An Enterprise Resource View of Metrology Software Systems

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Abstract

Software running on a single computer or platform is a thing of the past. Today's metrology software needs to be scalable, flexible, and dynamic. It must be designed to integrate with enterprise business systems, taking full advantage of distributed computing and service oriented protocols.
It is time to recalibrate our assumptions of efficiency, accuracy, and flexibility. We live in a connected world. While that world is slowly becoming the "The Internet of Things," many of those things are network enabled measurement instruments.

Problem

Last year we hired an Enterprise Software Architect to validate my plans moving our company into the next generation of software solutions. Overall, we agreed on the technical challenges of an ever changing world of computers and communications technologies. But as we were wrapping things up he very tactfully asked me a question "Do you think Windows® will be the dominant computing platform 5 years from now?"

That question really got me to thinking. Not about Microsoft®, but more along the lines of what computer will I have 5 years from now. I have a tablet, a smart phone, and I want to try Google Goggles®. When I think back 5 years ago, Blackberry and Palm were kings in the cell phone market, while today it's iPhone® and Android®. I am seeing more and more people with Macs and tablets.

The problem is the life cycle of metrology software is longer than most other software. You will replace your computer every couple of years and with that you will replace you operating system and many of the key programs you use every day. But in the lab, I have customers that are still using DOS and Windows 3.1® because they have some older system in use they need to support.

1. Our Approach

Businesses and technologies have a similar cycle. Expand the business, downsize, create more market share, and focus on key customers. We see the same thing in software: every new advancement in technology seems to trigger the next generation of software.

But this does not work for metrology! Many calibration labs operate on a shoe string budget. While the majority of the capital investment goes toward newer standards and better measurement capabilities, funding expensive software re-writes every couple of years is not feasible—especially when much of the cost goes towards validation and uncertainty calculations.

We started by thinking outside the box, I mean really outside. We felt the problems and challenges we faced in the metrology world had already been solved in existing technologies. And as expected, we found they had been solved, many times over.

2. Overview of SOA

Service Oriented Architecture (SOA) is something you may have never heard of but probably use every day. If you have ever booked a flight online on one of those travel sites, then you have seen SOA in action. In short, it is the business communications system used to collect the flight information from all of those airlines and put them together in one simple, easy to use interface.

There are three basic parts to SOA:

- The Service Provider
- The Contract
- The Consumer

The most important part of the three parts is the contract—this is the definition of how the service provider and the consumer will communicate and exchange data with each other. The three parts work together; you can't change one without changing the other two.

Converting your software over to a SOA solution means a complete rewrite of everything… yes, everything will have to be rewritten. But that is the beauty of a SOA; because it is service oriented, we don't have to rewrite everything on one false swoop and systems can be updated and integrated over time.

3. The Internet of Things

The Internet is here, we all know that, and we are all virtual surfers. We all know the client server relationship where, when we want to read something, a server somewhere in the world sends a page to our browser. But the next big thing for the internet is the Internet of Things. These are things on the network that provide information through a service. Already there are thousands of things that are network enabled. TVs, cell phones, refrigerators, even cars—they are all network enabled things.

This will affect metrology as well. We are all comfortable with our trusty GPIB interface, but the world is changing fast. Already there are network enabled Temperature and Humidity systems from various manufacturers. Personal weighing scales and cars that tell the driver the pressure in all 4 tires while he is driving have been available for awhile now, just to name a few examples.

The internet is here to stay and we will see more and more networked measurement systems. As each person has a new idea, that idea will spark two more, as measurement and technologies grow at an exponential rate.

4. Current State of Automation

A few years back I visited a calibration lab out in Florida. When I was there, the lab manager explained to me how efficient they were, how most everything is automated. At first I was very impressed, but something caught my attention. I watched a technician spend 40 minutes collecting standards, and moving them to his workstation. He racked them all up, connecting the 10 MHz Reference and GPIB cables. Then he spent an hour and a half to calibrate the UUT. When finished, it took about 20 minutes to put everything away. Though it took him 2.5 hours to complete a 4 hour calibration, he spent about 40% of his time configuring his station.

5. What If We Could

Move the UUT not the Standards: Instead of time lost to pull equipment and bring it in and out of the lab, standards should remain where they are and communicate via a network.

Test multiple UUTs: Software should support multiple UUT testing, so we don't have a calibration lab full of equipment sitting idle.

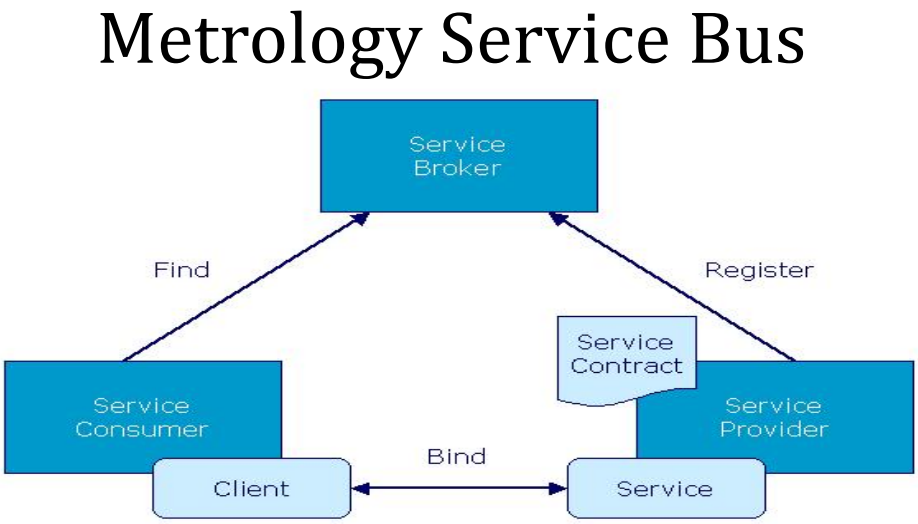
Be more flexible: We should be able to start, stop, and retest the UUT as needed, as well as move a UUT from station to station, in/out of the lab.

Integrate our scope of accreditation: The systems we use in our calibration labs should communicate with each other instead of functioning like islands where nothing talks with anything.

Decrease our development time: Not only should the development of a test procedure be completed in a reasonable amount of time, but it should be easily integrated it into our production and not sitting in multiple locations.

6. Metrology Services Bus™

Metrology Service Bus is a hybridized word pulled from Enterprise Resource systems. Think of it as a system with a set of defined rules where all the players can work together. It is our set of contract and interface rules service providers and consumers can use to communicate with each other.



How it works is pretty simple. Both the Service Provider and the Service Consumer register with the Service Broker. The Service Provider will provide the Service Broker with a manifest of what service it offers, as well as its current state and location. And the Service Consumer registers itself with the Service Broker as well.

When the Service Consumer needs a service, it is able to ask the Service Broker if that service is available and where it can be found. Then the Service Consumer can communicate directly with the Service Provider.

One over simplified way of looking at this is doing a Google Search. In this case your web browser is the consumer and somewhere on the internet is a web page that has the information you are looking for. Google gives you a list of service providers. You are then able to read a short description of the service and choose to use that service, in which case your web browser requests that the service provider send you the page so you can read it.

Applying this back to the metrology world, what if you needed to a 10.000 Volt DC Signal with an accuracy less than +/- 0.007 volts. You can't just Google this information, at least not yet. But let's fast forward a bit. What if every DC Voltage source was network enabled and could register its current state and what service it offered. Then you could see every station and every piece of equipment on that

station that could give you 10 Volts DC. The list could be sorted in most accurate, fastest, or currently available. (Its like Just In Time supply chain for metrology.)

Like all Enterprise Solutions, The Metrology Services Bus™ is scalable from a single computer to every location and instrument across your organization. As the system scales, local Metrology Brokers communicate with each other. So now when you need that 10.000000 Volts DC at an Accuracy of 2ppm, you see the only lab in the world that comes close is your Colorado lab.