

# Research on the application of train communication network technology

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**Keywords:** train communication; network topology; field bus

**Abstract:** with the high speed EMU project of technology import in our country, and the vigorous development of the urban rail transit construction, puts forward higher requirements for the reliability of the vehicle. Urgent need in order to realize the normal operation of the train in the rolling stock fast real-time data transmission between the computer and the exchange, with on the train running state and fault information and make accurate and quick judgment and processing. Aiming at the problem of train network control principle has carried on the thorough research, and put forward a more accuracy of train communication network, effectively improve the stability of train operation.

## 1 Introduction

With the continuous development of science and technology and the change of market demand, modern trains are moving in the direction of high speed, automation, comfortable, compared with the traditional train, more and more information (such as status, control, fault diagnosis, the passenger service, etc.). But in traditional train control technology has produced many problems, such as the standard is not unified, interface is not compatible, and poor extensibility, this restricted the development of the technology of network monitoring system. Therefore, the international electro technical commission established IEC61375 -1 (1999) the train communication network and the IEEE (the American association of electrical and electronic engineers) for the train network communication protocol, it includes two bus, namely WTB bus allows and MVB bus. From the point of view of train communication and control, the same car equipment through the MVB bus communication, carriages through the WTB bus transfer information, allows the train they constitute a communication bus has the characteristics of strong real-time performance, high reliability<sup>[1]</sup>.

## 2 The characteristics of the train network control

Finish on the train through train network train network control system of the main equipment management, information collection, the train operation of train running state monitoring and diagnosis; so as to realize the train safe and reliable operation, as well as the conductor train operation assistance and provide support for maintenance tasks. Network architecture is made of two levels of bus structure, trains and cars. Train level network to connect the marshalling the communication network of each vehicle, used for the transmission of information between vehicle. Vehicle level communication network of network connection car equipment, is a kind of train wiring minimized under the premise of implementation of train control and monitoring in the diagnosis of advanced, perfect, high reliability of train network[2].

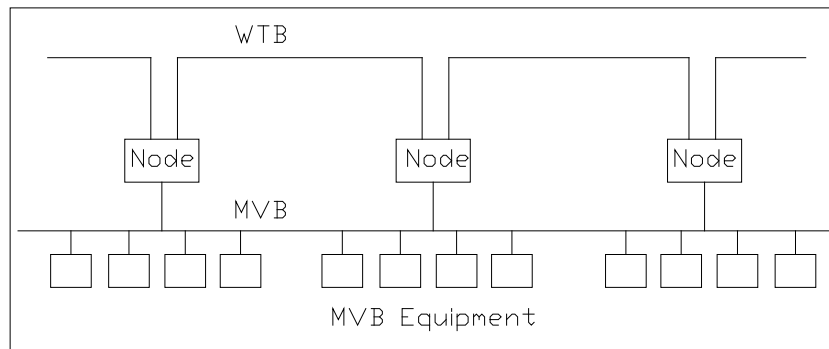


Figure 1 TCN network topology

## 2.1 WTB bus allows

WTB (allows Wire Train Bus) Train Bus is designed for railway locomotive reconnection (vehicle) and the development of high reliability and real-time of field bus, and is suitable for the need of dynamic grouping of open Train (also suitable for fixed closed Train marshalling), when using redundancy design, if the working problems of a Train, Bus, WTB/MVB gateway allows can automatically control switch to another job, ensure the normal order of the Train network communication with high reliability; Network topology for the total line of the simple structure, convenient wiring between vehicles; With functions of early trains run, support the dynamic organization of the train; The data link layer to support two kinds of basic data transmission mode; Process data transmission: fundamental period is 1 ms, mainly used for periodic data transmission time urgency demanding; Message data transfer: mainly used for accidental data transmission based on event driven, such as fault diagnosis data or monitor data transmission.

## 2.2 MVB bus

MVB bus device used to connect to the car, it during normal operation, not in separate car group is a carrier of the standard data. It provides both interconnection between programmable devices, also provides programmable devices and their interconnection between the sensor and actuator. MVB bus has a fixed structure and address, and the topology structure of point to multi-point master-slave mode. In a certain period, controlled by the bus manager is responsible for all car equipment access to the bus. Bus can have multiple bus manager, but in a given period of time, there can be only one bus manager into main equipment, other managers as redundancy in case of failure, can switch between them. Due to the interference of the train and running environment of the complex condition, so the reliability of the MVB bus communication demand is higher. Can ask communication with real-time MVB bus at the same time, within the prescribed sampling period, timely response operation command and can give control instructions, etc.

## 3 Field bus communication network analysis

Train communication network will be the whole train together as a whole, the driver of train control command on each car via train communication network, the each carriage of the train working state through train communication network transmits to the monitor screen of a driver chamber, make the safe and stable running of the train. Existing train communication network has two kinds: T and L shape, T the TCN (train communication network) network, L as stipulated in "specification for the free topology twisted-pair cable channel of Lon Works communication network.

The appearance of the field bus of train communication network performance is greatly improved, the field bus train communication network has become an essential technology. Train communication network field bus have their features in application and to follow the standard, such as field bus is one of the hot spot of today's automation technology development, known as the computer local area network (LAN) in the field of automation.

#### 4 TCN network topology in the application of the train

WTB as a train bus is mainly used for marshalling allows change constantly, other bus doesn't have the ability to automatically grouped[3]; MVB is suitable for used as a vehicle bus, have rapid response ability, is the bus for fast process control optimization. For fixed marshalling train, it can also be used for bus, train and MVB can also be applied to other need a quick response to the industrial control network. From a certain extent, WTB and MVB allows can also be considered to be applied to train the field bus standards, they are all from the development of field bus technology obtained the huge development[4].

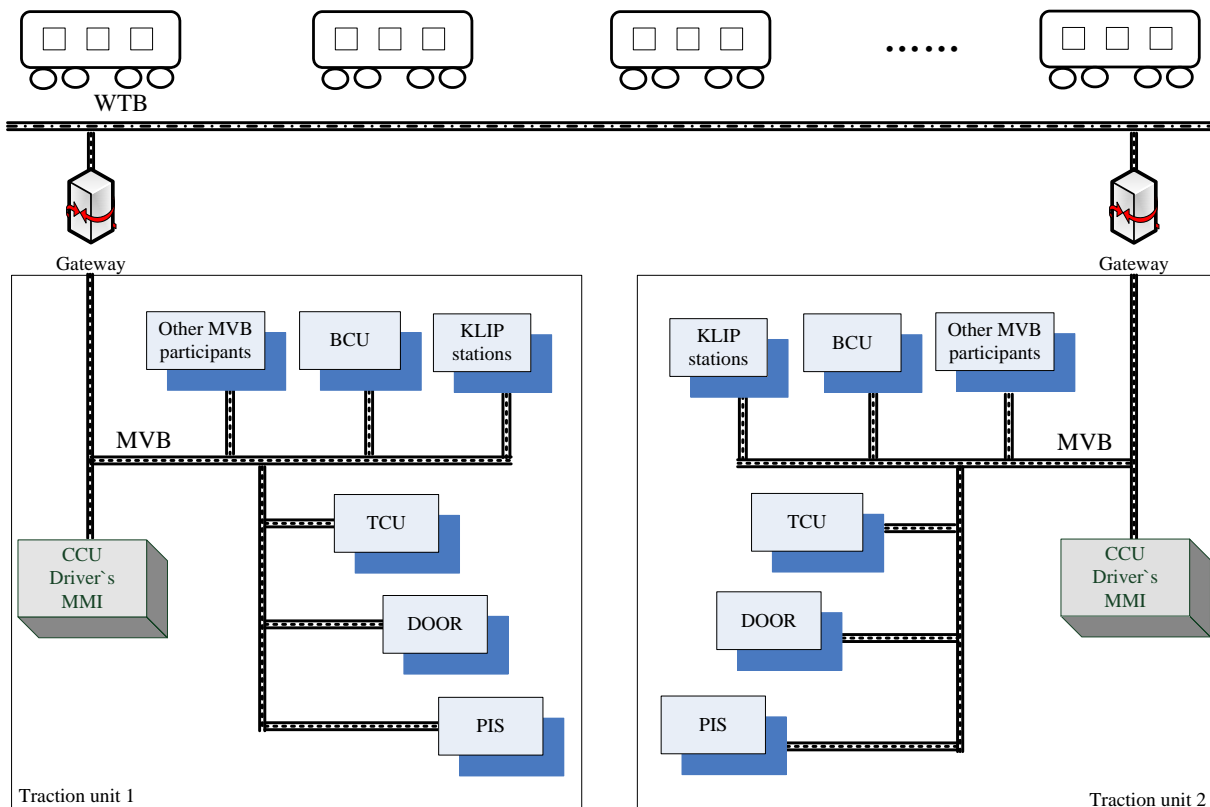


Figure 2 TCN network topology in the train

(1) the gateway, the gateway from the train bus (WTB) allows to vehicle bus (MVB) process of marshalling and message data, which in turn from MVB to WTB as allows.

(2) distributed input/output station: by connecting to the vehicle bus (MVB) distributed input and output station, for train communication and control unit of the control system of the digital and analog signal processing interface.

(3) Traction control unit : master CCU by vehicle bus (MVB) to the TCU for traction system sends out the set point, and receive status information through the TCU from traction system. Traction equipment of the important control command sent by TCU direct reading through the input/output channels.

(4) Brake control unit : in the respective vehicle brake control and diagnosis, head of the car two redundant BCU has for the respective traction device segmentation braking vehicle bus (MVB) management.

(5) The passenger information system: passenger information system is an independent system, not connected to the train control, also failed to pass the MVB directly or through SIBAS ® KLIP station indirectly connected to train control[5].

## 5 Conclusion

Based on the domestic and international train communication network and USES the comparative analysis of the field bus technology, put forward to satisfy the needs of the current train control train communication network topology. Domestic MVB development still faces many problems: such as many MVB products and core technologies still by several foreign company monopoly, seriously hindered the domestic independent development MVB network products; , and less in the domestic study of train communication network, the technical level is relatively backward, leading to domestic train communication network research progress has been slow. Therefore, on the basis of the technology and the successful experience of other countries for reference, through the depth of technology introduction and digestion and absorption, developed with completely independent intellectual property rights, in line with international standards of bus technology, which can take into consideration the needs in the current train control, but also has the best cost performance, in order to improve the competitiveness of the rolling stock products in our country

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