



Ensuring High Quality Voice Services: Automated Testing Frameworks Raise the Bar

A MapleWorks White Paper

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INTRODUCTION

Testing activities are time consuming but an essential part of any software development quality process. Testing ensures a product functions according to specifications and customer requirements. Testing ranges from executing simple unit test cases to running heavy load and performance testing in an endless variety of product configurations. In the past, testing was a time-consuming task executed manually. Today, test automation tools have supplemented manual testing, which have provided manufacturers with the ability to release a higher quality product to market faster.

A test automation system is a cost saving measure that:

- Provides a framework for regression testing previously released capabilities;
- Allows a tester to incrementally and easily add new test cases and test scenarios;
- Enables greater coverage and reliability of both functional and performance requirements; and
- Provides management of the results on an ongoing basis.

The payback for an investment in test automation is usually realized in the very first release of the product under test. Additional benefits also accrue from the improved product quality in the marketplace by reducing support costs and increasing sales.

Product development organizations are setting up automated test frameworks to:

- Organize various sets of existing test cases;
- Automate the execution of individual manual test cases;
- Facilitate regression testing of new product releases with established test suites;
- Extend current test suites with ease; and
- Automate the labor intensive process of scalability and performance testing.

MapleWorks has experience in building Test Automation Frameworks (TAF) for a variety of target products that allow customers to focus on their core competencies and release a higher quality product faster. MapleWorks builds TAFs that address testing needs for voice-based systems, data-based systems, and converged (voice and data) systems. (Note: MapleWorks has many different frameworks including a GUI testing framework that enables one to test UI application functionality. For more information, please visit www.mapleworks.com.)

This white paper describes a generic approach for the automation of functional and performance tests of a voice services platform for both incoming and outgoing call services by utilizing a TAF.

ACRONYMS USED IN THIS WHITE PAPER:

DTMF: Dual Tone Multi Frequency
DUT: Device Under Test
SIP: Session Initiation Protocol
SUT: System Under Test
TAF: Test Automation Framework
TDM: Time Division Multiplexing
VoIP: Voice over Internet Protocol

REQUIREMENTS FOR TEST AUTOMATION FRAMEWORKS

The objective of any framework is to provide a foundation on which many different test applications can live. The framework then facilitates the creation of specific test automation applications that meet the test requirements of a particular product.

Common requirements across implementations include the ability to:

- Script test cases in a variety of common languages (e.g. TCL, Expect, Perl, Python);
- Automate manual test cases that have been written to test a device;
- Control a distributed test environment across multiple boxes and Devices Under Test (DUT);
- Correlate test results for a given test case from multiple systems in the test environment;
- Integrate easily to third party test devices or software;
- Compare results observed versus expected results input in the test cases and compute a pass/fail result;
- Gather logs from a DUT and other boxes in a test environment;
- Create reports in popular output formats (e.g. HTML) based on test case pass or fail results;
- Export test results in a variety of formats (e.g. XML, HTML, CSV) for input to other reporting systems;
- Execute test suites at specific times;
- Set up an entire lab for testing and return it to a known state at the end of a test run;
- Generate email notifications at the end of a test run with test results included;
- Initiate tests and gather results remotely via a web interface; and
- Load a device under test with traffic and measure results.

MapleWorks has built Automated Test Frameworks that address all of these requirements and, in addition, satisfy the specific requirements that are dictated by the device being tested or by the specific customer design and test environment into which the framework is being deployed.

VOICE AUTOMATION

A voice or converged service product requires tools to drive its telephony interfaces and/or to collect outgoing traffic attempts from a system. A Test Head, which can be controlled or stimulated by a test management engine, must be capable of driving and accepting telephony calls over various TDM- or SIP-based interfaces.

Since the communication server offers systems integrations with various third party platforms, there is a need for testing the platform with each partner element for each release to ensure quality and performance. Fully manually testing all of these combinations is expensive and requires substantial test resources and time.

Test Heads

For voice services, Test Heads are typically one or more call generators used to drive the DUT. Test Heads can drive both functional traffic and performance traffic.

The Empirix Hammer is one of the more widely used call generators that can generate both analog and VoIP based calls to a DUT, or to sink calls from a DUT. It has the ability to stimulate the dialogs, capture and monitor the exchanges, and collect statistics about the success or failure of tests.

MapleWorks technical resources have extensive experience with the Empirix Hammer call generator.

The MapleWorks Call Load Tester is a bulk call generator built on a system housing standard TDM-based telephony cards. This system can be extended to provide additional functionality for driving or sinking speech or DTMF dialogs. The test generator can generate a very large number of calls—typically 4 T1 or E1 spans (up to 120 ports) per server.

Staging and Approach

The first step in determining an approach for test automation for a customer is the overall *needs analysis* stage. In this stage, a test topology is designed which includes the entire scope of devices under test. From this analysis, selection of a particular TAF is made which meets the requirements. A key part of this analysis is the means by which distributed control is achieved which requires product specific “hooks” that are used by a remote agent. In the next stage, MapleWorks typically performs *call flow* analysis to determine the nature and scope of the tests and the need for Test Heads to drive or receive the voice calls. The

Performance Testing

The objective of performance testing is to drive or receive high call connection rates, high concurrent resource use (host or card based speech services) and then observe both platform usage (CPU, memory, I/O) and service metrics (recognition rates, response times, speech quality). To do this effectively, it is required to drive many concurrent dialogs, large call rates, and then relate the service metrics gathered from the System Under Test (SUT) and from the user endpoint perspective (call generation platform).

Certain tools are optimized for functional testing but do not scale easily or inexpensively to perform high load testing. MapleWorks has used a combination of tools to meet functional and performance testing in a cost effective manner. For example, the MapleWorks Call Load Tester is a less refined test tool that can drive heavy call loads at a low per port cost. It can drive both TDM calls and VoIP calls through its internal TDM to VoIP gateway, and it can also drive TDM traffic to an external VoIP gateway. There’s no easy auditing of voice dialogs with the bulk call generator; however, the bulk call generator can generate background traffic in combination with Hammer (or other third party) call generation. Performance behavior can be observed in great detail using measurements from the Hammer without a high cost per port.

analysis includes reviewing the range of telephony interfaces which will be required to test the full functionality of the device(s) under test. This could include various telephony line and trunk interfaces and VoIP signaling and media interfaces supported by the DUT. Further, the needs for maximum performance of the system are considered here to understand the performance test requirements. The output of this stage is a decision on the proper Test Heads, and third party test tools to use including any need for custom development or extensions to open source tools.

Once a full understanding of the test call flows is achieved, *plans for remotes agents and their implementation* are completed. This can be done in parallel to the writing of test cases, adapting of current manual test cases into the test framework, organizing, and managing the test cases into test groups, test suites, and functional areas.

One of the most challenging and customer specific tasks is the *comparison of tests and results* and the analysis required to specify the reporting of the data. The flexibility of the test framework goes a long way to easing the correlation and data analysis. A framework which provides a variety of scripting languages and extension mechanisms is critical.

CONCLUSION

Automated Test Frameworks have become a mandatory weapon of a manufacturer's arsenal to *improve product quality, accelerate time-to-market, and reduce costs*. MapleWorks has extensive experience in designing, building, and deploying scalable TAFs for a wide variety of telecommunications applications. By outsourcing the creation of TAFs to MapleWorks, customers reap the benefits of a well designed TAF without distracting themselves from their core business of product creation.

THE AUTHOR OF THIS WHITE PAPER

The author of this white paper, MapleWorks Technology, is an experienced source of **software development services** for developers of **networking and communication products** for both the service provider and enterprise markets.

MapleWorks offers clients the following value:

Rich communications DNA

- o Average of 15 years experience in the network communications domain
- o Located in Silicon Valley North, their staff has experience from Nortel, Mitel, Siemens, RIM, etc.
- o Staff is technology focused and invest in staying on top of emerging technologies

Factors contributing to MapleWorks' proven track record of bringing products to market on time and on budget are the company's expert engineers and a proprietary **fluid, hybrid development process called MapleWorks OnTrack™**

Business practices

- o IP protection is respected and is the same as in the USA
- o Onshore service provider; therefore, visas are not required
- o Face-to-face knowledge transfer at client's site
- o Management philosophy is one of minimal handholding, operating in a fluid environment, and successfully adapting to each client's development processes

Business environment

- o Development culture is the same as the USA
- o English is the primary language
- o Close proximity to the Ottawa International Airport enables day trips or single overnight stays
- o Similar time zone
- o Geopolitical stability means no risk to client projects

Variable development cost is 30-40% less than in the USA

MapleWorks holds membership with each of the following industry associations:

Massachusetts Technology Leadership Council (MTLC) – www.masstlc.org

Massachusetts Network Communications Council (MassNetComms) – www.massnetcomms.org

Canadian Advanced Technology Alliance (CATA) – www.cata.ca

Ottawa Centre for Research and Innovation (OCRI) – www.ocri.ca

If you have questions about your outsourcing project, we invite you to contact us by phone at 781.897.1727 or send email to info@mapleworks.com



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