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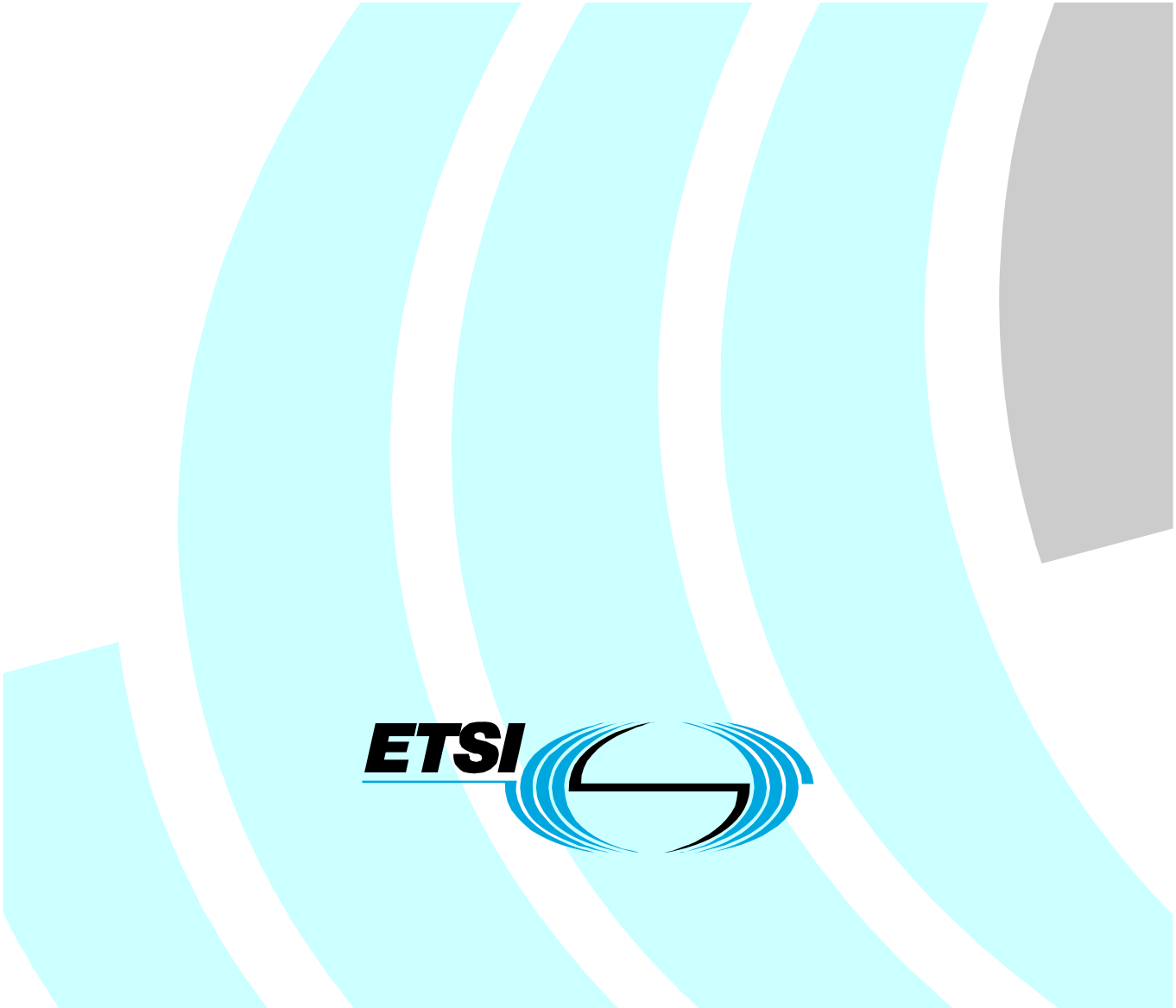
Technical Report

Methods for Testing and Specification (MTS); Recommendations for improvements to the ETSI Standards Engineering Process



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Foreword

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

1 Scope

The present document, "Recommendations for improvements to the ETSI standards engineering process" summarizes the results of an analysis of ETSI's development processes, makes comparisons with the processes of a representative group of other Standards Development Organizations (SDOs) and offers some recommendations on improvements that could be made to ETSI's standards engineering process. These recommendations have been formulated in the context of ETSI's growing role as a standardization "systems integrator" where it is involved the development of related standards within its own technical bodies as well as those of other SDOs.

2 References

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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Informative references

[1] ITU-T Recommendation I.130: "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[2] ETSI Technical Working Procedures, November 2006

[3] The ETSI Drafting Rules as contained in the ETSI Directives.

[4] 3GPP working procedures. October 2006.

[5] IEEE project 802: "LAN MAN Standard Committee (LMSC) policies and procedures".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

conformance: extent to which an implementation of a standard satisfies the requirements expressed in that standard

interoperability: end-to-end functionality between (at least) two communicating systems as required by the base standard(s) on which those systems are based

conformance requirement: elementary piece of a specification stating what an implementation shall or shall not do

feature: new or substantially enhanced functionality which represents value added to an existing system

validation: process by which an evaluation is made that a standard can be fully implemented, conforms to rules for standards and satisfies the requirements on which the standard is based

NOTE: In the context of the present document, validation refers only to the evaluation of standards. It does not include the evaluation of equipment to determine whether it correctly implements the requirements expressed in a particular standard.

3.2 Abbreviations

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

3GPP	Third Generation Partnership Project
ARIB	Association of Radio Industries and Businesses (Japan)
ATIS	Alliance for Telecommunications Industry Solutions
CCSA	China Communications Standards Association
CTI	Centre for Testing and Interoperability
DVB	Digital Video Broadcast
EN	European standards
IAB	Internet Architecture Board
IEEE	Institute of Electrical and Electronics Engineers
IESG	Internet Engineering Steering Group
IETF	Internet Engineering Task Force
IS	Internet Standard
ITU	International Telegraph Union
ITU-T	ITU Telecommunications standardization sector
LAN	Local Area Network
LMSC	LAN / MAN Standard Committee
MAN	Metropolitan Area Network
OCG	Operational Coordination Group
OMA	Open Mobile Alliance
RFC	Request For Comments
SA	Services system and Architecture
SDO	Standard Development Organization
TSAG	Telecommunication Standards Advisory Group
TTA	Telecommunications Technology Association (South Korea)
TTC	Telecommunications Technology Committee (Japan)
UN	United Nations

4 Introduction

The development of ICT standards has often involved close cooperation between working groups within a particular ETSI technical body and, to some extent, between technical bodies themselves. This is still true but, more and more, ETSI is turning to other Standards Development Organizations (SDOs) to provide input to its standardization projects. In some instances, this input is provided within the confines of a cooperative partnership but in others, ETSI is using external specifications without any direct control over the content. If not carefully managed, each of these multi-source development scenarios can cause problems in the ability of different implementations to interoperate. ETSI's standards engineering processes should ensure that such interoperability problems are at least minimized or, preferably, avoided altogether.

The present document offers a number of recommendations for modifications and extensions to the way that ETSI develops its standards so that the interoperability of implementations can be assured. These recommendations have been derived from an analysis of ETSI's existing processes and those of a representative set of other SDOs, capitalizing on their successes and learning from any obvious mistakes.

5 Executive summary of recommendations

The analysis of the standards engineering processes of a number of Standards Development Organizations (SDOs) has identified that ETSI's own process is very good in many aspects. However, lessons can be learnt from the other SDOs and there are a number of areas where changes in ETSI's process should result in improvements to the interoperability inherent in ETSI's standards. Clause 9 specifies a number of recommendations related to such changes and these are summarized here.

Recommendation 1:

ETSI's technical committees should use a hierarchical system for organizing and managing work items.

Recommendation 2:

If a hierarchical system for organizing work items is introduced to the ETSI standards engineering process (Recommendation 1), a coordinating editor should be appointed for each high-level work item with overall responsibility for the coordination of the content and schedule of the subordinate work items and deliverables.

Recommendation 3:

If the subject area of a new high-level work item does not fit clearly into the scope of a single existing technical committee, ETSI members should be encouraged to submit the work item request to OCG for approval and allocation of responsibilities.

Recommendation 4:

The ETSI Secretariat should investigate the provision of an easy-to-use project management software package that can be used for small projects as well as large ones.

Recommendation 5:

All technical committee support staff should be trained to be competent in project planning and management techniques and the associated software tools available in ETSI.

Recommendation 6:

The current set of fixed milestones associated with a work item should be extended to include significant stages within the drafting process.

Recommendation 7:

The ETSI Secretariat should investigate how the existing Work Programme Management application could be used to monitor the progress of work items upon which ETSI projects depend but which are developed in external SDOs.

Recommendation 8:

All technical committees should be encouraged to use a top-down and phased approach to the development of standards (particularly protocol specifications).

Recommendation 9:

All technical committees should identify for each work item, a method that will be used for validation purposes.

Recommendation 10:

ETSI should ensure that the use of the TC-MTS validation techniques and guidelines is promoted to all technical committees.

Recommendation 11:

"Specification Validated" should be included in the fixed set of WPM milestones.

Recommendation 12:

All technical committees should be encouraged to incorporate Plugtest events into their standards validation processes, where appropriate.

Recommendation 13:

The ETSI Board should require all technical committees to identify a method of change management which is appropriate to the nature of the specifications they produce.

Recommendation 14:

The ETSI Secretariat should investigate the provision of an easy-to-use, web-based change request and management system and train all TB support staff in its application and use.

Recommendation 15:

OCG and The ETSI Board should commission the production of a "Managing Standards Engineering" handbook to provide guidance and direction on all aspects ETSI's standards engineering process.

6 Standards engineering process elements

Before undertaking an analysis of the development processes which exist within ETSI and other SDOs, a checklist was compiled of procedural elements which are fundamental for any standards engineering process spanning more than one development body. These are the elements which should exist either explicitly or implicitly in all such processes if they are to be successful and include:

- A means of initiating new work items, ensuring that they are:
  - within the scope of the initiating standards body;
  - supported by members willing to take an active role in development;
  - technically feasible;
  - aligned with the strategic objectives of the parent SDO.
- A means of distributing elements of new work to multiple development bodies, including:
  - other work groups;
  - other technical committees;
  - other SDOs.

- A means of coordinating work distributed across multiple development bodies ensuring that:
  - progress is accurately reported and managed;
  - compliance with technical and user requirements is maintained;
  - duplication of effort is avoided;
  - cross referencing is consistent across specifications from different sources;
  - the bodies involved in the development have procedures defined for liaising and coordinating with each other;
  - the resultant set of documents is coherent, well-structured, easy-to-use and easy-to-read;
  - where multiple releases are envisaged, the basic content, scheduling and responsibilities are planned in advance.
- Document drafting methods and facilities which:
  - allow document drafts to be developed and distributed;
  - facilitate the submission, review and consolidation of contributions form any appropriate source;
  - encourage the use of good standards engineering practices.
- Procedures for validating completed standards and sets of standards. Validation methods could include:
  - independent peer review of specifications;
  - modelling and simulation;
  - evaluation of prototypes or early implementations;
  - development of test specifications:
    - conformance;
    - interoperability.
- A means of controlling changes to approved standards which provides:
  - facilities for reporting errors discovered by users;
  - facilities for requesting enhancements;
  - visibility of the status of a requested change.

7 Working procedures in SDOs outside ETSI

7.1 Selection of a representative set of SDOs

In order to evaluate the effectiveness of ETSI's current standards engineering process, it was necessary to review similar processes in other SDOs and fora. It would have been impractical to consider every other such organization and so a representative set of SDOs and fora were selected, as follows:

- 3rd Generation Partnership Project (3GPP):
  - a standardization body in which ETSI is a partner and that has similar processes to those within ETSI.
- Internet Engineering Task Force (IETF):
  - a large, open, international community of network designers, operators, vendors, and researchers developing specifications for Internet architecture and operation.

- International Telecommunications Union - Telecom Standardization (ITU-T):
  - a long established global SDO covering all aspects of non-radio telecommunications.
- Open Mobile Alliance (OMA):
  - an industry forum dedicated to ensuring interoperability of mobile services.
- Institute of Electrical and Electronic Engineers LAN/MAN Standards Committee (IEEE 802):
  - a successful and respected sub-branch of the professional engineers association, IEEE.
- Digital Video Broadcasting project (DVB):
  - a small industry forum involved solely in the development of global standards for digital television and associated data services.

7.2 3GPP

7.2.1 Organization

3GPP was created in 1998 as a partnership project between ARIB (Japan) CCSA (China), ETSI (Europe), ATIS (US), TTA (Korea) and TTC (Japan) to produce globally applicable Technical Specifications and Technical Reports for a 3rd Generation Mobile System based on evolved GSM core networks and the radio access technologies. Its member organizations represent the whole of the public mobile communications industry.

The members of 3GPP are organizations (mainly operators and manufacturers) rather than individuals. Standards are developed within a technical group and sub-group structure with overall coordination provided by a single, central body.

7.2.2 Analysis of the 3GPP standards engineering process

The 3GPP standards engineering process has been reviewed against the checklist of required elements identified in clause 5 with the following results:

- A means of initiating new work items:
  - a formal method exists which is similar to that already used by ETSI;
  - support is required from several members;
  - requests are approved at the appropriate organizational level;
  - work items are generally requested on a "top-down" basis where a single, topic-related work item request can be raised and this subsequently spawns further lower-level work items. These either relate to individual documents or result in further work items themselves.
- A means of distributing elements of new work to multiple development bodies:
  - responsibility for the lower-level work items which are the result of a high-level work item can be spread across more than one technical group or sub-group.
- A means of coordinating work distributed across multiple development bodies:
  - overall responsibility for a set of distributed work items remains with a single technical group within 3GPP;
  - any essential specification published by other SDOs is included in a 3GPP document by simple reference. As a general rule, neither endorsement nor profiling is used;
  - a list is maintained on the 3GPP web site indicating the status of external specifications (primarily IETF RFCs) upon which 3GPP is dependent;

  - parallel release development is facilitated by permanent support staff providing comprehensive and effective project tracking and management using software tools;
  - the contents of current and future development releases are not "fixed" and published prior to the start of development although a comprehensive development plan is maintained on 3GPP's web site.

- Document drafting methods and facilities:
  - drafting methods and facilities are identical to those available to ETSI committees;
  - services and protocols are specified strictly in accordance with the 3-stage process defined for ISDN in ITU-T Recommendation I.130 [1].

- Procedures for validating completed standards and sets of standards:
  - no formal process for validating specifications;
  - conformance test specifications are produced for services at the air interface;
  - validation of network elements occurs during early implementations by members.

- A means of controlling changes to approved standards:
  - well-defined, well-managed and formal change control system for all documents once approved by the responsible technical group.

7.2.3 3GPP summary

3GPP's standards engineering process is well defined and strictly adhered to. The important aspects which are worth noting are:

- Work items can be, and generally are, raised for high-level subjects which result in a number of lower-level items. As a result, there is a natural tendency towards at least an informal coordination and control of the development of the resultant documents.
- The strict use of the 3-Stage process in the specification of services (features) means that user requirements and information flows are understood before any protocols are specified. This can have a significant positive impact on the ultimate interoperability of product implementing the protocol standards.
- 3GPP have strong technical coordination and project management processes which ensure current progress and release contents are well-known.
- Release contents are only documented after a release has been made. However, the content of the release under development is carefully managed in a project plan on 3GPP's web site. This approach has the benefit of flexibility (contents can be changed rapidly if situations require it) but encourages time-based rather than content-based release planning.
- The change control process implemented by 3GPP works well in their particular environment. However, its strict and "heavy" nature could act as a deterrent in other environments.

7.3 IETF

7.3.1 Organization

The Internet Engineering Task Force (IETF) was established in 1983 as an open international body specifying Internet protocols. Although it does not have the status of a formal international standards body, it has enjoyed great success in publishing protocol specifications which are known, implemented and used on a truly global scale.

The members of the IETF are individuals rather than organizations and include network designers, researchers and engineers from both operators and equipment manufacturers. IETF working groups are grouped into Areas managed by Area Directors who are automatically members of the Internet Engineering Steering Group.

7.3.2 Analysis of the IETF standards engineering process

The IETF standards engineering process has been reviewed against the checklist of required elements identified in clause 6 with the following results:

- A means of initiating new work items:
  - new work items are initiated by an Area Director accepting a draft submitted by a member (or group of members) into the work plan;
  - IETF has no mechanism for members, as a body, to select new work items.
- A means of distributing elements of new work to multiple development bodies:
  - each draft is considered to be a single work item and it is the author who decides which Area it is submitted to. Consequently, in those cases where a particular work item requires multiple specifications, distribution to more than one Area, if necessary, is handled by the author(s).
- A means of coordinating work distributed across multiple development bodies:
  - the Internet Engineering Steering Group (IESG) and Internet Architecture Board (IAB) are responsible for the overall coordination of the work of the IETF;
  - Area Directors and Area Working Groups are responsible for coordinating related drafts within their own technical areas.
- Document drafting methods and facilities:
  - IETF provides authors with a template for new draft standards and guidance on the use of English, particularly modal verbs;
  - authors are encouraged to write drafts in simple text which means that diagrams and tables should be constructed from textual characters;
  - there is little control of the consistency and quality of draft documents as they progress through the Request For Comment (RFC) stages;
  - a defined process exists for progressing a Proposed Standard through to an Internet Standard.
- Procedures for validating completed standards and sets of standards:
  - draft text is reviewed extensively within IETF Area Working Groups prior to publication;
  - members are encouraged to implement specified protocols, test interoperability with other implementations and to feed back results to the standardization process;
  - publication of Draft Standards and Internet Standards depends on successful proofs of interoperability between different implementations.
- A means of controlling changes to approved standards:
  - IETF has no formal change control mechanisms;
  - revised specifications at the RFC stage are given completely new document numbers so it can be difficult to find the latest edition of a particular protocol specification
  - a new version of an established Internet Standard should progress through the full Internet standardization process as if it were a completely new specification. Once the new version has reached the Standard level, it will usually replace the previous version, which will be moved to Historic status;
  - in some cases both versions may remain as Internet Standards to honour the requirements of an installed base.

7.3.3 IETF summary

The IETF standards engineering process is reasonably well defined and quite strictly controlled by the Area Directors and the IESG. It is worth noting the following important aspects:

- although well defined and controlled, the IETF standards process is not supported by formal tools and adherence to the process is essentially voluntary;
- the process is contribution-driven with the Area Directors having a veto so most standards development has some level of implicit commercial justification;
- the quality of RFCs is variable. Some are well-constructed and easy to understand, others are less so;
- as a result of the informality and openness of the IETF, draft specifications can reach the RFC stage very quickly but the requirement for multiple interoperating implementations means that there is an extended period between the Proposed Standard stage and publication of the corresponding Internet Standard (IS);
- the time taken to publish an IS has resulted in the RFCs becoming de facto standards but without the strict controls that exist for ISs;
- the openness of the IETF and the ease with which a new work item can be introduced to the work programme has lead to the existence of competing, and in some cases contradictory, draft standards progressing through the process.

7.4 Open Mobile Alliance (OMA)

7.4.1 Organization

The mission of the Open Mobile Alliance is to facilitate global user adoption of mobile data services by specifying market driven mobile service enablers that ensure service interoperability across devices, geographies, service providers, operators, and networks, while allowing businesses to compete through innovation and differentiation.

The members of OMA are organizations rather than individuals and include mobile network operators, equipment manufacturers, service providers and software developers. Standards are developed within a technical group and sub-group structure with overall coordination provided by a single, central body.

7.4.2 Analysis of the OMA standards engineering process

The OMA standards engineering process has been reviewed against the checklist of required elements identified in clause 5 with the following results:

- A means of initiating new work items:
  - new work items relate to whole releases rather than individual documents;
  - a well-defined process exists for both members and non-members to raise new work-items which need the support of at least 4 members before being accepted into the OMA work programme.
- A means of distributing elements of new work to multiple development bodies:
  - work items are distributed by the central coordinating body (Technical Plenary) to appropriate working groups after analysis of the work item contents.
- A means of coordinating work distributed across multiple development bodies:
  - a Work Group is responsible for the coordination of related developments within its sub groups;
  - the Technical Plenary is responsible for the coordination of related developments across multiple Work Groups;
  - the Technical Plenary can establish temporary ad hoc groups to assist in managing developments spread across multiple groups.

- Document drafting methods and facilities:
  - process follows three-stages similar to those described in ITU-T Recommendation I.130 [1] although stages are referred to as Requirements Document, Architecture Document and enabler package;
  - responsibility for coordination and consistency within the documents is assigned to a single working group for the lifetime of the work item.
- Procedures for validating completed standards and sets of standards:
  - each detailed specification is required to include a set of conformance requirements which identify all mandatory and optional functions to be supported by an implementation;
  - specifications are sent out for review by the whole OMA membership;
  - if required, test specifications are developed and these act as a means of validating the base specifications;
  - OMA also initiates actual interoperability testing of implementations as part of the standard validation process.
- A means of controlling changes to approved standards:
  - feedback from validation activities is strictly managed using a well defined, formal change control procedure;
  - the same process is used to manage change requests for published specifications.

7.4.3 OMA summary

OMA's standards engineering process is well defined and strictly adhered to. The important aspects which are worth noting are:

- Work item initiation follows a "top-down" process.
- The strict use of a 3-Stage process in the specification of features means that user requirements and architectural issues are understood before any protocols are specified. This can have a significant positive impact on the ultimate interoperability of product implementing the protocol standards.
- The inclusion of conformance requirements in feature specifications ensures that implementers and test developers have a clear idea of how to conform to the specification.
- The change control process implemented by OMA enables both members and non-members to input requests for changes to approved specifications.

7.5 IEEE

7.5.1 Organization

The Institute of Electrical and Electronic Engineers (IEEE) was established in 1963 with the merger of the American Institute of Electrical Engineers and the Institute of Radio Engineers. Although its fundamental role is that of a professional association representing the engineers who are its members, the IEEE is also a producer of standards in areas as diverse as avionics, information technology and power electronics.

IEEE standards are developed by specialist committees managed by a complex hierarchy of higher bodies responsible for defining and assuring standards policy and process.

7.5.2 Analysis of the IEEE standards engineering process

The IEEE standards engineering process has been reviewed against the checklist of required elements identified in clause 5 with the following results:

- A means of initiating new work items:
  - new work items relate to whole projects rather than individual documents;
  - strong documentary process which ensures that new work items are reviewed against criteria of:
    - broad market potential;
    - compatibility with existing projects and standards;
    - uniqueness within the IEEE work programme;
    - technical feasibility;
    - economic feasibility.
- A means of distributing elements of new work to multiple development bodies:
  - work items are distributed by the central body (IEEE SA Standards Board) to appropriate standards development committees after analysis of the work item contents.
- A means of coordinating work distributed across multiple development bodies:
  - standards coordination committees manage standardization projects across multiple standards development committees;
  - the Standards Review Board is responsible for ensuring that standards development projects maintain consensus, due process, openness and balance;
  - the Standards Board is responsible for the review and final approval of all draft standards.
- Document drafting methods and facilities:
  - IEEE provides rapporteurs with a comprehensive on-line package of templates and standards-writing manuals;
  - responsibility for technical consistency within a single standard is assigned to an appropriate committee member;
  - responsibility for coordination and consistency within a multiple-standard project is assigned to a single IEEE staff member.
- Procedures for validating completed standards and sets of standards:
  - standards coordination committees are responsible for arranging peer reviews of draft standards prior to them entering the approval process;
  - validation of standards is assumed to be by implementation.
- A means of controlling changes to approved standards:
  - the process for initiating new work items is also used for requesting and approving amendments to published standards;
  - all standards have a lifetime of only five years after which they must be reviewed and revised or reaffirmed.

7.5.3 IEEE summary

IEEE's standards engineering process is a well-defined and closely controlled process. The important aspects which are worth noting are:

- standards development process is well documented and supported by extensive on-line material;
- the process is designed to accommodate multi-standard projects distributed across multiple committees;
- the development of communications standards is not required to follow a *requirements/architecture/protocol* process;
- the specification of interoperability and/or conformance test suites is not part of the standards development process;
- the complex hierarchy of management, approval and auditing committees assures consensus, due process, openness and balance in the development of standards but has the adverse effect of extending the development cycle.

7.6 DVB

7.6.1 Organization

The Digital Video Broadcasting consortium (DVB) was established in 1992 with the support of the European Commission. Its member organizations include broadcasters, manufacturers, network operators, software developers, regulatory bodies and others committed to designing global standards for the global delivery of digital television and data services.

DVB standards are developed by technical committees that are set up on an "as required" basis and exist only while the standards in their specialist area are being developed. Coordination is provided by a single central body (the Steering Board) which reports directly to the DVB General Assembly.

7.6.2 Analysis of the DVB standards engineering process

The DVB standards engineering process has been reviewed against the checklist of required elements identified in clause 5 with the following results:

- A means of initiating new work items:
  - new work items relate to whole projects rather than individual documents;
  - unlike most other SDOs, DVB processes its new work item requests within a commercial structure (the Commercial Module) which operates in parallel to the technical committees and considers commercial viability before accepting a proposal into the work programme;
  - commercial requirements must be specified and approved before development of the corresponding technical specification can begin.
- A means of distributing elements of new work to multiple development bodies:
  - commercial requirements are specified within one of the specialist commercial committees;
  - technical requirements are specified within one or more of the specialist technical committees;
  - new commercial or technical committees are established if new work items do not fit directly into an existing specialist committees.
- A means of coordinating work distributed across multiple development bodies:
  - a standards coordination committee (the Technical Module) manages standardization projects across multiple standards development committees;
  - the Steering Board is responsible for the review and final approval of all draft standards.

- Document drafting methods and facilities:
  - no strict rules for editing document;
  - all specifications, once approved by the Technical Module, the Commercial Module and the Steering Board, are submitted to ETSI for publication. Consequently, ETSI's drafting rules are followed by DVB standards writers.
- Procedures for validating completed standards and sets of standards:
  - there are no defined methods for validating DVB standards;
  - validation of standards is assumed to be by implementation;
  - DVB does not specify either interoperability or conformance test specifications.
- A means of controlling changes to approved standards:
  - no change control mechanism is implemented or recommended by DVB.

7.6.3 DVB summary

DVB's standards engineering process is simple and quite informal. The important aspects of it which are worth noting are:

- the acceptance of a new work project into the DVB work programme is based largely on commercial criteria;
- strong technical coordination is provided by the Technical Module which is attended by all DVB member organizations;
- DVB lacks formal processes for drafting, validation and change management but benefits from having its standards published by ETSI.

7.7 ITU-T

7.7.1 Organization

The International Telegraph Union (ITU) is a United Nations (UN) agency whose official members are 191 UN Member States. There also almost 800 other members from industry and academia. Within the ITU Telecommunications Standardization Sector (ITU-T) there are 13 Study Groups with a central coordination body, the Telecommunication Standards Advisory Group (TSAG).

ITU-T publishes Recommendations rather than standards and these are developed within the Working Parties of the Study Groups.

7.7.2 Analysis of the ITU-T standards engineering process

The ITU-T standards engineering process has been reviewed against the checklist of required elements identified in clause 5 with the following results:

- A means of initiating new work items:
  - ITU-T develops and publishes Recommendations rather than full international standards;
  - general areas of work are identified within a series of "Questions" which are approved centrally;
  - new draft Recommendations are created by the responsible Study Group (or one of its Working Parties) within the work area of one of its Questions.

- A means of distributing elements of new work to multiple development bodies:
  - general work areas are assigned by TSAG to Study Groups;
  - Study Groups are responsible for distributing Questions to its Working Parties and, if required, to other Study Groups.
- A means of coordinating work distributed across multiple development bodies:
  - either TSAG or an individual Study Group can propose the establishment of a Joint Coordination Group to coordinate work distributed across multiple Study Groups;
  - Joint Coordination Groups can be used to coordinate development projects involving other SDOs;
  - Focus Groups can be established as forum-like bodies to act as catalysts for new technological areas of study. Membership can be drawn from multiple Study Groups as well as from non-ITU member organizations.
- Document drafting methods and facilities:
  - ITU-T provide considerable guidance to standards writers in both paper and electronic format;
  - draft recommendations are prepared by contributing authors whose inputs are consolidated by the document editor;
  - overall coordination of related documents is provided by the relevant Question Rapporteur;
  - the ITU-T Secretariat does not provide any technical support to authors, editors and rapporteurs.
- Procedures for validating completed standards and sets of standards:
  - although some conformance test specifications are written for ITU-T protocol recommendations, this does not happen as a matter of course;
  - generally, the only validation is by peer review within the home Question, Working Party or Study Group.
- A means of controlling changes to approved standards:
  - ITU-T has no formalized change management system;
  - changes are proposed, evaluated and accepted or rejected as contributions to meetings.

7.7.3 ITU-T summary

The standards engineering process within ITU-T is reasonably straightforward and is very well defined and documented. Aspects of the process which are worth noting are:

- although the method of raising new work items is quite informal, the hierarchical approach provides a good framework for identifying sets of related documents;
- possibly as a result of its status within the UN, ITU-T is willing to work closely with other SDOs in developing recommendations related to a broad subject area;
- The Focus Group concept encourages multilateral study of new areas of interest;
- the facilities and structures for coordinating the development of document sets exist within ITU-T and handle projects which span multiple Study Groups as well as those which span multiple SDOs;
- there are only limited facilities for validating recommendations before they are published.

8 Working procedures inside ETSI

8.1 Organization

The European Telecommunications Standards Institute is an international body with responsibility for the development and publication of ICT standards within Europe. It is supported by the European Union and the European Free Trade Association and draws its membership from organizations in all areas of the telecommunications industry around the world.

ETSI's constitution allows it to publish European standards (ENs) directly and these can be used by the European Commission as the basis for regulation. It also produces voluntary standards, technical specifications, guides and technical reports. The work programme within ETSI is distributed across a number of technical committees that are managed and coordinated by a single central body (the Operational Coordination Group - OCG) which reports directly to the ETSI Board.

8.2 Analysis of the ETSI standards engineering process

ETSI's standards engineering process has been reviewed against the checklist of required elements identified in clause 5 with the following results:

- A means of initiating new work items:
  - a well documented procedure exists for processing requests for the introduction of new items to ETSI's work programme;
  - new work items are generally raised on a per-document basis;
  - active support is required from at least 4 members before a new work item can be introduced to ETSI's work programme;
  - a request for a new work item is submitted to a single technical committee.
  - when initiating the development of communications standards, technical committees do not, as a matter of course, insist upon a systematic process of requirements analysis, architectural design and detailed design.
- A means of distributing elements of new work to multiple development bodies:
  - there is no defined process for distributing associated work items across multiple technical committees;
  - in those cases where a body of work is distributed across more than one technical committee, this is handled on an ad hoc basis;
  - ETSI has established a number of cooperation agreements with external standardization bodies but most of these relate to the sharing of information rather than multilateral standards development;
  - Industry Specification Groups can be established to study new technologies where interest comes from outside ETSI as well as inside. Such groups are not associated with any specific ETSI Technical Body and can act as catalysts for new areas of standardization as well as means of distributing and coordinating work responsibilities across both ETSI and non-ETSI bodies.
- A means of coordinating work distributed across multiple development bodies:
  - ETSI has the concept of a "Starter Group" which can be established by the Board as a focussed technical committee where representatives of all interested committees can join together to facilitate and coordinate the development of a new technology that spans the interests of a number of groups. Starter Groups are considered to be transient and are closed when either the body of work has been satisfactorily distributed to existing committees or when the Starter Group transmutes into a more permanent technical committee itself;
  - a set of standard milestones is defined for each work item but these are oriented toward ETSI's role as a publisher of standards rather than a developer;

  - there is no central project management resource within ETSI. Each technical committee is responsible for the planning and management of its own work items.

- Document drafting methods and facilities:
  - ETSI has a well-defined drafting method with extensive Secretariat support:
    - The "ETSI drafting rules" [3] are available on-line and as a web-navigator tool;
    - skeleton documents and Microsoft Word stylesheets freely available for download;
    - editors (***editHelp!***) to check internal consistency (use of references, abbreviations and definitions) and compliance with drafting rules and stylesheets prior to publication;
    - ETSI provides authors with a template for new draft standards and guidance on the use of English, particularly modal verbs;
  - Technical Committee TC-MTS has a responsibility for providing guidance on developing standards of high technical quality:
    - use of formal languages such as SDL and ASN.1;
    - use of document styleguides;
    - the *Making Better Standards* web site acts as an on-line portal to the whole range of guidance documentation;
  - standards that require special skills and knowledge or that need to be publish within a timeframe which would be difficult to achieve using voluntary effort can be developed within a Specialist Task Force (STF) of paid experts;
  - the Centre for Testing and Interoperability (CTI) exists within the ETSI Secretariat to provide technical committees and individual rapporteurs with advice and assistance in developing, as its name implies, protocol standards and test specifications.
- Procedures for validating completed standards and sets of standards:
  - there is no systematic process within ETSI for validating standards;
  - conformance test specifications are developed for most protocol standards and this activity provides a measure of validation;
  - interoperability test specifications are developed for a growing number of protocol standards and these can provide an additional level of validation;
  - approval of a standard does not depend on a demonstration that any implementation is likely to perform as expected;
  - ETSI's Plugtest service exists to facilitate informal interoperability testing events. Such events, if integrated into the standards engineering process, can provide comprehensive validation of standards.
- A means of controlling changes to approved standards:
  - there is no central change management tool available within ETSI. Each technical committee is responsible for the method and means of controlling of changes to its own documents.

8.3 ETSI summary

ETSI's standards engineering process is very well designed although adherence to some parts of it varies from committee to committee. The important aspects which are worth noting are:

- new items can only be entered into ETSI's work programme with the active support of members;
- although it has a work item management system which permits a work item to relate to a broad subject area or project, the culture throughout ETSI is to raise work items only for documents;

- the distribution and management of sets of work items happens on an ad hoc basis usually at the discretion of committee officers. This is often very effective but is not consistent from committee to committee;
- management milestones defined for every work item are oriented towards the publication cycle rather than the development cycle;
- although not perfect, ETSI's drafting methods and support facilities are probably better than those in most of the other SDO's analysed:
  - ETSI has a rigorous semi-automatic system for assuring the quality of a standard prior to publication. However, this system only considers the cosmetic quality and not the technical quality of standards;
  - TC-MTS and the CTI provide considerable guidance and assistance to rapporteurs but the use of these facilities is entirely voluntary;
  - using the STF system, most test specifications are developed by highly skilled testing experts. However, such activities are not well integrated with the standards development process and there is only limited feedback of information that could be used to improve the quality of the base standards;
- except in the case of test specifications produced by an STF, ETSI does not insist on proof of validation prior to the publication of a standard;
- the ETSI Plugtest service is a useful resource for validating specifications from ETSI and from other SDOs. However, greater integration with the standards development process would make it even more effective;
- processes for managing changes to approved documents (collecting change requests and controlling changes to the documents) exist within some, but not all, technical committees. Where it exists, the change management infrastructure is not consistent across committees.

9 Recommendations

9.1 The current situation

The analysis of ETSI's standards engineering process alongside those of other standards development bodies shows that in many areas ETSI is, in fact, as good as, if not better, than most of these others. However, there are a number of improvements to the process that could either directly or indirectly increase the level of interoperability possible between implementations of ETSI's standards. Although it is clear that the use of more formal drafting methods and stricter validation of specifications will have a direct impact on interoperability, it is not so obvious that having a well-managed development process can also have a positive impact on interoperability, albeit indirectly.

The following clauses offer a range of recommendations for changes to the ETSI standards engineering process which will help to improve the overall interoperability associated with ETSI's published specifications.

9.2 Raising new work items

9.2.1 Initiating work items

Many of the standards development bodies included in the analysis use a hierarchical method for introducing new items into their work programmes. In this way, work items that relate to a broad subject area or even a new feature can be raised without the strict requirement for a documentary deliverable to be associated with it. Subsequently, as the result of further analysis and discussion, lower-level work items can be raised within the original. These may relate to specific deliverables but may also be used to sub-divide the higher-level work item further into more manageable segments. This process of subdivision continues until the full document set related to the top-level work item has been identified. This approach encourages a top-down method of work and also provides a natural inclination towards the coordination and management of related deliverables.

An example of this structured approach to work item management is shown in figure 1. This shows how a sample of the deliverables associated with the TC-MTS IPv6 Testing project could have been defined within a hierarchical arrangement of work items.

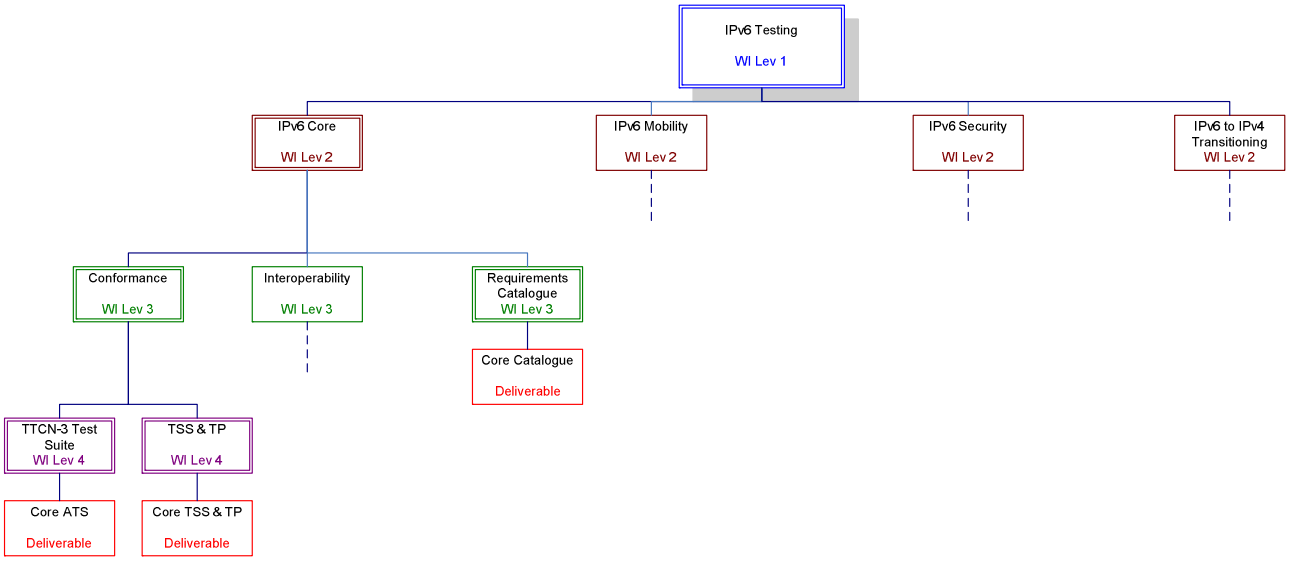

Figure 1: Example of a work item structure

Traditionally, each new ETSI work item has been directly related to a specific output document. Although the ETSI work programme management system allows hierarchical work items to be raised, this facility is rarely, if ever, used by technical committees. As a result, the opportunities for incorporating a top-down approach to the work programme and for coordinating and controlling sets of specifications is often missed.

Recommendation 1:
ETSI's technical committees should use a hierarchical system for organizing and managing work items.

As is the case within ETSI, both 3GPP and IEEE assign a volunteer member as rapporteur (Technical Editor in IEEE) for each work item that results in a specific deliverable. However, these two organizations also assign a staff member to each high-level work item to act as a coordinating editor for the set of subordinate items. This, too, helps to facilitate the coordination and control of the low-level items as well assuring the consistency of the contents of the resultant deliverables.

Recommendation 2:
If a hierarchical system for organizing work items is introduced to the ETSI standards engineering process (Recommendation 1), a coordinating editor should be appointed for each high-level work item with overall responsibility for the coordination of the content and schedule of the subordinate work items and deliverables.

9.2.2 Distribution of Work Items across multiple bodies

Within ETSI, work item requests are generally submitted to individual technical committees for approval and adoption into their work plans. As a result of this and the natural boundaries that exist between technical committees, the responsibility for the constituent parts of a set of specifications is not always disturbed optimally. Other organizations such as OMA and IEEE permit new work item requests to be submitted to and processed by a central coordination body. This ensures that an appropriate cross-committee management infrastructure is established and that responsibility for the development of individual specifications is allocated to the technical committee that has the right mix of:

- skills and experience;
- availability; and
- enthusiasm for the task.

Recommendation 3:
If the subject area of a new high-level work item does not fit clearly into the scope of a single existing technical committee, ETSI members should be encouraged to submit the work item request to OCG for approval and allocation of responsibilities.

9.3 Management of work distributed across multiple development bodies

Project planning and management are not widespread within ETSI's technical committees. Where it is used, its formality and depth ranges from a hand-drawn bar-chart on a single sheet of A4 up to complete project plans implemented in a software planning tool. Even in committees where there is a willingness to implement some form of project management, the fact that there is no easy-to-use planning tool available to technical committees and the lack of project planning and management skills within the Secretariat make it difficult for all but the most dedicated committees to implement.

Recommendation 4:
The ETSI Secretariat should investigate the provision of an easy-to-use project management software package that can be used for small projects as well as large ones.

Recommendation 5:
All technical committee support staff should be trained to be competent in project planning and management techniques and the associated software tools available in ETSI.

Although a standard set of management milestones is maintained for each active item in the ETSI work programme, the purpose of these is primarily to measure the progress of a document towards publication. There are no milestones defined between "Scope and Table of Contents" and "Draft available for Approval". The management of work item deliverables through their development stages would be simpler if more milestones were defined.

Recommendation 6:
The current set of fixed milestones associated with a work item should be extended to include significant stages within the drafting process.

As ETSI's dependence on external specifications increases, it will need to monitor the progress of work items in other SDOs. This will require the use of the existing Work Programme Management database to be extended to include work items from outside ETSI. It will also require that facilities are implemented to monitor the development progress of such external items.

Recommendation 7:
The ETSI Secretariat should investigate how the existing Work Programme Management application could be used to monitor the progress of work items upon which ETSI projects depend but which are developed external SDOs.

9.4 Drafting work item deliverables

One of the fundamental requirements for ensuring that implementations of standards will interoperate is that standard specifications should follow a phased, top-down design process which:

- identifies user requirements;
- defines a functional architecture for realizing these requirements; and
- specifies the detailed implementation design.

Many of the other standards bodies included in the analysis still use the 3 Stages specified in ITU-T Recommendation I.130 [1]. Indeed, during the development of ISDN and GSM standards, this recommendation was the basis for the specification of all service and protocol standards. However, for reasons which it is difficult to determine, this approach is no longer followed by all technical committees.

Recommendation 8:
All technical committees should be encouraged to use a top-down and phased approach to the development of standards (particularly protocol specifications).

9.5 Validation of draft standards

Even a specification that has been developed using the most rigorous design methodology will benefit from a validation cycle to provide final assurance that it meets the agreed operational requirements. There is a wide range of validation methods available and these include:

- expert walk-through of the standards (peer review);
- experimentation with prototypes or other early implementations;
- interoperability proofing activities such as ETSI Plugtest events and use of testbed facilities;
- development of associated test suites (of all kinds).

The validation method(s) chosen in any particular case would depend on the availability of appropriate resources and the ambitions of the responsible technical committee.

TC-MTS has produced guidelines on the use of a number of validation methods and members of the Centre for Testing and Interoperability (CTI) within the Secretariat are skilled in the application of such methods.

Recommendation 9:
All technical committees should identify for each work item a method that will be used to validate the resultant standard.

Recommendation 10:
ETSI should ensure that the use of the TC-MTS validation techniques and guidelines is promoted to all technical committees.

Recommendation 11:
"Specification Validated" should be included in the fixed set of WPM milestones.

Although many of the events organized each year by the ETSI Plugtest service are related to work that is going on within ETSI's technical committees, its calendar of events is not driven by the ETSI Work Programme. Consequently, the validation benefits that could be achieved by a systematic process of multi-lateral testing is not being realized.

Recommendation 12:
All technical committees should be encouraged to incorporate Plugtest events into their standards validation processes, where applicable.

9.6 Change control mechanisms

Once a document has been approved it is easy to destabilize its contents by allowing unregulated and gratuitous changes to be made to it. To avoid this, it is important that changes to such documents are managed using a well-defined process which facilitates the collection, evaluation and classification of change requests and the controlled incorporation of changes into the document. A number of technical committees already use change management systems for their documents but the methods and tools used are selected and developed on a committee-by-committee basis. The range of standardization projects undertaken by ETSI is very broad and different types of project may require different approaches to change management. It would be unreasonable, for instance, for a relatively small project to use a manual system which is not based on the use of software tools.

Recommendation 13:
The ETSI Board should require all technical committees to identify a method of change management which is appropriate to the nature of the specifications they produce.

Recommendation 14:
The ETSI Secretariat should investigate the provision of an easy-to-use, web-based change request and management system and train all TB support staff in its application and use.

9.7 Additional recommendations

If significant improvements are to be achieved in assuring interoperability through changes to ETSI's standards engineering process, it will be important for all rapporteurs, technical committee officers and Secretariat staff to be working together according the same underlying principles of development and management. Although the *Making Better Standards* web site can provide useful advice in these areas, this advice is very generic and relates primarily to the drafting of standards rather than the overall management of the process. Without clear guidance on the management of the standards engineering process, any benefits gained by implementing the recommendations specified above will be short-lived.

Recommendation 15:
OCG and The ETSI Board should commission the production of a "Managing Standards Engineering" handbook to provide guidance and direction on all aspects ETSI's standards engineering process.

Annex A: Bibliography

The following documents were reviewed as part of the analysis of working procedures within ETSI and the other SDOs. They provide a detailed background to the summary analysis presented in the present document.

- ETSI EG 202 237: "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); Generic approach to interoperability testing".
- ETSI ETR 184: "Methods for Testing and Specification (MTS); Overview of validation techniques for European Telecommunication Standards (ETSs) containing SDL".
- ESTI EG 201 015: "Methods for Testing and Specification (MTS); Specification of protocols and services; Validation methodology for standards using Specification and Description Language (SDL); Handbook".
- ETSI EG 202 107: "Methods for Testing and Specification (MTS); Planning for validation and testing in the standards-making process.
- OMA-ORG-Process-V1_3-20060529-A: "OMA Organization and Process".
- ITU-T Recommendation A.1: "Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T)".
- IETF RFC 1796: "Not All RFCs are Standards".
- IETF RFC 1818: "Best Current Practices" J. Postel, T. Li and Y. Rekhter.
- IETF RFC 2026: "The internet Standards Process - Revision 3" S. Bradner.

History

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