

4.7 Running programs in Virtual Terminals

Programs can be started automatically within virtual terminals using two methods. The first is the “XTERM” directive in the container section in the start.config file described in 4.2. That is intended for programs whose results are displayed within the virtual terminal, (see the plc lab for examples). The second method is intended for user authentication and for starting GUI based programs that will use the Linux host Xserver. If a file exists at:

```
$LABTAINER_DIR/labs/[labname]/[container name]/_bin/student_startup.sh
```

it will be executed from each virtual terminal created for the container. See the sql-inject lab and the centos-log lab examples, with the latter running the login program to require students to login prior to getting a shell prompt. ¹¹ Note that on CentOS systems, the student_startup.sh script will be executed twice: first as root and then as the default user. Use constructs such as the following to avoid repeating operations:

```
id | grep root >>/dev/null
result=$?
if [[ $result -eq 0 ]]; then
    # stuff to do as root
else
    # stuff to do as default user
fi
```

4.8 Final lab environment fixup

The initial environment encountered by the student is further refined using the optional _bin/fixlocal.sh script. The framework executes this script the first time a student starts the lab container. For example, this could be used to compile lab-specific programs after they have been parameterized, (as described below in 5). Or this script could perform final configuration adjustments that cannot be easily performed by the Dockerfile. These scripts are per-container and reside at:

```
$LABTAINER_DIR/labs/[labname]/[container name]/_bin/fixlocal.sh
```

Note the fixlocal.sh script runs as the user defined in the start.config for the container, regardless of whether root is set as the user in the Dockerfile. The fixlocal.sh script is primarily intended for parameterizing labs. Other initialization and synchronization between multiple components should be performed as within any Linux system, e.g., via services or rc.local.

¹²

4.9 Persistent storage

Sequences of labs may benefit from a student’s ability to employ tools they have developed within more than one lab. For example, a set of data analysis scripts initially developed for one lab may be a useful starting point when performing a subsequent, more advanced lab. You can provide students with persistent storage by defining the

```
MYSTUFF YES
```

¹¹On CentOS systems, copy the login program from labs/centos-log/centos-log/_system/sbin/login to your container’s _system/sbin directory. The login program from Ubuntu works as is.

¹²Use of `sed -i ...` to modify configuration files (e.g., in etc), might result in overwriting symbolic links. Use `sed -i --follow-symlinks ...` to avoid that pit.