DANCE - CIRA

Leveraging DNSSEC in Digital Identity

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Presented By
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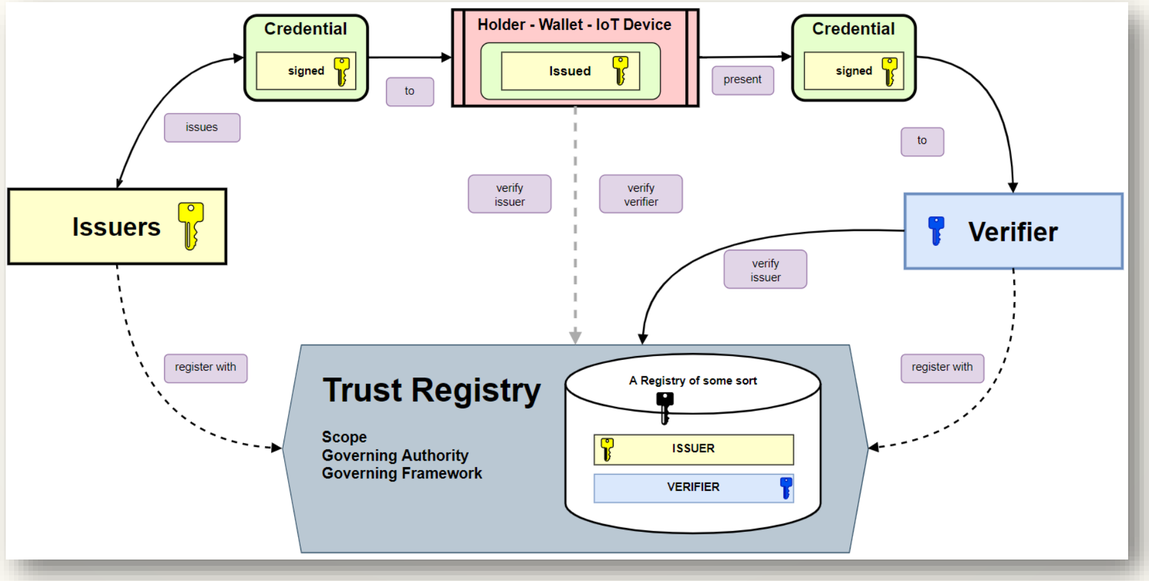
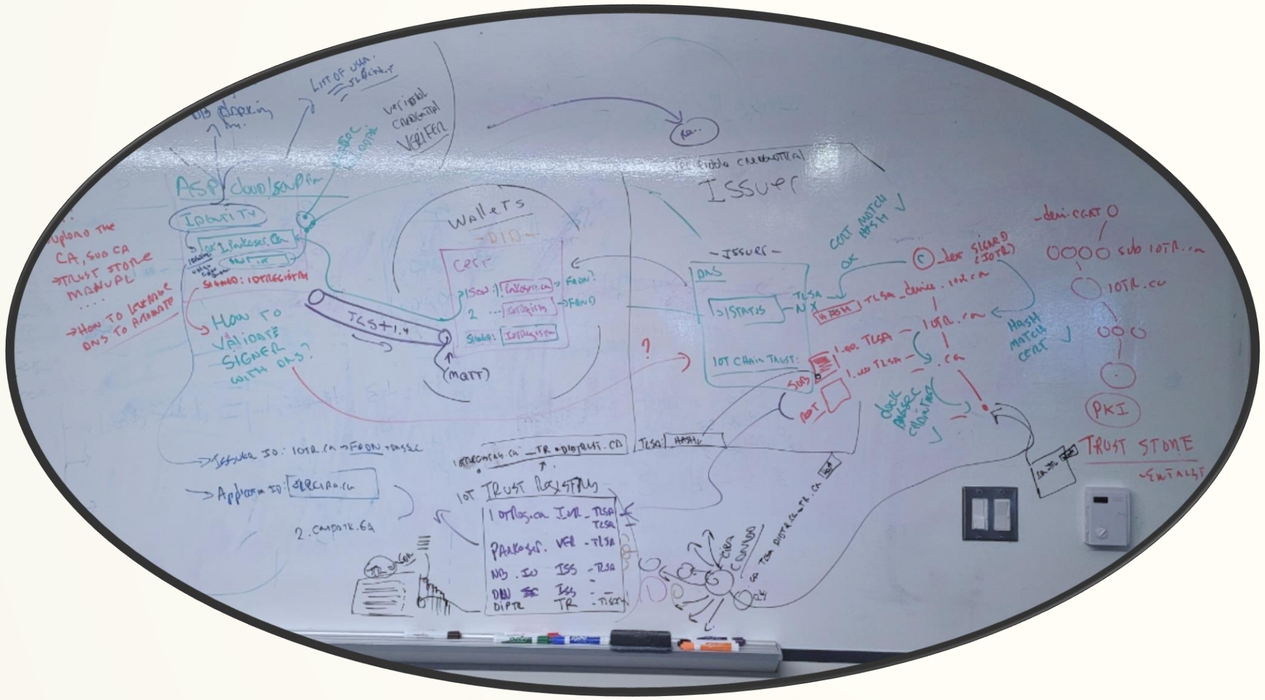
Problem Statement:

We’re missing DNS/DNSSEC support for finding, identifying and authenticating “Digital Identity Trust Registries”



There’s a story here, so here it goes, where to start?

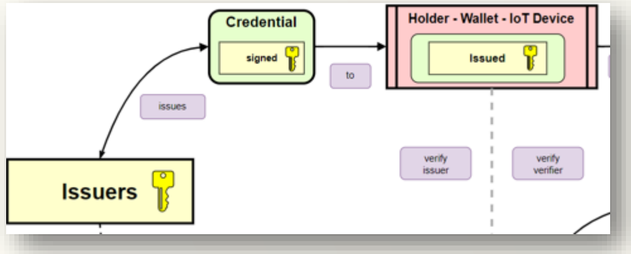


Disclaimer:

Using our **iotregistry.ca** as a example of an **issuer**
Using an **IoT Device** as example of a **wallet**
Using a **ASP** as an example of a **verifier**
May use incorrect terminology – not an expert yet ;)
Trying to explain the use case of trust registries
Some references to SSI/ToIP/Decentralized ID/W3C DID
CERT=certificate, not CERT RRTYPE ;)
And you should know PKI and DNSSEC better than me

WHERE'S THE BEGINNING?

Let's start with verifiable credentials



- The IoT device acts as a wallet that holds verifiable credentials
- A verifiable credential in this example is based on a signed Digital Certificate
- The issuer issued the verifiable credentials to the IoT Device
- Signed Digital Certificate Details
  - SAN: 1 or more FQDN unique identifier
    - i.e. SAN: uuid._**device**.iotregistry.ca
  - Signed by the issuer ← this is the important part
    - i.e. SAN: iotregistry.ca

- At least one SAN can be used to verify the credential status and authenticity (TLSA or NXdomain)
- The (self or not) Signed Certificate is used to establish the identity of the IoT device and facilitates the connection to the ASP (TLS, eventually using dane_clientid, DANCE proposal work here! ☺)

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THE ROLE OF THE ISSUER

We need TLSA records to track the issuers public keys and TLSA records of issued verifiable credentials

- These TLSA records for the root and sub cert can be used to verify the authenticity of the issuer
    - TLSA record for iotregistry.ca subCertificate (0 0 0) – public key
    - TLSA record for iotregistry.ca rootCertificate (0 0 0) – public key

- The verifiable credentials TLSA records can be used to verify their authenticity and status (NXDOMAIN = revoked)
    - TLSA record for the uuid._device.iotregistry.ca (3 0 1) – hash of public key

DANCE: no new stuff, this works so far, right?

THE ROLE OF THE VERIFIER

To verify the authenticity ‘technical trust’ of the verifiable credentials

- Against the digital certificate chain
  - i.e. SAN: uuid._device.iotregistry.ca
  - Signed by the iotregistry.ca SUB Certificate
  - (but they need to find those root/sub certificate in trust store)

- Over DNS/DNSSEC with TLSA
  - TLSA record for uuid._device.iotregistry.ca (3 0 1) (certificate hash)
  - TLSA record for iotregistry.ca subCertificate with public key (0 0 0)
  - TLSA record for iotregistry.ca rootCertificate with public key (0 0 0)

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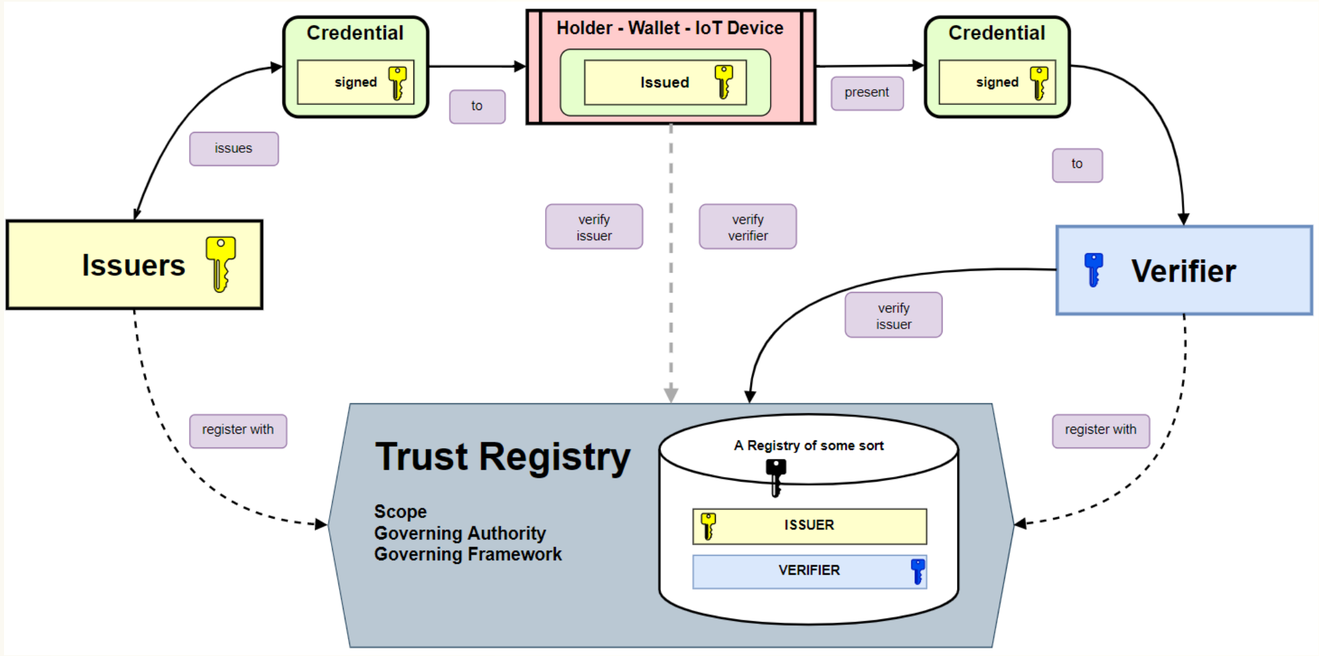
Please hang on
I’m going somewhere here!
(I hope ☺)

I SIMPLIFIED IT, LARGELY BASED ON SSI/TOIP/DECENTRALIZED ID

In the, let's call it "Digital Identity World", here's how I see it!



← FOCUSING HERE

This world is about Trust: do I trust the issuer, do I trust the verifier, do I trust the wallet holder, do I trust the Trust Registry, do I trust that Digital Identity ecosystem

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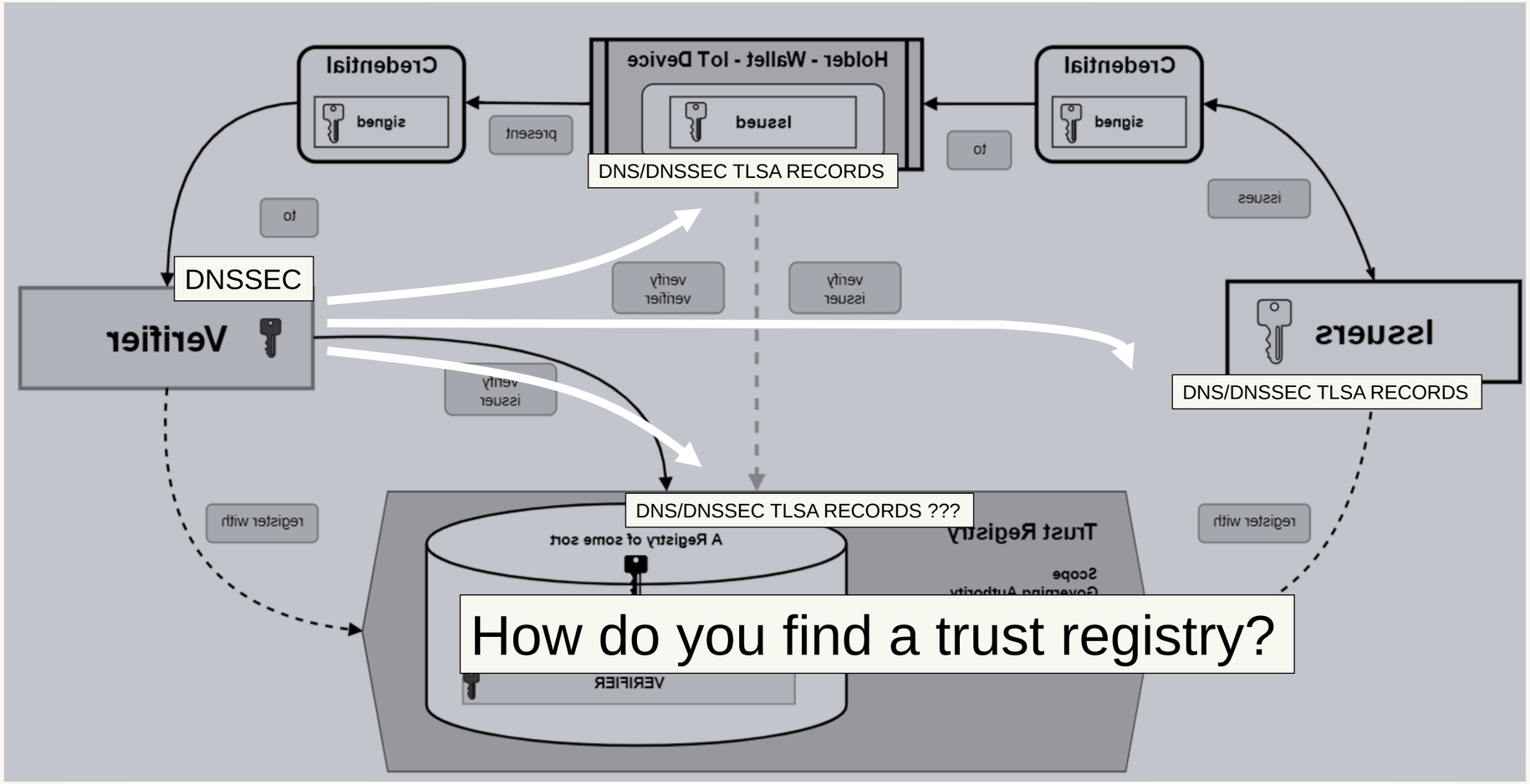
But how do you know the **issuer** of verifiable credentials is (wait for the famous word!)

trusted

IN THE UP-SIDE-DOWN WORLD, THIS IS WHERE DNSSEC IS IMPORTANT

Human/Legal Trust in the **front**, Technical Trust in the **back**



THE ROLE OF TRUST REGISTRIES

To register issuers, verifiers and other trust registries

- Trust Registry have a governance model and framework that defines the characteristic of a registration (what the registrant can and can't do, in a DID…)

- But we see a need for a **trust registry** to **prove** via TLSA that an **issuer** or **verifier** or another trust registry is part of its ecosystem using:
  - **<_trustregistry>** label

- And a need for an **issuer**, a **verifier** or another trust registry to **prove** their trust registry **affiliation** using:
  - **<TR>** RRTYPE (urg, another ;)

ISSUER REGISTRATION IN A TRUST REGISTRY

Let's look at the iotregistry.ca issuer registration in that context

- The issuer iotregistry.ca should have one or more TR (trust registry affiliation) records to point to the trust registries they belong to:

  iotregistry.ca TLSA (0 0 0) rootCertificate
  iotregistry.ca TR trustregistry.ca

- Trust registry **trustregistry.ca** should publish TLSA (0 0 1) **_trustregistry** record for the issuers that matches it's TLSA/Certificate public key

  trustregistry.ca TLSA (0 0 0) rootCertificate
  iotregistry.ca._trustregistry.trustregistry.ca TLSA (0 0 1)

  - TLSA of iotregistry.ca root CERT (like a DS record)
  - This record with would provide with authenticity the affiliation to a trust registry (but nothing about the human trust itself!!)

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Yes "_trustregistry" can be shortened ;)

PROPOSING THIS AS A GLOBAL CHAIN OF TRUST FOR TRUST REGISTRIES

From a verifiable credential, you can find the issuer and associated trust registries

- The issuer iotregistry.ca should have one or more TR trust registry affiliation record to point to the trust registries they belong to
  - iotregistry.ca TLSA (0 0 0) rootCertificate
  - iotregistry.ca TR trustregistry.ca
- Canada's Trust Registry (is affiliated with the IANA trust registry)
  - trustregistry.ca TLSA (0 0 0) rootCertificate
  - trustregistry.ca TR trustregistry.iana.org
  - iotregistry.ca._trustregistry.trustregistry.ca TLSA (0 0 1) hash of rootCertificate
- IANA Trust Registry: (Would have an entry for Canada's trust registry)
  - trustregistry.iana.org TLSA (0 0 0) rootCertificate
  - trustregistry.ca._trustregistry.trustregistry.iana.org TLSA (0 0 1) rootCertificate
- ROOT ZONE: (global trust registry anchor)
  - Root zone: trustregistry.iana.org._trustregistry. TLSA (0 0 1) rootCertificate

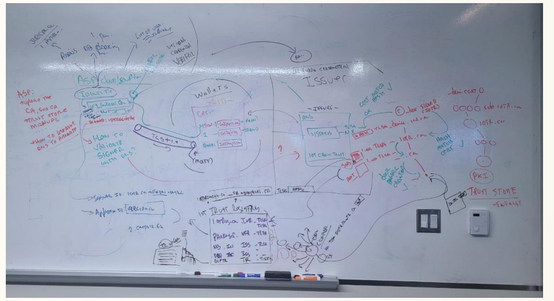
I went too far, didn’t I?

☺

There’s a good story here, hope it makes sense now ;)

- Something along the line presented here would provide a method and system for finding, identifying and authenticating “Digital Identity Trust Registries”
- Anchoring the Digital Identity world into the existing IANA ROOT ZONE DNSSEC trust anchor makes sense
- Allows for unique identifiers
- Allows for a single global trust anchor **(for those who wish to use)**
- Allows for ream time verifiable credentials management real time using DNS (non existence = revoked)
- Alex worked on https://tools.ietf.org/id/draft-mayrhofer-did-dns-03.html to link DID to DNS
- **Check our DANCE GitHub repository**

Question?



https://github.com/CIRALabs/dance

Thank You

https://www.cira.ca/labs

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