Digital Library

Hardware

Ver 1.1

Draft

Note: This document is intended to be read in conjunction with Digital Library Ver 1.0 firmware.

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1. Introduction

The Digital Library software is intended to run on simple, robust, low cost wifi router hardware that is readily available to users worldwide.

The system is built on OpenWRT, with Ver 1.0 based on OpenWRT 19.07 as the latest stable release.

In choosing router hardware, preference has been given to devices which operate natively on OpenWRT as this ensures a simple conversion / upgrade process.

It is fairly straightforward to build the firmware for other hardware devices as long as they are supported under a current version of OpenWRT.

'Tiny' Router Devices

Firmware for a number of TP-Link devices has been built because there are many of these devices operating in the field with legacy software such as Library Box, and Digital Library can extend their useful life.

These devices include MR3020, MR3040, and WR703.

However, these devices have only 4MB of Flash memory, and it is difficult to fit even the operating system into this space. A special 'tiny' version of OpenWRT 19.07 has been used for these devices, and some DL functionality has been ommitted or limited, specifically SFTP support and file upload.

This does not affect the basic operation of the device for use as a Digital Library, and they perform the basic functions quite well.

OpenWRT 19.07 is the last version that will support 'tiny' devices, so long term support will obviously be limited.

These devices are therefore not generally recommended for new purchases, and there are better alternatives available.

Memory Devices

The Digital Library generally uses flash memory devices such as Micro SD Cards and USB Memory Sticks to store the library content. Selection of appropriate memory devices is important to ensure correct and reliable operation.

2.   Memory Devices

The Digital Library uses flash memory devices such as Micro SD Cards and USB Memory Sticks to store the library content.

The default library content occupies some 40GB of storage 'on disk', so memory devices will typically be 32, 64 or 128GB SD Cards or USB Memory Sticks.

An SSD or HDD may also be used via a USB connection to provide larger storage.

Memory Device Specifications

Technical specifications (such as read/write speeds) for USB Memory Sticks are not generally part of the device labelling. USB 3 memory devices, such as the examples shown below, typically state a read speed of 100MB/s in the marketing / specification material, whereas USB 2 devices often don't show a speed rating.

Micro SD Cards on the other hand have various classifications as part of the device labelling e.g. *C10* for a Class 10 device, and *UHS1* for Ultra High Speed (up to 104 MB/s) . These classifications translate into practical speed ratings which are typically shown in the marketing material as 80, 100 or 120MB/s read speed.

The Digital Library has been tested to operate satisfactorily on a variety of router hardware using SD and USB memory devices with these speed specifications.

It is recommended to use memory devices that are from a reputable manufacturer and for which at least basic specifications are available, as above.

However, particular combinations of memory and router devices should be tested and to confirm correct operation before large scale purchase and deployment.

Power Consumption and Temperature

An issue that has been experienced with some USB devices is that they run at an elevated temperature due to additional power consumption. These devices are uncomfortably warm to the touch when in operation. USB Memory devices have been known to fail when used in 24x7 applications, and elevated temperatures will accelerate this type of failure.

Micro SD Card Adapters

To use a Micro SD Card with a router equipped with only a USB port, a Micro SD Card to USB adapter will be required.

SD Cards of 32GB or less are SDHC, while 64GB and above are SDXC. When selecting adapters, look for SDXC compliance, as SDHC adapters may not operate reliably with the larger SD cards.

2.1   Example Devices

Below are shown a variety of memory devices with links to their respective web sites showing typical marketing / specification data.

USB-3 Memory

SanDisk Ultra Shift

https://shop.westerndigital.com/en-au/products/usb-flash-drives/sandisk-ultra-shift-usb-3-0#SDCZ410-064G-G46

SanDisk Cruzer Glide 3.0

https://shop.westerndigital.com/en-au/products/usb-flash-drives/sandisk-cruzer-glide-usb-3-0#SDCZ600-016G-G35

SanDisk Ultra Fit USB 3.1

https://shop.westerndigital.com/en-au/products/usb-flash-drives/sandisk-ultra-fit-usb-3-1#SDCZ430-016G-G46

USB-2 Memory

SanDisk Cruzer Fit

https://shop.westerndigital.com/en-au/products/usb-flash-drives/sandisk-cruzer-fit-usb-2-0#SDCZ33-064G-G35
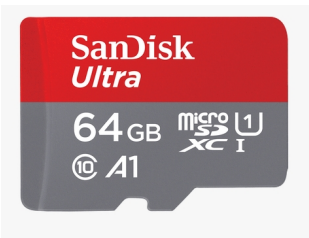
SanDisk Cruzer Blade

https://shop.westerndigital.com/en-au/products/usb-flash-drives/sandisk-cruzer-blade-usb-2-0#SDCZ50-064G-BQ35

Micro SD Cards

SanDisk Ultra 100MB/s

https://shop.westerndigital.com/en-au/products/memory-cards/sandisk-ultra-uhs-i-microsd#SDSQUA4-064G-GN6MA

Samsung Evo Plus 100MB/s

https://www.samsung.com/au/memory-storage/memory-card/evo-plus-microsd-card-64gb-mb-mc64ha-apc/

Micro SD / USB Adapters

Examples of Micro SD Card USB Adapters showing the **SDXC** labelling.

3.   GL-iNET WiFi Router Devices

GL-iNET devices operate natively on OpenWRT and the company actively supports end user development of their products.

Digital Library firmware has been built for a number of their products as follows:

- MT300N-V2
- AR300M
- AR750
- AR150

3.1   MT300N-V2 - 'Mango'

This device is based on the MediaTek MT7628NN @580Mhz chipset.

It is sold as a 'N300 Mini Router' for around $20.

The WiFi protocol is 802.11 b/g/n with 2x2 MIMO operation.

Antennas are internal on the PCB.

It provides 128MB RAM, 16MB Flash ROM, dual Ethernet ports and a single USB port.

Power connection is via Micro USB connector and is < 2.75 Watts.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, or by using the U-Boot Web Failsafe screen.

3.2 AR300M, AR300M-Ext - 'Shadow'

This device is based on the Atheros QCA9531, @650MHz chipset.

It is sold as a 'Mini Smart Router' for around $35 / $40.

The WiFi protocol is 802.11 b/g/n with 2x2 MIMO operation.

Antennas are internal on the PCB in the base model and external 2dB in the '-Ext' model.

It provides 128MB RAM, 16MB Flash ROM, two 10/100M Ethernet ports and a single USB port.

Power connection is via Micro USB connector and is < 2Watts.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, or by using the U-Boot Web Failsafe screen.

3.3   AR150, AR150-Ext, AR150-PoE - 'White'

This device is based on the Atheros AR9331, @400MHz chipset.

It is sold as a 'Mini Smart Router' for around $25 - $30 depending on options.

The WiFi protocol is 802.11 b/g/n.

Antennas are internal on the PCB in the base model and external 2dB in the '-Ext' models.

It provides 64MB RAM, 16MB Flash ROM, two 10/100M Ethernet ports and a single USB port.

Power connection is via Micro USB connector and is < 1.5Watts.

A PoE option is available on the '-PoE' models.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, or by using the U-Boot Web Failsafe screen.

3.4   AR750 - 'Creta'

This device is based on the Atheros QCA9531, @650MHz chipset.

It is sold as a 'Dual Band Wireless Router' for around $45.

Both 2.4GHz and 5GHz WiFi bands are provided.

The WiFi protocol is 802.11 802.11 a/b/g/n/ac with 2x2 MIMO operation on 2.4GHz band.

Antennas are internal on the PCB for 2.4GHz and internal via connector for the 5GHz band.

It provides 128MB RAM, 16MB Flash ROM, three 10/100M Ethernet ports and a single USB port.

An SD card port is also provided.

Power connection is via Micro USB connector and is < 4Watts.

Note: A mains plug pack is provided as the power consumption is too high for a normal USB port.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, or by using the U-Boot Web Failsafe screen.

4. Dragino WiFi Router Devices

4.1 MS14N-P

This device is based on the Atheros AR9331, @400MHz chipset.

It is sold as a 'Linux Appliance' for around $45.

The WiFi protocol is 802.11 b/g/n .

Antennas are internal on the PCB in the base model and external 2dB in the '-Ext' model.

It provides 64MB RAM, 16MB Flash ROM, dual Ethernet ports and a single USB port.

Power connection is via 12Volt Barrel connector , < 2Watts, and a mains plug pack is supplied.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, or by using the U-Boot Web Failsafe screen.

4.2   PAN

This device is based on the Atheros AR9331, @400MHz chipset.

It is sold as a 'Outdoor OpenWRT Appliance' for around $45.

The WiFi protocol is 802.11 b/g/n .

Antennas are internal on the PCB.

It provides 64MB RAM, 16MB Flash ROM, dual Ethernet ports and a single USB port.

Power connection is via 12Volt Barrel connector, < 2Watts, and a mains plug pack is supplied.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, or by using the U-Boot Web Failsafe screen.

5.   SEEED WiFi Router Devices

5.1   SEEEDuino Cloud Yun Board
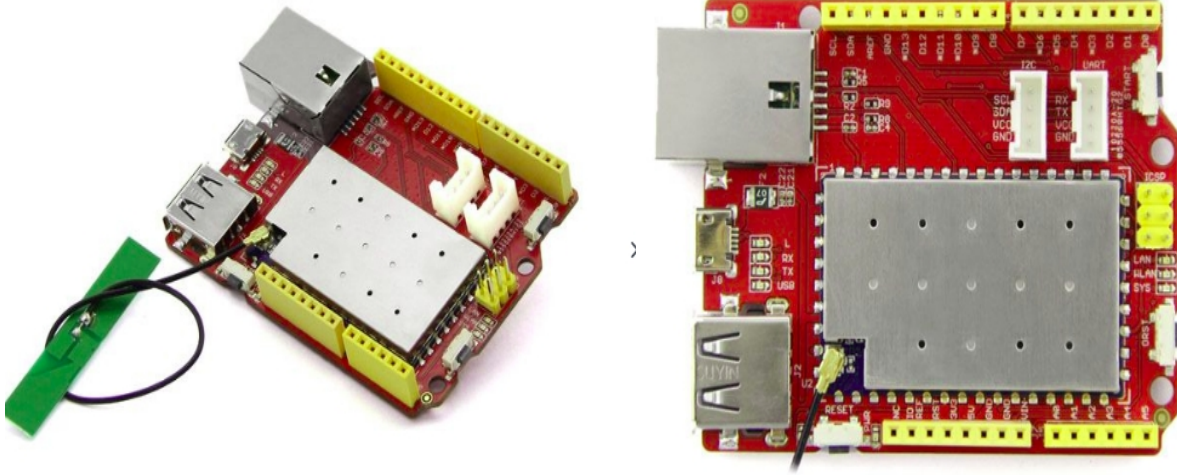
This device is based on the Atheros AR9331, @400MHz chipset.

It is sold as an 'Arduino Yun Controller for around $16.

The WiFi protocol is 802.11 b/g/n.

Antennas is external via connector.

It provides 64MB RAM, 16MB Flash ROM, one 10/100M Ethernet ports and a single USB port.

Power connection is via Micro USB connector and is < 1.5Watts.

Installation of the Digital Library requies a somewhat complex two step process to replace the default pre-installed YUN firmware.

This device includes a complete Arduino subsystem based on Atmega32u4 which may be programmed separately, and provides a wealth of I/O options including Analogue, Digital, I2C and UART.

6.   TP-Link WiFi Router Devices

6.1   TL-MR3020, TL-MR3040

NOTE: These are regarded as legacy devices due to the limited memory provided.

These devices are based on the Atheros AR9331, @400MHz chipset.

The WiFi protocol is 802.11 b/g/n with 2x2 MIMO

Antennas are internal on the PCB.

It provides 32MB RAM, 4MB Flash ROM, one 10/100M Ethernet port and a single USB port.

Power connection is via Mini / Micro USB connector and is < 1.5Watts.

The MR3040 has an internal Li-Ion battery so can operate stand-alone.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, initially using the special 'factory' firmware version, and subsequently upgraded using the normal 'sysupgrade' version.

6.2   TL-WR842N(D) V1, V2, V3

These devices are based on a variety of chipsets and memory depending on the version.

    Ver 1: Atheros AR7241 + AR9287   (8MB Flash / 32MB RAM)

    Ver 2: Atheros AR9341   (16MB Flash / 64MB RAM)

    Ver 3: Qualcomm Atheros QCA9531 (16MB Flash / 64MB RAM)

The WiFi protocol is 802.11 b/g/n with 2x2 MIMO.

Antennas are external and removable on some models (D).

It provides five 10/100M Ethernet ports and a single USB port.

Power connection is via 12V Barrel connector and a mains plug pack is supplied.

Installation of the Digital Library may be done using the Firmware Upgrade page in the native firmware, initially using the special 'factory' firmware version, and subsequently upgraded using the normal 'sysupgrade' version.