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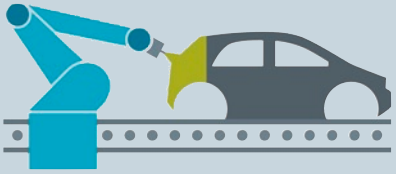
Technical article

Professional Services for greater transparency in the paint shop

Convenient network monitoring and diagnosis with SINEMA Server represent – so to say – the class A finish of the communication in the paint shop of a Chinese car factory. The system monitors the entire Ethernet/PROFINET topology of the paint shop, makes the diagnosis more efficient and transparent – and thus everything more reliable. A network specialist from Siemens customized the solution, installed it during production start-up and put it into operation. Subsequently, the maintenance staff was trained on-the-job.

The paint shop is a central, highly automated and extensively networked process section of every automobile production. Correspondingly high are the requirements on the availability of the industrial network components, which play a central role in the reliable operation and interaction of all plant components. Any malfunction, sometimes even a single error of a network component, can severely impact the production flow and must therefore be quickly identified, located and rectified.



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Efficient monitoring of 500 network participants

The paint shop is comprised of six lines – two each for the sub-processes sealing/underbody protection, priming and painting (base/clear coat). The German automotive equipment supplier primarily uses automation and industrial network components from Siemens for the communication of its plants, but also employs third-party devices. In total, almost 500 network participants, such as SIMATIC controllers and communication processors, SCALANCE switches, gateways and cameras. When it came to the key topic of availability, the idea of the additional network monitoring layer was developed in consultation with the local Siemens sales office. Experts of the Professional Services team became involved, requirements were discussed and possible solutions pointed out. Also very hands-on with a live demonstration of the possibilities of SINEMA Server.

Convincing network topology

The paint shop builder particularly liked the automatic device discovery and generation of the current network topology, as well as their graphical display that does not require any programming effort. The visualization is possible via access to the SINEMA web server – in this way, the network topology can be conveniently integrated into the customer's HMI system, and therefore be displayed on any authorized operator station in the network. This eliminates the previous need for the time-consuming, manual drawing of the network topologies and their update in case of a topology change.

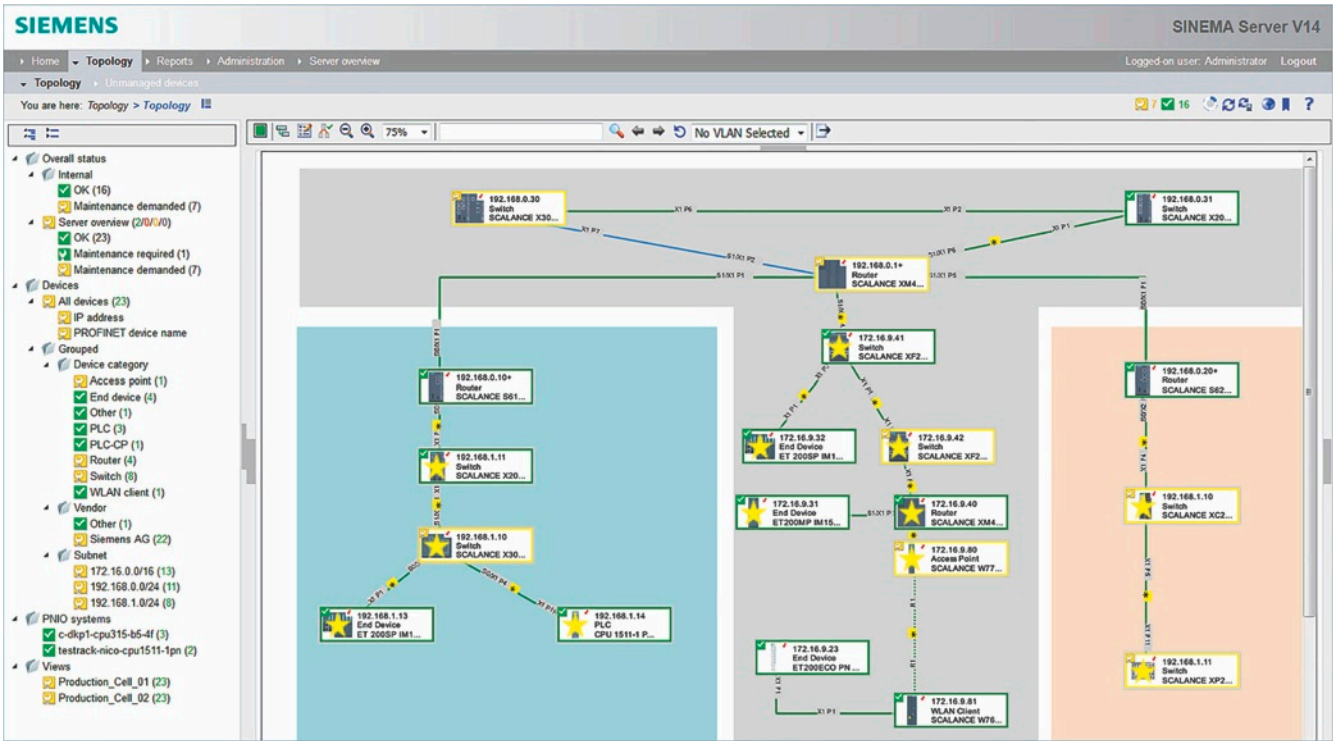
System ready for operation in just five days

The network monitoring for the paint shop was installed on two SINEMA Server PCs, one for monitoring the sealing process with approximately 120 participants, while the other monitors the painting process with approximately 350 participants. The servers are running in the production control room and operated as a master/slave pairing; there are two HMI PCs for the central operation and monitoring. Furthermore, a web browser interface enables the access to both servers from multiple remote stations in the plant.

For the commissioning and customization of the application during the production start-up phase, a network specialist from the Siemens Professional Services team was on-site, who also conducted individual training courses for the plant's maintenance staff – all in just five days.

Central, PROFINET standard and channel diagnosis

A requirement by the plant builder and focus of the training was the central PROFINET diagnosis with SINEMA Server. In particular, the handling of missing, defective and new or unknown participants was intensively taught in simulation exercises. This included, for example, the mastering of error procedures in the case of cable break, component error or an intentional or unintentional changed cabling.



During operation, the automatically generated plant topology SINEMA serves as reference during every cyclical query, on the basis of which the system recognizes and displays every change.

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The operator can recognize at a glance whether a participant is intact (green), malfunctioning (red) or in the maintenance state (yellow). By clicking on a message, the operator receives further information about the participant and error type – including the PROFINET port affected. By means of archivable network reports, various error scenarios can be easily analyzed, also at a later date, and, ideally, helping to continuously improve the communication flow in the whole monitored network.

In order to simplify the handling, the Siemens specialist – on the operating company's request – created approximately 30 topological detail views for the most important plant sections, which can be called up via URL function calls from any operator panel of the plant. With a simple click, the device status and associated events can be displayed. This quickly leads the user to the place of the incident, where safe and targeted measures can be carried out.

Focus on performance and availability

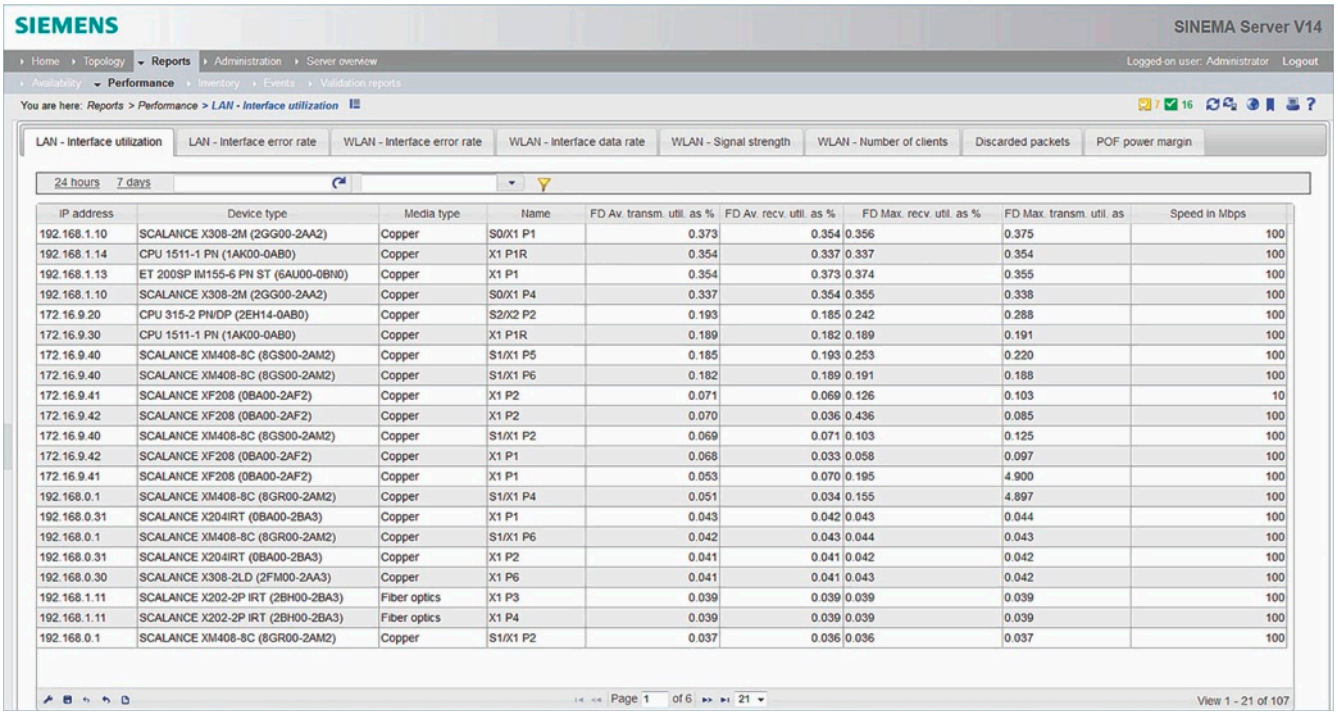
The interval of the cyclical requests (polling) was configured so that it does not appreciable increase the network load. Notwithstanding the above, components can report critical errors autonomously and immediately via SNMP traps.

Another standard function is the access to the command line interface (CLI) of one or more devices. For instance, the configuration files of CLI-enabled devices can be automatically and periodically saved. By means of this backup, possible replacement devices can be configured and put into operation quickly and without errors. This also contributes to a high availability.

Further optimization potential on-board

Not (yet) utilized in this project are the diverse functionalities of SINEMA Server concerning the actual network management. Among them, the option of automated firmware updates for all SCALANCE devices or the remote configuration of all participants via CLI script. This allows simple device configurations to be performed from a central location, such as the setting of LAN/IWLAN parameters. If, for example, the IP address of the central NTP time server needs to be changed on all monitored devices, a simple CLI script can be created for this and executed on the desired devices. Compared to the manual configuration, this is less error-prone, saves time and therefore money.

Even without these management functions, the paint shop builder and the operating company are fully satisfied with the SINEMA Server solution. The professional support during the commissioning of the monitoring functionality and the training of the maintenance staff played a decisive role in the throughout positive overall impression.



IP address	Device type	Media type	Name	FD Av. transm. util. as %	FD Av. recv. util. as %	FD Max. recv. util. as %	FD Max. transm. util. as	Speed in Mbps
192.168.1.10	SCALANCE X308-2M (2GG00-2AA2)	Copper	S0/X1 P1	0.373	0.354	0.356	0.375	100
192.168.1.14	CPU 1511-1 PN (1AK00-0AB0)	Copper	X1 P1R	0.354	0.337	0.337	0.354	100
192.168.1.13	ET 200SP IM155-6 PN ST (6AU00-0BN0)	Copper	X1 P1	0.354	0.373	0.374	0.355	100
192.168.1.10	SCALANCE X308-2M (2GG00-2AA2)	Copper	S0/X1 P4	0.337	0.354	0.355	0.338	100
172.16.9.20	CPU 315-2 PN/DP (2EH14-0AB0)	Copper	S2/X2 P2	0.193	0.185	0.242	0.288	100
172.16.9.30	CPU 1511-1 PN (1AK00-0AB0)	Copper	X1 P1R	0.189	0.182	0.189	0.191	100
172.16.9.40	SCALANCE XM408-8C (8GS00-2AM2)	Copper	S1/X1 P5	0.185	0.193	0.253	0.220	100
172.16.9.40	SCALANCE XM408-8C (8GS00-2AM2)	Copper	S1/X1 P6	0.182	0.189	0.191	0.188	100
172.16.9.41	SCALANCE XF208 (0BA00-2AF2)	Copper	X1 P2	0.071	0.069	0.126	0.103	10
172.16.9.42	SCALANCE XF208 (0BA00-2AF2)	Copper	X1 P2	0.070	0.036	0.436	0.085	100
172.16.9.40	SCALANCE XM408-8C (8GS00-2AM2)	Copper	S1/X1 P2	0.069	0.071	0.103	0.125	100
172.16.9.42	SCALANCE XF208 (0BA00-2AF2)	Copper	X1 P1	0.068	0.033	0.058	0.097	100
172.16.9.41	SCALANCE XF208 (0BA00-2AF2)	Copper	X1 P1	0.053	0.070	0.195	4.900	100
192.168.0.1	SCALANCE XM408-8C (8GR00-2AM2)	Copper	S1/X1 P4	0.051	0.034	0.155	4.897	100
192.168.0.31	SCALANCE X204IRT (0BA00-2BA3)	Copper	X1 P1	0.043	0.042	0.043	0.044	100
192.168.0.1	SCALANCE XM408-8C (8GR00-2AM2)	Copper	S1/X1 P6	0.042	0.043	0.044	0.043	100
192.168.0.31	SCALANCE X204IRT (0BA00-2BA3)	Copper	X1 P2	0.041	0.041	0.042	0.042	100
192.168.0.30	SCALANCE X308-2LD (2FM00-2AA3)	Copper	X1 P6	0.041	0.041	0.043	0.042	100
192.168.1.11	SCALANCE X202-2P IRT (2BH00-2BA3)	Fiber optics	X1 P3	0.039	0.039	0.039	0.039	100
192.168.1.11	SCALANCE X202-2P IRT (2BH00-2BA3)	Fiber optics	X1 P4	0.039	0.039	0.039	0.039	100
192.168.0.1	SCALANCE XM408-8C (8GR00-2AM2)	Copper	S1/X1 P2	0.037	0.036	0.036	0.037	100

SINEMA Server inherently determines interface usage rates as well as performance and quality data. Among other things, it detects interface error rates and discarded data packets, which are indicative of errors in the network.

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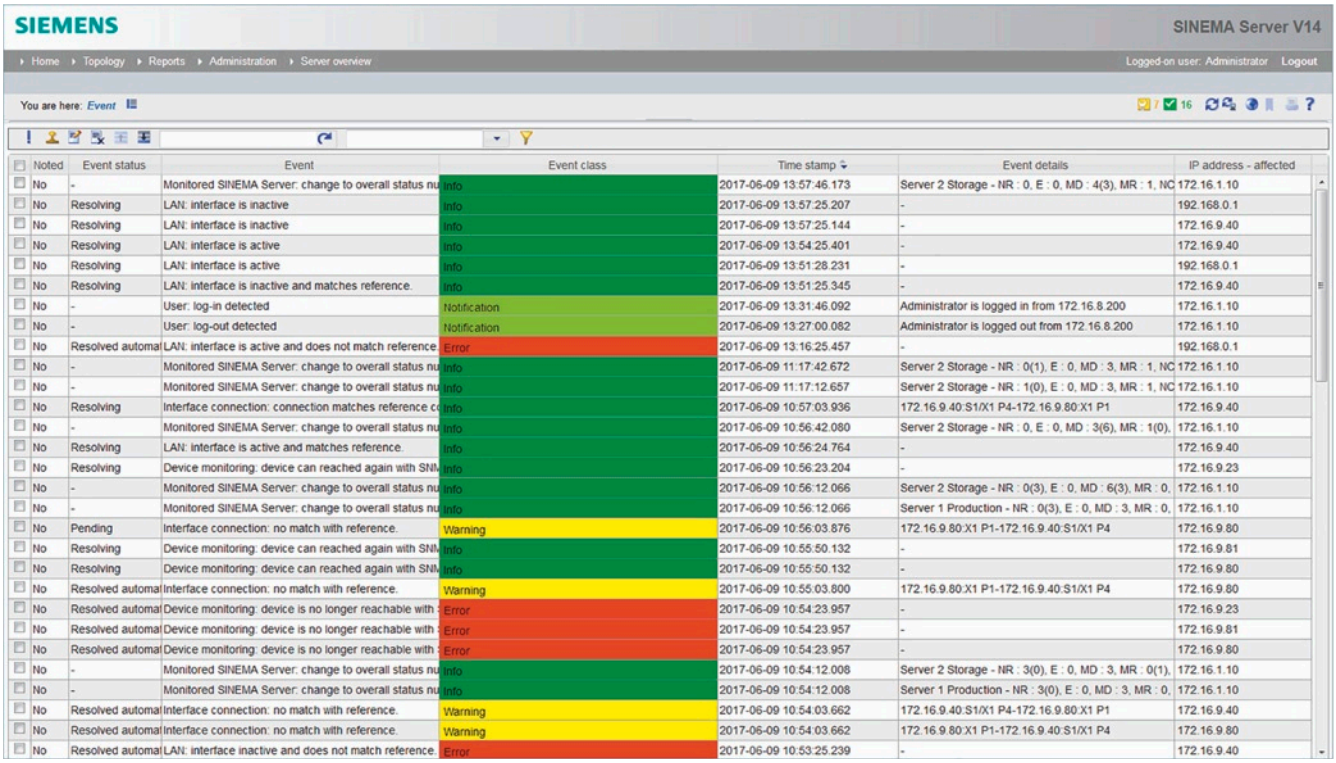

Noted	Event status	Event	Event class	Time stamp	Event details	IP address - affected
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 13:57:46.173	Server 2 Storage - NR : 0, E : 0, MD : 4(3), MR : 1, NC	172.16.1.10
No	Resolving	LAN: interface is inactive	Info	2017-06-09 13:57:25.207	-	192.168.0.1
No	Resolving	LAN: interface is inactive	Info	2017-06-09 13:57:25.144	-	172.16.9.40
No	Resolving	LAN: interface is active	Info	2017-06-09 13:54:25.401	-	172.16.9.40
No	Resolving	LAN: interface is active	Info	2017-06-09 13:51:28.231	-	192.168.0.1
No	Resolving	LAN: interface is inactive and matches reference.	Info	2017-06-09 13:51:25.345	-	172.16.9.40
No	-	User: log-in detected	Notification	2017-06-09 13:31:46.092	Administrator is logged in from 172.16.8.200	172.16.1.10
No	-	User: log-out detected	Notification	2017-06-09 13:27:00.082	Administrator is logged out from 172.16.8.200	172.16.1.10
No	Resolved automa	LAN: interface is active and does not match reference.	Error	2017-06-09 13:16:25.457	-	192.168.0.1
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 11:17:42.672	Server 2 Storage - NR : 0(1), E : 0, MD : 3, MR : 1, NC	172.16.1.10
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 11:17:12.657	Server 2 Storage - NR : 1(0), E : 0, MD : 3, MR : 1, NC	172.16.1.10
No	Resolving	Interface connection: connection matches reference c	Info	2017-06-09 10:57:03.936	172.16.9.40:S1/X1 P4-172.16.9.80:X1 P1	172.16.9.40
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 10:56:42.080	Server 2 Storage - NR : 0, E : 0, MD : 3(6), MR : 1(0),	172.16.1.10
No	Resolving	LAN: interface is active and matches reference.	Info	2017-06-09 10:56:24.764	-	172.16.9.40
No	Resolving	Device monitoring: device can reached again with SNI	Info	2017-06-09 10:56:23.204	-	172.16.9.23
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 10:56:12.066	Server 2 Storage - NR : 0(3), E : 0, MD : 6(3), MR : 0,	172.16.1.10
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 10:56:12.066	Server 1 Production - NR : 0(3), E : 0, MD : 3, MR : 0,	172.16.1.10
No	Pending	Interface connection: no match with reference.	Warning	2017-06-09 10:56:03.876	172.16.9.80:X1 P1-172.16.9.40:S1/X1 P4	172.16.9.80
No	Resolving	Device monitoring: device can reached again with SNI	Info	2017-06-09 10:55:50.132	-	172.16.9.81
No	Resolving	Device monitoring: device can reached again with SNI	Info	2017-06-09 10:55:50.132	-	172.16.9.80
No	Resolved automa	Interface connection: no match with reference.	Warning	2017-06-09 10:55:03.800	172.16.9.80:X1 P1-172.16.9.40:S1/X1 P4	172.16.9.80
No	Resolved automa	Device monitoring: device is no longer reachable with	Error	2017-06-09 10:54:23.957	-	172.16.9.23
No	Resolved automa	Device monitoring: device is no longer reachable with	Error	2017-06-09 10:54:23.957	-	172.16.9.81
No	Resolved automa	Device monitoring: device is no longer reachable with	Error	2017-06-09 10:54:23.957	-	172.16.9.80
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 10:54:12.008	Server 2 Storage - NR : 3(0), E : 0, MD : 3, MR : 0(1),	172.16.1.10
No	-	Monitored SINEMA Server: change to overall status nu	Info	2017-06-09 10:54:12.008	Server 1 Production - NR : 3(0), E : 0, MD : 3, MR : 0,	172.16.1.10
No	Resolved automa	Interface connection: no match with reference.	Warning	2017-06-09 10:54:03.662	172.16.9.40:S1/X1 P4-172.16.9.80:X1 P1	172.16.9.40
No	Resolved automa	Interface connection: no match with reference.	Warning	2017-06-09 10:54:03.662	172.16.9.80:X1 P1-172.16.9.40:S1/X1 P4	172.16.9.80
No	Resolved automa	LAN: interface inactive and does not match reference.	Error	2017-06-09 10:53:25.239	-	172.16.9.40

SINEMA Server recognizes these errors for every single PROFINET port of the monitored devices, archives them in its event database and clearly visualizes them in table form.

Professional Services: Comprehensive support in all aspects of industrial communication networks

Together with Siemens Solution Partners experienced in industry sectors and IT, Siemens offers coordinated Professional Services. The basis for a successful brownfield project includes a site inspection and analysis of already existing network structures, if necessary, also with radio coverage examination to eliminate interferences. This results in a specific documentation with recommendations for the implementation. On request, experienced specialists advise on the design of the LAN and WLAN network infrastructures and mechanisms, and also provide the commissioning as well as the optimization on-site.

This speeds up the implementation and enables a know-how transfer to the user. Furthermore, various standard and customized training courses impart product and network knowledge. The user also obtains full project transparency as well as adherence to schedules when project coordination is assigned to the network supplier.

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