New solution in the structured computer networks

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Abstract

When we build a new computer network, we have to know, that the lifetime of the network only 5-6 years. So we have to rebuild this network in every 5 years. According to this, it is very important to choose the cheapest and the easiest solution. Nowadays this solution is the structured computer network.

On the other hand – especially in the rent office – we have to reconstruct the working place frequently. If we use the structured computer network we can work without any new cable laying, we only have to restucture to the paching cabinet.

I would like to show the principle of the structured computer networks, and some new solution, especially the standardisation, cables, and testing.

Key words Structured computer networks, EMC, Category5e, Category 6, RJ45 socket, path panel, twisted cable

Introduction

Nowadays one of the most changeable fields is the structured cabling system, in spite of the spread of the wireless technology. If we want to build a new computer network, we have to choose the best solution of the cabling system. This is the prewiring system.

Prewiring a building involves integrating the necessary wiring infrastructure for telekommunications, either at the design stege or during renovation. The majority of prewiring systems accept both telephon and data connections. Low-power distribution must be designed to be both standardized and straightforward.

Any terminal can then be connected to the user sockets, which avoids disturbing the wiring each time the hardware is upgraded or moved, in the same way as for high-power connections.

The ideal approachis a star distribution system. Each socket is caonected to a distributior via a 4-twisted pair cable. For larger installations, each floor distributor is connected to a general distributor wia an optikal fiber.
The base of the build of computer networks is the installation standards. Nowadays we use Category 5e (100MHz), and Category 6 (250MHz) standards. These standards consist of four architectures of horizontal cable subsystem.

Fig. 2. Architectures of horizontal cable subsystem

a. interconnect - TO
b. cross connect - TO
c. Interconnect – CP - TO
d. Cross connect – CP - TO
The maximum length is 100m. The calculated length of the fixed horizontal cable is the following:

<table>
<thead>
<tr>
<th>Model</th>
<th>Figure</th>
<th>Class D channels using Category 5 components</th>
<th>Class E channels using Category 6 components</th>
<th>Class F channels using Category 7 components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interconnect - TO</td>
<td>a</td>
<td>$H \geq 109 - Fx$</td>
<td>$H \geq 107 - 3 - Fx$</td>
<td>$H \geq 107 - 2 - Fx$</td>
</tr>
<tr>
<td>Cross connect - TO</td>
<td>b</td>
<td>$H \geq 107 - Fx$</td>
<td>$H \geq 106 - 3 - Fx$</td>
<td>$H = 106 - 2 - Fx$</td>
</tr>
<tr>
<td>Interconnect - CP - TO</td>
<td>c</td>
<td>$H \geq 107 - Fx - CY$</td>
<td>$H \geq 106 - 3 - Fx$</td>
<td>$H = 106 - 3 - Fx - CY$</td>
</tr>
<tr>
<td>Cross connect - CP - TO</td>
<td>d</td>
<td>$H \geq 105 - Fx - CY$</td>
<td>$H \geq 105 - 3 - Fx - CY$</td>
<td>$H = 105 - 3 - Fx - CY$</td>
</tr>
</tbody>
</table>

*This length reduction is to provide an allocated margin to accommodate insertion loss deviation.*

**Fig. 3.**
Calculation of the length of the fixed horizontal cable

When the distance is longer than 100m between two active elements we can use the optical fibre.

If we want to install a new computer network, according to the Category 5e, or 6 standards, the most important is that all the equipment needs to be suitable for the rule of the standards.

Next to the standards, the EMC of surroundings is the very important question, when we start to plan a computer network. All the equipment, which is situated next to the computer, active elements or network have influence on these elements, each other of course.

**Fig. 4.**
The equipments which are sources of noise

This influence is the conducted disturbance. The conducted disturbance depend on the type of cable, the distance of the low voltage on high voltage cables, the common length, and the equipment which is the source of noise.
The structured computer networks consist of the following parts (in our presentation there will be only the passive elements)

1. wall sockets
2. cabinets
3. patch panels
4. cables
5. trunking system
6. accessories

**Wall sockets:**

The RJ 45 sockets is fit the requirements to the standard Category 5e, and Category 6. One of the most important think is the easy installation.
The new generation of the RJ 45 can be install without any tools. According to the EMC the RJ 45 socket can be unshielded, or shielded.
Beside the technical solution the design is a very important question.
Cabinets:

Wall and standing cabinets. The size of cabinets depends on the number of wall sockets, active elements and other accessories. The cabinets consist of two holders. The distance between this two holders is always 19”.

Patch panels:

It contains RJ 45 sockets, or/and optical sockets. A new solution can hold the media converter, too. So we can receive the optical signals, transform them to electrical signs and transfer these. All the patch panels have a standard size, which is 19”. Because the holders inside the cabinet have the same distance, we can install these panels directly these holders.

Cables:

The longest part of the computer networks are the cables, so they receive the most conducted disturbances. Our choice depends on the EMC of surroundings, and the protection of the environment. The basic protection is the twisted pair. Besides, when the EMC is bigger, we can use shielded cable.
Trunking system:

It gives us the most variable solution, which can contain the RJ 45 sockets or other wiring accessories.

Accessories:

They made the cabling system complete.

Test:

When the building of structured computer network is ready, the next step is the test.

The main parameters to be measured:

- mapping of connections
- length of links (informative)
- attenuation
- NEXT
- FEXT
- ACR
- return loss

These measurements give us all the information, which is necessary to know. (mapping – quality of connection, attenuation – quality of the cable, NEXT – quality of the wiring, ACR – quality of the transmission on the prewiring.) After that we can do a decision about the network.
Conclusion

The structured computer networks are very sensitive to the EMC. If we want to comply with the safety prescriptions and standardizations we have to choose equipment and cables, which are suitable for standardization and against to EMC. Sockets have to have shielded covers, and the cables shielded wrap if it necessary. Have to calculate the length of cable, and the NEXT, FEXT, ACR and attenuation are according to this length.

Nomenclature

EQP : equipment (switch)
TE : terminal equipment (computer)
TO : terminal outlet
CP : consolidation point
H : the maximum length of the fixed horizontal cable (m)
F : combined length of patch cords/jumpers, equipment and work area cords
C : the length of the CP cable (m)
X : the ratio of cord cable insertion loss (dB/m) to fixed horizontal cable insertion loss (dB/m)
Y : the ratio of CP cable insertion loss (dB/m) to fixed horizontal cable insertion loss (dB/m)
EMC : electromagnetic compatibility
NEXT : near-end crosstalk
FEXT: far-end crosstalk
ACR: attenuation to crosstalk ratio

References

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