OpenADR 2.0 Security

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Security Overview

- Client and server x.509v3 certificates
- TLS 1.2 with SHA256 ECC or RSA cipher suites
  - TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256
  - TLS_RSA_WITH_AES_128_CBC_SHA256
- Optional XML payload signatures
- Requirements above are “out of box”, deployment security may differ

Focus

- Most common support issue for OpenADR implementers is getting communication going over a secure channel
- This presentation will focus on the minimum necessary concepts and steps required to be successful setting up secured OpenADR communication

Cipher suites

- An algorithm for performing encryption or decryption.
- OpenADR support two types of cipher suites
  - ECC (Elliptical Curve Cryptography)
  - RSA
- The OpenADR RSA and ECC cipher suites used by OpenADR have a strong "SHA256" hash algorithm

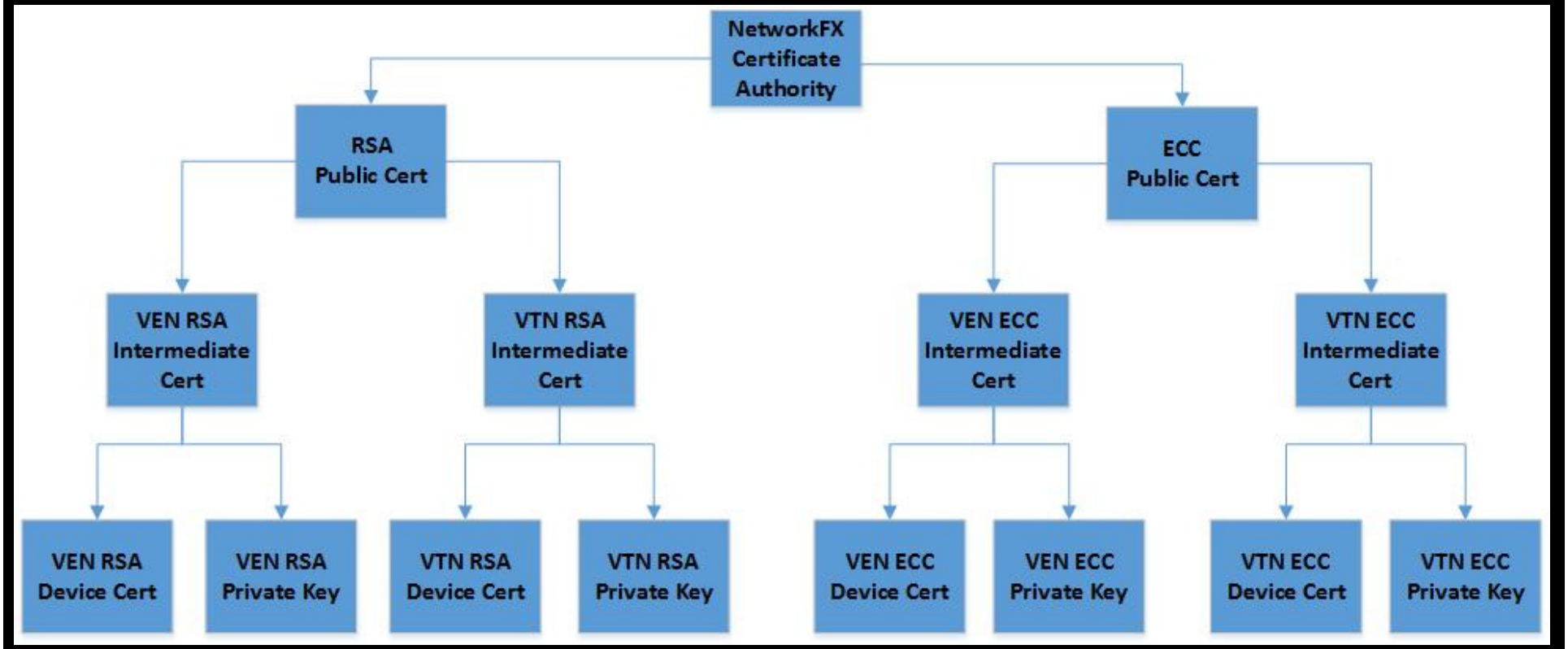
X.509 Certificates

- Root Certificate
  - Used to validate the identity of a counterparty such as a VEN trying to talk to a VTN
  - Certificates are managed by a Certificate Authority (CA), NetworkFX for OpenADR
  - OpenADR has a public cert each for RSA and ECC
- Intermediate Root Certificate
  - Signed by the root cert's private key
  - Used in conjunction with root cert for identifying counterparties
  - VENs and VTNs have separate intermediate certs

X-509 Certificates

- Device Certificate
  - Identifies a specific VTN or VEN
  - Signed by the intermediate cert's private key
- Private Key
  - Matching device certificate private key.
  - Used to encrypt hash of traffic payloads, which can only be decrypted with public device cert

Cert Tree


NetworkFX Certificate Authority
RSA Public Cert
ECC Public Cert
VEN RSA Intermediate Cert
VTN RSA Intermediate Cert
VEN ECC Intermediate Cert
VTN ECC Intermediate Cert
VEN RSA Device Cert
VEN RSA Private Key
VTN RSA Device Cert
VTN RSA Private Key
VEN ECC Device Cert
VEN ECC Private Key
VTN ECC Device Cert
VTN ECC Private Key

TLS Negotiation

- TLS is a cryptographic protocol designed to provide communications security over a computer network. Think “HTTPS”.
- TLS negotiation does the following
  - Sets the TLS version to use (TLS 1.2 for OpenADR)
  - Sets the cipher suites to use
  - Exchanges client and server device certificates
  - Validates certificates are trusted
  - Establishes symmetric encryption key for data exchange

TLS Negotiation

VTN
(ISO or Utility)

Client Hello (TLS/Cipher Options)

Server Hello(selected TLS/Cipher)

Send Server Device Certificate

Request Client Certificate

Send Client Device Certificate

Establish Symmetric Encryption Key

VEN
(C&I, SMB)

Certificate and Stores

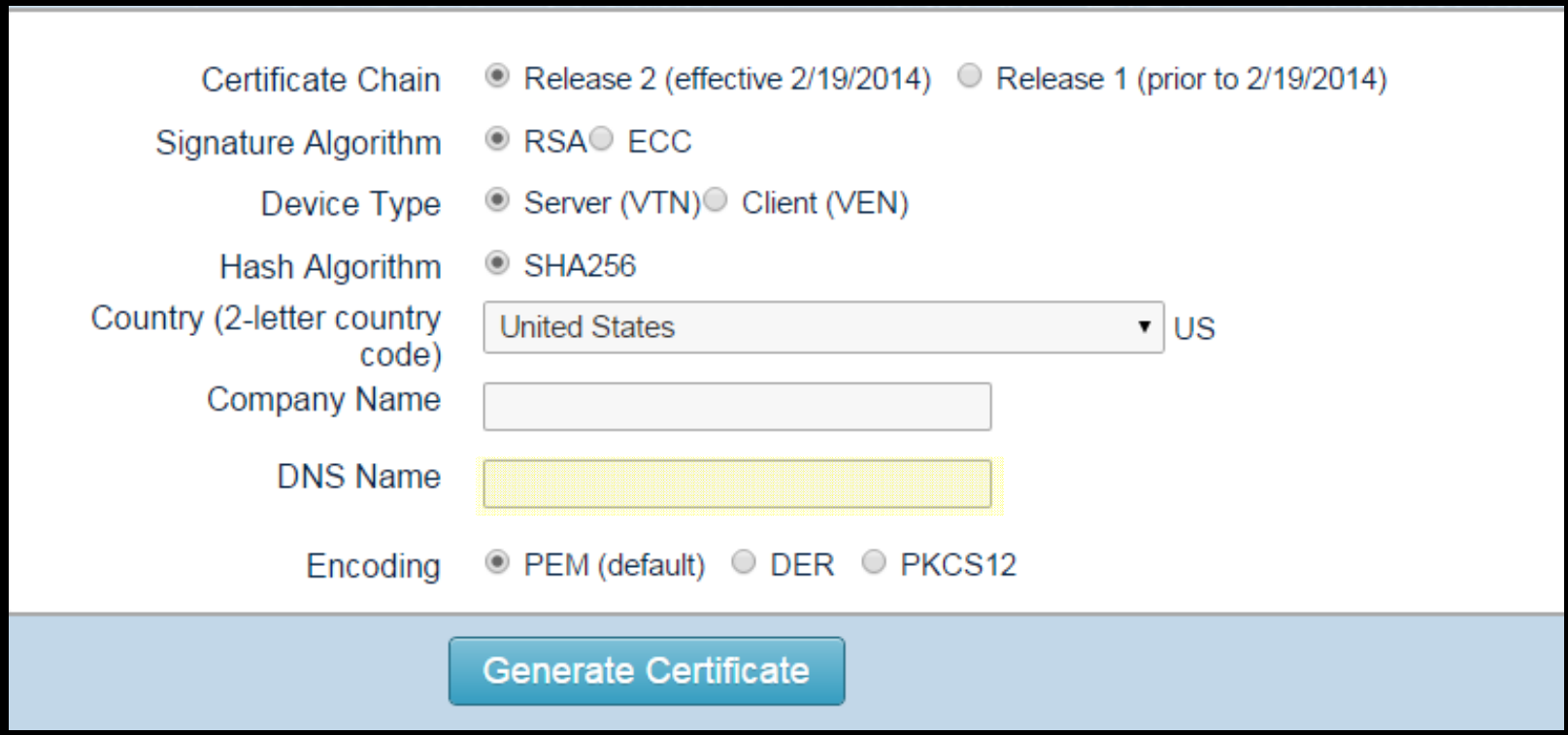
- Certificates are available in a number of formats:
  - PEM Format – Base64 encoded certificate
  - DER Format – Binary encoded certificates
  - PKCS12 Format – Contains both public device and private key
- Stores
  - Trust Store – Contains public root and intermediate Certs from counterparty
  - Key Store – Contains device cert and private key

Certificate Management Tools

- OpenSSL and Keytool
- Convert between certificate formats
- Create trust and key stores
- Verify device certs validate against public certs (OpenSSL)

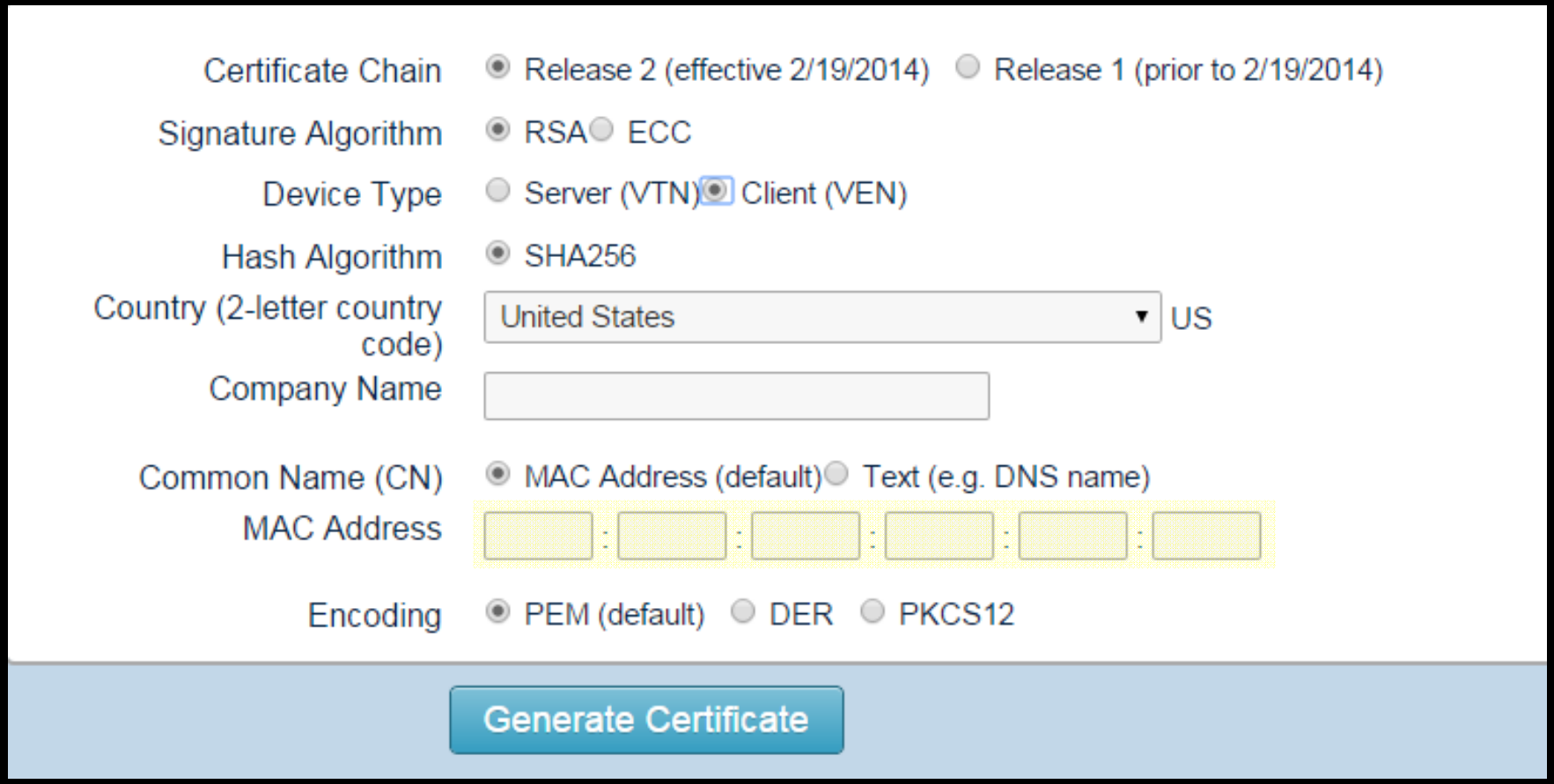
Test Certificates

- ww.networkfx.net



DNS name is stores in cert CN field. Must match VTN URL if host authentication not disabled.

Test Certificates



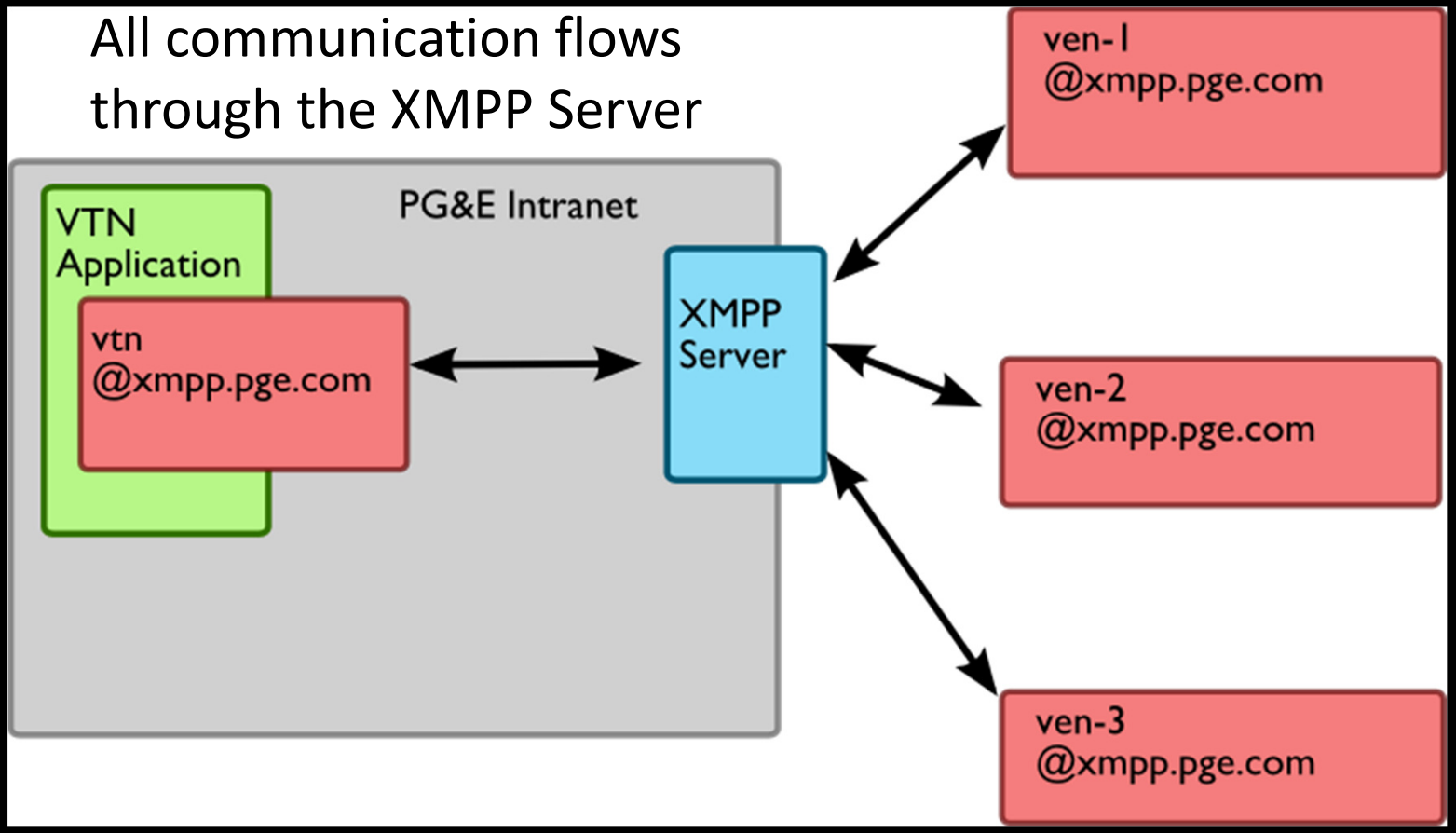
The MAC address is stored in the CN field of the VEN certificate with out colons. If using OpenFire XMPP Server, the XMPP user name must match the VEN CN Name in the Cert

HTTP Certificate Configuration Example

	VEN	VTN
Trust Store	Common Root Cert	Common Root Cert
	VTN Intermediate Cert	VEN Intermediate Cert
Key Store	VEN Device Cert	VTN Device Cert
	VEN Private Key	VTN Private Key

All Certs must be of a common type: RSA or ECC. Can be both

XMPP Transport



Note that the connection between the XMPP server and the VTN is a private connection. From the VEN's perspective the XMPP server "is" the VTN.

XMPP Certificate Configuration Example

	VEN	XMPP Server	VTN
Trust Store	Common Root Cert	Common Root Cert	Common Root Cert
	VTN Intermediate Cert	VEN Intermediate Cert	VTN Intermediate Cert
Key Store	VEN Device Cert	VTN Device Cert	VEN Device Cert
	VEN Private Key	VTN Private Key	VEN Private Key

The connection between the VTN and the XMPP server is a private connection. The cert configuration shown for the VTN is just a suggestion to deal with the OpenFire's CN name to user name match requirement

Fingerprint

- The VEN Zip package with certificates from NetworkFX will contain a fingerprint file
- This fingerprint value may need to be installed in the VTNs back-end server configuration in order to interoperate

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Questions?