

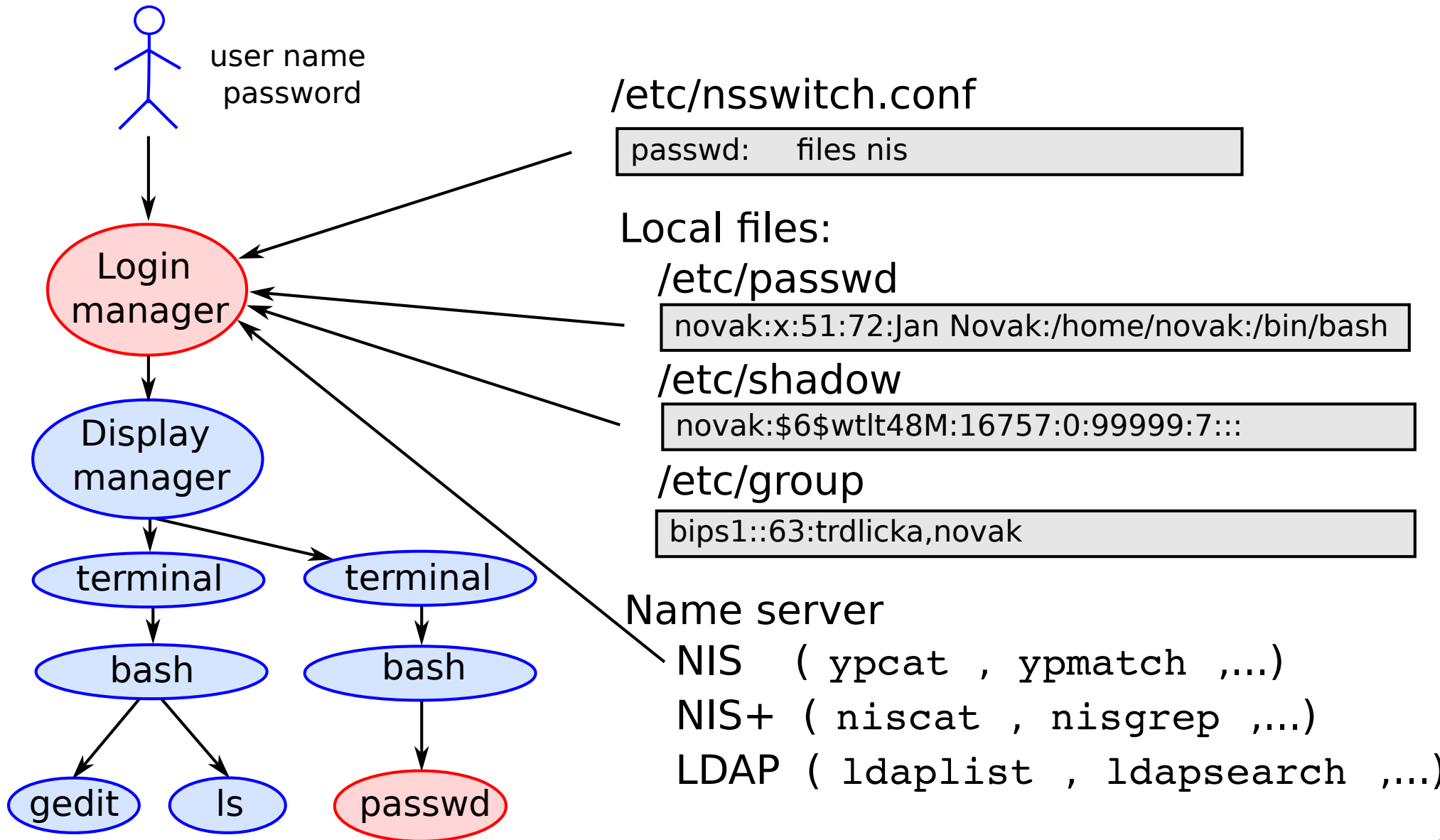


User, process and file identity. Access permissions.

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System login



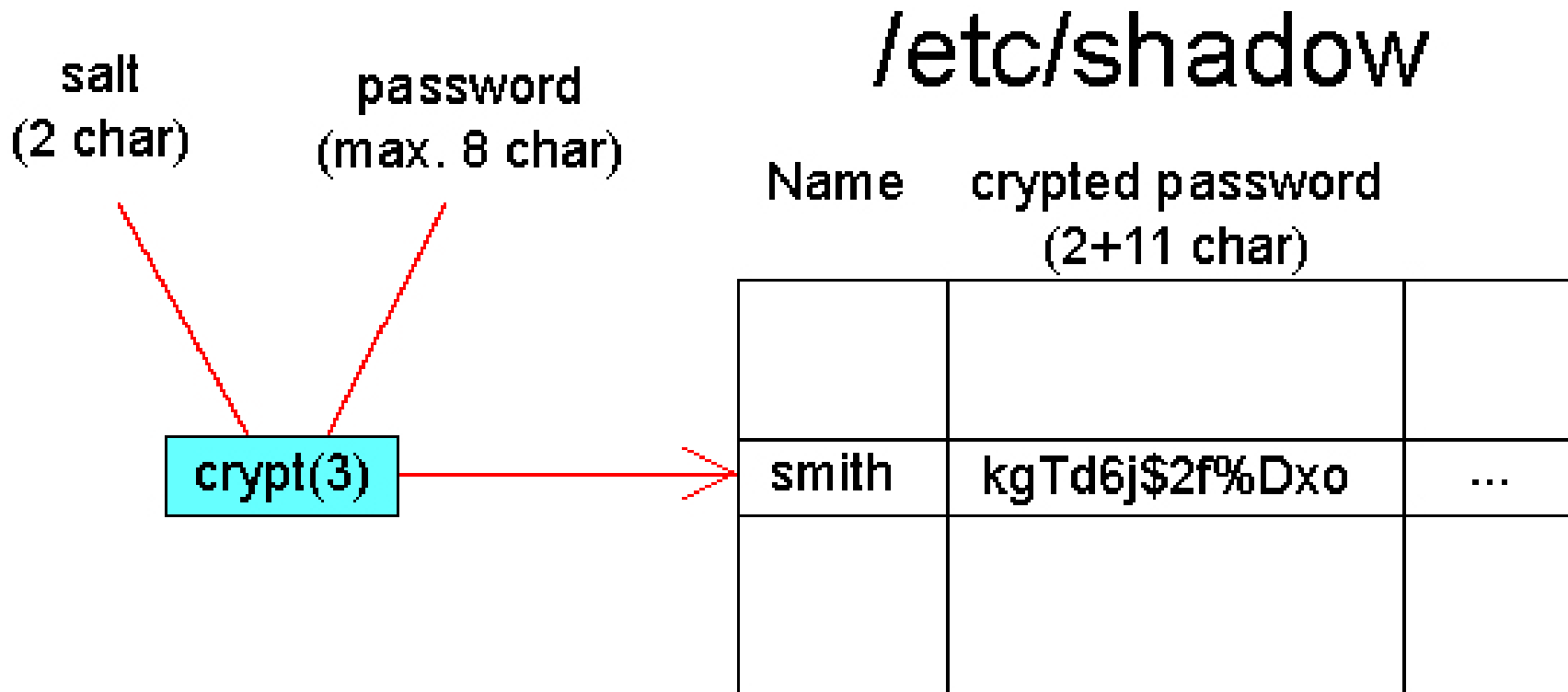


- **User name**
- **User ID (UID)**
 - UID=0 represents root account.
- **Primary group ID (GID)**
 - User belongs to at least one group (primary).
- **List of secondary group ID's (optional)**
 - User can set his secondary to primary group by command `newgrp`.
- **Comment**
 - Description of the user account.
- **Home directory**
 - Working directory is set to home directory after login.
- **Login shell**



- **Encrypted password**

- It can be changed by command `passwd`
- User must know the original password, root needn't
- User must satisfy password policy, root needn't





User account database

- **/etc/nsswitch.conf**
 - Defines where the information about user accounts are saved
- **Local Files**
 - `/etc/passwd`
 - `/etc/shadow`
 - `/etc/group`
- **Central name service**
 - Keeps information about user accounts at one place (not only about user accounts ...)
 - NIS (příkazy `ypcat`, `ypmatch`, ...)
 - NIS+ (příkazy `niscat`, `nisgrep`, ...)
 - LDAP (příkazy `ldaplist`, `ldapsearch`, ...)



User account database

- **File** /etc/passwd

name:x:UID:GID:comment:home_directory:login_shell

- **File** /etc/shadow

name:password:lastchg:min:max:warn:inactive:expire:flag

- **File** /etc/group

group::GID:list_of_users





Login process

- **System asks** for user **name** and **password**
- **System verifies the name and password** in database
- **After successful verification, login shell is started** and
 - **working directory** = home directory of the user account
 - **effective user ID (EUID) = UID**
 - **real user ID (RUID) = UID**
 - **save user ID (SUID) = UID**
 - **effective group ID (EGID) = primary GID**
 - **real group ID (RGID) = primary GID**
 - **save group ID (SGID) = primary GID**
 - **list of secondary group ID's**



Process identity

- **Real process identity (RUID, RGID)**

- It equals to the identity of the user that starts the process (by default)
- Can be printed by commands

```
ps -o ruid,rgid,comm  
pcred PID
```

- **Saved process identity (RUID, RGID)**

- It is equals to real identity (in most cases)
- It can be printed by commands

```
pcred PID
```

- **Effective process identity (EUID, EGID)**

- It is used to **verify the authenticity** of the process
- It is equals to real identity (in most cases)
- It can be changed to real or saved identity
- It can be printed by commands

```
ps -o uid,gid,comm  
pcred PID
```





Modification of process identity

- **Process identity is set by kernel** during process startup or kernel can change it on demand of process.
- **RUID, EUID, SUID** respectively **RGID, EGID, SGID** are the same in most cases and they are **inherited from the parent process**.
- **In some cases**, they are not inherited from parent and can be different:
 - During login (process **login/dtlogin**)
 - By commands **su/newgrp**
 - Execution of binary files with permission **suid** modifies **EUID, SUID**
 - Execution of binary files with permission **guid** modifies **EGID, SGID**



```
su [ - ] [ user_name]
```

- Starts new login shell with new process identity
- With option – new environment is set

```
newgrp secondary_group
```

- Start new shell with group identity=secondary group



Example

```
$ id
```

```
uid=0(root) gid=1(other)
```

```
$ su - trdlicka
```

```
Sun Microsystems Inc.      SunOS 5.10      Generic January 2005
```

```
You have new mail.
```

```
$ id -a
```

```
uid=4365(trdlicka) gid=1002(k336)  
groups=1002(k336),2003(y36uos)
```

```
$ newgrp y36uos
```

```
$ id
```

```
uid=4365(trdlicka) gid=2003(y36uos)
```

```
$ newgrp k336
```

```
$ id
```

```
uid=4365(trdlicka) gid=1002(k336)
```



Access permissions

- **File/directory**
 - Owner-user (**UID**)
 - Owner-group (**GID**)
 - Access permissions **r**ead, **w**rite and **e**xecute for **u**ser, **g**roup and **o**ther.
- These information about file can be printed by command: **ls -l**

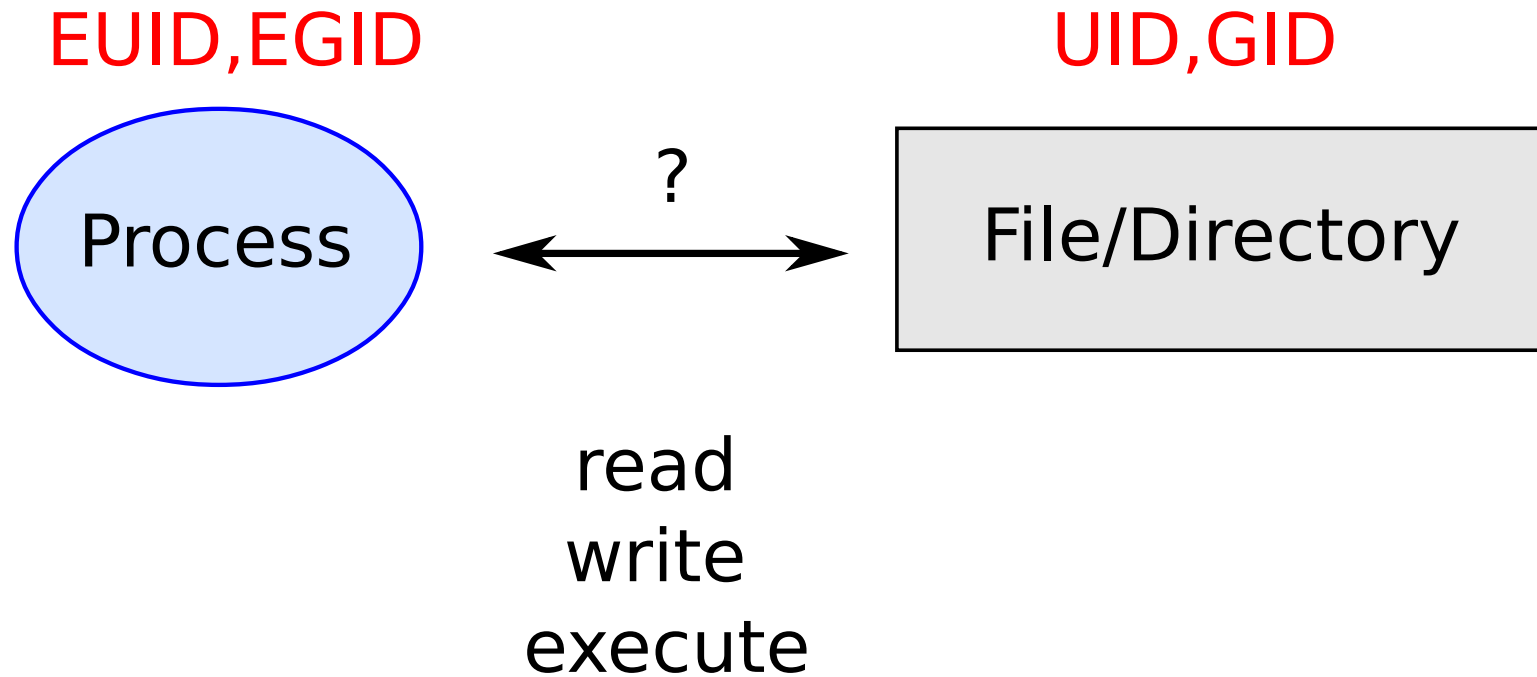
access permissions

user	group	other				
-r-xr-xr-x	1 root	bin	10260	Jan 23	2005	/usr/bin/cat

file type user (UID) group (GID)



Access permissions



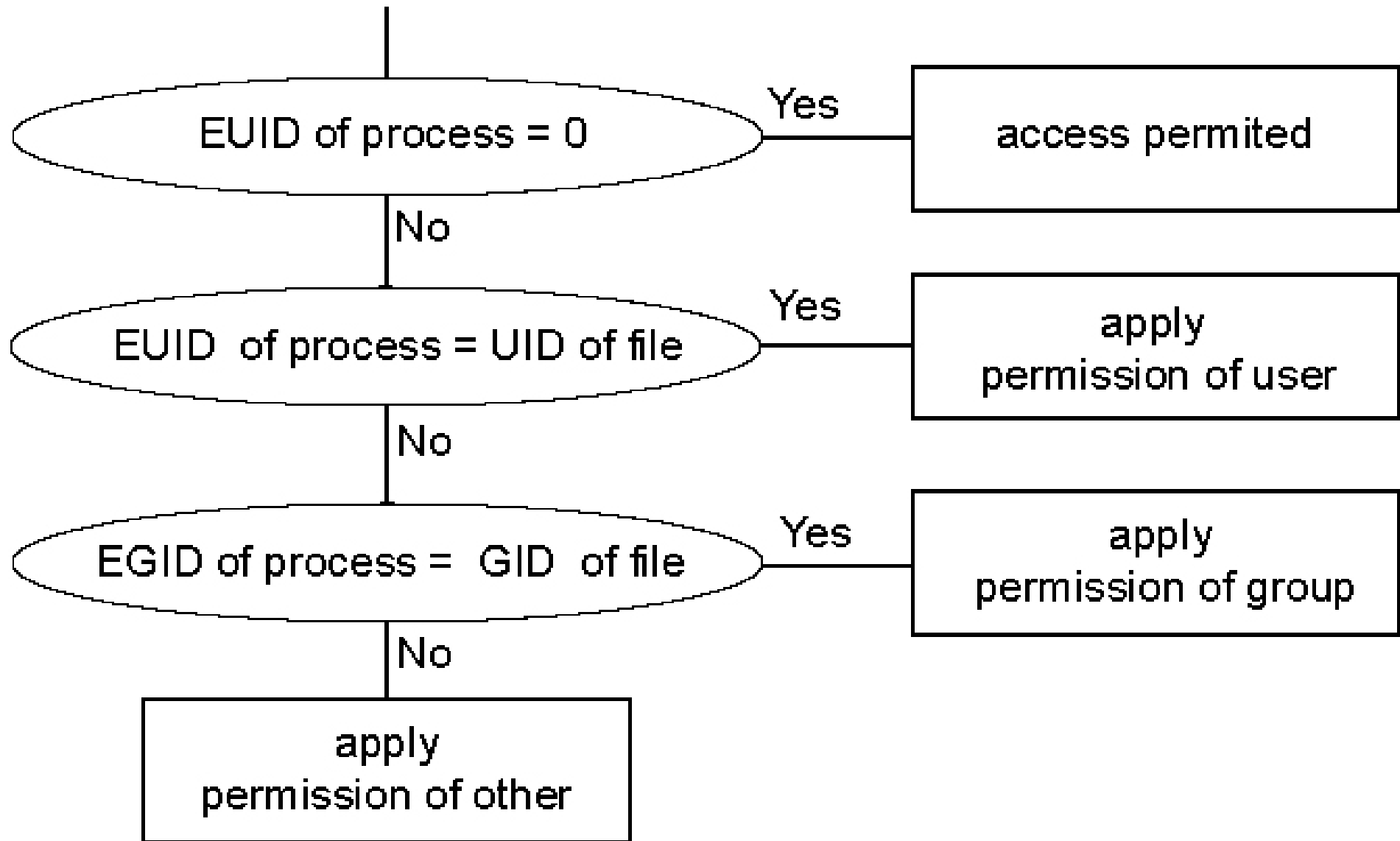


Access permissions

Permissions	File	Directory
r	Read content of file (cat)	List content of directory (ls) without attributes
w	Modify content of file (vi)	Create or remove files/subdirectory (rm)
x	Execute program	set and browse directory (cd)



Access permissions





Access permissions

`chmod [-R] permissions files`

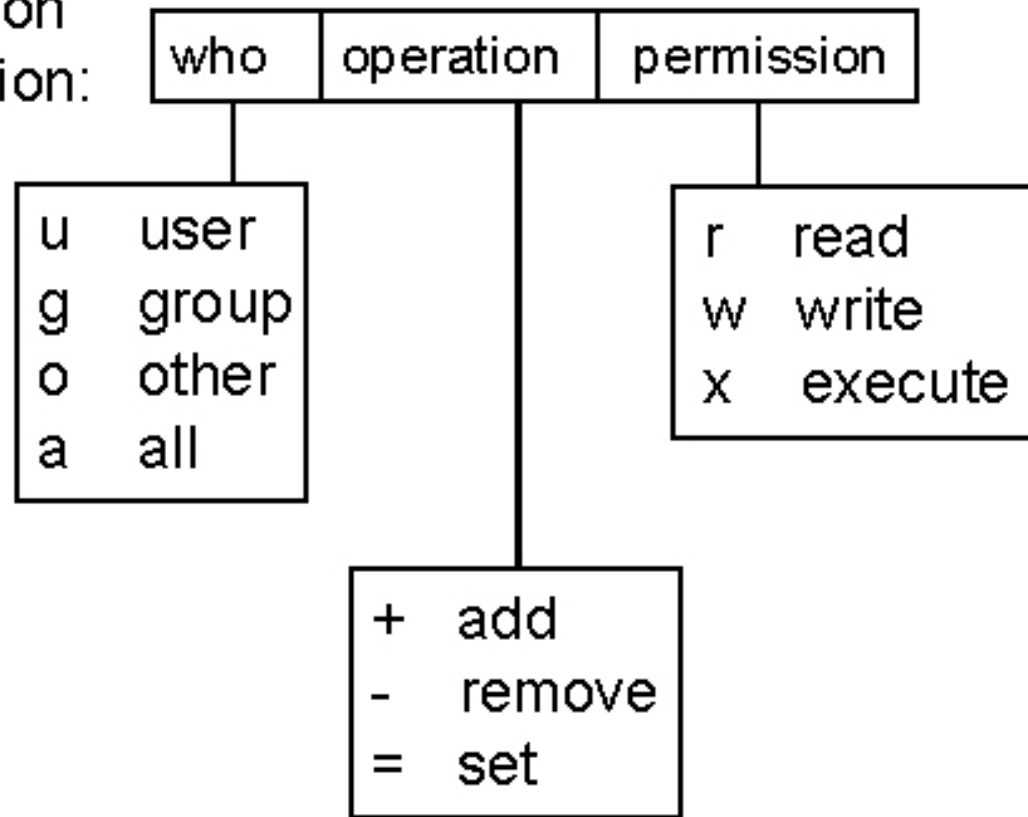
-R Recursively descends through directory arguments

permissions can be defined by symbolic or absolute (octal) mode



Symbolic mode

Permission
specification:



Example:

```
$ ls -l a.txt
```

```
-rw-r--r--  1 trdlicka k336          1105 Oct 23 20:52 a.txt
```

```
$ chmod u+x,g-r,o+w a.txt
```

```
$ ls -l a.txt
```

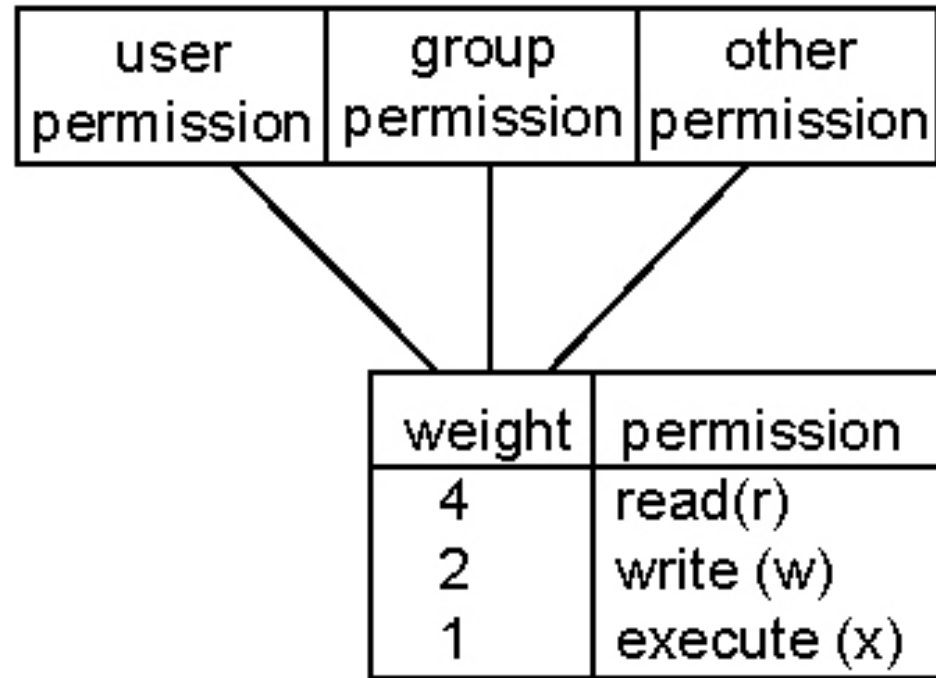
```
-rwx---rw-  1 trdlicka k336          1105 Oct 23 20:52 a.txt
```





Absolute (octal) mode

Permission
specification:



Example:

```
$ ls -l a.txt
```

```
-rw-r--r--  1 trdlicka k336          1105 Oct 23 20:52 a.txt
```

```
$ chmod 706 a.txt
```

```
$ ls -l a.txt
```

```
-rwx---rw-  1 trdlicka k336          1105 Oct 23 20:52 a.txt
```



File mode creation mask

- It defines permissions that are set to a file/directory during its creation.
- It is inherited from parent process.
- It can be printed or modified by command `umask`.
- File permissions = initial permissions \cap file mode creation mask
- **File Initial permissions are 666**
- **Directory initial permissions are 777**

mask	file	directory	note
000	666	777	Initial value, unsafe
022	644	755	Default
027	640	750	More safe
077	600	700	The most safe
066	600	711	Compromise



How to change user/group owner

- **Only root can.**
- By commands

```
chown [-R] user [:group] files
```

```
chgrp [-R] group files
```





Special access permissions

Permissions	Value	File	Directory
suid	4000 u+s	After execution of binary file, the process EUID equals to owner of binary file	No meaning
sgid	2000 g+s	After execution of binary file, the process EGID equals to group of binary file	New files from directory inherit GID of directory, not of GID of process
lock			
sticky sTicky	1000 o+t	No meaning	Anybody can create file/directory in this directory. Only owner can remove them.