

Towards Activity-Centric Access Control for Smart Collaborative Ecosystems

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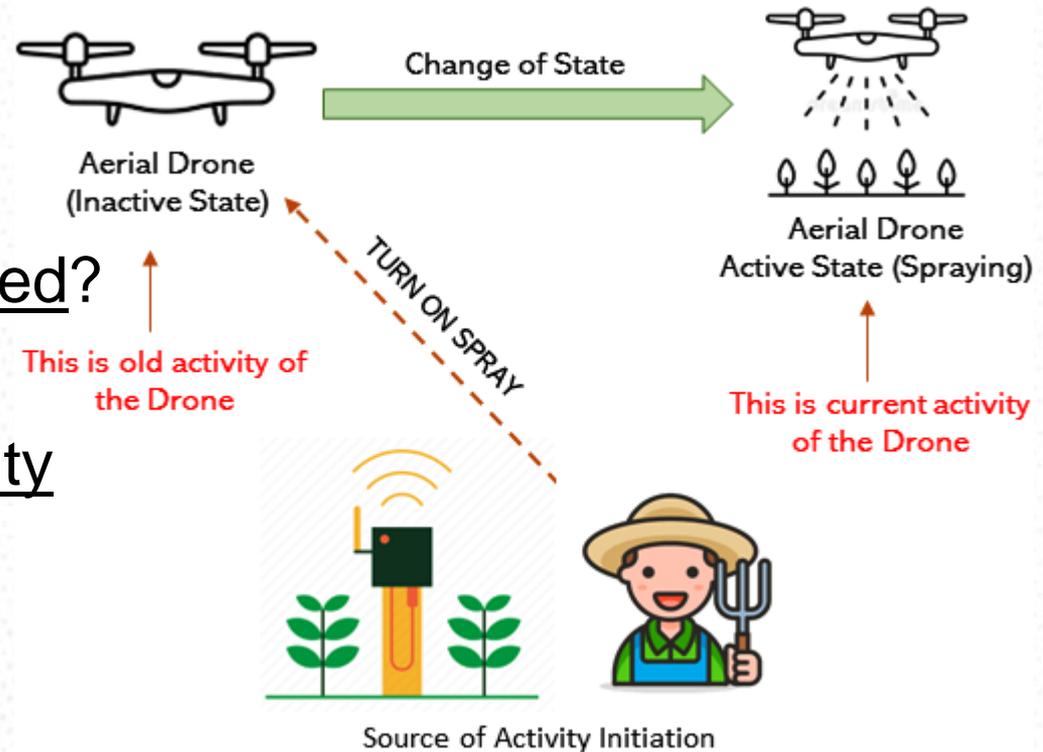
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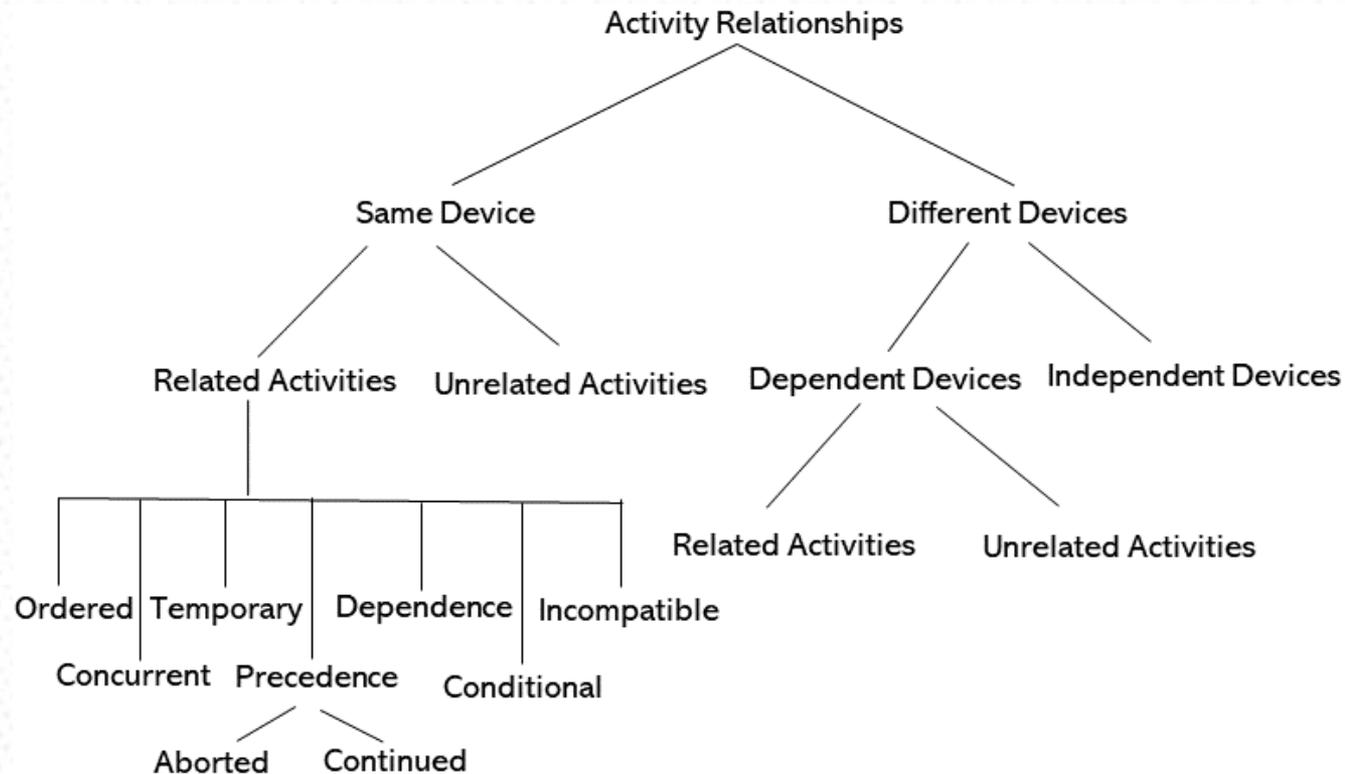
The Notion of Activity.

- What is an Activity?
- What are the entities involved in an activity?
- How an activity is initiated?
- Associated conditions, obligations and mutability

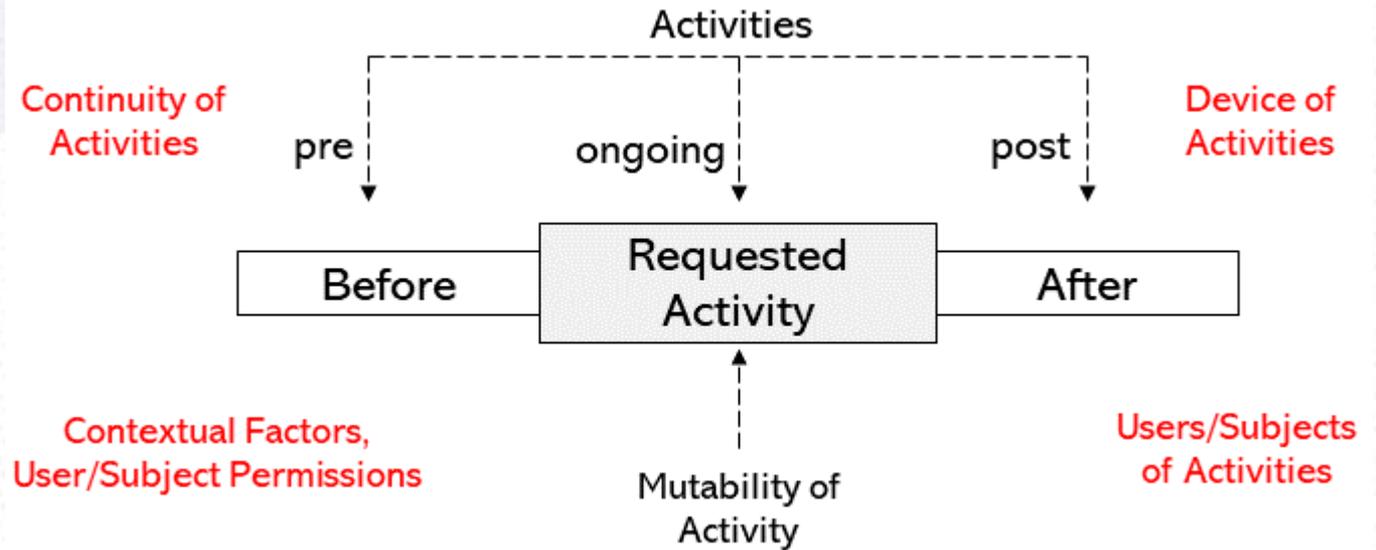


Activity Relation Characterization

- Ordered
- Concurrent
- Temporary
- Precedence
- Dependence
- Conditional
- Incompatible



Factors Impacting Activity Decision



Key Questions:

- Where is the activity allowed to perform?
- Who is allowed to perform the activity?
- When is the activity allowed?
- How many times an activity can be performed?
- Can an activity be performed when other activity is in place?
- Several unexplored questions..



Activity Control Expression

- Generalized structure and representation of expression
- No attempt to propose a formal language

Object: **ObjectX**

$\langle (\text{op}, \text{sourceX}, \text{activityX}),$

$(\text{pre_conditions}),$

$(\text{current_conditions}),$

$(\text{resulting_conditions}),$

$(\text{contextual_conditions}) \rangle$ where

pre_conditions , $\text{current_conditions}$ and $\text{resulting_conditions}$ can

be expressed as $\langle (\text{pre_state}, \text{objA}, \text{sourceY}), \dots \rangle$,

$\langle (\text{cur_state}, \text{objB}, \text{sourceZ}), \dots \rangle$, and as

$\langle (\text{new_state}, \text{objC}, \text{sourceX}), \dots \rangle$ respectively.



Example Expressions

Activity Control Policies in Smart Farming

Activity Example 1: A soil moisture sensor can issue operation **TURN ON** to a water sprinkler and change its state to active (i.e. water sprinkler is running), only if the water sprinkler is currently in an inactive state which was changed by farm-manager (this is a pre-condition).

Object: **Water Sprinkler**

⟨ (TURN-ON, moisture sensor, Spraying),
(cur_inactive, Water Sprinkler, farm-manager) ⟩.

Activity Example 3: Thermal imaging is activated on the Aerial Drone by autonomous tractor only after the drone is done with the spray which was initiated by weed detector, and as a consequence of the start of the new activity (i.e Thermal-imaging) the spraying should be stopped.

Object: **Aerial Drone**

⟨ (IMAGING-ON, autonomous tractor, Thermal imaging),
(cur_spraying, Aerial Drone, weed detector),
(new_inactive-spraying, Aerial Drone, autonomous tractor) ⟩.



Example Expressions

Activity Control Policies in Smart Manufacturing

Activity Example 6: Air Conditioner cooling in the pharmaceutical facility cannot be turned on by the thermostat if the moisture sensor is inactive, and the current temperature is greater than 75.

Object: Air Conditioner

⟨ (TURN-ON, thermostat, Cooling),
(cur_active, moisture sensor, ANY),
(value(temperature) > 75)⟩.

Activity Example 7: Oil pumping by the smart valve can be activated only after hydrotreating is performed by the hydrotreater unit by worker. After oil pumping, outlet valve should remain closed.

Object: Tank Pump

⟨ (TURN-ON, valve, pumping),
(pre_hydrotreating, hydrotreater-unit, worker),
(post_closed, outlet valve, ANY) ⟩.

Activity Example 8: Robotic Arm must be inactivated when production belt accelerometer is vibrating.

Object: Robotic Arm

⟨ (Inactive, ANY, Inactive),
(cur_vibrating, production belt, ANY) ⟩.



Research Questions

- Operational Model and Extensions
- Enforcement Architectures
- Policy Language and Constraints
- Administrative Models
- Convergence with existing models
- AI and data driven deployment
- Safety Analysis



Thank You..!!

Questions, Comments or Concerns

