CANONICAL

Ubuntu Desktop Certified Hardware Coverage for 22.04 LTS
Version 1.1

Introduction

This document lists the coverage for certification of Ubuntu Desktop 22.04 LTS.

The following test categories are specified:
- Blocking, or features that are required for certification. If any of the tests in the required category fails, the certification will fail.
- Non-blocking, or 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

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Blocking

Audio

Output sound needs to be undistorted between 0%-100%. Output lines tested:
- Internal speakers
- 3.5mm headphones
- 3.5mm headset
- HDMI audio output
- DisplayPort audio output

Input needs to be recorded undistorted between 0%-100%. Input lines tested:
- Internal microphone
- 3.5mm microphone
- 3.5mm headset

Plug detection: when a new audio line input or output is plugged in the system, it needs to be recognized.
Note (PulseAudio only): Internal audio devices are allowed to be disabled when attaching external audio devices.

Bluetooth

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

- Audio (A2DP)
- HID Over GATT Profile (HOGP), Low-Energy keyboard or mouse with basic functionality
- File transfer (OBEX)
- Bluetooth LE advertisement (Scan)

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.

Ethernet

- Connections are tested for functionality, but not for performance.
- Hot plugging must be supported and working.

Firmware

Ubuntu 22.04 LTS is installed using the factory default BIOS or UEFI, 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.

Systems supporting fwupd and with a correct HWID will undergo firmware update testing when newer firmwares are available to the system via online LVFS, to ensure that users can upgrade their firmware without issue. During the maintenance phase, firmware updates will be tested on a regular cadence.

Function keys

The following function or special keys in a laptop needs to be supported (only when they exist in the system under test).

- Super key (Windows logo key). The Super key needs to show all open windows.
- Volume. Output volume needs to react to up and down volume keys
- Volume mute. Audio output needs to be muted and unmuted when pressing the volume mute key.
- Microphone mute key: Audio input should be stopped and could be continued when pressing again.
- Brightness. Internal display brightness needs to react to brightness keys.
- Monitor. Several display modes need to react to the monitor hotkey.
- Media control. Keys that control media play need to be able to control a video played through "Totem" or an audio file played through "Rhythmbox"
- Wireless. Soft and hard wireless keys need to turn on and off wireless and Bluetooth in the system
- Non-RGB Keyboard backlight. Backlight of the internal keyboard needs to be turned on and off when pressing the keyboard backlight key.
- Power button. When the system is booted, pressing the power button will bring up the

dialog to power off, reboot or log out from the system.

Graphics

The ability to run the desktop environment out of the box is required. When certifying, stock Ubuntu open source drivers need to work to complete the installation of Ubuntu, although proprietary drivers are accepted, if they are installable through Ubuntu Drivers.

Laptops

- The integrated display is tested with its highest resolution (up to 4k). At its highest resolution, the image should look clean, without any type of corruption.
- Each of the available external video ports (currently supported: HDMI, DisplayPort, Mini Displayport, Thunderbolt 3) are tested one by one. Hot plugging and different modes (mirror, extended, just internal, just external) are required to work. If several external ports are available, they are not required (nor tested) to work simultaneously.
- Display brightness. It should be possible to dim the brightness of the internal display.
- The system must support Gnome Shell 42 and basic 3D rendering.
- On systems with Hybrid graphics, BIOS default mode must be "Hybrid". This is the only mode required to work for certification.
- Hybrid graphics:
  - On systems with an integrated and a NVIDIA discrete GPU users should be able to choose supported profiles from nvidia-settings, the default profile is "on-demand" mode and functions are required to work on default mode.
  - On systems with an integrated and an AMD discrete GPU users should be able to run graphics workloads in the discrete GPU.

Desktops with an integrated display (aka All-In-Ones)

- The integrated display is tested with its highest resolution. At its highest resolution (up to 4k), the image should look clean, without any type of corruption.
- The integrated display must support Gnome Shell 42 and basic 3D rendering.
- The system must support display rotation (0°, 90°, 180°, 270°)
- Each of the available external video ports (currently supported HDMI, DisplayPort, Mini Displayport, Thunderbolt 3) are tested one by one. Different modes (mirror, extended, just internal, just external) are required to work. If several external ports are available, they are not required (nor tested) to work simultaneously.

Desktops without an integrated display

- The system is tested using the default BIOS Graphics settings.
- Each of the available external video ports (currently supported HDMI, DisplayPort, Mini

Displayport, Thunderbolt 3) are tested one by one, at their highest resolution (up to 4k). Different modes (mirror, extended, just internal, just external) are required to work.

- If several external ports are available, no matter how many ports are designed to work synchronously on the graphic controller, only two of them (regardless of the combination) are supported simultaneously (dual-head), unless the hardware does not support two monitors setup.
- The system must support Gnome Shell 42 and basic 3D rendering.
- The system must support display rotation (0°, 90°, 180°, 270°)
- Desktops with multiple discrete GPUs are not supported; we only support one discrete GPU, as above.

Convertible Laptops (aka 2-in-1s)
- The system must support display rotation (0°, 90°, 180°, 270°)
- The desktop environment must rotate automatically when sensors detect a rotation
- A swipe up from the bottom edge of the touchscreen should bring up the on-screen keyboard

Input devices

Integrated input devices

- Internal keyboard (basic functionality)
- Trackpoint

Touch screens

Touch screens are tested for single touch and multitouch. Functionality tested:

- Single touch, including single tap and double tap
- For multitouch touch screens with more than two finger support, at least 4 finger gestures must be recognized by the OS. Gestures tested include:
    - 2 finger expand/pinch zoom
    - 3 finger touch-tap
    - 4 finger touch-tap

Touchpads

Capacitive touchpads are tested for single touch and multitouch. Functionality tested:

- Single touch, including single tap and double tap
- Scrolling feature (horizontal and vertical) should work either with the edge scrolling

option or the 2 finger scrolling option.

Internal Storage

All internal storage devices are tested to be properly detected. On all of them, an in-house performance test is run. All disks need to report at least a read performance of 15MB/s.

The following types of internal storage are currently supported/tested:
- PCIe NVMe SSD
- eMMC
- SATA SSD/HDD

LEDs

LED indicators are very common in laptops and some types of desktops. When those 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.

- Power/suspend button LED. This needs to work as prescribed by OEM's expected LED behavior.
- Suspend chassis LED. This needs to work as prescribed by OEM's expected LED behavior.
- Volume mute LED. This needs to work as prescribed by OEM's expected LED behavior.
- Microphone mute LED. Fixed light when input volume is muted.
- Caps lock LED. Fixed light when input is set to all caps.
- Num lock LED. Fixed light when numeric keypad is on.
- Power supply LED. This needs to work as prescribed by OEM's expected LED behavior.
- Camera LED. Fixed light when the camera is on.

Media Card readers

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

- SD
- SDHC

Memory

Proper detection of the amount of memory installed is required (the amount of memory

installed is the memory seen by the OS).

Optical Drives

Optical drives are tested for read based on specifications of the optical unit. Depending on the unit theoretical feature support, we will test:
- CD read capabilities (data only)
- DVD read capabilities (data only)
- Blu Ray-disc read capabilities (data only)

Power Management

Suspend/Resume

A 30 cycle suspend/resume stress test is performed using the fwts suspend test. Only the default suspend method (S3 or s2idle) is required to work. 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.

Apart from the stress test, a single cycle suspend/resume is performed, if it's a hybrid graphic system, suspend and graphic related functionalities are required to work flawlessly on the On-demand mode, and the following features and devices are tested and need to work after suspend:

- CPU
- Memory
- Networking (Wifi, Ethernet)
- Audio
- Bluetooth
- Display resolutions should be consistent before and after suspend
- USB and Thunderbolt controllers
- Input devices
- Mediacards

Cold/Warm boot
Both cold boot and warm boot are tested and required to work. Cold reboot is performed where an RTC is available (see next section).
The following features and devices are tested and need to work after cold/warm boot:

- USB and Thunderbolt controllers

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

Sensors

- Lid close events in laptops need to be recognized by the OS and trigger a system suspend
- Lid open events in laptops need to be recognized by the OS and trigger a system wake up, when suspended.

Thunderbolt 3/4
- Audio output needs to be undistorted over this port.
- USB 3.0 storage devices with hot plugging capability need to work on it with the default BIOS security level.
- Display hot plugging and different modes (mirror, extended, just internal, just external) are required to work.
- Daisy-chain should work with a storage device chained to a monitor (both DisplayPort Tunneling or DisplayPort Alt-Mode must be verified).

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 3.2
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 Type-C 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.

USB4

USB controllers are tested using storage devices in all available USB ports. And the USB human interface device, keyboard or mouse, should be working properly with any USB port.

- Storage devices
- Keyboard or mouse (basic functionality)
- For USB4 controllers that support Thunderbolt, Thunderbolt functionality will be tested

Wireless Networking

Wi-Fi interfaces are tested for connection to access points configured for 802.11 b/g/n/ac/ax (Wi-Fi 6) protocols.

Webcam

Internal main webcams are tested to be able to take static pictures and video.

Non-blocking

Bluetooth

Bluetooth 5.0 is tested for device scanning and pairing. Apart from pairing, several profiles are specifically tested and required:

- Audio (A2DP)
- HID Over GATT Profile (HOGP), Low-Energy keyboard or mouse with basic functionality
- File transfer (OBEX)
- Eddystone URL Beacon

Fingerprint Readers

- Fingerprint readers must be detected by the system, with the appropriate drivers being loaded by [fprintd](#).
- Fingerprint readers must be able to enroll and verify a user's fingerprint using fprintd-enroll and fprintd-verify.
- Use of fingerprint as an unlocking method must be tested and working.

Function keys

- The function keys from external keyboards shipped with the AIO system are supposed to work.
- RGB Keyboard backlight. Backlight of the internal keyboard needs to be turned on and off when pressing the keyboard backlight key.

Graphics

NVLink

Desktops with multiple GPUs can be certified as long as all GPUs are identical. Graphics testing needs to pass on the first GPU. Other GPUs are not tested for graphics output. The nvidia-smi command is used to confirm that NVLINK is set up. without an integrated display.

LEDs

- Wireless LED. Fixed light when wireless signal is on (it can blink when transmitting data).

- Bluetooth LED. Fixed light when bluetooth signal is on.
- Microphone mute LED. Fixed light when input volume is muted.

Input devices

Touchpads

Resistive touchpads are tested for single touch and multitouch. The experience of a resistive touchpad is allowed to be worse than a capacitive touchpad (needs higher FTF - force to fire - to active cursor moving).
Functionality tested:

- Single touch, including single tap and double tap
- Scrolling feature (horizontal and vertical) should work either with the edge scrolling option or the 2 finger scrolling option.

Light Sensor

Systems with an ambient Light Sensor must adjust the screen backlight if Automatic Brightness is enabled in Power settings. By covering the sensor during the test, the backlight should dim.

Optical Drives

Optical drives are tested for read based on specifications of the optical unit. Depending on the unit theoretical feature support, we will test:
- CD write capabilities
- DVD write capabilities
- Bluray-disc write capabilities

Power Management

Suspend/Resume time

On average, resume time needs to be less than 5 seconds, with an overall suspend/resume time of less than 10 seconds.

TPM 2.0

TPM 2.0 functionality will be tested using clevis encrypt and decrypt commands with both RSA and ECC keys with the following options:
- hash algorithm: sha256

- pcr algorithm bank to use for policy: sha256
- pcr ids: 0 and 1 only

Wireless Networking

- Wi-Fi interfaces are tested for connection to access points configured for Wi-Fi 6E protocol.
- network-manager hotspot mode.

Wireless Wide Area Network

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

Unsupported

- Dial-up modems
- Secondary camera (e.g. rear camera, 3D camera, IR Camera)

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.