Workgroup:	Internet Research Task Force
Internet-Draft:	draft-chen-nmrg-dtn-interface-00
Published:	20 October 2022
Intended Status:	Informational
Expires:	23 April 2023
Authors:	D. Chen	H. Yang	C. Zhou
---	---	---	---
	China Mobile	*China Mobile*	*China Mobile*

Requirements for Interfaces of Network Digital Twin

Abstract

The interfaces of Digital Twin Network can be divided as twin network southbound interface, internal interface and northbound interface. In order to build a digital twin network and realize its many advantages, different interfaces should be able to meet different requirements. And this memo introduces the requirements for the interfaces of the Digital Twin Network.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 23 April 2023.

Copyright Notice

Table of Contents

1. Introduction

As defined in the[I-D.irtf-nmrg-network-digital-twin-arch] , the digital twin network is defined as "a network system with a physical network entity and a virtual twin, and the two can interact with each other in real time". It should have four core elements: data, model, mapping and interaction. Accordingly, a "three-layer, three-domain and double-closed loop" architecture is adopted.) and the network telemetry technology

Based on the above architecture definition of three-layer, three-domain and double-closed-loop, the interfaces of each layer and their positions of the digital twin network are shown in Figure 1. The network elements in the physical entity network exchange network data and network control information with the twin network layer through the twin southbound interface. The twin network layer contains three key subsystems, which are data sharing warehouse, service mapping model and digital twin management. Through the corresponding interface protocol, the construction and interaction requirements of the three key subsystems should be met. And through the internal interface of the twin layer, the interaction between the three key subsystems and the physical network layer and network application layer is realized. Network applications input requirements to the twin network layer through the twin northbound

interface, and deploy services in the twin network layer through the model example. To sum up, there are differences in interface protocol requirements between different layers of DTN and within twin layers.

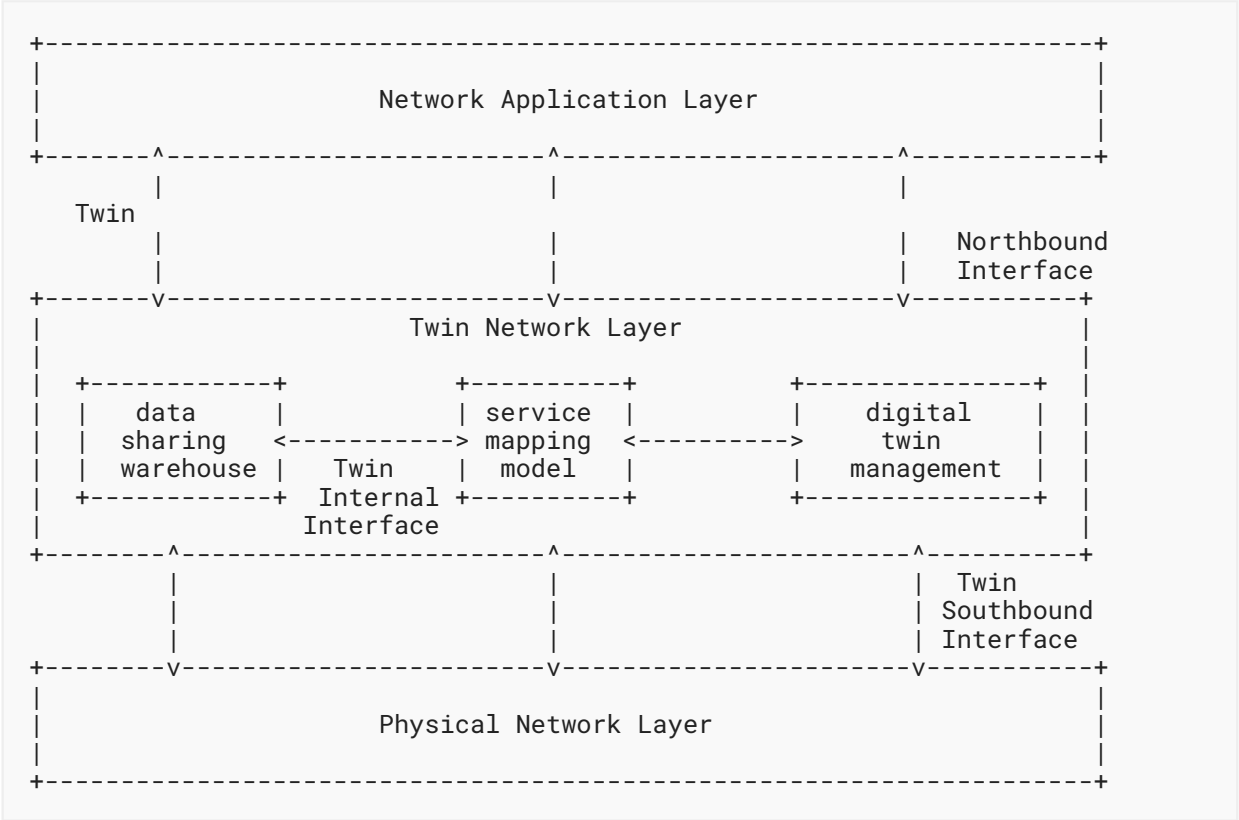

Figure 1: Schematic Representation of DTN Interface

2. Requirements for Different Interfaces

- Twin northbound interface
  - The twin northbound interface is the interface between the network application layer and the twin network layer. The network application requirements are input from the twin northbound interface to the twin network layer. The twin northbound interface can support the rapid deployment of network applications such as network operation and optimization, network visualization, intent verification, and network automatic driving with lower cost, higher efficiency, and less impact on live network services. Therefore, the twin northbound interface should have the characteristics of the following 4 aspects.
    - Openness: The twin northbound interface must meet the business requirements of different network applications and can be input to the twin network layer, so it needs to have good openness and compatibility;
    - Scalability: There are a variety of network applications in the network application layer, which will inevitably lead to the generation of network applications. At the same time,

the continuous development of the network is bound to introduce new network applications. With the upgrade of network applications and the generation of new applications, the twin northbound interface should be able to expand in time to meet the needs of new network applications;

- Portability: There are twins with different sizes and functions in the twin network layer. The same or similar requirements of various applications in the network application layer may be deployed on different twins. Therefore, the twin northbound interface should be easily transplanted and deployed on different twins;
- Flexible deployment: To reduce deployment time and cost, twin northbound interfaces must be flexibly deployed.

- Twin Internal interface
  - As shown in the "three-layer, three-domain, double-closed loop" of DTN architecture, the twin network layer contains three key subsystems, namely, data sharing warehouse, service mapping model and digital twin management, which is the most critical part of the digital twin network. The internal interface of the twin layer refers to the interface within and between the three subsystems: data sharing warehouse, service mapping model and digital Twin management. In order to support the functions of the three subsystems in the twin network layer and the interaction between the three subsystems, the internal interface of the twin layer should have the following four functions.
    - Unity: Each subsystem in the twin network layer should be able to provide the same data format and data service for other subsystems through the internal interface of the twin layer, that is, the interface should have unity.
    - Adaptability: The twin network layer must interact with the network application layer and the physical network layer, and should be well adapted to various network devices and interfaces. Therefore, the internal interfaces of the twin layer also need to be adaptive.
    - Portability: The data model instances provided by the service mapping model subsystem for different applications may have a high degree of similarity. In order to improve efficiency, the data model instances must be able to be provided and deployed through different internal interfaces of twin layers.
    - Flexible and extensible: The twin network layer must be able to verify different new network services. In order to shorten the implementation time of functions, the implementation of functions inside the twin layer should be simplified as far as possible. Therefore, the internal interface of the twin network layer must be flexible and extensible.

- Twin southbound interface
  - The twin southbound interface is the interface between the twin network layer and the physical entity network. Control updates are delivered from the twin southbound interface to the physical entity network, and various nes in the physical entity network exchange

network data and network control information with the twin network layer through the twin southbound interface. Therefore, the southbound twin interface should have three functions.

- Information interaction capability: the twin southbound interface should be able to collect the information of different physical nes or network devices, and send the configuration information of the twin network to the physical network for execution, that is, it can realize the information interaction between the twin network layer and the physical entity network.
- Real-time: The realization of twin network configuration verification and other functions must have certain real-time, so the information collected and uploaded from the physical entity network and the configuration information sent from the twin network to the physical network must have certain real-time, in order to meet the real-time requirements of the digital twin network.
- Compatibility: Network devices and nes from different manufacturers use different interfaces and protocols. The southbound interfaces must be compatible to ensure the reliability of information collection and configuration delivery.

3. Suggestions on the applicability of common protocols

TBD

4. Security Considerations

TBD

5. IANA Considerations

This document has no requests to IANA.

6. References

6.1. Informative References

[I-D.irtf-nmrg-network-digital-twin-arch] Zhou, C., Yang, H., Duan, X., Lopez, D., Pastor, A., Wu, Q., Boucadair, M., and C. Jacquenet, "Digital Twin Network: Concepts and Reference Architecture", Work in Progress, Internet-Draft, draft-irtf-nmrg-network-digital-twin-arch-01, 11 July 2022, <https://www.ietf.org/archive/id/draft-irtf-nmrg-network-digital-twin-arch-01.txt>.

6.2. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

Authors' Addresses

Danyang Chen
China Mobile
Beijing
100053
China
Email: chendanyang@chinamobile.com

Hongwei Yang
China Mobile
Beijing
100053
China
Email: yanghongwei@chinamobile.com

Cheng Zhou
China Mobile
Beijing
100053
China
Email: zhouchengyjy@chinamobile.com