



**Digital Library
User Guide**

Ver 2.2



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Based on a work at www.villagetelco.org.

Note: This document is intended to be read in conjunction with Digital Library Ver 2.4 firmware.

Revision History

Version	Date	Sections
Ver 1.1	Jan 2021	Sect 1, Sect 3.9
Ver 2.0	Oct 2021	Updated for Ver 2 functions
Ver 2.1	Apr 2022	Updated for USB Firmware Upgrade
Ver 2.2	Feb 2023	Updated Logout menu. Minor updates

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1. Introduction

The Digital Library project is intended to provide a low cost WiFi device hosting a library of electronic documents, browser based applications and other materials suitable for use in a classroom or similar environment, with PCs, tablets and mobile smart phones as client devices.

No Internet connection is required to use the device – the content is stored locally on the digital Library. Several off-the-shelf router devices may be used, starting at a cost of around \$20. The software is based on the well proven OpenWRT system.

Library content may be stored on USB, SD Card memory devices which may be 8GB to 128GB in size. A USB connected SSD may also be used for larger storage. Multiple USB devices may be used, allowing local content to be managed separately to the main library.

A basic library image has been developed containing some 40GB of content, largely drawn from the World Possible website (rachel.worldpossible.org/content). The library contains material with licences that allow free use. Additional applications such as Sugarizer (which provides the interactive Sugar graphical learning environment from XO laptops for younger students - sugarizer.org) have also been included.

The basic library image includes:

- Wikipedia for Schools
- Khan Academy Maths and Science Videos
- Phet Interactive Simulations for Science and Maths
- Siyavula / CK-12 Textbooks
- African Story Books / Book Dash / Cat and Dog Books / Mustard Seed Books / English Storybooks
- Gutenberg Project – Great Books of the World
- Blockly Games
- OLE Nepal Collection of Digital Learning Materials
- Women in African History
- Maps of the World
- MedlinePlus / Hesperian / Khan Academy Health and Medicine
- InfoNet-Biovision Articles on Agriculture, Environment and Health subjects.
- Practical Action Knowledge Bank of Technologies
- Sugarizer Interactive Sugar graphical learning environment from XO laptops.

You can add local content to the main library memory device or to a second memory device, either by uploading files via the web interface, or by preparing files for the memory devices on a separate PC, or by accessing the Digital Library device via SFTP.

The Digital Library can connect to an upstream network via Ethernet or WiFi in order to provide access to additional on line resources such as an Internet connection.

DNS Filtering is supported to ensure inappropriate content is not accessible through the Digital Library.

1.1 Digital Library Hardware

The Digital Library firmware is intended to run on low cost WiFi routers. Unfortunately many low cost routers have minimal Flash and RAM memory that limits what can be done with them. Many are no longer capable of running the current standard OpenWrt system that underpins the Digital Library.

A good example is the TP Link MR3020 Travel Router which has widely been used previously by projects such as PirateBox and LibraryBox, although the device has limited memory.

We have produced a Digital Library firmware (called Ver-1) that will operate on the MR3020 and some similar devices, simply because there are many of them in the field that can be re-purposed.

The Ver-1 firmware has all the core functions of the Digital Library, but is based on a stable release of OpenWrt that will not get ongoing updates.

For new work, we recommend using the Ver-2 firmware on later model devices that have more hardware resources that allow the use of current up to date software and which will provide a very good level of performance. The cost of these devices is still quite low, and it is quite feasible to put together a Digital Library device with 64GB of library content for around \$50.

We have chosen devices that are readily available and are well supported under OpenWRT. Obviously there are many other devices that would be suitable, and it is quite possible to port the firmware to other devices as required.

Below is a list of devices that can be used with the different firmware currently.

Devices that only use Ver-1 firmware

TP Link: MR3020, MR3040, WR842N

Ver-1 Firmware Download:

<https://download.villagetelco.org/firmware/digital-library/releases/Ver-1/Ver-1.6/>

Devices that use Ver-2 Digital Library firmware

GliNet: AR150, AR300M, AR750, MT300N-V2

Dragino: MS14

Ver-2 Firmware Download:

<https://download.villagetelco.org/firmware/digital-library/releases/Ver-2/Ver-2.4/>

2. Getting Started

When a new Digital Library (DL) device is received, it may need to have the Digital Library software installed. The process for doing this is covered in a later section of the document.

Once the software is installed, disconnect the power and install the USB memory device containing the Library content. Power up the device, wait a minute or so for it to start up, then look for a WiFi network on your PC, Tablet or Smartphone. You will see two WiFi Access Points, one called **Digital-Library** and another called **Digital-Library-Guest**.

You can connect your PC, Tablet or SmartPhone to one of these Access Points. The default WiFi passwords are **password** and **passwordguest** respectively.

The operation of these two Access Points is essentially the same in relation to the Library, but if the DL device is connected to an upstream network, for example with an Internet connection, the **Guest** Access Point will not allow access to the upstream network or the Internet connection.

Once you have made a successful WiFi connection to the Digital Library, open a web browser and enter the URL **http://Digital-Library** into the browser address field and click **Enter**. The browser will load up the home page of the Digital Library which allows you to navigate to the various content modules. You may also use the default IP Address **http://10.10.10.1** as the URL to access the Digital Library page. (Or **http://10.10.11.1** for a **Guest** WiFi connection).

If there is no Library memory device connected, you will see the Library home page, but you will not be able to navigate to any of the content modules.

Clicking on a content item on the Library home page will open a new tab on the browser, showing the Home page for the particular module. The main Library home page tab will remain open and you can swap between the two. You may also right click on an item and choose to open the item in a new browser tab or window.

Once you have checked that the Digital Library is working correctly, you can proceed to the administration web pages in order to set up the device configuration to suit your particular needs.

In particular, you should change the default passwords as a minimum.

3. Administration

To access the Administration web pages for the Digital Library, open a new browser tab and enter the URL <http://digital-library/admin> (or <http://10.10.10.1/admin> for the Digital-Library WiFi or the Ethernet LAN connection, or <http://10.10.11.1/admin> for the Digital-Library-Guest WiFi connection).

You will be prompted for login credentials.


There are two accounts which may be used, *admin* and *root*.

The default passwords for these accounts are *adminpassword* and *password* respectively.

Once you have logged in, the browser will display the *System Overview* page as shown below.

Other configuration pages may be selected from the menu at the top of the page.

3.1 Overview Screen



The screenshot shows the 'System Overview' page of the VillageTelco administration interface. The page has a teal header with navigation links: System Overview, Library, General, WiFi, Network, Firmware Upgrade, and Logout. The main content area displays system information in a key-value format:

Firmware:	Digital-Library-MT300N-V2-VER-2.4 MT300N-V2 Build date: 2022-04-10-08:25 Git: digital-library-dev Tag-Ver2.3-6-gaed0f7a5af
System:	"OpenWrt 19.07.9 r11405-2a3558b0de"
Hostname:	Digital-Library
System Time:	Mon Apr 11 15:31:32 AEST 2022
Uptime:	15 min
Internet:	Internet Connection OK
Load Avg:	0.00, 0.00, 0.00
Memory:	Available Memory: 77460kB / Total Memory: 124844kB
Storage:	Filesystem Type Size Used Available Use% Mounted on /dev/sda1 ext2 58.5G 54.7G 905.2M 98% /mnt/sda1

The System Overview screen displays the device identification and software version data, along with some operational information including time, Internet connection status, system load, system memory utilisation, and storage usage.

On this screen you can see that the device is a *MT300N-V2* with 128MB of Memory and that there is a storage device installed which is formatted as *ext2* and is 58.5GB in size. This storage device contains the main Library and is 98% full.

3.2 Library Management Screens

The Library Management screens allow you to add files from your PC to the main Library storage memory device in an area called **Local Content 1**, which may be accessed from the Library Home page via the menu at the top of the home page.

These pages are intended to be used primarily from a PC connected to the Digital Library.

There are two Library Management pages, **Add / Delete** and **Copy**.

There is also a menu item that will take you to the main Library Home page.

Library Add / Delete Screen

Library Management - Add / Delete Files

Add File to Local Library

Browse... No file selected.

Upload Upload selected file.

Store Cancel Refresh

Delete Local Library File/Dir

File/Dir to Delete

Delete Cancel Refresh

Local Files

- Digital-Library-Hardware.pdf
- Digital-Library-Intro.pdf
- Digital-Library-Manual-Ver-1.0.pdf
- Digital-Library-QuickStart-Ver-1.0.pdf
- ISTORIANATUREZAFINALFIXFINAL29092015MLT_yn9f7.pdf
- ISTORIANATUREZAFINALFIXFINAL29092015MLT_yn9f7.pptx

The Library Add / Delete screen allows you to add files from your PC to the main Library storage memory device in an area called **Local Content 1**, which may be accessed from the Library Home page via the menu at the top of the home page. You may also delete files and directories from this area.

Select **Library / Add/Delete** from the top menu.

This screen does not allow you to add or remove files from the main Library content area.

Adding Files

To add a file, click on the **Browse** button to open a file browsing window showing the file system of your PC.

Select a file that you want to upload and click **Enter**. The details of the selected upload will be displayed so you can check them.

Click on the **Upload** button to transfer the file(s) to the Digital Library.

Once the transfer is complete, click on the **Store** button to save the file(s) in the **Local Content** area.

A message will be displayed showing success of the copy operation.

Note that there is a limit of 16MB on the size of individual uploads. For large file uploads, it is better to put the memory device into your PC and load the files directly.

After loading new files, go to the Library home page and click on the **Local Content** link, and you will see the files listed in the file system structure. Clicking on an individual file in the list will open the file in the browser or whatever application is appropriate, depending on the file type.

Note that if you load a file called **index.html** or similar into the top level of the **Local Content** directory, when you access the link from the Library home page, then the contents of the **index.html** file will be displayed as a web page instead of the file list.

If you wish to add a complete directory of files, use the **Library / Copy** screen described in the next section.

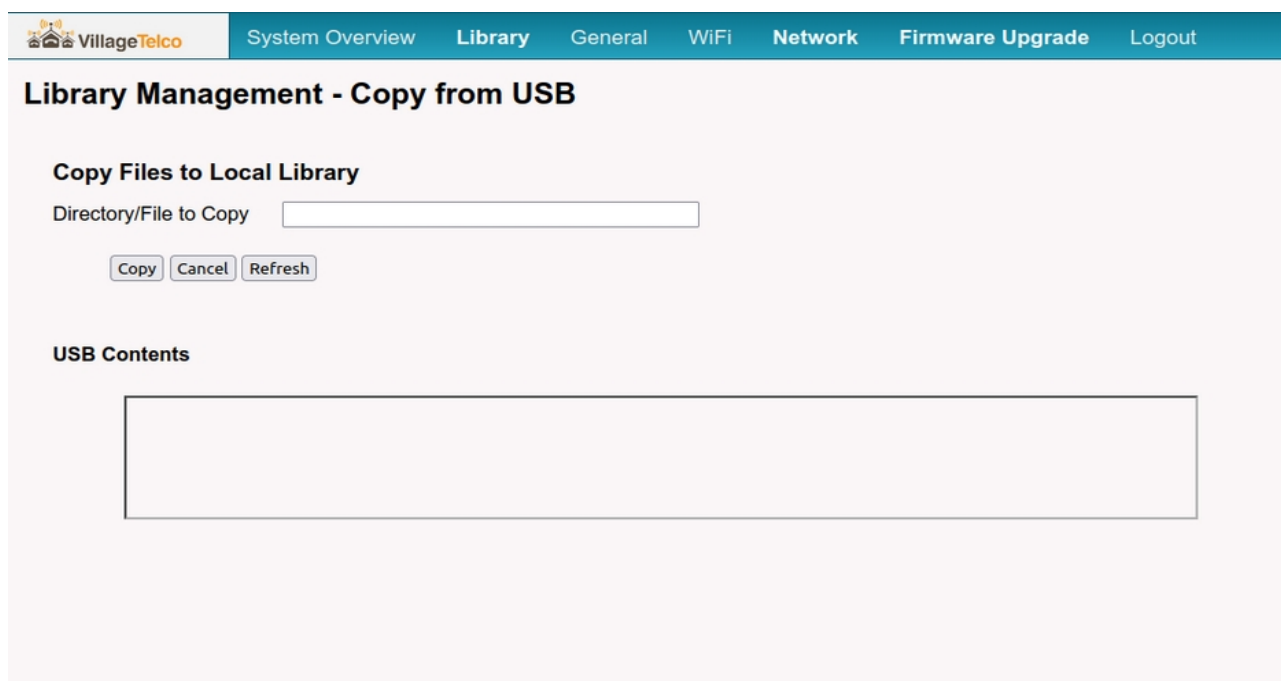
Alternatively, copy files directly to the memory device on your PC. Note that for memory devices formatted as **EXT2**, you will need to use a Linux based PC.

Deleting Files

To delete a file (or directory), simply enter the file (or directory) name into the **Delete** field and click on the **Delete** button.

You can copy the file name from the list shown in the box at the bottom of the page and then paste it into the **Delete** field.

Library Copy Screen



Library Management - Copy from USB

Copy Files to Local Library

Directory/File to Copy

USB Contents

The **Library Copy** screen allows you to copy files or directories from a **Secondary** memory storage device onto the main **Primary** Library storage device.

Select **Library / Copy** from the top menu.

The **USB Contents** box will display the contents of the **Secondary** memory device.

To copy a file or directory, enter the name into the **Copy** field and click on the **Copy** button.

You may copy the name from the **USB Contents** list and paste it into the **Copy** field.

A message will displayed showing success of the copy operation.

Note: If your Digital Library device has only a single USB slot used for the **Primary** library memory, then you may be able to use a USB Hub device to provide and additional USB port for the **Secondary** memory.

You may have to swap the USB memory sticks around on the Hub to get the Primary and Secondary devices correctly recognised by the Digital Library.

3.3 General Configuration Screen

The screenshot shows the 'System General' configuration page in the VillageTelco web interface. The page has a teal header with navigation tabs: System Overview, Library, General, WiFi, Network, Firmware Upgrade, and Logout. The main content area is titled 'System General' and contains several sections:

- Password (admin):** A password input field with a 'Show' button and a 'Set admin Password' button.
- TimeZone:** A dropdown menu set to 'UTC' and a 'Save&Apply' button.
- Port Forwarding:** A checkbox for 'Enable SSH Forward' which is checked, with 'Save&Apply' and 'Cancel' buttons.
- Restore Factory Default Settings:** A 'Restore Factory Defaults' button.
- Local Hosts File:** Two input fields for 'IP Address' and 'Name', with an 'Add Local Host' button.
- Saved Hosts:** A text area displaying two entries: '127.0.0.1 localhost' and '10.10.10.1 Digital-Library'. Below this area are 'Refresh' and 'Reset to Default' buttons.

Passwords

This section allows you to set the passwords for the *admin* and *root* accounts on the Digital Library system.

If the current login is the *root* account, the password fields for both accounts will be displayed.

If the current login is the *admin* account, only the password field for the *admin* account will be displayed.

Stored passwords will not be displayed.

To enter a new password, type the password into the field, click on *Show* to display the password, and when you have checked that it is correct, click on the respective *Set* button.

Time Zone

Select the required Time Zone from the drop down list and click on the *Save&Apply* button.

SSH Port Forward

Enable this setting to forward SSH on Port 2222 via the WAN if required. Disable on production systems for security. See also Remote Access section of the manual.

Restore factory Settings

Click on the button to restore all setting to Factory Default.

A message will be displayed when the settings have been reset.

To put the new settings into effect, reboot the Digital Library device.

You will be prompted to login again to the browser with the default password.

Local Hosts

This section allows you to make an entry into the *etc/localhosts* file. This allows you to access a resource on an upstream network by name rather than by IP address.

The current entries in the hosts file are shown in the box.

Enter the required new *IP Address* and *Name* into the respective fields and click on the *Add Local Host* button.

You may restore the hosts file to default by clicking on the *Reset to Default* Button. This will remove all additions to the file and leave just the default *localhost* entry.

3.4 WiFi Configuration Screen

The screenshot shows the WiFi configuration interface with the following sections and fields:

- Radio Settings:**
 - 2.4GHz Channel: 11 (dropdown)
 - Tx Power (0-18) dBm: 17 (input field)
- WiFi Access Point Settings:**
 - Enable 2.4GHz Access Point:
 - WiFi Name SSID: Digital-Library (input field)
 - Passphrase (8-32 char): [masked] (input field)
 - Max Connections (1-35): 30 (input field)
 - Encryption: WPA (dropdown)
- WiFi Guest Access Point Settings:**
 - Enable 2.4GHz Guest Access Point:
 - Guest WiFi Name SSID: Digital-Library-Guest (input field)
 - Passphrase (8-32 char): [masked] (input field)
 - Max Connections (1-35): 10 (input field)
 - Encryption: WPA (dropdown)
- WiFi WAN Client Settings:**
 - WiFi WAN is currently **DISABLED** See Network page (red text)
 - Host WiFi SSID: Host-SSID (input field)
 - Passphrase: [masked] (input field)
 - WiFi Survey: [dropdown]
 - Encryption: WPA2 (dropdown)
 - Scan button

Buttons at the bottom of each section include Save, Save&Apply, Cancel, and Refresh.

The WiFi configuration screen allows you to set up the operational parameters of the WiFi sub system. Select **WiFi** from the top menu.

Radio Settings

This section allows you to set the **Channel** and **Tx Power** level.

Note: It is recommended for 2.4 GHz systems, that the channel selected is one of the three non-overlapping channels i.e. **1, 6 or 11**.

It is recommended to set the **Tx Power** level to the minimum level which gives correct operation. For a classroom situation, a level of 9 or 12dBm is generally sufficient.

After making the required changes, click **Save&Apply** to store the settings and restart the WiFi sub-system.

WiFi Access Point Settings

These sections allow you to enable the two Access Points, and to set the SSID name, the WiFi **Passphrase** and the **Encryption** type for each one.

You may also set the **Max Connections** limit for the Access Points to ensure that the system does not get overloaded and remains stable. A maximum of 40 connections in total is recommended.

After making the required changes, click **Save&Apply** to store the settings and restart the WiFi sub-system.

WiFi WAN Settings

This section allows you to set up the connection details for the **WiFi WAN** connection. This allows you to connect to an upstream network via Wifi.

The **WiFi Survey** list will show all active WiFi Access Points in the area, and you can select one from the list to automatically populate the **SSID** and **Encryption** fields.

You must enter the **PassPhrase** details by typing into the field.

After making the required changes, click **Save** to store the settings and restart the WiFi sub-system.

To enable the connection, you must then move to the **Network** screen and select the **WiFi WAN** option, followed by **Save&Apply** on that screen.

3.5 Network Configuration Screen

The screenshot shows the 'Network' configuration page. At the top, there is a navigation bar with 'VillageTelco' logo and menu items: System Overview, Library, General, WiFi, Network (selected), Firmware Upgrade, and Logout. Below the navigation bar, the 'Network' section is titled. Under 'LAN Settings', there are input fields for IP Address (10.10.10.1), Gateway (255.255.255.255), Netmask (255.255.255.0), DNS 1 (8.8.8.8), DNS 2 (8.8.4.4), Enable DNS Filter (checked), and Enable DHCP (checked). There are also fields for Addr 1 (208.67.222.123) and Addr 2 (208.67.220.123). Under 'WAN Settings', there is a 'Select WAN type' section with radio buttons for Ethernet WAN (selected), WiFi WAN, Mesh WAN, Mesh WAN GW, and Disable WAN. Below this, there are 'Ethernet WAN Settings' and 'WiFi WAN Settings' sections, both with an 'IP Address' dropdown menu set to 'DHCP'. At the bottom, there are buttons for 'Save', 'Save&Apply', 'Cancel', and 'Refresh'.

The Network screen allows you to set up the networking parameters of the Digital Library.

Select *Network* / *Network* from the top menu.

LAN Settings

These settings control the IP parameters for the LAN to which the client devices connect.

These settings will not normally need to be changed unless you are integrating the Digital Library into an existing LAN.

Enable DNS Filter

By default, the Digital Library will utilise a DNS Filter to ensure that any content downloaded is appropriate for the intended classroom use.

The default *DNS Filter* addresses (208.67.222.123 and 208.67.220.123) are for the **Open DNS Family Shield** service, which blocks links to sites containing malware, phishing and adult content.

If the DNS Filter is not enabled, then the settings in the normal DNS fields will be used.

After making the required changes, click *Save&Apply* to store the settings and restart the Network sub-system.

WAN Settings

These settings allow you to connect the Digital Library to an upstream network via Ethernet or WiFi, or to use a simple Mesh network to link devices to share an upstream connection.

By default the **WAN Port** is set to use the **Ethernet** connection. This setting is OK to use for standalone operation of the Digital Library.

Alternatively, the **WAN Port** may be set to **WiFi WAN**, **Mesh WAN** or **Disabled**.

The **WiFi WAN** setting configures a WiFi Client interface to connect to an upstream network Access Point.

If the port is set to Disabled, neither Ethernet or WiFi Client is enabled.

For devices with a single Ethernet connector, this connector will be configured as a LAN port if the **WAN Port** setting is selected as either **Disabled** or **WiFi WAN**. This ensures that the Digital Library device can be accessed via Ethernet cable in the event that the WiFi subsystem is not operating correctly. (See below)

Ethernet WAN Settings

If the Ethernet WAN **IP Address** field is set to **DHCP**, the network settings for the Ethernet WAN port will be set automatically by the upstream network DHCP server.

If the Ethernet WAN **IP Address** field is set to **Static**, the network settings for the Ethernet WAN port may be set manually by entering the appropriate values for **IP Address**, **Netmask**, **Gateway** and **DNS** in the respective fields which will be displayed when the selection is made.

WiFi WAN Settings

If the WiFi WAN **IP Address** field is set to **DHCP**, the network settings for the WiFi WAN port will be set automatically by the upstream network DHCP server.

If the WiFi WAN **IP Address** field is set to **Static**, the network settings for the WiFi WAN port may be set manually by entering the appropriate values for **IP Address**, **Netmask**, **Gateway** and **DNS** in the respective fields which will be displayed when the selection is made.

When the required changes have been made to the settings, click on **Save&Apply** to store the settings and restart the Network sub-system.

WiFi WAN Interface Operation

Note that if the Digital Library is configured to use WiFi WAN, and the device is not able to connect to the host Access Point, then the whole WiFi sub-system will not operate.

On system start up, or after a Network or WiFi sub-system restart, the Digital Library will survey to check if the host Access Point is present, and, if not, the WiFi sub-system will be configured with the WiFi Client interface disabled in order that the Access Points will operate correctly.

Similarly if the host Access Point is present but a connection can not successfully be made to it within a minute, the WiFi sub-system will be configured with the WiFi Client interface disabled in order that the Access Points will operate correctly.

If the host Access Point fails during operation, the connection from the Digital Library will be lost and the Access Points will cease to operate. In this event it is necessary to restart the Digital Library

so that it can reconfigure itself to operate the Access Points correctly.

Mesh WAN Interface Operation

Selecting Mesh WAN or Mesh WAN GW (gateway) mode allows the device to join a simple mesh network on the WAN interface. This may be used, for example, to allow several Digital Library devices located in classrooms to share an Internet connection available in one classroom.

If one Digital Library device is set to the Mesh WAN GW mode and connected via its Ethernet port to an upstream router to provide an Internet connection, then the connection will be shared with other devices that are set to the Mesh WAN mode.

Each Digital Library device in the mesh will acquire an individual IP address from the upstream router for its WAN connection.

It is important to note that the Digital Library devices that are being joined together in the Mesh need to be within WiFi range of at least one other device to have a connection.

On devices with dual band radios, such as the GL-AR750, the Mesh will operate on the 5GHz band, while the Access Point operates on the 2.4GHz band.

3.6 Network Status Screen

The screenshot shows the 'System Status' page with a top navigation bar containing 'System Overview', 'Library', 'General', 'WiFi', 'Network', 'Firmware Upgrade', and 'Logout'. The 'Network / WiFi Status' section displays the following information:

```

Network
-----
Lan IP Address:
  inet addr:10.10.10.1 Bcast:10.10.10.255 Mask:255.255.255.0
  inet addr:172.31.255.254 Bcast:172.31.255.255 Mask:255.255.255.252

Eth WAN IP Address:
  inet addr:192.168.20.174 Bcast:192.168.20.255 Mask:255.255.255.0

WiFi WAN IP Address:

Bridge:
bridge name      bridge id          STP enabled      interfaces
br-lan           7fff.e4956e464f6c no                eth0.1
br-wan           7fff.e4956e464f6c no                eth0.2

WiFi
---
Main AP Connections 2.4GHz: 0
Guest AP Connections 2.4GHz: 0

wlan0  ESSID: "Digital-Library"
       Access Point: E4:95:6E:46:4F:6C
       Mode: Master Channel: 11 (2.462 GHz)
       Tx-Power: 17 dBm Link Quality: unknown/70
       Signal: unknown Noise: unknown
       Bit Rate: unknown
       Encryption: WPA PSK (CCMP)
       Type: nl80211 HW Mode(s): 802.11bgn

--
wlan0-3 ESSID: "Digital-Library-Guest"
       Access Point: E6:95:6E:46:4F:6C
       Mode: Master Channel: 11 (2.462 GHz)
       Tx-Power: 17 dBm Link Quality: unknown/70
       Signal: unknown Noise: unknown
    
```

A 'Refresh' button is located at the bottom left of the status display area.

This screen shows the status of the various Network interfaces.

Select **Network / Network Status** from the top menu.

It shows the LAN IP settings, and the WAN IP settings depending on which WAN Port mode has been selected – Ethernet or WiFi WAN.

Fallback IP Address

Note that there is a Fallback IP address (172.31.255.254) operating on the LAN or WAN interface depending on the particular configuration of the Digital Library device.

This interface is to support administrative connections via Ethernet cable to the Digital Library device in the event that the main network interfaces are not operating correctly.

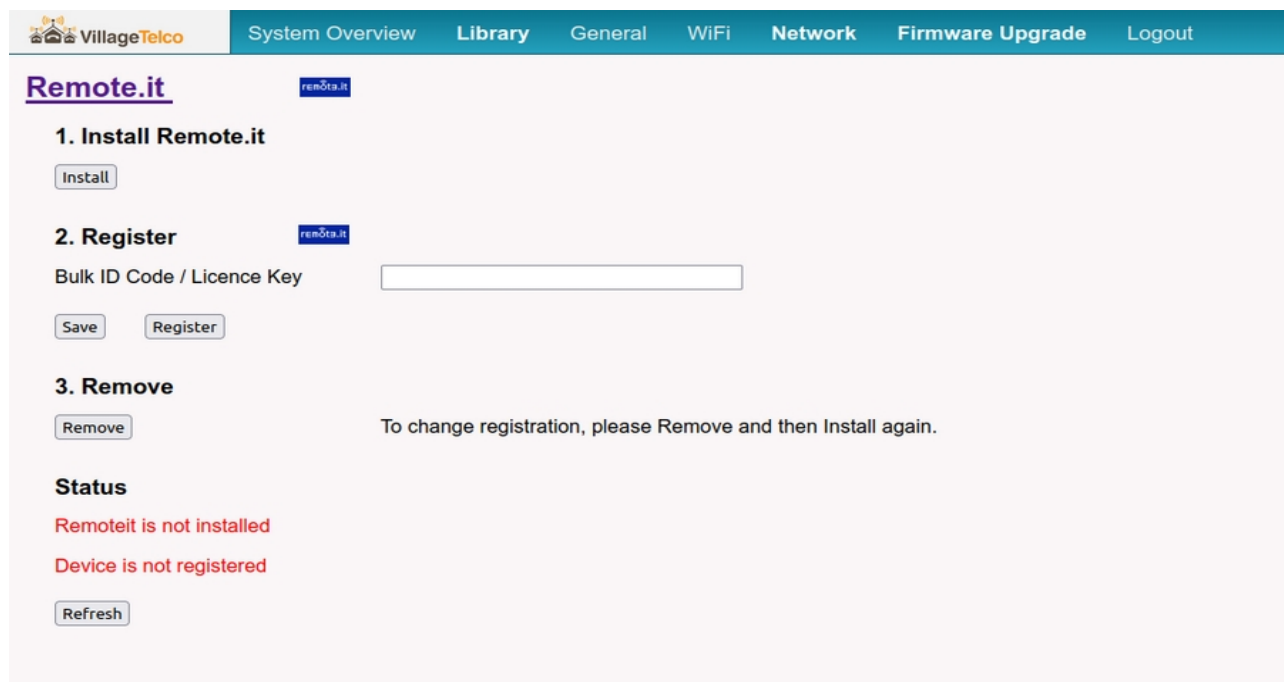
In particular, devices with single Ethernet connectors will be configured with the Fallback interface operating on the WAN interface.

This interface has a restricted Network Mask and will only accept connections from a device with its IP Address set to 172.31.255.253 with Network Mask set to 255.255.255.252.

When operating on the LAN, the Fallback interface supports HTTP and SSH connections.

When operating on the WAN, the Fallback interface supports only SSH on port 2222.

3.7 Remote Access Screen



The Remote Access screen allows you to set up a facility for secure remote management of the Digital Library device using the Remote.it service (<https://remote.it/>)

Select **Network / Remote Access** from the top menu.

Remote.it offer a Web portal and a Desktop Application that may be used to manage the remote access.

Each of these has a Device page that lists all the devices you have registered, and allows you to access the services you have defined (e.g. HTTP, SSH)

To use the remote access facility, you need to set up an account on the Remote.it web site, then register your Digital Library devices to the account.

Remote.it Account

To set up an account, go to the Remote.it website (<https://remote.it/>) and click on the Sign Up link.

There is a link (blue) at the top of the Digital Library Remote Access screen that will take you to a Help page explaining the sign up process.

Accounts are available at no cost for personal use on a limited number of devices.

Bulk ID Code

Once you have set up an account with Remote.id, you need to create a “Bulk ID Code” which is used to register devices to your account with the services that you want to access.

There is a link (blue) on the Digital Library Remote Access screen (next to the Register heading) that will take you to a Help page explaining how to set up a Bulk ID code.

The Bulk ID Code that you generate is unique to your account, and any device registered with the

code will appear in your Device list.

This code also defines the services that may be accessed on the device. For the Digital Library, the available services are HTTP to access the Administration and Library pages, and SSH to access the command line via a terminal program.

To generate a Bulk ID Code on the Remote.it Web Portal, select Products from the menu on the left, and then click on the Create Product button. Enter a name for the product definition, select the platform type, and set Product Scope to Private, then click Submit.

The new product will be displayed in the list. Click on the gear icon on the left to set up the Services.

One default service will be shown in the list.

Click on the Add button and select HTTP (Port), enter a display name (eg HTTP) and port (80), check “Service to start by default”, then click Submit.

Repeat the Add process for SSH using port 22.

Once the list of services is completed, click “Check to lock product” and click on Submit.

To obtain the Bulk ID Code, click on the “i” icon next to the gear icon for the product.

Install Remote.it

Ensure that the Digital Library device has an active Internet connection.

On the Digital Library Remote Access page, click on the Install button. After a short time the screen will refresh and the status will show that the installation has been successful.

Register

Enter the BulkID Code and click the *Save* button.

Click the Register Button. After a short time the screen will refresh and the status will show that the registration has been successful.

The device should appear on your Remote.it Web Portal on the Devices screen after a few minutes.

Accessing a Device

Click on the green Connect button for the device in the list, then click on the service (HTTP or SSH) that you wish to use.

The dialogue box will contain a URL for the HTTP connection, and a ssh command line for SSH.

If you enable ‘pop-ups’ in your browser for the Remote.it Web Portal screen, a new tab will open automatically when you select the HTTP service.

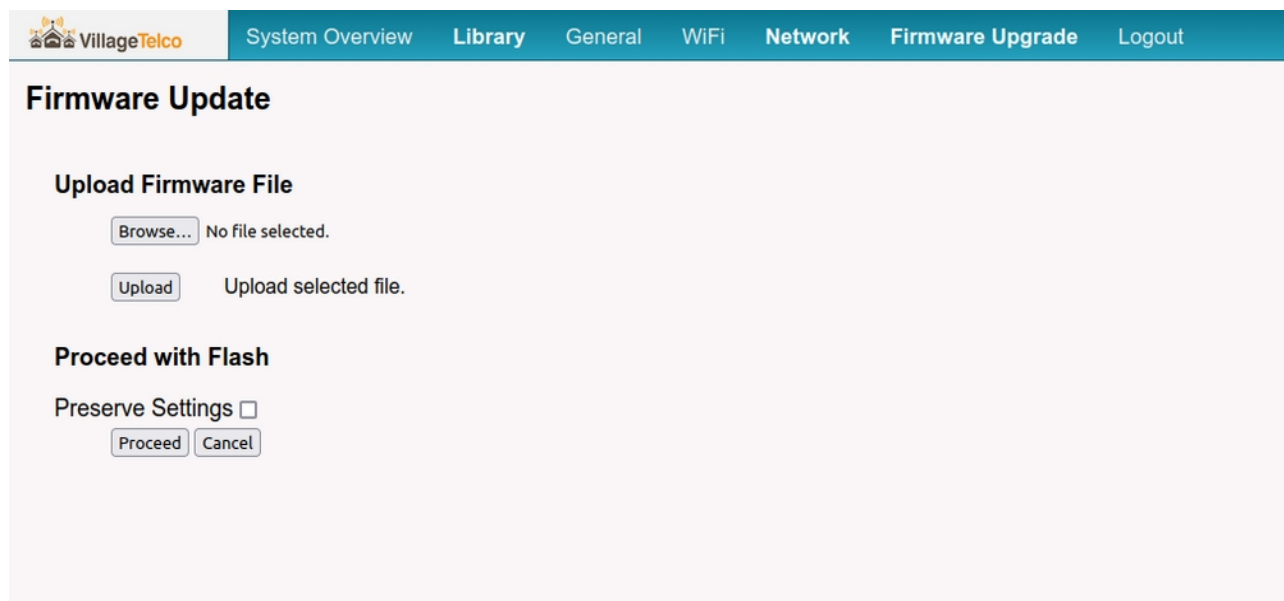
SSH Port Forwarding

Note that SSH Port Forwarding is enabled by default. See *General Setting* screen.

This facility can be used for remote access.

This is not required for Remote.it access and should be disabled for additional security.

3.8 Firmware Update Screen



The screenshot shows the 'Firmware Upgrade' section of the VillageTelco web interface. At the top, there is a navigation bar with the VillageTelco logo and several menu items: System Overview, Library, General, WiFi, Network, Firmware Upgrade (which is highlighted), and Logout. Below the navigation bar, the main heading is 'Firmware Update'. Under this heading, there are two sections. The first section is 'Upload Firmware File', which contains a 'Browse...' button next to the text 'No file selected.', and an 'Upload' button next to the text 'Upload selected file.'. The second section is 'Proceed with Flash', which contains a 'Preserve Settings' checkbox (which is unchecked) and two buttons: 'Proceed' and 'Cancel'.

This screen allows you to update the firmware on the device by uploading a sysupgrade file from your PC. Select ***Firmware Upgrade /Firmware Upgrade*** from the top menu.

Upload File

Click the ***Browse*** button to bring up a file browser window and select the required sysupgrade.bin file.

Click the ***Upload*** button to transfer the file to the Digital Library.

An upload message will be displayed including checksums for the file.

Flash Firmware

Check that the displayed checksum is correct, then click the ***Proceed*** button to flash the new firmware onto the Digital Library device.

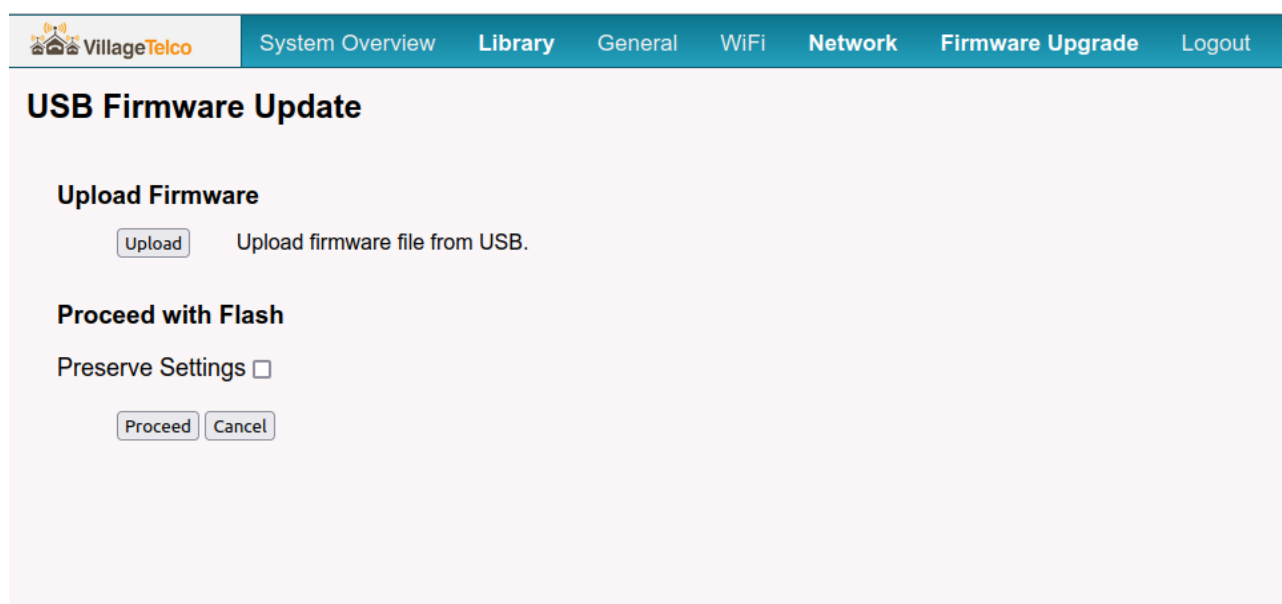
Preserve Settings

You may choose to click the ***Preserve Settings*** check box to have the device operate the new firmware with the previous system settings.

Note: Use this facility with caution as there is generally no guarantee of complete settings compatibility between versions.

It is recommended that ***Preserve Settings*** is not generally used, and the device is set up starting from the default settings to avoid the possibility of subtle configuration error issues.

3.9 USB Firmware Update Screen



The screenshot shows the 'USB Firmware Update' screen. At the top, there is a navigation bar with the VillageTelco logo and several menu items: System Overview, Library, General, WiFi, Network, Firmware Upgrade, and Logout. The main content area is titled 'USB Firmware Update' and contains two sections. The first section, 'Upload Firmware', has an 'Upload' button and the text 'Upload firmware file from USB.'. The second section, 'Proceed with Flash', has a 'Preserve Settings' checkbox (which is unchecked) and two buttons: 'Proceed' and 'Cancel'.

This screen allows you to update the firmware on the device by uploading a sysupgrade file from a USB memory stick installed on the Digital Library device in lieu of the memory device containing the normal library content.

Copy files to USB Memory

To use this facility, copy the required sysupgrade firmware file onto a USB memory stick, along with the corresponding MD5 checksum file e.g.

```
openwrt-Digital-Library-MT300N-V2-VER-2.4-MT300N-V2-mt300n-v2-squashfs-sysupgrade.bin
md5sums-Digital-Library-MT300N-V2-VER-2.4.txt
```

Ensure that these are the only files stored at the top level of the memory stick so the system can locate them correctly.

With the Digital Library device powered off, fit the USB memory stick containing the firmware files in lieu of the normal memory device that contains the library content.

Upload Firmware File

Power on the Digital Library and when it has started up, connect to it and point your web browser to: <http://digital-library/admin> or <http://10.10.10.1/admin>

then select **FirmwareUpgrade / USB Firmware Upgrade** from the top menu.

Click the **Upload** button to transfer the file to the Digital Library.

An upload message will be displayed including checksums for the file.

Flash Firmware

Check that the displayed checksum is correct, then click the *Proceed* button to flash the new firmware onto the Digital Library device.

HTML File

By default, when the Digital Library is started up with the USB memory stick containing just the firmware files installed, the Home page will show a listing of the files.

You can add a HTML file to the USB memory stick that will automatically redirect the browser to the USB Firmware Upgrade page.

To do this, create a text file with the contents below and save it to the USB Memory stick as *index.html*, along with the firmware and MD5Sum files.

Sample HTML file:

```
<html>
<head>
<meta http-equiv="refresh" content="0; URL=/cgi-bin/system-firmware-usb.has" />
</head>
<body>
<a href="/cgi-bin/system-firmware-usb.has"> Loading USB Firmware page. </a>
</body>
</html>
```

3.10 Logout

The Logout menu contains items as follows:

- *Logout* closes the access to the Admin screens until the user logs in again.
- *Shutdown* performs a safe system shutdown to prevent any data corruption.
- *Reboot* performs a system restart.

Selecting *Reboot* or *Shutdown* will display a page with the command shown. Click on the command to execute it.

It is recommended that *Shutdown* is used before power off to ensure that the Library memory is not corrupted.

Shutdown may also be executed by pressing the device *Reset* button for 2 seconds.

Wait several seconds for the shutdown to complete and the LEDs to stop flashing before power off.

3.11 Installing The Digital Library Firmware

You may receive a device that does not have the Digital Library firmware installed and you will need to download the firmware files and upgrade the firmware on the device.

Download the Firmware

The firmware may be downloaded from the VillageTelco Downloads site:

<http://download.villagetelco.org/firmware/digital-library/>

This site contains Development and Release versions of the firmware for a range of devices.

Select the correct version for your device and download the firmware file and the checksum file.

Install the Firmware

The existing firmware on the device will have a facility for upgrading the firmware.

Power up the device and log in to the administration pages in accordance with the manufacturer's instructions.

Identify the administration page that provides the firmware upgrade facility.

Upload the correct new firmware file to the device and start the upgrade process in accordance with the manufacturer's instructions.

Note: If there is an option to Save or Preserve Settings during the firmware upgrade, ensure that this option is NOT selected.

The new firmware needs to set up its own settings and not use the previous firmware settings.

For devices that are based on OpenWrt, (e.g. GL-iNet, Dragino, SEEED) the firmware file will be called:

openwrt.<version-device>-sysupgrade.bin

For devices that have original firmware that is not based on OpenWrt (e.g. TP-Link) there will be two firmware files called:

openwrt.<version-device>-sysupgrade.bin

openwrt.<version-device>-factory.bin

When the device is being re-flashed from the manufacturer's firmware to the Digital Library firmware, use the *factory* version of the firmware. Subsequently, to update to a newer version of the Digital Library firmware, use the *sysupgrade* version of the firmware.

CAUTION

Re-flashing the operating system firmware on devices is a critical process.

If you interrupt the process you will likely make the device unserviceable.

Use a cable connection rather than WiFi if possible.

Do NOT disconnect power or cables on the device or host PC during the process.

Wait at least five minutes for the re-flashing process to complete and for the device to restart.

Be patient...

3.12 Preparing Library Memory Devices

Choose a Memory Device

You will need to choose a memory device that suits the Digital Library device that you have. All devices will have a USB port, and some will have an SD Card slot. SD Cards may also be used with a USB adapter and fitted to the USB port.

If possible, use an SD Card either directly or with an adapter in the USB port.

Good quality SD Cards are generally better performing than USB memory sticks as they are rated for speed for use in cameras and similar equipment. They are also generally lower power which means that they will run cool and have better long term life.

Choose a good quality memory device from a reputable supplier. Unbranded memory devices are usually not of a high enough specification for use in the Digital Library.

You will need an 8GB, 32GB, 64GB or 128GB memory device. To accommodate the default Library, it is recommended that 64GB devices are used as the content currently occupies some 40GB.

Note that some older devices may not accommodate flash memory devices larger than 32GB, and most will not accommodate flash memory devices larger than 128GB.

You may also choose to use a low power SSD or HDD device as the Library memory, in which case these size limits will not apply.

Format the Memory Device

The memory device will generally need to be re-formatted in order to be able to accommodate the large number of files in the Library. By default, memory devices are normally formatted with a large block sizes eg 128kB and this makes them too inefficient to store the Library files. They are also commonly formatted as FAT32 or NTFS.

You will need to format the memory device with a block size of 4kB.

The Digital Library software supports EXT, F2FS and EXFAT file systems for the Library memory. NTFS is not supported.

The preferred file system to use is *EXT*, and specifically *ext2*. It is simple to format devices to this file system on a Linux PC (e.g. Ubuntu). This format uses a block size of 4kB by default.

The *ext2* file system has proven to be very robust in use. However it can not be read on Windows.

The *exFAT* file system may also be used, but will need to be specifically formatted for a 4kB block size. *exFAT* is supported on recent MS Windows PCs.

It is recommended **not** to use FAT32 (or NTFS) format for the main Library as they are problematic in service in this application.

Note: If you place multiple partitions on the memory device, only the first will be used by the Digital Library software. Additional partitions will be ignored.

Note: A Secondary library memory which generally has a relatively small number of files may use EXFAT (or possibly FAT32) format which makes it possible to manage the content on any type of PC – Linux/Ubuntu, MS Windows or Apple.

Install the VT Digital Library Template

You may install any content you wish onto the memory device.

If there is an *index.html* or similar file in the root directory of the memory device, this will be used as the home page.

If there is no *index.html* or similar file, the contents of the memory device will be displayed as a list of files and directories which you can navigate around.

To use the standard VT Digital Library Home page, download the compressed Zip file containing the Template from the VT Downloads page:

<http://download.villagetelco.org/firmware/digital-library/>

Unpack the compressed file into the root directory of the memory device. You will then have the files necessary to display the default VT Digital Library home page.

Install the Content Modules

After installing the Template, you will see a directory called *modules*, which in turn contains a directory for each of the items of content listed on the default Home page.

You can copy the required files for each module into the respective directories.

The content modules may be copied from another Digital Library memory device, or they may be downloaded from the World possible website:

<https://rachel.worldpossible.org/content>

The content modules contain quite large amounts of data and downloading them reliably can be problematic. The site offers *rsync*, *Zip* and *FTP* file downloads.

It is recommended to use the *rsync* download method from the World possible site if possible, as this method is the most reliable for large transfers, and, if interrupted, you may restart the download and it will resume from where it left off.

Note: The Template will place a few files in some of the module directories, typically a logo image file and an *index.html* file. These files are used by the Home page and need to be retained when the rest of the module content is added.

Copying Content

When copying the content files between memory devices, quite large volumes of data will need to be moved e.g. 40GB for the default library contents. Simple copy commands either on the command line or in a graphical file browser will generally result in quite slow rates of copying for very large data volumes.

If you are making copies of the library from an original memory device, it is worthwhile to copy the data from the original memory device onto the PC hard disk and use that as the source. The copy rate is largely determined by the write speed of the target memory device.

On a **Linux / Ubuntu** system, the *rsync* command will provide a fast and reliable copy process from the command line. A typical command to copy a complete USB library device to another would look like this:

```
rsync -r -a -v /media/mylogin/source-device-label/* /media/mylogin/target-device-label/
```

This will copy all the files and directories in the top level directory of the source memory device to the target memory device.

If the *rsync* copy process is interrupted, it may be restarted and it will continue from the point where it left off.

Note that you may need to check that the permissions for the memory device and subdirectories will allow writing by a non-root user if using the *ext2* format.

As an indication of copy times, a typical *rsync* copy rate of 12MBytes/sec to a SD card will copy 40GB in about an hour.

On a **Windows** system, the *xcopy* or *Robocopy* commands may be used to copy the content with typical commands like this:

```
xcopy /s /i /e C:\Library\* D:\
```

```
Robocopy /s /e C:\Library\* D:\
```

Where:

- D: is the target memory device
- /s to copy subdirectories
- /i assume destination is a directory, do not prompt
- /e copy empty directories

Using Multiple Memory Devices

You may use an additional memory device with the Digital Library to provide a *Secondary Library*. This is useful for easily managing local content without modifying the main Library memory.

The Secondary memory device may contain any files you wish. The content may be accessed from the *Secondary Library* link on the main *Home* page top menu.

If there is an *index.html* or similar file in the root directory of the Secondary memory device, this will be used as the home page for the Secondary Library. If there is no *index.html* or similar file, the contents of the memory device will be displayed as a list of files and directories which you can navigate around.

You can use a USB Hub device to provide a second USB port. The Digital Library will detect both memory devices and look for a signature file called *##Digital-Library##* in the root directory to identify the main Library device.

The System Overview administration page on the Digital Library will display details of the memory devices that have been detected.

Note: Not all USB Hub devices will work satisfactorily in this application. The majority of devices we have tested are OK, but a few have issues. Check the *System Overview* admin page to make sure that both devices have been correctly detected.

3.13 Accessing the Digital Library File System from a PC

The Digital Library software supports *SSH* (Secure Shell), *SCP* (Secure Copy), and *SFTP* (Secure FTP) connections.

This allows you to connect your PC to the Digital Library and access the command line and the file system using the *root* account.

Caution: You will have unrestricted access to the complete file system, including the operating system. Be careful not to modify or delete any files that you are not completely sure about. Make a backup of files before you modify them.

The USB / SD memory Library file system is located at */www/library*

The file system mount points for USB and SD memory devices are */mnt/sda1* and */mnt/sda2*

On a *Linux* (e.g. Ubuntu) PC you can access the SSH and SCP from the *Terminal* application command line with commands like:

```
$ ssh root@10.10.10.1
```

```
$ scp ./myfile root@10.10.10.1:/tmp
```

 Transfer myfile to */tmp* on the DL device.

In both cases you will be prompted for the *root* account password on the DL device.

You can access the file system using the *Nautilus File Browser* application by selecting:

Other Locations / Connect to Server

and entering the URL :

<sftp://root@10.10.10.1/www/library> This will display the contents of the *www/library* directory.

On a *MS Windows* PC, you can use the applications such as *OpenSSH*, *PuTTY* and *WinSCP* and connect with:

```
root@10.10.10.1
```

Windows 10 2018 update now provides a basic built-in SSH client.

On an *Apple* PC, you can use the *Terminal* program for SSH and SCP, and access the file system from a third party SFTP client such as *CyberDuck* or *FileZilla* applications.