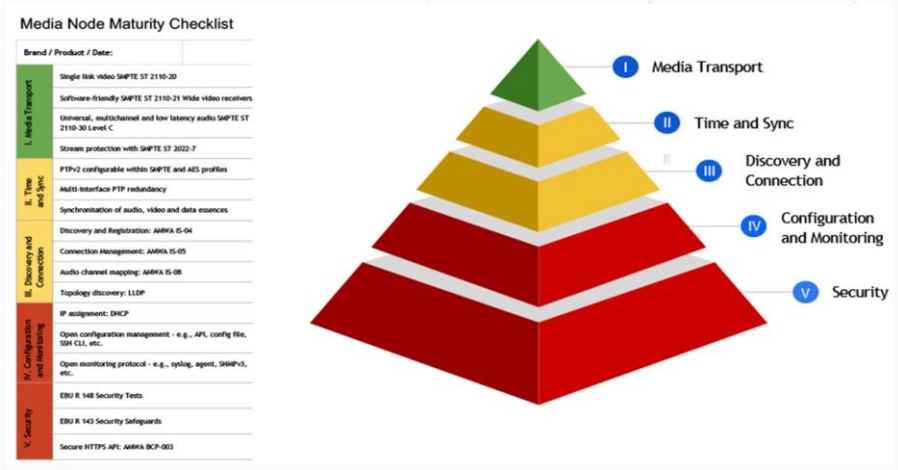
Security for Discovery and Connection management of ST 2110 Media Devices

Arne Bönninghoff – Head of IP Research
Riedel Communications GmbH & Co. KG

Media Node Maturity Checklist



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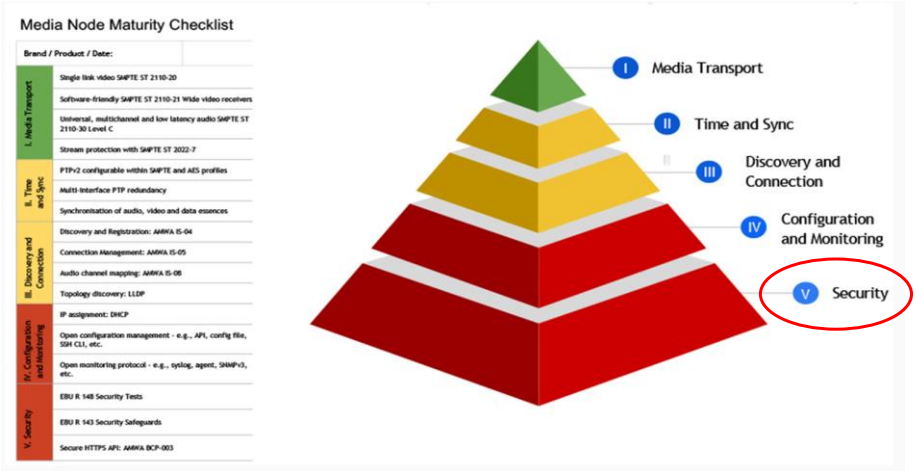
IP SHOWCASE THEATRE

Why security



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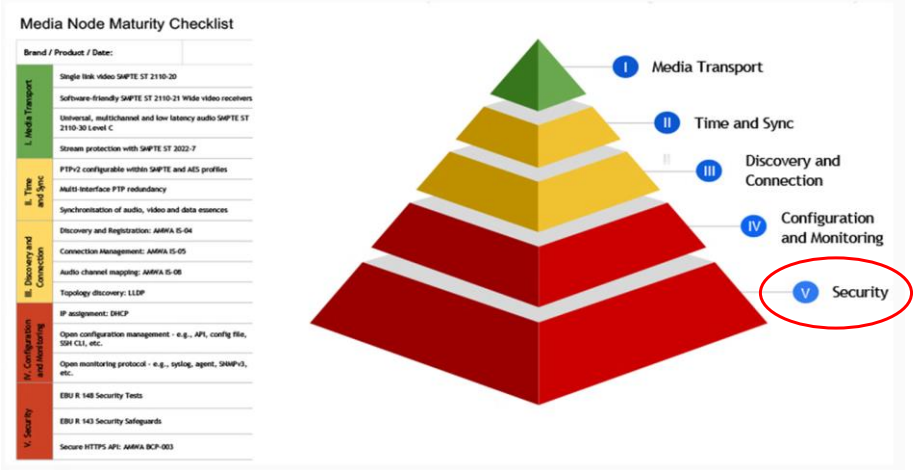
Why security



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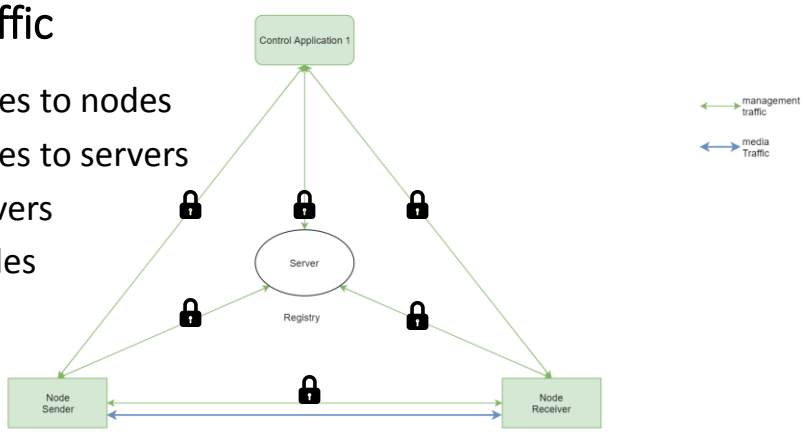
Types of traffic

- Control devices to nodes
- Control devices to servers
- Nodes to servers
- Nodes to nodes



Levels of security

- **Confidentiality** Data passing between client and the APIs is unreadable to third parties.
- **Identification** The client can check whether the API it is interacting with is owned by a trusted party.
- **Integrity** It must be clear if data travelling to or from the API been tampered with.
- **Authentication** The client can check if packets actually came from the API it is interacting with, and vice versa.
- **Authorisation** The API can determine whether the client interacting with it has authorisation to carry out the operation requested.

courtesy Simon Rankine BBC R&D

Work areas AMWA BCP-003

Establishing Trust
- Public key infrastructure with x509 certificates
- Explore how PKI can be used in a broadcast environment

Connection Security
- HTTP over TLS (HTTPS) – IS-04, -05, -06, (-07), -08, -09
- Identify cipher suites for interoperability
- Establish best practice for use of TLS with AMWA NMOS APIs

Client Authorisation
- OAuth 2.0 with JSON Web Tokens
- Identify what is needed to ensure interoperability

Work areas AMWA BCP-003

BCP-003-01

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BCP-003-02
IS-10

courtesy Simon Rankine BBC R&D

Key Exchange – establish trust

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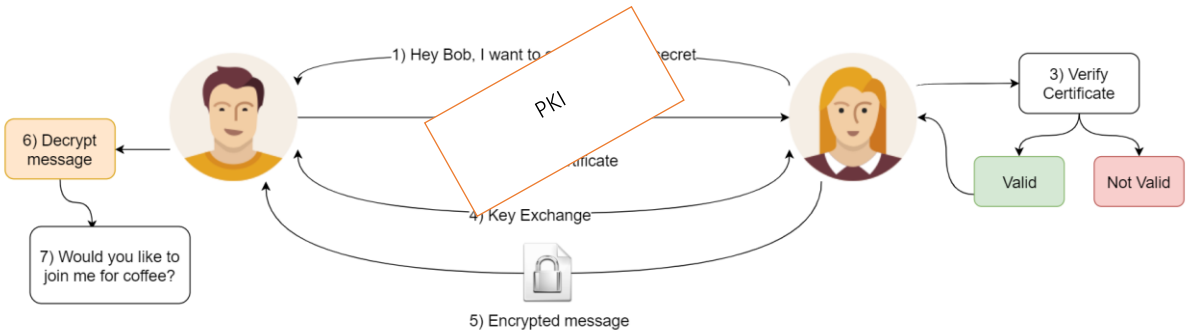
Key Exchange – establish trust



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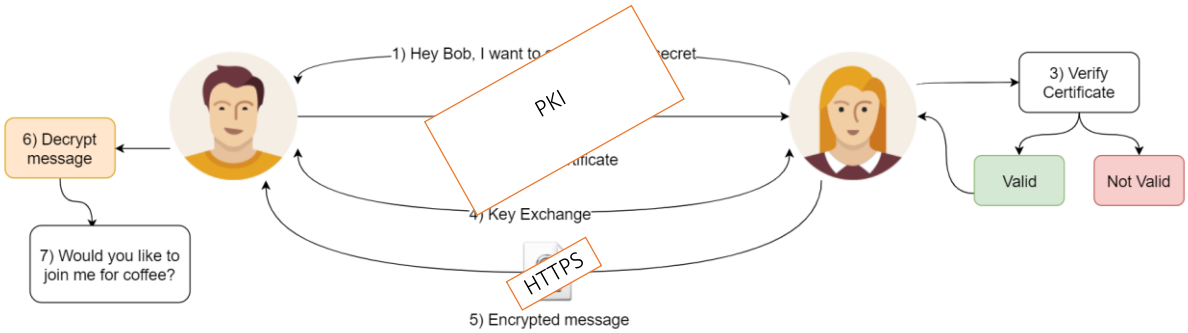
Key Exchange – establish trust



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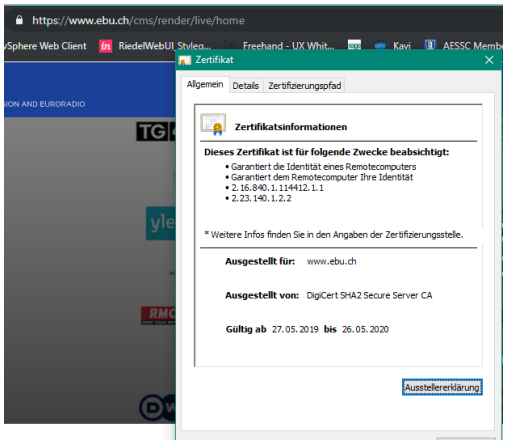
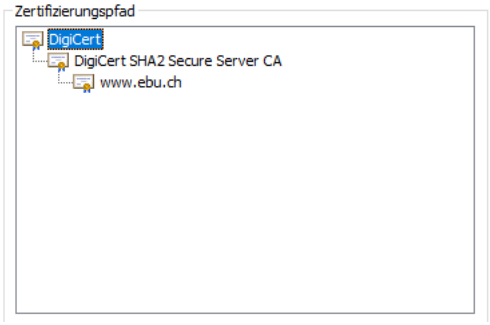
Key Exchange – DNS as a prerequesite





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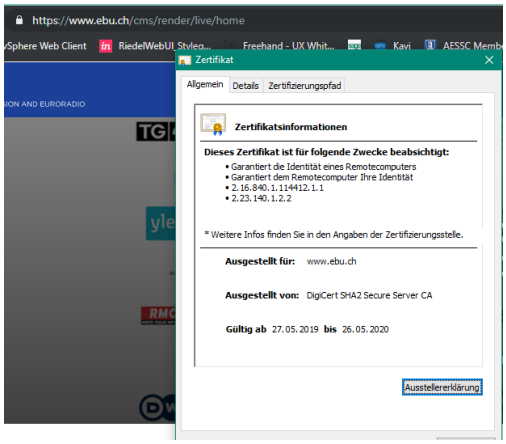

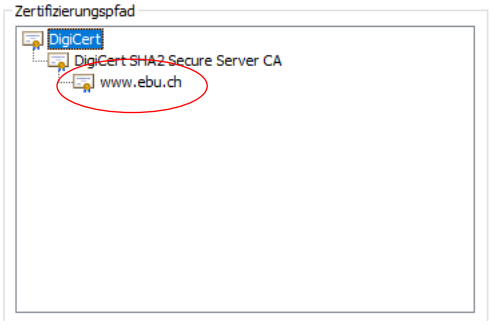

- Issued on Hostname not on IP Address
- DNS resolution essential

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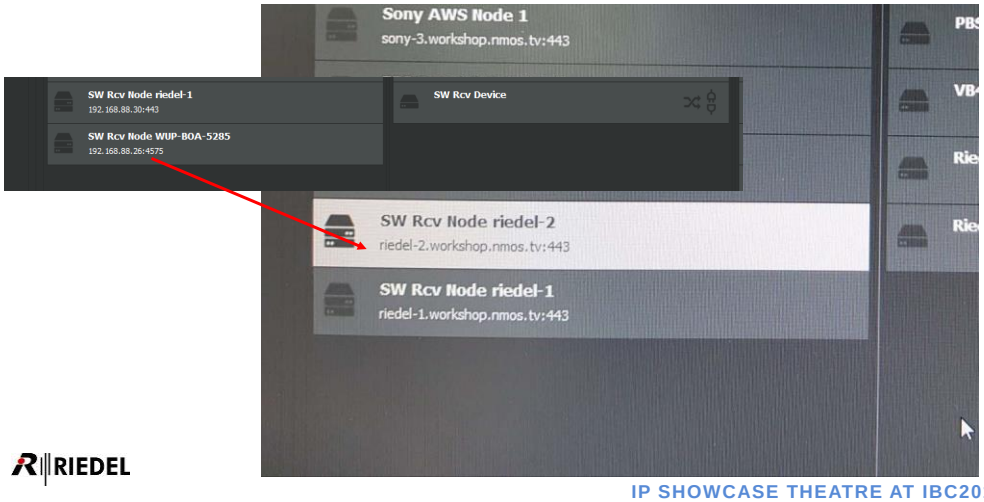
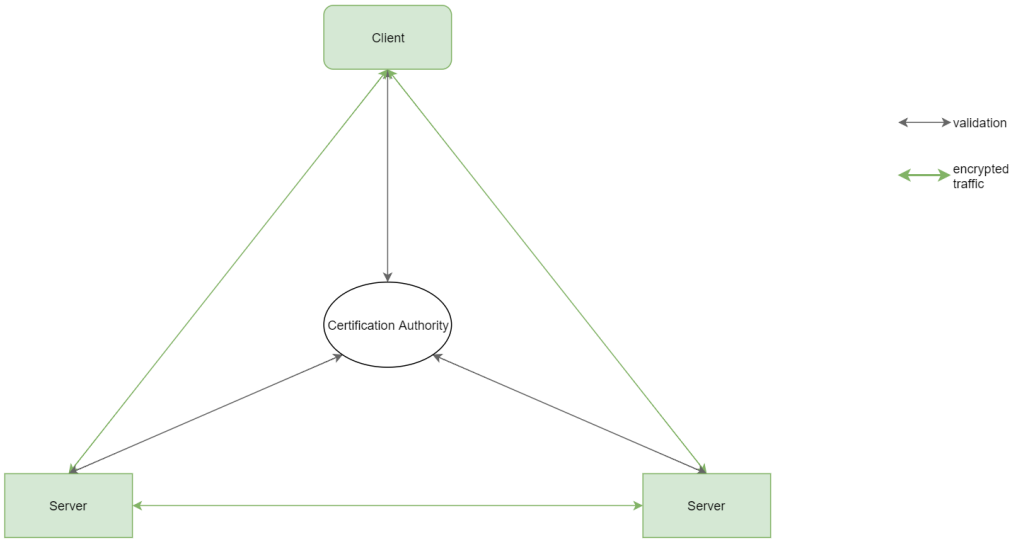
DNS Resolution – follow TR-1001





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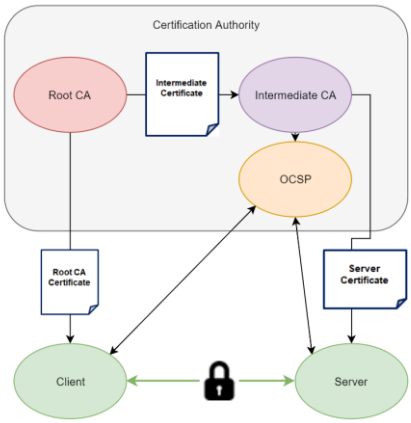
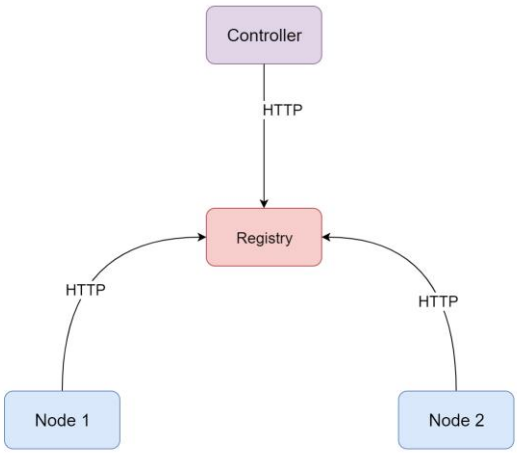
Certification Authorisation



Client and Server: Example IS-04



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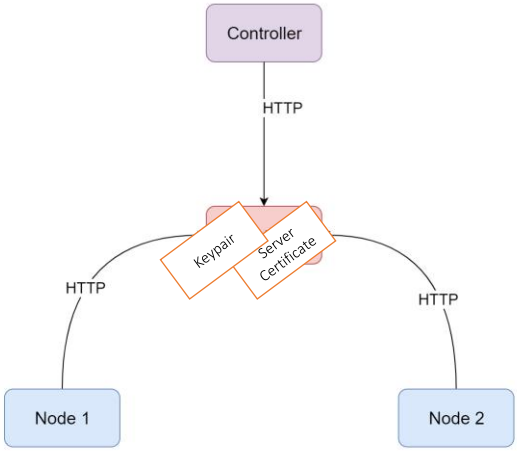
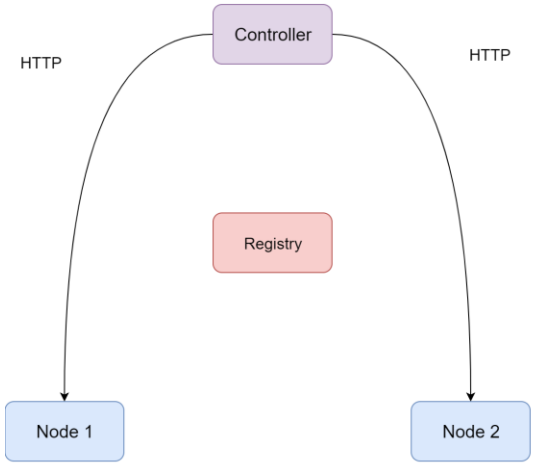
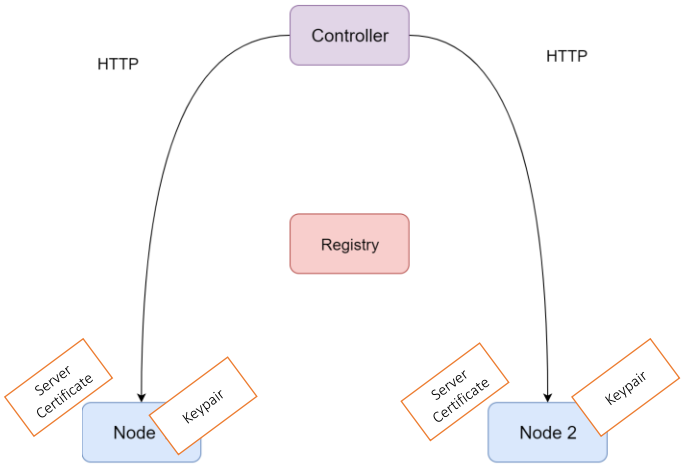
Client and Server: Example IS-04



Client and Server : Example IS-05



Client and Server : Example IS-05



Connection Security – Interoperable HTTPS Cipher Suites for keys

Should support

- TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256
- TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_DHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384
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Shall support

- TLS ECDHE ECDSA WITH AES 128 CCM 8

Use TLS v1.2 – be ready for v1.3 when available!

https://www.bbc.co.uk/rd/publications/whitepaper337

Interop Workshop discussion

Should support

- TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
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- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
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~~Shall support~~

- ~~TLS ECDHE ECDSA WITH AES 128 CCM 8~~

Use TLS v1.2 – be ready for v1.3 when available!

Interop Workshop discussion

TLS v1.2 Summary

Most-supported ciphers (by all who submitted results):

TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256
TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384
TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384

Note that the sample size below is just **four** implementations

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Conclusion BCP-003-01

- Broadcast devices need to be able to import Root CA certificates (trust Servers) as well as import or generate Key/Certificate pairs (acting as server)
- Broadcast devices need to support range of required cipher suites
- Broadcast Controller need to trust Root CA certificates
- **Broadcast Infrastructure needs to provide CA or Internet Access**
- **Broadcast Infrastructure needs to provide DNS workflow**

➢Security implementation simple for end devices – cipher suite topic aside
➢Infrastructure more challenging
  ➢CA, DNS, DHCP -> TR-1001
➢Needs more participation from vendors, all AMWA workshops now based on TLS
➢NMOS APIs prepared for TLS

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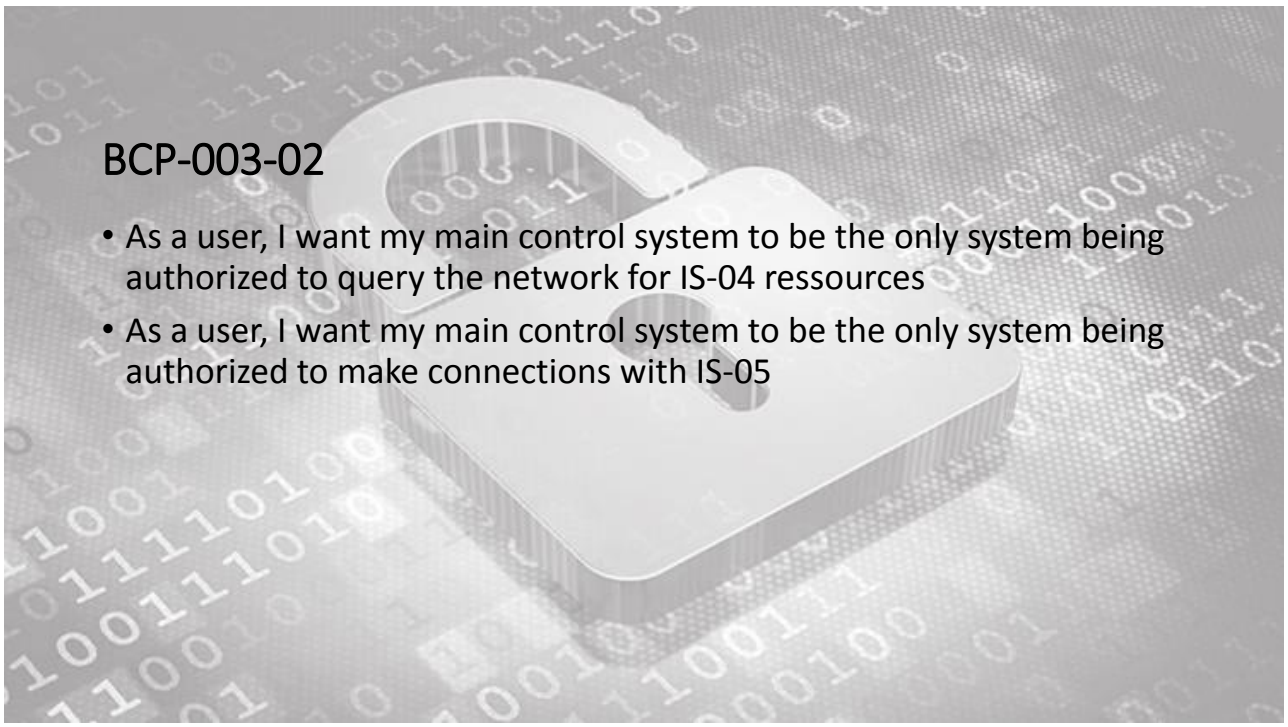
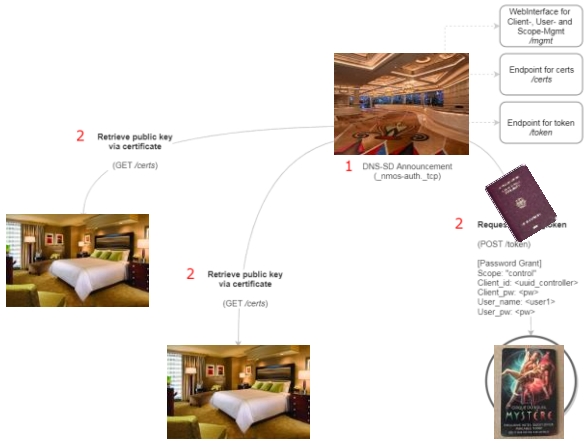


BCP-003-02

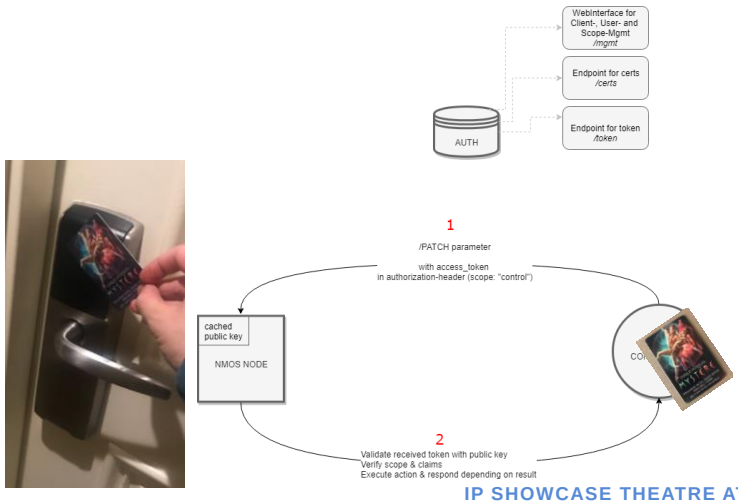
- Describes techniques how to retrieve a token and get authorized access
- Describes techniques for NMOS nodes how to validate tokens
- Describes the type of information stored in the token

How to become authorized?

Initial setup – IS-10



Accessing Resources



OAuth2 + JWT for NMOS

- Authorization server issues keys to ressource servers (=NMOS Nodes)
  - Needed to be able to decrypt tokens for validation
  - Keys are refreshed in short intervals (1 hour)
- Authorization server issues tokens to Clients (=control systems)
  - Needed to be able to perform actions against ressource servers
  - Clients need to be listed in advance in the auth server (out of scope)
    - LDAP/AD/SSO

JWT

Encoded PASTE A TOKEN HERE

```
eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.eyJleHAiOjE1MjE2MTg1OTQsInVzZXIiOiJqYXNwZXIiLCJzY29wZSI6ImFkbWluIn0.2pO9GURs9ZSskA7Banf53qB8ZizFt8sm_onnbtNuoF4
```

Decoded EDIT THE PAYLOAD AND SECRET

HEADER: ALGORITHM & TOKEN TYPE

```
{
  "typ": "JWT",
  "alg": "HS256"
}
```

PAYLOAD: DATA

```
{
  "exp": 1521618594,
  "user": "jasper",
  "scope": "admin"
}
```

VERIFY SIGNATURE

```
HMACSHA256(
  base64UrlEncode(header) + "." +
  base64UrlEncode(payload),
  3026ca5d3d13e5cc31c38b
) secret base64 encoded
```

- Header, Body, Signature
- Body containing claims
- Rfc7519
- ➢ Issued key needed to verify the signature
- ➢ only valid tokens are processed

- Simple claims today
- More granular claims in future
  - Location
  - Role

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BCP-003-02 in the “NMOS World”

- Authorisation server visible through DNS-SD
- Backwards compatible
  - Just send IS-04 and IS-05 without token
- Also applicable for IS-04 query API
  - Example: only some controllers are allowed to retrieve information

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Real word considerations

- Device exchange takes time
- Automating certificate handling and key exchange is a vulnerability

➢ Don‘t let additional effort stop you from implementing security best practices

Security - Conclusion

- IS-0x are based on standard IT technology
- HTTP and JSON are used by many other applications
- Other applications use OAuth2 and JWT already in large scale
- Key exchange workflow provides the fundamental environment for HTTPS transport
- Secure Transport enables OAuth2
- **TR-1001 workflows a must have**

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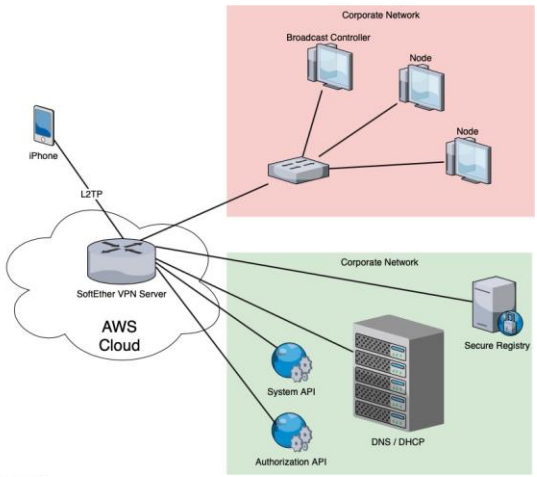
Virtual Workshop June 3-7 2019



- VPN Setup
  - DHCP
  - DNS
  - CA
  - Registry (HTTP/HTTPS)
  - Authorization
- Still online
- Become AMWA member
- Contact Thomas Edwards

Thank you

Arne Bönninghoff
arne.boenninghoff@riedel.net | +49 177 8347500

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