P1450.4 Test Program Flow Conceptual Model Discussion Document

1.0 Top-Down Conceptual View

The P1450.4 constructs will reside within a IEEE 1450-1999 STIL Std file. Its top level constructs will add to the STIL top level constructs/keywords. Figure1 shows the TestProgram block, TestModuleDefs, TestMethodDef and EntryPointDefs blocks. The “Defs” blocks contain all definitions of their respective definition blocks and parallel the MacroDef block in the 1450.0 STIL standard construct.

1.1 Terms in This Document

1. Test-Base or Test: This refers to the common denominator for any test including test flow. (Refer to section 2.4.1.) In a previous version of this document the term “Harness” was used in place of this term.
2. TestObject: Is an instantiation of a test method. In a previous verion of the document the term used was “Test Module” among other variations was used in place of this term. (In the syntax document TestObject is the same as TestInstance.)

2.0 Test Program Flow Extension Terms

2.1 TestProgram Block:

The top level test program construct. There can be one or more. One may be global (unnamed). There may be one or more named TestProgram blocks in a STIL file.

2.2 TestFlow:

This is the top level program flow construct. There can be one unnamed Flow block. There can be one or more named Flow blocks. This block contains definition of flow and bin entities that make up a given test program flow.

2.3 EntryPoint:

This is a reference to a special program level task activated by the tester (tester operating system, system interrupts, etc.) This entry point refers to a TestObject. There is a general set of EntryPoint entities defined by this extension (i.e. OnStart, OnReset, etc.). These can be named and one instance of each can be unnamed and treated as global to any TestFlow that and does not declare a named one of each type. (This will change to clarify how the TestProgram encompasses the EntryPoints. A TestProgram has a collection of pointers to TestObjects.)

2.4 TestMethod:

This represents a test type which when instantiated, becomes a TestObject. There are two kinds of types: integral and user defined. A user-defined TestMethod may be composed from a combination of integral and other user defined types. The means by which integral and user defined types are combined to form a new type is TestMethod Flow, the only concrete primitive TestMethod defined by P1450.4 (the other TestMethod, Test-Base, is abstract).

Integral types are sub-divided into primitives and purely derived types. All types are derived from "Test-Base", a base class which represents the common denominator (data and functions) between all TestMethods. An example of a primitive might be ForceMeas or VOH.

User-defined types are divided into combinatorial and purely derived types. An example of a combinatorial might be a vol/voh test performed both functionally and parametrically. An example of a purely derived type might be TopLevelFlow.

2.4.1 The TestMethod "Test-Base" Abstract Base Class

This represents the common denominator of all TestMethods, i.e., each TestMethod definition includes a single "Test-Base" component, explicitly or implicitly, but a TestMethod of purely type "Test-Base" can not be instantiated. Here are some proposed elements of the base class:

- Test id (a named data member and not a value)
- 0+ parameters/arguments: input, output, ioput, private (local) (This is handled differently in the Syntax document currently.)
- Ports: entry, exit (pass/fail), and associated actions:
  - variable assignment (conditional/unconditional)
  - bin (conditional/unconditional)
  - stop (conditional/unconditional)
  - skipTestAndActions (conditional/unconditional, entry action only)
  - actionlist (conditional/unconditional)
- Fail flag
- Result: scalar, array (should be typed, e.g., Volts, Seconds)
- Default fail bin (data container or an actual data item)

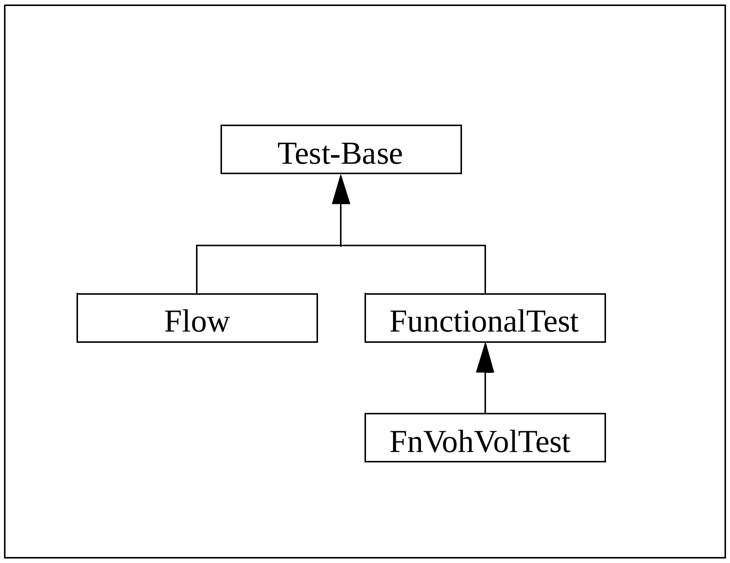
This is an informative term that is not intended to have a keyword in the extension language. It is a common denominator descriptor for all TestObject instantiations. Its use refers to a data type (or object type) from which the various types of TestObjects (shown in figures 3 and 5) are derived.

2.4.2 Defaults

Per type defaults provide the ability to have clear and brief STIL flow descriptions where intent might otherwise be obscured by specification of redundant detail.

The types for which defaults are provided are FlowNode, Test-Base, and individual integral and user-defined TestMethods (recall that Flow is an integral TestMethod). User-defined defaults for these types, if present, override STIL P1450.4 defaults. Defaults are applied to a FlowNode or TestMethod when it is instantiated (a TestMethod becomes a TestObject at this point).

There are many types of TestMethods of which only the integral types are known to STIL and of those, only Flow is known to P1450.4, so we require a mechanism for providing defaults for as yet undefined TestMethods. The inheritance hierarchy provides that mechanism. P1450.4 needs to provide defaults for Test-Base only, since it is the base class of all TestMethods. Its defaults trickle down to the derived TestMethod unless the derived TestMethod overrides. Given that Test-Base is at the root, the defaults of the more distant TestMethod override. Overrides take place on a per white box basis (see TestObject in figure 7) namely, PreActions, PostActions, Arbiter, PassActions, and FailActions.



For example, if the defaults for a particular TestMethod, e.g., FunctionalTest, describes FailActions only, it overrides base class FailActions but still inherits the others. If another TestMethod is derived from FunctionalTest, e.g., FnVohVolTest, it inherits defaults from its nearest ancestor.

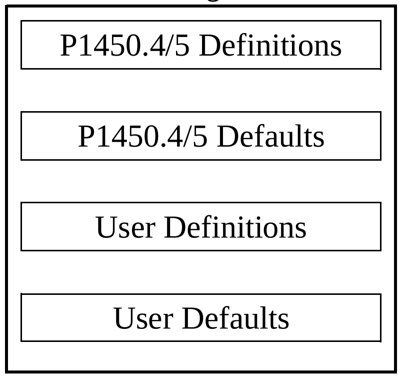
Since there is only one type of FlowNode, FlowNode defaults apply to all implicitly instantiated FlowNodes and all explicitly instantiated FlowNodes which lack pre or post section descriptions. These descriptions refer to the contents of the white boxes in figure 6 namely, PreActions, PostActions, Arbiter, and ExitActions 1 through n, and are applied on a per box basis, similar to the TestMethod defaults.

For example, the FlowNode default description may specify two exit actions, one called Pass and one called Fail, all boxes including Pass and Fail having a no-op content.

P1450.4 defaults are designed to provide a best common denominator from which production testflows for current ATE can be generated:

- FlowNode defaults:
  - Exit ports: pass and fail.
  - Actions: none on entry, post, pass, and fail.
  - Arbiter: exit via fail port if test object fails, exit via pass port otherwise.
- Test-Base defaults:
  - Arbiter: exit via fail actions if fail flag is set, exit via pass actions otherwise.
  - Test id: empty string.
  - Parameters/arguments: none.
  - Ports:
    Entry actions: none.
    Exit actions:
      Post: none.
      Pass: none.
      Fail: bin with stop if any test failed.
  - Fail flag: false.
  - Result: scalar = NaN (zero dimension array).
  - Default fail bin: undefined (equivalent to *no bin*).
- Flow defaults:
  - Actions: inherit Test-Base defaults.
  - Arbiter: exit via fail actions if any directly referred or contained test objects’ fail flag is set, exit via pass actions otherwise.
- TestMethod defaults:
  - Integral: all except TestMethod Flow and Test-Base are defined by P1450.5.
  - User-defined: defined by user.

FIGURE 1. TestMethod Parameter Default Assignment:



With regard to TestMethod parameter assignments, any parameter not assigned a default value during TestMethod definition must be assigned a value during Defaults specification. Defaults apply only to parameters left unset during TestMethod definition. User defaults override P1450.4/5 defaults.

2.5 FlowNode:

(See Figure2) A node in the program flow that contains a ModuleRef (Body) that references a TestObject or FlowModule. This node has PreActions that defines the entry point into the node and may contain actions, declarations such as Spec/Category selection, etc. Absence of actions may in the Pre section may cause default actions (tbd). The Post section contains PostActions, Arbitrator, and ExitActions. The ExitActions give directives as to the follow-on flow path taken out of the FlowNode.

2.6 BinNode and BinMap:

Not yet defined/discussed, but there has been a need discussed of having a binning mechanism that has a notion of “bin”, a notion of “Stop” and a notion of “Bin-and-Stop”.

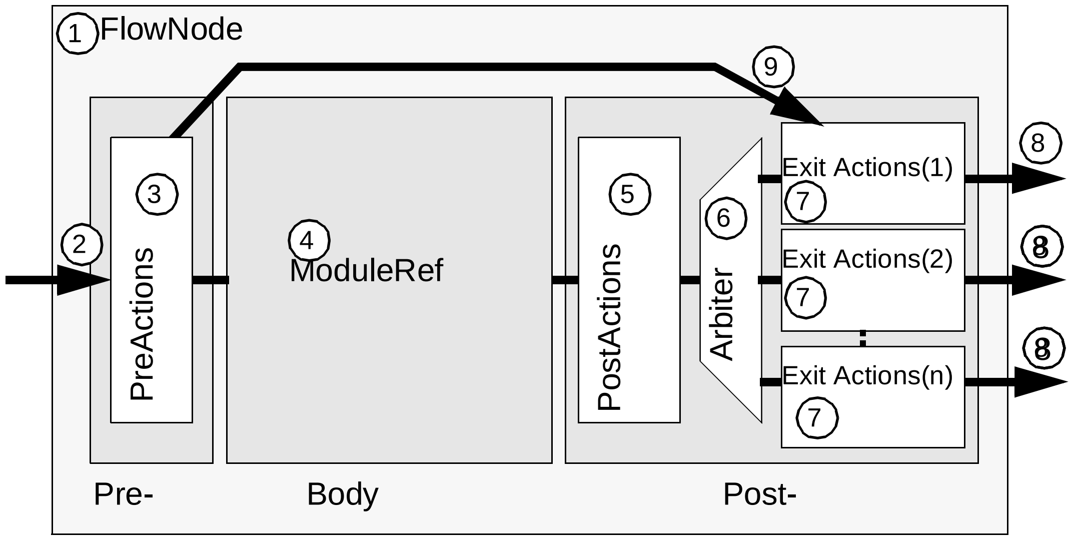
(Need two natures: terminal and flow-through)

2.7 TaskNode and DecisionNode:

Not yet defined/discussed, but these are non-test type nodes used for non-test activities and flow decision content. This may already exist if we have a TestMethond known as “No-op”. This is more for flow control purposes. This may not need a separate construct.

3.0 FlowNode Conceptual Model

FIGURE 2. The FlowNode Conceptual Model Diagram (with its named components)



3.1 FlowNode Components Descriptions

1. FlowNode: (to be described/clarified)

2. EntryPath: (to be described/clarified)

3. PreActions Block: (to be described/clarified)

4. ModuleRef (Module Reference): (to be described/clarified)

5. PostActions Block: (to be described/clarified)

6. Arbiter Block: (to be described/clarified)

7. ExitActions Block: (to be described/clarified)

8. ExitPath: (to be described/clarified)

9. SkipPath (can goto to any ExitAction Block): (to be described/clarified)

3.2 FlowNode Informative Term Descriptions

1. “Pre-” portion

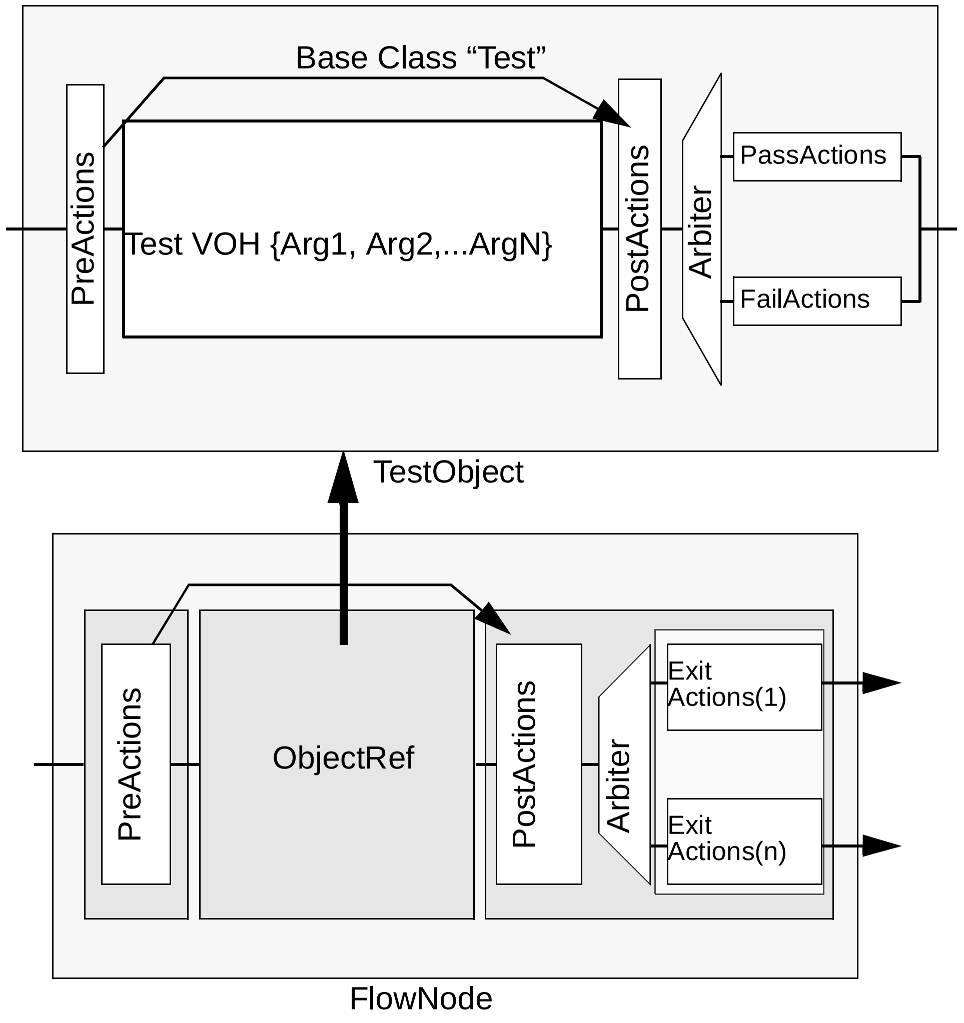
2. “Body” portion

3. “Post-” portion

4.0 Relationship of FlowNodes to TestObjects

In STIL dot4, a defined "TestMethod" is a type which by definition inherits from the abstract TestMethod "Test" (either directly or indirectly). In STIL dot4, that there are "integral" TestMethods defined by STIL dot4 and 5, and "user-defined" TestMethods. The instantiation of a TestMethod creates an "object". In the dot4 syntax, this "object" is referred to as a TestObject. A TestObject can be created two ways: 1- "In-line" (annonymous), or 2-"defined-before-use" (named as in STIL "domain name"). In Figure 7. the in the TestObject block, the TestObject is composed of two parts, the greyed part that comes from base class "Test" and the white from the concrete TestMethod "VOH".

FIGURE 3. Block Diagram View of FlowNode Where ObjectRef Refers a TestObject



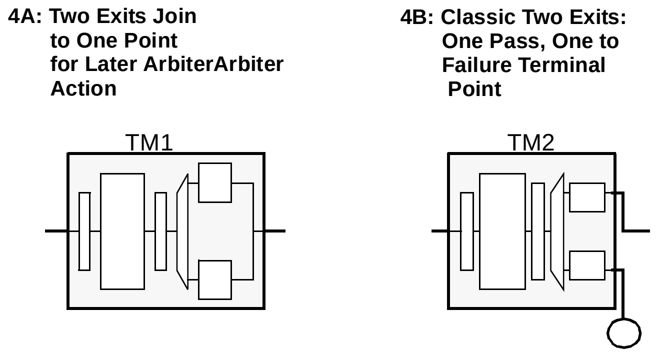
5.0 TestObject Characteristics

5.1 The "Test-Base" of the TestObject

Commonalities. What the Test-Base provideds. The FlowNode has dependencies on the the Test-Base. Describing the data interaction model. Perhaps an upper level view of the interface between the FlowNode and the TestObject. Examples. Cummunication with input and output arguments flowing into and out of the TestObjects.

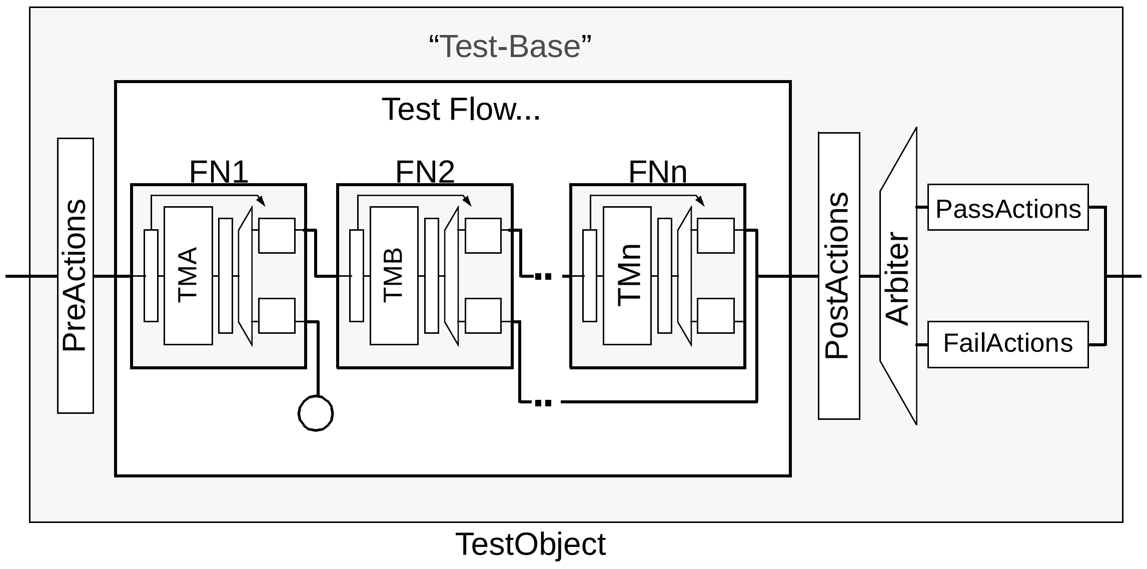
5.2 Two Types of “Outflow” Configurations for TestObjects

FIGURE 4. Conceptual Block Diagrams of the Two Outflow Types


4A: Two Exits Join to One Point for Later ArbiterArbiter Action
4B: Classic Two Exits: One Pass, One to Failure Terminal Point
TM1
TM2

5.3 TestFlow as the TestObject Body

FIGURE 5. TestObject Referencing a TestFlow



6.0 Binning thoughts

6.1 Guiding Values for Binning

1. Simplicity: Have same mechanism serve “Pass” and “Fail” binning
2.

6.2 Bin Mapping

Single axis for Fail bins

Single-Multiple axis for Pass binning with a BinMapping (expected usage is the multiple axis)

Single axis: Cell number 1 is associated with soft bin 1 cell number 2 is associated with soft bin 2.

There is a notion of “hard bin” and “soft bin”.

Concept of a default mapping with an option to have domain named mapping (per handler with different bins available.)

Expected usage of pass bins, when you fail, registration on an axis... so for example a VOH test fails

One axis is speed binning and the other axis is power supply tolerance. So there is an association of speed testing as a row of an array and a column for Power Supply tolerance. Now that we have two axis, you have an x and a y axis then you can have a cell. Each cell has a counter or (counters?). At the end you would be able to tally the counters to determine the tested performance and then you can determine a

7.0 Issues to be Resolved in This Draft

1.

2.