

attribute for a container in the `start.config` file. That will cause the associated container to have a directory at `$HOME/mystuff` which is mapped to the directory at `labtainer-student/mystuff`. All labs that employ the `MYSTUFF` attribute will share the same directory. It is intended that at most one container in any given lab will use this directory. And it is suggested that these directories only be used for labs that anticipate evolving development of tools by the student.

Persistent storage is also provided for purposes of re-using licensed software across different labs. See the use of the `VOLUME` option in 4.2.

## 5 Parameterizing a lab

This section describes how to individualize the lab for each student to discourage sharing of lab solutions. This is achieved by defining symbols within source code or/and data files residing on lab containers.<sup>13</sup> The framework will replace these symbols with randomized values specific to each student. The `config/parameter.config` file identifies the files, and the symbols within those files that are to be modified. A simple example can be found in

```
$LABTAINER_DIR/labs/formatstring/formatstring/config/parameter.config
```

That configuration file causes the string `SECRET2.VALUE` within the file:

```
/home/ubuntu/vul_prog.c
```

to be replaced with a hexadecimal representation of a random value between `0x41` and `0x5a`, inclusive.

This symbolic replacement occurs when the student first starts the lab container, but before the execution of the `_bin/fixlocal.sh` script. Thus, in the `formatstring` lab, the executable program resulting from the `fixlocal.sh` script will be specific to each student (though not necessarily unique).

### 5.1 Parameterization configuration file syntax

Symbolic parameter replacement operations are defined within the `config/parameter.config` file. Each line of that file must start with a `"<parameter_id> : "`, which is any unique string, and is followed by one of the following operations:

**RAND\_REPLACE** : `<filename> : <symbol> : <LowerBound> : <UpperBound>`

Replace a symbol within the named file with a random value within a given range. The random value generator is initialized with the lab instance seed.

where: `<filename>` - the file name (file must exist) where `<symbol>` is to be replaced. The file name is prefixed with a container name and a `:"`, (the container name is optional for single-container labs). This may be a list of files, delimited by semicolons. A file name of `"start.config"` will cause symbols in the lab's `start.config` file to be replaced, e.g., to randomize IP addresses.

`<symbol>` - the string to be replaced

`<LowerBound>` and `<UpperBound>` specifies the lower and upper bound

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<sup>13</sup>An exception is the `start.config` file, which can be parameterized as described in the syntax description.