it via satellite links.

"Parallel generation of standard time"

The JST sub-station at Kobe is one of these distributed stations and can function as a replacement for the JST station at NICT headquarters in an emergency(Fig.3). It is equipped with essential functions necessary for generation of Japan Standard Time, including five cesium atomic clocks (CS), two hydrogen masers, and a high-precision time comparison system via satellites, and as a result, it always generates synthetic atomic time in parallel with JST station at NICT headquarters. Besides, we have set up an NTP server and an optical telephone JJY system for use in the event of the supply services at NICT going offline.

The launch of this JST sub-station at Kobe means that the generation of Japan Standard Time is now multiplexed, making it much more reliable.

Fig.1 : The Japan Standard Time system at the JST sub-station at Kobe(left: Antenna of satellite time comparison system, right: Measurement system)

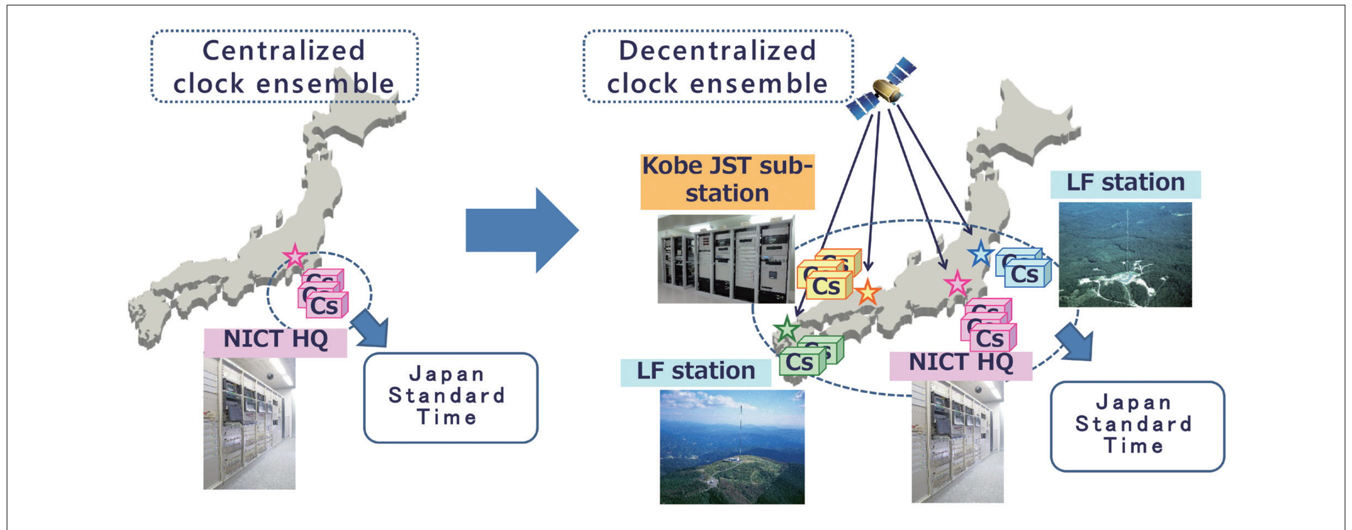


Fig.2 The distributed synthesis of Japan standard Time

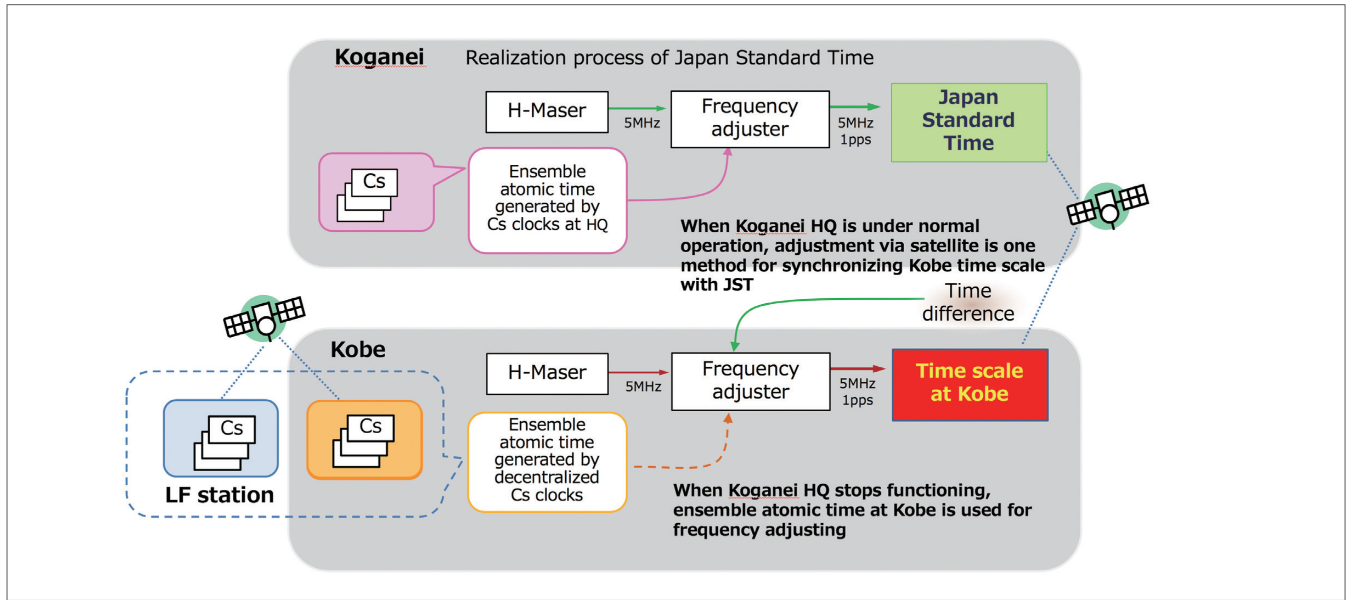


Fig.3 : The operation scheme of Japan Standard Time

CREATE

Aiming for further translation accuracy in the medical field

Augmenting VoiceTra with translation data from the MSD Manual (medical dictionary)

Eiichiro Sumita: Advanced Speech Translation Research and Development Promotion Center

In recent years, the use of artificial intelligence (AI) in speech translation technology has been actively researched, and products and services based on this research have also started to appear on the market. The VoiceTra*1 system figure developed by NICT uses AI to provide highly accurate multilingual speech translations on various themes such as tourism, healthcare, and shopping. Nowadays, the number of foreign visitors to Japan is growing year by year, and there is a growing need for medical translation services when these visitors fall ill during their stay. There is consequently a need for multilingual data covering a wide range of medical conditions in order to provide more robust translations in the medical field where precision is particularly important.

Under these circumstances, NICT and the pharmaceutical company MSD K.K. (based in Chiyoda-ku, Tokyo) have agreed to provide data in ten languages from MSD's digital medical dictionary (MSD Manual Consumer Version)*2 for use in Translation Bank (a translation data collection initiative being undertaken by the Ministry of Internal Affairs and Communications and NICT), and to cooperate in the strengthening of the AI speech translation engine. Through this joint effort, the quantity of medical translation data in VoiceTra has been increased by a factor of 3 or 4, and we can expect a substantial improvement in translation accuracy.

"We can expect to make great progress overcoming language barriers in the medical field."

In the words of Dr. Eiichiro Sumita, a NICT Fellow who has been researching speech translation at NICT for many years,

"As part of the global communications plan of the Ministry of Internal Affairs and Communications, NICT is promoting speech translation technology that is more precise and supports more languages and disciplines. By training a voice translation system with the MSD manual, which has been collecting the latest medical information in multiple languages for 120 years, we can expect to make great progress overcoming language barriers in the medical field."

An updated version of VoiceTra reflecting the MSD manual data is scheduled to be made available in the fall of 2018.

Footnote

***1 VoiceTra:**
A multilingual speech translation app developed by NICT. Provides highly accurate speech translation in 31 languages for free. http://voicetra.nict.go.jp/

***2 MSD Manual:**
A comprehensive medical dictionary provided by MSD for the benefit of society. Widely used throughout the world, and has been translated into 10 languages. https://www.msdmanuals.com/en-jp (Note: MSD is a trade name of Merck & Co., Inc., with headquarters in Kenilworth, N.J., U.S.A.)

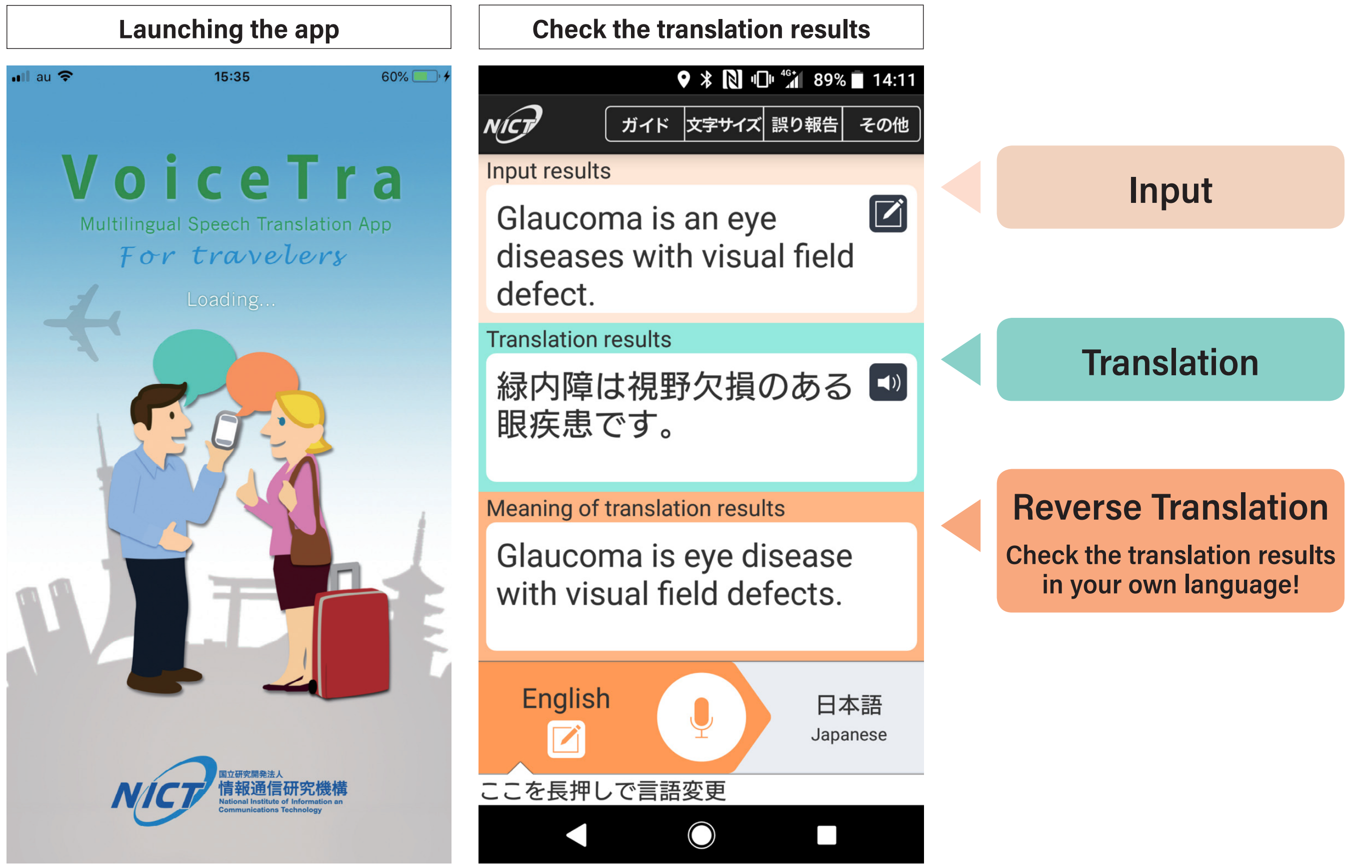


Fig. : "VoiceTra" translates your spoken words into different languages.

CONNECT

Multimode/multicore fiber system for practical optical communication infrastructure

World-record, 1.2Pb/s transmission through <0.2mm three-mode/four-core fiber was demonstrated

In order to cope with ever-increasing communication traffic, research on large-scale optical transmission using new types of optical fibers that allow exceeding the limit of conventional optical fibers and their application are actively conducted all over the world. The main new types of optical fibers studied are multicore fibers, in which multiple passages (cores) are arranged in an optical fiber, and multimode fibers that support multiple propagation modes in a single core with a larger core diameter. Ultimate throughputs of several

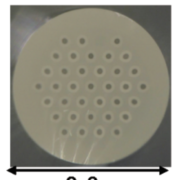
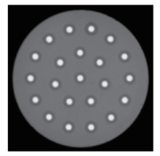
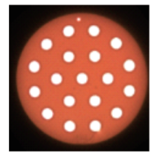
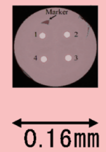
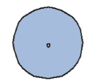
	Previous hybrid fibers			This report	SSMF
	2015, Mar.	2015, Sep.	2017, Sep.	2018, Sep.	
Throughput (bps)		2.15P	10.16P	1.2P	0.15P
Core/mode	36core/3mode	22core/1mode	19core/3mode	4core/3mode	1core/1mode
Cladding diameter	 0.3mm	 0.26mm	 0.267mm	 0.16mm	 0.125mm
Coating diameter				0.25mm	0.235~ 0.265mm

Fig. : Comparison of 3-mode/4-core fiber with previous fibers

Peta-b/s have been achieved by using hybrid of multimode/multicore fibers. However, such fibers were required to have much larger cladding diameter than standard single-mode fiber. To achieve practical implementation, the fiber cladding diameter must be reduced to less than 0.2mm to ensure the necessary reliability standards, mainly regarding mechanical strength.

NICT Network System Research Institute (NSRI), Fujikura Ltd. (Fujikura, President: Masahiko Ito) , Hokkaido Univ. (President: Toyoharu Nawa), and Macquarie Univ. MQ Photonics Research Centre (MQ)developed a three-mode four-core optical fiber, capable of wide-band wavelength multiplexing transmission with 0.16 mm cladding diameter (coating diameter: 0.25 mm) that can be easily cabled with existing equipment. They have successfully demonstrated a transmission experiment with a data-rate of 1.2 Peta-b/s. This is the world record throughput with an optical fiber with a cladding diameter below 0.2mm.

Thinner fibers have several advantages such as volume productivity from same size of preform, less failure probability and loss in fusion splicing, in addition to mechanical strength. Also, the core number of four has an affinity to data center communications.

In order to achieve the transmission capacity of 1.2 Peta-b/s, mode and core multiplexing in a single optical coupler was used in combination with 256-QAM (quadrature-amplitude modulation), which is a high-end practical high-density multilevel modulation optical signal, for a total of 368 wavelengths. Digital MIMO (multiple-input and multiple-output) enabled unscrambling the mixed modal signals for each individual core. This showed that multimode/multicore fiber which have compatible diameter with SMF can provide Peta-b/s transmission capability.

"This is promising for commercialization inter/intra-data center applications"

Yoshinari Awaji and Hideaki Furukawa, both Research manager of the NSRI Photonic Network System Laboratory have stated: "We succeeded in Peta-b/s transmission with much thinner fiber than before. When laying of standard outer diameter optical fibers takes place, the existing equipment for cabling can be used and the practical use at an early stage is promising. Such kind of transmission system can be applied to inter-/intra- data center applications earlier, then the transmission distance will be extended toward metro-area applications in the future if combined with brand-new fiber fabrication technology, which is researched by NICT through Industry-University-Government Cooperation."

The demonstration shows that SMF-compatible-diameter multimode/multicore fibers can increase the capacity potential for eight times within same cable accommodation space. They say, "We will continue to research and develop future optical communication infrastructure technologies which can smoothly accommodate traffic such as big data and 5G services and beyond."

Reference

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