

NUMERICAL SYSTEMS IN THE LEARNING PROCESS

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Abstract: Linking industrial networks to corporate networks enables companies to test new applications and services and access to information anywhere, anytime. Equally, the increasing use of the Internet provides access to critical real-time and is a competitive advantage. Improvements in industrial networks include the ability to transmit and industrial serial protocol over Ethernet in a wireless environment. Joining different networks (enterprise networks and network management and data collection), avoiding collisions, high transfer efficiency and the ability to add new devices to the network without interrupting the flow of traffic – these are all benefits of the new practice. Industrial fieldbuses different types of transfer's data at lower levels of process control and production. Their use shall be replaced by "classic" – analogue process variables, whereby there is a significant reduction in wiring. However, the actual limit the scope of wiring is not the main benefit of these communication systems. It lies mainly in manageability and diagnostic devices connected to the bus through which the device can be parameterized and continuously evaluate their condition.

Keywords: fieldbus, Publisher/ subscriber, Master/slave

INTRODUCTION

Industrial fieldbuses in Anglo-Saxon literature refers to as "Fieldbus". They are used for the lower end of the automated production system. These are levels of equipment and parts. Industrial fieldbuses were originally developed to replace the current loop digital interface for the transmission of information between intelligent field devices and equipment's and senior management level. Transferring those short blocks of data at the level of sensors, actuators and controllers.

Systems with industrial communication bus have the following characteristics:

— Flexibility and modularity – a system with industrial communication bus is easily extensible than a centralized system.

» Configurability – communication network enables parameter setting and configuration of field devices, which simplifies system installation and commissioning. Configurable via the communication network is a prerequisite for the use of intelligent field devices.

» Maintainability – use of industrial communication bus allows monitoring devices and equipment, introduction of firmware.

— Distribution – communication network is a prerequisite for the implementation of distributed systems. Data processing may not be executed in the central controller, but may be performed in the field devices.

PROPERTIES OF FIELDBUS AND INDUSTRIAL FIELDBUSES IN THE REFERENCE MODEL ISO / OSI

Properties fieldbus can be summarized as follows:

— A high volume of short data blocks:

- » the baud rate is compared with a global network cabling (up to 12 Mbit / s, in systems with industrial Ethernet up to 100 Mbit / s), but quite a large range of distances (tens of meters to several kilometers),
- » time synchronization of the devices connected to the communication bus (at microsecond),
- » simple installation carried out by trained personnel,
- » high integrity (high degree of treatment failure to receive data).

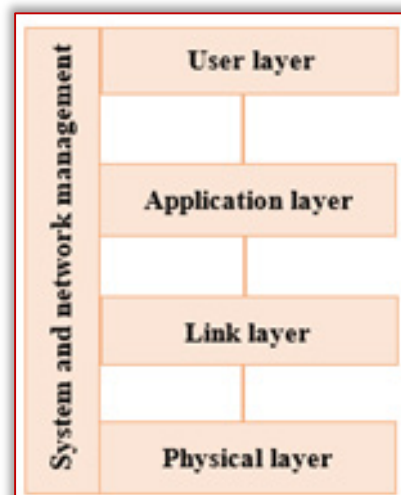


Figure 1. Layer model of industrial communication bus showing the position of the layers in the OSI layered model (application layer is not part of the OSI model)

For the operation of industrial communication buses are not required (and desired) all layers of the OSI model. Use the following layers of the OSI model:

— The physical layer implements transmit each bit-level signals. On the physical level, each communication bus defined by the physical characteristics of the

communication circuit type of transmission medium (media), voltage levels, size of load currents, bit rate, topology, features sets fieldbus (receiving optical signals), the maximum number of connectable devices (nodes) and below.

- Link layer implements communication between devices, among which signal lines (transmission lines). Controls access to the transmission medium.
- The application layer provides translation requirements of the application layer to the link layer. It provides access to a set of communication services supporting the operation of distributed systems. Implements transfer values and administration. It may be implemented commands to work with the device (device parameterization, diagnosis, etc.).
- The user layer is defined by the structure of the data collection and management functions device connected to the fieldbus. It may be defined function blocks device description of the devices in the formal language and means of communication with different types of devices (eg. Sensors, actuators, etc.). It allows interoperability of equipment.
- System and network management provides a method for configuring bus and recovery from failures. Monitors and manages the activities of the various parts of the bus.

METHODS OF DATA TRANSFER

— Master/slave

Master device (eg. PLC) sends a request for data transmission slave (eg. Sensor, actuator). Addressing (tbc) slave then responds to the request. Examples transfer methods master/slave:

- » acyclic data transmission on PROFIBUS DP in the transfer of configuration data from the PLC to the frequency converter,
- » cyclic read data from the encoder to the control PLC and then sending output demand (value of frequency) to frequency converter.

— Client/server

The buses, which are not clearly defined master and slave (ie. Foundation Fieldbus), this method of transmission is called "client / server". Device acting in the capacity of a client asks for data transfer and device server responds.

The possible use of the method of client / server:

- acyclic data transmission between the device (device on the bus – server) and operator workstation (client) – transmission configuration data, monitoring and visualization.

— Publisher/ subscriber

A device that performs the function of "publisher" sends the value to be able to take several devices simultaneously and to act in the capacity of "subscribers".

The advantage is that the transferred value is transmitted to multiple devices simultaneously.

This data transfer method is used in the Fieldbus Foundation in feedback management (closed-loop control).

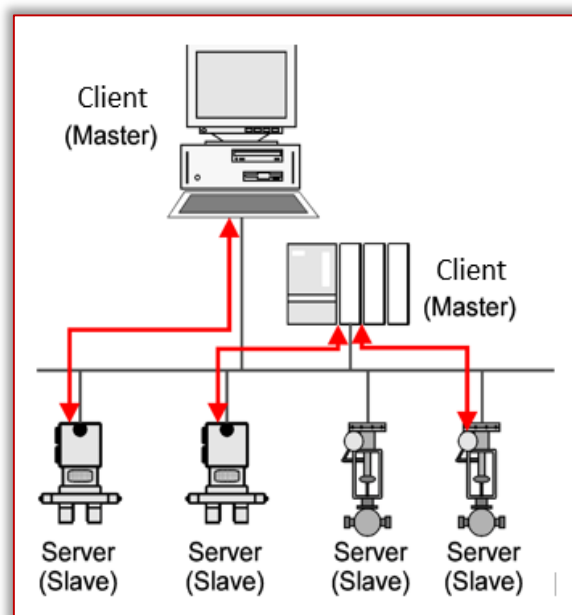


Figure 2. Data transmission on a "client / server" („master/slave")

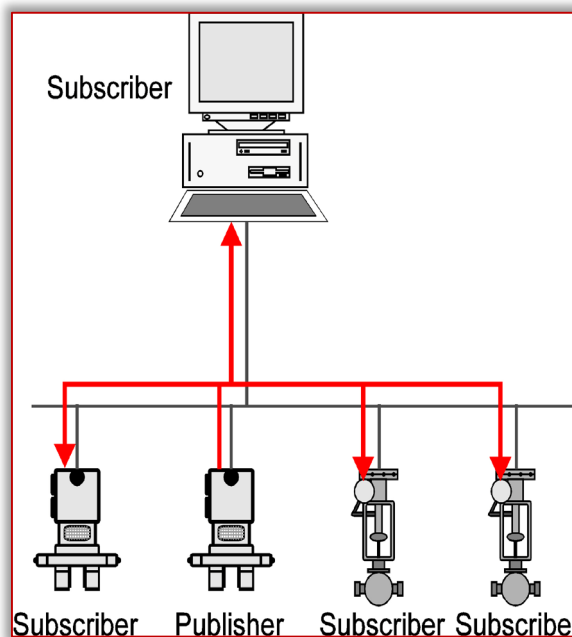


Figure 3. Data transmission method „publisher/subscriber"

Publisher remembers devices that act as recipients of his messages (subscriber): When a device wants to receive these messages, the device sends a request to the publisher to be included in the list of beneficiaries. Message transmission using group addressing.

If the data is transmitted between devices directly, without having to transfer via the master device, such transfer shall be marked „peer-to-peer". Possible methods of use publisher / subscriber: cyclic transmission of process variable from sensor.

— **Transmission of data without request (source/sink)**

A device that performs the function of "source" device transmits a "sink", without requiring the device management "sink". Data transmission is carried out a cyclically, for example, when an alarm. Application: Alarm transmission and fault data from devices on the operator panel, the appearance of faults.

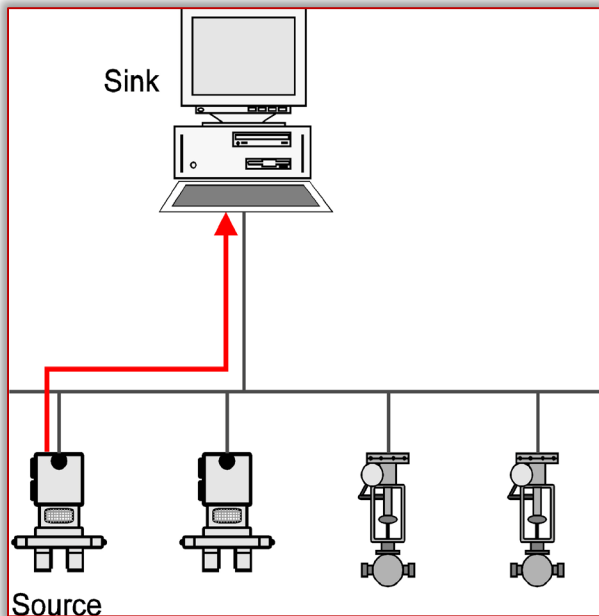


Figure 4. Transmission of data without request

SYSTEMS OF NUMERICAL CONTROL

Numerical control systems can be divided into two basic groups:

- » NC
- » CNC

Computer-controlled systems (CNC), for their benefits fully enforced and NC systems are both technically and morally obsolete and are used only to run out of their life.

— **NC control systems**

- » the system's memory is loaded only one sentence, which is carried out,
- » following sentence is loading new,
- » when you load a new sentence, the current contents of memory lubricates,
- » information is entered as a program on punched tape or manually from the keyboard,
- » program on punched tape is read again and again in the manufacture of other pieces,
- » the execution of the next piece to be tape rewinds to the beginning,
- » any modification program is possible only by adjusting punched tapes,
- » the program cannot use parameters and user subroutines program cannot branch out.

— **CNC control systems**

The system loads the entire program into memory from either disk or other media for storing information, or through LAN network, either wired or dateless.

In contrast to the NC of the interpolator it is not hardware but software issue.

The generation of the track can be used direct mathematical description of the shape of the track. It is thus possible to generate parabolas and higher order curve (spline) control systems with high computing power and carry out circular interpolation in space, but practically you do with linear and circular interpolation.

For the processing of technological information with the CNC system uses a programmable logic controller (PLC – Programmable Logic Controller).



Figure 5. Control systems CNC

The CNC systems are possible:

- easy edit program,
- branch program,
- use parameters,
- using subprograms,
- the graphical simulation of machining,
- use diagnostic programs,
- to compensate for system accuracy and machine parts.

CONCLUSION

Industrial fieldbuses different types of transfer's data at lower levels of process control and production. Their use shall be replaced by "classic" – analogue process variables, whereby there is a significant reduction in wiring.

However, the actual limit the scope of wiring is not the main benefit of these communication systems. It lies mainly in manageability and diagnostic devices connected to the bus through which the device can be parameterized and continuously evaluate their condition.

So in addition to the process variable to / from the device transmitted and other variables.

Acknowledgement

The work was supported by Ministry of Education of the Slovak Republic KEGA 039 TUKE-4/2016: The creating of virtual laboratories based on web technologies to support the educational process in the field of Manufacturing Technology.

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ISSN: 2067–3809

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