הטכניון - מכון טכנולוגי לישראל
הפקולטה לחינוך למדע וטכנולוגיה

קורס 216015, אביב 2021
חינוך מדעי וטכנולוגי בעידן המהפכה התעשייתית הרביעית

מִרְשֶׁתֶת הַדְּבָרִים, IoT

ד"ר דן קופרמן

המרכז לחינוך לרובוטיקה וטכנולוגיה דיגיטלית

שער ראשון
הגדרות

The internet

"A **global network of interconnected computer hardware and software systems**, making possible the **storage, retrieval, circulation, and processing** of information and communication across time and space". (Slavin, 2007)

Actually, an internet of computers!

Due to social media, Internet of people

The data is created by people and used by people.

What is Internet of Things?

מהי מִרְשֶׁתֶת הַדְּבָרִים?

“A network of **physical objects** that contains embedded technology to **communicate** and **sense or interact with their internal states or the external environmen**t.” (Gartner, 2017).

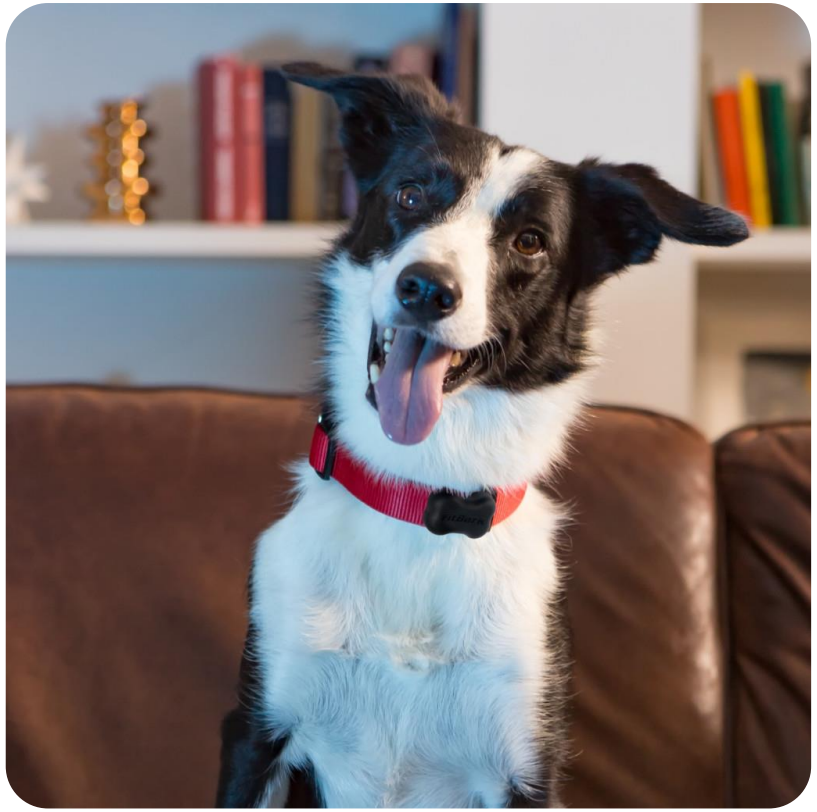
A “things” is comprised of:

A Product: the technical resource, needed to monitor or interact with an **Entity of Interest** (any object, its state, attributes or properties). The product itself can be The Entity of Interest

Connectivity: the resources that provide the technical link to access the product.

Application : provides the interface to monitor and control the product over the web.

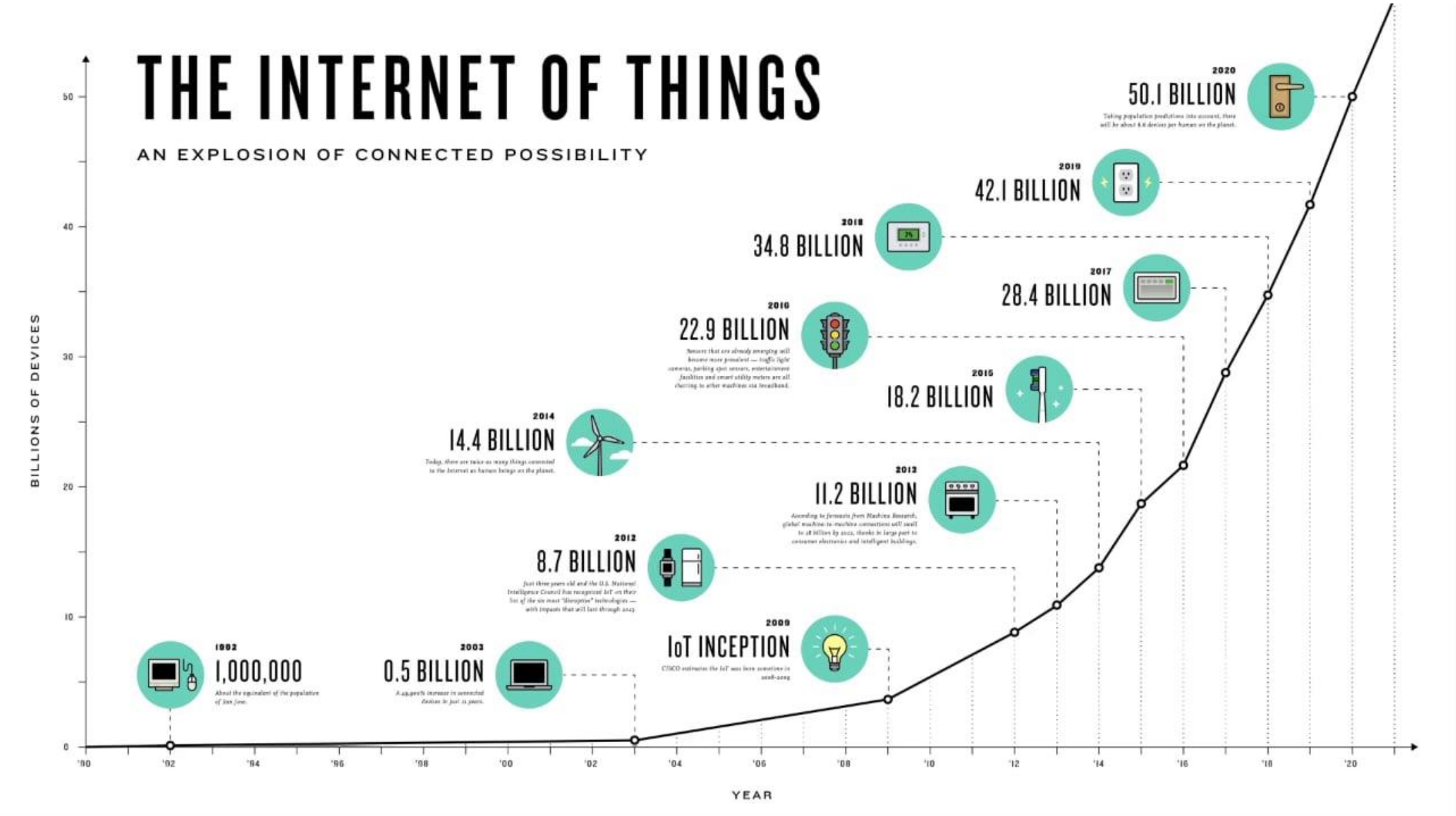
Can a dog be a things?



Early IoT milestones

- 1969- **The Internet**, Advanced Research Project Agency Network (ARPANET) used by academic and research fraternity.
- 1973 - **RFID** (Radio-Frequency Identification).
- 1974 - Embedded computer system, implemented using **single board computers and microcontrollers** embedded in a bigger system.
- 1984 - **First thing?** A coke machine was connected to internet to report the availability and temperature of the drink.

The “Only” Coke Machine on the Internet,
Carnegie Mellon University,
School of Computer Science


THE INTERNET OF THINGS
AN EXPLOSION OF CONNECTED POSSIBILITY
BILLIONS OF DEVICES
YEAR
1992
1,000,000
About the equivalent of the population of San Jose.
2003
0.5 BILLION
2009
IoT INCEPTION
2012
8.7 BILLION
2012
11.2 BILLION
2014
14.4 BILLION
Today, there are twice as many things connected to the Internet as human beings on the planet.
2015
18.2 BILLION
2016
22.9 BILLION
2018
34.8 BILLION
2019
42.1 BILLION
2020
50.1 BILLION
Taking population predictions into account, there will be about 6.6 devices per human on the planet.

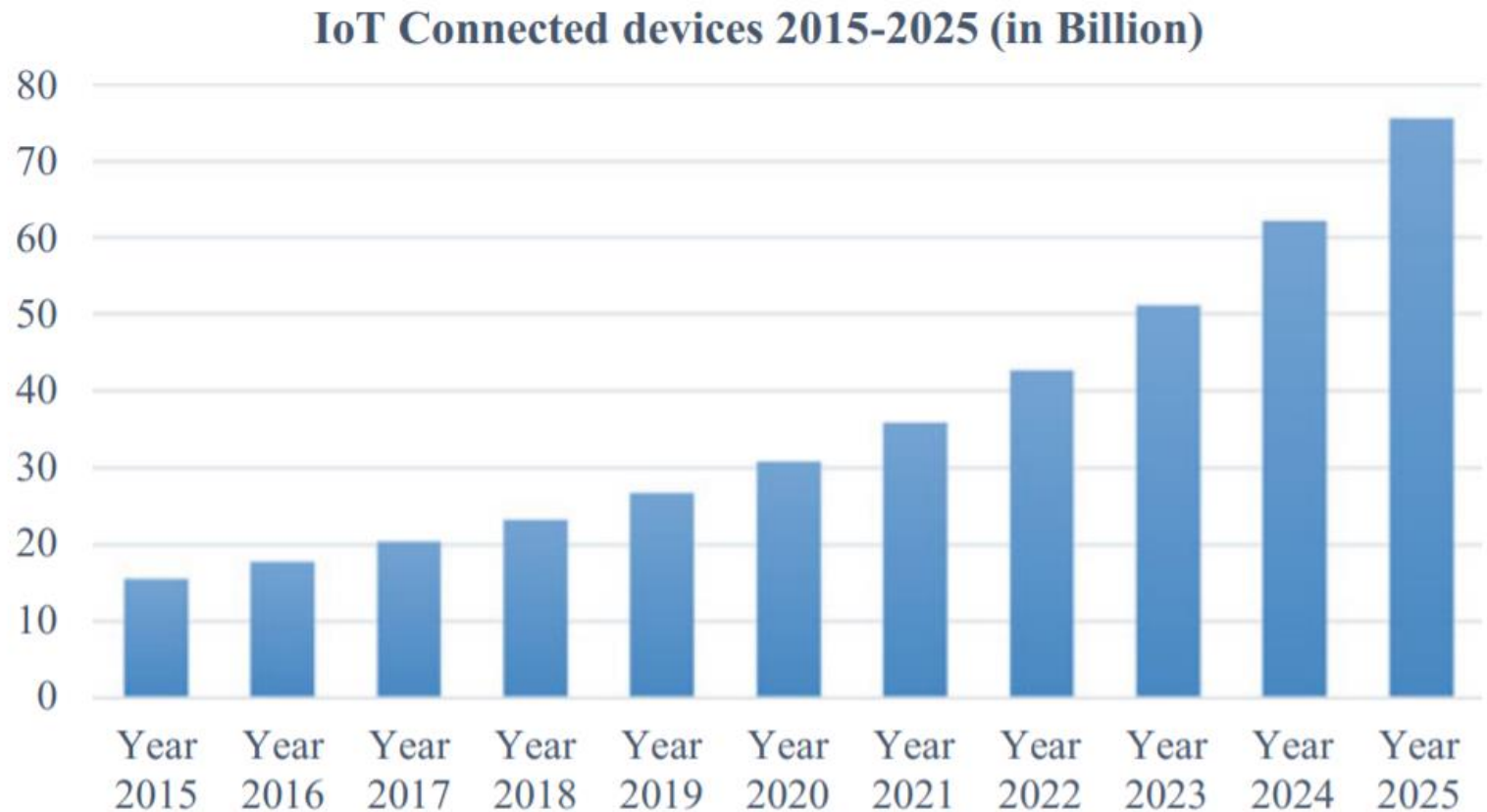
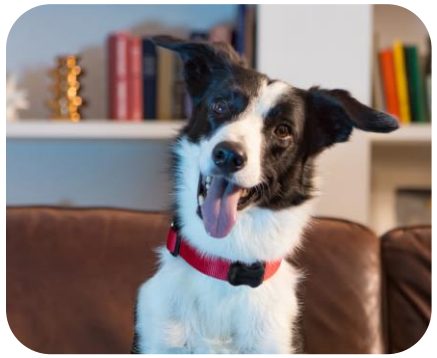


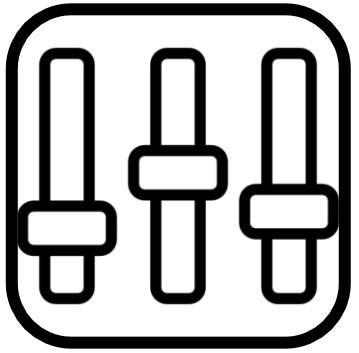
Fig. 3.10 IoTconnected devices installed base worldwide from 2015 to 2025 (in billions) [83]

What can we apply on the things?

Monitoring

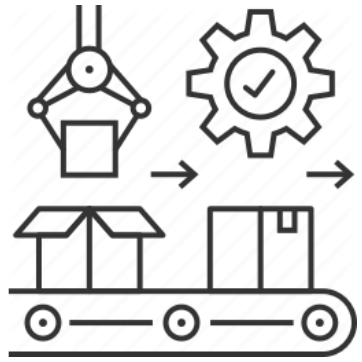


Control



Optimization

Automation



Control

I am smart!

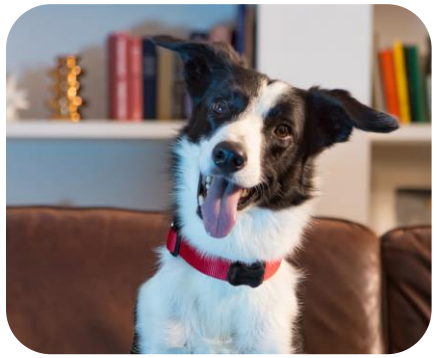
Cyber-Physical Systems (CPS)

Cyber-Physical Systems (CPS)

A system “of collaborating computational entities which are in intensive **connection with the surrounding physical world** and its on-going processes, providing and using, at the same time**,** **data-accessing and data-processing services available on the internet**.

What can we apply with the things?

Monitoring

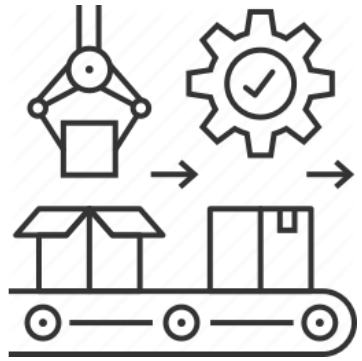


CPS ?

Control

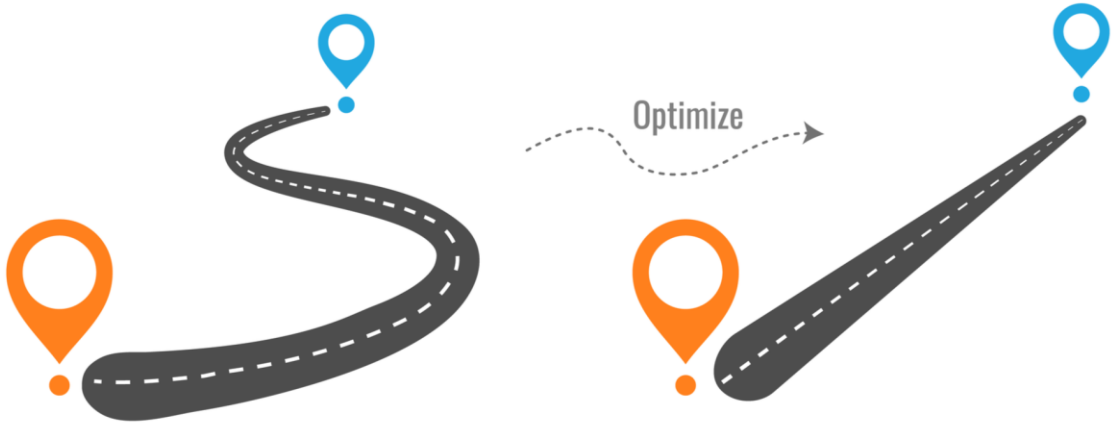
Optimization

Automation



Optimization

Smart, connected products can **apply algorithms and analytics** to in-use or historical data to dramatically **improve output, utilization, and efficiency**.



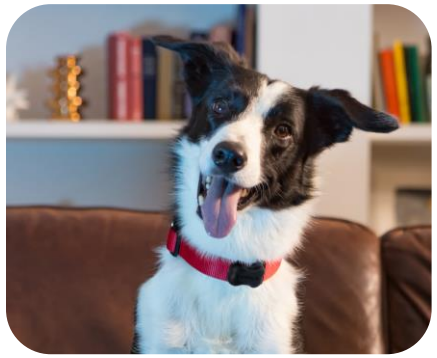
Automation

Monitoring, control, and optimization capabilities combine to allow smart, connected products to achieve a previously unattainable level of **autonomy**.

At the simplest level is autonomous product. More-sophisticated products are able to **learn about their environment, self-diagnose their own service needs, and adapt to users' preferences**.

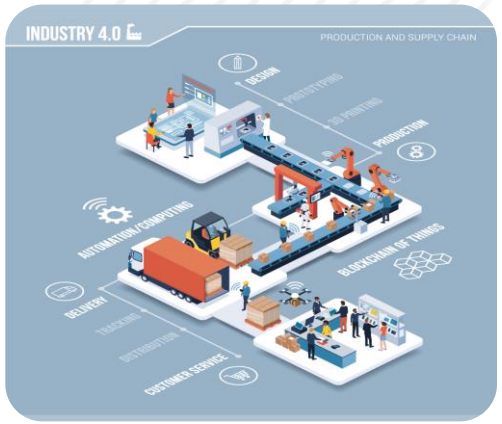
What can we apply with the things?

Monitoring

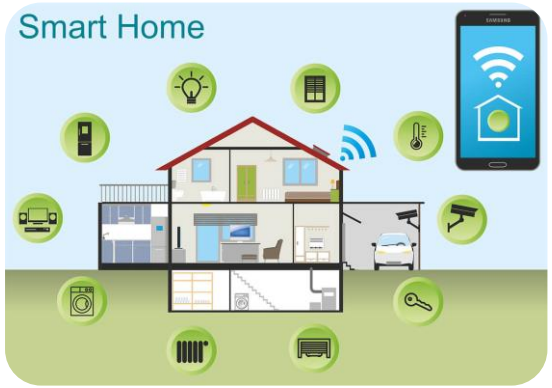


Control

Optimization

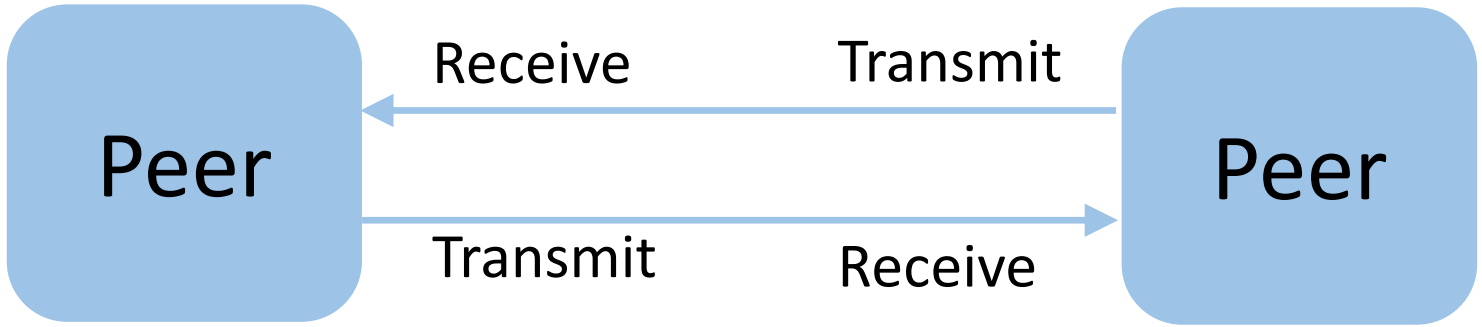


Automation

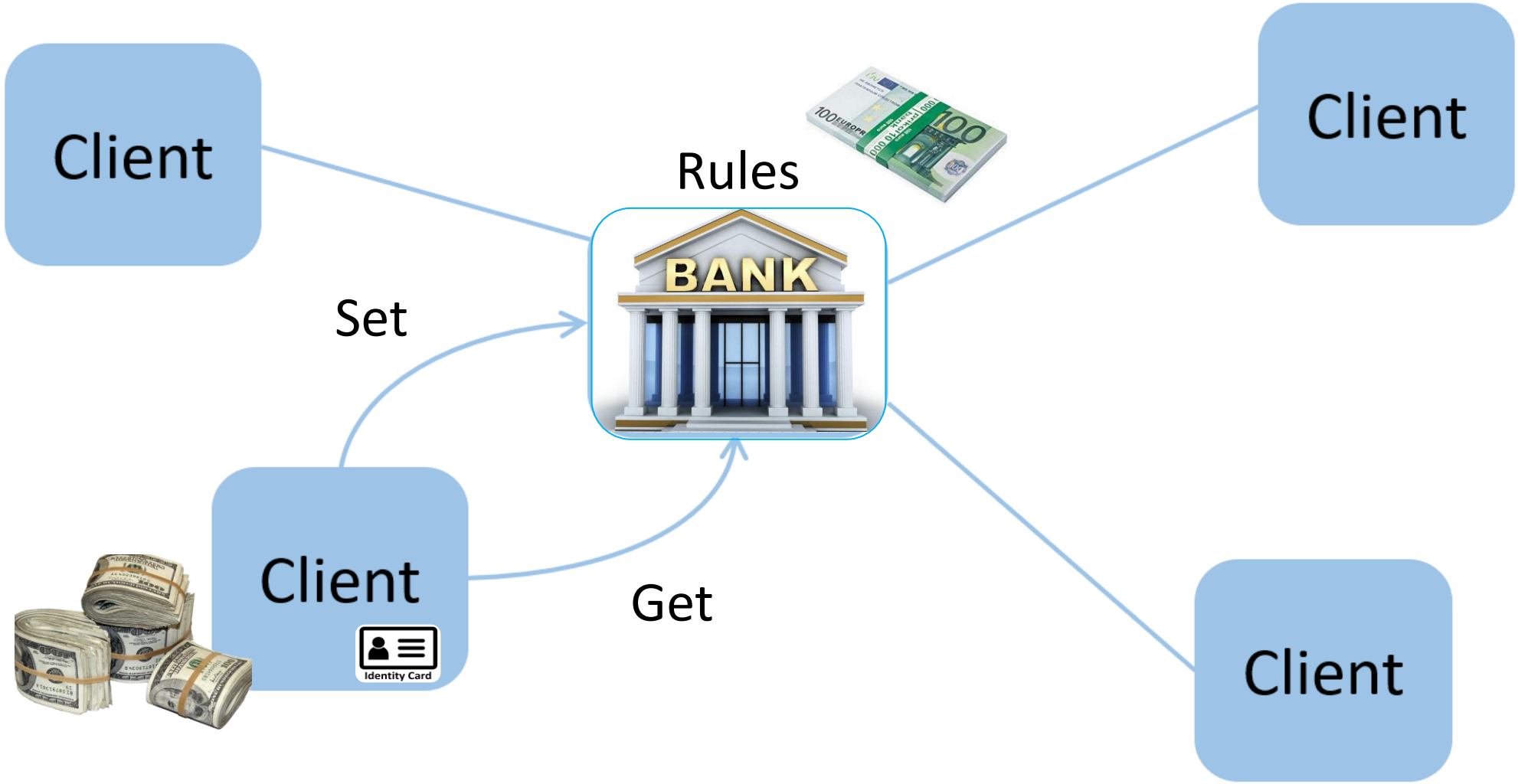


שער שני
קישוריות

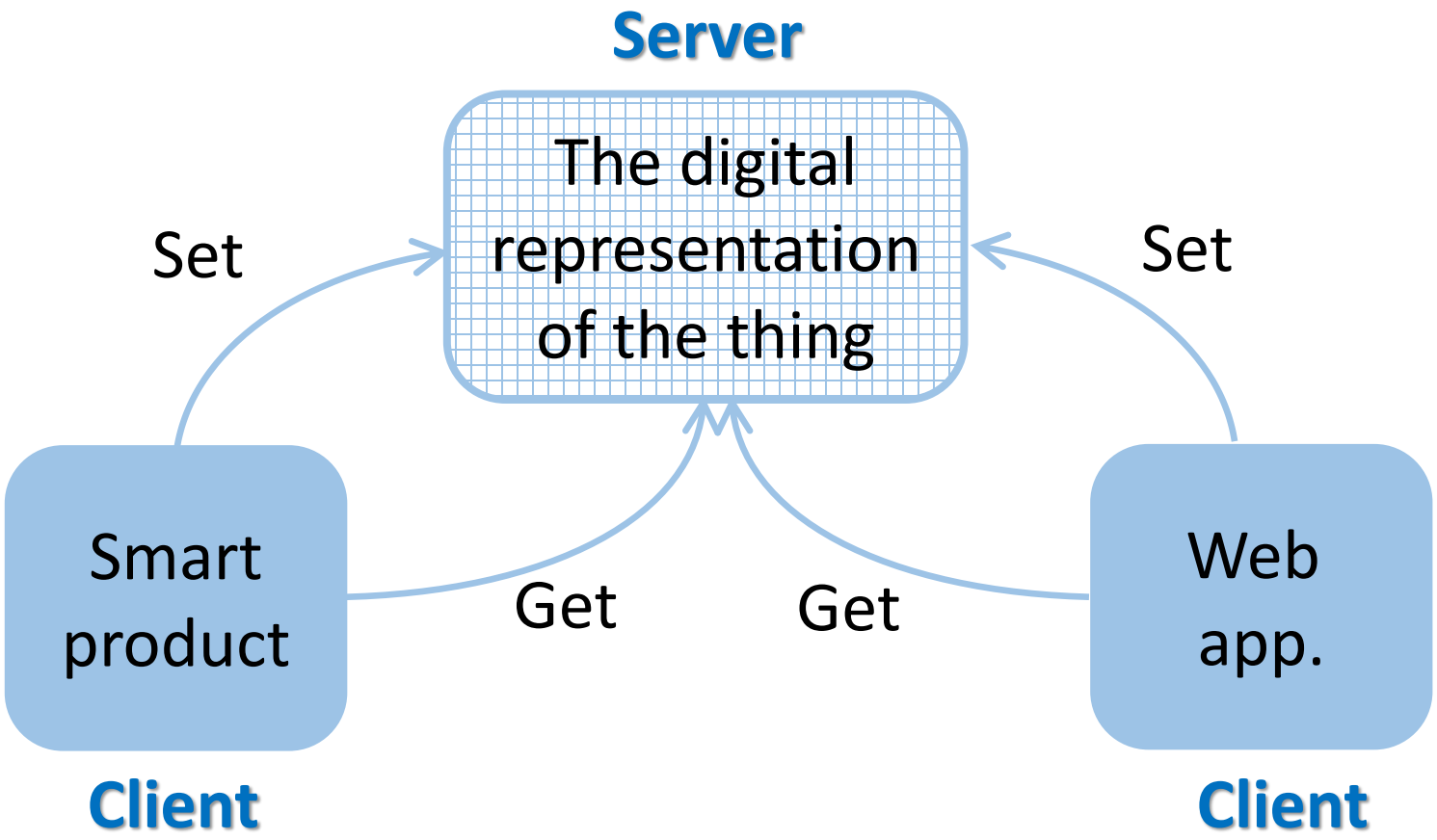
Peer to Peer communication architecture



Client Server communication architecture



Our Things

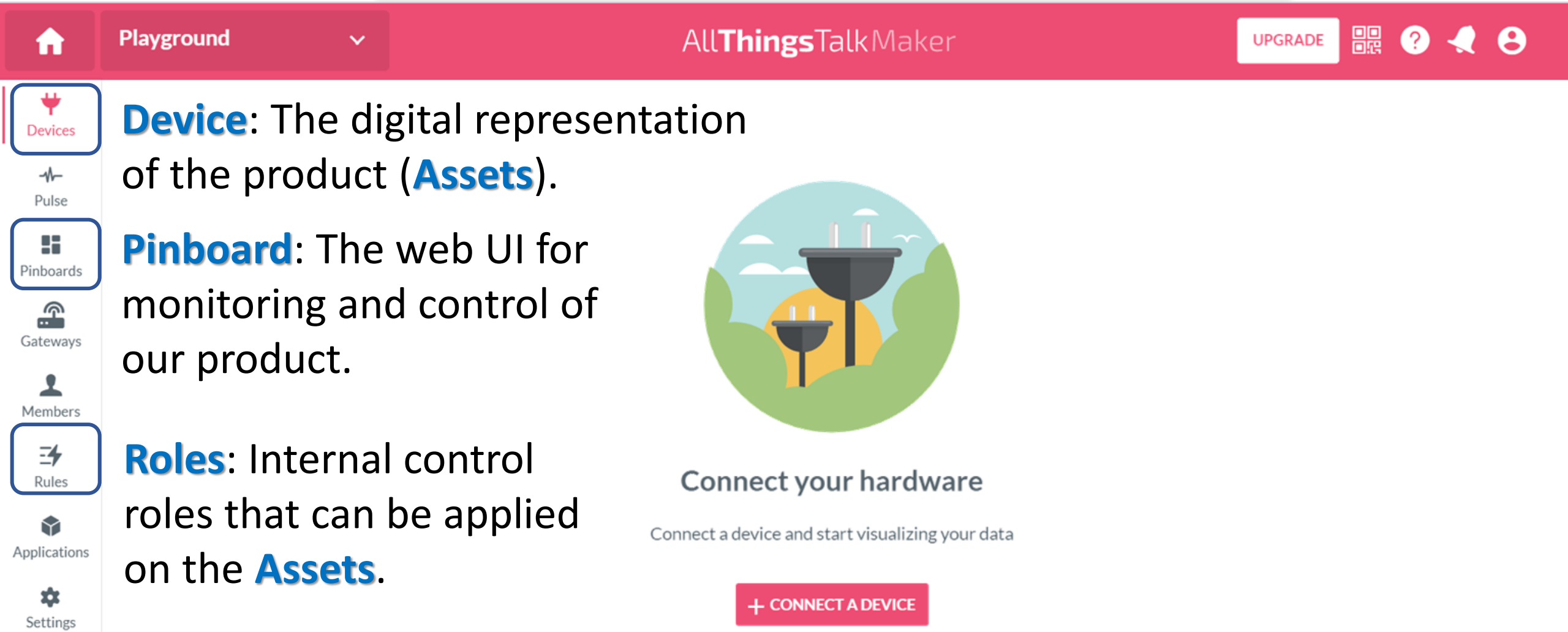

Server
The digital representation of the thing
Set
Set
Smart product
Web app.
Get
Get
Client
Client

In order to create a thing, we need to learn to:

1. Create a product.
2. Create the digital representation of the product (a web server).
3. Program the product to be a client.
4. Connect the product to its digital representation on the server.
5. Create a web user interface (UI).
6. Connect the UI to its digital representation on the server.

The platforms we will explore

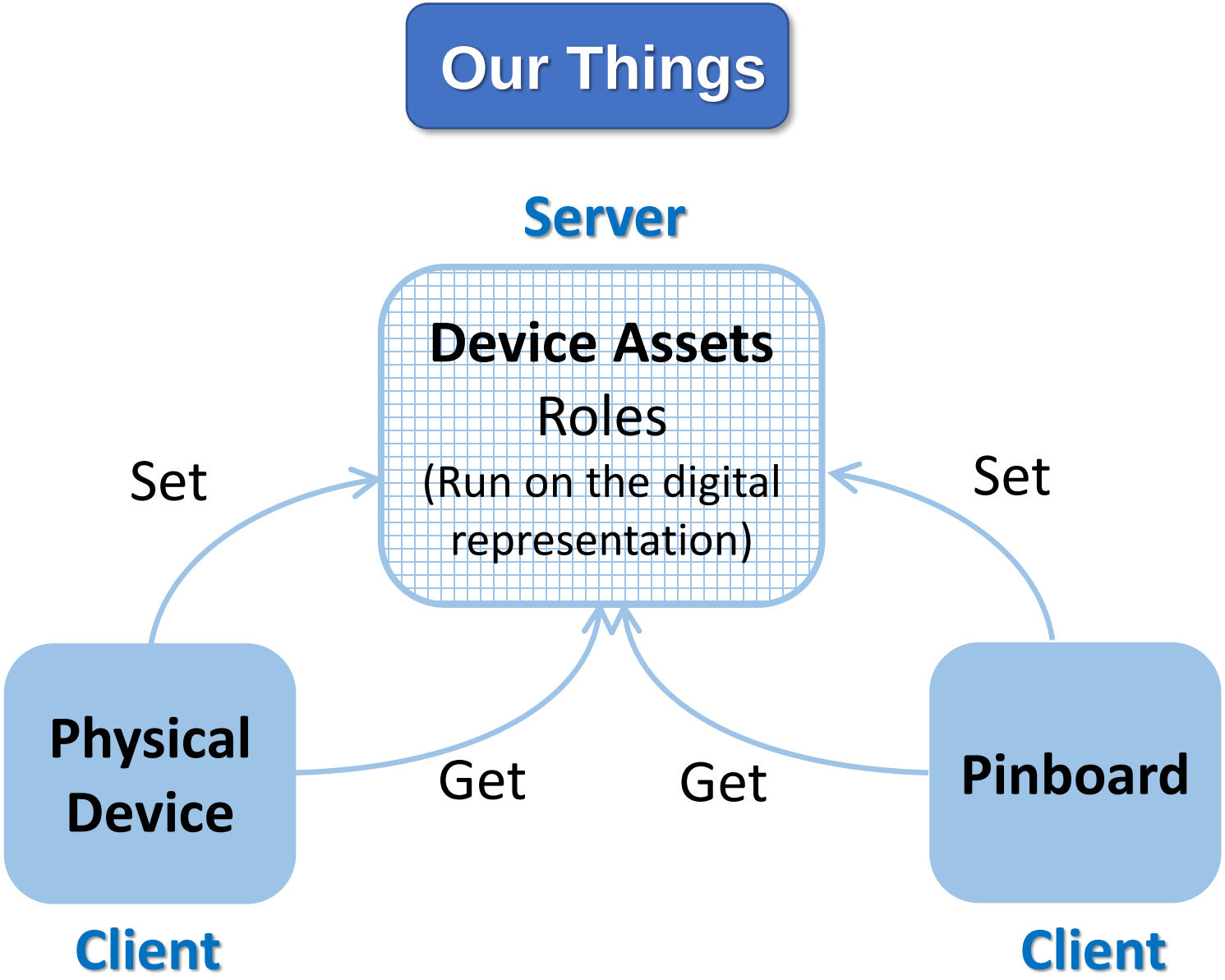
AllThingsTalk (ATT) composer main page



Device: The digital representation of the product (**Assets**).

Pinboard: The web UI for monitoring and control of our product.

Roles: Internal control roles that can be applied on the **Assets**.


Our Things
Server
Device Assets
Roles
(Run on the digital representation)
Set
Set
Physical Device
Pinboard
Get
Get
Client
Client

Lab exercise 1: your smartphone as a “thing”

1. Sign in to AllThingsTalk Maker.
2. Press on **Devices** and then on **CONNECT A DEVICE**.
3. At the end of the list of devices you will find **Your smartphone**, press on it.
4. Scann the QR code that appears at the right.
5. Eight **Assets** will appear for your device (6 sensors and 2 actuators). Notice that are a few types of assets (in this case, Strings, Objects, Booleans, and Number).
6. Press on **Pinboards**, create and name a pinboard.
7. Add to you pinboard 2 sensors and 2 actuator.
8. Make sure you can sense and actuate!
9. Add **Rules** to receive an indication when your battery drops below a specified value.

The End.