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# Hardware Testing at Hyperscale

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TEST AND VALIDATION

# Hardware Testing at Hyperscale

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# Presenters

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# The Early Days of DC Hardware Testing

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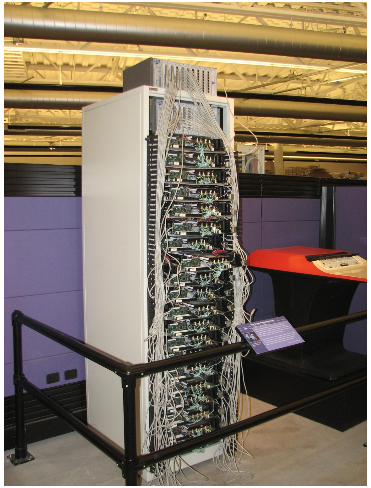
Before the days of Hyperscale:

- Server Counts were an insignificant fraction of what they are today.
- All machines were basically homogenous
    - It was a CPU centric world, and CPU was generally x86-64 based.
- SKU proliferation was low, and almost everything was "designed in house" for the Hyperscalers specific needs.
- Most of our testing and validation was done at one integration facility with a common set of infrastructure.



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# Enter the Hyperscale Era

- Machine counts have well exceeded linear growth.
- The proliferation of different machine types has continued to grow
- Several different instruction sets to target (x64, AArch64, RISC-V, etc)
- No longer only CPU-centric, there are many types of off-loads and accelerators that need testing.
- Increasingly, DC designs are becoming partnerships across many different organizations with different environments
- Tests and Diagnostics are no longer developed 100% internally. We use a variety of different diagnostics both internal and externally developed. Many tests and repair processes are proprietary with documented interfaces.
- The New Product Introduction (NPI) cycle has shortened, and elimination of duplicate work for testing/validation has become essential to be competitive.

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# Hardware Diagnostics - Low Volume/Early Life Cycle

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| | Hardware Bringup | System Integration Testing | Reliability Testing |
|---|---|---|---|
| Why? | First Boot, initial debug/design verification | Verify Hardware and Software quality/compatibility during development | Estimate Hardware Longevity Estimates and Reliability (MTBF, MTDL, etc), Thermal Limits and Design Issues |
| What? | Power Sequencing, Boot Up, Bus Training | Hardware diagnostic/performance/stress/load testing for software development life-cycle. | Stress Testing, Voltage/Frequency Margining<br>Environmental and Thermal Testing |
| Who? | Hardware/Software Engineers | Software Engineers | Hardware and Quality/Reliability Engineers |
| Where? | Design Partners and Hyperscalers<br>Lab Bench, Simulators | Design Partners and Hyperscalers<br>Dedicated CI Environment | Labs, Environmental Chambers, Shock and Vibe, etc |
| How? | Manual Execution<br>No/Light Automation<br>Ad Hoc Execution | Usually integrated into Continuous Integration/Continuous Release Environment and toolchain. | Long Tests<br>Highly Automated |

# Hardware Diagnostics - Volume Applications

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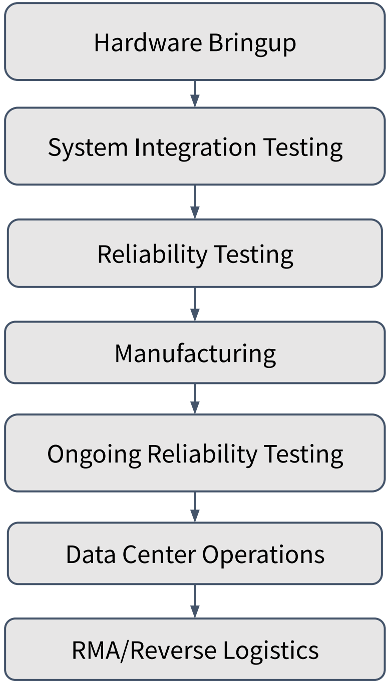
| | Manufacturing | Data Center Operations | RMA/Reverse Logistics |
|---|---|---|---|
| Why? | Verify Components, Provisioning and Assembly Processes | Verify Components, Provisioning and Assembly Processes | Verify Components, Provisioning and Assembly Processes |
| What? | Test All Components, Interconnects, and Assemblies | Test All Components, Interconnects, and Assemblies | Test Components |
| Who? | Manufacturing Engineers | Data Center Operations | Hardware/Vendor Engineering |
| Where? | Contract/Original Design Manufacturers | Data Centers, Colo Facilities | Contract/Original Design Manufacturers |
| How? | Highly Automated Test Executives with tight shop floor control integration<br>Indict to Component/BUS Level | High Automated Test Executives<br>High Security Requirements<br>Tight integration with Work Flow Management Systems<br>Indict to FRU Level | Various Levels of Automation<br>Indict to Component or FRU Level |

# Multiple Use-Cases, Multiple Requirements

- Different Execution Environments
  - Many Different Test Executives and Sequencers used for different testing scenarios
  - Different Security Requirements
  - Different Operating Systems
  - Different Data Schemas
- Different Test Use Cases
  - Long-Running vs. Short Running Tests
  - Component level vs. FRU level Root-Cause
  - FRU Level vs. System Level vs. Rack Level vs. Multi-Rack Testing
- Different Users, Engineers, and Stakeholders
  - Differing Skill-sets
  - Differing Preferred Toolsets
    - Development Languages
    - Continuous Integration Environments
    - Data Collection/Analysis Needs



# What are the new challenges we need to solve?

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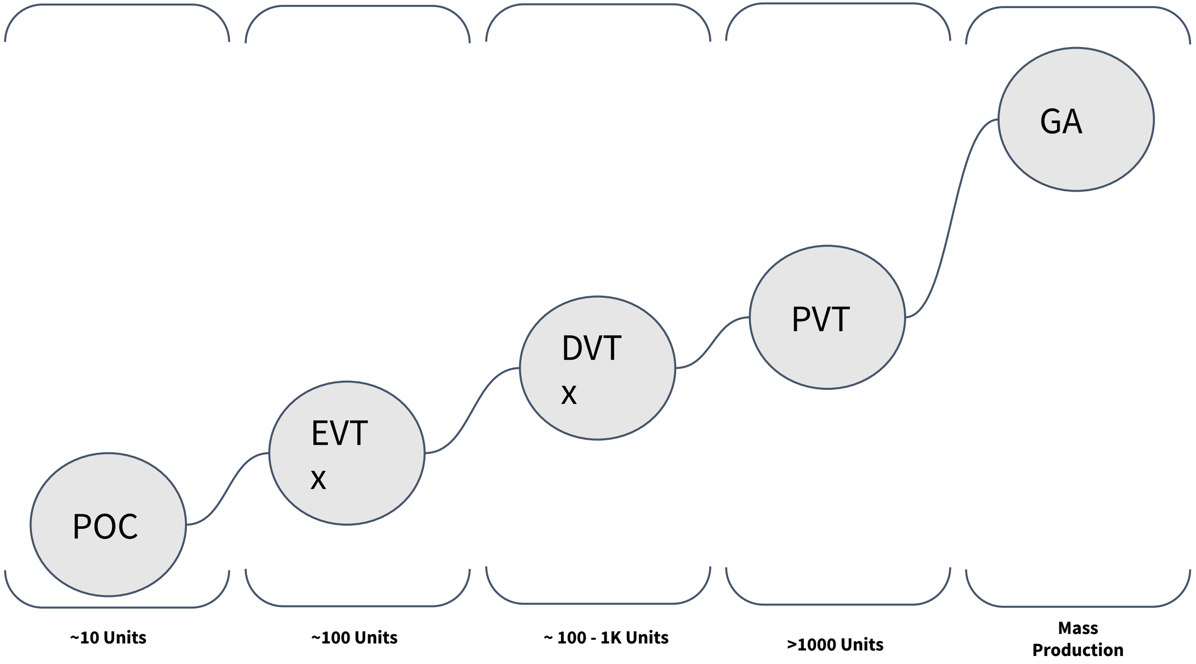
- Acceleration/re-use of diagnostic development and integration efforts at all stages of the product life-cycle.
- Diagnostic portability across multiple products, environments, and use-cases.
- Reproduction of test and validation issues across multiple hardware and software partners.
- Simple sharing of component vendor tests to accelerate RMA and root-cause analysis.

# Hardware Testing Applications

Testing requirements continue to change at each stage as volumes continue to increase in the product development life-cycle…

As the DUT counts increase, so does pressure for test time optimization and high fault isolation to aid repair cycles.

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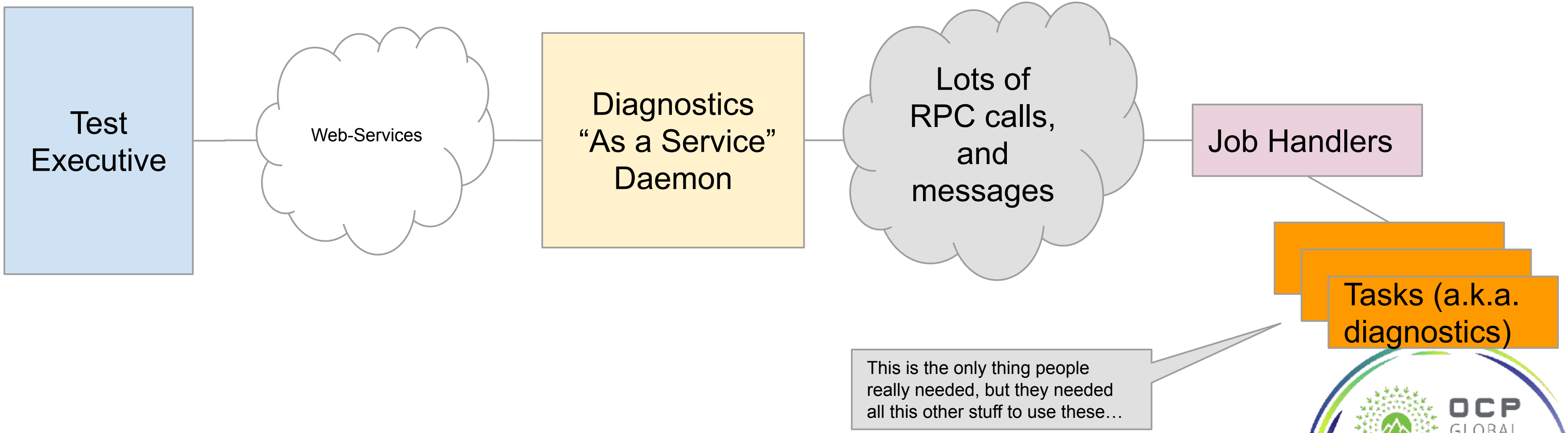
# How We Got Here

Before the proposed OCP Diagnostic standard, our diagnostics were very tightly integrated with our test framework, and it made portability very difficult.  In order to run our diagnostics, it meant exporting a great deal of our internal Infrastructure.



# How Test Execution Could Be Structured

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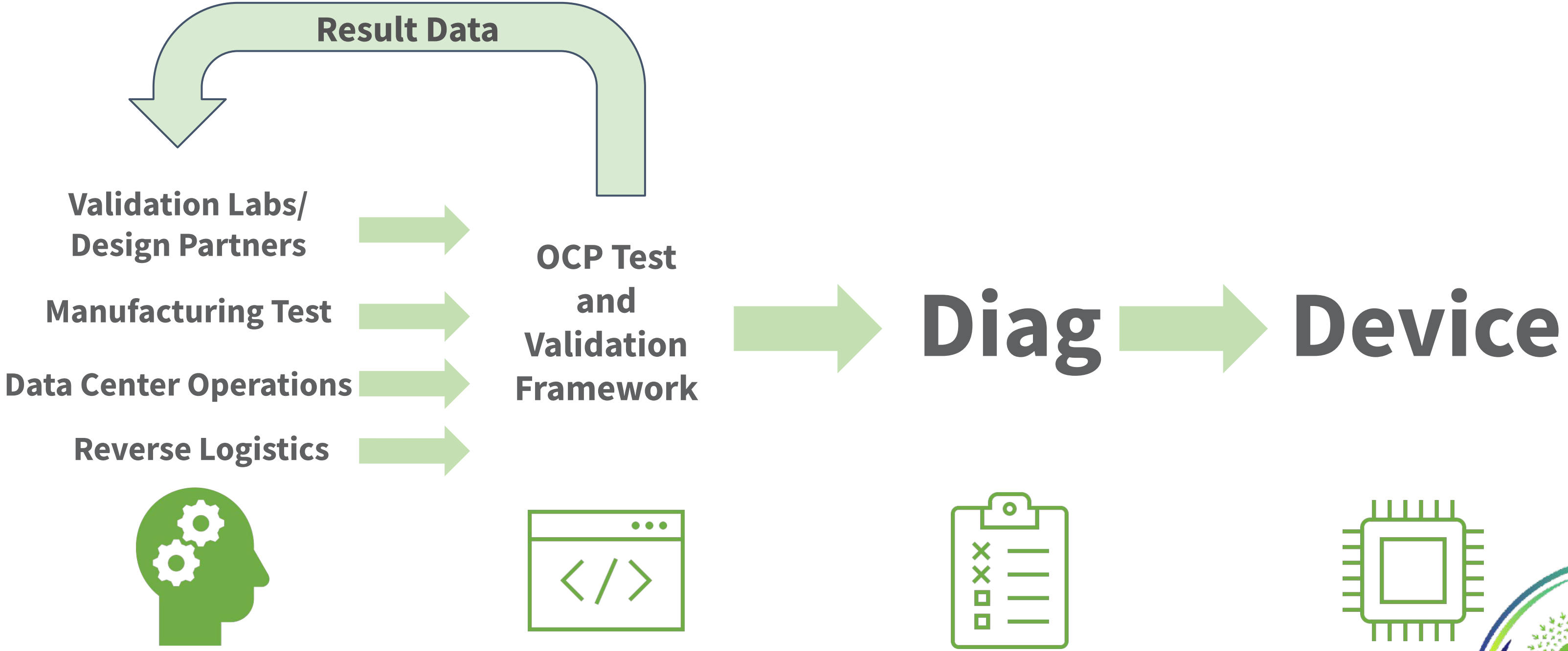

# OCP Diagnostic and Validation Framework

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This framework provides multi-language support for the following features…

- Proven Data Model for Diagnostic Output
- API’s to easily produce that output.
- Streaming Results For Long Running Tests
- Simple, Powerful Parameter Management
- An optional Device Communication Library
- An optional Hardware Abstraction Layer

# How does it fit in different environments?

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## Test Environment/Executive

- Provides sequencing for tests.
- Typically integrates with PLM and control systems.
- Records test results to some persistent store (database, etc)
- Provides arguments to a diagnostic
- May control the lifecycle of a diagnostic.
- May be responsible for installing a diagnostic payload onto a machine under test.
- Typically has final determination of pass/fail or at least the ability to override that.
- May transform OCP diagnostic output to an internal/alternative representation.

## OCP Diagnostic

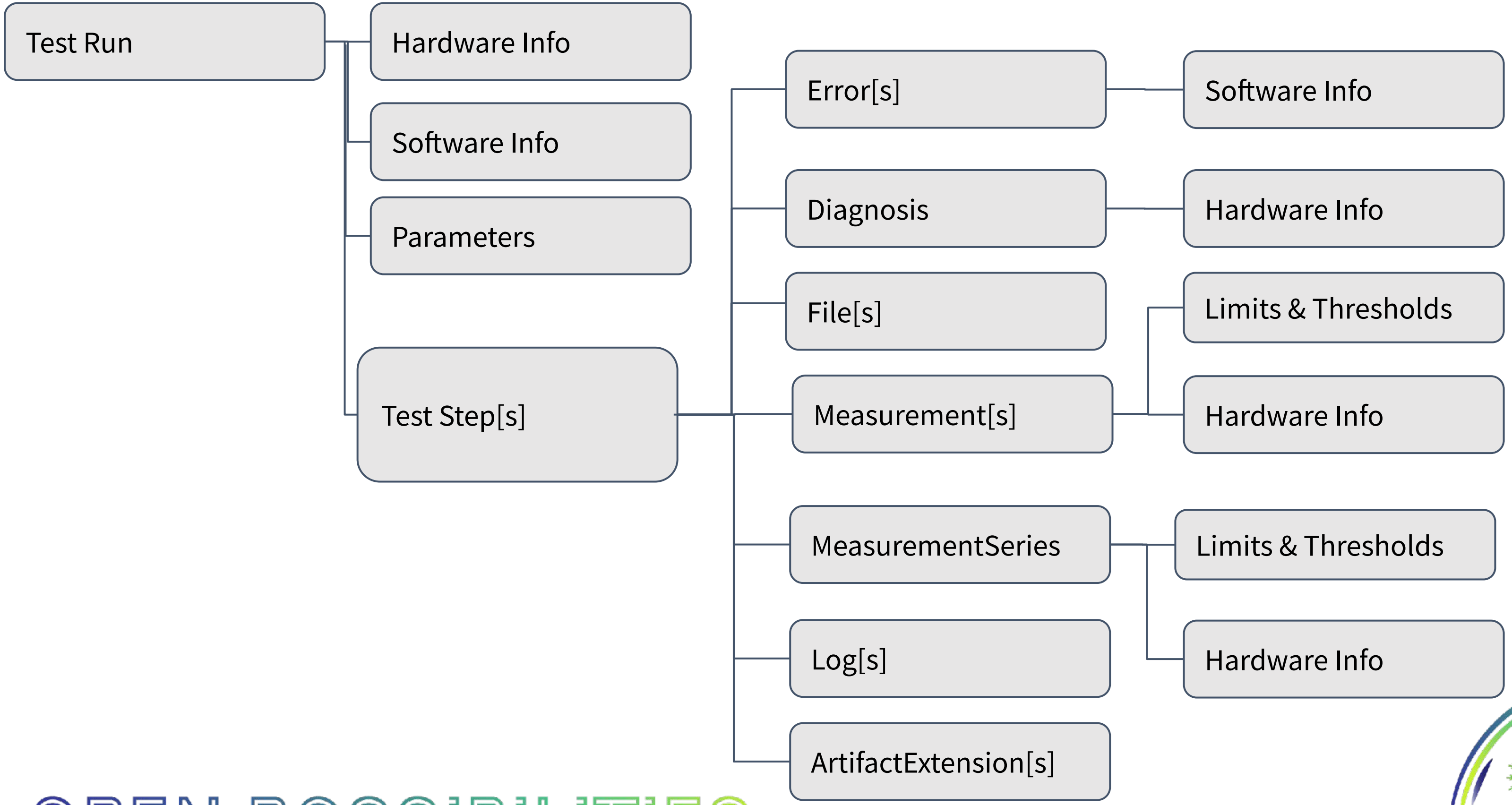
- Parses input arguments
- Performs actual testing either on or off the device under test.
- Provides a consistent output format.
- Provides pass/fail result which can be overridden by a test executive.

**The OCP Diagnostic framework is NOT a test executive.**

A test executive typically has dozens of integration points in an organization (i.e. ERP, MES, Data Collection, etc).

By contrast, the diagnostic or test typically only has two integration points, so portability is best achieved at interacting at this level.

# OCP Diagnostics - Result Model

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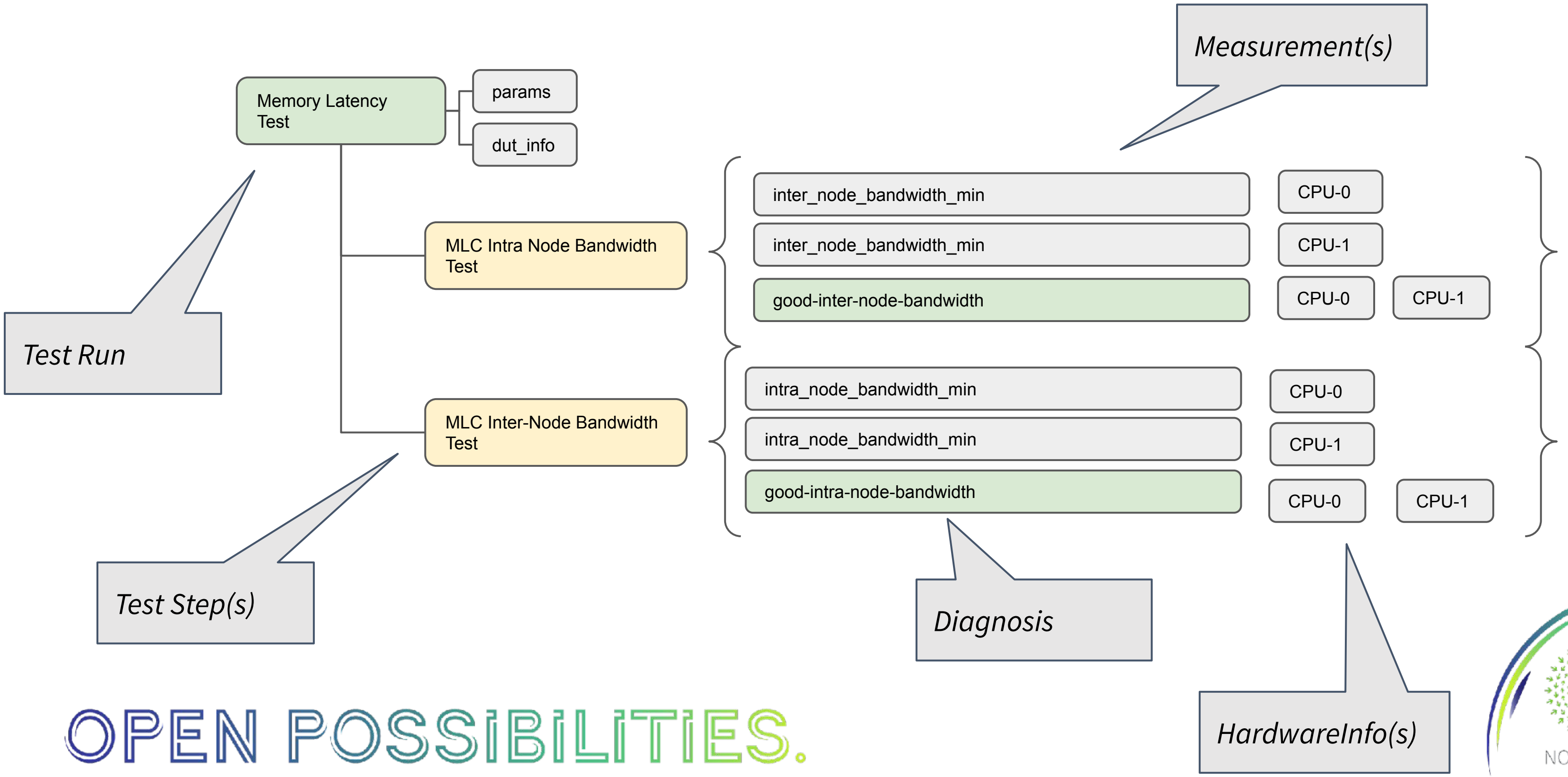
# OCP Diagnostics - Result Model Example

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# OCP Diagnostics - Result API's - Test Runs

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```
// Intended use is to have one TestRun object per OcpDiag Test.
class TestRun : public internal::LoggerInterface {
 public:
  ~TestRun() override { End(); }

  // Returns a TestRun object if successful. This is meant to be called only
  // once per test, and will fail if called a second time. `name`: a descriptive
  // name for your test.
  static absl::StatusOr<TestRun> Init(std::string

  // Emits a TestRunStart artifact and registers the DutInfos.
  // No additional DutInfos can be registered after this point.
  virtual void StartAndRegisterInfos(
      absl::Span<const DutInfo> dutinfos,
      const proto2::Message& params = google::protobuf::Empty());

  // Emits a TestRunEnd artifact and returns overall result.
  virtual third_party::OcpDiag::results_pb::TestResult End();

  // Skips and ends the Test.
  // Should be part of, or followed by a return statement.
  virtual third_party::OcpDiag::results_pb::TestResult Skip();

  // Emits an Error artifact, associated with the TestRun.
  // This is intended for scenarios where a software error occurs
  // before the test officially starts (i.e. the TestRun::StartAndRegisterInfos
  // method has not yet been called. For example, when gathering host
  // information with the hardware interface).
  // Once the test has started, prefer to use TestStep::AddError(...).
  virtual void AddError(absl::string_view symptom, absl::string_view message);
```

```
// Emits a Tag artifact, associated with the TestRun
virtual void AddTag(absl::string_view tag);

// Returns the current overall TestRun status
virtual third_party::OcpDiag::results_pb::TestStatus Status() const;

// Returns the current overall TestRun result
virtual third_party::OcpDiag::results_pb::TestResult Result() const;

// If true, it is ok to start creating TestSteps.
virtual bool Started() const;

// Returns true if the TestRun has ended (i.e. any of End(), Skip(), or
// fatal error have been called)
virtual bool Ended() const;

// Emits a Log artifact of Debug severity, associated with the TestRun.
void Debug(absl::string_view msg) override;
// Emits a Log artifact of Info severity, associated with the TestRun.
void Info(absl::string_view msg) override;
// Emits a Log artifact of Warn severity, associated with the TestRun.
void Warn(absl::string_view msg) override;
// Emits a Log artifact of Error severity, associated with the TestRun.
void Error(absl::string_view msg) override;
// Emits a Log artifact of Fatal severity, associated with the TestRun.
// Note: this may have downstream effects, such as terminating the program.
void Fatal(absl::string_view msg) override;
```

# OCP Diagnostics - Result API's - Test Steps

TEST AND VALIDATION

```
// TestStep is a logical subdivision of a TestRun.
class TestStep : public internal::LoggerInterface {
 public:
  ~TestStep() override { End(); }

  // Factory to create a TestStep. Emits a TestStepStart artifact if successful.
  static absl::StatusOr<TestStep> Begin(TestRun*, std::string name);

  // Emits a Diagnosis artifact. A FAIL type also sets TestRun result to FAIL,
  // unless an Error artifact has been emitted before this.
  virtual void AddDiagnosis(third_party::OcpDiag::results_pb::Diagnosis::Type,
                            std::string symptom, std::string message,
                            absl::Span<const HwRecord>);

  // Emits an Error artifact associated with this TestStep.
  // Also Sets TestRun status to ERROR.
  virtual void AddError(absl::string_view symptom, absl::string_view message,
                        absl::Span<const SwRecord>);

  // Emits a standalone Measurement artifact.
  // Acceptable Value kinds if using ValidValues limit: NullValue, number,
  // string, bool, ListValue.
  // Acceptable Value kinds if using Range limit: number, string.
  virtual void AddMeasurement(
      third_party::OcpDiag::results_pb::MeasurementInfo,
      third_party::OcpDiag::results_pb::MeasurementElement,
      const HwRecord* hwrec);

  // Emits a File artifact
  virtual void AddFile(third_party::OcpDiag::results_pb::File);

  // Emits an ArtifactExtension artifact
  virtual void AddArtifactExtension(std::string name,
                                    const proto2::Message& extension);

  // Emits a Log artifact of Debug severity, associated with the TestStep.
  void Debug(absl::string_view msg) override;
  // Emits a Log artifact of Info severity, associated with the TestStep.
  void Info(absl::string_view msg) override;
  // Emits a Log artifact of Warn severity, associated with the TestStep.
  void Warn(absl::string_view msg) override;
  // Emits a Log artifact of Error severity, associated with the TestStep.
  void Error(absl::string_view msg) override;
  // Emits a Log artifact of Fatal severity, associated with the TestStep.
  // Note: this may have downstream effects, such as terminating the program.
  void Fatal(absl::string_view msg) override;

  // Emits a TestStepEnd artifact
  virtual void End();

  // Skips and ends the step.
  virtual void Skip();

  // Returns true if End() or Skip() have been called
  bool Ended() const;

  // Returns current TestStep status
  third_party::OcpDiag::results_pb::TestStatus Status() const;
```

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# OCP Diagnostics - Result API's - MeasurementSeries

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```
// A collection of related measurement elements.
class MeasurementSeries {
 public:
  virtual ~MeasurementSeries() { End(); }

  // Factory method to create a MeasurementSeries. Emits a
  // MeasurementSeriesStart artifact if successful.
  static absl::StatusOr<MeasurementSeries> Begin(
      TestStep*, const HwRecord&,
      third_party::OcpDiag::results_pb::MeasurementInfo);

  // Emits a MeasurementElement artifact with valid range limit.
  // Acceptable Value kinds: string, number
  virtual void AddElementWithRange(
      google::protobuf::Value,
      third_party::OcpDiag::results_pb::MeasurementElement::Range

  // Emits a MeasurementElement artifact with valid values limit.
  // Acceptable Value kinds: NullValue, number, string, bool, ListValue.
  virtual void AddElementWithValues(
      google::protobuf::Value,
      absl::Span<const google::protobuf::Value> valid_values);

  // Emits a MeasurementElement artifact without a limit.
  // Acceptable Value kinds: NullValue, number, string, bool, ListValue.
  virtual void AddElement(google::protobuf::Value value);

  // Emits a MeasurementSeriesEnd artifact unless already ended.
  virtual void End();

  // Returns true if End() has already been called
  virtual bool Ended() const;
```

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# Diagnostic Output - JSON

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The OCP Diagnostic Framework by default returns results as executed as streaming JSON output.

Why JSON?

- Highly Portable, Self-Describing - No Metadata needed.
- Human readable and machine readable.
- Many visualization/validation tools available
- Widely known/expertise across all diagnostic functions.
- JSONL provides a format for streaming large amounts of JSON for long-running tests that require periodic updates.

Limitations of JSON

- Not Performant/High Level of Transmission Redundancy/Computationally expensive to parse
- Requires an intermediate schema for streaming long-running tests with real-time updates. Some of our use-cases for testing have very long durations (i.e. weeks)

We have selected portability over efficiency for the simplified integration, but internally all data is represented by a strongly typed, efficient protocol buffer implementation.

# Diagnostic Output - JSON

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```
{"testRunArtifact":{"testRunStart":{"name":"mlc","version":"399834856","parameters":{"@type":"type.googleapis.com/meltan.mlc.Params","interNodeBandwidthMin":0,"intraNodeBandwidthMin":0,"interNodeLatencyMax":0,"intraNodeLatencyMax":0,"useDefaultThresholds":true,"dataCollectionMode":false},"dutInfo":[{"hostname":"dut","hardwareComponents":[{"hardwareInfoId":"0","arena":"","name":"cpu0","fruLocation":{"devpath":"/phys/CPU0","odataId":"","blockpath":"","serialNumber":"cpu0_serial"},"partNumber":"cpu0_part","manufacturer":"MFG","mfgPartNumber":"","partType":"cpu"},{"hardwareInfoId":"1","arena":"","name":"cpu1","fruLocation":{"devpath":"/phys/CPU1","odataId":"","blockpath":"","serialNumber":"cpu1_serial"},"partNumber":"cpu1_part","manufacturer":"MFG","mfgPartNumber":"","partType":"cpu"}],"softwareInfos":[{"softwareInfoId":"1","arena":"","name":"system_daemon","version":"20210902.0-external-nightly-0"}]}]}},"sequenceNumber":0,"timestamp":"2021-09-30T03:09:44.678957932Z"}
{"testStepArtifact":{"testStepStart":{"name":"Measure Internode Bandwidth"},"testStepId":"1"},"sequenceNumber":1,"timestamp":"2021-09-30T03:12:40.667365379Z"}
{"testStepArtifact":{"measurement":{"info":{"name":"inter_node_bandwidth_min","unit":"MB/sec","hardwareInfoId":"0"},"element":{"index":0,"measurementSeriesId":"NOT_APPLICABLE","range":{"minimum":49500,"maximum":"Infinity"},"value":115649.4}},"testStepId":"1"},"sequenceNumber":2,"timestamp":"2021-09-30T03:12:40.667907305Z"}
{"testStepArtifact":{"measurement":{"info":{"name":"inter_node_bandwidth_min","unit":"MB/sec","hardwareInfoId":"1"},"element":{"index":0,"measurementSeriesId":"NOT_APPLICABLE","range":{"minimum":49500,"maximum":"Infinity"},"value":115704.2}},"testStepId":"1"},"sequenceNumber":3,"timestamp":"2021-09-30T03:12:40.668283952Z"}
{"testStepArtifact":{"diagnosis":{"symptom":"good-inter-node-bandwidth","type":"PASS","msg":"Measured value 115649.4 \u003e= minimum bandwidth threshold 49500","hardwareInfoId":["0","1"]},"testStepId":"1"},"sequenceNumber":4,"timestamp":"2021-09-30T03:12:40.668557351Z"}
{"testStepArtifact":{"testStepEnd":{"name":"Measure Internode Bandwidth","status":"COMPLETE"},"testStepId":"1"},"sequenceNumber":5,"timestamp":"2021-09-30T03:12:40.668732179Z"}
{"testStepArtifact":{"testStepStart":{"name":"Measure Intranode Bandwidth"},"testStepId":"2"},"sequenceNumber":6,"timestamp":"2021-09-30T03:12:40.668890997Z"}
{"testStepArtifact":{"measurement":{"info":{"name":"intra_node_bandwidth_min","unit":"MB/sec","hardwareInfoId":"0"},"element":{"index":0,"measurementSeriesId":"NOT_APPLICABLE","range":{"minimum":139500,"maximum":"Infinity"},"value":180296.1}},"testStepId":"2"},"sequenceNumber":7,"timestamp":"2021-09-30T03:12:40.669171538Z"}
{"testStepArtifact":{"measurement":{"info":{"name":"intra_node_bandwidth_min","unit":"MB/sec","hardwareInfoId":"1"},"element":{"index":0,"measurementSeriesId":"NOT_APPLICABLE","range":{"minimum":139500,"maximum":"Infinity"},"value":180585.5}},"testStepId":"2"},"sequenceNumber":8,"timestamp":"2021-09-30T03:12:40.669462376Z"}
{"testStepArtifact":{"diagnosis":{"symptom":"good-intra-node-bandwidth","type":"PASS","msg":"Measured value 180296.1 \u003e= minimum bandwidth threshold 139500","hardwareInfoId":["0","1"]},"testStepId":"2"},"sequenceNumber":9,"timestamp":"2021-09-30T03:12:40.669685368Z"}
{"testStepArtifact":{"testStepEnd":{"name":"Measure Intranode Bandwidth","status":"COMPLETE"},"testStepId":"2"},"sequenceNumber":10,"timestamp":"2021-09-30T03:12:40.669851968Z"}
{"testRunArtifact":{"testRunEnd":{"name":"mlc","status":"COMPLETE","result":"FAIL"}},"sequenceNumber":11,"timestamp":"2021-09-30T03:12:40.672711573Z"}
```


- Test Run Start
- Test Step Start
- Measurement
- Measurement
- Diagnosis
- Test Step End
- Test Step Start
- Measurement
- Measurement
- Diagnosis
- Test Step End
- Test Run End

# OCP Diagnostic Parameter Model

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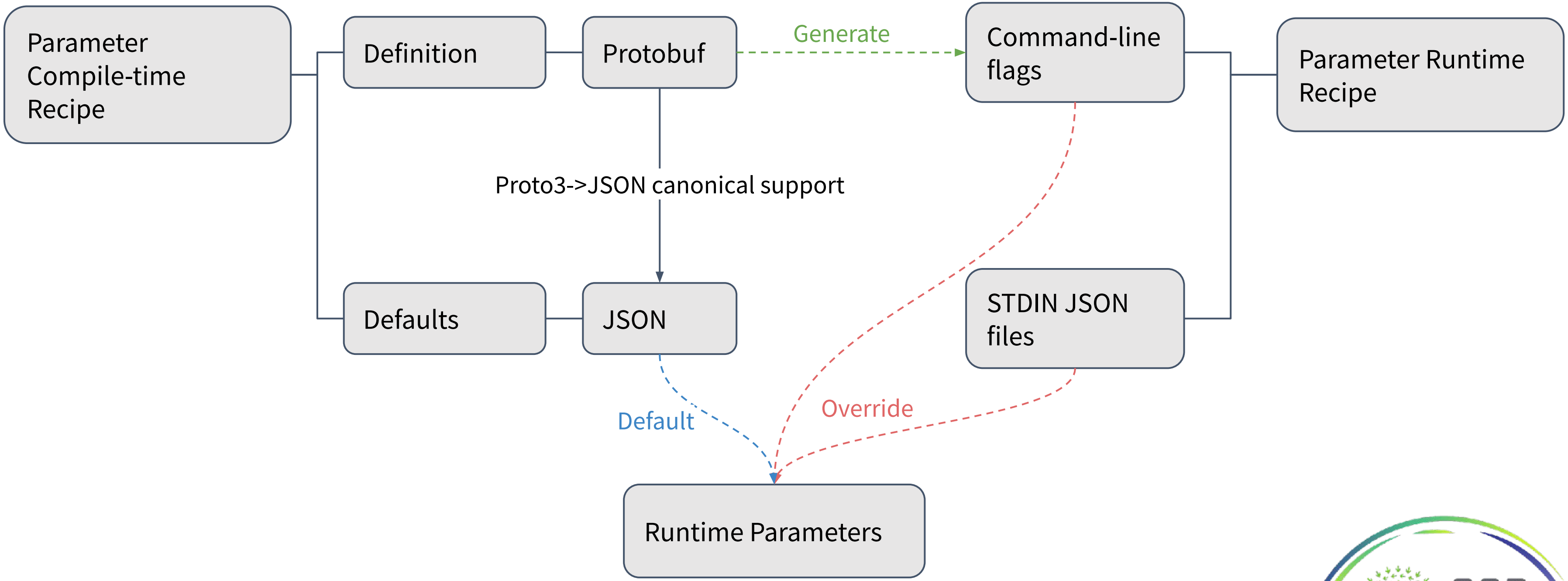
Due to the requirements to re-use diagnostics in multiple use-cases and environments, the ability to parameterize and configure the diagnostics at execution time rather than build time is essential.

In addition, some diagnostics have many different parameters, including complex-types and lists of values.

As a result, the ability to provide simple help to the consumers of the diagnostics, default parameters, and the ability to override those default parameters necessitates a powerful parameter model that allows developers to focus on the test challenge at hand, rather than the plumbing required to capture parameters and integrate with other test environments.

Parameters to OCP diagnostics can be specified as CLI arguments, or supplied via StdIn depending on the best approach for different users. This also provides the ability to leverage configuration files for very large parameter sets that are infrequently changing.

# OCP Diagnostic Parameter Model

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# Parameter Definition & Defaults

# --help can be used to print parameter flags.

```
$ ./mlc --help
Usage: ./mlc [options]              Name                 Description
  --inter_node_bandwidth_min  Minimum inter-node bandwidth required.
                  Type: float  Type
                  Default: 0
  --intra_node_bandwidth_min  Minimum intra-node bandwidth required.
                  Type: float
                  Default: 0
  --inter_node_latency_max  Maximum inter-node bandwidth allowed.
                  Type: float
                  Default: 0
  --inter_node_latency_max  Maximum intra-node bandwidth allowed.
                  Type: float
                  Default: 0
  --use_default_thresholds  Whether to use default thresholds
                  Type: bool
                  Default: true  Default
  --data_collection_mode  If this is true, the test won't compare the
bandwidth or data with any thresholds.
                  Type: bool
                  Default: false
```

```
// File: mlc/params.proto
syntax = "proto3";
package OcpDiag.mlc;

message Params {
  // Minimum inter-node bandwidth required.
  float inter_node_bandwidth_min = 1;
  // Minimum intra-node bandwidth required.
  float intra_node_bandwidth_min = 2;
  // Maximum inter-node latency allowed.
  float inter_node_latency_max = 3;
  // Maximum inter-node latency allowed.
  float intra_node_latency_max = 4;
  // Whether to use default thresholds.
  bool use_default_thresholds = 5;
  // If this is true, the test won't compare the
bandwidth or data with any thresholds.
  bool data_collection_mode = 7;
}
```

```
# File: mlc/params.json
{
  "use_default_thresholds" : true,
  "data_collection_mode" : false,
}
```

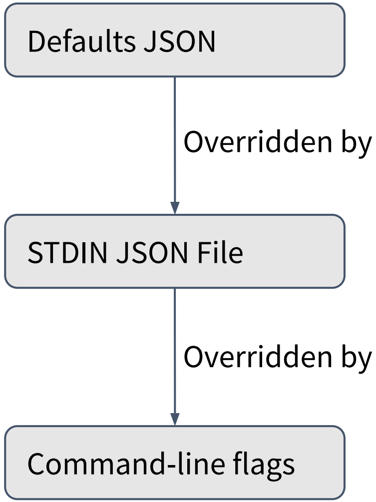
# "ocpdiag_test_pkg" Bazel Build Rule

TEST AND VALIDATION

```
# mlc/BUILD

load("//third_party/OcpDiag/lib:OcpDiag.bzl",
"ocpdiag_test_pkg")

# Parameter definition.
proto_library(
    name = "params_proto",
    srcs = ["params.proto"],
)

cc_proto_library(
    name = "params_cc_proto",
    deps = [":params_proto"],
)
```

```
# Test binary.
cc_binary(
    name = "mlc_bin",
    srcs = ["mlc_main.cc"],
    deps = [
        ":params_cc_proto",
    ],
)

# Test executable
ocpdiag_test_pkg(
    name = "mlc",
    binary = ":mlc_bin",
    json_defaults = "params.json",
    params_proto = ":params_proto",
)
```

# Parameter Overrides




Note: "**--dry_run**" flag can be used to sanity check parameter override combinations.

```
# Parameter override

$ ./mlc --dry_run
{
  "use_default_thresholds" : true,
  "data_collection_mode" : false,
}

$ cat param_override.json
{
  "use_default_thresholds" : false,
  "inter_node_bandwidth_min" : 100,
}

$ ./mlc --dry_run < param_override.json
{
  "inter_node_bandwidth_min" : 100,
  "use_default_thresholds" : false,
  "data_collection_mode" : false,
}

$ ./mlc --dry_run < param_override.json
--inter_node_bandwidth_min=200
{
  "inter_node_bandwidth_min" : 200,
  "use_default_thresholds" : false,
  "data_collection_mode" : false,
}
```

# OCP Diagnostics - Communication Interface

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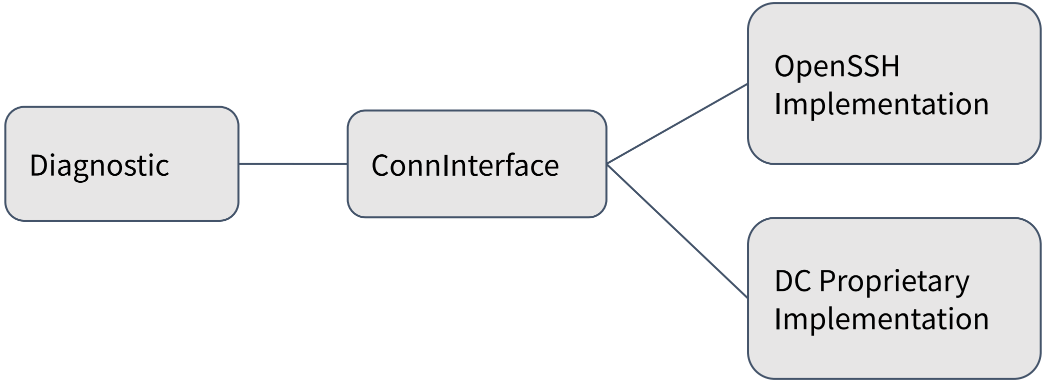
Diagnostics are typically invoked and sequenced from a control computer that is separate from the device under test. This control computer may be testing dozens, or even hundreds of DUT's in parallel depending on the environment. Different environments have different security needs. For instance, a manufacturing test environment may have different policies for remote execution than a tightly controlled production environment in a data center.

As such, the OCP Diagnostic framework includes an API to assist with common tasks that includes a simple interface for extending it into new environments, with new requirements. By default, an SSH based implementation is provided for users as part of the core framework.

# OCP Diagnostics - Communication Interface

TEST AND VALIDATION

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# OCP Diagnostics - Communication Interface APIs

```
// Class ConnInterface provides a remote connection to the specified machine
// node. It provides the file read/write operations, and the capability to
// launch a remote command on the machine node.
class ConnInterface {
 public:
  // Options to configure a command.

    // The following arguments specify an absolute file path for redirecting
    // stdout/stderr. Whenever the stdout/stderr is redirected, the
    // corresponding field in "CommandResult" will be empty.
    std::string stdout_file;
    std::string stderr_file;
  };

  // The exit code and the command's output to stdout and stderr.
  struct CommandResult {
    // set to -127 by default.
    // exit_code = 0 means OK. follows the python-style exit codes.
    int exit_code = -127;
    std::string stdout;
    std::string stderr;
  };
```

```
  // ReadFile reads a file from the machine node, and returns the full file
  // content on success, or the error status when applicable.
  virtual absl::StatusOr<absl::Cord> ReadFile(absl::string_view file_name) =
0;

  // WriteFile writes the given data to the file on the machine node and
returns
  // the status.
  virtual absl::Status WriteFile(absl::string_view file_name,
                                 absl::string_view data) = 0;

  // RunCommand runs a remote command on the machine node, and
returns the
  // command output on success, or the error status when applicable.
  // If the command's stdout/stderr is redirected by setting the
CommandOption
  // option, the corresponding field in "CommandResult" will be empty.
  virtual absl::StatusOr<CommandResult> RunCommand(
      absl::Duration timeout, const absl::Span<absl::string_view> args,
      const CommandOption& options) = 0;
};
```

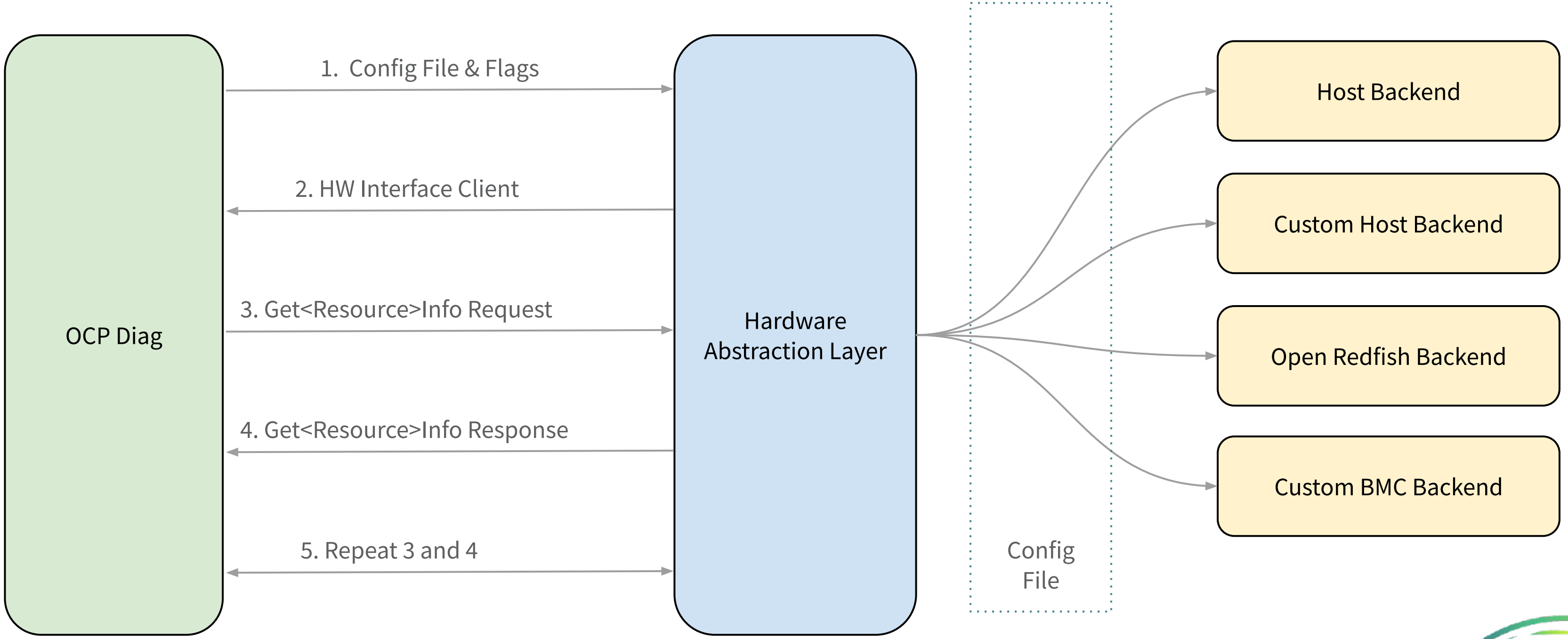
# OCP Diagnostics - Hardware Interface

TEST AND VALIDATION

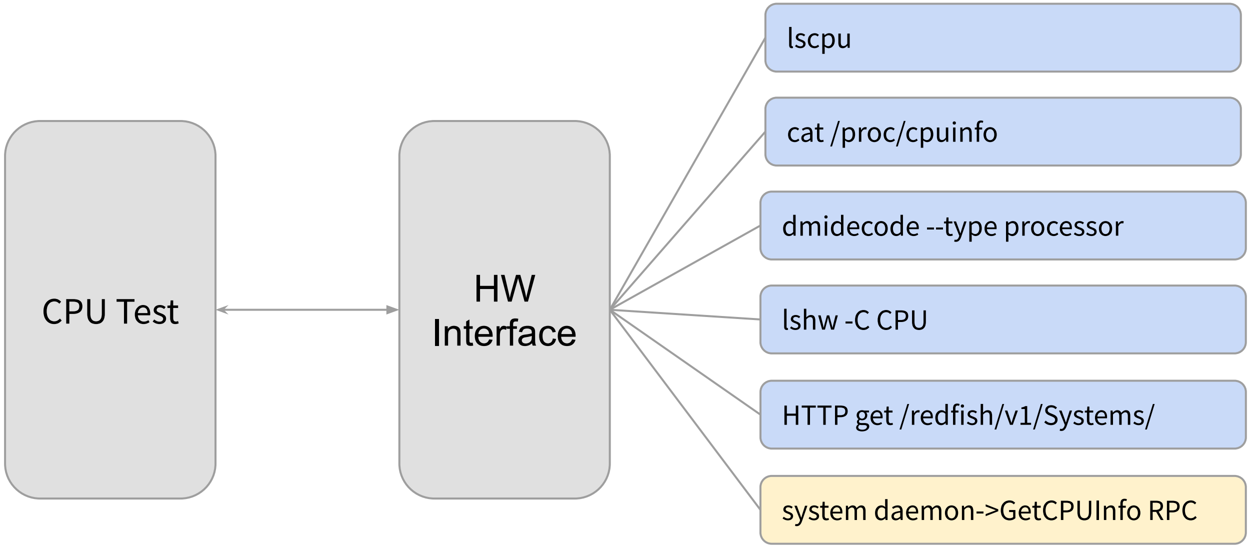
In some scenarios, the way that a diagnostic interrogates DUT hardware may not be consistent in different environments. This can be due to the execution environment of a diagnostic, or may be due to the need for a diagnostic to reference a unique hardware identifier to interface with shop-floor control systems or workflow systems for operations.

As a result, we include an optional HW interface that provides a communication abstraction layer for a device under test. In many cases, this may not be necessary and the diagnostic can communicate to the hardware directly, but in other scenarios, the use of a shim can be beneficial.

# OCP Diagnostics - Hardware Interface



# OCP Diagnostics - Hardware Interface




**Different Implementations**

Allows a single diagnostic to run in multiple OS's or different machine types cleanly.

Allows us to use a different interface between MFG and Production if required.

Provides  a transition path to migrate from from proprietary interfaces to open OPC/DTMF standards (i.e. RedFish)

OPEN POSSIBILITIES.

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# OCP Diagnostics - Multiple Language Support

TEST AND VALIDATION

The OCP Diagnostic Framework supports diagnostic development with common API's across these languages which are popular in the test development space

- Python
- C++
- Golang (Coming Soon)

# OCP Test and Validation Repository

TEST AND VALIDATION

- JSON format example for implementation.
- Consists of tests that are OCP ready written by the community.
- Community driven tests that can be picked up and dropped into any test executive supporting the OCP diagnostic and validation framework format.

# Supported Platforms

TEST AND VALIDATION

Open Source:

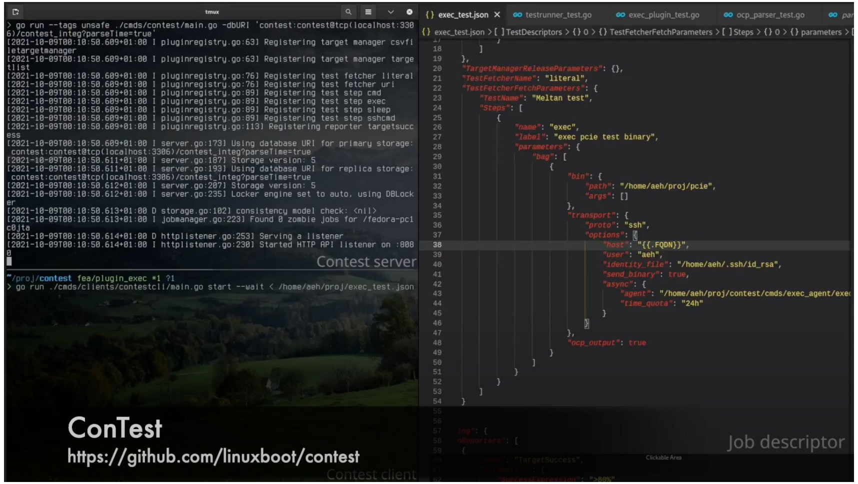
- OpenTAP Test Automation Project
- OpenTest Manufacturing Test Platform
- ConTest Test Automation Framework

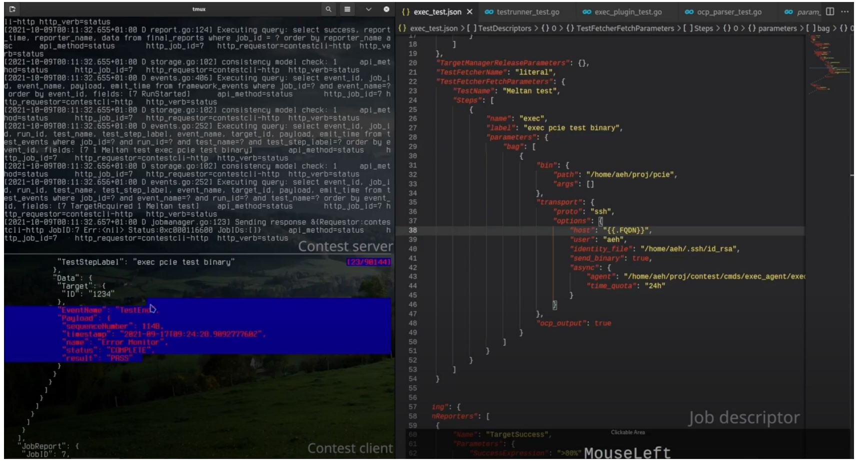
Proprietary:

- Google's Burnin Data Center Test Platform
- Meta's FAVA Hardware Test Platform

Many more coming soon!

# ConTest




Reference our "lightning talk", or visit the OCP experience center for more information.

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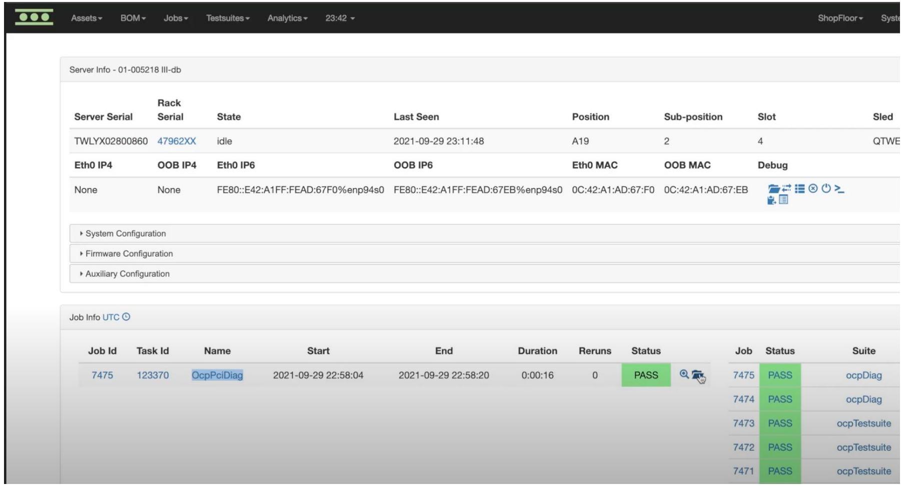
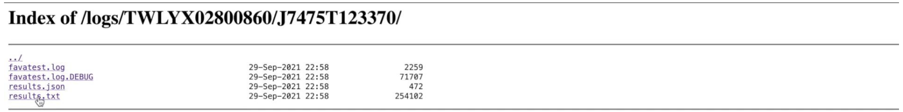
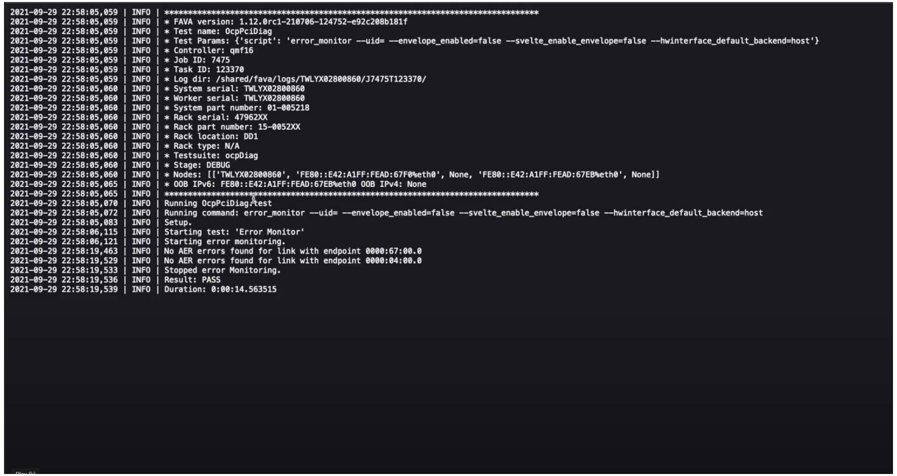
# FAVA by Meta

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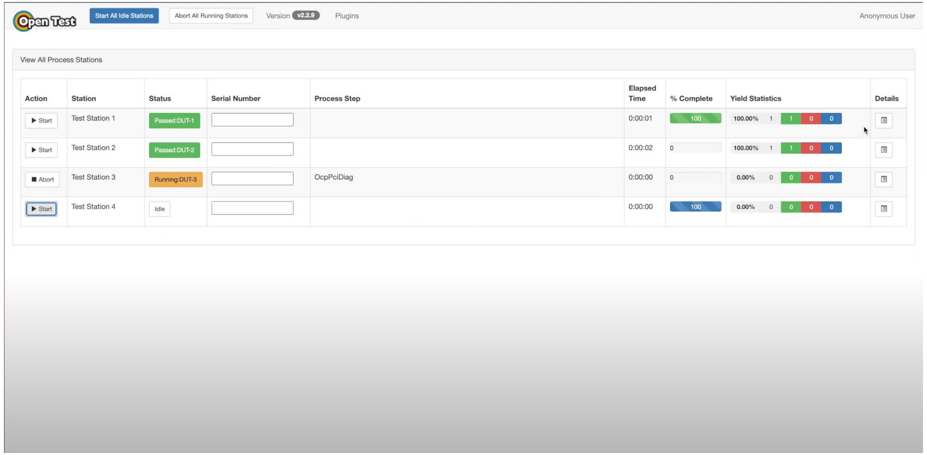
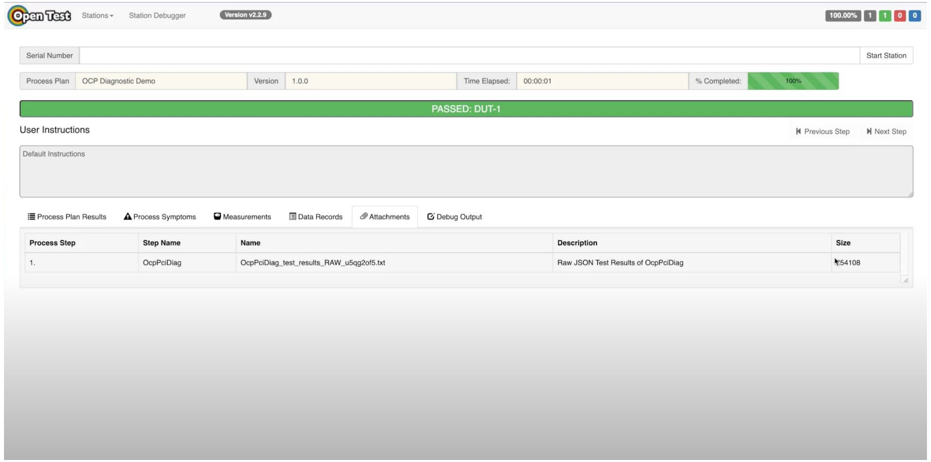
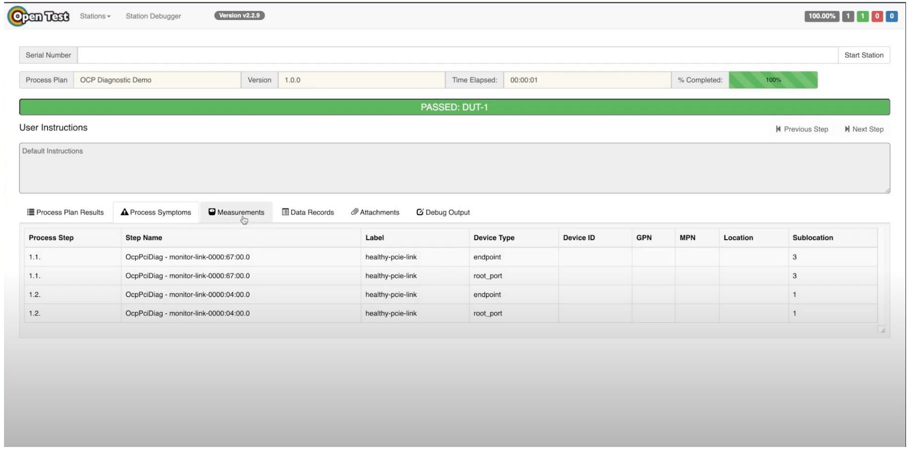
# OpenTest

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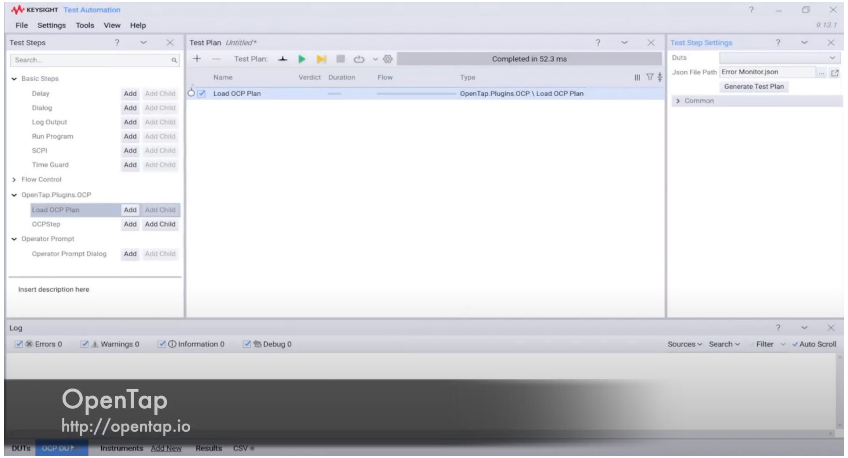
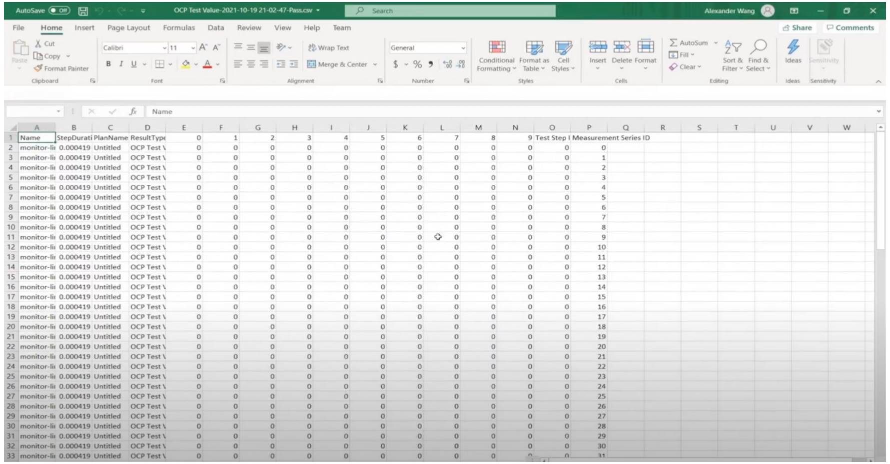
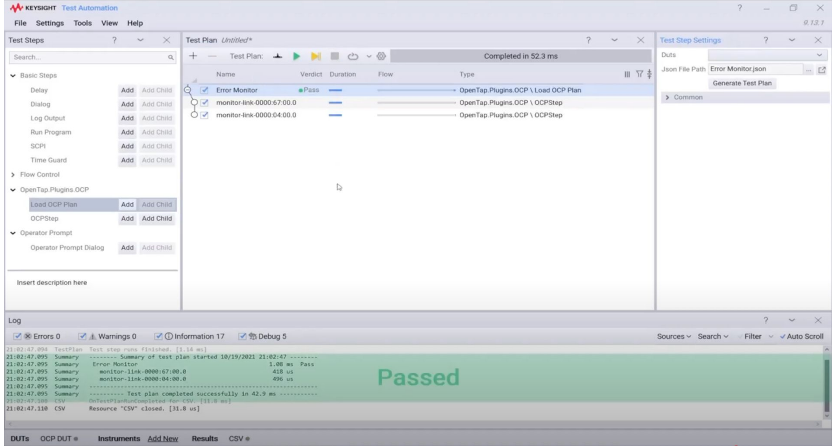
# OpenTAP



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# Test Executive Support

TEST AND VALIDATION

The test platforms we just highlighted are executing the same diagnostics via different communication methods, running on 3 different operating systems.

By implementing your diagnostic in the OCP framework, it's capable of running at:

- Hardware Validation Labs
- Original Design and Contract Manufacturing Partners
- Data Center Testing Systems at Major Hyperscalers

All of this requires no additional integration work, or specialized wrappers for each diagnostic.

If you add support for the OCP Diagnostic format to your test execution platform, you open up executing all OCP diagnostics with a single development effort.

# Where to Get it?

TEST AND VALIDATION

The latest version of the OCP Diagnostic Framework and documentation is available publicly at:

git clone https://github.com/opencomputeproject/ocp-diag-core

OPEN POSSIBILITIES.

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# What’s Next?

Over the coming months, we will be releasing many diagnostics based on this format focused on testing non-differentiated core server hardware including:

- Memory
- CPUs
- Storage
- Common Communication Buses
- Machine Check Error Monitoring
- Networking Interfaces
- Environmental/Thermal Monitors
- Power/Performance/Benchmark Monitors

We also will be including common interfaces for industry test executive’s such as Keysight’s OpenTAP test executive framework and other common open-source unit testing frameworks.

# Thanks!

TEST AND VALIDATION

## Special thanks to all the people who have participated in the project so far!

- Raveej Sharma – OCP
- Yuanlin Wen - Google
- Dharmesh Jani – Meta
- Daniel Alvarez Wise – Meta
- Tobias Fleig – Meta
- Adrian Enache – Meta
- Giovanni Colapinto - Meta
- Ron Minich – Google
- Ryan O'Leary – Google
- Kevin Byod – Google
- Brennen DiRenzo – Keysight
- Winston Liu - Keysight
- Jon Stroud - Keysight
- Alexander Wang – Keysight
- Christian Walters – 9Elements
- Jens Drehaus – 9Elements
- Jean-Marie Verdun – HPE
- Arun Koshy – HPE
- Gregg Shick – HPE
- Paula Kylas – HPE
- William Navas - HPE

# Call to Action

TEST AND VALIDATION

- If you are interested, and would like to participate, please join the Test and Validation working group.
- We are looking feedback, diagnostic contributions, as well as re-usable interfaces to common test executives used at ODM's, Hyperscalers, and contract manufacturers
- Check us out at the Experience Center!

Where to participate: https://github.com/opencomputeproject/ocp-diag-core

Wiki with latest specification: https://github.com/opencomputeproject/ocp-diag-core/wiki

Project Wiki : https://www.opencompute.org/wiki/OCP_Test_and_Validation_Enablement_Initiative

# Thank you!

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