Module Interface Specification MIS

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MIS: Purpose

A Module Interface Specification (MIS)

- specifies the *externally observable behaviour* of a module's *access routines*
- mathematically precisely
- input/output relationship
- domains, restrictions on use, "exceptions"
- application ("abstract") state variables
- application, not implementation, oriented

MIS: Language

A Module Interface Specification is written in

- mathematical
- application

language.

It is **not** written in the language of the implementation.

MIS: Viewpoint

A Module Interface Specification describes the intended behaviour of a module's access routines from an

- external,
- outside

viewpoint.

MIS: Viewpoint

A Module Interface Specification contains absolutely **no** information about the **insides** of the module or its access routines not implied by the specified external behaviour.

Internal aspects of the module's implementation are **secrets** of the module.

MIS: Target audience

A Module Interface Specification is written for

- module designer and implementer
- inspectors, testers of the module
- designers and implementers of program segments using the module's access routines

The last group above needs **only** the MIS.

MIS test: if not enough for them, then the MIS is not complete, not really an MIS

MIS: Content

- module name
- imported identifiers, e.g. constants, variables, data types, etc.
- exported identifiers, e.g. access routine names
- state variables
- state invariant
- assumptions
- access routine semantics

Access Routine Semantics: Content

- name
- input/output relation (e.g. precondition, postcondition)
- domain (e.g. restrictions, “exceptions”)

Access Routine Semantics: Content

- "input" consists of the values of the
  - formal parameters passed to the routine and
  - state variables before execution of the routine

- "output" consists of the values of the
  - formal parameters (and results, if any) passed by the routine back to the caller and
  - state variables after execution of the routine

Access Routine Semantics: Content

The input/output relation

- restricts the pairs of “input” and “output” to reflect *all* requirements (the specification)
- must be complete, i.e. any routine satisfying the input/output relation is “correct” and acceptable
- refers to “output” and usually also “input”

Access Routine Semantics: Content

The domain (restrictions, “exceptions”)

- defines the set of “inputs” for which the routine must function
- refers *only* to the “input”, *never* to the “output”
- states exception(s) and condition(s) for triggering, when applicable

MIS Example: Stack Module

- name: Stack
- imported identifiers: A (data type, see below)
- exported access routines: init, push, pop, depth, full
- state variables: s, where $s \in A^*$ (s is a sequence of elements of A, A is any set)
- state invariant: $|s| \leq$ MaxDepth
- assumptions: init called before any other access routine

MIS Example: Stack Module

where MaxDepth

- a positive integer
- an internal implementation parameter
- value is a design secret (secret at design time)

MIS Example: Access Routine Semantics

- name: init
- input/output relation: s' = [ ]
- restrictions on use: none

MIS Example: Access Routine Semantics

- name: push(x)
- input/output relation: s' = 's & [x]
- domain: (|'s| < MaxDepth) $\wedge$ (x$\in$ A)
- alternative:

  (|'s| < MaxDepth) $\wedge$ (s' = 's & [x])

  $\vee$ (|'s| = MaxDepth) $\wedge$ (s' = 's)

MIS Example: Access Routine Semantics

- name: pop
- input/output relation:

  $('s = (s' \,\&\, [result])) \wedge (result \in A)$
- restrictions on use: $0 < |'s|$

MIS Example: Access Routine Semantics

- name: depth
- input/output relation: $(result = |'s|) \wedge (s' = 's)$
- restrictions on use: none

MIS Example: Access Routine Semantics

- name: full
- input/output relation:

  $(result = (|'s| = \text{MaxDepth})) \wedge (s' = 's)$
- restrictions on use: none

MIS Example: Access Routine Semantics

Usual convention:

- If any state variable is not explicitly mentioned in the input/output relation, its value is not changed by the access routine in question

MIS: Summary

Module Interface Specification

- external view
- mathematically precise
- application (“abstract”) state variables
- application, not implementation, oriented
- not in the language of the implementation, but
- in mathematical and application language