



VORTEX



ABRIDGED INDUSTRIAL NETWORK SUPPORT REPORT

2022

PREFACE

Evolution instead of a dent: Networking changes the rules of the game

Dear Customers,
Dear Business Partners,
Dear Potential Customers,

after a brief low in 2020, the German economy is up and buzzing again. It has even exceeded the result from 2019 in 2021 already. Many companies exclude 2020 as an outlier caused by force majeure when looking at their business performance. Does this apply to the world of industrial networks as well? Certainly not!

The measurement engineers at Indu-Sol GmbH have been in action more than 400 times in each of the past three years to answer the calls of our customers for evaluation of the communication quality in their field buses or networks by measurements. They keep on producing, even in times of supposed crisis!

Isolated, "strict" automation networks are growing increasingly rare in the deployments of Indu-Sol measurement engineers. Machines and plants are often a lot more networked than their operators realise today. Based on this insight, new service approaches have become evident in the discussion with Indu-Sol, permitting contemporary network management within the scope of an integrated view and/or a long-term support instead of strictly analysing the actual situation.

What does this mean for the planning and design of such networks?
What level of service do these heterogeneous, convergent structures

require? Why do the most critical cases always happen on Friday afternoons?

Find a summary of our answers to these and some other questions concerning the state of fieldbuses and industrial networks on the following pages. These results are based on data from 487 Indu-Sol measuring deployments in 2021 across virtually all sectors of the manufacturing industry as well as from the logistics and water/wastewater areas.

By the way: Homogeneous, heterogeneous, convergent – what are the differences between these network structures and how can they be managed? Have a look at our explanatory clip:
www.indu-sol.com/netzwerke-im-wandel

I remain, with best wishes for always-sufficient bandwidth

Yours, René Heidl,



Managing director for technology & support
Indu-Sol GmbH

WHAT IS YOUR TYPE?

Gazing into the crystal ball: The horoscope for service staff

Researching the causes of unstable communication conditions in industrial networks often is a bit like gazing into a crystal ball if there are no measuring or monitoring devices to visualise the condition. This issue is growing in importance as networking of machines and plants increases. What is your sign? What's in the stars for you here?



CHANGED DEMAND

Network support: Permanent symbiosis instead of ad hoc service

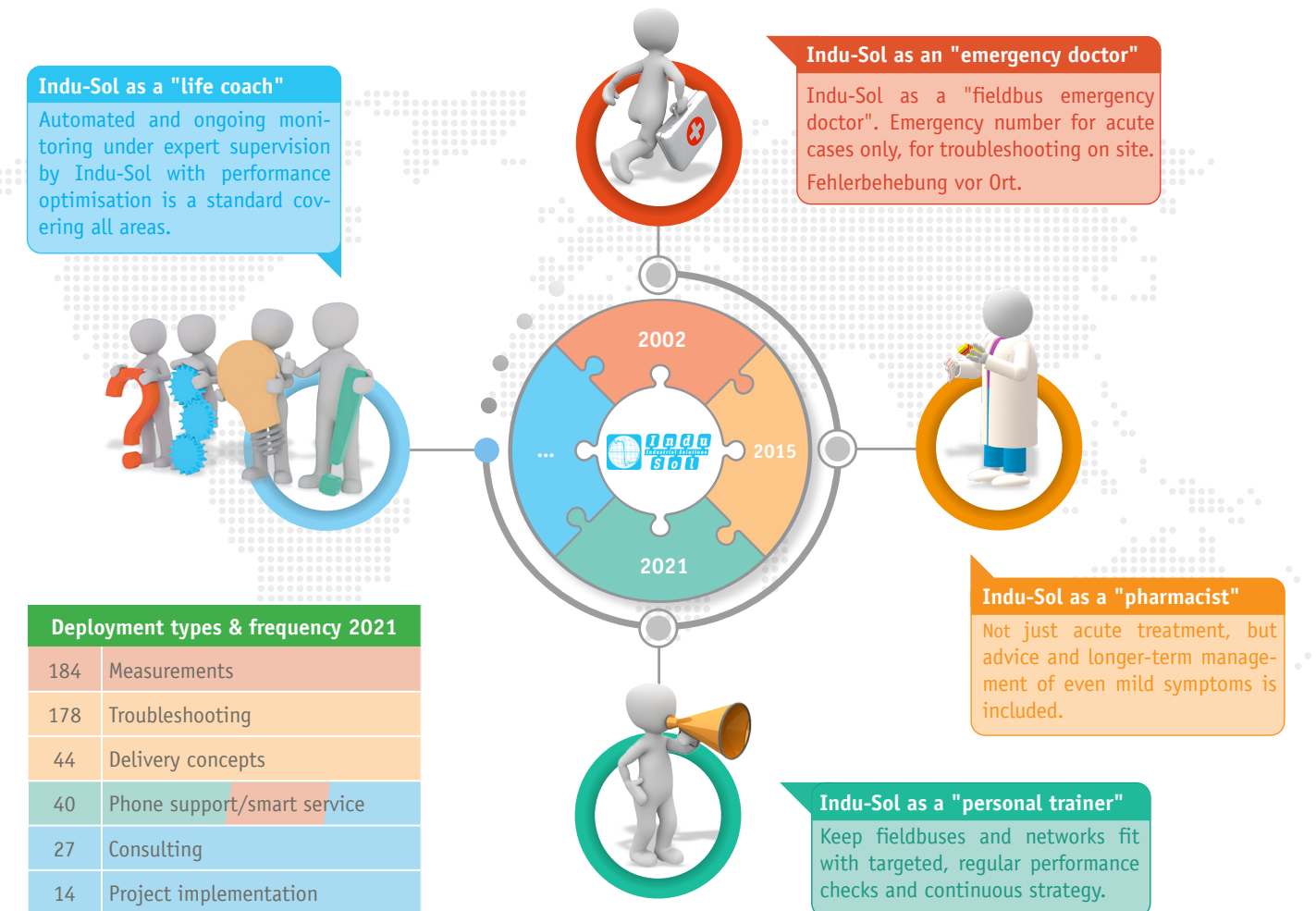
In 2002, the business activity of Indu-Sol GmbH started mainly as a "fieldbus emergency doctor", when interferences in the production process occurred that could not be solved with mechanical "cardiac massages". Technical progress, digitalisation, and global competition have strongly increased the degree of networking of machines and plants. Indu-Sol's knowledge of how to achieve permanently stable data communication has been incorporated into the network planning process at a very early stage, in particular in recent years. Has this increasingly diligent planning reduced the share of SOS deployments, however? Certainly not! "Age-related" signs of wear not only appear with PROFIBUS now; the first PROFINET systems are also getting on in years. Since they are a lot more convenient in terms of networking than PROFIBUS, the volume of data at a particular point in the network at time X cannot be predicted with certainty. You must keep an eye on parameters such as network load, discards, or jitter in order to identify load peaks and their causes.

Permanent condition monitoring for fieldbuses and networks is, therefore, indispensable to be able to provide needs-based service on the basis of historical and current diagnostic data – operators and, where applicable, external service providers benefit equally from this efficiency gain. In particular in light of the shortage of skilled workers that industrial companies are increasingly feeling – Apart from some notable parts of the automotive industry, barely anyone can do without external support anymore.

SERVICE-EVOLUTION

Distribution of Deployment Types

Customer demand for conceptual consulting services has risen sharply recently. Highly networked structures must be planned diligently and the data paths must be kept in mind. Indu-Sol's service offering has been changing in line with customer demand since its founding in 2002.



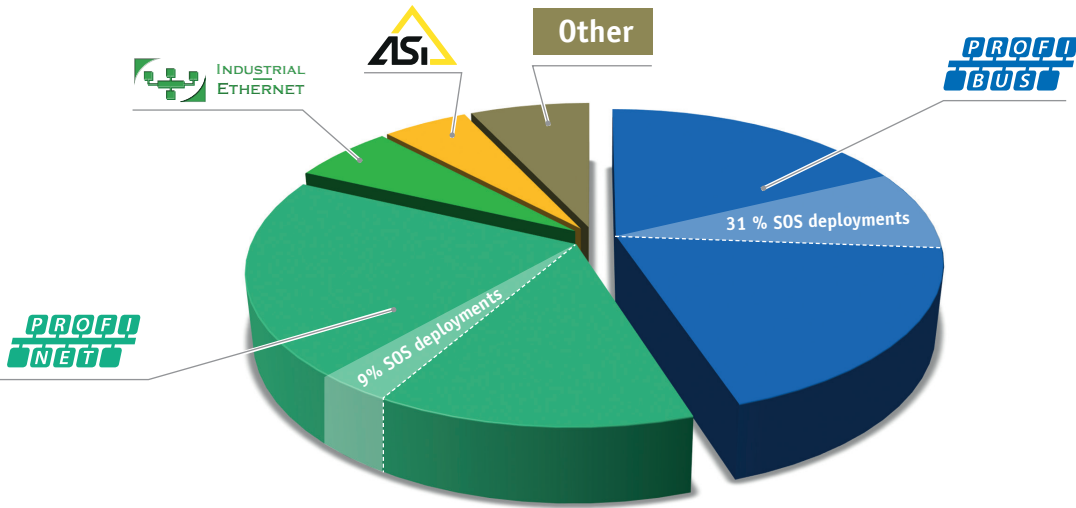
DEPLOYMENT DISTRIBUTION CHART

What to do when the trained ear has reached retirement age?

Ever since we started evaluating our measurement deployments in the VORTEX report on an annual basis, the share of deployments in PROFIBUS has kept reducing, while that in PROFINET has risen continuously. In 2020, PROFINET clearly predominated for the first time, not least due to its better remote diagnostics capabilities (see VORTEX, 2021, p. 6/7).

The proportions of 2021 are once again approximating now (cf. p. 7), though there is a noticeable difference: Less than every tenth PROFIBUS deployment is an SOS, while roughly every third PROFINET one is! At the same time, a great deal of this emergency assistance could be avoided by a robust, star-shaped structure and permanent BUS monitoring. Since the fieldbus condition cannot be perceived with human senses, it must be visualised using analogue-to-digital converters. The combination of decentralised data collectors and central monitoring software creates a digital twin of the BUS state. This allows automatic, objective, and permanent monitoring of the maintenance requirements by using plain-text diagnoses. The reports can be easily forwarded for internal/external evaluation as required. This relieves the technical service staff in the company of unnecessary work, avoids needless use of external service providers, and makes it possible to plan maintenance intervals based on condition. After all, skilled workers such as the maintenance worker at a steel mill in the far north, whom Indu-Sol met in 2005, are hardly available anymore: Lacking available measuring instruments, he had plugged in headphones to the Sub-D connector of his PROFIBUS for diagnosis, determining whether the BUS was alright or not based on the noise detected by hearing trained over the years!

Reasons for Customers Placing Measuring Orders with Indu-Sol



SOS

The average response for Indu-Sol measurement engineers to get to site to resolve acute interferences with a risk to operation in data communication is 2.3 days.

	2015	2016	2017	2018	2019	2020	2021
PROFINET	28%	32%	36%	38%	37%	55%	45%
PROFIBUS	55%	49%	45%	43%	43%	30%	37%
ASI	5%	5%	5%	3%	3%	7%	6%
INDUSTRIAL ETHERNET	0,07%	0,2%	0,3%	4%	5%	3%	5%
Other	5%	4%	3%	4%	6%	5%	7%

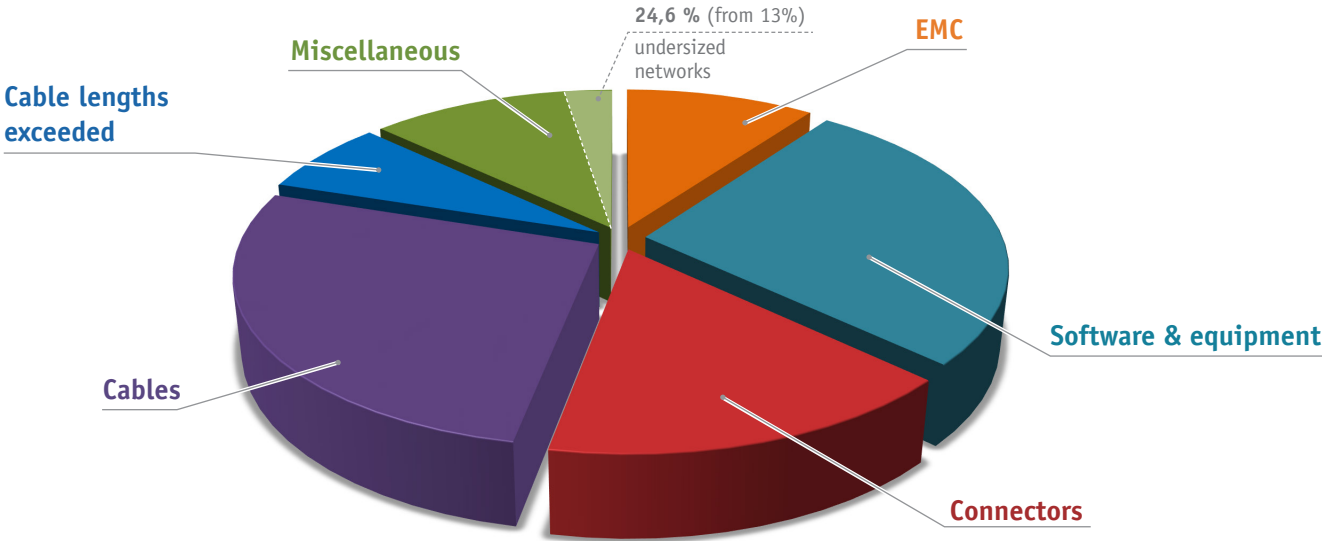
Better planning could avoid one in five measuring deployments

If most of a year's measuring deployments are centred on Ethernet-based networks, a high share of logical causes for poor communication quality is to be expected – devices and software were among the leaders once again in 2021 (cf. p. 9).

The success of years of lobbying by Indu-Sol, among other players, for the equipotential bonding that was passed down is clearly evident in the EMC area: The share of EMC in the interference causes has dropped from about a third to 10% over the years.

However, a new field is gradually opening up:
Monitoring or measuring data throughput increasingly reflects that networks are simply undersized, therefore lacking the physical requirements for the demands placed on them in terms of bandwidth (one in four "other" cases in 2021, see p. 9). This was already indicated in the review of the measuring deployments in 2019 (see VORTEX 2020, p. 8/9). As a result, the relocated network infrastructure often serves as the brake for digitisation projects. Appropriately designed, it would also offer the convenience of transporting data that are not directly required for the automation process (e.g. energy consumption, speeds), but is nevertheless essential for evaluating the TEEP or OEE. Together with excessive cable lengths and EMC, 20% of all faults found in 2021 are due to systematic, avoidable planning errors with effects that only become apparent in operation and have to be corrected at great expense.

Typical Error Sources in Measuring Deployments



	2015	2016	2017	2018	2019	2020	2021
Software & equipment	21 %	20 %	16 %	4 %	13 %	28 %	27 %
Cables	15 %	14 %	31 %	28 %	18 %	21 %	27 %
Connectors	11 %	18 %	20 %	30 %	18 %	14 %	16 %
EMC	36 %	24 %	23 %	20 %	15 %	20 %	10 %
Cable lengths exceeded	4 %	9 %	4 %	10 %	4 %	6 %	7 %
Miscellaneous	13 %	15 %	6 %	8 %	32 %	11 %	13 %

OUTLOOK

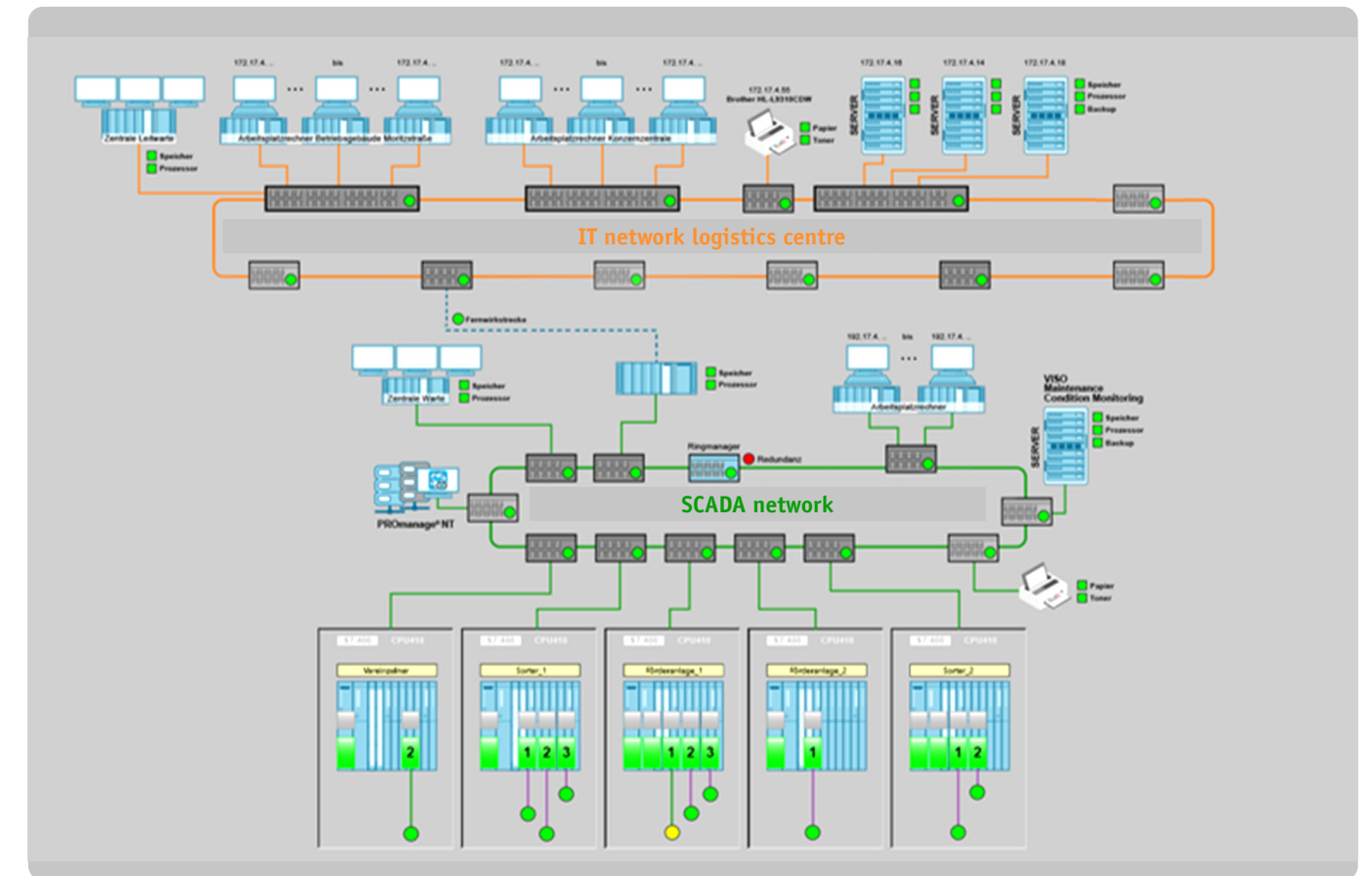
Networking, digitisation, remote maintenance: The rim of one's teacup

Associated automation networks are installed when new production facilities are built (greenfield projects). The immediate requirements for the automation process are often considered exclusively when dimensioning. This is why 100 MBit lines are usually laid at most for PROFINET. When the visualisation and condition monitoring experts then express their needs, the realisation often follows (too late) on site that capacity requires a "bypass" (= a separate network) for such tasks. This leads to: twice the infrastructure, twice the costs, and diagnostic messages that also need to be merged in a suitable manner. If you want to take maximum advantage of digitisation in industry, you can't get around eight-pole instead of four-pole lines for gigabit communication. After all: If an existing system has to be upgraded from 100 MBit to GBit (brownfield projects), the switches can be replaced comparatively quickly. Replacing cables across the board is a nightmare, however.

As described above in this report, customers increasingly demand that Indu-Sol not only deliver and install the network components, but also configure services such as the setup of diagnostic thresholds, connect alarm management to higher-level monitoring levels, and much else. As a result, it pays off if the network operation service partner is included in planning from the very beginning and, for example, brought together with the machine builder in order to save costs and conversion efforts in the long term.

PRACTICAL EXAMPLE

Integration of the reporting concepts of different networks into a central management



Customers increasingly require Indu-Sol to set up the logical separation of several linked networks via VLANs as a service. They request clear integration of the individual reporting concepts. You can see a successful practical example from the area of logistics here.



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More about Indu-Sol:

