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SAND2021-10424C

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Cybersecurity and Public Key Infrastructure for DER: Addressing a Global Challenge in the Australian Market

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Australia Workshop for Distributed Energy Resource Networks

August 31, 2021

SAND2021-XXXX

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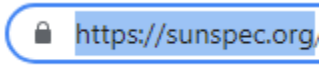
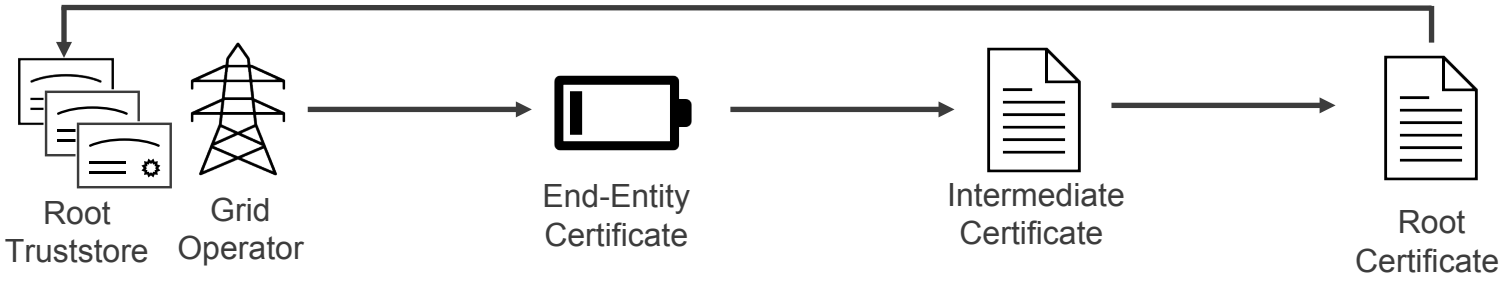
Public Key Infrastructure for DER

- PKI is designed for *identify management* in a *many-to-many trust environment*
  - Asymmetric cryptography provides confidentiality, but how can we trust it's who we think it is?
  - PKI links an *entity* with a *key* and verifies that relationship with the *certificate* from an *authority*
  - Chains of trust are constructed by linking certificates—underpinned by a root CA.
  - Browsers come with dozens of trusted root CA certificates: 

- Challenges for the DER environment
  - Grid operator must communicate with (and trust) products from many manufacturers
  - Scalability/cost issues with many utilities/grid operators/aggregator
    - How many root CAs will be created for a given country/jurisdiction?
    - Nearly impossible for DER vendors to provision private keys at the time of manufacturer if there are multiple root CAs *unless* they know the PKI ecosystem where the product will be deployed

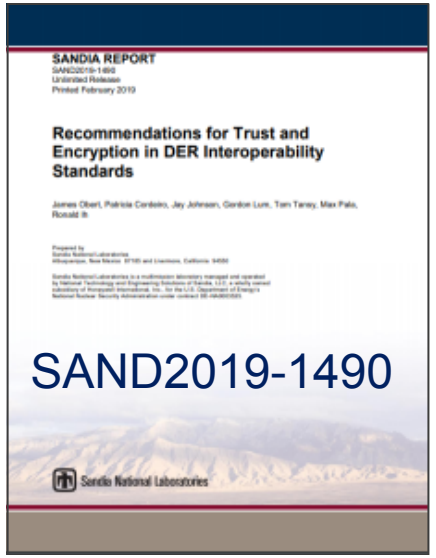


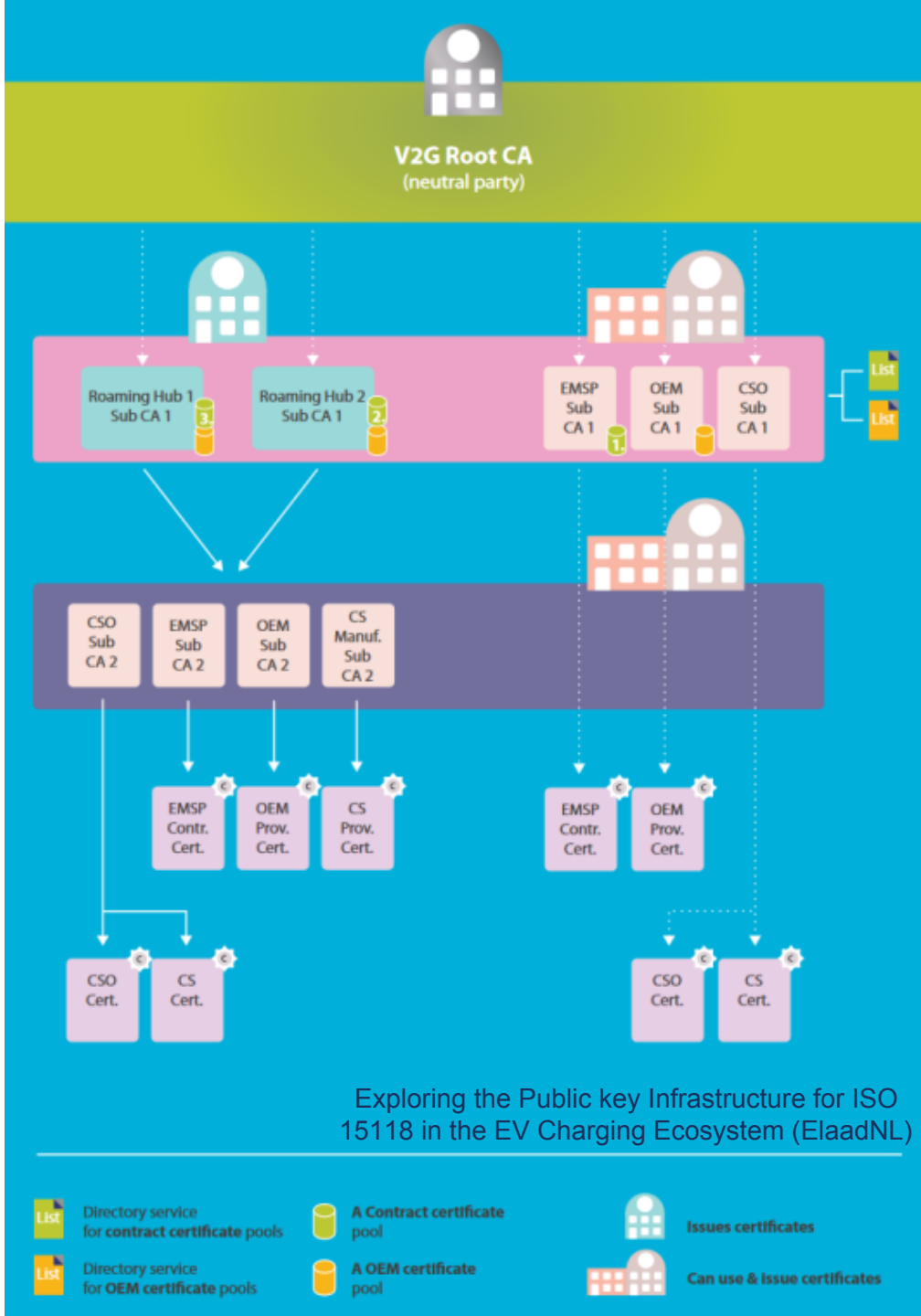
PKI Implementation Options

- Option 1: Create a **single** well-secured, offline, domestic root CA for IEEE 2030.5 communications in Australia
  - DER vendors and grid operators will operate intermediate CAs to provision clients and server certificates
  - Cost-effective and practical; all certificates are linked to neutral root CA
  - Aggregators/grid operators can manage whitelisted and blacklisted certificates/DERs locally
  - Manufacturers can provision certificate for Australian PKI during the manufacturing process
- Option 2: Create **multiple** well-secured, offline, domestic root CAs for IEEE 2030.5 communications in Australia
  - Grid operators have more leeway to control the environment and incorporate special cybersecurity features (e.g., certificate revocation, etc.)
  - Manufacturers can provision certificate during field commissioning when configured for interconnection (or potentially before if the root CA is known ahead of time)
    - DER may generate unique key-pair in field and send certificate signing request to appropriate CA (possibly via DER cloud system)
    - This capability is likely required for any DER company operating internationally since there will be multiple root CAs across the globe
- Option 3: Yet another approach!

IoT and Power System PKI Best Practices

- EV plug-and-charge PKI ecosystems in ISO 15118-2:2014 *Road vehicles — Vehicle-to-Grid Communication Interface — Part 2: Network and application protocol requirements* defines a PKI Infrastructure for electric vehicle ecosystem.
- PKI Key Lifecycle in IEC 62351-9 *Power systems management and associated information exchange - Data and communications security - Part 9: Cyber security key management for power system equipment*
- Sandia Technical Reports
  - Recommendations for Trust and Encryption in DER Interoperability Standards
  - Recommendations for Data-in-Transit Requirements for Securing DER Communications





Questions?

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