MODULE *Configuration*

INSTANCE *Naturals*

INSTANCE *FiniteSets*

LOCAL INSTANCE *TLC*

An empty constant
CONSTANT *Nil*

Status constants
CONSTANTS
InProgress,
Complete,
Failed

The set of all nodes
CONSTANT *Node*

Target is the set of all targets and their possible paths and values.

Example:
```
Target ≜
  [target1 ↦
    [persistent ↦ FALSE, values ↦ [
      path1 ↦ {"value1", "value2"},
      path2 ↦ {"value2", "value3"}]],
  target2 ↦
    [persistent ↦ TRUE, values ↦ [
      path2 ↦ {"value3", "value4"},
      path3 ↦ {"value4", "value5"}]]]
```
CONSTANT *Target*

A record of per-target configurations
VARIABLE *configuration*

A record of target states
VARIABLE *target*

A record of target *masterships*
VARIABLE *mastership*

LOCAL *InitState* ≜
[*configurations* ↦ *configuration*,
targets ↦ *target*,
masterships ↦ *mastership*]

```
LOCAL NextState ≜
   [configurations ↦ configuration′,
    targets        ↦ target′,
    masterships    ↦ mastership′]

LOCAL Trace ≜ INSTANCE Trace WITH
   Module    ← "Configuration",
   InitState ← InitState,
   NextState ← NextState
```

This section models the *Configuration* reconciler.

```
Reconcile(n, t) ≜
   ∧ ∨ ∧ Target[t].persistent
       ∧ configuration[t].state ≠ Complete
       ∧ configuration′ = [configuration EXCEPT ![t].state = Complete]
       ∧ UNCHANGED ⟨target⟩
     ∨ ∧ ¬Target[t].persistent
       ∧ ∨ mastership[t].term > configuration[t].config.term
         ∨ ∧ mastership[t].term = configuration[t].config.term
           ∧ mastership[t].master = Nil
       ∧ configuration′ = [configuration EXCEPT ![t].config.term = mastership[t].term,
                                                ![t].state       = InProgress]
       ∧ UNCHANGED ⟨target⟩
     ∨ ∧ configuration[t].state = InProgress
       ∧ mastership[t].term = configuration[t].config.term
       ∧ mastership[t].master = n
       ∧ target′ = [target EXCEPT ![t] = configuration[t].target.values]
       ∧ configuration′ = [configuration EXCEPT ![t].target.term = mastership[t].term,
                                                ![t].state       = Complete]
   ∧ UNCHANGED ⟨mastership⟩
```

Formal specification, constraints, and theorems.

```
Init ≜
   ∧ configuration = [t ∈ DOMAIN Target ↦
                        [state  ↦ InProgress,
                         config ↦
                           [index  ↦ 0,
                            term   ↦ 0,
                            values ↦
                               [path ∈ {} ↦
                                  [path  ↦ path,
                                   value ↦ Nil,
```

```
                                   index   ↦ 0,
                                   deleted ↦ FALSE]]],
                          proposal ↦ [index ↦ 0],
                          commit   ↦ [index ↦ 0],
                          target   ↦
                            [index  ↦ 0,
                             term   ↦ 0,
                             values ↦
                               [path ∈ {} ↦
                                  [path    ↦ path,
                                   value   ↦ Nil,
                                   index   ↦ 0,
                                   deleted ↦ FALSE]]]]]
   ∧ Trace!Init

Next ≜
   ∨ ∃ n ∈ Node :
        ∃ t ∈ DOMAIN configuration :
          Trace!Step("Reconcile", Reconcile(n, t), [node ↦ n, target ↦ t])
```

* Modification History
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