

SiLA ANALYZED

SiLA'S INDUSTRY LEADING
DATA STANDARD EXPLAINED

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SiLA FOR SOFTWARE VENDORS

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R&D, manufacturing and contract research laboratories across many industries are increasingly looking to digitise their processes and operations, with the goal of achieving end-to-end connectivity and automation in the lab environment. Realising this vision hinges on the ability to connect hardware and software seamlessly across an enterprise, as well as connect with partners and service providers.

Part of the role of laboratory software suppliers in this global drive is to provide the tools and solutions that will help to facilitate effortless digitisation. Enabling software and hardware connectivity across the laboratory will also help to optimise laboratory workflows, and so increase the efficiency and productivity of their customers' businesses. Ultimately, digitisation and automation should minimise the need for time consuming, error-prone manual tasks and data handling, and thus ensure data integrity and security.

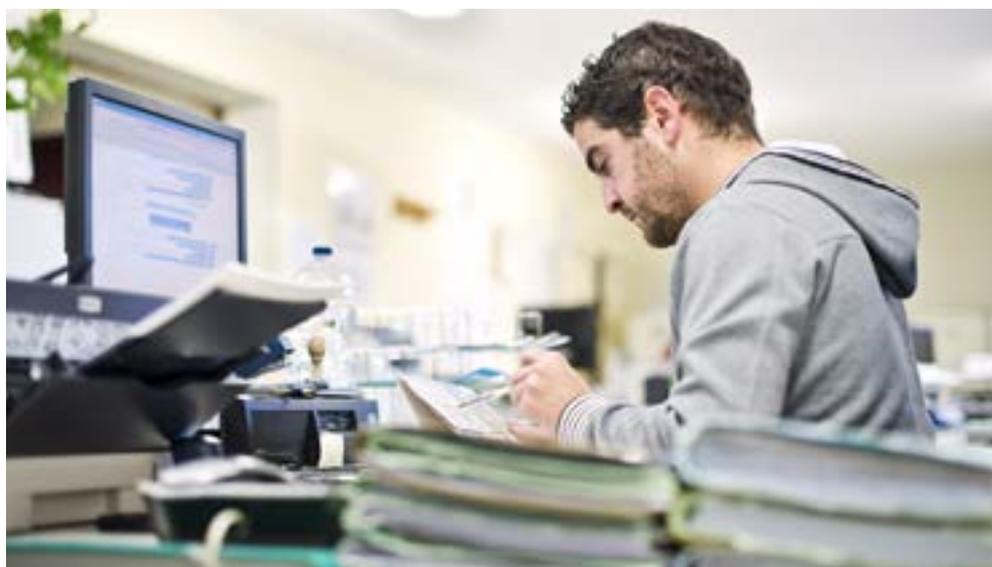
It seems reasonable that for their part, labs looking to acquire new software – say, a laboratory information management system (LIMS) or electronic laboratory notebook (ELN) – will select a package that satisfies a shopping list of must haves and desired features to support their end goals. But while a particular software solution may seem ideal at face value, in practice, realising its full worth might be challenging if the software can't be integrated within the ecosystem of instrumentation and other digital packages that are already in place.

THAT LAST MILE ...

At ground level, software integration can be a major, and expensive headache with re-

spect to resources, time, and money, both for the vendor and the lab. "And for the customer, the potential hurdles associated with

noted, "For scientists and other end users, integration issues can result in punctuated workflows, and impact on data quality,



« A SHOPPING LIST OF SOFTWARE MUST-HAVES AND DESIRED FEATURES. »

integrating software into an existing lab environment can have a very real impact on purchasing decisions," suggested Burkhard Schaefer, head of partner management at the non-profit SiLA (Standardization in Lab Automation) consortium. As Schaefer noted, when standard protocols for communication are not used, "It's that last mile to the instrument that becomes the real hurdle."

At the level of shopping for software, ease of integration should thus be high on the list of requirements, especially if that the software is to be connected to other digital tools and multiple pieces of hardware. Schaefer

management and utility. So when software and instruments can't communicate, the workflow essentially stalls, resulting in the need for manual data entry, retrieval and transfer, to bridge the gap."

THINK ABOUT DATA INTEGRITY

Human data input and handling introduces the risk of unintentional errors. At their most innocuous, such errors might mean a few minutes delay while someone backtracks to correct a mistake. "More critically, the very fact of manual data entry – and the errors that will at some stage inevitably occur – can

undermine experimental or test processes, leading to lengthy delays, skewing results and analyses, and potentially compromising data integrity," Schaefer suggested. And for regulated industries, data integrity issues can lead to questions during audit. A serious breach of data integrity may ultimately result in hefty fines, and potentially even close a facility until the issues are corrected^{1,2}.

"One workaround, when implementing software that can't naturally communicate with the existing infrastructure, is for an organization to build a custom interface between the software and the rest of the laboratory environment," Schaefer acknowledged. "But this may mean bringing in expertise from outside, which, again can delay implementation, and incur significant expense. When software and hardware speak different languages, achieving integration can necessitate complex configuration and/or the development of new drivers and interfaces, which can delay software implementation and rollout, and result in headaches for both vendor and customer."

MISSED REVENUE OPPORTUNITIES

Having to tailor an integration fix or generate new drivers/interfaces can result in missed revenue opportunities for instrument vendors as well as software vendors. "Software vendors may find a potential purchase of their platform sidelined because of connectivity hurdles, or the customer may adopt the software and focus on integration, but then have to hold back on instrument investment while they do so. It happens all the time," Schaefer stated.

Solving connectivity issues effectively ties up resources and staff, and ultimately, sales can then suffer. Schaefer continued, "A software vendor wants to sell licenses. That's what brings money into the bank. But if they have to deliver a hefty level of professional services together with that license, then what might start out as a seemingly profitable cash cow will ultimately slow them down." Repeat this process many times and integration issues may tie up resources to the point that it ultimately puts a cap on revenues and growth.

For labs that carry out multiple different, or complex workflows, the situation can be further complicated if connecting each

piece of software and hardware then requires a different interface/driver. Schaefer continued, "For LIMS and ELN vendors, for example, a key pain point is the need to build and maintain a library of potentially hundreds of drivers, adapters, or connectors, to interface with any of the global marketplace of instruments that a customer may have in their lab. It's simply not sustainable from the perspective of cost, or development effort, or maintenance."

A STANDARD COMMUNICATION PROTOCOL

These integration issues can be addressed by supporting a standard protocol for software and hardware communication. To this end, the SiLA consortium includes thousands of software and instrument developers, end-users and collaborators. The members are all effectively working together to develop a standard, open communication framework for the exchange, integration, sharing, and retrieval of electronic laboratory information. Daniel Juchli, chief technology officer for the SiLA consortium,

The SiLA (Standardization in Lab Automation) organization's vision is to develop the tools that drive laboratory interoperability, flexibility and resource optimization for instrument integration and software services.

SiLA's mission is to future-proof laboratory and instrument harmonization, through the development and adoption of future-proofed, standardized communication protocols and content specifications, which enable open, plug-and-play connectivity for lab automation.

Services that support SiLA 2 all communicate using the same open protocol that is built on cutting-edge web technologies, and which doesn't require complex configuration or customization.

The license-free SiLA 2 standard offers a framework for the secure, traceable exchange, integration, sharing and retrieval of electronic laboratory information. SiLA 2 allows users to discover and interact with different services in the lab. These services may be instruments or other systems.

SiLA 2 specifies interoperability schemes that allow laboratory devices and services to communicate with each other. SiLA 2 is founded on HTTP/2, an Internet Engineering Taskforce (IETF) standard, as a fundamental layer that represents device behaviour. Based on proven Internet-of-Things (IoT) / Lab-of-Things standards, SiLA 2 is a configurable protocol that is easy to implement, and offers a service-oriented, modular architecture focused on features and services – not on devices.

User friendly, and simple to understand, SiLA 2 is founded on the premise of easy accessibility for all end users, from software programmers to scientists. There is no barrier to adoption, whether the lab is a small, standalone site operating in a niche space, or operates in an environment that is part of a large multinational, or SME.

While SiLA provides web service-based communication standards for interfacing with instruments, AnIML (Analytical Information Markup Language) specifies an open source, XML-based standard data format for managing, and communicating analytical data. AnIML provides the data format to plan and document lab experiments.

The partnership between SiLA and AnIML is pioneering a new ecosystem that will enable end-to-end integration of instrument control, data capture, seamless connectivity through laboratory information management system (LIMS) and electronic laboratory notebook (ELN) platforms that orchestrate and underpin laboratory operations.

For further information, please go to https://sila2.gitlab.io/sila_base/

explained, “SiLA is an open communication protocol that allows software and instruments to talk to each other and deliver instructions and commands, using a common language, and without the need to configure custom drivers, or punctuate that workflow with manual data input. SiLA is a free and open standard, built using a message-driven architecture based on HTTP/2, so it supports data delivery and management to and from a diverse range of laboratory instrumentation.”

SiLA thus represents a key – though not the only – piece of the overall lab integration solution. “Enabling end-to-end lab interconnectivity and hands-off data management requires the marriage of a proven communication standard – such as SiLA – with support for a similarly open, robust data standard, such as AnIML, [Analytical Information Markup Language],” Juchli continued. “So while SiLA is a standard protocol for instruments and software to talk to each other, AnIML has been developed as an open, XML-based human-readable data standard for managing all experimental data, results, and measurements, generated by these instruments and software.”

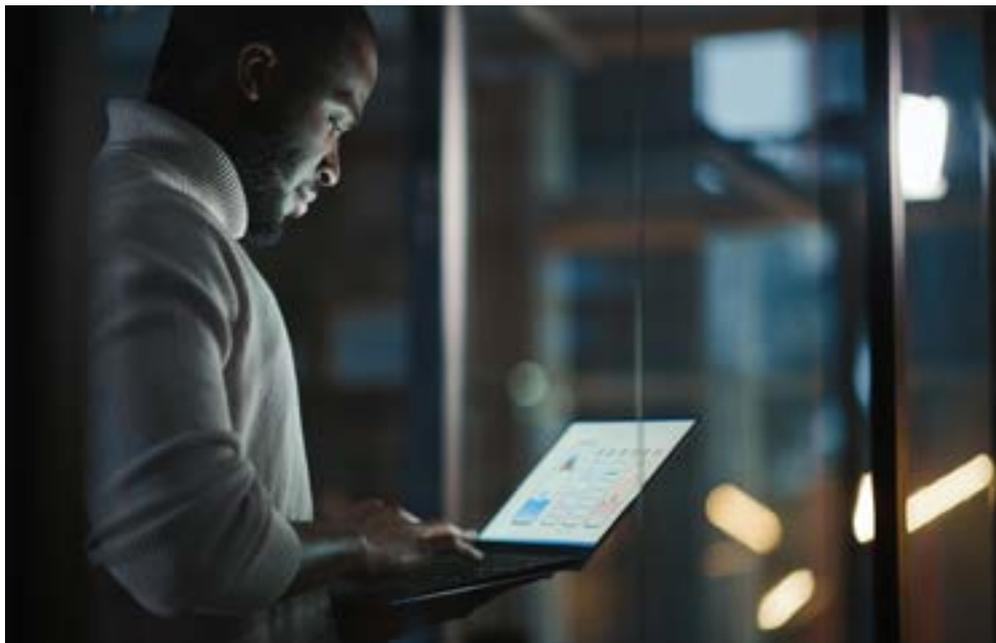
SILA IN THE REAL WORLD

For some software vendors the adoption of one standard has highlighted the need and benefits of adopting the other. “LabWare first embraced support for the AnIML data standard two years ago,” explained Jim Brennan, technical sales specialist at LabWare. “We quickly realised that AnIML represents a fantastic mechanism for handling and archiving data, and simplifying the lab’s interaction with instruments and the data that comes out of that instrumentation. But labs are increasingly focused on interoperability, as well as on interconnectivity. So while AnIML represents a great file format for data, it’s not the whole solution. Adopting SiLA in parallel with AnIML means we now also have a robust communication protocol for a standardized, automated, data-driven lab.”

This brings us back round to the concept of ultimately removing the need for manually keying in instructions, or accessing and reporting results, and letting laboratory software systems and equipment talk to each other, collect, collate, and transfer data. “Reducing the need for manual data entry and

file transfer doesn’t just reduce the likelihood of human error, it frees up scientists’ time to focus on scientific tasks,” Juchli commented. “Your LIMS and ELN can then represent the laboratory hub for orchestrating those tasks that are, at the end of the day, ideally suited to automation, whether it is requesting samples from freezers, or scheduling a test run or instrument calibration.”

collaborators within the SiLA initiative has resulted in the release of a cloud extension for SiLA 2, which gives labs the freedom to connect software and instrumentation that previously may have been locked into a closed lab environment, with remote or cloud services. SiLA 2 support for standardized cloud connectivity means organizations can collaborate, and embrace the power and opportunities of cloud services, IoT connectivity, and that Lab 4.0 vision.”



« DEVELOPING SILA AS A KEY ENABLER FOR END-TO-END, VENDOR AGNOSTIC LAB CONNECTIVITY. »»

A KEY ENABLER

SiLA has been developed as a fundamental tool that will make it possible to realise seamless lab- and enterprise-scale software and instrument connectivity, on a vendor-agnostic basis, both within labs and across an enterprise. “SiLA can be thought of as a key enabler for future focused ‘internet of laboratory things,’” Brennan noted. “It will ultimately facilitate digital transformation through a standard communication platform between remote Bluetooth- WiFi and cloud-connected systems, software and instrumentation.”

Mike Groezinger, CEO at Constance, Germany-based Siobra, expands on this further. “Siobra develops enabling integration solutions for organizations in multiple industries, and our partnership with SiLA and

Cloud connectivity facilitates working securely with partners and service providers off-site. Brennan stated, “Standard communication protocols enabled through SiLA, and standard data formats enabled through AnIML, mean that remote collaboration can be achieved more seamlessly, and securely, through fileless data communication.”

KNIME CLOUD ANALYTICS

Supporting SiLA 2 in the cloud has effectively opened up avenues for maximizing the utility of data and applying new methods of data analysis, from specialist providers. Groezinger further noted, “We have, for example, together with [KNIME](#), developed the tools that enable data communicated via

the SiLA standard in the cloud to be analyzed through the KNIME analytics platform. This will give labs the potential to process their lab results and data – microplate readouts and imaging data have been used for proof-of-concept – on the KNIME analytics engine, and then receive their results back to the SiLA server.”

The evident benefits of supporting communication and data standards have prompted



« COMMUNICATION BETWEEN LAB SYSTEMS SHOULD NOT BE A MAJOR TRIAL, BUT SOMETHING THAT JUST ‘HAPPENS’ IN THE BACKGROUND. »

many of the major, international software vendors to build in support for SiLA and AnIML. Juchli continued, “As the number and diversity of instruments and software platforms that labs may now adopt is increasing, pressure from end users is encouraging more widespread support for these standards. Software vendors are more understanding of the manifold advantages, both for their customers, and for their own business, of supporting interfaces and drivers for standard communication and data management protocols. This is especially helpful for smaller platform companies or providers of niche products, who can rely on proven, validated protocols and offer simple, integration tools to connect their software to the labs through the SiLA interface.”

Schaefer added, “Supporting standards means faster setup, and a much lower risk of post-implementation issues, so the software vendor can effectively move on to their next licence deal more quickly and have confidence that their software will function seamlessly, from the outset.”

WHY REINVENT THE WHEEL?

Negating the need for software and instrument vendors to maintain large libraries of integration tools saves on resources and reduces the need to develop new drivers as an ever-expanding catalogue of laboratory equipment becomes available and is adopted. “It makes obvious sense for a software vendor to tap into established libraries of tools that enable connection to equipment that supports SiLA,” Groezinger commented. “In other words, why reinvent the wheel?”

Software vendors such as LabWare are also encouraging their customers to discuss SiLA support with their instrument providers. Brennan commented, “Historically, one of the most significant justifications for implementing a LIMS was around interfa-

cing with instruments. The different interfaces required for the instruments presented a challenge. Anything that we can do to encourage participation in an ecosystem such as SiLA allows our mutual customers to realize a return on their investment based on system integrations. For one of our customers, for example, we provided a list of how SiLA and AnIML support would benefit not just that customer, but the vendors of the instruments that they use. In fact, SiLA already provides support for many instrument models, and offers free libraries for interfacing to those models.”

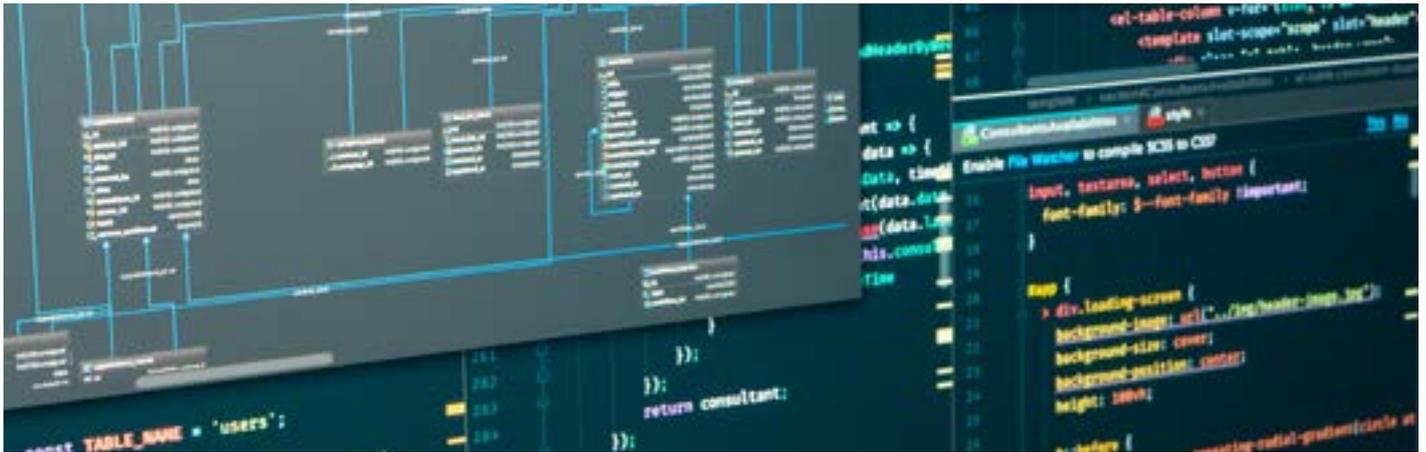
FOCUS ON WHAT’S IMPORTANT

While the focus here is on understanding why and how standards can benefit both software vendors and customer at multiple levels, standards should really just be a means to an end, and work quietly, and efficiently in the background. Schaefer pointed out, “Communication between lab systems should be something that just ‘happens’ in the background, and not something that is a major trial.” Juchli continued, “When I buy a printer, I don’t have to ask which printer protocol I’ll need for the printer to communicate with my operating system, or my model of laptop, desktop and tablet. I just expect it to plug and play. This means that I can focus on choosing a machine based on its features, resolution, etc., not on how to connect it to my home computing equipment.”

Consider that same level of freedom of choice for a lab environment, by removing locked and proprietary communication formats, and we can more easily visualize the benefits for the end user, but also for the software vendor, who can then focus their expertise on developing the products that will solve what the customer wants to achieve. “And if the software developer is good at what they do, then that will be what attracts the customers,” Schaefer commented.

EXTENDING EQUIPMENT LIFESPAN

Supporting SiLA as a standard communication protocol in parallel with AnIML as a standard for data management means that end-users can also more easily project how they might evolve use of their software investments as the lab evolves or expands. “If the need to support dated, proprietary and



« FILELESS CONNECTIVITY THROUGH SiLA PROTOCOLS INCREASES CONFIDENCE IN TRANSPARENT, TRACEABLE AND SECURE DATA FLOW. »

locked languages is no longer an issue, and you can connect easily with other hardware and software investments going forwards, then you can extend your equipment and software lifespan,” Juchli commented.

And this is aided by achieving that fileless connectivity that Brennan already touched on. Schaefer pointed out, “Typically, when you write a file, then that file is sent ‘to’ someone, who imports it, but that file transfer may also may involve editing. At that point you then lose control of the life cycle of that file and its data.” Realise fileless connectivity and data transfer, and you immediately have a major regulatory compliance gain, because your workflows and resulting data can’t be manipulated, diverted, or lost. Schaefer continued. “Labs connecting software through fileless SiLA protocols can effectively be more confident of transparent, traceable and secure data and information flow.”

GREATER INSIGHT AND INTELLIGENCE

Importantly, standards can also enable greater completeness of data, Schaefer continued. Combine support for AnIML and SiLA, and the result is not only seamless communication for the end user, but improved data richness, and context, and that could be a major selling point for software vendors. “So, for example, when you retrieve a simple weight or pH measurement, you don’t just get a numerical reading, you can assess and evaluate that reading as part of a more complete dataset that describes the experiment itself, as well as the instrument

configuration, along with a record of who carried out what function, and whether the experiment was run according to a standard operating procedure (SOP) or method. The increased depth and breadth of data and metadata then provide the end user with much greater insight and intelligence.”

The life science industry may have lagged behind other industries when it comes to the concept of seamless integration, suggested Groezinger, who works with customers across sectors of industry that may be relatively advanced with respect to their digitisation programs. “This may be partly because of the highly regulated nature of the life sciences environment, which makes vendors protective of their proprietary, and already validated ecosystems.” But the adoption of SiLA as a free, open, and community-developed standard is gaining traction, even among the larger players. They see the immediate benefits for themselves, in terms of having ready-made integration tools available, and also for their customers, who don’t have to consider expensive, time-consuming integration projects. The capacity to connect seamlessly to other systems in the lab environment, and to cloud-hosted solutions, data lakes, and remote partners or service providers, is a major development that will open up huge opportunities for business, R&D, and collaboration.”

For further information: [knime.com](https://www.knime.com)

References

1. <https://www.fda.gov/media/97005/download>
2. <https://www.fda.gov/news-events/press-announcements/statement-fda-commissioner-scott-gottlieb-md-agencys-efforts-improve-drug-quality-through-vigilantSiLA>

In conclusion, SiLA is a future-proof enabler, because it offers end-to-end integration by connecting instruments to instruments, and to informatics systems, and by connecting lab systems to each other and people with their data.

SiLA Rapid Integration

SiLA encourages membership, and different membership categories are available. Our thousands of members all have a voice through the SiLA standard working groups, so that they can be actively involved in helping to develop and refine the next generation of lab automation standards. And of course, members have access to all SiLA resources and a global community for networking, partnership and business.

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