SiLA ANALYZED

SiLA FOR INSTRUMENT VENDORS

SOPHIA KTORI

The FAIR data guidelines, published by Wilkinson et al in 2016[1], have been adopted across many industries as the foundation on which organizations of any size can build a data management infrastructure that will ultimately maximize the value, longevity, and security of their data. It's a set of principles – findability, accessibility, interoperability, and reusability – that, as Wilkinson and colleagues stated in their paper, "... put specific emphasis on enhancing the ability of machines to automatically find and use the data, in addition to supporting its reuse by individuals."

GOAL OF SEAMLESS INTEGRATION

The FAIR principles are rooted in the ability to digitise data, whatever that data source, destination, or format. Vendors of laboratory instrumentation, whether that instrument is a weight scale, pH meter, or shaker, a liquid handling robot, or a next generation sequencer, are witnessing the impact that the drive to embrace the FAIR principles is having on their customers. Labs are looking to more seamlessly integrate instrumentation to facilitate safe, secure, and regulatory compliant communication to and between devices, as well as data transfer between hardware and software.

The four FAIR principles can be naturally married to the concept of adopting open instrument communication and data standards across the laboratory infrastructure. This should have the upfront benefit of simplifying the integration of new instruments and devices, and reducing the IT burden and cost, both at initial setup, and throughout the lifespan of that instrument. And that could represent a key selling point for laboratory components, devices and systems.

As an instrument vendor, offering systems that support the use of communication and data standards encourages adoption of devices on a number of levels, suggests Jason

> **AS AN INSTRUMENT VENDOR, OFFERING SYSTEMS THAT SUPPORT THE USE OF COMMUNICATION AND DATA STANDARDS ENCOURAGES ADOPTION OF DEVICES ON A NUMBER OF LEVELS.**

Meredith, head of software product management at Tecan, the global lab automation giant that is one of the founding members of the non-profit SiLA (Standardization in Lab Automation) consortium. SiLA is spearheading the development of an open framework for the exchange, integration, sharing, and retrieval of electronic laboratory information. "The SiLA standards, which are now becoming widely adopted globally, effectively define how information is transferred between systems, and describe the language, structure and data types that enable

seamless instrument integration," Meredith pointed out.

STANDARDS FOR COMMUNICATION AND DATA

Building in support for standard data formats, as well as support for a standard communication protocol will further ease data management and handling, both up front, and over the lifetime of the system, noted Daniel Juchli, chief technology officer for the SiLA consortium "We can think of SiLA as the language that instruments use to communicate with each other. This is, effectively how instruments give and receive instructions, say, 'start shaking', or 'heat to

this temperature,' or 'run this method.' But many instruments also generate data that needs to be captured and reported, and for this, we will ideally support a widely used open data format standard, such as AnIML."

REDUCING MANUAL DATA ENTRY

Critically, instrument communication and data standards need to support the vendor within their own business model, added Juchli. "The benefits have to be evident and understood by product and laboratory ma-

nagers, as well as by business stakeholders." Make the instrument easier to use by facilitating integration with other systems in the lab, and this will naturally increase uptake and use of that instrument, he noted. Ultimately the aim is to reduce or negate the need for manual data entry, do away with complex interfaces, and ensure secure, regulatory compliant communication. For the customer this will increase their return on investment, and can be a major determining factor when purchasing decisions are made, Schaefer believes. Increased use of

an instrument will often result in increased purchasing of consummables, and that is not uncommonly where a large portion of vendors' profits are derived."

From an instrument vendor's perspective, the benefits of adopting instrument communication and data standards are thus evident, Meredith further acknowledged. One of the major pain points for laboratories is the challenge of integrating, maintaining and supporting potentially dozens of instruments – often from multiple vendors – and multiple software packages and communication protocols. "But if the device comes with a standardised interface then the cost to integrate isn't only a lot less at initial set-up, but also over the lifetime of the product. And if we can enable our customers to reduce integration costs for our instruments, and the costs of integrating instruments from other suppliers, then that's not only a major cost reduction benefit up front, but also a reduction in the total cost of ownership for our customers."

The SiLA (Stadardization 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/

MORE EFFICIENT DEVELOPMENT

This ability to ease integration through standards support is a key point reiterated by Rob Harkness, director of customer success EU/UK at Biosero, which develops software solutions to integrate end-to-end lab workflows and improve productivity in the lab. The firm's flagship product, Green Button Go® automation software, connects laboratory workflows, integrating manual procedures and automating instruments, capturing and contextualizing data in the process. "Supporting SiLA simplifies working with other vendors," Harkness said. "If we agree to work to a standard, we are not 'reinventing the wheel' each time it comes to defining a service interface, and we can be more efficient in the development work that we do."

Consider, for example, scheduling packages, which provide connectivity with data and instruments, he continued. "We need to be able to configure this setup easily and quickly. It's imperative that we can acquire data, work with sample management and process optimization software, and be able to contextualise data for other activities downstream. Biosero has the expertise to do this on a case-by-case basis, but it is abundantly clear that if standards are in place for the la-

different problems, because these configurations can use the same communication standards, then that's another major tick in our favour as a supplier."

GUIDING DEVELOPMENT OF STANDARDS

As a manufacturer of a diverse range laboratory instrumentation and automation systems, Tecan has been involved in development of the SiLA standard since the initiative

the major pain points for both instrument vendor and end user, and so if that pain point is largely eliminated across the board, then the vendors can focus on innovating, and their customers can start to think about selecting systems based on the features and capabilities that they are looking for, rather than the technicalities of setting systems up within often complex infrastructures."

Biosero does offer a library of connections to different drivers, but the development of each is associated with substantial cost, Harkness pointed out. "If vendors provide a SiLA interface, then their products will work with an integrators' existing SiLA connector, reducing cost and, again, complexity. And this effectively reduces current barriers, allowing people to select software integration packages that are best in class for the industry."

OPEN SOURCE TOOLS

Development of SiLA 2 has been very much a combined effort by the 2000+ life science, software, hardware, and other global members of the consortium, and there is now a range of open source tools available to help automate SiLA-compatible device interfaces for existing software. Meredith continued, "It all helps to reduce the cost of adoption. We don't want there to be a high barrier to entry, especially for the smaller innovative companies. It's important that there is an easy roadmap to getting involved. And as an instrument vendor, my vision is that ultimately all the devices that we integrate our systems with would be controlled using the SiLA protocol."

Community initiatives have also been integral to promoting support for the SiLA standard by the programming language Python, for example. Juchli noted, "So, in combination with the functionality through open source tools, robotic systems, for example, and other instruments that are typically used in the biological space can now be integrated through the Python language, without having to carry out any complex programming. This opens up a whole world of possibilities and accessibility for biologists, in particular."

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boratory, end-to-end integration would be far simpler for everyone."

EXTENDING INVESTMENT LIFESPAN

Another benefit of adopting SiLA as a standard communication protocol is that customers can think about extending the lifetime of their investment, because they will more likely have the potential to reconfigure their equipment themselves, or at least with minimal support. "Many hardware systems are commissioned and set up for a specific purpose, but that purpose may only be valid for a few years," Meredith continued. "If our customers know that at the end of that period they can reuse, or repurpose the components they have purchased from us, and put them into different configurations to solve

was established in 2008. "It's important for us as a hardware and software developer and vendor, to be involved, because we want to play a role in ensuring that the standards are usable, easily supported, and have tangible benefits," Meredith noted. "There has been really great engagement for the HTTP/2-based SiLA 2 standard – which is focused on device functionality, rather than device type – and we are increasingly using the standard internally."

ELIMINATING PAIN POINTS

Importantly, adoption of SiLA levels the playing field for device integration, even for vendors of niche devices and systems. "It's something that every vendor can understand," Meredith stated. "Integration is one of

NEW OPPORTUNITIES

And in time, adopting standards means that the vendor no longer has to create an

entire communication and integration eco-system around their instruments, "because they can adopt and support SiLA as an established protocol by piggybacking on the tools that are already out there," continued Burkhard Schaefer, SiLA head of partner management. "That's extremely powerful, and this commonality, functionality and open source toolkit could potentially open up access to a world of opportunities for lab automation, efficiency and operation."

Standards thus reduce the burden of R&D investment on the vendor's side, because the tools and languages are proven and available, and can be used across platforms. Schaefer continued, "And ultimately, by using standards that reduce the costs and complexity of communication and data retrieval, the value of a dataset created will increase, while the cost of access to that data is reduced."

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DATA INTEGRITY AND COMPLIANCE

"Seamless integration and commonality in communication can aid in assuring data integrity and regulatory compliance", Juchli noted. Looking at laboratories working in a regulated space – say, clinical trials or drug manufacturing – and you typically have an infrastructure driven by a laboratory information management system (LIMS), which will be controlling the instrument, for example, by scheduling and initiating analytical tests on specific samples.

Mechanisms carry an inherent data integrity risk because file transit may reside on a PC disk or server. Guaranteeing that data is free of manipulation is thus problematic. Schaefer continued, „And you have zero transparency about whether the file was even read at the destination. What SiLA provides is a secure, encrypted communication channel that cannot be intercepted and through which no files reside on disks. Communication is direct between instruments, and so data integrity is assured, and compliance is much easier to achieve."

REDUCING COMPLEXITY

SiLA adoption also simplifies the inner workings of complex, custom projects. Harkness noted, "Developing a proprietary interface carries with it the need to fully document development, but when working to

the SiLA protocol, much of that documentation is in effect already in place. Supporting SiLA brings with it a clarity that uncomplicates collaborations with other vendors, where all parties benefit."

FUTURE PROOFING

Implementing a single standard for instruments means that vendors can also look to the future development of all-in-one, multifunctional instruments on the one hand, as well as niche workstations that complement and collaborate with each other. Meredith stated, „At present, we commonly see customer embarking on ambitious automation projects, and they are often confronted with multiple communication protocols that add significant complexity. Using the SiLA2 standard simplifies this through a common language."

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.

References
1. Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018 (2016). https://doi.org/10.1038/sdata.2016.18

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.