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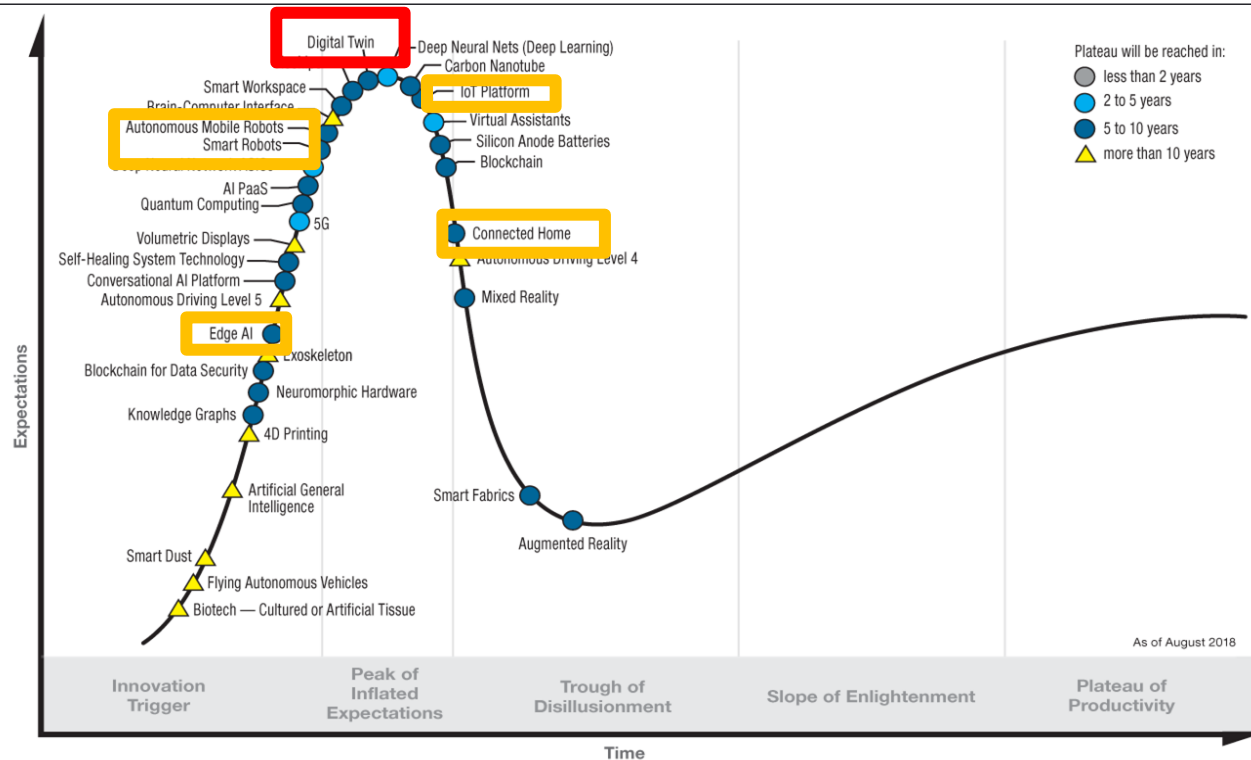
# Praktikum Software Engineering

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Lehner, Sametinger

Unit 0 - Introduction to Digital Twins

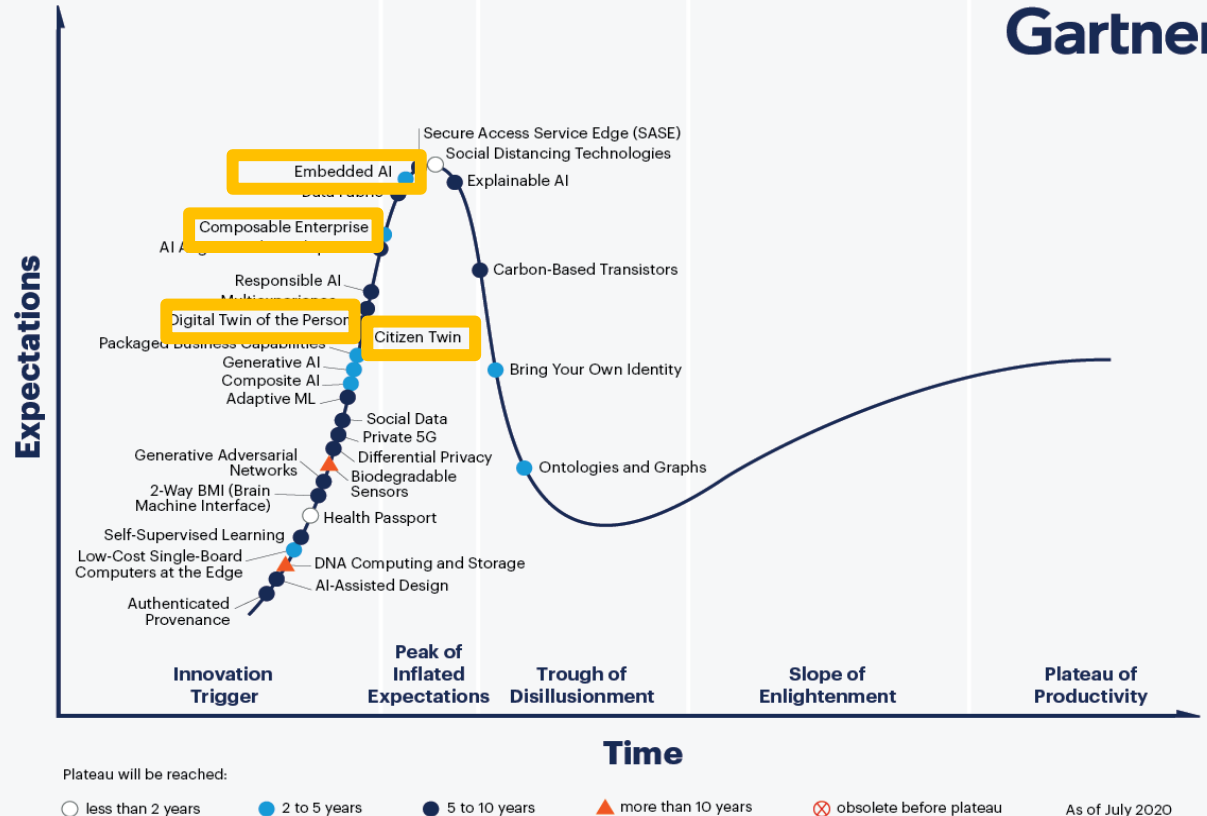
# Hype Cycle for Emerging Technologies, 2018



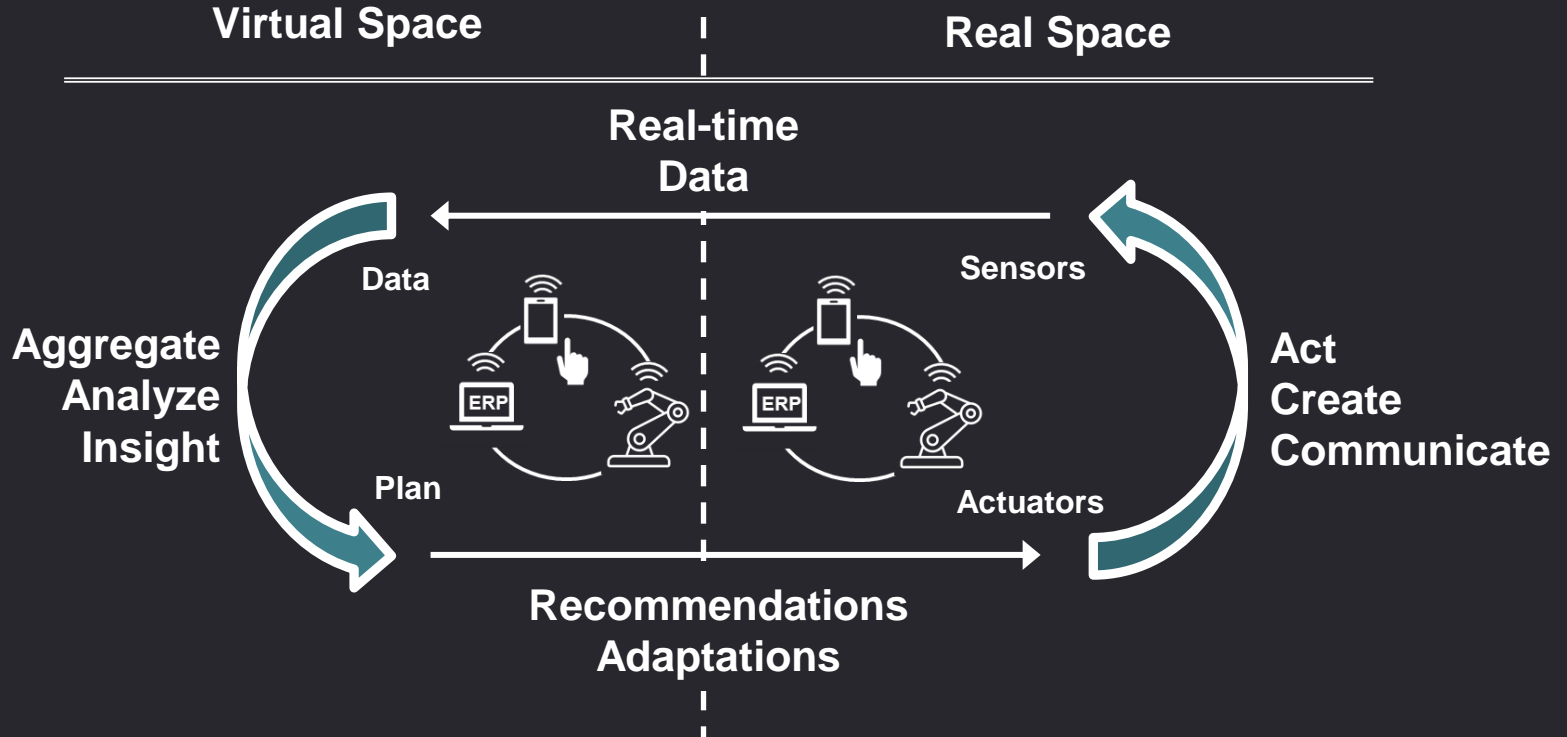
[gartner.com/SmarterWithGartner](https://gartner.com/SmarterWithGartner)

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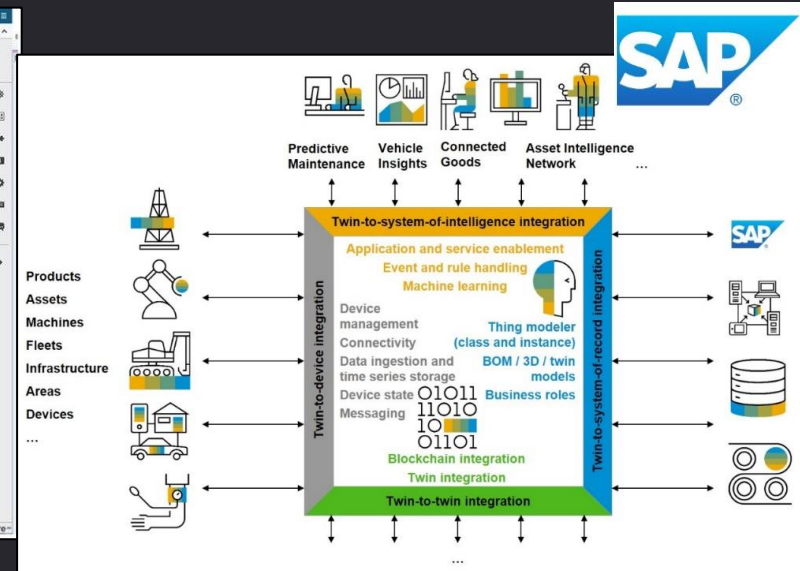
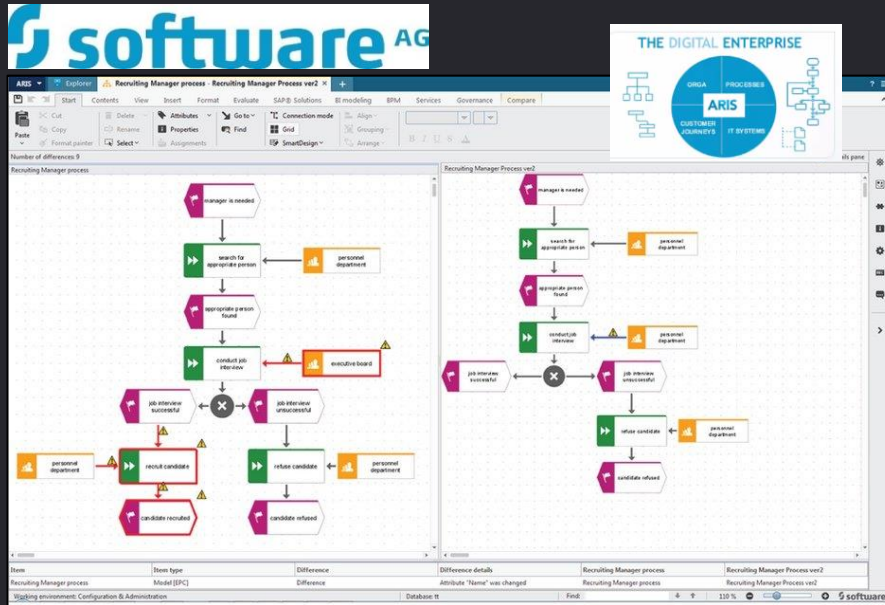
# Hype Cycle for Emerging Technologies, 2020



# Digital Twin at a glance



# Emerging Digital Twin Domains



<https://industrie.de/top-list/software-ag-stellt-enterprise-digital-twin-framework-vor/>

[https://blogs.sap.com/wp-content/uploads/2017/09/Digital\\_Twin\\_Implementation.jpg](https://blogs.sap.com/wp-content/uploads/2017/09/Digital_Twin_Implementation.jpg)

# Use Cases for Digital Representations

## ■ Digital Model

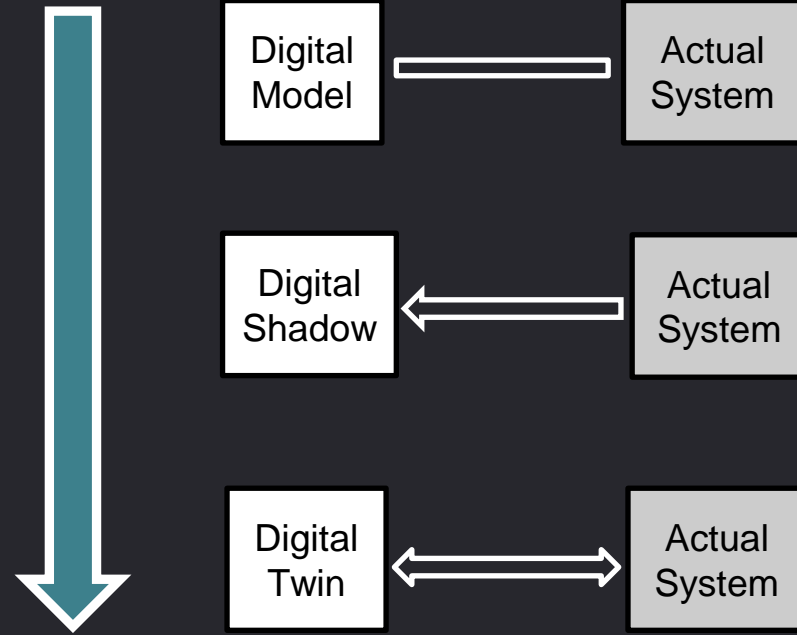
- Documentation & communication
- Simulation & code generation
- Design-space exploration
- Commissioning

## ■ Digital Shadow

- State inspection
- Runtime monitoring
- Predictive reasoning
- Conformance checking

## ■ Digital Twin

- Runtime adaptation
- Live updates & rollbacks
- Decision making
- Autonomy



## Digital Model



*Legend:*

*Automated  
Information flow*



*Manual  
Information flow*



# Example: Smart Room



## Digital Shadow



*Legend:*

*Automated  
Information flow*



*Manual  
Information flow*

# Example: Smart Room



**Note: You will be implementing this in the next months (See Basic Requirements)**

## Digital Twin



*Legend:*

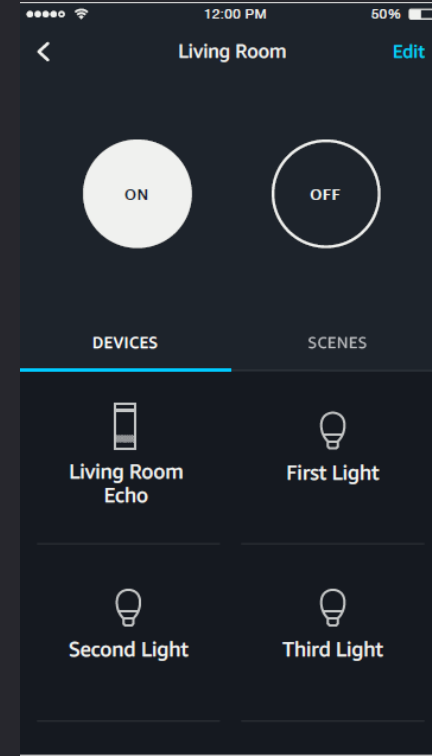
*Automated  
Information flow*



*Manual  
Information flow*

# Example: Smart Room

**Note: You will be implementing this in the next months (See Remote Control Requirements)**



## Development of an Application for Smart Rooms

A team of three developers should implement this project in several sprints over a period of 4 months creating all the necessary artifacts, such as: Software, Tests, Documentation, etc.

- Create, Read, Update and Delete (CRUD operations)
- Database storage solution
- Visualize data + available devices of a room
- Interact with the devices in the room
- Create automation rules

# High-Level Requirements

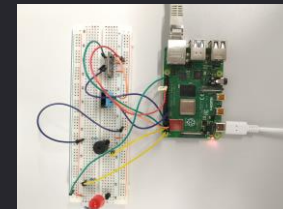
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- **See dedicated file**
- **Check and Discuss until next week**
- **Come up with a plan on how to implement these over the semester**
- **Next week: negotiation of requirements**



## MotionDetector Sensor

- Get number of people in the room



## Air Quality Sensor Sensor

- Get temperature, co2, humidity data from the room



## Smart Light Strip

### Sensor

- Lights on/off?

### Actuator

- Turn on/off
- Change color

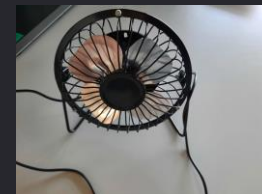
## Ventilator

### Sensor

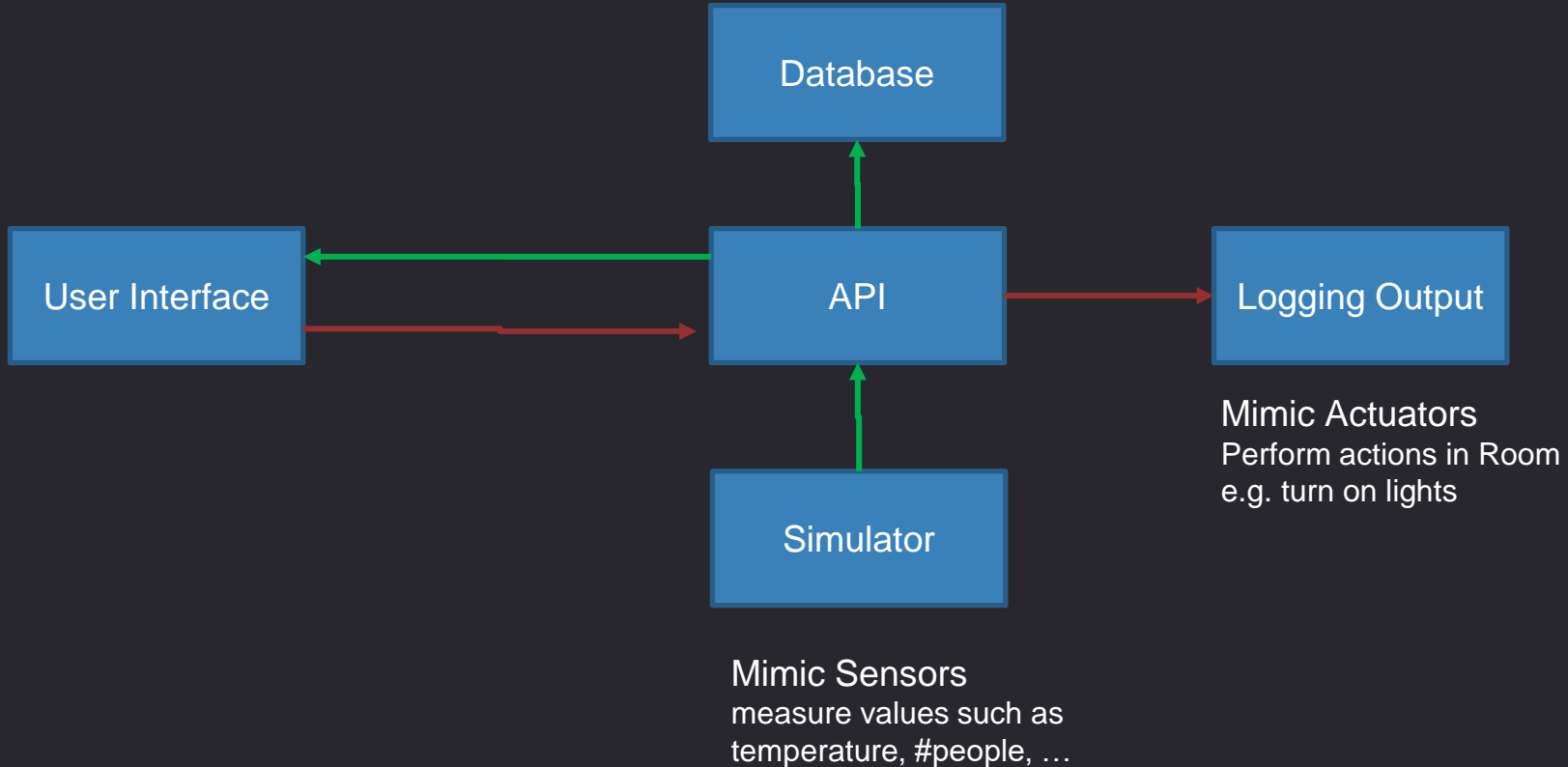
- Ventilator on/off?

### Actuator

- Turn on/off
- Change color







|        |                                     |                     |   |
|--------|-------------------------------------|---------------------|---|
| GET    | /Rooms                              | Get Allroom Details | ▼ |
| POST   | /Rooms                              | Add Room            | ▼ |
| GET    | /Rooms/{room_id}                    | Get Specific Room   | ▼ |
| PUT    | /Rooms/{room_id}                    | Update Roomdetails  | ▼ |
| DELETE | /Rooms/{room_id}                    | Delete Room         | ▼ |
| GET    | /Rooms/{room_id}/Lights             | Get All Lights      | ▼ |
| POST   | /Rooms/{room_id}/Lights             | Add Light           | ▼ |
| GET    | /Rooms/{room_id}/Lights/{light_id}/ | Get Specific Light  | ▼ |
|        |                                     |                     |   |

**/Rooms (POST, GET)**

**/Rooms/{id} (GET, PUT)**

**/Rooms/{id}/Doors (POST, GET)**

**/Rooms/{id}/Doors/{id} (GET, PUT)**

**/Rooms/{id}/Lights (POST, GET)**

**/Rooms/{id}/Lights/{id} (GET, PUT)**

**/Rooms/{id}/Windows (POST, GET)**

**/Rooms/{id}/Windows/{id} (GET, PUT)**

**/Rooms/{id}/Ventilators (POST, GET)**

**/Rooms/{id}/Ventilators/{id} (GET, PUT)**

**/Rooms/{id}/PeopleInRoom (POST, GET)**

**/Rooms/{id}/temperature (POST, GET)**

**/Rooms/{id}/co2 (POST, GET)**

**/Rooms/{id}/humidity (POST, GET)**

**/Rooms/{id}/Ventilators/{id}/Activation (POST, GET)**

**/Rooms/{id}/Lights/{id}/Activation (POST, GET)**

**/Rooms/{id}/Lights/{id}/SetColor (POST)**

**/Rooms/{id}/Windows/{id}/Open (POST, GET)**

**/Rooms/{id}/Doors/{id}/Open (POST, GET)**