VORTEX

ABRIDGED INDUSTRIAL NETWORK SUPPORT REPORT

2021

EN

PREFACE

Availability – Is It a Matter of Course, a Feat, or an Ongoing Process?

Dear Customers,
Dear Business Partners,
Dear Potential Customers,

Have you ever observed our teenagers today when “the Wi-Fi is down” all of a sudden? We have been able to watch a panicked reaction quite similar to that one around the toilet paper shelves when it became apparent that some stores would have to close for a while. An item that costs no more than a few cents and seemed to be incapable of running out in the store or on the loo suddenly turned into a precious commodity – never mind its status as “essential goods”.

These changes were also evident for paper-roll manufacturers as permanent full utilisation of their production capacities was required virtually over night. The demand might even have justified production capacity increases in many a company. About three weeks after the first lockdown commenced in the spring of 2020, Indu-Sol received its first emergency call from a toilet paper manufacturer. Its plant had stopped. The automation system needed to be repaired in a feat of strength.

This exemplary incident suddenly highlighted the essential position of yet another element doomed to exist in the shadows under normal circumstances: the network. While machines and plants are running and production is not utilised to capacity, no one tends to care about it. It's just assumed to be available. Isolated network-related incidents are acknowledged, and minor interruptions are tolerated. An availability of 80% seems sufficient and acceptable. The toilet paper example shows, however, how quickly the tide can turn, and why network availability should be scraping 100% as closely as possible by default. Anyone who has ever contracted a stomach bug (which tends to happen quite suddenly and unexpectedly) will remember their gratitude when they had more than a single roll with three sheets remaining on it at home...

We have prepared some other lessons learned from the year of 2020 in metrological terms on the following pages.

With kind regards, and wishing you enough toilet paper on the roll at all times, I remain

Yours, René Heidl,

Managing director for technology & support
Indu-Sol GmbH

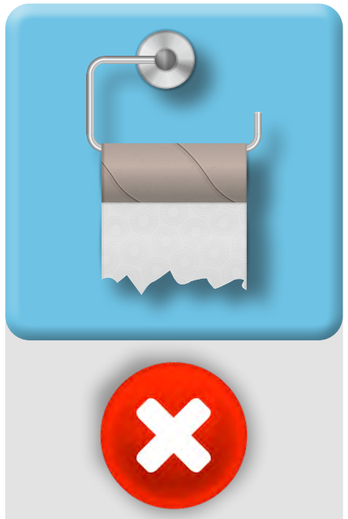
BUFFERS ARE KEY!

Network and Toilet Paper – Virtually Unnoticed and Yet Essential

When production utilisation needs to be ramped up quickly and stay at 100% of capacity permanently, strain on the network becomes evident as well. Anyone entering this extreme situation with an 80% availability buffer or less does so accepting needless competitive disadvantages. However, while the spare stocks are easily evident in the case of the toilet paper roll, networks require visualisation by way of a monitoring system. Let us show you a slightly frivolous comparison below.

100% reserve – you're ready to face any situation!

Your reserve feels alright, but if the demand were to increase suddenly (market change or stomach bug), it would quickly reach its limit.



The sudden demand increase cannot be served since there are not enough spare units in stock, leading to a loss of comfort or turnover that could have been avoided.

HELP FROM AFAR

The Rise of Remote Diagnosis – Reaching the Network through the Virtual Tunnel

What to do if troubleshooting or (regular) inspection measurements in the network are due, but no measuring engineer is available right then? For several years, companies have been technically able to give an external service engineer secure access to diagnostic data (if available) by way of a VPN tunnel (VPN = Virtual Private Network). However, this option was virtually never used in the past. It was subject to great security concerns and it seemed too convenient to have the service engineer physically travel to site even if it required more time and was subject to needlessly high costs.

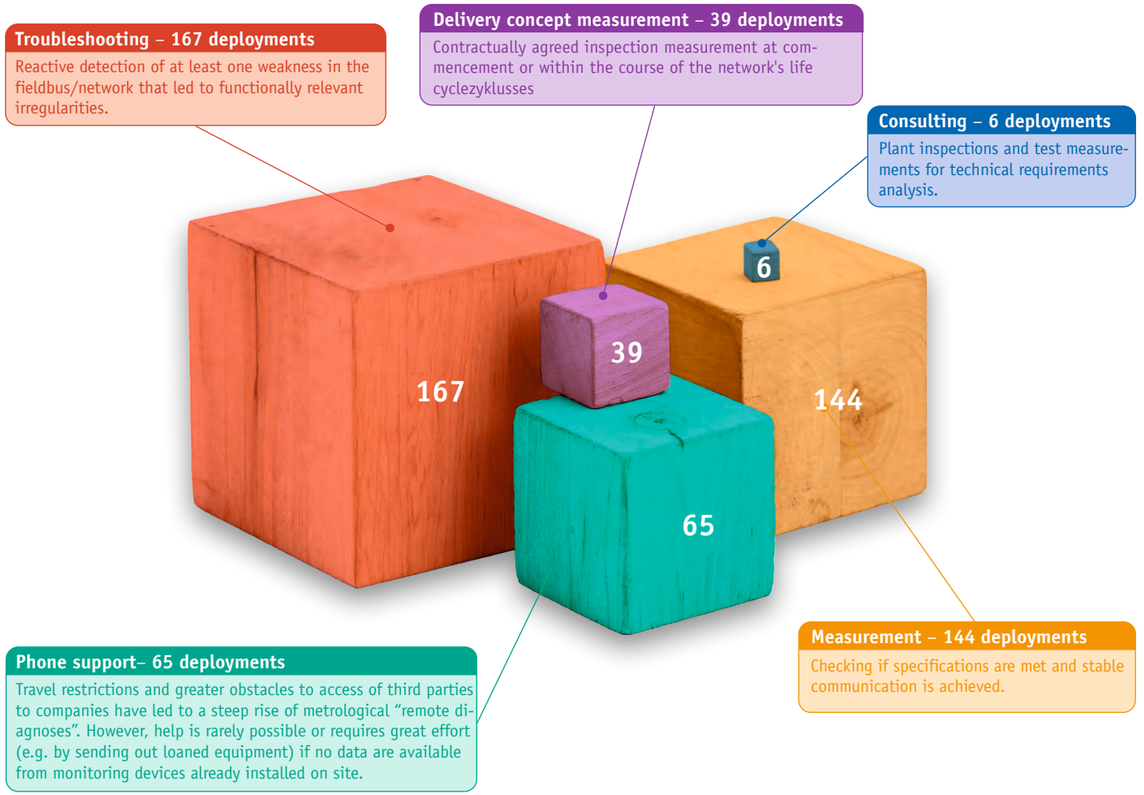
The security situation has not changed at all, but the pandemic has brought travel and access restrictions for external companies in 2020, inevitably changing the perception of remote access to internal networks by external partners within companies. Safety-relevant incidents have not become known yet. Every single time, however, the customer could be helped comparatively quickly.

If current and historical diagnostic data were available from a monitoring system already installed on site as well, many deployments could be completed remotely, increasing efficiency for the customer and the service provider alike. These observations suggest that remote access will be granted to external partners more frequently or more extensively in the future than it was before. For an interesting example from practice, see pages 10/11.

CHART

Distribution of Deployment Types

Indu-Sol measuring engineers were deployed to verify communication quality in the fieldbus or network on the customer's behalf a total of 421 times in 2020.



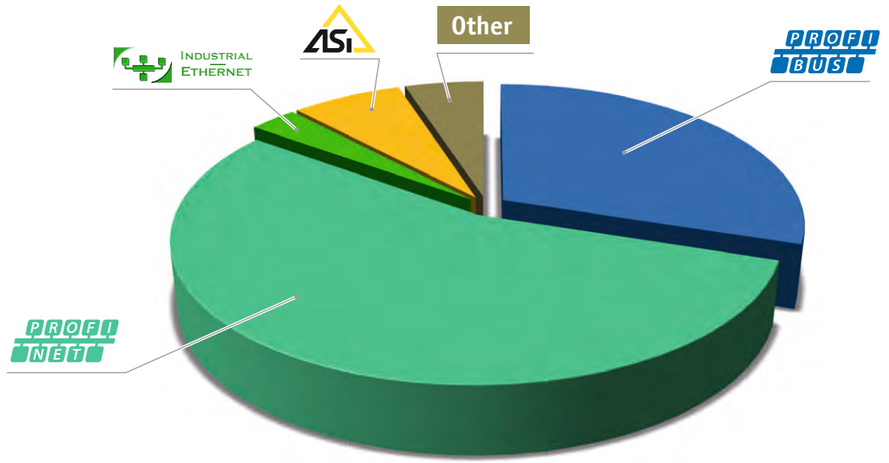
DEPLOYMENT DISTRIBUTION CHART

Measuring Methods Determine Remote Feasibility: The PROFINET Advantage

As already explained on pages 4 and 5, the pandemic rendered on-site measurements much less possible in 2020 than they used to be in the years before. This led to a lower number of PROFIBUS and EMC measuring deployments than in “regular years”. EMC, for example, has become insignificant in frequency in the table on page 7. PROFIBUS hardly permits precise diagnosis of the reasons for impaired data communication using nothing but logic analysis that is possible via remote access. Since all participants communicate on the same line, it is difficult to tell where the damaged telegram that reaches the master broke on its way. Issues for EMC analysis are even greater: Analogue measuring devices on site are vital for measuring impedances and shield currents on individual line sections. At least, there are some current meters that can measure shield currents on different sources in parallel.

Experience in PROFINET networks, on the other hand, has shown that poor data transmission quality usually has some logical causes. As a result, it can be determined quite well by reading out the diagnostic data from switches (provided that managed switches are installed) or a corresponding monitoring system. EMC analysis and even line diagnostics can be performed with a simple click, using switches with the corresponding function and avoiding any additional meters with their associated effort by now.

Reasons for Customers Placing Measuring Orders with Indu-Sol



	2015	2016	2017	2018	2019	2020
PROFINET	28%	32 %	36 %	38 %	37 %	55 %
PROFIBUS	55 %	49 %	45 %	43 %	43 %	30 %
ASi	5 %	5 %	5 %	3 %	3 %	7 %
Industrial Ethernet	0,07 %	0,2 %	0,3 %	4 %	5 %	3 %
Other	5 %	4 %	3 %	4 %	6 %	5 %

ERROR CAUSES

Clear Communication: The Network as the Tower of Babel

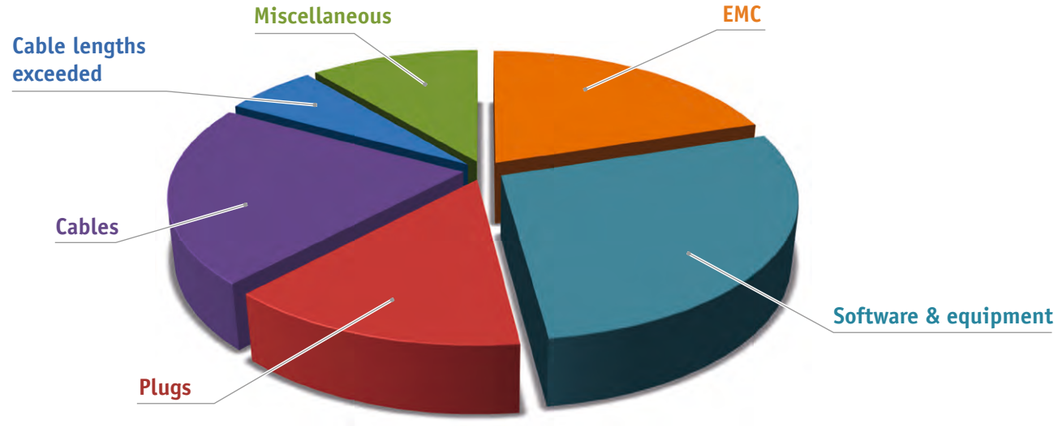
Some inexplicable gaps in the historical record mean that we will never learn whether industrial networks were already known in ancient Babylon or not. However, the biblical legend of the Tower of Babel symbolises the relevance of flawless communication for a complex project's success. Even the smallest flaw in the exchange of information may create a domino effect that causes everything to collapse. Measurement deployments reveal such intricacies in industrial networks.

The proportion of vulnerabilities found in the logical area can be expected to show the highest figures due to the increase in remote diagnostics as explained on the previous pages. This is compounded because existing networks keep “ageing”. Their devices lose functional efficiency due to their long operating times, and due to incompatibilities caused by multiple software and firmware versions. The latter reason was and remains needlessly frequent. Line issues, the second-most frequent cause in the past year, show that dispensing with line tests comes at a risk. Let us also mention that although EMC was initially suspected as the cause in a considerable share of the deployments, it was only identified as such in one fifth of all cases.

Poorly assembled or defective connectors must be kept in mind as an avoidable cause of communication errors, just as compliance with assembly and installation guidelines, e.g. concerning cable lengths.

CHART

Typical Error Sources in Measuring Deployments



	2015	2016	2017	2018	2019	2020
Software & equipment	21 %	20 %	16 %	4 %	13 %	28%
Cables	15 %	14 %	31 %	28 %	18 %	21%
EMC	36 %	24 %	23 %	20 %	15 %	20%
Plugs	11 %	18 %	20 %	30 %	18 %	14%
Cable lengths exceeded	4 %	9 %	4 %	10 %	4 %	6%
Miscellaneous	13 %	15 %	6 %	8 %	32 %	11%

OUTLOOK

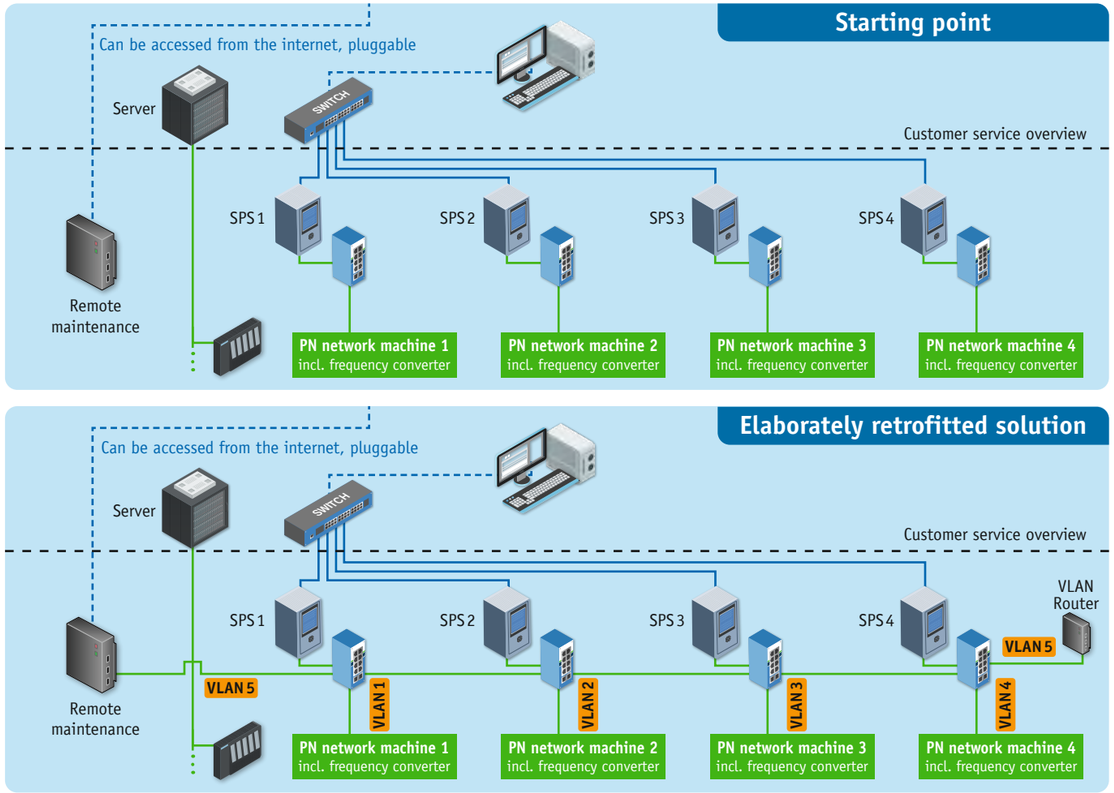
Case Study: Homogeneous, Separate Machine Networks are Disappearing

Physically separate networks are still frequently installed today, even in PROFINET- or Ethernet-based systems, for reasons of safety and avoidance of issues with double addressing. However, the example of a mechanical-engineering company that contacted us reflects their limited capacities in practice: The manufacturer of the frequency inverters installed in each machine network (see figure at the top of p. 11) needed remote access to the devices for reading the operating status and setting parameters. In the above starting position, this required four access points, i.e. one per device, due to the physically separated networks. The networks were first physically connected to each other and logically separated by means of VLAN. This did nothing to resolve the issue of needing four remote maintenance access points. Eventually (see figure at the bottom of p. 11), a VLAN router had to be installed. At least the current solution lives up to the highest demands to availability and security alike.

Nevertheless, this shows that physical separation of networks is becoming less and less appropriate. Logical separation combined with conscientious planning enables a justifiable “opening” of the internal system architecture to the outside. However, since this example was lacking in the planning stage, great effort was required in day-to-day operation and personnel resources had to be brought in from other points. The corresponding simulation software can help avoid such expensive subsequent retrofits from the beginning. Find a planning example here: www.indu-sol.com/en/pnp2-vlan.

PRACTICE TOPOLOGY

Secure Remote Access and Stable Operation: Logical Separation via VLAN



Initially not desired, but eventually added in an expensive retrofit that is at least secure and highly available: four homogeneous, physically separated PROFINET networks (top) were turned into a single heterogeneous network logically separated by a VLAN router (bottom).

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