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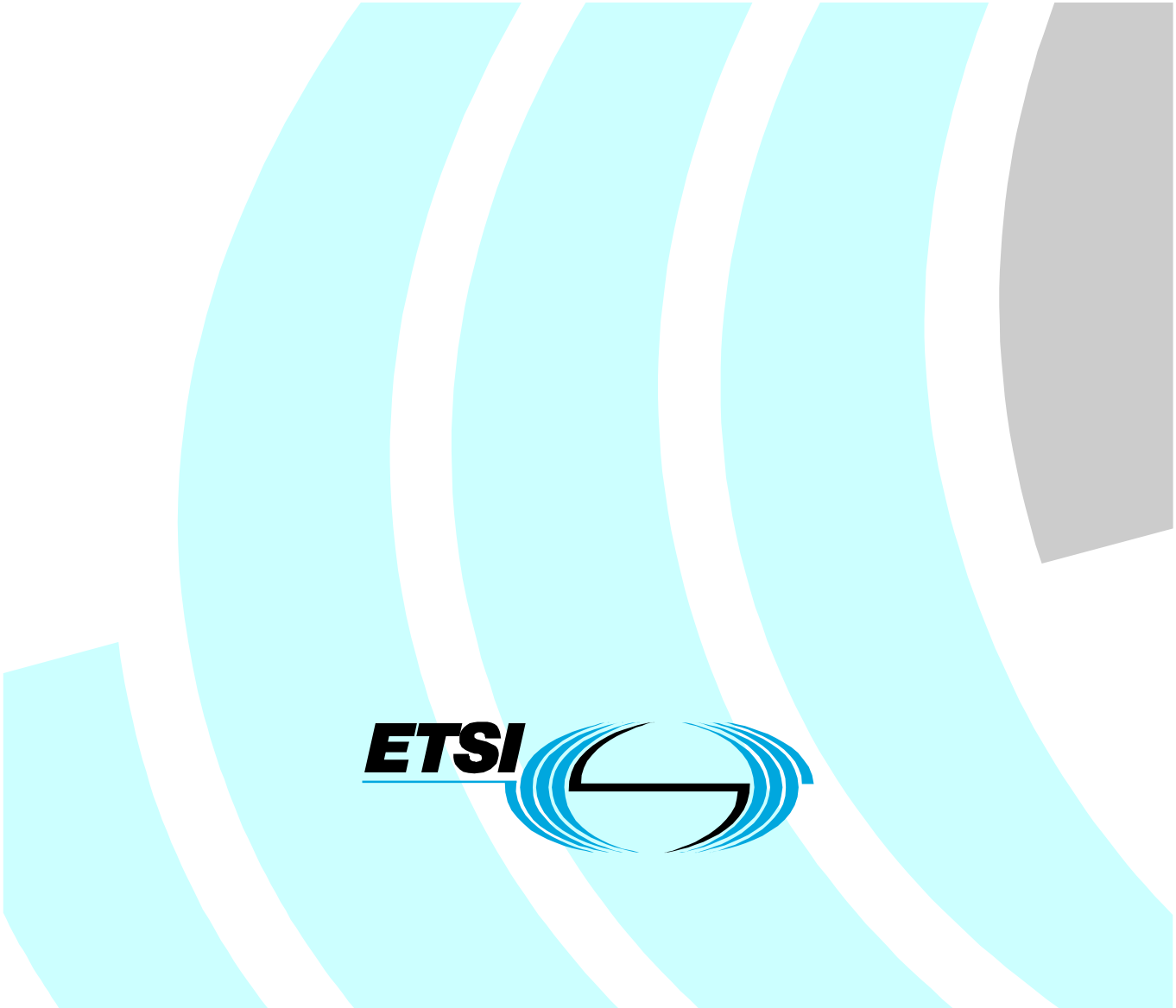
ETSI Standard

Methods for Testing and Specification (MTS);
The Testing and Test Control Notation version 3;
Part 6: TTCN-3 Control Interface (TCI)



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Contents

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS).

The present document is part 6 of a multi-part deliverable covering the Testing and Test Control Notation version 3, as identified below:

Part 1: "TTCN-3 Core Language";

Part 2: "TTCN-3 Tabular presentation Format (TFT)";

Part 3: "TTCN-3 Graphical presentation Format (GFT)";

Part 4: "TTCN-3 Operational Semantics";

Part 5: "TTCN-3 Runtime Interface (TRI)";

Part 6: "TTCN-3 Control Interfaces (TCI)".

1 Scope

The present document specifies the control interfaces for TTCN-3 test system implementations. The TTCN-3 Control Interfaces provide a standardized adaptation for management, test component handling and encoding/decoding of a test system to a particular test platform. The present document defines the interfaces as a set of operations independent of a target language.

The interfaces are defined to be compatible with the TTCN-3 standard (see references below). The interface definition uses the CORBA Interface Definition Language (IDL) to specify the TCI completely. Clauses 8 and 9 present language mappings for this abstract specification to the target languages Java and ANSI C. A summary of the IDL-based interface specification is provided in annex A.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] OMG CORBA v2.2: "é&, Section 3, February 1998".

[2] ETSI ES 201 873-5: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 5: TTCN-3 Runtime Interface (TRI).".

[3] ETSI ES 201 873-1: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

[4] ETSI ES 201 873-4: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 4: TTCN-3 Operational Semantics".

[5] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

3 Definitions and abbreviations

3.1 Definitions

For the purpose of the present document, the terms and definitions given in ISO/IEC 9646-1 [5] and the following apply:

Abstract Test Suite (ATS): test suite composed of abstract test cases

codec: encoder/decoder entity used for encoding and decoding data to be transmitted and received, respectively

Coding/Decoding (CD): entity that administers the value and type handling incl. encoding and decoding in the TTCN-3 test system

Component Handling (CH): entity that administers the handling of test components in the TTCN-3 test system

communication port: abstract mechanism facilitating communication between test components

NOTE: A communication port is modelled as a FIFO queue in the receiving direction. Ports can be message-based, procedure-based or a mixture of the two

control component: component that executes the behaviour of the control part of a TTCN-3 module

Executable Test Suite (ETS): Refer to ISO/IEC 9646-1 [3].

Implementation eXtra Information for Testing (IXIT): Refer to ISO/IEC 9646-1 [3].

Platform Adaptor (PA): entity that adapts the TTCN-3 Executable to a particular execution platform

NOTE: The Platform Adaptor creates a single notion of time for a TTCN-3 test system, and implements both, explicit and implicit, timers as well as external functions.

real test system interface: Refer to ISO/IEC 9646-1 [5].

System Under Test (SUT): Refer to ISO/IEC 9646-1 [5].

SUT Adaptor (SA): an entity that adapts the TTCN-3 communication operations with the SUT based on an abstract test system interface. It implements the real test system interface

Testing and Test Control Notation (TTCN-3): Refer to ISO/IEC 9646-1 [5].

test case: Refer to ISO/IEC 9646-1 [5].

test event: either sent or received test data (message or procedure call) on a communication port that is part of the test system interface as well as timeout events of timers

Test Management (TM): an entity which provides a user interface to as well as the administration of the TTCN-3 test system

Test Management and Control (TMC): a set of three entities providing test management and control; consists of the test management (TM), the component handling (CH) and the coding/decoding (CD)

NOTE: The TMC is an implementation of TCI.

test system: Refer to ISO/IEC 9646-1 [5].

Test system interface (TSI): test component that provides a mapping of the ports available in the (abstract) TTCN-3 test system to those offered by a real test system

TTCN-3 Executable (TE): the part of a test system that deals with interpretation or execution of a TTCN-3 ETS

TTCN-3 Control Interfaces (TCI): three interfaces that define the interaction of the TTCN-3 Executable with the test management, the coding and decoding, and the test component handling in a test system

TTCN-3 Runtime Interface (TRI): an interface that defines the interaction of the TTCN-3 Executable with the SUT and platform adaptors in a test system

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ATS	Abstract Test Suite
CD	Coding/Decoding
CH	Component Handler
ETS	Executable Test Suite
IDL	Interface Definition Language
IXIT	Implementation Extra Information for Testing
MSC	Message Sequence Chart
MTC	Main Test Component
OMG	Object Management Group
PA	Platform Adaptor

PTC	Parallel Test Component
SA	SUT Adaptor
SUT	System Under Test
TC	Test Control
TCI	TTCN-3 Control Interfaces
TE	TTCN-3 Executable
TL	Test Logging
TM	Test Management
TMC	Test Management and Control
TRI	TTCN-3 Runtime Interface
TSI	Test System Interface
TTCN-3	Testing and Test Control Notation

4 Introduction

The present document consists of two distinct parts, the first part describing the structure of a TTCN-3 test system implementation and the second part presenting the TTCN-3 Control Interfaces specification.

The first part introduces the decomposition of a TTCN-3 test system into four main entities: Test Management and Control (TMC), TTCN-3 Executable (TE), SUT Adaptor (SA), and Platform Adaptor (PA). The TMC consists itself of three entities: Test Management (TM), Coder/Decoder (CD), and Test Component Handler (CH). In addition, the interaction between these entities, i.e. the corresponding interfaces, is defined.

The second part of the present document specifies the TTCN-3 Control Interfaces (TCI). The interfaces are defined in terms of operations implemented as part of one entity and called by other test system entities. For each operation, the interface specification defines associated data structures, the intended effect on the test system and any constraints on the usage of the operation. Note that these interface specifications only define interactions between the TE and TM, TE and CD, and TE and CH. For interactions between the TE and SA and the TE and PA please refer to the TTCN-3 Runtime Interface specification ([2]).

5 Compliance

The minimum required for a TCI compliant TTCN-3 test system is to adhere to the interface specification stated in the present document. The TTCN-3 semantics in the test system must adhere to the operational semantics defined in [4]. In addition, one language mapping must be supported. For example, if a vendor supports Java, the TCI operation calls and implementations, which are part of the TTCN-3 executable, must comply with the IDL to Java mapping specified in the present document.

6 General structure of a TTCN-3 test system

A TTCN-3 test system can be thought of conceptually as a set of interacting entities. Each entity implements specific test system functionality. These entities:

- manage test execution;
- interpret or execute compiled TTCN-3 code;
- realize proper communication with the SUT;
- administer types, values and test components;
- implement external functions; and
- handle timer operations.

6.1 Entities in a TTCN-3 test system

The structure of a TTCN-3 test system implementation is illustrated in figure 1.

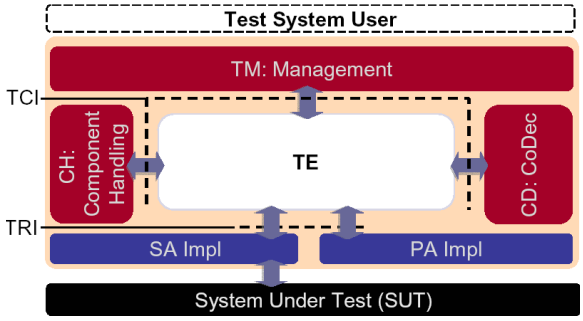

Figure 1: General structure of a TTCN-3 test system

As shown in figure 1, the TTCN-3 Executable (TE), also referred to as the Executable Test Suite (ETS), interprets and executes TTCN-3 modules. Various TE structural elements can be identified: control, behaviour, components, types, values and queues. The structural elements within the TE represent functionality that is defined within a TTCN-3 module or by the TTCN-3 standard [3] itself. For example, the structural element "Control" represents the control part within a TTCN-3 module, while the structural element "Queues" represents the requirement on a TTCN-3 Executable that each port of a test component maintains its own port queue. While the first is specified within a TTCN-3 module, the latter is required by the TTCN-3 specification.

Refinement of the TE, as shown in figure 1, is provided as an aid in defining the TTCN-3 Control Interfaces. The TE would typically correspond in a test system implementation either to the executable code produced by a TTCN-3 compiler or by a TTCN-3 interpreter.

The TE may be executed in a centralized or in a distributed manner. That is, on a single test device or across several test devices respectively. Although the structural entities of the TE implement a complete TTCN-3 module, single structural entities might be distributed over several test devices.

The TE implements a TTCN-3 module on an abstract level. The other entities of a TTCN-3 test system make these abstract concepts concrete. For example, the abstract concept of sending a message or receiving a timeout cannot be implemented within the TE. The remaining part of the test system implements the encoding of the message and its sending over concrete physical means or measuring the time and determining when a timer has expired, respectively.

The SA and PA and their interaction with the TE are defined in [2]. The TCI specification defines the interaction between the TE and the TMC.

6.1.1 Test Management and Control (TMC)

The TMC entity includes functionality related to management of:

- test execution;
- components; and
- encoding and decoding.

6.1.1.1 Test Management (TM)

The TM entity is responsible for the overall management of a test system. After the test system has been initialized, test execution starts within the TM entity. The entity is responsible for the proper invocation of TTCN-3 modules, i.e. propagating module parameters such as IXIT information to the TE if necessary. Typically, this entity would also implement a test system user interface. In addition, the TM entity performs test event logging and presentation to the test system user.

6.1.1.2 Coding and Decoding (CD)

The CD entity is responsible for the encoding and decoding of TTCN-3 values into bitstrings suitable to be sent to the System Under Tests. The TE determines which codecs shall be used. It passes the TTCN-3 data to the appropriate encoder to obtain the encoded data. Received data is decoded in the CD entity by using the appropriate decoder, which translates the received data into TTCN-3 values.

6.1.1.3 Component Handling (CH)

The TE can be distributed among several test devices. The CH implements communication between distributed test system entities. The CH entity provides the means to synchronize test system entities which might be distributed onto several nodes.

NOTE 1: Nodes and test devices are used as synonyms.

The general structure of a test system distributed among several nodes is depicted in figure 2.

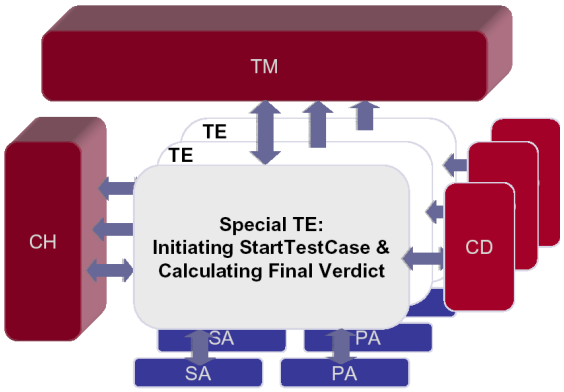

Figure 2: General structure of a distributed TTCN-3 test system

Each node within a test system includes the TE, SA, PA, and CD entities. The entities CH and TM mediate the test management and test component handling between the TEs on each node. The TE which starts a test case is a special TE. It shall calculate the final test case verdict. Besides this, all TEs are handled the same.

NOTE 2: A test system shall execute at most one test case at a given point in time. That is, a TTCN-3 module cannot execute multiple test cases at the same time.

The creation of the MTC, PTCs and the control component in TEs is controlled by CH. Please note the special role of the system component, which exists only conceptually and not as a running test component in a TE. System ports, i.e. the ports of the system component, may be distributed among several nodes. Further, test components on different nodes may have access to the same physical port of the SUT, i.e. they may be mapped to the same port of the test system interface.

EXAMPLE: Access to remote real SUT ports can be realized by TEs via local proxies.

Communication between TTCN-3 components is either message or procedure based. Therefore, the CH adapts message and procedure based communication of TTCN-3 components to the particular execution platform of the test system. It is aware of connections between TTCN-3 test component communication ports. It propagates send request operations from one TTCN-3 component to another TTCN-3 component. The receiving component may reside in a different instance of the same TE located on a different node. It then notifies the TE of any received test events by enqueueing them in the port queues of the TE.

Procedure based communication operations between TTCN-3 components are also visible at the CH. The CH shall distinguish between the different kinds of procedure-based communication, i.e. call, reply, and exception, and shall propagate them in the appropriate manner to the TE where the target component resides. TTCN-3 procedure based communication semantics, i.e. the effect of such operation on TTCN-3 test component execution, are to be handled in the TE.

Additional communication is needed to implement the distribution of test components onto several nodes. Component management communication includes the indication of the creation of test components, the starting of execution of a test component, verdict distribution, as well as component termination indication. The CH does not implement the TTCN-3 component behaviour. Rather, it implements the communication between several components implemented by a TE.

6.1.2 TTCN-3 Executable (TE)

The TE entity executes or interprets a TTCN-3 module. Conceptually, the TE can be decomposed into six interacting entities: a Control, Behaviour, Component, Type, Value, and Queue entity. This structural decomposition of the TE is defined in [2]. The terminology for TE defined in [2] is used within the present document.

6.1.3 SUT Adaptor (SA)

The SA is the implementation of the System under Test Adaptor (SA) as defined in [2]. The terminology for SA defined in [2] is used within the present document.

6.1.4 Platform Adaptor (PA)

The PA is the implementation of the Platform Adaptor (PA) as defined in [2]. The terminology for PA defined in [2] is used within the present document.

6.2 Execution requirements for a TTCN-3 test system

Each TCI operation call shall be treated as an atomic operation in the calling entity. The called entity, which implements a TCI operation, shall return control to the calling entity as soon as its intended effect has been accomplished or if the operation cannot be completed successfully. The called entity shall not block in the implementation of procedure-based communication.

As stated before, no assumption is made as to whether the TTCN-3 test system or individual entities are implemented in a single executable or process or whether they are distributed among different processes or even test devices.

A TCI implementation shall fulfil the above mentioned requirements.

7 TTCN-3 control interface and operations

This clause defines a set of abstract data types used to represent data communicated between the TE and the TMC. In addition, it defines TCI operations in terms of their signatures, when they are to be used and what their effects on the TTCN-3 test system are.

This definition also includes a more detailed description of the input parameters required for each TCI operation call and its return value.

7.1 Overview of the TCI

The TCI defines the interaction between the TTCN-3 Executable (TE), Component Handling (CH), the Test Management (TM), and the Coding/Decoding (CD) entities within a TTCN-3 test system. It provides means for the TE to:

- manage test execution;
- distribute execution of test components among different test devices; and
- encode and decode test data.

The TCI consists of three sub-interfaces:

- **TCI Test Management Interface (TCI-TM):** This interface includes all operations needed to manage test execution, provide module parameters and external constants and provide test event logging;
- **TCI Component Handling Interface (TCI-CH):** This interface consists of operations needed to implement the management of, and communication between TTCN-3 test components in a centralized or distributed test system. It includes operations to create, start and stop test components, establish connection between TTCN-3 components, manage test components and their verdicts, and handle message and procedure based communication between TTCN-3 components;
- **TCI Coding/Decoding Interface (TCI-CD):** This interface includes all operations needed to retrieve and access codecs, i.e. encoders or decoders, for encoding data to be sent, defined using the TTCN-3 encode attribute, and to decode received data.

All interfaces are bi-directional so that calling and called parts reside in the TE and in the TMC of the test system. The provided interfaces (those operations which an interface offers to the TE) and the required operations (those operation which an interface needs to use from the TE) are combined into the respective provided and required subinterface for each interface, i.e. TCI-TM Provided/ TCI-TM Required, TCI-CH Provided/ TCI-CH Required, and TCI-CD Provided/ TCI-CD Required.

7.1.1 Correlation between TTCN-3 and TCI operation invocations

For some TTCN-3 operation invocations, there is a direct correlation to a TCI operation invocation, which is shown in table 1. Some of the TTCN-3 operations correlate to a pair of TCI operation request and TCI operation to implement the propagation of TTCN-3 operations through the test system. For the other TCI operation invocations there is an indirect correlation - they are needed to implement the TTCN-3 semantics of underlying concepts.

The correlation shown for TTCN-3 communication operations (i.e. `send`, `call`, `reply`, and `raise`) only holds if these operations are invoked on a test component port connected to another test component port. The correlation for communication operations that are invoked on test component ports that are mapped to test system interface ports is defined in [2].

Table 1: Correlation between TTCN-3 and TCI operation invocations

TTCN-3 Operation Name	TCI Operation Name	TCI Interface Name
send	tciSendConnected	TCI-CH Provided
	tciEnqueueMsgConnected	TCI-CH Required
call	tciCallConnected	TCI-CH Provided
	tciEnqueueCallConnected	TCI-CH Required
reply	tciReplyConnected	TCI-CH Provided
	tciEnqueueReplyConnected	TCI-CH Required
raise	tciRaiseConnected	TCI-CH Provided
	tciEnqueueRaiseConnected	TCI-CH Required
create	tciCreateTestComponentReq	TCI-CH Provided
	tciCreateTestComponent	TCI-CH Required
start (a component)	tciStartTestComponentReq	TCI-CH Provided
	tciStartTestComponent	TCI-CH Required
stop (a component)	tciStopTestComponentReq	TCI-CH Provided
	tciStopTestComponent	TCI-CH Required
connect	tciConnectReq	TCI-CH Provided
	tciConnect	TCI-CH Required
disconnect	tciDisconnectReq	TCI-CH Provided
	tciDisconnect	TCI-CH Required
map	tciMapReq	TCI-CH Provided
	tciMap	TCI-CH Required
unmap	tciUnmapReq	TCI-CH Provided
	tciUnmap	TCI-CH Required
running	tciTestComponentRunningReq	TCI-CH Provided
	tciTestComponentRunning	TCI-CH Required
done	tciTestComponentDoneReq	TCI-CH Provided
	tciTestComponentDone	TCI-CH Required
mtc	tciGetMTCReq	TCI-CH Provided
	tciGetMTC	TCI-CH Required
execute	tciTestCaseExecuteReq	TCI-CH Provided
	tciTestCaseExecute	TCI-CH Required

7.2 TCI data

The TCI specification defines a set of abstract data types. These describe, at a very high level, which kind of data shall be passed from a calling to a called entity. The abstract data types are used to determine:

- how TTCN-3 data is passed from a TE to an encoder, to encode TTCN-3 value representations into a bitstring; and in the reverse case;
- how data passed from a decoder to the TE shall be decoded from a bitstring into its TTCN-3 value representation.

For these abstract data types a set of operations is defined to process the data by the coder/decoder.

The concrete representation of these abstract data types as well as the definition of basic data types like `string` and `boolean` are defined in the respective language mappings in clauses 8 and 9.

Notice that the values for any identifier data type shall be unique in the test system implementation where uniqueness is defined as being globally distinct at any point in time. This guarantees that different objects, e.g. two timers, are identified by different identifiers and identifiers are not reused.

7.2.1 General abstract data types

The following abstract data types are defined and used for the definition of TCI operations:

7.2.1.1 Management

`TciModuleIdType`	A value of `TciModuleIdType` is the name of a TTCN-3 module as specified in the TTCN-3 ATS. This abstract type is used for module handling
`TciModuleParameterIdType`	A value of `TciModuleIdType` is the qualified name of a TTCN-3 module parameter as specified in the TTCN-3 ATS. This abstract type is used for module parameter handling
`TciTestCaseIdType`	A value of `TciTestCaseIdType` is the qualified name of a TTCN-3 testcase as specified in the TTCN-3 ATS. This abstract type is used for testcase handling
`TciModuleIdListType`	A value of type `TciModuleIdListType` is a list of `TciModuleIdType`. This abstract type is used when retrieving the list of modules which are imported by a TTCN-3 module
`TciModuleParameterType`	A value of type `TciModuleParameterType` is a structure of `TciModuleParameterIdType` and `Value`. This abstract type is used to represent the parameter name and the default value of a module parameter
`TciModuleParameterListType`	A value of type `TciModuleParameterListType` is a list of `TciModuleParameterType`. This abstract type is used when retrieving the module parameters of a TTCN-3 module
`TciParameterType`	A value of type `TciParameterType` includes a TTCN-3 `Value` and a value of `TciParameterPassingModeType` to represent the parameter passing mode specified for the parameter in the TTCN-3 ATS
`TciParameterPassingModeType`	A value of type `TciParameterPassingModeType` is either `IN`, `INOUT`, or `OUT`. This abstract type is used when starting a test case or when the termination of a test case is indicated
`TciParameterListType`	A value of type `TciParameterListType` is a list of `TciParameterType`. This abstract type is used when starting a test case or when the termination of a test case is indicated
`TciParameterTypeType`	A value of type `TciParameterTypeType` is a structure of `Type` and `TciParameterPassingModeType`. This abstract type is used to represent the type and the parameter passing mode of a test case parameter
`TciParameterTypeListType`	A value of type `TciParameterTypeListType` is a list of `TciParameterTypeType`. This abstract type is used to represent the list of parameters of a test case
`TciTestComponentKindType`	A value of type `TciParameterListType` is a literal of the set of kinds of TTCN-3 test components, e.g. `MTC`, `PTC`, and `CONTROL`. This abstract type is used for component handling
`TciTypeClassType`	A value of type `TciTypeClassType` is a literal of the set of type classes in TTCN-3 such as boolean, float, record, etc. This abstract type is used for value handling

7.2.1.2 Communication

`TciSignatureIdType`	A value of type `TciSignatureIdType` is the name of a procedure signature as specified in the TTCN-3 ATS. This abstract type is used in procedure based TCI communication operations
`TciBehaviourIdType`	A value of type `TciBehaviourIdType` identifies a TTCN-3 behaviour functions

Additional abstract data types with the prefix Tri are taken from [2]: `TriPortIdType`, `TriPortIdListType`, `TriComponentIdType`, and `TriMessageType`.

7.2.2 Abstract TTCN-3 data types and values

This clause defines the set of abstract data types that build up the TTCN-3 type and value representation. Functionality of each data type is defined by an accompanying set of operations. Operations on or using this abstract data type return either a value of this abstract type or a basic type like `boolean`.

All operations have been defined using the Interface Description Language (IDL). Concrete language mapping for the operations on the abstract data types are given in clause 8 and 9. In certain languages, the application of an operation on an abstract data type is represented by passing (either by-value or by-reference, depending on the mapping) the concrete value as a parameter to the operation. Other languages might choose other referencing method to the concrete value, e.g. by considering the value as an object on which a method corresponding to the operation is invoked. To indicate the inability to perform a certain task or to indicate the absence of an optional parameter in the following, the distinct value `null` is used. It can be considered as being a reserved value indicating a special value. The language mappings will define a concrete representation of this distinct value `null`.

The abstract TTCN-3 type and value representation consists of two parts:

- an abstract data type `Type` that represents all TTCN-3 types in a TTCN-3 module;
- different abstract data types that represent TTCN-3 values, i.e. TTCN-3 values of a given TTCN-3 type. This can be either values of TTCN-3 predefined types or of TTCN-3 user-defined types.

For accessing, evaluating, and coding the TTCN-3 data the test system uses the abstract data type `Type` and the different abstract value data types. Therefore, these abstract data types define the abstraction level between the TTCN-3 Executable (TE) and the remaining test system using the TCI interfaces.

7.2.2.1 Abstract TTCN-3 data types

According to the present document TTCN-3 types, either predefined or user-defined, will be represented at the TCI interfaces using the abstract data type `Type`.

For the abstract data type `Type` a set of operations is defined to:

- reference predefined and user-defined TTCN-3 data types; and to
- create and maintain TTCN-3 values.

The following operations are defined for the abstract data type `Type`:

`TciModuleIdType getDefiningModule()`	Returns the module identifier of the module in which type is defined. Returns the distinct value `null` if type is a TTCN-3 base type, e.g. boolean, integer, etc.)
`TString getName()`	Returns the name of the type as defined in the TTCN-3 module
`TciTypeClassType getTypeClass()`	Returns the type class of the respective type. A value of `TciTypeClassType` can have one of the following constants: `ADDRESS, ANYTYPE, BITSTRING, BOOLEAN, CHAR, CHARSTRING, COMPONENT, ENUMERATED, FLOAT, HEXSTRING, INTEGER, OBJID, OCTETSTRING, RECORD, RECORD_OF, SET, SET_OF, UNION, UNIVERSAL_CHARSTRING, UNIVERSAL_CHAR, VERDICT`
`Value newInstance()`	Returns a freshly created value of the given type. This initial value of the created value is undefined
`TString getTypeEncoding()`	Returns the type encoding attribute as defined in the TTCN-3 module
`TString getTypeEncodingVariant()`	This operation returns the value encoding variant attribute as defined in TTCN-3, if any. If no encoding variant attribute is defined the distinct value `null` is returned

7.2.2.2 Abstract TTCN-3 values

According to the present document, TTCN-3 values are represented at the TCI interfaces via numerous abstract data types.

Figure 3 presents the hierarchy between the abstract data types for TTCN-3 values (short: abstract values).

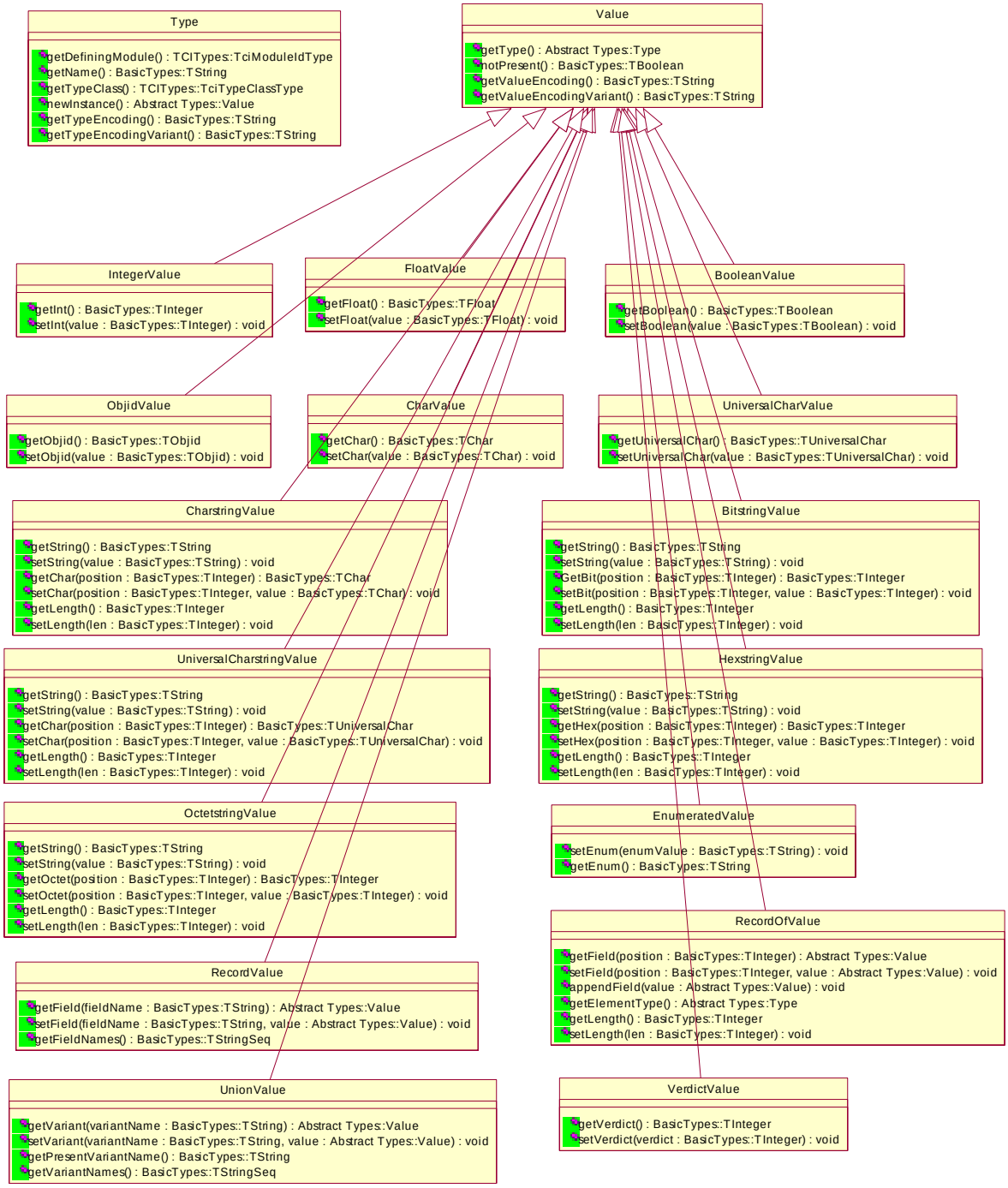

Figure 3: Hierarchy of abstract values

As shown in figure 3, all TTCN-3 abstract values share the same base abstract data type `Value`. All operations defined on this common base data type are implicitly defined also for the abstract value types derived from it.

7.2.2.2.1 The abstract data type `Value`

The following operations are defined on the base abstract data type `Value`. The concrete representations of these operations are defined in the respective language mapping sections:

`Type getType()`	Returns the type of the specified value
`TBoolean notPresent()`	Returns `true` if the specified value is `omit`, `false` otherwise
`TString getValueEncoding()`	Returns the value encoding attribute as defined in TTCN-3, if any. If no encoding attribute is defined the distinct value `null` is returned
`TString getValueEncodingVariant()`	Returns the value encoding variant attribute as defined in TTCN-3, if any. If no encoding variant attribute is defined the distinct value `null` is returned

7.2.2.2.2 The abstract data type `IntegerValue`

The abstract data type `IntegerValue` is based on the abstract data type `Value`. It represents TTCN-3 `integer` values.

The following operations are defined on the abstract data type `IntegerValue`:

`TInteger getInt()`	Returns the integer value of this TTCN-3 integer
`void setInt(in TInteger value)`	Sets this `IntegerValue` to `value`

7.2.2.2.3 The abstract data type `FloatValue`

The abstract data type `FloatValue` is based on the abstract data type `Value`. It represents TTCN-3 `float` values.

The following operations are defined on the abstract data type `FloatValue`:

`TFloat getFloat()`	Returns the float value of this TTCN-3 float
`void setFloat(in TFloat value)`	Sets this `FloatValue` to value

7.2.2.2.4 The abstract data type `BooleanValue`

The abstract data type `BooleanValue` is based on the abstract data type `Value`. It represents TTCN-3 `boolean` values.

The following operations are defined on the abstract data type `FloatValue`:

`TBoolean getBoolean ()`	Returns the boolean value of the TTCN-3 `boolean`
`void setBoolean(in TBoolean value)`	Sets this boolean value to `value`

7.2.2.2.5 The abstract data type `ObjidValue`

The abstract data type `ObjidValue` is based on the abstract data type `Value`. It represents TTCN-3 `objid` values.

The following operations are defined on the abstract data type `ObjidValue`:

`TObjid getObjid()`	Returns the object id value of the TTCN-3 `objid`
`void setObjid(in TObjid value)`	Sets this `ObjidValue` to `value`

7.2.2.2.6 The abstract data type CharValue

The abstract data type `CharValue` is based on the abstract data type `Value`. It represents TTCN-3 `char` values.

The following operations are defined on the abstract data type `CharValue`:

`TChar getChar()`	Returns the char value of the TTCN-3 `char`
`void setChar(in TChar value)`	Sets this `CharValue` to `value`

7.2.2.2.7 The abstract data type UniversalCharValue

The abstract data type `UniversalCharValue` is based on the abstract data type `Value`. It represents TTCN-3 `universal char` values.

The following operations are defined on the abstract data type `UniversalCharValue`:

`TUniversalChar getUniversalChar()`	Returns the universal char value of the TTCN-3 `universal char`
`void setUniversalChar(in TUniversalChar value)`	Sets this universal char value to `value`

7.2.2.2.8 The abstract data type CharstringValue

The abstract data type `CharstringValue` is based on the abstract data type `Value`. It represents TTCN-3 `charstring` values.

The following operations are defined on the abstract data type `CharstringValue`:

`TString getString()`	Returns the string value of the TTCN-3 `charstring`. The textual representation of the empty TTCN-3 `charstring` is `''`, while its length is zero
`void setString(in TString value)`	Sets this `CharstringValue` to `value`
`TChar getChar(in TInteger position)`	Returns the char value of the TTCN-3 charstring at `position`. Position 0 denotes the first char of the TTCN-3 `charstring`. Valid values for position are from `0` to `length - 1`
`void setChar(in TInteger position, in TChar value)`	Set the character at position to value. Valid values for position are from 0 to length - 1
`TInteger getLength()`	Returns the length of this CharstringValue in chars, zero if the value of this CharstringValue is omit
`void setLength(in TInteger len)`	setLength first resets this CharstringValue to its initial value and afterwards sets the length of this `CharstringValue` in chars to `len`

7.2.2.2.9 The abstract data type UniversalCharstringValue

The abstract data type `UniversalCharstringValue` is based on the abstract data type `Value`. It represents TTCN-3 `universal charstring` values.

The following operations are defined on the abstract data type `UniversalCharstringValue`:

`TString getString()`	Returns the textual representation of this `UniversalCharstringValue`, as defined in TTCN-3
`void setString(in TString value)`	Sets the value of this `UniversalCharstringValue` according to the textual representation as defined by `value`
`TUniversalChar getChar(in TInteger position)`	Returns the universal char value of the TTCN-3 `universal charstring` at position. Position 0 denotes the first `TUniversalChar` of the TTCN-3 `universal charstring`. Valid values for `position` are from `0 to length - 1`
`void setChar(in TInteger position, in TUniversalChar value)`	Sets the universal char at position to value. Valid values for `position` are from `0 to length - 1`
`TInteger getLength()`	Returns the length of this universal charstring value in universal chars, zero if the value of this universal charstring value is omit
`void setLength(in TInteger len)`	setLength first resets this UniversalCharstringValue to its initial value and afterwards sets the length of this `UniversalCharstringValue` in universal chars to `len`

7.2.2.2.10 The abstract data type BitstringValue

The abstract data type `BitstringValue` is based on the abstract data type `Value`. It represents TTCN-3 `bitstring` values:

The following operations are defined on the abstract data type `BitstringValue`.

`TString getString()`	Returns the textual representation of this `BitstringValue`, as defined in TTCN-3. E.g. the textual representation of `0101` is `"0101"B.` The textual representation of the empty TTCN-3 `bitstring` is `""B`, while its length is zero
`void setString(in TString value)`	Sets the value of this `BitstringValue` according to the textual representation as defined by `value`. E.g. the value of this `BitstringValue` is `0101` if the textual representation in `value` is `"0101"B`
`TChar getBit(in TInteger position)`	Returns the value `(0 | 1)` at position of this TTCN-3 bitstring as a character. Position 0 denotes the first bit of the TTCN-3 bitstring. Valid values for position are from `0 to length - 1`
`void setBit(in TInteger position, in TInteger value)`	Sets the bit at position to the value `(0 | 1)`. Position 0 denotes the first bit in this BitstringValue. Valid values for position are from `0 to length - 1`

`TInteger getLength()`	Returns the length of this `BitstringValue` in bits, zero if the value of this `BitstringValue` is `omit`
`void setLength(in TInteger len)`	setLength first resets this BitstringValue to its initial value and afterwards sets the length of this `BitstringValue` in bits to `len`

7.2.2.2.11 The abstract data type `OctetstringValue`

The abstract data type `OctetstringValue` is based on the abstract data type `Value`. It represents TTCN-3 `octetstring` values.

The following operations are defined on the abstract data type `OctetstringValue`:

`TString getString()`	Returns the textual representation of this `OctetstringValue`, as defined in TTCN-3. E.g. the textual representation of `0xCAFFEE` is `"CAFFEE"O`. The textual representation of the empty TTCN-3 `octetstring` is `""O`, while its length is zero
`void setString(in TString value)`	Sets the value of this `OctetstringValue` according to the textual representation as defined by `value`. E.g. The value of this `OctetstringValue` is `0xCAFFEE` if the textual representation in `value` is `"CAFFEE"O`
`TChar getOctet(in TInteger position)`	Returns the value `(0..255)` at `position` of this TTCN-3 octetstring. Position 0 denotes the first octet of the TTCN-3 octetstring. Valid values for position are from `0 to length - 1`
`void setOctet(in TInteger position, in TInteger value)`	Sets the octet at `position` to value `0..255)`. Position 0 denotes the first octet in the octetstring. Valid values for position are from `0 to length - 1`
`TInteger getLength()`	Returns the length of this `OctetstringValue` in octets, zero if the value of this `OctetstringValue` is `omit`
`void setLength(in TInteger len)`	setLength first resets this OctetstringValue to its initial value and afterwards sets the length of this `OctetstringValue` in octets to `len`

7.2.2.2.12 The abstract data type `HexstringValue`

The abstract data type `HexstringValue` is based on the abstract data type `Value`. It represents TTCN-3 `hexstring` values.

The following operations are defined on the abstract data type `HexstringValue`:

`TString getString()`	Returns the textual representation of this `HexstringValue`, as defined in TTCN-3. E.g. the textual representation of `0xAFFEE` is `"AFFEE"H`. The textual representation of the empty TTCN-3 `hexstring` is `""H`, while its length is zero
`void setString(in TString value)`	Sets the value of this `HexstringValue` according to the textual representation as defined by `value`. E.g. The value of this `HexstringValue` is `0xAFFEE` if the textual representation in `value` is `"AFFEE"H`

`TChar getHex(in TInteger position)`	Returns the value `(0..15)` at `position` of this TTCN-3 hexstring. Position 0 denotes the first hex digits of the TTCN-3 hexstring. Valid values for position are from `0 to length - 1`
`void setHex(in TInteger position, in TInteger value)`	Sets the hex digit at position to value `(0..15)`. Position 0 denotes the first octet in the `hexstring`. Valid values for position are from `0 to length - 1`
`TInteger getLength()`	Returns the length of this `HexstringValue` in octets, zero if the value of this `HexstringValue` is `omit`
`void setLength(in TInteger len)`	setLength first resets this `HexstringValue` to its initial value and afterwards sets the length of this `HexstringValue` in hex digits to `len`

7.2.2.2.13 The abstract data type `RecordValue`

The abstract data type `RecordValue` is based on the abstract data type `Value`. It specifies how to get and set the TTCN-3 `record` type. The same abstract data type applies for values whose type class is `SET`. The distinction between `record` and `set` is only relevant at matching time.

The following operations are defined on the abstract data type `RecordValue`:

`Value getField(in TString fieldName)`	Returns the value of the field named `fieldName`. The return value is the common abstract base type `Value`, as a record field can have any type defined in TTCN-3. If the field can not be obtained from the record the distinct value `null` is returned
`void setField(in TString fieldName, in Value value)`	Sets the field named `fieldName` of the record to `value`. No assumption shall be made on how a field is stored in a record. An internal implementation might choose to store a reference to this value or to copy the value. It is safe to assume that the value is copied. Therefore it should be relied on that subsequent modifications of `value` will not be considered in the record
`TStringSeq getFieldNames()`	Returns a sequence of string of field names, the distinct value `null`, if the record has no fields

7.2.2.2.14 The abstract data type `RecordOfValue`

The abstract data type `RecordOfValue` is based on the abstract data type `Value`. It specifies how to get and set elements in TTCN-3 `record of` types. The same abstract data type applies for value whose type class is `SET_OF`. The distinction between `record of` and `set of` is only relevant at matching time.

The following operations are defined on the abstract data type `RecordOfValue`:

`Value getField(in TInteger position)`	Returns the value of the `record of` at `position` if `position` is between `zero` and `length -1`, the distinct value `null` otherwise. The return value is the common abstract base type `Value`, as a `record of` can have fields of any type defined in TTCN-3

`void setField(in TInteger position, in Value value)`
: Sets the field at `position` to `value`. If `position` is greater than `(length -1)` the record of is extended to have the length `(position + 1)`. The `record of` elements between the original position at `length` and `position - 1` is set to `omit`. No assumption shall be made on how a field is stored in a `record of`. An internal implementation might choose to store a reference to this value or to copy the value. It is safe to assume that the value is copied. Therefore, it should be relied on that subsequent modifications of `value` will not be considered in the `record of`

`void appendField(in Value value)`
: Appends the value at the end of the `record of`, i.e. at position `length`. No assumption shall be made on how a field is stored in a `record of`. An internal implementation might choose to store a reference to this value or to copy the value. It is safe to assume that the value is copied. Therefore, it should be relied on that subsequent modifications of `value` will not be considered in the `record of`

`Type getElementType()`
: Returns the `Type` of the elements of this `record of`.

`TInteger getLength()`
: Returns the actual length of the `record of` value, zero if the `record of` value is `omit`

`void setLength(in TInteger len)`
: Sets the length of the `record of` to `len`. If `len` is greater than the original length, newly created elements have the value `omit`. If `len` is less or equal than the original length this operation is ignored

7.2.2.2.15 The abstract data type `UnionValue`

The abstract data type `UnionValue` is based on the abstract data type `Value`. It specifies how to get and set variants in a TTCN-3 `union` type. The TTCN-3 `anytype` is represented by a `UnionValue` where the type class of the type obtained by `getType()` is `ANYTYPE`. For details on type classes see clause 7.2.2.1.

The following operations are defined on the abstract data type `UnionValue`:

`Value getVariant(in TString variantName)`
: Returns the value of the TTCN-3 union `variantName`, if `variantName` equals the result of `getPresentVariantName`, the distinct value `null` otherwise. `variantName` denotes the name of the union variant as defined in TTCN-3

`void setVariant(in TString variantName, in Value value)`
: Sets `variantName` of the union to value. If `variantName` is not defined for this union this operation is ignored. If another variant was selected the new variant is selected instead

`TString getPresentVariantName()`
: Returns a String representing the currently selected variant name in the given TTCN-3 union. The distinct value `null` is returned if no variant is selected

`TStringSeq getVariantNames()`
: Returns a sequence of string of variant names, the distinct value `null`, if the union has no fields. If the `UnionValue` represents the TTCN-3 `anytype`, i.e. the type class of the type obtained by getType() is ANYTYPE, all predefined and user-defined TTCN-3 types is returned

7.2.2.2.16 The abstract data type EnumeratedValue

The abstract data type `EnumeratedValue` is based on the abstract data type `Value`. It specifies how TTCN-3 `enumerated` can be set and get.

The following operations are defined on the abstract data type `EnumeratedValue`:

`TString getEnum()`	Returns the string identifier of this `EnumeratedValue`. This identifier equals the identifier in the TTCN-3 specification
`void setEnum(in TString enumValue)`	Sets the enum to `enumValue`. If `enumValue` is not an allowed value for this enumeration the operation is ignored

7.2.2.2.17 The abstract data type VerdictValue

The abstract data type `VerdictValue` is based on the abstract data type `Value`. It specifies how TTCN-3 `verdict` can be set and get.

The following operations are defined on the abstract data type `VerdictValue`:

`TInteger getVerdict()`	Returns the integer value for this `VerdictValue`. The integer is one of the following constants: `ERROR, FAIL, INCONC, NONE, PASS`.
`void setVerdict(in TInteger verdict)`	Sets this `VerdictValue` to `verdict`. Note that a `VerdictValue` can be set to any of the above mentioned verdicts at any time. The `VerdictValue` does not perform any verdict calculations as defined in TTCN-3. For example, it is legal to set the `VerdictValue` first to `ERROR` and then to `PASS`.

7.3 TCI operations

This clause specifies the operations that a TTCN-3 Executable shall provide to a test system (*required operations*) and which functionality shall be provided by the test system to the TTCN-3 Executable (*provided operations*).

The terms "required" and "provided" reflect the fact that the present document defines the requirements on a TTCN-3 Executable from a user's point of view. The user "requires" from a TTCN-3 Executable certain functionality to build a complete TTCN-3-based test system. To fulfil its task the TTCN-3 Executable has to inform the user on certain events where the user has to "provide" this possibility to the TTCN-3 Executable.

All operation definitions in this clause are defined using the Interface Definition Language (IDL). Concrete language mappings are defined in clause 8 and 9.

For every TCI operation call all *in*, *inout*, and *out* parameters listed in the particular operation definition are mandatory. The value of an *in* parameter is specified by the calling entity. Calling entity refers to the direction of the call. For operations on a *required* interface the calling entity is the test system while the called entity is the TTCN-3 Executable. For operations on a *provided* interface the calling entity is the TTCN-3 Executable while the test system is the called entity.

Similarly, the value of an *out* parameter is specified by the called entity. In the case of an *inout* parameter, a value is first specified by the calling entity but may be replaced with a new value by the called entity. Note that although TTCN-3 also uses *in*, *inout*, and *out* for signature definitions the denotations used in TCI IDL specification are not related to those in a TTCN-3 specification.

Operation calls should use a reserved value to indicate the absence of parameters. The reserved values for these types are defined in each language mapping and will be subsequently referred to as the `null` value.

In addition, the `null` value will also be used to indicate the inability to perform a certain task.

As this clause specifies interfaces only and does not suggest concrete implementations on how to perform the specified functionality the term entity will be used to identify the part of the test system implementation that implements this interface and performs the requested functionality. For example, the calling entity in the tciSendConnected operation is the TE, i.e. the part of test system implementation that provides the TE functionality.

All functions in the interface are described using the following template. Descriptions that are not applicable for certain operations are removed:

Signature	`IDL Signature`
In Parameters	Description of data passed as parameters to the operation from the calling entity to the called entity.
Out Parameters	Description of data passed as parameters to the operation from the called entity to the calling entity.
InOut Parameters	Description of data passed as parameters to the operation from the calling entity to the called entity and from the called entity back to the calling entity.
Return Value	Description of data returned from the operation to the calling entity.
Constraint	Description of any constraints when the operation can be called.
Effect	Behaviour required of the called entity before the operation may return.

7.3.1 The TCI-TM interface

The TCI Test Management Interface (TCI-TM) describes the operations a TTCN-3 Executable is required to implement and the operations a test management implementation shall provide to the TE (figure 4).

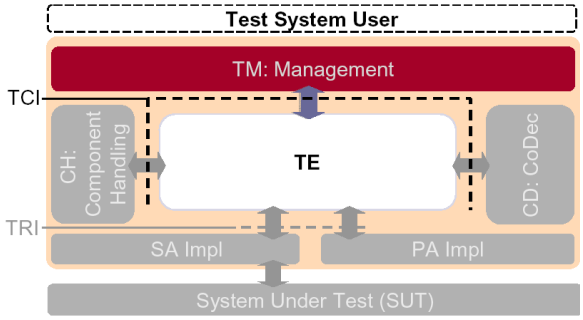

Figure 4: The TCI-TM interface

A test management implementation provides overall test management to the test system user. It requires from the TE the presence of operations to start and stop test execution of a TTCN-3 module or of certain test cases in a TTCN-3 module. In turn it provides operations to the TE for resolving module parameter at runtime, logging and the indication of execution termination.

Clause 10 illustrates the usage and sequential ordering of operation calls by either the TE or the test management.

7.3.1.1 TCI-TM required

This clause specifies the operations the TM requires from the TE. In addition to the operations specified in this clause, a test management requires the operations as required at the TCI-CD interface.

7.3.1.1.1 tciRootModule

Signature	`void tciRootModule (in TciModuleIdType moduleName)`	
In Parameters	`moduleName`	The `moduleName` denotes the module identifiers as defined in TTCN-3.
Return Value	`void`	
Constraint	Shall be used only if neither the control part nor a test case is currently being executed.	
Effect	`tciRootModule` selects the indicated module for execution through a subsequent call using `tciStartTestCase` or `tciStartControl`. A `tciError` will be issued by the TE if no such module exists.	

7.3.1.1.2 getImportedModules

Signature	`TciModuleIdListType getImportedModules()`	
Return Value	A list of all imported modules of the root module. The modules are ordered as they appear in the TTCN-3 module. If no imported modules exist, an empty module list is returned.	
Constraint	Shall be used only if a root module has been set before.	
Effect	The TE provides to the management a list of imported modules of the root module. If no imported module exist, an empty module list is returned. If the TE cannot provide a list, the distinct `null` value shall be returned.	

7.3.1.1.3 tciGetModuleParameters

Signature	`TciModuleParameterListType tciGetModuleParameters (TciModuleIdType moduleName)`	
In Parameters	`moduleName`	The `moduleName` denotes the module identifiers for which the module parameters should be retrieved.
Return Value	A list of all module parameters of the identified module. The parameters are ordered as they appear in the TTCN-3 module. If no parameters exist, an empty module parameter list is returned.	
Constraint	Shall be used only if a root module has been set before.	
Effect	The TE provides to the management a list of module parameters of the identified module. If no module parameters exist, an empty module parameter list is returned. If the TE cannot provide a list, the distinct `null` value shall be returned.	

7.3.1.1.4 tciGetTestCases

Signature	`TciTestCaseIdListType tciGetTestCases ()`
Return Value	A list of all test cases that are either defined in or imported into the root module.
Constraint	Shall be used only if a root module has been set before.
Effect	The TE provides to the management a list of test cases. If no test cases exist, an empty test case list is returned. If the TE cannot provide a list, the distinct `null` value shall be returned.

7.3.1.1.5 tciGetTestCaseParameters

Signature	`TciParameterTypeListType tciGetTestCaseParameters (in TciTestCaseIdType testCaseId)`	
In Parameters	`testCaseId`	A test case identifier as defined in the TTCN-3 module.
Return Value	A list of all parameter types of the given test case. The parameter types are ordered as they appear in the TTCN-3 signature of the test case. If no parameters exist, an empty parameter type list is returned.	
Constraint	Shall be used only if a root module has been set before.	
Effect	The TE provides to the management a list of parameter types of the given test case. If no test case parameters exist, an empty parameter type list is returned. If the TE cannot provide a list, the distinct `null` value shall be returned.	

7.3.1.1.6 tciGetTestCaseTSI

Signature	`TriPortIdListType tciGetTestCaseTSI (in TciTestCaseIdType testCaseId)`	
In Parameters	`testCaseId`	A test case identifier as defined in the TTCN-3 module.
Return Value	A list of all system ports of the given test case that have been declared in the definition of the system component for the test case, i.e. the TSI ports. If a system component has not been explicitly defined for the test case, then the list contains all communication ports of the MTC test component. The ports are ordered as they appear in the respective TTCN-3 component type declaration. If no system ports exist. an empty list. i.e. a list of length zero is returned.	
Constraint	Shall be used only if a root module has been set before.	
Effect	The TE provides to the management a list of system ports of the given test case. If no system ports exist, an empty port list is returned. If the TE cannot provide a list, the distinct `null` value shall be returned.	

7.3.1.1.7 tciStartTestCase

Signature	`void tciStartTestCase(in TciTestCaseIdType testCaseId, in TciParameterListType parameterList)`	
In Parameters	`testCaseId`	A test case identifier as defined in the TTCN-3 module.
	`parameterList`	A list of `Values` where each value defines a parameter from the parameter list as defined in the TTCN-3 test case definition. The parameters in `parameterList` are ordered as they appear in the TTCN-3 signature of the test case. If no parameters have to be passed either the `null` value or an empty `parameterList`, i.e. a list of length zero shall be passed.
Return Value	`void`	
Constraint	Shall be called only if a module has been selected before. Only `testCaseIds` for test cases that are declared in the currently selected TTCN-3 module shall be passed. Test cases that are imported in a referenced module can not be started. To start imported test cases the referenced (imported) module must be selected first using the `tciRootModule` operation.	
Effect	`tciStartTestCase` starts a testcase in the currently selected module with the given parameters. A `tciError` will be issued by the TE if no such test case exists. All *in* and *inout* test case parameters in `parameterList` contain `Value`. All *out* test case parameters in `parameterList` shall contain the distinct value of `null` since they are only of relevance when the test case terminates.	

7.3.1.1.8 tciStopTestCase

Signature	`void tciStopTestCase()`
Return Value	`void`
Constraint	Shall be called only if a module has been selected before.
Effect	tciStopTestCase stops the testcase currently being executed. If the TE is not executing a test case, the operation will be ignored. If the control part is being executed, `tciStopTestCase` will stop execution of the currently executed test case, i.e. the execution of the test case that has recently been indicated using the *provided* operation `tciTestCaseStarted`. A possible executing control part will continue execution as if the test case has stopped normally and returned with verdict ERROR.

7.3.1.1.9 tciStartControl

Signature	`TriComponentId tciStartControl()`
Return Value	A `TriComponentId` that represents the test component the module control part is executed on. If the TE cannot start control part of the selected module the distinct value `null` will be returned.
Constraint	Shall be called only if a module has been selected before.
Effect	Starts the control part of the selected module. The control part will start TTCN-3 test cases as described in TTCN-3. While executing the control part the TE will call the *provided* operation `tciTestCaseStarted` and `tciTestCaseTerminated` for every test case that has been started and that has terminated. After termination of the control part the TE will call the *provided* operation `tciControlPartTerminated`.

7.3.1.1.10 tciStopControl

Signature	`void tciStopControl()`
Return Value	`void`
Constraint	Shall only be called if a module has been selected before.
Effect	`tciStopControl` stops execution of the control part. If no control part is currently being executed the operation will be ignored. If a test case has been started directly this will stop execution of the current test case as if `tciStopTestCase` has been called.

7.3.1.2 TCI-TM provided

This clause specifies the operations the TM has to provide to the TE.

7.3.1.2.1 tciTestCaseStarted

Signature	`void tciTestCaseStarted(in TciTestCaseIdType testCaseId, in TciParameterListType parameterList, in TFloat timer)`	
In Parameters	`testCaseId`	A test case identifier as defined in the TTCN-3 module.
	`parameterList`	A list of values that are part of the test case signature. The parameters in `parameterList` are ordered as they appear in the TTCN-3 test case declaration.
	`timer`	A float value representing the duration of the test case timer.
Return Value	`void`	
Constraint	Shall only be called after either the control part of the module or a test case has been started using the *required* operations `tciStartControl` or `tciStartTestCase`.	
Effect	`tciTestCaseStarted` indicates to the TM that a test case with `testCaseId` has been started. It will not be distinguished whether the test case has been started explicitly using the *required* operation `tciStartTestCase` or implicitly while executing the control part.	

7.3.1.2.2 tciTestCaseTerminated

Signature	`void tciTestCaseTerminated (in VerdictValue verdict, in TciParameterListType parameterList)`	
In Parameters	`verdict`	The final verdict of the test case.
	`parameterList`	A list of values that are part of the test case signature. The parameters in parameterList are ordered as they appear in the TTCN-3 test case declaration.
Return Value	`void`	
Constraint	Shall only be called after either the control part of the module or a test cases has been started using the *required* operations `tciStartControl` or `tciStartTestCase`.	
Effect	This operation will be called by the TE to indicate the test management that the test case that has been currently executed on the MTC has terminated and that the final verdict was `verdict`. On the invocation of a `tciTestCaseTerminated` operation all *out* and *inout* test case parameters contain `Values`. All in test case parameters contain the distinct value of `null` because they are only of relevance to the test case start but not in the reply to the call.	

7.3.1.2.3 tciControlTerminated

Signature	`void tciControlTerminated ()`
Return Value	`void`
Constraint	Shall only be called when the module execution has been started using the `tciStartControl` operation.
Effect	This operation will be called by the TE to indicate the test management that the control part of the selected module has just terminated execution.

7.3.1.2.4 tciGetModulePar

Signature	`Value tciGetModulePar (in TciModuleParameterIdType parameterId)`	
In Parameters	`parameterId`	The identifier of the module parameter as defined in TTCN-3.
Return Value	A value.	
Constraint	This operation shall be called whenever the TE needs to access the value of a module parameter. Every accessed module parameter will be resolved only once between a `tciStartTestCase` and `tciTestCaseTerminated` pair if a test case has been started explicitly or between a `tciStartControl` and `tciControlTerminated` pair if the control part of a module has been started.	
Effect	The management provides to the TE a `Value` for the indicated `parameterId`. Every call of `tciGetModulePar()` will return the same value throughout the execution of an explicitly started test case or throughout the execution of a control part If the management cannot provide a TTCN-3 value, the distinct `null` value shall be returned.	

7.3.1.2.5 tciLog

Signature	`void tciLog (in TriComponentIdType testComponentId, in TString message)`	
In Parameters	`testComponentId`	Identifier of the component that logs the message.
	`message`	A string value, i.e. the message to be logged.
Return Value	`void`	
Constraint	Shall be called by the TE when the TTCN-3 statement log will be executed, either in the control part of a module or within the test case.	
Effect	The TM presents `testComponentId` and `message` to the user, how this done is not within the scope of the present document.	

7.3.1.2.6 tciError

Signature	`void tciError(in TString message)`	
In Parameters	`message`	A string value, i.e. the message error
Return Value	`void`	
Constraint	Can be called at any time by the TE to indicate an unrecoverable error situation. This error situation could either be indicated by the CH or the CD or could occur within the TE.	
Effect	The TE indicates the occurrence of an unrecoverable error situation. `message` contains a reason phrase that might be communicated to the test system user. It is up to the test management to terminate execution of test cases or control parts if running. The test management has to take explicit measures to terminate test execution immediately.	

7.3.2 The TCI-CD interface

The TCI Codec Interface (TCI-CD) describes the operations a TTCN-3 Executable is required to implement and the operations a codec implementation for a certain encoding scheme shall provide to the TE (figure 5).

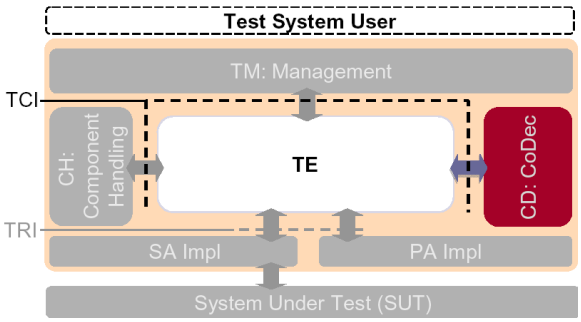

Figure 5: The TCI-CD interface

A codec implementation encodes TTCN-3 values according to the encoding attribute into a bitstring and decodes a bitstring according to decoding hypothesis. To be able to decode a bitstring into a TTCN-3 value the CD requires certain functionality from the TE. In turn the CD provides encoding and decoding functionality to the TTCN-3 Executable.

Clause 10 illustrates the usage and sequential ordering of operation calls by either the TE or the CD.

7.3.2.1 TCI-CD required

This clause specifies the operations the CD requires from the TE. All operations specified in this clause are also required at the TCI-TM and TCI-CH interfaces.

7.3.2.1.1 getTypeForName

Signature	`Type getTypeForName(in TString typeName)`	
In Parameters	`typeName`	The TTCN-3 name of the type as defined in the TTCN-3 module. The following are reserved type names and will return a predefined type: "integer" "float" "bitstring" "hexstring" "octetstring" "charstring" "universal charstring" "char" "universal char" "boolean" "verdicttype" "objid" typeName has to be the fully qualified type name, i.e. module.typeName
Return Value	A type representing the requested TTCN-3 type.	
Constraint	---	
Effect	Returns a type representing a TTCN-3 type. Predefined TTCN-3 types can be retrieved from the TE by using the TTCN-3 keywords for the predefined types. In this case `typeName` denotes to the basic TTCN-3 type like "charstring", "bitstring" etc. Returns the distinct value `null` if the requested type can not be returned. Note that the `anytype` and `address` can not be obtained with module set to `null`. Although they are predefined types they might be distinct between modules. For example, `address` can either be the unmodified predefined type, or a user-defined type in a module. Other predefined types can not be redefined.	

7.3.2.1.2 getInteger

Signature	`Type getInteger()`
Return Value	An instance of `Type` representing a TTCN-3 integer type.
Effect	Constructs and returns a basic TTCN-3 integer type.

7.3.2.1.3 getFloat

Signature	`Type getFloat()`
Return Value	An instance of `Type` representing a TTCN-3 float type.
Effect	Constructs and returns a basic TTCN-3 float type.

7.3.2.1.4 getBoolean

Signature	`Type getBoolean()`
Return Value	An instance of `Type` representing a TTCN-3 boolean type.
Effect	Constructs and returns a basic TTCN-3 boolean type.

7.3.2.1.5 getChar

Signature	`Type getChar()`
Return Value	An instance of `Type` representing a TTCN-3 char type.
Effect	Constructs and returns a basic TTCN-3 char type.

7.3.2.1.6 getUniversalChar

Signature	`Type getUniversalChar()`
Return Value	An instance of `Type` representing a TTCN-3 universal char type.
Effect	Constructs and returns a basic TTCN-3 universal char type.

7.3.2.1.7 getObjid

Signature	`Type getObjid()`
Return Value	An instance of `Type` representing a TTCN-3 object id type.
Effect	Constructs and returns a basic TTCN-3 object id type.

7.3.2.1.8 getCharstring

Signature	`Type getCharstring ()`
Return Value	An instance of `Type` representing a TTCN-3 charstring type.
Effect	Constructs and returns a basic TTCN-3 charstringtype.

7.3.2.1.9 getUniversalCharstring

Signature	`Type getUniversalCharstring ()`
Return Value	An instance of `Type` representing a TTCN-3 universal charstring type.
Effect	Constructs and returns a basic TTCN-3 universal charstring type.

7.3.2.1.10 getHexstring

Signature	`Type getHexstring ()`
Return Value	An instance of `Type` representing a TTCN-3 hexstring type.
Effect	Constructs and returns a basic TTCN-3 hexstring type.

7.3.2.1.11 getBitstring

Signature	`Type getBitstring()`
Return Value	An instance of `Type` representing a TTCN-3 bitstring type.
Effect	Constructs and returns a basic TTCN-3 bitstring type.

7.3.2.1.12 getOctetstring

Signature	`Type getOctetstring ()`
Return Value	An instance of `Type` representing a TTCN-3 octetstring type.
Effect	Constructs and returns a basic TTCN-3 octetstring type.

7.3.2.1.13 getVerdict

Signature	`Type getVerdict()`
Return Value	An instance of `Type` representing a TTCN-3 verdict type.
Effect	Constructs and returns a basic TTCN-3 verdict type.

7.3.2.1.14 tciErrorReq

Signature	`void tciErrorReq(in TString message)`	
In Parameters	`Message`	A string value, i.e. the error phrase describing the problem.
Return Value	`void`	
Constraint	Shall be called whenever an error situation has occurred.	
Effect	The TE will be notified about an unrecoverable error situation within the CD and forward the error indication to the test management.	

7.3.2.2 TCI-CD provided

This clause specifies the operations the TM shall provide to the TE.

7.3.2.2.1 decode

Signature	`Value decode(in TriMessageType message,` `in Type decodingHypothesis)`	
In Parameters	`message`	The encoded message to be decoded.
	`decodingHypothesis`	The hypothesis the decoding can be based on.
Return Value	Returns the decoded value, if the value is of a compatible type as the `decodingHypothesis`, else the distinct value `null`.	
Constraint	This operation shall be called whenever the TE has to decode an encoded value. The TE might decode immediately after reception of a encoded value, or might for performance considerations postpone the decoding until the actual access of the encoded value.	
Effect	This operations decodes `message` according to the encoding rules and returns a TTCN-3 value. The `decodingHypothesis` shall be used to determine whether the encoded value can be decoded. If an encoding rule is not self-sufficient, i.e. if the encoded message does not inherently contain its type `decodingHypothesis` shall be used. If the encoded value can be decoded without the decoding hypothesis, the distinct `null` value shall be returned if the type determined from the encoded message is not compatible with the decoding hypothesis.	

7.3.2.2.2 encode

Signature	`TriMessageType encode(in Value value)`	
In Parameters	`value`	The value to be encoded.
Return Value	Returns an encoded `TriMessage` for the specified encoding rule.	
Constraint	This operation shall be called whenever the TE has to encode a Value.	
Effect	Returns an encoded `TriMessage` according to the encoding rules.	

7.3.3 The TCI-CH interface

The TCI Component Handling Interface (TCI-CH) describes the operations a TTCN-3 Executable is required to implement and the operations a component handling implementation shall provide to the TE (figure 6).

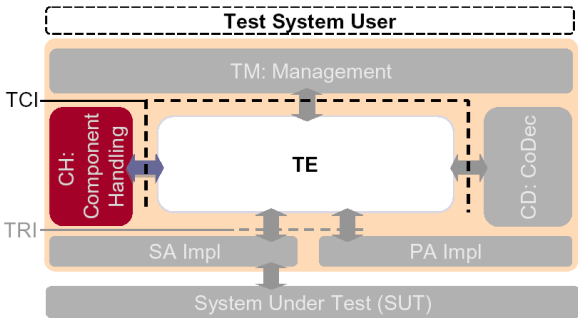

Figure 6: The TCI-CH interface

A component handling implementation distributes TTCN-3 configuration operations like create, connect and start and intercomponent communication like send on a connected port among one or more TTCN-3 Executables participating in a test session. Note that although multiple instances of a TE might participate in a test session this is not mandatory.

The basic principle is that TCI-CH is not *implementing* any kind of TTCN-3 functionality. Instead it will be informed by the TE that for example a test component shall be created. Based on Component Handling (CH) internal knowledge the request for creation of a test component will be transmitted to another (remote) participating TE. This second (remote) participating TE will create the TTCN-3 component and will provide a handle back to the requesting (local) TE. The requesting (local) TE can now operate on the created test component via this component handle.

Within the operation definitions the terms local TE and remote TE is used to highlight the fact that a test system implementation might be distributed over several test devices, each of them hosting a complete TE. The terms "local" and "remote" always refer to the interfaces currently being described. For convenience, the term "local" refers always to the TE being either the callee of an operation (for *required* operations) or the caller of an operation (for *provided* operations). While the TE is conceptually considered as being distributed, the CH is considered to be non-distributed. This can either be achieved using a centralized architecture or by using a middleware-platform that abstracts from distribution aspects. Although the TE might be distributed over different physical devices, there might be configurations where only one, non-distributed TE will participate in a test session. In this case the term "local" and "remote" refer to the same TE instance.

Clause 10 illustrates the usage and sequential ordering of operation calls by either the TE or the CH.

Although all TTCN-3 Executables participating in a test session are equal, there is a distinct TE*. This TE* is the TE where the explicit `tciStartTestCase`() or `tciStartControl` () has been processed. The reason for this distinction is, that TE* shall calculate the global verdict. TE* will notify the test management upon termination of test execution and shall provide then the global verdict of the test case.

7.3.3.1 TCI-CH required

This clause specifies the operations the CH requires from the TE. In addition to the operations specified in this clause, all *required* operation of the TCI-CD interface are also required.

7.3.3.1.1 tciEnqueueMsgConnected

Signature	`void tciEnqueueMsgConnected (in TriPortIdType sender, in TriComponentIdType receiver, in Value rcvdMessage)`	
In Parameters	`sender`	Port identifier at the sending component via which the message is sent.
	`receiver`	Identifier of the receiving component.
	`rcvdMessage`	The value to be enqueued.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at remote TE a *provided* `tciSendConnected` has been called.	
Effect	The TE enqueues the received value into the local port queue of the indicated receiver component.	

7.3.3.1.2 tciEnqueueCallConnected

Signature	`void tciEnqueueCallConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList)`	
In Parameters	`sender`	Port identifier at the sending component via which the message is sent.
	`receiver`	Identifier of the receiving component.
	`signature`	Identifier of the signature of the procedure call.
	`parameterList`	A list of value parameters which are part of the indicated signature. The parameters in `parameterList` are ordered as they appear in the TTCN-3 signature declaration.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciCallConnected` has been called. All *in* and *inout* procedure parameters contain values. All *out* procedure parameters shall contain the distinct value of `null` because they are only of relevance in a reply to the procedure call but not in the procedure call itself. The procedure parameters are the parameters specified in the TTCN-3 signature template.	
Effect	The TE enqueues the calls at the local port queue of the indicated receiver component.	

7.3.3.1.3 tciEnqueueReplyConnected

Signature	`void tciEnqueueReplyConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList, in Value returnValue)`	
In Parameters	`sender`	Identifier of the port sending the reply.
	`receiver`	Identifier of the component receiving the reply.
	`signature`	Identifier of the signature of the procedure call.
	`parameterList`	A list of value parameters which are part of the indicated signature. The parameters in `parameterList` are ordered as they appear in the TTCN-3 signature declaration.
	`returnValue`	(Optional) return value of the procedure call.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciReplyConnected` has been called. All *out* and *inout* procedure parameters and the return value contain values. All *in* procedure parameters shall contain the distinct value of `null` since they are only of relevance to the procedure call but not in the reply to the call. The `parameterList` contains procedure call parameters. These parameters are the parameters specified in the TTCN-3 signature template. If no return type has been defined for the procedure signature in the TTCN-3 ATS, the distinct value `null` shall be passed for the `returnValue`.	
Effect	The TE enqueues the reply at the local port queue of the indicated receiver component.	

7.3.3.1.4 tciEnqueueRaiseConnected

Signature	`void tciEnqueueRaiseConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in Value exception)`	
In Parameters	`sender`	Identifier of the port sending the reply.
	`receiver`	Identifier of the component receiving the reply.
	`signature`	Identifier of the signature of the procedure call.
	`exception`	The exception.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciRaiseConnected` has been called.	
Effect	The TE enqueues the exception at the local port queue of the indicated receiver component.	

7.3.3.1.5 tciCreateTestComponent

Signature	`TriComponentIdType tciCreateTestComponent (in TciTestComponentKindType kind, in Type componentType)`	
In Parameters	`kind`	The kind of component that shall be created, either `MTC`, `PTC` or `CONTROL`.
	`componentType`	Identifier of the TTCN-3 component type that shall be created.
Return Value	A `TriComponentIdType` value for the created component.	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided tciCreateTestComponentReq* has been called. `componentType` shall be set to the distinct value `null` if a test component of kind `control` shall be created.	
Effect	The TE creates a TTCN-3 test component of the `componentType` and passes a `TriComponentIdType` reference back to the CH. The CH communicates the reference back to the remote TE.	

7.3.3.1.6 tciStartTestComponent

Signature	`void tciStartTestComponent(in TriComponentIdType component, in TciBehaviourIdType behaviour, in TciParamaterListType parameterList)`	
In Parameters	`component`	Identifier of the component to be started. Refers to an identifier previously created by a call of `tciCreateTestComponent`
	`behaviour`	Identifier of the behaviour to be started on the component.
	`parameterList`	A list of Values where each value defines a parameter from the parameter list as defined in the TTCN-3 function declaration of the function being started. The parameters in `parameterList` are ordered as they appear in the TTCN-3 signature of the test case. If no parameters have to be passed either the `null` value or an empty `parameterList`, i.e. a list of length zero shall be passed.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciStartTestComponentReq` has been called. Since only *in* parameters are allowed for functions being started [3], `parameterList` contains only *in* parameters.	
Effect	The TE shall start the indicated behaviour on the indicated component.	

7.3.3.1.7 tciStopTestComponent

Signature	`void tciStopTestComponent(in TriComponentIdType component)`	
In Parameters	`component`	Identifier of the component to be stopped.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciStopTestComponentReq` has been called.	
Effect	The TE shall stop the indicated behaviour on the indicated component.	

7.3.3.1.8 tciConnect

Signature	`void tciConnect (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be connected from.
	`toPort`	Identifier of the test component port to be connected to.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciConnect` has been called.	
Effect	The TE shall connect the indicated ports to one another.	

7.3.3.1.9 tciDisconnect

Signature	`void tciDisconnect (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be disconnected.
	`toPort`	Identifier of the test component port to be disconnected.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciDisconnect` has been called.	
Effect	The TE shall disconnect the indicated ports.	

7.3.3.1.10 tciMap

Signature	`void tciMap (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be mapped from.
	`toPort`	Identifier of the test component port to be mapped to.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciMapReq` has been called.	
Effect	The TE shall map the indicated ports to one another.	

7.3.3.1.11 tciUnmap

Signature	`void tciUnmap (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be unmapped.
	`toPort`	Identifier of the test component port to be unmapped.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciUnmapReq` has been called.	
Effect	The TE shall unmap the indicated ports.	

7.3.3.1.12 tciTestComponentTerminated

Signature	`void tciTestComponentTerminated (in TriComponentIdType component, in VerdictValue verdict)`	
In Parameters	`component`	Identifier of the component that has terminated.
	`verdict`	Verdict after termination of the component.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciTestComponentTerminatedReq` has been called.	
Effect	The local TE is notified of the termination of the indicated test component on a remote TE. Since a function being executed on a test component can only have *in* parameters [3], the `tciTestComponentTerminated` operation does not have a `parameterList` parameter.	

7.3.3.1.13 tciTestComponentRunning

Signature	`TBoolean tciTestComponentRunning (in TriComponentIdType component)`	
In Parameters	`component`	Identifier of the component to be checked for running.
Return Value	`true` if the indicated component is still executing a behaviour, `false` otherwise.	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciTestComponentRunningReq` has been called.	
Effect	The local TE determines whether the indicated component is executing a test behaviour. If the component is executing a behaviour `true` will be returned. In any other case, e.g. test component has finished execution, or test component has not been started, etc. `false` will be returned. After the operation returns, the CH will communicate the value back to the remote TE.	

7.3.3.1.14 tciTestComponentDone

Signature	`TBoolean tciTestComponentDone (in TriComponentIdType component)`	
In Parameters	`component`	Identifier of the component to be checked for done.
Return Value	`true` if the indicated component has completed executing its behaviour, `false` otherwise	
Constraint	This operation shall be called by the CH at the local TE when at a remote TE a *provided* `tciTestComponentDoneReq` has been called.	
Effect	The local TE determines whether the indicated component has completed executing its test behaviour. If the component has completed its behaviour `true` will be returned. In any other case, e.g. test component has not been started, or test component is still executing, `false` will be returned. After the operation returns, the CH will communicate the value back to the remote TE.	

7.3.3.1.15 tciGetMTC

Signature	`TriComponentIdType tciGetMTC()`
Return Value	A `TriComponentIdType` value of the MTC if the MTC executes on the local TE, the distinct value `null` otherwise.
Constraint	This operation can be called by the CH at the appropriate local TE when at a remote TE a *provided* `tciGetMTCReq` has been called.
Effect	The local TE determines whether the MTC is executing on the local TE. If the MTC executes on the local TE the component id of the MTC is being returned. If the MTC is not executed on the local TE the distinct value `null` will be returned. The operation will have no effect on the execution of the MTC. After the operation returns, the CH will communicate the value back to the remote TE.

7.3.3.1.16 tciExecuteTestCase

Signature	`void tciExecuteTestCase (in TciTestCaseIdType testCaseId, in TriPortIdListType tsiPortList)`	
In Parameters	`testCaseId`	A test case identifier as defined in the TTCN-3 module.
	`tsiPortList`	Contains all ports that have been declared in the definition of the system component for the test case, i.e. the TSI ports. If a system component has not been explicitly defined for the test case, then the `tsiPortList` contains all communication ports of the MTC. The ports in `tsiPortList` are ordered as they appear in the respective TTCN-3 component type declaration. If no ports have to be passed either the `null` value or an empty `tsiPortList`, i.e. a list of length zero shall be passed.
Return Value	`void`	
Constraint	This operation shall be called by the CH at the appropriate local TE when at a remote TE a *provided* `tciExecuteTestCaseReq` has been called.	
Effect	The local TE determines whether static connections to the SUT and the initialization of communication means for TSI ports should be done.	

7.3.3.1.17 tciReset

Signature	`void tciReset ()`
Return Value	`void`
Constraint	This operation shall be called by the CH at appropriate local TEs when at a remote TE a *provided* `tciResetReq` has been called.
Effect	The TE can decide to take any means to reset the test system locally.

7.3.3.2 TCI-CH provided

This clause specifies the operations the CH shall provide to the TE.

7.3.3.2.1 tciSendConnected

Signature	`void tciSendConnected (in TriPortIdType sender, in TriComponentIdType receiver, in Value sendMessage)`	
In Parameters	`sender`	Port identifier at the sending component via which the message is sent.
	`receiver`	Identifier of the receiving component.
	`sendMessage`	The message to be send.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 send operation on a component port, which has been connected to another component port.	
Effect	Sends an asynchronous transmission only to the given receiver component. CH transmits the message to the remote TE on which receiver is being executed and enqueues the data in the remote TE.	

7.3.3.2.2 tciCallConnected

Signature	`void tciCallConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList)`	
In Parameters	`sender`	Port identifier at the sending component via which the message is sent.
	`receiver`	Identifier of the receiving component.
	`signature`	Identifier of the signature of the procedure call.
	`parameterList`	A list of value parameters which are part of the indicated signature. The parameters in `parameterList` are ordered as they appear in the TTCN-3 signature declaration.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 call operation on a component port, which has been connected to another component port. All *in* and *inout* procedure parameters contain values. All *out* procedure parameters shall contain the distinct value of `null` because they are only of relevance in a reply to the procedure call but not in the procedure call itself. The procedure parameters are the parameters specified in the TTCN-3 signature template.	
Effect	On invocation of this operation the TE can initiate the procedure call corresponding to the signature identifier `signature` at the called component receiver. The `tciCallConnected` operation shall return without waiting for the return of the issued procedure call. Note that an optional timeout value, which can be specified in the TTCN-3 ATS for a call operation, is not included in the `tciCallConnected` operation signature. The TE is responsible to address this issue by starting a timer for the TTCN-3 call operation in the PA with a separate TRI operation call, i.e. `triStartTimer.` CH transmits the call to the remote TE on which `receiver` is being executed and enqueues the call in the remote TE.	

7.3.3.2.3 tciReplyConnected

Signature	`void tciReplyConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList, in Value returnValue)`	
In Parameters	`sender`	Identifier of the port sending the reply.
	`receiver`	Identifier of the component receiving the reply.
	`signature`	Identifier of the signature of the procedure call.
	`parameterList`	A list of encoded parameters which are part of the indicated signature. The parameters in `parameterList` are ordered as they appear in the TTCN-3 signature declaration.
	`returnValue`	(Optional) return value of the procedure call.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 reply operation on a component port which has been connected to another component port. All *out* and *inout* procedure parameters and the return value contain values. All *in* procedure parameters shall contain the distinct value of `null` since they are only of relevance to the procedure call but not in the reply to the call. The `parameterList` contains procedure call parameters. These parameters are the parameters specified in the TTCN-3 signature template. If no return type has been defined for the procedure signature in the TTCN-3 ATS, the distinct value `null` shall be passed for the return value.	
Effect	On invocation of this operation the CH can issue the reply to a procedure call corresponding to the signature identifier `signature` and component identifier `receiver`. CH transmits the reply to the remote TE on which `receiver` is being executed and enqueues the reply in the remote TE.	

7.3.3.2.4 tciRaiseConnected

Signature	`void tciRaiseConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in Value exception)`	
In Parameters	`sender`	Identifier of the port sending the reply.
	`receiver`	Identifier of the component receiving the reply.
	`signature`	Identifier of the signature of the procedure call.
	`exception`	The exception value.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 raise operation on a component port which has been connected to another component port.	
Effect	On invocation of this operation the CH can raise an exception to a procedure call corresponding to the signature identifier `signature` and component identifier `receiver`. CH transmits the exception to the remote TE on which `receiver` is being executed and enqueues the exception in the remote TE.	

7.3.3.2.5 tciCreateTestComponentReq

Signature	`TriComponentIdType tciCreateTestComponentReq (in TciTestComponentKindType kind, in Type componentType)`	
In Parameters	`kind`	The kind of component that shall be created, either `MTC`, `PTC` or `CONTROL`.
	`componentType`	Identifier of the TTCN-3 component type that shall be created.
Return Value	A `TriComponentIdType` value for the created component.	
Constraint	This operation shall be called from the TE when a component has to be created, either explicitly when the TTCN-3 create operation is called or implicitly when the master test component (MTC) or a control component has to be created.	
Effect	CH transmits the component creation request to the remote TE and calls there the `tciCreateTestComponent` operation to obtain a component identifier for this component.	

7.3.3.2.6 tciStartTestComponentReq

Signature	`void tciStartTestComponentReq(in TriComponentIdType component, in TciBehaviourIdType behaviour, in TciParamaterListType parameterList)`	
In Parameters	`component`	Identifier of the component to be started.
	`behaviour`	Identifier of the behaviour to be started on the component.
	`parameterList`	A list of `Values` where each value defines a parameter from the parameter list as defined in the TTCN-3 function declaration of the function being started. The parameters in `parameterList` are ordered as they appear in the TTCN-3 signature of the test case. If no parameters have to be passed either the `null` value or an empty `parameterList`, i.e. a list of length zero shall be passed.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes the TTCN-3 start operation. Since only *in* parameters are allowed for functions being started [3], `parameterList` contains only *in* parameters.	
Effect	CH transmits the start component request to the remote TE and calls there the `tciStartTestComponent` operation.	

7.3.3.2.7 tciStopTestComponentReq

Signature	`void tciStopTestComponentReq(in TriComponentIdType component)`	
In Parameters	`component`	Identifier of the component to be stopped.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes the TTCN-3 stop operation.	
Effect	CH transmits the stop component request to the remote TE and calls there the `tciStopTestComponent` operation.	

7.3.3.2.8 tciConnectReq

Signature	`void tciConnectReq (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be connected from.
	`toPort`	Identifier of the test component port to be connected to.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 connect operation.	
Effect	CH transmits the connection request to the remote TE where it calls the `tciConnect` operation to establish a logical connection between the two indicated ports. Note that both ports can be on remote TEs. In this case, the operation returns only after calling the `tciConnect` operation on both remote TEs.	

7.3.3.2.9 tciDisconnectReq

Signature	`void tciDisconnectReq (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be disconnected.
	`toPort`	Identifier of the test component port to be disconnected.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 disconnect operation.	
Effect	CH transmits the disconnect request to the remote TE where it calls the `tciDisconnect` operation to tear down the logical connection between the two indicated ports. Note that both ports can be on remote TEs. In this case, the operation returns only after calling the `tciDisconnect` operation on both remote TEs.	

7.3.3.2.10 tciMapReq

Signature	`void tciMapReq (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be mapped from.
	`toPort`	Identifier of the test component port to be mapped to.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 map operation.	
Effect	CH transmits the map request to the remote TE where it calls the `tciMap` operation to establish a logical connection between the two indicated ports.	

7.3.3.2.11 tciUnmapReq

Signature	`void tciUnmapReq (in TriPortIdType fromPort, in TriPortIdType toPort)`	
In Parameters	`fromPort`	Identifier of the test component port to be unmapped.
	`toPort`	Identifier of the test component port to be unmapped.
Return Value	`void`	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 unmap operation.	
Effect	CH transmits the unmap request to the remote TE where it calls the `tciUnmap` operation to tear down the logical connection between the two indicated ports.	

7.3.3.2.12 tciTestComponentTerminatedReq

Signature	`void tciTestComponentTerminatedReq (in TriComponentIdType component, in VerdictValue verdict)`	
In Parameters	`component`	Identifier of the component that has terminated.
	`verdict`	Verdict after termination of the component.
Return Value	`void`	
Constraint	This operation shall be called by the TE when a test component terminates execution, either explicitly with the TTNC-3 stop operation or implicitly, if it has reached the last statement	
Effect	The CH is notified of the termination of the indicated test component. Since a function being executed on a test component can only have *in* parameters [3], the `tciTestComponentTerminateReq` operation does not have a `parameterList` parameter. CH communicates the termination of the indicated component to all participating TEs and to the special TE*, which keeps track of the overall verdict.	

7.3.3.2.13 tciTestComponentRunningReq

Signature	`TBoolean tciTestComponentRunningReq (in TriComponentIdType component)`	
In Parameters	`component`	Identifier of the component to be checked for running.
Return Value	`true` if the indicated component is still executing a behaviour, `false` otherwise.	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 running operation.	
Effect	CH transmits the running request to the remote TE having the test component to be checked, where it calls the `tciTestComponentRunning` operation to check the execution status of the indicated test component.	

7.3.3.1.14 tciTestComponentDoneReq

Signature	`TBoolean tciTestComponentDoneReq (in TriComponentIdType component)`	
In Parameters	`component`	Identifier of the component to be checked for done.
Return Value	`true` if the indicated component has completed executing its behaviour, `false` otherwise.	
Constraint	This operation shall be called by the TE when it executes a TTCN-3 `done` operation.	
Effect	CH transmits the done request to the remote TE having the test component to be checked, where it calls the `tciTestComponentDone` operation to check the status of the indicated test component.	

7.3.3.2.15 tciGetMTCReq

Signature	`TriComponentIdType tciGetMTCReq()`
Return Value	A `TriComponentIdType` value of the MTC.
Constraint	This operation shall be called by the TE when it executes a TTCN-3 mtc operation.
Effect	The CH determines the component id of the MTC.

7.3.3.2.16 tciExecuteTestCaseReq

Signature	`void tciExecuteTestCaseReq (in TciTestCaseIdType testCaseId, in TriPortIdListType tsiPortList)`	
In Parameters	`testCaseId`	A test case identifier as defined in the TTCN-3 module.
	`tsiPortList`	`tsiPortList` contains all ports that have been declared in the definition of the system component for the test case, i.e. the TSI ports. If a system component has not been explicitly defined for the test case, then the `tsiPortList` contains all communication ports of the MTC. The ports in `tsiPortList` are ordered as they appear in the respective TTCN-3 component type declaration. If no ports have to be passed either the `null` value or an empty `tsiPortList`, i.e. a list of length zero shall be passed.
Return Value	`void`	
Constraint	This operation can be called by the TE immediately before it starts the test case behaviour on the MTC (in course of a TTCN-3 execute operation).	
Effect	CH transmits the execute test case request to the remote TEs having system ports of the indicated test case. Static connections to the SUT and the initialization of communication means for TSI ports can be set up.	

7.3.3.2.17 tciResetReq

Signature	`void tciResetReq ()`
Return Value	`void`
Constraint	This operation can be called by the TE at any time to reset the test system.
Effect	CH transmits the reset request to all involved TEs.

8 Java language mapping

8.1 Introduction

This clause introduces the TCI Java language mapping. For efficiency reasons a dedicated language mapping is introduced instead of using the OMG IDL to Java language.

The Java language mapping for the TTCN-3 Control Interface defines how the IDL definitions described in clause 7 are mapped to the Java language. The language mapping is independent of the used Java version as only basic Java language constructs are used.

8.2 Names and scopes

8.2.1 Names

Although there are no conflicts between identifiers used in the IDL definition and the Java language some naming translation rules are applied to the IDL identifiers.

Java interfaces or class identifiers are omitting the trailing `Type` used in the IDL definition.

EXAMPLE: the IDL type **`TciTestCaseIdType`** maps to `TciTestCaseId` in Java.

The resulting mapping conforms to the standard Java coding conventions.

8.2.2 Scopes

The IDL module **`tciInterface`** is mapped to the Java package `org.etsi.ttcn3.tci`. All IDL type declarations within this module are mapped to Java classes or interface declarations within this package.

8.2 Type mapping

8.2.1 Basic type mapping

Table 2 gives an overview on how the native types TBoolean, TFloat, TChar, TInteger, TString, TStringSeq and TUniversalChar are mapped to the Java types.

Table 2: Basic type mappings

IDL Type	Java Type
`TBoolean`	`boolean`
`TFloat`	`float`
`TChar`	`char`
`TInteger`	`int`
`TString`	`java.lang.String`
`TStringSeq`	`java.lang.String[]`
`TUnviversalChar`	`int`

The native type TObjId is defined in the respective section of the ObjidValue interface.

8.2.1.1 boolean

The IDL **`TBoolean`** type is mapped to the java basic type `boolean`.

8.2.1.2 float

The IDL **`TFloat`** type is mapped to the java basic type `float`.

8.2.1.3 char

The IDL **`TChar`** type is mapped to the java basic type `char`.

8.2.1.4 int

The IDL **`TInteger`** type is mapped to the java basic type `int`.

8.2.1.5 String

The IDL **`TString`** type is mapped to the `java.lang.String` class without range checking or bounds for characters in the string. All possible strings defined in TTCN-3 can be converted to `java.lang.String`.

8.2.1.6 String[]

The IDL **`TStringSeq`** type is mapped to an array of the `java.lang.String` class.

8.2.1.7 Universal Char

The IDL **`TUniversalChar`** type is mapped to a java basic type `int`. The integer uses the canonical form as defined in ISO/IEC 10646-1 clause 6.2.

8.2.2 Structured type mapping

The TCI IDL description defines user defined types as native types. In the Java language mapping these types are mapped to Java interfaces. The interfaces define methods and attributes being available for objects implementing this interface.

8.2.2.1 TciParameterType

`TciParameterType` is mapped to the following interface:

```
// TCI IDL TciParameterType
package org.etsi.ttcn.tci;
public interface TciParameter {
    public String   getParameterName();
    public void     setParameterName(String name);
    public int      getParameterPassingMode();
    public void     setParameterPassingMode(TciParameterPassingMode mode);
    public Value    getParameter();
    public void     setParameter(Value parameter);
}
```

Methods:

- `getParameterName ()` Returns the parameter name as defined in the TTCN-3 specification;
- `setParameterName (String name)` Sets the name of this `TciParameter` parameter to `name`;
- `getParameterPassingMode()` Returns the parameter passing mode of this parameter;
- `setParameterPassingMode(TciParameterPassingMode mode)` Sets the parameter mode of this `TriParameter` parameter to `mode`;
- `getParameter()` Returns the Value parameter of this TciParameter, or the `null` object if the parameter contains the distinct value `null`;
- `setParameter(Value parameter)` Sets the Value parameter of this TciParameter to parameter. If the distinct value `null` shall be set to indicate that this parameter holds no value, the Java `null` shall be passed as parameter.

8.2.2.2 TciParameterPassingModeType

`TciParameterPassingModeType` is mapped to the following interface:

```
// TCI IDL TciParameterPassingModeType
package org.etsi.ttcn.tci;
public interface TciParameterPassingMode {
    public final static int TCI_IN      = 0;
    public final static int TCI_INOUT   = 1;
    public final static int TCI_OUT     = 2;
}
```

Constants:

- `TCI_IN` Will be used to indicate that a `TciParameter` is an `in` parameter;
- `TCI_INOUT` Will be used to indicate that a `TciParameter` is an `inout` parameter;
- `TCI_OUT` Will be used to indicate that a `TciParameter` is an `out` parameter.

8.2.2.3 TciParameterListType

`TciParameterListType` is mapped to the following interface:

```
// TCI IDL TciParameterListType
package org.etsi.ttcn.tci;
public interface TciParameteList {
    public int                      size() ;
    public boolean                  isEmpty() ;
    public java.util.Enumeration    getParameters() ;
    public TciParameter             get(int index) ;
    public void                     clear() ;
    public void                     add(TciParameter parameter) ;
    public void                     setParameters(TciParameter[] parameters) ;
}
```

Methods:

- `size()` Returns the number of parameters in this list;
- `isEmpty()` Returns `true` if this list contains no parameters;
- `getParameters()` Returns an `Enumeration` over the parameters in the list. The enumeration provides the parameters in the same order as they appear in the list;
- `get(int index)` Returns the `TciParameter` at the specified position;
- `clear()` Removes all parameters from this `TciParameterList`;
- `add(TciParameter parameter)` Adds `parameter` to the end of this `TciParameterList`;
- `setParameter(TciParameter[] parameters)` Fills this `TciParameterList` with `parameters.`

8.2.2.4 TciTypeClassType

`TciTypeClassType` is mapped to the following interface:

```
// TCI IDL TciTypeClassType
package org.etsi.ttcn.tci;
public interface TciTypeClass {
    public final static int ADDRESS         = 0 ;
    public final static int ANYTYPE         = 1 ;
    public final static int BITSTRING       = 2 ;
    public final static int BOOLEAN         = 3 ;
    public final static int CHAR            = 4 ;
    public final static int CHARSTRING      = 5 ;
    public final static int COMPONENT       = 6 ;
    public final static int ENUMERATED      = 7 ;
    public final static int FLOAT           = 8 ;
    public final static int HEXSTRING       = 9 ;
    public final static int INTEGER         = 10 ;
    public final static int OBJID           = 11 ;
    public final static int OCTETSTRING     = 12 ;
    public final static int RECORD          = 13 ;
    public final static int RECORD_OF       = 14 ;
    public final static int SET             = 15 ;
    public final static int SET_OF          = 16 ;
    public final static int UNION           = 17 ;
    public final static int UNIVERSAL_CHAR  = 18 ;
    public final static int UNIVERSAL_CHARSTRING    = 19 ;
    public final static int VERDICT                 = 20 ;
}
```

8.2.2.5 TciTestComponentKindType

`TciTestComponentKindType` is mapped to the following interface:

```
// TCI IDL TciTestComponentKindType
public interface TciTestComponentKind {
    public final static int TCI_CTRL_COMP       = 0;
    public final static int TCI_MTC_COMP        = 1;
    public final static int TCI_PTC_COMP        = 2;
    public final static int TCI_SYSTEM_COMP     = 3;
}
```

8.2.2.6 TciSignatureIdType

`TciSignatureIdType` is mapped to the following interface:

```
// TCI IDL TciSignatureIdType
package org.etsi.ttcn.tci;
public interface TciSignatureId  extends QualifiedName {
}
```

8.2.2.7 TciBehaviourIdType

`TciBehaviourIdType` is mapped to the following interface:

```
// TCI IDL TciBehaviourIdType
package org.etsi.ttcn.tci;
public interface TciBehaviourId  extends QualifiedName {
}
```

8.2.2.8 TciTestCaseIdType

`TciTestCaseIdType` is mapped to the following interface:

```
// TCI IDL TciTestCaseIdType
package org.etsi.ttcn.tci;
public interface TciTestCaseId  extends QualifiedName {
}
```

8.2.2.9 TciModuleIdType

`TciModuleIdType` is mapped to the following interface:

```
// TCI IDL TciModuleIdType
package org.etsi.ttcn.tci;
public interface TciModuleId  extends QualifiedName {
}
```

8.2.2.10 TciModuleParameterIdType

`TciModuleParameterIdType` is mapped to the following interface:

```
// TCI IDL TciModuleParameterIdType
package org.etsi.ttcn.tci;
public interface TciModuleParameterId  extends QualifiedName {
}
```

8.2.2.11 TciModuleParameterListType

`TciModuleParameterListType` is mapped to the following interface:

```
// TCI IDL TciModuleParameterListType
package org.etsi.ttcn.tci;
public interface TciModuleParameterList {
    public int                      size() ;
    public boolean                  isEmpty() ;
    public java.util.Enumeration    getModuleParameters() ;
    public TciModuleParameter       get(int index) ;
}
```

Methods:

- `size()` Returns the number of module parameters in this list;
- `isEmpty()` Returns `true` if this list contains no module parameters;
- `getModuleParameters()` Returns an `Enumeration` over the module parameters in the list. The enumeration provides the module parameters in the same order as they appear in the list;
- `get(int index)` Returns the `TciModuleParameter` at the specified position.

8.2.2.12 TciModuleParameterType

`TciModuleParameterType` is mapped to the following interface:

```
// TCI IDL TciModuleParameterType
package org.etsi.ttcn.tci;
public interface TciModuleParameter {
    public String       getModuleParameterName();
    public Value        getDefaultValue();
}
```

Methods:

- `getModuleParameterName ()` Returns the module parameter name as defined in the TTCN-3 specification;
- `getDefaultValue()` Returns the default Value module parameter of this `TciModuleParameter`, or the `null` object if the module parameter contains the distinct value `null`.

8.2.2.13 TciParameterTypeListType

`TciParameterTypeListType` is mapped to the following interface:

```
// TCI IDL TciParameterTypeListType
package org.etsi.ttcn.tci;
public interface TciParameterTypeList {
    public int                      size() ;
    public boolean                  isEmpty() ;
    public java.util.Enumeration    getParameterTypes() ;
    public TciParameterType         get(int index) ;
}
```

Methods:

- `size()` Returns the number of parameter types in this list;
- `isEmpty()` Returns `true` if this list contains no parameter types;
- `getParameterTypes()` Returns an `Enumeration` over the parameter types in the list. The enumeration provides the parameter types in the same order as they appear in the list;
- `get(int index)` Returns the `TciParameterType` at the specified position.

8.2.2.14 TciModuleIdListType

`TciModuleIdListType` is mapped to the following interface:

```
// TCI IDL TciModuleIdListType
package org.etsi.ttcn.tci;
public interface TciModuleIdList {
    public int                      size() ;
    public boolean                  isEmpty() ;
    public java.util.Enumeration    getImportedModules() ;
    public TciModuleId              get(int index) ;
}
```

Methods:

- `size()` Returns the number of modules in this list;
- `isEmpty()` Returns `true` if this list contains no modules;
- `getImportedModules()` Returns an `Enumeration` over the modules in the list. The enumeration provides the modules in the same order as they appear in the list;
- `get(int index)` Returns the `TciModuleId` at the specified position.

8.2.3 Abstract type mapping

The TTCN-3 data types are modelled in Java using the abstract type mapping as defined in this clause. The `Type` interface defines only operations used to retrieve in TTCN-3 defined types. No TTCN-3 types can be constructed using the `Type` interface. Types are modelled using the single interface `Type`, that provides methods to identify types and to retrieve values of a given type.

8.2.3.1 Type

`Type` is mapped to the following interface:

```
// TCI IDL Type
package org.etsi.ttcn.tci;
public interface Type {
    public TciModuleId  getDefiningModule ();
    public String       getName ();
    public int          getTypeClass ();
    public Value        newInstance ();
    public String       getTypeEncoding ();
    public String       getTypeEncodingVariant();
}
```

Methods:

- `getDefiningModule()` Returns the module identifier of the module the type has been defined in. If the type represents a TTCN-3 base type the distinct value `null` will be returned;
- `getName()` Returns name of the type as defined in the TTCN-3 module;
- `getTypeClass()` Returns the type class of the respective type. A value of `TciTypeClassType` can have on of the following constants: `ADDRESS, ANYTYPE, BITSTRING, BOOLEAN, CHAR, CHARSTRING, COMPONENT, ENUMERATED, FLOAT, HEXSTRING, INTEGER, OBJID, OCTETSTRING, RECORD, RECORD_OF, SET, SET_OF, UNION, UNIVERSAL_CHARSTRING, UNIVERSAL_CHAR, VERDICT;`
- `newInstance()` Returns a freshly created value of the given type. This initial value of the created value is undefined;
- `getTypeEncoding()` Returns the type encoding attribute as defined in the TTCN-3 module;
- `getTypeEncodingVariant()` This operation returns the value encoding variant attribute as defined in TTCN-3, if any. If no encoding variant attribute has been defined the distinct value `null` will be returned.

8.2.4 Abstract value mapping

TTCN-3 values can be retrieved from the TE and constructed using the Value interface. The value mapping interface is constructed hierarchically with Value as the basic interface. Specialized interfaces for different types of values have been defined.

8.2.4.1 Value

`Value` is mapped to the following interface:

```
// TCI IDL Value
package org.etsi.ttcn.tci;
public interface Value {
    public Type     getType() ;
    public boolean  notPresent() ;
    public String   getValueEncoding() ;
    public String   getValueEncodingVariant();
}
```

Methods:

- `getType()` Returns the type of the specified value;
- `notPresent()` Returns `true` if the specified value is `omit`, `false` otherwise;
- `getValueEncoding()` This operation returns the value encoding attribute as defined in TTCN-3, if any. If no encoding attribute has been defined the distinct value `null` will be returned;
- `getValueEncodingVariant()` This operation returns the value encoding variant attribute as defined in TTCN-3, if any. If no encoding variant attribute has been defined the distinct value `null` will be returned.

8.2.4.2 IntegerValue

`IntegerValue` type is mapped to the following interface:

```
// IntegerValue
package org.etsi.ttcn.tci;
public interface IntegerValue {
    public void     setInteger(int value);
    public int      getInteger();
}
```

Methods:

- `setInteger(int value)` Sets this IntegerValue to the int value value;
- `getInteger()` Returns the int value represented by this IntegerValue.

8.2.4.3 FloatValue

`FloatValue` type is mapped to the following interface:

```
// FloatValue
package org.etsi.ttcn.tci;
public interface FloatValue {
    public void     setFloat(float value);
    public float    getFloat();
}
```

Methods:

- `setFloat(float value)` Sets this FloatValue to the float value value;
- `getFloat()` Returns the float value represented by this FloatValue.

8.2.4.4 BooleanValue

`BooleanValue` type is mapped to the following interface:

```
// BooleanValue
package org.etsi.ttcn.tci;
public interface BooleanValue {
    public void     setBoolean(boolean value);
    public boolean  getBoolean();
}
```

Methods:

- `setBoolean(boolean value)` Sets this BooleanValue to the boolean value value;
- `getBoolean()` Returns the boolean value represented by this BooleanValue.

8.2.4.5 ObjidValue

`ObjidValue` is mapped to the following interface:

```
// TCI IDL ObjidValue
package org.etsi.ttcn.tci;
public interface ObjidValue {
    TciObjId    getObjid ();
    void        setObjid (TciObjId value);
}
```

Methods:

- `getObjid()` Returns the object id value of the TTCN-3 `objid`;
- `setObjid(`TciObjId `value)` Sets this `ObjidValue` to `value`.

8.2.4.6 TciObjId

`TciObjId` is mapped to the following interface. The native java representation of a TTCN-3 ObjectId consists of an ordered sequence of `TciObjIdElements`.

```
package org.etsi.ttcn.tci;
public interface TciObjId {
    public int              size() ;
    public void             setObjElement(TciObjIdElement[] objElemens) ;
    public TciObjIdElement  getObjElement(int index) ;
}
```

Methods:

- `size()` Returns the size of this Object Id in TciObjIdElements;
- `setObjElement(TciObjIdElement[] objElements)` Sets this ObjId to the list of objElements;
- `getObjElement(int index)` Return the TciObjIdElement at position `index`.

8.2.4.7 TciObjIdElement

A TciObjIdElement represent a single object element within a TTCN-3 ObjId value. It can be set using different representations like the ASCII representation or as integer.

`TciObjIdElement` is mapped to the following interface:

```
package org.etsi.ttcn.tci;
public interface TciObjIdElement {
    public void     setElementAsAscii(String element) ;
    public void     setElementAsNumber(int element) ;
    public String   getElementAsAscii() ;
    public int      getElementAsNumber() ;
}
```

Methods:

- `setElementAsAscii(String element)` Sets the internal representation of this ObjIdElement to string value `element`;
- `setElementAsNumber(int element)` Set this the internal representation of this ObjIdElement to the integer value `element`;
- `getElementAsAscii()` Returns the internal representation of this ObjIdElement as string;
- `getElementAsNumber()` Returns the internal representation of this ObjIdElement as integer.

8.2.4.8 CharValue

`CharValue` is mapped to the following interface:

```
// TCI IDL CharValue
package org.etsi.ttcn.tci;
public interface CharValue {
    char    getChar ();
    void    setChar (char value);
}
```

Methods:

- `getChar()` Returns the char value of the TTCN-3 `char`;
- `setChar(`char `value)` Sets this `CharValue` to `value`.

8.2.4.9 UniversalCharValue

`UniversalCharValue` is mapped to the following interface:

```
// TCI IDL UniversalCharValue
package org.etsi.ttcn.tci;
public interface UniversalCharValue {
    int     getUniversalChar ();
    void    setUniversalChar (int value);
}
```

Methods:

- `getUniversalChar()` Returns the universal char value of the TTCN-3 universal `char` as an `integer`;
- `setUniversalChar(`int `value)` Sets this Universal`CharValue` to `value`.

8.2.4.10 CharstringValue

`CharstringValue` is mapped to the following interface:

```
// TCI IDL CharstringValue
package org.etsi.ttcn.tci;
public interface CharstringValue {
    String  getString ();
    void    setString (String value);
    char    getChar (int position);
    void    setChar (int  position, char value);
    int     getLength ();
    void    setLength (int len);
}
```

Methods:

- `getString()` Returns the string of the TTCN-3 `charstring`. The textual representation of the empty TTCN-3 `charstring` is `''`, while its length is zero;
- `setString(String value)` Sets this `CharstringValue` to `value;`
- `getChar(int position)` Returns the char value of the TTCN-3 charstring at `position`. position 0 denotes the first char of the TTCN-3 `charstring`. Valid values for position are `0` to `length - 1`;
- `setChar(int position, char value)` Set the char at `position` to `value`. Valid values for `position` are `0` to `length - 1`;
- `getLength()` Returns the length of this `CharstringValue` in chars, zero if the value of this `CharstringValue` is `omit`;
- `setLength(int len)` Sets the length of this `CharstringValue` in chars to `len`.

8.2.4.11 BitstringValue

`BitstringValue` is mapped to the following interface:

```
// TCI IDL BitstringValue
package org.etsi.ttcn.tci;
public interface BitstringValue {
    String  getString ();
    void    setString (String value);
    int     getBit (int position);
    void    setBit (int  position, int value);
    int     getLength ();
    void    setLength (int len);
}
```

Methods:

- `getString()` — Returns the textual representation of this `BitstringValue`, as defined in TTCN-3. E.g. the textual representation of `0101` is `"0101"B`. The textual representation of the empty TTCN-3 `bitstring` is `""B`, while its length is zero;
- `setString(String value)` — Sets the value of this `BitstringValue` according to the textual representation as defined by `value`. E.g. The value of this `BitstringValue` will be `0101` if the textual representation in value is `"0101"B`;
- `getBit(int position)` — Returns the value `(0 | 1)` at position of this TTCN-3 bitstring. position 0 denotes the first bit of the TTCN-3 bitstring. Valid values for position are `0 to length - 1`;
- `setBit(int position, int value)` — Set the bit at position to value `(0 | 1)`. position 0 denotes the first bit in this BitstringValue. Valid values for position are `0 to length - 1`;
- `getLength()` — Returns the length of this `BitstringValue` in bits, zero if the value of this `BitstringValue` is `omit`;
- `setLength(int len)` — Sets the length of this `BitstringValue` in bits to `len`.

8.2.4.12 OctetstringValue

`OctetstringValue` is mapped to the following interface:

```
// TCI IDL OctetstringValue
package org.etsi.ttcn.tci;
public interface OctetstringValue {
    String  getString ();
    void    setString (String value);
    int     getOctet (int position);
    void    setOctet (int  position, int value);
    int     getLength ();
    void    setLength (int len);
}
```

Methods:

- `getString()` — Returns the textual representation of this `OctetstringValue`, as defined in TTCN-3. E.g. the textual representation of `0xCAFFEE` is `"CAFFEE"O`. The textual representation of the empty TTCN-3 `octetstring` is `""O`, while its length is zero;
- `setString(String value)` — Sets the value of this `OctetstringValue` according to the textual representation as defined by `value`. E.g. The value of this `OctetstringValue` will be `0xCAFFEE` if the textual representation in value is `"CAFFEE"O`;
- `getOctet(int position)` — Returns the value (0..255) at `position` of this TTCN-3 octetstring. position 0 denotes the first octet of the TTCN-3 octetstring. Valid values for position are 0 to length - 1;
- `setOctet(int position, int value)` — Set the octet at `position` to value (0..255). position 0 denotes the first octet in the octetstring. Valid values for position are 0 to length - 1;
- `getLength()` — Returns the length of this `OctetstringValue` in octets, zero if the value of this `OctetstringValue` is `omit`;
- `setLength(int len)` — Sets the length of this `OctetstringValue` in octets to `len`.

8.2.4.13 UniversalCharstringValue

`UniversalCharstringValue` is mapped to the following interface:

```
// TCI IDL UniversalCharstringValue
package org.etsi.ttcn.tci;
public interface UniversalCharstringValue {
    String  getString ();
    void    setString (String value);
    int     getChar (int position);
    void    setChar (int  position, int value);
    int     getLength ();
    void    setLength (int len);
}
```

Methods:

- `getString()` — Returns the textual representation of this `UniversalCharstringValue`, as defined in TTCN-3;
- `setString(String value)` — Sets the value of this `UniversalCharstringValue` according to the textual representation as defined by `value`;
- `getChar(int position)` — Returns the `UniversalChar` value of the TTCN-3 `universal charstring` at position. position 0 denotes the first `UniversalChar` of the TTCN-3 `universal charstring`. Valid values for `position` are `0 to length - 1`;
- `setChar(int position, char value)` — Set the `UniversalChar` at `position` to `value`. Valid values for `position` are 0 to length - 1;
- `getLength()` — Returns the length of this `UniversalCharstringValue` in `UniversalChars`, zero if the value of this `UniversalCharstringValue` is `omit`;
- `setLength(int len)` — Sets the length of this `UniversalCharstringValue` in `UniversalChars` to `len`.

8.2.4.14 HexstringValue

`HexstringValue` is mapped to the following interface:

```
// TCI IDL HexstringValue
package org.etsi.ttcn.tci;
public interface HexstringValue {
    String  getString ();
    void    setString (String value);
    int     getHex (int position);
    void    setHex (int  position, int value);
    int     getLength ();
    void    setLength (int len);
}
```

Methods:

- `getString()` — Returns the textual representation of this `HextstringValue`, as defined in TTCN-3. E.g. the textual representation of `0xAFFEE` is `"AFFEE"H.` The textual representation of the empty TTCN-3 `hexstring` is `""H`, while its length is zero;
- `setString(String value)` — Sets the value of this `HexstringValue` according to the textual representation as defined by `value`. E.g. The value of this `HexstringValue` will be `0xAFFEE` if the textual representation in `value` is `"AFFEE"H`;
- `getHex(int position)` — Returns the value (0..15) at `position` of this TTCN-3 hexstring. position 0 denotes the first hex digits of the TTCN-3 hexstring. Valid values for position are 0 to length - 1;
- `setHex(int position, int value)` — Set the hex digit at position to value (0..16). position 0 denotes the first octet in the `hexstring`. Valid values for position are 0 to length - 1;
- `getLength()` — Returns the length of this `HexstringValue` in octets, zero if the value of this `HexstringValue` is `omit`;
- `setLength(int len)` — Sets the length of this `HexstringValue` in hex digits to len.

8.2.4.15 RecordValue

`RecordValue` is mapped to the following interface:

```
// TCI IDL RecordValue
package org.etsi.ttcn.tci;
public interface RecordValue {
    public Value    getField(String fieldName) ;
    public void     setField(String fieldName, Value value) ;
    public String[] getFieldNames() ;
}
```

Methods:

- `getField(String fieldName)` — Returns the value of the field named `fieldName`. The return value is the common abstract base type `Value`, as a record field can have any type defined in TTCN-3. If the field can not be obtained from the record the distinct value `null` will be returned;
- `setField(String fieldName, Value value)` — Set the field named `fieldName` of the record to `value`. No assumption shall be made on how a field is stored in a record. An internal implementation might choose to store a reference to this value or to copy the value. It is safe to assume that the value will be copied. Therefore it should be relied on that subsequent modifications of `value` will not be considered in the record;
- `getFieldNames()` — Returns an array of String of field names, the distinct value `null`, if the record has no fields.

8.2.4.16 RecordOfValue

`RecordOfValue` is mapped to the following interface:

```
// TCI IDL RecordOfValue
package org.etsi.ttcn.tci;
public interface RecordOfValue {
    public Value    getField(String fieldName) ;
    public void     setField(int position, Value value) ;
    public void     appendField(Value value) ;
    public Type     getElementType() ;
    public int      getLength() ;
    public void     setLength(int len) ;
}
```

Methods:

- `getField(String fieldName)` Returns the value of the `record of` at `position` if `position` is between `zero` and `length -1`, the distinct value `null` otherwise. The return value is the common abstract base type `Value`, as `a record of` can have fields of any type defined in TTCN-3;

- `setField(int position, Value value)` Sets the field at `position` to `value`. If `position` is greater than `(length -1)` the record of will be extended to have the length `(position + 1)`. The `record of` elements between the original position at `length` and `position - 1` will be set to `OMIT`. No assumption shall be made on how a field is stored in a `record of`. An internal implementation might choose to store a reference to this value or to copy the value. It is safe to assume that the value will be copied. Therefore it should be relied on that subsequent modifications of `value` will not be considered in the `record of`;

- `appendField(Value value)` Appends the value at the end of the `record of`, i.e. at position `length`. No assumption shall be made on how a field is stored in a `record of`. An internal implementation might choose to store a reference to this value or to copy the value. It is safe to assume that the value will be copied. Therefore it should be relied on that subsequent modifications of `value` will not be considered in the `record of`;

- `getElementType()` This operation will return the `Type` of the elements of this `record of`;

- `getLength()` Returns the actual length of the `record of` value, zero if the `record of` value is `OMIT`;

- `setLength(int len)` Set the length of the `record of` to `len`. If `len` is greater than the original length, newly created elements have the value `OMIT`. If `len` is less or equal than the original length this operation will be ignored.

8.2.4.17 UnionValue

`UnionValue` is mapped to the following interface:

```
// TCI IDL UnionValue
package org.etsi.ttcn.tci;
public interface UnionValue {
    Value       getVariant  (String variantName);
    void        setVariant  (String variantName, Value value);
    String      getPresentVariantName ();
    String[]    getVariantNames ();
}
```

Methods:

- `getVariant(String variantName)` Returns the value of the TTCN-3 union `variantName`, if `variantName` equals the result of `getPresentVariantName`, the distinct value `null` otherwise. `variantName` denotes the name of the union variant as defined in TTCN-3;
- `setVariant(String variantName, Value value)` Sets `variantName` of the union to value. If `variantName` is not defined for this union this operation will be ignored. If another variant was selected the new variant will be selected instead;
- `getPresentVariantName()` Returns the variant name that has a value in this union set as a `String`. The distinct value `null` will be returned if no variant is selected;
- `getVariantNames()` Returns an array of `String` of variant names, the distinct value `null`, if the union has no fields. If the `UnionValue` represents the TTCN-3 `anytype`, i.e. the type class of the type obtained by getType() is ANYTYPE, all predefined and user-defined TTCN-3 types will be returned.

8.2.4.18 EnumeratedValue

`EnumeratedValue` is mapped to the following interface:

```
// TCI IDL EnumeratedValue
package org.etsi.ttcn.tci;
public interface EnumeratedValue {
    String  getEnum ();
    void    setEnum (String enumValue);
}
```

Methods

- `getEnum()` Returns the string identifier of this `EnumeratedValue`. This identifier equals the identifier in the TTCN-3 specification;
- `setEnum(String enumValue)` Set the enum to `enumValue`. If `enumValue` is not an allowed value for this enumeration the operation will be ignored.

8.2.4.19 VerdictValue

`VerdictValue` is mapped to the following interface:

```
// TCI IDL VerdictValue
package org.etsi.ttcn.tci;
public interface VerdictValue {
    public static final int NONE    = 0;
    public static final int PASS    = 1;
    public static final int INCONC  = 2;
    public static final int FAIL    = 3;
    public static final int ERROR   = 4;

    public int      getVerdict() ;
    public void     setVerdict(int verdict) ;
}
```

Methods:

- `verdictValue()` Returns the integer value for this `VerdictValue`. The `integer` is one of the following constants: `ERROR, FAIL, INCONC, NONE, PASS`;
- `setVerdict(int verdict)` Sets this `VerdictValue` to `verdict`. Note that a `VerdictValue` can be set to any of the above mentioned verdicts at any time. The `VerdictValue` does not perform any verdict calculations as defined in TTCN-3. For example, it is legal to set the `VerdictValue` first to `ERROR` and then to `PASS`.

8.3 Constants

Within this Java language mapping constants have been specified. All constants are defined `public final static` and are accessible from every object from every package. The constants defined within this clause are not defined with the IDL clause. Instead they result from the specification of the TCI IDL types marked as native.

The following constants can be used to determine the parameter passing mode of TTCN-3 parameters (see also clause 8.3.2.2).

- `org.etsi.ttcn.tci.TciParameterPassingMode.TCI_IN;`
- `org.etsi.ttcn.tci.TciParameterPassingMode.TCI_INOUT;`
- `org.etsi.ttcn.tri.TciParameterPassingMode.TCI_OUT;`

For the distinct parameter value `null`, the encoded parameter value shall be set to Java `null`.

The following constants shall be used for value handling (see also clause 8.3.2.4)

- `org.etsi.ttcn.tci.TciTypeClass.ADDRESS;`
- `org.etsi.ttcn.tci.TciTypeClass.ANYTYPE;`
- `org.etsi.ttcn.tci.TciTypeClass.BITSTRING;`
- `org.etsi.ttcn.tci.TciTypeClass.BOOLEAN;`
- `org.etsi.ttcn.tci.TciTypeClass.CHAR;`
- `org.etsi.ttcn.tci.TciTypeClass.CHARSTRING;`
- `org.etsi.ttcn.tci.TciTypeClass.COMPONENT;`
- `org.etsi.ttcn.tci.TciTypeClass.ENUMERATED;`
- `org.etsi.ttcn.tci.TciTypeClass.FLOAT;`

- `org.etsi.ttcn.tci.TciTypeClass.HEXSTRING;`
- `org.etsi.ttcn.tci.TciTypeClass.INTEGER;`
- `org.etsi.ttcn.tci.TciTypeClass.OBJID;`
- `org.etsi.ttcn.tci.TciTypeClass.OCTETSTRING;`
- `org.etsi.ttcn.tci.TciTypeClass.RECORD;`
- `org.etsi.ttcn.tci.TciTypeClass.RECORD_OF;`
- `org.etsi.ttcn.tci.TciTypeClass.SET;`
- `org.etsi.ttcn.tci.TciTypeClass.SET_OF;`
- `org.etsi.ttcn.tci.TciTypeClass.UNION;`
- `org.etsi.ttcn.tci.TciTypeClass.UNIVERSAL_CHAR;`
- `org.etsi.ttcn.tci.TciTypeClass.UNIVERSAL_CHARSTRING;`
- `org.etsi.ttcn.tci.TciTypeClass.VERDICT;`

The following constants shall be used for component handling (see also clause 8.3.2.5)

- `org.etsi.ttcn.tci.TciTestComponentKind.TCI_CTRL_COMP;`
- `org.etsi.ttcn.tci.TciTestComponentKind.TCI_MTC_COMP;`
- `org.etsi.ttcn.tci.TciTestComponentKind.TCI_PTC_COMP;`
- `org.etsi.ttcn.tci.TciTestComponentKind.TCI_SYSTEM_COMP;`

8.4 Mapping of interfaces

The TCI IDL definition defines three interfaces, the **`TCI-TM`**, the **`TCI-CH`** and the **`TCI-CD`** interface. As the operations are defined for different directions within this interface, i.e. some operations can only be called by the TTCN-3 Executable (TE) on the Test Management and Control(TMC) while others can only be called by the TMC on the TE. This is reflected by dividing the TCI IDL interfaces in two sub interfaces, each suffixed by `Required` or `Provided`.

Table 3: Sub interfaces

Calling/Called	TE	TM	CD	CH
TE	-	TCI-TM Provided	TCI-CD Provided	TCI-CH Provided
TM	TCI-TM Required	-	-	-
CD	TCI-CD Required	-	-	-
CH	TCI-CH Required	-	-	-

All methods defined in this interfaces should behave as defined in clause 7.

8.4.1 The TCI-TM interface

The **TCI-TM** interface is divided into two sub interfaces, the `TCI-TM Provided` interface, defining calls from the TE to the TM and the `TCI-TM Required` interface, defining calls from the TM to the TE.

8.4.1.1 TCI-TM provided

The `TCI-TM Provided` interface is mapped to the following interface:

```
// TCI-TM
// TE -> TM
package org.etsi.ttcn.tci;
public interface TciTMProvided {
    public void tciTestCaseStarted (TciTestCaseId testCaseId, TciParameterList parameterList, Float
timer);
    public void     tciTestCaseTerminated ( VerdictValue verdict, TciParameterList parameterList);
    public void     tciControlTerminated ();
    public Value    tciGetModulePar (TciModuleParameterId parameterId);
    public void     tciLog (TriComponentId testComponentId, String message);
    public void     tciError (String message);
}
```

8.4.1.2 TCI-TM required

The `TCI-TM Required` interface is mapped to the following interface:

```
// TCI-TM
// TM -> TE
package org.etsi.ttcn.tci;
public interface TciTMRequired {
    public void                     tciRootModule (TciModuleId moduleName) ;
    public TciModuleParameterList   tciGetModuleParameters (TciModuleId moduleId);
    public TciTestCaseIdList        tciGetTestCases ();
    public TciParameterTypeList     tciGetTestCaseParameters (TciTestCaseId TestCaseId);
    public TriPortIdList tciGetTestCaseTSI  (TciTestCaseId testCaseId);
    public void             tciStartTestCase(String testCaseId, TciParameterList parameterList ) ;
    public void             tciStopTestCase () ;
    public TriComponentId   tciStartControl () ;
    public void             tciStopControl () ;
}
```

8.4.2 The TCI-CD interface

The **TCI-CD** interface is divided into two sub interfaces, the `TCI-CD Provided` interface, defining calls from the TE to the CD and the `TCI-CD Required` interface, defining calls from the CD to the TE.

8.4.2.1 TCI-CD provided

The `TCI-CD Provided` interface is mapped to the following interface:

```
// TCI-CD
// TE -> CD
package org.etsi.ttcn.tci;
public interface TciCDProvided {
    public Value        decode (TriMessage message, Type decodingHypothesis );
    public TriMessage   encode (Value value);
}
```

8.4.2.2 TCI-CD required

The `TCI-CD Required` interface is mapped to the following interface:

```
// TCI-CD
// CD -> TE
package org.etsi.ttcn.tci;
public interface TciCDRequired {
    public Type     getTypeForName (String typeName);
    public Type     getInteger ();
    public Type     getFloat ();
    public Type     getBoolean ();
    public Type     getChar ();
    public Type     getUniversalChar ();
    public Type     getObjid ();
    public Type     getCharstring ();
    public Type     getUniversalCharstring ();
    public Type     getHexstring ();
    public Type     getBitstring ();
    public Type     getOctetstring ();
    public Type     getVerdict ();
    public void     tciErrorReq (String message);
}
```

8.4.3 The TCI-CH interface

The **`TCI-CH`** interface is divided into two sub interfaces, the `TCI-CH Provided` interface, defining calls from the TE to the CH and the `TCI-CH Required` interface, defining calls from the CH to the TE.

8.4.3.1 TCI-CH provided

The `TCI-CH Provided` interface is mapped to the following interface:

```
// TciCHProvided
// TE -> CH
package org.etsi.ttcn.tci;
public interface TciCHProvided {
    public void tciSendConnected    (TriPortId sender, TriComponentId receiver, Value sendMessage) ;

    public void     tciCallConnected(TriPortId sender,
                                     TriComponentId receiver,
                                     TriSignatureId signature,
                                     TciParameterList parameterList) ;

    public void     tciReplyConnected(TriPortId sender,
                                     TriComponentId receiver,
                                     TriSignatureId signature,
                                     TciParameterList parameterList,
                                     Value returnValue) ;

    public void     tciRaiseConnected(TriPortId sender,
                                     TriComponentId receiver,
                                     TciSignatureId signature,
                                     Value except) ;

    public TriComponentId   tciCreateTestComponentReq(int kind, Type componentType ) ;

    public void     tciStartTestComponentReq(TriComponentId comp,
                                             TciBehaviourId behavior,
                                             TciParameterList parameterList) ;

    public void     tciStopTestComponentReq(TriComponentId comp) ;

    public void     tciConnectReq(TriPortId fromPort, TriPortId toPort) ;

    public void     tciDisconnectReq(TriPortId fromPort, TriPortId toPort) ;

    public void     tciTestComponentTerminatedReq(TriComponentId comp, VerdictValue verdict) ;

    public boolean  tciTestComponentRunningReq(TriComponentId comp) ;

    public TriComponentId   tciGetMTCReq() ;

public void         tciMapReq(TriPortId fromPort, TriPortId toPort);
```

```
public void         tciUnmapReq(TriPortId fromPort, TriPortId toPort);

public void         tciExecuteTestCaseReq(TriComponentId testComponentId,
                                          TriPortIdList tsiPortList);

public void         tciResetReq() ;

public boolean      tciTestComponentDoneReq(TriComponentId testComponentId) ;
}
```

8.4.3.2 TCI-CH required

The `TCI-CH Required` interface is mapped to the following interface:

```
// TciCHRequired
// CH -> TE
package org.etsi.ttcn.tci;
public interface TciCHRequired extends TciCDRequired {
    public void     tciEnqueueMsgConnected(TriPortId sender,
                                           TriComponentId receiver,
                                           Value receivedMessage) ;

    public void     tciEnqueueCallConnected(TriPortId sender,
                                           TriComponentId receiver,
                                           TriSignatureId signature,
                                           TciParameterList parameterList) ;

    public void     tciEnqueueReplyConnected(TriPortId sender,
                                           TriComponentId receiver,
                                           TriSignatureId signature,
                                           TciParameterList parameterList,
                                           Value returnValue) ;

    public void     tciEnqueueRaiseConnected(TriPortId sender,
                                           TriComponentId receiver,
                                           TriSignatureId signature,
                                           Value except) ;

    public TriComponentId   tciCreateTestComponent(int kind, Type componentType) ;

    public void     tciStartTestComponent(TriComponentId comp,
                                           TciBehaviourId behavior,
                                           TciParameterList parameterList) ;

    public void     tciStopTestComponent(TriComponentId comp) ;

    public void     tciConnect(TriPortId fromPort, TriPortId toPort) ;

    public void     tciDisconnect(TriPortId fromPort, TriPortId toPort) ;

    public void     tciTestComponentTerminated(TriComponentId comp, VerdictValue verdict);

    public boolean  tciTestComponentRunning(TriComponentId comp);

    public boolean  tciTestComponentDone(TriComponentId comp);

    public TriComponentId   tciGetMTC ();

    public void     tciExecuteTestCase (TciTestCaseId TestCaseId, TriPortIdList tsiPortList);

    public void     tciReset ();

    public void     tciMap (TriPortId fromPort, TriPortId toPort);

    public void     tciUnmap (TriPortId fromPort, TriPortId toPort);
}
```

8.5 Optional parameters

Clause 7.4 defines that a reserved value shall be used to indicate the absence of an optional parameter. For the Java language mapping the Java `null` value shall be used to indicate the absence of an optional value. For example, if in the `tciReplyConnected` operation the value parameter shall be omitted the operation invocation shall be `tciReplyConnected (sender, receiver, signature, parameterList, null)`.

8.6 TCI initialization

All methods are non-static, i.e. operations can only be called on objects. As the present document does not define concrete implementation strategies of TE, TM, CD and CH the mechanism how the TE, the TM, the CD or the CH get to know the handles on the respective objects is out of scope of the present document.

Tool vendors shall provide methods to the developers of TM, CD and CH to register the TE, TM, CD and CH to their respective communication partner.

8.7 Error handling

All operations called from the TM,CH or CD that return have succeeded. If an erroneous situation has been identified by the TE a test case error will be communicated to the user using the procedures as defined in clause 7.3.1.2.6 (`tciError`). If an operation called by the TE in the TM, CH or CD produces an error, this erroneous situation should be communicated to the TE using the procedures as defined in clause 7.3.2.1.14 (`tciErrorReq`).

Beside this error handling no additional error handling is defined with this Java language mapping. In particular, no exception handling mechanisms are defined.

9 ANSI C language mapping

9.1 Introduction

This clause defines the TRI ANSI-C language mapping for the TCI data specified in clause

7.2 and for the TCI operations specified in clause 7.3.

9.2 Value interface

TCI IDL Interface	ANSI C representation	Notes and comments
Type		
TciModuleIdType getDefiningModule()	`TciModuleIdType getDefiningModule(TciType inst)`	
TString getName()	`String getName(TciType inst)`	String type reused from TRI (OMG recommendation) [1].
TciTypeClassType getTypeClass()	`TciTypeClassType tciGetTypeClass (TciType inst)`	
Value newInstance()	`TciValue tciNewInstance(TciType inst)`	
TString getTypeEncoding()	`String tciGetTypeEncoding(TciType inst)`	
TString getTypeEncodingVariant()	`String tciGetTypeEncodingVariant(TciType inst)`	
Value		
TString getValueEncoding()	`String tciGetValueEncoding(TciValue inst)`	
TString getValueEncodingVariant()	`String tciGetValueEncodingVariant(TciValue inst)`	
Type getType()	`TciType tciGetType(TciValue inst)`	
TBoolean notPresent()	`Boolean tciNotPresent(TciValue inst)`	Boolean type reused from TRI (OMG recommendation) [1].

TCI IDL Interface	ANSI C representation	Notes and comments
IntegerValue		
TInteger getInt()	`String tciGetIntAbs(TciValue inst)`	Returns the (10-base) integer absolute value as an ASCII string.
	`unsigned long int tciGetIntNumberOfDigits (TciValue inst)`	Returns the number of digits in an integer value.
	`Boolean tciGetIntSign(TciValue inst)`	Returns true if the number is positive, false otherwise
	`char tciGetIntDigit (TciValue inst, unsigned long int position)`	Returns the value of the digit at position 'position', where position 0 is the least significant digit.
void setInt(in TInteger value)	`void tciSetIntAbs(TciValue inst, String value)`	Sets the (10-base) absolute value of the integer via an ASCII string. The first digit must not be 0 unless the value is 0.
	`void tciSetIntNumberOfDigits (TciValue inst, unsigned long int dig_num)`	Sets the number of digits in an integer value.
	`void tciSetIntSign (TciValue inst, Boolean sign)`	Sets the sign to + (true) or - (false).
	`void tciSetIntDigit (TciValue inst, unsigned long int position, char digit)`	Sets the value of the digit at position 'position', where position 0 is the least significant digit.
FloatValue		
TFloat getFloat()	`double tciGetFloatValue(TciValue inst)`	
void setFloat(in TFloat value)	`void tciSetFloatValue(TciValue inst, double value)`	
BooleanValue		
TBoolean getBoolean()	`Boolean tciGetBooleanValue(TciValue inst)`	
void setBoolean (in TBoolean value)	`void tciSetBooleanValue (TciValue inst, Boolean value)`	
ObjidValue		
TObjid getObjid()	`TciObjidValue tciGetTciObjidValue(TciValue inst)`	
void setObjid(in TObjid value)	`void tciSetObjidValue(TciValue inst, TciObjidValue value)`	
CharValue		
TChar getChar()	`char tciGetCharValue(TciValue inst)`	
void setChar(in TChar value)	`void tciSetCharValue(TciValue inst, char value)`	
UniversalCharValue		
TUniversalChar getUniversalChar()	`TciUCValue tciGetUniversalCharValue (TciValue inst)`	
void setUniversalChar (in TUniversalChar value)	`void tciSetUniversalCharValue (TciValue inst, TciUCType value)`	

TCI IDL Interface	ANSI C representation	Notes and comments
CharstringValue		
TString getString()	`TciCharStringValue tciGetCStringValue(TciValue inst)`	
void setString(in TString value)	`void tciSetCStringValue (TciValue inst, TciCharString value)`	
TChar getChar (in TInteger position)	`char tciGetCStringCharValue (TciValue inst, long int position)`	
void setChar (in TInteger position, in char value)	`void tciSetCStringCharValue (TciValue inst, long int position, char value)`	
TInteger getLength()	`unsigned long int tciGetCStringLength (TciValue inst)`	
void setLength(in TInteger len)	`void tciSetCStringLength (TciValue inst, unsigned long int len)`	
UniversalCharstringValue		
TString getString()	`TciUCStringValuetciGetUCStringValue(TciValue inst)`	
void setString(in TString value)	`void tciSetUCStringValue (TciValue inst, TciUCStringValue value)`	
TUniversalChar getChar (in TInteger position)	`TciUCValue tciGetUCStringCharValue (TciValue inst, unsigned long int position)`	
void setChar (in TInteger position, in TUniversalChar value)	`void tciSetUCStringCharValue (TciValue inst, unsigned long int position, TciUCValue value)`	
TInteger getLength()	`unsigned long int tciGetUCStringLength(TciValue inst)`	
void setLength(in TInteger len)	`void tciSetUCStringLength (TciValue inst, unsigned long int len)`	
BitstringValue		
TString getString()	`String tciGetBStringValue(TciValue inst)`	
void setString(in TString value)	`void tciSetBStringValue (TciValue inst, String value)`	
TChar getBit (in integer position)	`int tciGetBStringBitValue (TciValue inst, long int position)`	
void setBit (in TInteger position, in TInteger value)	`void tciSetBStringBitValue (TciValue inst, unsigned long int position, int value)`	
TInteger getLength()	`unsigned long int tciGetBStringLength(TciValue inst)`	
void setLength(in TInteger len)	`void tciSetBStringLength (TciValue inst, long int len)`	
HexstringValue		
TString getString()	`String tciGetHStringValue(TciValue inst)`	
void setString(in TString value)	`void tciSetHStringValue (TciValue inst, String value)`	
TChar getHex (in TInteger position)	`int tciGetHStringHexValue (TciValue inst, unsigned long int position)`	
void setBit (in TInteger position, in TInteger value)	`void tciSetHStringHexValue (TciValue inst, unsigned long int position, int value)`	
TInteger getLength()	`long int tciGetHStringLength(TciValue inst)`	
void setLength(in TInteger len)	`void tciSetHStringLength (TciValue inst, unsigned long int len)`	

TCI IDL Interface	ANSI C representation	Notes and comments
OctetstringValue		
TString getString()	`String tciGetOStringValue(TciValue inst)`	
void setString(in TString value)	`void tciSetOStringValue (TciValue inst, String value)`	
TChar getOctet(in TInteger position)	`int tciGetOStringOctetValue (TciValue inst, unsigned long int position)`	
void setOctet (in TInteger position, in TInteger value)	`void tciSetOStringOctetValue (TciValue inst, unsigned long int position, int value)`	
TInteger getLength()	`unsigned long int tciGetOStringLength(TciValue inst)`	
void setLength(in TInteger len)	`void tciSetOStringLength (TciValue inst, unsigned long int len)`	
RecordValue		
Value getField(in TString fieldName)	`TciValue tciGetRecFieldValue (TciValue inst, String fieldName)`	
void setField (in TString fieldName, in Value value)	`void tciSetRecFieldValue (TciValue inst, String fieldName, TciValue value)`	
TString[] getFieldNames()	`char** tciGetRecFieldNames(TciValue inst)`	
RecordOfValue		
Value getField(in TInteger position)	`TciValue tciGetRecOfFieldValue (TciValue inst, unsigned long int position)`	
void setField (in TInteger position, in Value value)	`void tciSetRecOfFieldValue (TciValue inst, unsigned long int position, TciValue value)`	
void appendField(in Value value)	`void appendRecOfFieldValue (TciValue inst, TciValue value)`	
Type getElementType()	`TciType tciGetRecOfElementType(TciValue inst)`	
TInteger getLength()	`unsigned long int tciGetRecOfLength(TciValue inst)`	
void setLength(in TInteger len)	`void tciSetRecOfLength (TciValue inst, unsigned long int len)`	
UnionValue		
Value getVariant (in TString variantName)	`TciValue tciGetUnionVariant (TciValue inst, String variantName)`	
void setVariant (in TString variantName, in Value value)	`void tciSetUnionVariant (TciValue inst, String variantName, TciValue value)`	
TString getPresentVariantName()	`String tciGetUnionPresentVariantName (TciValue inst)`	
TString[] getVariantNames()	`char** tciGetUnionVariantNames(TciValue inst)`	
EnumeratedValue		
TString getEnum()	`String tciGetEnumValue(TciValue inst)`	
void setEnum(in TString enumValue)	`void tciSetEnumValue (TciValue inst, String enumValue)`	
VerdictValue		
TInteger getVerdict()	`int tciGetVerdictValue(TciValue inst)`	
void setVerdict(in TInteger verdict)	`void tciSetVerdictValue(TciValue inst, int verdict)`	

9.3 Operation interface

TCI-TM required		
void tciRootModule (in TciModuleIdType moduleId)	`void tciRootModule(String moduleId)`	
TciModuleParameterListType tciGetModuleParameters (in TciModuleIdType moduleName)	`TciModuleParameterListType tciGetModuleParameters (TciModuleIdType moduleName)`	
TciTestCaseIdListType tciGetTestCases()	`TciTestCaseIdListType tciGetTestCases()`	
TciParameterTypeListType tciGetTestCaseParameters (in TciTestCaseIdType testCaseId)	`TciParameterTypeListType tciGetTestCaseParameters (TciTestCaseIdType testCaseId)`	
TriPortIdListType tciGetTestCaseTSI (in TciTestCaseIdType testCaseId)	`TriPortIdList tciGetTestCaseTSI (TciTestCaseIdType testCaseId)`	
void tciStartTestCase (in TciTestCaseIdType testCaseId, in TciParameterListType parameterlist)	`void tciStartTestCase (TciTestCaseIdType testCaseId, TciParameterListType parameterlist)`	
void tciStopTestCase()	`void tciStopTestCase()`	
TriComponentId tciStartControl()	`TriComponentId tciStartControl()`	
void tciStopControl()	`void tciStopControl()`	
TCI-TM provided		
void tciTestCaseStarted (in TciTestCaseIdType testCaseId, in TciParameterListType parameterList, in Tfloat timer)	`void tciTestCaseStarted (TciTestCaseIdType testCaseId, TciParameterListType parameterList, double timer)`	
void tciTestCaseTerminated (in VerdictValue verdict, in TciParameterListType parameterlist)	`void tciTestCaseTerminated (TciVerdictValue verdict, TciParameterListType parameterlist)`	
void tciControlTerminated()	`void tciControlTerminated()`	
Value tciGetModulePar (in TciModuleParameterIdType parameterId)	`tciValue tciGetModulePar (TciModuleParameterIdType parameterId)`	
void tciLog(in String message)	`void tciLog(String message)`	
void tciError(in String message)	`void tciError(String message)`	
TCI-CD required		
Type getTypeForName (in String typeName)	`TciType TypeForName (String typeName)`	
Type getInteger()	`TciType tciGetIntegerType()`	
Type getFloat()	`TciType tciGetFloatType()`	
Type getBoolean()	`TciType tciGetBooleanType()`	
Type getChar()	`TciType tciGetCharType()`	
Type getUniversalChar()	`TciType tciGetUniversalCharType()`	
Type getObjid()	`TciType tciGetTciObjidType()`	
Type getCharstring()	`TciType tciGetTciCharstringType()`	
Type getUniversalCharstring()	`TciType tciGetUniversalCharstringType()`	
Type getHexstring()	`TciType tciGetHexstringType()`	
Type getBitstring()	`TciType tciGetBitstringType()`	
Type getOctetstring()	`TciType tciGetOctetstringType()`	
Type getVerdict()	`TciType tciGetVerdictType()`	
void tciErrorReq(in String message)	`void tciErrorReq(String message)`	
TCI-CD provided		
Value decode (in TriMessageType message, in Type decodingHypothesis)	`TciValue tciDecode (BinaryString message, TciType decHypothesis)`	BinaryString type reused from TRI
TriMessageType encode (in Value value)	`BinaryString tciEncode(TciValue value)`	

TCI-CH required		
void tciEnqueueMsgConnected (in TriPortIdType sender, in TriComponentIdType receiver, in Value rcvdMessage)	void tciEnqueueMsgConnected (TriPortId sender, TriComponentId receiver, TciValue rcvdMessage)	
void tciEnqueueCallConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList)	void tciEnqueueCallConnected (TriPortId sender, TriComponentId receiver, TriSignatureIdType signature, TciParameterListType parameterList)	
void tciEnqueueReplyConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList, in Value returnValue)	void tciEnqueueReplyConnected (TriPortId sender, TriComponentId receiver, TriSignatureIdType signature, TciParameterListType parameterList, TciValue returnValue)	
void tciEnqueueRaiseConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in Value exception)	void tciEnqueueRaiseConnected (TriPortId sender, TriComponentId receiver, TriSignatureIdType signature, TciValue exception)	
TriComponentIdType tciCreateTestComponent (in TciTestComponentKindType kind in Type componentType)	TriComponentId tciCreateTestComponent (TciTestComponentKindType kind, TciType componentType)	
void tciStartTestComponent (in TriComponentIdType component, in TciBehaviourIdType behavior, in TciParamaterListType parameterList)	void tciStartTestComponent (TriComponentId component, TciBehaviourIdType behavior, TciParamaterListType parameterList)	
void tciStopTestComponent (in TriComponentIdType component)	void tciStopTestComponent (TriComponentId component)	
void tciConnect (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciConnect (TriPortId fromPort, TriPortId toPort)	
void tciDisconnect (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciDisconnect (TriPortId fromPort, TriPortId toPort)	
void tciMap (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciMap (TriPortIdType fromPort, TriPortIdType toPort)	
void tciUnmap (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciUnmap (TriPortIdType fromPort, TriPortIdType toPort)	
void tciTestComponentTerminated (in TriComponentIdType component, in VerdictValue verdict)	void tciTestComponentTerminated (TriComponentId component, TciVerdictValue verdict)	
boolean tciTestComponentRunning (in TriComponentIdType component)	Boolean tciTestComponentRunning (TriComponentId component)	
boolean tciTestComponentDone (in TriComponentIdType component)	boolean tciTestComponentDone (TriComponentId component)	
TriComponentIdType tciGetMTC()	TriComponentId tciGetMTC()	
void tciExecuteTestCase (in TciTestCaseIdType testCaseId, in TriPortIdListType tsiPortList)	void tciExecuteTestCase (TciTestCaseIdType testCaseId, TriPortIdList tsiPortList)	
void tciReset()	void tciReset()	

TCI-CH provided		
void tciSendConnected (in TriPortIdType sender, in TriComponentIdType receiver, in Value sendMessage)	void tciSendConnected (TriPortId sender, TriComponentId receiver, TciValue sendMessage)	
void tciCallConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList)	void tciCallConnected (TriPortId sender, TriComponentId receiver, TriSignatureIdType signature, TciParameterListType parameterList)	
void tciReplyConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in TciParameterListType parameterList, in Value returnValue)	void tciReplyConnected (TriPortId sender, TriComponentId receiver, TriSignatureIdType signature, TciParameterListType parameterList, TciValue returnValue)	
void tciRaiseConnected (in TriPortIdType sender, in TriComponentIdType receiver, in TriSignatureIdType signature, in Value exception)	void tciRaiseConnected (TriPortId sender, TriComponentId receiver, TriSignatureIdType signature, TciValue exception)	
TriComponentIdType tciCreateTestComponentReq (in TciTestComponentKindType kind, in Type componentType)	TriComponentId tciCreateTestComponentReq (TciTestComponentKindType kind, TciType componentType)	
void tciStartTestComponentReq (in TriComponentIdType component, in TciBehaviourIdType behavior, in TciParamaterListType parameterList)	void tciStartTestComponentReq (TriComponentId component, TciBehaviourIdType behavior, TciParamaterListType parameterList)	
void tciStopTestComponentReq (in TriComponentIdType component)	void tciStopTestComponentReq (TriComponentId component)	
void tciConnectReq (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciConnectReq (TriPortId fromPort, TriPortId toPort)	
void tciDisconnectReq (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciDisconnectReq (TriPortId fromPort, TriPortId toPort)	
void tciMapReq (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciMapReq (TriPortId fromPort, TriPortId toPort)	
void tciUnmapReq (in TriPortIdType fromPort, in TriPortIdType toPort)	void tciUnmapReq (TriPortId fromPort, TriPortId toPort)	
void tciTestComponentTerminatedReq (in TriComponentIdType component, in VerdictValue verdict)	void tciTestComponentTerminatedReq (TriComponentId component, TciVerdictValue verdict)	
boolean tciTestComponentRunningReq (in TriComponentIdType component)	Boolean tciTestComponentRunningReq (TriComponentId component)	
boolean tciTestComponentDoneReq (in TriComponentIdType component)	Boolean tciTestComponentDoneReq (TriComponentId component)	
TriComponentIdType tciGetMTCReq()	TriComponentId tciGetMTCReq()	
void tciExecuteTestCaseReq (in TciTestCaseIdType testCaseId, in TriPortIdListType tsiPortList)	void tciExecuteTestCaseReq (TciTestCaseIdType testCaseId, TriPortIdList tsiPortList)	
void tciResetReq()	void tciResetReq()	

9.4 Data

TCI IDL ADT	ANSI C representation (Type definition)	Notes and comments
TciModuleIdType	`QualifiedName`	

TciModuleParameterType	`typedef struct TciModuleParameterType`
	`{`
	`  String   parName;`
	`  TciValue defaultValue;`
	`} TciModuleParameterType;`	

TciModuleParameterListType	`typedef struct TciModuleParameterListType`
	`{`
	`  long int                 length;`
	`  TciModuleParameterType[] modParList;`
	`} TciModuleParameterListType;`	

TciParameterType	`typedef struct TciParameterType`
	`{`
	`  TciParameterPassingModeType parPassMode;`
	`  TciValue                      parValue;`
	`} TciParameterType;`	

TciParameterPassingModeType	`typedef enum`
	`{`
	`  TCI_IN_PAR    = 0,`
	`  TCI_INOUT_PAR = 1,`
	`  TCI_OUT_PAR   = 2`
	`} TciParameterPassingModeType;`	

TciParameterListType	`typedef struct TciParameterListType`
	`{`
	`  long int           length;`
	`  TciParameterType[] parList;`
	`} TciParameterListType;`
		length 0 shall be interpreted as "empty list".

TciParameterTypeListType	`typedef struct TciParameterTypeListType`
	`{`
	`  long int  length;`
	`  TciType[] parList;`
	`} TciParameterTypeListType;`
		length 0 shall be interpreted as "empty list".

TciTestCaseIdListType	`typedef struct TciTestCaseIdListType`
	`{`
	`  long int        length;`
	`  QualifiedName[] idList;`
	`} TciTestCaseIdListType;`
		length 0 shall be interpreted as "empty list".

TciTypeClassType	`typedef enum`
	`{`
	`  TCI_ADDRESS_TYPE,`
	`  TCI_ANYTYPE_TYPE,`
	`  TCI_BITSTRING_TYPE,`
	`  TCI_BOOLEAN_TYPE,`
	`  TCI_CHAR_TYPE,`
	`  TCI_CHARSTRING_TYPE,`
	`  TCI_COMPONENT_TYPE,`
	`  TCI_ENUMERATED_TYPE,`
	`  TCI_FLOAT_TYPE,`
	`  TCI_HEXSTRING_TYPE,`
	`  TCI_INTEGER_TYPE,`
	`  TCI_OBJID_TYPE,`
	`  TCI_OCTETSTRING_TYPE,`
	`  TCI_RECORD_TYPE,`
	`  TCI_RECORD_OF_TYPE,`
	`  TCI_SET_TYPE,`
	`  TCI_SET_OF_TYPE,`
	`  TCI_UNION_TYPE,`
	`  TCI_UNIVERSAL_CHAR_TYPE,`
	`  TCI_UNIVERSAL_CHARSTRING_TYPE,`
	`  TCI_VERDICT_TYPE`
	`} TciTypeClassType;`	

TCI IDL ADT	ANSI C representation (Type definition)	Notes and comments

TciTestComponentKindType	typedef enum
	{
	  TCI_CTRL_COMP,
	  TCI_MTC_COMP,
	  TCI_PTC_COMP,
	  TCI_SYS_COMP
	} TciTestComponentKindType;	

TciSignatureIdType	QualifiedName	QualifiedName type reused from TRI.
TciBehaviourIdType	QualifiedName	

9.5 Miscellaneous

TCI concept	ANSI C representation	Notes and comments
Verdict representation		
NONE	const int TCI_VERDICT_NONE = 0	Since the TciVerdictValue interface is defined in terms of integers, consensus must be established on which value defines which verdict.
PASS	const int TCI_VERDICT_PASS = 1	
INCONC	const int TCI_VERDICT_INCONC = 2	
FAIL	const int TCI_VERDICT_FAIL = 3	
ERROR	const int TCI_VERDICT_ERROR = 4	
Objid representation		

Objid	typedef struct TciObjidValue
	{
	  long int length;
	  TciObjidElem[] elements;
	} TciObjidValue;
		Since the Objid value is returned "as is" via the Objid value interface, a representation must be defined.

TciObjidElem	typedef struct TciObjidElemValue
	{
	  char* elem_as_ascii;
	  long int elem_as_number;
	  void* aux;
	} TciObjidElemValue;	

CharstringValue representation		

TciCharString	typedef struct TciCharStringValue
	{
	  unsigned long int length;
	  char* string;
	} TciCharStringValue	

Universal Character[string] representation		
Universal Char	typedef unsigned char[4] TciUCValue	

Universal Charstring	typedef struct TciUCStringValue
	{
	  unsigned long int length;
	  TciUCType[] string;
	} TciUCStringValue;	

10 Use scenarios

This clause contains use scenarios that should help users of the TCI and tool vendors providing the TCI understand the semantics of the operations defined within the present document.

The scenarios are defined in terms of UML sequence diagrams. The sequence diagram shows the interactions between the TCI entities. The scenarios are explained and where applicable underpinned with a TTCN-3 fragment corresponding to the scenario.

10.1 Initialization, collecting information, logging

10.1.1 Use scenario: initialization

The scenario in figure 7 shows the initialization phase for a test system when a TTCN-3 module is to be selected for execution. At first, a root module has to be set with `tciRootModule`. The module parameters of the root module can be obtained with `tciGetModuleParameters`. Module parameter information can be used to ask the test system user for concrete values for each module parameter. The list of test cases available in the root module can be retrieved with `tciGetTestCases`. These test cases can be directly executed from the test management. Their parameters and their test system interface can be obtained with `tciGetTestCaseParameters` and `tciGetTestCaseTSI`, respectively.

10.1.1.1 Sequence diagram

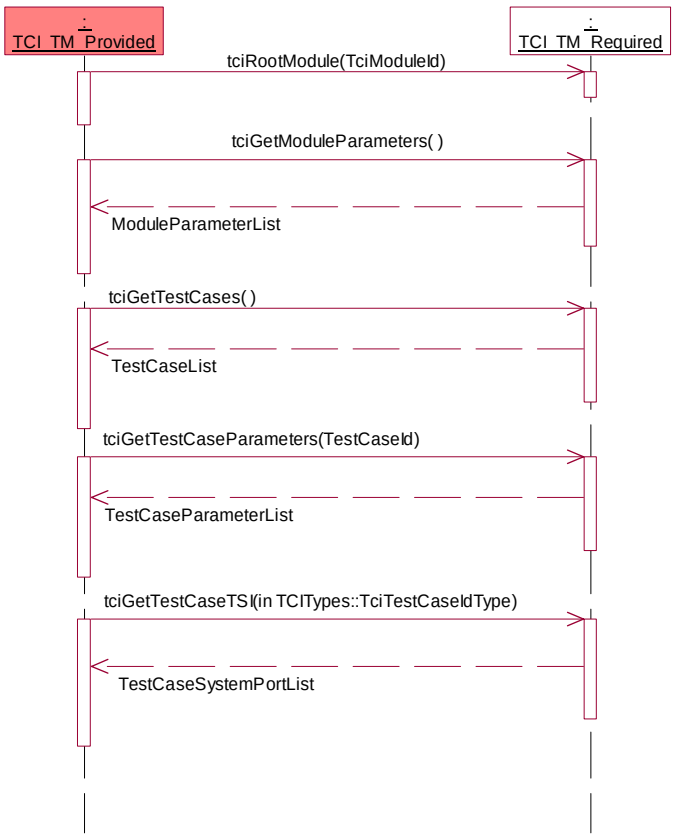

Figure 7: Use scenario - initialization

10.1.1.2 TTCN-3 fragment

The initialization is outside the scope of TTCN-3.

10.1.2 Use scenario: requesting module parameters

The scenario in figure 8 shows how a test component requests the actual value of a module parameter needed for the execution of its test behaviour. At first, the type of a module parameter is requested, then the value can be constructed by the TM and given to the TE.

10.1.2.1 Sequence diagram

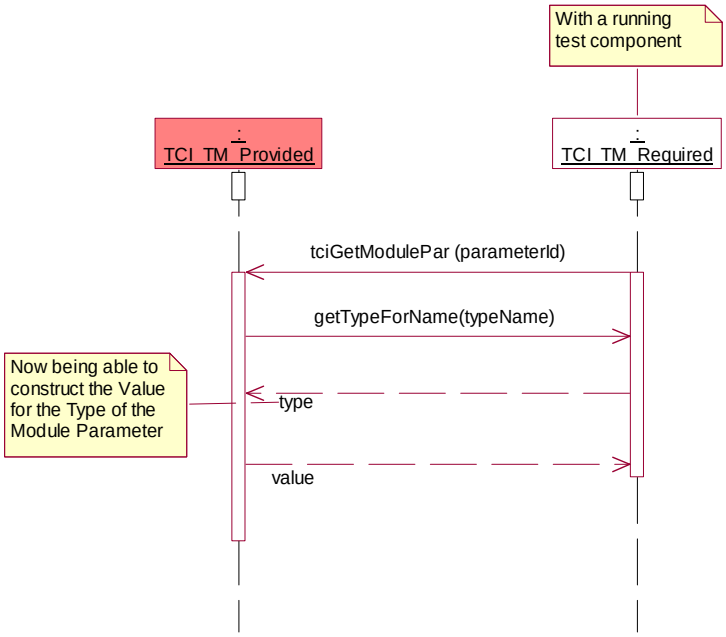

Figure 8: Use scenario - requesting module Pars

10.1.2.2 TTCN-3 fragment

```
module AModule {
    …
    modulepar {
        integer AModulePar
    }
    …
    function AFunction (…) … {
        integer x;
        …
        x:= 2+AModulePar; // an expression with a module parameter
        …
    }
    …
}
```

10.1.3 Use scenario: logging

The scenario in figure 9 shows logging of information during the execution of a test behaviour by a test component. The message to be logged is propagated to the test management.

10.1.3.1 Sequence diagram

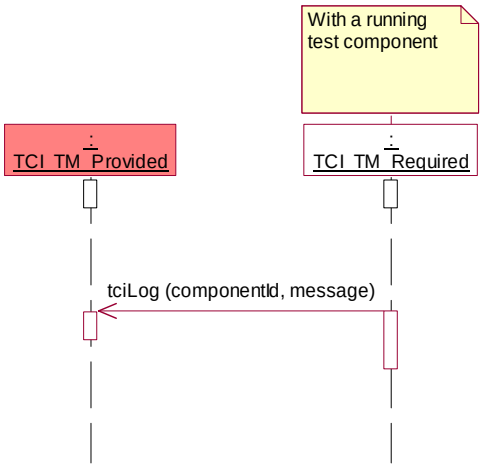

Figure 9: Use scenario - logging

10.1.3.2 TTCN-3 fragment

```
module AModule {
    …
    function AFunction (…) … {
        …
        log('AMessage');
        …
    }
    …
}
```

10.2. Execution of test cases and control

10.2.1 Use scenario: execution of control

The scenario in figure 10 shows the sequence of operations to execute the control part of a TTCN-3 module. The module containing the control part is selected first, then the control is started, then it is executed until the execution is terminated by TE.

10.2.1.1 Sequence diagram

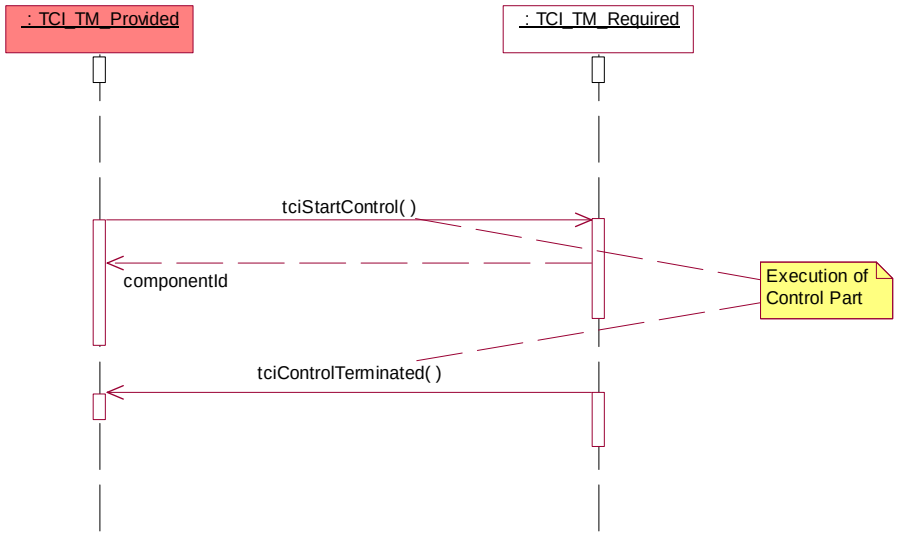

Figure 10: Use scenario - execution of control

10.2.1.2 TTCN-3 fragment

```
module AModule {
    …
    control {
        …
    }
    …
}
```

10.2.2 Use scenario: test case execution within control

The scenario in figure 11 shows how a test case is executed within the control part.

10.2.2.1 Sequence diagram

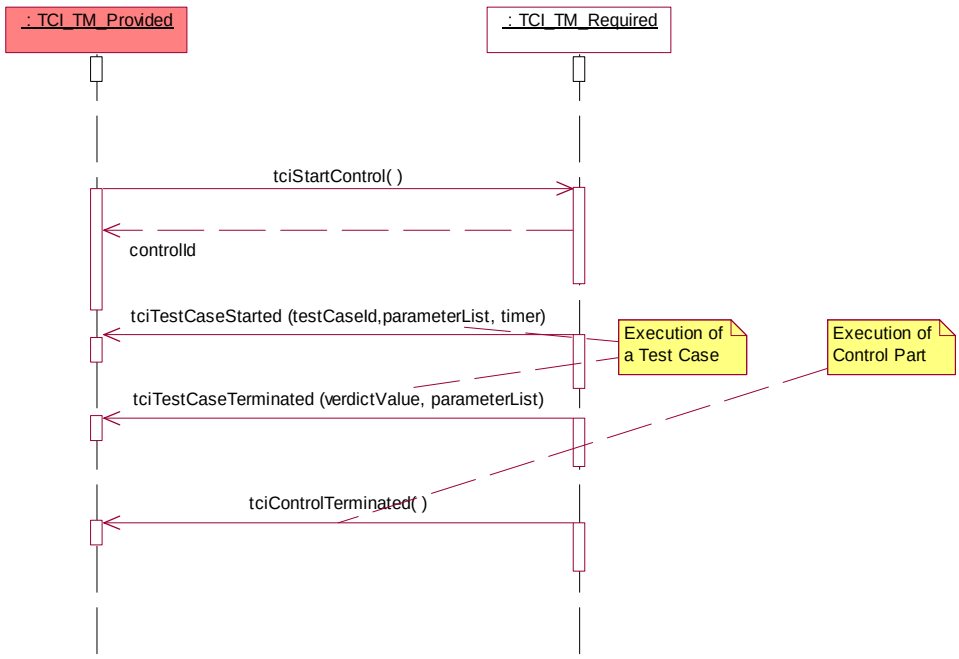

Figure 11: Use scenario - test case execution within control

10.2.2.2 TTCN-3 fragment

```
module AModule {
    …
    testcase ATestCase(…)… {
        … //the test case behaviour
    }
    …
    control {
        …
        execute(ATestCase(…));
        …
    }
    …
}
```

10.2.3 Use scenario: direct test case execution

The scenario in figure 12 shows how a test case can be directly executed from the test management outside the control part. After selecting the TTCN-3 module containing the test case to be executed, the start of the test case is requested. When the test case completes its execution, the test management is informed by the TE of the test case termination.

10.2.3.1 Sequence diagram

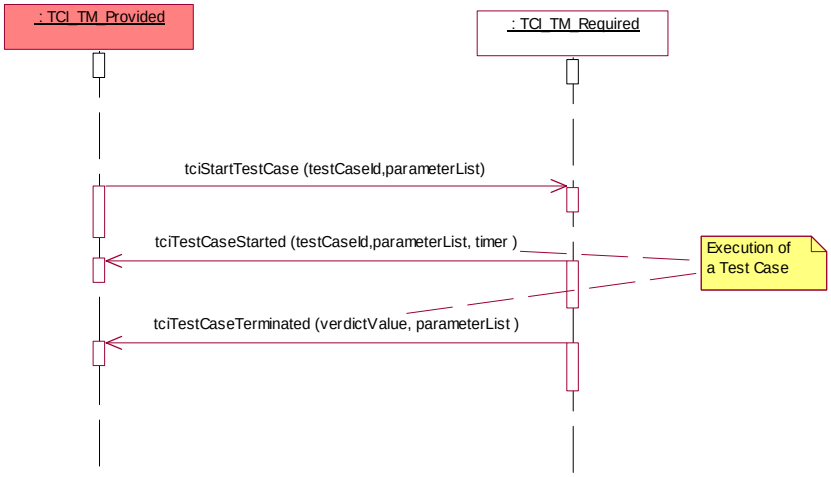

Figure 12: Use scenario - direct test case execution

10.2.3.2 TTCN-3 fragment

The direct execution of a test case is outside the scope of TTCN-3.

10.2.4 Use scenario: execute test case to TRI

The scenario in figure 13 shows how the TRI is informed about the execution of a test case so that it can set up and initialize system ports when needed. The execute test case request has to be issued before the test behaviour on the MTC of the current test case is started.

10.2.4.1 Sequence diagram

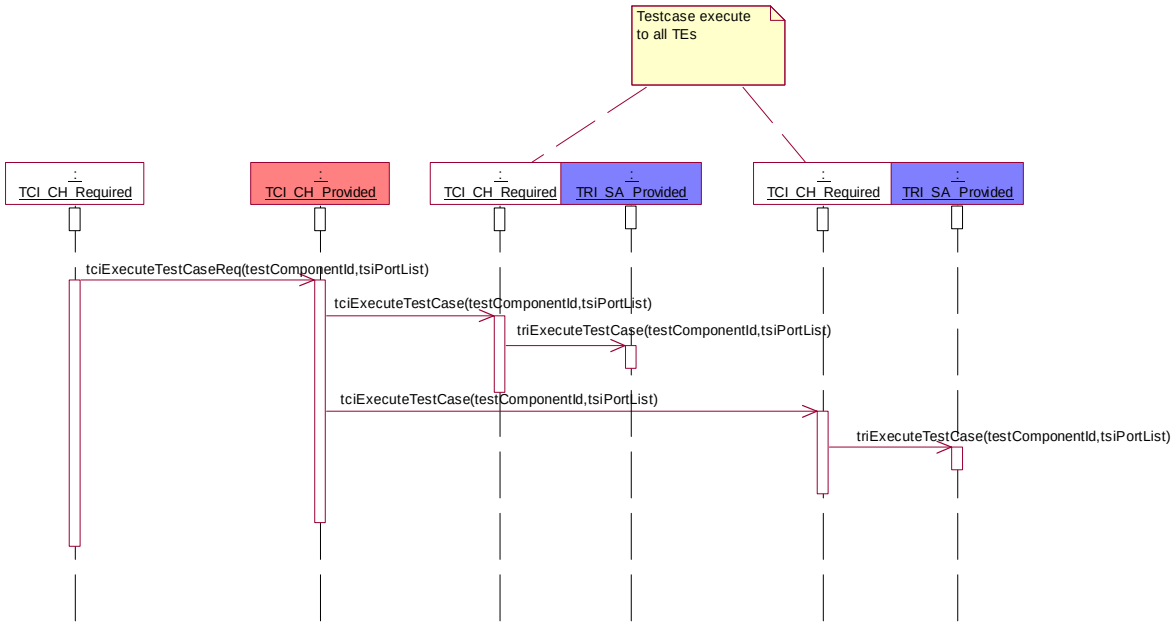

Figure 13: Use scenario - execute test case to TRI

10.2.4.2 TTCN-3 fragment

```
module AModule {
    …
    testcase ATestCase(…)… {
        … //the test case behaviour
    }
    …
    control {
        …
        execute(ATestCase(…));
        …
    }
    …
}
```

10.3 Component handling

10.3.1 Use scenario: local control component creation

The scenario in figure 14 demonstrates the creation of the control component on the same node where the user interface to the test management TCI-TM resides. A control component is created whenever the control part of a TTCN-3 module is executed. Whenever the test management TCI-TM issues the start of the control part, a create test component request is sent to the TCI-CH, which propagates it to the TE where the control component should be created. In this case it is the TE on the same node. The identifier for the control component is returned and given to the TCI-TM. The identifier is then used to start the behaviour of the control part on the control component.

10.3.1.1 Sequence diagram

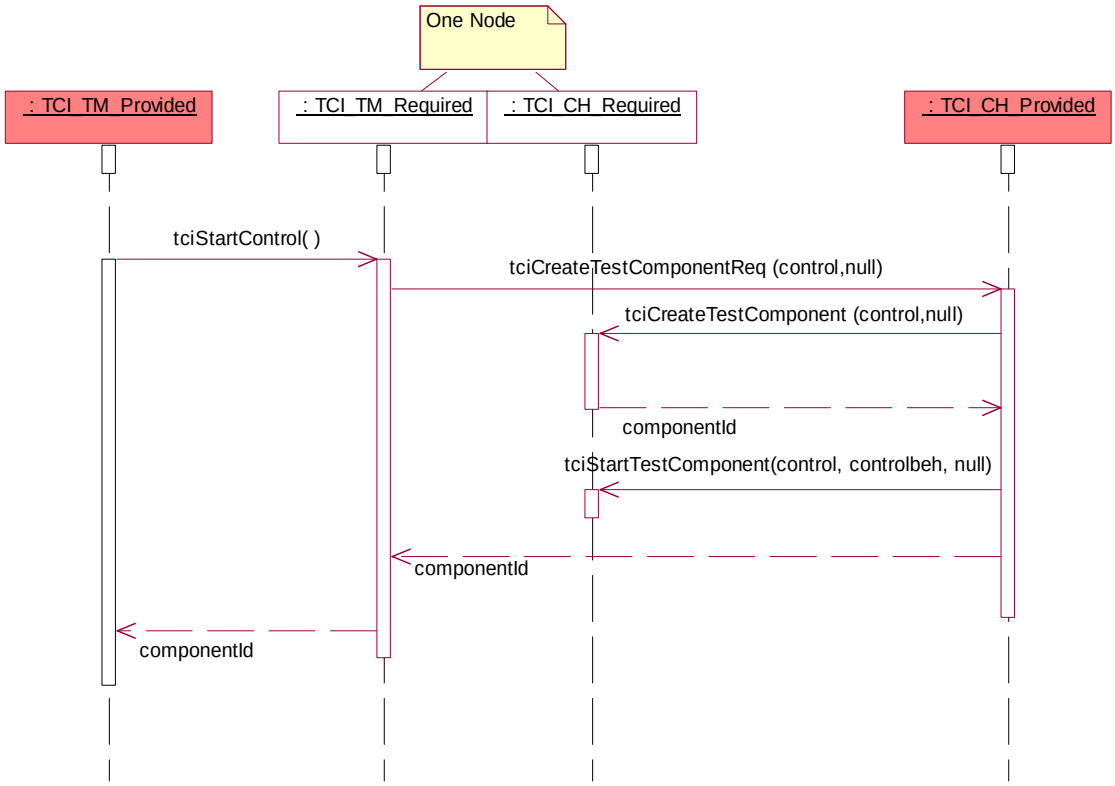

Figure 14: Use scenario - local control component creation

10.3.1.2 TTCN-3 fragment

```
module AModule {
    …
    control {
        …
    }
    …
}
```

10.3.2 Use scenario: remote control component creation

The scenario in figure 15 demonstrates the creation of the control component on another node than where the user interface to the test management TCI-TM resides. A control component is created whenever the control part of a TTCN-3 module is executed. Whenever the test management TCI-TM issues the start of the control part, a create test component request is sent to the TCI-CH, which propagates it to the TE where the control component should be created. In this case it is the TE on another remote node. The identifier for the control component is returned and given to the TCI-TM. The identifier is then used to start the behaviour of the control part on the control component.

10.3.2.1 Sequence diagram

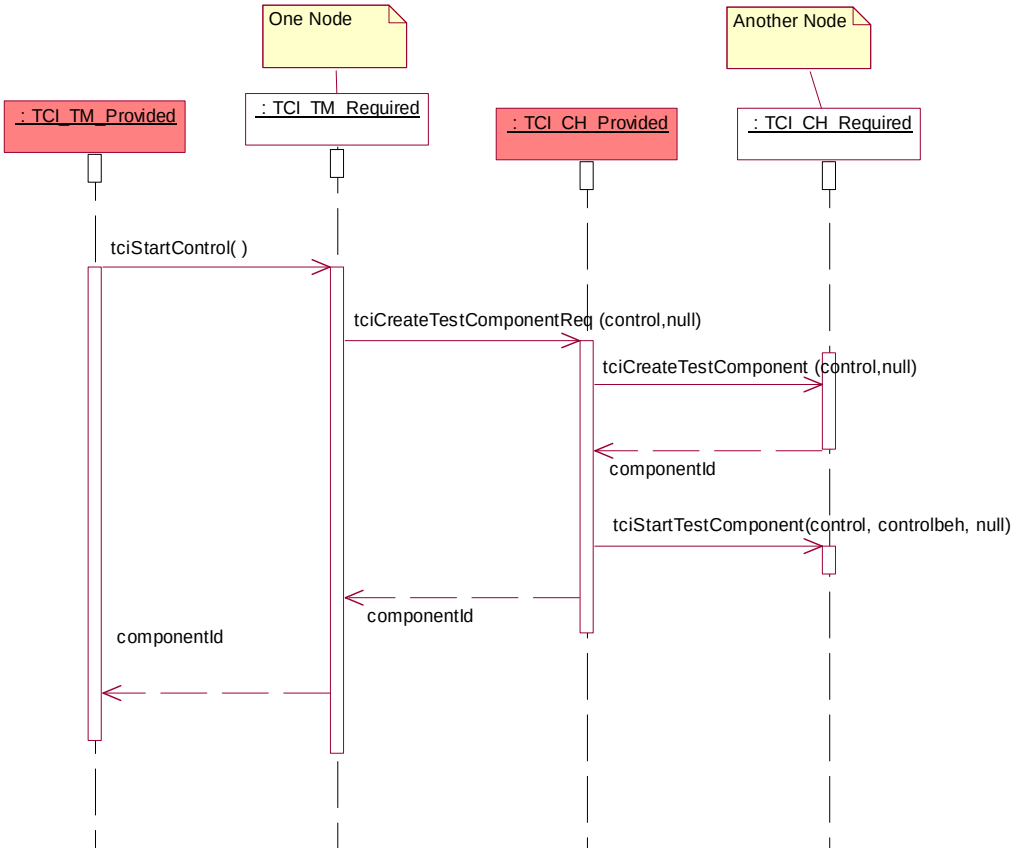

Figure 15: Use scenario - remote control component creation

10.3.2.2 TTCN-3 fragment

```
module AModule {
    …
    control {
        …
    }
    …
}
```

10.3.3 Use scenario: local MTC creation

The scenario in figure 16 demonstrates the local creation of the main test component. Local is meant for two cases; (1) on the same node where the user interface to the test management TCI-TM resides (when a test case is started directly) or (2) on the same node where the control component resides (when a test case is executed from a control part). A main test component is created whenever a test case is executed: a create test component request is sent to the TCI-CH, which propagates it to the TE where the main test component should be created. In this case it is the TE on the same node. The identifier for the main test component is returned and given to the TCI-TM. The identifier is then used to start the test case behaviour on the main test component (this is not shown here, but handled the same way as in the scenarios described in clause 10.3.6 and clause 10.3.5).

10.3.3.1 Sequence diagram

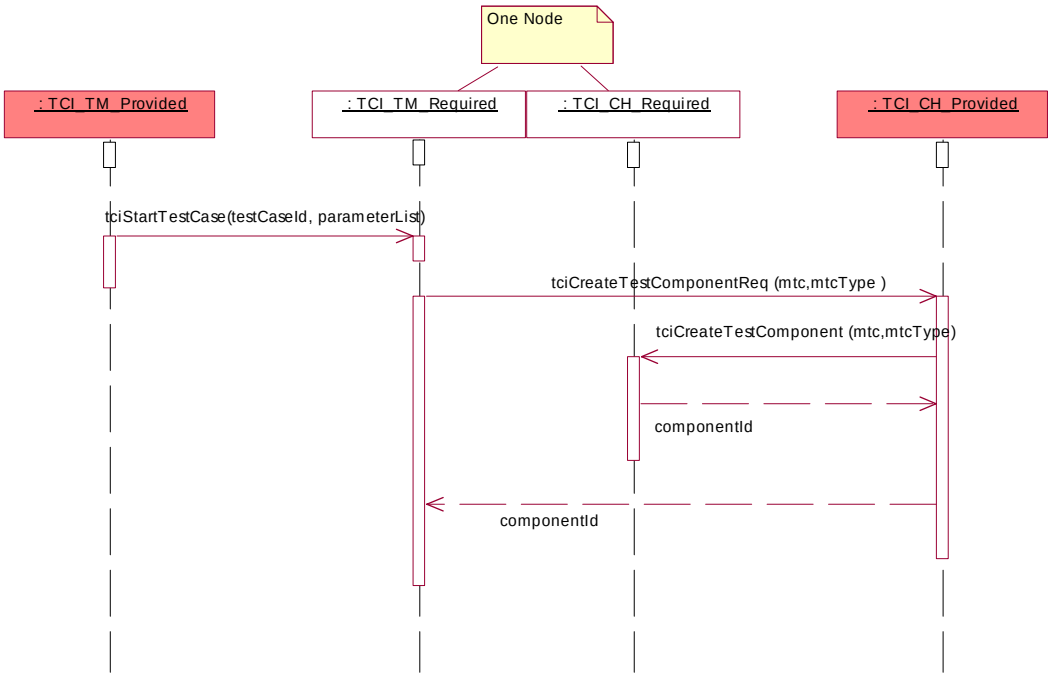

Figure 16: Use scenario - local MTC creation

10.3.3.2 TTCN-3 fragment

```
module AModule {
    …
    testcase ATestCase (…)runs on MTCType… {
        … //the test case behaviour
    }
    …
}
```

10.3.4 Use scenario: remote MTC creation

The scenario in figure 17 demonstrates the remote creation of the main test component. Remote is meant for two cases; (1) on another node than where the user interface to the test management TCI-TM resides (when a test case is started directly) or (2) on another node than where the control component resides (when a test case is executed from a control part). A main test component is created whenever a test case is executed: a create test component request is sent to the TCI-CH, which propagates it to the TE where the main test component should be created. In this case it is the TE on another node. The identifier for the main test component is returned and given to the TCI-TM. The identifier is then used to start the test case behaviour on the main test component (this is not shown here, but handled the same way as in the scenarios described in clause 10.3.6 and clause 10.3.5).

10.3.4.1 Sequence diagram

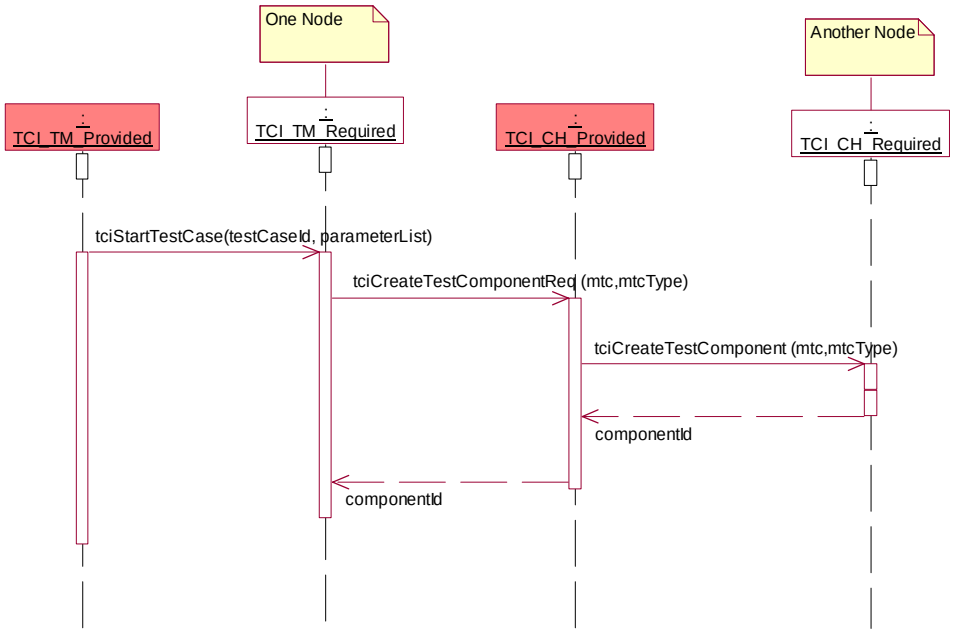

Figure 17: Use scenario - remote MTC creation

10.3.4.2 TTCN-3 fragment

```
module AModule {
    …
    testcase ATestCase(…)runs on MTCType … {
        … //the test case behaviour
    }
    …
}
```

10.3.5 Use scenario: component handling for test case execution within control

The scenario in figure 18 demonstrates the handling of components for the test case execution within a control part. When the control part is started, a control component is created and its component identifier returned to the test management. For each test case to be executed within the control part, a main test component is created and the component identifier returned to the control component. Afterwards, the test case behaviour is started on the main test component and the test management is informed about the start of the test case. When the main test component terminates, a request for the main test component termination together with the local verdict of the main test component is propagated to enable the derivation of the global test verdict and to enable the information about the test case termination.

10.3.5.1 Sequence diagram

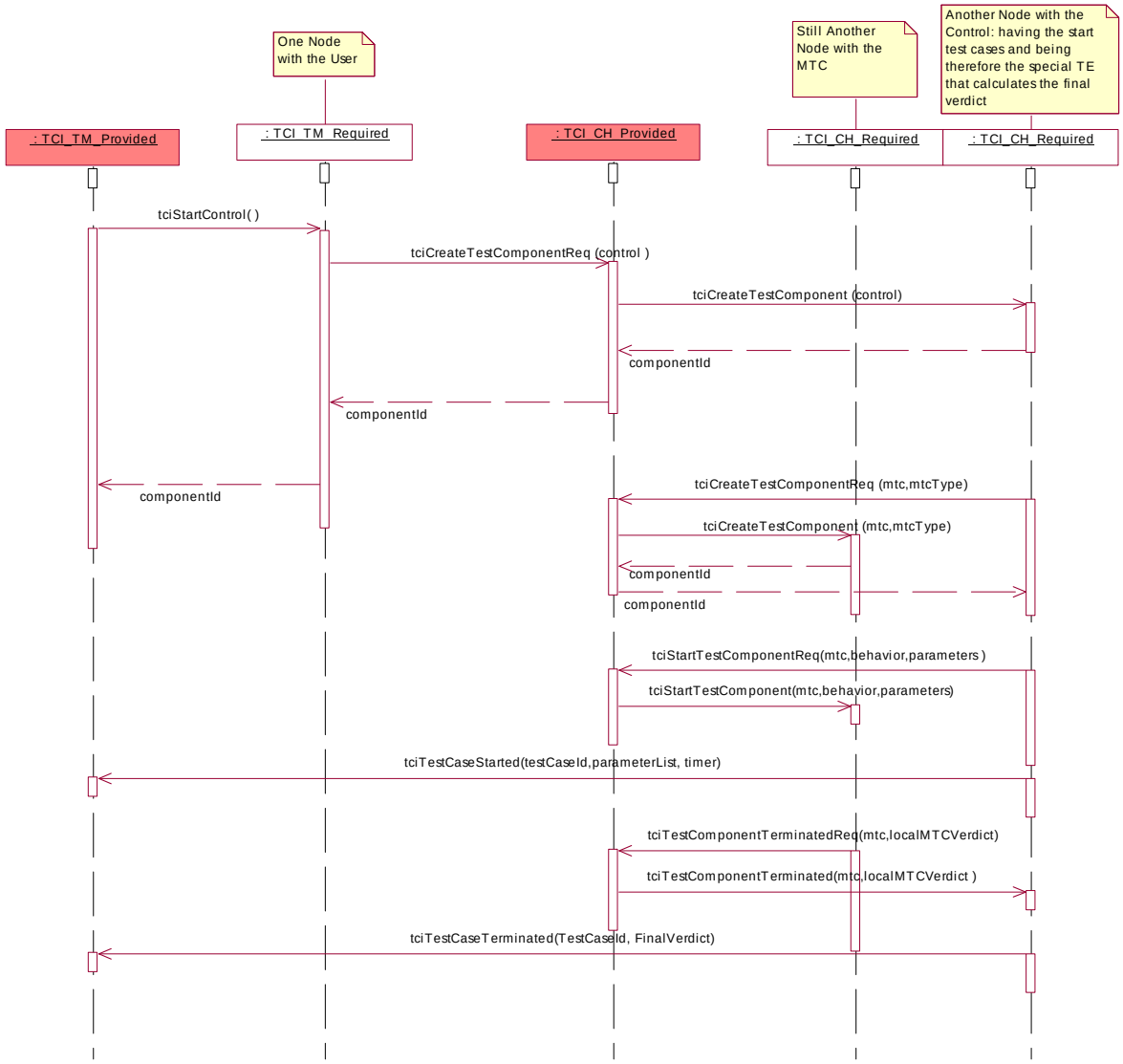

Figure 18: Use scenario: component handling for test case execution within control

10.3.5.2 TTCN-3 fragment

```
module AModule {
    …
    testcase ATestCase(…)… {
        … //the test case behaviour
    }
    …
    control {
        …
        execute(ATestCase(…));
        …
    }
    …
}
```

10.3.6 Use scenario: component handling for direct test case execution

The scenario in figure 19 shows how test components are handled when a test case is executed directly, i.e. outside a control part. When a test case is started, the main test component is created and the test case behaviour started on this main test component at first. Whenever a parallel test component is used within a test case, it is handled the same: the parallel test component is started first: giving a test component create request to the TCI-CH entity, which propagates the test component create to the TE in which the parallel test component shall be created. The identifier for the created parallel test component is returned. The identifier is then used to start the PTC behaviour for the start operation. When the PTC terminates its execution, a test component terminate request together with the local test verdict is issued to inform TCI-CH about this termination. The same is done when the main test component terminates. In addition, the termination of the main test component leads to the overall termination of the test case.

10.3.6.1 Sequence diagram

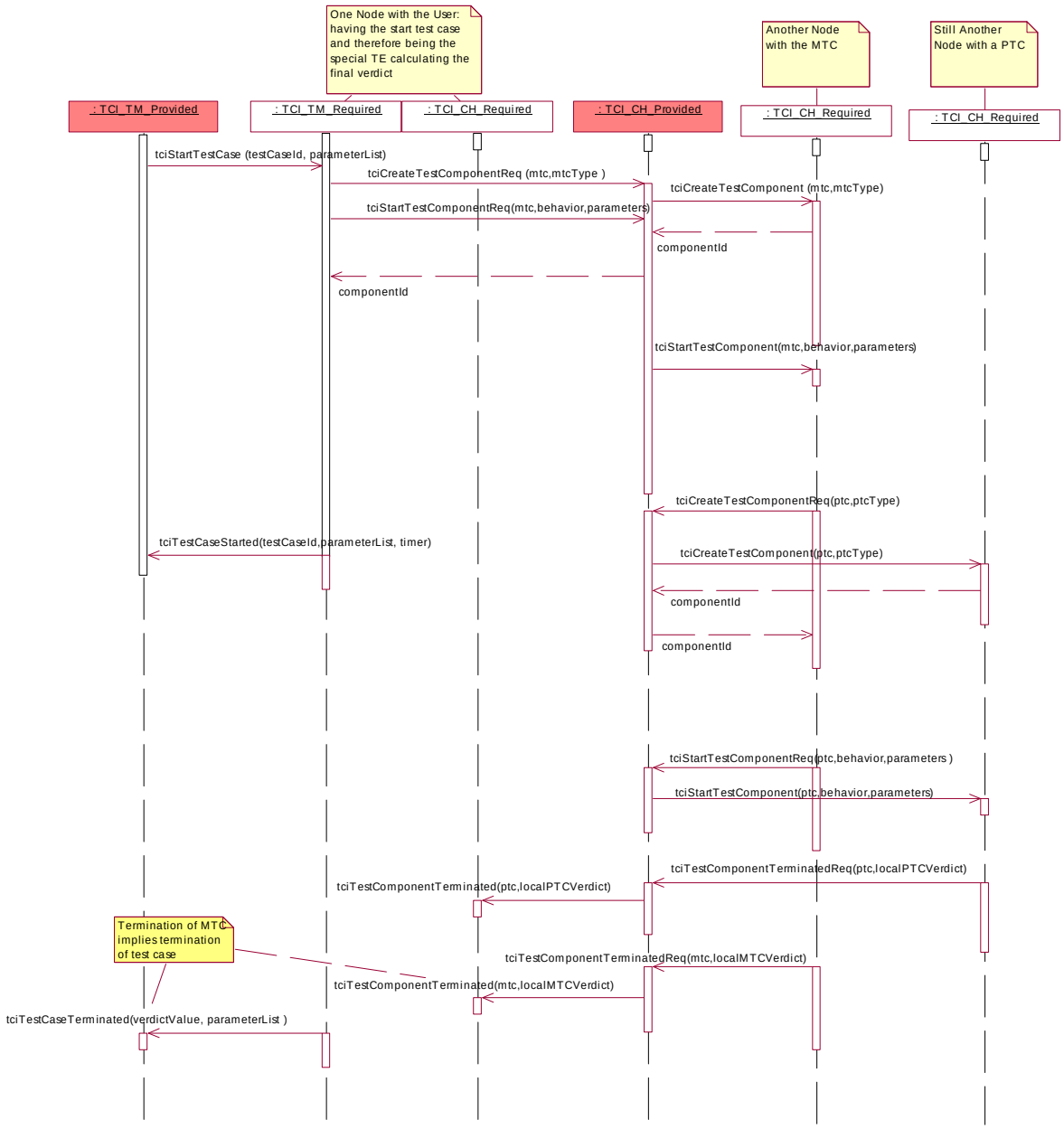

Figure 19: Use scenario: component handling for direct test case execution

10.3.6.2 TTCN-3 fragment

```
module AModule {
    …
    function APTCBehaviour(…) runs on APTCType {
        … //the PTC behaviour
    }
    …
    testcase ATestCase(…)… {
        … //the test case behaviour
        var APTCType PTC:= APTCType.create;
        …
        PTC.start(APTCBehaviour(…));
        …
    }
    …
}
```

10.3.7 Use scenario: propagation of map/connect

The scenario in figure 20 shows how ports are mapped. The request to map a port is propagated to the TE where the map is finally performed. The propagation of connect requests works analogously.

10.3.7.1 Sequence diagram

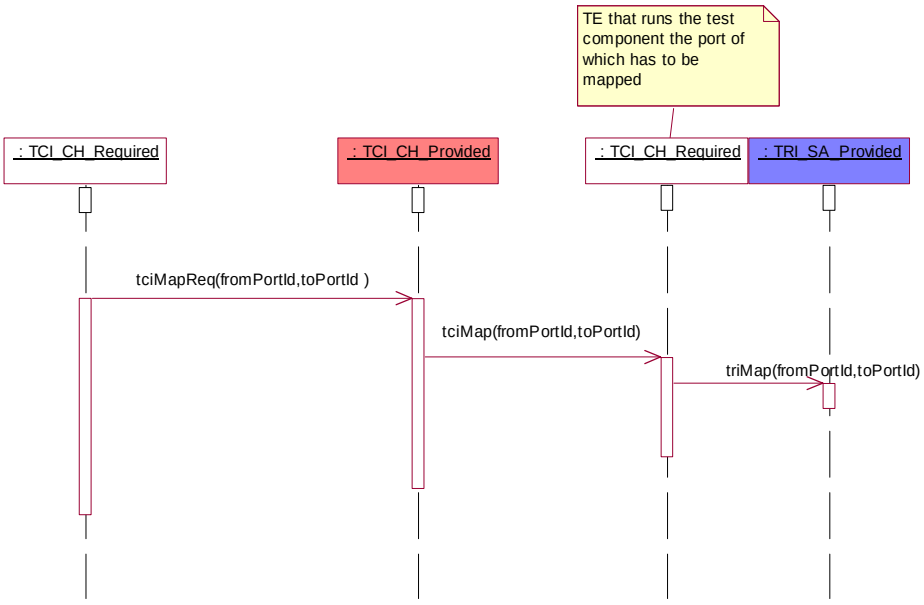

Figure 20: Use scenario: propagation of map

10.3.7.2 TTCN-3 fragment

```
module AModule {
    …
    type port A { … }
    type component CA { port A a }
        type component CB { port A a }
    …
    testcase ATestCase(…)runs on CA system CB {
        var CA ptc := CA.create;
        … //the test case behaviour
        map(ptc:a,system:a);
        …
    }
    …
}
```

10.3.8 Use scenario: propagation of unmap/disconnect

The scenario in figure 21 shows how ports are unmapped. The request to unmap a port is propagated to the TE where the unmap is finally performed. The propagation of disconnect requests works analogously.

10.3.8.1 Sequence diagram

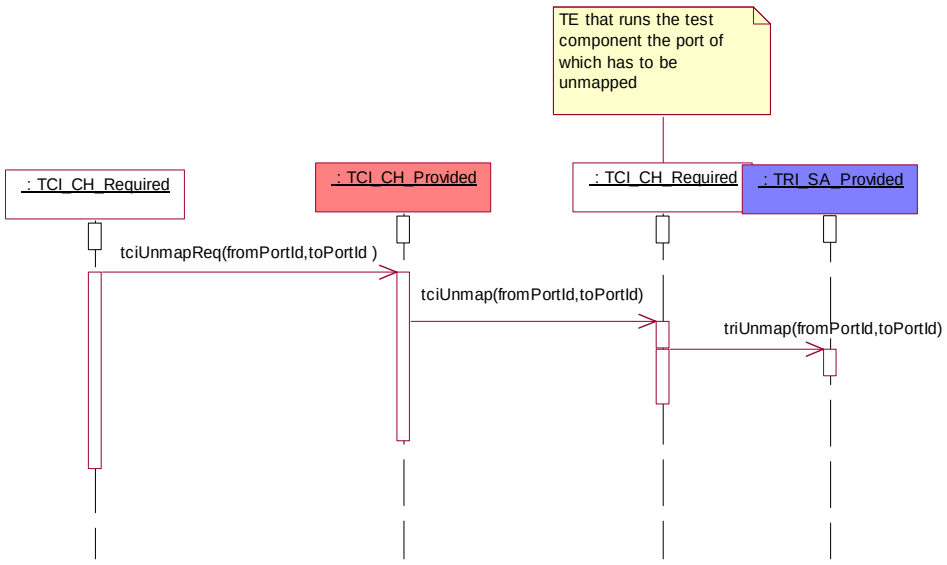

Figure 21: Use scenario - propagation of map

10.3.8.2 TTCN-3 fragment

```
module AModule {
    …
    type port A { … }
    type component CA { port A a }
    type component CB { port A a }
    …
    testcase ATestCase(…)runs on CA system CB {
        var CA ptc := CA.create;
        … //the test case behaviour
        unmap(ptc:a,system:a);
        …
    }
    …
}
```

10.4 Termination of test cases and control

10.4.1 Use scenario: stop a test case

The scenario in figure 22 shows how a test case is stopped from the test management during test case execution. Once the TM has received information about a started test case, a stop test case can be requested up until receiving the information that the test case has been terminated. Upon stopping a test case, all parallel test components will be stopped and the test system will be reset.

10.4.1.1 Sequence diagram

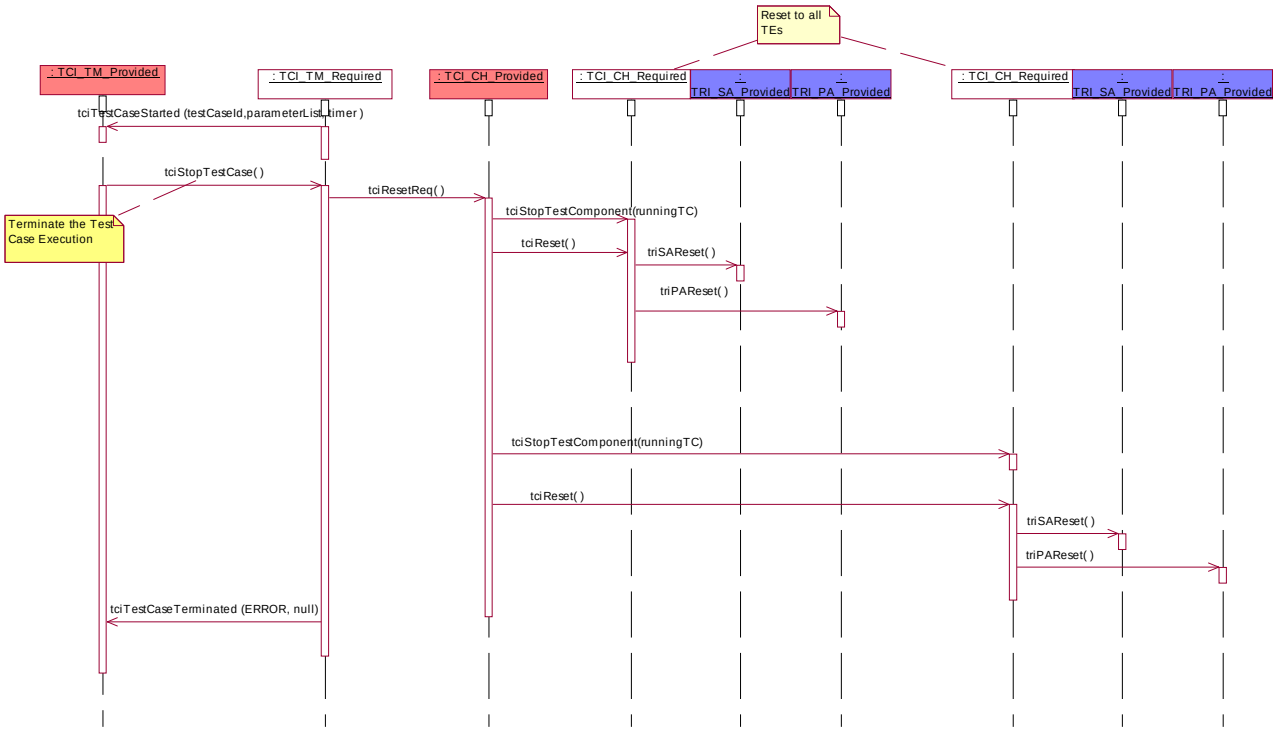

Figure 22: Use scenario: stop a test case

10.4.1.2 TTCN-3 fragment

There is no TTCN-3 code related to how the TM chooses to implement test case termination. This is outside the scope of TTCN-3.

10.4.2 Use scenario: stop control

The scenario in figure 23 shows how a control part is stopped from the test management during control part execution. A control part can be stopped in between starting the control and its termination. If the control part receives a stop test case request while a test case is executing, the executing test case shall be stopped. Furthermore, the test system shall be reset as described in figure 22.

10.4.2.1 Sequence diagram

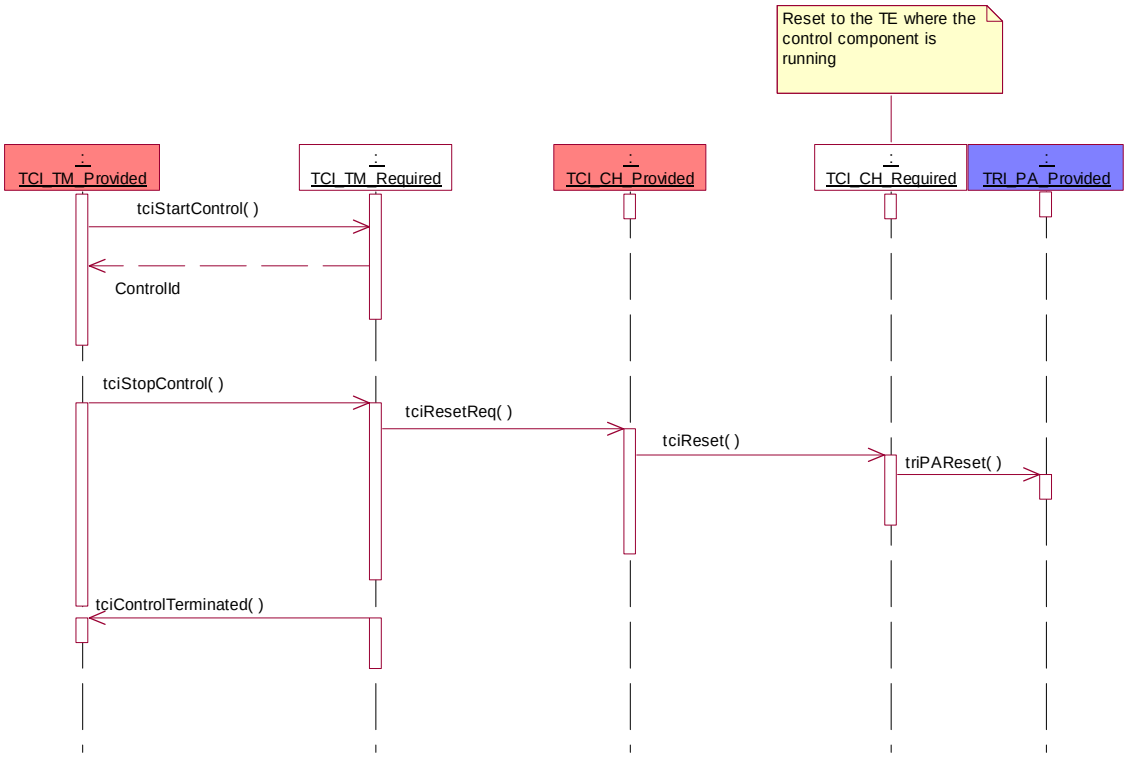

Figure 23: Use scenario - stop control

10.4.2.2 TTCN-3 fragment

Stopping a control part from the test management is outside the scope of TTCN-3 so that no TTCN-3 fragment exists.

10.4.3 Use scenario: termination of control after error

The scenario in figure 24 shows the handling of error situations during the execution of a control part when no test case is being executed. The test management is informed about the error situation and has then to terminate the execution of the control part explicitly. Upon termination of the control part, the test system will be reset.

10.4.3.1 Sequence diagram

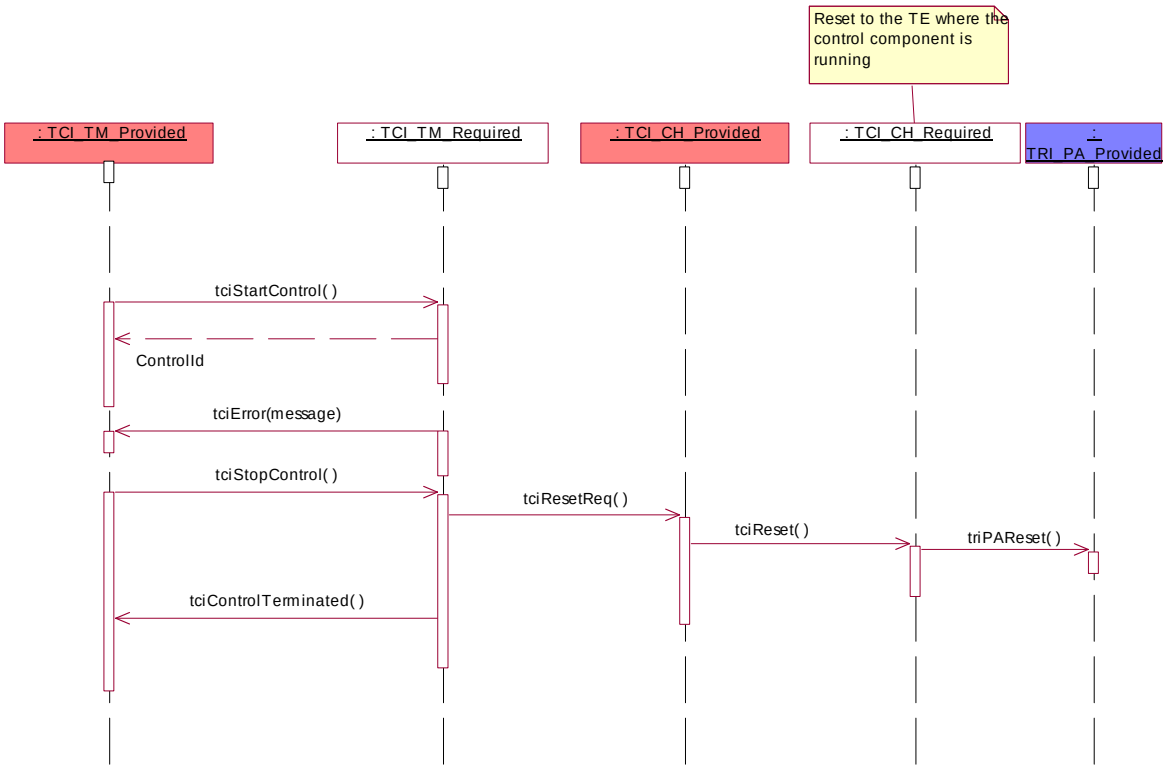

Figure 24: Use scenario - termination of control after error

10.4.3.2 TTCN-3 fragment

There is no TTCN-3 fragment for this scenario since error situations are exceptional cases in a test system and not a TTCN-3 concept as such. Rather, the TTCN-3 semantics describes various potential error situations in a test system.

10.4.4 Use scenario: termination of a test case after error

The scenario in figure 25 shows the handling of error situations during the direct execution of a test case. The test management is informed about the error situation. The TM must then explicitly terminate test case execution. Upon stopping a test case, the parallel test components will be stopped and the test system shall be reset.

10.4.4.1 Sequence diagram

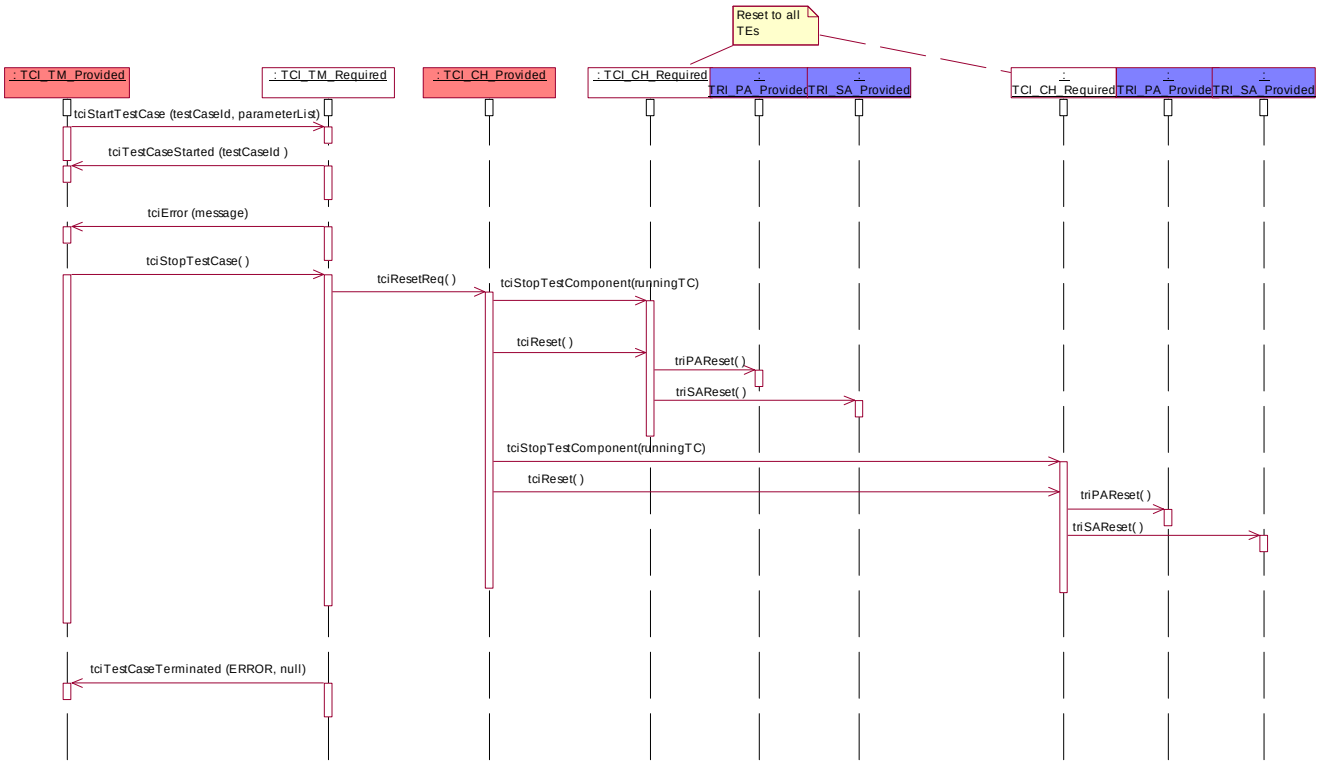

Figure 25: Use scenario - termination of a test case after error

10.4.4.2 TTCN-3 fragment

There is no TTCN-3 fragment for this scenario since error situations are exceptional cases in a test system and not a TTCN-3 concept as such. Rather, the TTCN-3 semantics describes various potential error situations in a test system.

10.4.5 Use scenario: reset

The scenario in figure 26 shows the reset of the test system. In that case all involved TEs together with their TRI system adaptors (SA) and platform adaptors (PA) are reset.

10.4.5.1 Sequence diagram

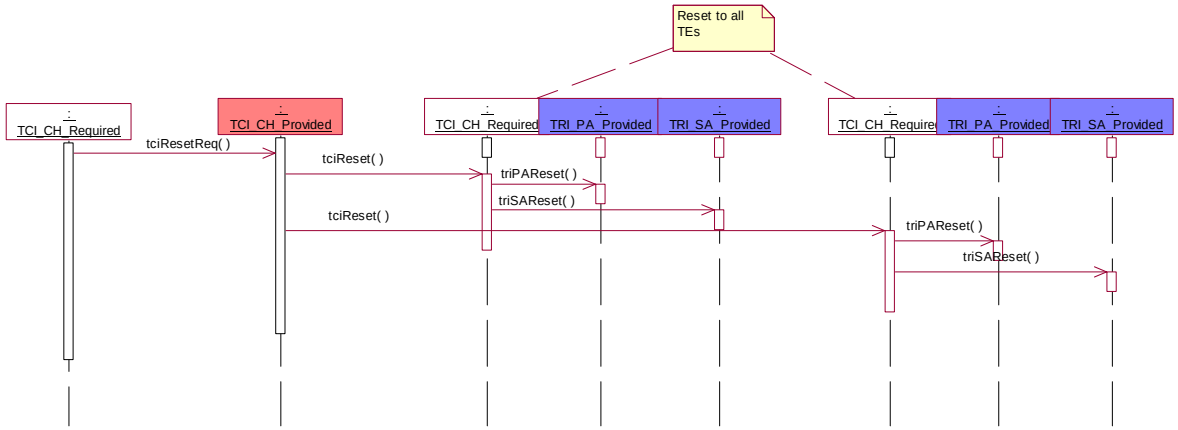

Figure 26: Use scenario - reset

10.4.5.2 TTCN-3 fragment

There is no TTCN-3 fragment for this scenario since reset as required after error situations are exceptional cases in a test system and not a TTCN-3 concept as such.

10.5 Communication

10.5.1 Use scenario: local intercomponent communication

The scenario in figure 27 shows the communication between test components (main test component or parallel test components), which reside on the same node. A communication request is given to the TCI-CH, which then decide where to enqueue this communication template. In this case, the communication is done locally via the TE on the same node. The scenario shows a message-based communication using the send operation - the scenario is the same for call, reply, and raise operations.

10.5.1.1 Sequence diagram

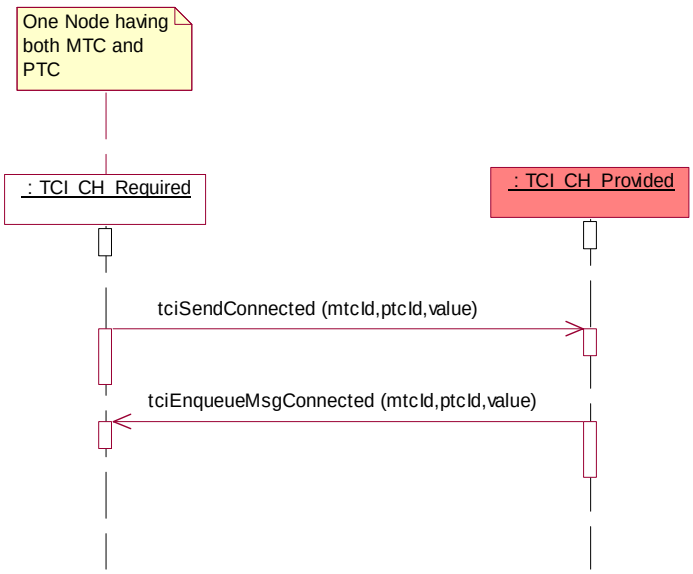

Figure 27: Use scenario - local intercomponent communication

10.5.1.2 TTCN-3 fragment

```
module AModule {
    …
    type port APortType message { … }
    …
    type component ATCType {
        …
        APortType APort;
        …
    }
    …
    template AType AMessageTemplate { … }
    …
    function APTCBehaviour(…) runs on APTCType {
        … //the PTC behaviour
    …
    }
    …
    testcase ATestCase(…) runs on ATCType… {
        … //the test case behaviour
        var ATCType PTC1:= ATCType.create;
        connect(PTC1:APort,mtc:APort);
        …
        PTC1.start(APTCBehaviour(…));
        APort.send(AMessageTemplate); //sending data to a test component
        …
    }
    …
}
```

10.5.2 Use scenario: internode communication between test components

The scenario in figure 28 shows the communication between test components (main test component or parallel test components), which reside on different nodes. A communication request is given to the TCI-CH, which then decides where to enqueue this communication template. In this case, the communication is done remotely via the TE on another node. The scenario shows a message based communication using the send operation - the scenario is the same for call, reply, and raise operations.

10.5.2.1 Sequence diagram

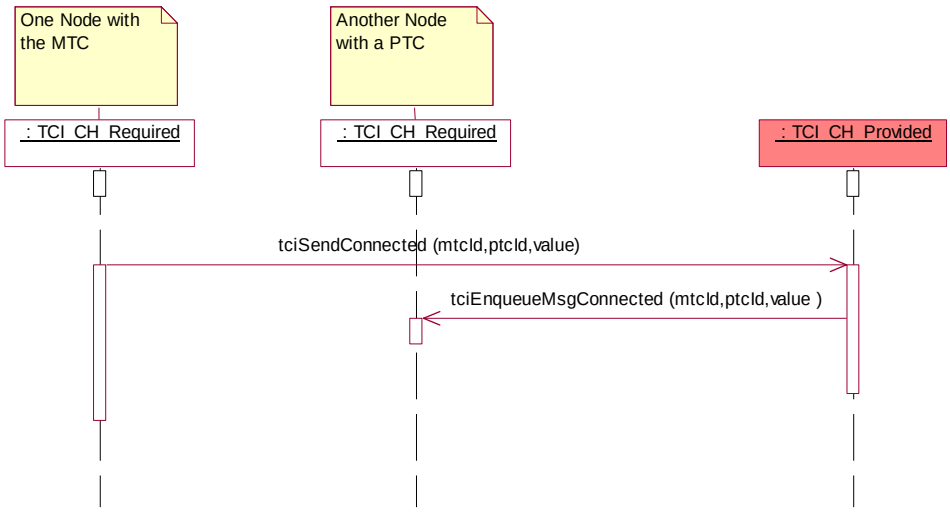

Figure 28: Use scenario - internode communication between test components

10.5.2.2 TTCN-3 fragment

```
module AModule {
    …
    type port APortType message { … }
    …
    type component ATCType {
        …
        APortType APort;
        …
    }
    …
    template AType AMessageTemplate { … }
    …
    function APTCBehaviour(…) runs on APTCType {
        … //the PTC behaviour
    …
    }
    …
    testcase ATestCase(…) runs on ATCType… {
        … //the test case behaviour
        var ATCType PTC1:= ATCType.create;
        connect(PTC1:APort,mtc:APort);
        …
        PTC1.start(APTCBehaviour(…));
        APort.send(AMessageTemplate); //sending data to a test component
        …
    }
    …
}
```

10.5.3 Use scenario: encoding

The scenario in figure 29 shows the encoding of data, which is sent to the SUT. The encoded data is received from the coding/decoding entity via the TCI-CD. The encoded value is sent to the SUT via the TRI-SA. The scenario is the same for the call, the reply, and the raise operations.

10.5.3.1 Sequence diagram

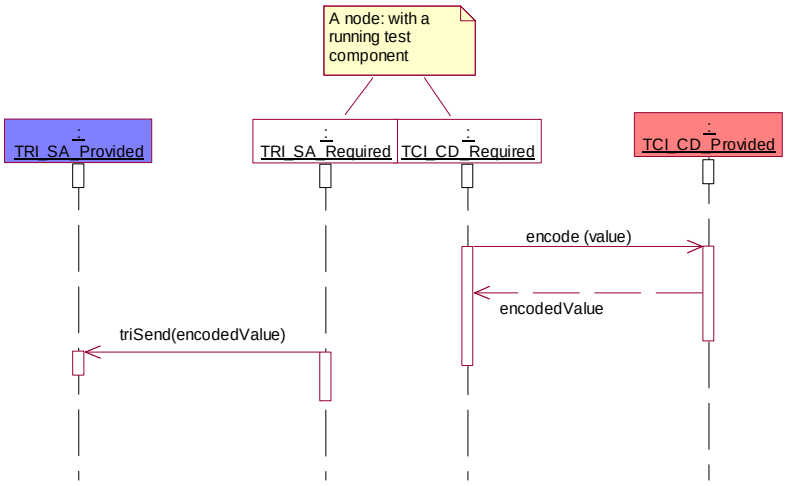

Figure 29: Use scenario - encoding

10.5.3.2 TTCN-3 fragment

```
module AModule {
    …
    type port APortType message { … }
    …
    type component APTCType {
        …
        APortType APort;
        …
    }
    …
    template AType AMessageTemplate { … }
    …
    testcase ATestCase(…) runs on APTCType system APTCType {
        … //the test case behaviour
        map(mtc:APort,system:APort);
        …
        APort.send(AMessageTemplate); //sending data to the SUT
        …
    }
    …
} with { encoding = '…' }
```

10.5.4 Use scenario: decoding

The scenario in figure 30 shows the decoding of data, which is received from the SUT via the TRI-SA. The decoded data is received from the coding/decoding entity via the TCI-CD. The scenario is the same for the receive, the getcall, the getreply, the catch, and the check operations.

10.5.4.1 Sequence diagram

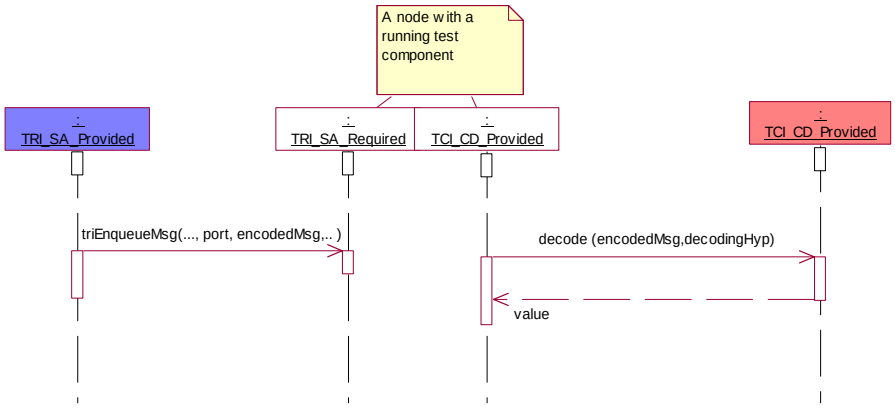

Figure 30: Use scenario - decoding

10.5.4.2 TTCN-3 fragment

```
module AModule {
    …
    type port APortType message { … }
    …
    type component APTCType {
        …
        APortType APort;
        …
    }
    …
    template AType AMessageTemplate { … }
    …
    testcase ATestCase(…) runs on APTCType system APTCType {
        … //the test case behaviour
        map(mtc:APort,system:APort);
        …
        APort.receive(AMessageTemplate); //receiving data from the SUT
        …
    }
    …
} with { encoding = '…' }
```

Annex A (normative): IDL Specification of TCI

A.1 TCI IDL

This annex defines the TTCN-3 Control Interfaces using the Interface Definition Language (IDL 1).

```
// ********************************************************************************
// * Interface definitions for the TTCN-3 Control Interfaces
// ********************************************************************************

module tciInterface {

  /* Forward declaration */
  interface Value;
  interface Type;

  // ********************************************************************************
  // * Data types taken from the TRI definitions
  // ********************************************************************************

  // Connection
  native TriPortIdType ;
  native TriPortIdListType;
  native TriComponentIdType ;

  // Communications
  native TriMessageType;

  // ********************************************************************************
  // * General Abstract Data Types
  // ********************************************************************************

  // Basic definitions
  native TBoolean;
  native TFloat;
  native TChar;
  native TInteger;
  native TString;
  native TUniversalChar;
  typedef sequence <TString> TStringSeq;
  native TObjid;

  struct QualifiedName {
    TString moduleName;
    TString baseName;
  };

  // General TCI abstract data types
  typedef QualifiedName TciBehaviourIdType;
  typedef QualifiedName TciSignatureIdType;
  typedef QualifiedName TciModuleIdType;
  typedef QualifiedName TciModuleParameterIdType;
  typedef QualifiedName TciTestCaseIdType;

  enum TciParameterPassingModeType {
    IN_MODE,
    OUT_MODE,
    INOUT_MODE
  };

  struct TciParameterType {
    Value parameterValue;
    TciParameterPassingModeType mode;
  };

  typedef sequence <TciParameterType> TciParameterListType;
```

```
struct TciParameterTypeType {
  Type parameterType;
  TciParameterPassingModeType mode;
};

typedef sequence <TciParameterTypeType> TciParameterTypeListType;

struct TciModuleParameterType {
  TciModuleParameterIdType parameterName;
  Value defaultValue;
};

typedef <TciModuleIdType> TciModuleIdListType ;

typedef sequence <TciModuleParameterType> TciModuleParameterListType;

typedef sequence <TciTestCaseIdType> TciTestCaseIdListType;


enum TciTestComponentKindType {
  MTC,
  PTC,
  CONTROL
};

enum TciTypeClassType {
  ADDRESS_CLASS,
  ANYTYPE_CLASS,
  BITSTRING_CLASS,
  BOOLEAN_CLASS,
  CHAR_CLASS,
  CHARSTRING_CLASS,
  COMPONENT_CLASS,
  ENUMERATED_CLASS,
  FLOAT_CLASS,
  HEXSTRING_CLASS,
  INTEGER_CLASS,
  OBJID_CLASS,
  OCTETSTRING_CLASS,
  RECORD_CLASS,
  RECORDOF_CLASS,
  SET_CLASS,
  SETOF_CLASS,
  UNION_CLASS,
  UNIVERSALCHAR_CLASS,
  UNIVERSALCHARSTRING_CLASS,
  VERDICT_CLASS
};


// ***************************************************************************
// * Abstract TTCN-3 Data Types And Values
// ***************************************************************************

// Abstract data type "Type"
interface Type {
  TciModuleIdType  getDefiningModule ();
  TString          getName ();
  TciTypeClassType getTypeClass ();
  Value            newInstance ();
  TString          getTypeEncoding ();
  TString          getTypeEncodingVariant ();
};

// Abstract TTCN-3 Values
interface Value {
  TString  getValueEncoding ();
  TString  getValueEncodingVariant ();
  Type     getType ();
  TBoolean  notPresent ();
};
```

```
interface RecordOfValue : Value {
  Value    getField (in TInteger position);
  void     setField (
             in TInteger position,
             in Value value
             );
  void     appendField (in Value value);
  Type     getElementType ();
  TInteger getLength ();
  void     setLength (in TInteger len);
};

interface RecordValue : Value {
  Value      getField (in TString fieldName);
  void       setField (
           in TString fieldName,
           in Value value
           );
  TStringSeq getFieldNames ();
};

interface VerdictValue : Value {
  TInteger getVerdict ();
  void     setVerdict (in TInteger verdict);
};

interface BitstringValue : Value {
  TString   getString ();
  void      setString (in TString value);
  TInteger  getBit (in TInteger position);
  void      setBit (
            in TInteger position,
            in TInteger value
            );
  TInteger  getLength ();
  void      setLength (in TInteger len);
};

interface OctetstringValue : Value {
  TString  getString ();
  void     setString (in TString value);
  TInteger getOctet (in TInteger position);
  void     setOctet (
             in TInteger position,
             in TInteger value
             );
  TInteger getLength ();
  void     setLength (in TInteger len);
};

interface FloatValue : Value {
  TFloat getFloat ();
  void  setFloat (in TFloat value);
};

interface HexstringValue : Value {
  TString  getString ();
  void     setString (in TString value);
  TInteger getHex (in TInteger position);
  void     setHex (
           in TInteger position,
           in TInteger value
           );
  TInteger getLength ();
  void     setLength (in TInteger len);
};

interface ObjidValue : Value {
  TObjid getObjid ();
  void   setObjid (in TObjid value);
};

interface EnumeratedValue : Value {
  void    setEnum (in TString enumValue);
  TString getEnum ();
};
```

```
interface IntegerValue : Value {
  TInteger getInt ();
  void     setInt (in TInteger value);
};

interface CharValue : Value {
  TChar getChar ();
  void  setChar (in TChar value);
};

interface CharstringValue : Value {
  TString  getString ();
  void     setString (in TString value);
  TChar    getChar   (in TInteger position);
  void     setChar   (
          in TInteger position,
          in TChar value
          );
  TInteger getLength ();
  void     setLength (in TInteger len);
};

interface BooleanValue : Value {
  TBoolean getBoolean ();
  void    setBoolean (in TBoolean value);
};

interface UniversalCharValue : Value {
  TUniversalChar getUniversalChar ();
  void           setUniversalChar (in TUniversalChar value);

};

interface UniversalCharstringValue : Value {
  TString        getString ();
  void           setString (in TString value);
  TUniversalChar getChar   (in TInteger position);
  void           setChar   (
                in TInteger position,
                in TUniversalChar value
                );
  TInteger       getLength ();
  void           setLength (in TInteger len);
};

interface UnionValue : Value {
  Value      getVariant  (in TString variantName);
  void       setVariant  (
              in TString variantName,
              in Value value
              );
  TString    getPresentVariantName ();
  TStringSeq getVariantNames ();

};


// *****************************************************************************
// Coding Decoding Interface
// -  Required
// *****************************************************************************

interface TCI_CD_Required {
  Type getTypeForName (in TString typeName);
  Type getInteger ();
  Type getFloat ();
  Type getBoolean ();
  Type getChar ();
  Type getUniversalChar ();
  Type getObjid ();
  Type getCharstring ();
  Type getUniversalCharstring ();
  Type getHexstring ();
  Type getBitstring ();
  Type getOctetstring ();
  Type getVerdict ();
  void tciErrorReq (in TString message);
};
```

```
// ********************************************************************************
// Coding Decoding interface
// -  Provided
// ********************************************************************************

interface TCI_CD_Provided {
  Value decode (
        in TriMessageType message,
        in Type decodingHypothesis
        );
  TriMessageType encode (in Value value);
};


// ********************************************************************************
// Test Management Interface
// -  Required
// ********************************************************************************

interface TCI_TM_Required : TCI_CD_Required {
  void tciRootModule (in TciModuleIdType moduleName);
  TciModuleIdListType getImportedModules()
  TciModuleParameterListType tciGetModuleParameters (TciModuleIdType moduleName);
  TciTestCaseIdListType tciGetTestCases ();
  TciParameterTypeListType tciGetTestCaseParameters (
                  in TciTestCaseIdType testCaseId
              );
  TriPortIdListType tciGetTestCaseTSI (
                  in TciTestCaseIdType testCaseId
              );
  void tciStartTestCase (
             in TciTestCaseIdType testCaseId,
             in TciParameterListType parameterList
             );
  void tciStopTestCase ();
  TriComponentIdType tciStartControl ();
  void tciStopControl ();
};

// ********************************************************************************
// Test Management Interface
// -  Provided
// ********************************************************************************

interface TCI_TM_Provided {
  void tciTestCaseStarted (
               in TciTestCaseIdType testCaseId,
               in TciParameterListType parameterList,
               in TFloat timer
               );
  void tciTestCaseTerminated (
              in VerdictValue verdict,
              in TciParameterListType parameterList
              );
  void tciControlTerminated ();
  Value tciGetModulePar (
             in TciModuleParameterIdType parameterId
             );
  void tciLog (
       in TriComponentIdType testComponentId,
       in TString message
       );
  void tciError (in TString message);
};


// ********************************************************************************
// Component Handling Interface
// -  Required
// ********************************************************************************
```

```
interface TCI_CH_Required : TCI_CD_Required {
  void tciEnqueueMsgConnected (
              in TriPortIdType sender,
              in TriComponentIdType receiver,
              in Value receivedMessage
              );
  void tciEnqueueCallConnected (
              in TriPortIdType sender,
              in TriComponentIdType receiver,
              in TciSignatureIdType signature,
              in TciParameterListType parameterList
              );
  void tciEnqueueReplyConnected (
                  in TriPortIdType sender,
              in TriComponentIdType receiver,
              in TciSignatureIdType signature,
              in TciParameterListType parameterList,
              in Value returnValue
              );
  void tciEnqueueRaiseConnected (
                  in TriPortIdType sender,
              in TriComponentIdType receiver,
              in TciSignatureIdType signature,
              in Value except
              );
  TriComponentIdType tciCreateTestComponent (
              in TciTestComponentKindType kind,
              in Type componentType
              );
  void tciStartTestComponent (
              in TriComponentIdType comp,
              in TciBehaviourIdType behavior,
              in TciParameterListType parameterList
             );
  void tciStopTestComponent (
                  in TriComponentIdType comp
               );
  void tciConnect (
          in TriPortIdType fromPort,
          in TriPortIdType toPort
          );
  void tciDisconnect (
          in TriPortIdType fromPort,
          in TriPortIdType toPort
          );
  void tciTestComponentTerminated (
          in TriComponentIdType comp,
          in VerdictValue verdict
          );
  TBoolean tciTestComponentRunning (
          in TriComponentIdType comp
          );
  TriComponentIdType tciGetMTC ();
  void tciMap (
       in TriPortIdType fromPort,
       in TriPortIdType toPort
       );
  void tciUnmap (
         in TriPortIdType fromPort,
         in TriPortIdType toPort
         );
  void tciExecuteTestCase (
         in TciTestCaseIdType testCaseId,
         in TriPortIdListType tsiPortList
         );
  TBoolean tciTestComponentDone (
         in TriComponentIdType component
         );
  void tciReset ();
};

// ********************************************************************************
// Component Handling Interface
// -  Provided
// ********************************************************************************
```

```
  interface TCI_CH_Provided {
    void tciSendConnected (
                in TriPortIdType sender,
                in TriComponentIdType receiver,
                in Value sendMessage
                );
    void tciCallConnected (
                in TriPortIdType sender,
                in TriComponentIdType receiver,
                in TciSignatureIdType signature,
                in TciParameterListType parameterList
                );
    void tciReplyConnected (
                 in TriPortIdType sender,
                 in TriComponentIdType receiver,
                 in TciSignatureIdType signature,
                 in TciParameterListType parameterList,
                 in Value returnValue
                 );
    void tciRaiseConnected (
                 in TriPortIdType      sender,
                 in TriComponentIdType receiver,
                 in TciSignatureIdType signature,
                 in Value except
                 );
    TriComponentIdType tciCreateTestComponentReq (
                 in TciTestComponentKindType kind,
                 in Type componentType
                 );
    void tciStartTestComponentReq (
                    in TriComponentIdType comp,
                    in TciBehaviourIdType behavior,
                    in TciParameterListType parameterList
                    );
    void tciStopTestComponentReq (
                   in TriComponentIdType comp
                   );
    void tciConnectReq (
            in TriPortIdType fromPort,
            in TriPortIdType toPort
            );
    void tciDisconnectReq (
                in TriPortIdType fromPort,
                in TriPortIdType toPort
                );
    void tciTestComponentTerminatedReq (
                    in TriComponentIdType comp,
                    in VerdictValue verdict
                    );
    TBoolean tciTestComponentRunningReq (
                    in TriComponentIdType comp
                    );
    TriComponentIdType tciGetMTCReq ();
    void tciMapReq (
            in TriPortIdType fromPort,
            in TriPortIdType toPort
            );
    void tciUnmapReq (
              in TriPortIdType fromPort,
              in TriPortIdType toPort
              );
    void tciExecuteTestCaseReq (
                 in TciTestCaseIdType testCaseId,
                 in TriPortIdListType tsiPortList
                 );
    void tciResetReq ();
    TBoolean tciTestComponentDoneReq (
                      in TriComponentIdType component
                      );
  };

};
```

Annex B (informative): Bibliography

- [GCI] INTOOL CGI/NPL038 (V2.2): "Generic Compiler/Interpreter interface; GCI Interface Specification" Infrastructural Tools, December 1996.
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History

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