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| CHANGE REQUEST |
| Meeting ID:\* | SDS #43 |
| Source:\* | Convida Wireless |
| Date:\* | 2019-12-05 |
| Contact:\* | Dale Seed, Convida, Seed.Dale@convidawireles.comLu Liu, Convida, Liu.Lu@convidawireless.comCatalina Mladin, Convida, Mladin.Catalina@convidawireles.com |
| Reason for Change/s:\* | Provides potential solution affecting process management for action triggering. |
| CR against: Release\* | Release 4 |
| CR against: WI\* | [x]  Active <WI-0093> [ ]  MNT / < Work Item number(optional)>Is this a companion CR? Yes [ ]  No [ ] Companion CR number: (Note to Rapporteur - use latest agreed revision)Is this a mirror CR? Yes [ ]  No [ ] Mirror CR number: (Note to Rapporteur - use latest agreed revision)[ ]  STE Small Technical Enhancements / < Work Item number (optional)>Only ONE of the above shall be ticked |
| CR against: TS/TR\* | TR-0060 V 0.0.1 |
| Clauses/Sub Clauses \* | Clause 7 |
| Type of change: \* | [ ]  Editorial change[ ]  Bug Fix or Correction[ ]  Change to existing feature or functionality[x]  New feature or functionalityOnly ONE of the above shall be ticked |
| Impacted other TS/TR(s) | N/A |
| Post Freeze checking:\* | This CR contains only essential changes and corrections? YES [x]  NO [ ] This CR may break backwards compatibility with the last approved version of the TS? YES [ ]  NO [x]  |
| Template Version: January 2017 (Do not modify) |

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GUIDELINES for Change Requests:

Provide an informative introduction containing the problem(s) being solved, and a summary list of proposals.

Each CR should contain changes related to only one particular issue/problem.

In case of a correction, and the change apply to previous releases, a separate “mirror CR” should be posted at the same time of this CR

Mirror CR: applies only when the text, including clause numbering are exactly the same.

Companion CR: applies when the change means the same but the baselines differ in some way (e.g. clause number).

Follow the principle of completeness, where all changes related to the issue or problem within a deliverable are simultaneously proposed to be made E.g. A change impacting 5 tables should not only include a proposal to change only 3 tables. Includes any changes to references, definitions, and acronyms in the same deliverable.

Follow the drafting rules.

All pictures must be editable.

Check spelling and grammar to the extent practicable.

Use Change bars for modifications.

The change should include the current and surrounding clauses to clearly show where a change is located and to provide technical context of the proposed change. Additions of complete clauses need not show surrounding clauses as long as the proposed clause number clearly shows where the new clause is proposed to be located.

Multiple changes in a single CR shall be clearly separated by horizontal lines with embedded text such as, start of change 1, end of change 1, start of new clause, end of new clause.

When subsequent changes are made to content of a CR, then the accepted version should not show changes over changes. The accepted version of the CR should only show changes relative to the baseline approved text.

## Introduction

The following introduces the procedures for state and process management based on the resources introduced in SDS-2019-0222R01.

R01 –

During review we discussed the need to clearly describe the values of various states or conditions after manual (or automatic) process state changes (active, enable, pause, etc)

R02 – clarified the descriptions of the new resources and procedures.

R03 – clarified the descriptions of the new resources and procedures.

R04 – added figures to describe the relationship between resources.

1.

### -----------------------Start of change 1-------------------------------------------

# Candidate Solutions

## Solution 1: State and Sequencing for Action Triggering

### 7.2.1 New Resource Type: *<state>*

An IoT process usually consists of multiple stages or states, and the transitions among the states are driven by various events and the corresponding actions. The *<state>* resource is proposed to store the information about the IoT process, and to monitor the status of the IoT process and define the actions and transitions in this IoT process.



Figure 7.2.1-1: Resource structure of <*state*>**Table 7.2.1-1: Attributes of *<state>* resource**

| **Attributes of *<state>*** | **Multiplicity** | **RW/****RO/****WO** | **Description** |
| --- | --- | --- | --- |
| *currentStatus* | 1 | RO | The indicator of whether this state is currently active. This attribute may take values from “active” or “inactive”. |
| *stateActions* | 0..1 (L) | RW | The link(s) to the <*action*> resource(s) that may be performed in this state. The actions include both the ones that will be performed unconditionally when entering this state, and the ones that may be triggered by certain events/conditions within this state. |
| *stateTransitions* | 0..1 (L) | RW | The possible transition(s) that may happen from the current state. Each transition is defined as a tuple [transition criteria, next state]:Transition criteria: the event or condition that may trigger state transition; the transition criteria could be defined in a similar way as evalCriteria.Next state: the *resourceID* of the next <state> resource to transition to.If this state is the last state in the process, this attribute will be empty.  |

Once an IoT process transitions to a given state, the value of the *currentStatus* attribute of the given <*state*> resource will be changed to “active”. Then, for all the <*action*> resources that are linked through the *stateActions* attribute, their *evalMode* attributes will be changed from “off” to “once”. For an unconditional action, the Hosting CSE will perform the action immediately. For a conditional action, the Hosting CSE will monitor the *evalCriteria* attribute of each <*action*> resource to determine if/when the action will be performed. In addition, the Hosting CSE will start to monitor the transition criteria defined in the *stateTransitions* attribute of the <*state*> resource. If/when any of the events/conditions defined in the *stateTransitions* are met, the Hosting CSE will trigger a state transition. When performing a state transition, the *currentStatus* attribute of the current <*state*> resource will be changed to “inactive” and all the *evalMode* attributes of the <*action*> resources referenced by the current <*state*> resource will be changed back to “off”. The Hosting CSE will then transition to the next state as indicated by the resource identifier of the next state’s <*state*> resource defined in the *stateTransitions* attribute of the current state’s <*state*> resource.

### 7.2.2 New Resource Type: <*processManagement>*

The *<processManagement>* resource is proposed to store the information of the entire process consisting of multiple states.



Figure 7.2.2-1: Resource structure of <*processManagement*>**Table 7.2.2-1: Child Resources of Proposed oneM2M <*processManagement*> Resource**

| **Child Resources of *<processManagement>*** | **Child Resource Type** | **Multiplicity** | **Description** |
| --- | --- | --- | --- |
| *[variable]* | *<state>* | 0..n | This resource describes the details of a particular state of an IoT process. |
| *[variable]* | *<subscription>* | 0..n | See clause 9.6.8 in [x]. |

**Table 7.2.2-2: Attributes of *<processManagement>* resource**

| **Attributes of *<processManagement>*** | **Multiplicity** | **RW/****RO/****WO** | **Description** |
| --- | --- | --- | --- |
| *processStatus* | 1 | RO | The status for the entire IoT process. The supported values for this attribute are:Disabled: The IoT process is disabled. Enabled: The IoT process is enabled, and the Hosting CSE will monitor the event/condition defined in the *preconditions* attribute. If the Hosting CSE detects that the *preconditions* are met, the Hosting CSE will update the *processStatus* attribute to “Active”. Active: The IoT process is active (“running”).Paused: The IoT process is paused and will remain in the current state until “Active” again or the *exitConditions* are met. .Ended: The IoT process has entered the final state or exited through *exitConditions*.When the *processStatus* is “Enabled”, “Paused” or “Ended”, the Hosting shall allow child <*state*> resources to be added, modified of deleted from the process. Otherwise, the Hosting CSE will reject requests to add, modify or delete <state> resources from the process. |
| *processControl* | 1 | RW | This attribute is used to control and set the status of the process. The supported values for the attribute are:Enable: The Hosting CSE will update *processStatus* to “Enabled”.Disable: The Hosting CSE will update *processStatus* to “Disabled”.Activate: The Hosting CSE will update *processStatus* to “Active”.Pause: The Hosting CSE will update *processStatus* to “Paused”. End: The Hosting CSE will update *processStatus* to “Ended”.The <*processManagement*> resource shall be created with this attribute set to “Disable”. |
| *currentState* | 1 | RO | The *resourceID* of the child <*state*> resource that has *currentStatus* set to active. If the *processStatus* is not “Active”, the value of this attribute will be empty. |
| *preconditions* | 0..1 (L) | RW | This attribute specifies any conditions that must be met for the process to begin. This attribute could be defined in a similar way as evalCriteria. It can be used to trigger the start of the IoT process. When the conditions are met, the Hosting CSE will update *processStatus* to “Active”, and the Hosting CSE will set *currentState* to the value defined in *initialState*. The Hosting CSE will also change the *currentStatus* of the <*state*> resource indicated by *initialState* to “Active”. |
| *exitConditions* | 0..1 (L) | RW | This attribute specifies what events can end the IoT process. This attribute could be defined in a similar way as evalCriteria. It allows for an asynchronous exit of the process from any state. When the exit conditions are detected by the Hosting CSE, the Hosting CSE will set *processStatus* to “Ended” and set the status of all child <*state*> resources to “inactive”. |
| *initialState* | 1 | RW | The *resourceID* of the first <*state*> resource of the process. |
| *finalState* | 0..1 | RW | The *resourceID* of the last <*state*> resource in the process. If the process is a loop, this attribute is empty. Before the Hosting CSE updates the *currentState* attribute, it checks to see if the current value of *currentState* matches the value of *finalState*. If so the Hosting CSE updates *processStatus* to “Ended”.  |

### 7.2.3 State and Process Management

7.2.3.1 Introduction

This clause describes the procedure for managing oneM2M state and process in action triggering via the <*state*> and <*processManagement*> resources.

7.2.3.2 Process Management Procedure

This clause describes the procedure a Hosting CSE performs to manage an IoT process.

**Step 1:** An AEcreates a <*processManagement*> resource.

**Step 2:** An AEcreates all the <*action*> resources that are involved in the IoT process and state transitions.

**Step 3:** An AEcreates all the <*state*> resources that are involved in the IoT process as child resources of <*processManagement*>.

**Step 4:** An AEenables the <*processManagement*> by updating the value of *processControl* to “Enable”. The Hosting CSE will update the value of *processStatus* to “Enabled”. The Hosting CSE will start to monitor the event/condition defined in *preconditions* and *exitConditions*.

**Step 5:** If/when the event/condition defined in *preconditions* is detected, the Hosting CSE sets the *processStatus* to “Active”. If *preconditions* is empty, the process can be manually activated by setting the value of *processControl* to “Activate” and the Hosting CSE will set the *processStatus* to “Active”. The Hosting CSE sets the *currentState* to the value in *initialState*.

**Step 6:** Starting from the *initialState*, whenever a transition happens, the *currentState* attribute is updated to the *resourceID* of the next <*state*> by the Hosting CSE. The <*state*> resource corresponding to the current state and cannot be modified, only RETRIEVE operation is allowed.

**Step 7:** If an AE updates *processControl* to “Pause” the Hosting CSE will change the *processStatus* to “Paused”. The paused IoT process will not transition to another state until *processControl* is updated to “Activate” or the *exitConditions* are met.

**Step 8:** If an AE updates *processControl* to “Disable” the Hosting CSE will change *processStatus* to “Disabled”. The Hosting CSE will set the *currentStatus* of all child <state> resources to “inactive”.

**Step 9:** If/when the event/condition defined in *exitConditions* is detected, the Hosting CSE will set *processStatus* to “Ended”. The Hosting CSE will set the *currentStatus* of all child <*state*> resources to “inactive”. The Hosting CSE will set *currentState* to empty.

**Step 10:** If the *currentState*  transitions to the value of *finalState*, the *processStatus* will be set to “Ended” by the Hosting CSE. The Hosting CSE will set the *currentStatus* of all child <*state*> resources to “inactive”. The Hosting CSE will set *currentState* to empty.

7.2.3.3 State Transition Procedure

This clause describes the procedure a Hosting CSE performs to manage an IoT process that has been “Enabled”.

**Step 1:** <*state*> resources are created as child resources of the <*processManagement*> resource.

**Step 2:** The IoT process enters a new state, e.g. after a state transition, or a process is initialized when the pre-conditions are met.

**Step 3:** The Hosting CSE sets the value of the *currentStatus* attribute of the <*state*> indicated in *currentState* to “active”.

**Step 4:** When a <*state*> is activated the Hosting CSE shall monitor the *stateActions.* The Hosting CSE shall set the *evalMode* attribute of all the <*actions*> indicated in *stateActions* attribute to “once”.

For an <action> that has *evalCriteria* attribute that is empty (an unconditional action) it will be performed immediately.

For a conditional action, the Hosting CSE will check the *evalCriteria* attribute of the <*action*> to determine whether the action will be triggered or not.

**Step 5:** The Hosting CSE will start to monitor the conditions specified in *stateTransitions*.

**Step 6:** If one of the events or conditions defined in *stateTransitions* is detected by the Hosting CSE, the Hosting CSE shall update the *currentState* of the <*processManagement*>.

**Step 7:** If/when the value of the *currentStatus* attribute is set to “inactive” by the Hosting CSE.

**Step 8:** For all the state specific <*actions*> that are linked through the *stateActions* attribute, their *evalMode* attributes are changed to “off” by the Hosting CSE.

**Step 9:** The Hosting CSE transitions to the next state as indicated by the next state ID.

-----------------------End of change 1 -------------------------------------------

CHECK LIST

* Does this Change Request include an informative introduction containing the problem(s) being solved, and a summary list of proposals.?
* Does this CR contain changes related to only one particular issue/problem?
* Have any mirror CRs been posted?
* Does this Change Request make **all** the changes necessary to address the issue or problem? E.g. A change impacting 5 tables should not include a proposal to change only 3 tables?Does this Change Request follow the drafting rules?
* Are all pictures editable?
* Have you checked the spelling and grammar?
* Have you used change bars for all modifications?
* Does the change include the current and surrounding clauses to clearly show where a change is located and to provide technical context of the proposed change? (Additions of complete clauses need not show surrounding clauses as long as the proposed clause number clearly shows where the new clause is proposed to be located.)
* Are multiple changes in this CR clearly separated by horizontal lines with embedded text such as, start of change 1, end of change 1, start of new clause, end of new clause.?