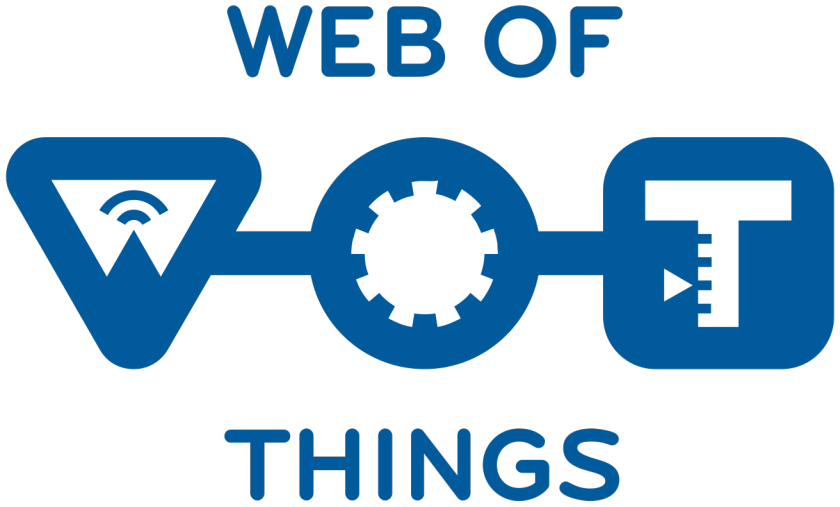


The Web of Things, IoT, and Publishing

October 2020

Outline

Internet of Things

- What is it?
- What is its value?

Web of Things

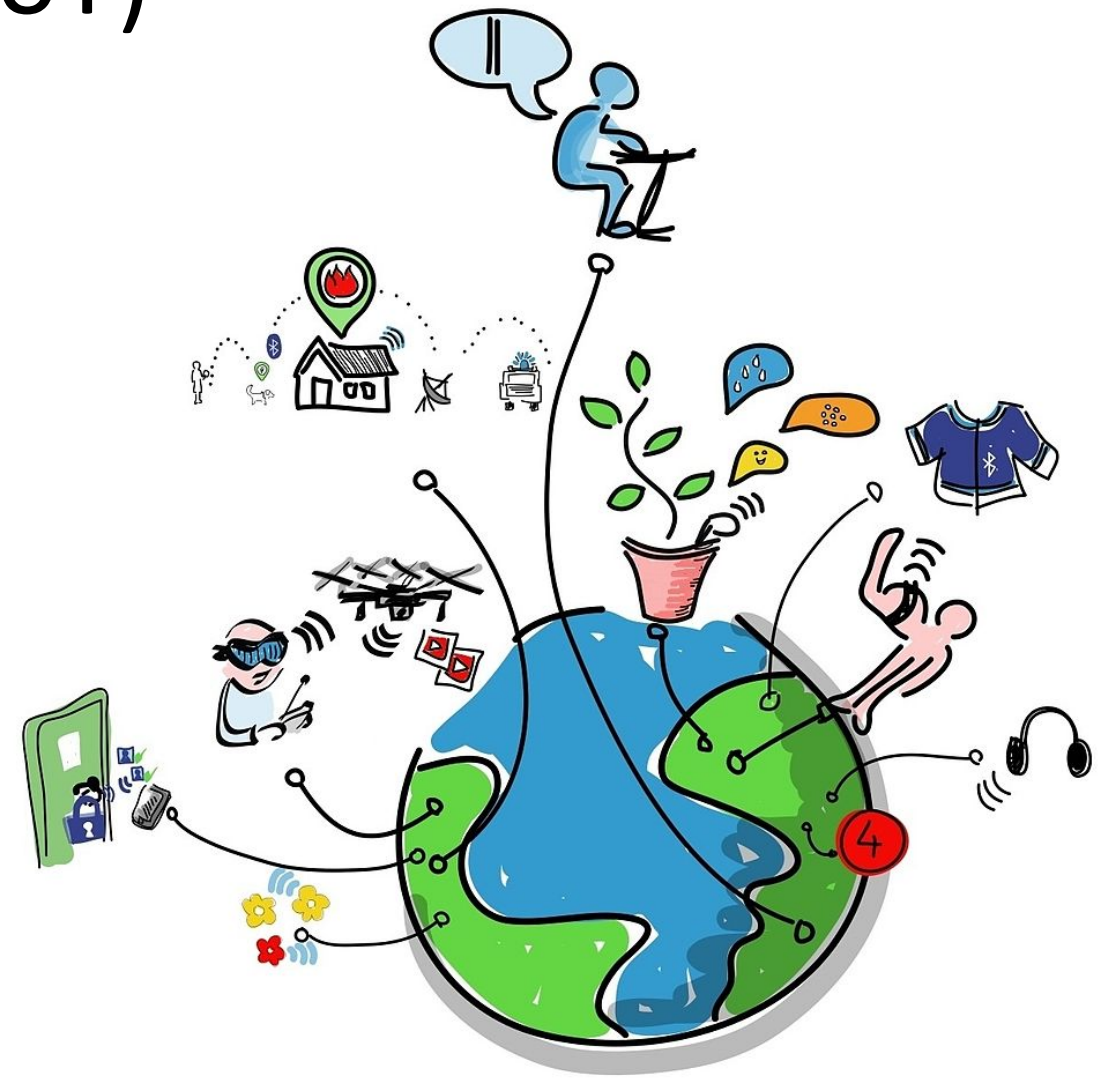
- Addressing the problem of interoperability
- Align the IoT with web standards

Publication Use Cases – Discussion

- Hybridcast (NHK)
- Interactive education
- eBook as a Thing

Internet of Things (IoT)

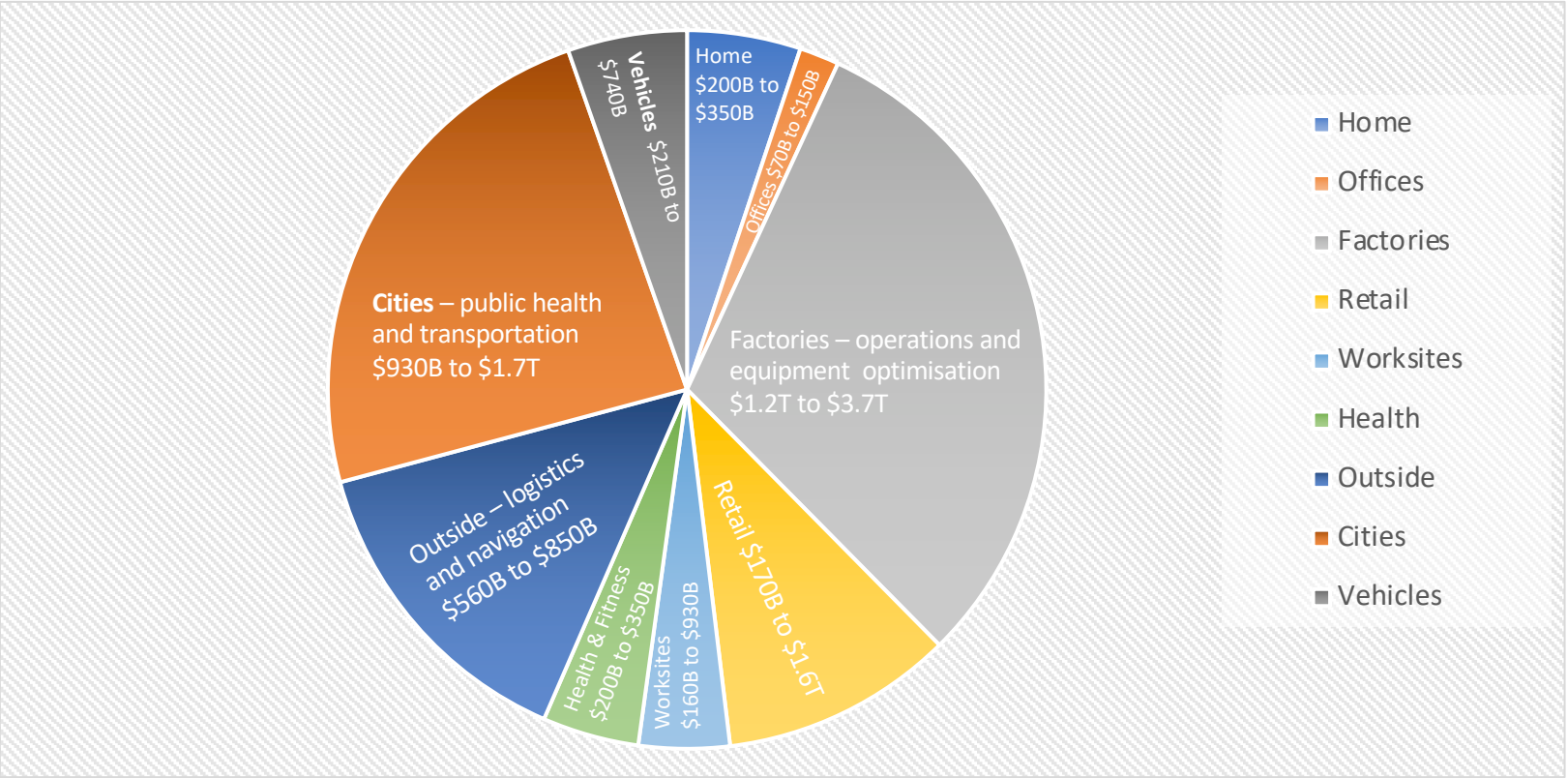
- Network of physical objects: “Things”
- Things embedded with sensors, software, and other technologies
- Things can connect and exchange data with other devices and systems over a network.



Wilgengebroed on Flickr / CC BY

What is the Value of the IoT?

- Aggregated value - $3.9 trillion to $11.1 trillion per year in 2025
- **Interoperability** is required to capture 40% of total value

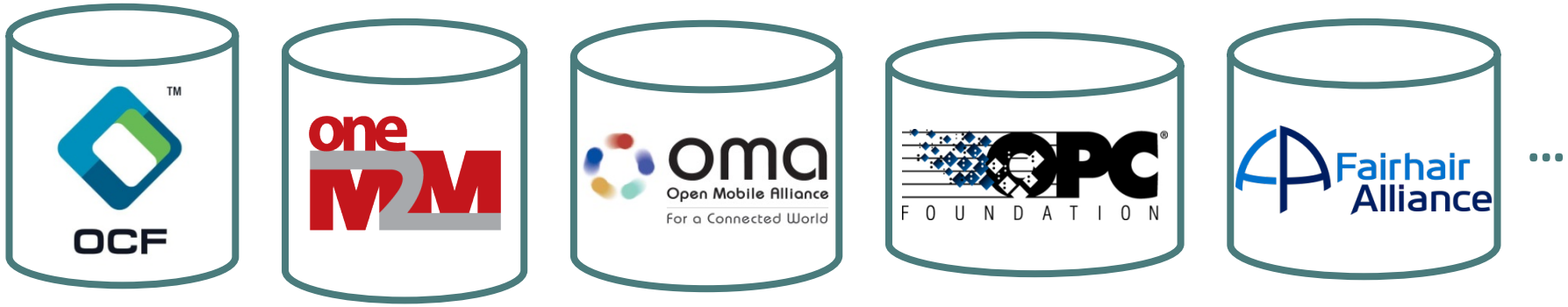


➢ Most of the potential value is in the data and value added services rather than the IoT devices and IoT communication technologies.

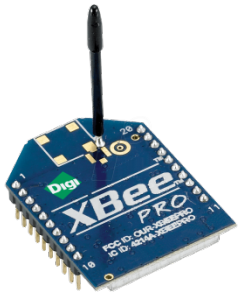
✓ Open standards are needed to overcome fragmentation, connect the silos and unlock the network effect for exponential growth

McKinsey, June 2015 – "The Internet of Things: mapping the value beyond the hype"

Problem: Application/Platform Silos

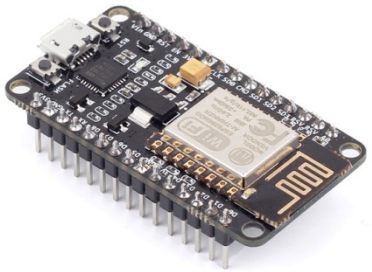


Internet of Things: **Connectivity**

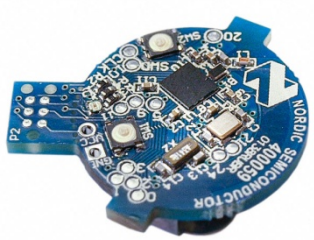


IEEE 802.15.4

Ethernet



Wi-Fi



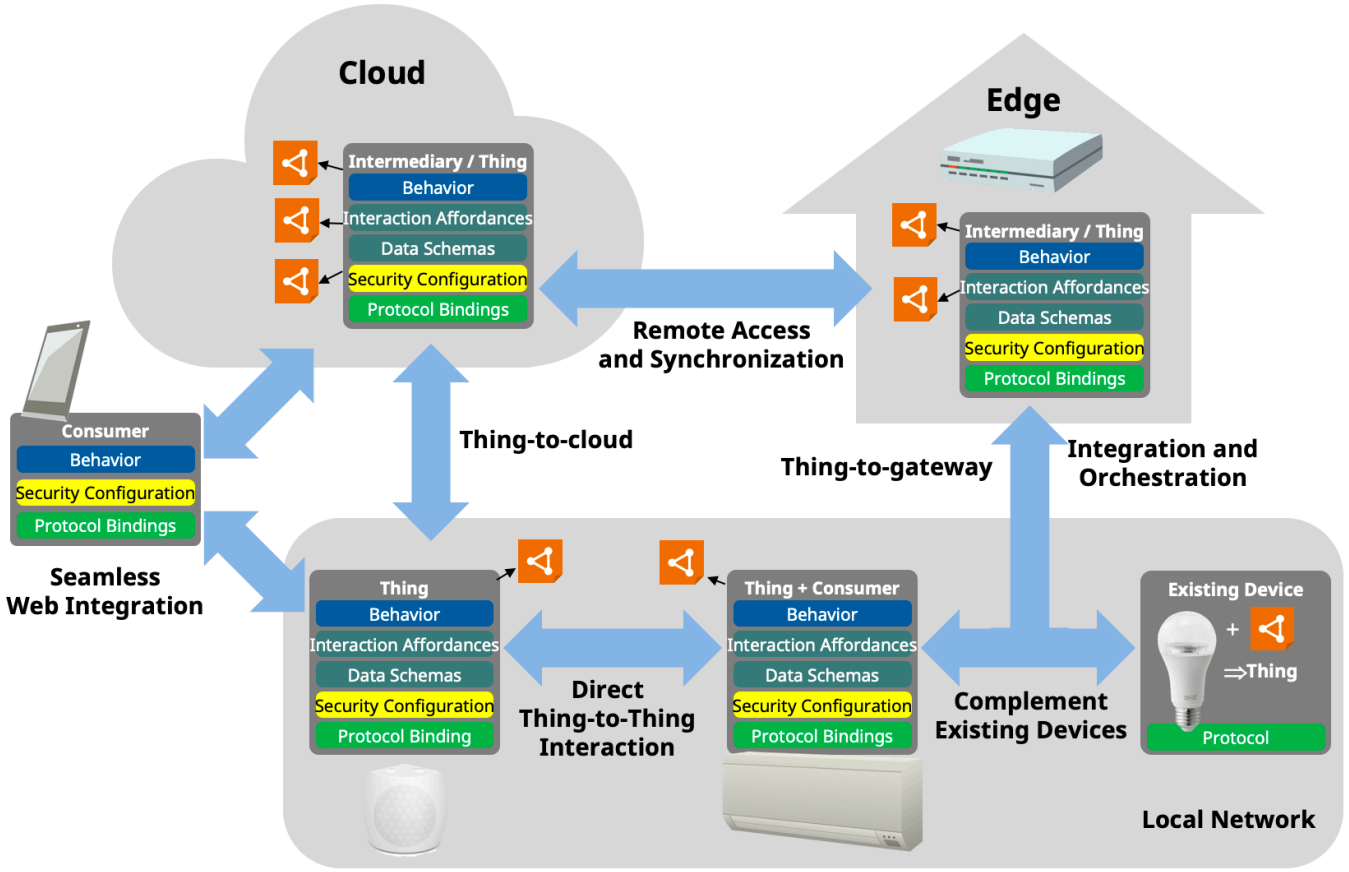
Bluetooth

LoRa

...

WoT Goal: Support Interoperability

- Simplify usage
  - Interaction abstraction
- Simplify data ingestion
  - Unified data schemas
- Bridge silos
  - Protocol bindings
- Enable "mashups"
  - Scripting API



Current Work Items

Deliverables	Updates	New

Informative	• Scripting API
	• Security and Privacy
	  • Guidelines
	  • Best Practices
		• Use Cases

Normative	• Architecture • Thing Description • Thing Models	• Discovery • Interoperability Profiles

Thing Description

- Metadata for IoT services
  - ID, versions, types, creation time, ...
  - Titles, descriptions, ...
- Describes interactions
  - What they are (abstraction)
  - How to use them (protocol binding)
  - How to interpret data (schemas)
- JSON-LD 1.1
  - Vocabulary extensions
  - Semantic annotation (e.g. OneDM)
  - Protocol-specific vocabulary

```
{
  "@context": [
    "https://www.w3.org/2019/wot/td/v1",
    { "iot": "http://iotschema.org/" }
  ],
  "id": "urn:dev:org:32473:1234567890",
  "title": "MyLEDThing",
  "description": "RGB LED torchiere",
  "@type": ["Thing", "iot:Light"],
  "securityDefinitions": ["default": {
    "scheme": "bearer"
  }],
  "security": ["default"],
  "properties": {
    "brightness": {
      "@type": ["iot:Brightness"],
      "type": "integer",
      "minimum": 0,
      "maximum": 100,
      "forms": [ ... ]
    }
  },
  "actions": {
    "fadeIn": {
      ...
```

New Work Items

Use Cases:

- Expanding catalog of use cases
- Identifying requirements
- Identifying gaps and overlaps
  - Edge computing
  - Geospatial systems
  - Data modeling
  - …

Discovery:

- Define how TDs are distributed
- Both local and global contexts
  - Spatial search not limited to local network
- Two-phase introduction/exploration
- Emphasis on privacy protection
  - Protected queries and exploration services

Architecture:

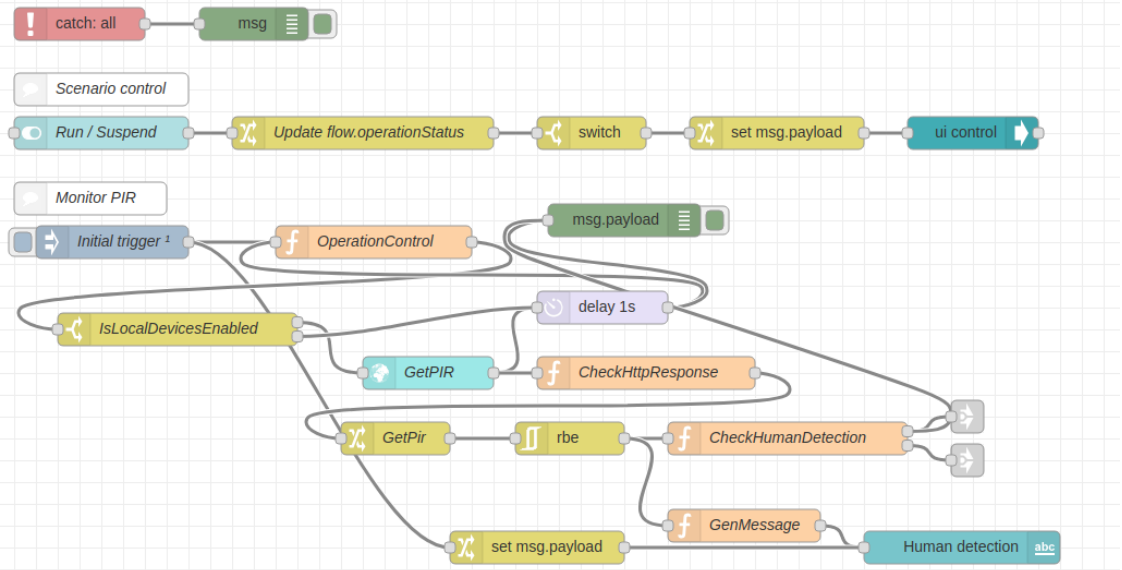
- Lifecycle
- Updated requirements analysis
  - Based on new use cases
- Alignment with other standards

Interoperability Profiles:

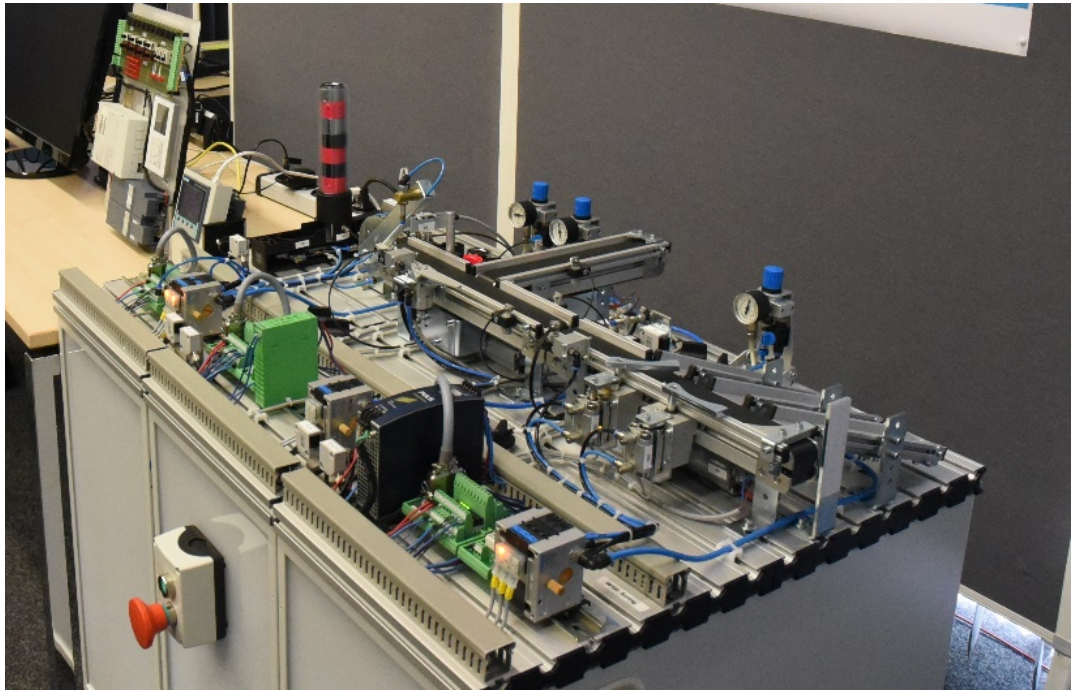
- Support interoperability
  - Out-of-the-box plug-and-play
- Constrain features
  - Allow for finite, in-advance implementation of consumers

Implementation, Tools, Validation…

- Node-wot
  - Scripting API implementation
- Node-gen
  - Node-RED integration

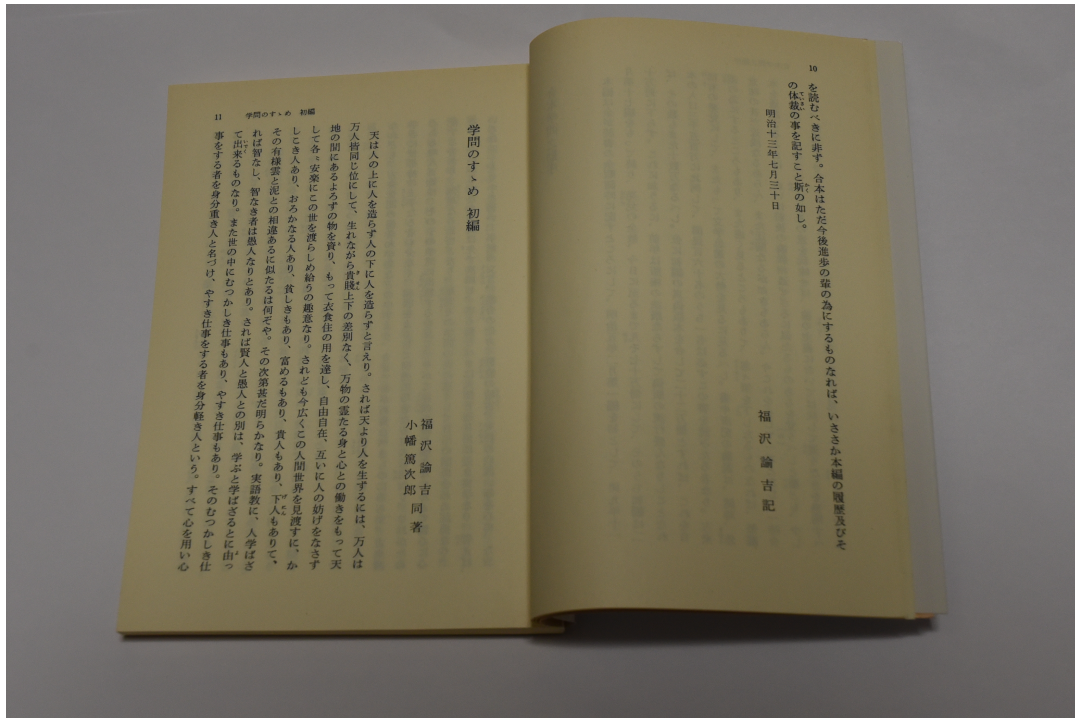


- Playground
  - TD checker
- Plugfests



Publishing: From Paper Books to E-Books

Paper Books



E-Books

What is beyond replication of the print experience?

For Discussion: Some Use Cases…

Hybridcast (NHK)

- TV receiver as IoT control hub
- Data embedded in content
- IoT devices used as means to interact with content
  - Can trigger changes to lighting, sound levels, media control
  - Can be used to trigger novel output devices, e.g. haptic displays
  - Accessable/customizable controls and input devices for media control

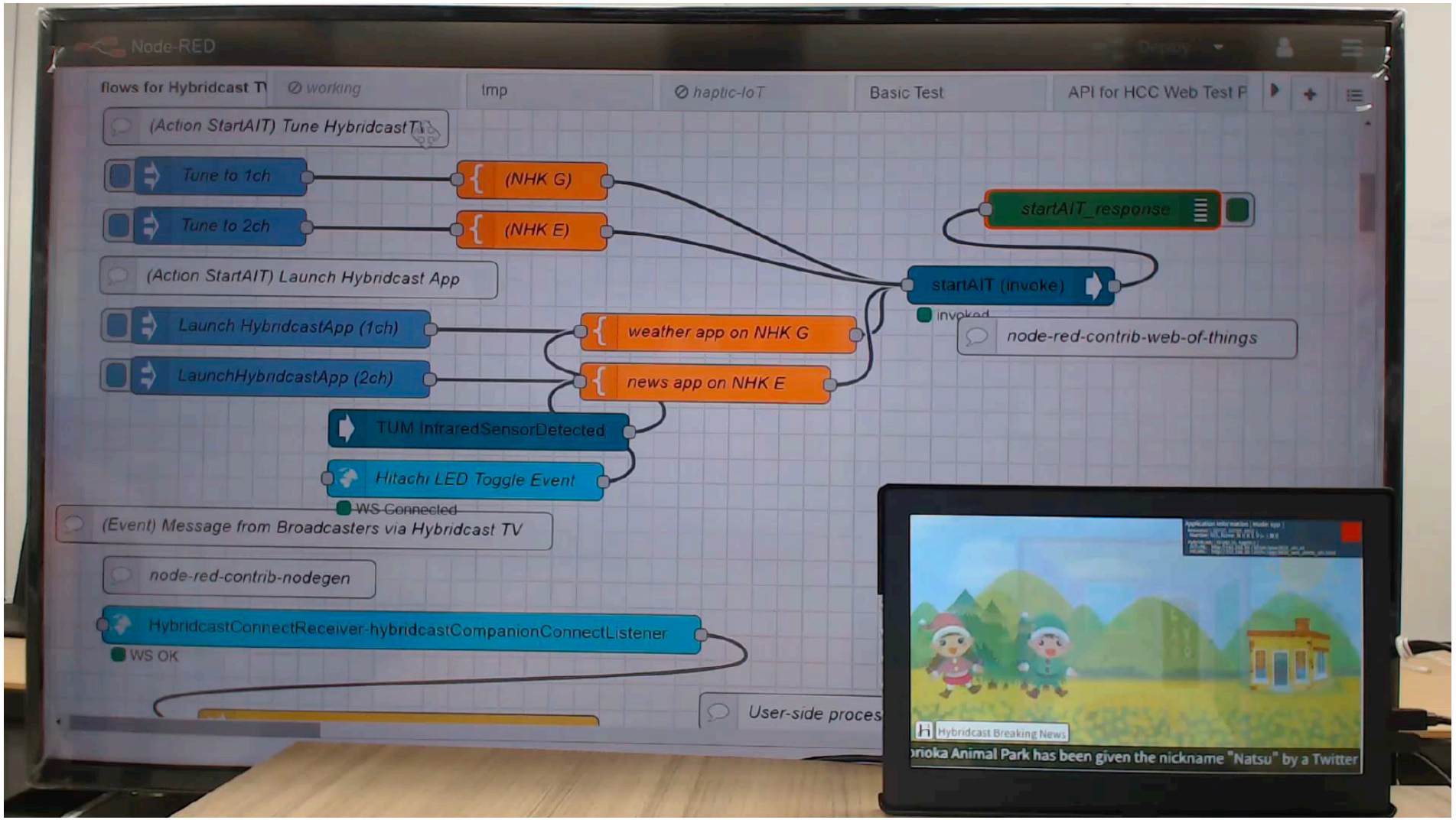
Interactive Education

- A science notebook can not only describe an experiment, it can help run it!
- “Book” can connect to devices, collect and visualize data

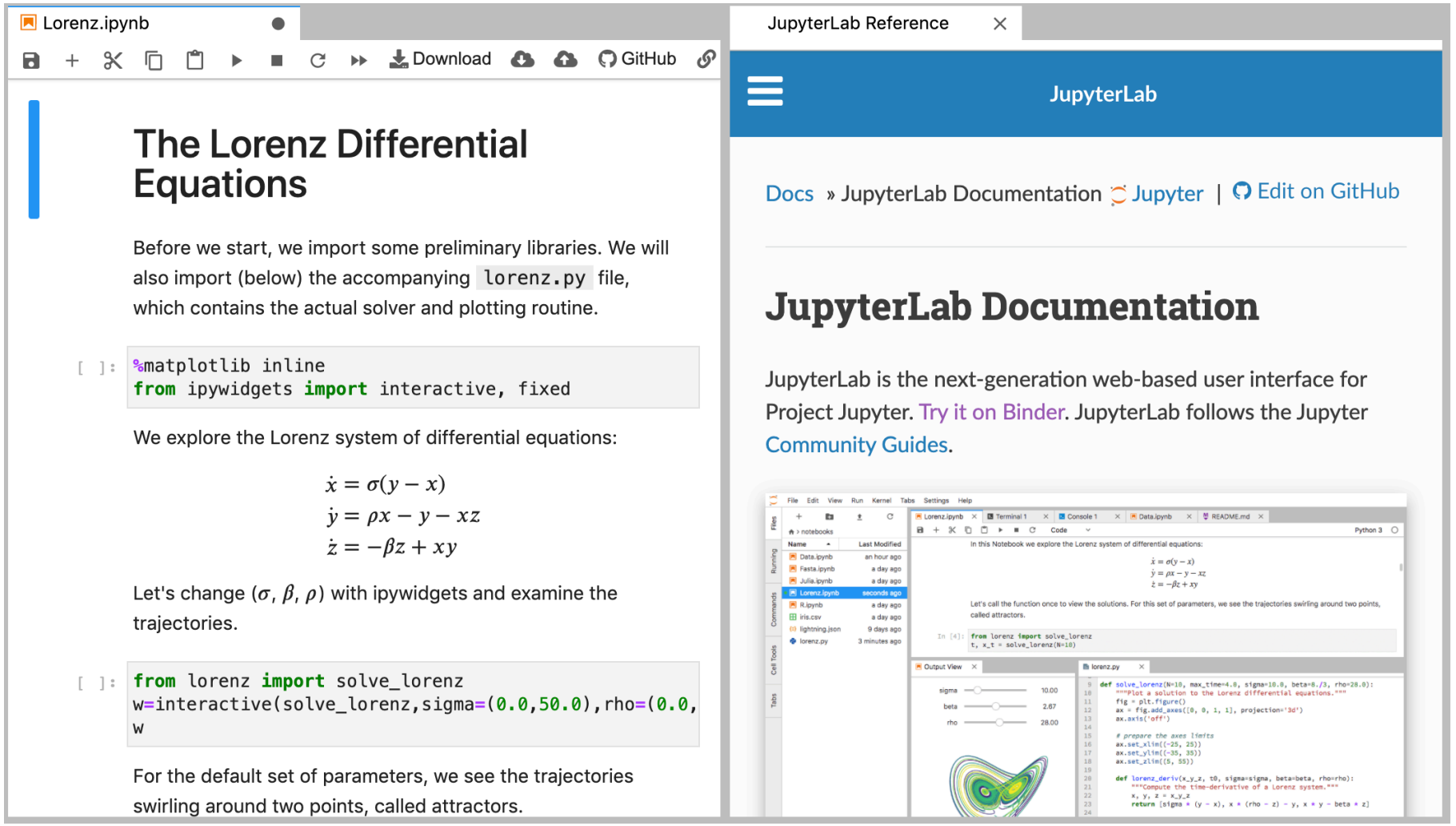
eBook as a Thing

- An eBook could expose controls or stream visual/audio media to other devices

Hybridcast


Node-RED
flows for Hybridcast T
working
tmp
haptic-IoT
Basic Test
API for HCC Web Test F
(Action StartAIT) Tune HybridcastT
Tune to 1ch
Tune to 2ch
(NHK G)
(NHK E)
startAIT_response
startAIT (invoke)
invoked
(Action StartAIT) Launch Hybridcast App
Launch HybridcastApp (1ch)
LaunchHybridcastApp (2ch)
weather app on NHK G
news app on NHK E
node-red-contrib-web-of-things
TUM InfraredSensorDetected
Hitachi LED Toggle Event
WS Connected
(Event) Message from Broadcasters via Hybridcast TV
node-red-contrib-nodegen
HybridcastConnectReceiver-hybridcastCompanionConnectListener
WS OK
User-side proces
Hybridcast Breaking News
rioka Animal Park has been given the nickname "Natsu" by a Twitter

Interactive Notebooks Example: JupyterLab



W3C WoT Resources

- W3C WoT Wiki
  - https://www.w3.org/WoT/IG/wiki
    (IG/WG organizational information)
- W3C WoT Interest Group
  - https://www.w3.org/2016/07/wot-ig-charter.html
    (old charter)
  - https://www.w3.org/2019/10/wot-ig-2019.html
    (new charter)
  - https://lists.w3.org/Archives/Public/public-wot-ig/
    (mailing list)
  - https://github.com/w3c/wot
    (technical proposals)
- W3C WoT Working Group
  - https://www.w3.org/2016/12/wot-wg-2016.html
    (old charter)
  - https://www.w3.org/2020/01/wot-wg-charter.html
    (new charter)
  - https://www.w3.org/WoT/WG/
    (dashboard)
- W3C WoT Candidate Recommendations
  - https://www.w3.org/TR/wot-architecture/
  - https://www.w3.org/TR/wot-thing-description/
- W3C WoT Working Drafts / Group Notes
  - https://www.w3.org/TR/wot-binding-templates/
  - https://www.w3.org/TR/wot-scripting-api/
  - https://www.w3.org/TR/wot-security/
- W3C WoT Editors' Drafts and Issue Tracker
  - https://github.com/w3c/wot-architecture/
  - https://github.com/w3c/wot-thing-description/
  - https://github.com/w3c/wot-binding-templates/
  - https://github.com/w3c/wot-scripting-api/
  - https://github.com/w3c/wot-security/
  - https://github.com/w3c/wot-security-best-practices/
  - https://github.com/w3c/wot-profile/
  - https://github.com/w3c/wot-discovery/
  - https://github.com/w3c/wot-usecases/
- Reference Implementations and Tools: node-wot
  - node-wot: https://github.com/eclipse/thingweb.node-wot
  - TD playground: https://github.com/thingweb/thingweb-playground

Contacts

https://www.w3.org/WoT/WG/

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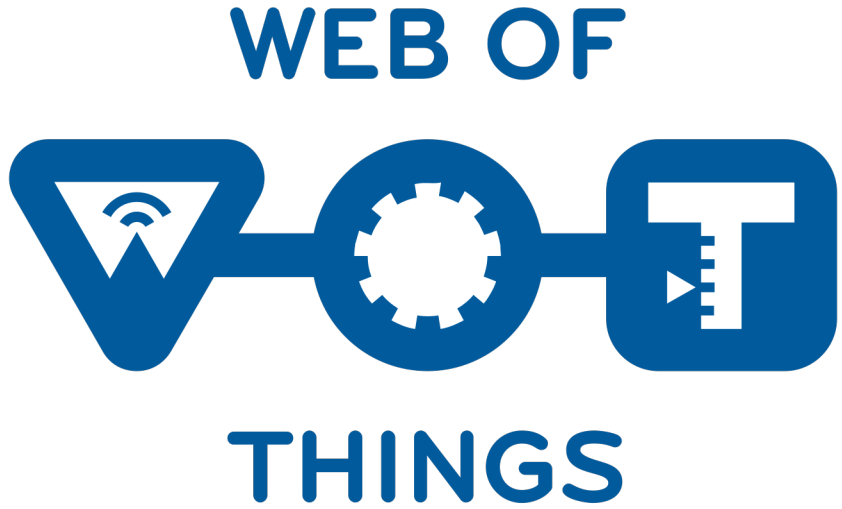
WEB OF
THINGS