OpenTAP Adoption

The Open Source Path to Effortless Automation

This white paper follows the OpenTAP adoption experience of a test and measurement organization and the company that depends on that lab to ready products for market. It explores the motives that drive the test and measurement team, and the challenges met and overcome in migration to a standards-based, off-the-shelf, open source test automation platform – OpenTAP.

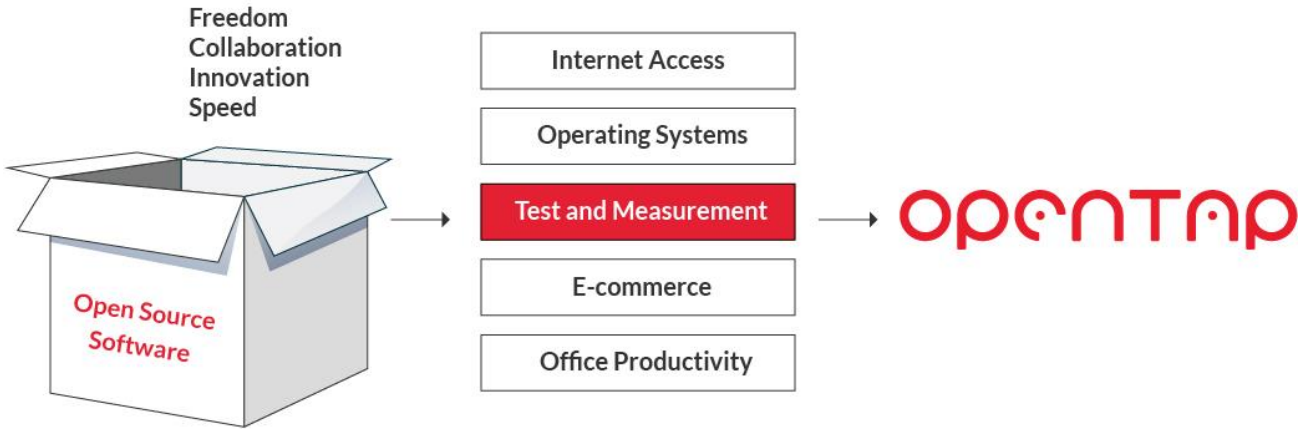
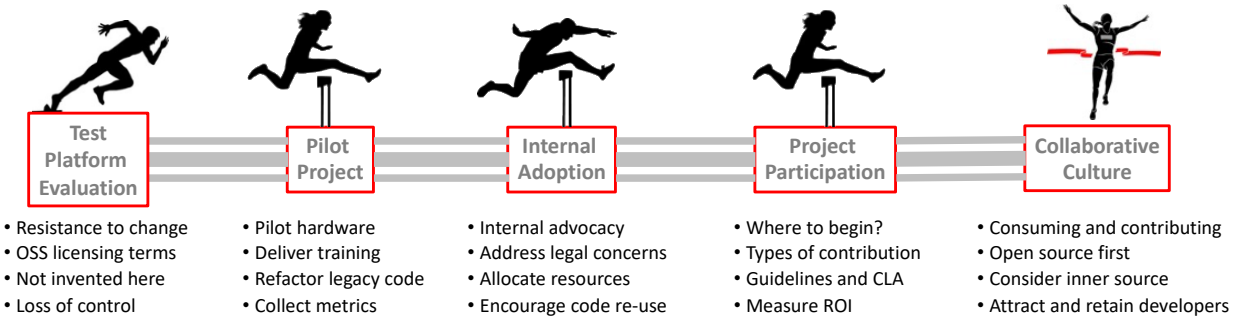


Table of Contents

Introduction

Shorter development cycles and growing complexity present testing challenges to organizations working in all technology domains. Today's fastest moving industries – such as telecommunications, finance, and automotive – speed development by leveraging modular architectures and open source software developed and maintained by broad collaborative communities and ecosystems. By contributing to and supporting the OpenTAP project, the test automation industry will realize similar benefits.

Following is a narrative drawn from the experience of multiple device manufacturers across the abovementioned industries. While the particulars of their (and your) test automation journey can vary, testing teams encounter comparable hurdles across the design and test lifecycle.



Legacy Test Platform Bottlenecks

Meet our "change angel", a hard working engineer determined to streamline his company's test automation workflow. His test automation team has been struggling to keep pace with the changes in test requirements and the complexity of new multi-function products. Things came to a head when a new product, developed in mere weeks, needed six months to integrate, validate and test using legacy test software. That legacy test infrastructure also needed upgrading and customization to handle new product test requirements. Test had become the biggest bottleneck.

Gabriel
"Change Angel"

Learn about real-world best practices for migration from legacy test automation at Broadcom and Rebase.


Tanya
VP Engineering

The challenges faced by Gabriel and his team are not uncommon. Most hardware manufacturers take a "homegrown" approach to test automation, working with platforms that have evolved piece-meal over time; such in-house test automation platforms and tools are typically not highly modular or flexible and are difficult to maintain. Homegrown platforms accrue capabilities from specific test projects and are not easily reused for new ones. Even when homegrown platforms are well designed, they must be developed and supported entirely with internal resources, forcing new development and maintenance to compete for scarce resources.


Francisco
Test Lab Lead


Codie
OSPO Lead

Gabriel approaches his VP of Engineering to discuss the legacy bottleneck, and they agree that a new test automation platform is needed – one that is more open, standards-based and supports agile development. Looking for solutions, Gabriel seeks out the test lab lead, , who introduces him to the lead for the Open Source Program Office (OSPO). From them, Gabriel learns about OpenTAP, an open source project for test automation.

OpenTAP features a modular, plugin architecture and a broad range of tools and applications, a strong technical community and an ecosystem of third-party hardware and software vendors.

Our change angel is intrigued by the idea of working with a broader test automation community instead of developing test systems from scratch internally with limited resources. But can he convince his organization to migrate to a new platform?

Change is Challenging

Platform change can be difficult, even in forward-thinking organizations. The test team faces resistance to change:

- Open Source licensing terms can face objections from legal
- Policy issues, especially around IP raise concerns about disruption to existing practices and processes
- Not Invented Here – "no one's ever been fired for using existing software"

OSPO – Open Source Program Office

Fortunately, the company has established an Open Source Program Office (OSPO). He is fortunate that his company has a designated expert in the use and management of open source software – OSPO lead, Codie. She has faced similar challenges in other parts of the organization. "Seeing is believing," she says. "Examples of successful deployment really build confidence."

To address the concerns, Codie focuses on the key open source management activities – *discovery*, *contribution*, *integration* and *compliance*. Codie also reminds Gabriel of important considerations for change management, most importantly avoiding disruption. For example, the pace of change must align with agile development and existing DevOps lifecycle. And Codie emphasizes the need for creating a culture receptive to change, horizontally across the organization, and vertically, spanning the layers of management.

Open Source Software

Open source software is hardly a new concept. Today, computer software and hardware industries are dominated by open source software. The leading open source project hosting site, Github, boasts over 60 million project repositories created in the last year alone by 56 million participating developers. Technology companies, from semiconductor suppliers to equipment manufacturers (OEMs, TEMs and NEPs), software vendors (ISVs) and service providers (network operators and ISPs) depend on open source software to develop and deploy their wares and host their services. These companies choose open source to develop solutions faster, leveraging community software and shared expertise. Building with open source also benefits from ongoing community development and maintenance and offers lower overall cost than homegrown or commercial proprietary solutions.

A Starting Point

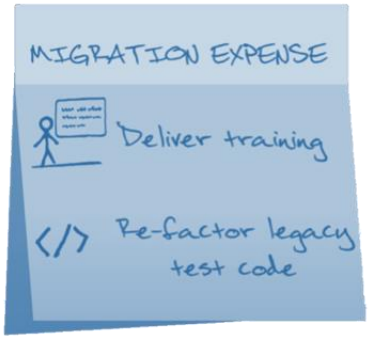
Organizations using, integrating and deploying open source software (OSS) typically traverse a path that starts with consumption and can evolve to deploying OSS in their products and services, contributing to open source projects and even becoming leaders of open source project communities.

Many companies start by establishing an *ad hoc* review board, focused on vetting open source licenses and use cases, comprised of representatives from engineering, legal, product management and stakeholders. As OSS usage and integration increases, companies often assign an open source program officer to lead OSS management and adoption efforts.

Larger organizations will establish a permanent program office, with dedicated resources to coordinate technology selection and approval, implement OSS policies and processes, mitigate IP and security risks, help choose and deploy OSS management tools, promote OSS adoption across the company, coordinate inner source programs and enhance ROI from investments in open source.

OpenTAP Pilot

Together, Codie and Gabriel decide the best way to provide proof points for migration to OpenTAP is with a pilot project. Before starting the pilot, the team knows it must address the technical hurdles, including how to deliver training and refactor legacy code to run under OpenTAP.



The key to a successful pilot lies in building on a familiar foundation while highlighting the new technologies and methods. Development and test organizations can typically leverage lab instruments, test hardware and even test code from existing / legacy infrastructure.

Gabriel and R&D Engineer Francisco start by

- Selecting pilot hardware (see low-cost examples below if you need ideas)
- Leveraging existing lab equipment (using available OpenTAP plugins)
- Building wrappers (when possible) for existing test code and hosting existing code using language support plugins (e.g., the Python Plugin for OpenTAP)
- Engaging with other OpenTAP users and developers on the OpenTAP Forum

Choice of hardware is important to a successful pilot. Too simple and the pilot can look like a “toy”; too complex and the pilot gets bogged down in hardware and instrument details. When familiar legacy hardware is not an option, many teams turn to Arduino or Raspberry Pi. An excellent alternative lies in the Pocket Science Lab. The PSLab is a small USB-powered board and integrates oscilloscope, multimeter, wave

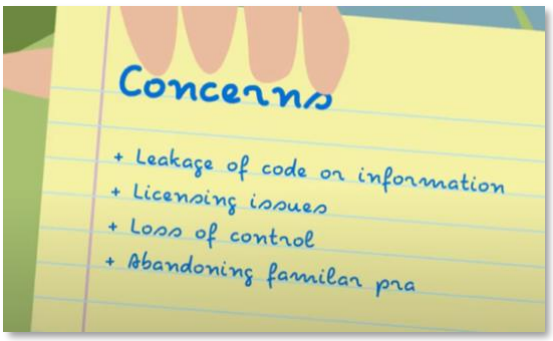
generator, logic analyzer and other functionality in a single package and supports hundreds of available sensors. Check out PSLab capabilities in this tutorial that shows how to integrate the PSLab Python driver with OpenTAP. And find all the plugin code to get started on Gitlab.

As the pilot gets underway, Gabriel's managers and peers applaud but also discover new concerns.

The Importance of Metrics

A pilot isn't the same as production deployment. Team members in Gabriel's organization are still uneasy with using open source for mission-critical operations. Their concerns include

- Leakage of code or other critical information
- Licensing Issues
- Loss of control
- Abandoning familiar practices



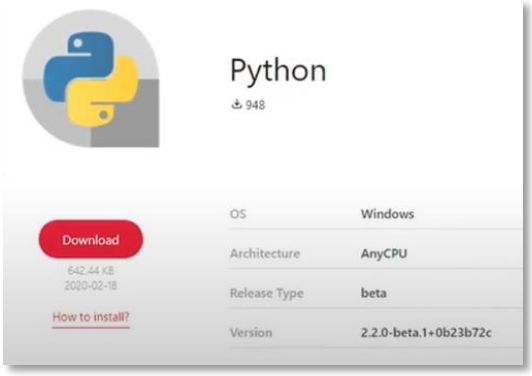
The Power of Metrics

Nothing is more convincing than measurable results – actual, testable metrics. But compelling metrics take time to collect and analyze. The team decides on measuring three key factors:

Code Re-Use

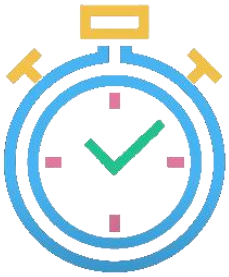
Migrating to a new platform doesn't mean that existing code should be thrown away. Legacy test code can represent years of invested time and effort. Whenever possible, avoid starting over — use wrappers and other migration tools to salvage known-working test code.

To accelerate the OpenTAP pilot, Francisco integrates legacy test code in Python and other code using OpenTAP plugins. Multiple testbeds can use the same code to implement identical functions. Increasing the level of code re-use is a good measure of collaboration, best design/implementation practices and development cost savings.



There are many types of, and use cases for, code re-use. Most organizations are accustomed to re-using some amount of code from project to project. Some organizations even share code across groups. Real efficiencies are achieved when entire organizations consume shareable internal and/or proprietary code (Inner Source) as well as employ standard software components, frameworks, libraries, and platforms from open source projects.

Time-to-Deployment



An open test automation platform supports more flexible testing, promotes re-use, and lets developers access a growing ecosystem of plugins and other off-the-shelf and ready-to-use functionality. These capabilities positively impact time-to-deployment by eliminating the need to "re-invent the wheel" and also benefit from debugging and testing by other users and developers. Faster time-to-deployment of test code can also mean faster time-to-market for devices under test.

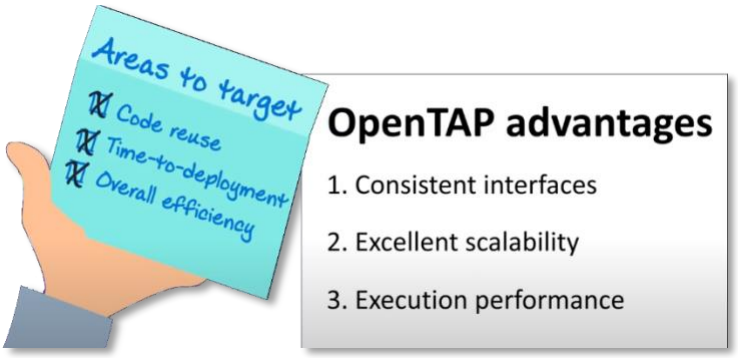
Since the team had kept careful records of the time required for all phases of testing on their legacy platforms, the comparison was a snap.

Efficiency

Many aspects of a software platform can impact efficiency. A key efficiency factor lies in available tools and workflows. The OpenTAP Package Manager is a case in point. Most legacy, in-house test automation systems don't even have the concept of a package, leaving test developers to fend for themselves, relying on ad hoc archiving and custom-built scripts for packaging, re-installation, and deployment.

Using the OpenTAP package manager, the team can deploy more tests, more quickly and more efficiently. Francisco and his colleagues can test multiple aspects of devices under test in parallel, cutting total test time in half. No longer concerned about execution failures, the lab can also run tests overnight and remotely.

Metrics in Context



The above metrics and benefits they represent don't materialize by themselves. High code re-use, shorter time-to-deployment and efficient operation are the direct result of the advantages conferred by using the OpenTAP platform: consistent interfaces, excellent scalability and high performance execution.

Plus, as Codie reminds us, OpenTAP is open source. Standing behind OpenTAP is a global community of users and developers, sharing development and maintenance, overseeing quality and security, and ensuring interoperability.

Production Ready?

Gabriel and Francisco are building their case for using OpenTAP, but is it strong enough to green-light open source test automation for production deployment?

Overcoming Resistance

Unanticipated Barriers to Adoption

Despite the very positive outcomes highlighted by collecting and analyzing key metrics, Gabriel and his team encounter new, unanticipated barriers to deploying open source OpenTAP into production. First and foremost is unfamiliarity and the need to build confidence in the platform through training and internal marketing. The legal department has also raised concerns about licensing terms and obligations related to open source.

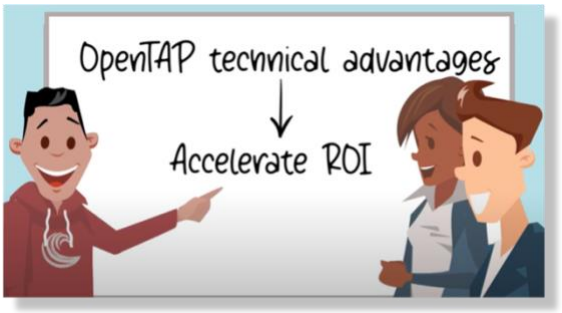
Codie, in her role with the OSPO, nods in recognition, encouraging the team to overcome the barriers by addressing the organization both horizontally and vertically, with advocacy targeting both management and peers across the company.

Codie recommends employing

- **Internal Communications** — High-profile newsletters, intranets, seminars, quarterly business reviews (QBRs) and other types of advocacy
- **Training** – technology and open source management training together with HR and corporate training

Lab tech Francisco also highlights how technical advantages of the OpenTAP platform enhance return on investment (ROI):

- Faster time to prototype and to production
- Lower costs of acquisition and maintenance
- No vendor lock-in



This angle appeals directly to department director Tanya and her peers in management.

Addressing Concerns from Legal

OSPO lead Codie is also accustomed to working with corporate attorneys with widely varying levels of familiarity and comfort with open source software licenses. It's the job of legal departments to reduce risk to their employers, so unfamiliar licensing terms and obligations can lead attorneys to mistrust or even ban use of software governed by some license types.

Codie eases the concerns of company lawyers by pointing out that OpenTAP is distributed under a license previously approved by the legal team with similarly-licensed software deployed in other parts of the organization.

Obtaining approval from Legal not only enables Gabriel and his team to deploy OpenTAP in the lab, but also supports contribution of bug fixes and new functionality by the team to the OpenTAP community, without concerns about "contamination" of company intellectual property (IP).

Advocacy and Persistence Pay Off

Having met and overcome both technical and legal challenges, the first OpenTAP production test implementation goes live! Codie shares the team's experience on the OpenTAP Forum and is invited to pen a guest blog on blog.opentap.io.

Advocacy by Codie, Gabriel, Francisco, and the rest of the test lab team paid off, internally with a decision to move towards production deployment, and externally, as the team's experience is highlighted on the OpenTAP Forum and Codie is asked to pen a guest blog at blog.opentap.io.

From Consumption to Participation

Everyone agrees that they've made great progress. However, such impressive business outcomes are not the same as fundamental change – the team needs the corporate culture to evolve to take full advantage of OpenTAP. A good place to start is changing the culture of consumption of open source code to one of participation in open source project communities.

Participation doesn't begin (or end) with major code contributions

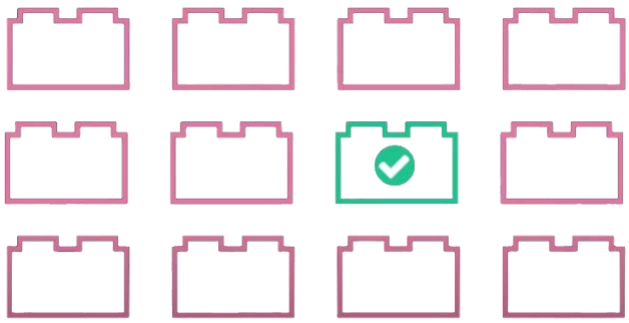
---

Consumption is where most organizations begin their open source journey, because participating in an open, public community can be daunting. While more "eyes and hands" can mean higher quality code and lower maintenance costs, the exposure of company code to critics and competitors makes some companies stop short. While the stated concerns usually focus on losing control of intellectual property, the unstated ones come from discomfort with a development culture shift.

It's important to realize that participation usually doesn't begin (or end) with major code contributions. Participation activities also include joining in community forums, reporting bugs, suggesting features, writing documentation, sponsoring events, submitting patches to existing code, creating test cases and writing test code, to name but a few options. In the wide world of open source, relatively few organizations end up donating significant amounts of code, let alone business-critical code, to a project in which they participate.

Choosing a Participation Starting Point

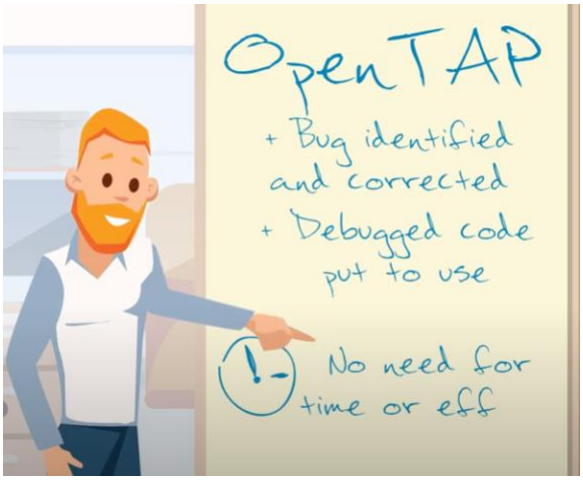
OpenTAP features a highly modular architecture, with key functionality and extensions to its core delivered as plugins (Test Steps, DUTs, Instruments, Listeners, etc.). This modularity offers Gabriel and his team the opportunity to participate in the OpenTAP project with a narrow scope and consequently limited risk. Our heroes decide to publish a plugin that does not expose business-critical IP but does provide the OpenTAP ecosystem with useful new functionality, and Francisco gets to work. Examples of this type of plugin include a generic Device Under Test (DUT) or DUT template, a plugin to support a new or legacy instrument, or a listener with support for new data or document formats.



The Legal team is still hesitant, but finally approves a one-time contribution to the OpenTAP ecosystem. Inside Counsel reviews the OpenTAP Contribution Guidelines and executes and submits a copy of the OpenTAP Contributor License Agreement (CLA). Codie also promises to come back with data to help evaluate Risk-Return from the contribution.

Rapid ROI from Participation

Soon after Francisco publishes the plugin, along with documentation, on OpenTAP.io other community members begin downloading and evaluating it. One community member notices a bug in the plugin, fixes the bug and submits a patched version back to the project. All without taking time or effort from the original dev team.

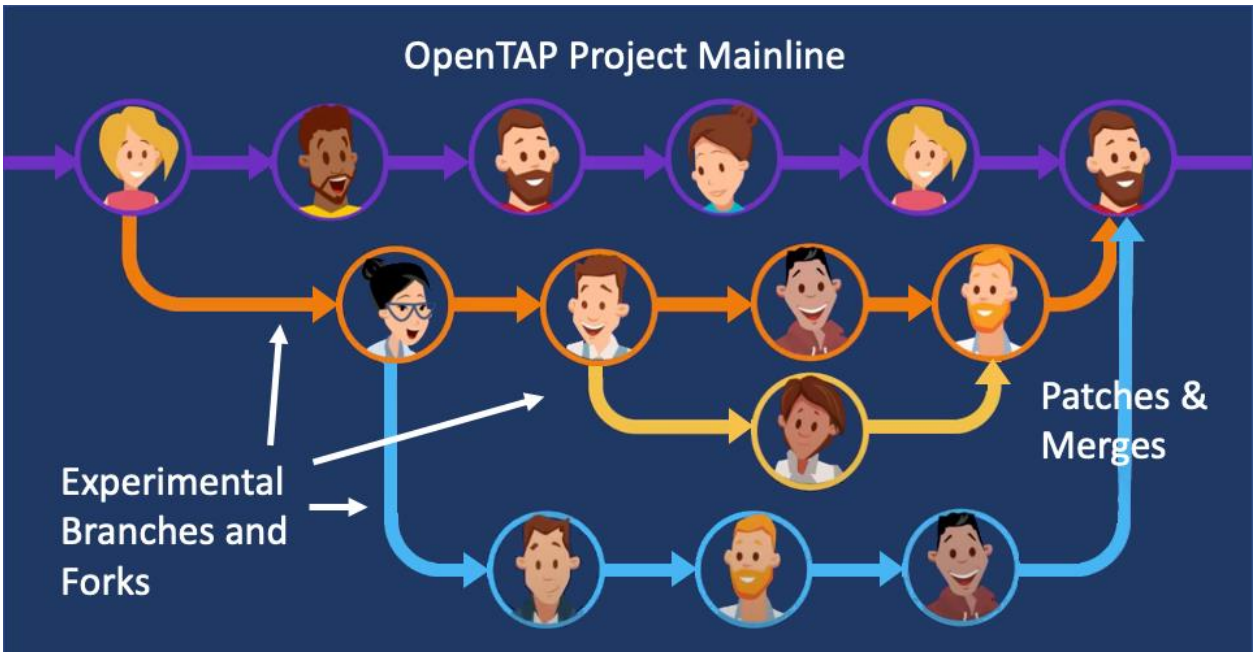


Not only do group director Tanya and other company executives take notice, but this rapid return reduces

remaining hesitancy from the Legal team for further project participation in OpenTAP and possibly other open source projects. Legal begins working with Codie on more flexible participation and contribution policies. Recognition of the value of participation also makes its way around the organization, along with acknowledgment that contribution needn't carry risk to valuable company IP.

Collaboration is Contagious

After this first success, development, and product teams from across the company begin deploying and also participating in OpenTAP and to help maintain the OpenTAP platform, submit patches and develop OpenTAP plugins. Instead of building and maintaining purpose-built test systems, they can leverage and improve shared open ones.



Collaboration crosses department lines and brings together developers from companies across an ecosystem, even competitors, to share in creating and maintaining non-differentiating technology.

The Results

- Faster time-to-market – reduced time spent "reinventing the wheel" and rapid innovation
- Improved margins – QA / code curation become shared activities vs. fragmented, repeated ones
- Lower defect rates – "Many eyes make bugs shallow" (Linus's Law)

These results have a visible impact and are noticed by company management, ecosystem partners, and most importantly, customers.

Challenges Met and Overcome

By leveraging the experience and enthusiasm of team members like OSPO lead Codie, and community participation by lab tech Francisco, the whole team was able to meet and overcome a range of challenges to adopting OpenTAP and other open source technology:

- Familiarity and comfort with legacy in-house and proprietary test automation solutions
- Concerns from the legal department about licensing terms, obligations and control of IP
- General resistance to change – a factor in all organizations

Fortunately, the team was able to point to a string of internal successes to justify OpenTAP adoption:

- A smooth pilot that leveraged existing hardware, software and test cases, outperforming expectations
- An early production implementation that kept the test team on or ahead of schedule
- Collecting and sharing compelling metrics for performance and engineering effort

Moreover, group director Tanya and other managers were impressed to learn how adopting OpenTAP and participating in an open source project helped to eliminate risk from internal legacy software as well as from commercial vendor lock-in, reducing or eliminating delays and overhead from maintaining in-house test platforms, lowering defect rates and improving margins. Win-win-win.

All teams benefitted from the insights, resources and experience of the OpenTAP community. Soon even critics were becoming advocates of OpenTAP-based transformation of test automation.

Collaboration is its Own Reward, and More

The company benefited fiscally, operationally, technically and reputationally.

- Building on open source OpenTAP reduced costs of technology acquisition and upkeep, freeing up resources and supporting re-use of legacy hardware and software
- Standardizing on a single test automation platform allowed test teams to consolidate development efforts and re-use code across projects
- OpenTAP delivered boosts in performance and capabilities, streamlining test execution and supported greater parallelism in test operations
- Visible participation in a community-based project enhanced the company's reputation for innovation, attracting new talent and helping to engage a global partner ecosystem

The individuals behind the adoption and integration of OpenTAP and open source software were willing to take risks and exert leadership, within their groups, the company and beyond.

For that, they were rewarded:

Gabriel – the "Change Angel"

- Built a new career on technology transformation
- Promoted to Director
- Now responsible for transforming a larger organization that requires next-generation automation of testing and other technologies

Codie – OSPO Lead

- Part-time open source advocacy now fully funded
- Elevated to new levels of visibility and importance
- OSPO is now a permanent fixture in the CTO's office

Francisco – Lab Tech

- Internally, became chief architect on the manufacturing test team
- Externally, as the company's participation and contributions evolved, Francisco was offered the role of a project maintainer for OpenTAP
- He began blogging and presenting at conferences on open source test automation

Tanya – Executive Sponsor

- Promoted from VP of system test to CTO
- Now oversees all R&D, design validation and manufacturing test
- Encouraging other groups to look at open source technologies and projects

Michael – Corporate Attorney

- Worked with the OSPO to establish company-wide policies for use of open source and contribution to open source projects
- Benefiting from community programs to support legal expertise
- Now has more time to devote to contracts, patents and other strategic issues

---

All teams benefitted from the insights, resources and experience of the OpenTAP community. Soon even critics became advocates for OpenTAP.

Now It's Your Turn

Like our heroes, you can revolutionize your approach to test automation, transform your organization, and advance your career, with OpenTAP.

Take the first step.

Visit OpenTAP.io and join the OpenTAP Community.