http://1248.io

Interoperability on the Internet of Things

IfM 2pm Thu 7 Nov 2013

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Today

- My background
- M2M and IoT today
- Lessons from TSB IoT Interop Demonstrator
  - HyperCat: machine-discoverable APIs
- 1248 work in progress
- Concluding thoughts

My background

creating smart homes

Smart Energy Analytics

Smart Heating

Smart Appliances

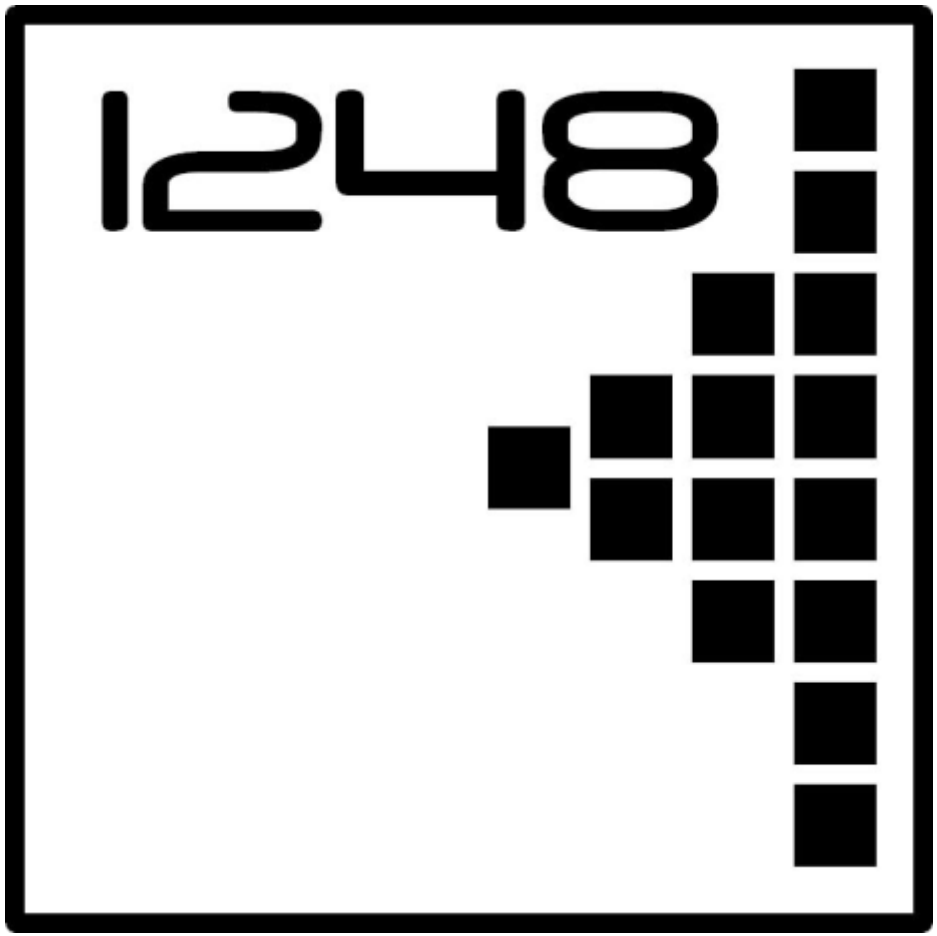
Smart Home

Information

Analysis on how I & when I use energy to help understand my bill and advice on how to save.

Remote Control

- Heating
- Cooling
- Hot water
- Appliances
- Lights
- Locks
- Security
- Cameras



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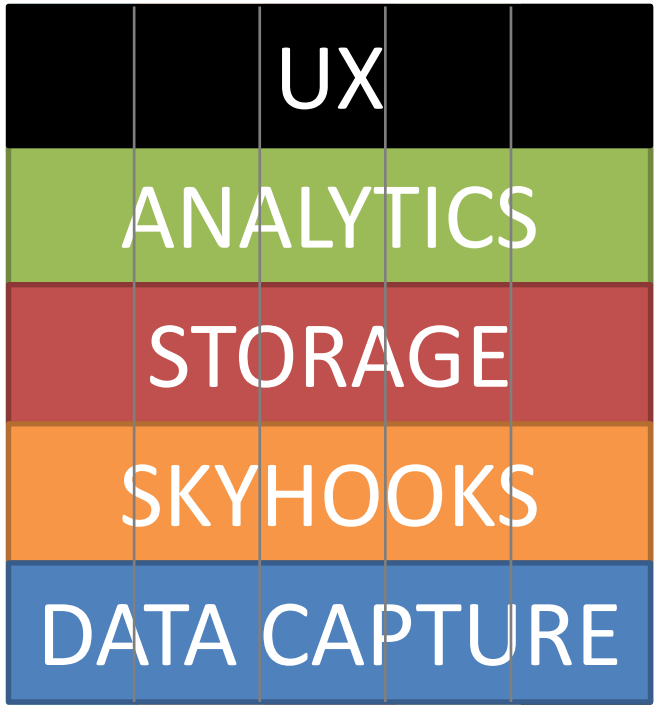
M2M a precursor to IoT
From vertical silos to horizontal IoT

old

each provider delivered entire vertical

new

each provider delivers horizontal slice



TSB IoT Interoperability Demonstrator

- £6m project, 1 year
- Goal: Break down the vertical M2M silos!
- ~40 entities, most already with vertical end-to-end platforms

  1248.io, Aimes Grid Services, AlertMe, Amey, ARM, Avanti, BalfourBeatty, BRE, British Telecom, Carillion, Critical Software, Ctrl-Shift, EDF, Enlight, ExplorerHQ, Flexeye, Guildford Borough Council, IBM, Intel, Intellisense.io, Intouch, LivingPlanIT, London City Airport, Merseyside Transport, Milligan Retail, Neul, Open Data Institute, Placr, SH&BA, Stakeholder Design, Traak, UK Highways Agency, Westminster City Council, Xively and the Universities of Birmingham, Cambridge, Lancaster, Surrey, UCL & Open University
- 8 clusters with diverse use-cases:
  - Airports
  - Transport logistics
  - Schools and Campuses
  - Homes
  - Streets

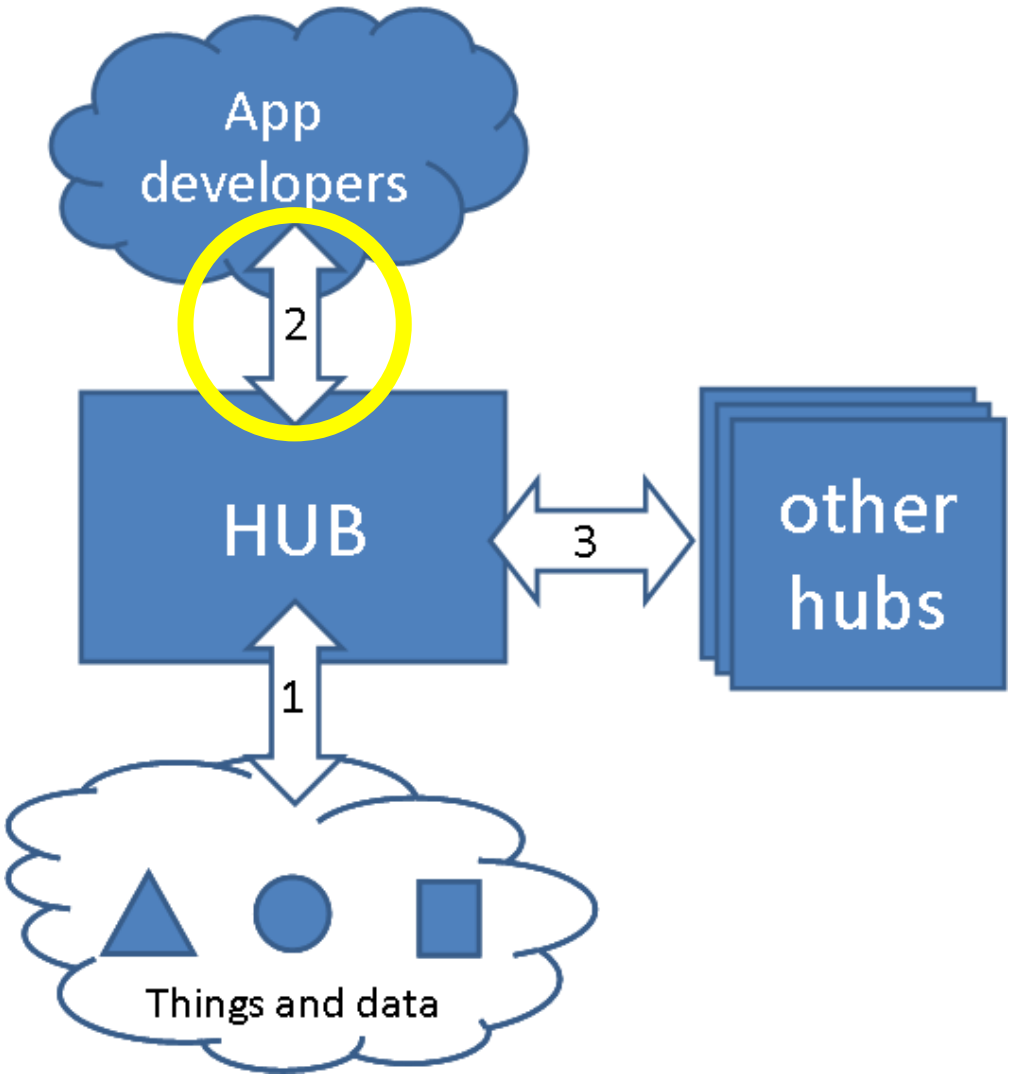
Q1: Work out what problem we all share

Q2: Implement

Q3: Interop

Q4: Serendipity

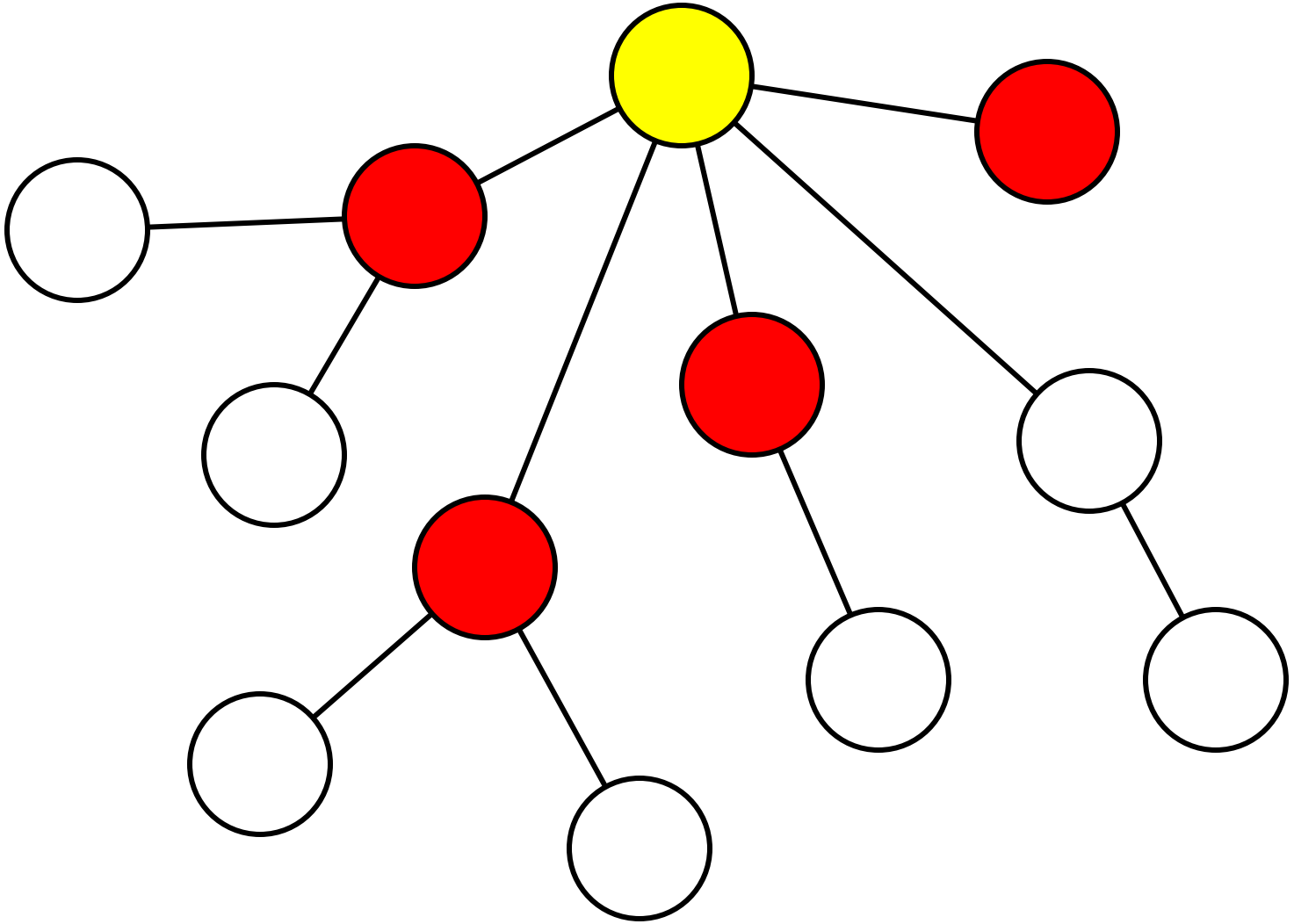
Everyone's system architecture




HYPER/CAT

HYPER/CAT

You need data from several data services



HYPER/CAT

All services support the same open standards

JSON

JavaScript Object Notation

RESTful API

GET PUT POST DELETE

https:

HYPER/CAT

But each is organised differently

/customers/building/room/temperature

/users/hubs/devices/

/localauthority/street/post

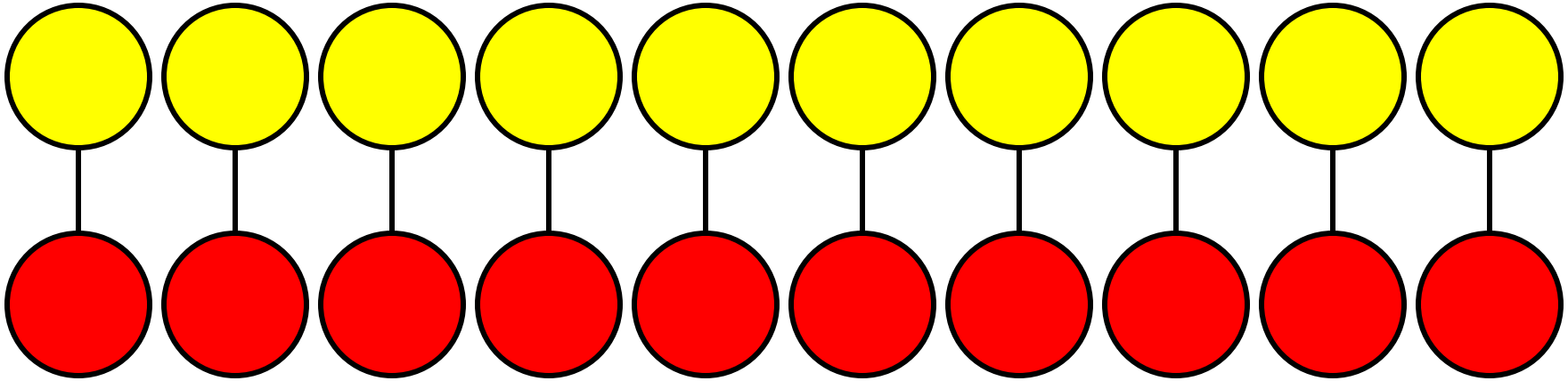
HYPER/CAT

So for each service you have to…

- Read the documentation
- Write code specific to that service

HYPER/CAT

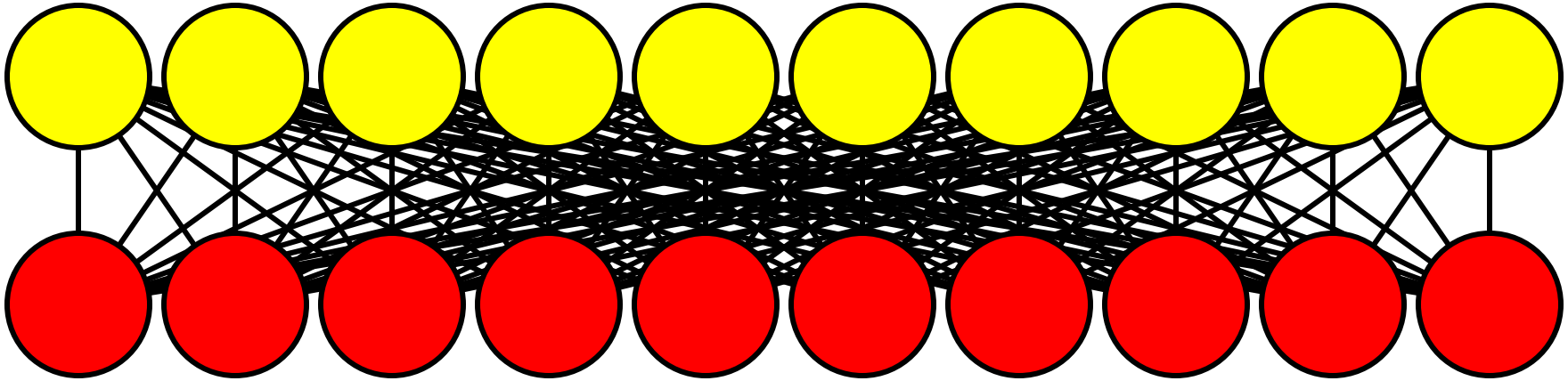
Everyone wants an ecosystem



If each application is specific to each service
we call it “vertical-integration”.

To grow, we need to go “horizontal”
and build an ecosystem where
all applications work with all services

…but Humans Don't Scale

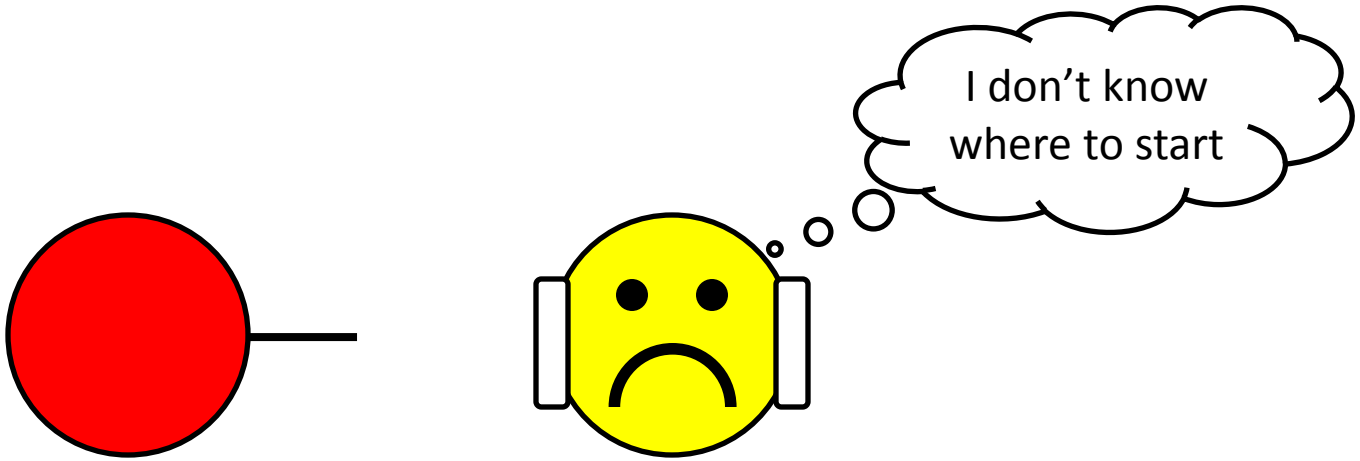


But adapting 10 Applications x 10 services
= 100 pieces of code to write

(and imagine 1,000,000 Applications…)

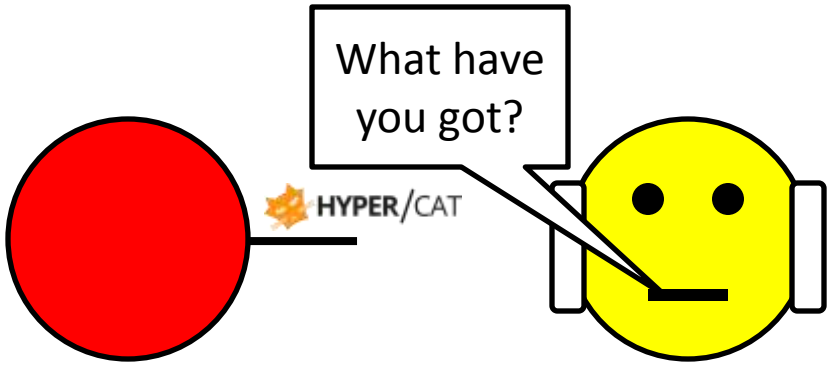
Problem:
Services not machine-browsable

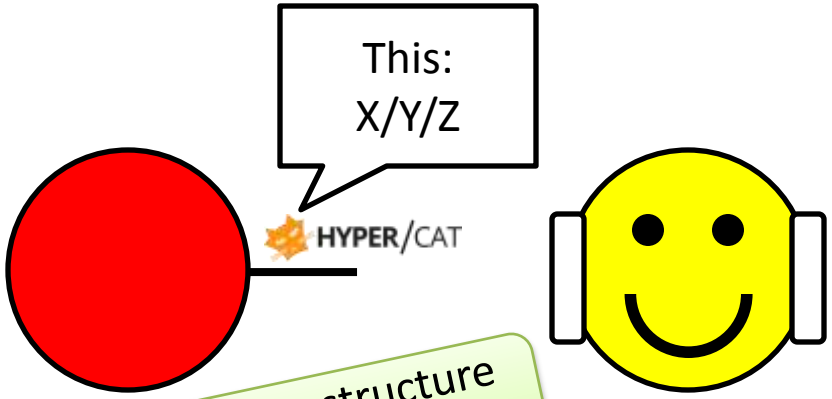
An application cannot automatically discover a new service's resources … so a human has to write code every time to enable it to do that.



HYPER/CAT

HyperCat:
Makes services machine-browsable





browse by structure
search by metadata

HyperCat makes life easier for everyone

- Developers
  - More data, quicker
- Service and Data providers
  - More customers
- End-customers
  - More choice
- Ecosystems and markets
  - Removes barriers

HyperCat Developer 101

Where to get started

- Very simple spec (6 pages)
  - http://www.openiot.org/apis
- Build on the open standards you already use
  - HTTPS, RESTful, JSON
- Growing set of Catalogues to test against
- Growing set of Tools for Client & Services
  - Online, and as Code Libraries
  - See http://wiki.1248.io

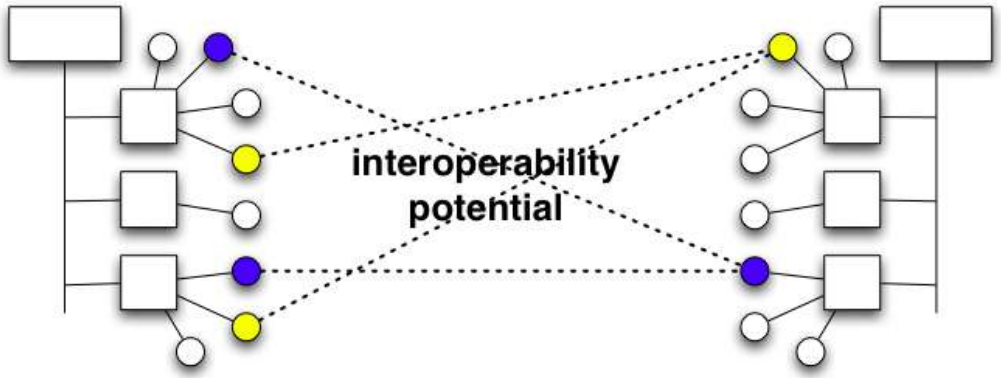
How to use HyperCat

- GET http(s)://cat
- Returns a catalogue:
  - Tagged with metadata
  - Containing zero or more Resource items
- Each Resource item:
  - Has an HREF pointer to the resource
  - Is tagged with metadata, so you can tell what it is
- The only defined metadata tag is for the catalogue itself
  - Catalogues can contain catalogues
- Security model & basic search

Pathfinder
Scalable, Open-Source
HyperCat server

HyperCat is not a panacea

- Applications and Services still have to agree on high level semantics
  - i.e. if a service provides temperatures in °C then the application needs to understand °C
- What HyperCat does is enable an application to find those things that it does understand, in any service
  - e.g. “show me all the resources which are in °C”



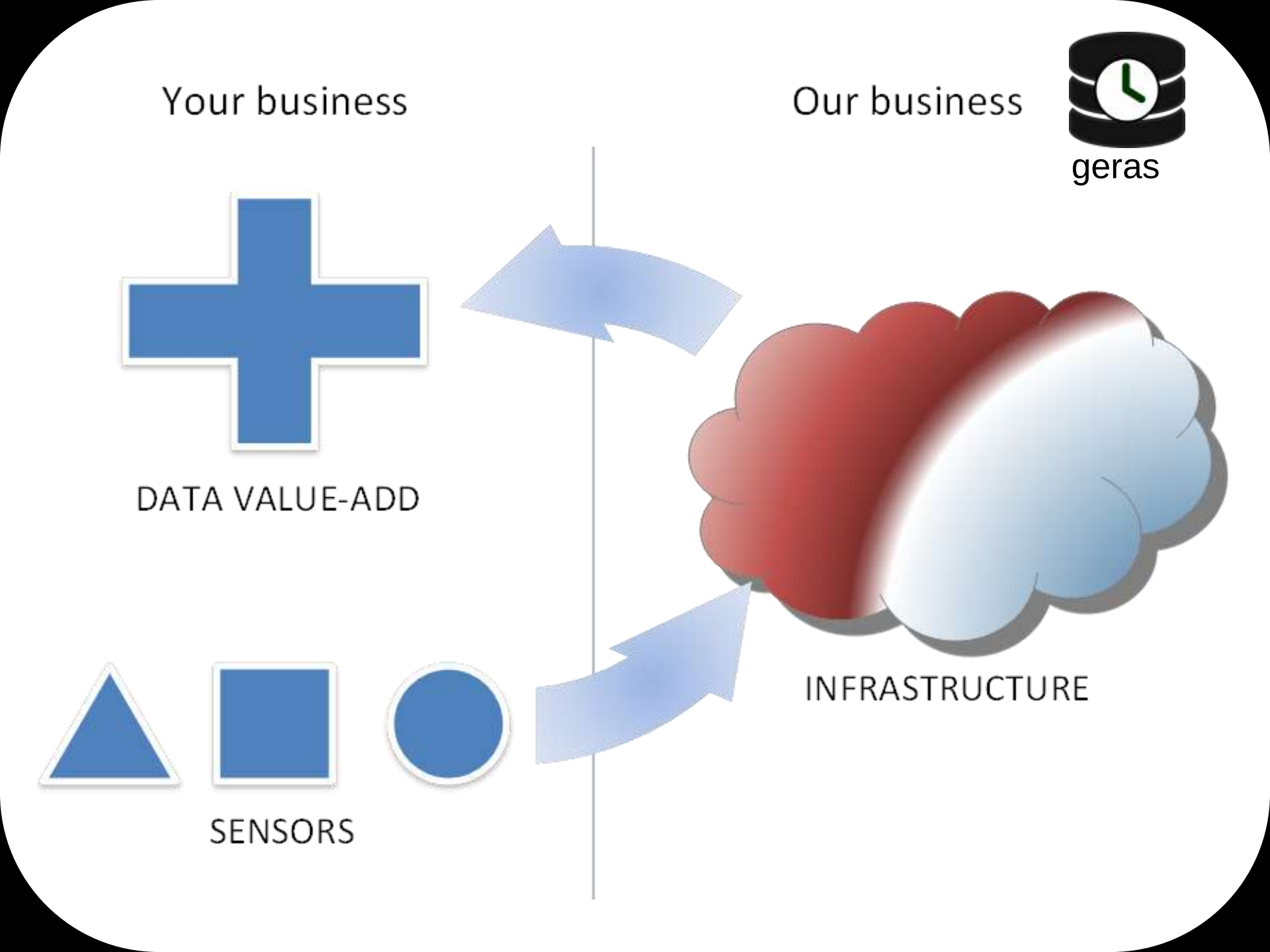
IoT work in progress…

All the things we kicked out of scope!

- Data formats: (JSON certainly, and…)
  - JSON-LD
  - SenML
- Ontologies (general, and more & more specific)
- Registration
- Standard Licenses
- Key management
- Monetisation models
- “run-anywhere” Rules
  - Rollups, triggers. Message-passing paradigm. Database-agnostic.

geras

1248 work in progress


Your business
Our business
geras
DATA VALUE-ADD
INFRASTRUCTURE
SENSORS

Geras

- A live and historical streaming data service for IoT devices and hubs
- Built for scale (C* & RabbitMQ)
- Interfaces:
  - MQTT (streaming pubsub)
  - HTTP(S)
  - Supports pure HTML5 apps
    - MQTT over Websockets
    - JSONP

Management Dash (live data)

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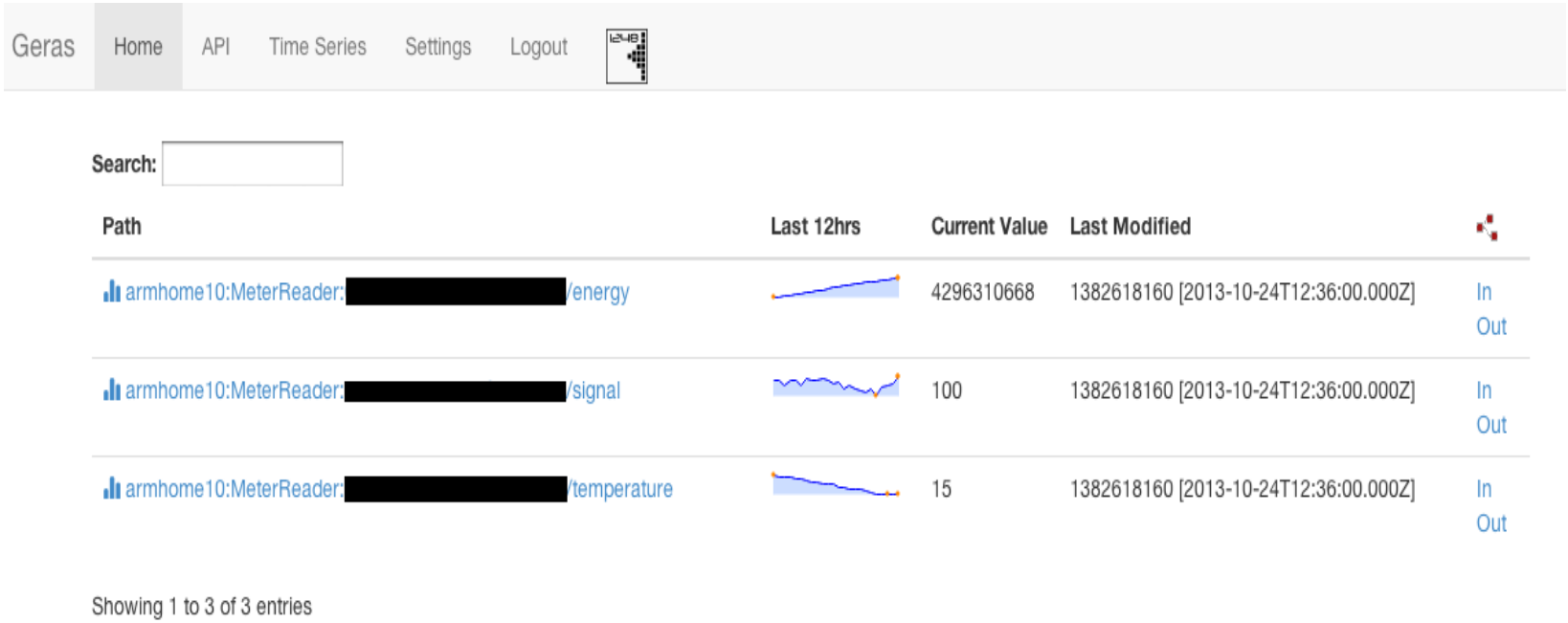

Charts, rollups, windowing

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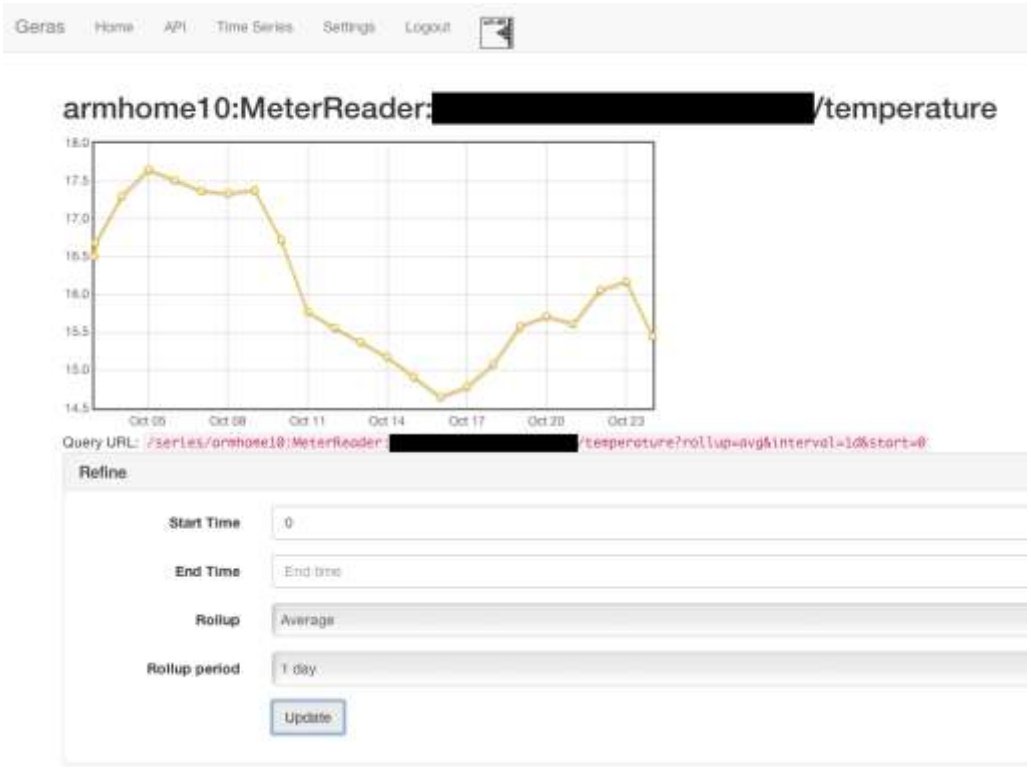
- “Weekly minimum this month”
- “Yearly average”
- “Daily sum”
- etc.



Data format is SenML

- Streaming JSON, in and out

```
{
  "e":[
    {"t":1001,"n":"temperature","v":22.5,"u":"Cel"},
    {"t":1001,"n":"power","v":1210000,"u":"W"},
    {"t":1002,"n":"temperature","v":22.5,"u":"Cel"},
    {"t":1002,"n":"power","v":1210000,"u":"W"},
    {"t":1007,"n":"temperature","v":22.5,"u":"Cel"},
    {"t":1007,"n":"power","v":1210000,"u":"W"}
  ],
  "bn":"http://example.org/thing1/"
}
```

Feeding data in

HTTP(S) POST (bulk SenML)

```
curl -XPOST -u "APIKEY:"
   https://geras.1248.io/series/foo
    --header "Content-Type: application/json“
    -d@data.json
```

MQTT publish raw values

```
mosquitto_pub -v -u APIKEY
    -h geras.1248.io
    -t /foo/temperature
    -m "22.5"
```

Reading data out

HTTP(S) GET (SenML)

```
curl -XGET -u "APIKEY:"
   https://geras.1248.io/series/foo/temperature?
       rollup=min&interval=1d

curl -XGET -u "APIKEY:"
   https://geras.1248.io/series/foo?recursive
```

MQTT subscribe (SenML)

```
mosquitto_sub -v -u APIKEY -h geras.1248.io -t /foo/#
```

Discovery

- Per-user HyperCat (SenML resources)

```
curl -XGET -u "APIKEY:" https://geras.1248.io/cat
```

- Public HyperCat of user shares
  - Everything discoverable, optional keys for resources

```
curl -XGET http://geras.1248.io/publiccat
```

Metadata search and storage

- Per-stream searchable JSON properties

```
curl -XPOST -u "APIKEY:" -d@tags.json
    https://geras.1248.io/tags/foo/temperature

curl -XGET -u "APIKEY:“
    https://geras.1248.io/tags/foo/temperature

curl -XGET -u "APIKEY:“
    https://geras.1248.io/tagsearch?manufacturer=acme
```

Streaming graph UI (MQTT)

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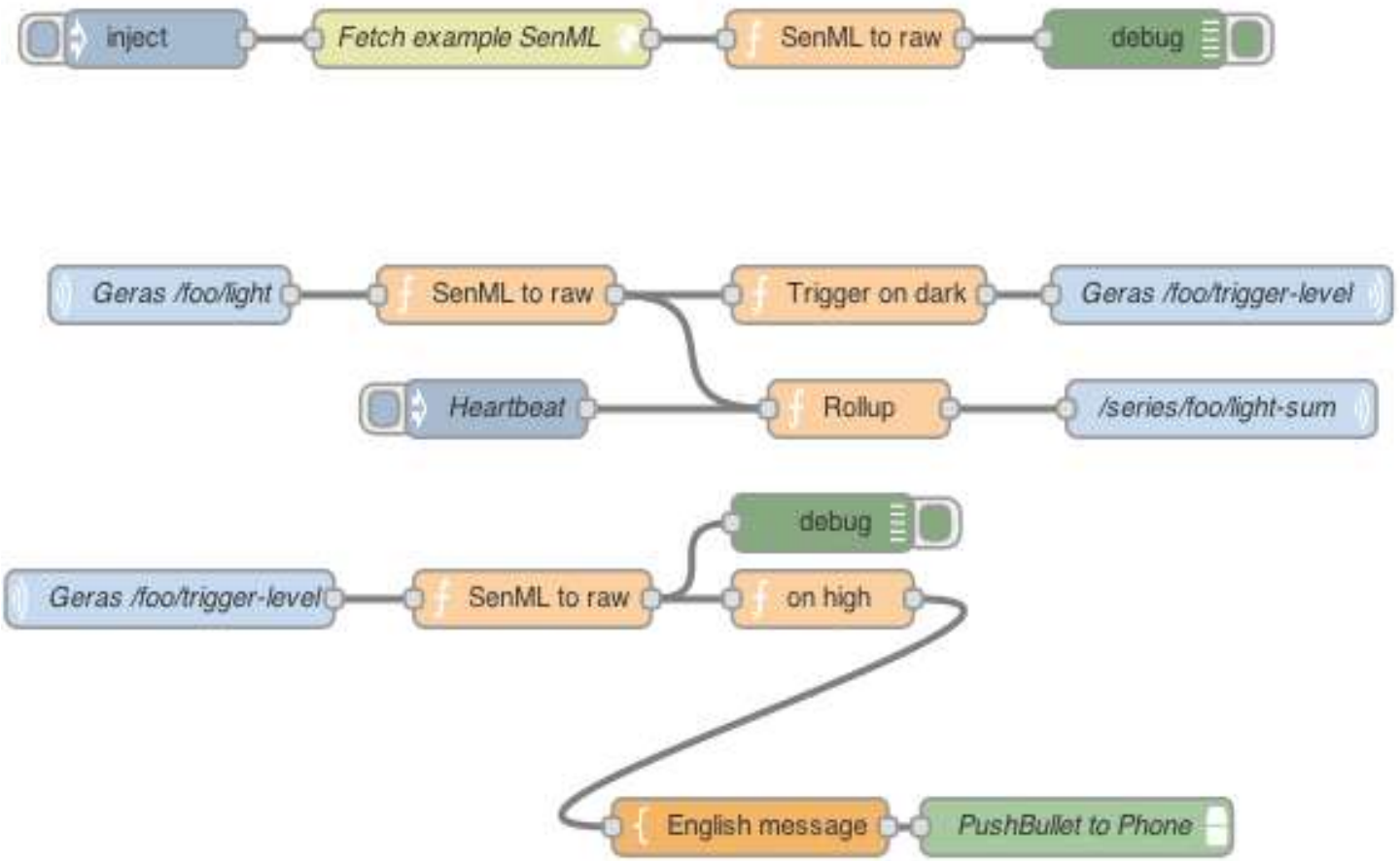
Node-RED



Sign-up as a beta tester!

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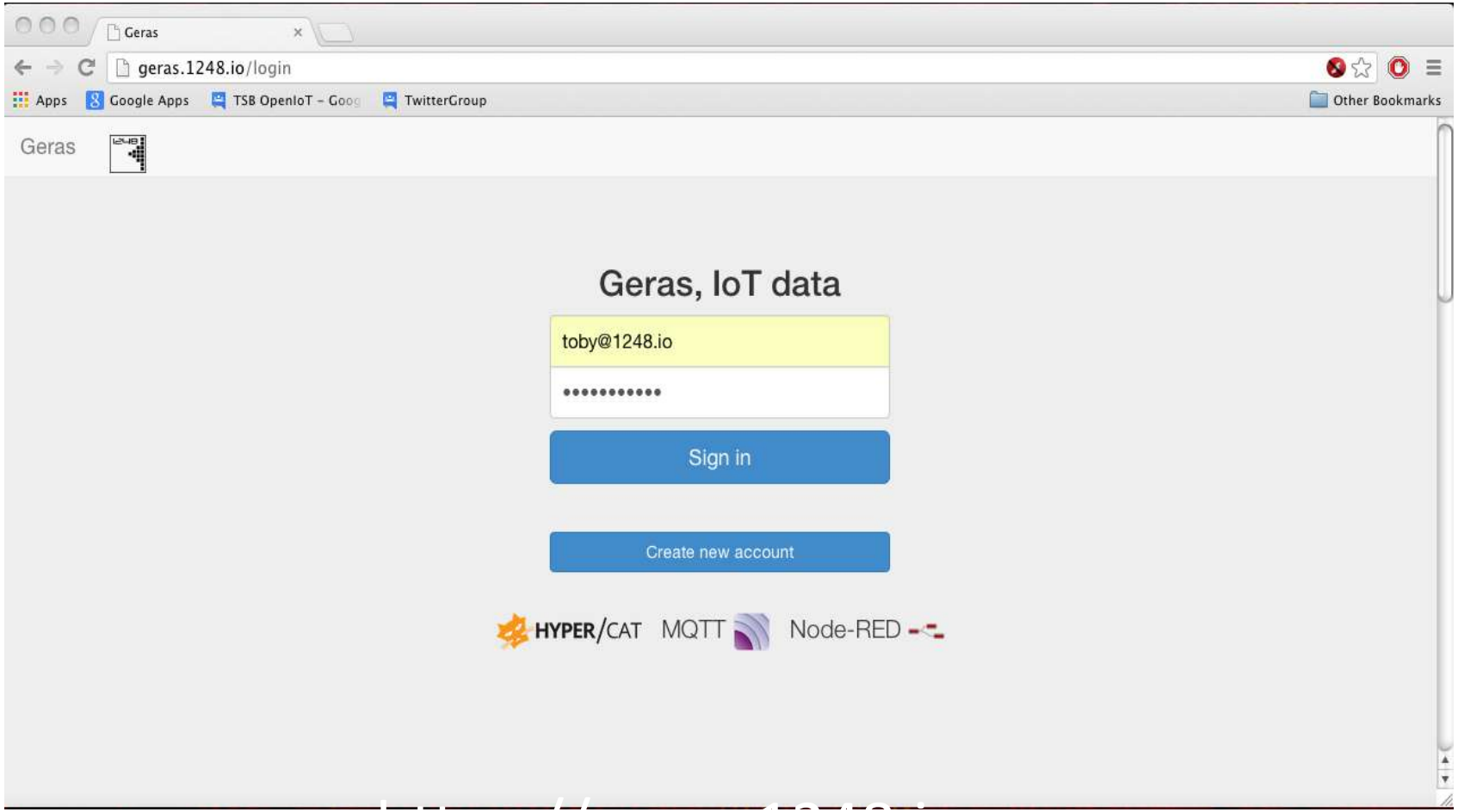


Thoughts

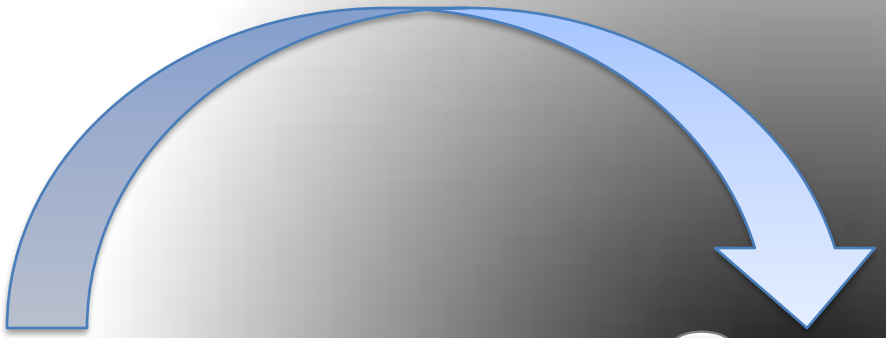
NEWS

ARM's acquisition of Sensinode

(personal view)

- "Symmetry-breaking"
- Sensinode literally wrote the book (& RFCs):
  - 6LoWPAN (IPv6 over 802.15.4 radio)
  - CoAP (binary HTTP over UDP for constrained environs)
  - DTLS (SSL for UDP, ECC/RSA + AES)
  - LWM2M (OMA device management standard, bootstrap, registration, upgrade, telemetry)

From edge to centre



IoT

They're the same thing.
One day, almost all Open Data will come from IoT

Open Data

Billions of tiny sensors

Very large databases

“Open”

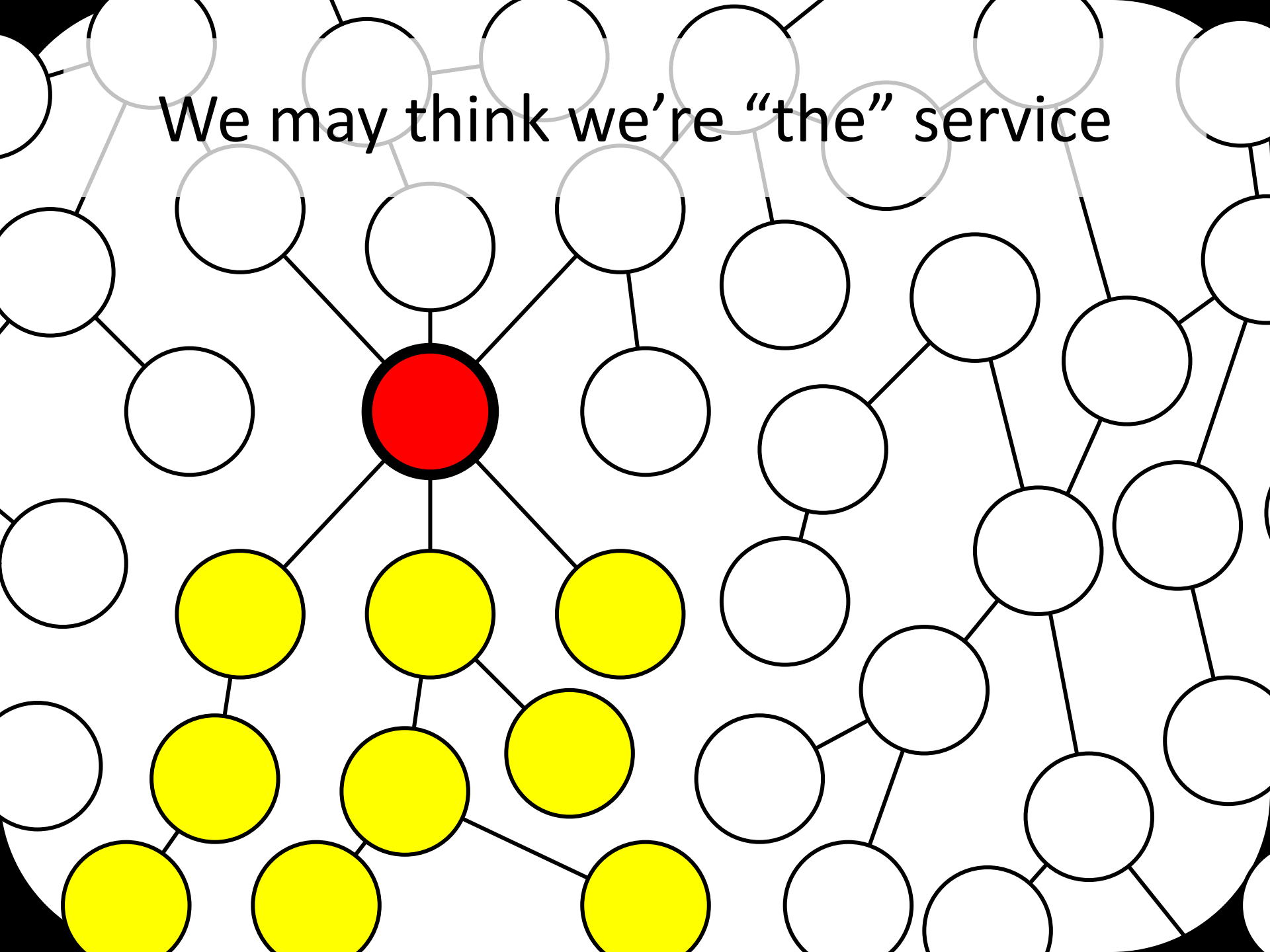
Not (necessarily):

- Free
- Public

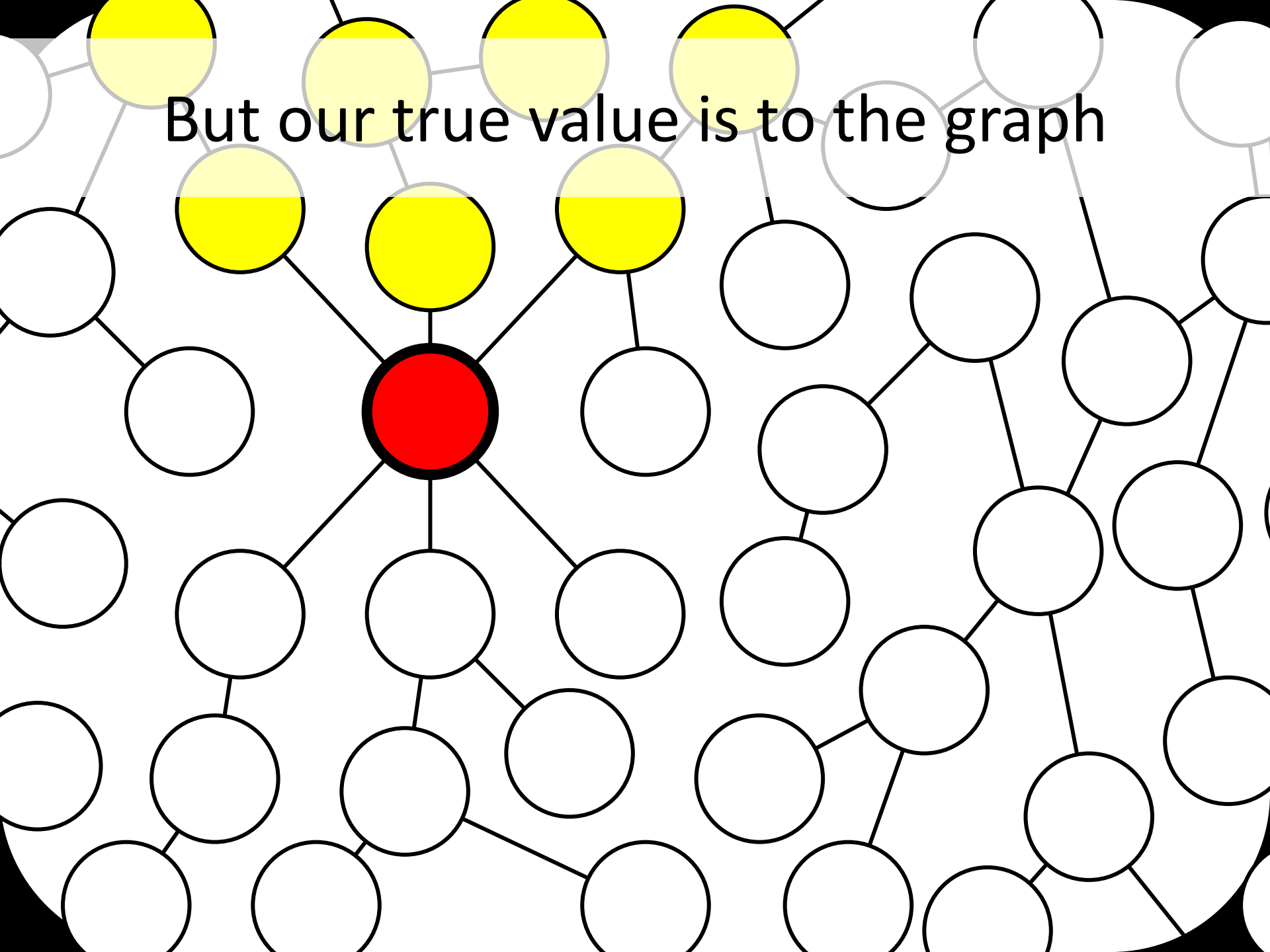
Means:

- My service works with your service
- We can swap providers without a lot of effort
- Requires less trust

We may think we're "the" service



But our true value is to the graph



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