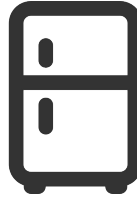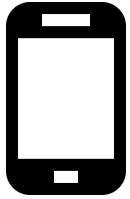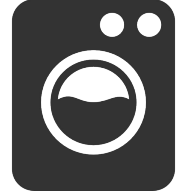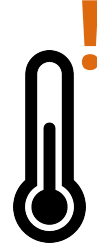# Interoperability Issues with the Internet of Things
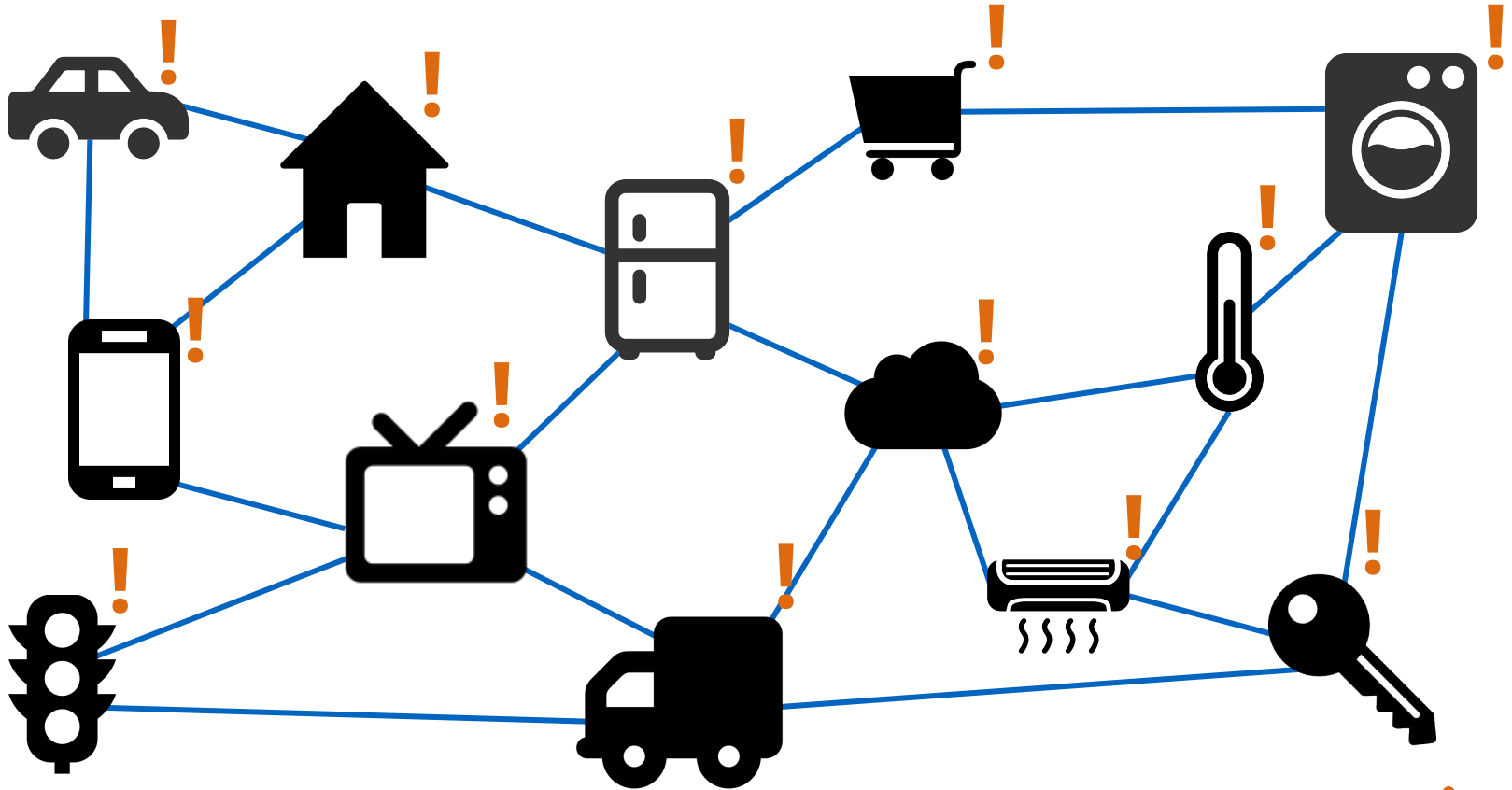
The Idea
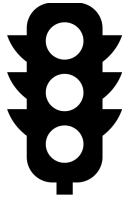
Make It Smart

Connect It

Smart Home / Grid Example

1. Washing Machine > Solar Panel: Enough energy?

2. Solar Panel > Washing Machine: No!

3. Washing Machine > Grid Operator: Cheap energy?

4. Grid Operator > Washing Machine: No!

5. Washing Machine > Car: Surplus energy?

6. Car > Google Calendar: Appointments requiring the car?

7. Google Calendar > Car: No!

8. Car > Washing Machine: Enough energy for washing!
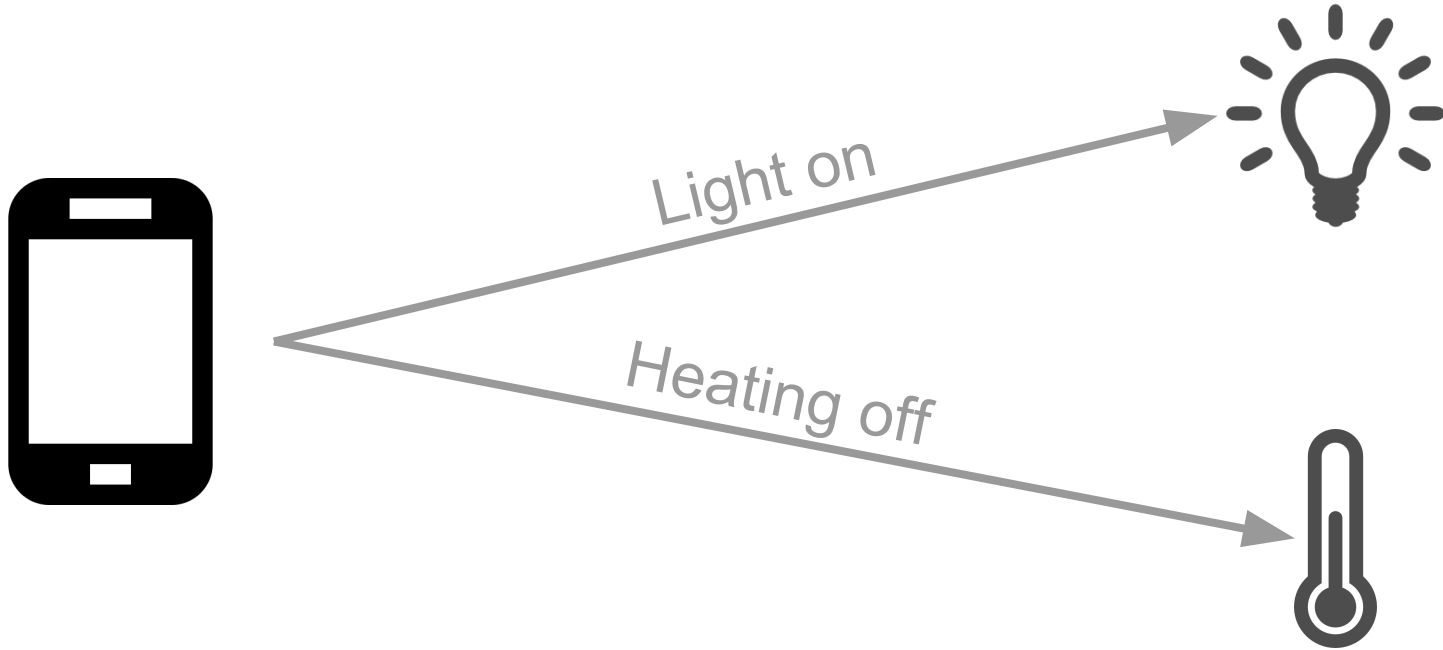
CloudRail

Domains

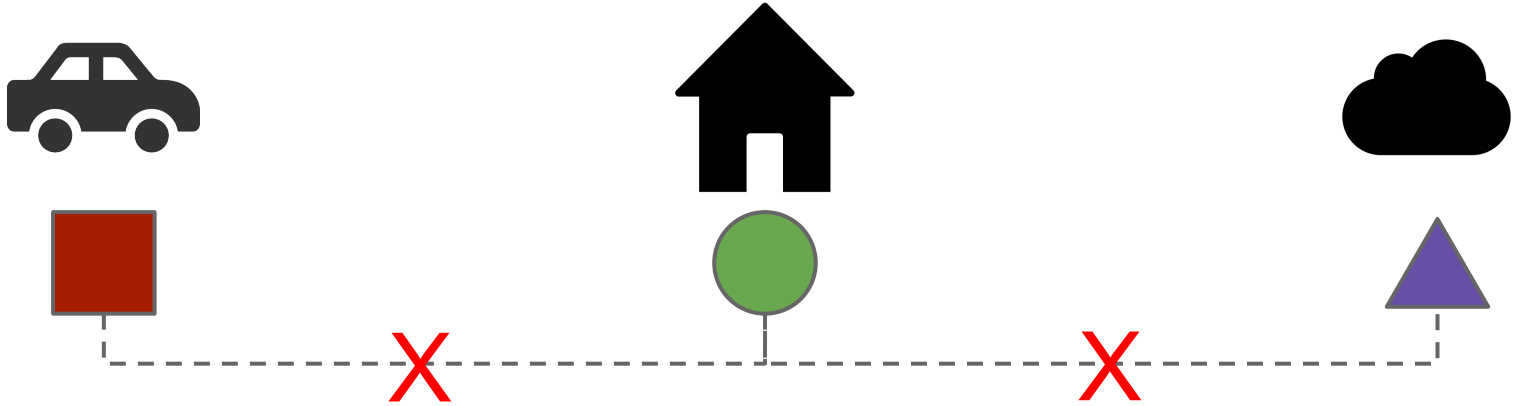| Smart Home	Smart Industry	Smart Energy	Smart City	Smart Mobility

CloudRail

Situation today

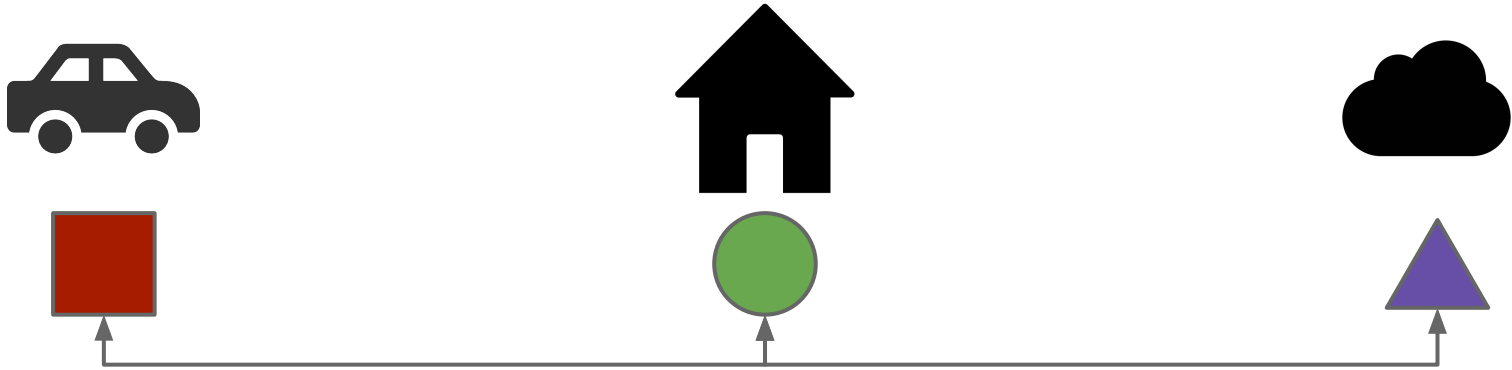Light on

Heating off

CloudRail

Problem

Different APIs, Data Formats, Semantics

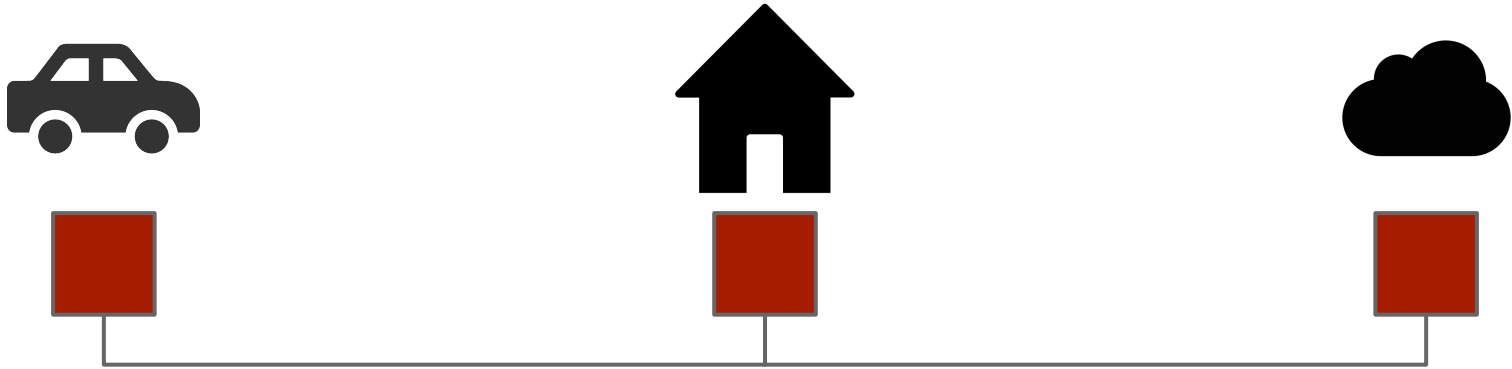Communication often impossible

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Solution Approaches

Manual Integration

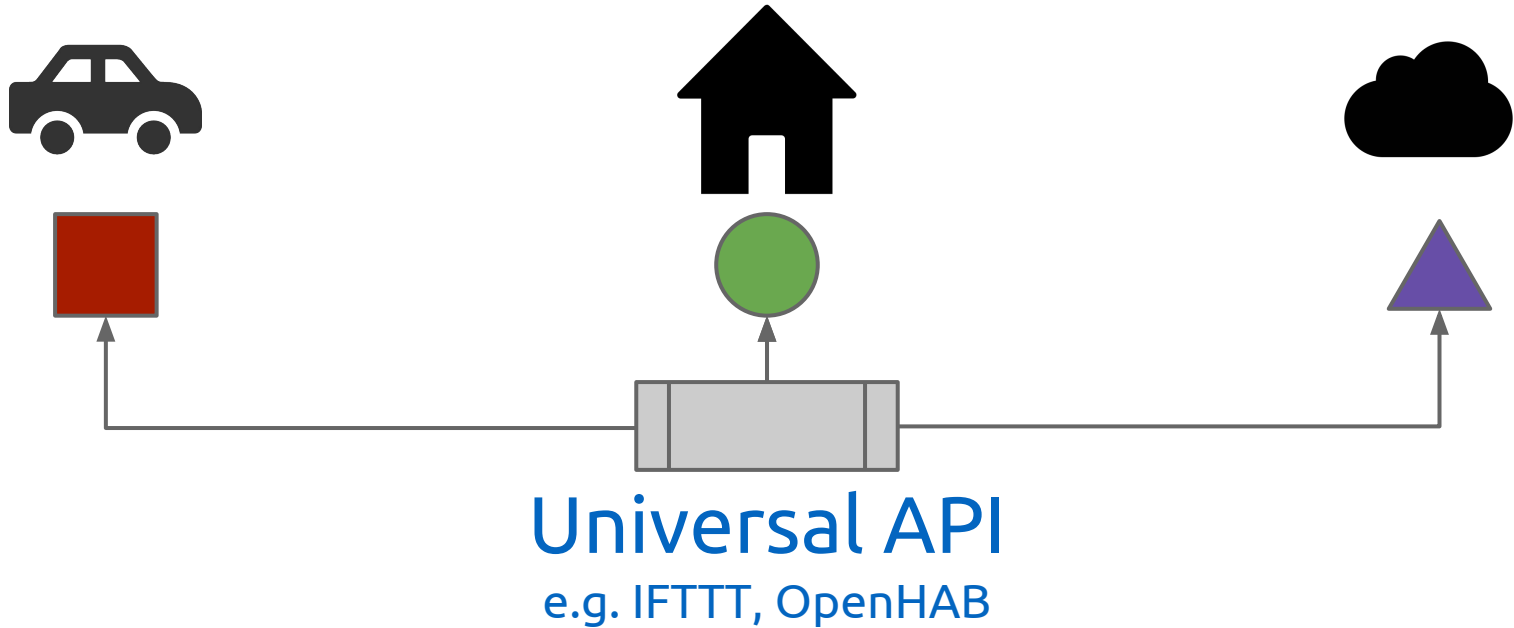### N:M Problem, Maintenance, Lack of Reusability

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Solution Approaches

Common Standard

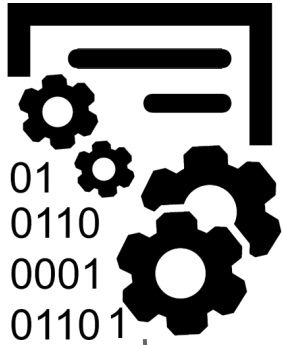E.g. AllSeen Alliance, Apple, Google

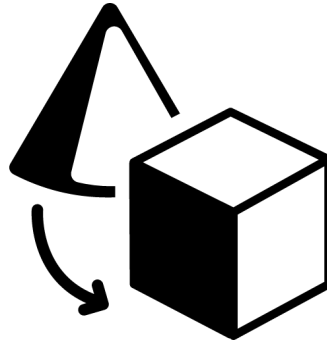Takes long to agree on, imposes limitations

CloudRail

Solution Approaches

Universal API
e.g. IFTTT, OpenHAB

None is really universal as of now

CloudRail

Universal API - Challenges

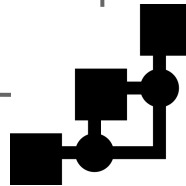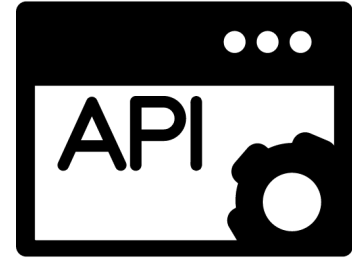Definitions   Conversions   Endpoints

Semantics

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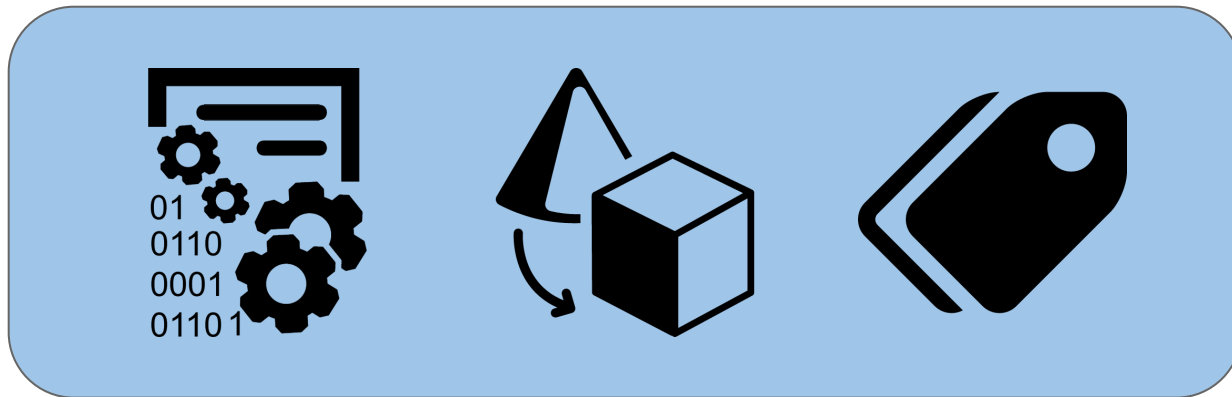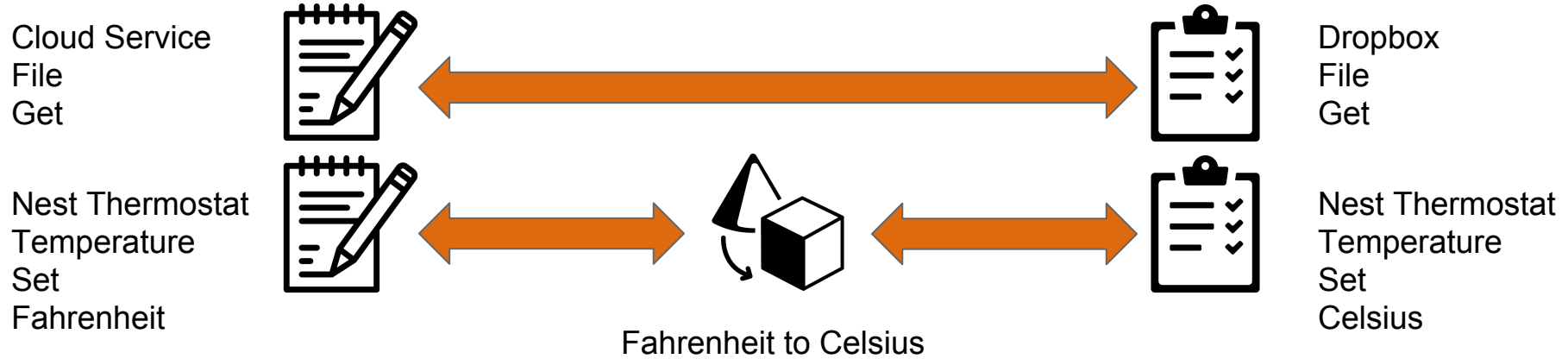
CloudRail - Database

Cloud storage
Definitions, Conversions and Tags

New definitions describe e.g.
URLs, Authentication, JSON schemas

CloudRail

CloudRail - Actions and Operations

Cloud Service
File
Get

Dropbox
File
Get

Nest Thermostat
Temperature
Set
Fahrenheit

Fahrenheit to Celsius

Nest Thermostat
Temperature
Set
Celsius

Match specified actions to operations
Conversions inserted when necessary

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CloudRail - Individual SDK
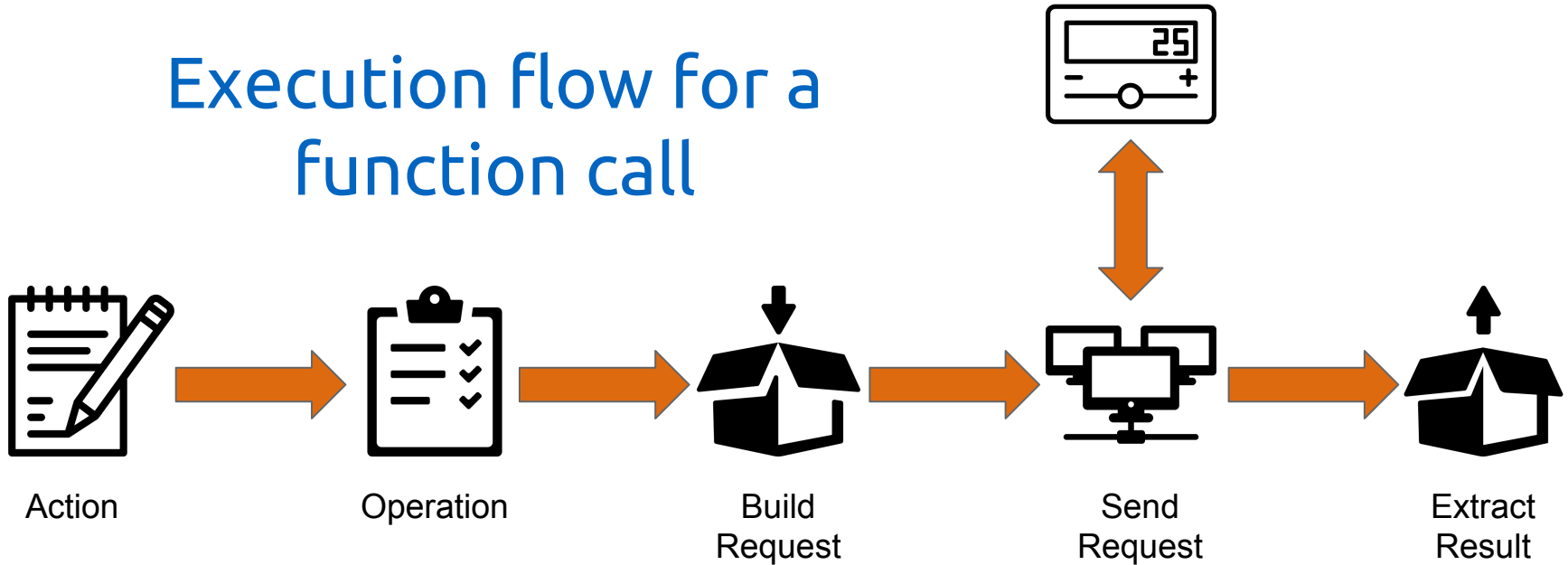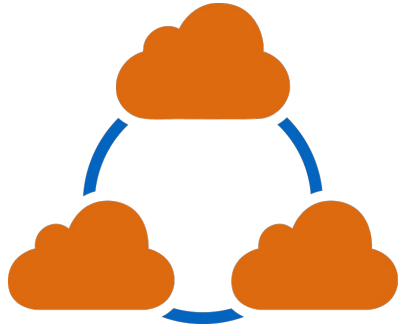
SDK   Config   Wrapper

Application
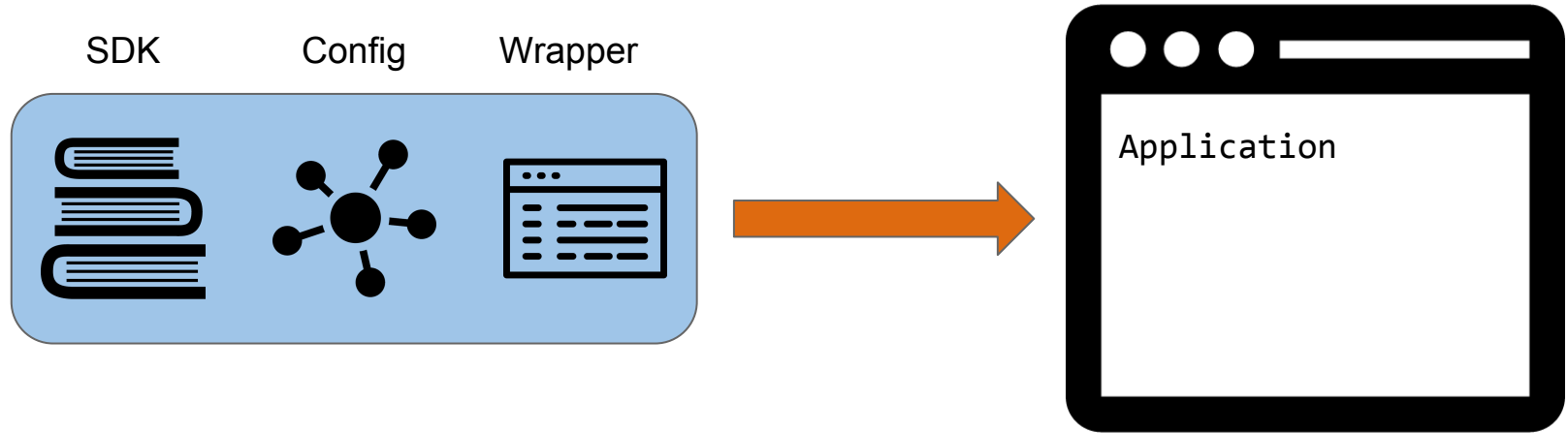
SDKs for various platforms
Individualized through configuration file

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CloudRail - Execution

Execution flow for a function call

Action → Operation → Build Request → Send Request → Extract Result

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See for yourself @
workbench.cloudrail.com

Florian Wendel

florian@cloudrail.com
+49 621 31954363
Twitter: @cloudrail
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Intern or Thesis:

Technical, Business, Design, Marketing