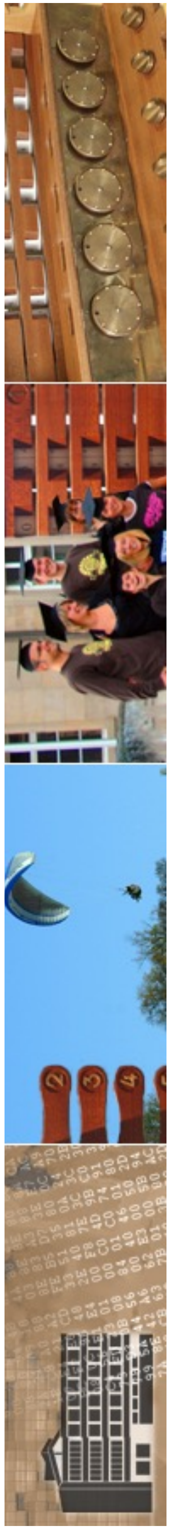


EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

MATHEMATISCH-
NATURWISSENSCHAFTLICHE FAKULTÄT
FACHBEREICH INFORMATIK
INFORMATIONSDIENSTE

Grundlagen der Web-Entwicklung

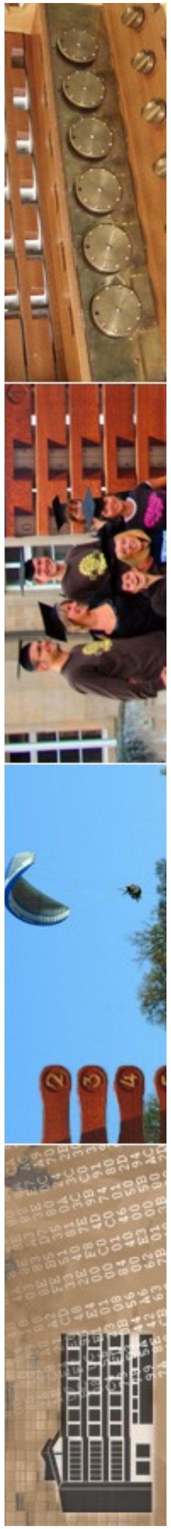
INF3172

Performante Webserver: NGINX und Caddy

Thomas Walter

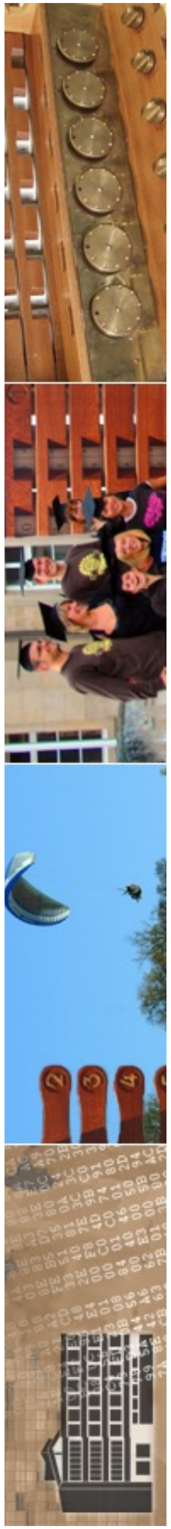
18.11.2021

Version 1.0



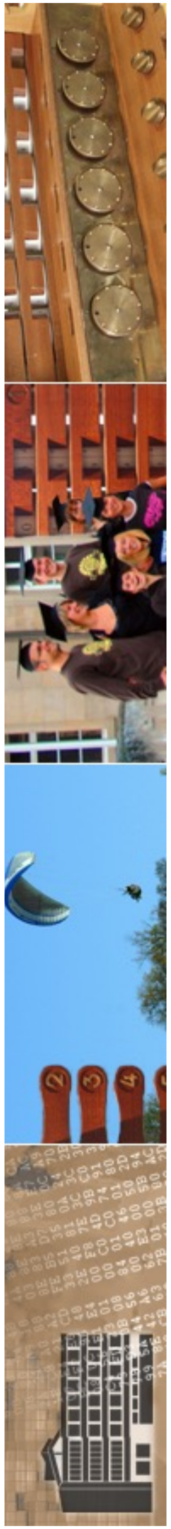
aktuelles

- Weihnachtsrätsel erfolgreich gelöst!
- Gratulation!
- Auflösung vorgesehen für die Vorlesung am **23.12.2021** (oder Altenrative!) einschließlich Verlosung der Gewinne!!!



aktuelles

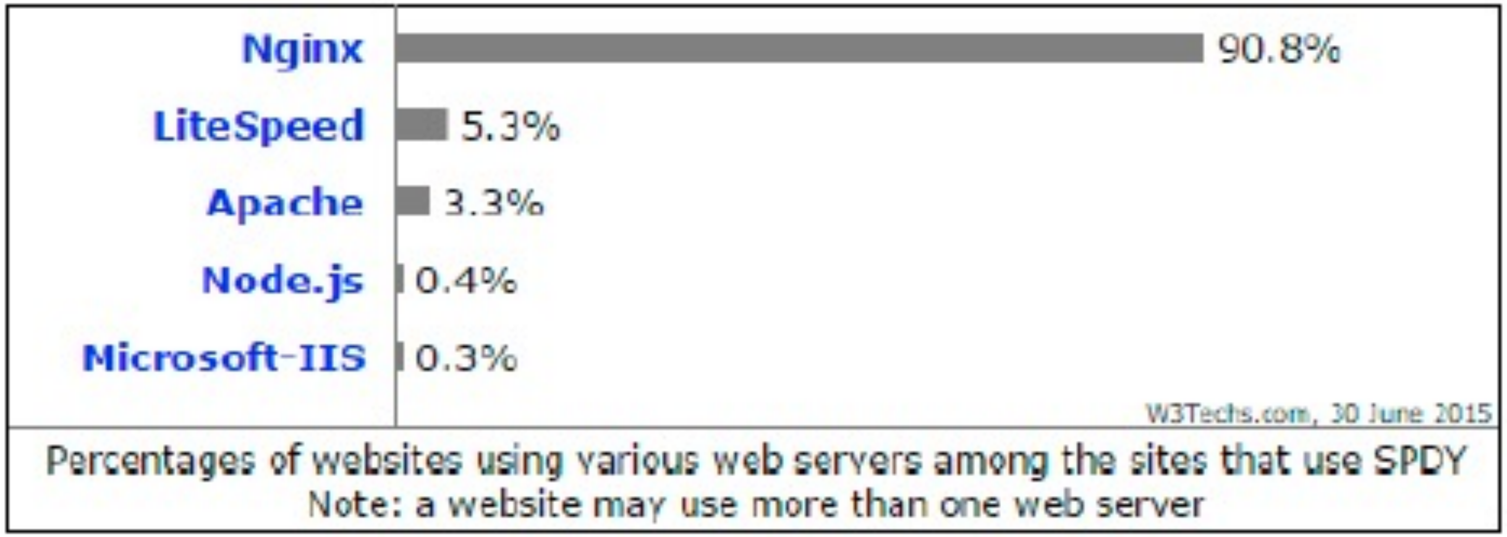
- Zoom gibt es jetzt mit E2EE



NGINX

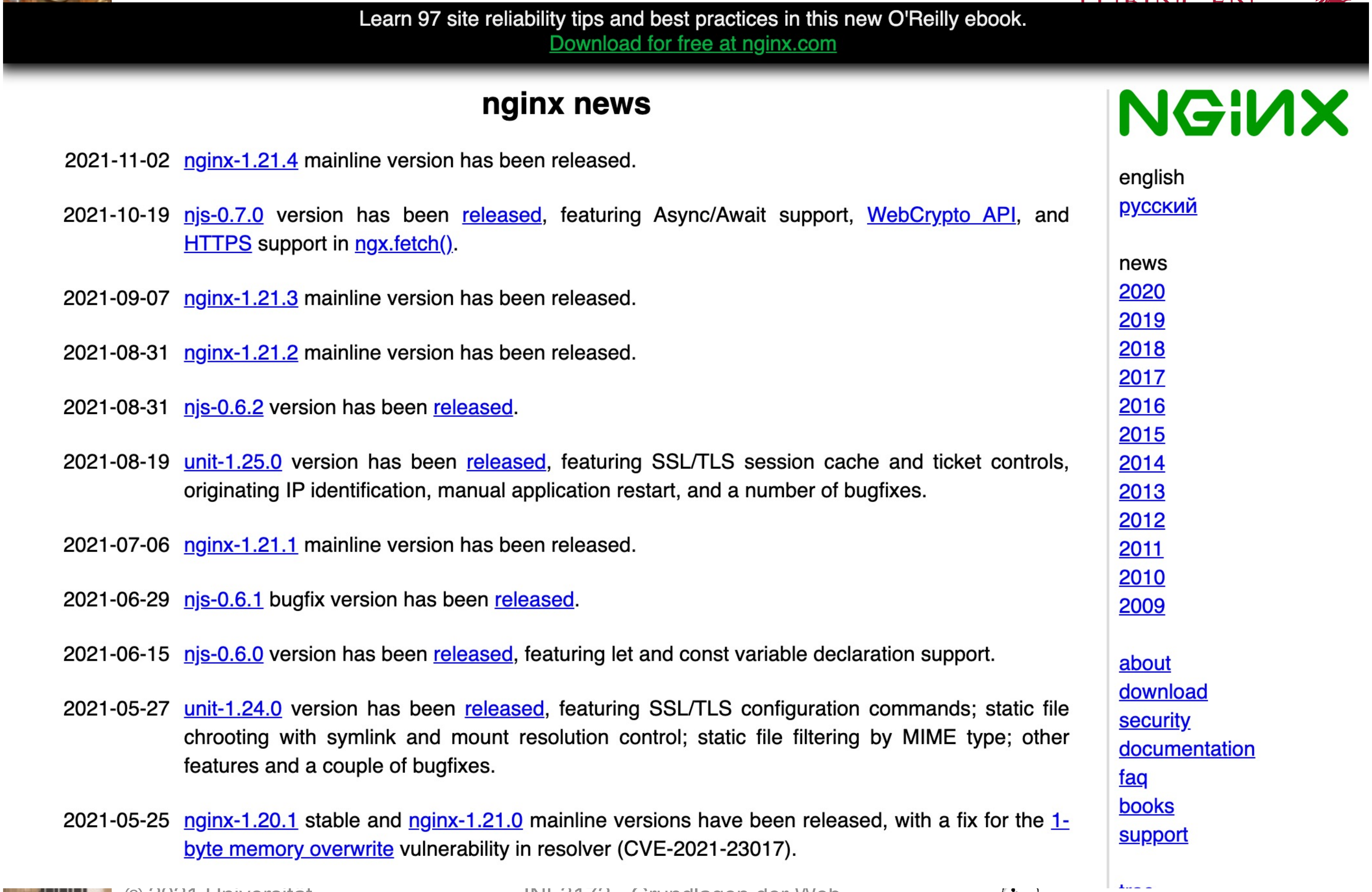
- Web Server & Reverse/Mail Proxy
- nginx.org (nginx.com existiert auch)

- Optimiert auf Performance



W3Techs.com, 30 June 2015

Percentages of websites using various web servers among the sites that use SPDY
Note: a website may use more than one web server



Learn 97 site reliability tips and best practices in this new O'Reilly ebook.
Download for free at nginx.com

nginx news

2021-11-02 nginx-1.21.4 mainline version has been released.

2021-10-19 njs-0.7.0 version has been released, featuring Async/Await support, WebCrypto API, and HTTPS support in ngx.fetch().

2021-09-07 nginx-1.21.3 mainline version has been released.

2021-08-31 nginx-1.21.2 mainline version has been released.

2021-08-31 njs-0.6.2 version has been released.

2021-08-19 unit-1.25.0 version has been released, featuring SSL/TLS session cache and ticket controls, originating IP identification, manual application restart, and a number of bugfixes.

2021-07-06 nginx-1.21.1 mainline version has been released.

2021-06-29 njs-0.6.1 bugfix version has been released.

2021-06-15 njs-0.6.0 version has been released, featuring let and const variable declaration support.

2021-05-27 unit-1.24.0 version has been released, featuring SSL/TLS configuration commands; static file chrooting with symlink and mount resolution control; static file filtering by MIME type; other features and a couple of bugfixes.

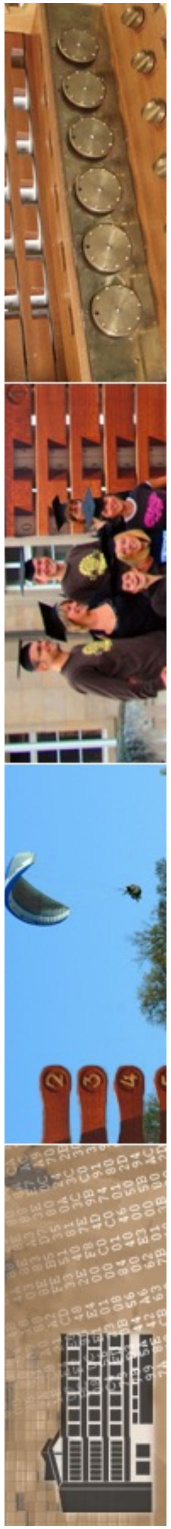
2021-05-25 nginx-1.20.1 stable and nginx-1.21.0 mainline versions have been released, with a fix for the 1-byte memory overwrite vulnerability in resolver (CVE-2021-23017).

NGINX

english
русский

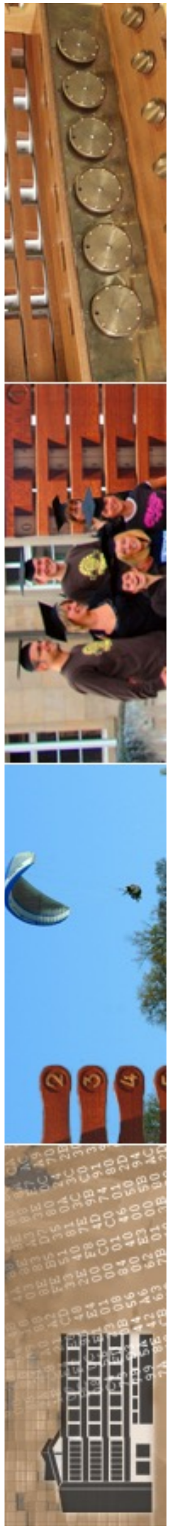
news
2020
2019
2018
2017
2016
2015
2014
2013
2012
2011
2010
2009

about
download
security
documentation
faq
books
support



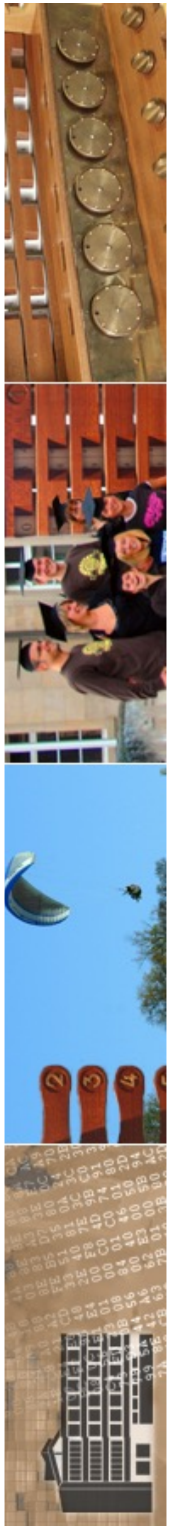
Eigenschaften

- Auslieferung von statischem Inhalt
- Reverse Proxy mit Caching
- Load Balancing
- TLS (SSL)
- FastCGI, CGI
- Streaming
- HTTP 1.1/2.0, SPDY
- Websockets
- Embedded Perl Scripting



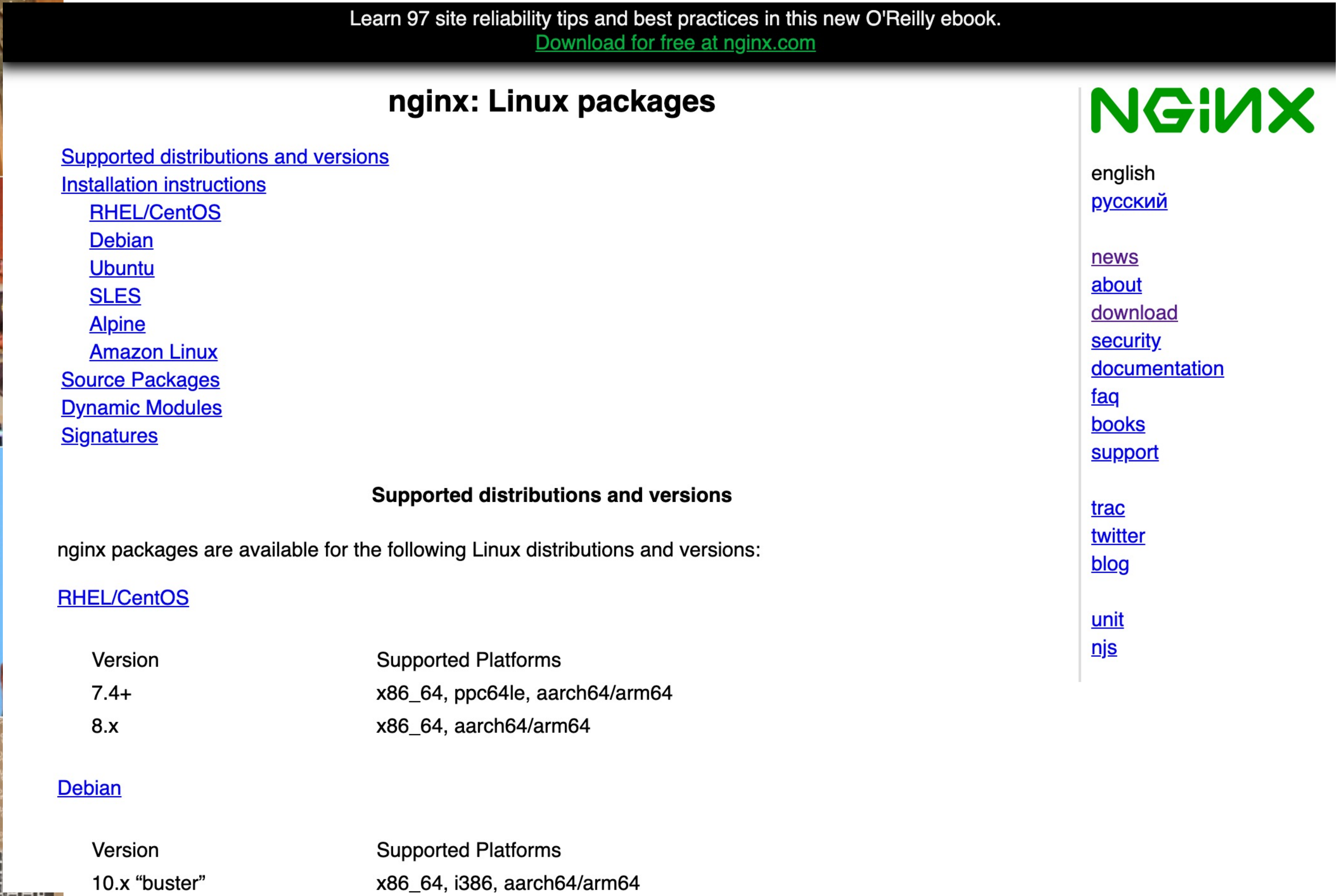
Genese

- 2002: Entwicklungsbeginn durch Igor Sysoev
- 2004: Veröffentlichung von Version 0.1.0
- 2011: Veröffentlichung von Version 1.0
- 2012 Gründung von NGINX Inc.
- 2013 NGINX plus (kommerzielle Version)
- November 2021: NGINX 1.21.4



NGINX in Details

- Architektur
  - Modular
  - C
- Betriebssysteme
  - alle gängigen
    - Linux, OIS-X, FreeBSD
    - Windows nicht so stark performanced-optimiert



nginx: Linux packages

- Supported distributions and versions
- Installation instructions
  - RHEL/CentOS
  - Debian
  - Ubuntu
  - SLES
  - Alpine
  - Amazon Linux
- Source Packages
- Dynamic Modules
- Signatures

Supported distributions and versions

nginx packages are available for the following Linux distributions and versions:

RHEL/CentOS

Version	Supported Platforms
7.4+	x86_64, ppc64le, aarch64/arm64
8.x	x86_64, aarch64/arm64

Debian

Version	Supported Platforms
10.x “buster”	x86_64, i386, aarch64/arm64

english
русский

news
about
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security
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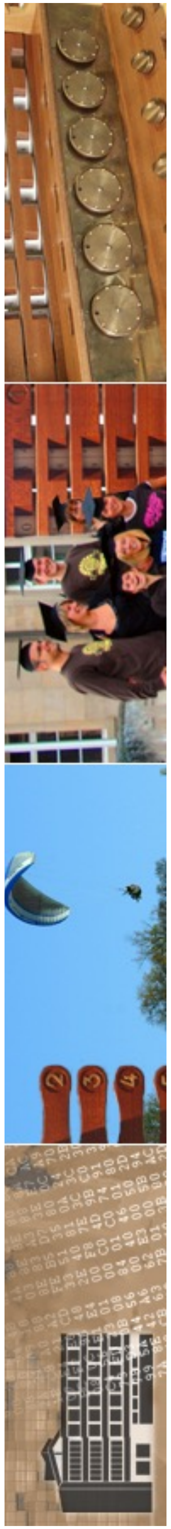
faq
books
support

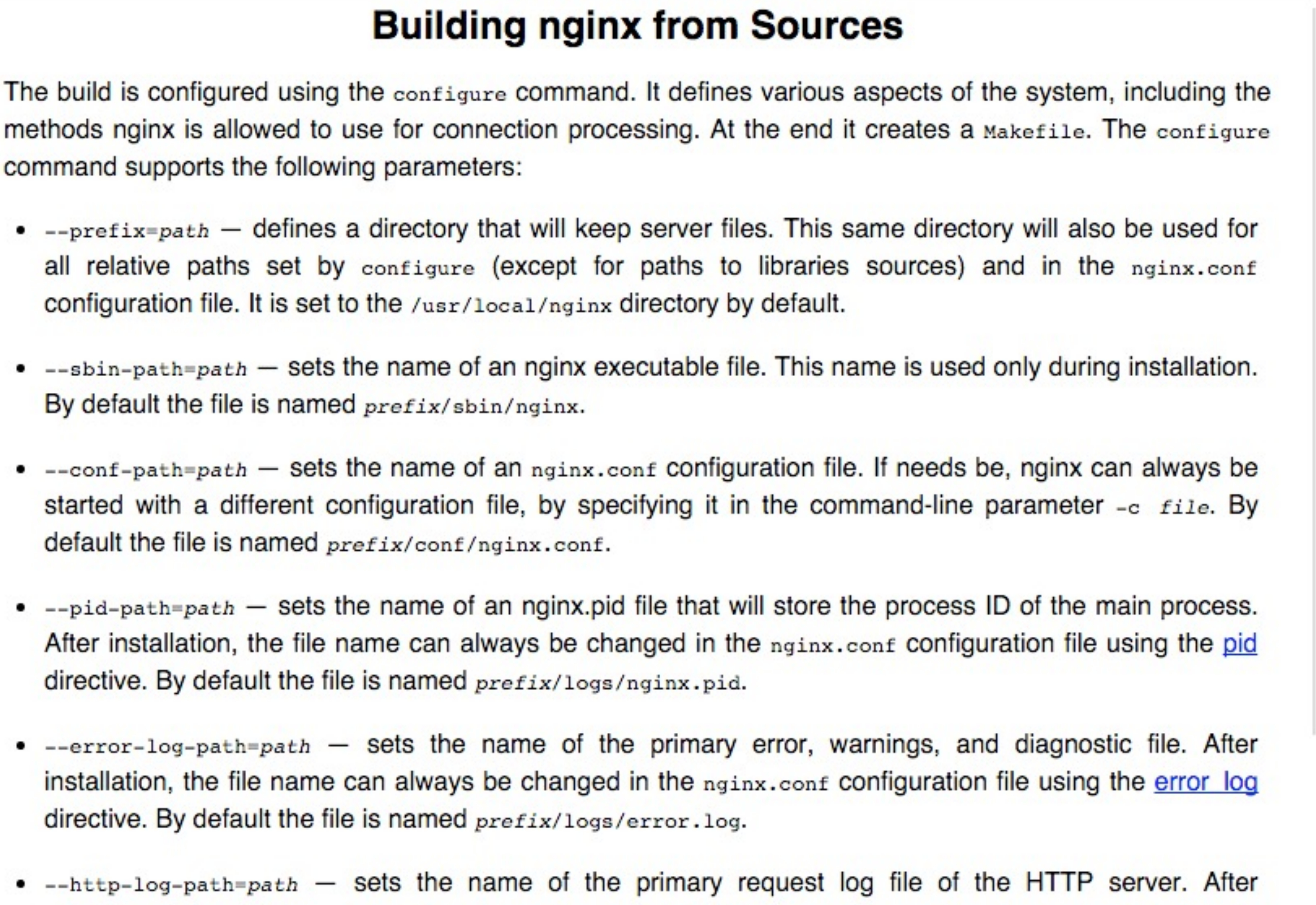
trac
twitter
blog

unit
njs



manuelle Installation

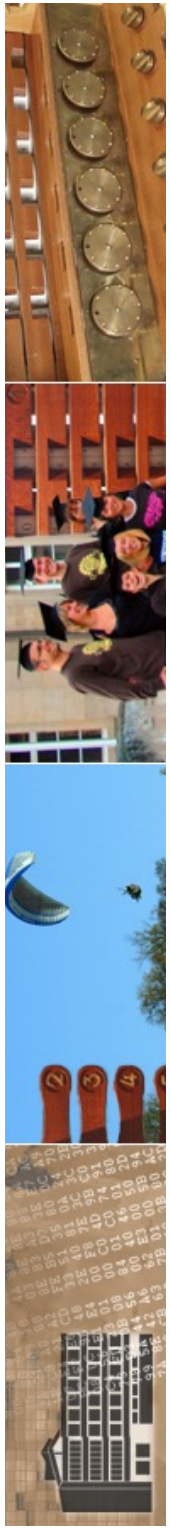
- ähnlich zu Apache
  - (als fertiges Linux-Paket)
  - aus den Source-Files mit
    - configure
    - make
    - make install

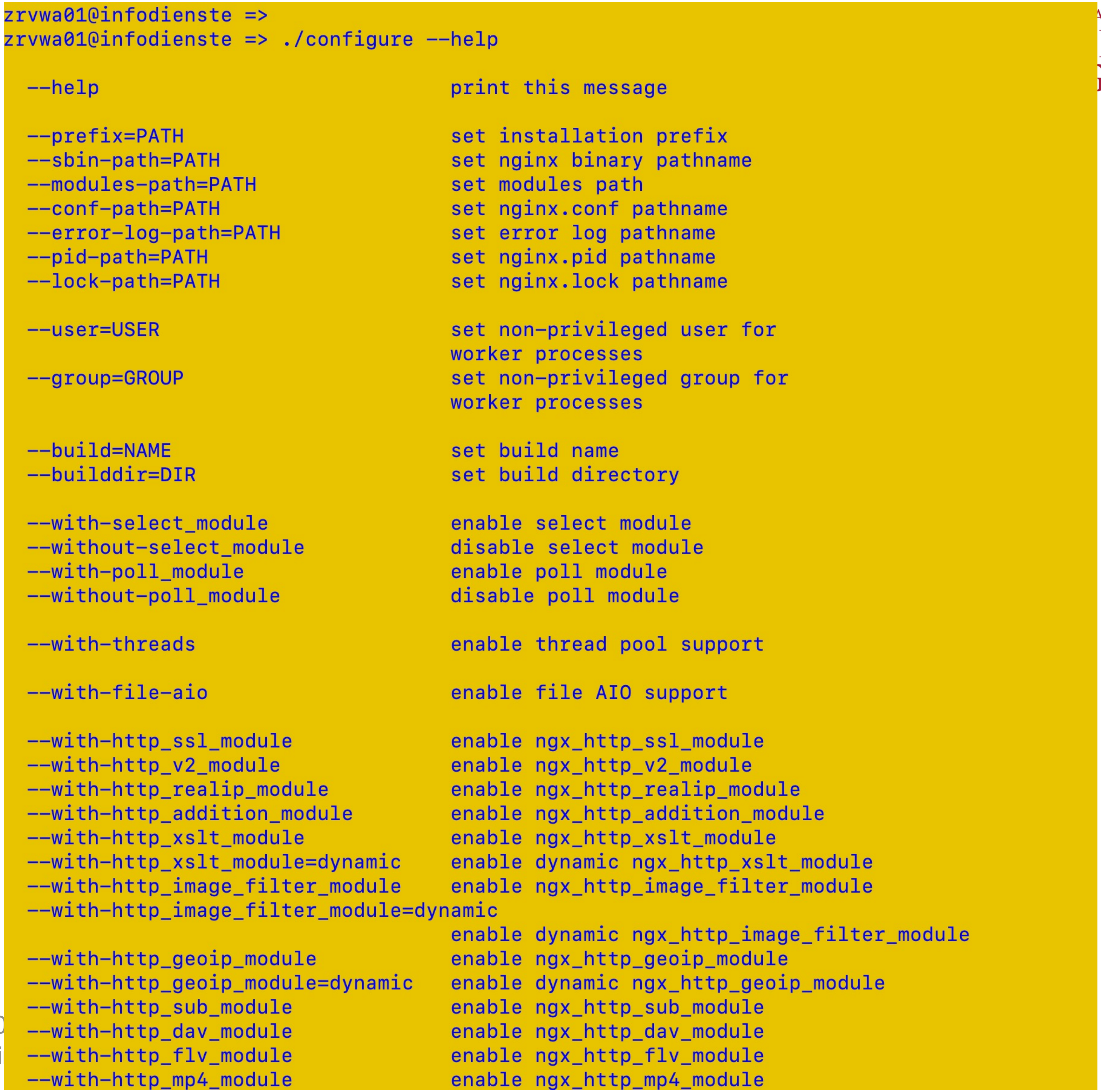


Building nginx from Sources

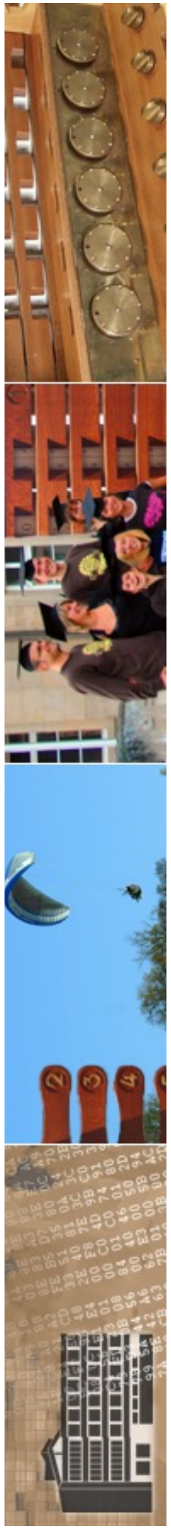
The build is configured using the `configure` command. It defines various aspects of the system, including the methods nginx is allowed to use for connection processing. At the end it creates a `Makefile`. The `configure` command supports the following parameters:

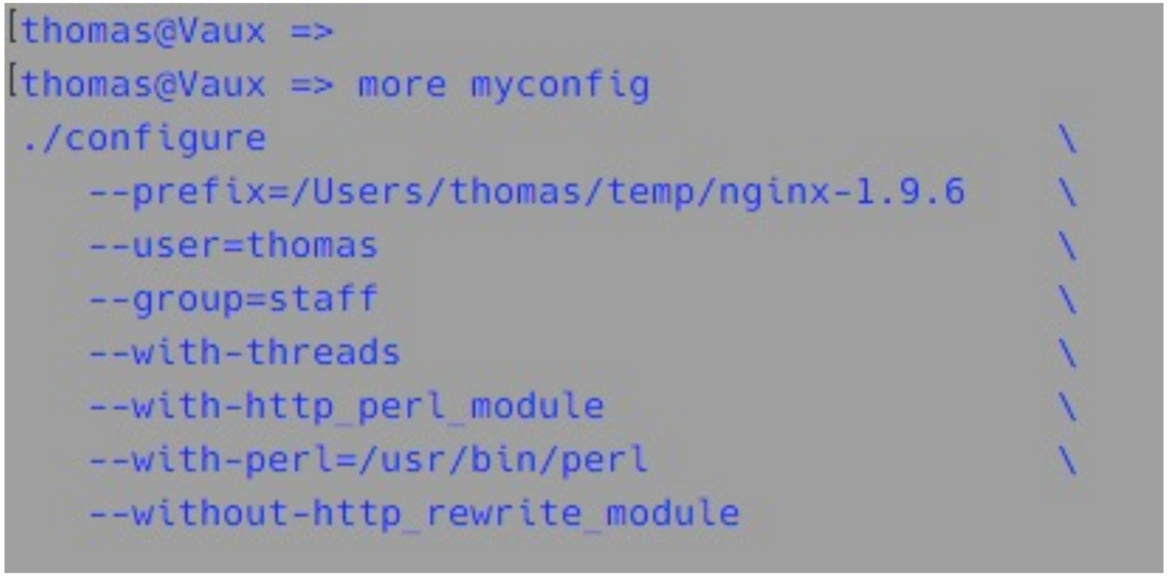
- `--prefix=`*`path`* — defines a directory that will keep server files. This same directory will also be used for all relative paths set by `configure` (except for paths to libraries sources) and in the `nginx.conf` configuration file. It is set to the `/usr/local/nginx` directory by default.
- `--sbin-path=`*`path`* — sets the name of an nginx executable file. This name is used only during installation. By default the file is named *`prefix`*`/sbin/nginx`.
- `--conf-path=`*`path`* — sets the name of an `nginx.conf` configuration file. If needs be, nginx can always be started with a different configuration file, by specifying it in the command-line parameter `-c` *`file`*. By default the file is named *`prefix`*`/conf/nginx.conf`.
- `--pid-path=`*`path`* — sets the name of an nginx.pid file that will store the process ID of the main process. After installation, the file name can always be changed in the `nginx.conf` configuration file using the pid directive. By default the file is named *`prefix`*`/logs/nginx.pid`.
- `--error-log-path=`*`path`* — sets the name of the primary error, warnings, and diagnostic file. After installation, the file name can always be changed in the `nginx.conf` configuration file using the error_log directive. By default the file is named *`prefix`*`/logs/error.log`.
- `--http-log-path=`*`path`* — sets the name of the primary request log file of the HTTP server. After



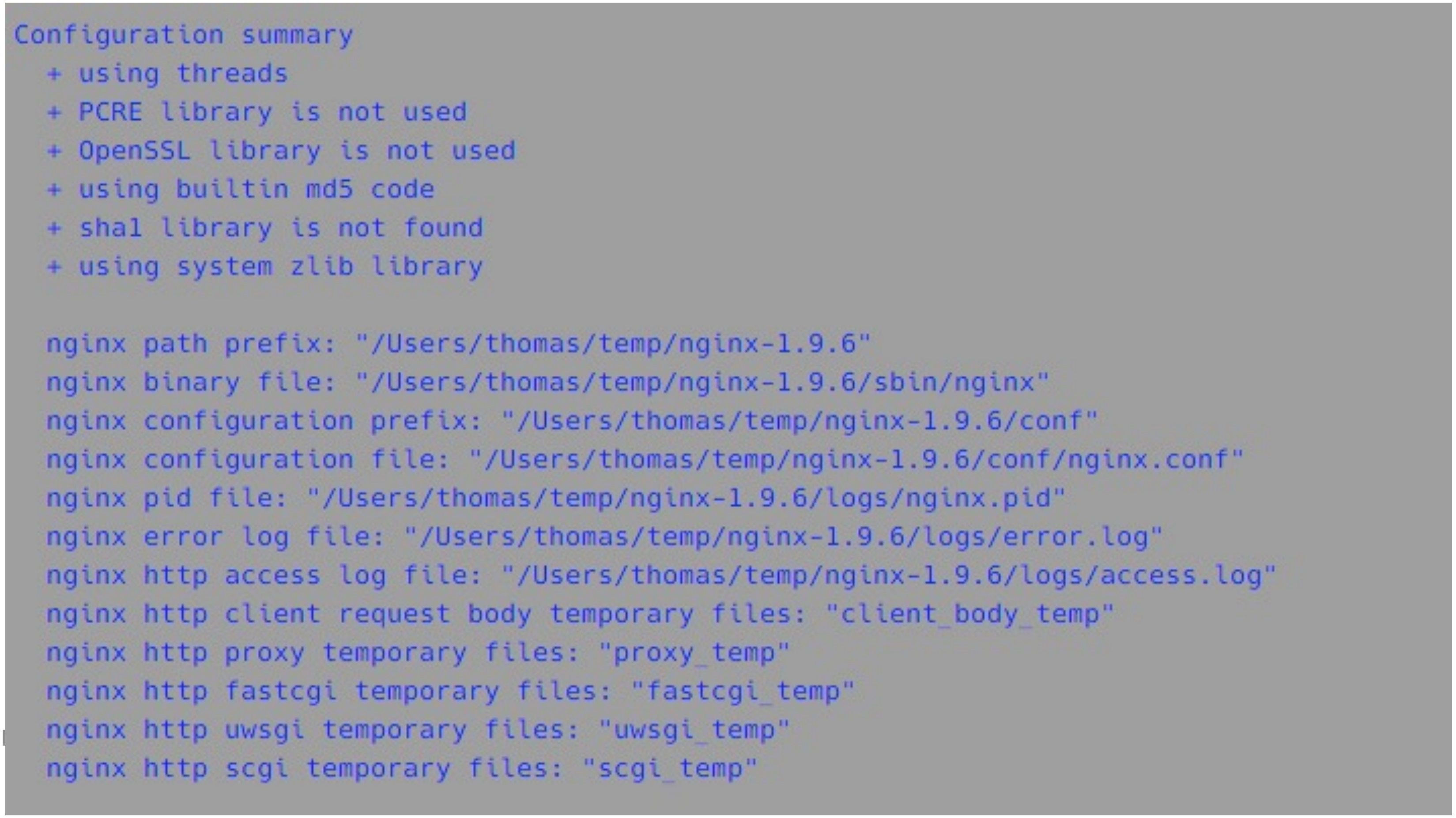


```
zrvwa01@infodienste =>
zrvwa01@infodienste => ./configure --help

  --help                             print this message

  --prefix=PATH                      set installation prefix
  --sbin-path=PATH                   set nginx binary pathname
  --modules-path=PATH                set modules path
  --conf-path=PATH                   set nginx.conf pathname
  --error-log-path=PATH              set error log pathname
  --pid-path=PATH                    set nginx.pid pathname
  --lock-path=PATH                   set nginx.lock pathname

  --user=USER                        set non-privileged user for
                                     worker processes
  --group=GROUP                      set non-privileged group for
                                     worker processes

  --build=NAME                       set build name
  --builddir=DIR                     set build directory

  --with-select_module               enable select module
  --without-select_module            disable select module
  --with-poll_module                 enable poll module
  --without-poll_module              disable poll module

  --with-threads                     enable thread pool support

  --with-file-aio                    enable file AIO support

  --with-http_ssl_module             enable ngx_http_ssl_module
  --with-http_v2_module              enable ngx_http_v2_module
  --with-http_realip_module          enable ngx_http_realip_module
  --with-http_addition_module        enable ngx_http_addition_module
  --with-http_xslt_module            enable ngx_http_xslt_module
  --with-http_xslt_module=dynamic    enable dynamic ngx_http_xslt_module
  --with-http_image_filter_module    enable ngx_http_image_filter_module
  --with-http_image_filter_module=dynamic
                                     enable dynamic ngx_http_image_filter_module
  --with-http_geoip_module           enable ngx_http_geoip_module
  --with-http_geoip_module=dynamic   enable dynamic ngx_http_geoip_module
  --with-http_sub_module             enable ngx_http_sub_module
  --with-http_dav_module             enable ngx_http_dav_module
  --with-http_flv_module             enable ngx_http_flv_module
  --with-http_mp4_module             enable ngx_http_mp4_module
```

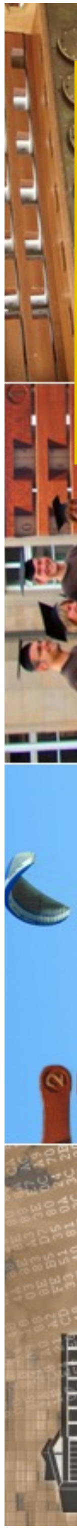


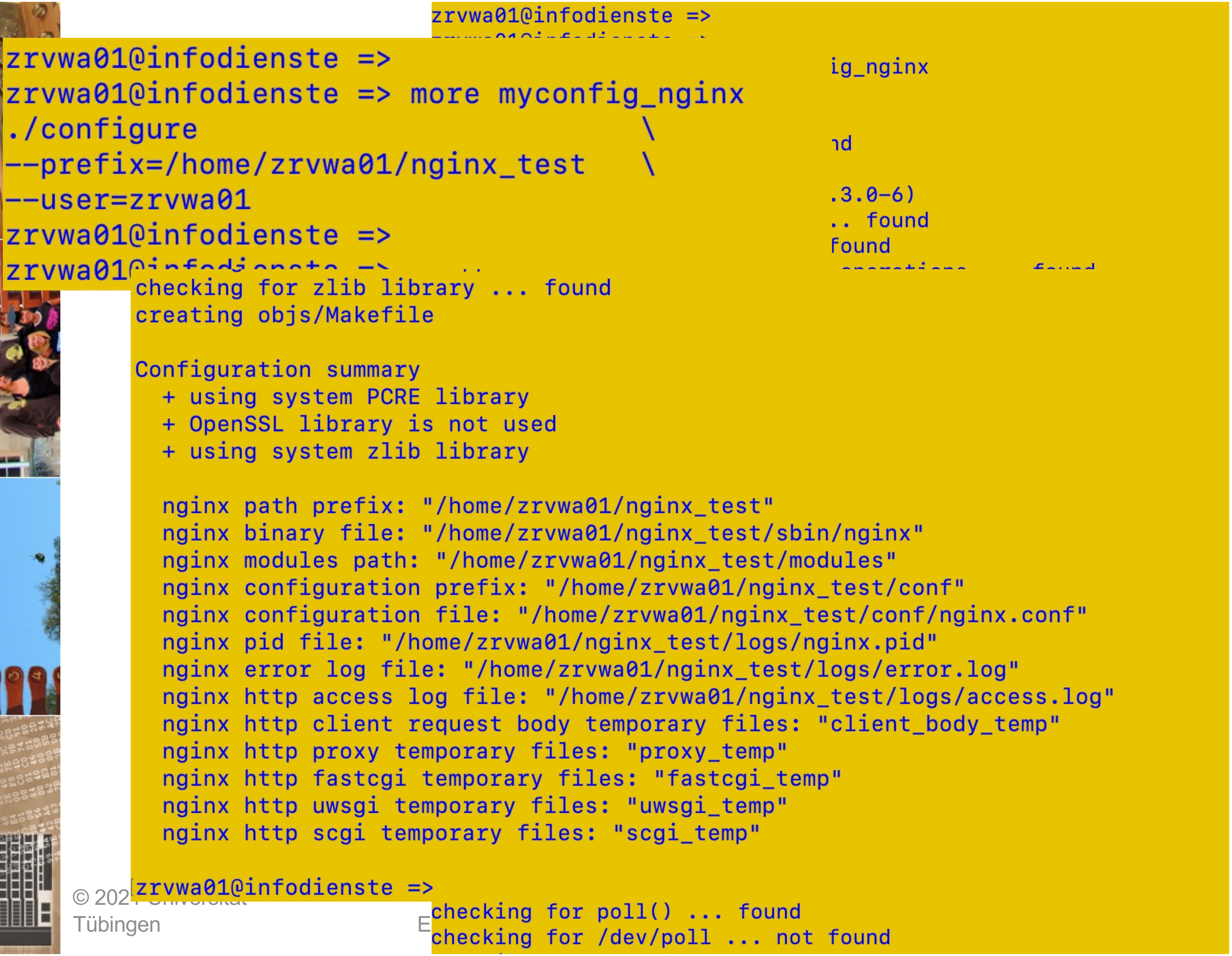


```
[thomas@Vaux =>
[thomas@Vaux => more myconfig
 ./configure                                      \
    --prefix=/Users/thomas/temp/nginx-1.9.6       \
    --user=thomas                                 \
    --group=staff                                 \
    --with-threads                                \
    --with-http_perl_module                       \
    --with-perl=/usr/bin/perl                     \
    --without-http_rewrite_module
```



```
Configuration summary
  + using threads
  + PCRE library is not used
  + OpenSSL library is not used
  + using builtin md5 code
  + sha1 library is not found
  + using system zlib library

  nginx path prefix: "/Users/thomas/temp/nginx-1.9.6"
  nginx binary file: "/Users/thomas/temp/nginx-1.9.6/sbin/nginx"
  nginx configuration prefix: "/Users/thomas/temp/nginx-1.9.6/conf"
  nginx configuration file: "/Users/thomas/temp/nginx-1.9.6/conf/nginx.conf"
  nginx pid file: "/Users/thomas/temp/nginx-1.9.6/logs/nginx.pid"
  nginx error log file: "/Users/thomas/temp/nginx-1.9.6/logs/error.log"
  nginx http access log file: "/Users/thomas/temp/nginx-1.9.6/logs/access.log"
  nginx http client request body temporary files: "client_body_temp"
  nginx http proxy temporary files: "proxy_temp"
  nginx http fastcgi temporary files: "fastcgi_temp"
  nginx http uwsgi temporary files: "uwsgi_temp"
  nginx http scgi temporary files: "scgi_temp"
```



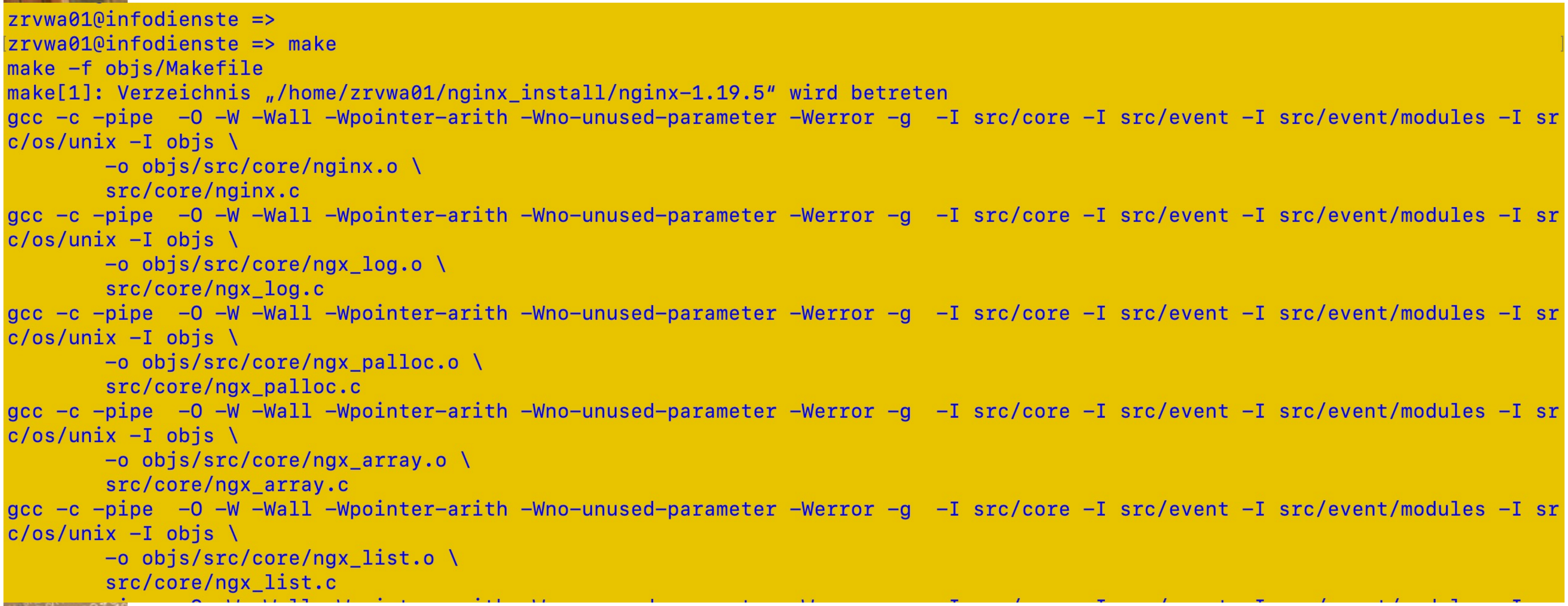


```
zrvwa01@infodienste =>
zrvwa01@infodienste => more myconfig_nginx
./configure                            \
--prefix=/home/zrvwa01/nginx_test     \
--user=zrvwa01
zrvwa01@infodienste =>
```

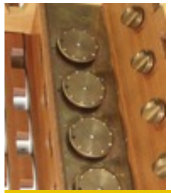
```
ig_nginx

nd

.3.0-6)
.. found
found
```

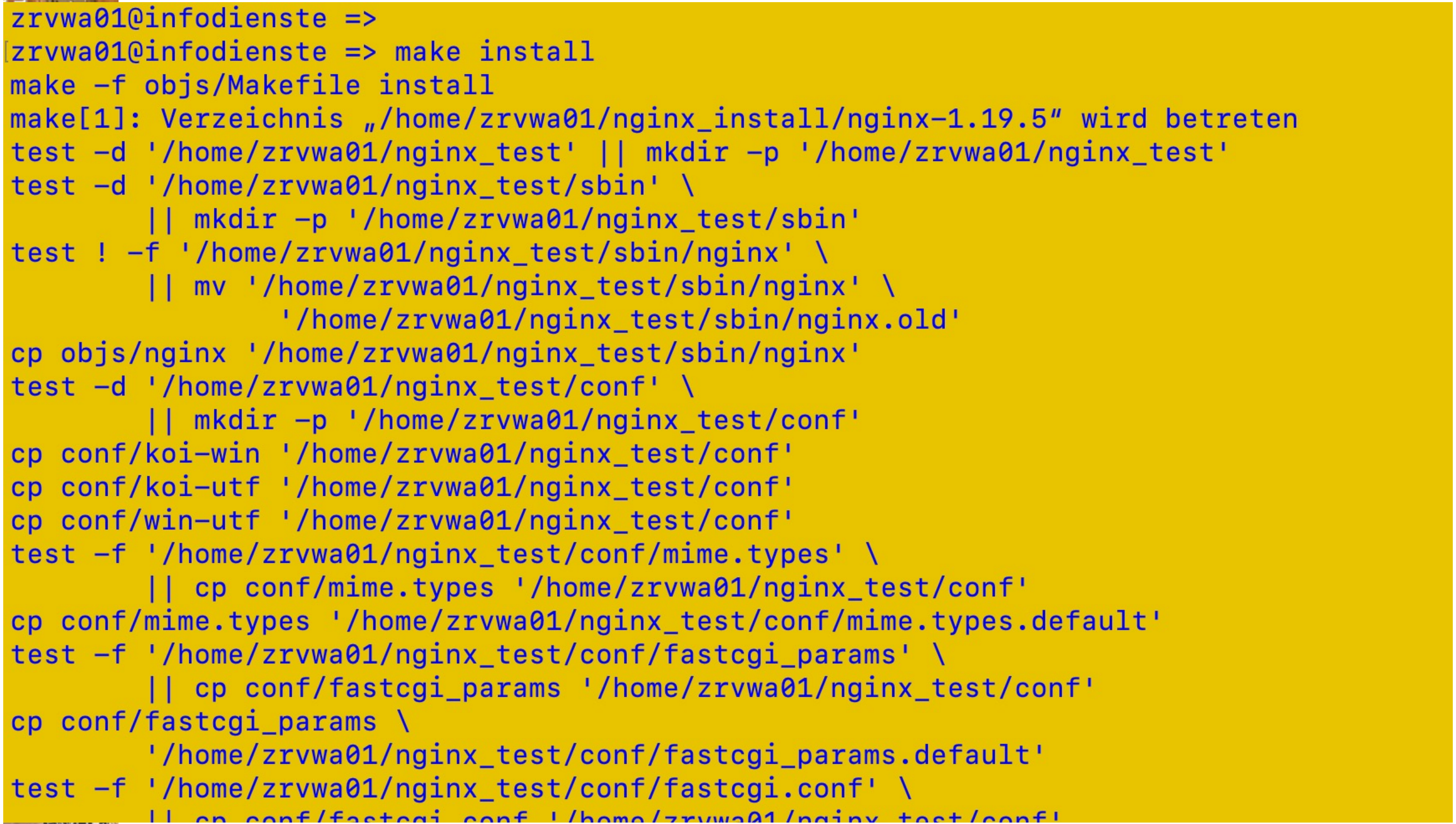
```
checking for zlib library ... found
creating objs/Makefile

Configuration summary
  + using system PCRE library
  + OpenSSL library is not used
  + using system zlib library

  nginx path prefix: "/home/zrvwa01/nginx_test"
  nginx binary file: "/home/zrvwa01/nginx_test/sbin/nginx"
  nginx modules path: "/home/zrvwa01/nginx_test/modules"
  nginx configuration prefix: "/home/zrvwa01/nginx_test/conf"
  nginx configuration file: "/home/zrvwa01/nginx_test/conf/nginx.conf"
  nginx pid file: "/home/zrvwa01/nginx_test/logs/nginx.pid"
  nginx error log file: "/home/zrvwa01/nginx_test/logs/error.log"
  nginx http access log file: "/home/zrvwa01/nginx_test/logs/access.log"
  nginx http client request body temporary files: "client_body_temp"
  nginx http proxy temporary files: "proxy_temp"
  nginx http fastcgi temporary files: "fastcgi_temp"
  nginx http uwsgi temporary files: "uwsgi_temp"
  nginx http scgi temporary files: "scgi_temp"

zrvwa01@infodienste =>
```

```
checking for poll() ... found
checking for /dev/poll ... not found
```

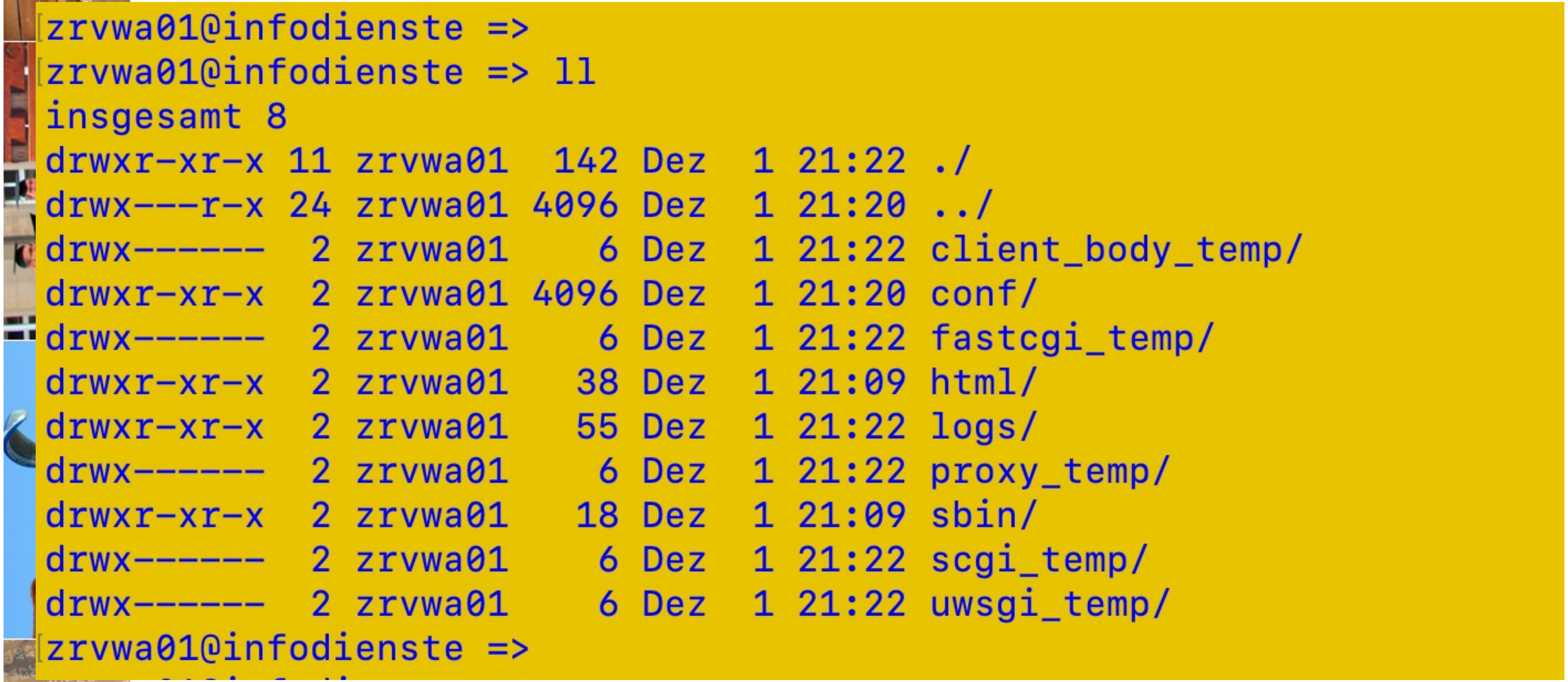


```
zrvwa01@infodienste =>
zrvwa01@infodienste => make
make -f objs/Makefile
make[1]: Verzeichnis „/home/zrvwa01/nginx_install/nginx-1.19.5“ wird betreten
gcc -c -pipe  -O -W -Wall -Wpointer-arith -Wno-unused-parameter -Werror -g  -I src/core -I src/event -I src/event/modules -I sr
c/os/unix -I objs \
        -o objs/src/core/nginx.o \
        src/core/nginx.c
gcc -c -pipe  -O -W -Wall -Wpointer-arith -Wno-unused-parameter -Werror -g  -I src/core -I src/event -I src/event/modules -I sr
c/os/unix -I objs \
        -o objs/src/core/ngx_log.o \
        src/core/ngx_log.c
gcc -c -pipe  -O -W -Wall -Wpointer-arith -Wno-unused-parameter -Werror -g  -I src/core -I src/event -I src/event/modules -I sr
c/os/unix -I objs \
        -o objs/src/core/ngx_palloc.o \
        src/core/ngx_palloc.c
gcc -c -pipe  -O -W -Wall -Wpointer-arith -Wno-unused-parameter -Werror -g  -I src/core -I src/event -I src/event/modules -I sr
c/os/unix -I objs \
        -o objs/src/core/ngx_array.o \
        src/core/ngx_array.c
gcc -c -pipe  -O -W -Wall -Wpointer-arith -Wno-unused-parameter -Werror -g  -I src/core -I src/event -I src/event/modules -I sr
c/os/unix -I objs \
        -o objs/src/core/ngx_list.o \
        src/core/ngx_list.c
```

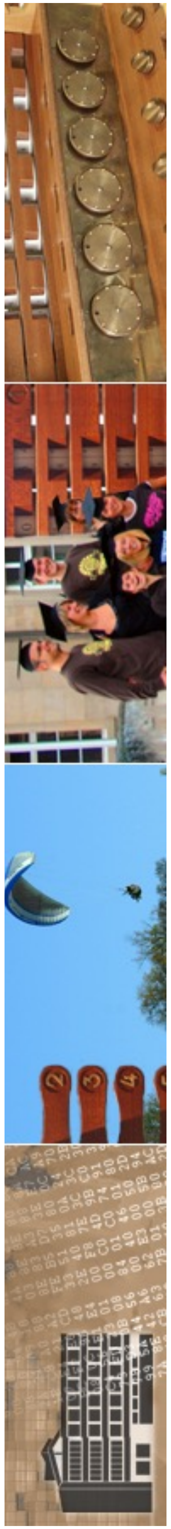


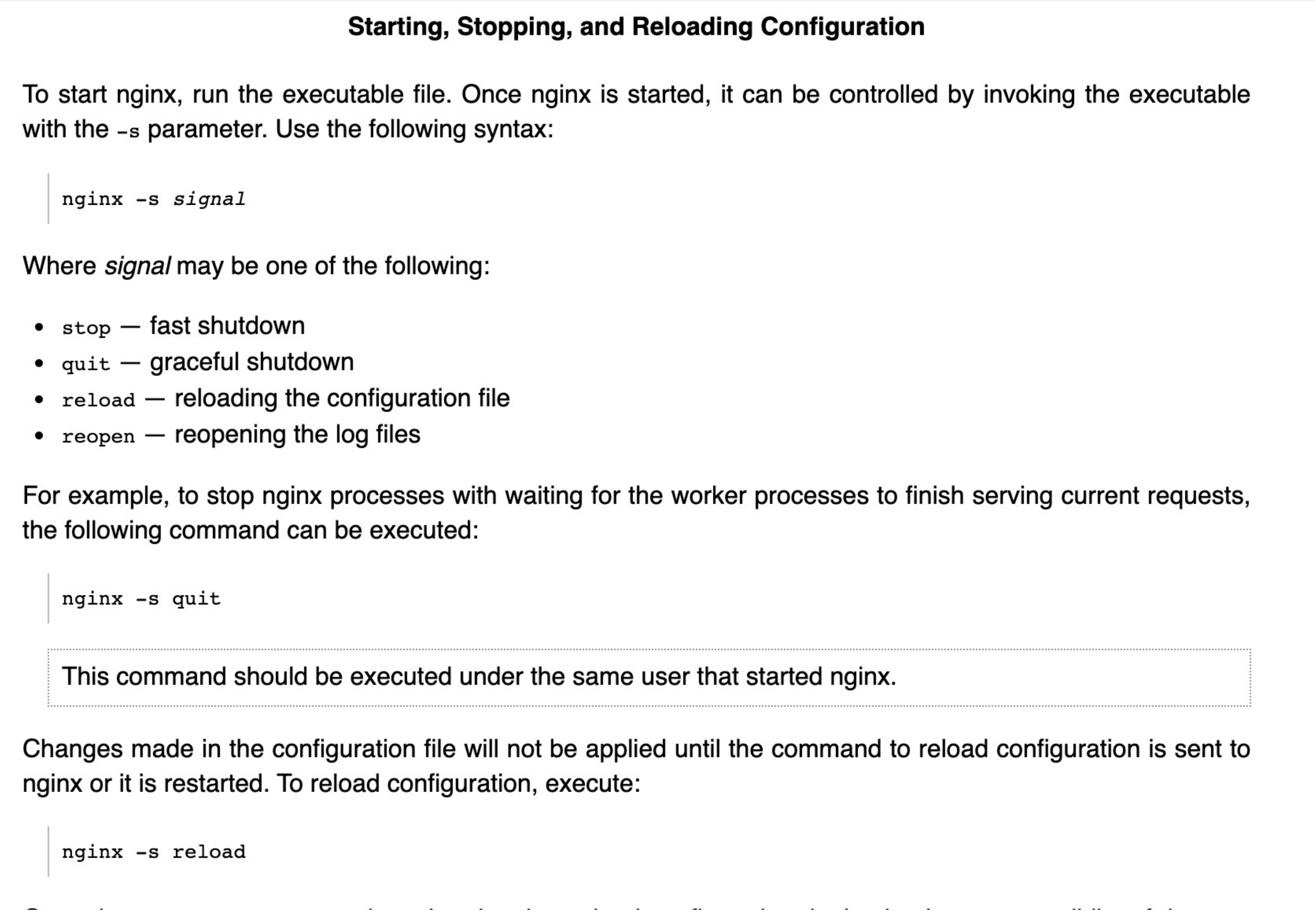


```
zrvwa01@infodienste =>
[zrvwa01@infodienste => make install
make -f objs/Makefile install
make[1]: Verzeichnis „/home/zrvwa01/nginx_install/nginx-1.19.5“ wird betreten
test -d '/home/zrvwa01/nginx_test' || mkdir -p '/home/zrvwa01/nginx_test'
test -d '/home/zrvwa01/nginx_test/sbin' \
        || mkdir -p '/home/zrvwa01/nginx_test/sbin'
test ! -f '/home/zrvwa01/nginx_test/sbin/nginx' \
        || mv '/home/zrvwa01/nginx_test/sbin/nginx' \
                '/home/zrvwa01/nginx_test/sbin/nginx.old'
cp objs/nginx '/home/zrvwa01/nginx_test/sbin/nginx'
test -d '/home/zrvwa01/nginx_test/conf' \
        || mkdir -p '/home/zrvwa01/nginx_test/conf'
cp conf/koi-win '/home/zrvwa01/nginx_test/conf'
cp conf/koi-utf '/home/zrvwa01/nginx_test/conf'
cp conf/win-utf '/home/zrvwa01/nginx_test/conf'
test -f '/home/zrvwa01/nginx_test/conf/mime.types' \
        || cp conf/mime.types '/home/zrvwa01/nginx_test/conf'
cp conf/mime.types '/home/zrvwa01/nginx_test/conf/mime.types.default'
test -f '/home/zrvwa01/nginx_test/conf/fastcgi_params' \
        || cp conf/fastcgi_params '/home/zrvwa01/nginx_test/conf'
cp conf/fastcgi_params \
        '/home/zrvwa01/nginx_test/conf/fastcgi_params.default'
test -f '/home/zrvwa01/nginx_test/conf/fastcgi.conf' \
        || cp conf/fastcgi.conf '/home/zrvwa01/nginx_test/conf'
```



```
zrvwa01@infodienste =>
zrvwa01@infodienste => ll
insgesamt 8
drwxr-xr-x 11 zrvwa01  142 Dez  1 21:22 ./
drwx---r-x 24 zrvwa01 4096 Dez  1 21:20 ../
drwx------  2 zrvwa01    6 Dez  1 21:22 client_body_temp/
drwxr-xr-x  2 zrvwa01 4096 Dez  1 21:20 conf/
drwx------  2 zrvwa01    6 Dez  1 21:22 fastcgi_temp/
drwxr-xr-x  2 zrvwa01   38 Dez  1 21:09 html/
drwxr-xr-x  2 zrvwa01   55 Dez  1 21:22 logs/
drwx------  2 zrvwa01    6 Dez  1 21:22 proxy_temp/
drwxr-xr-x  2 zrvwa01   18 Dez  1 21:09 sbin/
drwx------  2 zrvwa01    6 Dez  1 21:22 scgi_temp/
drwx------  2 zrvwa01    6 Dez  1 21:22 uwsgi_temp/
zrvwa01@infodienste =>
```





Starting, Stopping, and Reloading Configuration

To start nginx, run the executable file. Once nginx is started, it can be controlled by invoking the executable with the `-s` parameter. Use the following syntax:

```
nginx -s signal
```

Where *signal* may be one of the following:

- `stop` — fast shutdown
- `quit` — graceful shutdown
- `reload` — reloading the configuration file
- `reopen` — reopening the log files

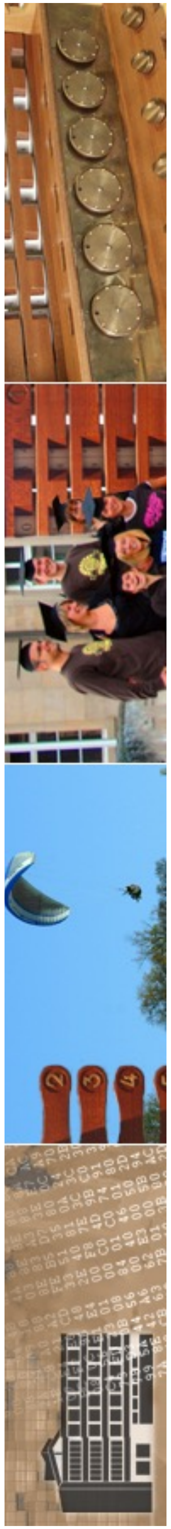
For example, to stop nginx processes with waiting for the worker processes to finish serving current requests, the following command can be executed:

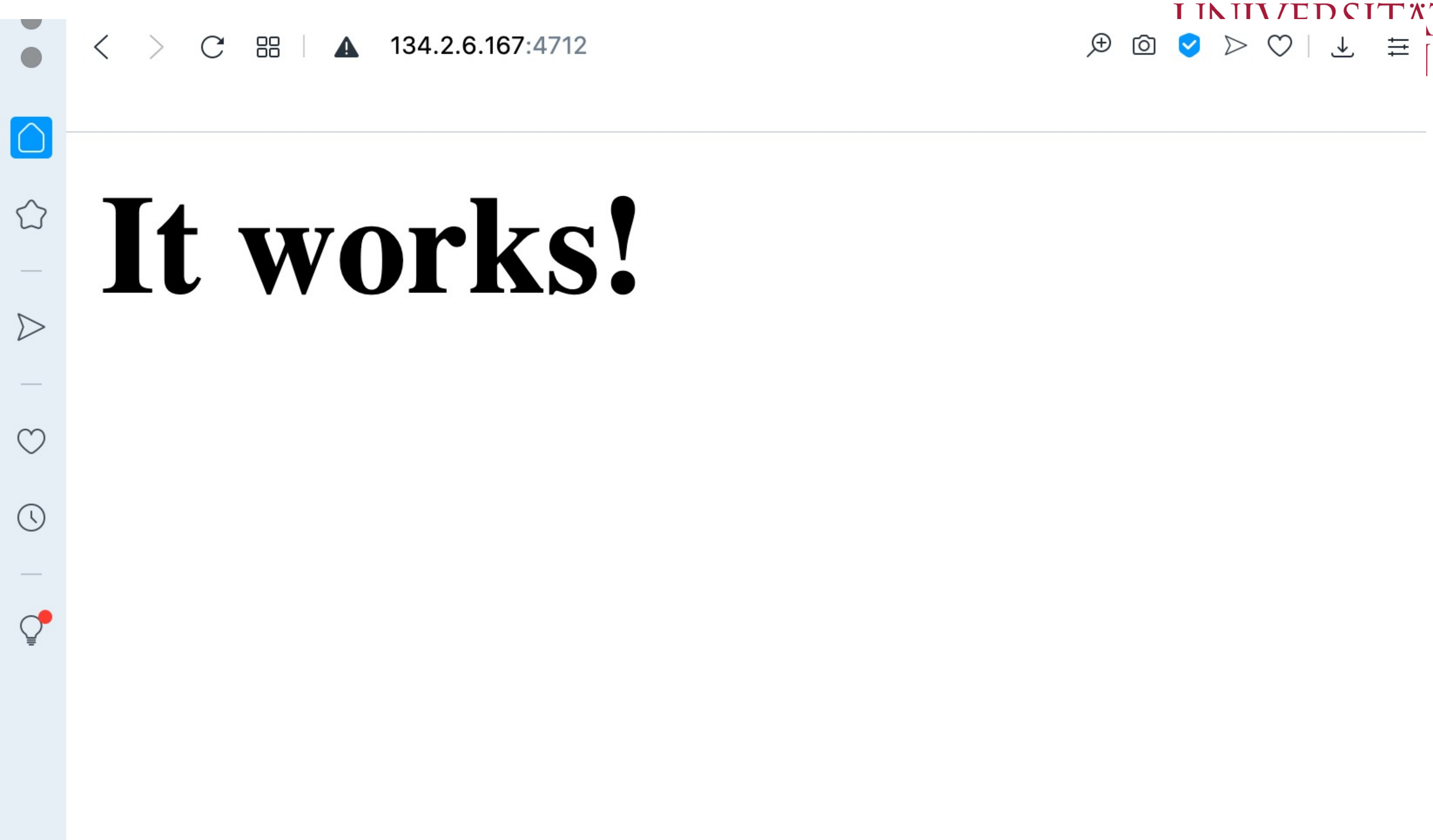
```
nginx -s quit
```

This command should be executed under the same user that started nginx.

Changes made in the configuration file will not be applied until the command to reload configuration is sent to nginx or it is restarted. To reload configuration, execute:

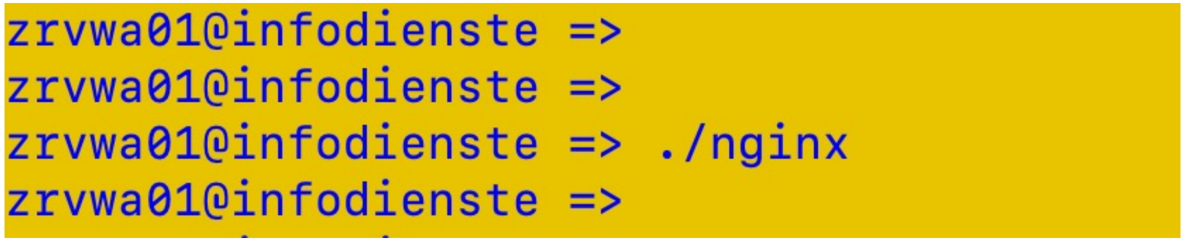
```
nginx -s reload
```



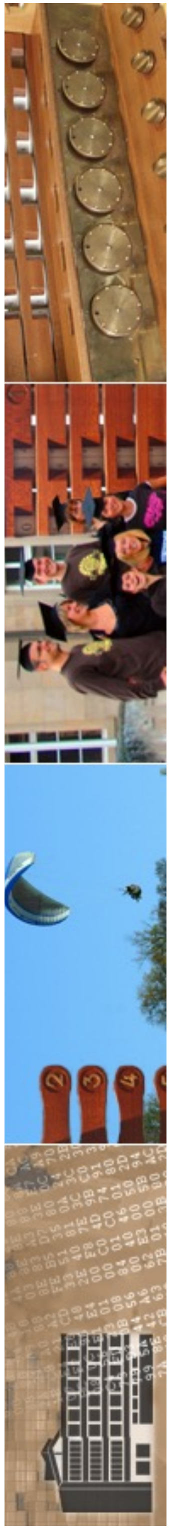


134.2.6.167:4712

It works!



```
zrvwa01@infodienste =>
zrvwa01@infodienste =>
zrvwa01@infodienste => ./nginx
zrvwa01@infodienste =>
```



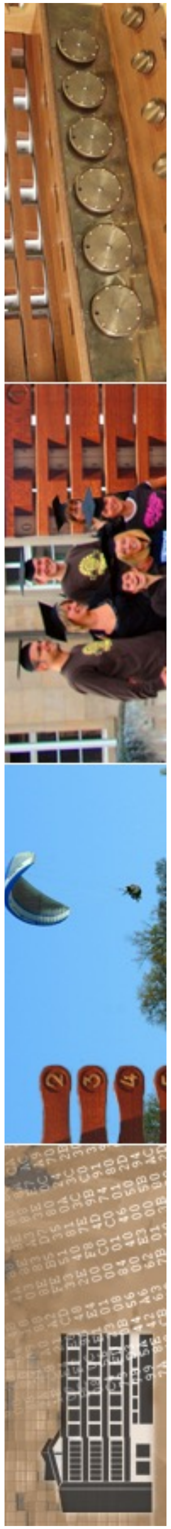
Konfiguration

- zentrale Konfigurationsdatei ist

  `nginx.conf`

  im Unterordner conf

- hat nur 117 Zeilen...



compilieren: Apache versus nginx

Apache 2.4.51

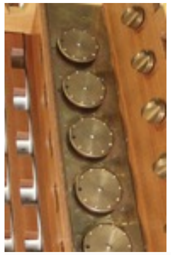
- `make | wc -l`

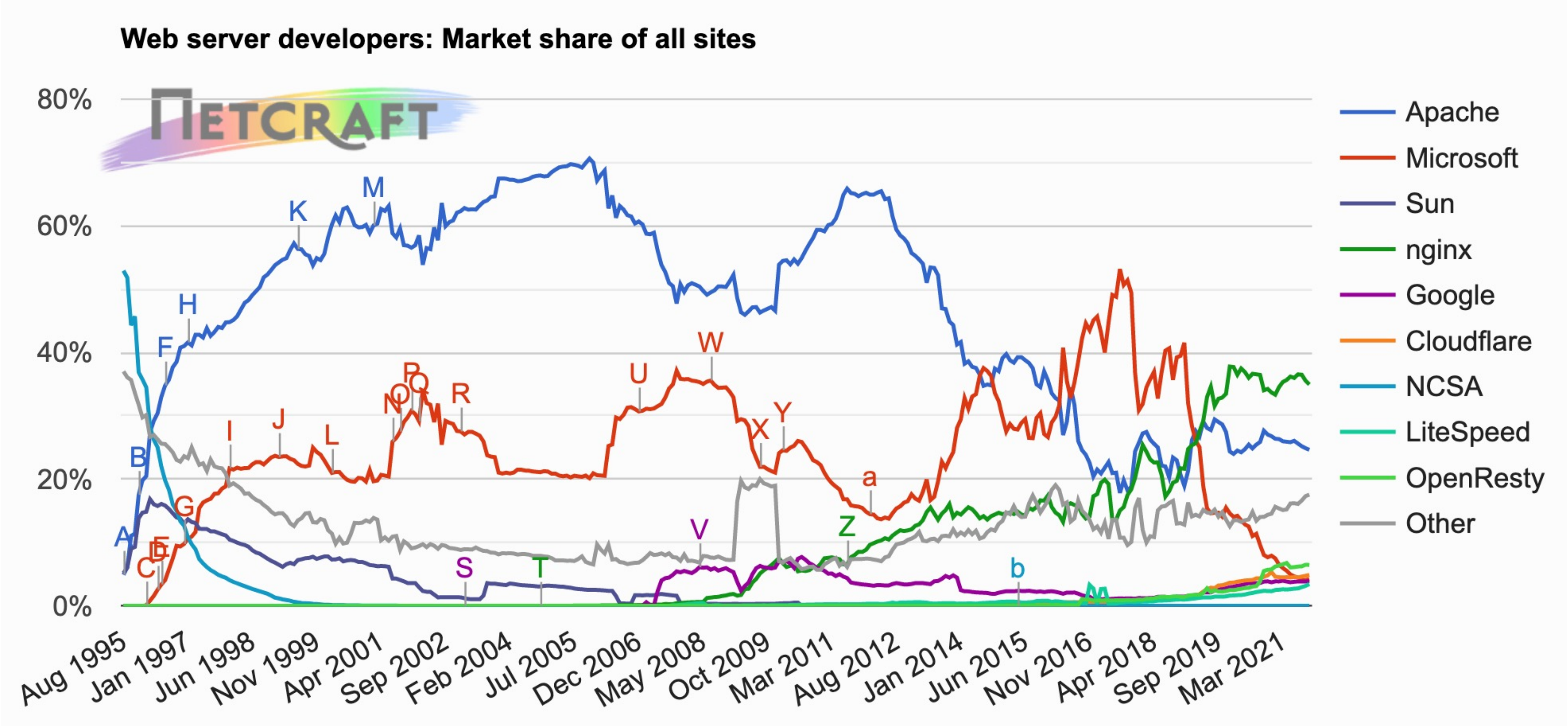
527

nginx 1.21.4

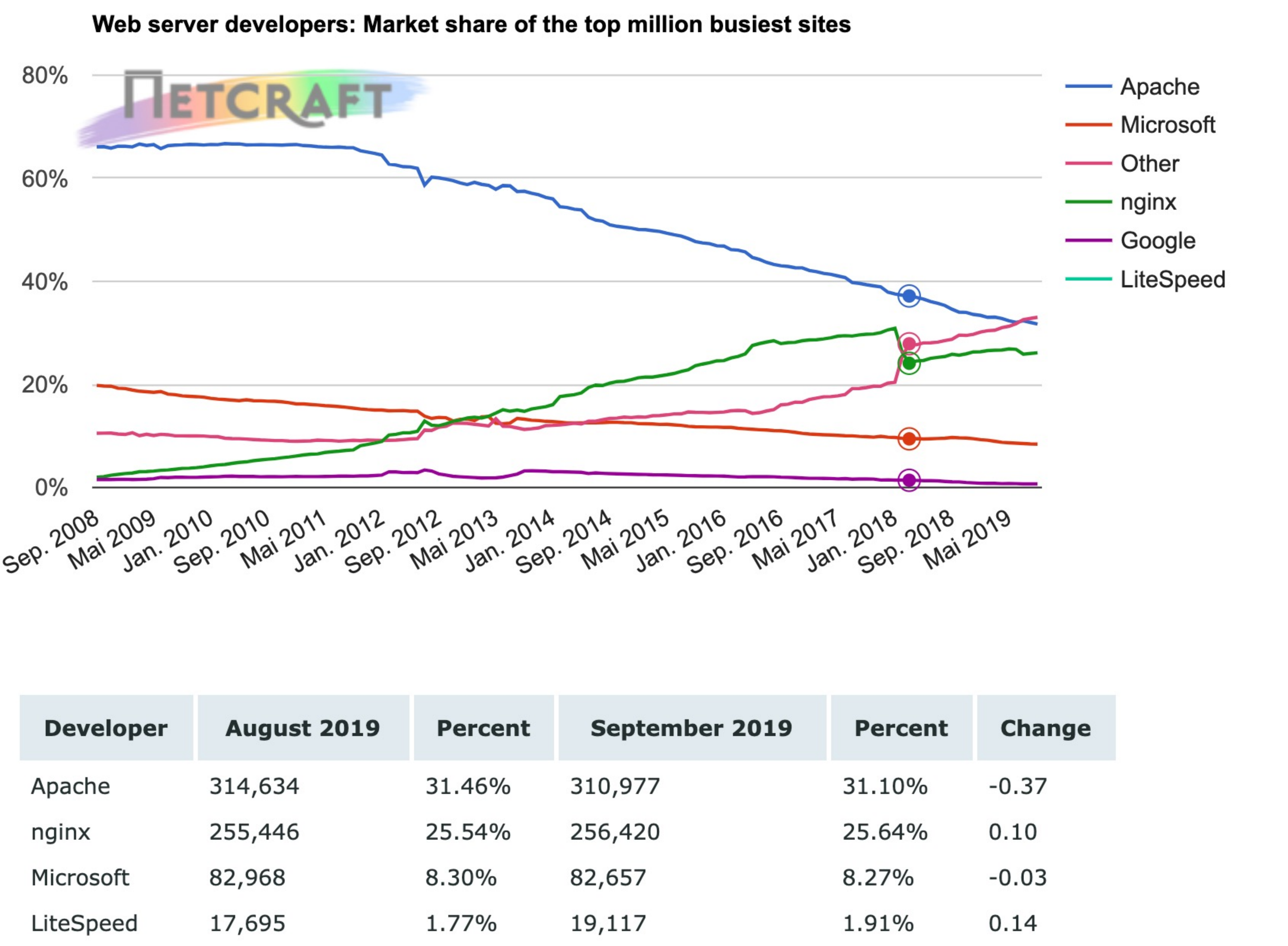
- `make | wc -l`

491



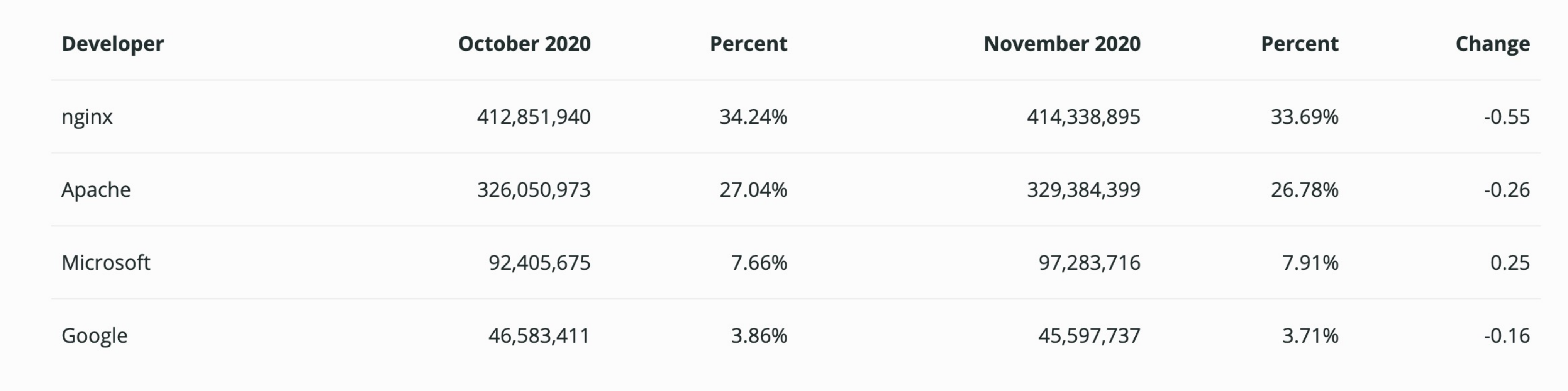


https://news.netcraft.com/archives/category/web-server-survey/

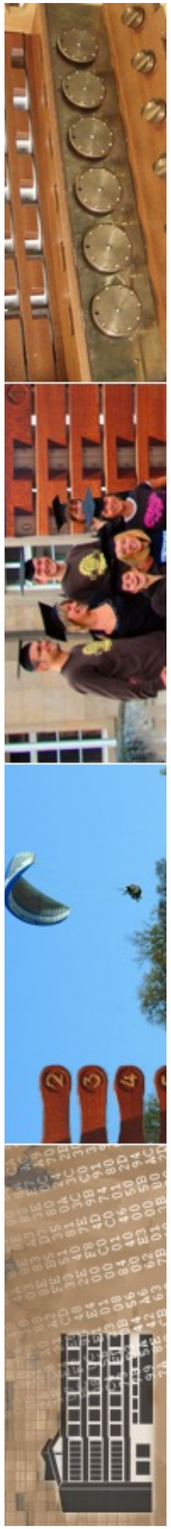


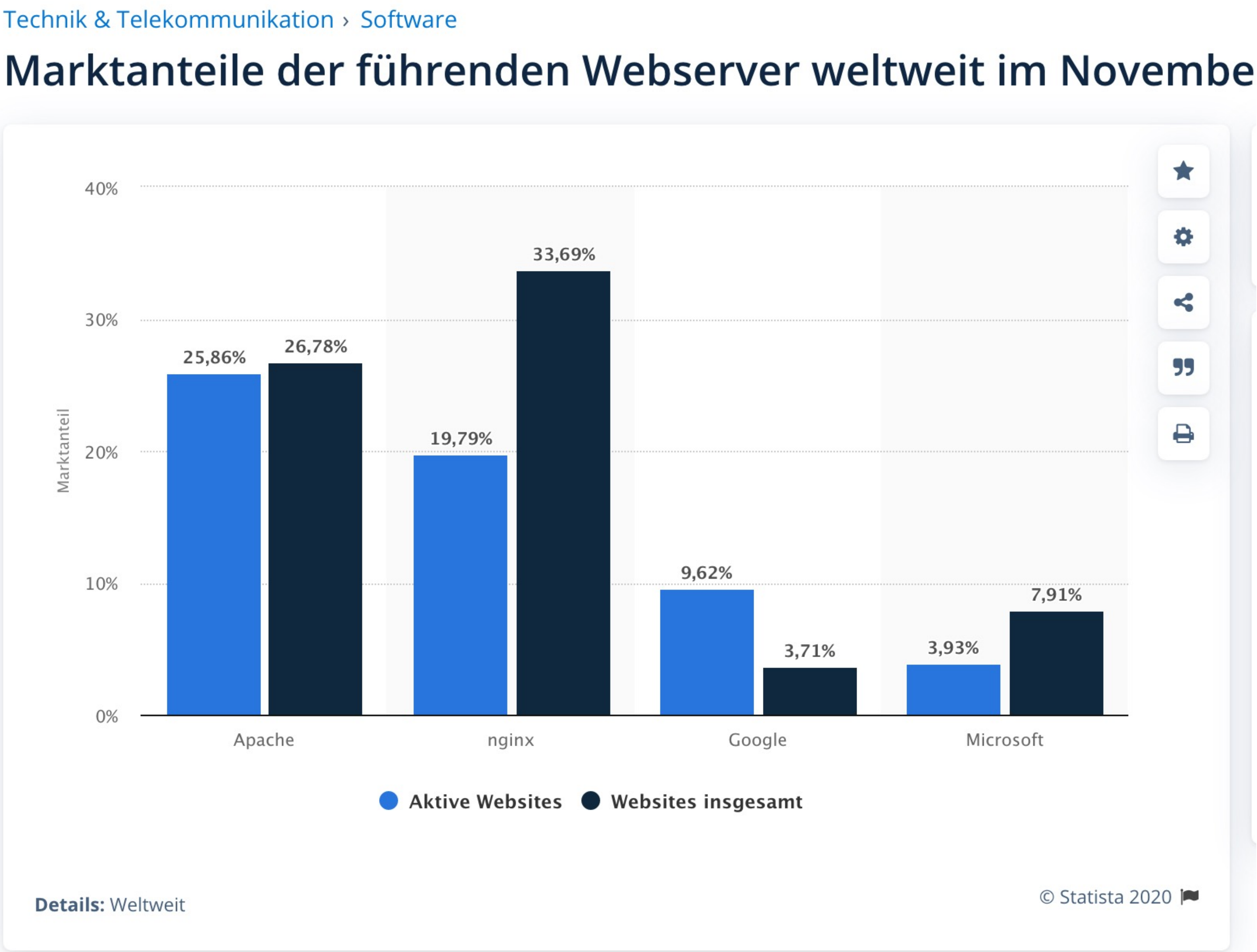
Web server developers: Market share of the top million busiest sites

Developer	August 2019	Percent	September 2019	Percent	Change
Apache	314,634	31.46%	310,977	31.10%	-0.37
nginx	255,446	25.54%	256,420	25.64%	0.10
Microsoft	82,968	8.30%	82,657	8.27%	-0.03
LiteSpeed	17,695	1.77%	19,117	1.91%	0.14



Developer	October 2020	Percent	November 2020	Percent	Change
nginx	412,851,940	34.24%	414,338,895	33.69%	-0.55
Apache	326,050,973	27.04%	329,384,399	26.78%	-0.26
Microsoft	92,405,675	7.66%	97,283,716	7.91%	0.25
Google	46,583,411	3.86%	45,597,737	3.71%	-0.16





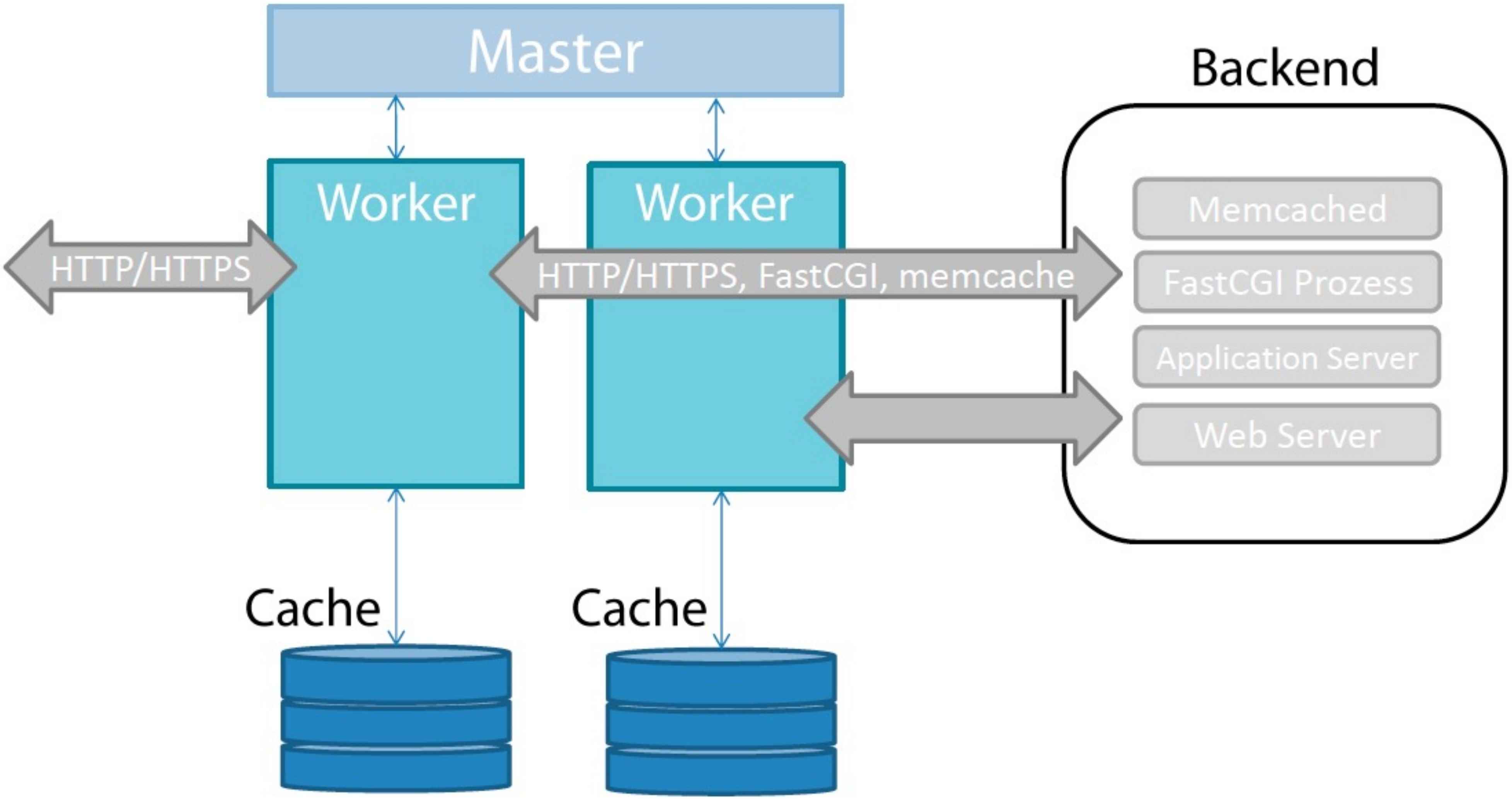
Technik & Telekommunikation › Software

Marktanteile der führenden Webserver weltweit im Novembe

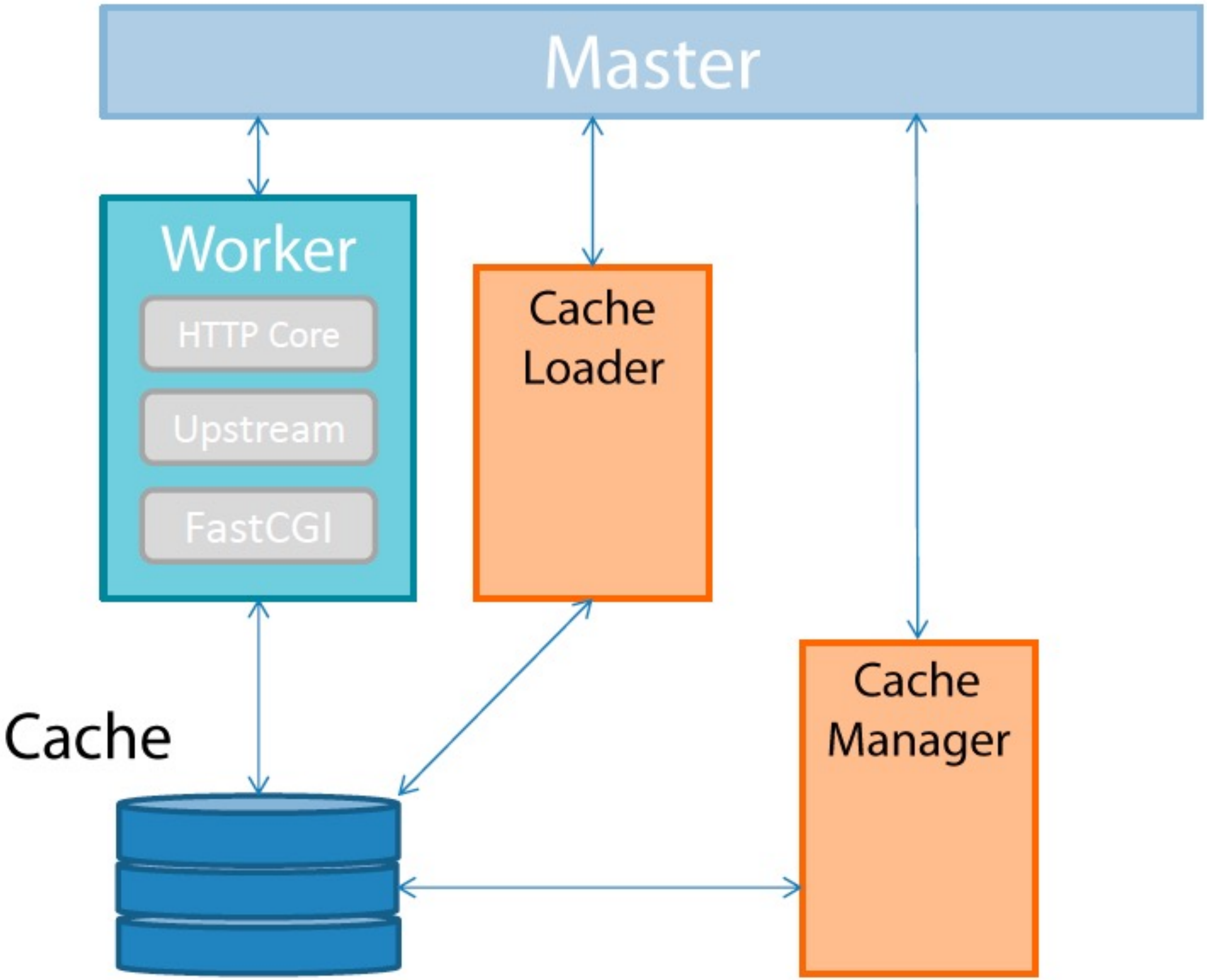
Details: Weltweit

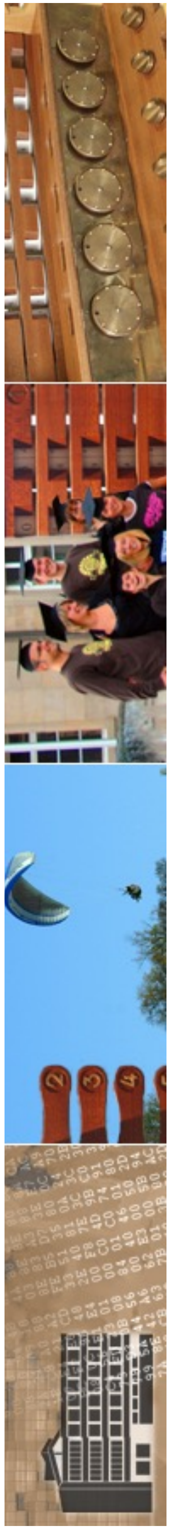
© Statista 2020

Nginx Architektur



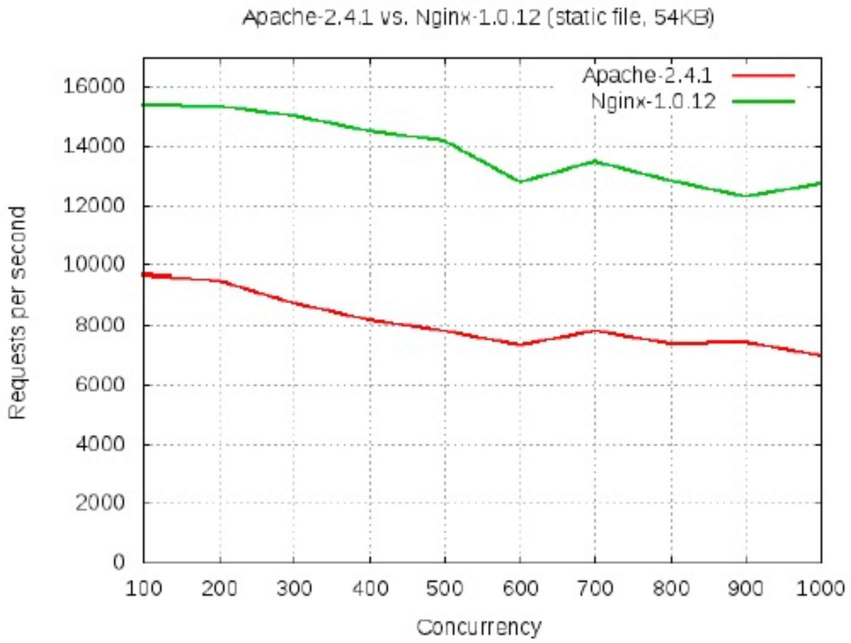
Nginx Architektur Cache



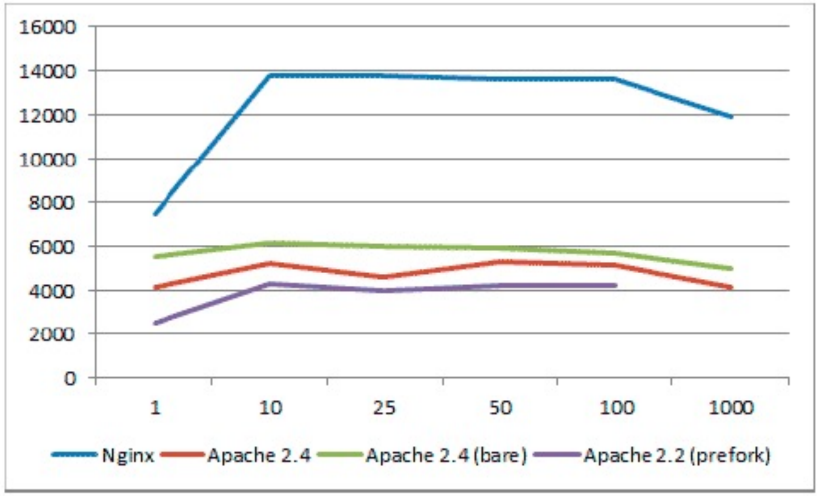


Benchmarks

- Webserver-Benchmakls: schwierig wegen zahlreicher Parameter
- NGINX vorteilhaft bei großer Nutzerzahl und *statischem Inhalt*



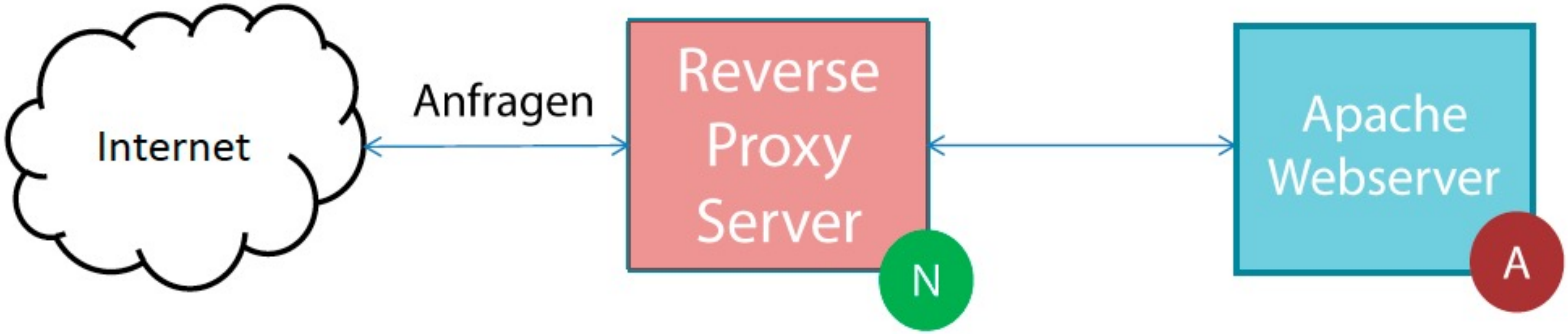
http://tengine.taobao.org/images/benchmark2.png

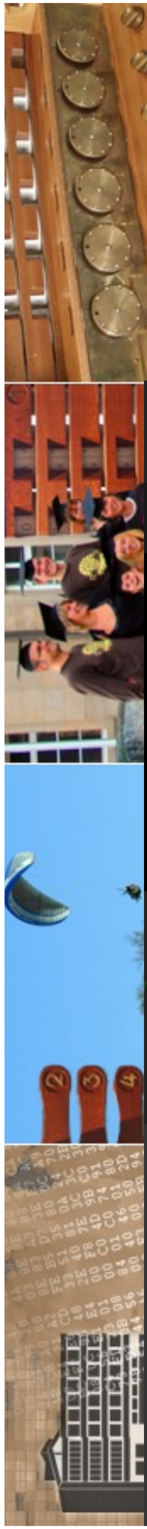


http://www.eschrade.com/page/performance-of-apache-2-4-with-the-event-mpm-compared-to-nginx/

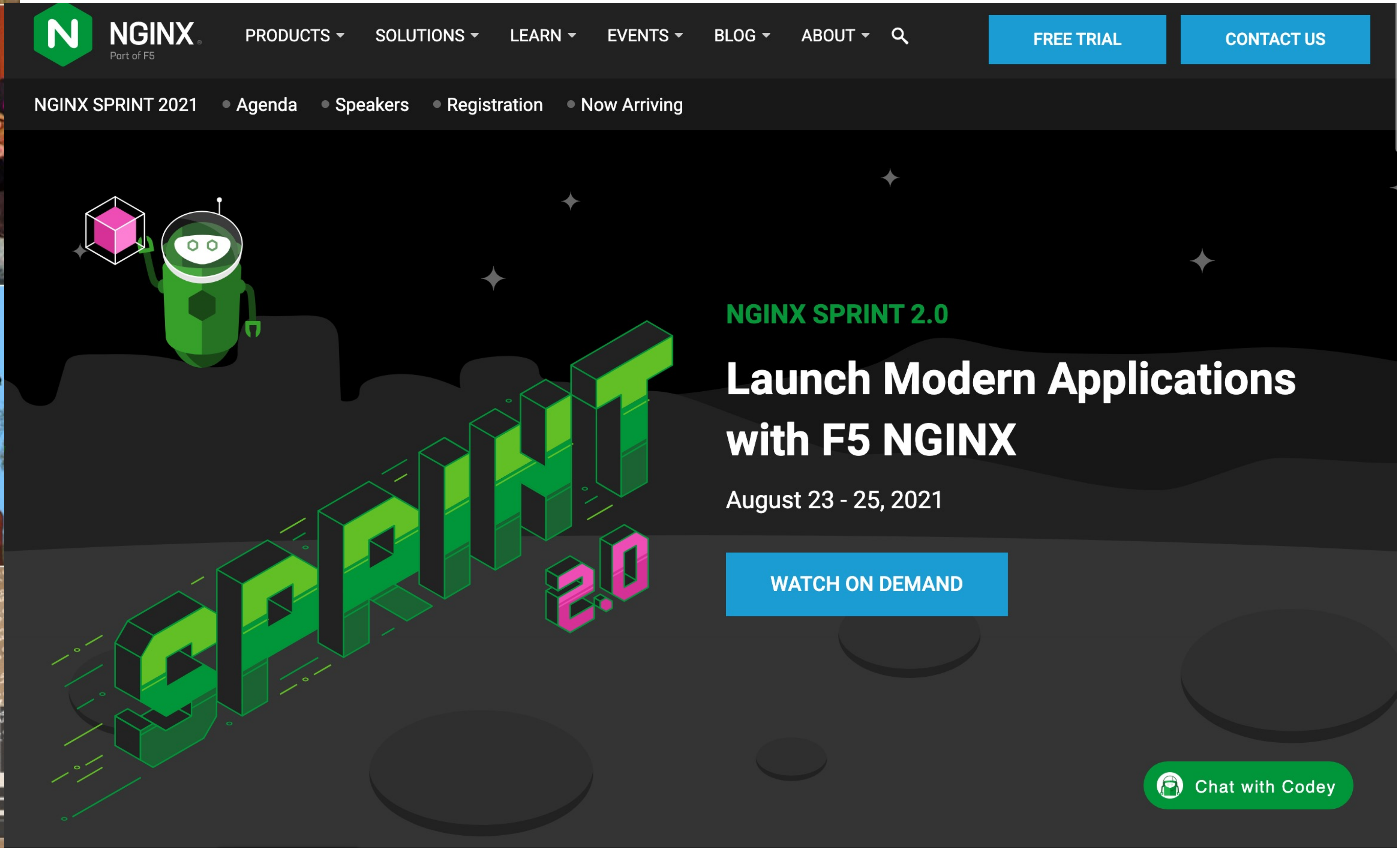
Hybrid-Model: Apache und NGINX

- NGINX: schnelle Auslieferung statischer Inhalte
- Apache: dynamische Inhalte





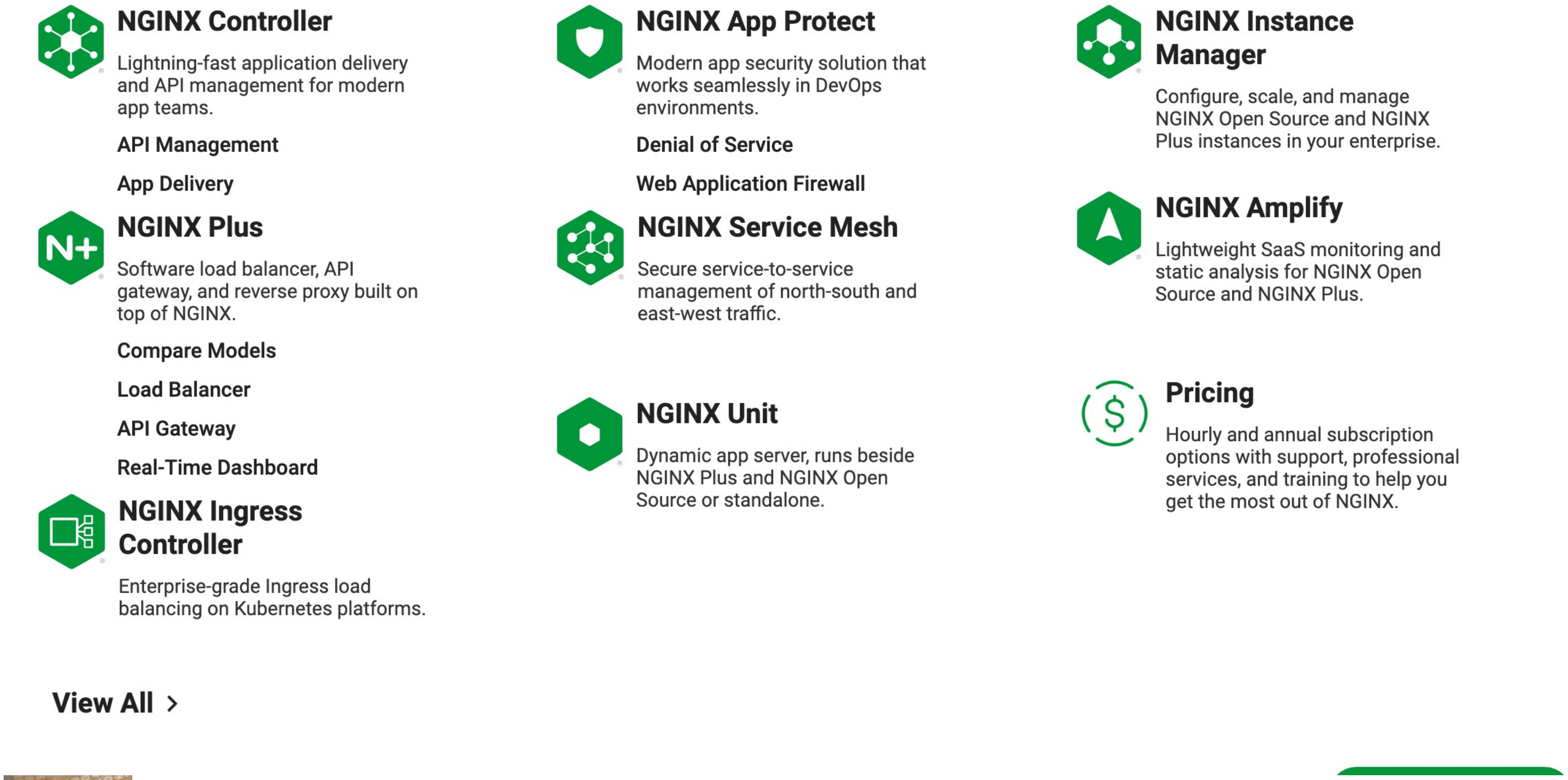
kommerzielle Version



NGINX SPRINT 2.0

Launch Modern Applications with F5 NGINX

August 23 - 25, 2021



NGINX Controller

Lightning-fast application delivery and API management for modern app teams.

API Management

App Delivery

NGINX Plus

Software load balancer, API gateway, and reverse proxy built on top of NGINX.

Compare Models

Load Balancer

API Gateway

Real-Time Dashboard

NGINX Ingress Controller

Enterprise-grade Ingress load balancing on Kubernetes platforms.

NGINX App Protect

Modern app security solution that works seamlessly in DevOps environments.

Denial of Service

Web Application Firewall

NGINX Service Mesh

Secure service-to-service management of north-south and east-west traffic.

NGINX Unit

Dynamic app server, runs beside NGINX Plus and NGINX Open Source or standalone.

NGINX Instance Manager

Configure, scale, and manage NGINX Open Source and NGINX Plus instances in your enterprise.

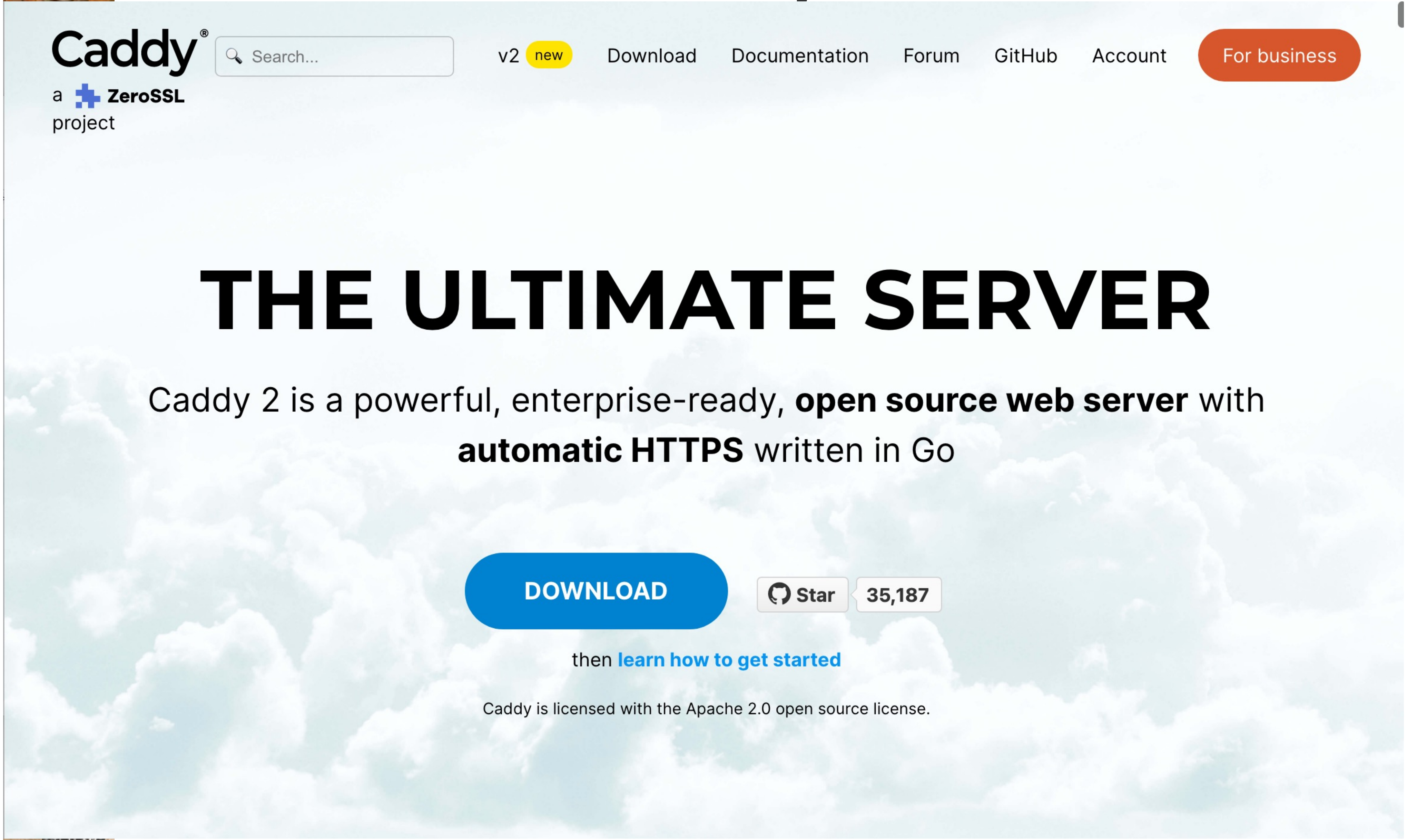
NGINX Amplify

Lightweight SaaS monitoring and static analysis for NGINX Open Source and NGINX Plus.

Pricing

Hourly and annual subscription options with support, professional services, and training to help you get the most out of NGINX.

Caddy

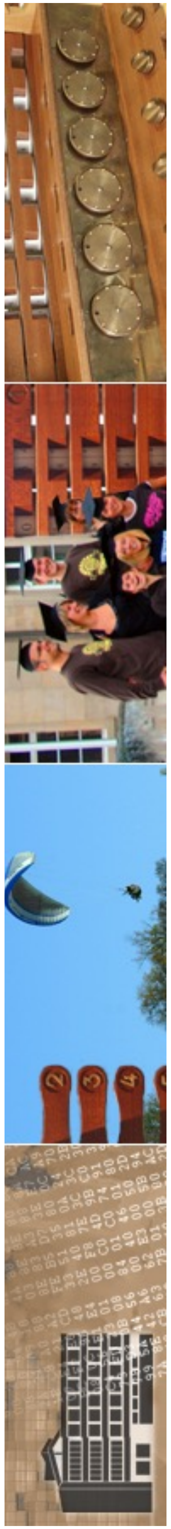


THE ULTIMATE SERVER

Caddy 2 is a powerful, enterprise-ready, **open source web server** with **automatic HTTPS** written in Go

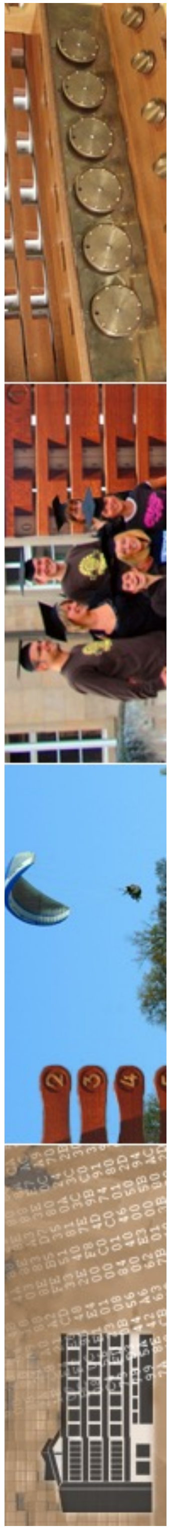
then **learn how to get started**

Caddy is licensed with the Apache 2.0 open source license.



Caddy

- Hauptsächlich für statische Inhalt
  - Kann auch Dynamik mit fastCGI
  - Einfache Nutzbarkeit
  - Automatische SSL Zertifikate mit Let’s Encrypt
  - Support von IPV6, HTTP/2
  - Performance für meiste Seiten ähnlich zu Nginx

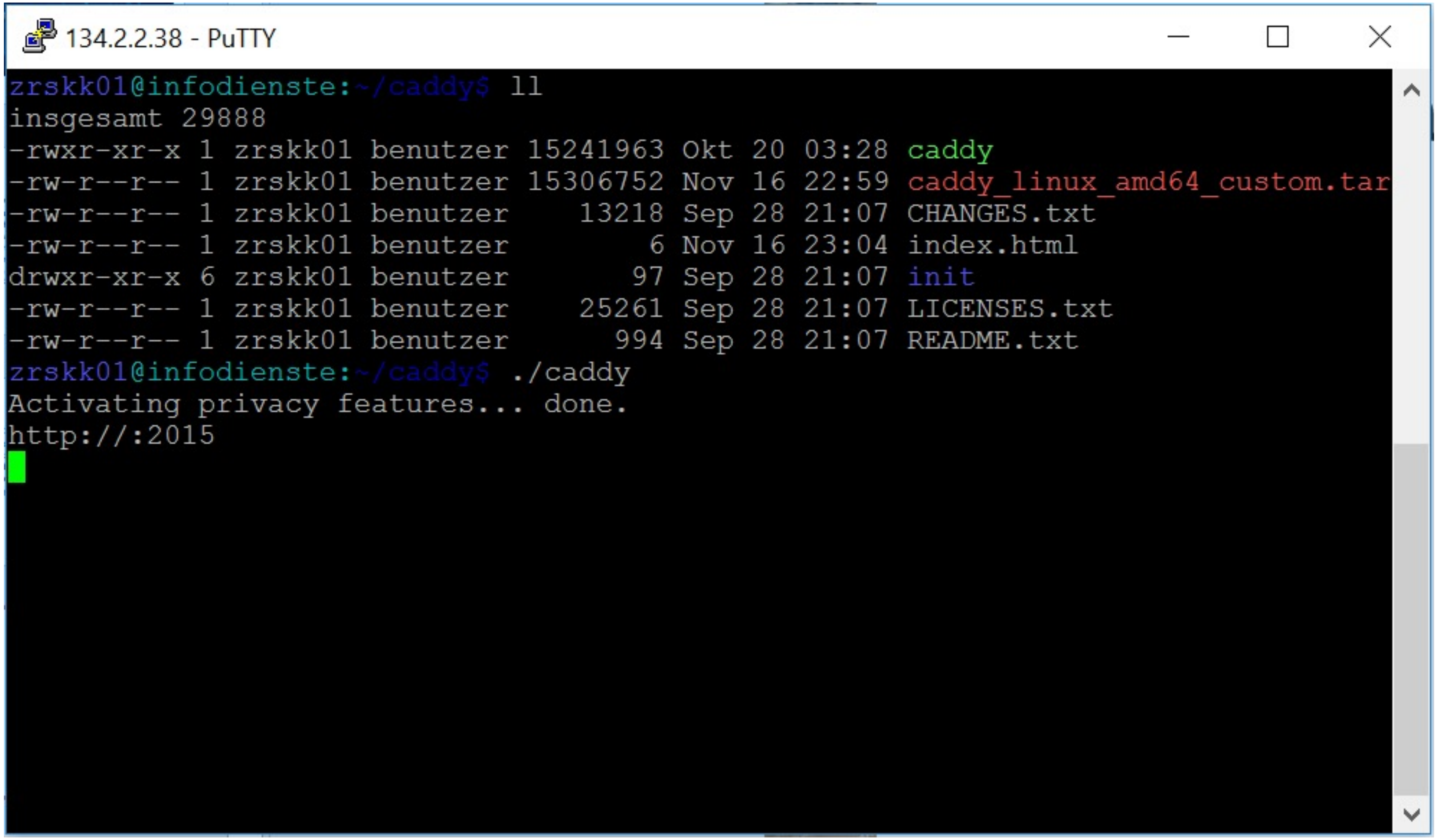


Caddy

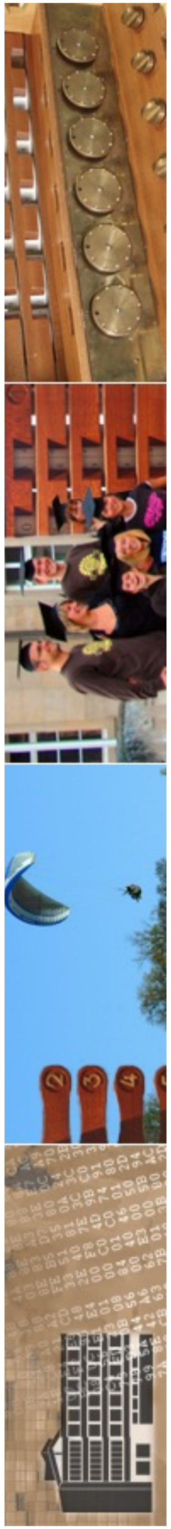
- Installation maximal einfach
  - Download
  - Entpacken
  - ./caddy ausführen
  - Aufrufen der Seiten über localhost:2015

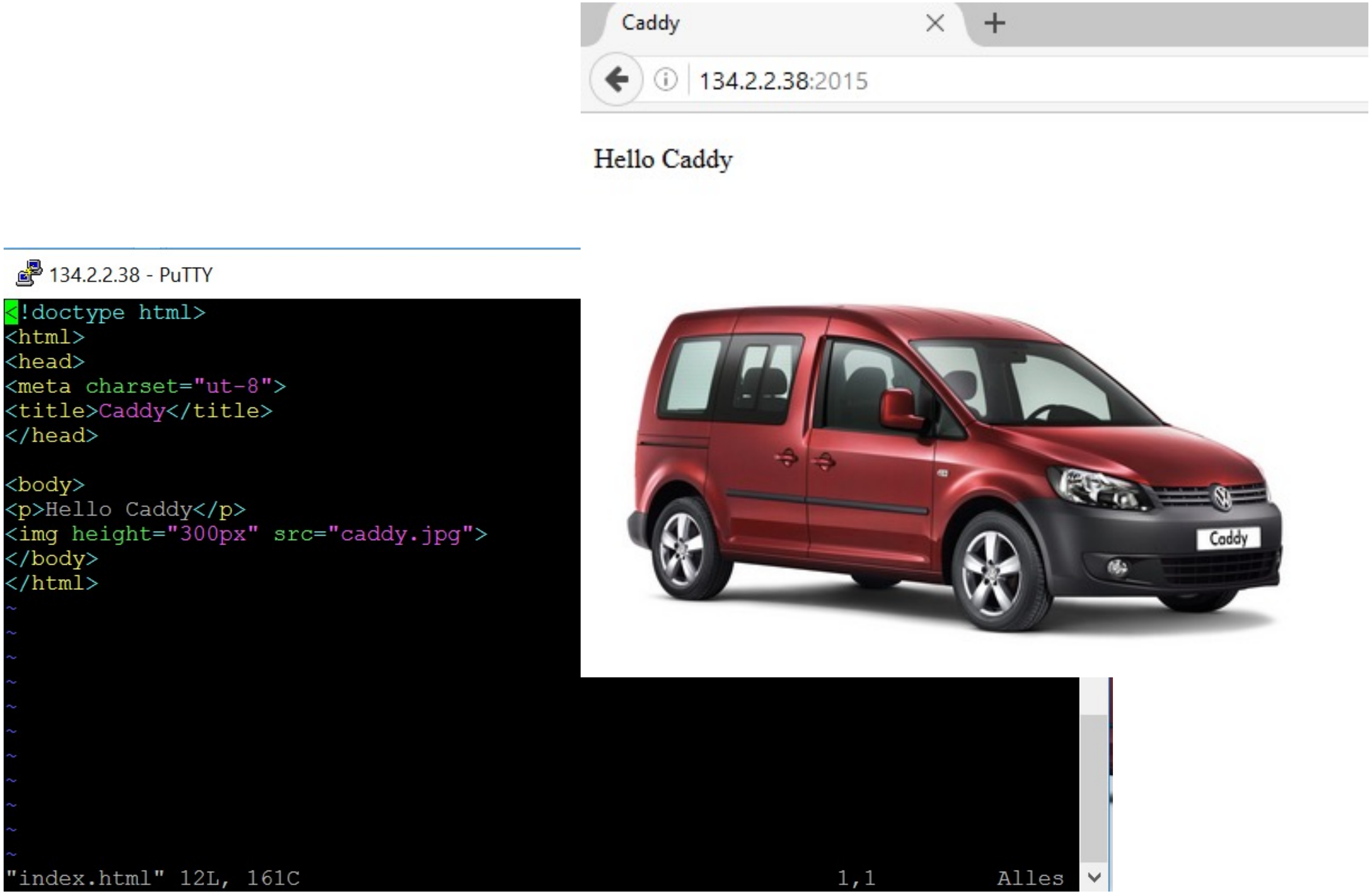
- Erweiterungen aktuell in Entwicklung

Caddy



```
zrskk01@infodienste:~/caddy$ ll
insgesamt 29888
-rwxr-xr-x 1 zrskk01 benutzer 15241963 Okt 20 03:28 caddy
-rw-r--r-- 1 zrskk01 benutzer 15306752 Nov 16 22:59 caddy_linux_amd64_custom.tar
-rw-r--r-- 1 zrskk01 benutzer    13218 Sep 28 21:07 CHANGES.txt
-rw-r--r-- 1 zrskk01 benutzer        6 Nov 16 23:04 index.html
drwxr-xr-x 6 zrskk01 benutzer       97 Sep 28 21:07 init
-rw-r--r-- 1 zrskk01 benutzer    25261 Sep 28 21:07 LICENSES.txt
-rw-r--r-- 1 zrskk01 benutzer      994 Sep 28 21:07 README.txt
zrskk01@infodienste:~/caddy$ ./caddy
Activating privacy features... done.
http://:2015
```

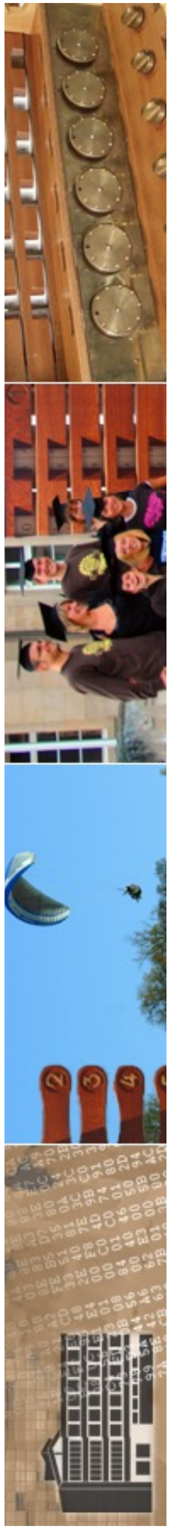


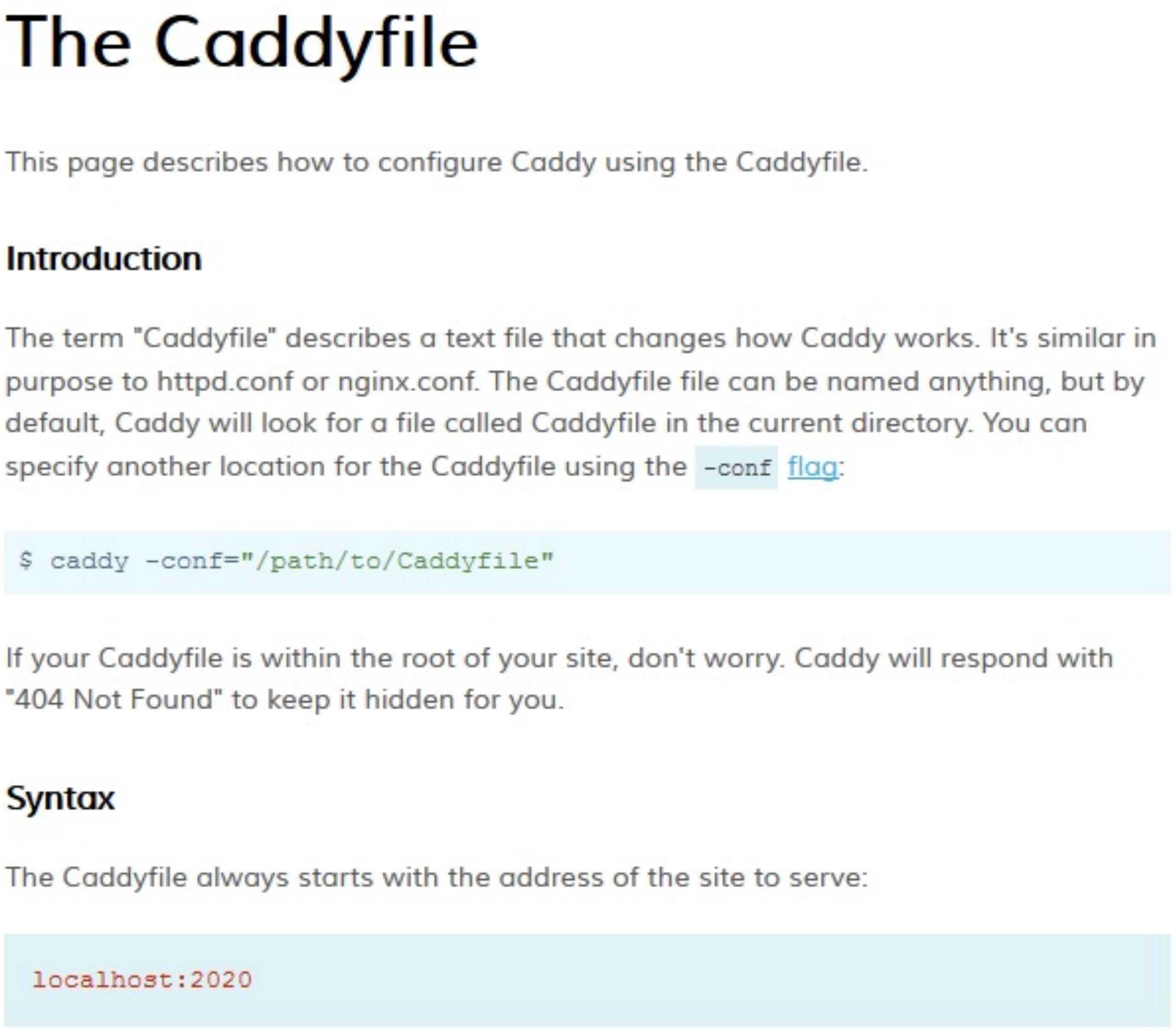


134.2.2.38:2015

Hello Caddy

```
<!doctype html>
<html>
<head>
<meta charset="ut-8">
<title>Caddy</title>
</head>

<body>
<p>Hello Caddy</p>
<img height="300px" src="caddy.jpg">
</body>
</html>
~
~
~
~
~
~
~
~
~
~
~
"index.html" 12L, 161C                                    1,1          Alles
```





The Caddyfile

This page describes how to configure Caddy using the Caddyfile.

Introduction

The term "Caddyfile" describes a text file that changes how Caddy works. It's similar in purpose to httpd.conf or nginx.conf. The Caddyfile file can be named anything, but by default, Caddy will look for a file called Caddyfile in the current directory. You can specify another location for the Caddyfile using the `-conf` flag:

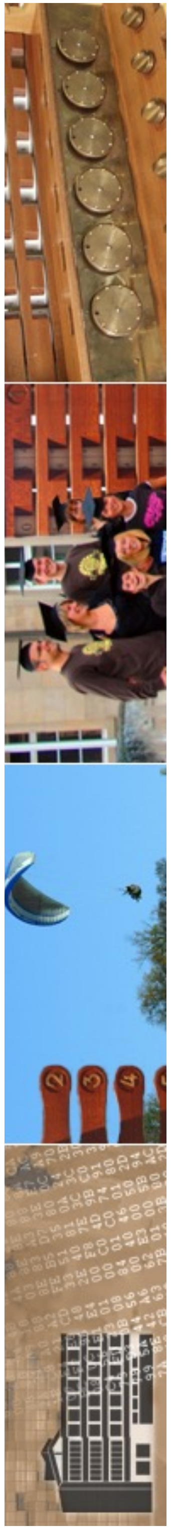
```
$ caddy -conf="/path/to/Caddyfile"
```

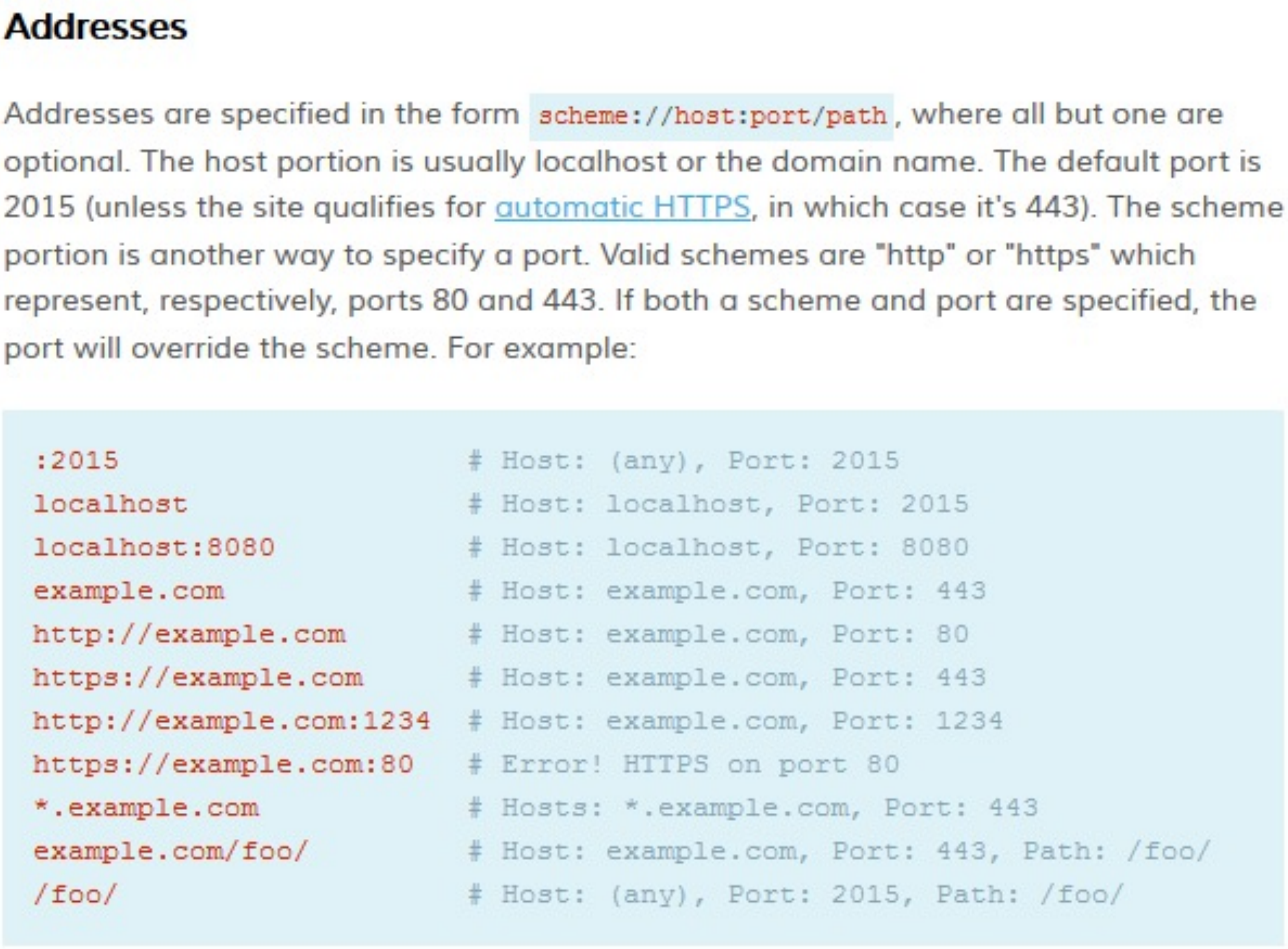
If your Caddyfile is within the root of your site, don't worry. Caddy will respond with "404 Not Found" to keep it hidden for you.

Syntax

The Caddyfile always starts with the address of the site to serve:

```
localhost:2020
```

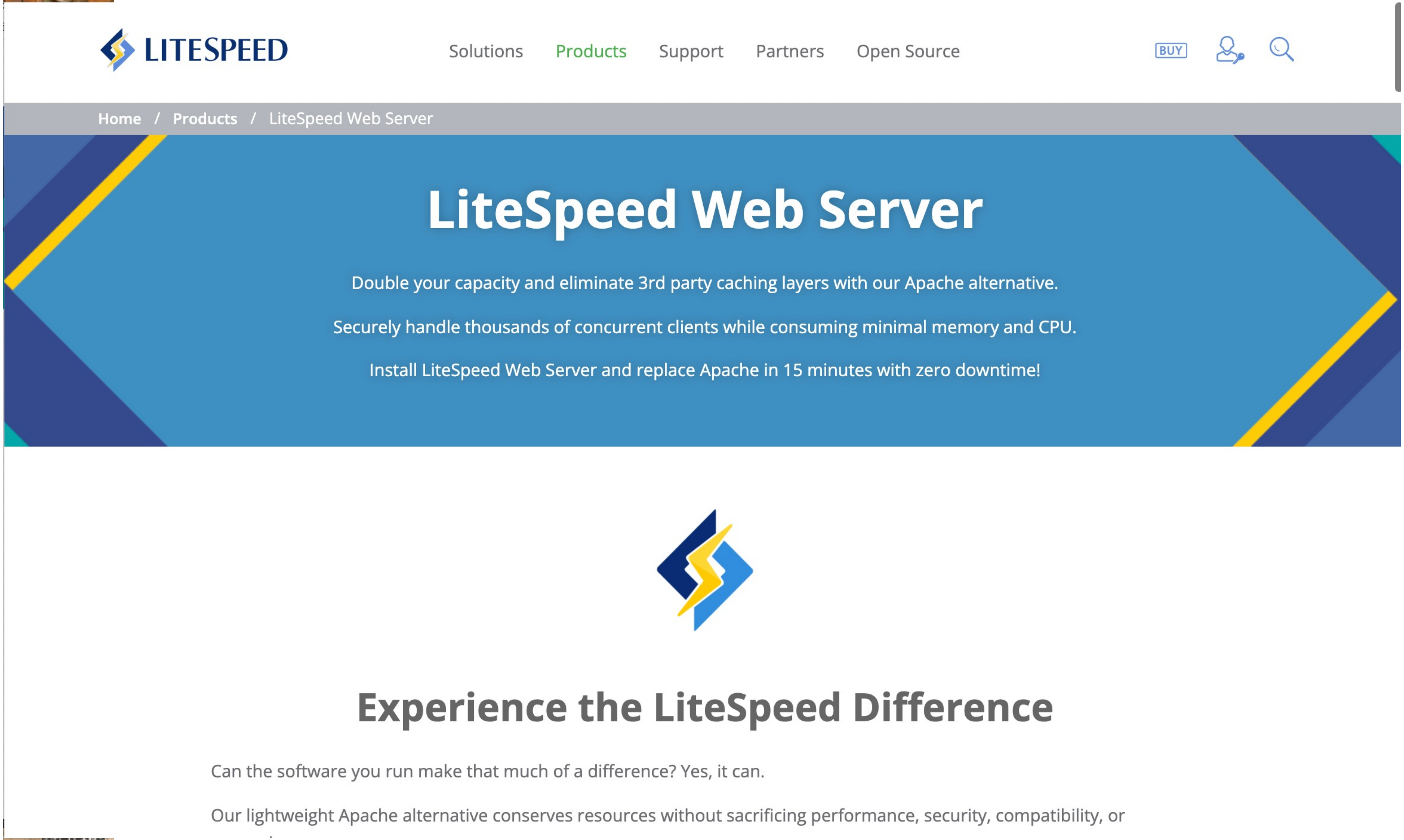




Addresses

Addresses are specified in the form `scheme://host:port/path`, where all but one are optional. The host portion is usually localhost or the domain name. The default port is 2015 (unless the site qualifies for automatic HTTPS, in which case it's 443). The scheme portion is another way to specify a port. Valid schemes are "http" or "https" which represent, respectively, ports 80 and 443. If both a scheme and port are specified, the port will override the scheme. For example:

```
:2015                    # Host: (any), Port: 2015
localhost                # Host: localhost, Port: 2015
localhost:8080           # Host: localhost, Port: 8080
example.com              # Host: example.com, Port: 443
http://example.com       # Host: example.com, Port: 80
https://example.com      # Host: example.com, Port: 443
http://example.com:1234  # Host: example.com, Port: 1234
https://example.com:80   # Error! HTTPS on port 80
*.example.com            # Hosts: *.example.com, Port: 443
example.com/foo/         # Host: example.com, Port: 443, Path: /foo/
/foo/                    # Host: (any), Port: 2015, Path: /foo/
```



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LiteSpeed Web Server

Double your capacity and eliminate 3rd party caching layers with our Apache alternative.

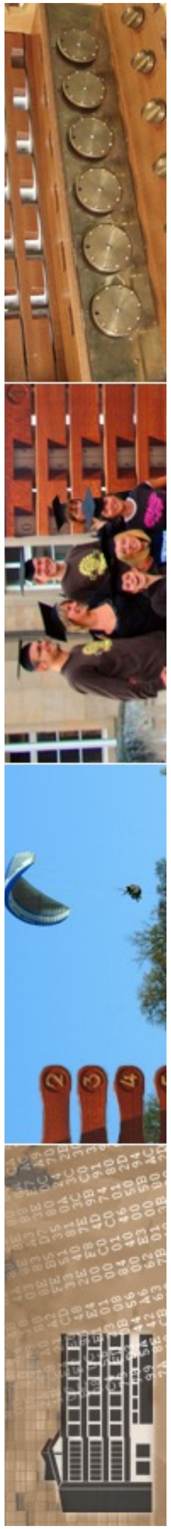
Securely handle thousands of concurrent clients while consuming minimal memory and CPU.

Install LiteSpeed Web Server and replace Apache in 15 minutes with zero downtime!

Experience the LiteSpeed Difference

Can the software you run make that much of a difference? Yes, it can.

Our lightweight Apache alternative conserves resources without sacrificing performance, security, compatibility, or



…und nun…

- haben wir zwei aktuelle, sehr performante Web-Server kennen gelernt:
  nginx und Caddy

- als nächstes:
  fastCGI und ServerSideIncludes