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Industrial communication networks –
Fieldbus specifications –

Part 4-7: Data-link layer protocol specification – Type 7 elements

CORRIGENDUM 1

Annex C – Topology of multi-segment DL-subnetwork

Replace the existing text of the annex by the following:

Annex C
(informative)

Topology of multi-segment DL-subnetwork

C.1 Introduction

This annex describes how to specify the topology of a multi-segment DL-subnetwork. The aim is to propose a data structure, which could be minimal while allowing correct operation of the bridge retransmission function.

The topology of a DL-subnetwork can first be specified globally, in order to verify a certain number of properties (topological connectivity, non-meshing, etc.); then on the basis of this specification the local data base specific to each bridge must be calculated in order to ensure it operates correctly.

Although this appendix proposes a method to achieve this goal, only the specifications of the data structures, global or local to each bridge, which define the DL-subnetwork topology, as well as the properties which it should fulfil, must be taken into account in the standard. The suggested method shows how to obtain a solution to the problem by taking into account certain optimization problems.

C.2 Global specification

The topology of a multi-segment DL-subnetwork can be defined by the following elements:

— the set S of its segments: $S = \left\{ s_i \mid i \in [1, n] \right\}$

— the set B of its bridges: $B = \left\{ b_k \mid k \in [1, m] \right\}$

— and for each bridge of B, the data of a matrix B^k of dimension n × n. whose coefficients b_{ij}^k are defined by:

— $b_{ij}^k = 0$ if i = j;

— $b_{ij}^k = \infty$ if the bridge b_k does not allow transfer of messages from segment s_i to segment s_j ;

— $b_{ij}^k = \alpha$ with $\alpha \in \mathbf{R}^{+*}$, if the bridge b_k allows the transfer of messages from segment s_i towards segment s_j, with α as load coefficient which allows taking into account of a different efficiency rate according to the transfers.

A load coefficient b_{ij}^k can represent the load, as a rate of occupation of the medium, of the retransmission segment s_j. In reality, either the destination is directly s_j, or there are several paths possible, passing through intermediate segments, to reach s_j and in this case the choice shall be to pass by the least loaded path.

It is of course possible to take as coefficients the same value (1 for example).

If a bridge allows two-way retransmission with the same load coefficient for the two directions, its matrix is symmetrical.

The matrix B^k of a bridge also allows knowing all the segments to which it is connected:

— either in reception, S_r^k = { segments whose corresponding line in the matrix includes at least one non-null finite coefficient}; note n_r^k = card (S_r^k),

— or in transmission, S_e^k = {segments whose corresponding column in the matrix includes at least one non-null finite coefficient}; note n_e^k = card (S_e^k).

C.3 Local specification

The information which a bridge must have locally allows it to answer the following question: when I receive a message on a segment $sr_i \in S_r^k$ destined for another segment s_j, must I do nothing or must I retransmit on segment $se_h \in S_e^k$).

To fulfil this purpose, it is enough to allocate to each bridge b_k a transfer matrix T^k with dimensions $n_r^k \times$ n, whose elements r_{ij}^k are defined by:

— the line index $i \in [1, n_r^k]$ references segments sr_i connected in reception ($\in S_r^k$),

— the column index j $\in$ [1, n] references the segments s_j of the DL-subnetwork ($\in S$),

— $r_{ij}^k = 0$ if on reception of a message on segment $sr_i \in S_r^k$ addressed to segment s_j, the bridge shall not do anything, either because s_j cannot be reached via this bridge, or because $sr_i = s_j$ (a bridge shall not retransmit a message received from a segment towards this same segment),

— $r_{ij}^k = se_h$, with $se_h \in S_e^k$, if on reception of a message on segment $sr_i \in S_r^k$ addressed to segment s_j, the bridge must retransmit to segment se_h.

NOTE Indexes i and h correspond to channel numbers whereas sr_i is the segment connected in reception to channel i and se_h is the segment connected in transmission to channel h.