**X.X Proposal for a “Parallel Step” representation**

At the time of writing, CACAO “Parallel Steps” are meta-steps that can reference a given set of Workflow steps and, consequently, indicate the possibility for an operator/application to run those steps in parallel.

"step--46c1d6e1-874e-4588-b2a4-16d31634372c": {

  "type": "parallel",

  "next\_steps": [

    "step--9afbcb12-8f82-4d35-ba70-f755b83725e1",

    "step--b4161d26-1c8d-4f19-b82f-aad144de4828"

  ],

  "on\_completion": "step--44924d92-58c9-4fcc-9435-6fb651dbbddd"

},

# Alternative

The same suggestion might also be represented by “labeling” a given Workflow step with an extra attribute that implies the possibility of parallelizing the execution of that step with the one the follows.

"step--46c1d6e1-874e-4588-b2a4-16d31634372c": {

  "type": "single",

  "parallelizable": true,

 …

  "on\_completion": "step--44924d92-58c9-4fcc-9435-6fb651dbbddd"

},

***Worflow Step Common Properties***

|  |  |  |  |
| --- | --- | --- | --- |
| **Property Name** | **Rq** | **Data Type** | **Details** |
| **…** |  | … | … |
| **parallelizable** |  | boolean | If true, the execution of the next step referenced either by the **on\_success** or the **on\_completion** attributes **MAY** start without waiting the conclusion of the step.  |

The parallel execution applies until, and including, the first step that does not carry attribute “parallelizable” (or the same attribute is false).

# Motivation

Assuming the absence of scenarios in which the parallel execution of two or more Workflow steps is mandatory, inducing the author of a Playbook to think sequentially and, thus, apply the parallelization label at a later stage might improve overall quality of Playbooks and readability. This approach might also avoid potentially incongruous situations in which the steps referenced within a parallel step carry references (via the “on\_success” or the “on\_completion” attributes) to steps that follow the parallel step itself. Such scenarios could be identified in a Playbook validation phase but will be much rarer (if not impossible) using the alternative representation.

Finally, it is worth noting that the Parallel step seems to be the only workflow step in CACAO that does not bring any key information needed for the correct execution of a Playbook (given the assumption above). This consideration raises a question related to the objectives of CACAO (e.g., what information is important to represent?). Given the heterogeneity of infrastructures in which a CACAO Playbook could be deployed and the numerous conditions to be considered for its actual execution, it might be safer to equip Playbooks only with necessary informative steps rather than including optimizations.

# Example

***Current Version***

  "workflow": {

    "workflow-step-uuid01": {

      "type": "start",

      "name": "Start Traffic Flow Redirect Playbook Example",

      "on\_completion": "workflow-step-uuid02"

    },

    "workflow-step-uuid02": {

      "type": "if-condition",

      "name": "Redirect Traffic Flow",

      "description": "In this step the traffic flow will be redirected if it matches a particular domain",

      "condition": "$$domain == www.test.com",

      "on\_true": [ "workflow-step-uuid03" ],

      "on\_false": [ "workflow-end" ]

    },

    "workflow-step-uuid03": {

      "type": "parallel",

      "name": "Log and Copy",

      "description": "In this step the traffic flow will be logged and redirected",

      "next\_steps": [

        "workflow-step-uuid03.1",

        "workflow-step-uuid03.2"

      ]

      "on\_completion": "workflow-uuid4",

      "on\_failure": "workflow-end"

    },

    "workflow-step-uuid03.1": {

      "type": "single",

      "name": "Log the event",

      "description": "This is a step the traffic flow will  be logged",

      "timeout": "$$method\_timeout",

      "step\_name": "logTrafficFlows",

      "commands" : [

 {

 "type": "http-api",

 "command" : "logTrafficFlows["](https://datastore/getactivethreats)

 [}](https://datastore/getactivethreats)

[],](https://datastore/getactivethreats)

["in\_args" : [ "$$domain", “5mins” ],](https://datastore/getactivethreats)

["out\_args" : null,](https://datastore/getactivethreats)

["target" :](https://datastore/getactivethreats) {

 "type": "http-api",

 "http\_url" : "https://trafficcontroller/logTrafficFlows["](https://datastore/getactivethreats)

 ["http\_auth": // username/password](https://datastore/getactivethreats)

[}](https://datastore/getactivethreats),

      "on\_completion": $$RETURN\_CALLER,

      "on\_failure": "workflow-end"

    },

    "workflow-step-uuid03.2": {

      "type": "single",

      "name": "Log the event",

      "description": "This is a step the traffic flow will  be copied to a new destination",

      "timeout": "$$method\_timeout",

      "step\_name": "copyTrafficFlows",

      "commands" : [

 {

 "type": "http-api",

 "command" : "copyTrafficFlows["](https://datastore/getactivethreats)

 [}](https://datastore/getactivethreats)

[],](https://datastore/getactivethreats)

["in\_args" : [ "$$domain", “$$copy\_to\_ip”, “5mins” ],](https://datastore/getactivethreats)

["out\_args" : null,](https://datastore/getactivethreats)

["target" :](https://datastore/getactivethreats) {

 "type": "http-api",

 "http\_url" : "https://trafficcontroller/copyTrafficFlows["](https://datastore/getactivethreats)

 ["http\_auth": // username/password](https://datastore/getactivethreats)

[}](https://datastore/getactivethreats),

      "on\_completion": $$RETURN\_CALLER,

      "on\_failure": "workflow-end"

  },

  "workflow-end": {

      "type": "single",

      "name": "End",

      "description": "This is a step to end the workflow",

      "action\_id": "action--end"

  }

***Alternative***

  "workflow": {

    "workflow-step-uuid01": {

      "type": "start",

      "name": "Start Traffic Flow Redirect Playbook Example",

      "on\_completion": "workflow-step-uuid02"

    },

    "workflow-step-uuid02": {

      "type": "if-condition",

      "name": "Redirect Traffic Flow",

      "description": "In this step the traffic flow will be redirected if it matches a particular domain",

      "condition": "$$domain == www.test.com",

      "on\_true": [ "workflow-step-uuid03.1" ],

      "on\_false": [ "workflow-end" ]

    },

    "workflow-step-uuid03.1": {

      "type": "single",

      "name": "Log the event",

      "description": "This is a step the traffic flow will  be logged",

 "parallelizable": true,

      "timeout": "$$method\_timeout",

      "step\_name": "logTrafficFlows",

      "commands" : [

 {

 "type": "http-api",

 "command" : "logTrafficFlows["](https://datastore/getactivethreats)

 [}](https://datastore/getactivethreats)

[],](https://datastore/getactivethreats)

["in\_args" : [ "$$domain", “5mins” ],](https://datastore/getactivethreats)

["out\_args" : null,](https://datastore/getactivethreats)

["target" :](https://datastore/getactivethreats) {

 "type": "http-api",

 "http\_url" : "https://trafficcontroller/logTrafficFlows["](https://datastore/getactivethreats)

 ["http\_auth": // username/password](https://datastore/getactivethreats)

[}](https://datastore/getactivethreats),

      "on\_completion": "workflow-step-uuid03.2",

      "on\_failure": "workflow-end"

    },

    "workflow-step-uuid03.2": {

      "type": "single",

      "name": "Log the event",

      "description": "This is a step the traffic flow will  be copied to a new destination",

      "timeout": "$$method\_timeout",

      "step\_name": "copyTrafficFlows",

      "commands" : [

 {

 "type": "http-api",

 "command" : "copyTrafficFlows["](https://datastore/getactivethreats)

 [}](https://datastore/getactivethreats)

[],](https://datastore/getactivethreats)

["in\_args" : [ "$$domain", “$$copy\_to\_ip”, “5mins” ],](https://datastore/getactivethreats)

["out\_args" : null,](https://datastore/getactivethreats)

["target" :](https://datastore/getactivethreats) {

 "type": "http-api",

 "http\_url" : "https://trafficcontroller/copyTrafficFlows["](https://datastore/getactivethreats)

 ["http\_auth": // username/password](https://datastore/getactivethreats)

[}](https://datastore/getactivethreats),

      "on\_completion": "workflow-uuid4",

      "on\_failure": "workflow-end"

  },

  "workflow-end": {

      "type": "single",

      "name": "End",

      "description": "This is a step to end the workflow",

      "action\_id": "action--end"

  }