

The needle in the Haystack

Industry 4.0 in focus

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Industry 4.0, Data Mining, Big Data, Cloud Computing: At the Sensor + Test 2015 exhibition, the magazine O+P spoke to Peter Scholz, Managing Director, imc Test & Measurement GmbH, and Martin Riedel, Head of Technical Product Marketing, imc Meßsysteme GmbH.

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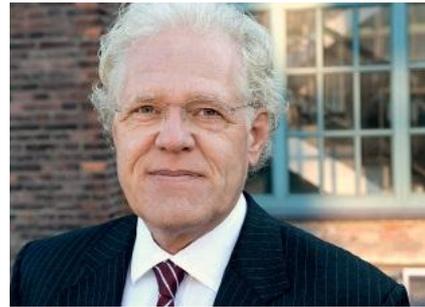
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Interview with Peter Scholz (imc T&M) and Martin Riedel (imc Meßsysteme GmbH)

In connection with the mega-topic “Industry 4.0”, you always hear the term Data-Mining. In your business, this has long been a regular occurrence. What is so special about this topic?

Peter Scholz: As test and measurement technology specialists focusing on data acquisition and processing, we have to face ever increasing demands and expectations. Until now, one of the main challenges was to be able to uniformly capture, save and display data from multiple sources. In a typical “Industry 4.0” environment, where everyone and everything is connected and able to communicate



and interact, this is already assumed as the precondition – just the starting point. Technically, there is hardly a limit any more in terms of speed, bandwidth or memory depth - Literally “Big Data”. The focus is increasingly shifting towards the challenge of interpretation: data mining in the sense of digging for valuable knowledge in these heaps of data. imc sees itself as a supplier of tools that systematically apply statistical methods to discover patterns in order to gain and convey technical knowledge and insight. Examples can be found in fields such as “Predictive Maintenance” or “Model Development from Experimental Data”.

Martin Riedel: This is also apparent when distinguishing between pre- and post-processing. In pre-processing, the focus is on data reduction and direct “feedback” from the measurement process: for this purpose, imc measurement systems perform data analysis in real time. Analysis results become available as “immediate results” – to be directly evaluated or even used for real-time control in the testing process. On the other hand, in post-processing, the manifold interrelations of a complex system under test, are often not even fully understood yet. Here, one would prefer to save the entire amount of available data, to be able to reveal any possible hidden information in later analysis – even to be refined in the future. Similar to data retention, one does not yet know all the relevant questions to ask, but nevertheless collects all available data to be prepared to answer them later when they arise.



To this end, we have created imc SEARCH: a database application for test and measurement that can efficiently structure and manage the accumulating masses of data (in the sense of Big Data). The imc FAMOS signal analysis software is then the perfect tool to precisely navigate, filter and access them: create smart links and efficiently analyze them to make maximum use of the information (in the sense of Data-Mining). This is how you can finally find the

infamous needle in the haystack, and even better: gain new insights and reveal relationships about the tested object or process that previously were “hidden” within the raw data!

Peter Scholz: Since database and signal analyses are particularly suited to the specific needs of the measurement technician, we consider this a breakthrough and indeed a genuine innovation: from data acquisition and management, to mathematical analysis, perfectly adapted visualizations and tools for systematic and automated Data-Mining.

Keyword Big Data: Collecting data is one thing, but preparing and interpreting them is another. How does one achieve manageable, usable results?

Martin Riedel: One achieves these results through the interplay of the tools mentioned above: with secure data recording by imc measurement modules or other measurement devices; adding meaningful descriptive information and attributes through the use of metadata; optimal pre-processing and data reduction, already in the acquisition device or the PC; structuring through customized database models and high-performance data management; systematic application of statistical methods (Data-Mining). Using the highly comfortable and efficient mathematical analysis tool, imc FAMOS, in conjunction with database-controlled data access, allows for intelligent search and filtering strategies leading to the desired goal.

Peter Scholz: We provide all equipment, tools and also experience and expertise in the form of our available services to move quickly and efficiently to beneficial results – thus, the term Big Data will not remain an end in itself and an empty buzz-word!

Measurement	Experiment	Files								
Page 1 of 1										
Name	Weather	temperature [°C]	Location	Braking_Distance [m]	Speed_Begin [km/h]	Braking_Time [s]	Speed_End [km/h]	Begin	End	Device_und
Meas 121	Rain	27.3	Berlin	358	80	12.35	20	6/18/2008 12:21:52 PM	6/18/2008 12:22:12 PM	-
Meas 126	Rain	27.6	Berlin	200	100	9.72	50	6/18/2008 12:45:20 PM	6/18/2008 12:45:40 PM	-
Meas 128	Rain	27.6	Hanburg	386	80	13.28	20	6/18/2008 12:57:04 PM	6/18/2008 12:57:24 PM	-
Meas 135	Rain	27.6	Berlin	306	100	9.8	50	6/18/2008 1:28:00 PM	6/18/2008 1:28:20 PM	-
Meas 136	Rain	27.3	Berlin	357	80	11.93	20	6/18/2008 1:32:16 PM	6/18/2008 1:32:36 PM	-
Meas 141	Rain	27.3	Hanburg	393	80	13.79	20	6/18/2008 1:55:44 PM	6/18/2008 1:56:04 PM	-
Meas 142	Rain	27.1	Hanburg	350	80	11.44	20	6/18/2008 2:00:00 PM	6/18/2008 2:00:20 PM	-
Meas 147	Mistr	27.7	Berlin	398	80	14.70	20	6/18/2008 2:26:40 PM	6/18/2008 2:27:00 PM	-
Meas 179	Mistr	27.5	Hanburg	179	80	12.35	20	6/18/2008 2:36:16 PM	6/18/2008 2:36:36 PM	-
Meas 205	Rain	27.2	Hanburg	200	100	9.65	50	6/18/2008 3:01:52 PM	6/18/2008 3:02:12 PM	-
Meas 206	Rain	27.1	Hanburg	381	80	12.88	20	6/18/2008 3:06:08 PM	6/18/2008 3:06:28 PM	-
Meas 211	Rain	27.1	Berlin	126	60	13.12	10	6/18/2008 3:31:44 PM	6/18/2008 3:32:04 PM	-

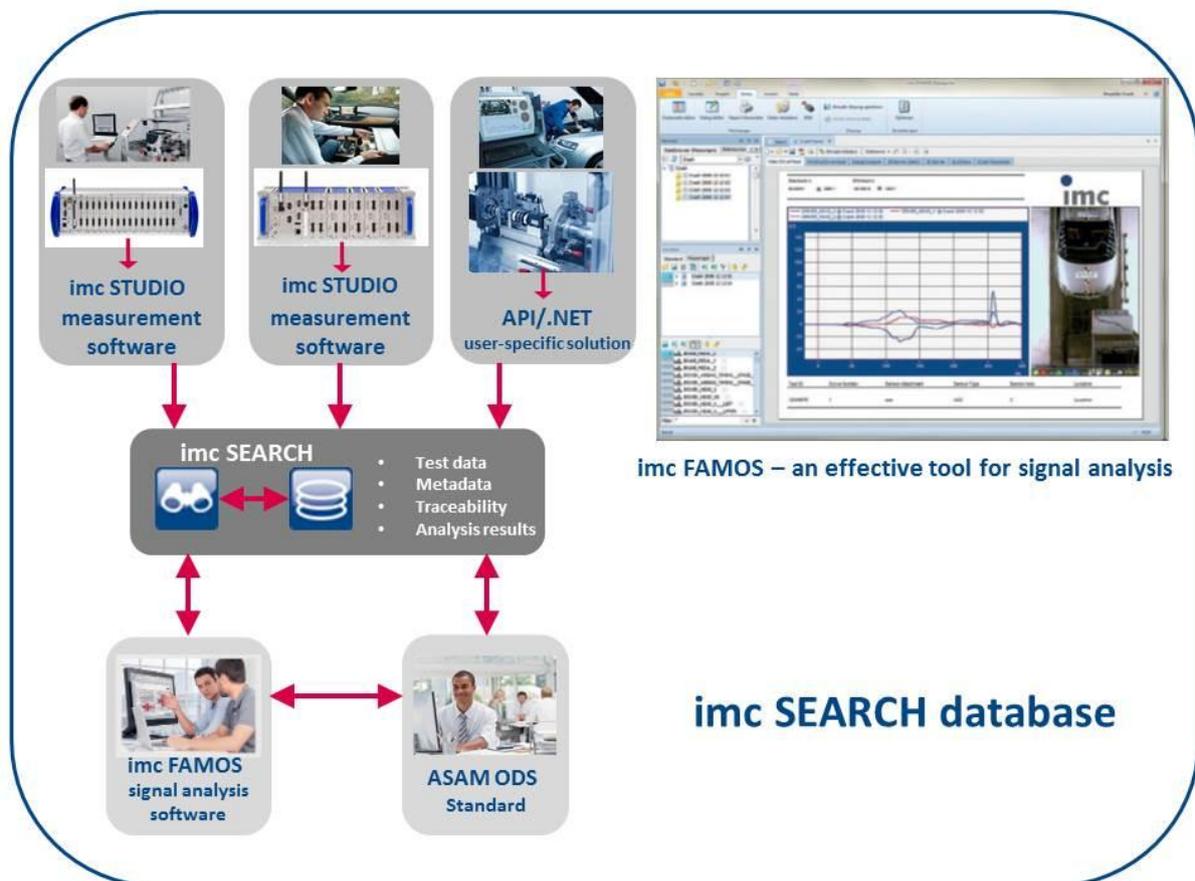
Conjunction	Attribute	Function	Parameter
AND	Measurement.Weather	<> (not equal)	Sunny
Condition	Measurement.temperature	> (greater)	32

Measurement data require a special measurement database

To program these algorithms, extensive knowledge from different fields is needed. What qualification must this programmer have?

Martin Riedel: The imc SEARCH measurement database is tailored to meet the needs of the measurement engineer or technician, and like the imc FAMOS signal analysis software, it is easy and intuitive to operate. Of course, for actual Data-Mining, specific statistical knowledge is necessary. But our goal, however, is that Data-Mining in test and measurement technologies should not just be limited to the IT and database specialists, mathematicians or statisticians. It is like one finds in other disciplines: methods alone cannot work miracles. Only when intelligent techniques are combined with profound application know-how about the actual origin and physical meaning of the measured data, can real substantial gains and new insights then arise. Typically, the test and measurement technician, together with the product specialist, yield this background knowledge when testing.

Peter Scholz: Our customers and end users typically have a background of mechatronics engineering and development. And when it comes to development of complex algorithms and methods, such services are often directly contracted to specialists like us at imc. We offer the appropriate experience and an interdisciplinary team of multiple engineering branches and IT specialists.



Are such personnel sufficiently available?

Peter Scholz: Yes and no! Here, large global corporations and small to middle-sized companies are different stories. Ideally, in larger companies, these tasks are handled by existing personnel who have extensive experience with test and measurement technology, that is, for example, with component or mobile testing. The employees of smaller companies are generally less specifically trained and don't deal daily with data analysis or method and algorithm development. This is where subtasks are often outsourced to external specialists like us.

Martin Riedel: Through the client-server approach to measurement database usage, an efficient distribution of tasks is supported: database systems and Clouds are precisely suited for environments where many dispersed users work together and coordinate with centrally managed data sets. This naturally promotes cooperation, in which some specialists are more concerned with the data acquisition and others deal with evaluation algorithms and share them.

Peter Scholz: It is generally quite true, however, that engineers are scarce, especially in the mechanical and electrical sectors. Career opportunities and salaries are high, but one must wonder, why there are so few young women taking an interest in such fields. Currently there is a fierce competition for the best brains and the graduates unfortunately often go in favor of well-known, large companies. But that's another topic.

Data security will certainly be one of the main issues related to Industry 4.0. What must the user be aware of from your point of view?

Martin Riedel: This is, of course, a central and controversial issue! Currently things are in such a state of flux, that even buzzwords that used to be cutting edge just yesterday, can get discredited very suddenly – and this can reverse directions just as easily... Political and technical developments are just too hard to predict right now. So consequently, the order of the day can only be: beware of overhasty decisions and judgements and go for maximum flexibility instead! Maintain several options and consider the legitimate security concerns of the user. Whether massive data exchange via internet and corresponding Cloud solutions will prevail or whether security aspects promote solutions where "Cloud" is rather a concept related to company intranets – both approaches are neither identified nor ruled out. It also depends on the different needs and priorities of the users. It is crucial, therefore, to offer uniform solutions that support both approaches equally and at any time can be flexibly configured and expanded in both ways – depending on which direction "Zeitgeist", trends and technical development are taking.

Peter Scholz: What is certain is that innovation and innovative leadership no longer pertains only to the product and its properties, but in addition, it also pertains to the fields of data and IT security. This is probably the greatest challenge for Industry 4.0.