



▶ ADI *FTC*



ADI **FTC**

Software hands-on training kit: Customizing ADI Kuiper 2 Linux Distribution

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analog.com

Agenda

- Theoretical Concepts:
 - Introduction to ADI Kuiper Linux
 - What Does Kuiper Include
 - Unlocking the Power of Kuiper 2
 - Key Features
 - Stages Anatomy
 - Build Flow
 - Configuration File
 - Supported Versions
 - Extra scripts
- Hands-on Activity:
 - Build a Custom Kuiper 2 Image
 - Boards and accessories
 - Layout
 - Workshop Networking structure
 - Exercises carriers
 - Prepare the SD card to boot
 - Raspberry Pi 5 Networking Exercise via MQTT
 - Boot your Custom Kuiper 2 Image on Raspberry Pi 5
- Product Support and Acknowledgements

Introduction to ADI Kuiper Linux

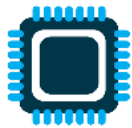
ADI Kuiper Linux is an Open-Source Linux Distribution for Analog Devices



It is the primary distribution for product evaluation boards and reference designs



It includes pre-built boot files, device drivers and a variety of development utilities



Supports over 140 FPGA-based projects and over 30 Raspberry Pi-based designs

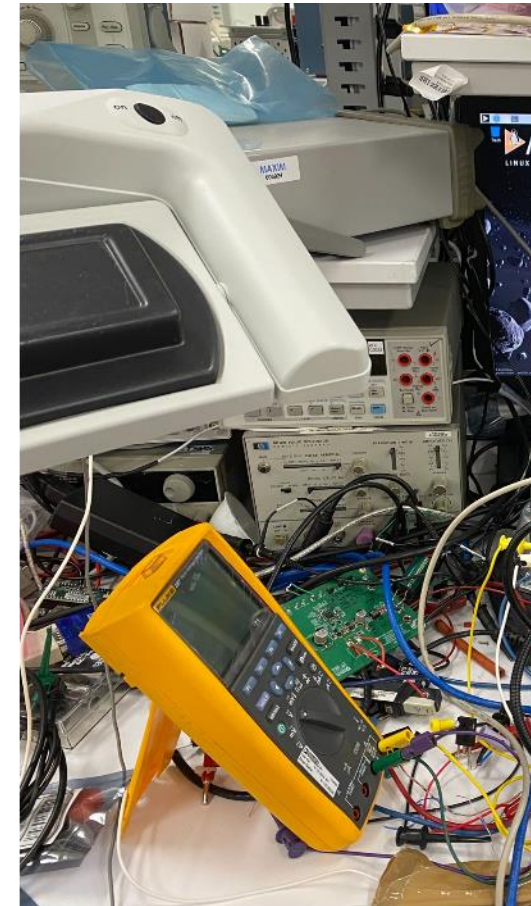
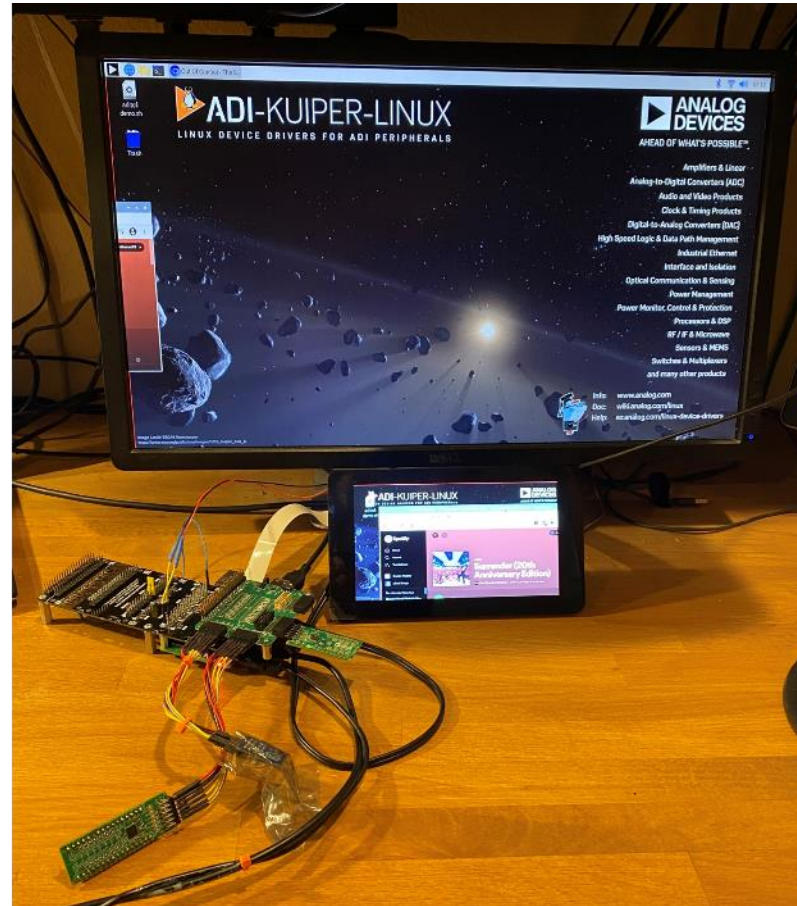


The first release was published at the beginning of 2021

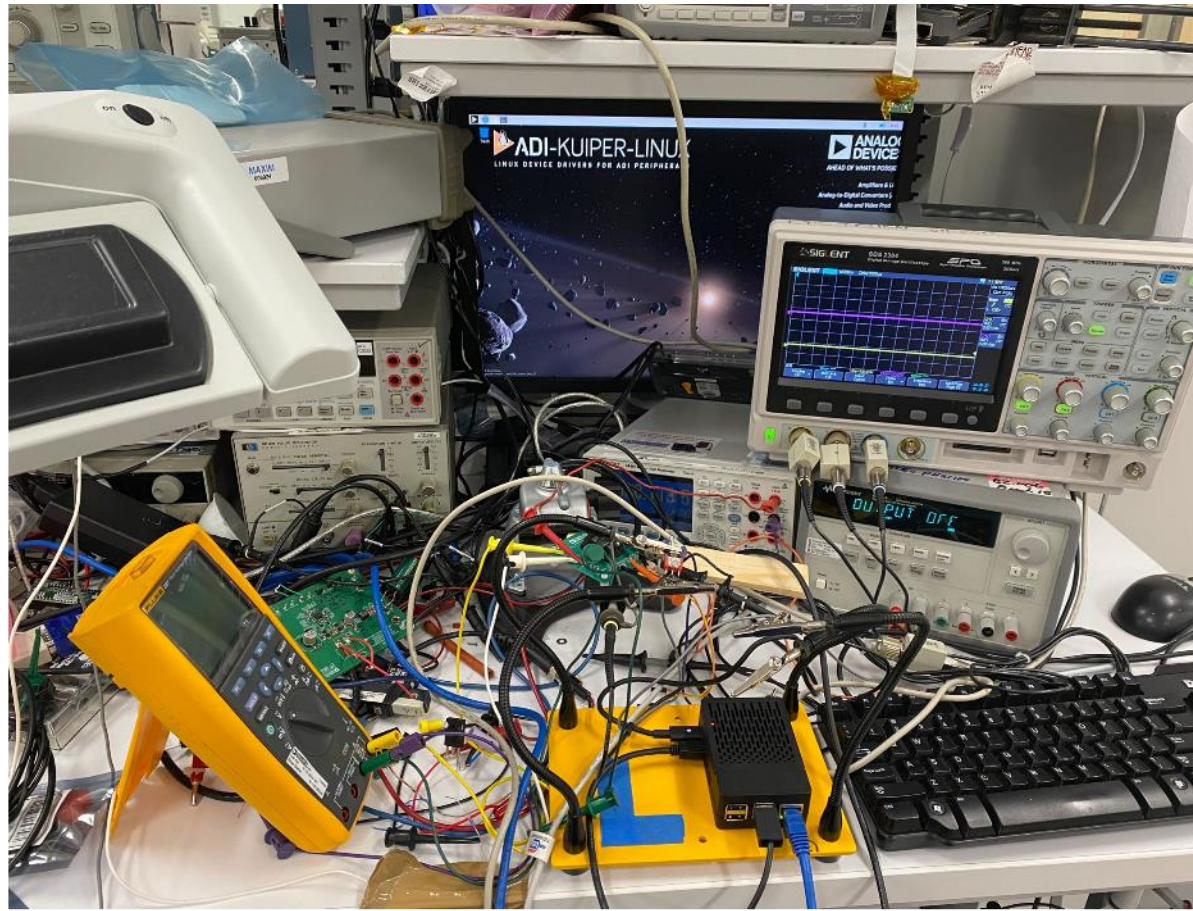
Kuiper is Everywhere!



Kuiper is Everywhere!



Kuiper is Everywhere!



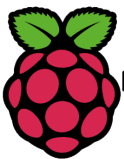
What does Kuiper Include

Boot Files

- More than 1,300 Linux device drivers for Analog Devices products
- Pre-built boot files for over 140 FPGA-based projects and over 30 RPi-based designs



Zynq
Zynq MP
Versal



RaspberryPi



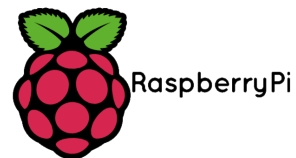
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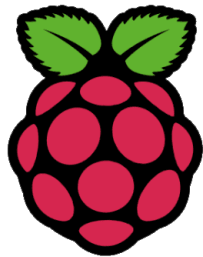
Cyclone5
Arria10
Stratix10



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RaspberryPi

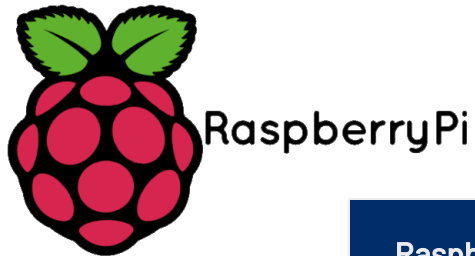
RaspberryPi
2 / 3 / 4 / 5



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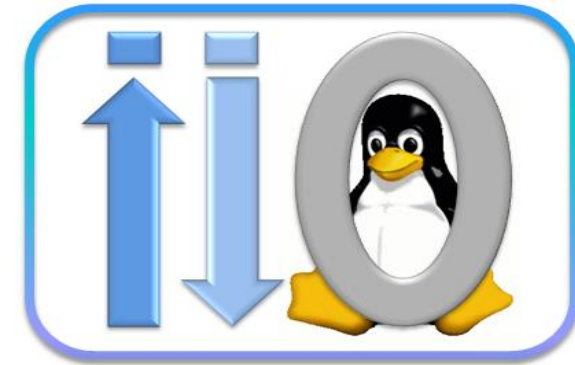
RaspberryPi

RaspberryPi
2 / 3 / 4 / 5

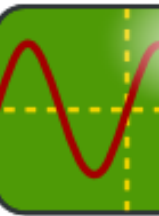


Libraries and Applications

- A variety of development utilities, software libraries and examples for different projects



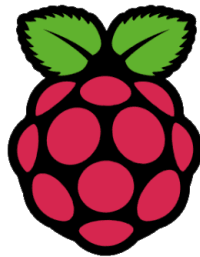
LibIIO



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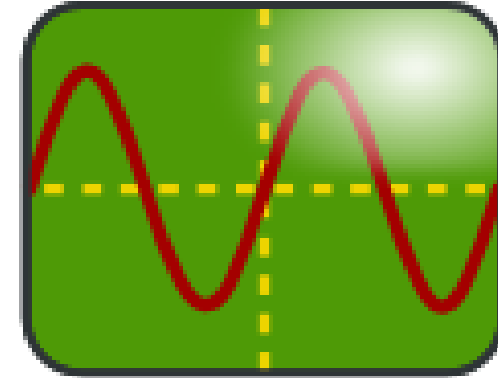
RaspberryPi

RaspberryPi
2 / 3 / 4 / 5



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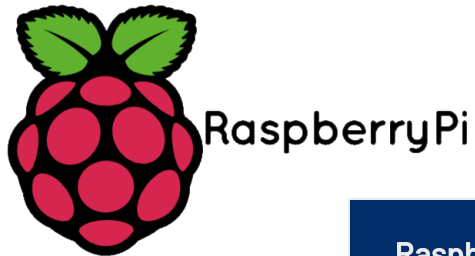
IIO Oscilloscope



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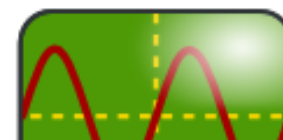
RaspberryPi

RaspberryPi
2 / 3 / 4 / 5



Libraries and Applications

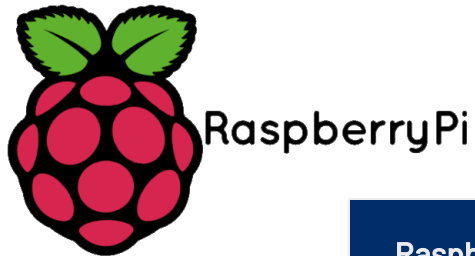
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RaspberryPi

RaspberryPi
2 / 3 / 4 / 5



Libraries and Applications

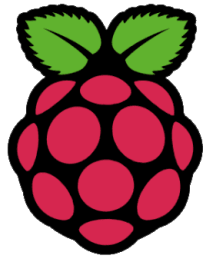
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RaspberryPi

RaspberryPi
2 / 3 / 4 / 5



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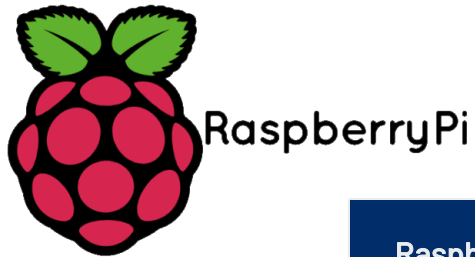
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RaspberryPi

RaspberryPi
2 / 3 / 4 / 5



Libraries and Applications

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Unlocking the Power of Kuiper 2: Key Features



Kuiper 2 is a **Debian based** Distribution



Contains a **configuration file**, where every setting can be done without modifying the source code



Supported architectures are **armhf** (32 bits) and **arm64** (64 bits)



Analog Devices **libraries can be added individually**, making the image completely customizable for each project



Supports installation of **different versions of boot files** for Xilinx and Intel carriers and Raspberry Pi platforms



Can **configure the image at build time for a specific hardware setup**, preparing the image to be transferred on an SD card and booted on a board, without the need to manually copy boot files

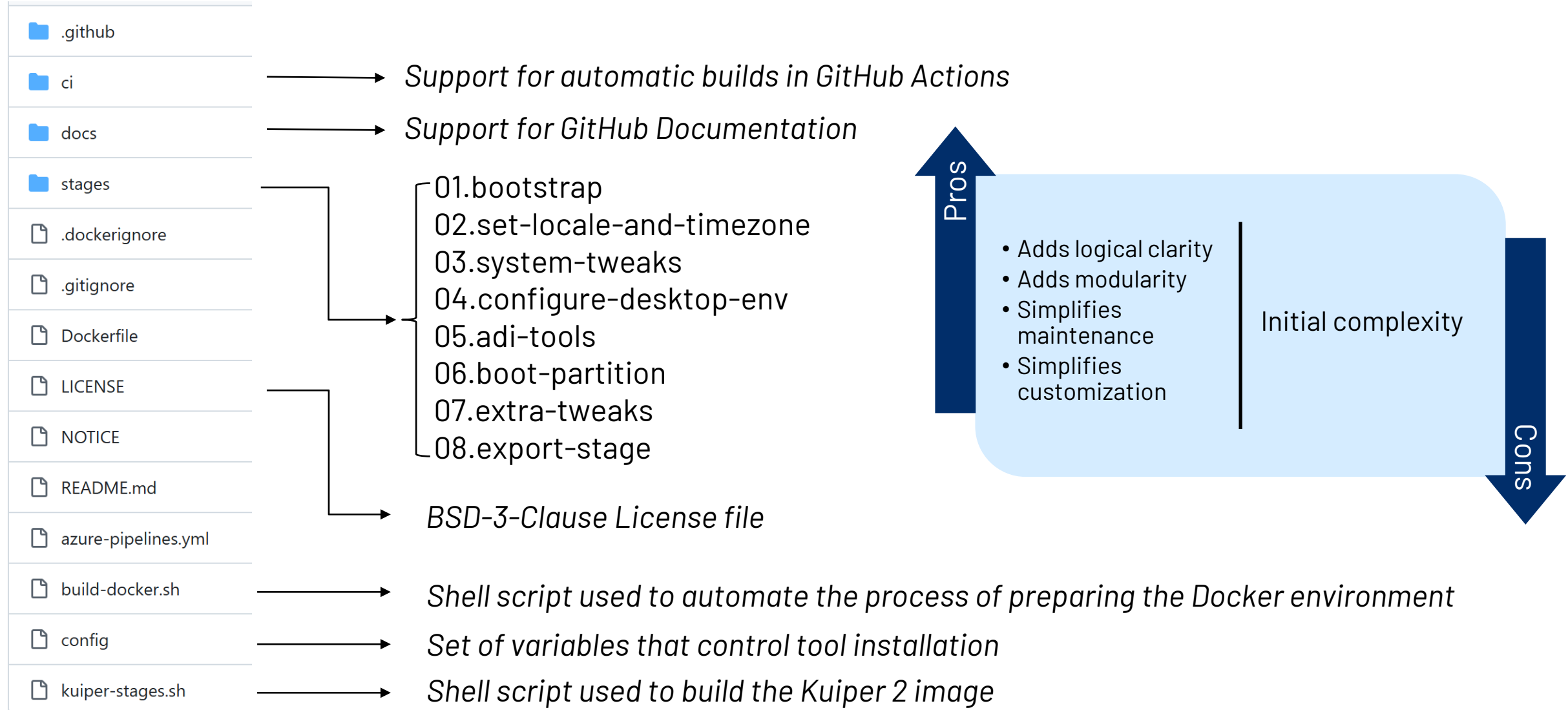


Supports running a **custom script** at build time, to cover even more custom settings that are not standard in the config file

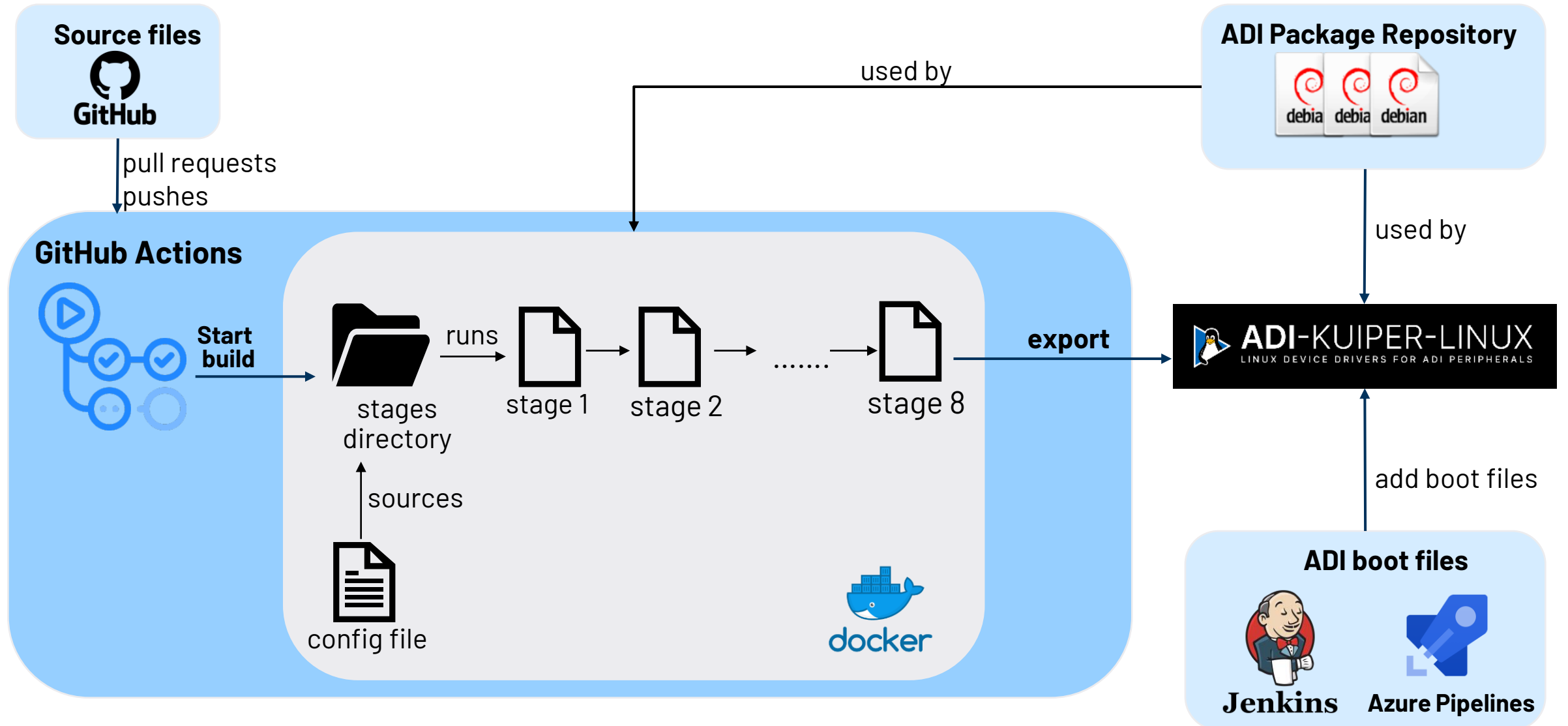


Supports **exporting the source files** of all the packages used in the Kuiper 2 image at build time

Unlocking the Power of Kuiper 2: Stages Anatomy



Unlocking the Power of Kuiper 2: Build Flow



Unlocking the Power of Kuiper 2: Configuration File



Unlocking the Power of Kuiper 2: Configuration File



Unlocking the Power of Kuiper 2: Supported Versions

Version	Variable in the configuration file	Stage/substage
<i>Basic image</i>	No variable	01.bootstrap 02.set-locale-and-timezone 03.system-tweaks 05.adi-tools/14.write-git-logs 06.boot-partition 08.export-stage/01.extend-rootfs 08.export-stage/03.generate-license 08.export-stage/04.export-image
<i>With desktop environment</i>	CONFIG_DESKTOP	04.configure-desktop-env
<i>With ADI tool</i>	CONFIG_[ADI tool] CONFIG_[ADI tool]_CMAKE_ARGS BRANCH_[ADI tool](if the case)	05.adi-tools/xx.install-[ADI tool]
<i>With exported sources</i>	EXPORT_SOURCES	08.export-stage/02.export-sources
<i>With custom script</i>	EXTRA_SCRIPT	07.extra-tweaks/01.extra-scripts
<i>With boot partition ready for a specific hardware setup</i>	ADI_EVAL_BOARD CARRIER	08.export-stage/04.export-image

Unlocking the Power of Kuiper 2: Extra Scripts

Kuiper allows you to run additional scripts during the build process to customize the resulting image. This feature enables advanced customization beyond the standard configuration options.

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Add the script

Place your script file inside the `adi-kuiper-gen/stages` directory.

Make it executable

Make sure your script is executable:
`chmod +x your-script.sh`

Add the path

Set `EXTRA_SCRIPT` in the config file to your script's path, relative to `adi-kuiper-gen` directory

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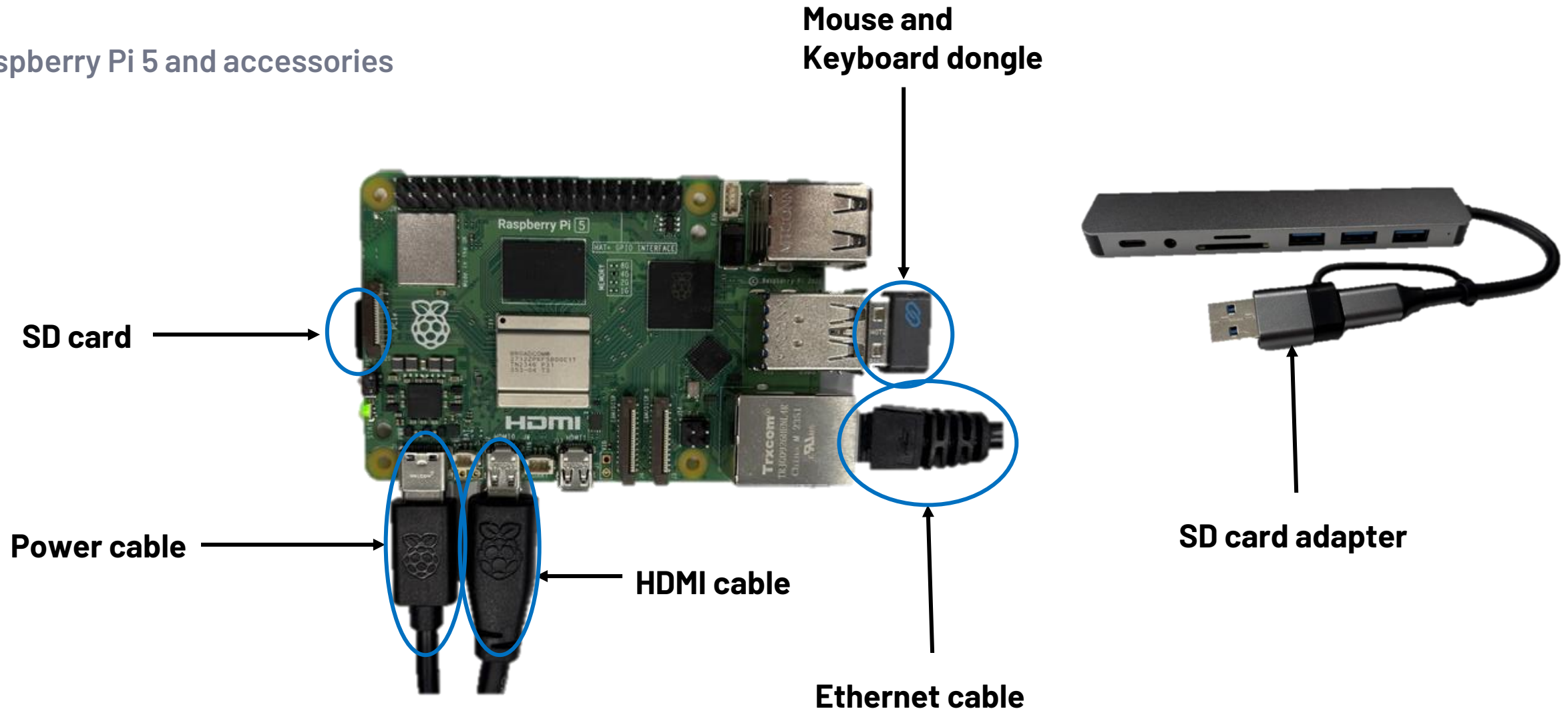
Set `EXTRA_SCRIPT` in the config file to your script's path, relative to `adi-kuiper-gen` directory



You can also turn your additional configurations into a Debian package that can be stored in the ADI Package Repository and easily installed on any Debian-based Linux.

Hands-On Activities

Raspberry Pi 5 and accessories



Hands-On Activities

Build a Custom Kuiper 2 Image

1. Open a terminal on the Raspberry Pi 5 in front of you and run the following commands:

```
$ git clone https://github.com/analogdevicesinc/adi-kuiper-gen
$ cd adi-kuiper-gen
$ code .
```

2. Modify the config file according to the table:

Line	Old string	Modified string
8	TARGET_ARCHITECTURE=armhf	TARGET_ARCHITECTURE=arm64
23	CONFIG_DESKTOP=n	CONFIG_DESKTOP=y
30	CONFIG_LIBIIIO=n	CONFIG_LIBIIIO=y
226	EXTRA_SCRIPT=	EXTRA_SCRIPT= stages/07.extra-tweaks/01.extra-scripts/examples/extra-script-example.sh

3. Create a new file in *stages/07.extra-tweaks/01.extra-scripts/examples/* named *custom-file.txt* and write to it "Hello FTC25" (or anything you want).

4. Open file *stages/07.extra-tweaks/01.extra-scripts/examples/extra-scripts-example.sh* and add the following line at the end of the file:

```
$ cp stages/07.extra-tweaks/01.extra-scripts/examples/custom-file.txt /home/analog
```

5. Close Visual Studio Code and write to the terminal:

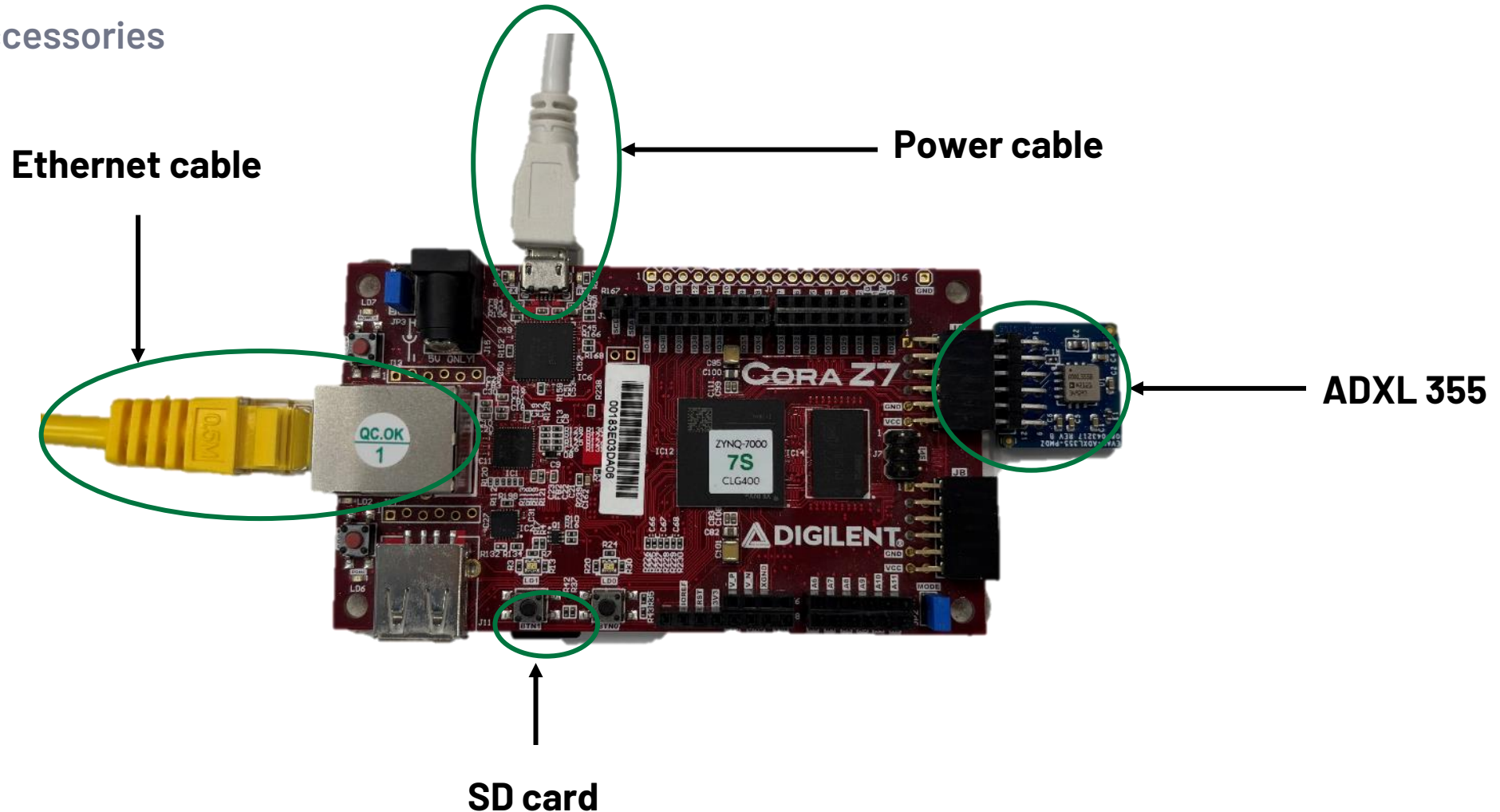
```
$ sudo bash build-docker.sh
```

Password: *analog*.

Congratulations! You started your first Kuiper 2 custom build!

Hands-On Activities

CoraZ7s and accessories

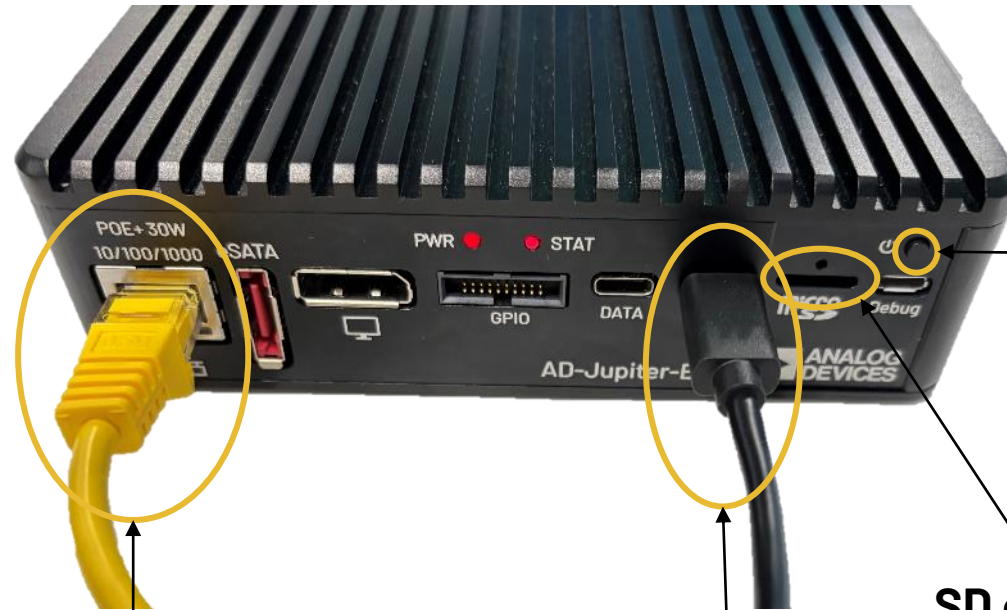


Hands-On Activities

Jupiter SDR and accessories



**Loopback cable
+ 2 antennas**



Ethernet cable

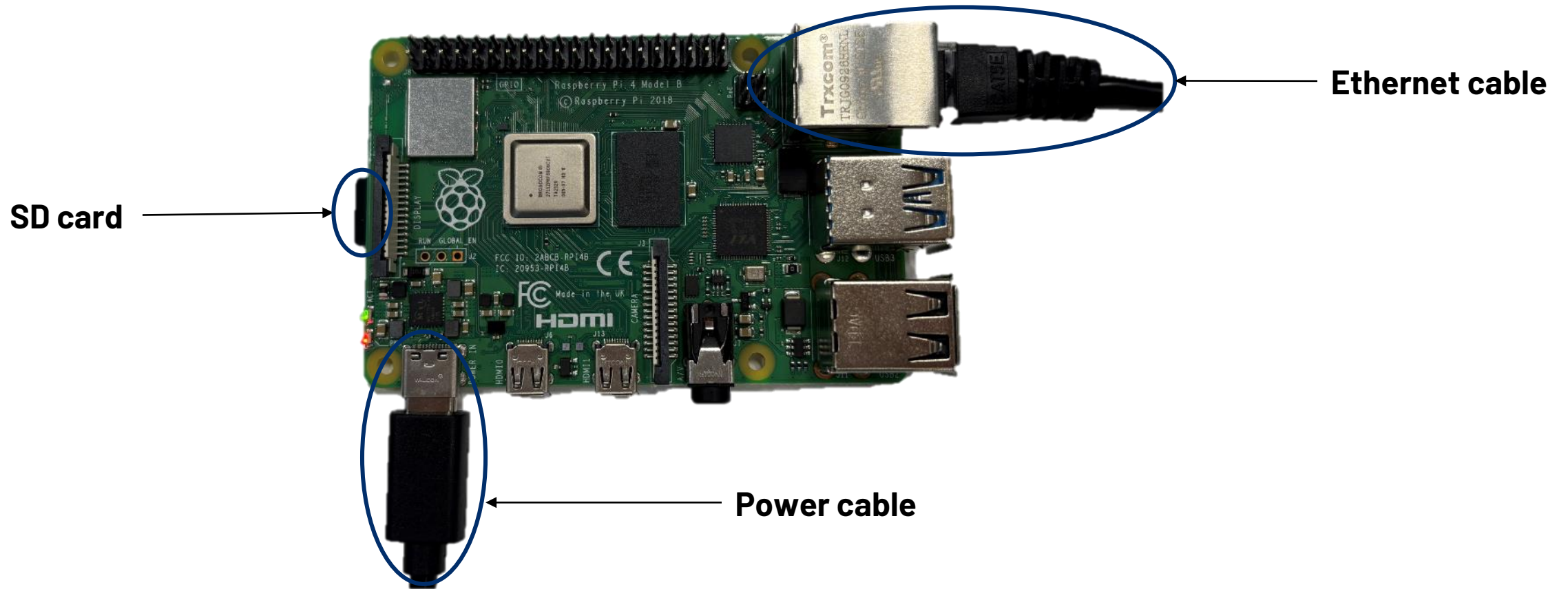
Power cable

SD card

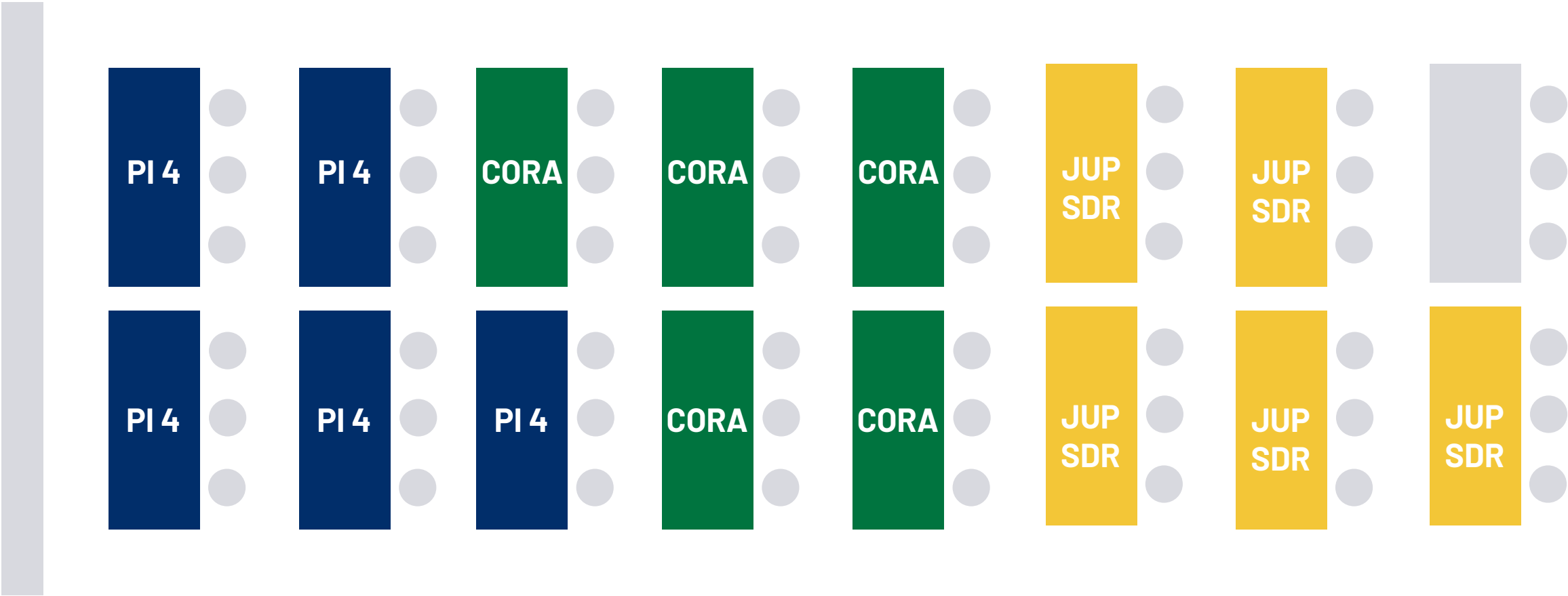
**Power
button**

Hands-On Activities

Raspberry Pi 4 and accessories



Hands-On Activities




Hands-On Activities

Networking and SSH


Wi-Fi Public IP
10.87.54.161



Raspberry Pi 5 Workstation

Local Link IP:
169.254.67.65


Jupiter SDR



ftc25-jupiter@169.254.107.214

Cora Z7s



ftc25-cora@169.254.187.204

Raspberry Pi 4



ftc25-rpi4@169.254.187.80

Hands-On Activities

Exercises

CoraZ7s

- Integrate and control hardware devices within Linux
- Use sensors and outputs to control interactive applications
- Apply scripting and automation to manage device behavior

Jupiter SDR

- Loopback testing with GNU Radio – transmit/receive complex sinewaves and visualize signals
- Wireless experimentation using antennas with hands-on RF parameter tuning

Raspberry Pi 4

- Read temperature sensors locally using IIO libraries and visualize data
- Access remote sensors over the network and compare RPi5 vs RPi4 temperatures in real-time

Hands-On Activities

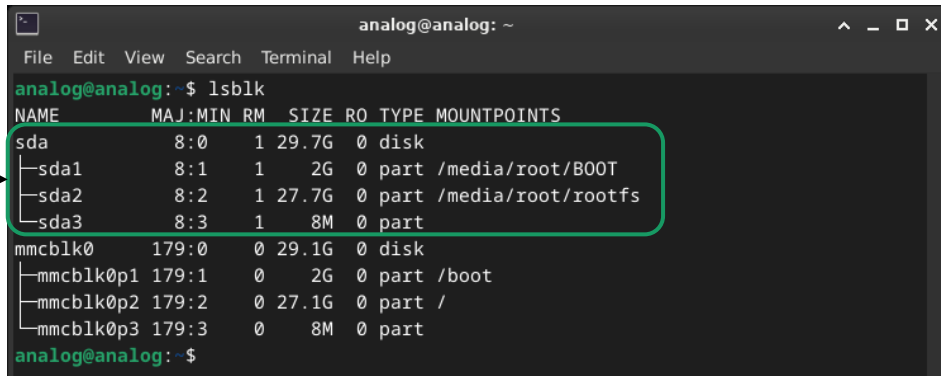
Prepare the SD card to boot

Steps

1. Connect the adapter via USB to the RPi5 workstation.
2. Insert the SD card from the carrier board (CoraZ7S, RPi 4, Jupiter SDR) into the adapter.
3. Check connected storage devices (typically /dev/sda)

```
$ lsblk
```

Identify the SD card (verify its size and mountpoint).



```
analog@analog: ~  
File Edit View Search Terminal Help  
analog@analog:~$ lsblk  
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS  
sda          8:0    1 29.7G  0 disk  
├─sda1       8:1    1    2G  0 part /media/root/BOOT  
├─sda2       8:2    1 27.7G  0 part /media/root/rootfs  
└─sda3       8:3    1    8M  0 part  
mmcblk0     179:0    0 29.1G  0 disk  
├─mmcblk0p1 179:1    0    2G  0 part /boot  
├─mmcblk0p2 179:2    0 27.1G  0 part /  
└─mmcblk0p3 179:3    0    8M  0 part  
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```

4. List available boot configurations:

```
$ sudo configure-setup.sh -b /media/$USER/BOOT --help
```

5. Prepare the boot files:

For Jupiter SDR:

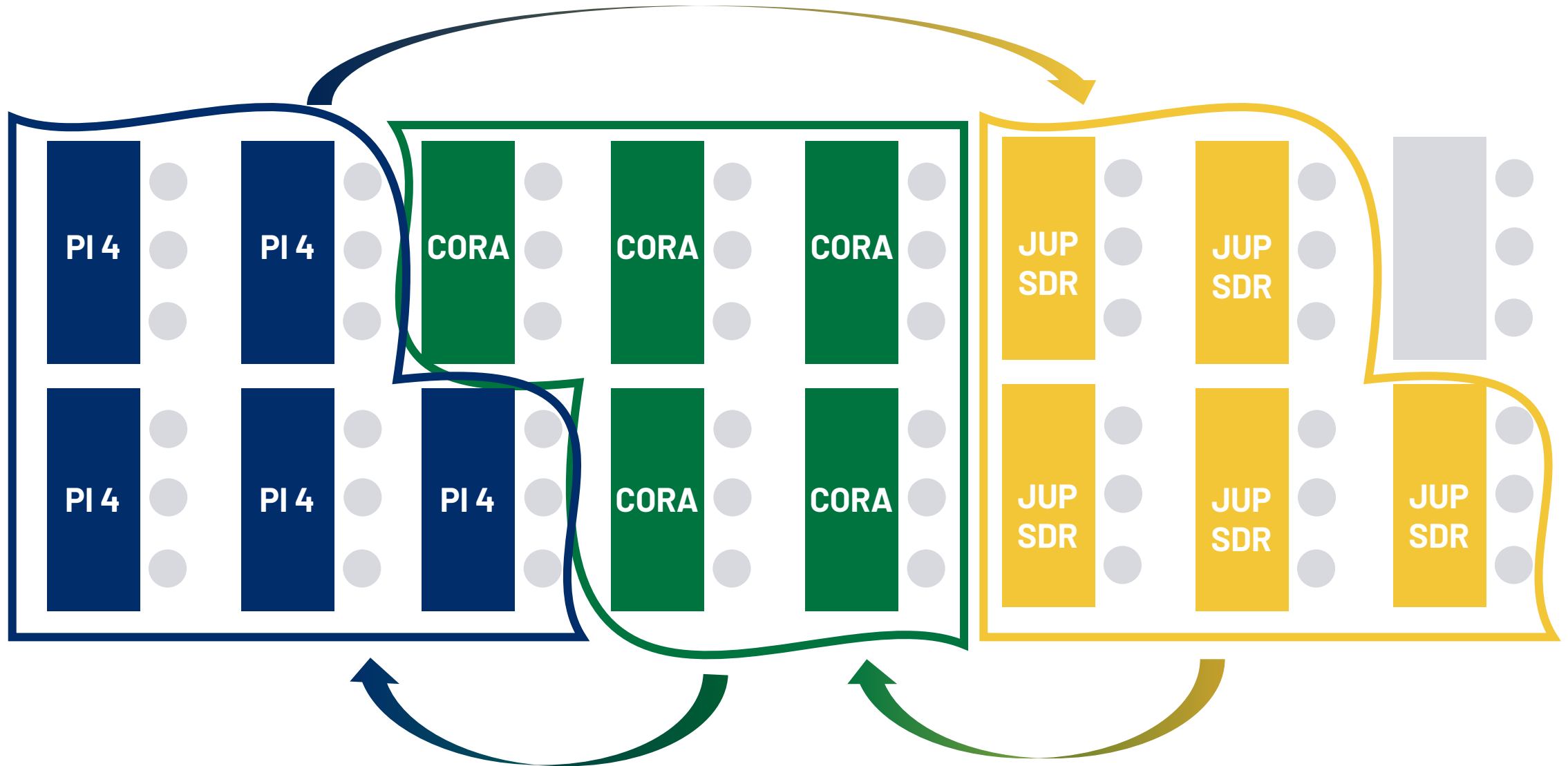
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$ sudo configure-setup.sh -b /media/$USER/BOOT  
jupiter_sdr jupiter_sdr
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For CoraZ7s:

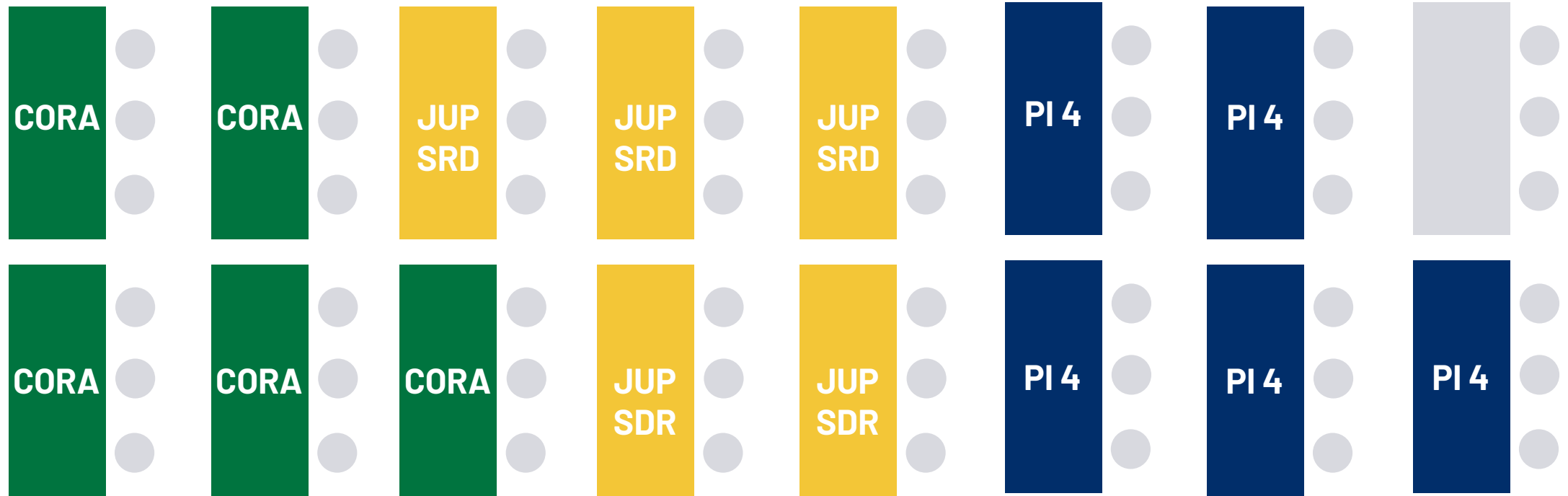
```
$ sudo configure-setup.sh -b /media/$USER/BOOT adxl355  
coraz7s
```

No need for configuration on Raspberry Pi 4.

Hands-On Activities



Hands-On Activities



Hands-On Activities

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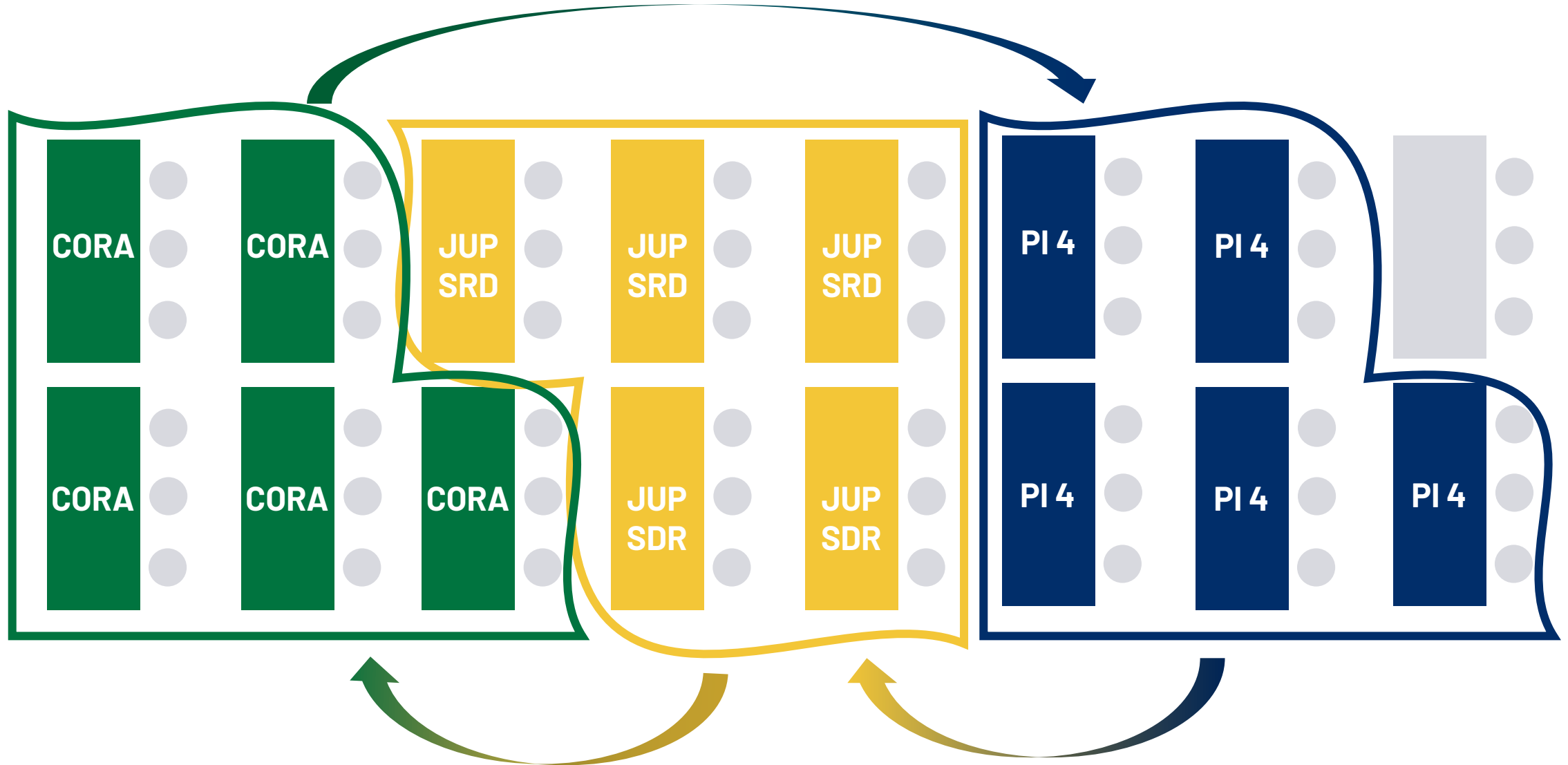
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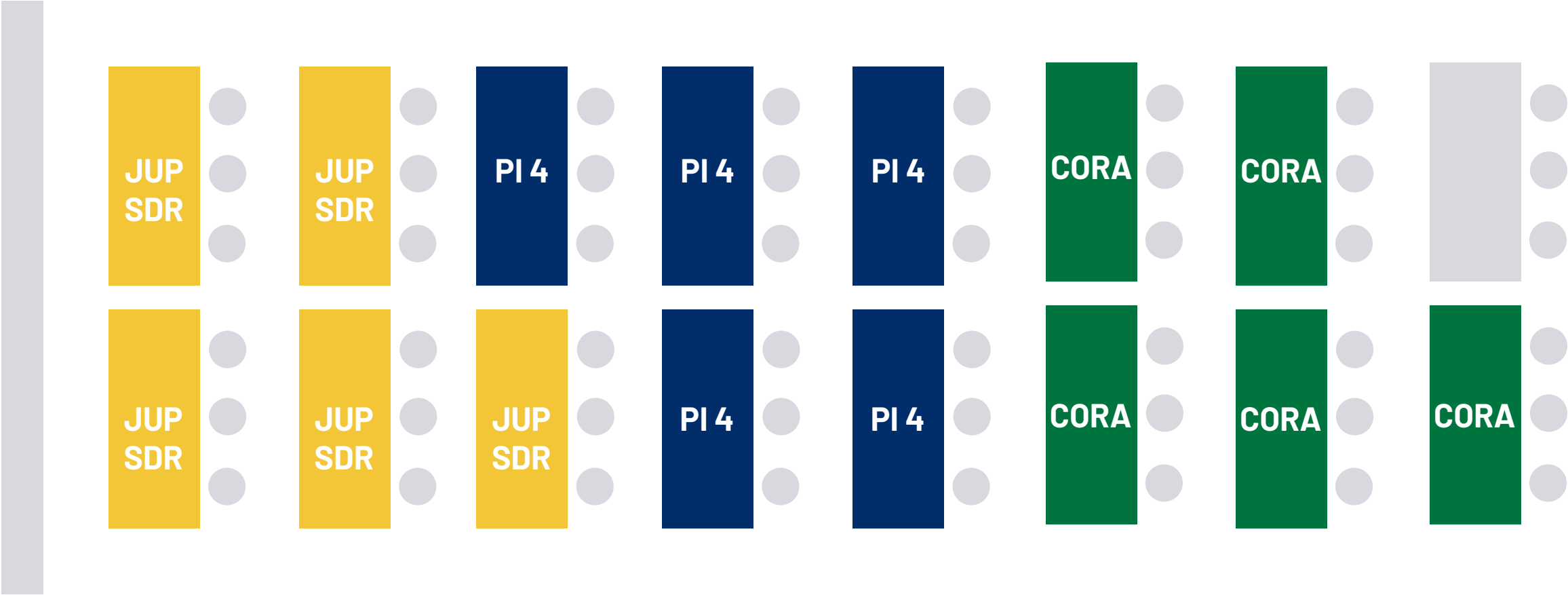
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Hands-On Activities



Hands-On Activities



Hands-On Activities

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For CoraZ7s:

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coraz7s
```

No need for configuration on Raspberry Pi 4.

Hands-On Activities

Raspberry Pi 5 Networking Exercise via MQTT

For this exercise you will communicate with other participants via a lightweight publish/subscribe protocol called MQTT.

Steps:

1. Open a terminal and run the following command to listen to a port where all participants will write messages:

```
$ mosquitto_sub -h test.mosquitto.org -t "ftc25-kuiper"
```

2. Open a new terminal and write the following command to send messages to the port everyone listens to:

```
$ mosquitto_pub -h test.mosquitto.org -t "ftc25-kuiper" -m "Hello from Pi $HOSTNAME"
```

Hands-On Activities

Boot your Custom Kuiper 2 Image on Raspberry Pi 5

Steps:

1. Power-off the carrier board in front of you (CoraZ7s, Raspberry Pi 4 or Jupiter SDR), take the SD card from it and connect it to the Raspberry Pi 5 via the adapter.
2. Open a terminal in *adi-kuiper-gen/kuiper-volume* folder, unarchive and copy the Kuiper image on the SD card. Use *lsblk* command to check the partition. As you saw earlier, the SD card from the adapter is mounted at SDA.

```
$ lsblk  
$ sudo unzip image_2025-11-10-ADI-Kuiper-Linux-arm64.zip  
$ sudo dd if=image_2025-11-10-ADI-Kuiper-Linux-arm64.img of=/dev/sda bs=1M status=progress
```

3. After the image is copied successfully, poweroff the Raspberry Pi 5 and disconnect it from the power cable, take out the SD card from it and replace it with the recently copied card, and then connect back the Pi board to power.
4. Look after the file you copied with the extra script and check what it contains.

Product Support and Acknowledgements

Contact information:

Larisa Radu – larisa.radu@analog.com

Alisa Roman – alisa.roman@analog.com

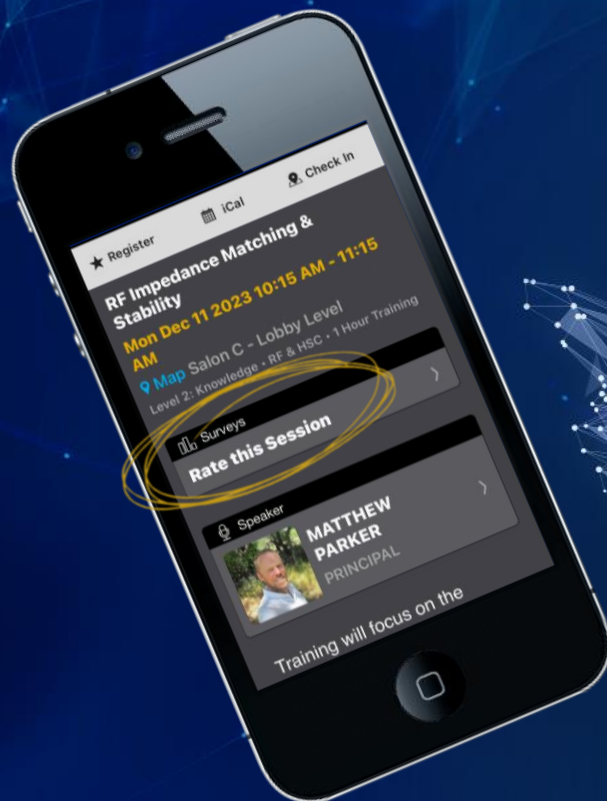
Stefan Raus – stefan.raus@analog.com

Dragos Bogdan – dragos.bogdan@analog.com

SDP Enablement – SDP_Enablement@analog.com

Questions and problems:

[Linux Software Drivers – EngineerZone](#)



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