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The future in ETSI of
quality of standards-making, validation and testing

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 4 92 94 42 00 - Fax: +33 4 93 65 47 16

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Foreword

This ETSI Technical Report (ETR) has been produced by the Methods for Testing and Specification (MTS) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

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1 Scope

This ETR sets out an **analysis by objectives** of the **different validation and testing activities possible for ETSI**, and suggests recommendations for the implementation of the different activities.

It starts from recommendation 31 of the High-Level Task Force, endorsed in the decisions of ETSI GA23, that deals with the **validation of standards**, in the broad sense, including all "*possibilities for adding quality to the ETSI products and communicating this quality to users*".

Recognizing that the provision of specifications for formal conformance testing has been the only way hitherto, it suggests that ETSI should also engage itself in other activities aiming at checking and demonstrating quality of ETSI standards and products, such as inter-operability testing, field trials, use of formal languages, etc.

The palette of such activities is broad, and ETSI may choose to engage itself in the **different activities** having in mind the fulfilment of **different objectives**: making the standardization process cheaper and faster, facilitating the implementation of standards, promoting the quality and facilitating the success of ETSI-based products on the market, facilitating the construction of the European Information Infrastructure, etc.

This ETR was published after its contents were contributed in August 1995 to the ETSI High-Level Task Force Implementation Group. The recommendations contained herein are not definitive and reflect the initial contribution from TC MTS to the ETSI reflections on the question of standards quality, validation and testing.

The involvement of ETSI in regulatory testing matters is not covered by this ETR.

2 References

None.

3 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

ASN.1	Abstract Syntax Notation One
ASIC	Application Specific Integrated Circuit
CCBS	Call Completion on Busy Subscriber
DCC	Directorate Corporate Communications
DSS1	Digital Subscriber Signalling System No.one
ECITC	European Committee for IT Testing and Certification
GSM	Global System for Mobile Communication
HLTF	High Level Task Force
INAP	Intelligent Network Application Protocol
IOPT	InterOPerability Testing
ISDN	Integrated Services Digital Network
LAN	Local Area Network
MOU	Memorandum Of Understanding
MSC	Message Sequence Chart
MTS	Methods for Testing and Specification
NIT	Network Integration Testing
NNI	Network-Network Interface
PBX	Private Branch eXchange
PEX	Permanent Expert
PNE	Présentation des Normes Européennes
QSIG	Q interface Signalling protocol (ECMA standard)
SDL	Specification and Description Language
SMG	Special Mobile Group
SPS	Signalling Protocols and Switching
TETRA	Trans European Trunked Radio
TSP1	Test Synchronization Protocol One
TTCN	Tree and Tabular Combined Notation

UNI   User-Network Interface

4   Management summary - Summary of recommendations

The different **activities** of ETSI related to testing, validation, etc. are examined according to the **objectives** they can contribute to satisfying: making the standardization process cheaper and faster, facilitating the implementation of standards, promoting the quality and facilitating the success of ETSI-based products on the market, facilitating the construction of the European Information Infrastructure, etc.

12 different possible objectives are identified (in clause 5), related to the 5 following types of activities:

-        ETSI Activities related to the quality of **ETSI deliverables:**

         - Improving the quality of ETSI deliverables during their development (quality in standards-making);
         - Validating the quality of ETSI deliverables;
         - Communicating the quality of ETSI deliverables.

-        ETSI Activities related to the quality of **products and services:**

         - Testing products and services;
         - Communicating the quality of products and services.

It should be noted, in particular, that the technical activities related to **testing** products/services (e.g. inter-operability testing) are distinguished from the **promotion** activities related to **communicating** the quality of products/services (e.g. inter-operability demonstrations). The recommended ETSI involvement is different in the two domains.

The activities are analysed in detail in clause 7 and lead to the following recommendations:

Recomm. i   Develop the PEX/MTS concept as a group of "Good technical practices in standards-making and validation" in the technical competence centre.

Recomm. ii   Establish a practice whereby the management and planning for validation (using the various available validation techniques) of a standard is incorporated in the initial workplan for any new work item.

Recomm. iii   Make validation of an ETS, according to the established plan, necessary before the ETS can be approved.

Recomm. iv   Establish a practice of requirements capture and agreement on "what a standard should do" before its development is started.

Recomm. v   Ensure correct performance, in a co-ordinated way, of the following tasks:

         -        monitoring and co-ordinating quality assurance and in particular validation;

         -        supporting technically the use of computer support tools for validation;

         -        developing criteria for good standards, based on experience.

         (group of "Good technical practices in standards-making and validation").

Recomm. vi   Encourage the establishment of MOUs for validation of standards by pilot implementation (as fora do).

Recomm. vii   Production of test specifications: decide which type of tests, if any, on a case-per-case basis according to criteria/categorization as, for instance, in table 1.

Recomm. viii   Whatever type of test specification is chosen in a given case, make a rigorous development, based on a sound methodology - for instance, the NIT methodology developed by Eurescom may be adapted to many situations of inter-operability testing.

Recomm. ix   Whatever type of test specifications is chosen in a given case, produce good quality test specifications (i.e. test specifications in their turn validated) - standardize test specifications as I-ETS or TS if not validated.

Recomm. x   Whatever type of test specifications is chosen in a given case, maintain the test specifications (today, not done in ETSI to the necessary extent).

Recomm. xi   ETSI should leave demonstrations of inter-operability (outside, perhaps, the domain of functionally simple components) to independent Test Houses.

Recomm. xii   It is not the mission of ETSI to provide a framework (organization, promotion,...) for Inter-operability Testing and Inter-operability Demonstration, performed by Test Houses. ECITC could provide such a framework. To achieve this, ECITC could change its mode of operation and in particular provide a system more open and more simple than Agreement Groups.

Recomm. xiii   ETSI should favour, and provide organizational and promotional support to, multivendor exhibition of inter-operating implementations at trade fairs, etc. The establishment of ad-hoc MoUs should be encouraged. When ETSI supports such exhibitions:

-    It should be clearly stated that the objective of the exercise is not to **provide evidence** that different implementations are inter-operable (it is not a demonstration of inter-operability);

    NOTE: This wrong interpretation could result from the fact that the name of ETSI (a formal standardization body) is naturally associated with rigour and responsibility: the ETSI logo generally **attests** something. ETSI should thus be more careful in this domain than the fora, less exposed to such misinterpretations.

-    The responsibility of ETSI should not be engaged. The exhibition and its results are only under the responsibility of the involved partners.

5   Objectives of ETSI involvement in validation/testing activities

Different objectives   Recommendation 31 of the High-Level Task Force identifies three key objectives for an ETSI involvement in activities related to adding and communicating quality:

-    be faster;
-    be cheaper;
-    contribute to users' confidence in, and user's acceptability of ETSI products.

It is clear that having a high quality output is a strategic objective for ETSI (credibility of ETSI and its members on the international scene), and to the success of Europe in its endeavour towards an information society.

of different pragmatic values   In subclauses 5.1 and 5.2, all the possible objectives of ETSI's involvement in activities for adding and communicating quality are explored in detail.

It should be noted that the weight and pragmatic value of the different objectives is uneven. For instance, objectives 8 and 9 (in subclause 5.2.1) have been the only ones recognized today. But doubts can be expressed concerning their reachability. On the other hand, objectives 10 and 11 (in subclause 5.2.1), not recognized as such today, have constituted the main benefit thus far drawn from ETSI activities in the domain of testing.

Different
activities

One can distinguish two main domains of activities:

1)   activities related to the quality of the **ETSI deliverables** themselves. For instance, ETSI can make use of formal notations and languages, can use computer tools to validate models of the specified technologies;

2)   activities related to the quality of the **products or services** implemented after ETSI standards. For instance, ETSI can produce testing specifications that will be used in the market to assess and demonstrate the performance of an equipment, a set of equipments, or a service.

In this clause, the objectives of the following types of activities are explored:

1) ETSI Activities related to the quality of **ETSI deliverables**

   - Improving the quality of ETSI deliverables during their development (quality in standards-making);

   - Validating the quality of ETSI deliverables;

   - Communicating the quality of ETSI deliverables.

2) ETSI Activities related to the quality of **products and services**

   - Testing products and services;

   - Communicating the quality of products and services.

5.1   ETSI Activities related to the quality of ETSI deliverables

5.1.1   Improving the quality of ETSI deliverables during their development (quality in standards-making)

The main objectives are:

Objective 1   *To make sure that standards meet their technical and market objectives (Acceptable)*

Objective 2   *To make standards available on time (Faster)*

Objective 3   *To make a minimal use of resources in standards making (Cheaper)*

5.1.2   Validating the quality of ETSI deliverables

The main objectives are:

Objective 4   *To reduce late error detection in standards (Faster, Cheaper)*

*To-day, it happens that errors in standards are detected at a late stage of their production, e.g. during Public Enquiry. Taking account of hundreds of Public Enquiry comments has a significant **cost** on member companies, and may lead to a **late** delivery of a standard to the market. ETSI should ensure that errors in standards are detected earlier. Using the Public Enquiry phase for detecting errors is a distortion of the objective of the Public Enquiry: the Public Enquiry comments should be limited to those points for which consensus is difficult to establish.*

A sound validation, if properly organized, does not delay the standard's availability, and is likely to reduce the future costs of maintenance of standards.

Summarizing, the lack of standards validation has a significant cost, before and after the standards are published.

Objective 5   *To secure product/service suppliers' investment (Acceptable, Giving confidence)*

To-day, errors are often detected after the publication of a standard, at the time of implementation. Product and service suppliers should be assured to base their development on sound specifications. They should be assured not to invest in developing products (e.g. ASICs) and to lose this investment because the ETSI specification contained errors or because it was not complete enough and another interpretation has become the reference instead of the standard itself.

It should be noted that this question may involve the liability of ETSI, when errors remain in approved standards.

Confidence of ETSI members in specifications should also exist before the standards are formally approved, so that they can anticipate the formal publication of a standard in starting their developments.

Objective 6   *To make the testing process cheaper (Cheaper)*

The production of test specifications is easier and cheaper if the base standard has been validated before (long-term objective).

Technically, a validated standard is a sounder basis for testing. For example, when a test detects a problem, it may be costly and delaying to look for the problem in the product if it lies in the standard.

5.1.3   Communicating the quality of ETSI deliverables

A general objective can be identified:

Objective 7   *Promotion of ETSI and European industry/technologies (Confidence, Acceptability)*

5.2   ETSI Activities related to the quality of products and services

5.2.1   Testing products and services

The traditional ETSI activity related to testing products and services is the production of conformance testing specifications. It could be extended to the production of other testing specifications (inter-operability, performance, etc.). It could be extended to the monitoring or organization of testing programmes.

The objectives are:

Objective 8   *Facilitation of marketing of products (manufacturers - Confidence, Acceptability)*

Test specifications produced by ETSI can be the basis for communicating information about the quality of the product, via such channels as product certification, marking, self declaration of conformity by suppliers, exhibitions of products inter-operability. These channels for communicating quality of a product are examined in subclauses 2.2.2 and 4.5.

Objective 9   *Facilitation of procurement of products (operators - Confidence, Acceptability)*

Test specifications produced by ETSI can be referenced in calls for tender, or a technical basis for acceptance testing.

Objective 10   *Facilitation of product implementation (manufacturers - Cheaper, Faster)*

Agreeing, in a collaborative manner in a standards body, on how products can be tested may facilitate the implementation of products from standards, thanks to:

- A collaborative investment in testing technology

    The (costly) development of test specifications can be shared by ETSI participants.

    An MoU, complementary to the ETSI work, can be set up to ensure the common financing of the development of testing tools based on the commonly agreed test specifications.

    It should be noted that the fora have, in general, invested in producing detailed testing specifications.

- The provision of a consistent market for testing tool providers

    Testing tools are expensive, and their market is much narrower than the market of the products themselves. Testing tool providers will only invest in the development of a new tester (for a new technology) if they foresee that they will sell the same tester to several customers (e.g. product manufacturers). When several potential customers of testing tools agree - by producing test specifications in collaboration - on how to test their products, they agree at the same time on a common definition of what test tools should be. They thus unify their requirements for test tools, and create a real market for test tools based on the specifications. On the contrary, if each potential customer of testing tools wants something specific, test tool manufacturers may hesitate to invest.

- An earlier availability of testing means

    Testing means available early can ease an early placement of a product on the market. Without test tools available in time, modern technologies cannot be developed safely.

- Confidence in "reference" procedures for testing and avoidance of repeated testing

    This last point is particularly important when there is a chain of integration of a component, e.g. a software protocol implementation, by different companies before the final product is made. If no "reference" procedure for testing exists, the same components may be re-tested in different ways at different stages of integration, with negative consequences on overall cost and delay.

    NOTE: Reference procedures for testing means an agreement, at the technical level, on the actual contents of the testing. In practice, this is achieved by approving abstract test specifications - even if they deserve, in some cases, to be adapted or customized to different needs.

Objective 11 *Facilitation of service implementation and deployment, interworking, interconnection (operators - Cheaper, Faster)*

Some of the objectives that apply to implementation of product standards (in objective 10) also apply to service deployment:

- The provision of a consistent market for testing tool providers (same as in objective 10);

- a collaborative investment in testing technology (same as in objective 10).

Today, Eurescom develops test specifications in common for several operators; MoUs exist (e.g. GSM) that, among others, ensure the common financing of testing tools development.

- An earlier availability of testing means (same as in objective 10)

In addition, the development of test specifications can present other interests to operators, specific to service deployment:

- Non-regression testing: Reduction of testing cost vs. network evolution

When a network evolves, because new nodes, gateways, etc. are added, the service needs to be re-tested. This is facilitated by the existence of well defined service testing specifications, in particular when tools, based on these specifications, allow the re-testing to be automated.

- Common grounds for inter-operators service testing

The (end-to-end) test of a service involving several operators, equivalent to the test of interworking between networks, requires testing procedures agreed upon by the different operators, that identify the sequence of events, the checks to be performed at each interface involved, as well as the co-ordination procedures. Eurescom is, today, producing such test specifications for the end-to-end testing of ISDN networks (narrowband and broadband).

5.2.2 Communicating the quality of products and services

The objective of these activities is:

Objective 12 *To influence procurement decision (Confidence, Acceptability)*

These activities belong to the domain of promotion of products and services.

They generally consist in communicating the results of the testing of products and services. They are thus generally based on testing activities mentioned in subclauses 2.2.1 and 4.4.

These activities can be based on more or less detailed testing activities, and range:

- *from the exhibition of marks/certificates or the registration of products, generally based on formal conformance testing results (this way is clearly rejected by the market);*

- *to the demonstration of products at trade fairs, etc., generally based on limited inter-operability testing.*

6 The present situation

Today's
activity
Today, the production of conformance testing specifications has tended to be the only ETSI activity, related to "testing and validation", officially recognized in a policy (TCR-TR 006, document only available within ETSI), even though some initiatives of standards validation have been undertaken by some TCs individually (some with the assistance of MTS).

One
recognized
objective
The policy for producing conformance testing specifications for every standard was justified by one objective: formal harmonization and mutual recognition of test results, mainly by means of a certification scheme, for which the conformance test specifications were the technical basis.

The two only recognized objectives of the analysis in clause 4 were thus objectives 8 and 9: facilitation of the marketing of products, and facilitation of the procurement of products. A manufacturer would have exhibited a proof of conformity of its product (e.g. by means of a certificate), a purchaser would have considered a proof of conformity as a basic step towards being confident that a product would inter-operate with other products. But this failed.
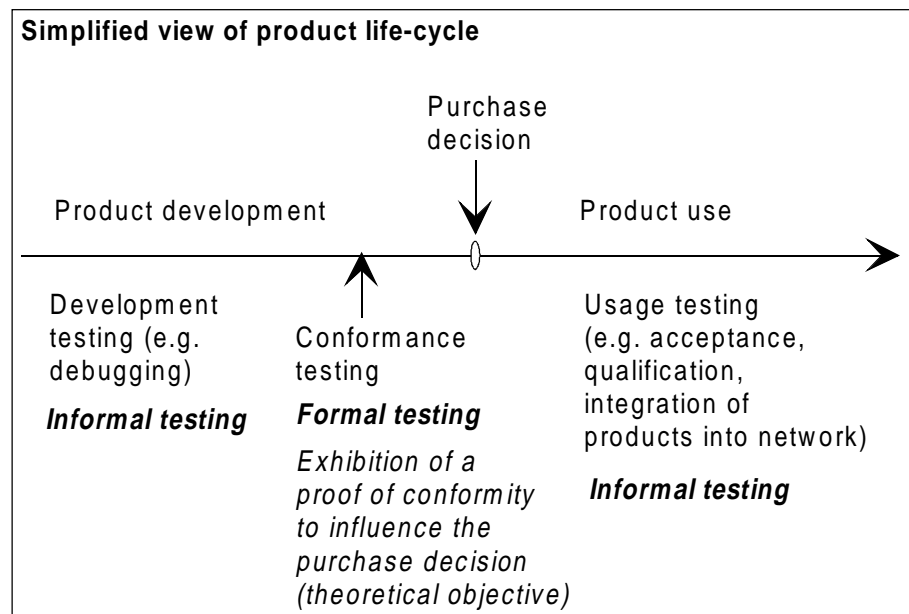
Several
"side"
objectives
fulfilled
In actual fact, it seems that the conformance test specifications produced in ETSI were not much used in a formal context of exhibition of proofs of conformity.

But they have achieved other roles, related to others of the objectives in clause 4. These are mainly:

- Facilitation of **product** implementation (objective 10).

- Facilitation of **service** implementation and deployment (objective 11), mainly by making possible the collaborative investment in testing technology.

- Some validation of standards (objectives 4, 5, 6), because, in order to produce test specifications, experts have explored standards systematically, and thereby detected a number of errors in the standards. This is indeed a technical side effect.

- Wide spreading and acceptance of some testing methodologies, in particular the TTCN notation for specifying test suites. Tools now exist to edit, exchange, compile specifications in TTCN. These tools would probably not have been developed if standardization had not provided a "critical mass" of test specifications using the same notation. This wide spreading of methodologies and notations is the indirect result of both the production of test specifications in standards bodies and the establishment of EC-funded programmes (CTS - Conformance Testing Services). The existence of a common notation for tests, widely recognized, has proven to reduce testing costs.

Technically
Technically, it means that:

- the *conformance testing specifications* were not much used in a *formal* context of testing products before their placement on the market. But the conformance testing specifications were used as a technical basis for *informal* testing at other stages of product life-cycle (debugging tests, acceptance or integration tests). See figure below.

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┌─────────────────────────────────────────────────────────────────┐
│  Simplified view of product life-cycle                            │
│                                                                   │
│                                    Purchase                       │
│                                    decision                       │
│                                                                   │
│       Product development            │        Product use         │
│                                      ▼                            │
│   ──────────────────────────────────○──────────────────────────▶ │
│                                  ▲                                │
│   Development                    │    Usage testing               │
│   testing (e.g.                       (e.g. acceptance,           │
│   debugging)           Conformance    qualification,             │
│                        testing        integration of             │
│   Informal testing                    products into network)     │
│                        Formal testing                            │
│                                         Informal testing         │
│                        Exhibition of a                           │
│                        proof of conformity                       │
│                        to influence the                          │
│                        purchase decision                         │
│                        (theoretical objective)                   │
│                                                                   │
└─────────────────────────────────────────────────────────────────┘
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- the *process* of producing test specifications (rather than the produced specifications) has had a very valuable feed-back effect of validating standards - in particular in the absence of a well defined programme of explicit standards validation.

7 Analysis and recommendations

In this clause, the different types of activities listed in clause 5 are expanded and analysed. Objectives are recalled, the possible involvement of ETSI is detailed, recommendations are provided.

7.1 Improving the quality of ETSI deliverables during their development (quality in standards-making)

7.1.1 Definition

Quality in the develop-ment All the methods, procedures, tools, support, logistics, that are used during the development of standards, in order to increase the chance that standards:

- meet their technical and market objectives;

- are timely available;

- are developed with a minimal use of resources.

7.1.2 Recall of objectives

The objectives are the same as in the definition:

Objective 1 ***To make sure that standards meet their technical and market objectives (Acceptability)***

Objective 2 ***To make standards timely available (Faster)***

Objective 3 ***To make a minimal use of resources in standards making (Cheaper)***

7.1.3   Analysis - Possible ETSI activities

Good technical practices in standards-making

A significant improvement of the standards development can be achieved by the use of appropriate methods, procedures, specification techniques, tools. In a few words, good technical practices in standards making.

For instance, some TCs and STCs have already established practices of using formal notations in all standards being drafted. In terms of tools and support, ETSI has invested today in a number of initiatives striving in the right direction: Permanent Experts (PEX), distribution of tool licences, ETSI seminar for Rapporteurs, etc.

Today, outside the TCs and STCs (i.e. the developers themselves), the technical aspects of standards development are often neglected while the emphasis is made on the formal aspects: procedure, presentation, etc.

Specifica-tion techniques, including Formal languages

The HLTF recommendation 31 rationale mentions that "Overall performance of ETSI results can be facilitated by the greater use of formal languages in drafting standards". The use of formal languages, and of specification techniques in general, is a major way to improvement. Not only do they allow to achieve the three objectives above; they also make easier the activities of validation (see subclause 3.2) and of test specification (see subclause 3.3). The business benefits of the use of specification techniques, including formal languages, had been officially recognized by TA19, that amended the TA Working Procedures with the sentence "*ETSI Standards shall, where applicable, use standardized languages and notations (such as SDL, MSC, ASN.1 and TTCN)*". Specification techniques, including formal languages, should be part of good technical practices in standards-making.

A generalized use of good technical practices in standards-making, requires that these practices are first identified and developed, second that they are deployed.

Develop practices

A number of good practices in standards-making exist - and some groups use them. Some others require to be developed, mostly by adapting known practices of engineering, management, and quality assurance, to the specific environment of standardization in telecommunications. Pilot use of practices in some specification projects is an efficient way of developing pragmatic and efficient practices.

A group for developing good technical practices in standards-making should be pragmatic, and should weave links - interact - with the standards-making groups. It should be comprised of persons having a role in standards-making, not only of experts in formalism or of tool makers.

The development of good standards-making practices should be based on two inputs:

- a synthesis of experience in standardization practice - this can come from permanent experts (PEX) involved in standardization activities;

- an outlook of specification techniques and tools developed in the "external world" (in the member organizations, other standardization bodies, etc.).

Deploy practices

Once identified and developed, good practices in standards-making need to be deployed. This means making potential users aware of their existence and of the benefit they can bring, and providing support to their use. In order to achieve this, there is a need for:

- Education and awareness programmes (today, the Permanent experts and the MTS project teams provide some).

- Support to the use of specification techniques (here also, permanent experts and MTS project teams today).

- Co-ordination and background support:

    - Libraries of specification elements (*e.g.* protocol specification elements, in SDL, ASN.1).

    - Recording of Best Practices - *It is essential to create a technical culture in ETSI, to allow different ETSI groups to communicate experience with each other. A technical culture is missing in ETSI today because of the high turnover of experts and a project management distributed over several committees.*

    - Planned provision of tools - *after the recommendation that "ETSI Standards shall, where applicable, use standardized languages and notations", some tool support was made available to editors and Rapporteurs, but it was on request (not planned) and the number of tool licences available was sometimes lower than the need. It ensued that Rapporteurs willing to improve their practices often had to wait.*

Need to plan and to coordinate

Today, some expertise exists (mainly in the group of PEX and in the Technical Committee MTS) that can be used to establish good practices in standards-making, at the technical level of engineering, management, and quality assurance. The need for such practices is recogn*ize*d and some initiatives can be observed. What should be improved is:

- the co-ordination of actions related to establishing and deploying good practices;

- the interaction of standards-makers and the experts developing the practices.

A group in the technical competence centre

Two functions have been identified here:

- development of good practices;

- deployment of good practices.

In terms of organization, a single horizontal group should be in charge of these two functions. This group should be permanent in the technical competence centre, and be built around the SDL and TTCN permanent experts group (technical expertise in some practices; involvement in standards-making) and the technical editors' department (organizational expertise; follow-up of all standardization activities).

This group should be responsible for the synthesis of good standards-making practices, for the planning and co-ordination of support and for the deployment of good practices in standards-making. This group should also be responsible for the planning of, and support to, standards validation.

This group should receive some input on specification techniques and tools developed in the "external world" (in the member organizations, other standardization bodies, etc.), to ensure that standardization practices do not diverge from design practices used in the industrial world, and benefit from the latest techniques, notations, tools, etc. available in the world.

7.1.4 Recommendations

Recomm. i   Develop the PEX/MTS concept as a group of "Good technical practices in standards-making and validation" in the technical competence centre.

7.2 Validating the quality of ETSI deliverables

7.2.1 Definition

Validation of   The process by which appropriate methods, procedures and tools are used to evaluate
standards   that a standard:

- satisfies the purpose expressed in the record of requirements on which the standard is based;

- can be fully implemented;

- when implemented is able to offer, at minimal cost, all the functionality and performance expressed in the record of requirements on which the standard is based;

- conforms to the established criteria for standards.

Here, the term "at minimal cost" should be understood essentially as minimum level of redundancy and complexity when compared with the intended level of functionality and performance.

Validation of standards relates to the quality of the specifications delivered by ETSI. It should not be confused with activities related with the quality of the products implemented after ETSI specifications. For the latter, the word "validation" is avoided, and the term "testing" (of products and services) is used.

7.2.2 Recall of objectives

Objective 4   *To reduce late error detection in standards (Faster)*

Objective 5   *To secure product/service suppliers' investment (Acceptability, confidence)*

Objective 6   *To make the testing process cheaper (Cheaper)*

7.2.3 Analysis - Possible ETSI activities

Establish validation plans for standards

In 1992, an ad-hoc group on quality management reported to the TA14: "*The management and planning for validation of a standard should be incorporated in the initial workplan for a new work item*". This has not yet been implemented in ETSI. The planning of validation of a standard is essential. It should identify what validation techniques will be applied, and who will apply them. All standards do not require the same validation process.

Require-ments capture as a prerequisite

It is important to note that part of the validation activity deals with ensuring that a standard "satisfies the purpose expressed in the record of requirements on which the standard is based". Today, the requirements on which the standard is based are never documented, and are sometimes still unclear while the development of a standard is under way - scope of work items are often expressed in general words. The result can be that:
- rapporteurs are unsure of the objectives they have to satisfy;
- their objectives may change depending on the influential members in a committee at a given point in time;
- the standards-making appears too "technician-driven", due to a lack of defined objectives.

The result is also that no assessment of a standard vs. its objectives can be made if a serious requirements capture is not established as part of the good practices of standards-making.

Validation also deals with ensuring that a standard "conforms with established criteria for standards". In other words, that a standard reaches a satisfactory level of intrinsic quality. This supposes that criteria exist, that define what a good standard is (e.g. that it is not ambiguous, etc.) Very few criteria exist today, and they are mainly related to the presentation of the standards (PNE rules), or to the proper use of formal languages. Criteria should continuously be developed, based on experience. The development of criteria for standards will be started by the MTS Project Team 76V, and should be taken over by a permanent structure in ETSI.

Validation as part of Quality Assurance

Validation should be considered as one facet of a Quality Assurance process. Validation, as a step before the standard can be approved, appears as the "final review" of the deliverable. A quality assurance process should also define reviews of the deliverable along its development, as well as reviews of the development project itself.

Techniques

Various techniques can be used to validate the standards. The two main types are:

- analysis or simulation, based on computer support tools and mathematical techniques, that can be used internally to ETSI;

- pilot implementations, or prototypes, that can be realized externally to ETSI, and monitored by ETSI.

Internal: Analysis and simulation

In the domain of radio specifications, the use of mathematical analysis and tools is often made in ETSI. For instance, GSM, Radio LANs, etc.

In the domain of protocol specifications, tools and techniques exist and are available in ETSI. The benefits of these tools and techniques begin to be demonstrated by MTS/PT65, and practical experience on their use is consolidated. Partnerships are established between MTS/PT65 and TC SMG (CCBS) and TC SPS (INAP). It should be noted that these tools and techniques can only be applied if formal languages (SDL) have been used in the standards. The TETRA project is undergoing a process of re-drafting of the protocol standards (using formal languages) and validating them with tools, due to the fact that the initial standards came back from the public enquiry with too many comments.

External: Prototyping

The (external) prototyping of implementations can be useful for some standards.

For instance, the test specifications (considered themselves as standards) can only be fully validated by implementing them (on a testing tool). A successful example of such a validation was achieved for the V5.1 interface test specification, that was validated by implementation on a test tool (at a manufacturer's), in partnership with ETSI experts.

The problem with prototyping and pilot implementation is that the member(s) who are entrusted such a pilot implementation receive a significant advantage with respect to competition. ETSI should monitor such an activity, but the choice of a member to build a prototype should be made on a case-per-case basis, and ETSI should encourage the establishments of MOU agreements.

It is important to note that the concept of pilot implementation is not necessarily limited to *one* implementation. Several pilot implementations can be built, if it is necessary to involve several members of ETSI to avoid any bias in the competition. In addition, the ability of several pilot implementations to work together (inter-operate) constitutes a valuable validation of the standard. However, the more implementations are involved, the more complex and costly is the technical analysis of the experiments' results.

Quality indexes accounting for the market satisfaction in standards
In addition to the establishment of internal (analysis) and external (prototyping) validation programmes, ETSI should gather feed-back on the quality of standards, by improving Quality indexes accounting for the market satisfaction in standards.

Today, the weight of quality indexes is high on form and procedure (e.g. price, invoicing, delivery of standards), and not relevant enough in terms of business results of the standards.

ETSI is often required to be market oriented. This does not only mean receiving an input on the perception of the market by strategic groups. It should also mean monitoring closely the market and gathering feed-back on the real implementation of standards.

7.2.4 Recommendations

Recomm. ii Establish a practice whereby the management and planning for validation (using the various available validation techniques) of a standard is incorporated in the initial workplan for any new work item.

Recomm. iii Make validation of an ETS, according to the established plan, necessary before this ETS can be approved.

Recomm. iv Establish a practice of requirements capture and agreement on "what a standard should do" before its development is started.

Recomm. v Ensure correct performance, in a co-ordinated way, of the following tasks:

- monitoring and co-ordinating quality assurance and in particular validation;

- supporting technically the use of computer support tools for validation;

- developing criteria for good standards, based on experience.

(group of "Good technical practices in standards-making and validation".)

Recomm. vi Encourage the establishment of MOUs for validation of standards by pilot implementation (as fora do).

7.3 Communicating the quality of ETSI deliverables

7.3.1 Definition

Communica -tion of ETSI quality
All activities that relate to promoting the quality of ETSI results, of ETSI-based technologies, of the ETSI environment for standards-making.

7.3.2   Recall of objectives

Objective 7   Promotion of ETSI and European industry/technologies (Confidence, acceptability)

7.3.3   Analysis - Possible ETSI activities

Promotion of ETSI results is well-organized today, and belongs to the domain of ETSI's Corporate Communications (DCC).

If actions are taken to communicate the quality of products and services implemented after ETSI standards (see subclause 3.5), these actions may be used to fulfil a side objective of promotion of ETSI.

7.3.4   Recommendations

(none)

7.4   Testing products and services

7.4.1   Definition

Testing   Testing, in the broad sense, is the set of *technical* activities that can be performed to check functionality and performance offered by products or services at different stages of their life-cycle or their deployment.

7.4.2   Recall of objectives

Objective 8   Facilitation of marketing of products (manufacturers - Confidence, acceptability)

Objective 9   Facilitation of procurement of products (operators - Confidence, acceptability)

Objective 10   Facilitation of product implementation (manufacturers - Cheaper, faster)

- The provision of a consistent market for testing tool providers

- A collaborative investment in testing technology

- An earlier availability of testing means

Objective 11   Facilitation of service implementation and deployment, interworking, interconnection (operators - cheaper, faster)

- The provision of a consistent market for testing tool providers

- A collaborative investment in testing technology

- An earlier availability of testing means

- Reduction of testing cost vs. network evolution

- Common grounds for inter-operators service testing

7.4.3   Analysis - Possible ETSI activities

ETSI involvement   The involvement of ETSI in the testing activities is to provide the technical basis:

- standard methods and interfaces for an open provision of testing tools. Traditional MTS activity. An example of this is the publication of the TSP.1 protocol used to synchronize several test tools in end-to-end testing campaigns;

- test specifications (not necessarily formal conformance testing).

The HLTF recommendation 31 mentions that ETSI should offer a service of support and co-ordination to demonstrations of products and services, and of their inter-operability. This belongs to the domain of "*communicating* the quality of products and services", treated in subclause 3.5.

But there is *no* recommendation that, as a standards body, ETSI gets involved in the technical activity of testing (by opening a testing laboratory, for instance).

Beyond conforman-ce testing

The objectives 8 and 9 were the only ones considered hitherto, and their fulfilment was only considered by means of formal conformance testing. See "2 The present situation".

The objectives 8 and 9 would also require, in some cases, the specification of other kinds of test specifications, for instance:

- *inter-operability* test specifications, on the basis of which it is possible to claim seriously that two products from two different manufacturers really inter-operate;

- *performance* test specifications, that would allow a manufacturer to claim seriously performance figures (in terms of number of connections, load, etc.).

The objectives 10 and 11 (facilitation of implementation of standard-based products and services) may be achieved thanks to other kinds of test specification, for instance:

- *end-to-end* or *integration* test specifications, that can be used by operators to ensure that several network elements can work together;

- *protocol mapping* test specifications, for instance related to the correct mapping of signalization elements between DSS.1 and ISUP.

A categoriza-tion

The development of test specifications (and the type of tests required) should be decided on a case-per-case basis, from the categorization of products and services in table 1.

Table 1: Categorization of products and services and applicable production of testing specifications in ETSI

	Low-end products (terminals)		Corporate networks			Public Networks			Transm. systems	Components	
	interface with network	function-alities	Inter-faces	Inter PBX (e.g. QSIG)	Services	UNI	NNI	Services note 3		Simple (e.g. codecs)	Complex (e.g. comm. adaptors)
Objectives of testing: note 2											
O.8 - marketing	X			X	X				X	X	X
O.9 - procurement	X			X	X		X		X		
O.10 - facilit. implem. products				X	X	X	X	X	X		X
O.11 - facilit. deploy. services						X	X	X			
Interested parties	manuf.			manuf. users	manuf. users	oper?	oper. (manuf.) note 1	oper.		manuf.	manuf.
Level of interest - note 2	medium	low	low	high	high	?	high	high	high	medium	medium
Types of test specifications that ETSI should consider	conform. (including radio physical measure)	-	-	conform and compat.	end-to-end	conform	end-to-end, compat.	end-to-end, compat.	physical (as today)	limited compat.	conform to APIs and protocols
						mapping (e.g. ISUP-DSS1)					

NOTE 1: The availability of test specs for interfaces internal to network is of high interest to operators. However, they may prefer to retain them in the domain of competition and may prefer that ETSI avoid standardizing them.

NOTE 2: The objectives and levels of interest mentioned are proposals and deserve to be validated/refined by strategic entities of ETSI.

NOTE 3: Distributed or single node.

conform = conformance test specifications
compat = compatibility test specifications
end-to-end = end-to-end test specifications
mapping = mapping test specifications

As can be seen from table 1, the appropriate test specifications can be chosen according to the type of product and the context of interest to manufacturers, operators, or users.

Different types of testing activities are distinguished from the point of view of the ETSI's involvement in producing specifications. It should be noted that the mapping of these different types of testing onto real operational testing activities would require a more elaborated and more precise breakdown, avoided here because it is not relevant at the level of standardization.

Conforman-ce testing   Testing the extent to which an implementation conforms to a standard specification. For instance, conformance to specifications of radio interfaces, to communication protocols, to APIs, etc.

COMMENT:

When applied to products, which is generally the case, the importance of the type of product is essential. For instance, for some types of products (e.g. switches), conformance testing would cover a very limited domain (some studies reveal a figure of 5 %) of product functionalities. It is not with a test covering 5 % of product functionalities that one will influence a purchaser's decision. Conformance testing, for those products, will thus not be in a position to contribute to objective 8 (marketing of products).

Interoper-ability testing   Testing that two or more products, equipments, or services, are able to perform together a set of functions defined in specifications. The communication interfaces/protocols between the products may be also specified.

In this category can be, practically, distinguished:

- end-to-end testing;

- compatibility testing;

- mapping testing.

This definition of inter-operability is broad enough, and the commentary on demonstrations of inter-operability mentioned in 4.5 can be related to the different types of testing mentioned here.

COMMENT:

Inter-operability testing is of high interest in some cases. It should be borne in mind that inter-operability testing is not the miracle solution to all situations. In particular, inter-operability testing:

- is not necessarily cheaper than conformance testing, especially if the standards are defective;

- necessitates a serious methodology and should not be superficial - otherwise not credible. EURESCOM has already defined a simple methodology, named NIT, and a set of NIT Test Specification (e.g. for the ISDN/IDN and for low ATM layers) are already available and validated, according to this methodology;

- presents some technical difficulties, and is viable only in well-defined cases (in particular, services should be specified).

End-to-end testing   Testing that one or more products, equipments, or networks, directly or indirectly connected, are able to provide a global end-to-end service at user access interfaces, as defined in the specifications. For instance, testing IDSN supplementary services over two national networks. The user access interfaces involved in end-to-end testing generally belong to different equipments. When applied to a single product, end-to-end testing (that can then be called functional testing) can be for instance the test of transit functions.

Compatibility testing	Testing that two or more products or equipments, connected together through a specified interface or protocol, are compatible and able to communicate according to specifications. For instance, node-to-node testing of two implementations of an NNI protocol like ISUP.
Mapping testing	Testing the effective interworking between heterogeneous services or protocols. For instance, the interworking between GSM and ISDN supplementary services, or testing the mapping between DSS1 and ISUP protocols. The tested mapping can involve one single product or several products in a network.
Performance testing	Performance testing (e.g. load, stability, robustness) is concerned with testing characteristics that are generally outside the domain of standardization. One could consider producing performance testing specifications, that would be used with specific performance figures declared by suppliers. The benefit would be a common understanding on the meaning of performance figures. However, performance is a question that depends much on actual architectures and configurations. For this reason, the involvement of ETSI in this domain is not considered here.

7.4.4   Recommendations

Recomm. vii	Production of test specifications: Decide which type of tests, if any, on a case-per-case basis according to criteria/categorization as, for instance, in table 1.
Recomm. viii	Whatever type of test specifications is chosen in a given case, make a rigorous development, based on a sound methodology - for instance, the NIT methodology developed by Eurescom may be adapted to many situations of inter-operability testing.
Recomm. ix	Whatever type of test specifications is chosen in a given case, produce good quality test specifications (i.e. test specifications in their turn validated) - standardize test specifications as I-ETS or TS if not validated.
Recomm. x	Whatever type of test specifications is chosen in a given case, maintain the test specifications (today, not done in ETSI to the necessary extent).

7.5   Communicating the quality of products and services

7.5.1   Definition

Communication of products' quality	All activities that relate to promoting the quality of products (and services) implemented after ETSI standard specifications. These activities can be based on testing activities (see subclause 4.4) and can range:

-         from the exhibition of marks/certificates or the registration of products, generally based on formal conformance testing results;

-         to the demonstration of products at trade fairs, etc., generally based on limited inter-operability testing.

7.5.2   Recall of objectives

Objective 12   To influence procurement decision (Confidence, acceptability)

7.5.3   Analysis - Possible ETSI activities

A sensitive area	A general observation is that the involvement of ETSI in the promotion of products would constitute a radical change in the policy of ETSI - not without risks. Hitherto, ETSI has avoided to look closely into the actual implementation of ETSI standards by industry, and to register implementations, of to dispatch information about the products available for a given technology.

Entering this area would unavoidably pose problems of balancing the effort of promotion. For instance:

- promoting implementations would impose to promote "all" implementations with the same energy, in particular the products of "small" and "big" ETSI members;

- promoting the product of an industrial may indirectly reveal that a competitor has no product yet;

- offering a promotion service to ETSI members would increase the difference of treatment between ETSI members and non-ETSI members.

Three possible communication activities

The communication of the quality of products and services may be achieved in three ways:

- **Formal conformance testing**: publicizing the results of conformance test reports, providing some evidence that a product or a service conforms with standard specifications;

- **Demonstrations of inter-operability**: publicizing the results of inter-operability tests, providing some evidence that several products or services are compatible and can work together;

- **Multivendor exhibition of inter-operating implementations at trade fairs, etc**. The objective of such an exercise is not to **provide evidence** that different implementations are inter-operable, but to show that products are developed, according to "workable" technologies, by different suppliers that "talk with each other". This exercise may also promote the quality of the technologies of ETSI, and hence also indirectly participates in the communication of ETSI quality (see subclause 4.3).

Formal conformance testing

ETSI should - when formal conformance testing is deemed desirable (see table 1) - provide the technical basis i.e. the test specifications. ETSI should not get involved in the testing process itself.

Formal schemes of certification, marking, registration, have failed or are strongly rejected by the market (manufacturers).

Self declaration of conformity is favoured by suppliers and appears more credible to purchasers since it implies a real commitment from the supplier.

Demonstrations of interoperability

Demonstrations of inter-operability are generally seen as a cheap and easy activity, leading to immediately visible results. Some programmes exist, in particular in the IT sector, that provide an exhibition of "compatibility matrixes" between manufacturers. The credibility of the information resulting from these programmes is not always recognized beyond the marketing exercise of publicizing the products' ability to communicate in a global manner.

Simple components

A domain in which it can be useful to consider demonstrations of inter-operability is the domain of functionally *simple components*. The HLTF recommendation 31 mentions voice codecs, video codecs, etc. This domain (see table 1) does not necessarily require extensive testing, since the number of functionalities of the components is limited. Demonstrating inter-operability in a global and superficial manner may have a significant value and convince prospective customers that the products based on a standard technology are effectively compatible and provide an acceptable level of service.

Outside the domain of simple components, demonstrations of inter-operability in ETSI should be considered with extreme caution.

Independ-ence	**Bodies involved in demonstrations of inter-operability should be independent enough** (vis-à-vis suppliers of equipment) to:

- ensure a sufficient level of rigour in the way the tests are conducted - in particular, that the declarations of inter-operability are not based on superficial tests of basic interconnection between products;

- be in a position to arbitrate when inter-operability is not straightforward.

This lack of independence has proven fatal to some well-known IOPT programmes and frameworks.

The only ETSI entities legitimate to perform technical arbitration would be groups of experts (e.g. Technical Committees) delegated by member organizations. Therefore, it seems difficult to establish an independent technical arbitration scheme in ETSI.

Seriousness and credibility	**Exhibition of a proof of inter-operability is a valuable marketing argument. But it needs to be based on a credible evidence.** Tests should have been realized in a rigorous manner, and should not be limited to checking the basic interconnection capabilities of products when the user wants confidence on inter-operability of operational functions of applications.

ETSI should avoid being involved (in any way) in superficial inter-operability demonstrations, that would quickly loose any credibility.

Does not compensate defects in standards	**Demonstration of inter-operability needs to be based on good standards**

When requirements are insufficiently expressed in the standards, Conformance Testing does not detect any problem but implementations do not inter-operate. Conformance Testing is often accused of not bringing enough confidence that implementations will inter-operate, but it is often just revealing a lack of requirement expression in the standard itself.

In fact, inter-operability testing would also be less effective if based on defective standards:

If standards are too ambiguous, or contain too many incompatible options, products will only inter-operate if they are based on the same interpretation of the standards and the same choice of options (appearance of "islands" of inter-operability).

And if there is little chance to find products based on the same interpretation and the same choice of options, there is little chance of demonstrating inter-operability.

IOPT could quickly become a demonstration of non-inter-operability.

Need an arbitrator	**Demonstration of inter-operability requires an arbitration party**

Promoters of inter-operability demonstrations always assume that products will inter-operate... and that the only question is to demonstrate it.

But what happens when they do not inter-operate ?

A practical experience of inter-operability tests between different manufacturers often showed a "locked" situation, with each partner arguing that the non-inter-operability was caused by the other's implementation.

- arbitration should be performed by an independent party;

- arbitration makes necessary a detailed technical activity - comparable to conformance testing - that has a significant cost. This is why it is often advised to perform conformance testing - perhaps less detailed than often made today - prior to IOPT. But this is another debate.

Bias	**Demonstration of inter-operability may give power to first or big implementors** (a bias that standardization is normally here to stifle)

One of the problems for new entrants into a particular established field is that conformance with the original standard is no longer relevant, as the only way to have a product recognized becomes: conforming with the existing products.

Even if demonstrations of inter-operability were made in an ETSI context, such a bias could not be avoided. This would inevitably lead to a competition distortion, incompatible with the very mission of ETSI.

Conclusion - demonstrations of interoperability	ETSI is not in an ideal position to be directly involved in demonstrations of inter-operability, and would expose itself to problems of credibility, of funding of expensive technical activities, and of impartiality.

The only exception to this conclusion is the domain of functionally simple components, for which a limited inter-operability testing is affordable and has a real value of demonstrating the workability of technologies and products.

Multivendor exhibitions	Multivendor exhibition of inter-operating implementations at trade fairs, etc. can be an efficient manner to launch new technologies and lines of products. This is particularly true in a context where increasingly complex technologies (networks of networks, containing intelligence and state-of-the-art technologies like ATM) are proposed to decreasingly technical customers (e.g. new "operators" coming from sectors of broadcast).

Multivendor exhibition of inter-operating implementations essentially shows that:

- the concerned technologies are "workable" and able to support useful applications;
- products are developed by different suppliers that "talk with each other";
- the concerned technologies have a real future, since several suppliers invest on them.

Also promoting the quality of the technologies of ETSI, this exercise indirectly participates in the communication of ETSI quality (see subclause 4.3).

Fora often organize multivendor exhibitions of inter-operating implementations. Similarly, ETSI can have an efficient role of organizational and promotional support.

Distinguish from demonstrations of interoperability *(not a proof)*	The objective of multivendor exhibitions is not to provide any **evidence** that different implementations are inter-operable (multivendor exhibitions are not demonstrations of inter-operability).

The technical activity behind multivendor exhibitions is the definition of some scenarios, according to available functionalities (the products shown may be prototypes), and under the direction of marketing experts for the definition of attractive and meaningful applications. It is very different from the (more detailed) technical activity of inter-operability testing of final products.

When engaging itself in an activity supporting multivendor exhibitions, ETSI should ensure that the message is clear: it is not an inter-operability demonstration. This wrong interpretation could result from the fact that the name of ETSI (a formal standardization body) is naturally associated with rigour and responsibility: the ETSI logo generally **attests** something. ETSI should thus be more careful in this domain than the fora, less exposed to such misinterpretations.

No ETSI responsibility	The responsibility of ETSI should not be engaged (ETSI having an instrumental and supporting role). The exhibition and its results are only under the responsibility of the involved partners.

The choice of the involved partners should not engage ETSI either: ETSI should encourage the open establishment of MoUs between market players of converging interests.

7.5.4 Recommendations

Recomm. xi   ETSI should leave demonstrations of inter-operability (outside, perhaps, the domain of functionally simple components) to independent Test Houses.

Recomm. xii   It is not the mission of ETSI to provide a framework (organization, promotion,...) for inter-operability Testing and inter-operability Demonstration, performed by Test Houses. ECITC could provide such a framework. To achieve this, ECITC could change its mode of operation and in particular provide a system more open and more simple than Agreement Groups.

Recomm. xiii   ETSI should favour, and provide organizational and promotional support to, multivendor exhibition of inter-operating implementations at trade fairs, etc. The establishment of ad-hoc MoUs should be encouraged. When ETSI supports such exhibitions:

- It should be clearly stated that the objective of the exercise is not to **provide evidence** that different implementations are inter-operable (it is not a demonstration of inter-operability);

- The responsibility of ETSI should not be engaged. The exhibition and its results are only under the responsibility of the involved partners.

History

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