Poly-Instantiated Directories and SE Linux

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I prefer an interactive format for my presentations, please ask questions at any time.

- The problem space for non-MLS systems
- MLS requirements
- Linux implementation
- How well the problem is solved

The problem space for non-MLS systems

- Traditionally /tmp and /var/tmp are used for temporary storage by all users and daemons
- Many programs use fixed or predictable file names permitting race-condition attacks (including DOS attacks)
- Sometimes the file name may contain sensitive information, it may be created without the user's knowledge
- Need to solve this without re-writing tens of thousands of programs and re-training millions of users

Specific Attack Scenarios

- Attack by user on user
- Attack by user on daemon
- Attack by non-root daemon on user
- Attack by root daemon on user

Previous attempts

- Restrictions on creating links - OpenWall
- Hiding file names, only works for the case where file names are secret, not for boolea file names

MLS requirements

- Multiple instances of home directory for each sensitivity level
- Multiple instances of shared directories with sensitive file names being the main motivation
- MLS itself solves the confidentiality issues related to reading files and the SE Linux domain-type model solves most integrity issues related to writing and reading files (an mitigates the rest), so sensitive file names is the remaining problem
- There are situations where users who have the same SE Linux role and MLS level need to be prevented from seeing each other's data

Linux implementation

- New systemcall unshare() to create private name-space for filesystems (among other things) - can be called from PAM module to work with unmodified programs
- Directory such as /tmp/.inst/tmp.inst-rjc-rjc is created and bind mounted to /tmp
- /proc/self/mounts shows the filesystems mounted for a process, /proc/mounts links to /proc/self/mounts
- PAM setting

session required pam_namespace.so

- Option unmnt_remnt for su and comparable programs (probably suexec, maybe MTA local delivery)

Shared-subtrees

- Allow autofs and sys-admin mount commands to work

```
mount --make-shared /
mount --bind /tmp /tmp
mount --make-private /tmp
```

- Only works on mount points, bind mount of /tmp needed for /tmp in root FS
- If PI directories are not excluded from the shared name space then things go horribly wrong

How well the problem is solved

- Non-root daemons started via runuser will have PI
- User processes from regular login and cron jobs have PI
- Support for excluding some users from PI, to prevent them from attacking PI users an daemons all directories are under /tmp/.inst which is a mode 000 directory
- Adds significant integrity and confidentiality benefits both with and without SE Linux
- On SE Linux systems there is an option of instantiating based on context, UID, or both

Further Work

- All initial goals met - new design goals after paper was written
- Daemons such as Apache that change UID after being started are not run with PI, need wrapper for this
- Need suexec support, support for local MTA delivery, and possibly other support for system processes acting on behalf of users
- Probably need to make more daemons support PAM session, suexec and postfix/loca are two good possibilities

Q/A

- #selinux on irc.freenode.net
- http://www.nsa.gov/selinux/ Official SE Linux web site
- http://www.coker.com.au/selinux/ My SE Linux web pages

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