BeagleY-AI

Release 1.0.20240415

BeagleBoard.org Foundation
Apr 15, 2024

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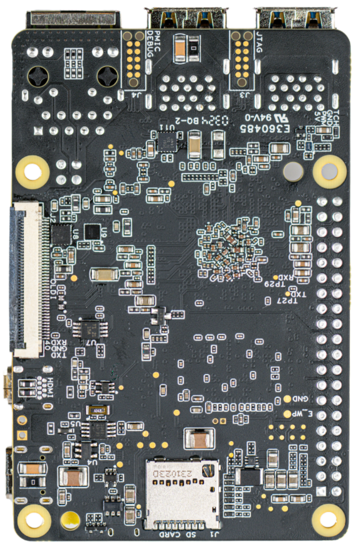
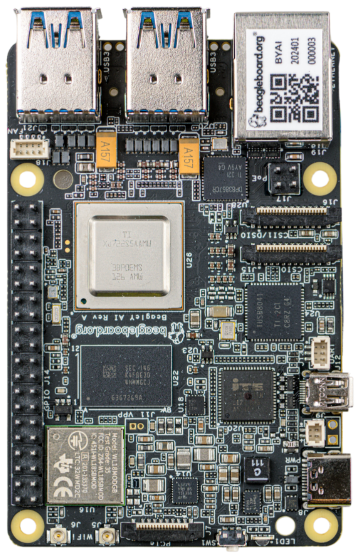
Important: This is a work in progress, for latest documentation please visit https://docs.beagleboard.org/latest/

BeagleY-AI is an open-source single board computer based on the Texas Instruments AM67A Arm-based vision processor.

License Terms

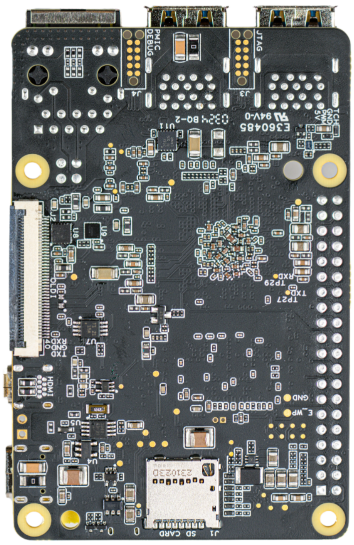


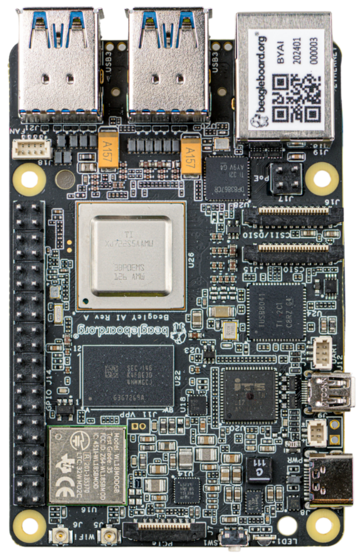


Chapter 1

Introduction

BeagleY-AI is an open-source single board computer designed for edge AI applications.





1.1 Detailed overview

It is based on Texas Instruments AM67A Arm-based vision processor with quad-core 64-bit Arm®Cortex®-A53 CPU subsystem at 1.4GHz, Dual general-purpose C7x DSP with Matrix Multiply Accelerator (MMA) capable of 4 TOPs, Arm Cortex-R5 subsystem for low-latency I/O and control, GPU, video and vision accelerators, and other specialized processing capability.

Table 1.1: BeagleY-AI features

Feature	Description
Processor	TI AM67, Quad 64-bit Arm® Cortex®-A53 microprocessor subsystem at up to 1.4 GHz, multiple cores including Arm/GPU processors, DSP, and vision/deep learning accelerators
RAM	4GB LPDDR4
Wi-Fi	Beagleboard BM3301, 802.11ax Wi-Fi
Bluetooth	Bluetooth Low Energy 5.4 (BLE)
USB Ports	4 x USB 3.0 TypeA ports supporting simultaneous 5Gbps operation, 1 x USB 2.0 TypeC, supports USB 2.0 device
Ethernet	Gigabit Ethernet, with PoE+ support (requires separate PoE+ HAT)
Camera/Display	1 x 4-lane MIPI camera/display transceivers, 1 x 4-lane MIPI camera
Display Output	1 x HDMI display, 1 x OLDI display
Real-time Clock (RTC)	Supports external button battery for power failure time retention. only populated on EVT samples.
Debug UART	1 x 3-pin debug UART
Power	5V/5A DC power via USB-C, with Power Delivery support
Power Button	On/Off included
PCIe Interface	PCI-Express® Gen3 x 1 interface for fast peripherals (requires separate M.2 HAT or other adapter)
Expansion Connector	40-pin header
Fan connector	1 x 4-pin fan connector, supports PWM speed control and speed measurement
Storage	microSD card slot, with support for high-speed SDR104 mode
Tag Connect	1 x JTAG, 1 x Tag Connect for PMIC NVM Programming

1.1.1 AM67A SoC

1.1.2 Board components location

Front

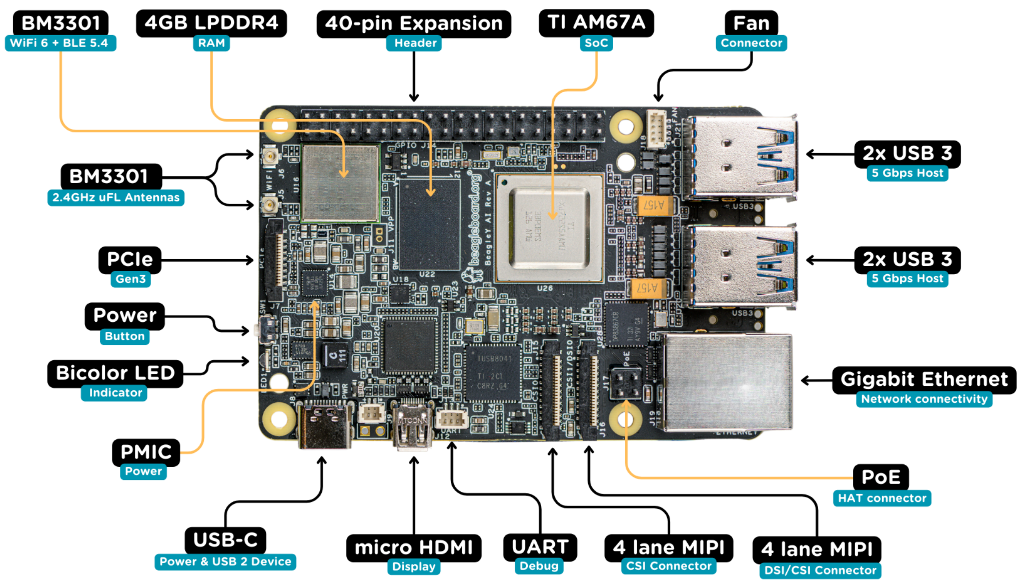


Table 1.2: BeagleY-AI board front components location

Feature	Description
WiFi/BLE	Beagleboard BM3301 with 802.11ax Wi-Fi & Bluetooth Low Energy 5.4 (BLE)
RAM	4GB LPDDR4
Expansion	40pin Expansion header compatible with HATs
SoC	TI AM67A Arm®Cortex®-A53 4 TOPS vision SoC with RGB-IR ISP for 4 cameras, machine vision, robotics, and smart HMI
Fan	4pin Fan connector
USB-A	4 x USB 3 TypeA ports supporting simultaneous 5Gbps operation host ports
Network Connectivity	Gigabit Ethernet
PoE	Power over Ethernet HAT connector
Camera/Display	1 x 4-lane MIPI camera/display transceivers, 1 x 4-lane MIPI camera
Debug UART	1 x 3-pin JST-SH 1.0mm debug UART port
Display Output	1 x HDMI display
USB-C	1 x Type-C port for power, and supports USB 2 device
PMIC	Power Management Integrated Circuit for 5V/5A DC power via USB-C with Power Delivery support
Bicolor LED	Indicator LED
Power button	ON/OFF button
PCIe	PCI-Express® Gen3 x 1 interface for fast peripherals (requires separate M.2 HAT or other adapter)

Back

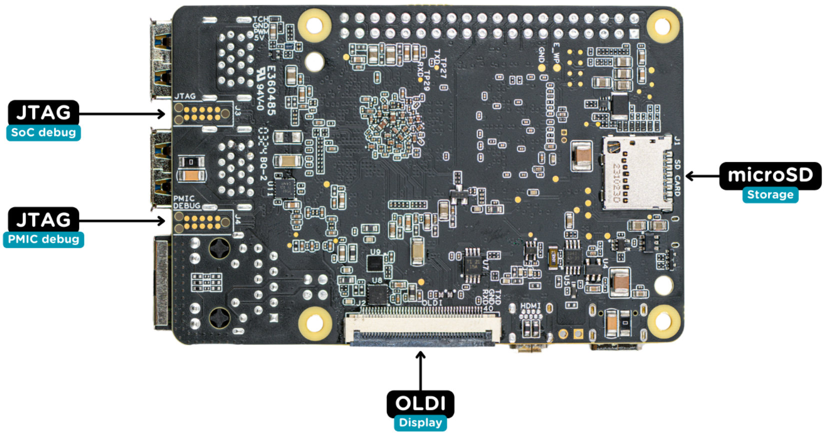


Table 1.3: BeagleY-AI board back components location

Feature	Description
Tag-Connect	1 x JTAG & 1 x Tag Connect for PMIC NVM Programming
Display output	1 x OLDI display
Storage	microSD card slot with support for high-speed SDR104 mode

Chapter 2

BeagleY-AI Quick Start

2.1 What's included in the box?

When you purchase a brand new BeagleY-AI, In the box you'll get:

1. BeagleY-AI
2. JST-SH cables
3. 2.4GHz antennas
4. Quick-start card

Tip: For board files, 3D model, and more, you can checkout BeagleY-AI repository on OpenBeagle.

2.2 Getting started

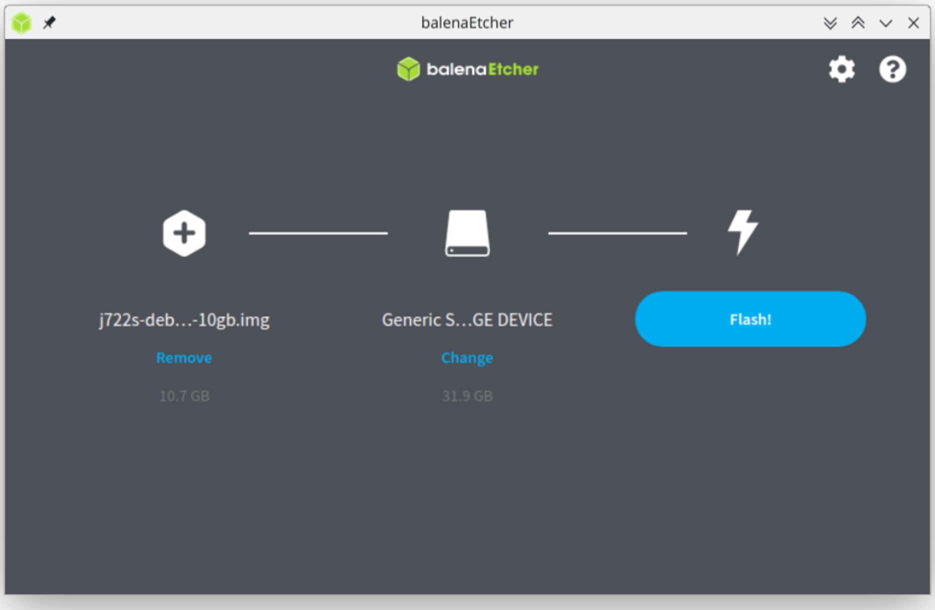
To get started you need the following:

1. USB Type-A to Type-C cable or Type-C to Type-C cable
2. 5V > 3A power supply
3. Micro SD Card
4. Boot media

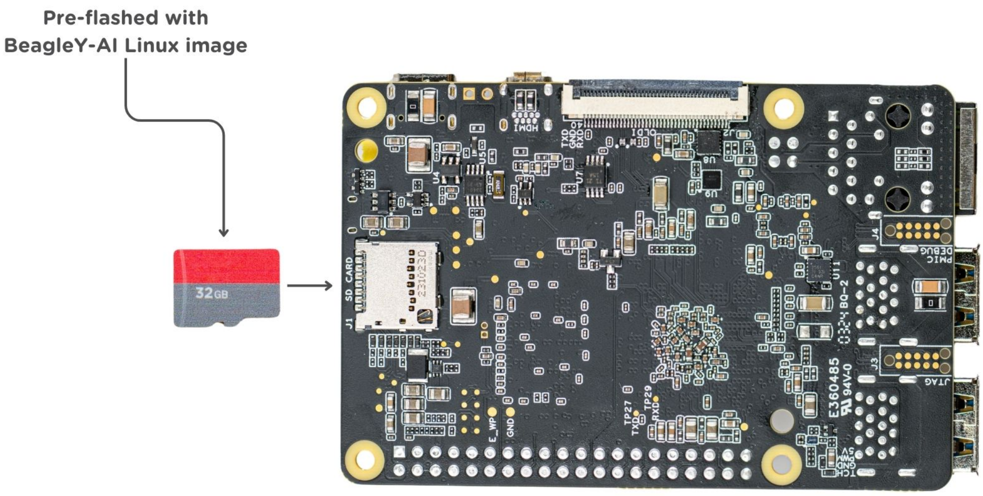
2.2.1 Boot Media

Download the boot media from https://www.beagleboard.org/distros/beagley-ai-debian-xfce-12-5-2024-03-25 and flash it on a micro SD Card using using Balena Etcher following these steps:

1. Select downloaded boot media
2. Select SD Card
3. Flash!



Once flashed, you can insert the SD card into your BeagleY-AI as shown in the image below:



2.2.2 Power Supply

To power the board you can either connect it to a dedicated power supply like a mobile charger or a wall adapter that can provide 5V ≥ 3A. Checkout docs power supply page for recommended power supply.

2.2.3 Board connection

There is only one USB type-c port on board, if you choose to use a dedicated power supply you have to access to board via any of the following methods:

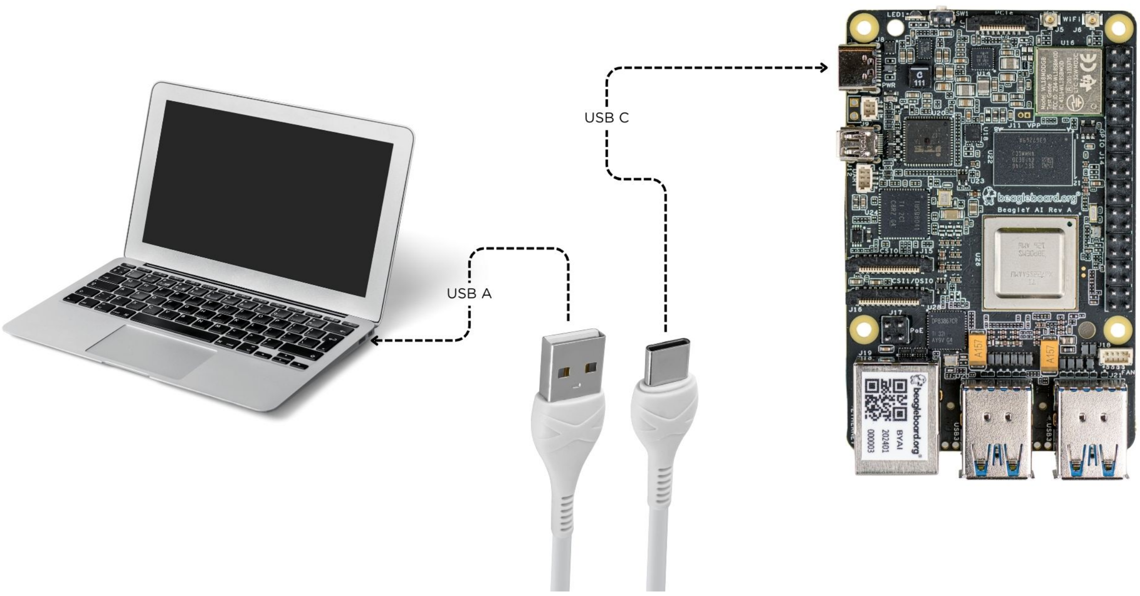
1. Connection to HDMI display, Keyboard and Mouse
2. UART using rpi pico debug probe or similar
3. Ethernet network connection

Another direct and easy option is to connect the board directly to your PC or Laptop using a USB type-a to type-c cable. This is not recommended if you are doing any heavy task on your BeagleY-AI but, for testing this should be fine.

Note: If you are using the board with a fan or running a heavy task you should always power the board with a dedicated power supply that can supply 5V ≥ 3A.

2.2.4 USB Tethering

To initially test your board, you can connect the board directly to your computer using a type-a to type-c cable shown in the image below.



After connecting, you should see Power LED glow, and soon just like with other Beagles, you'll see a virtual wired connection on your computer. To access the board you can use ssh as shown below.

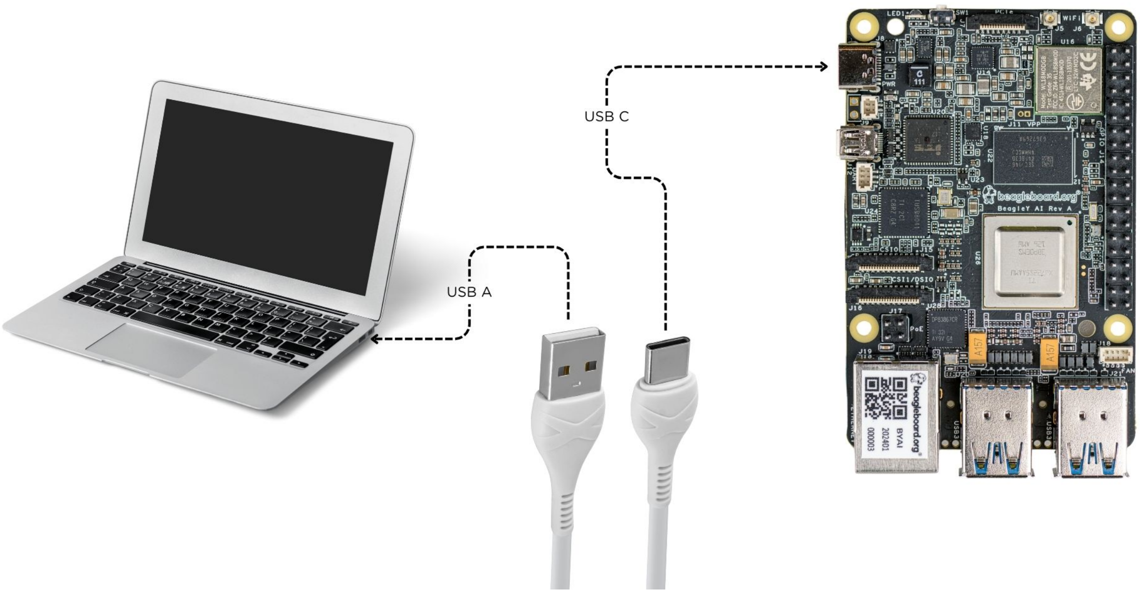
Note: Here you must update the default password to something safer.

```
[lorforlinux@fedora ~] $ ssh debian@192.168.7.2
Debian GNU/Linux 12

BeagleBoard.org Debian Bookworm Xfce Image 2024-03-25
Support: https://bbb.io/debian
default username is [debian] with a one time password of [temppwd]

debian@192.168.7.2's password:
You are required to change your password immediately (administrator enforced).
You are required to change your password immediately (administrator enforced).

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Mar 25 06:56:39 2024 from 192.168.7.1
WARNING: Your password has expired.
You must change your password now and login again!
Changing password for debian.
Current password:
```

2.2.5 Using BeagleY-AI

To setup your BeagleY-AI for normal usage, connect the following:

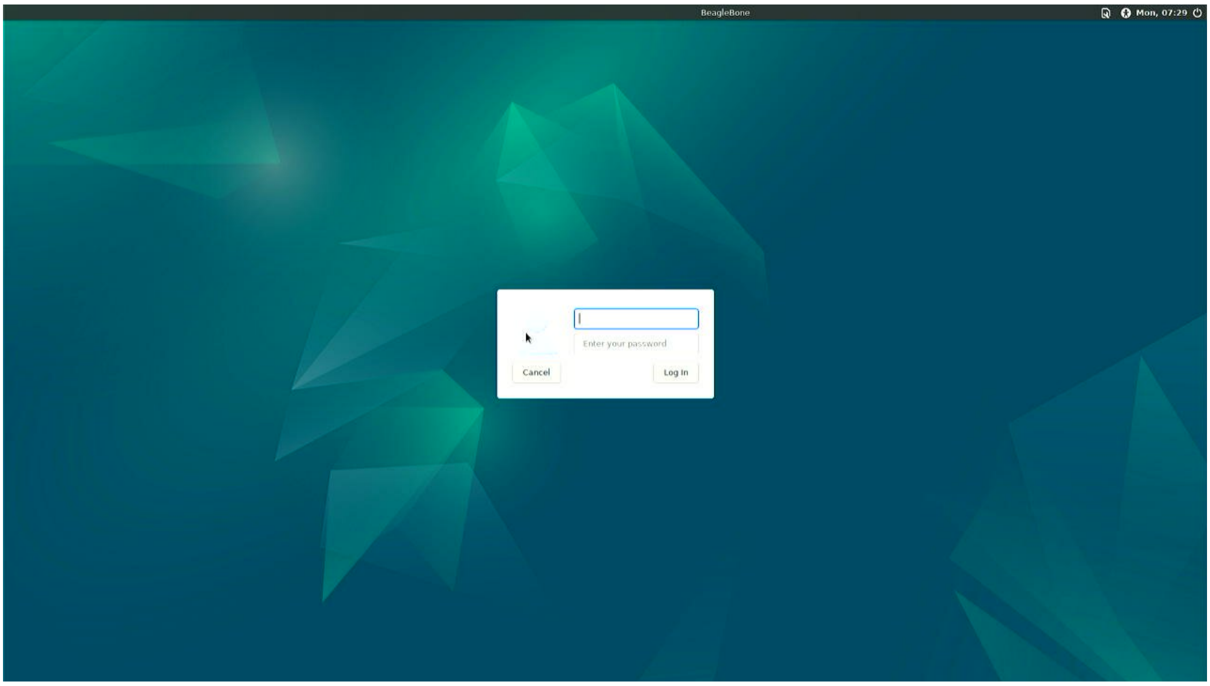
1. 5V ≥ 3A power supply
2. HDMI monitor using micro HDMI to full-size HDMI cable
3. Ethernet cable from the board to your router
4. Wireless or wired keyboard & mice



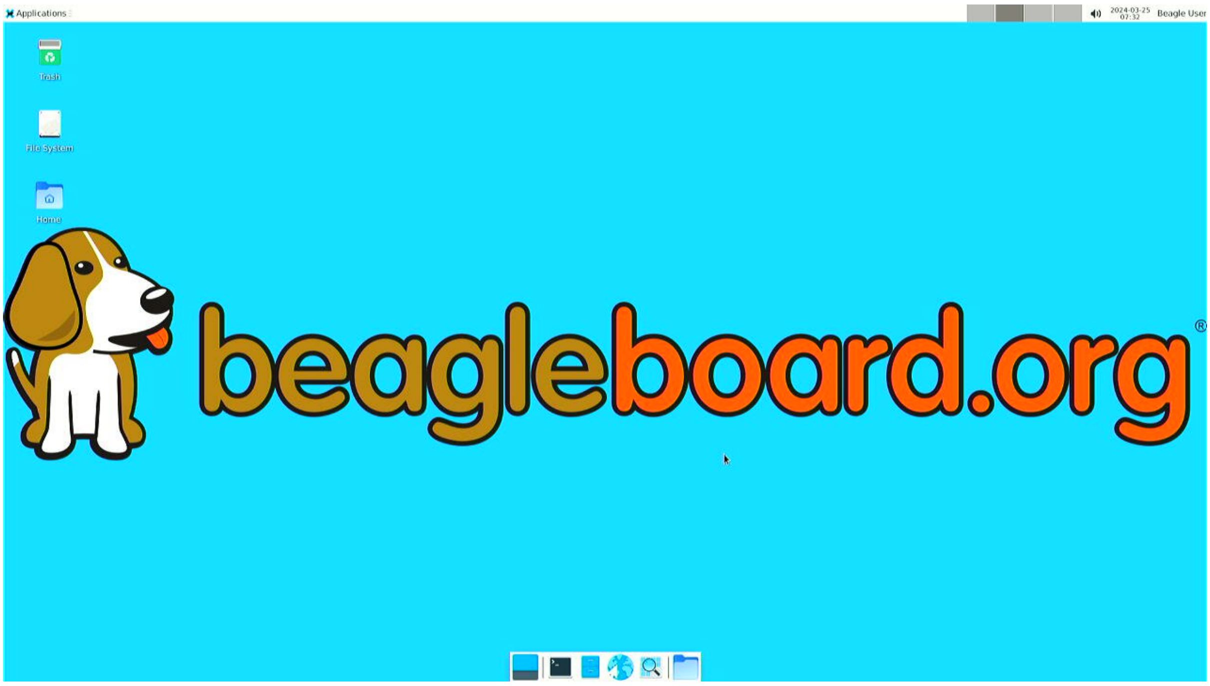
If everything is connected properly you should see four penguins on your monitor.

When prompted, log in using the updated login credentials you updated during the USB tethering step.

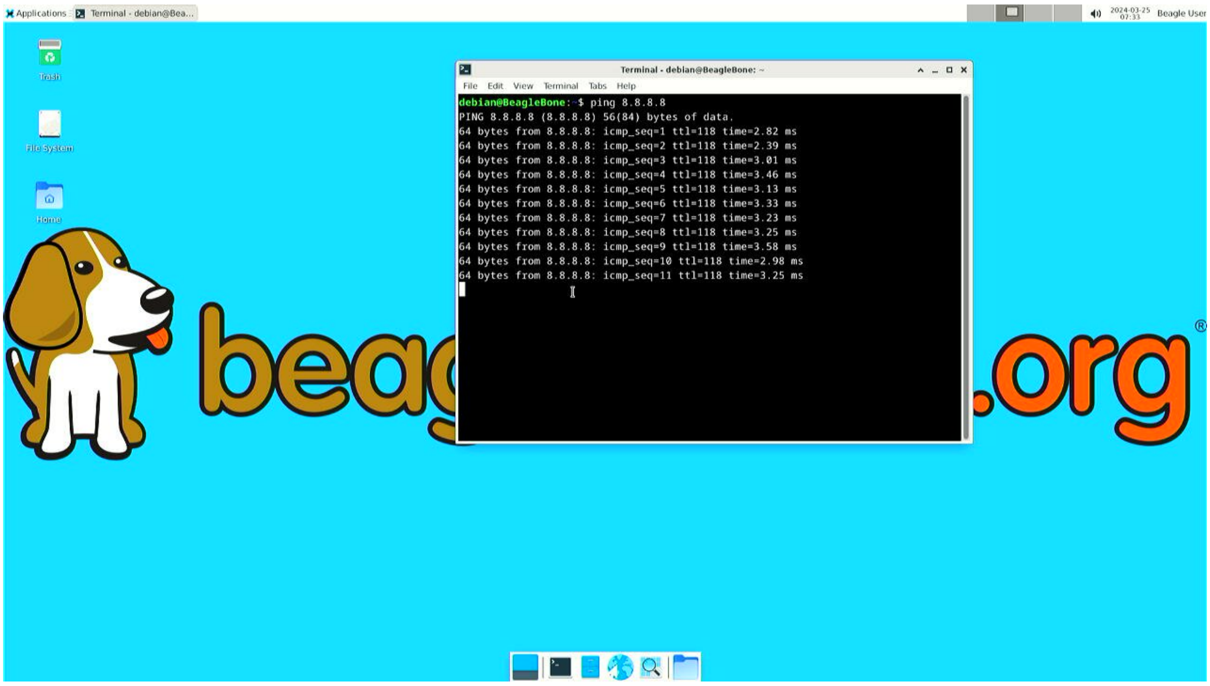
Note: You can not update login credentials at this step, you must update them during USB tethering step!



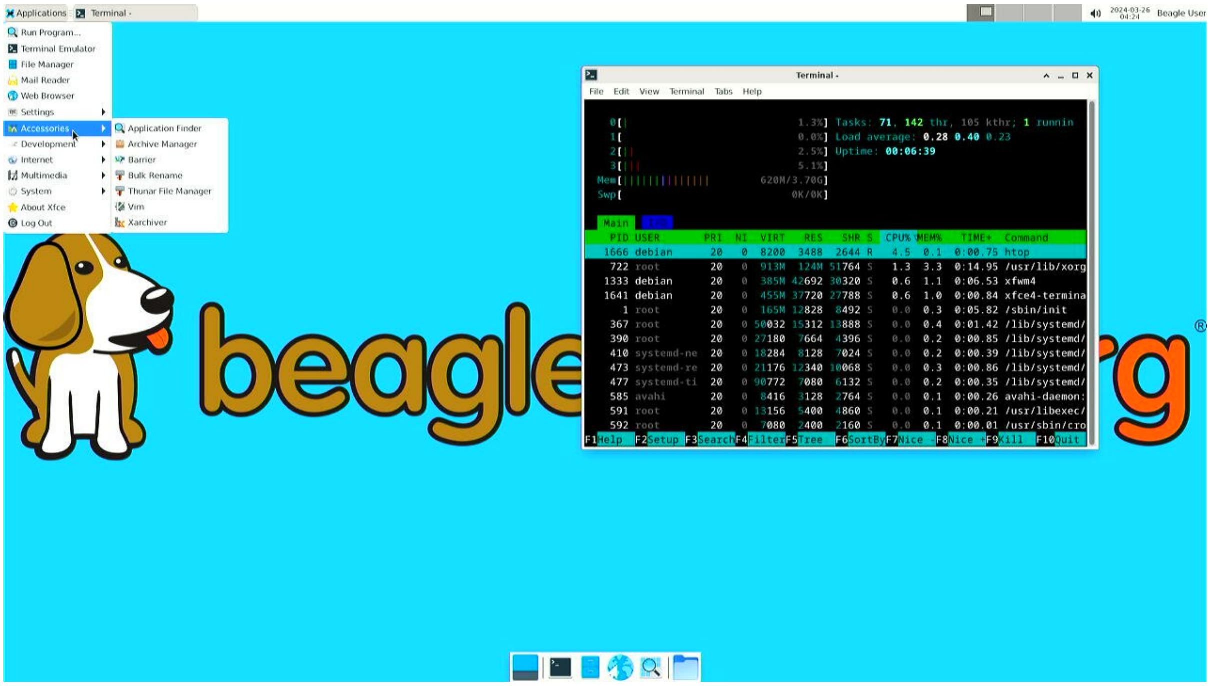
Once logged in you should see the splash screen shown in the image below:



Test network connection by running ping 8.8.8.8



Explore and build with your new BeagleY-AI board!



2.2.6 Connecting to WiFi

Connect 2x antennas to your BeagleY-AI board if not pre-attached.

After successfully attaching the antenna, power up the board. Once booted you can follow the commands below to connect to any WiFi access point,

- To list the wireless devices attached, (you should see wlan0 listed)

```
iwctl device list
```

- Scan WiFi using,

```
iwctl station wlan0 scan
```

- Get networks using,

```
iwctl station wlan0 get-networks
```

- Connect to your wifi network using,

```
iwctl --passphrase "<wifi-pass>" station wlan0 connect "<wifi-name>"
```

- Check wlan0 status with,

```
iwctl station wlan0 show
```

- To list the networks with connected WiFi marked you can again use,

```
iwctl station wlan0 get-networks
```

- Test connection with ping command,

```
ping 8.8.8.8
```

Chapter 3

Design and specifications

Chapter 4

Expansion

Chapter 5

Demos and tutorials

Chapter 6

Support

All support for BeagleY-AI design is through BeagleBoard.org community at BeagleBoard.org forum.

6.1 Production board boot media

6.2 Certifications and export control

6.2.1 Export designations

- HS: 8471504090
- US HS: 8543708800
- UPC: 640265311062
- EU HS: 8471707000
- COO: CHINA

6.2.2 Size and weight

- Bare board dimensions: **TBD**
- Bare board weight: **TBD**
- Full package dimensions: **TBD**
- Full package weight: **TBD**

6.3 Additional documentation

6.3.1 Hardware docs

For any hardware document like schematic diagram PDF, EDA files, issue tracker, and more you can checkout the BeagleY-AI design repository.

6.3.2 Software docs

For BeagleY-AI specific software projects you can checkout all the BeagleY-AI project repositories group.

6.3.3 Support forum

For any additional support you can submit your queries on our forum, https://forum.beagleboard.org/tag/beagley-ai

6.3.4 Pictures

6.4 Change History

Note: This section describes the change history of this document and board. Document changes are not always a result of a board change. A board change will always result in a document change.

6.4.1 Board Changes

For all changes, see https://openbeagle.org/beagley-ai/beagley-ai. Versions released into production are noted below.

Table 6.1: BeagleY-AI board change history

Rev	Changes	Date	By