Open Source MANO

Building operators from the ground up
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Charm development guidelines
Do one thing well
Best practices

1. Use meaningful names (config, actions, endpoints)
2. Follow Python best practices
   a. Write clean code
      i. Formatting: black, flake8
      ii. Meaningful names for vars and functions
      iii. Functions with few/none parameters
      iv. SRP: Single Responsibility Principle
      v. Reuse code; avoid duplication
   b. Test your code: harness
3. Understanding Juju:
   a. Hooks/events: what is expected in each
4. Make the best operator
Understanding hooks/events
Hooks are events generated by the Juju Controller
Hook $\rightarrow$ Code script
```python
def _on_install(self, _):
    subprocess.run(['snap', 'install', 'prometheus'])

def _on_start(self, _):
    subprocess.run(['service', 'snap.prometheus.prometheus', 'start'])
```
Rules writing hooks

1. Hooks are idempotent
2. Hooks are easy to read and understand
3. Where possible, hooks reuse common code
4. Hooks do not return errors… unless there a good reason

Use the Operator Framework
- **install:**
  - When: At the beginning of the life cycle. Once only.
  - Purpose: Install prerequisite software.

- **config-changed:**
  - When: After `install`, `upgrade-charm`, or after configuration changes. At least once after the agent restarts.
  - Purpose:
    - Cannot assume that SW has started
    - Should not start stopped SW
    - Should restart running SW to update the configuration.

- **start:**
  - When: Immediately after the first `config-changed`.
  - Purpose: Should ensure the charm’s software is running

- **stop:**
  - When: Immediately before the end of the unit destruction
  - Purpose:
    - Stop the application
    - Remove any files/configuration created during the application lifecycle
    - Prepare any backup(s)
- **upgrade-charm:**
  - When: Runs immediately after any upgrade operation
  - Purpose: used to reconcile local state written by some other version of the charm into whatever form it needs to take to be manipulated by the current version.

- **update_status:**
  - When: Run by Juju at regular intervals (default=5m)
  - Purpose: Provides constant feedback to the user about the status of the application

- **leader-elected:**
  - When: Run at least once to signify that Juju decided this unit is the leader

- **leader-elected-changed:**
  - When: Run when the leader has set values for other units to respond to
- **[name]-relation-joined:**
  - When: Run only when that remote unit is first observed by the unit.
  - Should not depend on any other relation setting more than the `name` of the joining unit and the remote `private-address` setting. If more information is needed, should wait for the relation-changed hook.

- **[name]-relation-changed:**
  - When: Always run after `-joined` and after the relation data changes.
  - Take into account:
    - The settings in the relation (relation data) are determined by the interface
    - If data is missing, do not raise errors, just wait until the data will eventually be there.

- **[name]-relation-departed:**
  - When: Run once only, when the remote unit is known to be leaving the relation
  - Purpose: Should be used to remove all references to the remote unit

- **[name]-relation-broken:**
  - When: Run after every necessary `-departed` hook has been run
Documentation

- Juju: https://juju.is/docs
- Charms:
  - Charm hooks/events: https://discourse.charmhub.io/t/charm-hooks
  - Operator framework:
    - Github: https://github.com/canonical/operator
    - Api docs: https://ops.readthedocs.io/en/latest/
    - Talk to us: https://discourse.charmhub.io/
- Examples:
  - Kubernetes Charm: https://github.com/charmed-osm/squid-operator
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