Declarative Goal Mediation in Smart Environments

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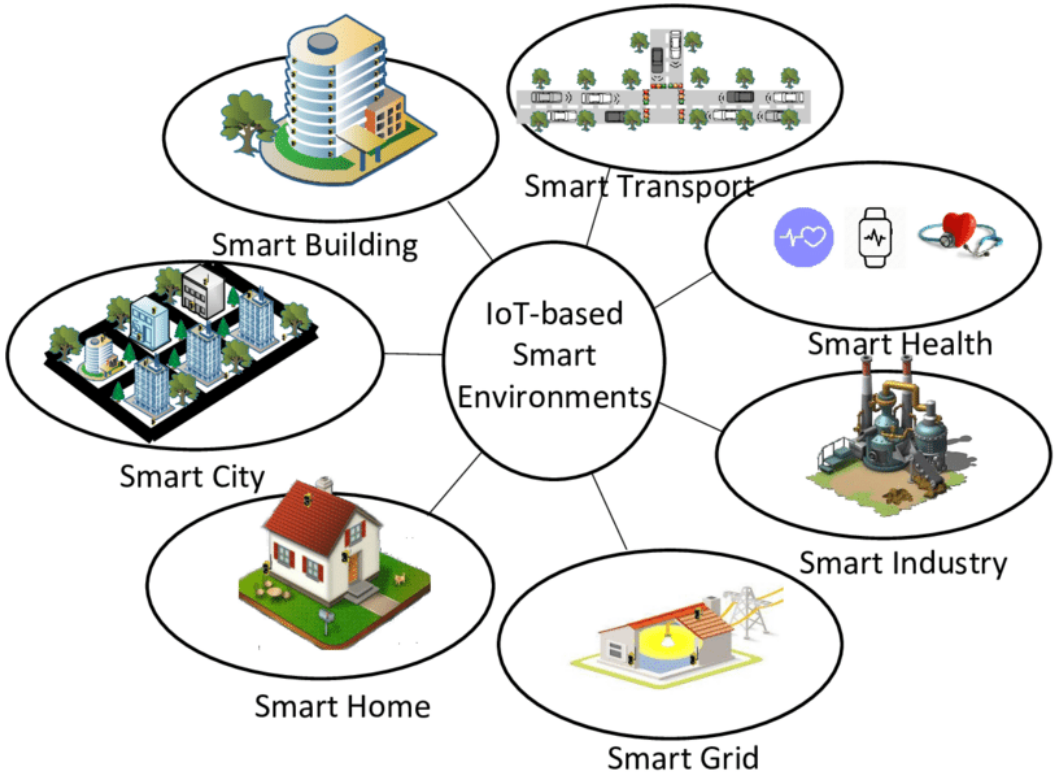
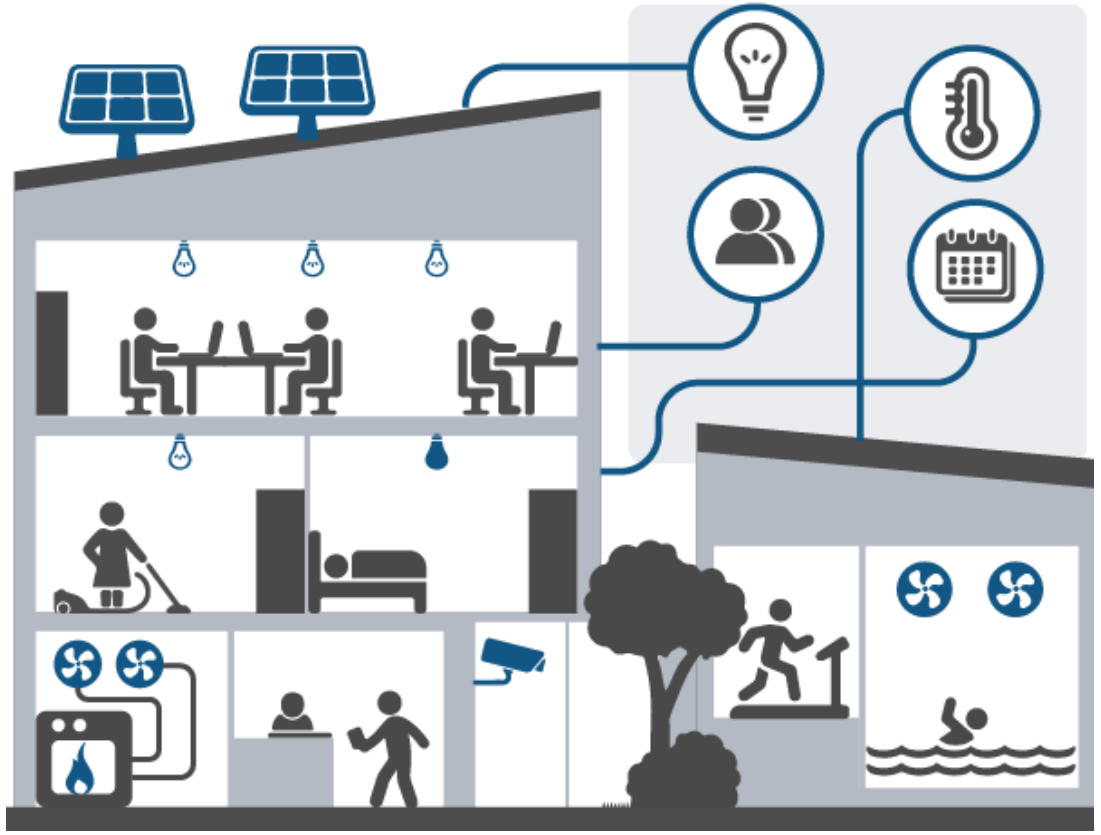
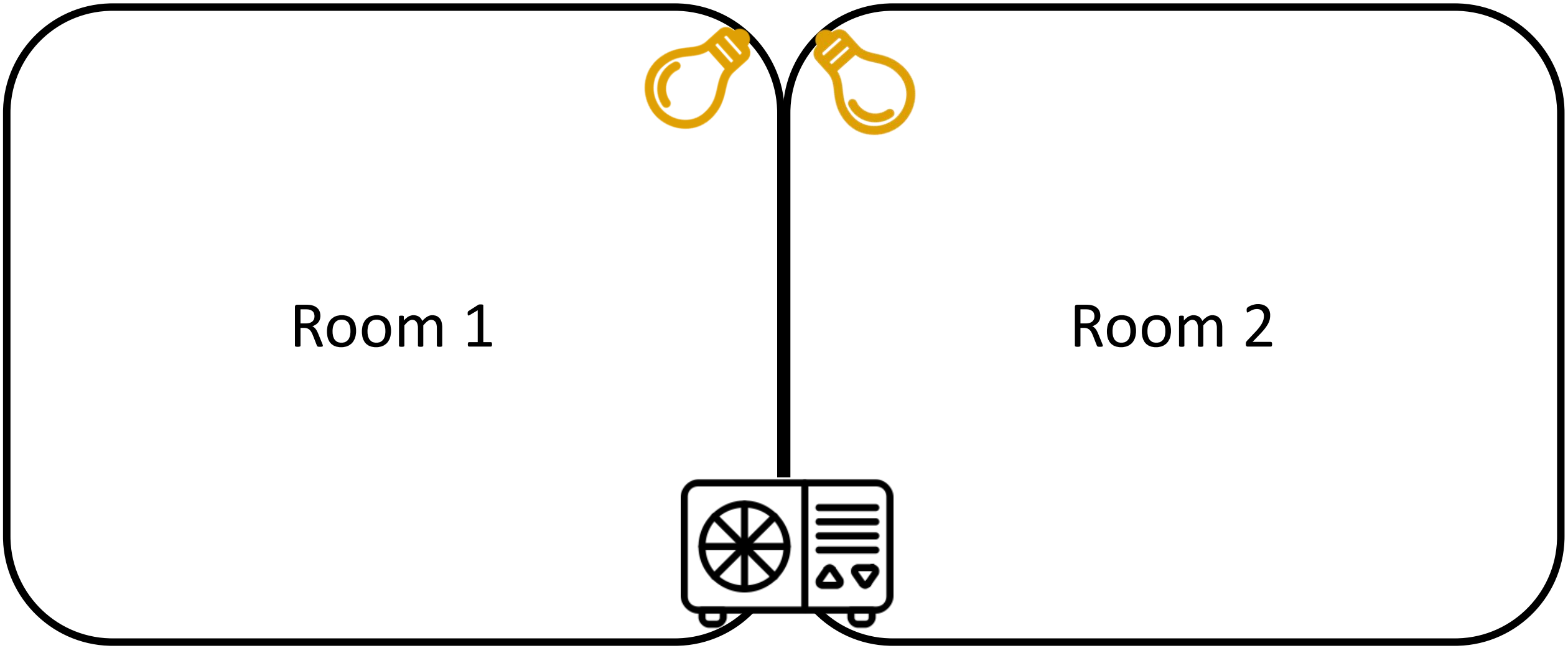
7th IEEE International Conference on Smart Computing (WiP track), 23-27 August 2021

Smart Environments





Motivating Scenario



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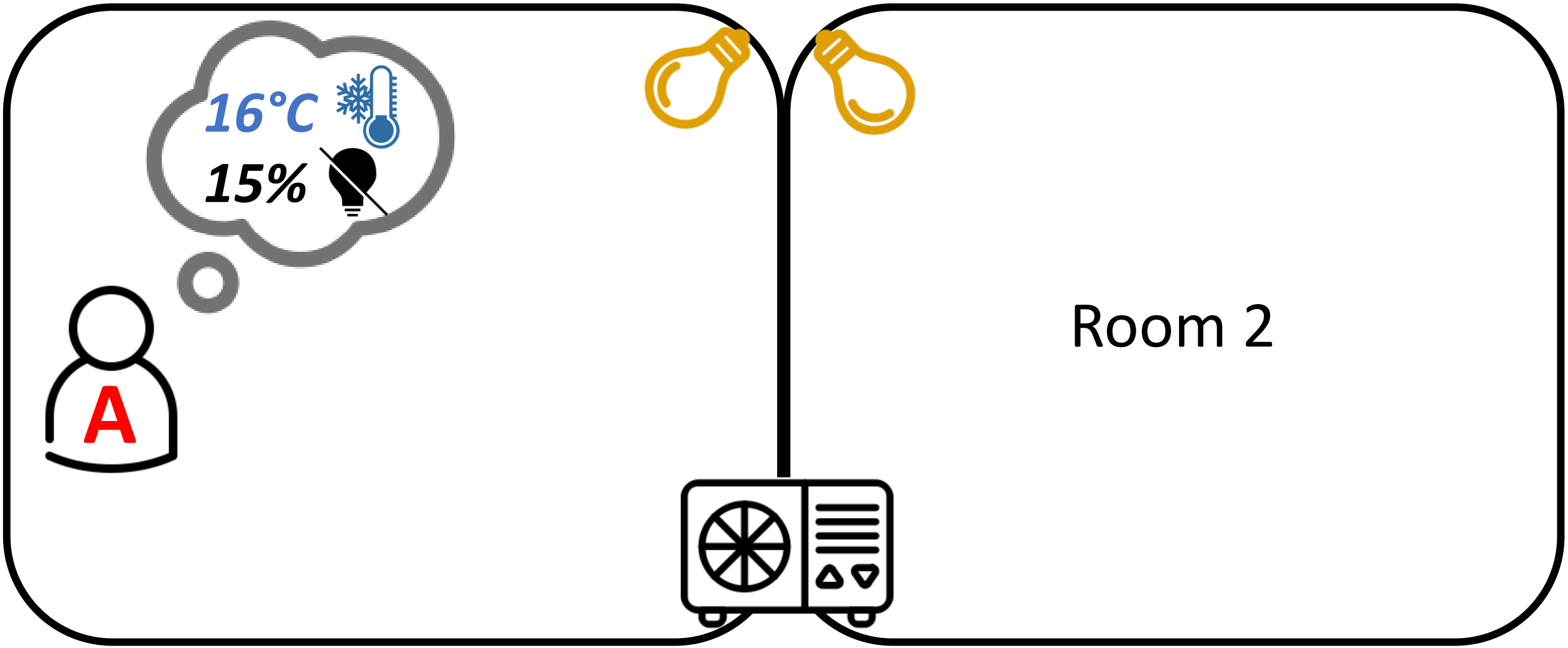

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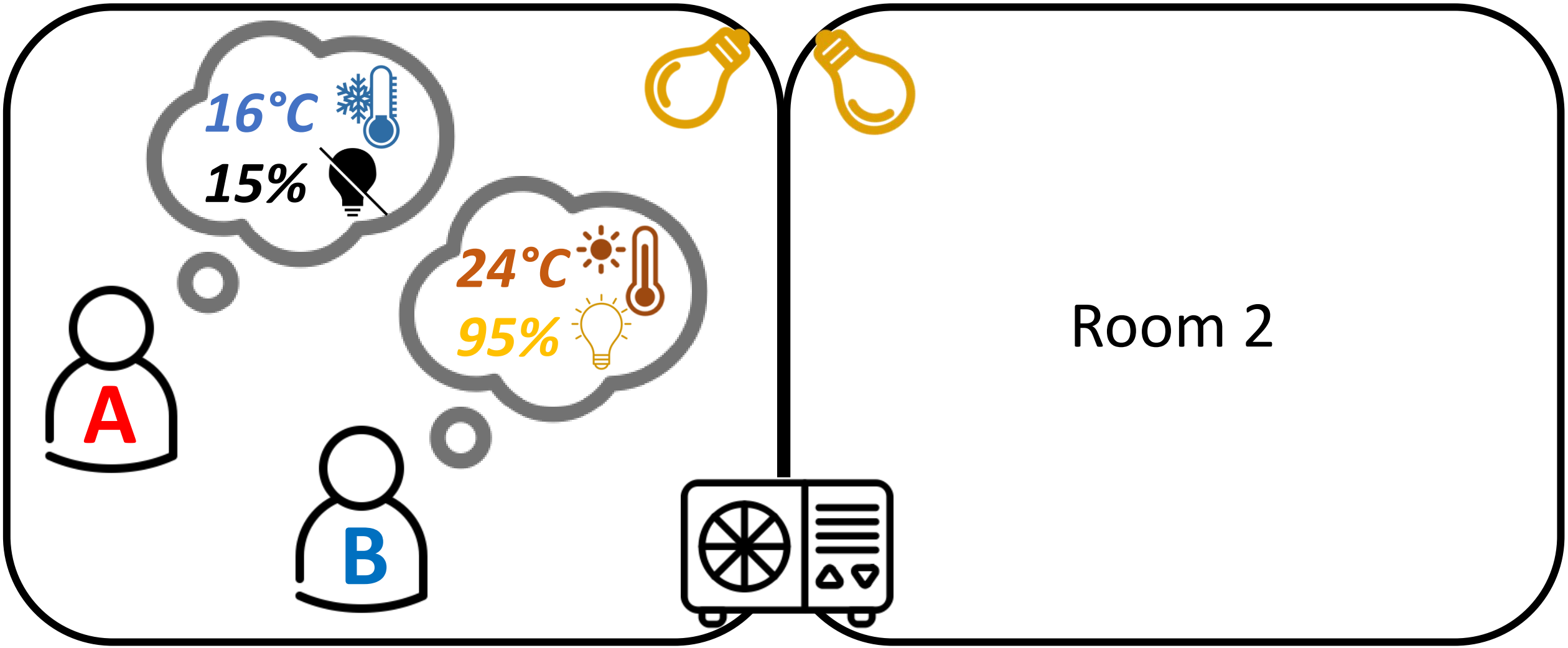

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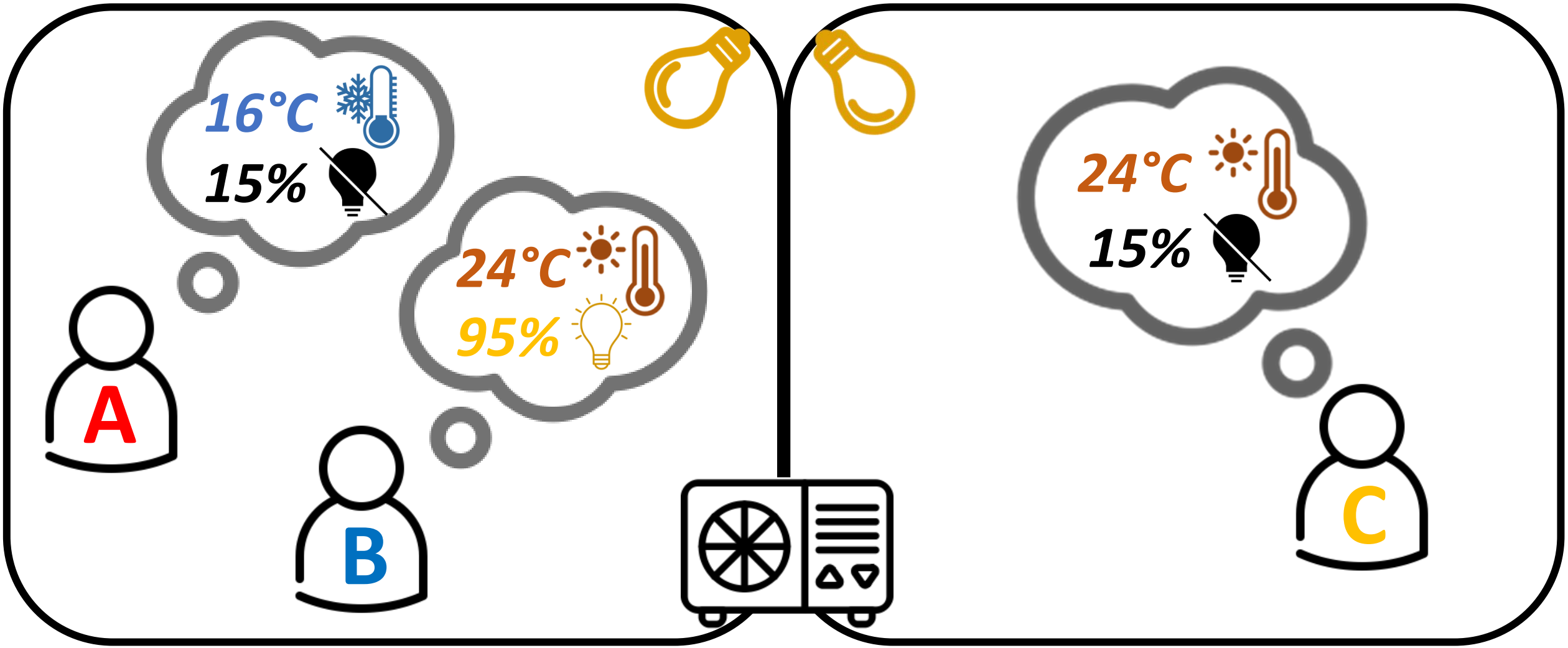

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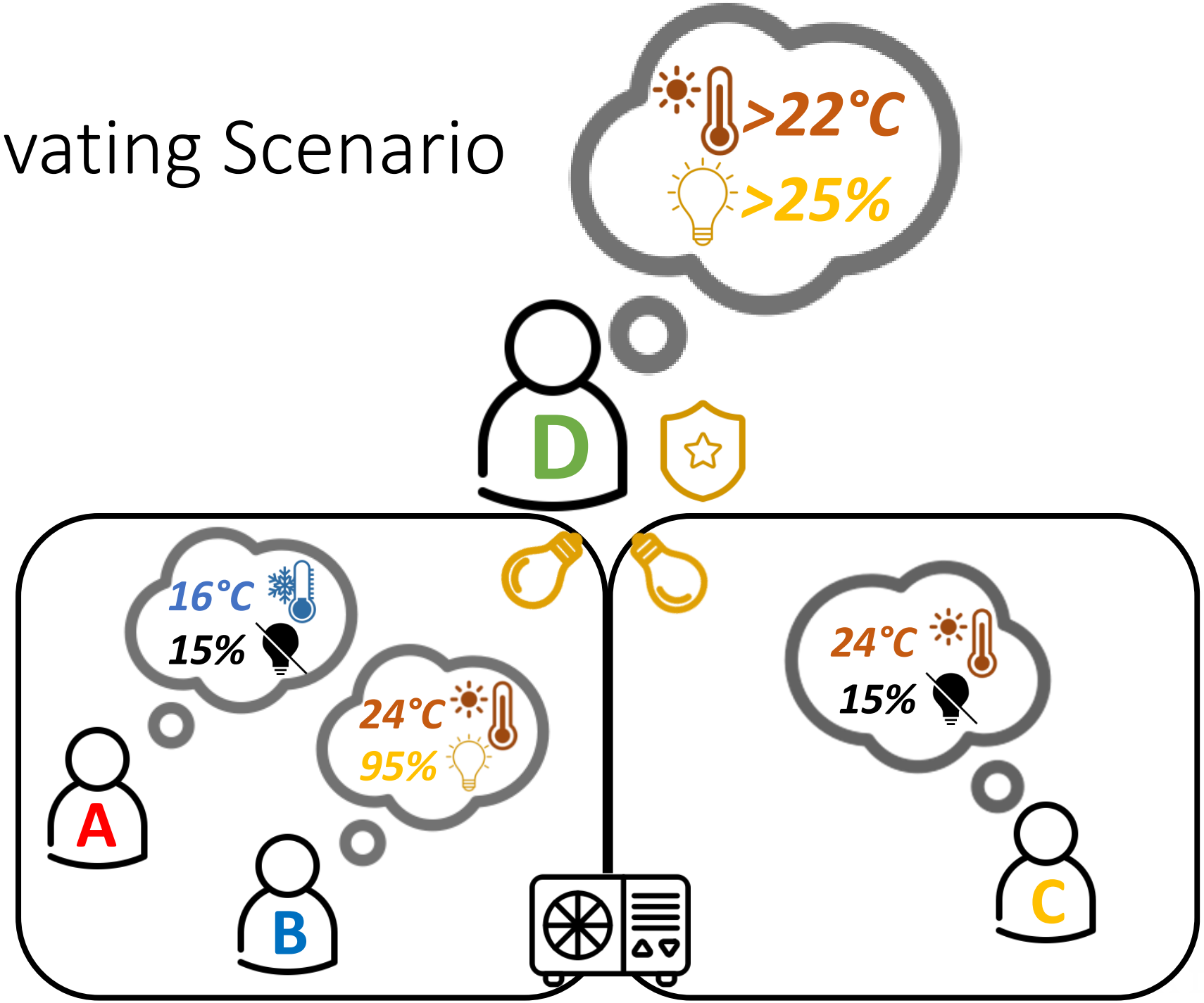
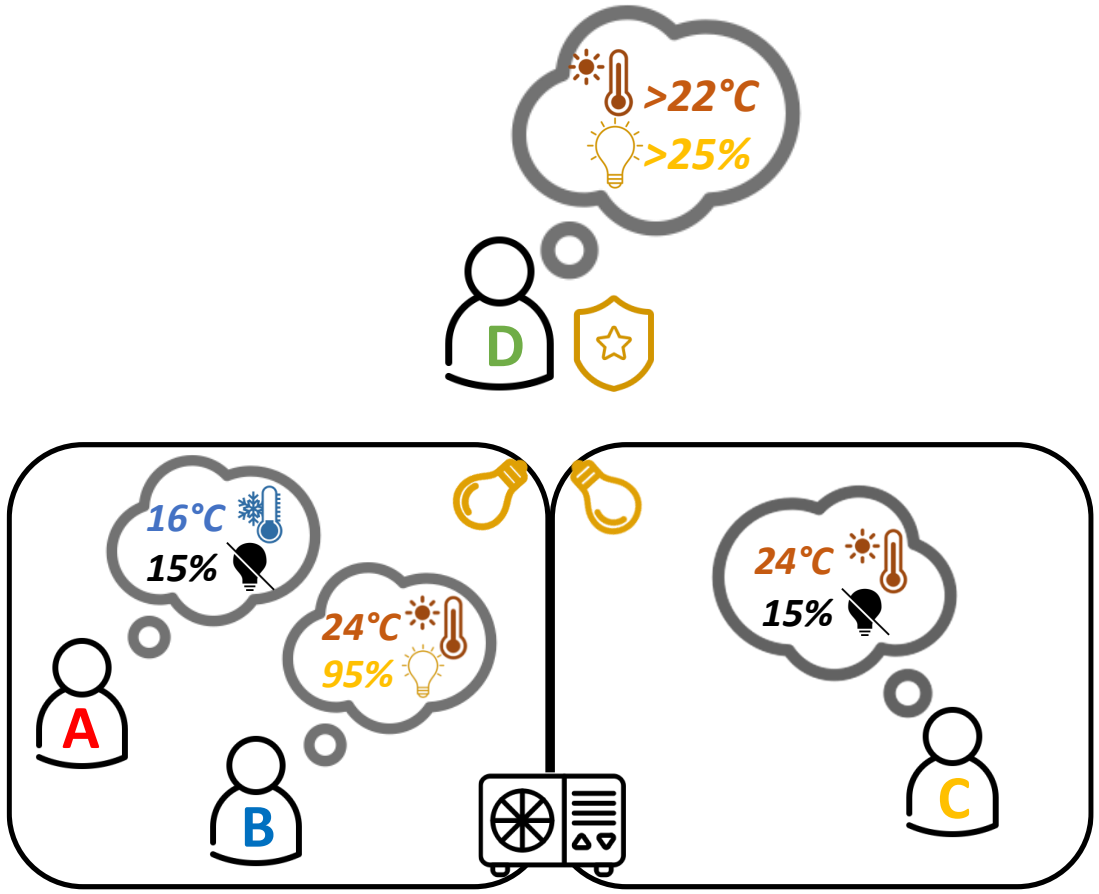


Open Questions

Three types of **conflict** can arise:

- **[User-User]** *How to **mediate all preferences** to satisfy them in the best possible way?*



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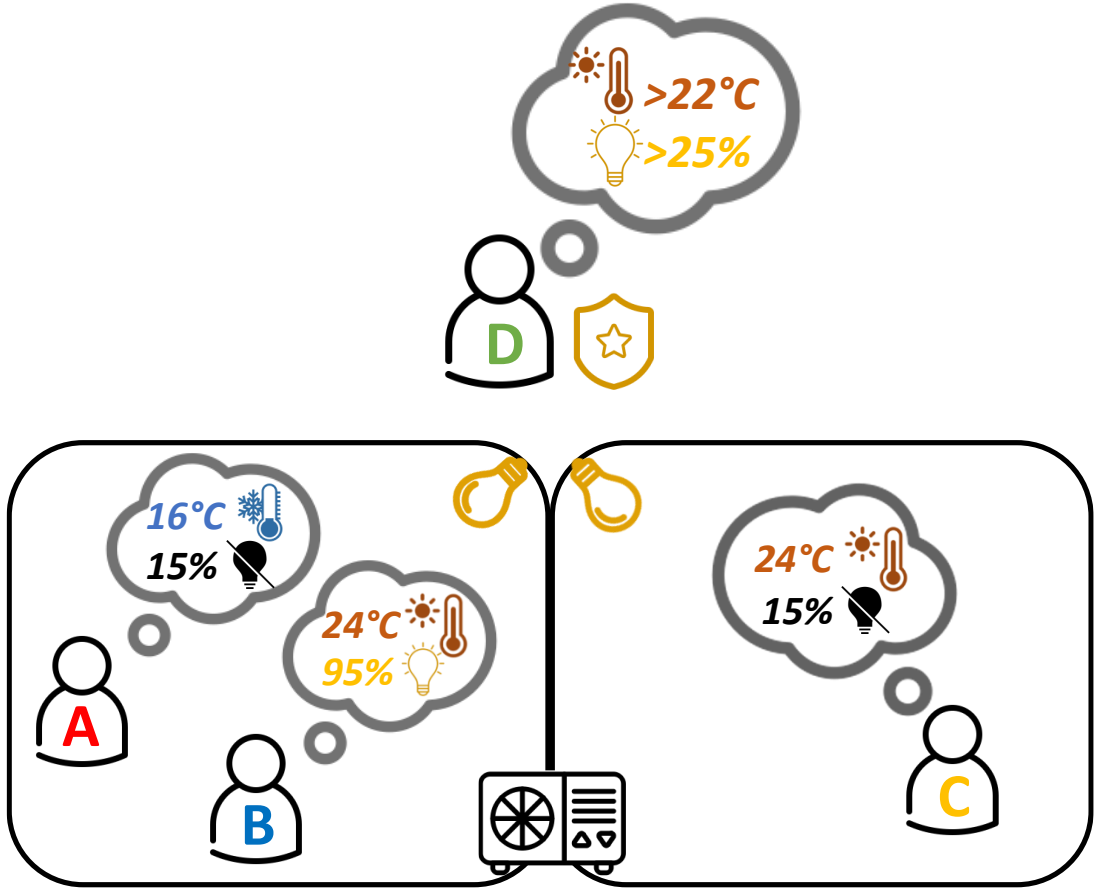

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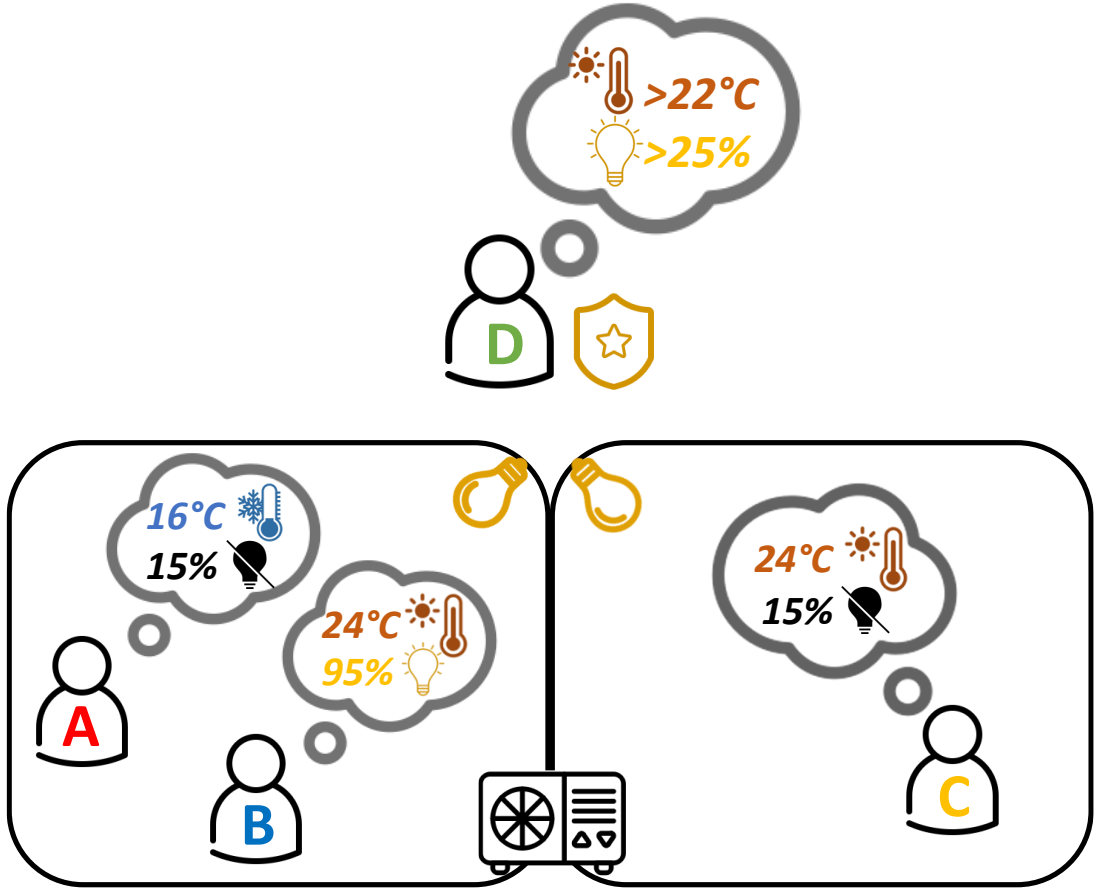
- **[User-User]** *How to **mediate all preferences** to satisfy them in the best possible way?*
- **[User-Admin]** *How to **achieve goals** set by the Sys. Admin. (e.g. energy savings)?*
- **[IoT-IoT]** *How to **reach a mediated target state** by suitably settings the available actuators?*



Our Proposal

A **declarative framework** -- and its prototype **Solomon** -- to specify **customisable mediation policies** for reconciling **contrasting goals** and actuator settings in **smart environments**.

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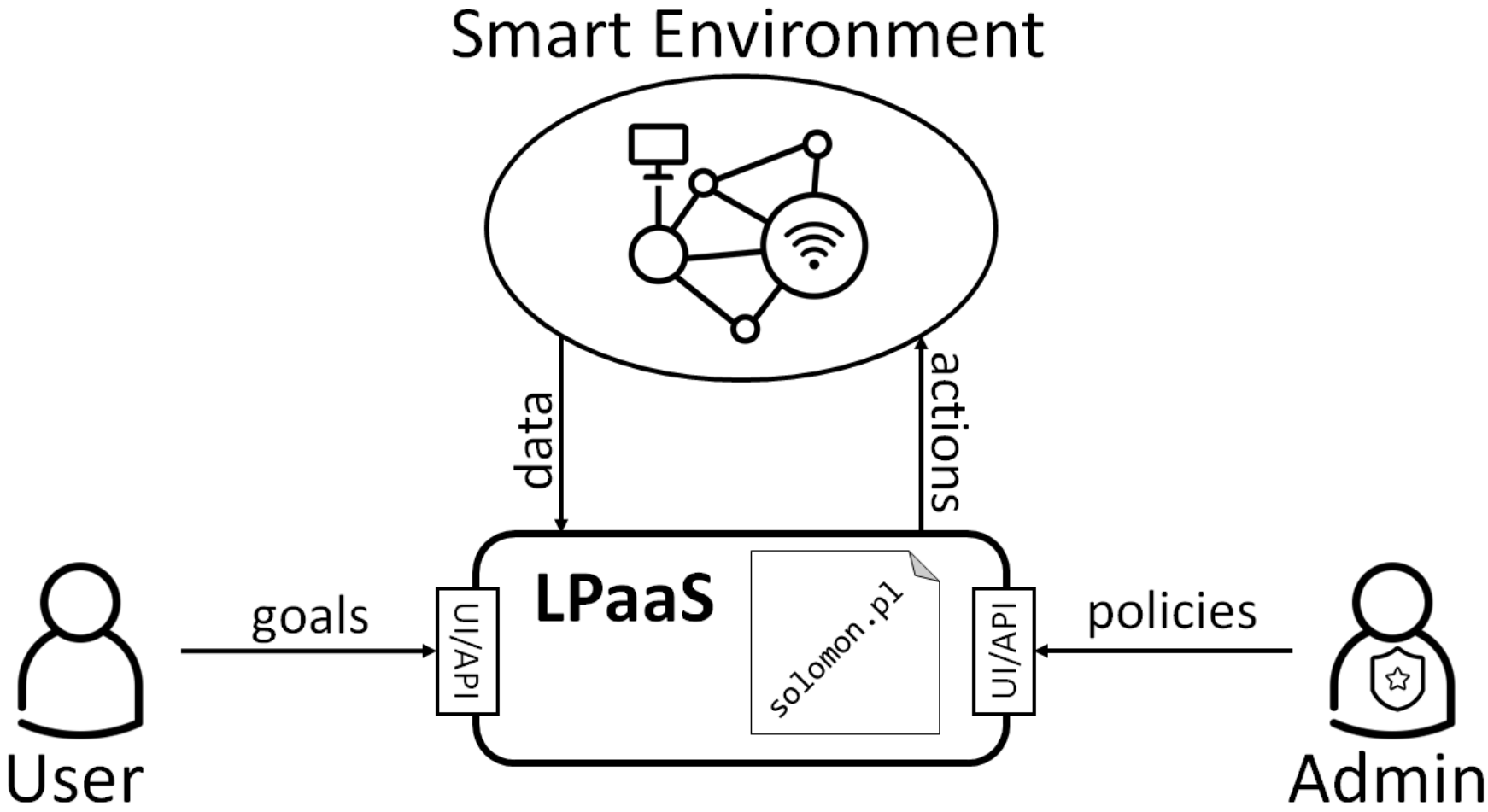
How?

- By **reasoning on a model** of the available **IoT infrastructure** and on (possibly contrasting) goals.
- Specifying **ad-hoc mediation policies** for *User-User*, *User-Admin* and *IoT-IoT* conflicts.

Our Prototype



Our **declarative methodology** has been **prototyped in Prolog** and offered **as-a-service** through the **LPaaS paradigm**. The code is **open-source** and available at: https://github.com/di-unipi-socc/Solomon

Solomon Functioning

1. Collecting all user requests.

```
react(Requests, MediatedRequests, Actions) :-
    getRequests(Requests, ValidRequests),
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3. **Determining actions** for **individual IoT actuators.**

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react(Requests, MediatedRequests, Actions) :-
    getRequests(Requests, ValidRequests),
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    validMediation(MediatedRequests),
    associateActions(MediatedRequests, Actions),
    validActions(Actions).
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Solomon Functioning

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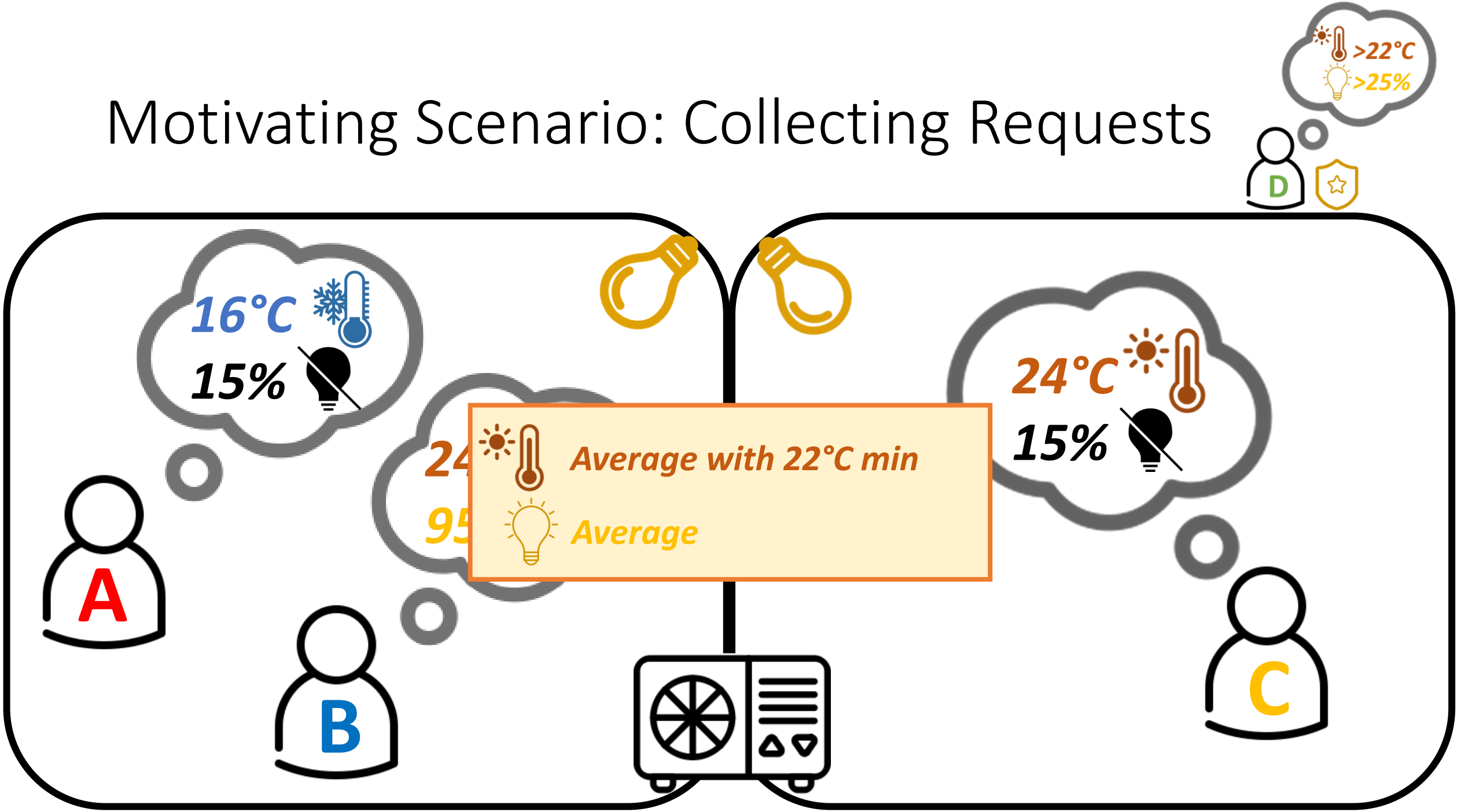
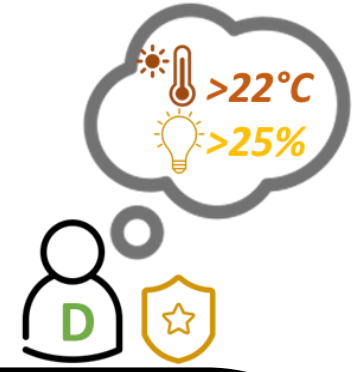
```
react(Requests, MediatedRequests, Actions) :-
    getRequests(Requests, ValidRequests),
    mediateRequests(ValidRequests, MediatedRequests),   % Defined by the Sys. Admin
    validMediation(MediatedRequests),
    associateActions(MediatedRequests, Actions),        % Defined by the Sys. Admin
    validActions(Actions).
```

*Solomon also offers a **library of standard predicates** to implement **mediation policies** (e.g. average, consensus, min/max).*

Motivating Scenario: Collecting Requests



Motivating Scenario: Mediating Requests



22°C

55%

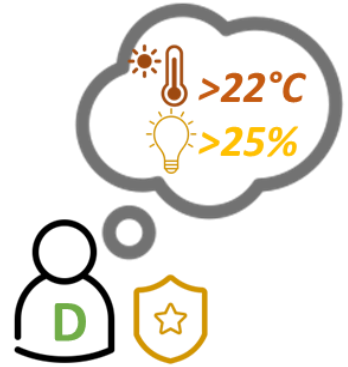
Average with 22°C min

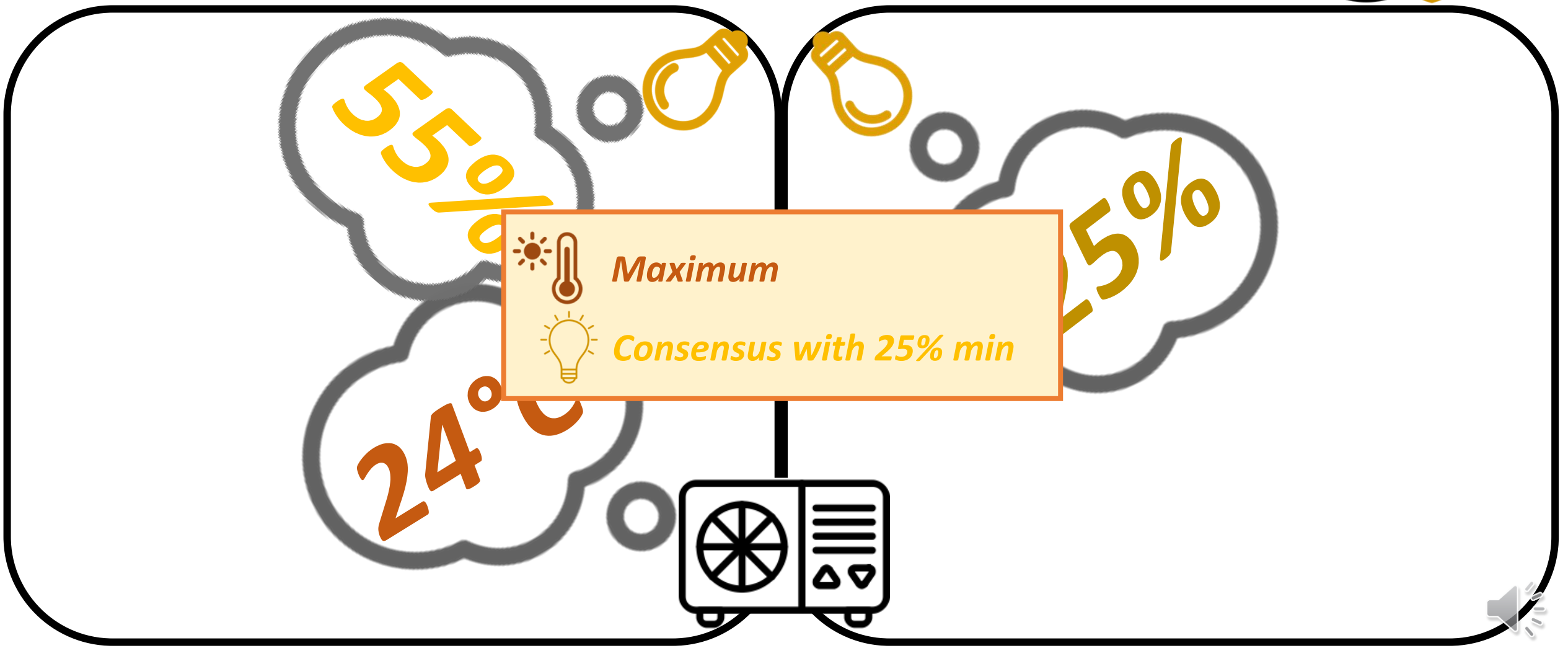
Average

24°C

15%

Motivating Scenario: Determing Actions





Conclusions

goal-driven

It **considers** and **mediates** among them **goals**, from all (human and machine) **stakeholders** involved in a Smart Environment, to reach a **target state**.

customisable

Being **open-source** and **enabling customisation** from its end-users. **Code** and **Docs** at: https://github.com/di-unipi-socc/Solomon

As it is **Prolog** code: **concise** (around **50 sloc**) and featuring a good level of **abstraction** and **flexibility** to **accommodate new emerging needs of Smart Environments**.

declarative

As it features a **well-defined REST API** based on **LPaaS**, it enables **interoperability** with other systems through **remote interactions**.

as-a-Service

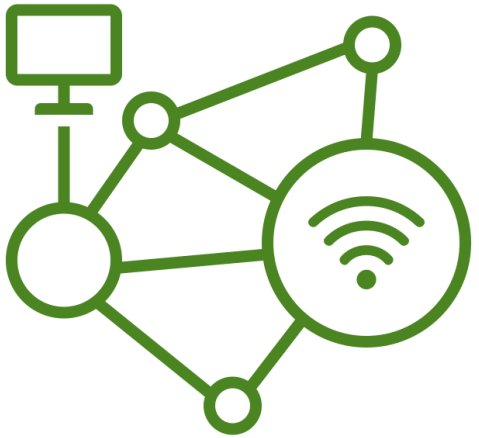
Future Work

New Policies

to propose a set of modular policies to the end-users

Goal Geolocalisation

to predict users' movements so to reduce manual interactions



Web of Things

to exploit Solomon in actual smart environments

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