected.

LEDs

The following LEDS will be tested for functionality:

- Cloud LED
- Wireless LED
- Bluetooth LED
- WWAN LED

Appendix A. FWTS tests

As part of the certification process, we run a series of firmware tests that are part of the Canonical Firmware Test Suite. In general, any HIGH or CRITICAL error found in the fwts log can cause potential errors in the system and should be looked at by OEMs/ODMs.

Category	Test Item	Description
Information	acpidump	Check ACPI table acpidump
Information	version	Gather kernel system information
ACPI	acpitables	ACPI table settings sanity checks
ACPI	apicinstance	Check for single instance of APIC/MADT table
ACPI	hpet_check	High Precision Event Timer configuration test
ACPI	mcfg	MCFG PCI Express* memory mapped config space
ACPI	method	ACPI DSDT Method Semantic Tests
CPU	mpcheck	Check Multi Processor tables
CPU	msr	CPU MSR consistency check
CPU	mtrr	MTRR validation
System	apicedge	APIC Edge/Level Check
System	klog	Scan kernel log for errors and warnings