TOSHIBA

Field Test of QKD Secured Video Conference System for Clinical Use

Ririka Takahashi[1*], Yoshimichi Tanizawa[1], Alexander R. Dixon[1], Akira Murakami[1], Kazuaki Doi[1], Mamiko Kujiraoka[1], Hideaki Sato[1], Muneaki Shimada[3], Inaho Danjoh[2], Fumiki Katsuoka[2, 4], Yasunobu Okamura[2, 4], Fuji Nagami[2, 4]

[1]*Corporate Research and Development Center, Toshiba Corporation,* [2]*Tohoku Medical Megabank Organization, Tohoku University,*
[3]*Tohoku University Hospital, Tohoku University,*
[4]*Advanced Research Center for Innovations in Next-Generation Medicine, Tohoku University*
**E-mail: ririka.takahashi@toshiba.co.jp*

Abstract

To realize highly secure communication required for sensitive personal information, **quantum key distribution (QKD) was applied to a video conference system for clinical use in a field trial**. We demonstrated that the system provides a QKD secured environment for discussion and for sharing screens of patient cases among medical experts. The results indicated that our QKD system's secure key rate is sufficient for a video conference in real time. This demonstrated that QKD is applicable to video conference systems for practical use.

Introduction

Medical histories is considered as special care-required personal information that should be protected. Genomic data is one example of data related to medical histories. Sequencers analyze genomic data and the results are used to determine the optimal targeted therapy. An expert panel of medical experts

- examines the genomic analysis reports to determine the expected effect of the therapeutic drug.
- discusses information on patient cases to determine diagnosis and treatment.
- can be convened remotely as a video conference.

We introduce a system for video conferencing using QKD and show the result of the field test demonstration by medical experts between Tohoku University Tohoku Medical Megabank Organization (ToMMo) and Tohoku University Hospital (TUH) in Sendai, Japan.

Methods

QKD transmitter/receiver pair

- is linked by optical fibers.
- provides the QKD keys for each site.

QKD-VPN (Virtual Private Network) servers

- encrypt/decrypt **with one-time pad** using the QKD keys.
- provide the QKD encrypted link as a QKD-VPN [1].
- have a packet routing function to forward packets to the encrypted link.

Video conference application

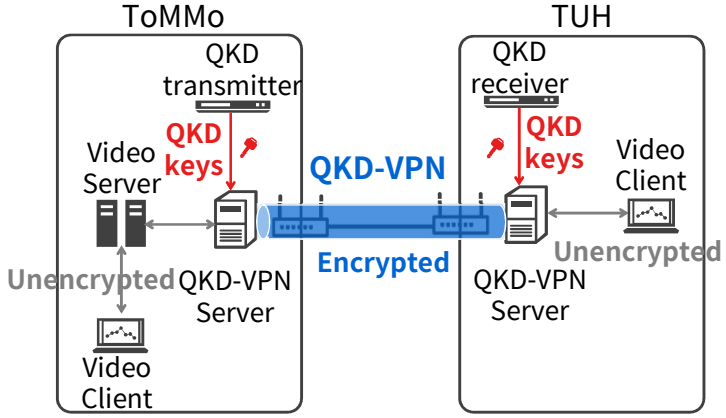
- One video server
  - is installed on a server at ToMMo.
- One or more video clients
  - are deployed at each site.
  - Local client uses a unencrypted link.
  - Remote client uses an encrypted link via QKD-VPN servers.

Contents discussed by the expert panel

- are based on the analysis result reports on genomic data.
- are not only video and audio but also the analytical reports.
- should be protected by high security.

Analytical reports on genomic data

- are generated by sequencing by next-generation sequencers.
- are generated by genomic analysis and genome annotation based on the large amount of reference data by supercomputer.
- are used for determining the diagnosis and the treatment.



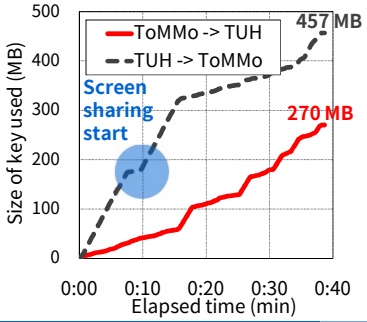
Results

Demonstration overview

- TUH explained a simulated document of a patient case by using an application screen sharing function.
- ToMMo provided the simulated genomic analysis report generated by sequencers of that patient case.
- the contents were transmitted via an encrypted link.
- The simulated conference was held **for 39 minutes**.

Size of the key used

- Total sizes / average rates
  - ToMMo (server) to TUH (client): **270 MB (avg. 923 kb/s)**
  - TUH (client) to ToMMo (server): **457 MB (avg. 1.56 Mb/s)**
- Our QKD system [2] having a 10 Mb/s secure key rate is sufficient to provide the QKD keys for point-to-point expert panel in real time.



Conclusion

We applied QKD to a video conference system in a field environment. Our system provided the environment for medical experts to discuss the contents remotely with high security with information theoretic security by one-time pad encryption/decryption. The results showed that our high-speed QKD system has a sufficient secure key rate to support a point-to-point video conference by providing the QKD keys in real time.

Reference

[1] R. Takahashi et al, doi: 10.1109/ICUFN.2019.8806052 (2019).
[2] Z. L. Yuan et al., J. Lightw. Technol., vol. 36, no. 16, pp. 3427-3433, (2018).

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