DOA-like Persistent Identifiers over DNS: a Prototype

draft-durand-doa-over-dns-03

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31 October 2017

Disclaimer

- The ICANN Office of the CTO has initiated a research project related aimed at demonstrating if DOA-like, persistent identifiers can be achieved as an application of the DNS.
- This talk will present the state of the research and introduce a prototype made in collaboration with the University of La Plata in Argentina that will be demonstrated at ICANN60 next week.
- This research project is not an endorsement of the DOA technologies by the ICANN organization.

DOA & Persistency /1

- **URLs can break for many reasons**:
  - organizational changes
  - company name changes
  - mergers and acquisitions
  - …

DOA & Persistency /1

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  - mergers and acquisitions
  - …

- A number of solutions exist in the industry:
  - URL redirect
  - Tiny URL
  - ….

DOA & Persistency /2

- To address this issue, one of the **DOA's design goals** was to provide **persistent iden**tifiers
- The DOA solution is the Handle System
  - **Handle prefixes use numbers**, not names overloaded with semantic
  - **Handle suffixes use a flat space** (no hierarchical structure)

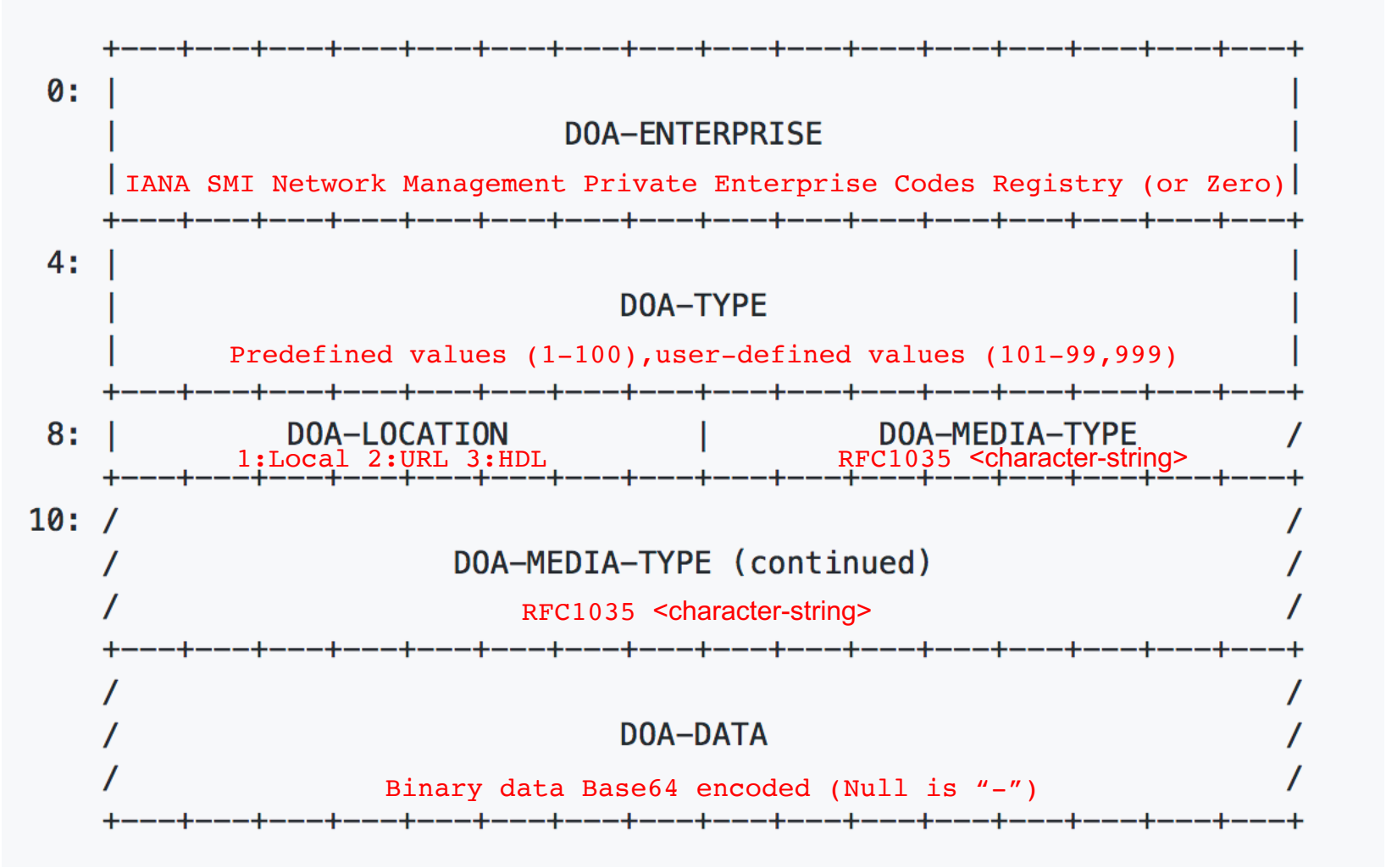
DOA & Persistency /3

- To address this issue, one of the **DOA's design goals** was to provide **persistent iden**tifiers
- The DOA solution is the Handle System
  - **Handle prefixes use numbers**, not names overloaded with semantic
  - **Handle suffixes use a flat space** (no hierarchical structure)
  - The Handle System uses specific protocols that are **not standardized in open standard bodies** such as IETF.
    - Those protocols do not really add to the persistency story, they are mostly a different way to resolve identifiers.

Can the DNS Provide DOA-Styled Persistency?

- Short answer: **Yes**. We need 3 things:
  - Branch of the DNS name space to attach those identifiers
    - Persistency Anchor ($**PANCHOR**)
    - Maybe more than one to introduce competition
  - **Naming convention** similar to the one used in the Handle System
    - Use labels that do not have mnemonic properties
    - Do not map organization structure, use flat as much as possible
  - New **DNS RR type** to structure data
    - DOA RR type, (see: draft-durand-doa-over-dns-03)

RR Type


0:
DOA-ENTERPRISE
IANA SMI Network Management Private Enterprise Codes Registry (or Zero)
4:
DOA-TYPE
Predefined values (1-100),user-defined values (101-99,999)
8:
DOA-LOCATION
1:Local 2:URL 3:HDL
DOA-MEDIA-TYPE
RFC1035 <character-string>
10:
DOA-MEDIA-TYPE (continued)
RFC1035 <character-string>
DOA-DATA
Binary data Base64 encoded (Null is "-")

DOA vs DNS Representation

DOA:

20.500.1234/object1	index 2
	index 3
	index 300

DNS:

$PANCHOR	
1234.500.20.$PANCHOR	IN DOA Type 2
	IN DOA Type 3
	IN DOA Type 300

Example: BigCo

BigCo: Assigned label 12 under $PANCHOR
BigCo makes IoT devices, e.g. device model number 78902

12.$PANCHOR IN DOA

101	Description	local
2	Webpage	URL
1	Email	local
100	Pubkey	local

78902.12.$PANCHOR IN DOA

101	Description	local
2	Webpage	URL
102	Firmware	URL
103	Firmware-sig	local
104	Firmware-version	local

DOA over DNS Prototype

Universidad Nacional de La Plata

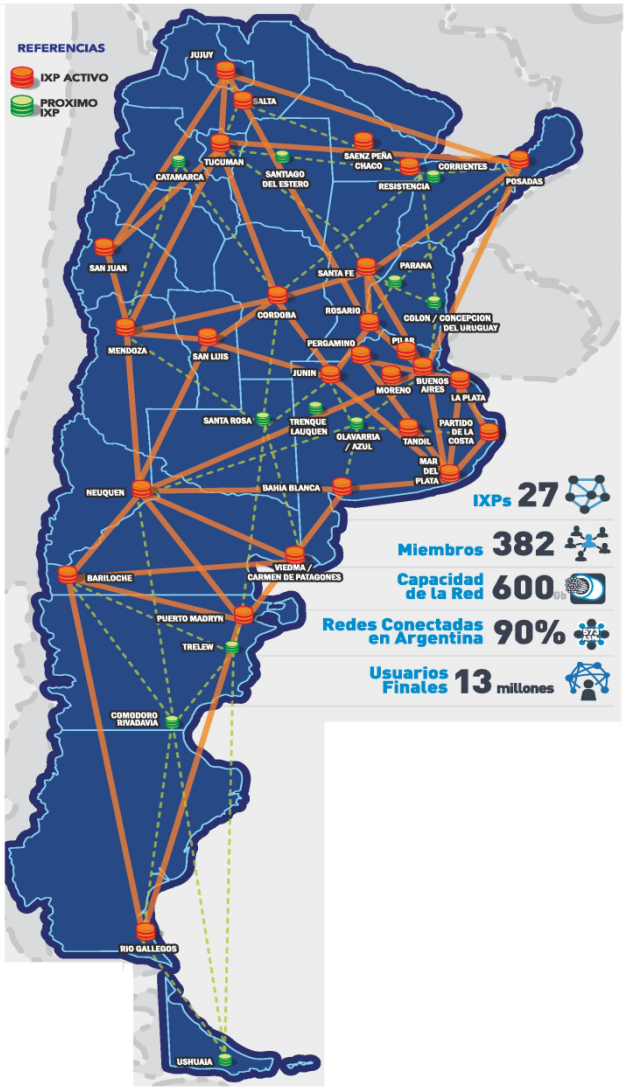
17 Facultades	05 Escuelas secundarias
123.000 Estudiantes de pregrado	12.217 Estudiantes de posgrado
13.240 Docentes	148 Carreras de pregrado
6.222 Investigadores	3.016 Personal de Apoyo
193 Posgrados	98 Especializaciones
67 Maestrías	28 Doctorados
753 Proyectos de investigación	199 Proyectos de extensión
800 Estudiantes de pregrado provenientes de varios países del mundo.	1.000 Pasantes en empresas

UNIVERSIDAD NACIONAL DE LA PLATA

www.unlp.edu.ar

Project Leader: Pedro Brisson, Diego Vilches
IoT Development: Fernando López, Francisco Torre y Emilio Crudele
DNS implementation & Web Interface development: Matías Banchoff, Matías Ferrigno, Andrés Barbieri

• CABASE – Argentina



- Argentina Internet Association, founded in 1989 in Buenos Aires
- Has a membership of 400+ companies and entities
- Main project has been the national network of Internet Exchange Points (IXPs), currently has 27 IXPs that include 350+ ISPs and Connectivity Providers, services 14 million end users, delivers major Content Delivery Networks (CDNs) locally, and accounts for almost 60% of Argentina Internet traffic.
- Recently established the IoT Coordination Center & Marketplace for Argentina.
- Has attended ICANN since it's formation and is member of the ISPCP leadership.

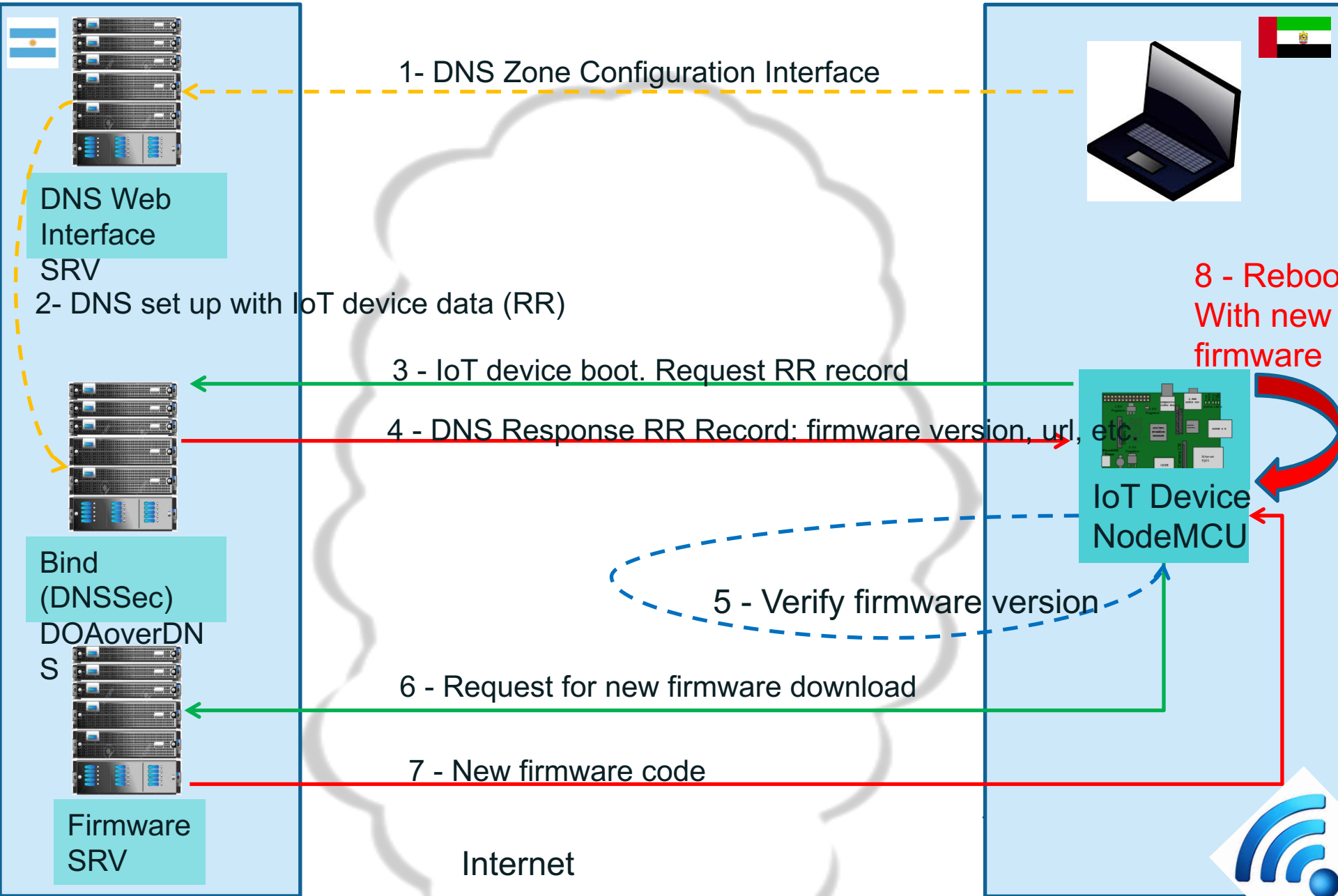
Bind Implentation

- CABASE registered the domain "***persistent.lat***" with the purpose of using it for this demo.
- Two VMWare virtual machines were instantiated for serving as master and slave DNS servers: ns1-doa.unlp.edu.ar and ns2-doa.unlp.edu.ar
- Both implemented with private branch Bind-9.11.2 provided by ICANN. DOA option will be made public with the release of bind 9.12.0 which is in final beta test.
- Ansible 2.3.2 implemented for provisioning.
- Zone persistent.lat configured with **DNSSEC** support.
- An small Django 1.11.6 application developed for updating DNS register (performing CRUD operations over DNS registers in a simpler way):
  - The user can create, update or delete DNS records.
  - Records are store in a small sqlite3 data base.
  - A cron task runs an Ansible playbook, which updates -if necessary- the configuration in both DNS servers.

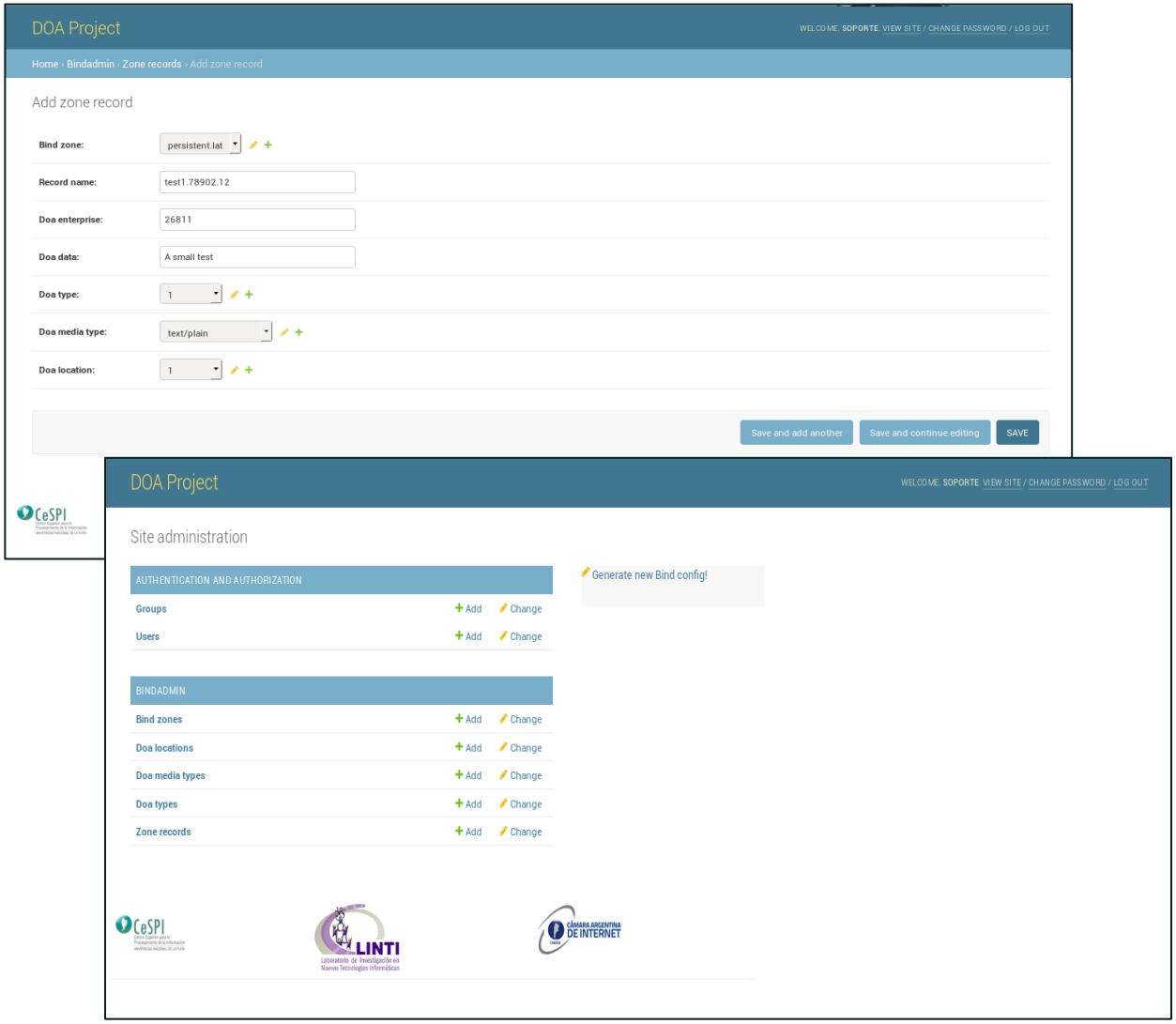
IoT Device Implementation

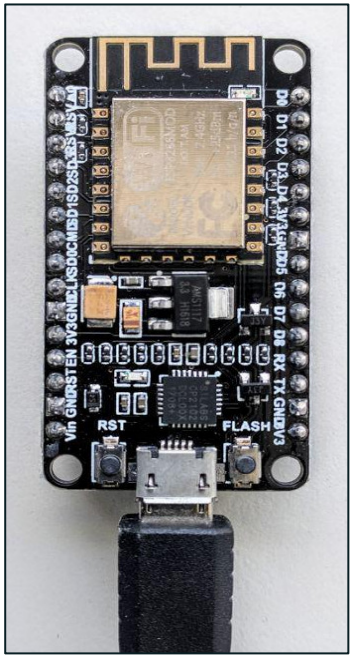
- **$PANCHOR:** persitent.lat
- **Test hardware**: NodeMCU board
  - based on ESP8266 MCU with WiFi.
  - Price < USD 1.5 (on a 10,000 unit basis)
- **Test software**: Arduino
  - open-source platform used for building electronics projects. It consists of both a microcontroller and a programing interface IDE.
  - LWIP library patched to support DOA DNS records

Demo Synopsis



Photos


DOA Project
WELCOME, SOPORTE. VIEW SITE / CHANGE PASSWORD / LOG OUT
Home › Bindadmin › Zone records › Add zone record
Add zone record
Bind zone:
persistent.lat
Record name:
test1.78902.12
Doa enterprise:
26811
Doa data:
A small test
Doa type:
1
Doa media type:
text/plain
Doa location:
1
Save and add another
Save and continue editing
SAVE
DOA Project
WELCOME, SOPORTE. VIEW SITE / CHANGE PASSWORD / LOG OUT
Site administration
AUTHENTICATION AND AUTHORIZATION
Groups
Add
Change
Users
Add
Change
BINDADMIN
Bind zones
Add
Change
Doa locations
Add
Change
Doa media types
Add
Change
Doa types
Add
Change
Zone records
Add
Change
Generate new Bind config!
CeSPI
LINTI
CÁMARA ARGENTINA DE INTERNET


RST
FLASH

References

- *draft-durand-doa-over-dns-03:*
  https://tools.ietf.org/html/draft-durand-doa-over-dns-03
- *IoT device code:*
  https://github.com/iot-linti/Arduino-esp8266/tree/doa
  https://github.com/iot-linti/doa-sketchs/tree/master/DNSDOA-linti

- *Contacts:*
  - *Alain Durand (ICANN)*
  - *Pedro Brisson (UNLP)*
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  - *Matias Banchoff (UNLP)*
  - *Walter Tourn (Cabase)*