大学杂记

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目录

前言

一本关于个人成长、软件开发、系统运维、产品运营、思维、思考的杂记。

贡献名单

按时间先后

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Chapter 1. C

基于 CentOS 7

1.1. CentOS7安装配置

1.1.1. 准备分区

```
# XFS必须启用ftype参数，比如硬盘分区 /dev/sda1
mkfs.xfs -n ftype=1 -f $硬盘分区

# 挂载硬盘分区，用于存储Docker数据
echo `ll /dev/disk/by-uuid/|grep $硬盘分区|awk '{print "UUID="$9" /data
xfs     defaults        0 0"}'` >> /etc/fstab

# 自动挂载所有分区
mount -a

# 验证挂载
df -h|grep /data

mkdir -p /data/var/lib/docker
```

1.1.2. 升级内核

由于内核版本太低，Docker 存储方面有限制。需要升级到更版本内核。

每次官方更新了内核版本，grub.cfg会被覆盖。需要重新执行以下步骤。

```
rpm --import https://www.elrepo.org/RPM-GPG-KEY-elrepo.org
rpm -Uvh http://www.elrepo.org/elrepo-release-7.0-3.el7.elrepo.noarch.rpm

# 稳定版本内核
yum --enablerepo=elrepo-kernel install kernel-ml
# 长期支持版本内核
yum --enablerepo=elrepo-kernel install kernel-lt


# 查找内核启动项
grep "menuentry 'CentOS Linux" /boot/grub2/grub.cfg|awk -F "'" '{print
$2}'
grep "menuentry 'CentOS Linux" /boot/efi/EFI/centos/grub.cfg|awk -F "'"
'{print $2}'

# 设置默认内核版本
grub2-set-default 'CentOS Linux (4.4.112-1.el7.elrepo.x86_64) 7 (Core)'

cp /boot/grub2/grub.cfg /boot/grub2/grub.cfg.bak
cp /boot/efi/EFI/centos/grub.cfg /boot/efi/EFI/centos/grub.cfg.bak

grub2-mkconfig -o /boot/grub2/grub.cfg
grub2-mkconfig -o /boot/efi/EFI/centos/grub.cfg

重启服务器。
```

1.1.3. 安装

```
yum install -y yum-utils \
  device-mapper-persistent-data \
  lvm2

yum-config-manager \
    --add-repo \
    http://mirrors.aliyun.com/docker-ce/linux/centos/docker-ce.repo

yum install -y docker-ce
curl -L https://github.com/docker/compose/releases/download/1.18.0/docker-
compose-`uname -s`-`uname -m` -o /usr/local/bin/docker-compose
```

1.1.4. 配置

```
echo "net.bridge.bridge-nf-call-ip6tables = 1" >> /etc/sysctl.conf
echo "net.bridge.bridge-nf-call-iptables = 1" >> /etc/sysctl.conf
echo "net.ipv4.ip_forward = 1" >> /etc/sysctl.conf

sysctl -p

mkdir -p /etc/docker
cat << EOF > /etc/docker/daemon.json
{
  "registry-mirrors": [
    "https://registry.docker-cn.com",
    "https://hub-mirror.c.163.com"
  ],
  "graph": "/var/lib/docker",
  "storage-driver": "overlay2",
  "dns" : [
    "223.5.5.5",
    "223.6.6.6"
  ]
}
EOF
```

mirrors 位置最后一个优先级高

参数说明

registry-mirrors

Docker镜像源

graph

Docker数据目录

storage-driver

Docker 数据文件存储路径

dns

容器默认DNS。如果不设置可能出现 `git pull` 缓慢

1.1.5. 启动

```
systemctl enable docker
systemctl start docker

docker info
```

1.1.6. 新建自定义网桥

```
docker network create --subnet=10.10.10.0/16 --gateway=10.10.10.1 fifilyu
docker network inspect fifilyu
```

1.2. CentOS8安装配置

1.2.1. 准备分区

```
# XFS必须启用ftype参数，比如硬盘分区 /dev/sda1
mkfs.xfs -n ftype=1 -f $硬盘分区

# 挂载硬盘分区，用于存储Docker数据
echo `ll /dev/disk/by-uuid/|grep $硬盘分区|awk '{print "UUID="$9" /data
xfs     defaults        0 0"}'` >> /etc/fstab

# 自动挂载所有分区
mount -a

# 验证挂载
df -h|grep /data

mkdir -p /data/var/lib/docker
```

1.2.2. 安装

```
dnf install -y yum-utils

yum-config-manager \
    --add-repo \
    https://download.docker.com/linux/centos/docker-ce.repo

dnf install -y docker-ce docker-ce-cli containerd.io

systemctl enable docker
```

1.2.3. 配置

```
echo "net.bridge.bridge-nf-call-ip6tables = 1" >> /etc/sysctl.conf
echo "net.bridge.bridge-nf-call-iptables = 1" >> /etc/sysctl.conf
echo "net.ipv4.ip_forward = 1" >> /etc/sysctl.conf

sysctl -p

mkdir -p /etc/docker
cat << EOF > /etc/docker/daemon.json
{
  "registry-mirrors": [
    "https://registry.docker-cn.com",
    "https://dockerhub.azk8s.cn",
    "https://hub-mirror.c.163.com"
  ],
  "graph": "/var/lib/docker",
  "storage-driver": "overlay2",
  "dns" : [
    "223.5.5.5",
    "223.6.6.6"
  ]
}
EOF
```

mirrors 位置最后一个优先级高

参数说明

registry-mirrors

Docker镜像源

graph

Docker数据目录

storage-driver

Docker 数据文件存储路径

dns

容器默认DNS。如果不设置可能出现 `git pull` 缓慢

最后，启动或重启docker服务：

```
systemctl restart docker
```

1.2.4. 查看Docker运行信息

```
[root@dell7 ~]# docker info
Client:
 Debug Mode: false

Server:
 Containers: 0
  Running: 0
  Paused: 0
  Stopped: 0
 Images: 1
 Server Version: 19.03.13
 Storage Driver: overlay2
  Backing Filesystem: xfs
  Supports d_type: true
  Native Overlay Diff: true
 Logging Driver: json-file
 Cgroup Driver: cgroupfs
 Plugins:
  Volume: local
  Network: bridge host ipvlan macvlan null overlay
  Log: awslogs fluentd gcplogs gelf journald json-file local logentries
splunk syslog
 Swarm: inactive
 Runtimes: runc
 Default Runtime: runc
 Init Binary: docker-init
 containerd version: 8fba4e9a7d01810a393d5d25a3621dc101981175
 runc version: dc9208a3303feef5b3839f4323d9beb36df0a9dd
 init version: fec3683
 Security Options:
  seccomp
   Profile: default
 Kernel Version: 4.18.0-147.8.1.el8_1.x86_64
 Operating System: CentOS Linux 8 (Core)
 OSType: linux
 Architecture: x86_64
 CPUs: 4
 Total Memory: 15.46GiB
 Name: dell7
 ID: WFX3:WXWH:WPML:VRCA:QRTN:LGCB:6UBM:V73O:QEGU:KADY:V3FH:E4Q6
 Docker Root Dir: /var/lib/docker
 Debug Mode: false
 Registry: https://index.docker.io/v1/
 Labels:
 Experimental: false
 Insecure Registries:
```

```
  127.0.0.0/8
 Registry Mirrors:
  https://hub-mirror.c.163.com/
 Live Restore Enabled: false
```

1.2.5. 测试

拉取测试镜像：

```
docker pull hello-world
```

控制台输出

```
[root@dell7 ~]# docker pull hello-world
Using default tag: latest
latest: Pulling from library/hello-world
0e03bdcc26d7: Already exists
Digest:
sha256:e7c70bb24b462baa86c102610182e3efcb12a04854e8c582838d92970a09f323
Status: Downloaded newer image for hello-world:latest
docker.io/library/hello-world:latest
```

创建测试容器：

```
docker run --name hello hello-world
```

控制台输出

```
[root@dell7 ~]# docker run --name hello hello-world

Hello from Docker!
This message shows that your installation appears to be working correctly.

......
```

查看已经创建的容器：

```
docker ps -a
```

控制台输出

```
[root@dell7 ~]# docker ps -a
CONTAINER ID        IMAGE               COMMAND             CREATED
STATUS                      PORTS               NAMES
59cc42b09fce        hello-world         "/hello"            24 seconds ago
Exited (0) 22 seconds ago                       hello
```

删除测试容器：

```
docker rm hello
```

1.3. 拉取镜像慢的问题

很多时候就算更换了源之后，`docker pull` 还是很慢时，用拷贝的方法更快。

在有镜像的系统上导出镜像：

```
docker save -o docker-centos6-php52.tar fifilyu/docker-centos6-php52
```

用 `scp` 或 `rsync` 把 `docker-centos6-php52.tar` 上传到目标系统，然后导入：

```
docker load -i docker-centos6-php52.tar
```

1.4. Pure-FTPd in Docker

必须使用 `--without-capabilities` 参数重新编译 Pure-FTPd，否则会出现以下错误：

```
[root@690bec85ee11 /]# /usr/sbin/pure-ftpd
421 Unable to switch capabilities : Operation not permitted
```

1.4.1. 重新打包

准备打包环境

```
cd ~
yum install yum-utils rpm-build gcc
yumdownloader --source pure-ftpd
rpm -ivh pure-ftpd-1.0.42-3.el7.src.rpm
yum-builddep pure-ftpd
```

修改包文件

```
sed -i 's/--with-capabilities /--without-capabilities /g'
rpmbuild/SPECS/pure-ftpd.spec
```

准备源代码

```
rpmbuild -bp rpmbuild/SPECS/pure-ftpd.spec
```

重新打包

```
rpmbuild -ba rpmbuild/SPECS/pure-ftpd.spec
```

安装测试

```
rpm -ivh ~/rpmbuild/RPMS/x86_64/pure-ftpd-1.0.42-3.el7.centos.x86_64.rpm
/usr/sbin/pure-config.pl /etc/pure-ftpd/pure-ftpd.conf --daemonize

ps aux|grep ftp
```

1.5. 容器启动命令

```
docker run -d --restart=always --name test  centos:7 docker-entrypoint.sh
```

`docker-entrypoint.sh` 表示容器中的 `/usr/local/bin/docker-entrypoint.sh`，通常内容为：

```
#!/bin/sh
/usr/bin/rm -f /run/nginx.pid && /usr/sbin/nginx -t && /usr/sbin/nginx

# 始终放到最后，防止以上命令启动失败，导致容器无法启动。
# 容器启动失败的处理流程较复杂，用此代码保证能进入容器处理故障。
while true
do
    sleep 100
done
```

单行版本

```
docker run \
    -d \
    --restart always \
    --env LANG=en_US.UTF-8 \
    --env TZ=Asia/Shanghai \
    --name lift360_all_data \
    --mount type=bind,source=/etc/localtime,target=/etc/localtime,readonly
\
    --mount source=lift360_all_data,target=/data \
    centos:6 \
    bash -c 'while true; do sleep 100; done;'
```

1.5.1. 程序启动命令汇总

PSQL

```
docker pull centos/postgresql-94-centos7

docker run \
    -d \
    --restart always \
    --env LANG=en_US.UTF-8 \
    --env TZ=Asia/Shanghai \
    --mount type=bind,source=/etc/localtime,target=/etc/localtime,readonly
\
    -p 18080:8080 \
    --name xxl_job_tomcat \
    xxl_job_tomcat \
    docker-entrypoint.sh

#免密码登录
echo '127.0.0.1:15432:esafesys_com:postgres:GcMuEKzRtvNIAiX1' > ~/.pgpass
chmod 600 ~/.pgpass

psql -h 127.0.0.1 -p 15432 -U postgres -c "create database esafesys_com;"

#导入数据库
psql -h 127.0.0.1 -p 15432 -U postgres esafesys_com -f foo.sql
```

MySQL5.1

```
/usr/bin/mysqld_safe
```

或者

```
/usr/libexec/mysqld \
    --basedir=/usr \
    --datadir=/var/lib/mysql \
    --user=mysql \
    --log-error=/var/log/mysqld.log \
    --pid-file=/var/run/mysqld/mysqld.pid \
    --socket=/var/lib/mysql/mysql.sock
```

MySQL5.6+

```
/usr/sbin/mysqld \
    --basedir=/usr \
    --datadir=/var/lib/mysql \
    --plugin-dir=/usr/lib64/mysql/plugin \
    --user=mysql --log-error=/var/log/mysqld.log \
    --pid-file=/var/run/mysqld/mysqld.pid \
    --socket=/var/lib/mysql/mysql.sock
```

Tomcat

```
su tomcat --shell /usr/libexec/tomcat/server start
```

zookeeper

```
su - zookeeper -c '/usr/local/zookeeper/bin/zkServer.sh start-foreground'
```

Nginx

```
/usr/bin/rm -f /run/nginx.pid && /usr/sbin/nginx -t && /usr/sbin/nginx
```

Pure-FTPd

```
/usr/sbin/pure-config.pl /etc/pure-ftpd/pure-ftpd.conf --daemonize
```

要在 Docker 中使用 Pure-FTPd，请查看 Pure-FTPd in Docker

Chapter 2. Math

2.1. NAT + FTP

Docker 网桥默认转发所有数据包，不限制。

```
iptables -A FORWARD -i br-da448a6a9576 ! -o br-da448a6a9576 -j ACCEPT
iptables -A FORWARD -i br-da448a6a9576 -o br-da448a6a9576 -j ACCEPT

iptables -t nat -A PREROUTING -i br_wan -p tcp -m tcp -m multiport
--dports 21,52000:52050 -j DNAT --to-destination 172.18.0.4
iptables -t nat -A POSTROUTING -s 172.18.0.0/16 ! -o br-da448a6a9576 -j
MASQUERADE
```

KVM 网桥，默认只允许内网发起的连接，但限制外部访问内网服务端口。

必须增加 `--dports 21:63535 -j ACCEPT` 放行服务端口。

被动模式端口

    52000:52050

```
iptables -A FORWARD -d 192.168.122.0/24 -o virbr0 -p tcp -m multiport
--dports 21:63535 -j ACCEPT
iptables -A FORWARD -d 192.168.122.0/24 -o virbr0 -m conntrack --ctstate
RELATED,ESTABLISHED -j ACCEPT
iptables -A FORWARD -s 192.168.122.0/24 -i virbr0 -j ACCEPT
iptables -A FORWARD -i virbr0 -o virbr0 -j ACCEPT
iptables -A FORWARD -o virbr0 -j REJECT --reject-with icmp-port-
unreachable
iptables -A FORWARD -i virbr0 -j REJECT --reject-with icmp-port-
unreachable

iptables -t nat -A PREROUTING -i br_wan -p tcp -m tcp --dport 18421 -j
DNAT --to-destination 172.18.0.4:21
iptables -t nat -A PREROUTING -i br_wan -p tcp -m tcp -m multiport
--dports 52000:52050 -j DNAT --to-destination 172.18.0.4
iptables -t nat -A POSTROUTING -s 192.168.122.0/24 ! -o virbr0 -j
MASQUERADE
```

Chapter 3. Composition

3.1. HTTP基本身份验证

3.1.1. 生成密码文件

安装 `htpasswd` 命令的软件包和 `pwgen` 包：

Debian/Ubuntu

```
apt install apache2-utils pwgen
```

RHEL/CentOS

```
yum install -y httpd-tools pwgen
# 或
dnf install -y httpd-tools pwgen
```

```
git_password=`pwgen -s 20`
echo $git_password

# 添加第一个用户时，创建 /etc/nginx/.htpasswd 文件
echo $git_password | htpasswd -i -c /etc/nginx/.htpasswd git
```

添加第二个用户时，不需要 `-c` 参数（创建密码文件）

```
echo 'test123456' | htpasswd -i /etc/nginx/.htpasswd test
```

配置Nginx

在Nginx的Server配置中，加入：

```
location /api {
    auth_basic            "Administrator's Area";
    auth_basic_user_file /etc/nginx/.htpasswd;
}
```

生效新配置：

```
nginx -t && nginx -s reload
=== `proxy_pass` 传递查询参数
```

proxy_pass 最后一个 "/" 表示传递查询参数到后端。

```
location /api-elevator/ {
    proxy_pass http://ttd1_api_elevator:8080/;
}
```

```
yum install -y httpd-tools
htpasswd -b -c /etc/nginx/conf.d/dl.2012iot.com.pass admin
CaNxR7doJLW76HPXGkrsMmH9epCtSIbn23bz6bOm
```

```
server {
    listen    80;
    server_name dl.2012iot.com;
    root /usr/share/nginx/html;
    access_log off;

    auth_basic "auth";
    auth_basic_user_file /etc/nginx/conf.d/dl.2012iot.com.pass;

    charset UTF-8;
    autoindex on;
    autoindex_exact_size off;
    autoindex_localtime on;
}
```

3.2. 目录浏览

```
server {
        listen       80;

        server_name dl.cdgeekcamp.com;
        root /data/web/dl.cdgeekcamp.com;

        location / {
            autoindex on;
            autoindex_localtime on;
            # 设置文件大小显示单位
            autoindex_exact_size off;
        }
}
```

3.3. 缓存静态文件

官方文档 Syntax: proxy_cache_path

```
proxy_cache_path /var/lib/nginx/tmp/static_cache levels=1:2
keys_zone=static_cache:100m inactive=1d max_size=10g;

server {
    listen 80;
    server_name chinakaoyan.com www.chinakaoyan.com;
    root /usr/share/nginx/html/;
    access_log  /var/log/nginx/www.log  main;

    location / {
        proxy_pass http://192.168.2.204:80;
    }

    location ~*
\.(ico|gif|jpg|jpeg|png|bmp|zip|rar|7z|js|css|docx?|xls|pdf)$ {
        proxy_cache_valid 200 10d;
        proxy_cache_key $uri;
        proxy_cache static_cache;
        proxy_pass http://192.168.2.204:80;
    }
}
```

Chapter 4. Database

4.1. 常用参数

`\l`

查看所有表

查看表大小

```
select relname, pg_size_pretty(pg_relation_size(relid)) from
pg_stat_user_tables where schemaname='public' order by
pg_relation_size(relid) desc;
```

Chapter 5. Linux

5.1. 常用命令

5.1.1. 烤机必备

从0设备到空设备持续写入，会占用单核100%：

```
dd if=/dev/zero of=/dev/null
```

如果不够，多来几个就行。

5.1.2. find分别查找目录和文件

修改当前路径所有目录的权限

```
find . -type d|xargs  -d '\n' chmod 755
```

修改当前路径所有文件的权限

```
find . -type f|xargs  -d '\n' chmod 644
```

由于 `xargs` 默认使用空格为分隔符，导致目录或文件中有空格时无法正常使用。

5.1.3. 创建用于运行服务的用户

```
useradd --comment  "Python User" --user-group --no-create-home --shell
/usr/bin/nologin  python
```

5.1.4. 仅修改子目录中的文件权限，忽略目录

```
find . -type f -exec chmod 644 -- {} +
=== NetworkManager
```

5.1.5. nmcli

配置IP地址

```
nmcli c modify eth0 ipv4.addresses 192.168.2.12/24 ipv4.method manual
nmcli c modify eth0 ipv4.gateway 192.168.2.1
nmcli c modify eth0 ipv4.dns "223.5.5.5 223.6.6.6"
```

物理网卡加入网桥

```
nmcli c add type Ethernet autoconnect yes con-name em1 ifname em1

nmcli c add type bridge autoconnect yes con-name br1 ifname br1
nmcli c modify br1 bridge.stp no
nmcli c modify br1 ipv6.method ignore
nmcli c modify br1 ipv4.addresses 192.168.2.8/24 ipv4.method manual
nmcli c modify br1 ipv4.gateway 192.168.2.1
nmcli c modify br1 ipv4.dns "223.5.5.5 223.6.6.6"

# 以下3条命令必须同时执行，最好放到脚本里面执行。因为，
delete网卡后，可能会断网。重启网络服务或启动网桥后才能恢复
cat << EOF > /tmp/set_br1.sh
nmcli c delete em1
nmcli c add type bridge-slave autoconnect yes con-name em1 ifname em1
master br1
nmcli c up br1
EOF

sh /tmp/set_br1.sh &
rm -f /tmp/set_br1.sh
```

Chapter 6. Python

6.1. 常用命令

6.1.1. 烤机必备

从0设备到空设备持续写入，会占用单核100%：

```
dd if=/dev/zero of=/dev/null
```

如果不够，多来几个就行。

6.1.2. find分别查找目录和文件

修改当前路径所有目录的权限

```
find . -type d|xargs  -d '\n' chmod 755
```

修改当前路径所有文件的权限

```
find . -type f|xargs  -d '\n' chmod 644
```

由于 `xargs` 默认使用空格为分隔符，导致目录或文件中有空格时无法正常使用。

6.1.3. 创建用于运行服务的用户

```
useradd --comment  "Python User" --user-group --no-create-home --shell
/usr/bin/nologin  python
```

6.1.4. 仅修改子目录中的文件权限，忽略目录

```
find . -type f -exec chmod 644 -- {} +
=== NetworkManager
```

6.1.5. nmcli

配置IP地址

```
nmcli c modify eth0 ipv4.addresses 192.168.2.12/24 ipv4.method manual
nmcli c modify eth0 ipv4.gateway 192.168.2.1
nmcli c modify eth0 ipv4.dns "223.5.5.5 223.6.6.6"
```

物理网卡加入网桥

```
nmcli c add type Ethernet autoconnect yes con-name em1 ifname em1

nmcli c add type bridge autoconnect yes con-name br1 ifname br1
nmcli c modify br1 bridge.stp no
nmcli c modify br1 ipv6.method ignore
nmcli c modify br1 ipv4.addresses 192.168.2.8/24 ipv4.method manual
nmcli c modify br1 ipv4.gateway 192.168.2.1
nmcli c modify br1 ipv4.dns "223.5.5.5 223.6.6.6"

# 以下3条命令必须同时执行，最好放到脚本里面执行。因为，
delete网卡后，可能会断网。重启网络服务或启动网桥后才能恢复
cat << EOF > /tmp/set_br1.sh
nmcli c delete em1
nmcli c add type bridge-slave autoconnect yes con-name em1 ifname em1
master br1
nmcli c up br1
EOF

sh /tmp/set_br1.sh &
rm -f /tmp/set_br1.sh
```

Chapter 7. JAVA

7.1. 常用命令

7.1.1. 烤机必备

从0设备到空设备持续写入，会占用单核100%：

```
dd if=/dev/zero of=/dev/null
```

如果不够，多来几个就行。

7.1.2. find分别查找目录和文件

修改当前路径所有目录的权限

```
find . -type d|xargs  -d '\n' chmod 755
```

修改当前路径所有文件的权限

```
find . -type f|xargs  -d '\n' chmod 644
```

由于 `xargs` 默认使用空格为分隔符，导致目录或文件中有空格时无法正常使用。

7.1.3. 创建用于运行服务的用户

```
useradd --comment  "Python User" --user-group --no-create-home --shell
/usr/bin/nologin  python
```

7.1.4. 仅修改子目录中的文件权限，忽略目录

```
find . -type f -exec chmod 644 -- {} +
=== NetworkManager
```

7.1.5. nmcli

配置IP地址

```
nmcli c modify eth0 ipv4.addresses 192.168.2.12/24 ipv4.method manual
nmcli c modify eth0 ipv4.gateway 192.168.2.1
nmcli c modify eth0 ipv4.dns "223.5.5.5 223.6.6.6"
```

物理网卡加入网桥

```
nmcli c add type Ethernet autoconnect yes con-name em1 ifname em1

nmcli c add type bridge autoconnect yes con-name br1 ifname br1
nmcli c modify br1 bridge.stp no
nmcli c modify br1 ipv6.method ignore
nmcli c modify br1 ipv4.addresses 192.168.2.8/24 ipv4.method manual
nmcli c modify br1 ipv4.gateway 192.168.2.1
nmcli c modify br1 ipv4.dns "223.5.5.5 223.6.6.6"

# 以下3条命令必须同时执行，最好放到脚本里面执行。因为，
delete网卡后，可能会断网。重启网络服务或启动网桥后才能恢复
cat << EOF > /tmp/set_br1.sh
nmcli c delete em1
nmcli c add type bridge-slave autoconnect yes con-name em1 ifname em1
master br1
nmcli c up br1
EOF

sh /tmp/set_br1.sh &
rm -f /tmp/set_br1.sh
```

Appendix A: The Extended ASCII Table

A.1. ASCII control characters (character code 0-31)

The first 32 characters in the ASCII-table are unprintable control codes and are used to control peripherals such as printers.

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
0	000	00	00000000	NUL	&#000		Null char
1	001	01	00000001	SOH	&#001		Start of Heading
2	002	02	00000010	STX	&#002		Start of Text
3	003	03	00000011	ETX	&#003		End of Text
4	004	04	00000100	EOT	&#004		End of Transmission
5	005	05	00000101	ENQ	&#005		Enquiry
6	006	06	00000110	ACK	&#006		Acknowledgment
7	007	07	00000111	BEL	&#007		Bell
8	010	08	00001000	BS	&#008		Back Space
9	011	09	00001001	HT	&#009		Horizontal Tab
10	012	0A	00001010	LF	&#010		Line Feed
11	013	0B	00001011	VT	&#011		Vertical Tab
12	014	0C	00001100	FF	&#012		Form Feed
13	015	0D	00001101	CR	&#013		Carriage Return

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
14	016	0E	00001110	SO	&#014		Shift Out / X-On
15	017	0F	00001111	SI	&#015		Shift In / X-Off
16	020	10	00010000	DLE	&#016		Data Line Escape
17	021	11	00010001	DC1	&#017		Device Control 1 (oft. XON)
18	022	12	00010010	DC2	&#018		Device Control 2
19	023	13	00010011	DC3	&#019		Device Control 3 (oft. XOFF)
20	024	14	00010100	DC4	&#020		Device Control 4
21	025	15	00010101	NAK	&#021		Negative Acknowledgement
22	026	16	00010110	SYN	&#022		Synchronous Idle
23	027	17	00010111	ETB	&#023		End of Transmit Block
24	030	18	00011000	CAN	&#024		Cancel
25	031	19	00011001	EM	&#025		End of Medium
26	032	1A	00011010	SUB	&#026		Substitute
27	033	1B	00011011	ESC	&#027		Escape
28	034	1C	00011100	FS	&#028		File Separator
29	035	1D	00011101	GS	&#029		Group Separator
30	036	1E	00011110	RS	&#030		Record Separator

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
31	037	1F	00011111	US	&#031		Unit Separator

A.2. ASCII printable characters (character code 32-127)

Codes 32-127 are common for all the different variations of the ASCII table, they are called printable characters, represent letters, digits, punctuation marks, and a few miscellaneous symbols. You will find almost every character on your keyboard. Character 127 represents the command DEL.

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
32	040	20	00100000		&#32		Space
33	041	21	00100001	!	&#33		Exclamation mark
34	042	22	00100010	"	&#34;	&quot;	Double quotes (or speech marks)
35	043	23	00100011	#	&#35		Number
36	044	24	00100100	$	&#36		Dollar
37	045	25	00100101	%	&#37		Procenttecken
38	046	26	00100110	&	&#38;	&amp;	Ampersand
39	047	27	00100111	'	&#39		Single quote
40	050	28	00101000	(	&#40		Open parenthesis (or open bracket)
41	051	29	00101001	)	&#41		Close parenthesis (or close bracket)
42	052	2A	00101010	*	&#42		Asterisk
43	053	2B	00101011	+	&#43		Plus

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
44	054	2C	00101100	,	&#44		Comma
45	055	2D	00101101	-	&#45		Hyphen
46	056	2E	00101110	.	&#46		Period, dot or full stop
47	057	2F	00101111	/	&#47		Slash or divide
48	060	30	00110000	0	&#48		Zero
49	061	31	00110001	1	&#49		One
50	062	32	00110010	2	&#50		Two
51	063	33	00110011	3	&#51		Three
52	064	34	00110100	4	&#52		Four
53	065	35	00110101	5	&#53		Five
54	066	36	00110110	6	&#54		Six
55	067	37	00110111	7	&#55		Seven
56	070	38	00111000	8	&#56		Eight
57	071	39	00111001	9	&#57		Nine
58	072	3A	00111010	:	&#58		Colon
59	073	3B	00111011	;	&#59		Semicolon
60	074	3C	00111100	<	&#60;	&lt;	Less than (or open angled bracket)

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
61	075	3D	00111101	=	&#61		Equals
62	076	3E	00111110	>	>	>	Greater than (or close angled bracket)
63	077	3F	00111111	?	&#63		Question mark
64	100	40	01000000	@	&#64		At symbol
65	101	41	01000001	A	&#65		Uppercase A
66	102	42	01000010	B	&#66		Uppercase B
67	103	43	01000011	C	&#67		Uppercase C
68	104	44	01000100	D	&#68		Uppercase D
69	105	45	01000101	E	&#69		Uppercase E
70	106	46	01000110	F	&#70		Uppercase F
71	107	47	01000111	G	&#71		Uppercase G
72	110	48	01001000	H	&#72		Uppercase H
73	111	49	01001001	I	&#73		Uppercase I
74	112	4A	01001010	J	&#74		Uppercase J
75	113	4B	01001011	K	&#75		Uppercase K
76	114	4C	01001100	L	&#76		Uppercase L
77	115	4D	01001101	M	&#77		Uppercase M

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
78	116	4E	01001110	N	&#78		Uppercase N
79	117	4F	01001111	O	&#79		Uppercase O
80	120	50	01010000	P	&#80		Uppercase P
81	121	51	01010001	Q	&#81		Uppercase Q
82	122	52	01010010	R	&#82		Uppercase R
83	123	53	01010011	S	&#83		Uppercase S
84	124	54	01010100	T	&#84		Uppercase T
85	125	55	01010101	U	&#85		Uppercase U
86	126	56	01010110	V	&#86		Uppercase V
87	127	57	01010111	W	&#87		Uppercase W
88	130	58	01011000	X	&#88		Uppercase X
89	131	59	01011001	Y	&#89		Uppercase Y
90	132	5A	01011010	Z	&#90		Uppercase Z
91	133	5B	01011011	[	&#91		Opening bracket
92	134	5C	01011100	\	&#92		Backslash
93	135	5D	01011101	]	&#93		Closing bracket
94	136	5E	01011110	^	&#94		Caret - circumflex

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
95	137	5F	01011111	_	&#95		Underscore
96	140	60	01100000	`	&#96		Grave accent
97	141	61	01100001	a	&#97		Lowercase a
98	142	62	01100010	b	&#98		Lowercase b
99	143	63	01100011	c	&#99		Lowercase c
100	144	64	01100100	d	&#100		Lowercase d
101	145	65	01100101	e	&#101		Lowercase e
102	146	66	01100110	f	&#102		Lowercase f
103	147	67	01100111	g	&#103		Lowercase g
104	150	68	01101000	h	&#104		Lowercase h
105	151	69	01101001	i	&#105		Lowercase i
106	152	6A	01101010	j	&#106		Lowercase j
107	153	6B	01101011	k	&#107		Lowercase k
108	154	6C	01101100	l	&#108		Lowercase l
109	155	6D	01101101	m	&#109		Lowercase m
110	156	6E	01101110	n	&#110		Lowercase n
111	157	6F	01101111	o	&#111		Lowercase o

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
112	160	70	01110000	p	&#112		Lowercase p
113	161	71	01110001	q	&#113		Lowercase q
114	162	72	01110010	r	&#114		Lowercase r
115	163	73	01110011	s	&#115		Lowercase s
116	164	74	01110100	t	&#116		Lowercase t
117	165	75	01110101	u	&#117		Lowercase u
118	166	76	01110110	v	&#118		Lowercase v
119	167	77	01110111	w	&#119		Lowercase w
120	170	78	01111000	x	&#120		Lowercase x
121	171	79	01111001	y	&#121		Lowercase y
122	172	7A	01111010	z	&#122		Lowercase z
123	173	7B	01111011	{	&#123		Opening brace
124	174	7C	01111100	|	&#124		Vertical bar
125	175	7D	01111101	}	&#125		Closing brace
126	176	7E	01111110	~	&#126		Equivalency sign - tilde
127	177	7F	01111111		&#127		Delete

A.3. The extended ASCII codes (character code 128-255)

There are several different variations of the 8-bit ASCII table. The table below is according to ISO 8859-1, also called ISO Latin-1. Codes 128-159 contain the Microsoft® Windows Latin-1 extended characters.

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
128	200	80	10000000	€	&#128;	&euro;	Euro sign
129	201	81	10000001				
130	202	82	10000010	‚	&#130;	&sbquo;	Single low-9 quotation mark
131	203	83	10000011	ƒ	&#131;	&fnof;	Latin small letter f with hook
132	204	84	10000100	„	&#132;	&bdquo;	Double low-9 quotation mark
133	205	85	10000101	…	&#133;	&hellip;	Horizontal ellipsis
134	206	86	10000110	†	&#134;	&dagger;	Dagger
135	207	87	10000111	‡	&#135;	&Dagger;	Double dagger
136	210	88	10001000	☒	&#136;	&circ;	Modifier letter circumflex accent
137	211	89	10001001	‰	&#137;	&permil;	Per mille sign
138	212	8A	10001010	☒	&#138;	&Scaron;	Latin capital letter S with caron
139	213	8B	10001011	‹	&#139;	&lsaquo;	Single left-pointing angle quotation
140	214	8C	10001100	Œ	&#140;	&OElig;	Latin capital ligature OE
141	215	8D	10001101				
142	216	8E	10001110	☒	&#142;		Latin captial letter Z with caron

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
143	217	8F	10001111				
144	220	90	10010000				
145	221	91	10010001	‘	&#145;	&lsquo;	Left single quotation mark
146	222	92	10010010	’	&#146;	&rsquo;	Right single quotation mark
147	223	93	10010011	“	&#147;	&ldquo;	Left double quotation mark
148	224	94	10010100	”	&#148;	&rdquo;	Right double quotation mark
149	225	95	10010101	•	&#149;	&bull;	Bullet
150	226	96	10010110	–	&#150;	&ndash;	En dash
151	227	97	10010111	—	&#151;	&mdash;	Em dash
152	230	98	10011000	☒	&#152;	&tilde;	Small tilde
153	231	99	10011001	™	&#153;	&trade;	Trade mark sign
154	232	9A	10011010	☒	&#154;	&scaron;	Latin small letter S with caron
155	233	9B	10011011	›	&#155;	&rsaquo;	Single right-pointing angle quotation mark
156	234	9C	10011100	œ	&#156;	&oelig;	Latin small ligature oe
157	235	9D	10011101				
158	236	9E	10011110	☒	&#158;		Latin small letter z with caron
159	237	9F	10011111	☒	&#159;	&Yuml;	Latin capital letter Y with diaeresis

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
160	240	A0	10100000				Non-breaking space
161	241	A1	10100001	¡	&#161;	&iexcl;	Inverted exclamation mark
162	242	A2	10100010	¢	&#162;	&cent;	Cent sign
163	243	A3	10100011	£	&#163;	&pound;	Pound sign
164	244	A4	10100100	¤	&#164;	&curren;	Currency sign
165	245	A5	10100101	¥	&#165;	&yen;	Yen sign
166	246	A6	10100110	¦	&#166;	&brvbar;	Pipe, Broken vertical bar
167	247	A7	10100111	§	&#167;	&sect;	Section sign
168	250	A8	10101000	¨	&#168;	&uml;	Spacing diaeresis - umlaut
169	251	A9	10101001	©	&#169;	&copy;	Copyright sign
170	252	AA	10101010	ª	&#170;	&ordf;	Feminine ordinal indicator
171	253	AB	10101011	«	&#171;	&laquo;	Left double angle quotes
172	254	AC	10101100	¬	&#172;	&not;	Not sign
173	255	AD	10101101	-	&#173;	&shy;	Soft hyphen
174	256	AE	10101110	®	&#174;	&reg;	Registered trade mark sign
175	257	AF	10101111	¯	&#175;	&macr;	Spacing macron - overline
176	260	B0	10110000	°	&#176;	&deg;	Degree sign

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
177	261	B1	10110001	±	±	±	Plus-or-minus sign
178	262	B2	10110010	²	²	²	Superscript two - squared
179	263	B3	10110011	³	³	³	Superscript three - cubed
180	264	B4	10110100	´	´	´	Acute accent - spacing acute
181	265	B5	10110101	µ	µ	µ	Micro sign
182	266	B6	10110110	¶	¶	¶	Pilcrow sign - paragraph sign
183	267	B7	10110111	·	·	·	Middle dot - Georgian comma
184	270	B8	10111000	¸	¸	¸	Spacing cedilla
185	271	B9	10111001	¹	¹	¹	Superscript one
186	272	BA	10111010	º	º	º	Masculine ordinal indicator
187	273	BB	10111011	»	»	»	Right double angle quotes
188	274	BC	10111100	¼	¼	¼	Fraction one quarter
189	275	BD	10111101	½	½	½	Fraction one half
190	276	BE	10111110	¾	¾	¾	Fraction three quarters
191	277	BF	10111111	¿	¿	¿	Inverted question mark
192	300	C0	11000000	À	À	À	Latin capital letter A with grave
193	301	C1	11000001	Á	Á	Á	Latin capital letter A with acute

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
194	302	C2	11000010	Â	&#194;	&Acirc;	Latin capital letter A with circumflex
195	303	C3	11000011	Ã	&#195;	&Atilde;	Latin capital letter A with tilde
196	304	C4	11000100	Ä	&#196;	&Auml;	Latin capital letter A with diaeresis
197	305	C5	11000101	Å	&#197;	&Aring;	Latin capital letter A with ring above
198	306	C6	11000110	Æ	&#198;	&AElig;	Latin capital letter AE
199	307	C7	11000111	Ç	&#199;	&Ccedil;	Latin capital letter C with cedilla
200	310	C8	11001000	È	&#200;	&Egrave;	Latin capital letter E with grave
201	311	C9	11001001	É	&#201;	&Eacute;	Latin capital letter E with acute
202	312	CA	11001010	Ê	&#202;	&Ecirc;	Latin capital letter E with circumflex
203	313	CB	11001011	Ë	&#203;	&Euml;	Latin capital letter E with diaeresis
204	314	CC	11001100	Ì	&#204;	&Igrave;	Latin capital letter I with grave
205	315	CD	11001101	Í	&#205;	&Iacute;	Latin capital letter I with acute
206	316	CE	11001110	Î	&#206;	&Icirc;	Latin capital letter I with circumflex
207	317	CF	11001111	Ï	&#207;	&Iuml;	Latin capital letter I with diaeresis
208	320	D0	11010000	Đ	&#208;	&ETH;	Latin capital letter ETH
209	321	D1	11010001	Ñ	&#209;	&Ntilde;	Latin capital letter N with tilde
210	322	D2	11010010	Ò	&#210;	&Ograve;	Latin capital letter O with grave

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
211	323	D3	11010011	Ó	&#211;	&Oacute;	Latin capital letter O with acute
212	324	D4	11010100	Ô	&#212;	&Ocirc;	Latin capital letter O with circumflex
213	325	D5	11010101	Õ	&#213;	&Otilde;	Latin capital letter O with tilde
214	326	D6	11010110	Ö	&#214;	&Ouml;	Latin capital letter O with diaeresis
215	327	D7	11010111	×	&#215;	&times;	Multiplication sign
216	330	D8	11011000	Ø	&#216;	&Oslash;	Latin capital letter O with slash
217	331	D9	11011001	Ù	&#217;	&Ugrave;	Latin capital letter U with grave
218	332	DA	11011010	Ú	&#218;	&Uacute;	Latin capital letter U with acute
219	333	DB	11011011	Û	&#219;	&Ucirc;	Latin capital letter U with circumflex
220	334	DC	11011100	Ü	&#220;	&Uuml;	Latin capital letter U with diaeresis
221	335	DD	11011101	Ý	&#221;	&Yacute;	Latin capital letter Y with acute
222	336	DE	11011110	Þ	&#222;	&THORN;	Latin capital letter THORN
223	337	DF	11011111	ß	&#223;	&szlig;	Latin small letter sharp s - ess-zed
224	340	E0	11100000	à	&#224;	&agrave;	Latin small letter a with grave
225	341	E1	11100001	á	&#225;	&aacute;	Latin small letter a with acute
226	342	E2	11100010	â	&#226;	&acirc;	Latin small letter a with circumflex
227	343	E3	11100011	ã	&#227;	&atilde;	Latin small letter a with tilde

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
228	344	E4	11100100	ä	ä	ä	Latin small letter a with diaeresis
229	345	E5	11100101	å	å	å	Latin small letter a with ring above
230	346	E6	11100110	æ	æ	æ	Latin small letter ae
231	347	E7	11100111	ç	ç	ç	Latin small letter c with cedilla
232	350	E8	11101000	è	è	è	Latin small letter e with grave
233	351	E9	11101001	é	é	é	Latin small letter e with acute
234	352	EA	11101010	ê	ê	ê	Latin small letter e with circumflex
235	353	EB	11101011	ë	ë	ë	Latin small letter e with diaeresis
236	354	EC	11101100	ì	ì	ì	Latin small letter i with grave
237	355	ED	11101101	í	í	í	Latin small letter i with acute
238	356	EE	11101110	î	î	î	Latin small letter i with circumflex
239	357	EF	11101111	ï	ï	ï	Latin small letter i with diaeresis
240	360	F0	11110000	ð	ð	ð	Latin small letter eth
241	361	F1	11110001	ñ	ñ	ñ	Latin small letter n with tilde
242	362	F2	11110010	ò	ò	ò	Latin small letter o with grave
243	363	F3	11110011	ó	ó	ó	Latin small letter o with acute
244	364	F4	11110100	ô	ô	ô	Latin small letter o with circumflex

DEC	OCT	HEX	BIN	Symbol	HTML Number	HTML Name	Description
245	365	F5	11110101	õ	&#245;	&otilde;	Latin small letter o with tilde
246	366	F6	11110110	ö	&#246;	&ouml;	Latin small letter o with diaeresis
247	367	F7	11110111	÷	&#247;	&divide;	Division sign
248	370	F8	11111000	ø	&#248;	&oslash;	Latin small letter o with slash
249	371	F9	11111001	ù	&#249;	&ugrave;	Latin small letter u with grave
250	372	FA	11111010	ú	&#250;	&uacute;	Latin small letter u with acute
251	373	FB	11111011	û	&#251;	&ucirc;	Latin small letter u with circumflex
252	374	FC	11111100	ü	&#252;	&uuml;	Latin small letter u with diaeresis
253	375	FD	11111101	ý	&#253;	&yacute;	Latin small letter y with acute
254	376	FE	11111110	þ	&#254;	&thorn;	Latin small letter thorn
255	377	FF	11111111	ÿ	&#255;	&yuml;	Latin small letter y with diaeresis