

Caelaris Linux

Complete Capabilities, Desktop Environments, Performance Optimizations, Driver Matrix, and Feature Comparison

Product Name	Caelaris Linux (x86_64)
Document Type	Product Features & Capabilities Specification
Target Audience	Gamers, Developers, Power Users, and System Evaluators
Primary Desktops	KDE Plasma 6 (Default) & GNOME 4x (Wayland)
Installer Subsystem	Caelaris Native Graphical Installer (PyQt6)
Gaming Stack	Steam, GameMode, MangoHud, VKD3D & Pro-Tuned Sysctl
Date Generated	September 2026

1. Executive Product Overview

Caelaris Linux is a next-generation Arch-based operating system designed for gamers, software engineers, and power users who demand cutting-edge performance with zero configuration headaches. By combining Arch Linux's rolling package model with pre-configured dual desktop environments, automated hardware/virtualization drivers, a custom graphical installer, and pro-grade gaming enhancements, Caelaris Linux delivers an uncompromising desktop experience straight from the ISO.

CAELARIS LINUX FEATURE HIGHLIGHTS	
[1] Dual Desktop Environments	→ KDE Plasma 6 (Default) + GNOME 4x on Wayland
[2] Live Session Hot-Switcher	→ Switch between KDE & GNOME in 2 seconds
[3] Native Graphical Installer	→ Python/PyQt6 wizard with guided Btrfs & Ext4
[4] Silent Direct Bootloader	→ Clean single "Caelaris Linux" entry to SDDM
[5] Single User Profile Purity	→ Zero leftover liveuser profiles after setup
[6] Pro-Grade Gaming Stack	→ vm.max_map_count, GameMode, MangoHud, Steam
[7] Universal Hypervisor Tools	→ VMware, VirtualBox, and QEMU/UTM auto-scaling
[8] Full Software Access	→ Pacman, yay (Arch User Repository), Flathub
[9] Caelaris Welcome Assistant	→ 1-click maintenance tool (shown only once)
[10] PipeWire Pro Audio Graph	→ Low-latency audio with JACK/ALSA/Pulse bridges

2. Desktop Experiences & User Interface

2.1 KDE Plasma 6 (Default Environment)

- **Native Wayland Compositing:** Powered by KWin Wayland compositor, delivering tear-free rendering, fractional display scaling, and multi-touch trackpad gestures.
- **Caelaris Dark Breeze Styling:** Modern visual styling with translucent panels, responsive system tray, and custom wallpapers.
- **Default Utilities:** Dolphin file manager, Konsole terminal emulator, Kate text editor, and Spectacle screenshot utility.

2.2 GNOME 4x (Alternative Environment)

- **Fluid Navigation:** Driven by Mutter Wayland compositor with gesture-driven workspace management and unified Activities search.
- **Default Suite:** Nautilus file manager, GNOME Terminal, Loupe image viewer, and Text Editor.

2.3 Instant Desktop Hot-Switcher

Users can seamlessly switch between KDE Plasma 6 and GNOME during live preview via `caelaris-switch-desktop` in under 2 seconds without restarting the system. Post-installation, the user can freely choose between Plasma and GNOME at every SDDM login.

3. Installation & First-Boot Experience

3.1 Caelaris Native Graphical Installer

- **PyQt6 Wizard:** High-performance multithreaded GUI installer ensuring responsive feedback during intensive disk operations.
- **Guided Storage Layout:**
 - **Btrfs Mode (Recommended):** Automatically configures subvolumes (`@` , `@home` , `@cache` , `@snapshots`) with transparent zstd compression.
 - **Ext4 Mode:** Traditional, highly robust filesystem for maximum compatibility.
 - **EFI System Partition:** Automatic FAT32 creation mounted to `/boot/efi`.
- **Automated Driver Activation:** Auto-enables VMware tools, VirtualBox guest services, SPICE agents, and NVIDIA DRM modesetting.

3.2 Single User Profile Guarantee

Pristine System State: Only your setup profile will exist on the installed disk.

The installer completely removes `liveuser` (via `userdel -r -f liveuser`), purges `/etc/sysusers.d/caelaris-liveuser.conf`, and removes all installer shortcuts from the user's Desktop so the system boots into a clean personal workspace.

3.3 Silent Direct Bootloader

- **Clean Title:** Displays strictly `Caelaris Linux` in the GRUB boot menu.
- **Suppressed Terminal Clutter:** Uses `quiet loglevel=3 rd.udev.log_level=3 systemd.show_status=0 vt.global_cursor_default=0` to transition silently straight into SDDM.
- **Universal Removable Fallback:** Deploys `EFI/B00T/B00TX64.EFI` to prevent UEFI boot loops in VMware Workstation.

4. Gaming & Extreme Performance Stack

4.1 Pro-Grade Sysctl Tuning

Kernel Sysctl Parameter	Configured Value	Gaming & Performance Benefit
<code>vm.max_map_count</code>	<code>2147483642</code>	Prevents crashes in memory-mapped titles (Star Citizen, Hogwarts Legacy, Proton).
<code>vm.swappiness</code>	<code>10</code>	Keeps game memory pages in physical RAM, preventing disk I/O stutters.
<code>net.core.default_qdisc</code>	<code>cake</code>	Eliminates bufferbloat and latency spikes during multiplayer online gaming.
<code>net.ipv4.tcp_congestion_control</code>	<code>bbr</code>	Google BBR congestion algorithm for maximum network throughput and lower ping.

4.2 Gaming Software Suite

- **Steam Client:** Pre-installed and Proton-ready.
- **MangoHud:** Real-time hardware telemetry overlay for 64-bit and 32-bit Vulkan/OpenGL titles.
- **Feral GameMode:** Automatically applies CPU performance governors and process priority during games.
- **VKD3D:** Full DirectX 12 translation layer.

5. Universal Virtualization & Hardware Drivers

Platform / Hardware	Integrated Drivers & Daemons	User Capabilities
VMware Workstation / Fusion	<code>open-vm-tools</code> , <code>vmtoolsd</code> , <code>vmware-vmblock-fuse</code>	Dynamic 1080p window auto-resize, host shared folders, two-way clipboard.
Oracle VirtualBox	<code>virtualbox-guest-utils</code> , <code>vboxservice</code>	Bidirectional clipboard, mouse integration, auto display scaling.
QEMU / KVM / UTM (macOS)	<code>spice-vdagent</code> , <code>spice-vdagentd</code> , <code>qemu-guest-agent</code>	SPICE guest display scaling, clipboard sharing, host management.
NVIDIA GeForce GPUs	NVIDIA proprietary utils & auto DRM modeset	Full 3D acceleration with <code>options nvidia-drm modeset=1</code> .
AMD Radeon GPUs	<code>amdgpu</code> & Mesa <code>vulkan-radeon</code> (RADV)	Out-of-the-box Vulkan gaming and hardware VA-API video decode.
Intel Arc / Iris Xe	<code>i915</code> / <code>xe</code> & Mesa <code>vulkan-intel</code> (ANV)	Hardware acceleration and Intel Media Driver VA-API video decode.

6. Feature Comparison Matrix

Feature / Capability	Caearis Linux	Vanilla Arch	Manjaro	Pop!_OS	Fedora
Dual Desktop (KDE + GNOME)	Yes (Unified)	Manual	Separate ISOs	Separate Spins	Separate Spins
Live Session Hot-Switcher	Yes (< 2s)	No	No	No	No
Custom Graphical Installer	Yes (PyQt6)	No (CLI)	Calamares	Custom	Anaconda
Tuned Low-Latency Gaming Sysctl	Yes (Default)	Manual	No	Partial	Partial
VMware & VBox Auto-Resize	Yes (Built-in)	Manual	Partial	Partial	Partial
Silent Direct Bootloader	Yes	Manual	Partial	Partial	Yes
Purged Single User Profile	Yes	N/A	Yes	Yes	Yes
Bundled yay AUR Helper	Yes	Manual	Pamac	Paru/Yay	No (COPR)
PipeWire Low-Latency Audio	Yes	Manual	Yes	Yes	Yes

7. Platform Architecture & Raspberry Pi / ARM64 Roadmap

7.1 Tier 1: x86_64 PCs, Laptops & Virtual Machines (Production)

The current production release of Caelaris Linux targets 64-bit x86_64 hardware (Intel & AMD) alongside major desktop hypervisors (VMware, VirtualBox, QEMU/SPICE). It is distributed as a live bootable hybrid ISO featuring automated Btrfs partitioning and native PyQt6 installation.

7.2 Tier 2: ARM64 & Raspberry Pi Edition (Active Build & Release Pipeline)

Single-Board Computer Expansion: Bringing Caelaris Linux's dual Wayland desktop environments and pro performance tuning to ARM64 single-board computers, natively supporting the **Raspberry Pi 5**, **Raspberry Pi 4 Model B**, and **Raspberry Pi 3 Model B+**.

Subsystem	Raspberry Pi Edition Specification	Technical Capabilities
Target Devices	Raspberry Pi 5 (4GB / 8GB), Raspberry Pi 4 Model B (4GB / 8GB), Raspberry Pi 3 Model B+ (1GB).	Desktop-class dual session performance on Pi 5; tuned Wayland profile on Pi 4; memory-optimized zstd ZRAM swap & CMA tuning on Pi 3B+.
OS Baseline	Arch Linux ARM (<code>aarch64</code> ALARM).	Rolling release model, full Arch User Repository (AUR) access via bundled <code>yay</code> .
Kernel & Graphics	<code>linux-rpi</code> vendor kernel + Broadcom VideoCore VII (Pi 5), VI (Pi 4), and IV (Pi 3B+).	Hardware-accelerated Wayland rendering (V3D / VC4 KMS) for KDE Plasma 6 and GNOME sessions.
Distribution Formats	Hybrid UEFI ARM64 ISO (<code>.iso</code>) & Flashable raw disk image (<code>.img.xz</code>).	Direct writing to MicroSD cards, USB SSDs, or NVMe HATs via Raspberry Pi Imager or BalenaEtcher, plus universal UEFI ISO booting.
Gaming & Emulation	<code>Box64</code> , <code>FEX-Emu</code> , RetroArch, Steam ARM experimental.	Enables execution of x86 game binaries and retro console emulation on ARM64.

7.3 Tier 3: ARM64 Laptops, Apple Silicon & Snapdragon PCs (Active Release Pipeline)

ARM Laptop Revolution: Engineered for high-efficiency mobile compute, providing native Wayland desktop performance on **Apple Silicon (M1/M2/M3/M4)** and **Qualcomm Snapdragon X Elite / Plus** laptops.

Subsystem	ARM64 Laptop Specification	Technical Capabilities
Target Devices	Apple Silicon Macs (M1/M2/M3/M4), Qualcomm Snapdragon X Elite/Plus laptops, ThinkPad X13s, ARM64 workstations.	Dual-boot on Mac via Asahi U-Boot or 100% native CPU virtualization via UTM; standard UEFI boot on Snapdragon laptops.
OS Baseline	Arch Linux ARM (<code>aarch64</code> ALARM).	Rolling release model, full Arch User Repository (AUR) access via bundled <code>yay</code> .
Kernel & Graphics	Standard AArch64 kernel + Mesa Freedreno (Adreno) & Mesa Apple AGX.	Hardware-accelerated Wayland rendering for KDE Plasma 6 and GNOME sessions.
Distribution Format	Uncompromised Full Desktop Hybrid UEFI ARM64 ISO (<code>caelaris-arm64-pc.iso</code> , ~4.0GB).	Multi-part split downloads, 1-click <code>combine.bat</code> reassembly, and standard UEFI bootloader (<code>BOOTAA64.EFI</code>) on dedicated <code>arm64-pc-release</code> .
Emulation & Memory	<code>Box64</code> , <code>FEX-Emu</code> , dynamic zstd ZRAM.	High-speed x86 translation for games and apps with dynamic memory compression.