Discovery and Search for IoT Devices with Semantic Identifiers and DNS Names

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May 27, 2021

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Use case
Many devices deployed
Different kind of devices (IP, LoRaWAN, sensors, ...)
Different properties

Ex: Field, City, Building, ...
Context

- Many devices deployed
- Different kind of devices (IP, LoRaWAN, sensors, ...)
- Different properties

Ex: Field, City, Building, ...

Find all devices with given properties

- Devices in a given area
- Device types (sensor, actuator, ...)
- Devices providing a given type of data
Encoding properties in a name
In DNS, we store data with a name key:

inria.fr IN A 128.93.162.83
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One device, many names

In DNS, we store data with a name key:

```
inria.fr IN A 128.93.162.83
```
Binary tree encoding for logical position & properties

![Binary Tree Diagram]
Binary tree encoding for logical position & properties

Encoded semantic properties

Context 01 10 00 10

2 bits 2 bits 2 bits 2 bits 2 bits
Geographic encoding

0

1
Geographic encoding

- Adaptable precision
- Prefix proximity
Geographic encoding

- Adaptable precision
- Prefix proximity
base32 encoding:

- Pure ASCII
- No similar characters (O0-I1-ao)

5 bits per character
From binary to DNS name

base32 encoding:

- Pure ASCII
- No similar characters (00–Il–ao)

5 bits per character

0000101110000000010010110010
base32 encoding:

- Pure ASCII
- No similar characters (00–Il–ao)

5 bits per character

```
00001 01100 00001 00101 00010
```

1d152
### Geohash precision

<table>
<thead>
<tr>
<th>Length (char)</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>±2500 km</td>
</tr>
<tr>
<td>4</td>
<td>±20 km</td>
</tr>
<tr>
<td>8</td>
<td>±19 m</td>
</tr>
<tr>
<td>10</td>
<td>±59 cm</td>
</tr>
<tr>
<td>11</td>
<td>±1.84 cm</td>
</tr>
</tbody>
</table>
Let’s discover devices!
Discover a device with DNS-Service Discovery

Select the area: get the coordinates of the area
Encode the coordinates: generates a binary string
Encode to a name: use base32 to get <geohash>
Query the DNS: <geohash>._iot._udp.iot.org IN PTR
Receive the multiple names: <name>._iot._udp.iot.org
Find devices info: <name>._iot._udp.iot.org IN SRV
Receive the data: IP/Protocol/Server/Port of the devices
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Conclusion
How to find devices based on their properties?

- One device can have MANY names
- Encode properties in names (geolocation, device type,...)
- Store them in the DNS
- Discover with DNS-SD
Thank you

Questions?