

Tour of My Embedded Linux Powered Private Smart Home

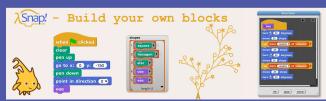
Kathy Giori May 2021

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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

Security

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

Smart home concerns

What risks are worth the value?

Privacy

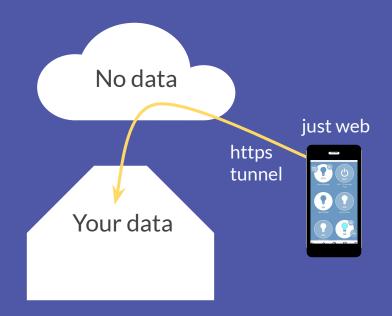
My data in the wrong hands would reveal when to break in. Analysts viewing my home habits feels creepy. I don't want any of those listening devices!

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



IP Connected Devices (Wi-Fi, Ethernet,...)

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

Your Own Private Smart Home

Gateway



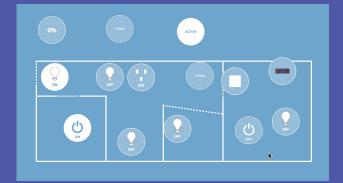
WebThings Gateway

Smart Devices





buy __ or __ build Consumer Privacy

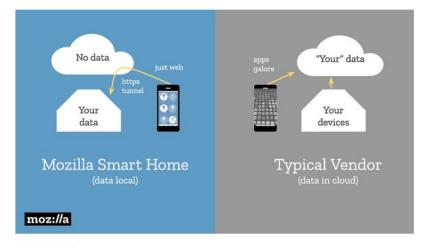


Gateway Tutorial

 Online <u>tutorial</u> walks through setup and configuration process of WebThings Gateway

Set Up Your Own WebThings Gateway: It Respects Your Privacy!

June 2020 Tutorial



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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

Mozilla WebThings Libraries













Node.js

Third-Party Libraries



Moddable









dravenk)



akshayvernekar)



PHP (by maliknaik16)



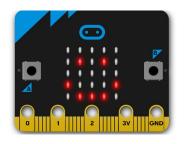
Python (by hidaris)



MicroBlocks: Small, Fast, Human Friendly

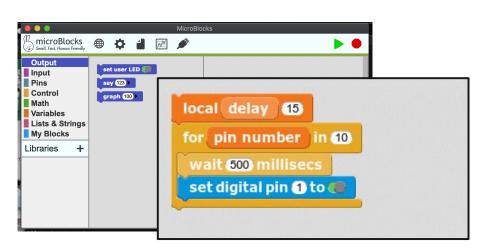
- Excellent tool for teaching physical computing in education
- Software is open source, free to use, translatable to any language
- Supports popular boards (BBC micro:bit, Circuit Playground Express, several Espressif models, ...)
- Open curriculum shared via CC BY SA 4.0

http://microblocks.fun









Behind the blocks, is JSON

Capabilities Properties

Alarm

BinarySensor

ColorControl

ColorSensor

DoorSensor

EnergyMonitor

LeakSensor

Light

Lock

MotionSensor

MultiLevelSensor

MultiLevelSwitch

OnOffSwitch

PushButton

SmartPlug

TemperatureSensor

Thermostat

BooleanProperty OnOffProperty

MotionProperty

OpenProperty

LeakProperty

PushedProperty

AlarmProperty

LevelProperty

BrightnessProperty

ColorTemperatureProperty

InstantaneousPowerProperty

CurrentProperty

VoltageProperty

FrequencyProperty

TargetTemperatureProperty

TemperatureProperty

set thing name to Hello LED set thing capability to Light set boolean property on → title On-Off @Type OnOffProperty → start WebThing server {"title":"Hello LED","@context":"https://iot.mozilla. org/schemas/","@type":["Light"],"links":[{"rel": "events", "href": "/events"}, {"rel": "properties", "href": "/properties"}],"properties":{"on":{"links":[{"href": "/properties/on"}],"title":"On-Off","type":"boolean", "@type":"OnOffProperty", "readOnly":false}}, "events": thing description JSON

Events

OverheatedEvent

PressedEvent

DoublePressedEvent

LongPressedEvent

AlarmEvent

ColorProperty

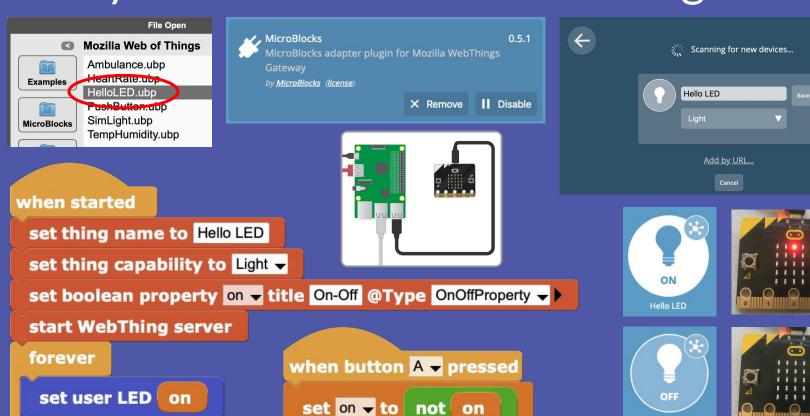
TextProperty

HeatingCoolingProperty

LockedProperty

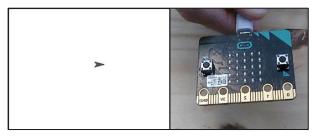
ThermostatModeProperty

Easily Build Your Own Web Things



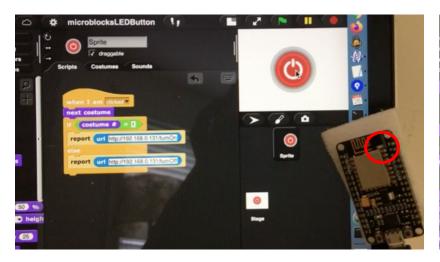
Hello LED

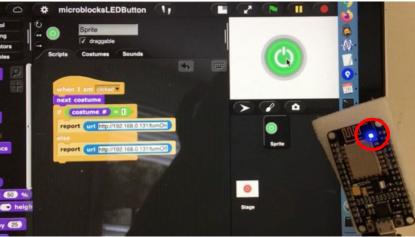
Snap! \Snap!





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

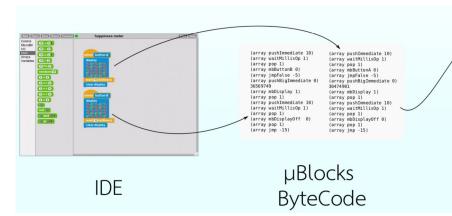


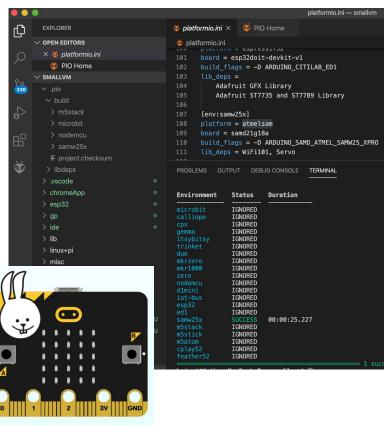




VM Built Using PlatformIO

- 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





μBlocks

Virtual Machine

https://youtu.be/YZqRQPkmjSk

Extending "Things" to the Internet, **Privately!**

Controlling my house...



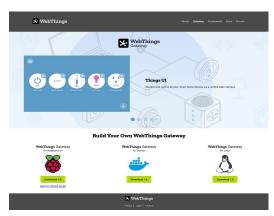
WebThings Links

Using MicroBlocks: wiki project

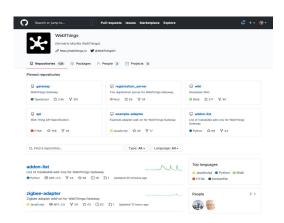
webthings.io



webthings.io/gateway



github.com/webthingsio



YouTube Playlists

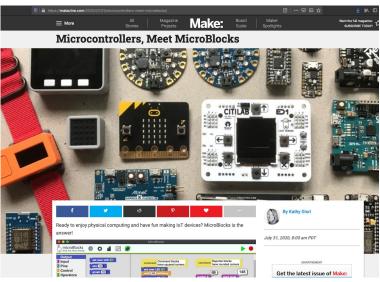
MicroBlocks: https://www.youtube.com/playlist?list=PLHsB9Dgp QuNmxqbDnyDc3sFLGb rFGHR

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/2020/08/03/set-up-your-own-private-smart-home/





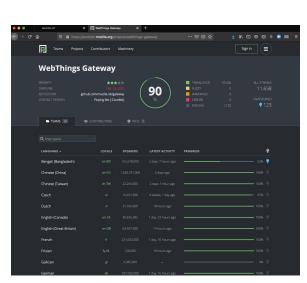
Get Involved!

- 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
 - <u>LinkedIn</u>, <u>Twitter</u>, (Instagram and Facebook mostly inactive): kgiori
 - Email: kathy.giori@gmail.com
 - Messaging apps (ask me)
- Q&A

WebThings: Language Translators Wanted

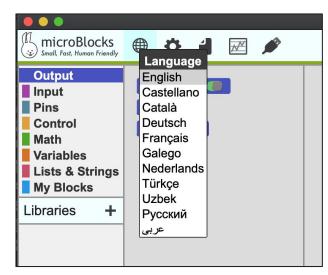
- Project: https://pontoon.mozilla.org/projects/webthings-gateway/
- 29 partial or complete translations

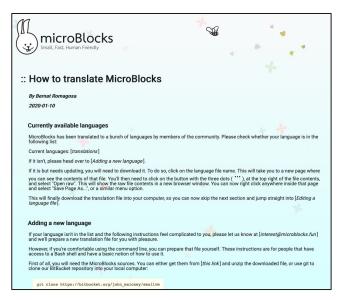




MicroBlocks: Language Translators Wanted

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











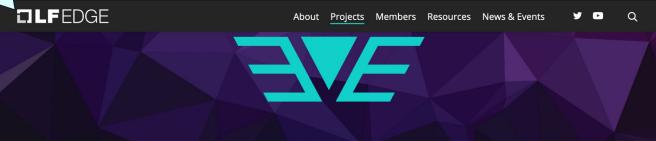


Project	MicroBlocks	WebThings	PlatformIO	Snap!
Web	microblocks.fun	webthings.io	platformio.org	snap.berkeley.edu
Source code	bitbucket.org/john_maloney	github.com/webthingsio	github.com/platformio	snap.berkeley.edu/source
Twitter	@MicroBlocksFun	@WebThingsIO	@PlatformIO_Org	@SnapCloud
Description	LIVE 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.



Open API "edge to cloud" specification

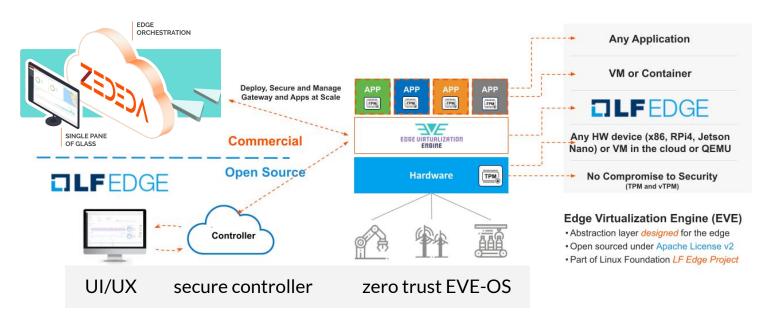
Intended to integrate "security by design" into mass scale deployments of edge nodes using the convenience of cloud orchestration tools.

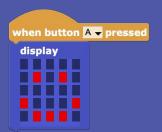


The explosion of data is driving a necessary increase in processing at the edge for reasons including latency, bandwidth savings, security, privacy and autonomy. However, deploying compute at the distributed edge – both on-prem and in the field – for use cases spanning IoT, AI, 5G, network virtualization, and security is especially challenging because the landscape is inherently heterogeneous, comprised of a diverse mix of technologies, legacy investments and skill sets. In order to scale edge computing, we need to tame this complexity by supporting a variety of deployment models in a more standardized and open way, in addition to enabling continued use of legacy investments.

Project EVE is building EVE-OS, a universal, open Linux-based operating system for distributed edge computing. EVE-OS aims to do for the distributed edge what Android did for mobile by creating an open foundation that simplifies development, orchestration and security of edge computing nodes deployed on-prem and in the field. Supporting Docker containers, Kubernetes clusters and virtual machines, EVE-OS provides a flexible foundation for distributed edge deployments with choice of any hardware, application and cloud.

EVE offers OTs app flexibility and reduces IT headaches





Demo Time!

<u> https://youtu.be/Z8maG977u0o</u>



Output
Input
Pins
Control
Operators
Variables
Data
My Blocks



Thank You! Q&A









