V1.0

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Overview

This document provides information about the Linux Board Support Package (BSP) release for the CIX P1

System-on-Chip (SOC). This BSP is designed to support development on platforms and evaluation boards

based on the CIX P1 SOC. This document contains important information about the package contents,

supported features, known issues and limitations in this release. The BSP is based on the Linux kernel 6.6.89

and includes necessary drivers, bootloaders, kernel configurations, and Debian12 OS to enable core

functionality and facilitate product development.

Version Information

The following table lists the Key Version information for the BSP release.

Table 1. BSP Key version information

Component	Version / Details
BSP Version	CIX_P1_BSP_Linux_K6.6_25Q4

Component	Version / Details
Linux Kernel	Kernel Version 6.6.89
Bootloader	UEFI EDK2
Toolchain	GCC 12.3, Glibc 2.38
Linux OS	Debian12.11, OpenKylin 2.0, Deepin v23
Supported Boards List	Radxa O6 Board, CIX P1 EVB

Release contents

This release consists of the following:

- UEFI edk2 source code

- Linux Kernel source code

    o Including Kernel source and all IP's KMD driver source code

- Chromium-cix source code

- Cix ffmpeg patch source code

- Cix gstreamer patch source code

- Cix_vpu_test source code

- Cix Building System

  - Construct the building environment for SDK, building and generating BIOS, Debian12 OS image

- Documentation:

  - Please download OS documemts from https://developer.cixtech.com/

  - Radxa O6 : https://docs.radxa.com/orion/o6

Table 2. BSP and Middleware deb packages

Category	Deb Filename	Description
Graphics & Display	cix-gpu-umd_2.0.0_arm64.deb	CIXGPU-Pro graphics stack, support OpenGL ES, Vulkan and OpenCL
	cix-mesa_24.0.4_arm64.deb	CIXGPU-compat graphics stack base on mesa lib, support OpenGL, OpenGL ES
	cix-gpu-driver_1.0.0_arm64.deb	GPU kernel mode driver

	cix-gpu-dkms_1.0.0_arm64.deb	GPU kernel DKMS build
	cix-libglvnd_1.7.0_arm64.deb	CIX customized libglvnd
	mutter-common_43.8-0+deb12u1+cix_all.deb	Mutter Common
	libmutter-11-0_43.8-0+deb12u1+cix_arm64.deb.deb	CIX customized libmutter
	cix-libdrm_1.0.0_arm64.deb	Cix customized gpu drm
	xwayland_22.1.9-1+cix_arm64.deb	Xserver 1.0.0 version
Multimedia – Video encoder/decoder	cix-vpu-driver_1.0.0_arm64.deb	VPU kernel mode driver
	cix-gstreamer_1.22.1_arm64.deb	Gstreamer 1.22.1 CIX pre-compiled pack, with VPU accelerated V4L2 plug-in.
	ffmpeg_5.1.7-0+deb12u1+cix_arm64.deb libavcodec59_5.1.7-0+deb12u1+cix_arm64.deb libavformat59_5.1.7-0+deb12u1+cix_arm64.deb libavutil57_5.1.7-0+deb12u1+cix_arm64.deb	ffmpeg 5.1.6 CIX pre-compiled pack, with VPU accelerated V4L2 M2M decoders and encoders.

	libswscale6_5.1.7-0+deb12u1+cix_arm64.deb libavfilter8_5.1.7-0+deb12u1+cix_arm64.deb libavdevice59_5.1.7-0+deb12u1+cix_arm64.deb	
	chromium_128.0.6613.84-1~deb12u1_arm64.deb chromium-common_128.0.6613.84- 1~deb12u1_arm64.deb	Chromium 128.0.6613.84 CIX pre-compiled pack with VPU decode acceleration.
	cix-vpu-test_1.0.0_arm64.deb	VPU unit test apps and tools including mvx_decoder, mvx_encoder, mvx_logd and mvx_info
AI SDK	cix-npu-driver_2.0.2_arm64.deb	NPU kernel mode driver
	cix-npu-onnxruntime_1.1.0_arm64.deb	NPU onnxruntime libs
	cix-llama-cpp_1.2.4_arm64.deb	Llama.cpp libs and bins for LLM

	cix-mnn_1.2.1_arm64.deb	MNN runtime libs and bins for LLM
	cix-noe-umd_2.0.2_arm64.deb	NPU NOE userspace libs for inference APIs
Audio-DSP SDK	cix-audio-dsp_1.0.0_arm64.deb	DSP SDK for Audio encoder and decoder with HIFI
ISP SDK	cix-isp-driver_1.0.0_arm64.deb	ISP Linux driver
	cix-isp-driver-v4l2_1.0.0_arm64.deb	ISP V4L2 Linux driver
	cix-isp-umd_1.0.0_arm64.deb	ISP demo app & sensor tuning parameter
	cix-csidma-driver_1.0.0_arm64.deb	MIPI CSI DMA linux driver
Wireless	cix-bt-driver_1.0.0_arm64.deb	RTL USB BT driver BT stack
	cix-wlan_1.0.0_arm64.deb	RTL WIFI linux driver

Security SDK	cix-optee_1.0.0_arm64.deb	Optee OS and TA/CA application
Debian 12	cix-env_1.0.0_arm64.deb	Cix Debian 12 environment setup
	cix-debian-misc_1.0.0_arm64.deb	Debian configuration
	linux-headers-6.6.89-cix-build-generic_6.6.89-02745-g0c00331da44a-2_arm64.deb	Linux header
	linux-image-6.6.89-cix-build-generic_6.6.89-02745-g0c00331da44a-2_arm64.deb	Linux Kernel Image
	linux-libc-dev_6.6.89-02745-g0c00331da44a-2_arm64.deb	Linux userspace libaries
	cix-cpipe_1.0.0_arm64.deb	Cix data pipe control
	cix-common-misc_1.0.0_arm64.deb	OS service configuration
	irqbalance_1.9.2-1+cix_arm64.deb	Irqbalance optimized by Cix
	cix-tools_1.0.0_arm64.deb	Debian general tools

	firmware-amd-graphics_20230210-5_all.deb	Linux Firmware and Cix
	firmware-linux-nonfree_20230210-5_all.deb	wlan/bt/vpu/gpu/sensor
	firmware-misc-nonfree_20230210-5_all.deb	firmware
	cix-firmware_1.0.0_arm64.deb	

What's New?

This section describes the changes in this release, including new features and defect fixes.

New features

A summary of the main new features is as follows. New features added for all supported boards:

• Upgraded the kernel to 6.6.89 with consolidated Linux Factory Kernel.

• Audio framework switch to Pipewire from Pulseaudio

• Audio HDA driver update to compatible with Linux HDA common framework

• Cix AI libnoe and noe_engine api upgrade

• libnoe and noe_engine upgrade through whl package

• Cix AI modelhub new models and demo support

• Support GPU kernel DKMS build

• Support AV1 P010 format for mpv

• Add more Debian12 Applications support like shimo document and yelp

• Support for multiple cameras in V4L2/Gstreamer cmd

• FFmpeg:

    - Support VAAPI HEVC decode acceleration

    - Support dma-buf in v4l2m2m codec

    - Support VPU accelerated scaling and CSC filter

• Added VAAPI H.264 & HEVC decode driver

• Added nnstreamer NOE plug-ins for AI inference pipeline

• Added VPU dkms driver

• VPU: support priority scheduling and encode lambda tuning features

BSP Supported Features

The following table describes the features that are supported in this BSP release. In this table, if no board is explicitly stated, the feature is shared across all boards listed. Otherwise, the feature is only supported on the supported boards listed.

Table 3.   BSP Feature List

Category	Features

UEFI	・Support boot Linux OS(Debian/Openkylin/Deepin) with Grub
	・Support Linux Distro like Debian12 and Ubuntu offical release
	・Boot Storage from SPI Nor Flash
	・OS Boot Device from NVME and USB storage
	・Serial Console under UEFI
	・UEFI Shell support
	・Filesystem Ext4 and FAT support
	・Show Information with EC/BIOS version
	・GOP support with eDP, TypeC DP and HDMI
	・OS Installation from USB
	・Firmware package and Tools delivery
	・Enable cpuidle by default
	・After rebooting LinuxOS, the bootloader supports entering fastboot mode.
	・UEFI add AP-to-CSU message for PMIC version
Security	・ARM Trusted Firmware
	・Secure Boot
	・Optee OS and TEE crypto/KM support
Multimedia	・HW decode support: JPEG, MPEG-4 / MPEG-2, AV1, H.263, H.264, H.265, VP8, VP9

	・HW encode support: JPEG, H.264, H.265, VP8, VP9・Dynamic resolution change in non-key-frame
	・VPU DFS support
	・Dsp Codecs (mp3 decoder, vorbis decoder, heaacv2 encoder, xheaac decoder, opus codec, aaceldv2 codec, flac decoder, mixer) based on XAF API 3.6
	・Totem with VPU and GPU acceleration
	・Gstreamer v4l2 video encoder/decoder support
	・Gstreamer image decoders and encoders - JPEG and HEVC still
	・Audio with ALSA-lib support
	・Audio HDA HP/LINE out and IN support
	・Audio JACK detection support
	・ISP supports online & offline pipeline
	・Support dual-camera
Graphics & Display	・Support OpenGL ES, Vulkan and OpenCL
	・WebGL support with OpenGL ES acceleration
	・Gnome Wayland/XWayland support for Debian12
	・DDE Kwin_wayland support for Deepin
	・WLCOM support for Openkylin2.0
	・Glvnd based application adoption layer support
	・Support Display with eDP, TypeC, HDMI

	・Support DPU crop, scale, rotate feature ・Multiple displays support ・Direct Render Manager (DRM) ・Linux FB console support
AI	・Model-hub & AI SDK
IO	・USB2.0, USB3.0 HOST/Device ・USB UVC support ・PCIe x1/x2/x4 support ・GPIO/PWM/UART/I2C/SPI/DMA support ・PCIe NIC ・PCIe WLAN + USB BT ・GMAC 10/100/1000Mps support with TSO
Power Management	・System idle ・System STR ・SMP, CPU hotplug ・Clock Manager (Linux CCF) ・CPU idle, CPU dvfs ・Power domain manager ・IP Runtime PM ・System shutdown

	・System reboot ・Thermal Management
OS	・Debian12, Openkylin2.0 and Deepin v23 OS support ・Debian12, Openkylin2.0 and Deepin v23 suspend/resume ・Support Debian12, Openkylin2.0 and Deepin v23 shutdown ・Support Debian12, Openkylin2.0 and Deepin v23 S3/S5 wakeup and Reboot ・Support Debian12, Openkylin2.0 and Deepin v23 multiple display with GPU rendering desktop ・Support USB and USB BT mouse/keyboard ・Support EC keyboard and backlight ・Support charger and battery status display ・Support Network Wired and WIFI, Bluetooth ・Audio Output and Input device selectable ・Audio System Volume selectable ・Support Display mode configuration ・Support display extension, orientation and mirror mode ・Support Multiple Displays Join / Mirror selectable ・Support Multiple Displays Primary Display selectable ・Support Multiple Displays Turn off/on one display ・Support Debian12 ISO installer

	・Support Arm64 application for the native compiling with GCC 12.3 ・Support Arm64 kernel module built with DKMS
Key apps for demo	・WPSOffice/ Libreoffice ・Fcitx / IBus ・VLC / SMplayer / Totem / MPV ・浩辰 CAD ・Vscode ・Chromium ・AI Demo Manager

Known Issues/Limitations

Read through all hardware-related reference material and ensure that the necessary

hardware modifications are made before using the software.

The following tables list some key known issues:

- System rarely occurred "xhci-hcd xhci-hcd.10.auto: PM: failed to suspend async: error -22" during str stress.

- System rarely failed to enter fastboot mode and ASSERT in UEFI

- Kernel panic occurred on snd_hda_core during video playback with STR, rarely

- It appears "Wait for STR magic failed" during stress STR, rarely

- The screenshot app cause kernel panic on Deepin OS

- PCIe NIC WOL setting reverts from g to d after system reboot

- USB2.0 device is lost during reboot stress, rarely

- Chromium cannot launch firstly after installing the system using ISO, still work after reboot

- The 192K recording file has big noise using DMIC for HDA/I2S

- The screen flicker during the test of the model-hub sd-demo on a 4K screen

- AOC(U27N10R) HDMI display does not light up after STR wake-up

- Not detect /dev/video device on Linux PC when EVB as UVC mode

- No audio output from the right channel after reboot, need to set up again

- The isp.ko module prevents the camera from capturing images on Deepin OS

- Cheese preview showing green pictures at begin few frames

- SAMSUNG 4K display may not light up after boot, rarely

- The value of NPU top power state register is inconsistent with the actual

  situation

- TEE secure storage case test failed on Linux EVB (w25 chip)