NETENG Assignment 1
ENGR3821
Network Engineering
Wiki and Dynamic Web Server Selection, Deployment and Documentation

21/04/2019

College of Science and Engineering

Consent

I, the author, give consent to ENGR3821 Topic Staff to distribute this document for the purposes of peer marking and assessment.

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Definitions

Term	Definition
ACL	Access Control List
CAPTCHA	Completely Automated Public Turing test to tell Computers and Humans Apart
CGI	Common Gateway Interface
DSS	Decision Support System
FLOSS	Free, Libre and Open Source
GPL	(GNU) General Public Licence
IIS	Internet Information Services
ISP	Internet Service Provider
LAMP	Linux Apache MySQL PHP
LAN	Local Access Network
LDAP	Lightweight Directory Access Protocol
LEMP	Linux Engine-X MySQL PHP
MS	MicroSoft
NAT	Network Address Translation
PHP	PHP: Hypertext Preprocessor
QoL	Quality of Life
SQL	Structured Query Language
SRS	Software Requirements Specification
ufw	Uncomplicated Fire Wall
VM	Virtual Machine

0 Introduction

0.0 Revision History

Table 1 - Author and Revision History

Revision No.	Author	Date	Details
0	<REDACTED1>	21/04/19	Initial Documentation
1	<REDACTED1>	15/06/19	Proofreading Fixes

0.1 Purpose

The purpose of this document is to detail the selection of a FLOSS wiki, web server and accompanying scripting language and document the installation process on a clean Oracle VirtualBox 6.0.4 r128413 VM running Linux Ubuntu 18.04. Through a selection process, the software package to be installed is "DokuWiki" wiki software on a LAMP-stack without a MySQL database.

0.2 Scope

The software installation is meant for a computer hobbyist organisation's discussion and administration. The entire application package should be installable, compliable and executable on a single machine host, with room for some scalability. Access should be restricted to organisation members registered with the wiki and some sort of analytics should be available for administrators. The software should contain some sort of QoL features for users such as syntax highlighting.

The software requirements section is not meant to be an SRS but a summary of the derivation of selection criteria.

1 Software Selection

1.0 Requirements

The selection criteria of this software package stem from the following general requirements for a hobbyist organisation's use cases:

1. Ease of installation
2. Content Version Control
3. Useability regarding code manipulation and other QoL features
4. Basic Security
    a. Authentication
    b. Authorisation
5. Usage Statistics
6. Mandatory Features
    a. Runs on Linux Ubuntu
    b. Dynamic Webpage scripting language interface
    c. Extensibility
    d. Reverse-proxy compatibility

Wiki features for content version control may include revision diffs, a conflict handling mechanism, page histories and concurrent editing. Syntax highlighting and automatic signatures upon creation and editing of a page may help streamline workflow and administration across the site.

Authorisation can be implemented in the form of page permissions on the wiki layer and access control in the file system layer such as a Linux ACL. CAPTCHAs may provide enough human authentication to prevent spam and registration may be an option to authenticate users. Registration rules are up to the administrator to implement and will not be discussed in this document. Usage statistics that can perform a micro-scale DSS-like function can assist the administrators and managers of the organisation to form an agenda.

The mandatory technical requirements for this software package are the availability of dynamic webpages through scripting, extensibility features such as plugins or other interfaces and support for reverse-proxy topology.

1.1 Wiki Comparison

The following decision matrix evaluates a number of wikis against the weighted selection features and outputs a score out of 200 where a higher score represents more criteria being matched more closely. It measures approximately the comparison of the wiki against the requirements and the ease of deployment. The scores for each criterion per wiki are as follows:

Table 2 - Scoring Structure for wikis against criteria

Score	Feature
0	None/Unknown
1	Partial support/Plugin required
2	Available without configuration or extension

Criteria with weight 0 are mandatory and should not influence the outcome. If a wiki scores 0 for any mandatory criteria, it is unfit for use in this case. Dynamic webpage scripting and reverse-proxy support for the scores for PHPWiki, MediaWiki and DokuWiki are based off the LAMP/LEMP web-server capabilities recommended on their respective wiki pages.

Table 3 - Decision Matrix

Criteria	Weight [%]	PHPWiki	MediaWiki	Aneuch	DokuWiki
Content Version Control					
Page Revision diffs	15	2	2	2	2
Conflict Handling	15	2	2	2	2
Page history	10	2	2	2	2
Concurrent Editing	5	0	0	0	0
Useability					
Syntax highlighting	10	1	1	0	2
Automatic Signature	5	2	2	2	2
Security					
Per-page Permissions	10	2	2	0	2
ACL	10	2	0	0	2
CAPTCHA	10	2	1	2	1
Other					
Dynamic webpage scripting	0	2	2	0	2
Extensible Interface(s)	0	2	2	2	2
Reverse-proxy support	0	1	1	0	1
Usage statistics	10	1	2	0	1
n=10, Σ:	100	**170**	**150**	**110**	**170**

1.2 Dependencies

To reduce the semi-infinite number of options when selecting web servers, operating systems and languages the table below shall identify dependencies for the wikis installed on a Linux Ubuntu system[1].

Table 4 - Wiki dependencies

PHPWiki	MediaWiki	Aneuch	DokuWiki
Linux Ubuntu	Linux Ubuntu	Linux Ubuntu	Linux Ubuntu
Apache2 web server	Any web server (PHP)	Any web server	Any web server (PHP)
MariaDB server	Any DB Server	PERL	PHP5.6+
PHP	PHP	Web browser	Web browser
MySQL	Web Browser		
Web Browser			

1.3 Selection Rationale

Evaluating the decision matrix in section 1.1, Aneuch does not meet the mandatory requirements for this package[2]. It was designed to be “enough” for it to be defined for a wiki and thus does not have some of the required features[3].

MediaWiki does not have ACL support and requires more initial configuration and installation of key features and therefore rates slightly below the other two wikis.

DokuWiki suits this use-case slightly better even though it was the same criteria score as PHPWiki due to the existence of slightly more features relevant to the hobbyist organisation. As the use-case is more casual, mobile support may be a valid comparison feature which PHPWiki does not have[4]. DokuWiki also supports mail encryption for registered users[5] which gives it a slight security edge over PHPWiki. DokuWiki uses text files instead of a database[5]. Therefore, Dokuwiki has one less major dependency than the database-reliant strictly LAMP-stacked PHPWiki which may make DokuWiki easier to install, configure and maintain.

DokuWiki is selected as the suitable wiki.

1.4 Package Specifications

DokuWiki claims to support any PHP-based web server including Lighttpd, Apache, Microsoft IIS, litespeed, nginx and more[6]. Since the software is to be run on a Linux machine, Apache seems to be the best choice. Apache also features a reverse-proxy and load balancer that requires minimal initial configuration[7]. The Apache web server features a CGI which supports scripts in languages such as Python, PERL, PHP, Ruby, shell scripts and programming languages such as C,C++[8]. While concurrent connection benchmarks place nginx above Apache, this is relevant in the large-scale network environment and neither has significant advantage in a small organisation[9].

Since one of the non-functional soft requirements is ease and simplicity of installation, PHP and Bash can be used as Apache scripting languages over CGI as DokuWiki requires a PHP installation to function and Bash is installed with Ubuntu systems. Therefore, no additional installation is necessary for dynamic page delivery.

1.5 Package Extension

DokuWiki has a community-supported plugin index with 1225 plugins at time of writing. Which include ACLs, backend authentication such as LDAP and MS Active Directory, CAPTCHAs along with other user-experience features like polls, Github integration and image editing.

Apache has a list of official modules for version 2.4 and up that provide proxy services such as `mod_proxy`, `mod_proxy_balancer` and related modules. Server-side dynamic scripting through CGI can be performed after the installation of `mod_cgi` and `mod_fcgi`. Many other modules are available for extension of this package[10].

2. Deployment Procedure

2.0 Package List

The following list of sources and packages are required to install DokuWiki 2018-04-22b "Greebo" under GPL2[11], on an Apache 2.4 web server under the Apache Licence 2.0[12], on Linux Ubuntu 18.04 without plugins or extensions. The user should be non-root and have `sudo` privileges. `sudo apt-get update` should be run before attempting to install these packages.

Table 5 - Packages required for full installation

Package	Version	Source
Oracle VirtualBox	6.0.4	https://www.virtualbox.org/
Linux Ubuntu	18.04	https://www.ubuntu.com/download/desktop
Apache	2.4.29	sudo apt-get install apache2
PHP	7.2.15-0ubuntu0.18.04.2	sudo apt-get php
libapache2-mod-php	-	sudo apt-get libapache2-mod-php
php-xml	-	sudo apt-get php-xml
DokuWiki	2018-04-22b "Greebo"	https://download.dokuwiki.org/
Web Browser	Recent	Any recent web browser
Plugins	Optional	DokuWiki Distr. Page or Apache Distr. Page

2.1 Dependencies

2.1.1 Machine Setup

Install a clean instance of Ubuntu 18.04 using normal installation settings.

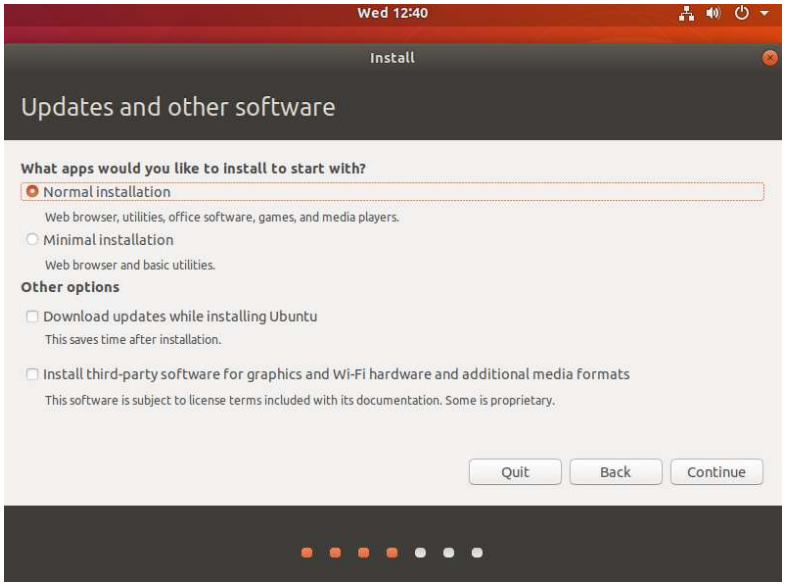

Figure 1 - Normal installation of Ubuntu 18.04

Restart the machine to finalise the installation.
Open a terminal instance and update the package database using:

```
sudo apt-get update
```

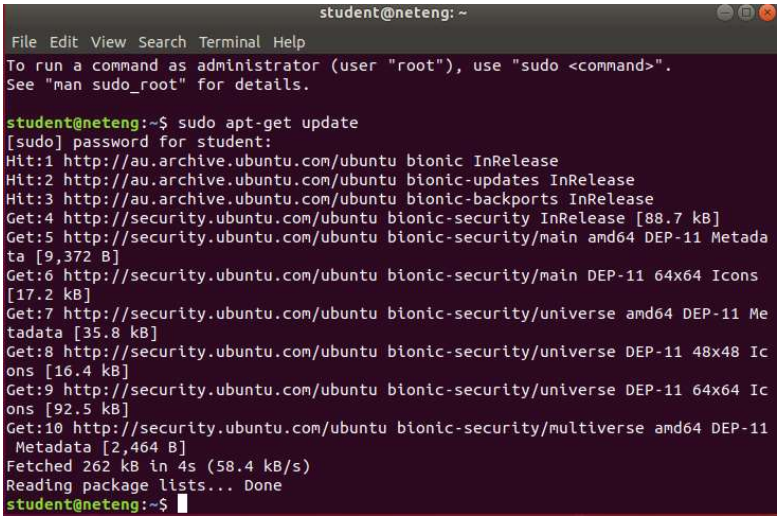

Figure 2 - Updating the apt database

2.1.2 Apache2 Web Server

To install the web server that DokuWiki will run on, use the following command with a `-y` option to skip verification and install the latest version of Apache2:

```
sudo apt-get install -y apache2
```

To verify installation of Apache2, use:

```
apache2 -version
```

Output:

```
Server version: Apache/2.4.29 (Ubuntu)
Server built:   2019-04-03T13:22:37
```

The Apache server is located by default at: `/var/www/html` which will now be referred to as the working directory: `~/`

Configure the ufw by checking for an Apache entry and then allowing it through:

```
sudo ufw app list
```

Output:

```
Available Applications
  Apache
  Apache Full
  Apache Secure
  CUPS
```

Allow Apache through the firewall:

```
sudo ufw allow ‘Apache’
```

Output:

```
Rules Updated
Rules Updated (v6)
```

Check that ufw is active, if not, enable it:

```
sudo ufw status
```

Output:

```
Status: inactive
```

Use:

```
sudo ufw enable
```

```
student@neteng:~$ sudo ufw allow 'Apache'
Rules updated
Rules updated (v6)
student@neteng:~$ sudo ufw status
Status: inactive
student@neteng:~$ sudo ufw enable
Firewall is active and enabled on system startup
student@neteng:~$ sudo ufw status
Status: active

To                         Action      From
--                         ------      ----
Apache                     ALLOW       Anywhere
Apache (v6)                ALLOW       Anywhere (v6)

student@neteng:~$
```

Figure 3 - ufw status outputs

To verify that the Apache web server is up and running use:

```
sudo systemctl status apache2
```

```
student@neteng:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset:
  Drop-In: /lib/systemd/system/apache2.service.d
           └─apache2-systemd.conf
   Active: active (running) since Sun 2019-04-21 19:29:07 ACST; 15min ago
 Main PID: 4654 (apache2)
    Tasks: 55 (limit: 2319)
   CGroup: /system.slice/apache2.service
           ├─4654 /usr/sbin/apache2 -k start
           ├─4656 /usr/sbin/apache2 -k start
           └─4657 /usr/sbin/apache2 -k start

Apr 21 19:29:07 neteng systemd[1]: Starting The Apache HTTP Server...
Apr 21 19:29:07 neteng apachectl[4643]: AH00558: apache2: Could not reliably det
Apr 21 19:29:07 neteng systemd[1]: Started The Apache HTTP Server.
lines 1-15/15 (END)
```

Figure 4 - Apache status output

Open a web browser and verify that local access to the service is available by typing in the address bar `localhost` or the loopback address `127.0.0.1`.

Figure 5 - Default landing page through localhost

The Apache2 web server is now installed and firewall rules are not set up to facilitate access to the web server.

Skip to Section 2.1.4 if you expect your network environment to be different and be aware that some ISPs will block http (port 80 and 8080) on a non-business service package.

2.1.3 Network Environment

Depending on your network environment, the next steps may differ. Before continuing onto section 2.1.4, ensure that your web service can be accessed from everywhere it should be (i.e. host machine, LAN, internet etc.).

Skip this section if your network environment is not virtualised.

There are several methods of accessing the web service hosted on a VM through NAT or using bridging. This document will use bridging methods.

Safely power off the VM. On your VirtualBox Manager window, go to the settings window of your VM and navigate to the Network section and select an unused adapter such as “Adapter 2”. Check the “Enable Network Adapter” checkbox and use the “Attached to:” dropdown menu and choose “Bridged Adapter”.

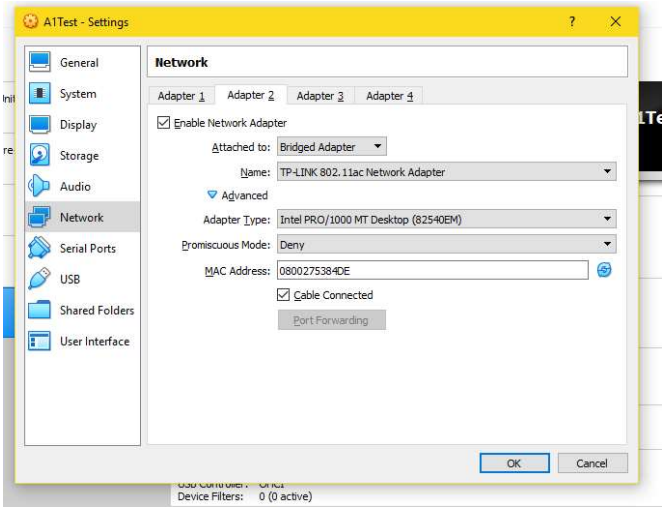

Figure 6 - VirtualBox Manager Network Settings

Boot the VM and in a terminal window check the LAN address of your machine which will be of the form `aaa.bbb.ccc.ddd`. From this point onwards, the LAN address of the VM will be referred to as `aaa.bbb.ccc.ddd`.

Use `ip` or a similar command (e.g. `ifconfig`) to find your server address:

```
ip a
```

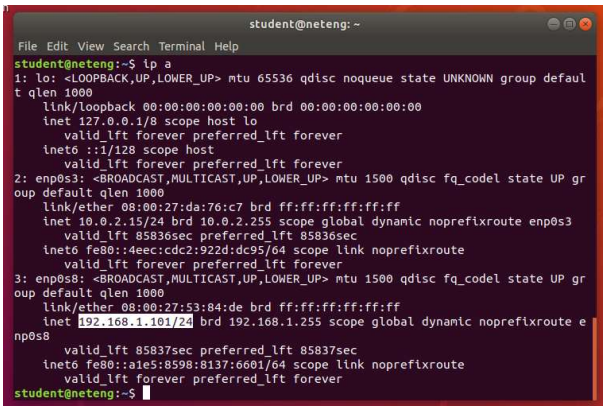

Figure 7 - Find the correct network address

Check that the Apache server is accessible through the LAN address `aaa.bbb.ccc.ddd`:

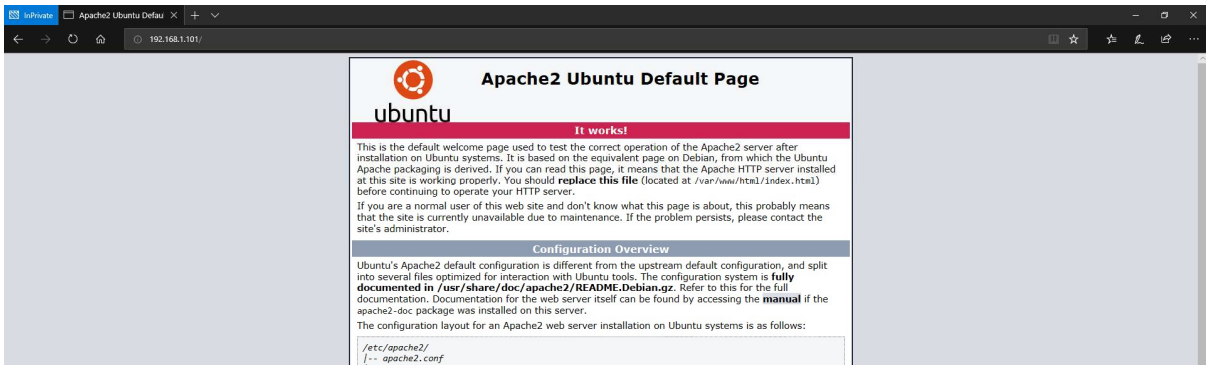

Figure 8 - Default landing page through LAN

2.1.4 PHP Support

DokuWiki requires PHP 5.6+. This installation will install PHP 7.2 and will also require `libapache2-mod-php` and `php7.0-xml` packages.

Install the latest version of php along with the other two packages listed above:

```
sudo apt-get install php libapache2-mod-php php-xml
```

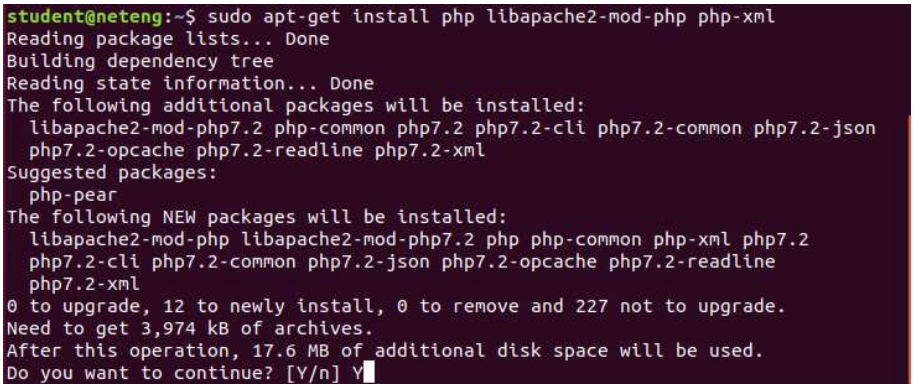

Figure 9 - Install php packages

Checking that PHP and Apache work together can be done by calling `phpinfo()` on the web server[13]. To do this, the working directory permissions must be changed. The permissions are not strictly dictated and recommendations can be found at[14]:

https://www.dokuwiki.org/security

This installation guide will change the `owner:group` of `~/html` to `root:student` and give `rwx` permissions to the `student` group:

```
sudo chown root:student /var/www/html
sudo chmod g+rwx /var/www/html
```

Create info.php in your working directory and modify its contents as follows:

```
<?php
	phpinfo();
?>
```

alternatively use a script such as:

```
#! /bin/bash
printf “<?php\n\tphpinfo();\n?>” > /var/www/html/info.php
```

Use a web browser to access `aaa.bbb.ccc.ddd/info.php` and verify that this page shows:

Figure 10 - phpinfo() output

PHP has now been set up to work with Apache.

2.2 DokuWiki Installation

2.2.1 Package Extraction

Download DokuWiki from the download page at: https://download.dokuwiki.org/
This document uses the 2018-04-22b "Greebo" version of DokuWiki from the “Stable” branch. Choose the languages and plugins that you require. This document uses the English version and no plugins.

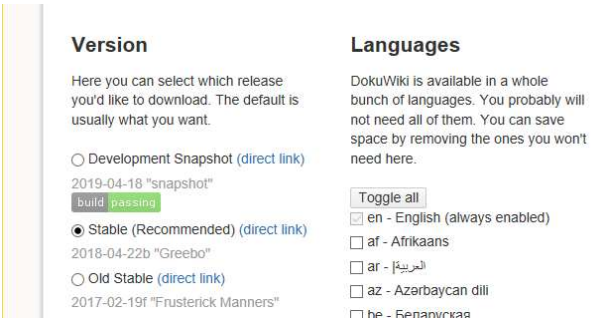

Figure 11 - Downloaded build and language options

Extract the package to the working directory:

```
tar zxf dokuwiki-*.tgz
cp -R dokuwiki /var/www/html
```

The working directory should look like this:

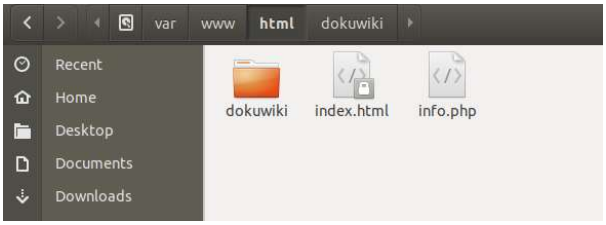

Figure 12 - ~/ contents

Figure 13 - ~/dokuwiki contents

2.2.2 Permissions

After using `install.php` detailed in Section 2.2.3, the following permissions *should* be automatically set (this does not seem to happen all the time, try manually setting permissions as detailed below). Therefore, the rest of Section 2.2.2 is optional. You may choose to modify these standard permissions.

From the DokuWiki Documentation[15] the following directories must be writable by the web server process (by default the user is `data-www`):

```
~/data/
~/lib/plugins
~/lib/tpl
```

i.e. `sudo chown www-data data && sudo chmod 700 data`
The following directories must have at least 755 permissions for style sheets to work:

```
~/lib
```

The following directories should not be accessible by `others` (from www) for security and integrity reasons:

```
~/data
~/conf
~/inc
~/vendor
```

2.2.3 Installation and Configuration

Attempt to access `aaa.bbb.ccc.ddd/dokuwiki/install.php`. If you did not manually set permissions in Section 2.2.2, the following page should appear:

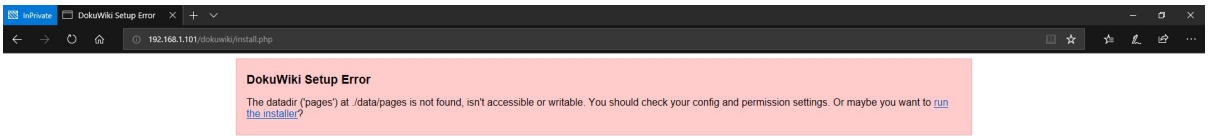

Figure 14 - Permission error when accessing install.php

The following minimal permissions must be set for the installer to work:

```
sudo chown -R www-data data
sudo chown -R www-data conf
sudo chmod -R 700 data
sudo chmod -R 700 conf
```

Following this, attempting to access `aaa.bbb.ccc.ddd/dokuwiki/install.php` should result in the following page:

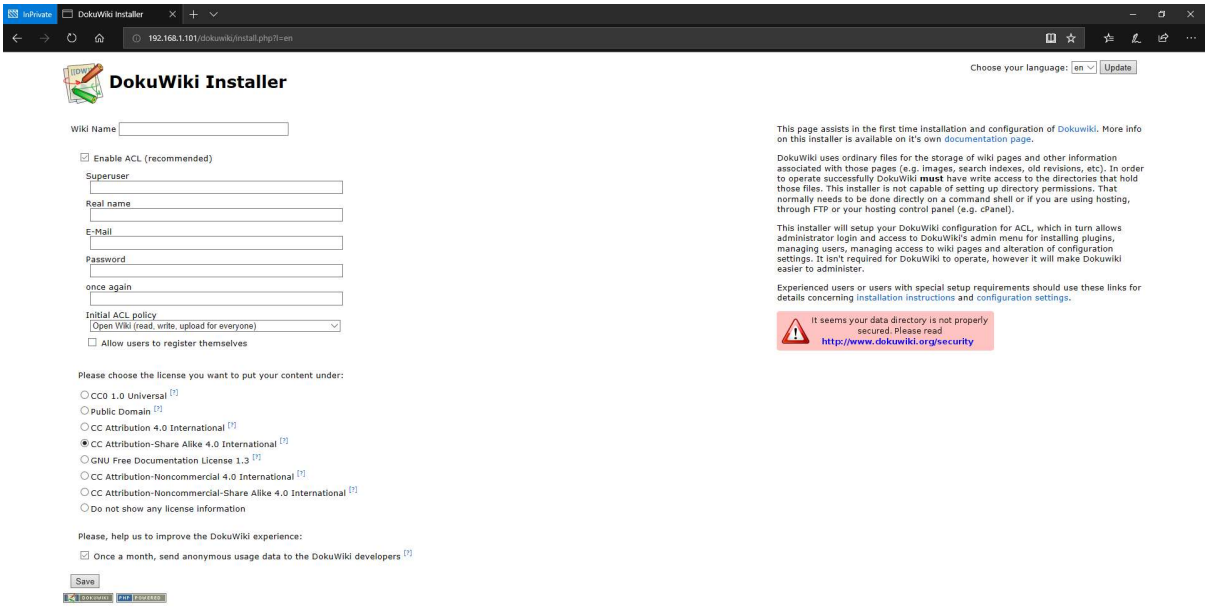

Figure 15 - Install page

Tick the “Enable ACL” checkbox and enter your administrator information. Chose the initial ACL policy based on your use case and then press “Save”.

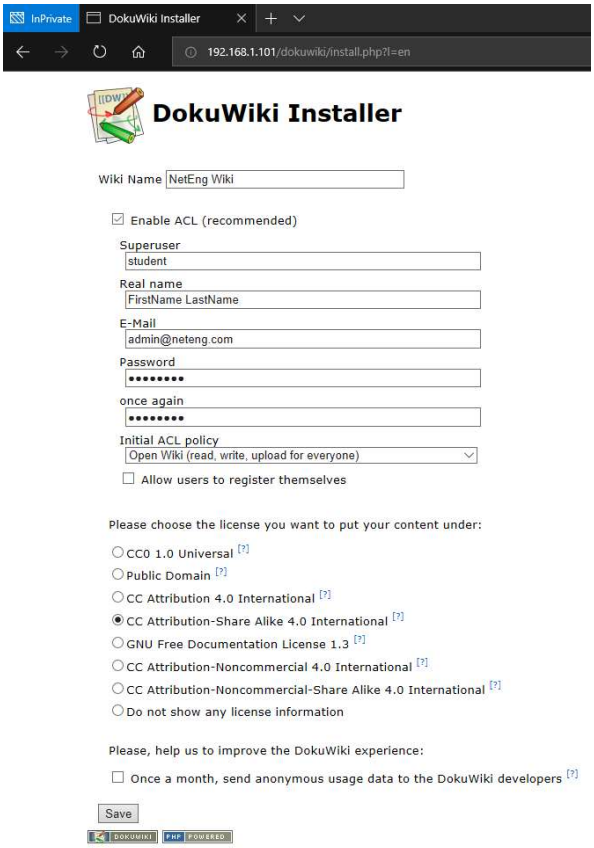

Figure 16 - Install page with example form filled

The page should appear after saving:

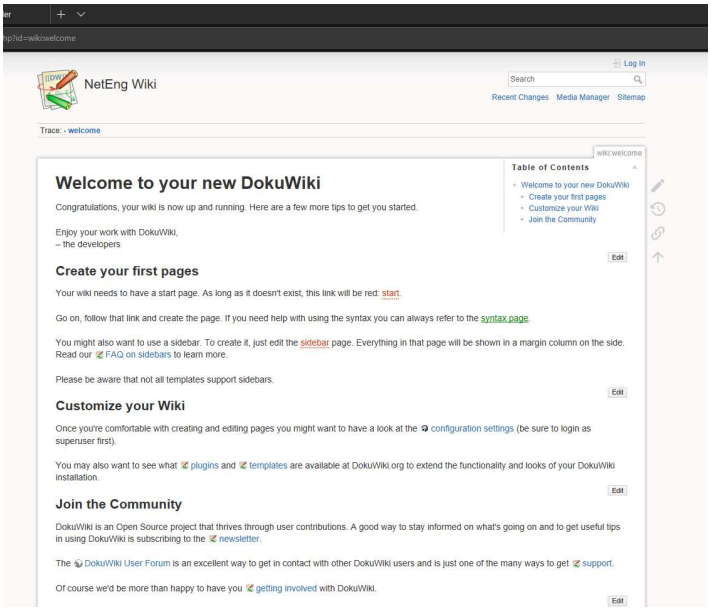

Figure 17 - DokuWiki welcome page

DokuWiki is now set up and ready for use and plugin installation.

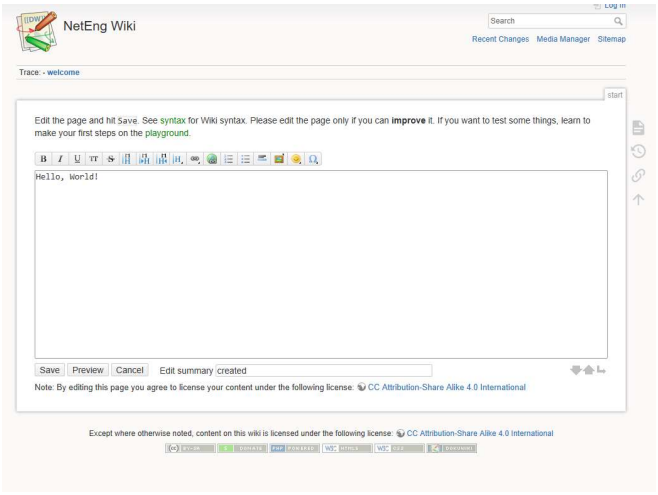

Figure 18 - Editing the start page

END OF INSTALLATION PROCEDURE

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