Apache

HTTP Server 2.4: install, virtual hosts, TLS and rewrites.

01 Install & check version

```
sudo apt install apache2    # Debian/Ubuntu
sudo dnf install httpd      # RHEL/Fedora
brew install httpd          # macOS
apachectl -v                # version
docker run -d -p 80:80 httpd
```

Debian calls the package, service and config folder apache2; RHEL, Homebrew and the Docker image use httpd. Commands below use the Debian names.

02 Service & config test

```
sudo apachectl configtest       # Syntax OK?
sudo systemctl reload apache2   # graceful
sudo systemctl restart apache2  # full
sudo systemctl enable apache2   # on boot
apachectl -S                    # vhosts
apachectl -M                    # modules
```

configtest (same as -t) checks syntax without touching the running server: run it before every reload. reload lets open requests finish; restart drops them.

03 Sites & modules (Debian)

```
sudo a2ensite mysite.conf
sudo a2dissite default-ssl.conf
sudo a2enmod rewrite ssl headers
sudo a2dismod status
sudo a2enconf security
sudo systemctl reload apache2
```

Main file: /etc/apache2/apache2.conf. The a2en tools link files from sites-, mods- and conf-available/ into -enabled/. RHEL: /etc/httpd/conf/httpd.conf plus conf.d/*.conf.

04 Name-based virtual hosts

```
<VirtualHost *:80>
    ServerName example.com
    ServerAlias www.example.com
    DocumentRoot /var/www/example.com
</VirtualHost>
```

Sites share one IP and port: the Host header picks the vhost by ServerName or ServerAlias (aliases can use *.example.com). Save as sites-available/example.com.conf.

05 Directories & access

```
<Directory /var/www/example.com>
    Options -Indexes +FollowSymLinks
    AllowOverride All
    Require all granted
</Directory>
```

AllowOverride All turns on .htaccess files (2.4 default: None). Require ip 10.0.0.0/8 replaces 2.2 Order/Allow/Deny.

06 HTTPS virtual host

```
<VirtualHost *:80>
    ServerName example.com
    Redirect 301 / https://example.com/
</VirtualHost>
<VirtualHost *:443>
    ServerName example.com
    SSLEngine on
    SSLCertificateFile /path/to/cert.pem
    SSLCertificateKeyFile /path/to/key.pem
</VirtualHost>
```

Needs a2enmod ssl. Vhosts cannot nest, so the :80 redirect is a sibling. HTTP/2: a2enmod http2, Protocols h2 http/1.1.

07 Let's Encrypt with Certbot

```
sudo apt install certbot \
    python3-certbot-apache
sudo certbot --apache \
    -d example.com -d www.example.com
sudo certbot renew --dry-run
```

The apache plugin gets the certificate and writes an HTTPS vhost using fullchain.pem and privkey.pem from /etc/letsencrypt/live/. Schedule certbot renew --quiet.

08 Redirects & error pages

```
Redirect 301 /old-page /new-page
Redirect 301 /blog https://blog.example.com
RedirectMatch 301 ^/products/(.*)$ \
    https://shop.example.com/$1
ErrorDocument 404 /errors/404.html
ErrorDocument 503 "Service unavailable"
```

mod_alias is simpler than mod_rewrite for fixed moves. 301 is permanent and cached by browsers; 302 is temporary. ErrorDocument takes a path, a URL or a quoted message.

09 mod_rewrite rules

```
RewriteEngine On
RewriteRule ^old-page$ /new-page [R=301,L]
RewriteRule ^user/([0-9]+)$ \
    /profile.php?id=$1 [L]
RewriteCond %{REQUEST_FILENAME} !-f
RewriteCond %{REQUEST_FILENAME} !-d
RewriteRule . /index.php [L]
```

Shown as .htaccess, where the path has no leading slash; in a vhost it starts with /. RewriteCond lines gate the next rule: here, missing files go to index.php.

Apache

Rewrite recipes, proxying, logs, security and tuning.

10 Rewrite recipes

```
# Force HTTPS
RewriteCond %{HTTPS} off
RewriteRule (.*) https://%{HTTP_HOST}/$1 \
    [R=301,L]
# Drop www
RewriteCond %{HTTP_HOST} ^www\.(.+)$ [NC]
RewriteRule (.*) https://%1/$1 [R=301,L]
```

Same .htaccess form as 09. %1 is a RewriteCond capture, $1 a RewriteRule capture. Escape literal dots as \.

11 RewriteRule flags

[L]	Last: stop this round of rules
[R=301]	External redirect; plain R is 302
[NC]	Case-insensitive match
[QSA]	Append the original query string
[F]	Return 403 Forbidden
[P]	Proxy through mod_proxy

Combine with commas: [R=301,L]. Debug with LogLevel alert rewrite:trace3; RewriteLog was removed in 2.4.

12 Reverse proxy

```
ProxyPreserveHost On
ProxyPass /static !
ProxyPass / http://localhost:3000/ \
    upgrade=websocket
ProxyPassReverse / http://localhost:3000/
```

a2enmod proxy proxy_http. The first matching ProxyPass wins, so exclusions (!) go first. upgrade=websocket (2.4.47+) tunnels WebSockets.

13 Load balancing

```
<Proxy balancer://myapp>
    BalancerMember http://localhost:3001
    BalancerMember http://localhost:3002
</Proxy>
ProxyPass / balancer://myapp/
ProxyPassReverse / balancer://myapp/
```

Needs proxy_balancer and lbmethod_byrequests, the default method. mod_proxy_http adds X-Forwarded-For.

14 Logs & formats

```
ErrorLog ${APACHE_LOG_DIR}/error.log
LogLevel warn
LogFormat "%h %t \"%r\" %>s %b %D" timed
SetEnvIf Request_URI "^/health$" dontlog
CustomLog ${APACHE_LOG_DIR}/access.log \
    timed env=!dontlog
```

The stock config defines combined and common. %>s: final status, %b: body bytes, %D: microseconds. Escape inner quotes as \".

15 Basic authentication

```
htpasswd -c /etc/apache2/.htpasswd admin
```

```
<Directory /var/www/admin>
    AuthType Basic
    AuthName "Admin Area"
    AuthUserFile /etc/apache2/.htpasswd
    Require valid-user
</Directory>
```

Omit -c when adding users or it replaces the file. For a login plus an IP check, wrap both Require lines in <RequireAll>.

16 Hardening & headers

```
ServerTokens Prod
ServerSignature Off
Header set X-Content-Type-Options "nosniff"
Header set Strict-Transport-Security \
    "max-age=31536000; includeSubDomains"
<FilesMatch "^\.|\.(bak|sql|log)$">
    Require all denied
</FilesMatch>
```

ServerTokens Prod sends only "Server: Apache". FilesMatch refuses dotfiles like .env. Needs a2enmod headers.

17 Compression & caching

```
AddOutputFilterByType DEFLATE text/html \
    text/css text/plain application/json \
    application/javascript image/svg+xml
ExpiresActive On
ExpiresByType text/css "access plus 1 month"
ExpiresByType image/png "access plus 1 year"
```

Needs a2enmod deflate expires. Long expiry suits fingerprinted files such as style.a1b2c3.css.

18 MPM & connections

```
apachectl -V | grep MPM
```

```
<IfModule mpm_event_module>
    ThreadsPerChild         25
    MaxRequestWorkers      150
    MaxConnectionsPerChild   0
</IfModule>
```

event suits busy sites; mod_php needs prefork. Keep MaxRequestWorkers a multiple of ThreadsPerChild.