



ICAO

**The Fifth Meeting of System Wide Information Management Task Force (SWIM TF/5)**

Video Tele-conference, 9 – 11 August 2021.

**Agenda Item 9:** State, Regional and Global SWIM Updates**A HYBRID NETWORKING SOLUTION COMPATIBLE WITH LEGACY SYSTEMS**

(Presented by China)

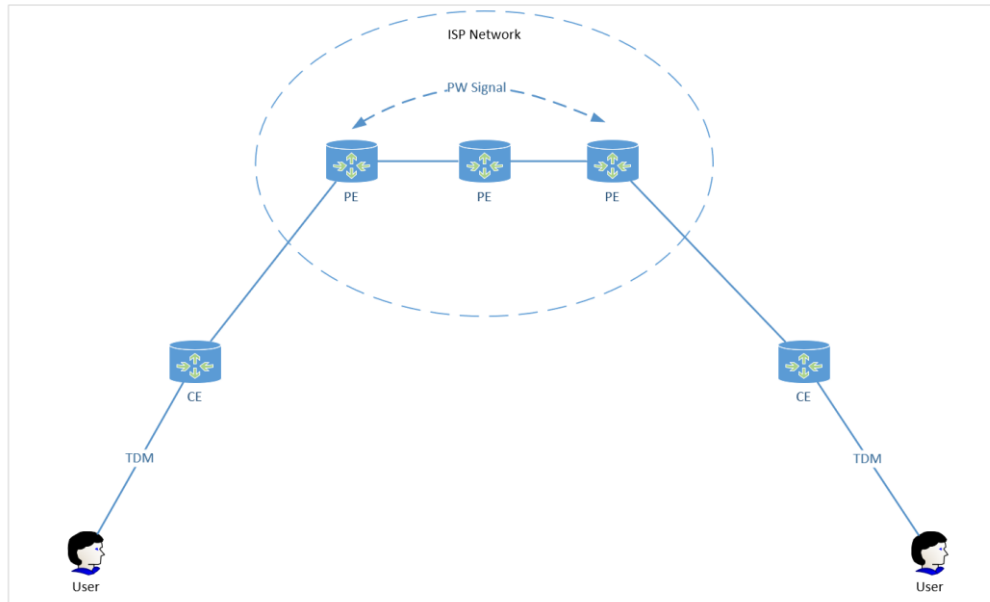
**SUMMARY**

This paper presents a hybrid networking solution compatible with legacy systems under IP backbone network. It contains both transport layer protocols and application layer protocols. It realizes compatible transition between legacy systems and SWIM-enabled systems through emulation technology at the transport layer and data protocol conversion technology at the application layer.

**1. INTRODUCTION**

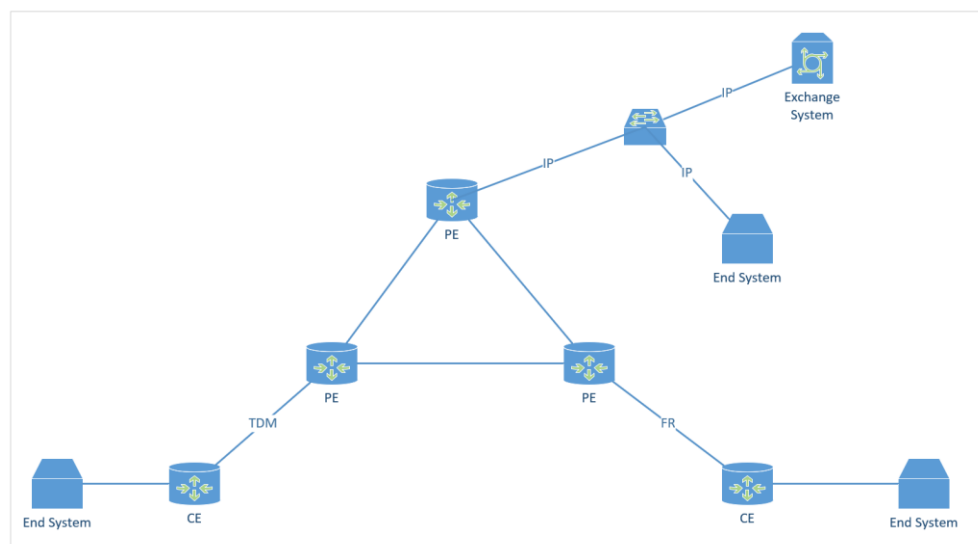
- 1.1 At this stage, the legacy systems are constructed based on earlier technical requirements during the construction process. It is difficult to realize a comprehensive upgrade of the legacy system.
- 1.2 In order to be compatible with the legacy system, it is necessary to design a set of hybrid operation mode to cope with the situation that SWIM-enabled system coexists with legacy systems.
- 1.3 To solve the interconnection problems at both the transport and application layers simultaneously, it is indispensable to upgrade the transport network structure and data exchange system in the meantime.
- 1.4 Transport Layer Network
  - 1.4.1 The implementation of SWIM relies on a high-speed IP backbone network regarding the underlying network structure. SWIM-based data services are realized through the IP backbone network, XML data model and other control protocols.

- 1.4.2 In order to achieve compatibility with legacy systems, PWE3 (Pseudo-Wire Emulation Edge to Edge) is used to emulate early transmission networks over a backbone network provided by ISP.



**Figure 1 PWE3 connection schematic**

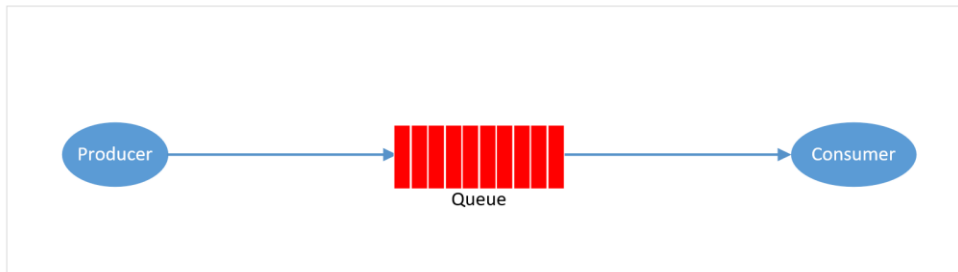
- 1.4.3 A part of network protocol is simulated based on MPLS network through emulation technology in the transport layer, such as ATM and TDM. Data exchange based on IP protocol and legacy protocols are both allowed to run simultaneously within a single network architecture.



**Figure 2 Diagram of the hybrid network structure**

1.5 Application Layer

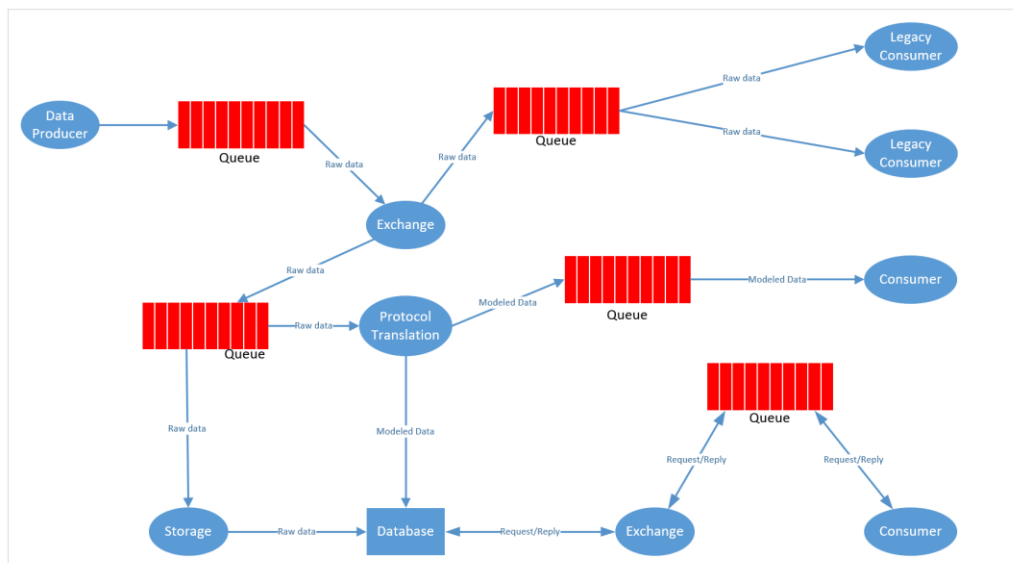
1.5.1 The construction of the exchange system is based on message middleware technology while solving the interconnection problem between hetero-systems through EMS. This system implements the storage, forwarding, querying and formatting of messages.



**Figure 3 Diagram of message middleware**

1.5.2 During the exchange process, each message consists of two parts, the header and the body. The header part consists of a set of optional attributes, which include routing information, priority, destination, etc. The body part contains the details of the message.

1.5.3 In order to improve system operation efficiency and reduce message latency, Body part is not recommended to be encoded and decoded as much as possible. For communication between hetero-systems, the message latency is increased by using adapters for protocol conversion.



**Figure 4 Logical diagram of message routing**

1.5.4 Real-time exchange requirements are implemented using the publish/subscribe model, and non-real-time exchange requirements are implemented using the request/response

model, these data services are integrated in a unified gateway. Interface components customized to applications are used to connect gateways to legacy systems.

## **2. DISCUSSION**

2.1 Message priority management is an important aspect in a single switching system that handles multiple types of messages. In addition to giving high priority to messages with high real-time requirements, the processing process needs to be strictly controlled, in order to guarantee the real-time of messages. There should not be too many processing steps. Protocol conversion should be carried out as little as possible, including transport protocols and data protocols. Messages with high priority labels need to be processed first in the queue.

2.2 The XML data model is rarely be used at this stage. Although all data exchanged through the system is formatted and stored, only partial bi-directional conversion of the FIXM and IWXXM formats has been implemented. The system using FIXM and IWXXM data is still a very small part in practice. On the other hand, the use of the XML format during data transfer is not as high as one might expect. JSON is not as comprehensive as XML in terms of functionality, it can also satisfy most of the application scenarios. Considering the advantages of JSON data in terms of processing and resource consumption, more systems use JSON for data communication.

2.3 Analog voice messages can be transmitted under this network architecture. However, the need for more distribution and reuse of analog voice messages has not been explored. Analog voice is only transmitted as a data stream without much processing. It will be considered for synchronization between different VHF stations in the case of wide coverage of the same frequency later.

## **3. ACTION BY THE MEETING**

- 3.1 The meeting is invited to:
- a) note the information contained in this paper; and
  - b) discuss any relevant matter as appropriate

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