ETSI ISG QKD

Industry Specification Group on QKD

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 ‘Standardisation and certification of QKD systems and QKD networks’ 1st Workshop, AIT (online)

Areas of activity of ETSI ISG QKD

Security

- Common Criteria Protection Profile for QKD
- Design of QKD interfaces with Authentication
- Structuring security models
- Implementation security

Interoperability

- Application / key delivery interfaces
- Interoperable KMS interface
- Introducing QKD into SDN networks
- Network architectures

Optical characterisation

- Characterization of optical components
- Optical characterization of QKD modules

Vocabulary

- Improving and aligning terminology

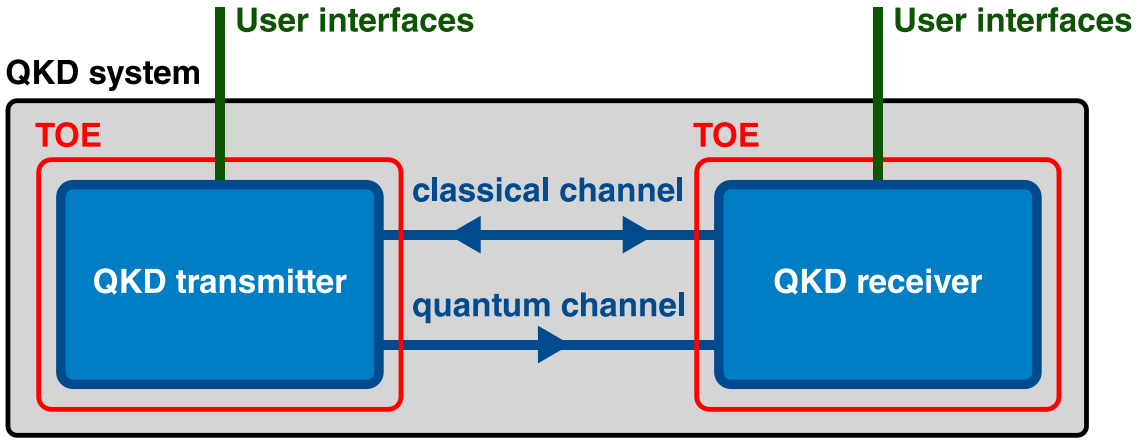
https://www.etsi.org/committee/qkd

Participation in an ETSI ISG

- ISG composed of ETSI Member and ISG Participants
  (ETSI membership is not a requirement to participate in an ISG)
- QKD specifications require a broad range of expertise
- ISG QKD benefits from the expertise of Members and Participants from:
  - QKD vendors
  - Telecom operators
  - Application vendors
  - National Bodies and Certification Labs
  - National Metrology Institutes
  - Academic experts
- International profile: Europe, Japan, South Korea, Canada, US, Russia etc.

DGS/QKD-016-PP
Common Criteria Protection Profile

Certification of QKD systems is an important objective for QKD vendors and users



- PP will frame future ISG security work to develop background documents
- Manfred Lochter (BSI) will explain in the next session

RGS/QKD-0005ed2_SecProofs
Security Proofs Revision

We are preparing an update to ETSI GS QKD 005

- Structuring security proofs of QKD protocols and security models
- V1.1.1 was published in 2010
- Fundamentals remain unchanged
- General updates to terminology and examples
- Common assumptions on the environment, the adversary etc.
- Developments in post-processing techniques:
  - Data Partitioning, Sifting, Symbol Map, Refined Symbol Map, Error Correction, Error Verification, Parameter Estimation, Privacy Amplification
- Implementation security is not the main subject of this deliverable

DGS/QKD-0010_ISTrojan
Protection against Trojan horse attacks

First work item on implementation security

- Example of the analysis of implementation security issues
- Attempting to align with the Protection Profile at the moment

- Design guidance
- Time-resolved reflectivity measurements (e.g., OTDR)
- Bounding the probability of relevant reflected photon
- Advice on subsequent security analysis

DGS/QKD-0013_TransModChar
Optical Characterisation of QKD transmitter modules

Behaviour of components and modules is critical to evaluation activities for QKD systems

- Previously: ETSI GS QKD 011 V1.1.1
  Component characterization: characterizing optical components for QKD systems
  - many properties of components of transmitter and receiver module

- Current work item: DGS/QKD-0013_TransModChar
  Characterisation of Optical Output of QKD transmitter modules
  - including photon number statistical properties, spectral properties, polarization states
- A similar work item on receiver modules is expected to follow
- Focus is on measurements of complete QKD modules

DGR/QKD-019_AUTH
Design of QKD interfaces with Authentication

Authentication is a critical element of QKD protocols

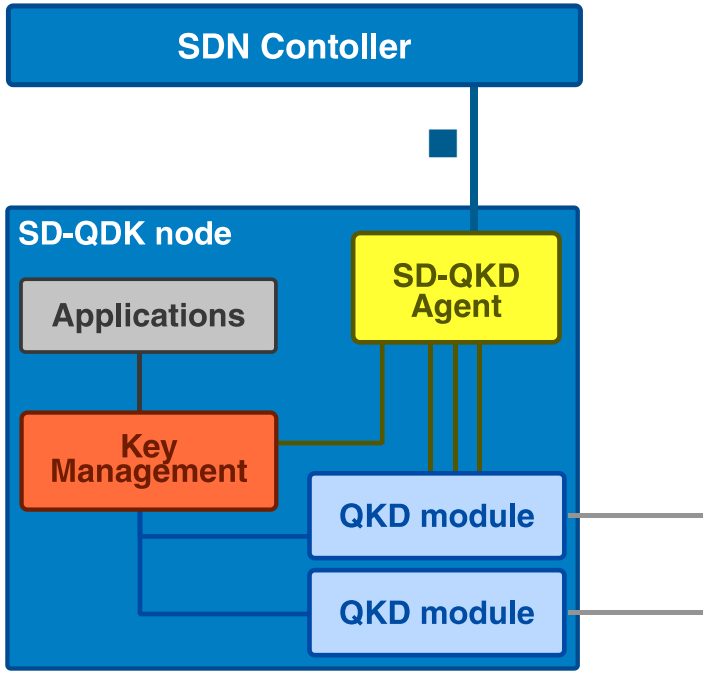
- The ISG is studying uses of authentication in QKD systems
- Protocols used in the classical channel of a quantum link
- Assumptions on long-term or physical security
- Information-theoretic secure (e.g., Wegman Carter) authentication protocols
- Currently a lack of existing standards

Introducing QKD into Software Defined Networks

SDN is of growing importance to many telecom operators

- Need integration of QKD services into SDN
- Define management interfaces
  - Delivery of QKD keys via dedicated interfaces

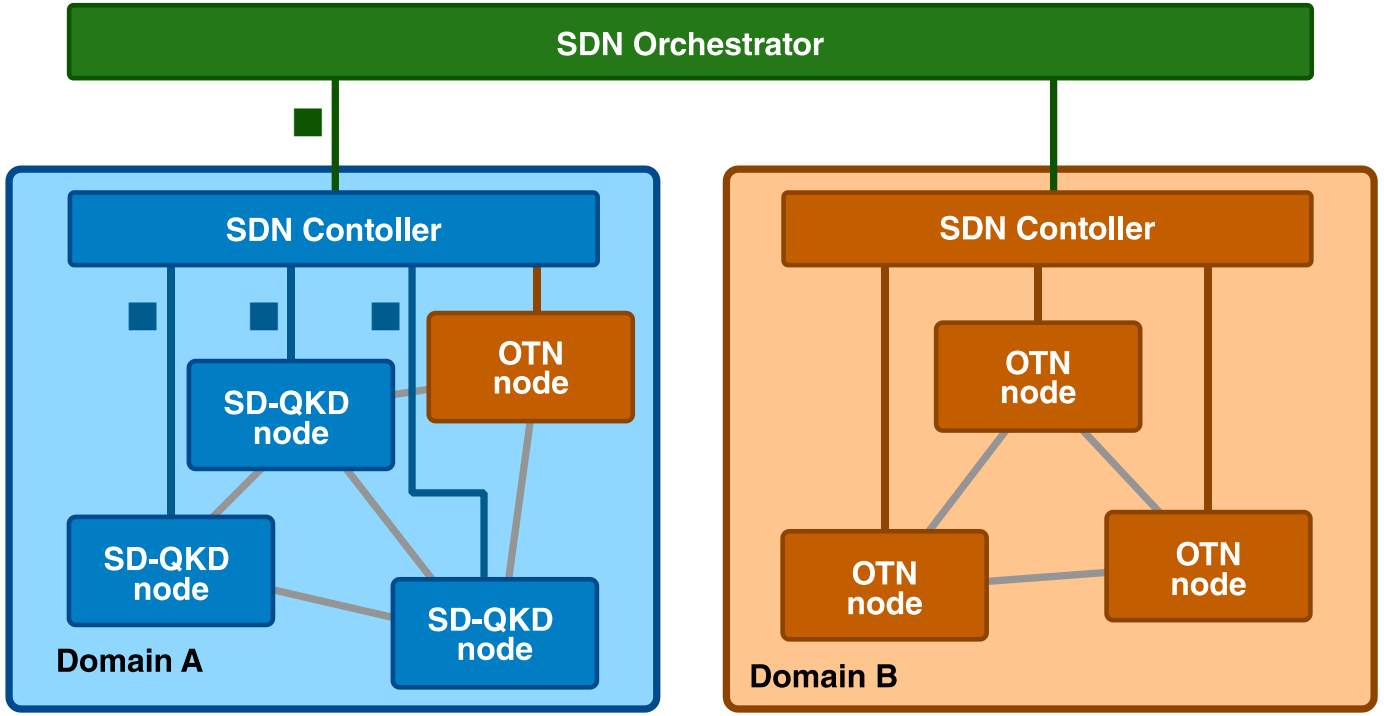
- ETSI GS QKD 015 V1.1.1 (2021-03)
- Abstraction models and workflows between a SD-QKD node and the SDN Controller:
  - Resource discovery; Capabilities; Dissemination; System configuration operations



DGS/QKD-018OrchIntSDN
Introducing QKD into SDN networks

Considering multi-domain SDN networks

- ETSI GS QKD 015 V1.1.1
  - Control Interface for SDN
- ETSI DGS/QKD-018OrchIntSDN
  - Orchestration Interface of SDN
  - Final draft stage



- YANG models on ETSI Forge: https://forge.etsi.org/rep/qkd

Application / Key delivery APIs

To enable vendors to develop applications to use QKD the ISG has defined two application / key delivery APIs:

- ETSI GS QKD 014 V1.1.1 (2019-02)
  - REST-based key delivery API defined over HTTPS
  - Ease of adoption by application vendors e.g. encryptors

```
{ "keys": [{ "key_ID": "bc490419-7d60-487f-adc1-4ddcc17
  "key": "wHHVxRwDJs3/bXd38GHP3oe4svTuRpZS0
```

- ETSI GS QKD 004 V2.1.1 (2020-08)
  - Session based application interface
  - Use cases include restricted power / performance

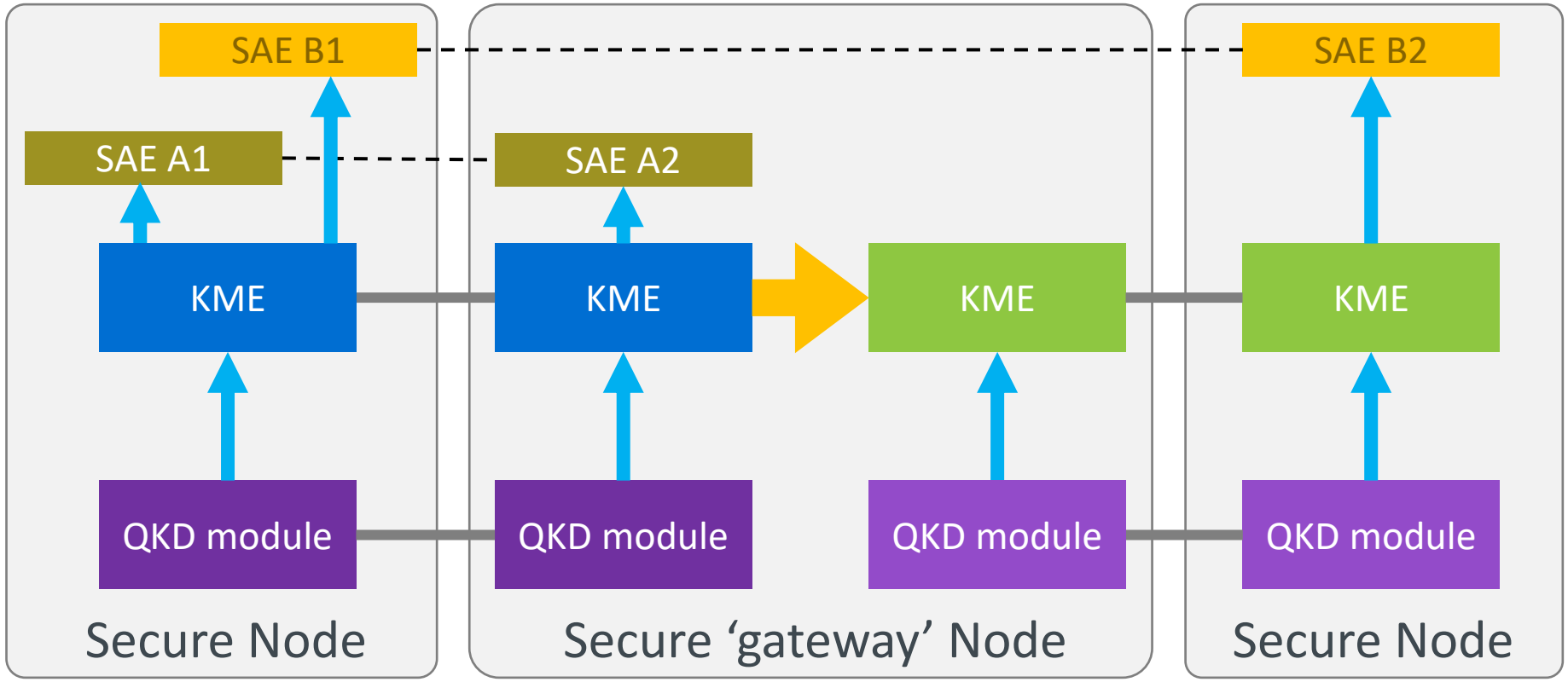
```
Interface QKD {
  OPEN_CONNECT (in source, in destination, inout QOS, inou
  GET_KEY (in Key_stream_ID, inout index, out Key_buffer,
  CLOSE (in Key_stream_ID, out status); }
```

- A mapping is possible between the APIs

DGS/QKD-020_InteropKMS
Interoperable Key Management System API

Horizontal interface for key transfer between KMEs within a trusted node

- Enable key requests to be handled between different parts of a QKD network



DGR/QKD-017NwkArch
Network architectures

Group Report analysing aspects of QKD network architectures

- Survey of some existing QKD network architectures
- Architectural components: purposes and conceptual interfaces
- Commonalities between architectures and potential interoperability

GR/QKD-007ed2_Vocab
Vocabulary

The ISG is reviewing its use of terms

- GR QKD 007 V1.1.1 (2018-12) pulled together definitions from existing ISG deliverables
- RGR/QKD-007ed2_Vocab will update this vocabulary
- Significant review of some fundamental terminology undertaken
- Consistency with terminology from other areas of cryptography
- Additional text and figures to explain intended usage of key terms
- Terms in other deliverables will be aligned as updates are published

Current Work Items

RGS/QKD-0005ed2_SecProofs	Security Proofs
RGS/QKD-007ed2_Vocab	Update to Vocabulary
DGS/QKD-0010_ISTrojan	Implementation security against Trojan horse
DGS/QKD 0013_TransModChar	Characterisation of Optical Output of QKD Transmitter Module
DGS/QKD-016-PP	Protection Profile
DGR/QKD-017NwkArch	Network architectures
DGS/QKD-018OrchIntSDN	Orchestration Interface of SDN
DGR/QKD-019_AUTH	Design of QKD interfaces with Authentication
DGS/QKD-020_InteropKMS	Interoperable KMS API

https://portal.etsi.org/tb.aspx?tbid=723

Published Deliverables

- GS QKD 015 Control Interface for Software Defined Networks
- GS QKD 014 Protocol and data format of REST-based key delivery API
- GS QKD 012 Device and Communication Channel Parameters for QKD Deployment
- GS QKD 011 Component characterization: characterizing optical components for QKD systems
- GS QKD 008 QKD Module Security Specification
- GR QKD 007 Vocabulary
- GS QKD 005 Security Proofs
- GS QKD 004 Application Interface
- GR QKD 003 Components and Internal Interfaces
- GS QKD 002 Use Cases

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The Standards People