SLOVENSKI STANDARD
SIST ETSI/TCR-TR 019 E1:2005

01-april-2005

Signalizacijski protokoli in komutacija (SPS) - Vrednotenje orodij zapisa abstraktne skladnje št. 1 (ASN.1) za uporabo kot sintaktično in semantično preverjanje

Signalling Protocols and Switching (SPS); Evaluation of Abstract Syntax Notation One (ASN.1) tools for use as syntax and semantics checkers

Ta slovenski standard je istoveten z: **TCRTR 019 Edition 1**

ICS:

33.040.30	Komutacijski in signalizacijski sistem	Switching and signalling systems

SIST ETSI/TCR-TR 019 E1:2005 **en**

ETSI TECHNICAL COMMITTEE REFERENCE TECHNICAL REPORT

TCR-TR 019

October 1994

Source: ETSI TC-SPS

Reference: DTR/SPS-02025

ICS: 33.020, 33.040.40

Key words: ASN.1

Signalling Protocols and Switching (SPS);
Evaluation of Abstract Syntax Notation One (ASN.1) tools for use as syntax and semantics checkers

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New presentation - see History box

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Foreword

This Technical Committee Reference Technical Report (TCR-TR) was prepared by the Signalling Protocols and Switching (SPS) Technical Committee of the European Telecommunications Standards Institute (ETSI).

A TCR-TR is a deliverable for use inside ETSI which records output results of ETSI Technical Committee (TC) or Sub-Technical Committee (STC) studies which are not appropriate for European Telecommunication Standard (ETS), Interim European Telecommunication Standard (I-ETS) or ETSI Technical Report (ETR) status. They can be used for guidelines, status reports, co-ordination documents, etc. They are to be used to manage studies inside ETSI and shall be mandatorially applied amongst the concerned TCs. They shall also be utilised by the TC with overall responsibility for a study area for co-ordination documents (e.g. models, reference diagrams, principles, structures of standards, framework and guideline documents) which constitute the agreed basis for several, if not all, TCs and STCs to pursue detailed standards.

Introduction

Signalling information to be exchanged between telecommunication systems becomes more and more complex. For this reason, it becomes necessary to change the description technique of signalling messages from the tabular notation to the Abstract Syntax Notation One (ASN.1).

It is considered very important that the ASN.1 which is used in standards is without errors. The same applies to ASN.1 modules which could be made available for general use.

In order to ensure that an ASN.1 specification is without errors, an automated checker could be used. A number of tools is available that could be used for this purpose. This TCR-TR presents the results of the testing of the capabilities to check ASN.1 modules for a number of these tools.

According to the test results the tools have been divided into two groups: recommended tools and other tools. The classification of the tools was based on a pre-defined set of requirements (described in clause 4), but minor discrepancies have been ignored.

The following conventions are used to refer to elements of the ASN.1 language:

- Terms which refer directly to items or productions defined by the ASN.1 specification are used between quotation marks. The terms that are defined in CCITT Recommendation X.208 (1988), § 3 are used without quotation, with the exception that sometimes **"any" type** is used instead of **any type** in order to prevent misunderstandings.

- Instead of **value of an integer type,** usually **integer value** is used (and similar for all other types).

- Instead of **an identifier with which an integer value is associated**, **defined integer** is used (and similar for all other types).

- Instead of **"Type"**, **type** is used.

- Instead of **"DefinedType"**, **defined type** is used.

- Instead of **"BuiltinType"**, **built-in type** is used.

- The terms that are used in the titles of CCITT Recommendation X.208 (1988), §§ 37.1 to 37.6 (describing subtype value sets) are used instead of references to the corresponding productions (e.g. **inner subtyping** instead of **"InnerSubtyping"**).

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1 Scope

The main objective of this Technical Committee Reference Technical Report (TCR-TR) is to present a list of recommended tools which can be used to ensure that an ASN.1 specification complies with the syntax and semantics defined in CCITT Recommendation X.208 [1].

In order to establish the list a number of tools have been evaluated. The evaluation was based on the list of requirements given in clause 4.

The evaluation concerns the syntax and semantics checking capabilities of the tools. Other functions, such as code generation, have not been evaluated.

It is not the objective of this TCR-TR to identify a single tool to be used by all editors and by the ETSI secretariat.

Inclusion of a tool in the list of recommended tools does not imply any guarantee for other versions of the tool or for the quality of support supplied by the provider of the tool.

2 References

For the purposes of this TCR-TR, the following references apply:

[1] CCITT Recommendation X.208 (1988): "Specification of abstract syntax notation one (ASN.1)" (also published as ISO/IEC 8824:1990).

[2] CCITT Recommendation X.209 (1988): "Specification of basic encoding rules for abstract syntax notation one (ASN.1)" (also published as ISO/IEC 8825:1990).

[3] ETR 060 (1992): "Signalling Protocols and Switching (SPS); Guidelines for using Abstract Syntax Notation One (ASN.1) in telecommunication application protocols".

[4] ITU-T Recommendation Q.773 (1993): "Specifications of Signalling System No.7; Transaction Capabilities Application Part (TCAP); Transaction capabilities formats and encoding".

[5] ISO/IEC DIS 8824-1 (1992): "Information technology - Open Systems Interconnection - Abstract Syntax Notation One (ASN.1)".

[6] CCITT Recommendation X.219 (1988): "Remote operations: Model, notation and service definition".

3 Abbreviations

For the purposes of this TCR-TR, the following abbreviations apply:

ASN.1	Abstract Syntax Notation One
BER	Basic Encoding Rules (as defined in CCITT Recommendation X.209 [2])
ROSE	Remote Operation Service Element
SNMP	Simple Network Management Protocol
TCAP	Transaction Capabilities Application Part

4 Requirements

The tool shall accept any valid ASN.1 specification (CCITT Recommendation X.208 [1]), apart from the exceptions listed below. A transformation of the ASN.1 specification by the user of the tool shall not be required (e.g. addition of semicolon between assignments, sorting of type definitions, etc.).

The tool shall indicate if a rule defined in CCITT Recommendation X.208 [1] was violated by an ASN.1 specification.

Support of contained subtyping and inner subtyping is not required.

Support of the MACRO notation is not required, as long as the usage of the ERROR or OPERATION macro (as specified in CCITT Recommendations X.219 [6] and Q.773 [4]) are supported.

Any of the following notations for choice values will be admitted:

1) identifier value (standard notation)
2) {identifier value} ({}-notation)
3) identifier : value (:-notation)

Any of the following notations for "any" values will be admitted:

1) type value
2) {type value}
3) {type : value}

NOTE: The first option is according to CCITT Recommendation X.208 [1]. Since this notation is problematic for automatic parsers, the second option has been used by some tool developers. The third option is according to the notation as specified in ISO/IEC DIS 8824-1 [5].

5 Classification

In total 10 tools were tested. The test method is described in annex A. The resulting test reports and the requirements were used as the basis for classification. Minor discrepancies between the requirements and the test results have been ignored. These limitations can be found in the individual test report for the tool.

For two tools, ISODE and OSIkit, the test procedure was only partly executed. It became apparent in an early stage that the tools would not qualify as recommended tools, and therefore no detailed test report was written.

Two other tools were not tested. The provider of one of these, AsTool/T, considered that the tool would not qualify, and decided not to supply an evaluation copy. The other tool, TWICE, was not tested since the documentation made clear that it would not qualify.

The four tools that were not (fully) tested do feature in the list of tools. An indication is given of the reasons why they do not qualify as recommended tools.

NOTE 1: Both for the definition of the requirements and for the individual decisions whether a discrepancy could be considered of minor importance, the current practice of specification within SPS has been taken as a basis. These decisions may not be appropriate for different ways of specification. Notably the use of macros other than OPERATION and ERROR may cause some of the recommended tools to be of limited use. The test report lists all limitations that were found for each tool.

NOTE 2: Most of the tools do not have the checking of ASN.1 as their primary function. If such a tool is not included in the list of recommended tools, this does not imply that this tool is not suited for its primary task.

6 Contents of the test report

The test report for the recommended tools covers all items that are listed below. For the other tools, the item "practical aspects" is omitted.

- **General information**
  This information was supplied by the provider of the tool. It is not a result of the evaluation.

  NOTE 1: Since the ASN.1 specification is likely to change from the one given in CCITT Recommendation X.208 [1] to the one of ISO/IEC DIS 8824-1 [5] (the "1992" standard), it is indicated which of the features in this new standard are supported by the tool. These features were not tested, apart from the :-notation for choice values. Furthermore, it is indicated whether the provider plans to adapt the tool to the new standard.

- **Tested version**

- **Practical aspects**
  Some of the aspects that are of importance for the practical use of the tool are described here. This information has no influence on the classification of the tools, but it may influence the ease with which the tool may be used.

  - **Error reporting and recovery**
    Error messages that do not indicate the type of error or the location of the error in the specification can pose problems with its correction. This type of error often occurs if a syntactical construct is used that is not supported by the tool.
    Good error recovery will enable the user to find several errors in a module with one pass of the tool. This can be especially useful if the person who checks the specification is not the same as the one who is responsible for corrections, e.g. in the case where an editor uses the tool.

  - **Supported notation for choice and any values**
    If the tool supports another method to specify choice and any values than the one which is used in the specification that has to be tested, this means that the specification may have to be adapted.

  - **Restrictions on files**
    For some tool the name of the file which contains the specification has to fulfil certain requirements. Furthermore, some tools only allow one module per file.

  - **Import/export**
    Specifications often consist of several interdependent modules. In order to check such specifications, these modules will have to be organised according to the scheme that the used tool supports. This may involve putting all modules in separate files with specific file names and/or sorting the modules according to dependencies.
    In case there are circular dependencies between modules, it is not possible to fulfil the requirements that are placed on the organisation of the input by some of the tools.

- **Test results**
  For the recommended tools, a full report is given of all errors that where found. For the other tools, a list of the most serious limitations is given. In some cases, reference is made to examples which are given in annex B.

  If a limitation corresponds to usage of ASN.1 which is deprecated in ETR 060 [3] (and which, therefore, should not occur), this is indicated.

  NOTE 2: A concise overview of the test results for all tested tools can be found in annex C.

  NOTE 3: The number of items in the list of limitations is not significant. If a tool supports a certain feature, but there are some limitations in this support, this will cause more items to appear in the list than the case of not supporting the feature at all.

The test results are divided in two groups:

- **Unsupported ASN.1 features**
  These limitations will generally make it impossible to parse a specification in which such a feature occurs.

NOTE 4: There are some syntactical constructs that are very difficult to parse: the definition and use of macros and the (standard) value notation for choice and any types. None of the tools fully supports all of these items.

- **Limitations of error checking**
  These are mostly missing error messages for semantic errors. These limitations do not prohibit the parsing of a module. However, the usefulness of a tool decreases with the increasing number of errors that are not detected by it.

NOTE 5: CCITT Recommendation X.208 [1] specifies some error conditions which are very difficult to check. Examples of this are the requirement that the subtype notation shall not be used so as to produce a subtype with no values and the requirement that it should be possible to define values which have a finite representation for a recursive type.

7 Recommended tools

Using the method of classification described in clause 5, the tools that are listed in this clause have been classified as recommended tools. They are listed in alphabetical order.

7.1 CASN

7.1.1 General information

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Other relevant functions (apart from checking ASN.1 specifications):

- Generation of decoder and encoder code for the Basic Encoding Rules (BER).
  Target languages: C. Support for C++ will be available in 1994.
- Generation of interactive test functions.

Platform(s) on which the tool can be executed:

UNIX, VMS, MS-DOS.

Supported 1992 features:

The new CASN 2.01 syntax-checker (beta test version available) accepts the following "1992 notation" as specified in ISO/IEC DIS 8824-1 [5]:

- extended character string types;
- information object specification;
- constraint specification;
- parametrization of ASN.1 specifications.

Schedule for the implementation of the 1992 notation:

See above.