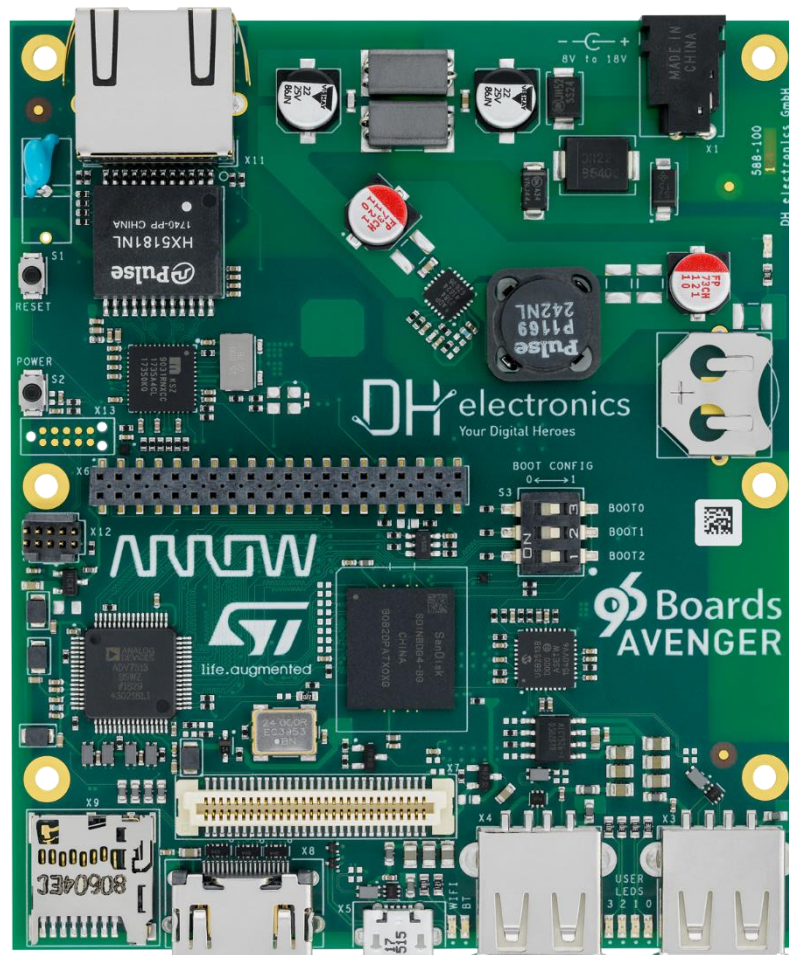




96Boards Avenger96 - Getting Started



DH electronics GmbH • Am Anger 8 • 83346 Bergen • Germany

YOUR DIGITAL HEROES.

History

Revision	Date	Description / Change	Name
R01	21.02.2019	First release	MH, AG
R02	25.02.2019	Some corrections	KH
R03	05.03.2019	Replaced wrong minus character at chapter 1.2.4.2	MH
R04	29.03.2019	Add new demo image version v1.1 Add GPU demo information	AG
R05	31.03.2019	Add new demo image version v1.2	AG

Summary

1	Getting Started with the 96Boards Avenger96	4
1.1	Overview.....	5
1.1.1	Product Features	5
1.1.2	Block diagram	6
1.1.3	Key components.....	7
1.1.4	Expansion Connectors.....	9
1.1.5	Low Speed Expansion Connector.....	9
1.1.6	High Speed Expansion Connector.....	10
1.2	Set Up Guide	11
1.2.1	Easy step by step guide	11
1.2.2	Boot Mode	11
1.2.3	Power Supply	12
1.2.4	Software	12
1.2.4.1	Configuring ethernet.....	13
1.2.4.2	Starting GPU Demo	13
1.2.4.3	Configuring WiFi.....	13
1.2.4.4	SSH server	14
1.2.4.5	Debug UART.....	14
1.2.4.6	Debug UART.....	14

1 Getting Started with the 96Boards Avenger96

CAUTION!

THIS DOCUMENT IS DESIGNED FOR THE 96Boards Avenger96 FS00009 (PCB number 588-100) ONLY!

The PCB number of the board can be found on the top right corner of the board next to the power jack.

This is a pre-series product, which means that the hardware has some known limitations:

- Ethernet port has no unique MAC address. Linux works with random generated MAC address.
- Ethernet is currently limited to 100 Mbit/s.

Note: With image version v1.1, ethernet can be used in Gbit mode.

- Pull-ups are missing on I2C0 and I2C1 (low speed expansion connector).

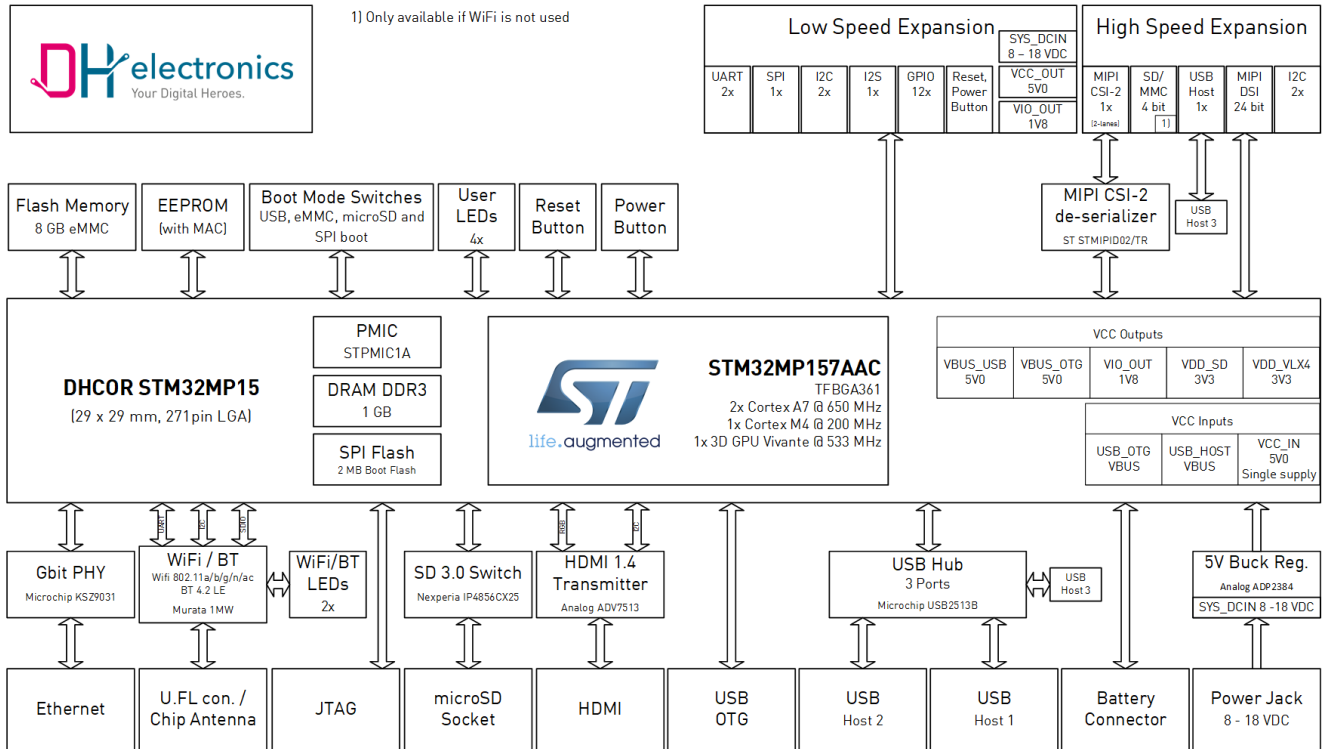
1.1 Overview

This chapter describes all features and key components of the Avenger96 board.

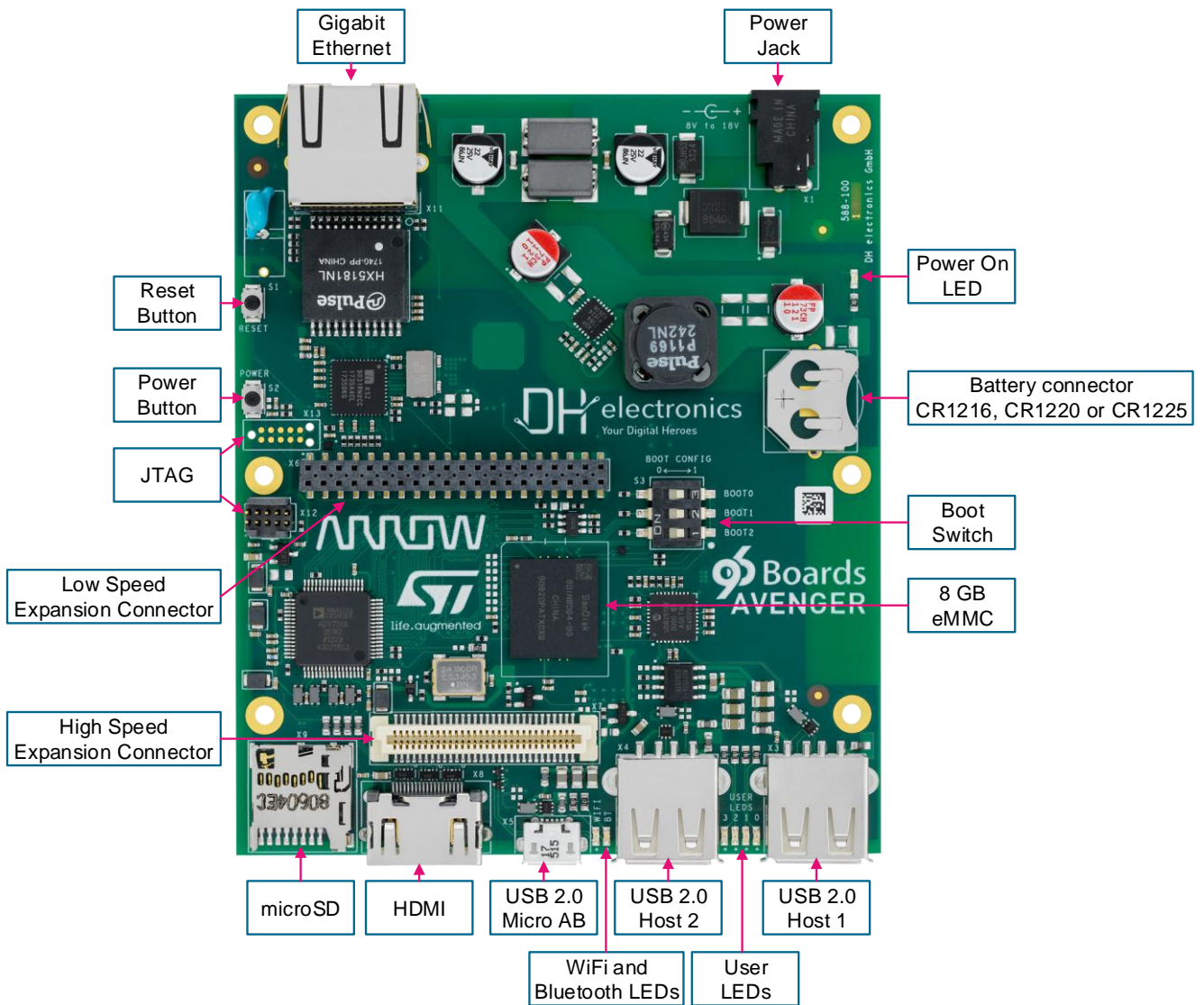
1.1.1 Product Features

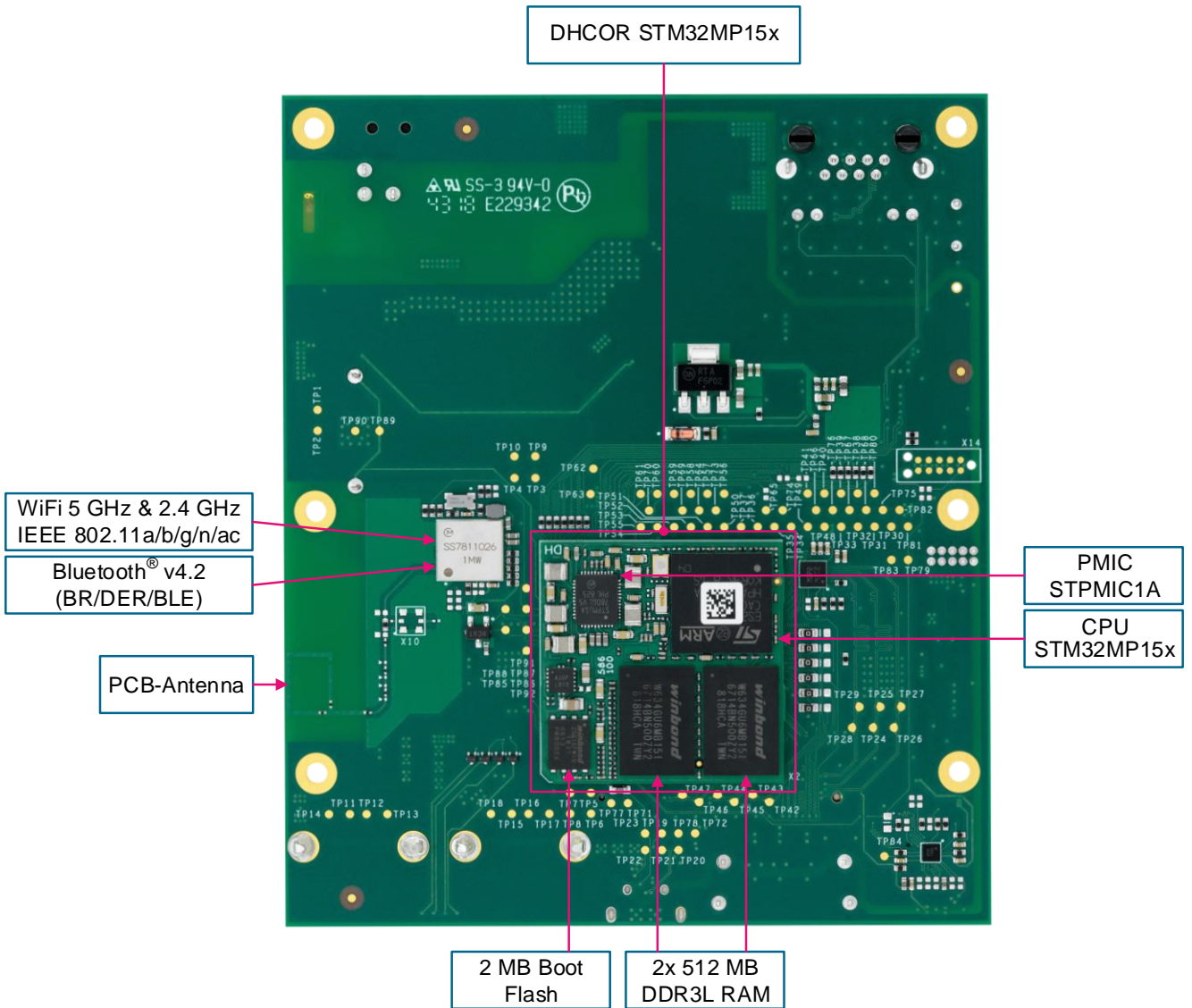
TECHNICAL DETAILS	
Processors	STM32MP157AAC 2x ARM® Cortex-A7 up to 650 MHz 1x ARM® Cortex-M4 up to 200 MHz
GPU	1x 3D GPU Vivante® @ 533 MHz - OpenGL® ES 2.0
PMIC	STPMIC1A
DDR3 DRAM	1024 Mbyte @ 533 MHz
eMMC Flash	8 Gbyte, v4.51 interface
NOR Flash	2 Mbyte, Quad SPI interface
E²Prom	128 byte
microSD Socket	UHS-I speed grade, v3.01
USB Host	2x type A, 2.0 high-speed
USB OTG	1x type micro-AB, 2.0 high-speed
HDMI	WXGA [1366x768] @ 60 fps, HDMI 1.4
WiFi / Bluetooth	WiFi 5 GHz & 2.4GHz IEEE 802.11a / b / g / n / ac Bluetooth® v4.2 (BR/EDR/BLE) PCB antenna
Ethernet	10 / 100 / 1000 Mbit/s, IEEE 802.3-compliant
Push-Buttons	Power and reset
Battery Socket	CR1216, CR1220 and CR1225
LEDs	4x green user controlled LEDs, 1x blue Bluetooth enabled, 1x yellow WiFi enabled, 1x red power supply okay
Boot Mode	3 bit boot mode switch
Debug Interface	JTAG interface via tag-connect
Supply (SYS_DCIN)	8 - 18 VDC
Temperature Range	0 - 40 °C
Dimensions	100 x 85 mm

1.1.2 Block diagram



1.1.3 Key components

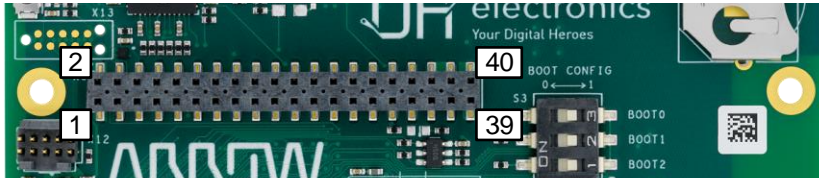




1.1.4 Expansion Connectors

The Avenger96 has two expansion connectors which enables connection to a variety of Mezzanine boards. These boards allows to expand the interfaces of your Avenger96.

1.1.5 Low Speed Expansion Connector

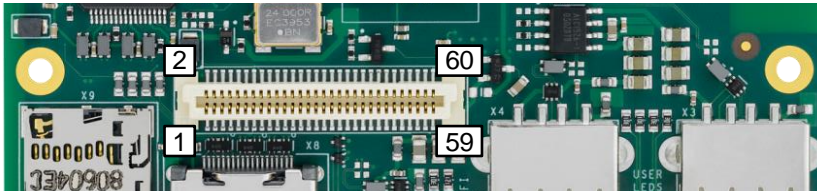


TECHNICAL DETAILS

UART 0	Rx / Tx / Rts / Cts
UART 1 (Standard interface to CPU)	Rx / Tx
SPI 0	Max. 52 Mbps
I2C 0	100 kHz, 400 kHz and 1000 kHz
I2C 1	100 kHz, 400 kHz and 1000 kHz
I2S	SAI interface in master mode
GPIOs	12 IOs
Supply	5 VDC, 1.8 VDS output, SYS_DCIN
RESET	Reset external request
POWER	Power on/off external request

GND	Pin 1	Pin 2	GND
UART0_CTS	Pin 3	Pin 4	PWR_BTN_N
UART0_TxD	Pin 5	Pin 6	RST_BTN_N
UART0_RxD	Pin 7	Pin 8	SPI0_SCLK
UART0_RTS	Pin 9	Pin 10	SPI0_DIN (MISO)
UART1_TxD	Pin 11	Pin 12	SPI0_CS
UART1_RxD	Pin 13	Pin 14	SPI0_DOUT (MOSI)
I2C0_SCL	Pin 15	Pin 16	PCM_FS
I2C0_SDA	Pin 17	Pin 18	PCM_CLK
I2C1_SCL	Pin 19	Pin 20	PCM_DO
I2C1_SDA	Pin 21	Pin 22	PCM_DI
GPIO-A	Pin 23	Pin 24	GPIO-B
GPIO-C	Pin 25	Pin 26	GPIO-D
GPIO-E	Pin 27	Pin 28	GPIO-F
GPIO-G	Pin 29	Pin 30	GPIO-H
GPIO-I	Pin 31	Pin 32	GPIO-J
GPIO-K	Pin 33	Pin 34	GPIO-L
+1V8	Pin 35	Pin 36	SYS_DCIN
+5V	Pin 37	Pin 38	SYS_DCIN
GND	Pin 39	Pin 40	GND

1.1.6 High Speed Expansion Connector



TECHNICAL DETAILS

MMC/SD	4bit mode, v3.01 interface (only available if WiFi is not used)
MIPI CSI-2	2x Rx lanes
MIPI DSI	2x Tx lanes @ 1Gbit/s
I2C 0	100 kHz, 400 kHz and 1000 kHz
I2C 1	100 kHz, 400 kHz and 1000 kHz
USB Host	2.0 high-speed

SD_DAT0	Pin 1	Pin 2	CSI0_C+
SD_DAT1	Pin 3	Pin 4	CSI0_C-
SD_DAT2	Pin 5	Pin 6	GND
SD_DAT3	Pin 7	Pin 8	CSI0_D0+
SD_SCLK	Pin 9	Pin 10	CSI0_D0-
SD_CMD	Pin 11	Pin 12	GND
GND	Pin 13	Pin 14	CSI0_D1+
CSI_MCLK	Pin 15	Pin 16	CSI0_D1-
Not connected	Pin 17	Pin 18	GND
GND	Pin 19	Pin 20	Not connected
DSI_CLK+	Pin 21	Pin 22	Not connected
DSI_CLK-	Pin 23	Pin 24	GND
GND	Pin 25	Pin 26	Not connected
DSI_D0+	Pin 27	Pin 28	Not connected
DSI_D0-	Pin 29	Pin 30	GND
GND	Pin 31	Pin 32	I2C0_SCL
DSI_D1+	Pin 33	Pin 34	I2C0_SDA
DSI_D1-	Pin 35	Pin 36	I2C1_SCL
GND	Pin 37	Pin 38	I2C1_SDA
Not connected	Pin 39	Pin 40	GND
Not connected	Pin 41	Pin 42	Not connected
GND	Pin 43	Pin 44	Not connected
Not connected	Pin 45	Pin 46	GND
Not connected	Pin 47	Pin 48	Not connected
GND	Pin 49	Pin 50	Not connected
USB_D+	Pin 51	Pin 52	GND
USB_D-	Pin 53	Pin 54	Not connected
GND	Pin 55	Pin 56	Not connected
Not connected	Pin 57	Pin 58	GND
Not connected	Pin 59	Pin 60	+1V8 (Reserved)

1.2 Set Up Guide

This short guide leads you through the first steps to start exploring your Avenger96.

In the Box you can find the Avenger96 as well as a microSD card which comes with a pre-installed linux.

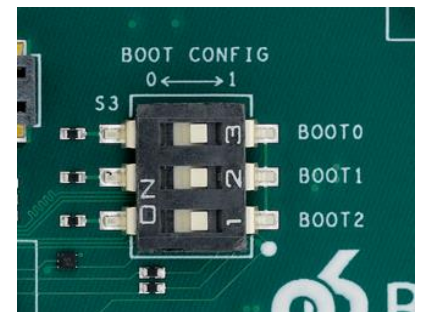
1.2.1 Easy step by step guide

The board can be put in operation by following steps:

- Make sure the boot switch is set to boot from the “SD-Card (Standard)” (See chapter 1.2.2)
- Insert the included microSD card with pre-installed linux
- Connect an display via the HDMI-connector
- Connect keyboard and mouse to the host USB ports
- Connect a proper power supply (See chapter 1.2.3)
- Plug the power supply into the power socket

1.2.2 Boot Mode

The Avenger96 supports multiple boot options which are selected by the DIP-switch S3. To select a logical “1” a switch needs to be pushed to the right. Therefore a logical “0” is set by pushing the switch to the left. The numeration of these pins is printed next to the switch on the circuit board.



BOOT Mode	Comments	Switch 1 - BOOT 2	Switch 2 - BOOT 1	Switch 3 - BOOT 0
UART and USB	USB high-speed Device	0	0	0
NOR-Flash	On Quad SPI	0	0	1
eMMC	On SDMMC2	0	1	0
NAND-Flash (Not available)	SLC NAND Flash	0	1	1
Reserved (NoBoot)	Get boot access without boot from Flash memory	1	0	0
SD-Card (Standard)	On SDMMC1	1	0	1
UART and USB	USB OTG	1	1	0
Serial NAND Flash (Not available)	NAND flash on Quad SPI	1	1	1

1.2.3 Power Supply

The Avenger96 is equipped with a 1.65 mm centre pin positive DC jack connector. This connector supports an input voltage between 8 V to 18 V with a power consumption of up to 24 W. The recommended power supply provides 12 V at a maximum output current of 2 A.

1.2.4 Software

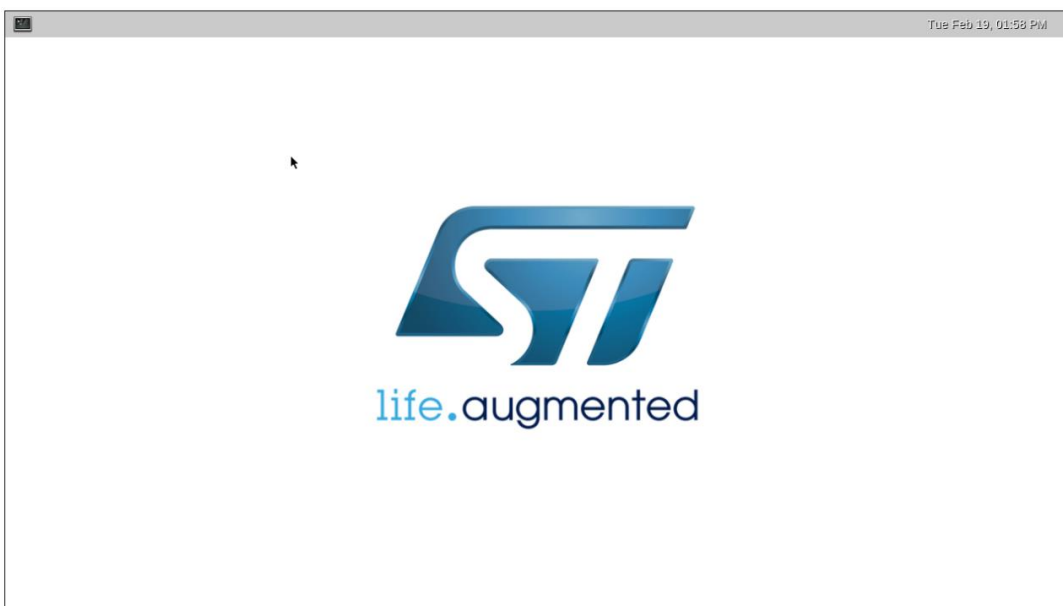
The current Avenger96 “Avenger96_v1.2_2019-03-29” image is based on ST beta1 “openstlinux-4.14-rocko-mp1-18-11-26” release.

U-Boot version: U-Boot 2018.09-stm32mp1-r2

Linux version: Linux stm32mp1-av96 4.14.48

Linux Distribution: ST OpenSTLinux - Weston - (A Yocto Project Based Distro)

When Linux starts up the standard Weston desktop will appear on the display. A terminal window can be opened by clicking on the terminal icon in the top left corner:



Known image limitations / missing features:

- SPI support
- SAI support
- MIPI DSI and MIPI CSI are not yet supported
- SPI flash support
- GPIOs and user LEDs
- Bluetooth support

1.2.4.1 Configuring ethernet

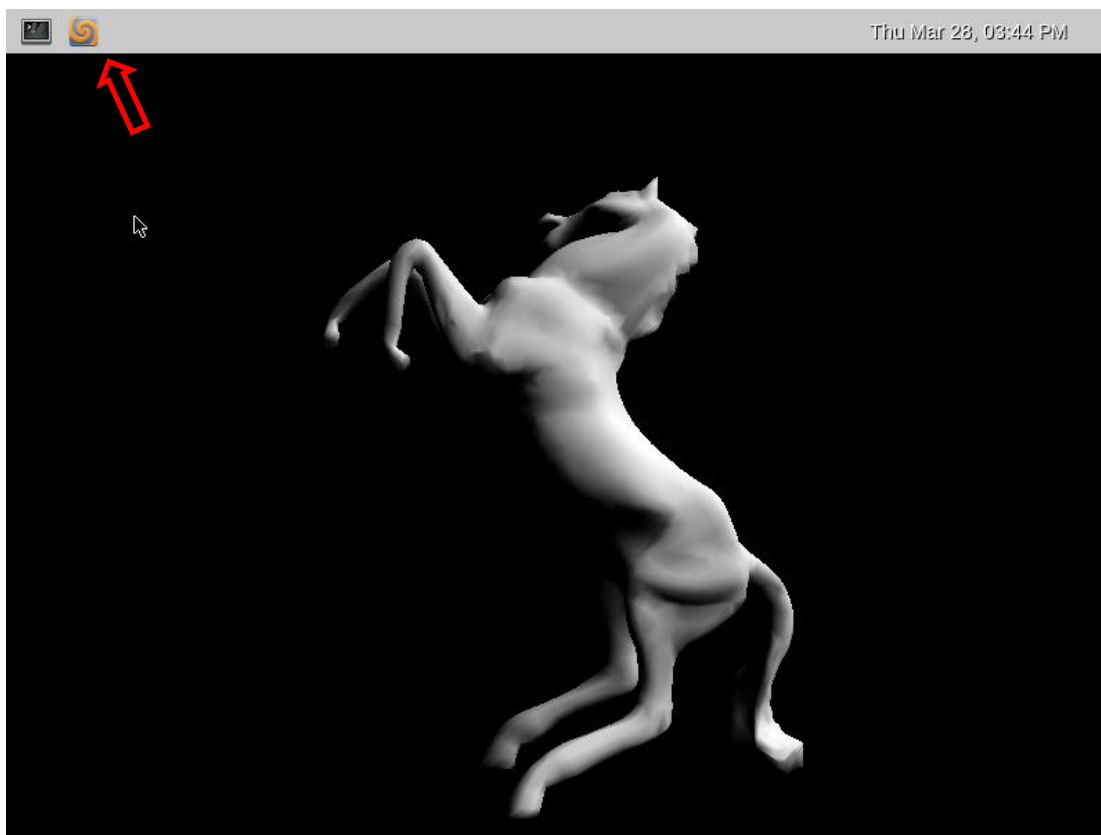
When an ethernet cable is plugged into the RJ45 connector, autonegotiation will start automatically and the network service will try to get IP address over DHCP. The progress of network card configuration can be checked by executing:

```
# ifconfig eth0
```

When eth0 has already received IP address the network connection can be tested by

```
# ping google.com
```

1.2.4.2 Starting GPU Demo



The GPU demo glmark2 can be started and stopped with the marked button.

1.2.4.3 Configuring WiFi

Before configuring WiFi it is best to shut down other interfaces:

```
# ifconfig eth0 down
```

```
# ifconfig usb0 down
```

Now let's start WiFi:

```
# ifconfig wlan0 up
```

```
# iw dev wlan0 scan | grep ssid -i
```

The last command will list the WiFi hot spots in range. If a WiFi network uses WPA authentication the following commands will connect to it:

```
# cd
# cp /etc/wpa_supplicant.conf .
# wpa_passphrase [SSID] [passphrase] >> ./wpa_supplicant.conf
```

Please insert the name of the WiFi network and the passphrase in the command above without quotes or the brackets.

Now connect to the WiFi network.

```
# wpa_supplicant -B -Dnl80211 -iwlan0 -cwpa_supplicant.conf
```

The connection can be checked by:

```
# iw dev wlan0 link
```

When connected to the network IP address can be requested by:

```
# dhclient wlan0
```

1.2.4.4 SSH server

The pre-installed Linux automatically starts SSH server on all interfaces. One can connect to the board by executing the following command on the PC (which has access to the same network as the Avenger96):

```
# ssh root@[IP address of board]
```

1.2.4.5 Debug UART

U-Boot and Linux boot logs as well as a standard Linux console is accessible on the debug UART connected to pin 11 and 13 on the low-speed expansion connector (UART1 - see above). One can log into the Linux tty console with the help of a USB-serial converter like this:

<https://www.96boards.org/product/uartserial/>

Any other USB-serial converter can be attached to the UART1 pins but care must be taken that signal levels are 1.8V CMOS.

1.2.4.6 Debug UART

Show image information:

```
# cat /etc/issue
```