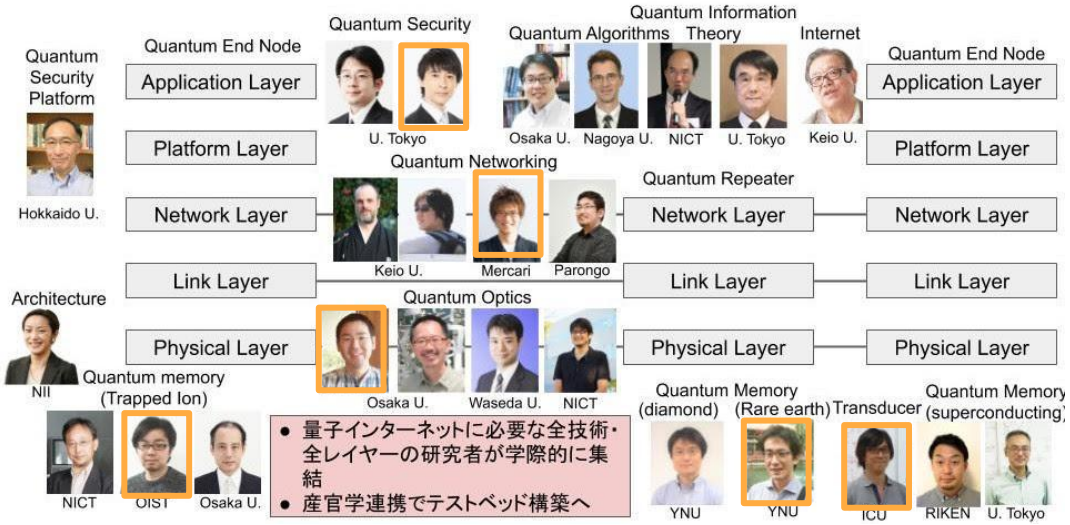
Quantum Internet Testbed Efforts in Japan (overview)

Shota Nagayama

https://qitf.org/

Quantum Internet Task Force

- Contribution to achieve **global quantum network!**
- establish a community for interdisciplinary collaboration from hardware to application
  - 2018~ Preparation started from
  - 2019~ Voluntary organization
  - 2021~ Consortium (office at Keio Univ.)
- Steered by Young researchers (responsible for 30 yrs later~)
  - Rikizo Ikuta (Osaka Univ.)
  - Toshihiko Sasaki (The Univ. of Tokyo./WIDE)
  - Takahiko Satoh (Keio Univ./WIDE)
  - Yoshiaki Tsujimoto (NICT)
  - Shota Nagayama (Keio Univ./Mercari, Inc./WIDE, Representative)
  - Tomoyuki Horikiri (Yokohama National Univ.)
  - Rekishu Yamazaki (International Christian Univ.)
- Supported by well-experienced advisory boards
  - Nobuyuki Imoto (The Univ. of Tokyo
  - Hideo Kosaka (YNU)
  - Kae Nemoto (OIST)
  - Rodney Van Meter (Keio Univ./WIDE)
  - Jun Murai (Keio Univ./WIDE)
  - Takashi Yamamoto (Osaka Univ.)



ホワイトペーパー

“The” 量子インターネット

-この宇宙の物理法則に許されるサイバー空間の極致-

産官学連携研究開発コンソーシアム
量子インターネットタスクフォース

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https://qitf.org/news/20210210-whitepaper/

Quantum Internet

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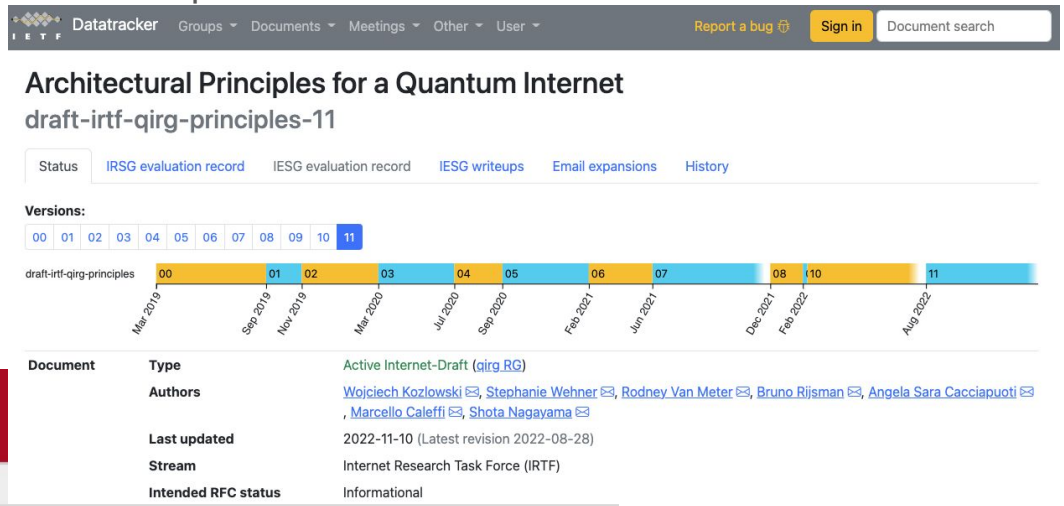
- PoC of “quantum repeating” started to be achieved.
- “Internet Architecture Philosophy” should live in transferring Quantum data

- Effort at IETF/IRTF
  - Quantum Internet Research Group @IRTF
  - The first RFC has been approved. Should be published before IETF116.



Vision of society: **Quantum computer networks** achieves
the paradigm where quantum data is at will generated, communicated, and processed over the world.

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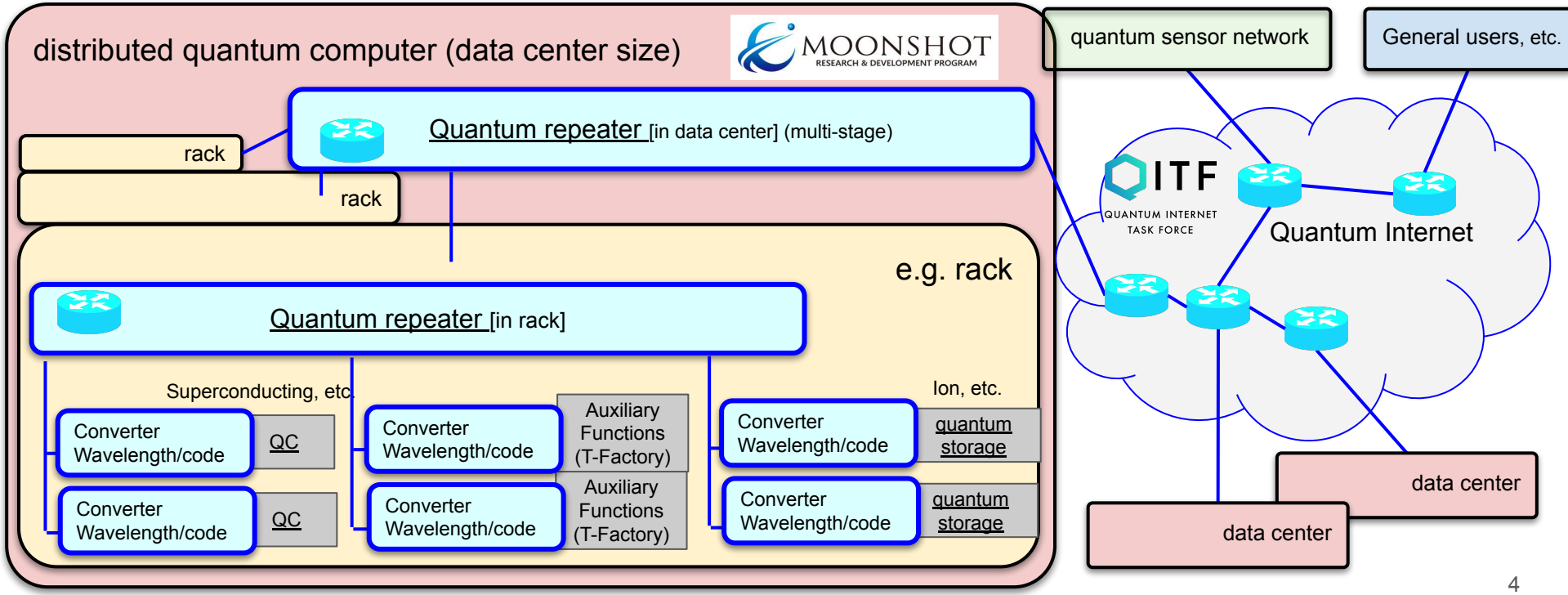
Infrastructure for generation, distribution, and processing of quantum information is needed =
Distributed quantum computers and quantum Internet, both based on quantum networks.



Testbed plan in Japan

Concept 1: Lab-area Network

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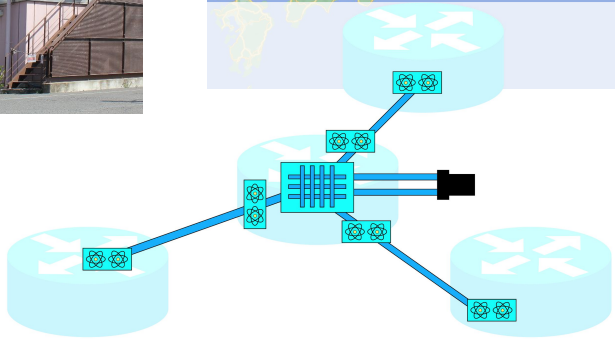
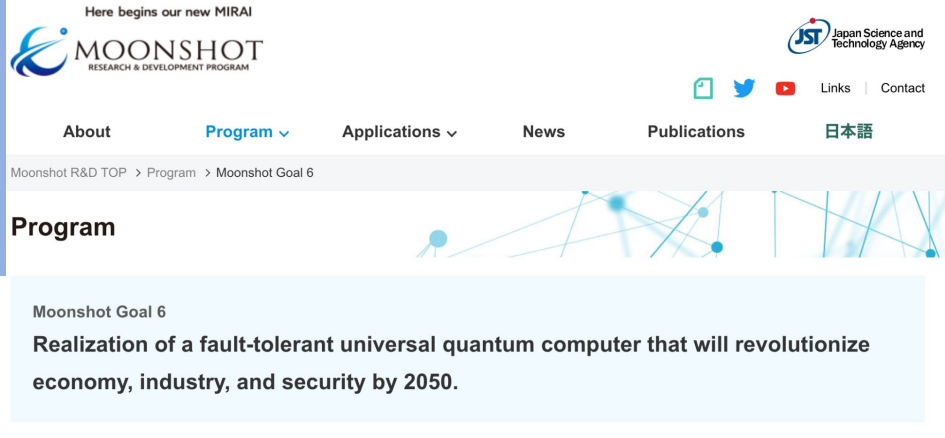
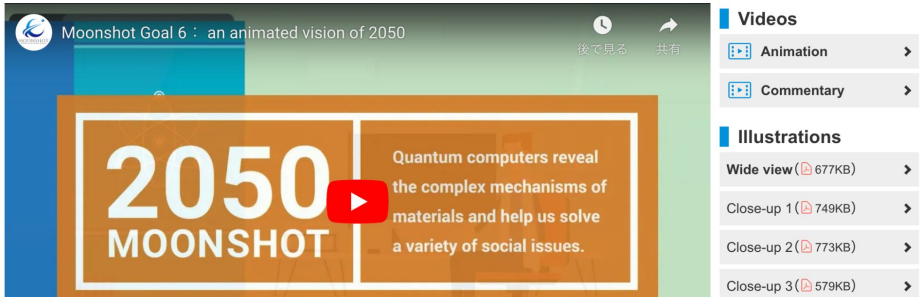
Short Range Quantum Computer Network (Intranet)



Demonstration of full system of quantum network by integrating various elemental technologies to be researched (Moonshot Goal6 Nagayama PJ)





- A laboratory at Shinkawasaki-city (Tokyo-area)
  - construct a 4-node star network
  - Realize the entire network system, including routing, etc.

Concept 2: Campus Network

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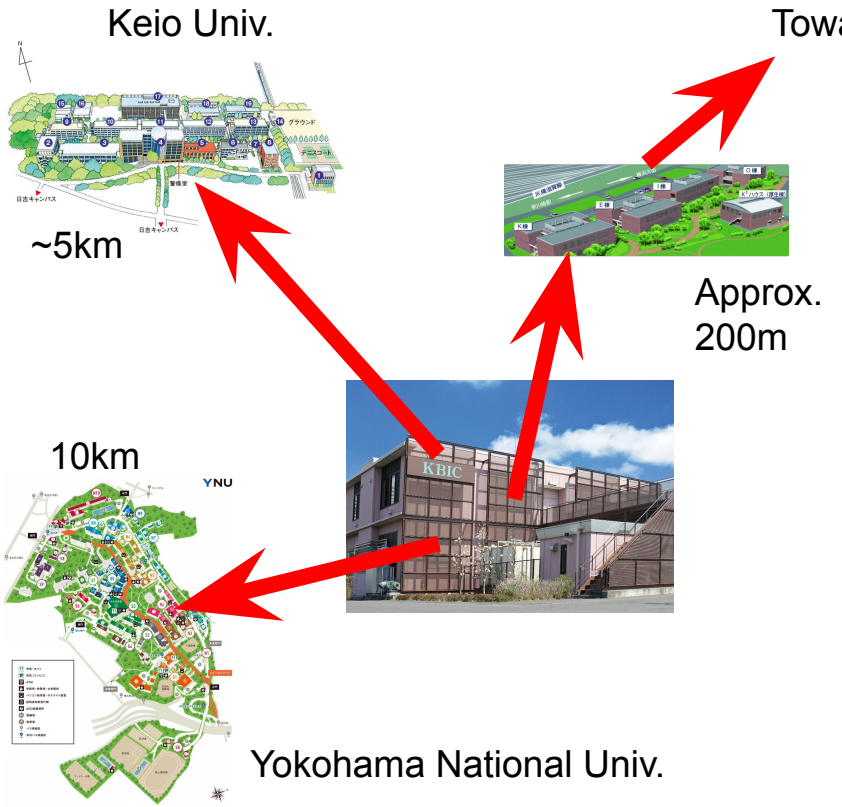
On-campus field experiment (Internet)

Approx. 200m

- A laboratory at Shinkawasaki-city (Tokyo-area)
  - construct a 4-node star network
  - Realize the entire network system, including routing, etc.
- Keio University Shin-Kawasaki Campus
  - Elemental Research on Quantum optical technologies @ Moonshot

Concept 3: Inter-Campus network

Inter-campus field experiment (Internet)



- A laboratory at Shinkawasaki-city (Tokyo-area)
  - construct a 4-node star network
  - Realize the entire network system, including routing, etc.
- Keio University Shin-Kawasaki Campus
  - Elemental Research on Quantum optical technologies @ Moonshot
- Keio University Yagami Campus
- Yokohama National University
- Further Expansion

The Future & Roadmap to the Quantum Internet
- Testbed Efforts in Japan -

Shota Nagayama & Rodney Van Meter

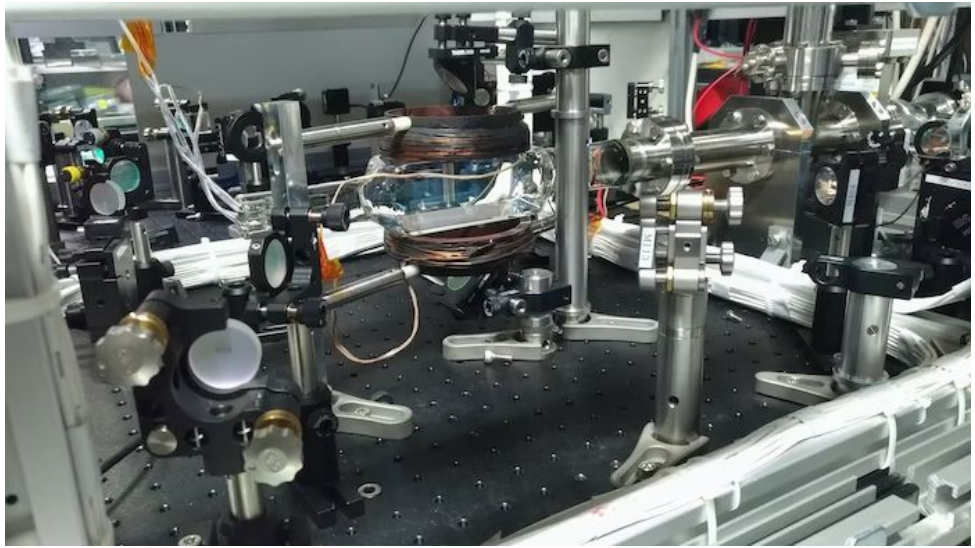
Date: 11:45-12:45, Thursday, March 30, 2023
Venue: G303

※Lunch will be provided. (First come, first served.)

Global Quantum Internet

Lab Tour

Lab Tour to Yokohama National University Friday, 1400~1630.
Apologies to those we had to cut from the list! Capacity overflowed before we cut off registration.



picture by Osaka univ.