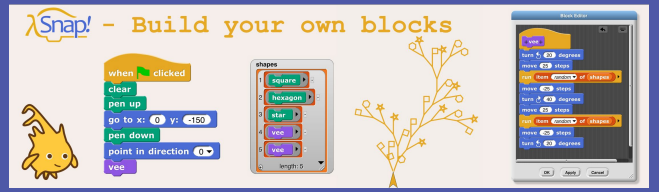
Tour of My Embedded Linux Powered Private Smart Home

Kathy Giori

May 2021

CC BY-SA 4.0



MicroBlocks is a registered trademark of the Software Freedom Conservancy and PlatformIO is a registered trademark of PlatformIO.org

But First, Free Software and Me

First job -- Fortran data analysis, NI LabVIEW test programs, running Linux + custom sw on rugged luggables with packet radio and GPS

Startups -- 1) Linux on laptops, VNC, the web, “view source” screen scraping with perl:cgi for wireless Palm VII apps, 2) synchronous mesh networking, 3) flashing Linksys and other routers for managed Wi-Fi hotspot SaaS

Corporate -- succeeded with upstream Wi-Fi drivers and OpenWrt as base SDK, in a proprietary world

Education -- physical computing (microcontrollers), embedded Linux and apps for Raspberry Pi, … open/free!

Lesson learned -- go for impact over profit, filter rolodex to maintain ties with best/brightest, those philosophically aligned and passionate about free software, who want to make the world a better place

Smart home concerns

What risks are worth the value?

Security

I don’t want hackers accessing my home network nor launching attacks.

Privacy

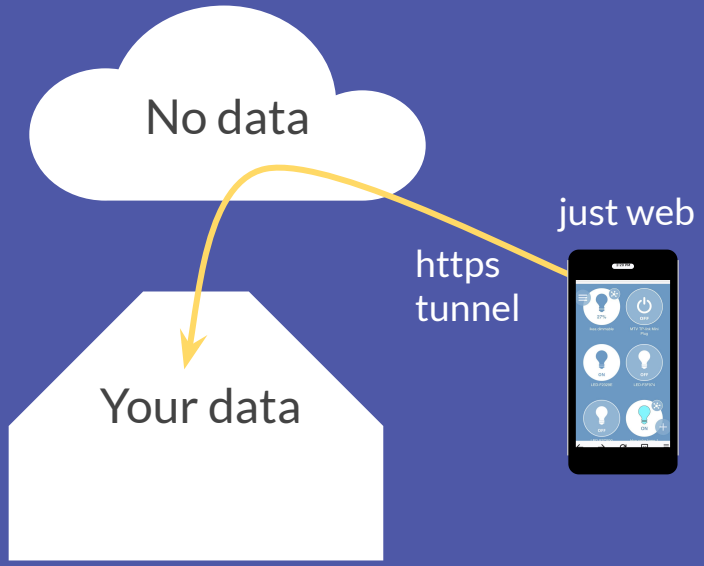
My data in the wrong hands would reveal when to break in. Analysts viewing my home habits feels creepy. I don’t want any of those listening devices!

Interoperability

I can’t figure out how pushing the doorbell can trigger turning on the outside light.

Overall Value

I worry that my investment in time, money, and effort will not provide sufficient value.



Private Smart Home

(data local, private)

Typical Vendor

(data in cloud)

Web of Things = IoT Interoperability

Linking together different smart home systems using the Web of Things.

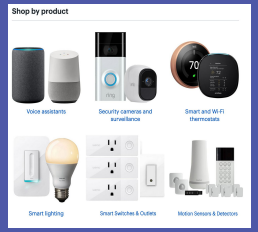
Your Own **Private** Smart Home

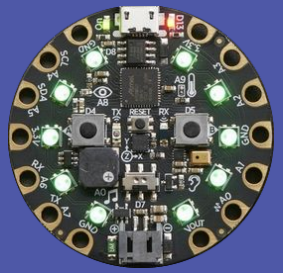
Gateway

WebThings Gateway

+

Smart Devices

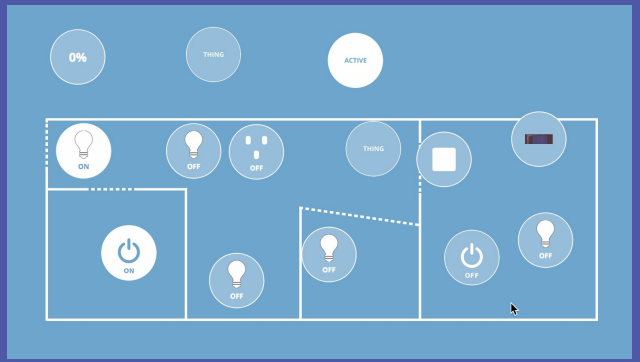




buy
or
build

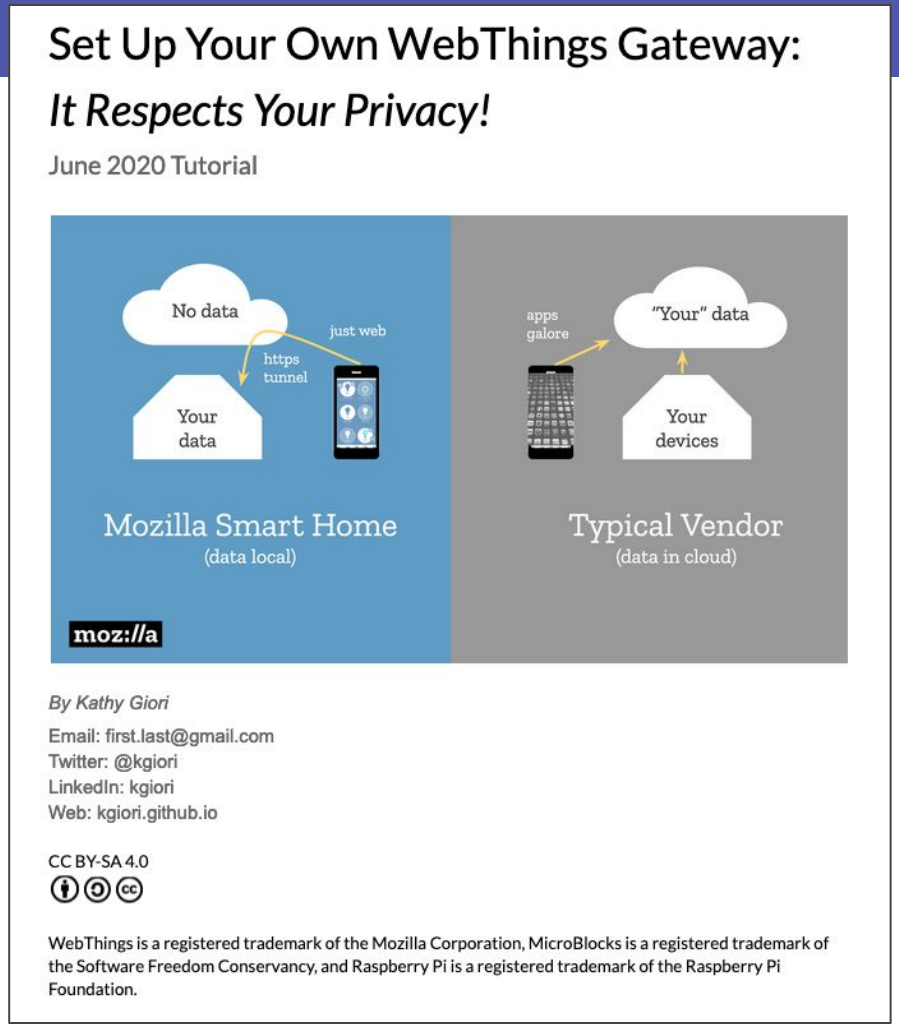
=

Consumer Privacy



Gateway Tutorial

- Online tutorial walks through setup and configuration process of WebThings Gateway



Set Up Your Own WebThings Gateway:

It Respects Your Privacy!

June 2020 Tutorial

By Kathy Giori

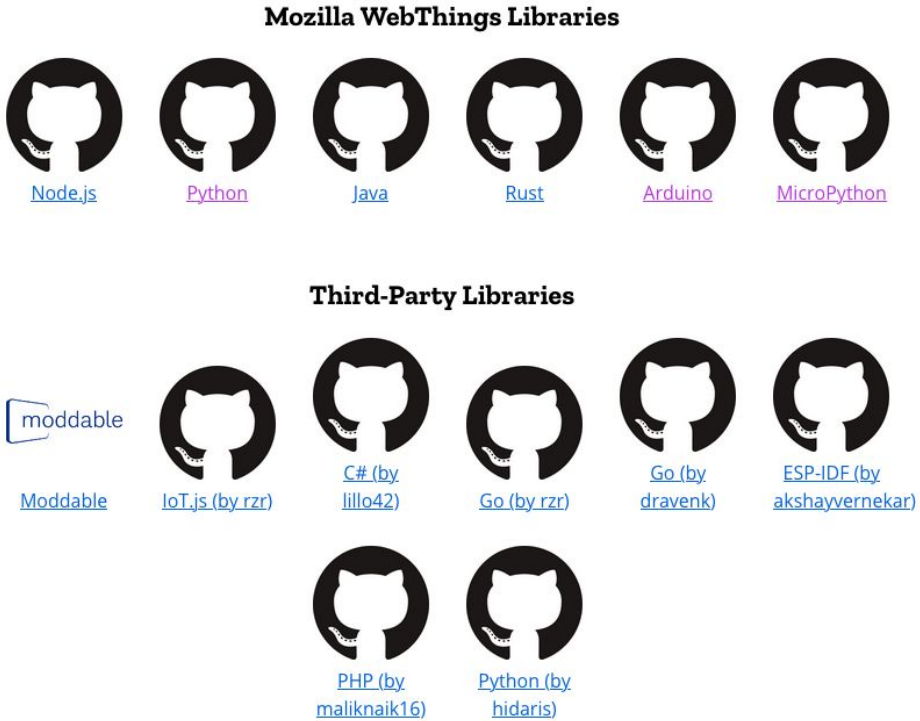
Email: first.last@gmail.com
Twitter: @kgiori
LinkedIn: kgiori
Web: kgiori.github.io

CC BY-SA 4.0

WebThings is a registered trademark of the Mozilla Corporation, MicroBlocks is a registered trademark of the Software Freedom Conservancy, and Raspberry Pi is a registered trademark of the Raspberry Pi Foundation.

WebThings Framework

- Library support for many different programming languages
- Mozilla schemas defined at https://iot.mozilla.org/schemas

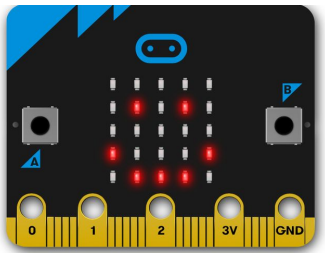


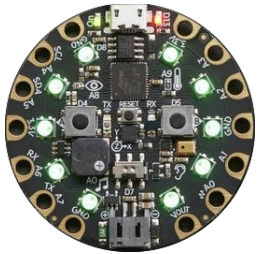
microBlocks
Small, Fast, Human Friendly

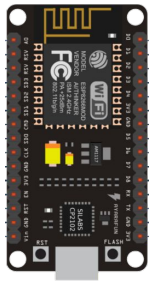
MicroBlocks: Small, Fast, Human Friendly

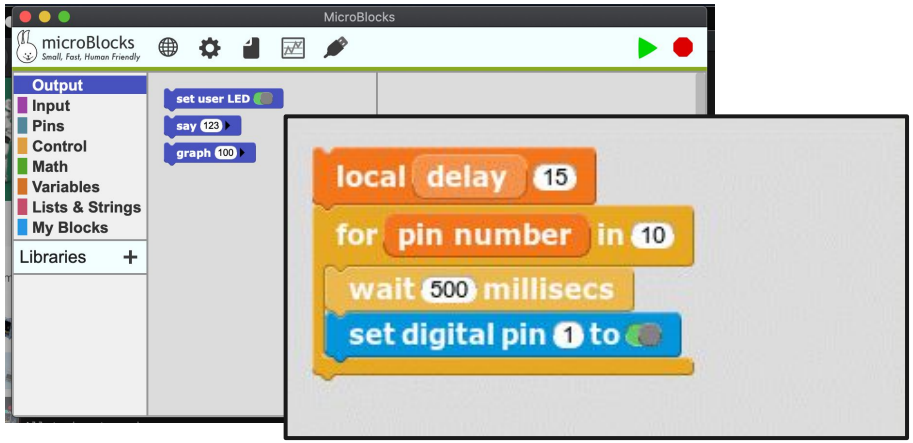
- Excellent tool for teaching physical computing in education
- Software is open source, free to use, translatable to any language
- Supports popular boards (BBC micro:bit, Circuit Playground Express, several Espressif models, ...)
- Open curriculum shared via CC BY SA 4.0

http://microblocks.fun

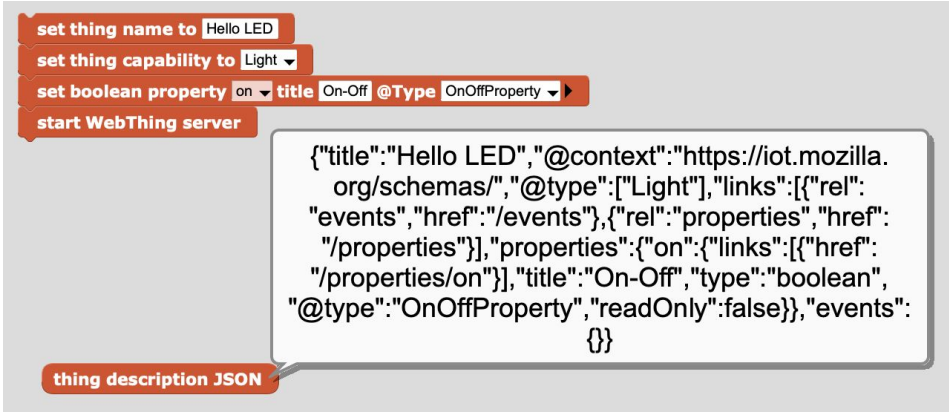








Behind the blocks, is JSON



Capabilities

- Alarm
- BinarySensor
- ColorControl
- ColorSensor
- DoorSensor
- EnergyMonitor
- LeakSensor
- Light
- Lock
- MotionSensor
- MultiLevelSensor
- MultiLevelSwitch
- OnOffSwitch
- PushButton
- SmartPlug
- TemperatureSensor
- Thermostat

Properties

- BooleanProperty
- OnOffProperty
- MotionProperty
- OpenProperty
- LeakProperty
- PushedProperty
- AlarmProperty

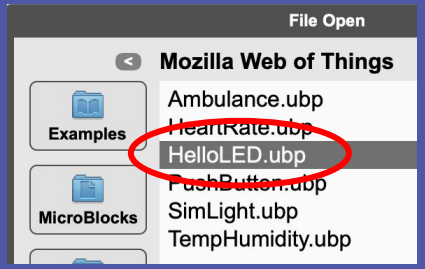
- LevelProperty
- BrightnessProperty
- ColorTemperatureProperty
- InstantaneousPowerProperty
- CurrentProperty
- VoltageProperty
- FrequencyProperty
- TargetTemperatureProperty
- TemperatureProperty

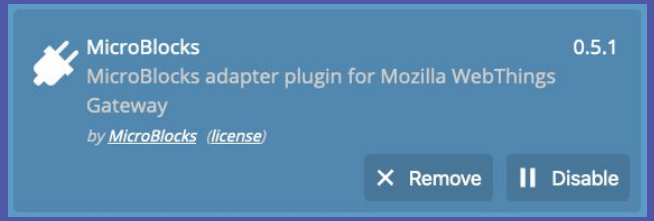
- ColorProperty
- TextProperty
- HeatingCoolingProperty
- LockedProperty
- ThermostatModeProperty

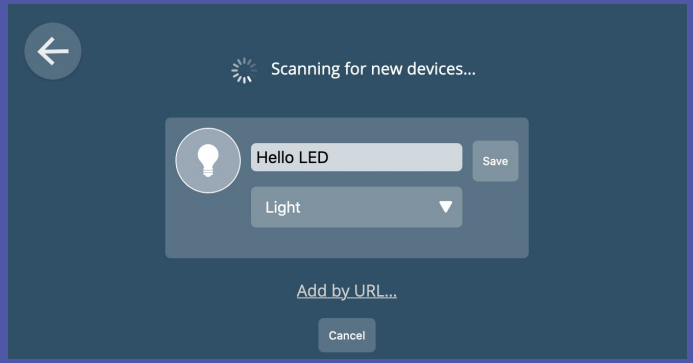
Events

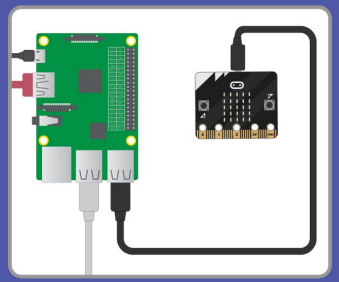
- OverheatedEvent
- PressedEvent
- DoublePressedEvent
- LongPressedEvent
- AlarmEvent

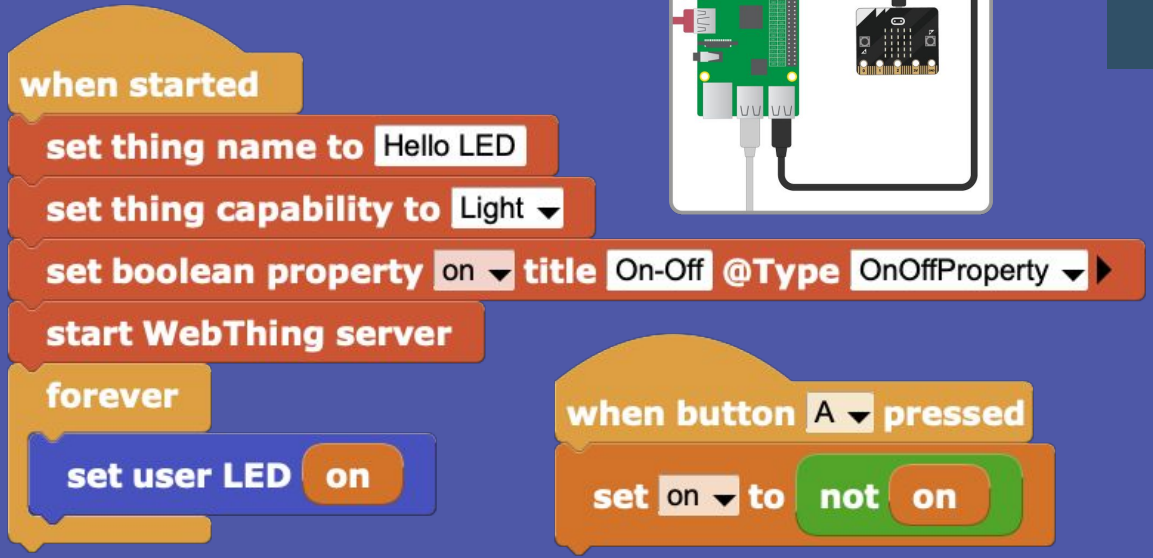
Easily Build Your Own Web Things

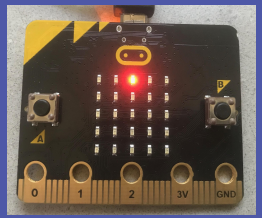


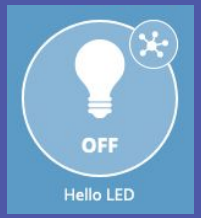


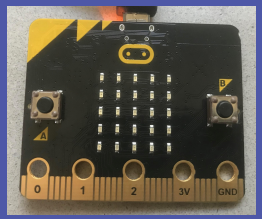




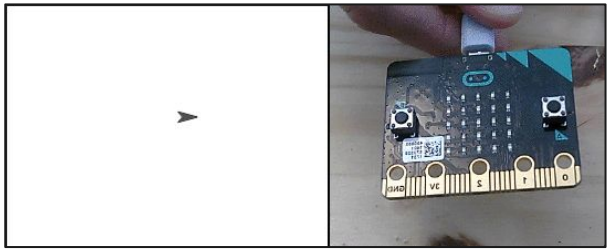


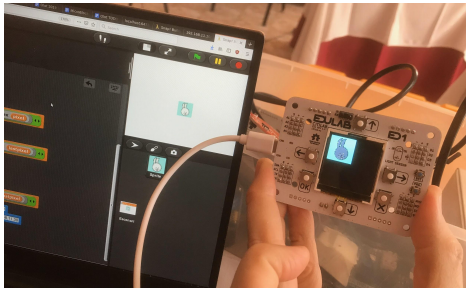




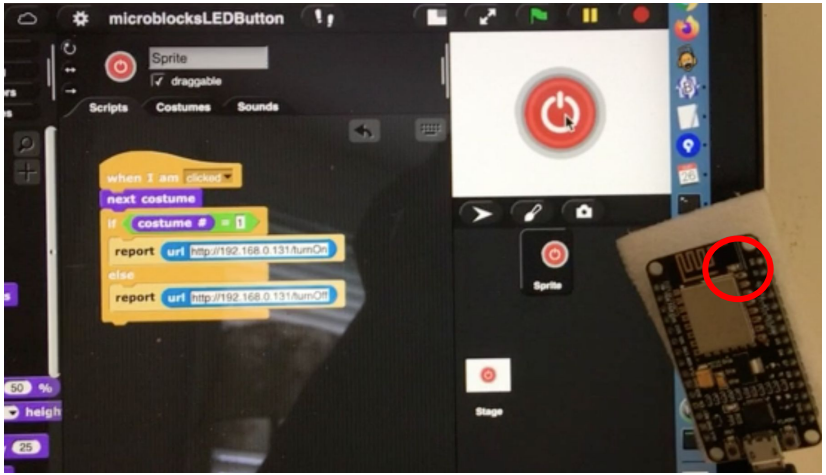


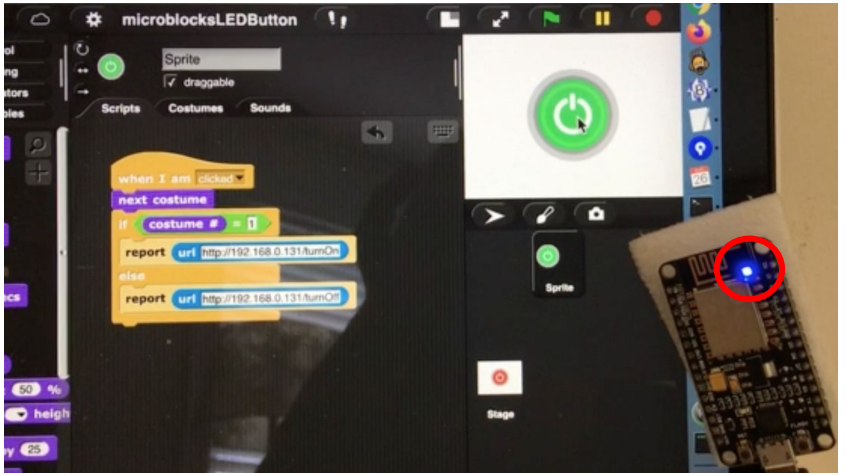
Snap!





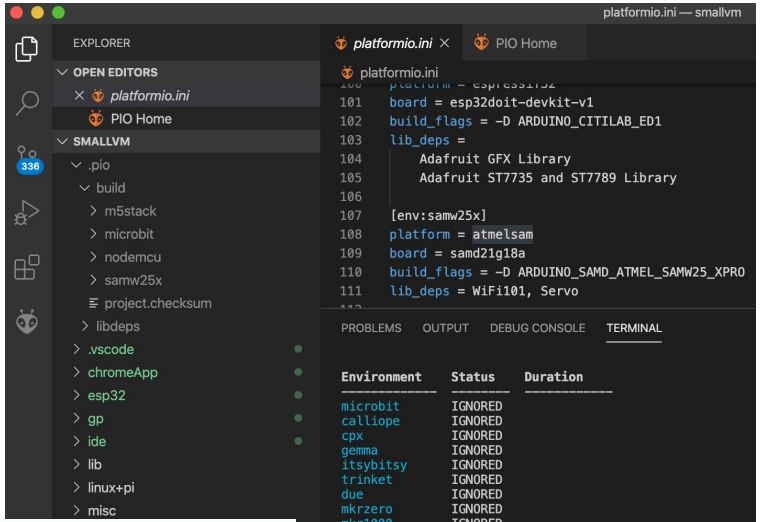
- Become a powerful coding wizard (e.g., images, sounds, actions, …)
- Collaboration between Snap! and MicroBlocks brings the power of the two environments together

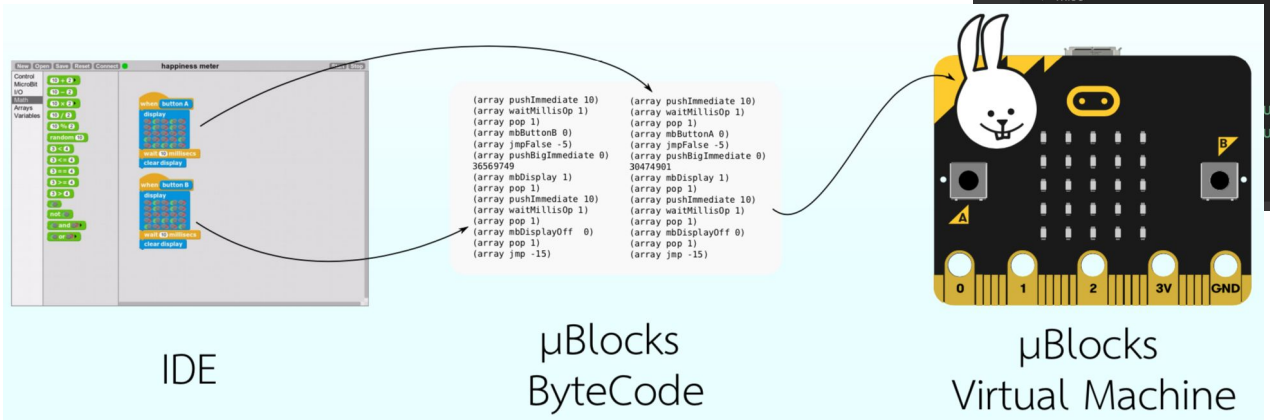




VM Built Using PlatformIO

- Blocks run in a virtual machine as byte code
- VM compiled using Arduino framework running in PlatformIO
- See currently supported hardware in platformio.ini file

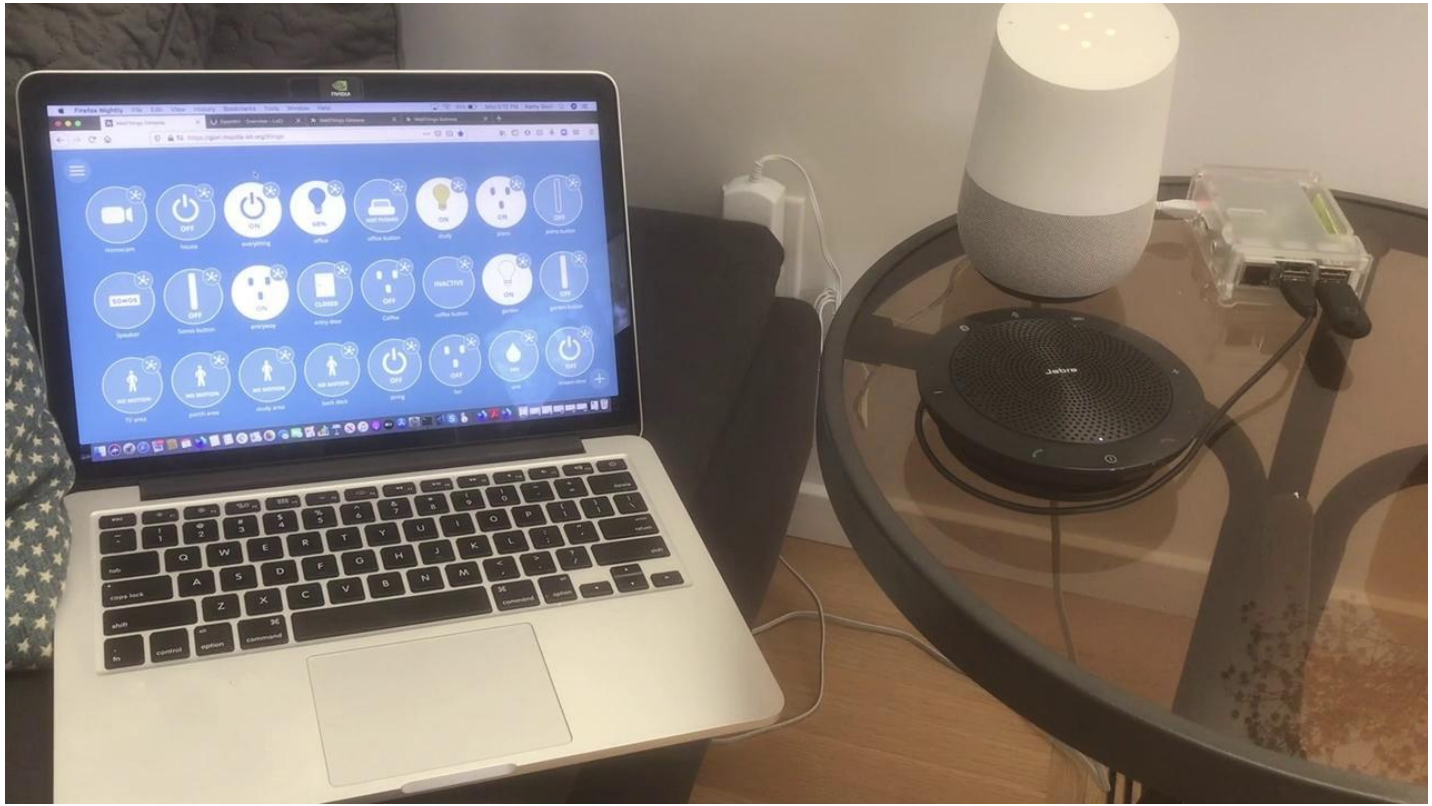




Extending “Things” to the Internet, Privately!

Controlling my house...

https://youtu.be/YZqRQPkmjSk

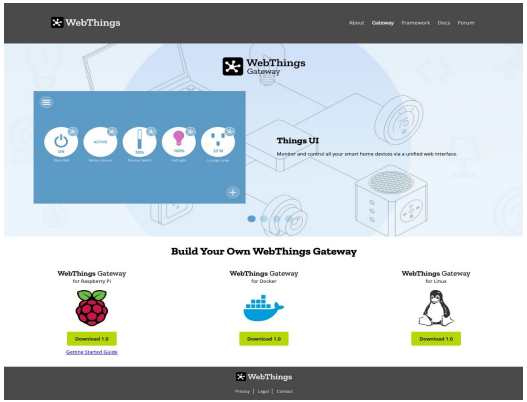


WebThings Links

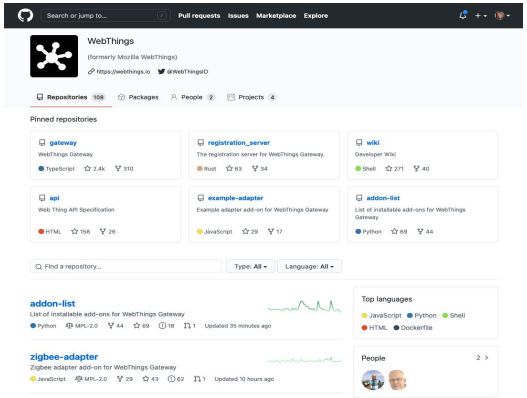
Using MicroBlocks: [wiki project]

[webthings.io]

[webthings.io/gateway]



[github.com/webthingsio]



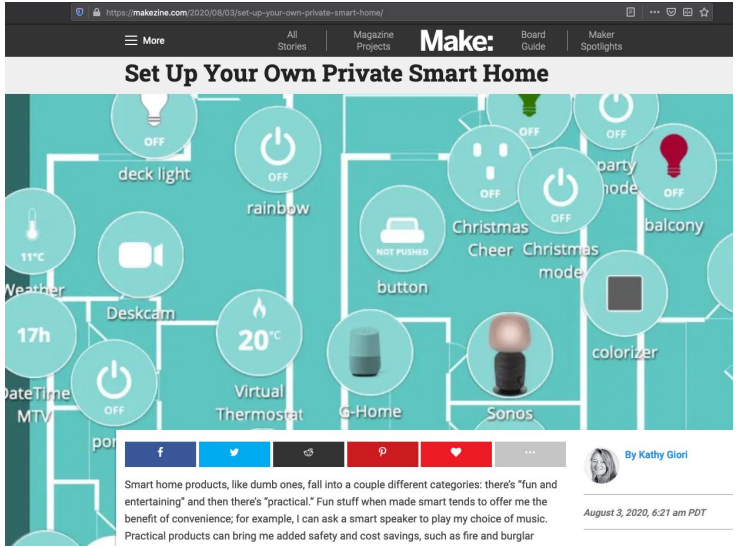
YouTube Playlists

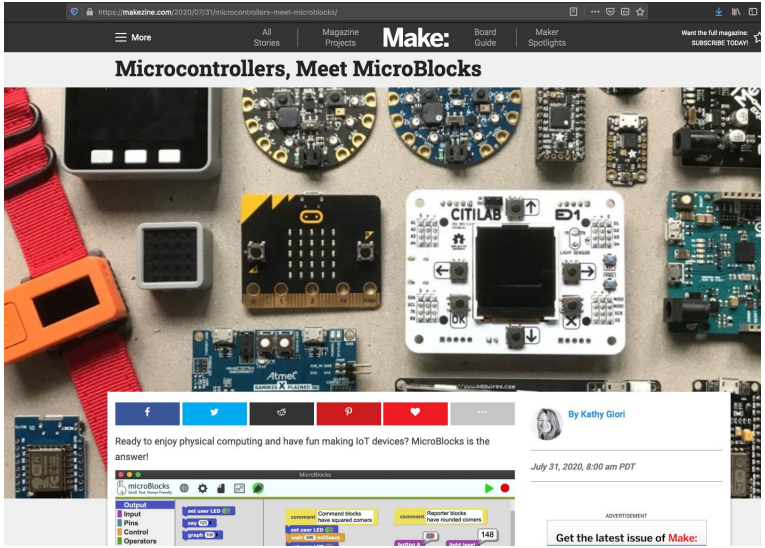
MicroBlocks: https://www.youtube.com/playlist?list=PLHsB9Dgp_QuNmxgbDnyDc3sFLGb_rFGHR

IoT: https://www.youtube.com/playlist?list=PLHsB9Dgp_QuP5oyMz76BHbN0GeTfR_dT-

Online Articles in Make Magazine

WebThings: https://makezine.com/2020/08/03/set-up-your-own-private-smart-home/
MicroBlocks: https://makezine.com/2020/07/31/microcontrollers-meet-microblocks/



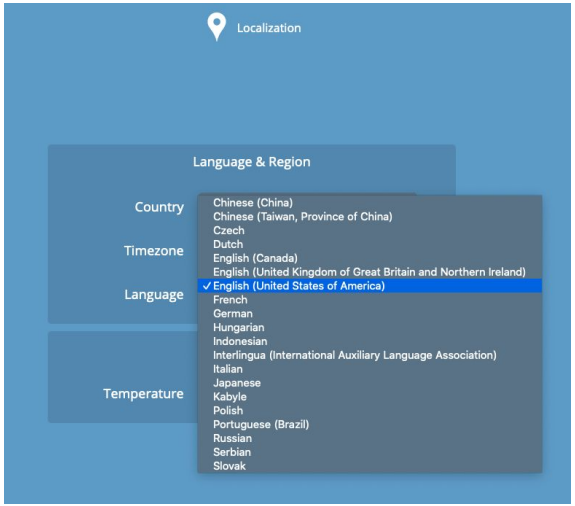


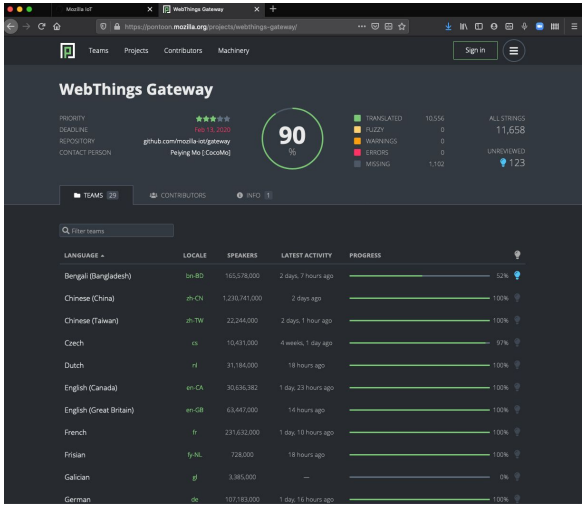
Get Involved!

- Options
  - Provide training to your local educators and students
  - Seek sponsorships for obtaining hardware and host events where you give it away
  - Support language translation (software and/or curriculum)
- Contact Me
  - How to keep in touch
    - https://chat.mozilla.org **#iot** and **#physicalcomputing** channels
    - LinkedIn, Twitter, (Instagram and Facebook mostly inactive): kgiori
    - Email: kathy.giori@gmail.com
    - Messaging apps (ask me)
- Q&A

WebThings: Language Translators Wanted

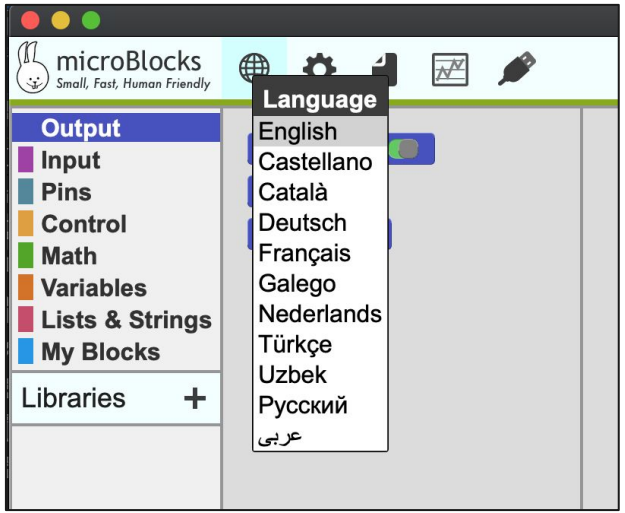
- Project: https://pontoon.mozilla.org/projects/webthings-gateway/
- 29 partial or complete translations





MicroBlocks: Language Translators Wanted

- How to help: http://wiki.microblocks.fun/Translation
- 14 partial or complete translations



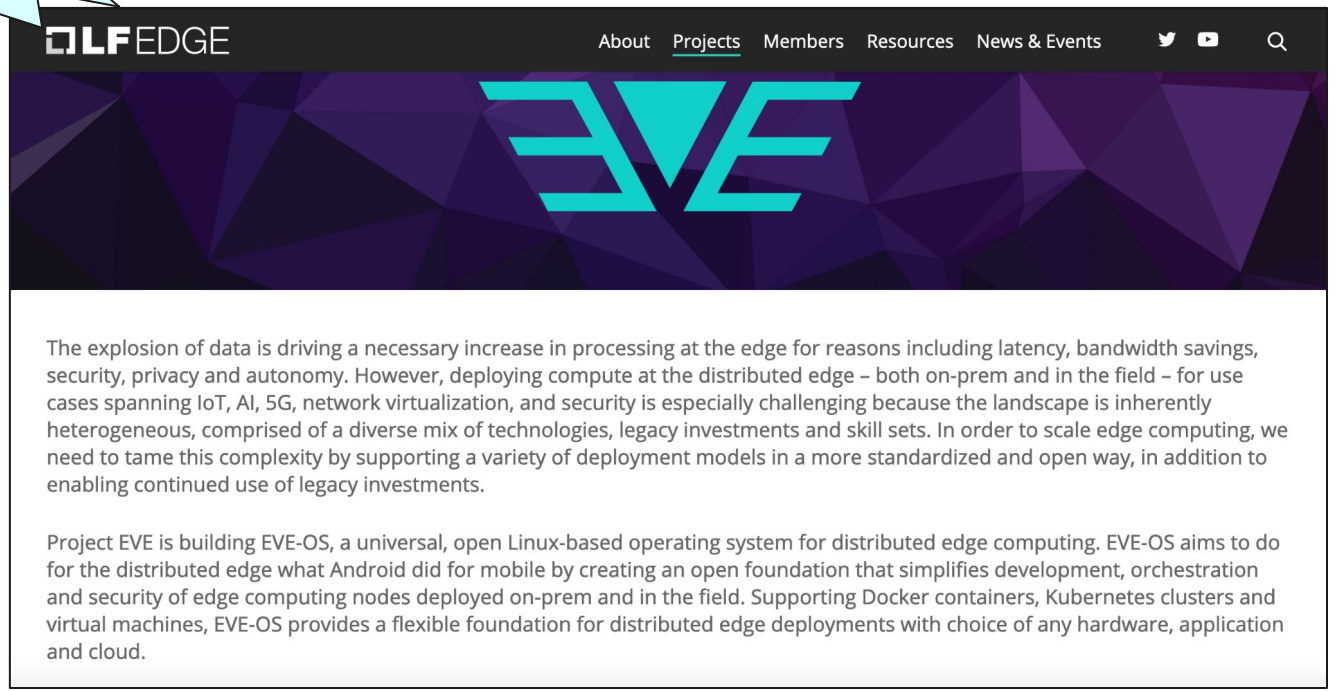
Project	MicroBlocks	WebThings	PlatformIO	Snap!
Web	microblocks.fun	webthings.io	platformio.org	snap.berkeley.edu
Source code	bitbucket.org/john_maloney	github.com/webthingsio	github.com/platformio	snap.berkeley.edu/source
Twitter	@MicroBlocksFun	@WebThingsIO	@PlatformIO_Org	@SnapCloud
Description	LIVE blocks-based code environment for physical computing. Lets you program microcontrollers with ease.	Local, private, secure, W3C interoperable gateway project for IoT device control. Great for private smart home control.	Best embedded development tool, whether a fan of Arduino or advanced SDKs. One system, any platform.	Easy start, no limits. Snap! is the ultimate power tool of blocks-based coding. Connected, media rich, portable.

another FOSS fave!

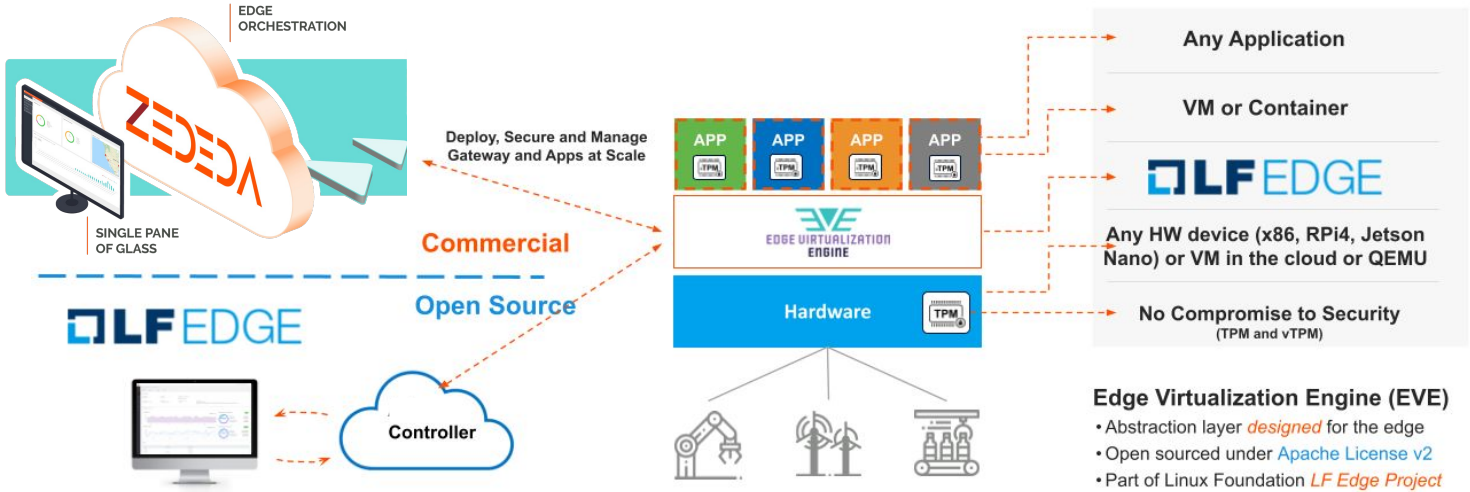
EVE

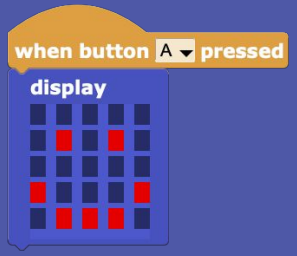
Open API “edge to cloud” specification

Intended to integrate “security by design” into mass scale deployments of edge nodes using the convenience of cloud orchestration tools.



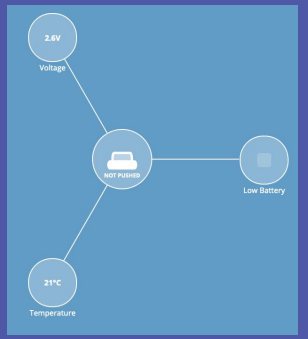
EVE offers OTs app flexibility and reduces IT headaches

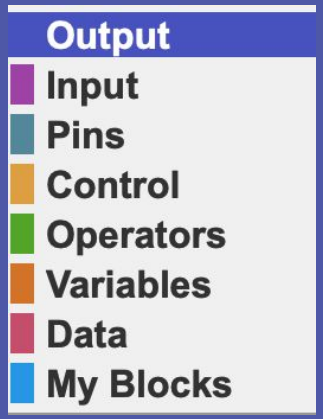




Demo Time!

https://youtu.be/Z8maG977u0o

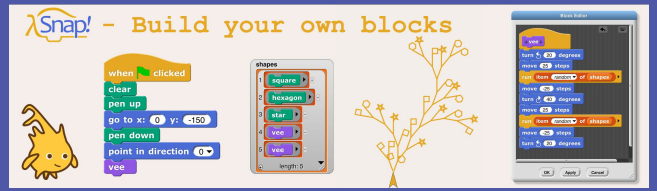




Thank You!
Q&A

microBlocks
Small, Fast, Human Friendly

PLATFORMIO.ORG


Snap! - Build your own blocks
when clicked
clear
pen up
go to x: 0 y: -150
pen down
point in direction 0
vee
shapes
square
hexagon
star
vee
vee