

Development of an e-VLBI data Transport Software Suite with VDIF

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1. Overview

Space geodetic technology has been widely used for positioning and navigation. Quick and accurate provision of the earth rotation parameters (EOP), which links terrestrial reference frame and celestial one, is an important role of the IERS. One of the EOP parameters, UT1-UTC represents the rotation of the earth with respect to distant quasars. Therefore VLBI, which measures the earth's altitude in the quasi-inertial space with respect to distant quasars, is only one technique to determine UT1-UTC with long term stability. The IVS is promoting so called Intensive session for provision of quick and accurate UT1 information. Wettzell and Tsukuba stations are two of the stations supporting the intensive sessions. The Wettzell station has been already using high speed network for data transfer to correlation center for quick derivation of UT1 parameters (Fig. 1). Recorded Mark5 data is not directly accessible from public internet due to security reason. Thus data is copied to a server outside of firewall of the network. Then data is transferred to Tsukuba station in Mark5 data format and they are converted to K5/VSSP32 format for correlation processing. We have developed a new C++ class library for manipulating data in VDIF (VLBI Data Interchange Format). This software suite is designed for easy and extension for support K5/VSSP32, Mark5B, VDIF and other VLBI data formats with object oriented structure in mind. As an application of this class library, data transmission software was developed and going to be used for real-time data transmission from Wettzell to Tsukuba for rapid UT1 derivation(Fig.2).

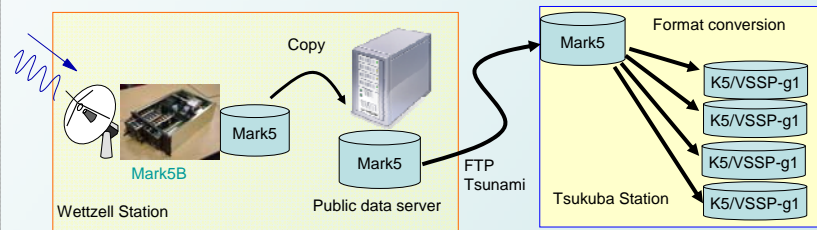


Fig. 1 Current data transmission scheme for INT2 experiment. Copying data at Wettzell and format conversion at Tsukuba take time and resources.

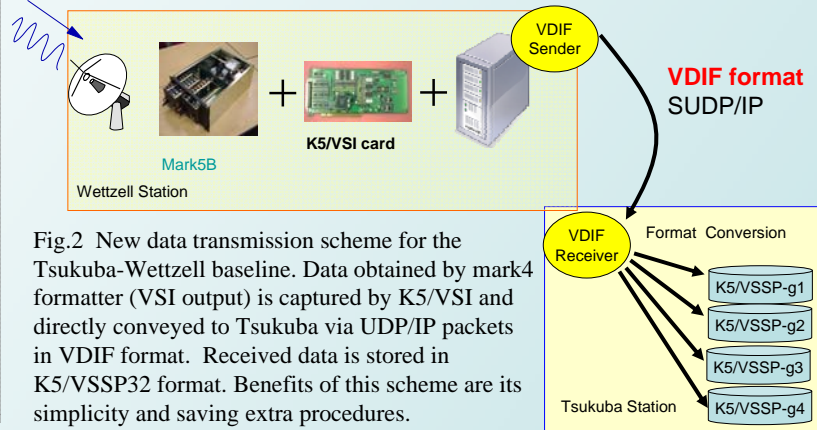


Fig.2 New data transmission scheme for the Tsukuba-Wettzell baseline. Data obtained by mark4 formatter (VSI output) is captured by K5/VSI and directly conveyed to Tsukuba via UDP/IP packets in VDIF format. Received data is stored in K5/VSSP32 format. Benefits of this scheme are its simplicity and saving extra procedures.

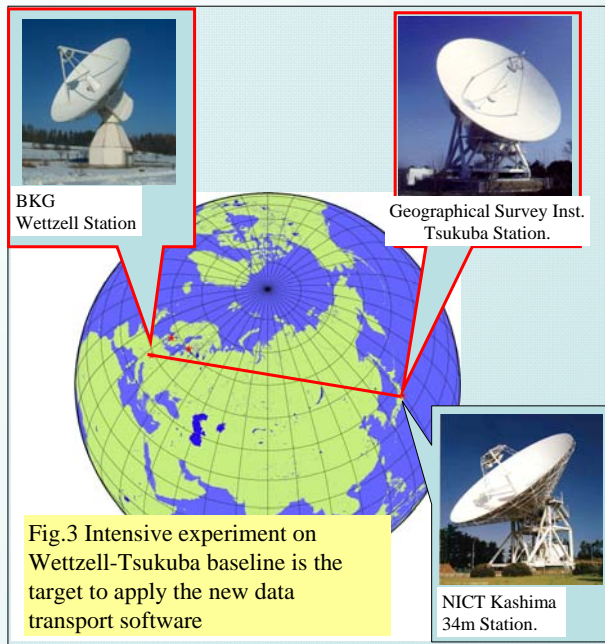


Fig.3 Intensive experiment on Wettzell-Tsukuba baseline is the target to apply the new data transport software

2. VLBI Data Interchange Format (VDIF)

A new standard VLBI data format VDIF (see paper by A. Whitney: S3 P01) is designed for exchanging data over the computer based media. Notable characteristic of VDIF is that the VDIF data format is flexible and independent from recording media. The VDIF has been ratified as the next standard data format at the eVLBI workshop held in Madrid in June 2009.

Fig. 4 indicates the position of VDIF on the 7 layers network model. Flexible usage example of the VDIF is indicated in Fig. 5.

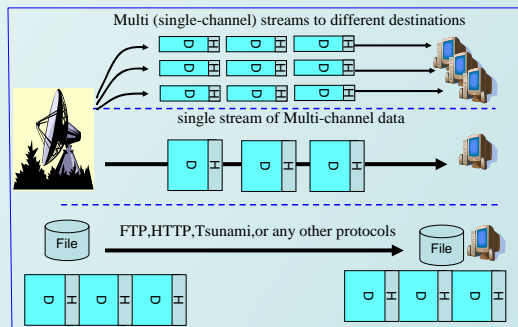


Fig. 5 Examples of VDIF usages; Data transportation from data source to the destination can be performed flexibly by any of real-time multiple single channel streams, single multiple channel stream, and offline data of recording media.

Fig. 4 Position of VDIF in the network layer model. VLBI Data Interchange format (VDIF) is designed with network data transportation in mind. Thus it is not only used for data file format, but also good for data packets. Additionally it is independent from protocols of lower layers.

3. A New Data Transport Software with Software Suite with VDIF

Class library for data transport by VDIF was developed with C++ language.

Data sender/receiver server(Fig.6) is written by using this suite and is remotely controlled by TCP/IP. Data payload is transmitted by UDP packet with simple header of sequential number. Currently no re-transmission control, but this should work because VLBI is tolerant on packet losses.

The software can accept, transmit, and record data in K5/VSSP, Mark5B, and VDIF

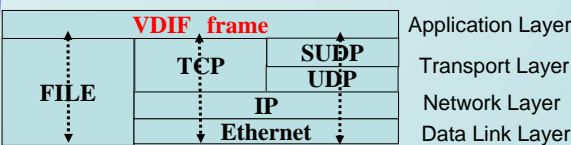


Fig. 6. Overview of data transport software (sender/receiver) with the new C++ class library. SUDP is our naming of protocol for simple UDP packet with sequential number.

Acknowledgement

C++ class library (Software Suite) of VTP-1.0H developed by D.Lapslay was partly used for a base of network communication module of the software suite of VDIF. We appreciate his contribution of the class library VTP-1.0H, which is instructive and gives good example to learn object oriented programming. We thank to G.Kroshnab at BKG Wettzell station for kind cooperation on testing use of our new data transport software with VDIF packets.

Software disclosure

Our C++ class library with VDIF and data sender/receiver software are going to be open to public as free software. Although the URL for the software release is not fixed yet. Please contact us (3ken@kakusan.nict.go.jp) for requests and inquiry.