Project Things
A secure gateway to connect your things to Internet

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<https://fosdem.org/2019/schedule/event/project_things>
Speakers

Dipesh Monga
@ Mozilla Techspeakers

Philippe Coval
@ Samsung OpenSource
The hidden dangers of uploading our physical lives to the cloud.

---UPDATE---
> You have 15 pairs of underwear left.
   [Ok] [buy more underwear] [find help online]
> Your cat checked in at the litterbox.
> Your microwave just heated a lasagna.
> Record: You stared out the window for 23 minutes.
   [Ok] [post your score]
> Your couch likes your microwave's status update.
> It's raining again.
   [Ok]
> 15 of your things are broken.
> You haven't left the house in 5 days.
   [Ok]
Shodan: The scariest search engine on the Internet

Explore the Internet of Things
Use Shodan to discover which of your devices are connected to the internet, where they are located and who is using them.

Monitor Network Security
Keep track of all the computers on your network that are directly accessible from the internet. Shodan lets you understand your digital footprint.

See the Big Picture
Websites are just one part of the Internet. There are power plants, Smart TVs, refrigerators and much more that can be found with Shodan.

Get a Competitive Advantage
Who is using your product? Where are they located? Use Shodan to perform empirical market intelligence.
Shodan: Potential Targets

- Routers
- Webcams
- SCADA systems
- Traffic Lights
- Wind farms
- Refrigerators
- Printers
- Gas station pumps, Power Grids
Project Things
by Mozilla
Mozilla Solution Addresses Biggest Smart Home Concerns

- Monthly service cost would be too high: 51%
- It could compromise the privacy of my personal information: 36%
- Initial cost of set up would be too high: 35%
- The technology could malfunction on a regular basis: 29%
- Reliability of the technology system in a power outage situation: 29%
- It could compromise the security of my home: 26%
- The technology will not be easy enough to use: 19%
- It might be unattractive in my home: 9%

Price Concerns
62% also agree with the statement: “Smart home products and services are too expensive for me.”

Source: Forrester. Based on North American Consumer Technographics Consumer Tech, Media, & Telecom Online Benchmark Recontact Survey 2, Q3 2016. Base: US Online Adults 18+ (Online Weekly or More); n= 4,515
Mozilla Project Things

Vision

We envision an open and decentralized Internet of Things that puts people first, where individuals can shape their own experience and are empowered, safe and independent.

Mission

Our mission is to create an open source Web of Things implementation which embodies Mozilla’s values and helps drive IoT standards for security, privacy, and interoperability.
Directly monitor and control your home over the web, without a middleman

- Affordable one-off purchase, no monthly subscription
- Private data stays in your home by default
- Expand with devices from multiple manufacturers
Things Gateway - Use Cases

- Turn appliances on and off remotely and monitor power consumption.
- Be alerted on your smartphone if smoke is detected.
- Expand your smart home with existing smart home devices, without the need for additional apps.
- Authorize third party apps & services to access your home monitoring data.
- Turn a light on, sound an alarm or be alerted if motion is detected.
- Check what time the kids got home.
W3C Web of Things Cuts Across Silos

- Mature and secure web technologies
- Web Thing Description (plain JSON serialization)
- Web Thing API (REST + WebSockets API)
Web of Things Smart Toaster

```json
{
  "@context": "http://iot.schema.org",
  "@type": "Toaster",
  "name": "Acme Toaster",
  "description": "A web connected toaster",
  "properties": {
    "on": {
      "type": "boolean",
      "description": "Whether the toaster is currently heating bread",
      "href": "/properties/on"
    },
    "timeRemaining": {
      "type": "number",
      "unit": "seconds",
      "href": "/properties/timeRemaining"
    }
  },
  "actions": {
    "pop": {
      "description": "Pop up the toast"
    }
  },
  "events": {
    "ready": {
      "description": "Your toast is ready!"
    }
  },
  "links": {
    "properties": "/properties",
    "actions": "/actions",
    "events": "/events",
    "websocket": "wss://toaster.smith.home"
  }
}
```

The Web of Things means addressing Things via URLs and following standard APIs. Using a web framework makes things discoverable and linkable, and provides web developers with an opportunity to let users interact via a wide range of interfaces: screens, voice, gesture, augmented reality… It works even without an Internet connection.
Things Gateway 0.7 (2019-01)

Build your own gateway with a Raspberry Pi

Gateway OEM product support

- Secure, private remote access tunnels
- Over-the-air software updates
- Future options: Encrypted backups, security monitoring, 3rd party web services (via OAuth)

What Goes on in the Cloud?

Existing Wi-Fi AP

Controllers

Things Gateway (Linux)

Things

[mozilla logo]
Mozilla Project Things Framework

- **Cloud**: support for setup, backup, updates, 3rd party apps and services integration, and remote encrypted tunneling
- **Gateway**: always on IoT connectivity hub in the home
- **Controllers**: smart speakers, tablets/phones, AR headsets...
- **Devices**: sensors and actuators ("things") to instrument your smart home
Things Gateway - Security

- HTTPS via mozilla-iot.org tunnelling service TCP tunnel uses PageKite (no need to open ports on your router).
- Unique subdomains with LetsEncrypt TLS certificates: (Optionally configure your own NAT, DNS & TLS)
- JSON Web Tokens used for authentication
- OAuth to authorise third party apps & services
Things Gateway

- Downloadable OS image for Raspberry Pi
- Perfect for hackers and makers

Things Gateway

Build your own Web of Things Gateway

1. Raspberry Pi
   Get your hands on a Raspberry Pi, a single board computer. The latest Raspberry Pi has WiFi and Bluetooth support built in, as well as access to GPIO ports for direct hardware connections. This is not obligated if you can use an alternative. You'll also need a SD card to store the operating system. Raspberry Pi is the perfect bare metal computer, but it will currently provide the best experience.

2. USB Dongles
   To use your Web of Things gateway with other wireless protocols like Zigbee and Z-Wave you will need USB dongles. See the wiki for a list of compatible USB dongles and smart home devices.

3. Flash an SD card
   Download the pre-built Raspberry Pi OS image from Mozilla and flash it onto an SD card. Please note that this is experimental pre-release software and at this prototype stage it is not ready for production use. It is intended as an early preview for hackers, makers and web developers to get their hands on the Web of Things.

   Alternatively, if you'd prefer to try out the software on your PC you can follow the instructions below to checkout the code and build it yourself.

For a more detailed How-to guide and a tour of the gateway's features, see our blog post on Mozilla Hacks.

iot.mozilla.org/gateway
Tech details 😱
Setup: Things Gateway

- Download gateway
  - Dump supported image to SDcard for RPi
  - or rebuild srcs for desktop or other boards
- Connect to it using web browser
  - Optionally: Setup WiFi, domain
- Install addons (ie: Virtual WebThings)
- Add more things to dashboard
- Automate conditions from sensors to actuators
  - Use rules engine from GUI
What are WebThings?

- Webthings are just HTTP servers
  - Connected to gateway (star topology, not P2P)
- Specified by MozIot schema (Described in JSON)
- Easy to implement (JS, Python, C/C++, Rust...):
  - for **node.js** runtime:
    - npm install webthing
  - for **IoT.js** alt runtime: webthing-iotjs (fork)
    - IoT.js uses JerryScript engine (ES 5.1)
    - Develop on POSIX OS (GNU/Linux)
    - Deploy on MCU: TIZEN™ RT
    - More: “Bring JS to IoT” (Sun 14h JS room)
var webthing = require('webthing-iotjs');

function SomeProperty(thing) {
    webthing.Property.call(this, thing, 'SomeProperty', new webthing.Value(42), {'@type':'LevelProperty'});
}

var thing = new webthing.Thing('SomeThing');
thing.addProperty(new SomeProperty(thing));

var server = new webthing.WebThingServer(new webthing.SingleThing(thing), 8888);
server.start();

$ curl http://localhost:8888
{
    "name": "SomeThing",
    "href": "/",
    "@context": "https://iot.mozilla.org/schemas",
    "@type": [null],
    "properties": {
        "SomeProperty": {
            "links": [
                {"rel": "property",
                "href": "/properties/SomeProperty"}
            ]
        }
    },
    "links": [
        {"rel": "properties",
        "href": "/properties"}
    ]
}

$ curl http://localhost:8888/properties/SomeProperty
{"SomeProperty":42}
Protocol Interoperability using REST

var mqtt = require('mqtt'); // IoT.js built-in module
function MqttProperty(thing) {
  var self = this;
  webthing.Property.call(this, thing,
    'Humidity', new webthing.Value(0), {'@type': 'LevelProperty'});
  thing.client.subscribe('workgroup/$MACHINE_ID/air/humidity');
  thing.client.on('message', function(data) {
    var update = JSON.parse(data.message.toString())['humidity'];
    self.value.notifyOfExternalUpdate(update);
  });
}

var thing = new webthing.Thing('MqttSensor');
thing.client = new mqtt.connect({host: 'iot.eclipse.org', port: 1883},
  function() {
    thing.addProperty(new MqttProperty(thing));
    (new webthing.WebThingServer(...)).start();
  });
Extends gateway With addons

- Adapters to bridge:
  - Other IoT devices (or protocols)
    - E.g: Onvif Cameras...
  - Or online services:
    - E.g: ActivityPub/Mastodon, EMail
  - I/O: Generic Sensors (I2C), GPIO, USB?

- Can be implemented in any language
  - IPC is used for Node.JS using nanomsg

- Community supported
Live demo

https://youtu.be/OT0Ahuy3Cv4#webthing-iotjs-opendata-20190202rzr
Get Involved

Build a Web Thing
Build your own web things with the Things Framework

Create an adapter
Create a Things Gateway adapter add-on to bridge an existing IoT device or protocol to the web

Hack on Project Things
Help us develop our Web of Things implementation

iot.mozilla.org/contribute
Find Out More

iot.mozilla.org

#iot on IRC
@MozillaIoT on Twitter
Mozilla IoT on Discourse
APPARENTLY OUR SMART HOUSE DECIDED IT DIDN'T NEED US ANYMORE.

LET US IN!

“CAN I INTEREST YOU IN A FIREWALL FOR YOUR TOASTER?”
Thank you

#mozilla

#moztechspeakers

@diipeshmonga

@RzrFreeFr irc://irc.mozilla.org/iot

https://social.samsunginter.net/@rzr/

https://github.com/rzr/webthing-iotjs/wiki