Road to IOWN at NTT EAST

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Abstract

As the first commercial service of the Innovative Optical and Wireless Network (IOWN), NTT EAST launched the All-Photonics Network (APN) IOWN1.0 service on March 16, 2023. In this article, we introduce our demonstration efforts in taking advantage of low latency, use cases, and future prospects of APN IOWN1.0.

Keywords: IOWN, All-Photonics Network, low latency

1. Significance of NTT EAST's IOWN initiative

The NTT EAST Group aims to become a social innovation company that supports the future of regional communities for building a regional circular society. A regional circular society means expanding the distinctive culture and diversity of the region through information and communication technology and digital technology, completing transportation within the region, producing and consuming energy locally, and distributing data regionally. By promoting such a society, the population, economic activities, and data that are concentrated in urban cities would be dispersed across the region. As a result, we can create new industries and employment locally. The NTT EAST Group promotes the REIWA Project [1] to achieve this society. This is a project that maximizes the use of assets (buildings, equipment, etc.) owned by the NTT EAST Group in the region to solve the problems of regional customers.

We believe that the Innovative Optical and Wireless Network (IOWN) will drive our REIWA Project further. Interconnecting the regional edge clouds with the low-latency and high-capacity All-Photonics Network (APN) enables a seamless ecosystem. By implementing this system in society, we aim to build a sustainable community.

2. Demonstration efforts

The NTT EAST Group conducted a demonstration of a remote concert that used the low latency and large capacity of the APN, which is a technical component of IOWN. Due to the changes in society by the spread of COVID-19, our psychological hurdles to remote communication have been lowered, and new styles of co-creation and appreciation of music, such as online streaming of concerts and remote lessons, are expanding. However, low-latency interactive communication, which has been considered difficult with conventional Internet-based networks, is necessary for remote concerts (**Fig. 1**). We aimed to resolve this problem by incorporating low-latency video-processing technology and low-latency transmission technology, which are elemental technologies of the APN.

We first held a remote concert in March 2022 [2] by connecting Bunkamura Orchard Hall (Shibuya-ku, Tokyo) and NTT Inter Communication Center (Shinjuku-ku, Tokyo). This was the first case of a remote concert with APN-related technology in Japan. Through the concert, we verified that even professional musicians could perform a remote concert stress-free by reducing communication delay with the use of the low-latency video-processing and the low-latency transmission technologies.

We then held another remote concert that created more unity between two venues by connecting Tokyo Opera City (Shinjuku-ku, Tokyo) and Dalton Tokyo Junior & Senior High School (Chofu-shi, Tokyo) in November 2022 [3]. The performances of the encore program "Radetzky March" by the orchestra in Tokyo Opera City and by the snare drum player in Dalton Tokyo Junior & Senior High School were transmitted bi-directionally to establish a remote performance. By bi-directionally transmitting the

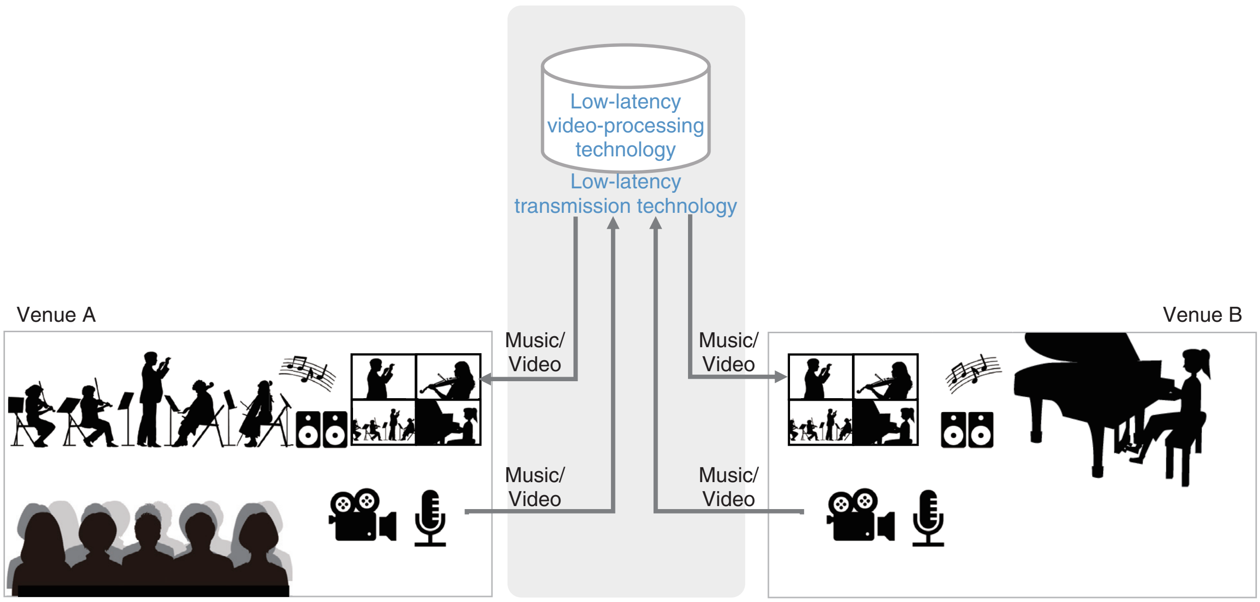


Fig. 1. Remote concert (two venues).

clapping of the audience at both venues along with the music with low latency, we achieved a new music co-creation and appreciation experience in which the audience felt as if they were in the same place even though these venues were about 10 km away.

The third demonstration was a multipoint and long-distance concert [4] held in February 2023 by connecting four locations, Tokyo, Osaka, Kanagawa, and Chiba. The Tokyo and Osaka venues had performers and audiences, the Kanagawa venue had performers, and the Chiba venue had an audience. We could provide an interactive musical experience among these locations. We also verified the feasibility of the network configuration for interconnecting multi-vendor devices in accordance with the standard specifications (**Fig. 2**).

Through these demonstrations, we confirmed the possibility of holding a new style of remote concert with a sense of unity among distant venues. In the future, we will use the data and knowledge obtained through these demonstrations to create new businesses for music performances, events, education, etc. as one of the new co-creation and appreciation models in the field of culture and art.

3. Efforts to create use cases of APN IOWN1.0

NTT EAST launched the APN IOWN1.0 service on March 16, 2023 as the first service of IOWN initiative. APN IOWN1.0 can provide low-latency communication without fluctuations. In addition, APN IOWN1.0 enables unprecedented delay visualization and adjustment functions by being combined with terminal device called "OTN (optical transport network) Anywhere."

Since these functions are effective for e-sports and real-time communication with music and video, an event sponsored by NTTe-Sports was held as a service release event for APN IOWN1.0 [5]. Response speed has a large impact on winning or losing in e-sports. Therefore, the play environment must be precisely prepared. In fact, there are many players who have postponed or hesitated to participate in online tournaments due to concerns about the play environment such as transmission delays. In this event, APN IOWN1.0 was used to connect Miyashita Park (Shibuya-ku, Tokyo: Miyashita) and eXeFelid Akiba (Chiyoda-ku, Tokyo: Akiba) to hold an e-sports exhibition match. No personal computer (PC) was installed on the Miyashita side, and players remotely controlled the Akiba side PC via APN IOWN1.0. The PC on the Akiba side was configured to add the same amount of delay as the transmission delay between Miyashita and Akiba (**Fig. 3**). As a result, we achieved a play environment with no difference in delay between the Miyashita-side and Akiba-side players.

In terms of real-time communication with music

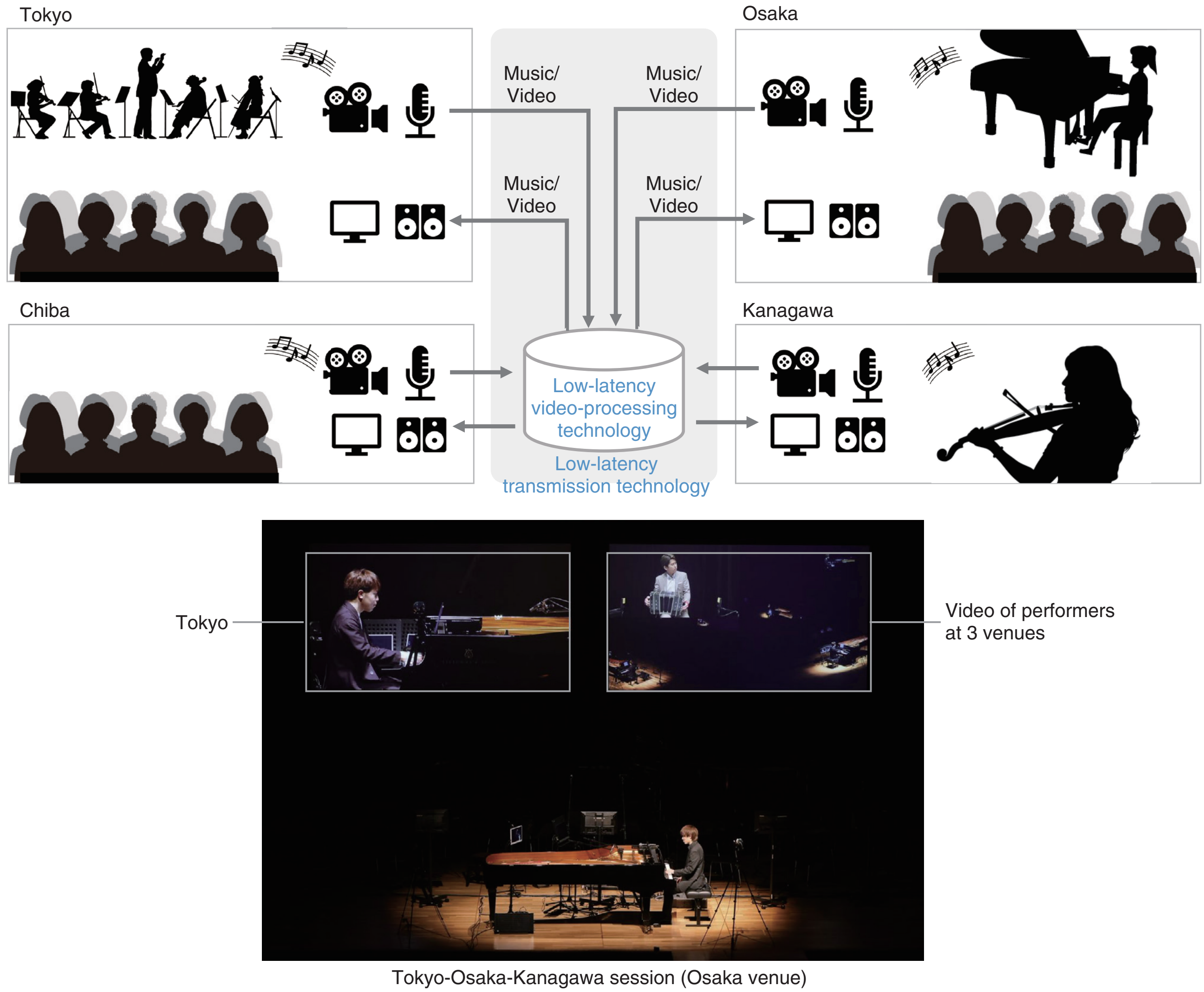


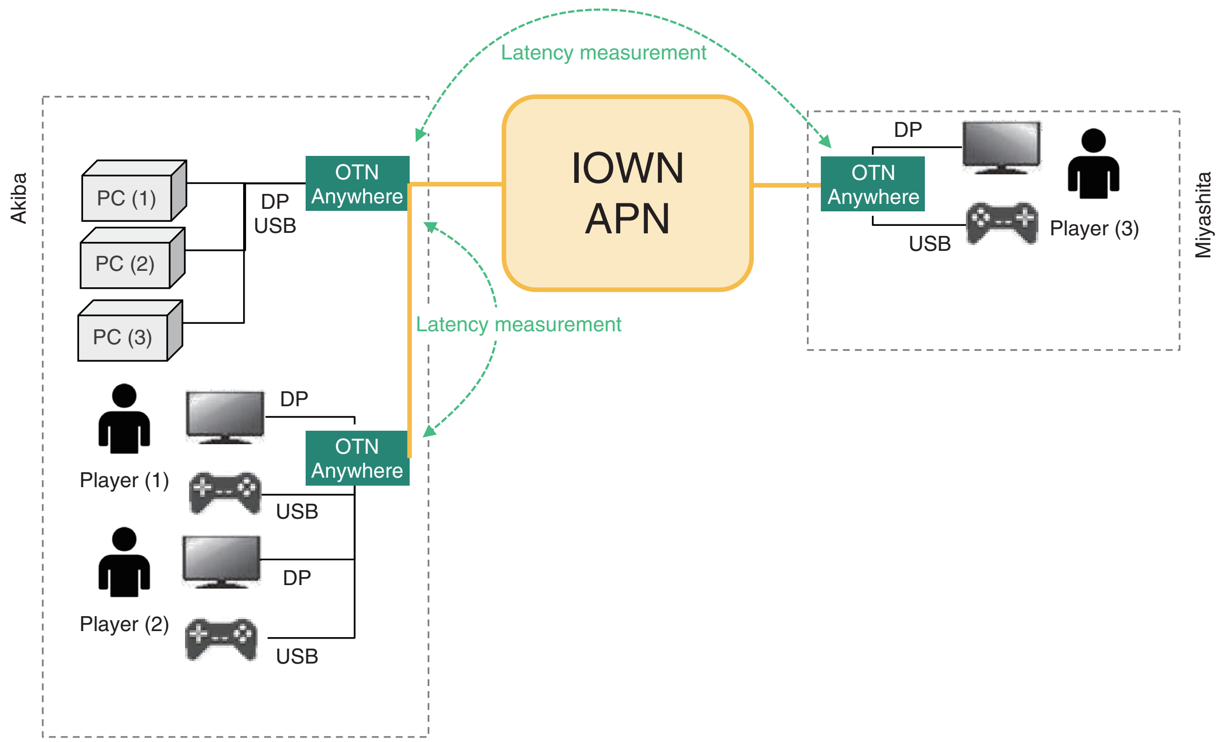
Fig. 2. Remote concert connecting four venues.

and video, we demonstrated remote dance lessons. NTTe-Sports is focusing on these activities because they believe the demand of these remote lessons is high in regional revitalization and the Japanese government policy on transferring the operation of school club activities from schools to the local communities. A dance coach in Akiba instructed students in Miyashita remotely with the background music played at Akiba studio. We confirmed whether the students in Miyashita could perform the lesson without any problems.

The e-sports players, dance coach, and students who participated in these events said that they felt no discomfort and could play and dance as if they were in the same place. We will use APN IOWN1.0 for e-sports competitions at multiple sites in urban and rural areas and for remote instruction such as arts and sports.

4. Efforts toward expansion of use cases and future prospects

We will promote the IOWN initiative through further expansion of use cases of APN IOWN1.0. For example, the APN can be used in remote productions, in which operators in a remote location can switch or edit video sources when sending real-time video data from a venue such as a stadium (**Fig. 4**). The data amount of the video source is generally so huge that it is necessary to compress and convert the video data



DP: DisplayPort
USB: Universal Serial Bus

Fig. 3. Structure between Miyashita and Akiba.

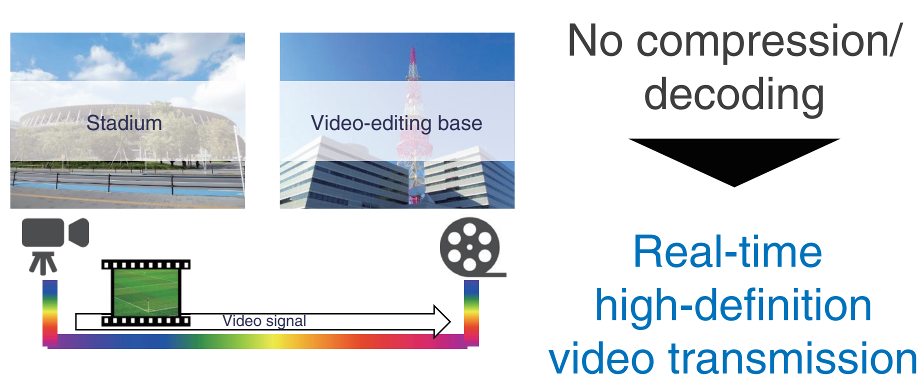


Fig. 4. APN utilization for remote production.

at the venue for transmission and decode them at the video-editing base. However, since the APN can resolve such a problem, we can transmit high-quality images in real time without compressing or decoding the data.

By connecting small and medium-sized datacenters with the APN, they can be operated like one datacenter. With the APN, we can contribute to the decentralization of datacenters by reducing land use and electricity. Furthermore, the APN has the potential to be applied to remote precision-machine operations by taking advantage of the APN's low-latency and zero-fluctuation characteristics, which also leads to local energy production and consumption.

These are just a few examples, and we believe that there are still more value of APN IOWN1.0 that we are not yet aware of. With this service release as an opportunity, we will expand the use cases with our customers.

References

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