**SIEMENS**

Technical article

Simply – quickly – exportable

**Nothing is lost -
Quick and comprehensive Data Analysis**

If the communication in a network comes to a halt, the cause must be quickly found so that, e.g., production processes are not unnecessarily slowed down. Management tools can quickly provide an overview of the network to localize the error. However, the cause sometimes can only be uncovered via a targeted telegram export and analysis of the telegrams.

The communication networks in today's production plants are like the arteries in the human body. A body having problems with the oxygen transport to the muscles can be directly compared with communication problems in automation systems. If oxygen does not reach the right places, muscles can not move. If telegram commands do not reach the right I/O device, the control of actuators or the correct acquisition of data by sensors is not possible.

siemens.com/tap
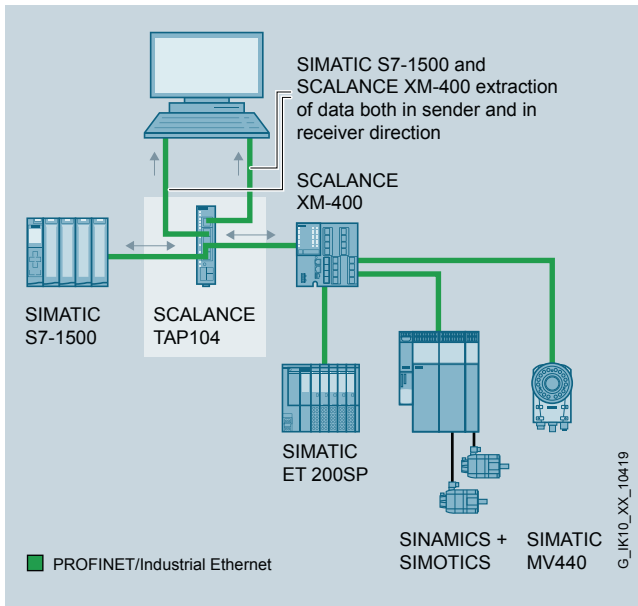
Easy integration of the TAP104 into existing network structures, without affecting data traffic or the maximum cable length (100 m)

The communication networks in today's production plants are like the arteries in the human body. A body having problems with the oxygen transport to the muscles can be directly compared with communication problems in automation systems. If oxygen does not reach the right places, muscles can not move. If telegram commands do not reach the right I/O device, the control of actuators or the correct acquisition of data by sensors is not possible.

Causes of Communication Problems

Today's production networks are no longer conceivable without Ethernet communication. In contrast to the past, automation systems in this digital age no longer communicate only among themselves. The exchange of data between machines and higher-level systems as well as the connection to cloud-based tools and databases are becoming more and more important. If communication problems occur in these structures, the root cause analysis becomes difficult. Particularly in industrial plants, data telegrams must be protected well against external influences such as EMC – so that they can survive the journey from the transmitter to the receiver unaltered. Even though telegram repetition procedures allow the systems to repeat telegrams to respond to destroyed ones, a transmission error will usually be reported after three attempts have been made.

The causes of this can wildly differ in nature. Communication problems, for example, can be the result of telegrams that are too long or too short. This occurs when network interfaces are incorrectly configured or applications generate faulty telegrams. Telegrams can also be changed by external influences while passing through the network. As already mentioned, electromagnetic interference – as generated during the startup of a large motor – or dirty optical connections can lead to a telegram breakdown in a copper or fiber-optic network. Components specifically developed for the industry minimize these influences, but with the increased mechanical and thermal stresses in such applications, even these components can be weakened over their service life – with a resultant impact on the telegrams.

Localization and Diagnosis

If communication problems occur in a plant, they are very quickly reported by the components involved. Network monitoring systems such as SINEMA Server from Siemens visualize the problem and the affected plant devices for the user. The user can thus quickly identify the plant section affected, and to which individual components the communication is disrupted. The user can then check the located area of her plant for failed components, lines mechanically interrupted by construction work, or interfaces damaged by environmental influences such as dust or aggressive gases in the air. If the investigation fails to find the cause of the error, the communication problem has to be researched in more detail. The active network components from the SCALANCE product family by Siemens enable the active monitoring of the data traffic. With the mirror port function, the data traffic of an affected port can be exported on a parallel port. In doing so, the same data as flowing over the affected port are simultaneously exported on a second port at the switch. Via this mechanism, the data traffic can be monitored using a commercially available telegram analysis tool. The disadvantage of this export is that a free port is required for this type of diagnosis, and that the switch, as is its task, only passes on unaltered telegrams. Should the cause of the communication fault lie with defective telegrams, however, this can not be detected via the mirror port. The mirror port is usually used to track data streams in meshed networks and to verify a proper VLAN structuring.

Detailed analysis – unconditionally

If the normal diagnostic approaches do not reveal useful leads to correct the communication problem, then the patient, like a human being, has to go to a doctor, who can perform a more detailed examination. A doctor wanting to understand the cause of the complaint will carry out a blood analysis. Blood is drawn and analyzed. This is also the right way to get to the bottom of communication problems. On the communication path between the participants, all telegrams must be exported and analyzed. And "all" really means all telegrams. That is unaltered and altered telegrams. This is made possible with a so-called TAP (test access port). Without influencing the communication between the participants, the TAP exports all telegrams from both transmission directions for further analysis. The telegrams can then be processed and evaluated using an analysis software. The software shows the actual communication on the network in the proper chronological order. Thus, telegrams that are too short, too long or damaged can be spotted. Also easy to detect is the lack of a response during a handshake procedure between two participants. With this detailed information, the cause of communication problems can very quickly be determined.

Some communication problems can only be revealed using a detailed telegram evaluation. For this, Siemens offers the new SCALANCE TAP104. The TAP104 enables a reactionless export of all telegrams – from both transmission directions of a 100 Mbps copper-line data connection. Installing a TAP104 between two active network participants does not reduce the maximum possible connection length of 100 meters. The TAP104 in the SIMATIC S7-1500 design is intended for installation in control cabinets and can be employed anywhere in the network. All data telegrams in this connection can thus be exported unaltered. If the TAP104 is installed precautionary for preventive purposes without the current need for a diagnosis, it can remain in the network without a voltage feed. The network does not perceive it – just as if there was only one cable connection between the two participants. For the user, the TAP104 represents a cost-effective solution for the telegram export should there be a fault in an industrial network – where reliable communication has top priority.

Easy temporary installation of the SCALANCE TAP104 with stand for diagnosing data in a network