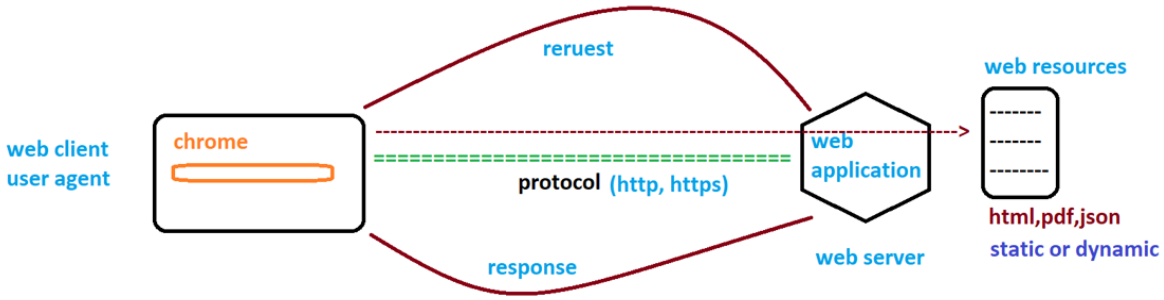
Apache Web-Server



1. What is a Web Server?

A web server is a software that processes requests via HTTP (Hypertext Transfer Protocol) and serves web pages to users. It handles client requests and delivers content like HTML, images, and other web resources.

2. What is Web Hosting?

Web hosting is a service that allows individuals and organizations to make their websites accessible via the internet. Hosting providers offer server space, security, and bandwidth to store and serve website content.

3. Types of Web Hosting

- **Shared Hosting**: Multiple websites share the same server resources.
- **VPS Hosting**: Virtual Private Server with dedicated resources for a website.
- **Dedicated Hosting**: A full server dedicated to a single website.
- **Cloud Hosting**: Resources distributed across multiple servers for scalability.
- **Managed Hosting**: Hosting with administrative support and maintenance.

4. Different Web Server Tools

- **Apache HTTP Server** (Most widely used open-source web server)
- **Nginx** (High-performance, event-driven architecture)

- **Microsoft IIS** (Windows-based web server)
- **LiteSpeed** (Optimized for speed and performance)
- **Tomcat** (For Java-based applications)

5. Difference Between Apache and Nginx

Feature	Apache	Nginx
Architecture	Process-based	Event-driven
Performance	Slower for high traffic	High performance for static files
Configuration	.htaccess support	Uses config files
Load Balancing	Limited	Built-in

6. Ports of Web Server

- **Port 80**: Default HTTP port
- **Port 443**: Default HTTPS (SSL) port

7. What is DocumentRoot?

DocumentRoot is the directory where website files are stored and served by Apache. The default location is:

```
/var/www/html
```

8. Important Files of Web Server

Configuration Files:

- `/etc/httpd/conf/httpd.conf` (Main Apache configuration file)
- `/etc/httpd/conf.d/` (Additional configuration files)
- `/etc/httpd/conf.modules.d/` (Modules configuration)

Log Files:

- `/var/log/httpd/access_log` (Records all access requests)

- `/var/log/httpd/error_log` (Records all error messages)

9. Installing Apache (httpd) on Linux (rhel9)

```
yum install httpd -y
```

10. Start and Enable Apache Service

```
systemctl start httpd
systemctl enable httpd
```

11. Allow HTTP and HTTPS Ports in Firewall

```
firewall-cmd --permanent --add-service=http
firewall-cmd --permanent --add-service=https
firewall-cmd --reload
```

12. Basic Explanation of httpd Config Files

- `httpd.conf`: Core configuration file
- vhost.conf: Virtual hosts configuration
- ssl.conf: SSL settings for secure connections

13. Create a Test index.html File

```
echo "<h1>Apache Web Server is Working</h1>" > /var/www/html/index.html
```

Restart the Apache service:

```
systemctl restart httpd
```

Access the test page using the server's IP:

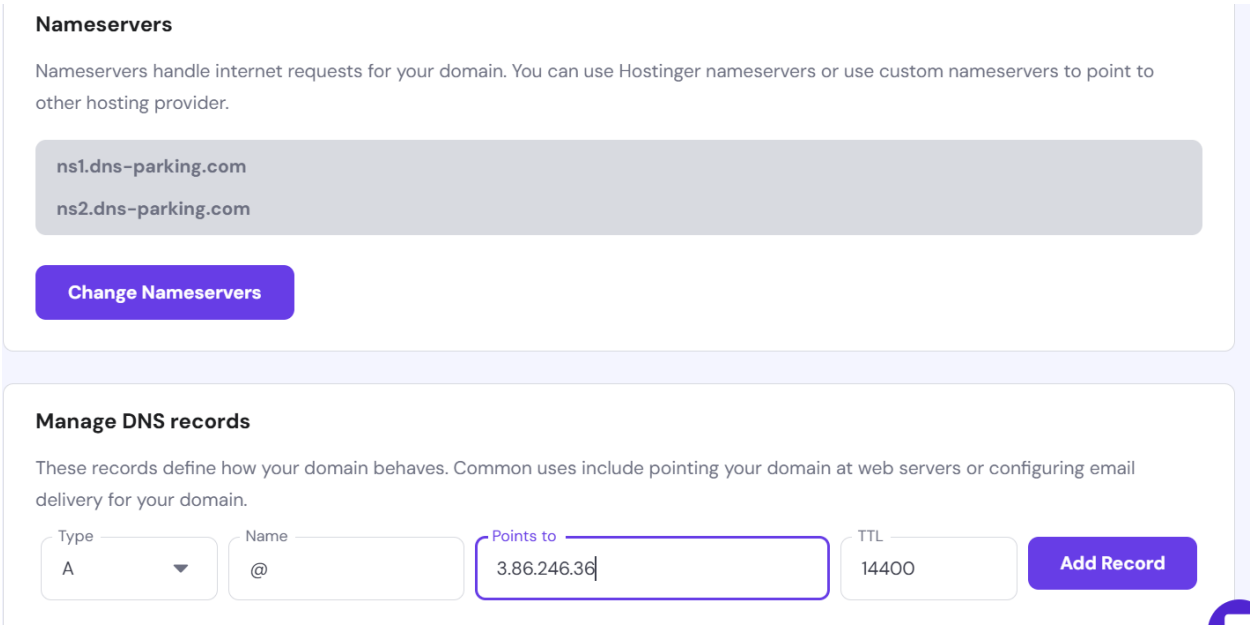
```
http://your-server-ip
```

14. Map Server Public IP with Domain (Hostinger)

1. Log in to **Hostinger**.
2. Navigate to **DNS Management**.
3. Update the **A Record** with your public server IP.
4. Wait for DNS propagation (may take up to 24 hours).
5. Verify by running:

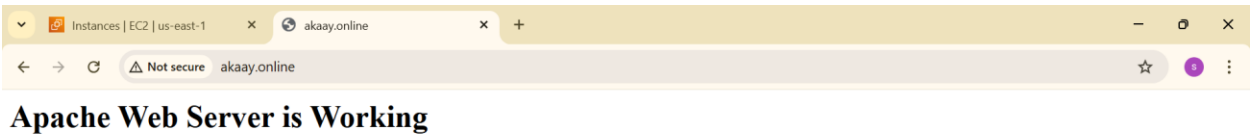
Get Public IP via Command line

```
curl -s ifconfig.me
```




```
dig akaay.online
```

Your Apache Web Server is now ready to serve websites!



Virtual Hosting

Okay, now we will set up virtual hosting on our server.

Here, we will configure virtual hosting for the following three websites:

- www.akaay.online
- udaipur.akaay.online
- jaipur.akaay.online

To achieve this, we need to create **three custom configuration files** and set up **three different DocumentRoot directories**.

We will create the following configuration files in the **/etc/httpd/conf.d/** directory:

- `akaay.conf`
- `udaipur_akaay.conf`
- `jaipur_akaay.conf`

16. Create akaay.conf

```
vim /etc/httpd/conf.d/akaay.conf
```

```
<VirtualHost *:80>
  servername www.akaay.online
  serveradmin root@localhost
  documentroot /var/www/html
</VirtualHost>
```

17. Create udaipur_akaay.conf

```
vim /etc/httpd/conf.d/udaipur_akaay.conf
```

```
<VirtualHost *:80>
   servername udaipur.akaay.online
   serveradmin root@localhost
   documentroot /var/www/udaipur
</VirtualHost>
```

17. Create jaipur_akaay.conf

```
vim /etc/httpd/conf.d/jaipur_akaay.conf
```

```
<VirtualHost *:80>
   servername jaipur.akaay.online
   serveradmin root@localhost
   documentroot /var/www/jaipur
</VirtualHost>
```

A DocumentRoot **/var/www/html** has already been created. So now, we need to create **/var/www/udaipur** and **/var/www/jaipur.**

```
mkdir /var/www/{udaipur,jaipur}
```

18. Download free css templates

Okay, now we will prepare the web content for all three websites.

We are going to host **static websites**, so we will use **three free website templates**. You can download them from **www.free-css.com**.

Download css template for www.akaay.online

wget https://www.free-css.com/assets/files/free-css-templates/download/page296/oxer.zip

Next we need extract it.

we don't have **zip and unzip** command so 1st we need to install zip package.

```
yum install -y zip

unzip oxer.zip

cp -rf oxer-html/* /var/www/html/

[root@web-server ~]# ls /var/www/html/

about.html  blog.html  class.html  css  images  index.html  js

[root@web-server ~]#
```

We will perform the same this steps for others domains or documentroot. Download free css template , extract it and copy all content to the documentroot
(/var/www/udaipur & /var/www/jaipur)

19. Restart httpd service

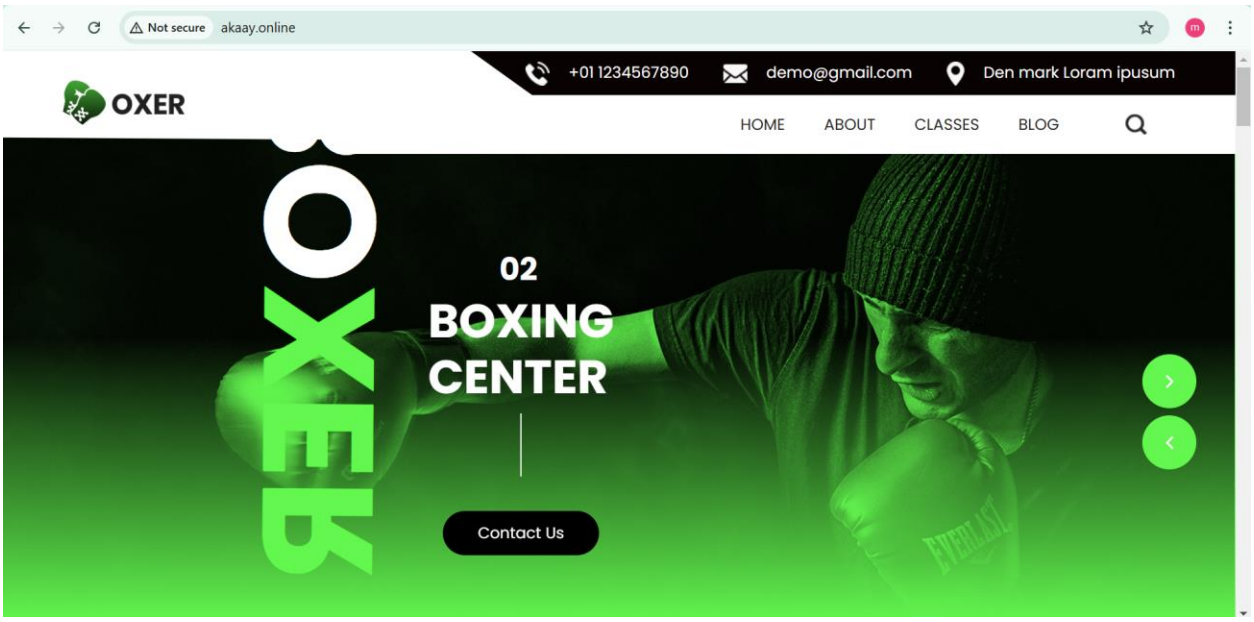
```
systemctl restart httpd
```

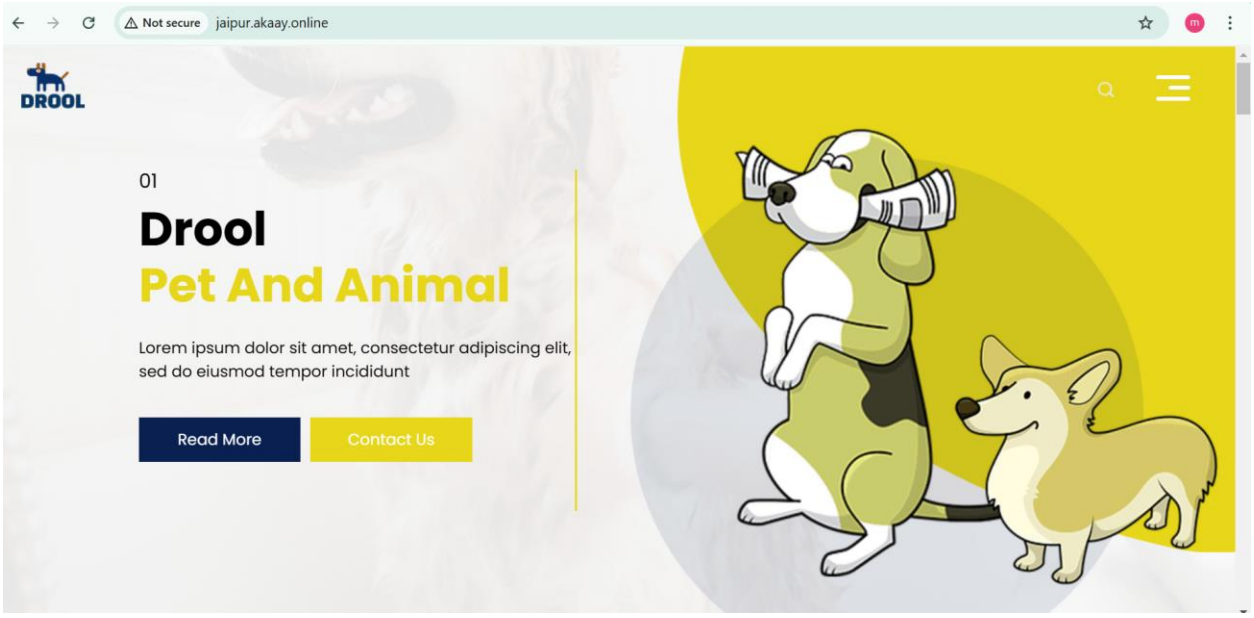
20. Create A and CNAME record on hostinger

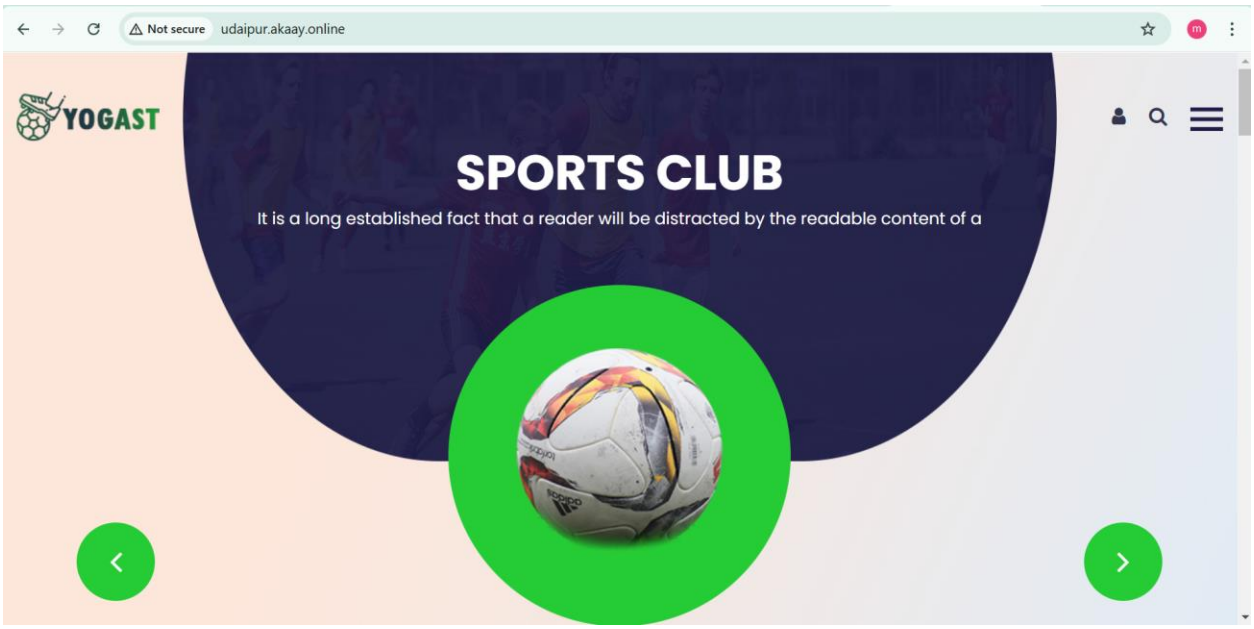
Okay, now we will create a **CNAME** record for **www.akaay.online** on Hostinger and create **A** records for **udaipur.akaay.online and jaipur.akaay.online**, mapping them to our web server's public IP.

Type	Name	Priority	Content	TTL		
CNAME	www	0	akaay.online	14400	Delete	Edit
A	jaipur	0	3.86.246.36	14400	Delete	Edit
A	udaipur	0	3.86.246.36	14400	Delete	Edit
A	@	0	3.86.246.36	14400	Delete	Edit

21. Okay, now let's open the browser and check all three websites.


Not secure
akaay.online
OXER
+01 1234567890
demo@gmail.com
Den mark Loram ipusum
HOME
ABOUT
CLASSES
BLOG
OXER
02
BOXING
CENTER
Contact Us


Not secure
jaipur.akaay.online
DROOL
01
Drool
Pet And Animal
Lorem ipsum dolor sit amet, consectetur adipiscing elit,
sed do eiusmod tempor incididunt
Read More
Contact Us



Okay, now let's change the document root of jaipur.akaay.online from /var/www/jaipur to /jaipur and see what issues we face and how we can fix them.

mkdir /jaipur

rm -rf /var/www/jaipur/

wget https://www.free-css.com/assets/files/free-css-templates/download/page291/drool.zip

unzip drool.zip

cp -rf drool-html/* /jaipur/

```
[root@web-server ~]# ls /jaipur/
about.html  contact.html  css  images  index.html  js
[root@web-server ~]#
```

Let's change documentroot location into configuration file

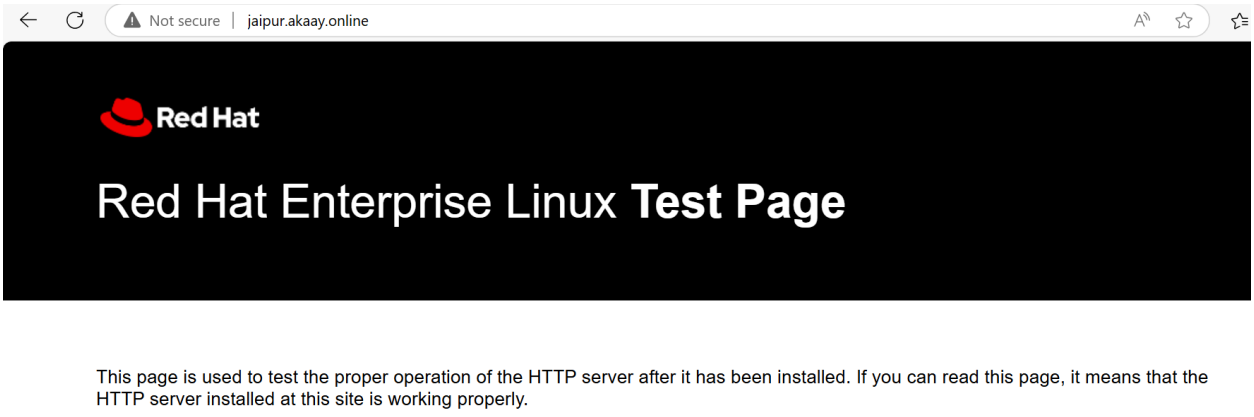
```
vim /etc/httpd/conf.d/jaipur_akaay.conf
```

```
<VirtualHost *:80>
    servername jaipur.akaay.online
    serveradmin root@localhost
    documentroot /jaipur
</VirtualHost>
~
```

Restart httpd service

```
systemctl restart httpd
```

Let's access jaipur.akaay.online



As we can see that it is showing Test Page.

So now let's check the httpd logs to find out the issues.

```
tail -f /var/log/httpd/error_log
```

```
[root@web-server ~]# tail -f /var/log/httpd/error_log
[Wed Feb 12 18:06:33.919889 2025] [authz_core:error] [pid 2076:tid 2191] [client 170.39.218.1
09:45412] AH01630: client denied by server configuration: /jaipur/config.env
[Wed Feb 12 18:06:34.085188 2025] [authz_core:error] [pid 2076:tid 2192] [client 170.39.218.1
09:45412] AH01630: client denied by server configuration: /jaipur/production
[Wed Feb 12 18:06:34.297164 2025] [authz_core:error] [pid 2076:tid 2193] [client 170.39.218.1
09:45412] AH01630: client denied by server configuration: /jaipur/dev
[Wed Feb 12 18:06:34.520695 2025] [authz_core:error] [pid 2076:tid 2194] [client 170.39.218.1
09:45412] AH01630: client denied by server configuration: /jaipur/api
```

This issue is looks like that it is permission related issues.

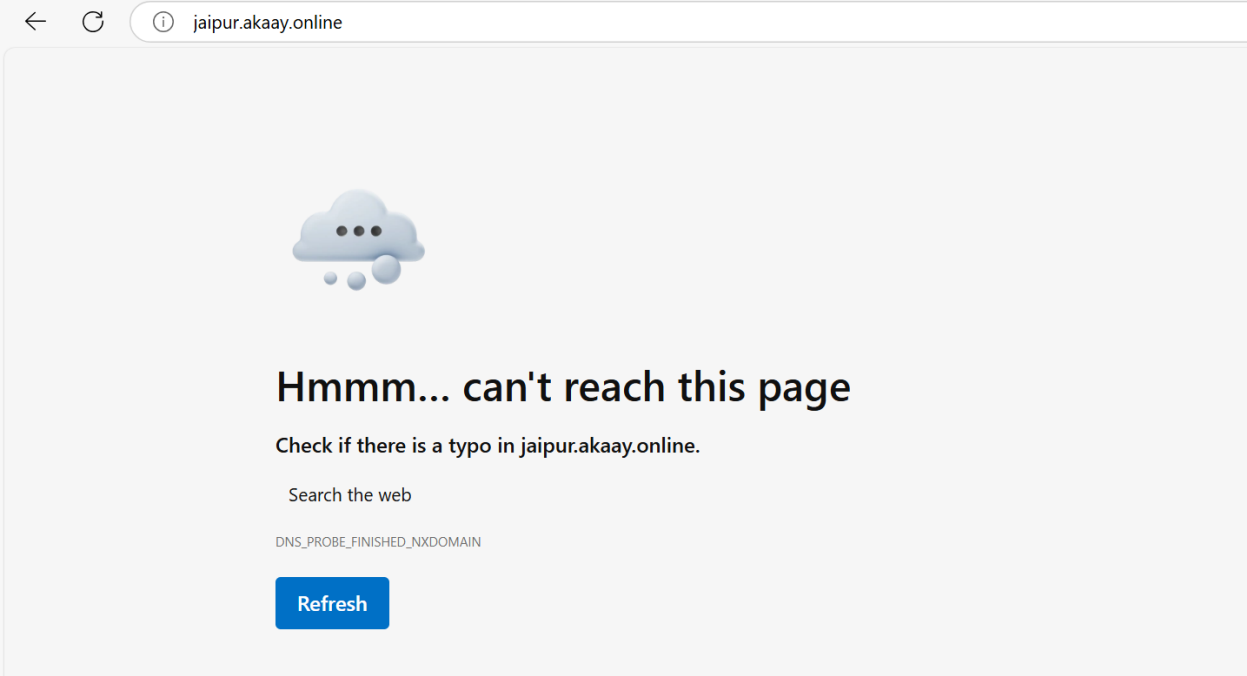
To fix the issue, we need to allow the /jaipur directory in the configuration file. This is because directories created inside /var/www/html and /var/www/ are allowed by default.

Here's how you can modify your Apache configuration to allow /jaipur:

```
<VirtualHost *:80>
    servername jaipur.akaay.online
    serveradmin root@localhost
    documentroot /jaipur
</VirtualHost>

<Directory "/jaipur">
    Require all granted
</Directory>
~
```

```
systemctl restart httpd
```



Still we are facing issue to access webpage but this time problem is different. Let's check logs.

```
[root@web-server ~]# tail -f /var/log/httpd/error_log
[Wed Feb 12 18:28:30.749727 2025] [core:notice] [pid 2477:tid 2477] SELinux policy enabled; h
ttpd running as context system_u:system_r:httpd_t:s0
[Wed Feb 12 18:28:30.750641 2025] [suexec:notice] [pid 2477:tid 2477] AH01232: suEXEC mechani
sm enabled (wrapper: /usr/sbin/suexec)
[Wed Feb 12 18:28:30.753099 2025] [ssl:warn] [pid 2477:tid 2477] AH01906: www.akaay.online:44
3:0 server certificate is a CA certificate (BasicConstraints: CA == TRUE !?)
[Wed Feb 12 18:28:30.753357 2025] [ssl:warn] [pid 2477:tid 2477] AH01909: www.akaay.online:44
3:0 server certificate does NOT include an ID which matches the server name
[Wed Feb 12 18:28:30.767344 2025] [ssl:warn] [pid 2477:tid 2477] AH01906: www.akaay.online:44
3:0 server certificate is a CA certificate (BasicConstraints: CA == TRUE !?)
[Wed Feb 12 18:28:30.767441 2025] [ssl:warn] [pid 2477:tid 2477] AH01909: www.akaay.online:44
3:0 server certificate does NOT include an ID which matches the server name
[Wed Feb 12 18:28:30.767596 2025] [lbmethod_heartbeat:notice] [pid 2477:tid 2477] AH02282: No
 slotmem from mod_heartmonitor
[Wed Feb 12 18:28:30.774131 2025] [mpm_event:notice] [pid 2477:tid 2477] AH00489: Apache/2.4.
62 (Red Hat Enterprise Linux) OpenSSL/3.2.2 configured -- resuming normal operations
[Wed Feb 12 18:28:30.774228 2025] [core:notice] [pid 2477:tid 2477] AH00094: Command line: '/
usr/sbin/httpd -D FOREGROUND'
[Wed Feb 12 18:36:42.785408 2025] [core:error] [pid 2665:tid 2699] (13)Permission denied: [cl
ient 43.157.22.57:59548] AH00035: access to /index.html denied (filesystem path '/jaipur/inde
x.html') because search permissions are missing on a component of the path
```

Ok got this is selinux related isses. To fully track this issue, you can also check the **SELinux logs** for detailed information.

```
cat /var/log/audit/audit.log | grep AVC
```

```
[root@web-server ~]# cat /var/log/audit/audit.log | grep AVC
type=AVC msg=audit(1739385402.783:249): avc:  denied  { getattr } for  pid=2665 comm="httpd"
path="/jaipur/index.html" dev="xvda4" ino=17707506 scontext=system_u:system_r:httpd_t:s0 tcon
text=unconfined_u:object_r:default_t:s0 tclass=file permissive=0
type=AVC msg=audit(1739385402.783:250): avc:  denied  { getattr } for  pid=2665 comm="httpd"
path="/jaipur/index.html" dev="xvda4" ino=17707506 scontext=system_u:system_r:httpd_t:s0 tcon
text=unconfined_u:object_r:default_t:s0 tclass=file permissive=0
[root@web-server ~]#
```

NOTE - AVC (Access Vector Cache) is a logging mechanism in SELinux that tracks denied access attempts.

If SELinux is enabled, you need to set the **httpd_sys_content_t** label on **/jaipur** and its content.

```
[root@web-server ~]# ls -lZ /jaipur/
total 48
-rw-r--r--. 1 root root unconfined_u:object_r:default_t:s0  9553 Feb 12 18:00 about.html
-rw-r--r--. 1 root root unconfined_u:object_r:default_t:s0  6940 Feb 12 18:00 contact.html
drwxr-xr-x. 2 root root unconfined_u:object_r:default_t:s0   105 Feb 12 18:00 css
drwxr-xr-x. 2 root root unconfined_u:object_r:default_t:s0  4096 Feb 12 18:00 images
-rw-r--r--. 1 root root unconfined_u:object_r:default_t:s0 22948 Feb 12 18:00 index.html
drwxr-xr-x. 2 root root unconfined_u:object_r:default_t:s0    53 Feb 12 18:00 js
[root@web-server ~]#
```

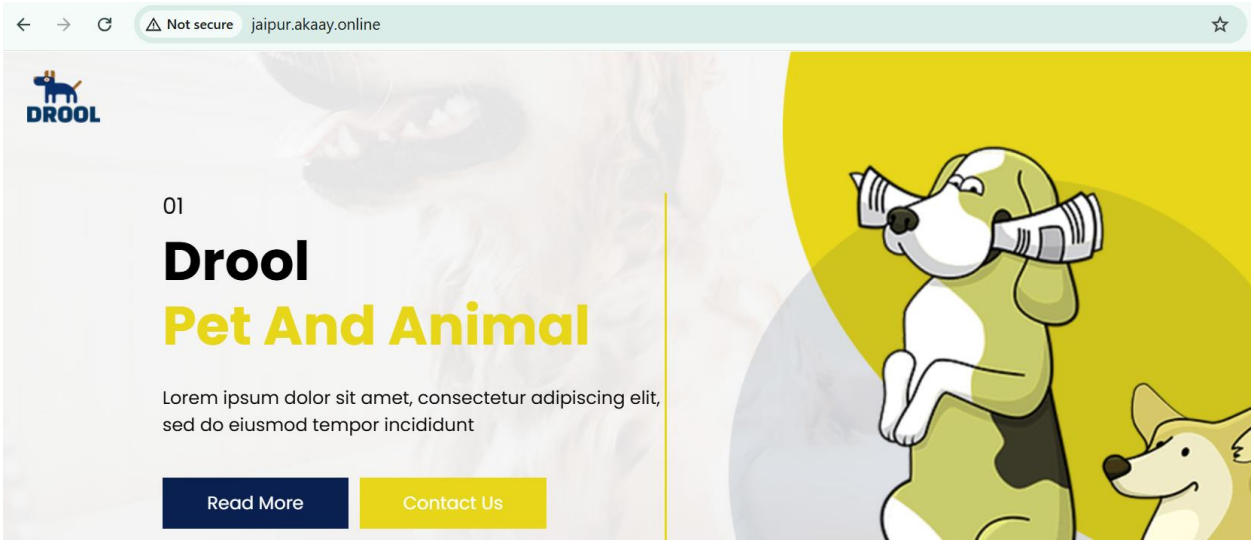
If you want to set the label permanently, use **semanage** and **restorecon**.

```
semanage fcontext -a -t httpd_sys_content_t "/jaipur(/.*)?"

restorecon -Rv /jaipur

systemctl restart httpd
```

```
[root@web-server ~]# ls -lZ /jaipur/
total 48
-rw-r--r--. 1 root root unconfined_u:object_r:httpd_sys_content_t:s0  9553 Feb 12 18:00 about
.html
-rw-r--r--. 1 root root unconfined_u:object_r:httpd_sys_content_t:s0  6940 Feb 12 18:00 conta
ct.html
drwxr-xr-x. 2 root root unconfined_u:object_r:httpd_sys_content_t:s0   105 Feb 12 18:00 css
drwxr-xr-x. 2 root root unconfined_u:object_r:httpd_sys_content_t:s0  4096 Feb 12 18:00 image
s
-rw-r--r--. 1 root root unconfined_u:object_r:httpd_sys_content_t:s0 22948 Feb 12 18:00 index
.html
drwxr-xr-x. 2 root root unconfined_u:object_r:httpd_sys_content_t:s0    53 Feb 12 18:00 js
[root@web-server ~]#
```

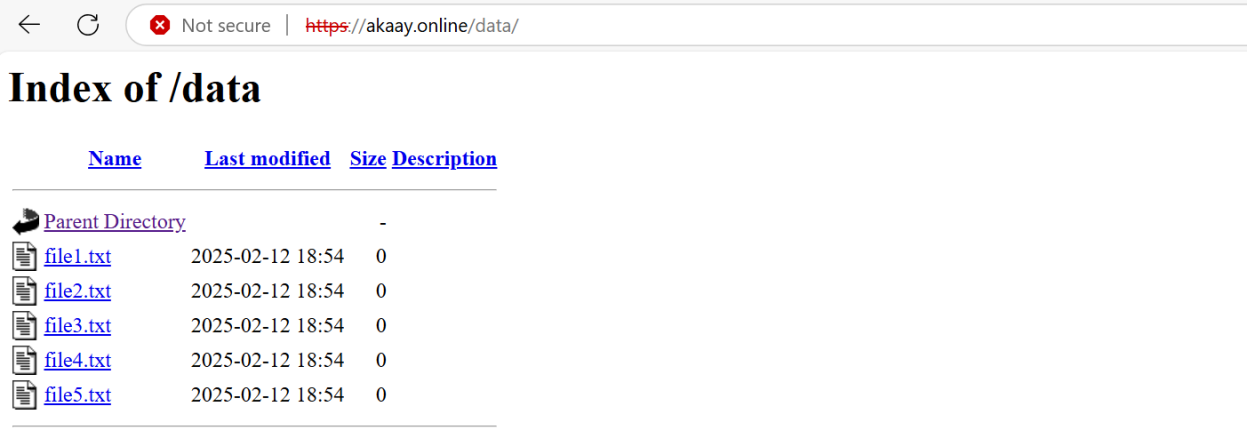


Okay, now let's create a directory named "data" inside the document roots of both websites:

- **For** www.akaay.online → `/var/www/html/data`
- **For jaipur.akaay.online** → `/jaipur/data`

And then, we will try to access the content inside these directories.

```
[root@web-server ~]# mkdir /var/www/html/data
[root@web-server ~]#
[root@web-server ~]# mkdir /jaipur/data
[root@web-server ~]#
[root@web-server ~]# touch /var/www/html/data/file{1..5}.txt
[root@web-server ~]#
[root@web-server ~]# touch /jaipur/data/file{1..5}.txt
[root@web-server ~]#
[root@web-server ~]#
```



As we can see, we are able to access the content at **https://akaay.online/data/**, but we are getting a **403 Forbidden** error at **http://jaipur.akaay.online/data/**. Let's check the logs.

```
tail -f /var/log/httpd/error_log
```

```
49:32535] AH01276: Cannot serve directory /jaipur/data/: No matching DirectoryIndex (index.ht
ml) found, and server-generated directory index forbidden by Options directive
[Wed Feb 12 19:06:38.075394 2025] [autoindex:error] [pid 3028:tid 3078] [client 223.184.132.1
49:32520] AH01276: Cannot serve directory /jaipur/data/: No matching DirectoryIndex (index.ht
ml) found, and server-generated directory index forbidden by Options directive
[Wed Feb 12 19:06:38.429821 2025] [autoindex:error] [pid 3028:tid 3079] [client 223.184.132.1
49:32520] AH01276: Cannot serve directory /jaipur/data/: No matching DirectoryIndex (index.ht
ml) found, and server-generated directory index forbidden by Options directive
```

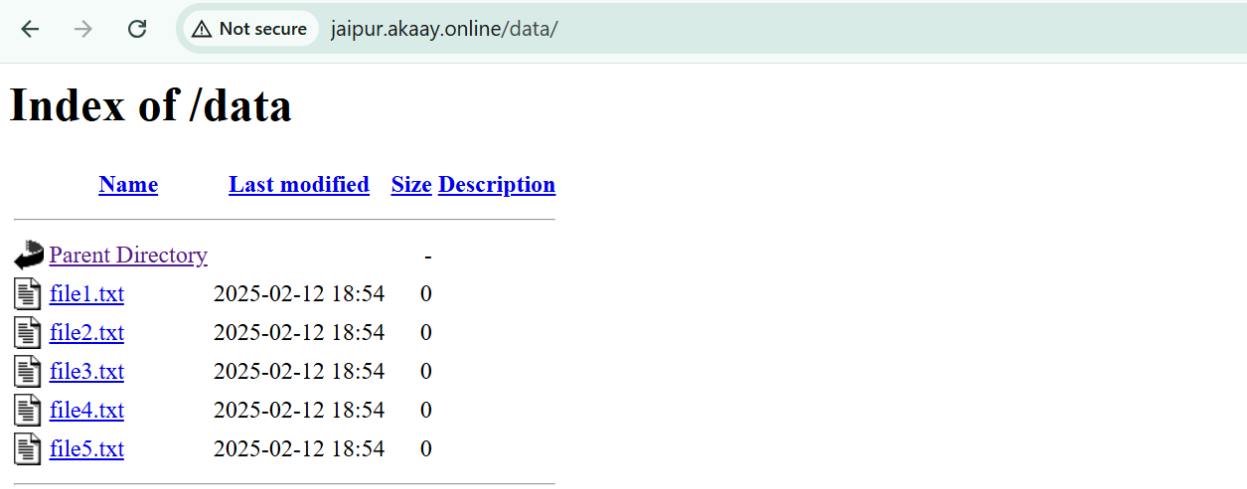
Okay, got it. This problem is occurring because **/var/www/html** allows **index files by default**, but if we set a different **DocumentRoot**, indexing is **denied by default**. To fix this, we need to allow indexing in the configuration file.

```
vim /etc/httpd/conf.d/jaipur_akaay.conf
```

```
<VirtualHost *:80>
    servername jaipur.akaay.online
    serveradmin root@localhost
    documentroot /jaipur
</VirtualHost>

<Directory "/jaipur">
    Require all granted
    Options Indexes FollowSymLinks
</Directory>
~
```

```
systemctl restart httpd
```



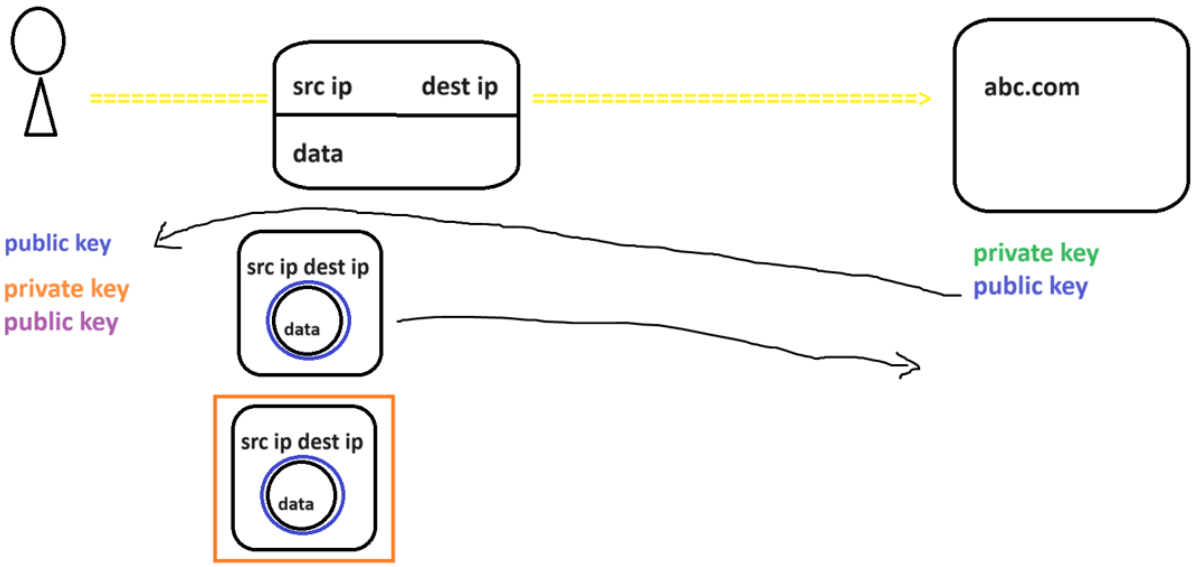
Using HTTPS For the client-server communication

1. How HTTPS Works

HTTPS (HyperText Transfer Protocol Secure) is an encrypted version of HTTP that ensures secure communication between the client and the server using **SSL/TLS (Secure Sockets Layer / Transport Layer Security).**

How it Works?

1. **Client Request** → A user visits an HTTPS website.
2. **SSL Handshake** → The server responds with its SSL certificate.
3. **Certificate Verification** → The browser checks if the certificate is valid and issued by a trusted Certificate Authority (CA).
4. **Encryption Established** → A secure connection is established using asymmetric and symmetric encryption.
5. **Secure Data Transfer** → All communication between the client and server is now encrypted.



2. Configuring HTTPS on Apache Web Server

To enable HTTPS on Apache, follow these steps:

Step 1: Install OpenSSL

Ensure that Apache and OpenSSL are installed on your system.

For **RHEL-based systems (CentOS, Rocky Linux, AlmaLinux, etc.):**

```
dnf install httpd mod_ssl openssl –y
```

Step 2: Create a Self-Signed Certificate

If you don’t want to use Let's Encrypt, create a self-signed certificate:

```
openssl req -x509 -nodes -days 365 -newkey rsa:2048 -keyout server.key -out server.crt
```

```
[root@web-server ~]# ls
drool-html  drool.zip  server.crt  server.key
[root@web-server ~]#
```

Step3: Copy crt file to /etc/pki/tls/certs/ and key file to /etc/pki/tls/private/ directory

```
cp server.crt  /etc/pki/tls/certs/
cp server.key /etc/pki/tls/private/
```

Step4: Modify ssl.conf file

Define the path of key and cert file into the ssl.conf file

```
vim /etc/httpd/conf.d/ssl.conf
```

```
#   parallel.
SSLCertificateFile /etc/pki/tls/certs/server.crt

#   Server Private Key:
#   If the key is not combined with the certificate, use this
#   directive to point at the key file.  Keep in mind that if
#   you've both a RSA and a DSA private key you can configure
#   both in parallel (to also allow the use of DSA ciphers, etc.)
#   ECC keys, when in use, can also be configured in parallel
SSLCertificateKeyFile /etc/pki/tls/private/server.key
```

Step5: Modify akaay.conf (custom conf file) file

```
vim /etc/httpd/conf.d/akaay.conf
```

```
<VirtualHost *:80>

SSLEngine on
```

```
SSLCertificateFile /etc/pki/tls/certs/server.crt
SSLCertificateKeyFile /etc/pki/tls/private/server.key
   servername www.akaay.online
   serveradmin root@localhost
   documentroot /var/www/html
</VirtualHost>
```

Step6: Restart httpd service

```
systemctl restart httpd
```

Now Get SSL Certificate from Let's Encrypt jaipur.akaay.online using certbot

Install **Certbot** to generate a free SSL certificate:

```
dnf install certbot python3-certbot-apache –y

certbot –apache                NOTE:- Before install certbot you need to configure epel repo.
                                      And to use epel repo need to configure swap on the machine

rm -f /etc/httpd/conf.d/ssl.conf

certbot --apache -d akaay.online
```

Step7: Go to browser and search https://www.akaay.online

Set Up Password Authentication in Apache on CentOS/RedHat

(Click here and will be diverted on google docs page.)