Beyond Consortia, Beyond Standardisation?
New Case Material and Policy Threads

Final Report for the European Commission

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Management summary

Current standards policy appears to be caught up in a polarised discussion about what type of organisation best serves the market for democratic and timely standards: standards consortia or the traditional formal standards bodies. The general feeling is that standards consortia work more effectively, but that they have restrictive membership rules and are undemocratic. The latter is a cause of concern for the European Commission, which requires democratic accountability in the standards process if it is to refer to such standards in a regulatory context. The Commission's request for new input on how to deal with consortium standards is set against this background.

Aim
The Standardisation Unit of DG Enterprise had two objectives when it issued this grant to the Delft University of Technology. It sought:

- *new case material*: the aim was to acquire contemporary case material that illustrates how consortia work, why sometimes consortium standardisation is preferred to formal standardisation, and whether consortia work in ways that will deliver open standards.
- *new policy threads*: the aim was to develop a perspective on consortium standardisation that clarified its significance for EU standards policy. This required re-examination of current understanding of standards consortia, and of the underlying assumptions. Does the way the problem of standards consortia is defined - i.e. that their procedures are restrictive and undemocratic, and that their standards are therefore unfit as an instrument of regulatory governance - accurately describe what is at stake?

Methodology
Two case studies took place: Java standardisation in *ECMA, an International Industry Association for Standardising Information and Communication Systems*, and standardisation of the Extended Markup Language (XML) in the *World Wide Web Consortium* (W3C). Data was gathered, foremost, by means of participant observation, i.e. attending ECMA standards committee meetings, interviews with committee participants, face-to-face and by email, and content analysis of (electronic) documents and emails regarding the standards process.

Structure of the report
The report consists of three parts. The two cases are presented in part I. Dominant assumptions on consortium standardisation are confronted with the case findings in part II. The current basis for standards policy is examined, and new policy threads are developed. Conclusions are drawn and recommendations are made in part III.

Conclusions
Why is consortium standardisation sometimes preferred to formal standardisation? Consortia successfully market their feats. They are associated with timely standardisation and pragmatic standards solutions, despite some critical observations to the contrary.

This, and possibly the homogeneity and suggested exclusiveness of consortium standardisation, attracts companies. The two cases further show that (a) some consortia are used as a stepping stone for formal standardisation, (b) consortia are often equally relevant with respect to market co-ordination, and (c) changing a formal standard significantly is easier if the standards work is moved to a different setting, i.e. standards consortium.

Does the current definition of the problem of standards consortia accurately describe what is at stake? No, it does not. A redefinition of the problem is desirable, one which addresses the themes of democracy and compatibility.

- *Democracy.* According to the dominant view, consortia lack openness and are undemocratic. This view underestimates the openness of most industry consortia and overestimates the democratic procedures of formal standardisation. The research findings indicate that formal standards bodies and standards consortia work in similar ways. Consortia, too, strive for consensus, address minority viewpoints, etc.. Although the latter more explicitly target industrial parties, both settings include and exclude the same constituencies.
  The framework of rivalry merely leads to new hybrid forms of organisation like the CEN workshops. Speculating somewhat, these will not lure companies away from consortia but instead lead to a shift within the CEN standards domain away from the more formal procedures. Moreover, it by-passes the more significant difference between standardising and not-standardising. The real issues lie at a higher level.

- *Compatibility.* The cases further highlight that company and government policies overly emphasise the means of standardisation while largely bypassing its aim, namely technical compatibility. The latter can also be achieved by other means than standardisation. Among these are the proprietary and open source strategies to Information and Communication Technology (ICT) development. In certain circumstances, the latter strategies are more effective in achieving compatibility than standardisation. A more systematic inventory of compatibility-enhancing strategies is needed to supplement those deduced from the findings of the case studies.

Recommendations
The report pleads, firstly, for a European standards policy that bypasses possible rivalry between standardisation settings, goes beyond the inclusion of consortium standardisation, and works towards a differentiated standards policy. The latter should, on the one hand, reflect a pragmatic view where the majority of market standards is concerned (e.g. more exclusive, multi-party committees; focus more on standards implementation and market co-ordination). On the other hand, it should give more substance to the aim of democratic accountability which is required in *de jure* contexts. Secondly, a policy is desirable that goes beyond the standards process and centres on the objective of compatibility. This vantage point puts ‘the consortium problem’ into a very different, and clearer perspective. The Commission is therefore recommended to focus its policy on compatibility strategies, and not to restrict itself to standardisation. It is

recommended that companies and governments re-assess their standardisation policy from the *de facto* compatibility standpoint.

Questions raised

The report raises several questions. An important one concerns a difficult issue in the ICT field, namely that the supply-side of the market often lacks the necessary incentives to prioritise compatibility. What mechanisms does the public, i.e. the demand-side of the market, have at its disposal to advance collective compatibility interests? Would it be desirable legally to anchor compatibility interests in a way similar to that of how intellectual property interests are presently represented in regulation?

Foreword

This report presents the findings of a study on consortium standardisation, a project funded as a spontaneous grant by the European Commission DG Enterprise/ Standardisation Unit, and with additional funding from Verdonck Holding B.V. and the Delft University of Technology. It took place in the period January 2000 - June 2001 (draft report), and was finalised in September - October 2001.

There are several people whom I want to thank personally. First of all, Jan van den Beld (ECMA) and Christine Berg (DG Enterprise Standardisation Unit) for starting me off in a very efficient way; the members of the Commission of Recommendation Prof. Theun Bruins, Wim Verdonck, and Prof. Wim Vree for providing the necessary contacts, the additional financial support, and comments on papers, respectively; Arjan Loeffen for his crucial part in the W3C case; Willem Wakker for the discussions, the cooperation, the interesting material, and for commenting on papers; Richard Hawkins, Raymund Werle, and my colleagues of the ICT department for commenting on papers and ideas; ECMA TC41 members and the interviewees (see Appendix I); and last but not least members of the European Commission's Standardisation Unit/ DG Enterprise: Mr. Vardakas and Didier Herbert for their critical comments on the intermediary product, and Christine Berg, Christopher Roberts, and Michael Kirosingh, for their valuable advice along the way. They need not agree with the contents of this report.

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1. Introduction

In the past, the European Commission has always been very committed to formal European and international standardisation. For the reader who is less familiar with the issue at hand, *formal standardisation* refers to the voluntary consensus standards processes that take place in technical committees under the auspices of national, regional (e.g. European), and international standards bodies. The procedures that govern these committees express democratic values, aim to be inclusive (e.g. Public Enquiry of the International Standardization Organization (ISO) allows all interested parties that did not participate in drawing up a standard to comment on the draft standard), and reflect the desirability of a technical and politically neutral standards process (e.g. in the approval stage of a standard only the negative votes which are accompanied by technical arguments are counted). At stake is what could be called a *democratic ideology* (Egyedi, 1996). Its characteristic features are, for example, decision making by consensus; voluntary application of standards; broad constituency of (national) delegations; well-balanced influence of national members in the management of international standards bodies; and impartial, politically and financially independent procedures.

Formal standards are an important point of reference for European regulation (New Approach, 1985) and public procurement. Furthermore, formal standards have been at the basis of a harmonised European market. However, in the field of information and telecommunication technologies standards have emerged with high market relevance, standards that stem from other sources than the formal standards bodies. Examples are Adobe's Portable Document Format (PDF), the Internet standards developed by the Internet Engineering Task Force (IETF), and the Extended Markup Language (XML) recommendation developed under the auspices of the World Wide Web Consortium (W3C). How should these (de facto) standards be dealt with? Should the Commission revise its exclusive focus on the formal standards bodies, or should it encourage assimilation of these de facto standards by the formal standards institutions?

Questions to this intent are also raised in the European *Council Resolution* of October 1999 (Article 14). The Council observes "(...) an increasing tendency of interested parties to elaborate technical specifications outside recognised standardisation infrastructures" (Article 7). An important source for developing such specifications - and one on which the current research was requested to focus[1] - is the standards consortium[2]. A standards consortium is defined here as "an alliance of firms and organisations, financed by membership fees, formed for the purpose of co-ordinating technology development and/or implementation activities (...)" (Hawkins, 1998, p.1) Its outcomes are publicly available, multi-party industry specifications or standards. Usually its members are large companies,

[1] The scope of this research does not include some interesting, recent phenomena such as the significance of the CEN workshops and the meaning of the Open Source phenomenon for standardisation. These settings deserve separate attention.

[2] Other sources of what Bruins (1993) calls *grey standards*, are trade- or profession-oriented organisations (e.g. IEEE, ASE), and organisations like the IETF, a non-commercial multi-party forum, that work towards a specific environment (see e.g. Abbate, 1994; CRE, 2000; Egyedi, 1994, 1996).

which indicates that the resulting standards are likely to be very relevance for the market. These consortia are also referred to as 'market-driven consortia' (CRE, 2000).

The common feeling is that standards consortia work more effectively than the formal standards bodies do. But, according to the same sources, their disadvantage is that they have restrictive membership rules and are undemocratic. The latter is a cause of concern for the European Commission, which requires a minimum degree of democratic accountability if it is to refer to such standards in a regulatory context. At first sight, the Commission seems to face a policy dilemma: adhere to a principled approach, one that prioritises a democratic standards process, or pragmatically include undemocratic consortia as a source of standards. The Commission's request for new input on how to deal with consortium standards is set against this background.

Objectives

The current research was initiated, firstly, to provide contemporary case material that illustrates how consortia work, why sometimes consortium standardisation is initiated rather than formal standardisation, and whether consortia work in ways that will deliver open standards. For, although the phenomenon has been identified and studied since the early 1990s (e.g. Bruins, 1993), few case studies of consortium standardisation exist.

The second objective was to develop a new perspective on consortium standardisation that clarifies its significance for EU standards policy. This requires re-examination of current understanding of standards consortia, and of the assumptions and beliefs that underlie it.

Method: Case studies

Initially, one consortium standards process was to be studied from start to end by means of participant observation (i.e. attending standards committee meetings), and interviews with committee participants. Concerned was standardisation of Java, a key network technology owned by Sun Microsystems, in the ECMA consortium, an International Industry Association for Standardising Information and Communication Systems.[3] However, after two meetings the ECMA standards committee was prematurely disbanded. Since this reduced the time needed for data gathering, there was time left for a brief examination of a second case: standardisation of the eXtensible Markup Language (XML) by the World Wide Web Consortium (W3C). XML is presently viewed as a very important standard for structured information exchange. Since the standard was already finalised, data gathering for this case was done by means of document analysis, interviews with experts, and their feedback on the resulting working paper.

Structure of the report

The structure of the report is as follows. In Part I, the two cases are presented. They can be read separately. In Part II current assumptions on consortium standardisation are confronted with the case findings. The current basis for standards policy is examined, and new policy threads are developed. In Part III conclusions are drawn and recommendations are made.

The project has led to a number of papers and articles. These are listed in Appendix II.

[3] The standards process was to be concluded within the initial period of the EU research grant (15 January 2000 - 15 March 2001).

Part I: Cases of consortium standardisation

Industry consortia differ. Some focus solely on the development of technical standards or specifications: standards consortia, or *specification groups* (Updegrove, 1995). As the CEN/ISSS website indicates, there are many such consortia (CEN/ISSS, 2000). They may be R&D-oriented and pre-competitive (*research consortia*, Updegrove, 1995; *proof of technology consortia,* Weiss & Cargill, 1992), or focus on heightening the usability of existing standards (*implementation and application consortia;* Weiss & Cargill, 1992). Other consortia foremost aim to promote the adoption of a certain technology and seek the support of a business community (*strategic consortia*, Updegrove, 1995). To achieve a critical mass, suppliers of primary technologies and providers of complementary products and services must be directed along defined paths (Hawkins, 1998). To this end, consortia may rally support by organising educational activities for users of standards (Hawkins, 1999) or by combining promotional activities with specification development. In sum, although there are many differences between consortia, their common emphasis is on co-ordinating a segment of the market.

In this part of the report, two contemporary cases of consortium standardisation are presented: the industry consortia of ECMA and W3C. The ECMA, which was founded in 1961, is one of the oldest standards consortia, while W3C, a consortium founded in 1994, is one of the younger ones. Both of them foremost seek the support of the business community, and focus on developing standards (- according to the above typology: they are both *specification group* and *strategic consortium)*. More specifically, the cases of Java standardisation in ECMA (1999-2000), and XML standardisation in W3C (1998) will be described. The findings shed light on questions such as why consortium standardisation is initiated, how consortia work, and whether consortia work in ways that will deliver open standards. An analysis follows in Part II.
In order to present the case findings in an interesting way, questions have been formulated that draw out the main characteristics of the cases. In the case of Java standardisation (chapter 2), the red thread is the question why a company would want to standardise its technical specification if the latter is already a *de facto* standard. The account is based on extracts from an article titled "Why Java was - not standardised twice" (Egyedi, 2001b, see Appendix II). In the XML case, another puzzling element is addressed. According to its developers, the XML standard is based on the Standard Generalized Markup Language (SGML), a standard developed in the formal standards setting (ISO/IEC JTC1). Why did XML developers, most of whom were SGML experts, choose to standardise XML within the World Wide Web Consortium rather than in JTC1? To a large extent, this chapter (chapter 3) is an extract of "Succession in standardisation: Grafting XML onto SGML" (Egyedi & Loeffen, see Appendix II). Specific case-bound literature is included at the end of both chapters. General literature in included in the main reference list of this report.

2. Java in the ECMA consortium

When Sun Microsystems approached the ISO/IEC Joint Technical Committee 1 (JTC1) to standardise its Java™ Technology in 1997, Java was already well on its way to become a *de facto* standard. Sun became a recognised submitter of Publicly Available Specifications (PAS)[4] late 1997 but refrained from using its submitter status, allegedly because JTC1 had changed the PAS procedure in a way that would make the actual acceptance of the Java specs difficult. In April 1999, Sun approached the ECMA standards consortium, an international industry association for standardising information and communication systems, for the same purpose. If Java became an ECMA standard, it could be submitted to JTC1 by way of the Fast Track process[5]. However, after the first meeting of the ECMA standards committee Sun again withdrew. This time ECMA's Intellectual Property Right (IPR) rules were not elaborate enough, according to Sun. Two main questions arise. Firstly, why did Sun initiate formal and consortium standards activities in the first place? Secondly, why did Sun pull back twice?

There is a host of literature that addresses why companies partake in standardisation. Standardisation is part of the competitive product development process between producers (Weiss & Sirbu, 1990; Grindley, 1995). Companies partake in order to develop new markets and protect established markets (e.g. prevent compatibility to block competitors from their market). They use standards as change agents. They use them as strategic tools to consolidate a market position or gain advantage over competitors (Cargill, 1989; Bonino & Spring, 1991). This body of literature suggests that dominant market players, whose products have become a *de facto* standard, have few incentives to standardise. They are more likely to withhold information on interface specifications or change proprietary product interfaces at regular times to put off competitive product development. Or they may try to tie complementary products of other firms to their proprietary component technology. With an eye to long-term advantages, they may give away a technology or enter into coalitions with rivals to enlarge their user base and widen support for their proprietary standard (David & Greenstein, 1990). However, the step towards formal standardisation is seldom taken.[6] In this respect, the initiative to standardise Java™ is rather unique.

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[4] The procedure for the *Transposition of Publicly Available Specifications into International Standards* is based on the Fast Track process (see next note). It also allows an external organization to submit its specification as a draft International Standard, which means that according to JTC1's aims, the transposition can be completed within 11 months (ISO/IEC JTC1, 1999b). But the criteria for becoming a recognized PAS submitter are less restrictive than those for an A-liaison membership.

[5] The Fast Track process is an option for consortia and other multi-party fora that have an A-liaison membership status in JTC1. The A-liaison status is meant for organizations that contribute actively to JTC1 standards committees (e.g. ECMA and IEEE). It gives access to the Fast Track procedure: an A-liaison member can submit its specification as a final Draft International Standard - and thus skip the prior phases of the JTC1 standards process. This procedure strongly reduces the time needed for standardization. ("The duration of the final ballot, to become an IS ballot is six months." (ISO/IEC JTC1, 1999a)

[6] Two other significant exceptions are Adobe's PDF-format (ISO/DIS 15929; 15930) and HTML (ISO/IEC 15445:2000) which was offered first to the IETF and later to ISO.

2.1 Sun's Java Technology™ and the user environment

Java started as a programming language. In 1995, Sun realised that it could be used for the Internet. Its platform-independence, about which more below, allowed small Java programs to be downloaded and executed by web browsers. These moving, colourful applets triggered Java's breakthrough on the Internet.

Java's platform-independence. One of Sun's maxims was 'Write Once Run Anywhere' (WORA): a Java software developer should not need to rewrite his or her software program for different platforms. Java programs were to be portable and scaleable. In order to achieve cross-platform compatibility, Sun created a standardised application programming environment. Each system and browser provider was to fully implement the specifications and Application Programming Interfaces (APIs)[7] of the standardised Java environment if WORA was to be achieved. Several system providers, such as IBM and HP, did so. That is, they developed compatible Java Virtual Machines (JVMs, i.e. software that runs on proprietary operating systems and is capable of interpreting compiled Java byte code). Java is also applied in dedicated devices such as household appliances, television sets, cars, etc. in which case it is referred to as *embedded Java*, *or real-time Java*. The emphasis is in the case study on the Java programming environment.

Java user environment. Sun started by giving interested parties access to it source code. It invited developers to comment on, experiment with and improve the original source code. The source code was 'open' in the sense of being accessible and free of charge, but, for example, the decision about changes to the original code lay in Sun's hands and commercial use was bound to license restrictions.
Part and parcel of Sun's licensing policy were the test suites used to certify compatible Java products, and the Java-compatible logo (the steaming cup of coffee) to brand compatible products. These instruments of control were closely tied to Sun's IPRs to trademarks (e.g. Java™ and Java Compatible logo), patents (software algorithms) and copyright on the specifications. Pressed by its commercial licensees, Sun developed a 'Community Source' licensing model, which sought to combine the advantages of the Open Source licensing model and the Proprietary licensing model (Gabriel & Joy, 1998). It did, indeed, represent a more liberal licensing regime for commercial parties, but Sun still retained ownership of the original code, the upgrades, and the test suites.
A Java community had developed. Sun tried to institutionalise this community in December 1998 with the Java Community Process (JCP) manual. However, the document was criticised for Sun's too dominant role therein (Harold, 1999; Vizard, 1998). The second version issues in 2000 differed in many ways and answered to much of the critique (Shankland, 2000; Sun, 2000a).
The idea of WORA and Sun's strategies to involve others in developing and implementing the Java platform led to a large user base. In 1999, there were more than 1,3 million Java developers (International Data Corporation, op. cit. in Babcock, 2000).

[7] APIs comprise the standard packages, classes, methods and fields made available to software developers to write programs (Sun, 1997c).

This figure consists of developers who work for companies and, for the majority, of independent developers.

2.3 JTC1, the first attempt

Sun was the first private company to apply as a recognised PAS submitter. IBM strongly backed up Sun's application. This happened in March 1997. It caused a stir because although the rules allowed individual companies to apply, the criteria favoured open, consensus-oriented organisations. Within the American National Standards Institute (ANSI)[8], Sun's home base, opinions already strongly differed (Rada, 1998). In July, Sun's application was turned down with comments. The comments of the JTC1 national members roughly focused on Sun's desire to keep the Java trademark for itself and have the JTC1 standard called something else; on what body would be responsible for updating and maintaining the Java standard; and on whether Sun would be open in accepting changes to the standard (Clark, 1997). Sun addressed the comments in September 1997 and reapplied as PAS submitter (Sun, 1997a). It suggested, for example, that a JTC1 working group, which would be open to all stakeholders, would address the standards maintenance work, and it offered to supply the project editor. Two months later, Sun was accepted as a PAS submitter. But, again, there were comments (ISO/IEC JTC1, 1997). The national bodies expected their comments to be addressed in the Explanatory Report that would accompany Sun's submission of the Java specs, and they added that voting 'yes' at this stage did not automatically include approval of the specs.
According to Sun, the positive outcome of the voting was to be understood as international approval of Sun’s open Java development process. In the following year, Sun did not take steps to actually submit the Explanatory Report or the Java specifications to JTC1. Sun silently withdrew from the PAS process, a move that became apparent when Sun's overtures to ECMA became public.

2.3.1 Initiative

In the following sections, the events are examined in more detail. I thereby distinguish between Sun's explanation of the events and my interpretation of them, because they do not always coincide. I use the headings of 'stated reasons' and 'interpretation' for this purpose.

Stated reasons. Sun said its goal always was to "have Java, already a de facto international standard, codified as a *de jure* standard" (Sun, 1997b). From a business perspective, Sun's interest in standardisation was to increase the visibility and importance of Java and to promulgate a network-centric view on ICT developments. By approaching JTC1, Sun signalled that Java was to be a specification that people could rely on as being

[8] Of interest is that Sun had taken first steps to formalize Java through ANSI, the first most obvious step for a U.S.-headquartered company. According to Sun's head of standardization, Sun did not pursue this route because of "arcane and potentially obstructionist processes" in ANSI (Cargill, 2000).

stable and that it would not be changed unexpectedly. It allowed people to make a commitment to it.
Sun chose the PAS procedure because this was the most effective way to get the Java technology formally accepted world-wide. It was a means to get easier access to the public procurement market, and to preserve industry's substantial investment in Java. The latter argument can be understood as a way of saying that the Java submission should not undergo serious changes during the PAS review process.

Interpretation. Sun did not intend to hand over the evolution of Java to JTC1 (Sun, 1997d). It expected to retain control over the standards maintenance process by safeguarding the role of the Java community during JTC1 standardisation, whose input was co-ordinated by Sun itself. ("The JTC1 working group that will address standards maintenance must be responsive to international Java community." (Sun, 1997a)) Sun upheld essential IPRs, and retained its patents (although no fees are asked), its copyright (joint-copyright ownership was suggested, no fees asked), and trademarks (e.g. control over compatibility logo). An additional benefit of the PAS procedure was that ongoing Java developments would become tightly linked to standards development. The revenues from IPRs were forfeited in exchange for enlarging and stabilising the Java market - without compromising control over cross-platform compatibility (e.g. by means of the Java compatible logo and the test suites). JTC1 's role was to codify and ratify the specification development activities supervised by Sun.
Sun's PAS initiative can therefore best be understood as a means to orchestrate the orientation of market players. There are two main reasons to think so. Firstly, because JTC1 was the pre-eminent international standards body for IT matters, it was a focal point for consensus-based standards development. The PAS procedure would appear to leave room for the influence of competitive market players, keep them oriented towards Java developments led by Sun, and dissuade competitive developments.
Secondly, in the years that preceded the PAS initiative Java was becoming a hype (1995-1996). Mainly by way of Netscape Navigator, copies of Sun's Java runtime environment were downloaded to the PC systems of Windows users. Sun's network-centric vision and Java's promise of platform-independence made Microsoft nervous. Sun was challenging the basis of Microsoft's software market, the Windows platform. In 1995, Microsoft had already approached other companies to withdraw from activities that supported Java™ developments (e.g. Netscape and Intel). By late spring of 1996, senior Microsoft executives were deeply worried about the potential of Sun’s Java technologies to diminish the applications barrier to entry (US, 1999).
In March 1996, Sun and Microsoft signed a Technology License and Distribution Agreement (TLDA) for the use of Java. The agreement included the incorporation of Sun's Java™ Technology in Microsoft's Internet Explorer 4.0. Late 1996, Microsoft released Internet Explorer 3.0. It was a much-improved version. Some reviewers considered it competitive to Netscape Navigator. In order maximise the usage of Internet Explorer, Microsoft decided that the next version would be more tightly integrated into Windows (US, 1999). Moreover, Microsoft was using its Java license to create its own Java development tools and its own Windows-compatible Java runtime environment. It did so in a manner that undermined Java portability and that was incompatible with Sun's Java products. In the same month that Sun started the PAS application, Microsoft

distributed its own incompatible Java toolkit. When Sun applied as a PAS submitter for the second time, it was preparing a lawsuit against Microsoft for copyright infringement. For Sun, the rumours of Microsoft's previous dealings with other players and a premonition of Microsoft's strategy to develop a Windows-dependent Java browser and toolkit would have been reasons not to overestimate its own position in the market. In this market, the step towards international standardisation may well have served the purpose of rallying support for Java™. Sun most likely assessed that its footing in the Java market was not secure enough, which explains its willingness to standardise. On the other hand, it also explains why Sun could not relinquish control over Java.

2.3.2 Withdrawal

Stated reasons. Sun withdrew from the PAS process because it did not agree with changes in the PAS procedure decided on in November 1998 (ISO/IEC JTC1, 1999b). The old procedures still applied, but Sun's status as a PAS submitter would have to be reconfirmed in November 1999, at which time the new rules would apply. The new procedures, according to Sun, implied that Sun would have had to turn standards maintenance and the evolution of Java over to JTC1. Moreover, standards maintenance would not be restricted to minor adjustments such as bug fixing. JTC1, on the other hand, remarked that the changes were clarifications (ISO/IEC JTC1, 1999d).
Comparing the 1999 version of the PAS procedure with the previous version (1995), in the latter version handling of standards maintenance is settled 'in accordance with the agreements made between JTC1 and the recognised PAS Submitter'. The 1999 version stipulates that the normal JTC1 rules for maintenance apply, regardless of the origin of the International Standard. JTC1 would take the lead in corrections to defects and - which will have alarmed Sun - revisions of existing standards. Reacting to Sun's objections, the JTC1 chairman writes, that "the clause addressing the topic of maintenance in the revised JTC 1 PAS procedure is consistent with the comments made by a number of JTC 1 National Bodies that voted to approve Sun as a PAS Submitter but noted the need for JTC 1 involvement in the maintenance of the resulting International Standard." (ISO/IEC JTC1, 1999c)
But much had happened behind the scenes. Sun attributed the changes made to the PAS procedure to lobbying by Microsoft, Hewlett-Packard (HP) and others from the 'Wintel world' (Shankland, 1999b). (Microsoft wanted its own Java functionalities enabled.) Sun withdrew because it felt that the change of procedures was only a next stage in the opposition. The procedural changes signalled that Sun would encounter problems when submitting the Java specification. For example, a Java Study Group had been installed in JTC1 Sub-Committee 22 (SC22) and people were discussing how they were going to change the Java specification. It was at that point that Sun seriously started considering alternatives.

Interpretation. Sun judged that JTC1 would probably not agree to ratify Sun's work in view of the influence of the 'Wintel-world in JTC1. But, apart from the reasons Sun gave for withdrawing, there were developments in the market that threatened Sun's position, occurrences which increased Sun's desire to keep a grip on Java developments. Firstly, Microsoft did not abide to the Java licensing agreement, and posed a threat to cross-platform compatibility. In October 1997, Sun filed a complaint against Microsoft for copyright infringement. In March 1998, the court granted Sun's request for a preliminary injunction. Microsoft was not allowed to use the Java Compatible trademark unless its products passed Sun's test suites. In May, Sun filed a complaint for unfair competition. In November 1998, the court ordered Microsoft to change its software and development tools. Microsoft appealed against the ruling (Egyedi, 2000b).

Secondly, in the same period there were disquieting developments in the area of real-time embedded Java. Hewlett-Packard (HP) announced in March 1998 that it had developed a *clean-room* version of real-time embedded Java, that is, a version that was developed without looking at Sun's source code (Concerned is a manner of reverse engineering by which Sun's IPRs on Java are circumvented.). In June, the US National Institute for Standards and Technology (NIST) started organising workshops to develop specification requirements for real-time Java. Sun participated, as did competitors such as HP and Microsoft (Jensen, 1999). In November 1998, a Real-Time Java Working Group (RTJWG) led by Microsoft and HP was formed. Sun did not participate. The RTJWG approached the US national standards channels, that is, the National Committee for Information Technology Standardisation (NCITS/ NIST), to formalise its standards work. But in January 1999 its request was turned down because NCITS feared this could lead to fragmentation of the Java market. The RTJWG subsequently founded the J Consortium. Meanwhile the Real-Time Expert Group (RTEG) was formed within the Java Community Process, a group that was led by IBM.

The RTJWG activities were disquieting to Sun, because real-time Java draws on the base specifications of Java™. According to the experts whom Sun consulted, it was not possible to write real-time specs in a useful way without making changes to the base specifications. There was therefore a risk that competitive developments in the field of real-time Java would affect the work done on Java™ within Sun's JCP.

Sun reacted to the market pressure and to changes in the PAS procedure by elaborating the procedures for Sun-led Java community participation, withdrawing from JTC1, and exploring alternative options for international standardisation. In December 1998, Sun issued its first version of the JCP and presented its Community Source licensing model (see earlier). They were designed to signal that Sun had taken the criticism of 'benevolent dictatorship' to heart and accepted more far-going influence of the community on Java development. The Community Source model, which partly sympathised with the open source movement, was to underscore Sun's new approach. It mainly served to re-orient players in the field of real-time Java. Sun's JTC1 initiative had failed to keep the real-time Java dissidents in line. The withdrawal in itself was based on Sun's assessment that it would not be able to manoeuvre the Java specification through the PAS procedure unscathed. It was a move that followed from its compatibility control strategy. To keep control of Java it needed to withdraw. This time it did not attempt to re-orientate the market, since those involved with the Java™ programming environment publicly heard about Sun's withdrawal only when Sun had already approached ECMA (May 1999). To them, Sun was still pursuing the standardisation path.

2.4 ECMA, the second attempt

In April 1999, Sun formally approached the ECMA to discuss Java standardisation (Shankland, 1999a). Sun initially proposed that ECMA would carry out 'passive maintenance' of the Java standard, meaning that Sun's JCP would still determine Java development (Sliwa, 1999). But ECMA refused to endorse this approach. The two parties ultimately agreed to the instalment of a technical committee on Platform-Independent Computing Environments (TC41) which would 'standardise the syntax and semantics of both general-purpose and domain specific platform-independent computing environments.' The committee would develop a standard for a cross-platform computing environment based upon the Java 2™ Standard Edition Version 1.2.2, a specification that consists of the Java Language Specification, the Java Virtual Machine Specification, and the Java API Core Class Library Specification. The aim was to contribute the standard to ISO/IEC JTC1 by means of the Fast Track process. The ECMA General Assembly gave its approval in June 1999.
The first TC41 meeting took place in October 1999. It was chaired by IBM. During the meeting, Sun emphasised that the TC should focus on 'edition rather than addition' of the Java specifications. Sun provided the main editor. The JTC1 SC 22 Java Study Group, with which the ECMA liaised, would be asked for input before formally invoking the Fast Track process. Three task groups were installed to tackle the work. A Microsoft representative chaired the group working on the API specifications. Sun was to distribute the Java 1.2.2 specification on CD-ROM at the meeting. However, at the end of the two-day meeting a Sun representative announced that Sun lawyers required more time to consider the IPR issues involved (ECMA, 1999a). The second meeting was set in January 2000.
In December 1999, Sun made public that it would not contribute the Java specifications to ECMA. At the January meeting, the TC41 participants debated whether it would be feasible to draft a Java standard without Sun's contribution. But some large companies objected (Fujitsu, Siemens, HP and Compaq). In March 2000 the TC was disbanded.

2.4.1 Initiative

Stated reasons. Sun chose ECMA because ECMA had close ties with the formal European and international standards bodies and an A-liaison with JTC1, which gave it access to the Fast Track procedure. Sun understood that in the past ECMA standards had been submitted to a yes/no vote in JTC1 without any modifications, and often successfully so. If Java would become an international standard, customers, partners and developers would feel more confident about investing in it (Perez, 1999). But, Sun said, it would also be pleased if Java would remain an ECMA standard (Shankland, 1999b).
From Sun's standpoint, ECMA TC41 would edit the Java version that resulted from Sun's JCP trajectory, because there were products based on it and there was a developer community working to the specification. Sun was under the impression that ECMA had agreed that Sun would retain copyright of the specifications during the standards process,

and that ECMA would copyright the resulting standard. The latter was necessary to submit it to JTC1 through the Fast Track procedure. (Although Sun would not claim copyright of the standard, it would hold on to IPRs such as the Java name and the Java Compatibility logo, which had a business value to Sun.)
Furthermore, TC41's program of work was specifically limited to the Java Standard Edition version 1.2.2. Any risks which Sun was taking would be restricted to this Java version. More far-reaching changes would be part of a new Java version, a development process that would take place within the JCP environment (Sliwa, 1999).

Interpretation. ECMA was an open standards consortium and thus an answer to continuous pressure from licensees and real-time Java developers to open up the Java development process. Many large companies were members. So ECMA processes also promised to be relevant in respect to co-ordination of the market. Sun's move further suggested consistency in its aim towards international standardisation. But at the same time, the move was an alibi for withdrawing from the PAS procedure without gravely letting down those who were pressing Sun for open standardisation.
Sun's position in ECMA was stronger than in JTC1. Sun participated at the time in the ECMA Coordinating Committee (Mr.R. Cargill) and shortly after in its Management (Ms.V. Horsnell, treasurer); and the acting chair of the JTC1 SC22 Java Study Group, with which ECMA liaised, was a Sun representative (Mr. J. Hill). Sun further controlled the conditions under which the process would take place by means of its IPRs and by restricting the scope of the program of work. Perhaps, too, in the preparatory period of defining TC41's program of work, Sun had less reason to fear Microsoft. The judicial system was partly checking Microsoft's undermining actions with regard to Java compatibility.
In the set up of this standards initiative, Sun had a more focused control strategy than during the PAS initiative. Its emphasis appears to have been on technology content-oriented standardisation.

2.4.2 Withdrawal

Stated reasons. Sun's official reason to withdraw from the ECMA process was that "(…) ECMA has formal rules governing patent protections; however, at this time there are no formal protections for copyrights or other intellectual property." (Sun, 1999) Unofficial Sun sources indicated that problems had arisen between the ECMA GA meeting (June 1999) and the first ECMA TC41 meeting (October 1999). These concerned the timing and place of the first meeting, which was scheduled months later than Sun had intended, and procedural issues. (Certain companies insisted that the committee would not be chaired by Sun, that the editors would not be Sun people, and proposed that Microsoft co-ordinate the development of API specifications.) There were also hints, according to Sun, that the oral agreement on copyright, as Sun understood it, would not be upheld. Sun became wary.
At the first committee meeting, Sun lawyers were taken by surprise by the ECMA secretary general's explanation of IPR rules regarding contributions to standardisation. As a rule ECMA documents were not copyrighted. Regarding the copyright status of the

Java specs, Sun's contribution would become an ECMA document once it was assigned a TC document submission number. When Sun representatives protested, the ECMA secretary general proposed to explore means by which Sun could maintain copyright during the standards process. ("Contributions from member companies to ECMA can be copyrighted, and can retain their copyright status if the owner of such a specification allows ECMA to freely use the contents of the contribution for the development of an ECMA Standard." (ECMA 1999c)

The problem was, firstly, that the parties (Sun and ECMA) had a different view on what was previously agreed, and in particular who was to copyright the Java specs during the standards process. But, secondly, Sun's ideas with respect to the meaning of copyright at that point appeared to differ from ECMA's. Sun differentiated between a copyrighted specification and a copyright of the contents of the specification (i.e. roughly speaking, the difference between paper and software). The problematic part was how TC41 would handle the latter copyright interpretation, which was new to all concerned. At the subsequent meeting of the ECMA Coordinating Committee (November 1999), Sun explained the distinction, and said that it intended "to provide ECMA with a derivative copyright but that this has to be treated as an IPR, under a copyright license agreement" (ECMA, 1999b). The conditions of such an agreement were not yet decided on. Early December, Sun announced its withdrawal.

George Paolini, vice president of Java community development at Sun, provided another reason for Sun's withdrawal. He said in a letter to ECMA that Sun had decided to keep control of Java within its Java Community Process. "The Java Community Process has expanded its level of activity to a point where we now believe the interests of the entire Java community will be best met by continuing to evolve the Java specifications with the open JCP process." (ECMA, 1999b) By then, a proposal for the second version of the Java Community Process had been developed.

Interpretation. The events that took place before the first ECMA TC41 meeting, indicated that Sun's influence on the standards process was under attack: procedural issues were discussed that would undermine Sun's position. Furthermore, according to a member of the ECMA Coordinating Committee the prior informal agreement about copyright issues was ambiguous.

The steps which Sun took in the months following its withdrawal give credence to Sun's official reason to withdraw. The industry association of European Information and Communication Technology Industry Association, founded in January 2000, installed a Standards Policy Group chaired by Sun. The policy group was to develop a position on the licensing terms of software technology embedded in standards protected by copyrights rather than patents[9]. Sun also planned to raise the issue at a meeting of the European ICT Standards Board, but refrained from doing so before the meeting (ICTSB, 2000). Lastly, Sun called together a Standards IPR Forum meeting during the Open Group Conference (April 2000, London) to address, among other things, ownership of copyright on submissions.

[9] The EICTA position paper is referred to in CSN 337-03 Sun's Up To Something.

Sun actions > Co-ordination strategies	Formal Standardisation (JTC1)		Consortium Standardisation (ECMA)	
	Initiation	*Withdrawal*	*Initiation*	*Withdrawal*
Technology-oriented compatibility control	-	X Java would not survive PAS unscathed	x Focus on Java version 1.2.2	X Procedural disputes Copyright ambiguity Sun-Microsoft lawsuit
Orchestration of market orientation	X Heighten market's commitment to Java	x JCP installed to attract real-time Java developers	X Heighten market's commitment to Java	-

Table 2.1 Summary of the findings. (The largesse of the X indicates whether technical compatibility and market orientation are significant factors (X) or not (-), or to a lesser degree (x).

However, the primary issue was not that the copyright agreement was ambiguous and informally arranged - probably both ECMA and Sun initially had an interest in this arrangement. The above-mentioned procedural disputes between June (approval of the TC41 work program) and October 1999 (the first TC41 meeting) seem crucial. Moreover, in August, Sun heard that in its ongoing lawsuit against Microsoft the court had granted Microsoft's appeal against the preliminary injunction for copyright infringement. The appeal was, in brief, that the punishment did not fit the crime committed (i.e. a breach of contract should not be punished by means of an injunction). This verdict was a blow to Sun, and had consequences for Sun's stance in ECMA. If Sun would loosen its IPR claims for the purpose of ECMA standardisation, it might jeopardise its position in the next stage of the lawsuit.[10] Furthermore, possibly also the outcome of the lawsuit raised Sun's doubts about what legal protection a copyright offers (-although this was to my opinion not the issue in the August trial). This would explain Sun's introduction of a dual meaning of copyright. In sum, procedural issues and the Sun v. Microsoft lawsuit fuelled Sun's wariness. By not clearing the copyright issue beforehand, Sun could introduce a new meaning of copyright, one which would not be acceptable to the ECMA TC, to pave the way for total withdrawal. "[Sun] just does not want to give up control", as the ECMA Secretary General, Jan van den Beld, told the press (Niccolai & Rohde, 2000), and it had several reasons not to do so. Possibly Sun did not believe Java was stable enough or had achieved sufficient critical mass to relinquish control (Niccolai & Rohde, 2000). Whatever reason presided with regard to ECMA standardisation, Sun’s actions focused on preserving control over the Java™ specifications.

[10] Informal communication with ECMA TC41 participants. The ruling was confirmed in January 2000. Sun's compliant against Microsoft for unfair competition was granted. (Sun, 2000b).

2.5 Conclusion

Sun primarily initiated standardisation in JTC1 and ECMA because an international standard implied stability, would increase market confidence and would therefore encourage commitment to Java. It wanted JTC1 and ECMA to 'ratify' the existing Java™ specification and did not seek the involvement of their committee members in its development. Rather, it sought commitment from the clients of these standards bodies (i.e. implementers of JTC1 standards). It withdrew from JTC1 because it suspected standards politics behind procedural changes, because of incompatible and competing market developments, and - above all - because it expected that its Java specification would not survive the PAS procedure unscathed. Sun intensified its compatibility control strategy in subsequent negotiations with ECMA. To minimise risks, it focused its standards initiative on a specific version of the Java specifications. However, the procedural disputes that preceded the first ECMA committee meeting made Sun wary. Added to new developments in the lawsuit with Microsoft, Sun referred to ECMA's ambiguous copyright rules to pull back from ECMA standardisation.

Table 2.1 summarises the main findings. It shows that Sun's initiative to formalise its de facto standard was primarily motivated by its aim to orchestrate the market. Whereas, a basic fear of a fragmented technical platform - and ensuing market effects - motivated Sun to withdraw.

Sun pursued a protective and defensive control strategy. Whether it should instead have followed a more offensive strategy, based on confidence in a market-co-ordinated development of platform-independent Java, is a matter for debate.

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3. XML in the World Wide Web Consortium

The XML standard (1998) was well received by the information technology practitioner community. While the trade press mostly hailed it as a functionally rich sequel to the HyperText Markup Language (HTML), it sometimes described it as a welcome leaner version of the Standard Generalized Markup Language (SGML). According to XML developers themselves, XML (1998) was a compatible successor[11] to SGML (1986/1988), a standard developed in the formal standards setting of ISO/IEC JTC1. Was XML, indeed, compatible? If so, why did XML developers, most of whom were SGML experts, standardise XML within the World Wide Web Consortium rather than in ISO/IEC JTC1?
To provide the background necessary to answer these questions, a brief sketch of the technologies concerned follows.

3.1 SGML

Work on SGML started in 1969 with the development of a language called the Generalized Markup Language (GML) at IBM (Goldfarb, 1990). It was used to manage the large amount of complex industrial documents at IBM. GML was designed to record document structures independent of how these structures would subsequently be processed. For example, GML documents recorded headings, paragraphs, lists and figures –that is, information that is useful for editorial applications– but no formatting instructions. In this manner, GML separated the document description from the formatting languages (IBM used several such languages for printing). Also, because GML identified document structures, fragments of documents could be addressed and reused in different contexts.
In 1978, the ANSI took an interest in IBM's work on GML. By the efforts of Charles Goldfarb, one of the three inventors of the language, work started on a more generic version: SGML. A major addition to the original design was made. In order to determine the validity of the document structure, and to support a wide variety of lexically different languages (e.g. different signs for start-tag), a formal description, or *grammar,* would accompany each document. Firstly, this grammar identified the type of components (*elements*) and their interrelations (*content model*). It was defined separately in what was called a *Document Type Definition* (DTD). Secondly, the DTD included a descriptive lexical and syntactical model that defined how the data was to be recorded, archived and distributed.

[11] *Compatible succession* - or 'grafting' as it is called in Egyedi & Loeffen, 2002 - refers to a situation where software products that comply to the successor standard also interoperate with products based on its predecessor. Such is typically the aim when the successor is a new edition or a minor revision of a standard. Concerned are *incremental* innovations, where the problem addressed by the old standard has not changed and - in essence - neither has the means to solve it. Both standards are part of the same *technological paradigm* (Dosi, 1982).

Working drafts were published between 1980 and 1983. In 1983, the Graphic Communications Association (GCA) produced the first SGML recommendation. It was adopted by the US International Revenue Services and the US Department of Defense (DoD). The International Organization for Standardisation (ISO), too, became interested. It started a working group on SGML (ISO/IEC JTC1/SC18/WG8, now equivalent to ISO/IEC JTC1/SC34). This led to an international standard in 1986 (ISO 8879: 1986). An amendment was issued in 1988 (ISO 8879: 1988).

SGML Objectives (Source: ISO 8879:1986, Clause 0.2)	**Design goals for XML** (Source: XML 1.0, 2nd ed., 2000)
1. Documents “marked up” with the language must be processable by a wide range of text processing and word processing systems. 2. The millions of existing text entry devices must be supported. 3. There must be no character set dependency, as documents might be keyed on a variety of devices. 4. There must be no processing, system, or device dependencies. 5. There must be no national language bias. 6. The language must accommodate familiar typewriter and word processor conventions. 7. The language must not depend on a particular data stream or physical file organization. 8. “Marked up” text must coexist with other data. 9. The markup must be usable by both humans and programs.	1. XML shall be straightforwardly usable over the Internet. 2. XML shall support a wide variety of applications. 3. XML shall be compatible with SGML. 4. It shall be easy to write programs which process XML documents. 5. The number of optional features in XML is to be kept to the absolute minimum, ideally zero. 6. XML documents should be human-legible and reasonably clear. 7. The XML design should be prepared quickly. 8. The design of XML shall be formal and concise. 9. XML documents shall be easy to create. 10. Terseness in XML markup is of minimal importance.

Box 3.1: Aims of the SGML and XML standardisers.

The 1988 version remained stable for eight years. In that period, ISO also published a number of SGML-related, supplementary standards. We mention two important ones. The first is the *Hypermedia/Time-based structuring language* (HyTime, ISO/IEC 10744:1992), a standard that addresses hypermedia relations. It offers a rich model for addressing and linking SGML documents as well as other type of information objects. Another important standard, called the *Document Style Semantics and Specification Language* (DSSSL, ISO/IEC 10179.2:1996) addresses styling. It specifies rules for transforming and formatting SGML documents. Furthermore, various tools and applications were created. Because the SGML concept was based on process-independent document structures, the same data in SGML documents could be understood by, for example, database and text processing tools. The range of SGML supporting tools included word processors, parsers, transformers, publishing engines, browsers, document

management systems, and even dedicated programming languages and libraries. Areas of application included publishing (e.g. so used by the American Association of Publishers, IBM, and the US Department of Defense in the CALS initiative), text research (Text Encoding Initiative), and the exchange of product information (Society of Automotive Engineering J2008).
One of the important uses made of SGML was the HyperText Markup Language (HTML). It was developed by Tim Berners-Lee (CERN, and founder of W3C) for the World Wide Web, and first standardised by the IETF in 1995 (Berners-Lee & Connolly, 1995). HTML did not start out as a fully SGML-compliant application. It complied from the second version onwards. Many of the rules imposed on SGML documents were not – and are still not– enforced by browsers for HTML documents. Most browsers even accept and process invalid HTML documents.

3.2 XML

The W3C installed the SGML Editorial Review Board (ERB) in 1996 to develop XML (Connolly, 1997). Its members all had SGML expertise. Many also participated in SGML(-allied) ISO working groups. Apart from bringing the power of SGML to the web (XML), the ERB aimed to develop specifications for 'XML hypertext link types' and for DSSSL use in an Internet context.[12]
The review board became a regular working group (XML WG) the year after. Microsoft, one of the three active members of the XML WG, was an early adopter of XML for Internet Explorer. Netscape, likewise an active member, supported XML at a later stage. Together, these two companies covered a large share of the HTML market, which is of interest because at the time the web-browser was the main platform for XML document exchange. The W3C recommendation for XML 1.0 was published in February 1998 (Bray, Paoli & Sperberg-McQueen, 1998).
A wide range of XML applications, tools and standards has emerged since. Presently, the number of public applications exceeds 250. They address very different areas: publishing, electronic data interchange (XML/EDI), data modelling (UML/XMI), workflow management (WfMC), software engineering (SOAP), and so on. The functionality offered by XML-based software tools is equivalent to those for SGML. But, firstly, the advent of web content delivery, and the emergence of XML servers and middleware has led to additional XML functionality. Secondly, many libraries and XML extensions to existing programming environments have become available. Thirdly, the number of W3C XML-based specifications and standards by far exceeds those for SGML. W3C has produced additional recommendations on naming (namespaces), normalisation (XML information set), transformation (XSLT), publication (XSL, Associating style sheets), implementation (DOM), addressing (Xpath) and linking (Xlink) of XML documents.

12 Jon Bosak: "Re: Welcome to w3c-sgml-wg@w3.org!", one of the first submissions to the discussion list of the W3C SGML Working Group, contribution to w3c-sgml-wg@w3.org discussion list, Aug 28 1996.

3.3 Efforts to create a compatible successor

The participants in XML development were SGML experts. They partly were or had been active in SGML or SGML-allied standards developments (e.g. DSSSL-O), and often knew each other from, for example, GCA conferences. The constituency of W3C's working group and JTC1's WG8 overlapped. Because of overlapping membership there was reciprocal influence. However, there was also a degree of group identification (we-them)[13] and standards politics (e.g. personal differences and the Not-Invented-Here syndrome)[14].

When the W3C's working group started, it was clear that "(...) the ultimate goal of this effort is the creation of a form of SGML that can be used to transmit documents (or document fragments) to a future generation of Web browsers and similar Internet client applications." [15] But whether this XML would be an SGML subset, a derivative, a conformance level, or an application profile was not yet decided and, as the chair of the working group writes, "our uncertainty has two levels: we're not sure where the optimum balance is between SGML compatibility and ease of implementation as a general goal, and we're not sure which specific features of SGML should be retained in XML. (...)"[16]

The starting point was, that XML would be compatible with SGML. That is, existing SGML tools should be able to read and write XML data, and XML instances were to be SGML documents without changes to the instance.[17]

Overlap between the constituents of the W3C and the JTC1 working groups kept the compatibility intent alive. In September 1996, soon after the electronic discussion list of the W3C working group started, Eve Maler posted a contribution which illustrates some of the compatibility concerns and dilemmas that were at stake[18]. For example,

> "Who is the customer/audience for XML -- existing robust-SGML users, existing Web/HTML users who are not SGML-aware, or both? (...) I'd rather think of XML as an effort to define a cohesive SGML 'application profile' that benefits both tool creators and document creators, rather than a set of unrelated cool hacks that make it easier to write parsers. (...)What should happen when existing SGML documents (including valid HTML) are processed by XML tools? Should a 'round trip' between the two forms be possible, or is only XML->SGML or SGML->XML okay?"

[13] Tim Bray quoted in Charles F. Goldfarb, 'Re: Compliance with 8879, a moving target', 12 Sep 1996.

[14] Private communication.

[15] Jon Bosak, 'W3C SGML WG: The work begins', contribution to w3c-sgml-wg@w3.org discussion list, 5 Sep 1996

[16] Jon Bosak, 'W3C SGML WG: The work begins', 5 Sep 1996.

[17] Two other aims are "For any XML document, a DTD can be generated such that SGML will produce "the same parse" as would an XML processor.", and "XML should have essentially the same expressive power as SGML."

[18] Eve L. Maler, 'Compatibility issues and principle #3', contribution to w3c-sgml-wg@w3.org discussion list, Sep 16 1996.

Partly these were resolved. Some were impossible to resolve satisfactorily [19]. The outcome was a largely but not fully aligned XML specification in respect to SGML (1988). That is, the XML Recommendation included a non-normative part which, if implemented, "increased the chances" of XML-SGML interoperability. But it provided no guarantee. JTC1, on the other hand, developed a new version of SGML (SGML 1999) to re-established compatibility. (For a technical discussion of the SGML-XML relationship and efforts to re-forge compatibility between them, see Egyedi & Loeffen, Appendix II.)

3.4 Analysis of standardisation outcome

Why was XML not fully compatible with SGML (1988), as had been the aim? Did XML represent a paradigm shift? What sort of causes led to discontinuity in standardisation?

3.4.1 Paradigmatic elements

To briefly refresh the reader's memory, a *paradigm* is a set of shared views, heuristics, exemplars, etc. that guide and structure the way a practitioners community normally solves its problems. Which paradigmatic features structure the way SGML practitioners (i.e. standards developers and implementers) work? That which characterises the SGML problem and started things off was the need to reuse information fragments and share documents across publication systems in a future-proof way. IBM addressed the problem by separating the syntactical and the logical document structure. It determined – as it were – the sort of answers with which to solve the puzzle and laid the fundaments for the SGML approach.
XML developers were raised with the principles of SGML. SGML was a technical exemplar and an exemplar in respect to the functionality it could offer: the identification, exchange and reuse of information fragments in different contexts. XML, too, was initially document-oriented. Furthermore, in discussions XML was called a "lean-and-mean dialect of SGML"[20]. It was to become a simpler version of SGML. It could become so, for example, because different from SGML it could refer for character sets to Unicode and the ISO 10646 standard. Simplifications like these emphasise continuity rather than deviation from SGML features. Except for the DTD-less document, which we would typify as a shift within the SGML paradigm, the general SGML mindset and strategies also apply to XML.

[19] David G. Durand, 'Last unstructured discussion: SGML compatibility', 9 Oct 1996, contribution to w3c-sgml-wg@w3.org discussion list.
[20] "Re: Capitalizing on HTML (was Re: equivalent power in SGML and XML)" , C. F. Goldfarb, contribution to w3c-sgml-wg@w3.org discussion list, Sept. 19 1996.

3.4.2 Causes for Discontinuity

Context of Use. What explains the discontinuity between the standards successors? Firstly, the web-based context of use had little in common with the context of SGML in the 1980s (*technological anachronism)*. The technology of the 1990s offered new opportunities and posed different constraints. The domains of use shifted together with the practitioners involved *(migration of use)*. See Figure 1. Although the information modelling approaches of SGML and XML were in principle identical, the SGML problem was foremost how to manage the *company-internal*, complex flow of documents. XML, on the other hand, developed as a solution to the limitations of HTML in respect to *company-external, web-oriented* document exchange. See Table 5.

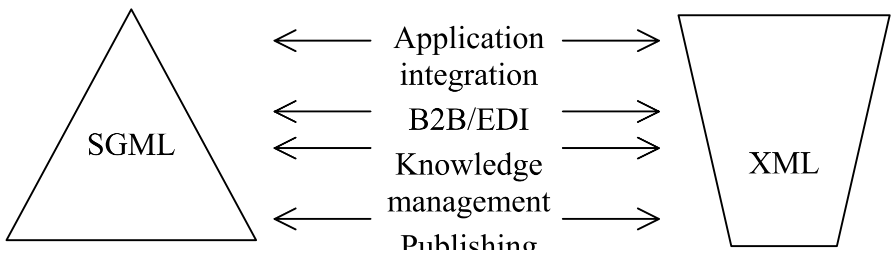

Figure 3.1: A schema of the relative importance of domains of use in SGML and XML.

Context of Standardisation. Some thought the XML market would only be of interest to SGML users [21]. Others hoped to target the huge, well-funded, energetic Web population. [22] There would be an important marketing advantage in being able to say "XML processors can read HTML".[23] Therefore compromises to XML compatibility with SGML were considered that left the installed base of HTML untouched. The deliberations are well illustrated by the following quotation, and explains part of the discontinuity in the SGML trajectory.

> " (...) For the 99% of the world that doesn't care a bit about SGML (...). They know HTML, so we must make things look like HTML. But when it comes to adding the important things that HTML doesn't have, we should make them as attractive as possible. (...) The SGML folks need a standard, as well as capability so they will continue to need SGML. But for the rest of

[21] Charles F. Goldfarb, 'Re: Make DTDs optional?', contribution to w3c-sgml-wg@w3.org discussion list, 30 Sep 1996)

[22] Tim Bray, 'XML, HTML, SGML, life, the universe, and everything', contribution to w3c-sgml-wg@w3.org discussion list, 08 Nov 1996.

[23] Tim Bray, 'Recent ERB votes', 06 Nov 1996. In: Reports From the W3C SGML ERB to the SGML WG And from the W3C XML ERB to the XML SIG, Compiled for the use of the WG and SIG by C. M. Sperberg-McQueen, 4 December 1997.

> the world, clean extendible markup is the biggest need, not SGML compatibility." [22]

However, more influential was the successful spread of HTML use. It was an exemplary achievement in the eyes of XML developers. Its implication for standardisation was: aim for simplicity. If we compare the SGML aims with the design goals of XML, the latter's emphasis on ease of implementation and usability is salient. (See Box 1.) Simplicity was difficult to align with compliance to SGML.

Causes for discontinuity ↓	**SGML**	**XML**
Information problem		
• Orientation	Company-internal	Company-external
Context of use		
• Technology	1980s (mainframes etc.)	1990s (Internet, chips etc.)
• Domains	Publishing	B2B, application integration
Standardisation		
• Frame of reference	GML	SGML, HTML
• Standards body: culture	ISO: stability, accountability	W3C: pragmatism, speed
• Problem, emphasis on	Ubiquitous applicability	Simplicity, implementability

Table 3.1: Causes for discontinuity: differences between the problems, context of use, and context of standardisation of SGML and XML.

3.5 Conclusion

This case study focused on XML as a successor of SGML (1988). It shows that a discrepancy existed between the claimed compatibility between XML and SGML, and the actual outcome of XML standardisation. XML deviated from the decade-old stable SGML trajectory. This did not occur because of any paradigmatic change in the way SGML principles were used in XML - although the abandonment of DTDs was a revolutionary step. There were other reasons. Firstly, XML's context of use differed from SGML's. It was *company-external and web-oriented,* whereas SGML foremost had a company-internal focus. Secondly, the HTML context of standardisation played a role. The spread of HTML use was exemplary for XML developers. The message was: aim for simplicity in standardisation, which at times conflicted with aim of compatibility with SGML. In other words, two exemplars guided XML development and coloured its heritage relation with SGML: SGML, which was a technical exemplar and an exemplar in respect to the functionality it could offer, and HTML, which was a standardisation exemplar in terms of its simplicity and widespread diffusion. In respect to the type and setting of standardisation, therefore, the W3C consortium headed by the pragmatic developer of HTML (Tim Berners-Lee) was a more likely choice for XML standardisation than the more formal ISO. This change of institutional setting made it easier for XML developers to deviate for practical or other purposes (e.g. Not-Invented-Here) from standard SGML solutions developed in JTC1. Incompatible succession is then more likely to occur.

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[N1929] Draft SGML TC2, WG8, *Proposed TC for WebSGML Adaptations for SGML*, 1 June 1997, Annex K (normative), WebSGML Adaptations.

[N1955] *Final Text of SGML Technical Corrigendum*, WG4, 'ISO 8879 TC 2', 4 December 1997)

Part II: Analysis

EU policy on consortium standardisation, or the lack of it, is partly based on some unchecked - but widely shared - assumptions and beliefs. In this part of the report these are confronted with the findings of the case studies and other, additional sources. Examples are discussed to underscore why 'the consortium problem' needs to be redefined. The current policy framework is examined, and a new one is developed.

Specifically, chapter 4 addresses consortium standardisation, compares it to formal standardisation, and lays the basis for recommendations on this point. But the insight gained by the cases reaches beyond consortium standardisation. In chapter 5, consortium standardisation is discussed within this wider context.

4. Consortium standardisation

In so far as consortia focus on specification development, they are seen as rivals of the formal standards bodies (e.g. CEN/ISSS, 2000). They compete on different dimensions. For example, they compete for committee participants. Standards consortia are thought to drain away the scarce technical expertise needed in the formal standards committees, and some of the large industrial companies who tend to volunteer for the required committee secretariats. A certain degree of competition would therefore seem plausible. However, there is little research on the matter. What information there is, for example, in respect to whether or not the rise of standards consortia has led to a decline of industry participation in formal standardisation, is inconclusive (Hawkins, 1999; Cargill, 2000).

Lack of hard data also exists in respect to the two dimensions on which this chapter focuses, and on which standards consortia and the formal standards bodies are most often compared: democracy and time. Standards rhetoric refers to them in terms of the 'consensus versus speed' dilemma. In the past, the formal standards processes have often been criticised for being slow and bureaucratic. This was later seen to explain the rise of consortia in the early1990s, which were significantly more effective in developing standards. In response, the formal standards bodies introduced many new measures and procedures to speed up the process (Egyedi, 1996). However, the criticism held on. Indeed, the rationale behind the age old criticism still seemed to apply: consortia produce specifications quicker than the formal bodies do because they need not bother with the lengthy democratic and open process, with consensus decisions, with a well-balanced representation of interest groups, etc. (Meek, 1990; Rada, 2000). Because for consortia consensus is not a main issue, the reasoning goes. Indeed, the CRE report (2000) states that consortia deliver *non*-consensus specifications. Therefore, among other advantages[24], consortia need not compromise on standards content as much as the formal standards bodies do; they can operate in a more timely manner; and they can therefore better cater to the needs of time-sensitive technologies. Such is currently the dominant view. See Table 4.1.

This view is not self-evident. It contains several values and assumptions that are a matter for debate. For example, 'democracy' is not a concept well-understood in relation to the standards setting. Its meaning and significance for standardisation has not been held to closer scrutiny.[25] Its implications for standardisation have therefore largely remained unspecified.

[24] Cargill (1999) notes a number of advantages. Consortia are generally more under control of their members than the formal standards bodies; they have more financial room to manoeuvre; and they need not forgo the public procurement market of the US government, which in practice also accepts consortium specifications (In the OMB circular of the United States it says that no preference is given to formal (consensus) standards in respect to (non-consensus) consortium standards. CRE, 2000).

[25] The democratic rationale is: A democratic standards process best serves the aim of widespread, international use of standards and specifications (e.g. compatible products, consumer protection, etc.). This rationale has not been checked. See Egyedi (1996).

Speed> Degree of democracy	Slow	Fast
Democratic	Formal standards bodies	
Undemocratic		Standards consortia

Table 4.1: Schema of the rhetorical basis of the framework for current standards policy: the formal standards bodies are slow but operate democratically, while industry consortia are undemocratic but effective in developing standards.

The way 'democracy' is defined is of immediate relevance to the 'consensus versus speed' assumptions that lie at the basis of - among others - EU standards policy, which are

1. Formal standardisation proceeds much slower than consortium standardisation.
2. Formal standardisation is democratic in theory (i.e. standards procedures).
3. Formal standardisation is democratic in practice.
4. Consortium standardisation is undemocratic in theory (i.e. standards procedures).
5. Consortium standardisation is undemocratic in practice.
6. A generic standards policy well-serves both public and market interests.

Speed dimension. The first assumption addresses the speed dimension. Although very little quantitative data exists on the matter, at present doubts are being raised about the timeliness of consortium standardisation (Hawkins, 1999; Krechmer, 2000). The two cases discussed in Part I are not very helpful in this respect. In a sense, the Java/ECMA case confirms these doubts, since Java standardisation never really took off. Moreover, as was noted in chapter 2, in order to allow ECMA standards to be fast-tracked through the formal JTC1 process, ECMA procedures need to be compatible with JTC1 procedures. This comes with a certain degree of bureaucracy. Therefore, had Java standardisation proceeded, it would have been submitted to a certain degree of bureaucracy too. More in general, no significant difference in standardisation pace is to be expected between formal standards bodies and consortia that have close ties with the formal standards bodies. In the W3C case, the initial draft XML standard took 11 weeks to develop (September-November 1996)[26], which is very fast. (Of course, this high pace was made easier because the XML working group built upon ISO's decade old SGML technology, and had gained ample experience with SGML.) The standard was published in February 1998, 15 months later.

The two cases cannot confirm or disaffirm recent doubts about the high speed of consortium standardisation. Quantitative research is needed to provide a definitive answer. What about formal standardisation? Do the formal standards bodies still merit criticism for their slow pace? Since the mid-1980s many different measures have been

[26] Tim Bray, ' Boston, for those who weren't there' , 22 Nov 1996 (contribution to w3c-sgml-wg@w3.org discussion list).

taken at the European and international level to speed up standardisation[27]. To give an impression of the pace at that time and the changes that followed:

- according to the ISO/IEC Directives, 7 years were needed to take a standard from start to Draft International Standard in 1989, while in the Directives of 1992 this period had been reduced to 3 years.
- the approval time of recommendations in the ITU-T has been reduced from 4 years in 1988 to a maximum of 9 months in 2000 (ITU-T, 2000).

Other important innovations were the Fast-Track process and the PAS procedure of ISO/IEC (see chapter 2). These last years have seen, for example, an increasing amount of web-based information exchange among committee members; pre-standardisation initiatives for the timely development of industry specifications (e.g. CEN workshop agreements, CWAs; ISO-organised Industry Technical Agreements, ITAs); and pre-publication of standards on the website of the standards sector of the International Telecommunications Union (ITU-T)[28]. Therefore, already if one only takes the changes applied by the formal bodies into account, the difference in pace of standardisation with standards consortia has been fast diminishing. See Table 4.3. The arrows in the 'speed dimension' indicate that consortia take longer than would be expected according to the dominant rhetoric, while the formal standards bodies operate faster than would be expected.

Below, the democratic dimension of the 'consensus versus speed' rationale is examined. First supposed lack of democracy in standards consortia is addressed and cross-checked with the two consortium cases (section 4.1). Next a comparison is made with formal standardisation. Again, this is to determine whether both standards environments are as different as standards literature and standards policy would have it (section 4.2). Having compared both settings on the dimensions of speed and democracy, in the final section of this chapter the more fundamental question is posed whether this comparison has actual relevance for EU standards policy. It is related to the sixth assumption listed above, which will be introduced in more detail in section 4.3.

[27] Egyedi, 1996, section 4.3.2.

[28] Placing on the website may occur from a few days to 4 weeks after approval of the text. *Approval Time* runs from determination/consent to final approval. (Source: "The IT Standardization and ITU", presentation of Houlin Zhao, Director of the Telecommunication Standardization Bureau of the ITU, at the IEEE SIIT 2001 conference in Boulder US, 3-5 October 2001.

4.1 Consortia: Democracy and Openness

Lack of "openness" and "democracy" sum up the main problem of governments with consortia. I take the terms to refer to a want in membership procedures (i.e. lack of diversity among committee participants and the exclusion of certain groups) and in decision making procedures (i.e. not consensus-driven and no provisions for the inclusion of minority standpoints), respectively. Is this perception of consortia correct? In the following, first the standards procedures (i.e. theory) are examined, and then the way they are applied (i.e. praxis).

4.1.1 Undemocratic procedures?

The focus is, again, on the two cases of ECMA and W3C. As an illustration, their membership and decision procedures of two consortia are discussed in more detail.

Membership. ECMA and W3C have several membership categories. Apart from the usual industry members, small and medium-sized Enterprises (SMEs), and governmental and educational institutions can participate[29]. The consortia demand membership fees. Members pay a fee according to the membership category they are in. Only Ordinary ECMA members (i.e. full membership fee is 70,000 Swiss Franc) have a vote in the General Assembly. W3C bestows no extra voting benefits on full members ($US 50,000 per year).

Consortia **Degree of democratic decision making within ...**	**ECMA**	**W3C**
Standards consortium	democratic (General Assembly)	undemocratic ('benevolent dictator')
Standards committee	consensus-oriented	consensus-oriented

Table 4.2: Characterisation of the two consortia in respect to their (un)democratic approach at the level of the standards committee and the overall organisation based on their respective procedures.

Decision procedures. The decision structures of ECMA and W3C differ strongly. In ECMA the ultimate power lies in the hands of the General Assembly (GA). But only ordinary members have a vote in the GA. In other words, there is full democracy among members that pay the ordinary membership fee (large companies). In W3C, the ultimate power lies in the hands of the director, who formally has the role of a benevolent dictator. In other words, there is no democracy at this level. Indeed, where the chairs of W3C technical committees are concerned, 'if it is necessary to move on' this person also has

[29] ECMA procedures are less explicit on this account than W3C procedures.

far-going powers. However, the W3C standards process is consensus-oriented, and strives for a vendor-neutral solution and an open process, according to the W3C rules. Some procedures give room to minority standpoints. W3C's combination of these democratic ideological features with 'dictatorship' leads to an interesting mix of procedural directions (W3C, 2001).
ECMA procedures are internally - ideologically - consistent. The process should be consensus-oriented and give room to minority standpoints as well. Where W3C's director appoints committee chairs, in the ECMA committee members elect the chair. If there is a deadlock in an ECMA committee, voting takes place by simple majority of the members present at the meeting. In both W3C and ECMA, each member may assign several representatives to participate in the standards work, but the company has only one vote. See Table 4.2.

The two cases do not simply confirm the widely shared bleak picture. On the contrary, although there may be practical and organisational exclusion mechanisms (e.g. membership fee[30]), in principle consortium membership is open. Indeed, in certain respects they appear more open than the formal bodies. For example, while the latter usually keep access to committee drafts restricted to participants - and, thus, seek consensus within a limited group - consortia more often post their drafts on the web and actively seek comments from outside (Rada, 2000).
The W3C case indicates that the procedures of - some - consortia allow them to be reigned in an autocratic manner. However, at committee level their procedures embody the same values as those of the formal standards bodies (i.e. strive for consensus, address minority viewpoints, etc.). There is one exception: consortia do not explicitly include in their policy the aim to involve diverse participants.

4.1.2 Undemocratic practice?

The inclusion or exclusion of individuals or groups can differ during and after the standards process. Unlike the formal standards bodies, participation in the consortium standards process is not automatically linked to standards use. Often it may not be in the interest of early members of a consortium committee to seek additional committee members from other interest groups since this often makes the standards process more complex. Therefore, depending on the market, an exclusive standards process might be preferred during this phase. However, once the standard is finished - to satisfaction - committee members have an interest in the diffusion of its use. The inclusive phase begins. The attention of other market players must be directed towards the new standard in order to heighten interoperability among multi-vendor products.

[30] High membership fees are often viewed as a stumbling block for participation by small- and medium-sized enterprises (SMEs) and users. However, criticisers are usually not aware, firstly, of special lower fees for non-profit organisations; secondly, of the costs incurred by participating in formal standardisation (travel, hotel and subsistence costs of going to committee meetings, the membership fees (e.g. ITU annual fee 20.000 $; associate fee 6.000 $); thirdly, of the - often publicly accessible - discussion lists of consortium standards committees, and invitations to participate in external reviews.

An exclusive phase followed by an inclusive phase is normal practice where proprietary specifications become de facto standards (e.g. Java). However, with regard to consortium standardisation, pragmatism and instrumentalism rather than principle may sometimes exclude parties during standardisation. Indeed, exclusion does not typify the standards process in the two cases addressed in this report.

- The W3C/ XML working group primarily used an easily accessible discussion list for standards development, where technical as well as strategic and pragmatic questions were raised. Contributions to the discussion list give the impression that individuals rather than company representatives are participating. Openness and inclusion seem to characterise the standards process as well as the diffusion phase.
- Only two plenary face-to-face meetings had been held when Java standardisation in ECMA prematurely stopped[31]. Those who attended partook as company or organisational representatives. Interestingly, a large group of business users (SHARE) was represented in the technical committee. The woman in question was chair to one of the three task groups, a very inclusive move towards users.

In sum, consortia do not automatically link more and diverse participation in the standards process to wider standards use. Therefore, they do not expressly aim to be inclusive at committee level. However, in practice they may nevertheless show a high degree of inclusion (e.g. open, publicly accessible discussion lists, user participation, and user representation in key functions).

4.2 Formal standardisation: Democratic praxis?

The second assumption in the 'consensus versus speed' dilemma is that the procedures of the formal standards bodies embed democratic ideals. Content analysis of official documents confirm this assumption (Egyedi, 1996). However, are these ideals also evident in formal standards practice?
Standards consortia typically have an informal manner of handling procedures (Hawkins, 2000). That is, theory and praxis is likely to diverge lightly. The significance of the procedures of formal standards bodies, too, must not be overemphasised. As Schoechle's (2001) tale about the Emperor and the Professor illustrates, politically correct procedures are at times leniently applied or downright misused.
If we look at the inclusive procedures of the formal standards bodies, do they lead to a greater amount of or higher quality consensus decisions, or to a higher diversity of participant categories? The formal standards bodies have not systematically monitored aspects of democracy and openness characteristics of their technical committees. To my knowledge, regrettably, no other quantitative data exists on the matter. Therefore, in this respect the experiences of individuals are an important main source. According to such sources, the democratic aims of the formal process are not met (Cargill, 2000). Often the formal standards process is an exclusive one. Generally, the participation of end-users and SMEs is very low (Jakobs, 1999); formal procedures are often exploited in 'undemocratic'

[31] Although an electronic mailing list was installed, the committee was disbanded before it had been put to use for technical discussion.

ways (e.g. staging a voting during Christmas holiday; Egyedi, 2000b), or redefined (as when e.g. US multinationals participate in European national delegations; Cargill, 1999). The regional governments and formal standards bodies are well aware that in formal standardisation the objectives of democracy, diversity and openness are often not met. Under the present conditions, it would be as difficult for the formal bodies to amend this situation as it would be for consortia to meet such objectives.
In fact, the formal standards bodies and standards consortia are rather similar in other respects as well. For example, in respect to Java, JTC1 and ECMA dealt with Sun in much the same way. The same parties participated and the same issues arose. In both fora, Sun insisted on 'edition, not addition'. This illustrates that 'rubberstamping' - which is a crude generalisation of the work which 'edition' would nevertheless entail - is a practice which takes place in standards consortia[32] as well as formal standards bodies.

In sum, although consortia more explicitly target industrial parties, in practice the formal standards bodies and standards consortia include and exclude the same constituencies. Like the formal bodies, they also strive for consensus, address minority viewpoints, etc, that is, they share the values of the formal ideology at committee level. However, unlike the organisational set-up of the formal bodies, there is much variation in who is the ultimate gatekeeper, an individual director, like in W3C, or a collective, like the General Assembly in ECMA.

Speed dimension -> **Degree of democracy**	**Slow**	**Fast**
Democratic	Formal standards bodies	
Undemocratic		Standards consortia

Table 4.3: Convergence in the standards process between formal standards bodies and standards consortia along the dimensions of 'speed' and 'democracy'.

4.3 European Union: Single policy - Two areas of interest

The conclusion is that by and large committee standardisation in consortia is (a) not undemocratic in theory (striving for consensus & accounting for minority standpoints), and (b) as undemocratic as formal committee standardisation in practice. Moreover, the alleged difference in pace between the two types of standards fora seems to be based on dated information about the formal standards bodies, and is overrated. Since both

[32] W3C has been accused of rubberstamping the products of major vendors because of the 'member submission process' (Rada, 2000 p.22). This process makes it possible to consider proposals developed outside of W3C. The W3C rules explicitly state that this process is "**not** a means by which Members ask for 'ratification' of these documents as W3C Recommendations."

standards development environments increasingly seem to show similar characteristics in theory (procedures) and in practice (committee process), has the distinction made by standards policy become arbitrary? Before answering, let us return to the central issue.

In chapter 1, the following reasoning was introduced: formal standards are an important point of reference for European regulation in particular. The European Commission requires a degree of democratic accountability if it is to refer to such standards in a regulatory context. However, in the field of ICT standards have emerged with a high market relevance, standards that stem from standards consortia. How should these standards be dealt with? According to the previous discussion, one could reason, the Commission can take the pragmatic route and include consortia as a source of standards. For in democratic respect the consortium standards process does not differ notably from the formal one.

This answer, however, does not take into account that, firstly, in the field of ICT, on which this report focuses, standards will seldom be part of regulation. Overall, the regulator's need for democratic accountability of ICT standards processes - whether it takes place in a formal standards body or in a standards consortium - is absent.

Secondly, where such a need does exist, should not the regulator's concern for democratic accountability be given more substance? As a first step, more clarity should be created by the European regulator about what type of democracy is needed and for what purpose. The second step would be to monitor systematically if 'democratic' standards developing organisations follow up the democratic requirements, be they formal standards bodies or consortia.

The two previous points already more or less argue the case that a comparison between and a polarisation of formal and consortium standardisation has little actual relevance for European standards policy. The next and third point takes these arguments one step further. It is related to the sixth assumption that underlies European standards policy: "A generic standards policy well-serves both public and market interests." Much of what happens in standards committees is of little interest to the Commission[33]. The standards have no relation with issues of health, safety, environment, privacy etc. The latter issues concern the general public, are subjects likely to be addressed by regulation, and therefore typically need monitoring by the European Commission. A two-fold standards policy for regulation-related, and other, mostly market-related standards would seem appropriate. Thereby the requirement of democratic accountability would only apply to standards processes that include public interest issues addressed by regulation. These processes would be closely monitored. For all other standards, no changes would be need to be made. Both formal standards bodies and consortia could apply for the status of 'accredited, monitored democratic standards development environment'. In this respect, the ITU-T has recently introduced an Alternative Approval Process for all its standards, except for those which have policy or regulatory implications. The latter still need to

[33] In exceptional cases, consortium standards are likely to be relevant as indirect means for market governance, that is, in situations of complex market coordination problems where government support is needed to break dead-locks in the market. As such, consortium standards are relevant as part of the European Union's public procurement policy.

undergo the Traditional Approval Process (ITU, 2000).[34] The reverse would be at stake for public interest standards. A specified concept of democracy would need to lay the basis for a well-monitored type of democratically accountable standardisation.

[34] In the alternative process the approval time is 2-9 months and publication time is 3-9 months *Approval Time* runs from determination/consent to final approval. (Source: "The IT Standardization and ITU", presentation of Houlin Zhao, Director of the Telecommunication Standardization Bureau of the ITU, at the IEEE SIIT 2001 conference in Boulder US, 3-5 October 2001.

5. Standardisation and other Compatibility Strategies

Instead of fuelling rivalry and pitting standards environments against each other, it would be more appropriate to underscore the common ground between them[35]: the belief that in certain instances standardisation is the preferred mechanism for coordination of the ICT market. In areas where coordinative action is needed, any multi-party standard - whether of consortium or formal origin - will be preferred to no standard at all. Or are there other, more effective means of coordination apart from standardisation which also enhance compatibility among products and services?

With regard to compatibility standards[36], policy developers are prone to lose sight of the aim of compatibility[37] and focus more narrowly on the means instead, namely on committee standardisation[38]. The latter is a means to co-ordinate the activities of parties that compete in the market (Schmidt & Werle, 1998; Weiss & Sirbu, 1990). Ideally, the resulting standards become the shared basis for compatible implementations. However, standards do not guarantee compatibility. Whether compatibility is achieved de facto, depends on the scale and manner in which standards are implemented. Little information exists on this aspect of standardisation[39].

Ultimately policy interest should focus on technical compatibility and on compatible implementations. These outcomes can be contributed to and achieved by other means than standardisation as well. Compatibility often results as a by-product of market dominance. In the field of computer software, for example, de facto standards such as PDF and UNIX have emerged that sometimes more forcibly induce widespread compatibility than some committee standards do. The origin of these de facto software specifications differs. Some result from in-company R&D efforts, others from various forms of co-operation between multiple parties. The type of specification development process need have no bearing on how the ownership of the specification is handled. A company may keep the proprietary technology for itself. It may, for example, monopolise the production of a key component, and define an interface which ties complementary products of other firms to the proprietary component technology (David & Greenstein, 1990). However, it may also give away its technology with an eye to expected long-term advantages, or enter into coalitions with rivals to enlarge its user base and increase support for its technology. At present, the practice of giving free access to the software source code is gaining interest. Well-known examples are Linux, TCP/IP, SMTP, DNS

[35] Private discussion with Carl Cargill.

[36] The term 'compatibility standard' is used in this chapter to distinguish this category of standards from safety and health standards (e.g. Grindley, 1995).

[37] The ISO defines compatibility as the "suitability of products, processes or services for use together under specific conditions to fulfil relevant requirements without causing unacceptable interactions." (ISO/IEC, 1991) ICT practitioners also use the term 'interoperability'.

[38] The term 'standardisation' refers here to activities that are exclusively set up to lead to standards and that take place within formal standards bodies such as ISO or in standards consortia such as W3C (i.e. multi-party industry standards fora).

[39] Presently, an EU project on the impact of standardisation is taking place, which promises to throw light on the subject (see www.standardsimpact.org).

and C. An 'open source-mindedness' seems to be developing, also among commercial companies (O'Gara, 2000).
Whatever ownership approach is used - proprietary, open source or other approach - a sizeable market share may result. If a software specification acquires market dominance, we retrospectively speak of 'de facto standardisation'. This would seem to refer to a standards process[40], whereas it actually refers to a process of software diffusion. The term 'de facto compatibility' would better express the relevance of the compatibility outcome. Compatibility is in this situation a by-product of a successful product development and diffusion - which *may* include compatibility aims - rather than the outcome of a proprietary or multi-party standards trajectory. See Table 5.1. This table compares committee standardisation with software development. Both are specification processes. How the specifications are developed - multi-party or by a company - need have no direct effect on their use. If a committee standard is implemented widely the consequence is similar to that of a dominant product specification: de facto compatibility results. For compatibility can only be measured as an aspect of the market, and not as an aspect of the specification process.

<table>
<tr><th rowspan="2">Stages >
Type of Specification Process</th><th colspan="2">Specification Process</th><th colspan="2" rowspan="2">Market Process</th></tr>
<tr><th>Participation</th><th>Outcome</th></tr>
<tr><td>Committee Standardisation</td><td>Multi-party</td><td>Standard</td><td>Implemented widely?</td><td rowspan="3">Yes > de facto compatibility
No > local or no compatibility</td></tr>
<tr><td rowspan="2">Software Development</td><td>Multi-party</td><td rowspan="2">Specification</td><td rowspan="2">Market dominance?</td></tr>
<tr><td>In-company</td></tr>
</table>

Table 5.1: The two specification processes that may lead to de facto standards in software (i.e. compatibility).

5.1 Other compatibility enhancing measures: Sun's Java strategies

There is a wide diversity of strategies which companies may use to enhance software compatibility. Sun Microsystems illustrates this in respect to its de facto Java standard. To briefly refresh the memory, Java is a middleware technology for which compatibility, and in particular the integrity of the Java platform, is crucial. Sun has therefore introduced several complementary, compatibility-enhancing measures such as the Java programmer certificate and the Java Compatibility Logo (Egyedi, 2001a).
Firstly, Sun started by giving interested parties access to its source code. It invited developers to comment on, experiment with and improve the original source code. Since the developer community worked with the same source code, this open source approach had a light coordinating effect. Likewise, the instructional books which Sun authors and

[40] See for an example Grindley, 1995, p.140 a.f..

others wrote on Java, and the training programs that led to 'certified' Java developers added to a coordinated Java trajectory. These activities fortified the development of a Java practitioner community, but they did not guarantee compatible Java implementations. More effective in this respect was the free distribution of the Java Software Development Kit (SDK, formerly JDK). The SDK contained a full suite of development tools to write, compile, debug, and run applications and applets. Use of the SDK narrowed down the number of possible programs to those that would run on 'standard' Java platforms.

Secondly, another means to enhance compatibility is IPR licensing. Sun's licensing policy was based on its intellectual property, which it protected by means of trademarks (Java name, Java-Compatible logo), patents (software algorithms) and copyrights (specifications). Part and parcel of Sun's licensing policy were its test suites. These were used to certify compatible Java products. They gave licensees access to the 'Java compatible' logo (the steaming cup of coffee). The logo had much goodwill among Java programmers. Different from e.g. the strategy of encouraging the use of the SDK, which is a means to coerce developers towards compatible implementations (compatibility push), the logo created an incentive towards developing compatible commercial products (compatibility pull).

The Java Community Process (JCP) was a third means to co-ordinate the development of Java. Together with a new licensing model (Community Source License), Sun issued *The Java Community Process (sm) Program Manual: The formal procedures for using the Java Specification development process* (1998, 2000).

The last and most evident compatibility strategy to mention here are Sun's two failed standardisation attempts in JTC1 and ECMA (see chapter 2).

Sun applied these compatibility strategies sometimes successively, sometimes simultaneously, sometimes in combination. Some strategies were focused (e.g. the Java Software Development Kit), others were more diffuse (e.g. the Java Community Process); some were forceful (e.g. licensing combined with IPRs), while others were more coercive (e.g. compatibility logo); some strategies were based on proprietary control (e.g. IPRs), while others primarily aimed to broaden the Java user base (standardization); some strategies primarily aimed to direct the attention of market players towards Java developments (e.g. standardization), while others specifically targeted technical compatibility (IPRs). Its strategies are listed in Table 5.2.[41]

The table distinguishes between compatibility strategies that control the initial phase of a specification process (what goes in: input control) and those that control its outcome (output control). The specification process at stake can either be a software development process or a standards process. For example, Sun's problem with JTC1 and ECMA standardization was, partly, that while it could control its own standards input (i.e. the Java specification), it could not control the outcome of the standards process. Therefore its standardisation attempts are listed in the left column. A more output-oriented means to control Java compatibility (right column) was the use of Sun test suites to determine Java compatibility.

[41] NB: Other case studies would probably show up additional strategies.

Sun initiatives that contribute towards Java compatibility	
Input Control	**Output Control**

• JTC1 Standardisation
• ECMA Standardisation
• Instructional books, conferences, certified training programs, etc.
• Open source code
• Distribution of the Java Software Development Kit
	• Java Community Process (incl. Participation Agreement)
	• Reference Implementations
	• IPRs
	• Licenses
	  • Technology License and Distribution Agreement
	  • Sun Community Source Licensing model
	• Test suites & Compatibility logo

Table 5.2: Overview of Sun's compatibility-enhancing measures regarding Java.

5.2 Why choose the standards strategy ?

Why would a company want to initiate standardisation if there are other, possibly easier means to achieve compatibility, or if, as in the case of Java, de facto compatibility already exists? Firstly, the straightforward rationale for approaching a standards body is to foster technical compatibility among existing or future products and services. The resulting standard then serves as a concrete means to co-ordinate product and service development of different producers and providers. Secondly, companies also profit from another level of co-ordination. Economic studies have pointed out the relevance of compatible product pre-announcements (Farrell & Saloner, 1986) and 'embrace-and-extend' strategies regarding standards (Vercoulen & van Wegberg, 1999). These aim to direct the actions and orientations of other market players. They address the strategic level of market co-ordination and complement the operational level of technical compatibility[42]. In sum, the standardisation process unites two complementary co-ordinative functions: technical compatibility and market co-ordination. Both aspects to committee standardisation serve as an *ex ante* mechanism for structuring the market.

Turning to our example, at a very early stage of Java development Sun had announced that it intended to standardise Java. If Java were to become an International Standard, this would signal stability in Java development, increase market confidence and encourage commitment to Java. It needed the commitment of industry to counteract possible competing Java developments and prevent fragmentation of the Java market. This early promise was, similar to the effect of product pre-announcements, a means to keep Java

[42] The two types of co-ordination are complementary explanatory frameworks- although specific strategies may sometimes be explained by both.

programmers and competitor companies focused towards Sun-driven Java initiatives. The step towards formal JTC1 standardisation in 1997 was in line with the promises made. Since Java was already a de facto standard, Sun wanted JTC1 - and later ECMA - to ratify its Java specification, not change it ('edition, not addition'). It did not seek committee standardisation in the usual sense. In other words, Sun's actions mainly targeted market co-ordination. This aim was better served by the status of formal International Standard than consortium standard or de facto industry standard, according to Sun.

Standardisation remains a well-used option. Although in Sun's case, it was not a very successful strategy, Sun's competitors in the embedded Java area, the J Consortium, have applied it more successfully. The consortium has become a recognised PAS submitter, which allows it to submit its embedded Java specifications to ISO/IEC JTC1. Its efforts triggered Sun's recent decision to adapt Java in order to better suit the requirements of embedded Java users.

5.3 Contribution towards compatibility

The list of compatibility enhancing strategies in Table 5.2 puts standardisation into perspective. Of interest is then, of course, how effective standardisation is in securing technical compatibility relative to other strategies. The question is difficult to answer because little empirical data exists. For example, little is known about the actual impact of standardisation. But some preliminary observations can be made.

The problem of all voluntary standards, formal standards and consortium standards alike, lies in not being able to enforce - partial or full - compliance to standards (i.e. little output control). Even submission to conformance testing is mostly a voluntary matter. Apart from regulatory requirements, conformance to standards depends almost solely on market-pull mechanisms. That is, demand-driven conformance to standards is needed if standardisation is to lead to actual compatibility. The demand-side of the market is reasonably developed where individuals are concerned (e.g. consumer organisations). However, mechanisms to coordinate shared consumer interests in compatibility are lacking in the post-standardisation phase. This contrasts strongly with the diversity of coordination mechanisms used by the supply side of the market. In other words, because of the voluntary nature of standards implementation (voluntary technical base) the degree of compatibility that is ultimately achieved is uncertain and non-transparent. See Table 5.3 (second column). Are other types of specification processes, possibly in combination with compatibility-enhancing measures, more effective?

Several types of specification processes are imaginable. The previous chapters mentioned four of them: pure proprietary specification development, the open source approach to software development, and the two middle-of-the-road approaches used by Sun: proprietary-led multi-party specification development and the community source approach. Let us focus the comparison with standardisation on the two most extreme strategies: the proprietary and the open source strategy. They come with different licenses (Cargill, 2000; O'Mahoney, 2000). A well-known open source license is the General Public License (GPL) used for the operating system Linux. It allows one to download Linux, and use, change and distribute adapted source code without charge. These adaptations should in turn be made available in source code. This license thus removes the incentive to turn a program into a proprietary product[43].

Aspects of Compatibility	Specification Processes		
	Standardization	Software Development	
		Proprietary Approach	Open Source Approach
Conformance Mechanism	market pull, demand-driven	compatibility push	market pull, demand-driven
Ultimate Technical Compatibility of Software	uncertain voluntary techn. base non-transparent outcome	high controlled techn. base controlled outcome	uncertain shared techn. base diffuse but transparent outcome

Table 5.3: Assessment of the type of and degree of compatibility achieved in different specification processes.

The open source approach faces many of the same compatibility problems as standardisation does. Sharing the same source code need not imply a compatible technical base. The license does not diminish the incentive the change source code[44], and - if software compatibility would be prioritised - there are no easy means to control the outcome of the open source process. Therefore, with the open source strategy compatibility is uncertain and the outcome may be diffuse - albeit transparent (see Table 5.3 column 4). Market pull is needed to maintain compatibility among software products.
In contrast, the proprietary approach to specification development, where IPRs are usually kept under tight control, prescribes other players to how to deal with the specifications by means of licensing agreements. The proprietary specs start out as being compatible (controlled technical base; compatibility push) and compatibility is imposed on licensees (controlled outcome), a strategy that is usually very effective (Table 5.3, column 3).

In sum, apart from standardisation, there are other, sometimes more effective compatibility strategies which lead to de facto compatibility. Whether or not the European Commission should involve itself in compatibility strategies other than standardisation - or even as little as possible in standardisation - is a matter for debate.

[43] The license is 'viral': all changes to the source code automatically become part of the software commons (Op cit. from 'The world is taking to open source', Apr 12th 2001, From The Economist print edition, Opinion, Economist.com, Out in the open.)
[44] Although, when the source code diverges at least with open source software the differences are retraceable.

For the moment, this debate should be kept open. It should not be closed beforehand with reference to the danger of reinforcing monopolies. The Java case study suggests that in certain circumstances, the public's primary interest is in solutions that prevent unnecessary fragmentation of the market. Since there are few legal means to safeguard the public interest in compatibility, if the latter coincides with a company interest, proprietary solutions deserve consideration. At the same time, we should not overemphasise the idea of compatibility control: the case also shows that even tightly controlled compatibility strategies (e.g. licensing combined with IPRs) cannot prevent incompatible developments (Microsoft's use of Java).

Part III: Conclusion and Recommendations

The research on which this report is based aimed, firstly, to provide contemporary case material that illustrates how consortia work. The main material of the two case studies was presented in Part I of the report.

The material partly served to answer the questions: Why is sometimes consortium standardisation initiated rather than formal standardisation? Do standards consortia work in ways that will deliver open standards? These questions were answered in Part II. A summary of the answers is given in section 6.1 and 6.2.

The second objective was to examine

(a) the assumptions and beliefs that are part of current understanding of standards consortia (see chapter 4, introduction), and

(b) to develop a new perspective on the significance of consortium standardisation for EU standards policy (see chapters 4 and 5).

In this part of the report, the consortium problem is readdressed, and core-arguments for the proposed new policy direction is summarised (section 6.3). Overall conclusions are drawn, and recommendations are made (chapter 7).

6. Reviewing Consortium Standardisation

6.1 Why is consortium standardisation sometimes preferred?

The case studies and literature show that standards consortia successfully market their feats. They are associated with timely standardisation and pragmatic standards solutions, despite incidental critical observations to the contrary. This, and possibly the homogeneity and suggested exclusiveness of consortium standardisation attracts companies. The two case studies further show that

- the consortium can be a stepping stone for and offer easier access to formal recognition of technical specifications:
  Sun chose ECMA because ECMA had an A-liaison with JTC1, which gave it access to the Fast Track procedure. In the past ECMA standards had been submitted to a yes/no vote in JTC1 without any modifications, and often successfully so.
- a consortium may be seen as equally relevant to market co-ordination as a formal standards body is:
  ECMA was an open standards consortium and thus an answer to continuous pressure from licensees and real-time Java developers to open up the Java development process. Many large companies were members. So ECMA processes also promised to be relevant in respect to co-ordination of the market.
- a consortium may represent an exemplary style of standardisation (simple and widely used standards):
  For XML developers, HTML was a standardisation exemplar in terms of its simplicity and widespread diffusion. In respect to the type and setting of standardisation, therefore, the W3C consortium headed by the pragmatic developer of HTML (Tim Berners-Lee) was a more likely choice for XML standardisation than the ISO.
- improving a standards is easier if this takes place in a new institutional setting (consortium):
  The change from SGML's JTC1 setting to the setting of W3C made it easier for XML developers to deviate for practical or other purposes (e.g. Not-Invented-Here) from standard SGML solutions.

6.2 Do consortia deliver open standards?

The two cases do not simply confirm the widely shared assumption that consortia are undemocratic. To the contrary, although there may be some practical exclusion mechanisms, in principle consortium membership is open. Indeed, in certain respects consortia appear more open than the formal bodies. For example, while the latter usually keep access to committee drafts restricted to participants - and, thus, seek consensus within a limited group - consortia more often post their drafts on the web and actively seek comments from outside.

The W3C case indicates that - some - consortia are reigned in an autocratic manner. However, at committee level their procedures embody the same values as those of the formal standards bodies (i.e. strive for consensus, address minority viewpoints, etc.). There is one exception: consortia do not explicitly aim to involve diverse participants.
Consortia do not automatically link more and diverse participation in the standards process to wider standards use. Therefore, they do not expressly aim to be inclusive at committee level. However, in practice they may nevertheless show a high degree of inclusion (e.g. open, publicly accessible discussion lists, user participation, and user representation in key functions). In fact, the formal standards bodies include and exclude the same constituencies.
Therefore, in so far as compatibility standards (i.e. market standards) are concerned, standards consortia will probably do the job as well as formal standards bodies do.[45] (In other situations, see below point 2.)

6.3 Redefining the consortium problem

Standards consortia are defined as a problem. Their procedures are held to be undemocratic and therefore unfit as an instrument of regulatory governance. Does this accurately describe what is at stake? As was discussed in Part II, there are several questionable aspects to the way the consortium problem is defined. They are listed in Table 6.1 and briefly summarised below.

	Aspect of the Consortium Problem	**as defined**	**as redefined**
1	primary characterisation of the standards setting	regulatory governance	market coordination among competitors
2	democratic standards process • compatibility standards	consensus, well-balanced participation of interest groups	multi-party
	• health/safety/environm./ etc. standards		(discussion needed to further refine 'democratic standards needs')
3	policy	single	twofold
4	aim of technical co-ordination	standardisation	compatibility
5	stage of standardisation emphasised	standards development	standards implementation

Table 6.1: The shift in perspective needed in standards policy based on an analysis of the consortium problem.

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[45] NB: Quantitative research is needed to confirm this.

Democratic standardisation? [1, 2, 3]. Consortia procedures are held to be unfit for use in a regulatory governance context because they are undemocratic. However, should the standards setting primarily be seen as an extension of regulation? A sharp distinction should be made between *de jure* uses of standards that touch on issues of health, safety, privacy, environment, etc., on the one hand, and compatibility standards, on the other. Consortia usually address the latter. This type of standardisation is more aptly characterised as market coordination among competitors. How this takes place, that is, whether consortia operate in true or quasi-democratic way (e.g. multi-party standardisation), the level of democracy is here foremost a marketable asset of the standard. The consumer decides its value.

For *de jure* uses, where the public interest is involved, the democratic requirements of the European government need to be re-examined and defined more sharply. Once these are clarified and operationalised in measurable terms, 'democratic standardisation' need not be restricted to the formal standards bodies.

Because of this difference between the use of standards in a market and in a *de jure* public interest context, in this respect a more specific, twofold standards policy for each of these areas seems appropriate.

Co-ordination of Technology: Compatibility [4]. The 'consortium problem' is defined as a standards development problem. Standardisation, whether by means of formal standards committees, hybrid workshops (e.g. CEN/ISSS workshops), or specification consortia, it is one means to co-ordinate technology development. However, the compatibility objective can also be achieved by other means. Other compatibility strategies are, for example, proprietary-led multi-party specification development, and the open source approach to software development.

Many issues that seem very important from a standardisation standpoint take on a different meaning in the light of the compatibility objective. For example, the distinction between specifications and standards becomes unimportant; and, instead of concerns about non-consensus consortium standards, there should be relief about the fact that companies prefer standardisation above proprietary strategies. De facto compatibility should be the central issue.

Market Co-ordination by Specification and Strategic Consortia [5]. Most specification consortia are implementation-oriented. They aim at coordinating technology development in a multi-vendor environment. They succeed if companies implement the specifications. The result is, ideally, a co-ordinated segment of the market. This outcome requires the support of a business community. Strategic consortia focus on developing such communities. However, the 'problem as defined' almost exclusively emphasises standards development issues. Instead issues concerning standards implementation should acquire more emphasis. A re-definition of this aspect of the consortium problem is required.

7. Conclusions & Recommendations

Beyond Consortia. Current standards policy appears to be caught up in a polarised discussion about which category of organisations best serves the market for democratic and timely standards: standards consortia or the traditional formal standards bodies. It is an unhelpful discussion, this framework of rivalry.
Let us, for a moment, go along with it. In the discussion, consortia are seen as a problem. They lack an open and democratic standards process. However, neither recent literature nor the case studies in this report can confirm this. The findings show that in theory the standards committees of both settings strive for consensus and address minority viewpoints, while in practice both largely include and exclude the same constituencies. The framework of rivalry merely leads to new hybrid forms of organisation like the CEN workshops, which, speculating somewhat, will not lure companies away from consortia but instead lead to a shift within the CEN standards domain. Moreover, it by-passes the more significant difference between standardising and not-standardising. The real issues lie elsewhere. These are discussed below as main threads for standards policy. (For more detail, I refer to the previous chapter.)

Democracy: beyond rhetoric. European standards policy shows too little interest in whether democratic standards procedures provide the desired democratic accountability or not. Where a *de jure* need for standards exists, that is, where standardisation touches on aspects of health, safety, environment, privacy, security, etc., should not the regulator's concern for democratic accountability be given more substance? Firstly, more clarity would need to be created about what type of democracy is needed and for what purpose – in practice. This is a political decision. Secondly, the Commission should monitor systematically if 'democratic' standards developing organisations follow-up the democratic requirements, be they formal standards bodies or consortia. For where democratic accountability is still important, insight into the factual democratic course of the standards process is needed. For market coordination, on the other hand, the democratic requirement of 'balanced representation of interest groups' could be simplified to 'multi-party participation'.
A differentiated standards policy is recommended to better cater to the significance of standardisation as a means to coordinate the market and as an instrument of regulatory governance. Differentiation prevents a situation where democratic (or other political) ideals are diluted in order to be able to apply a market-oriented standards policy to *de jure* situations - or, as presently happens, vice versa. In this scenario, the assignment of a work item to either the multi-party or to the more demanding 'democratic' standards environment becomes an important decision. An interesting case for gaining experience about problems of assignment would be the ITU-T's recent introduction of a two-fold track of the Traditional and the Alternative Approval Process for *de jure* and non-*de jure* standards.

Beyond Standardisation. Standardisation - whether by means of formal standards bodies, hybrid workshops or specification consortia - is one means to achieve technical

compatibility. There are other means to this end as well. In standards policy the vantage point of compatibility should take priority. It puts into perspective the distinction between (a) standards and specifications (de facto standards), and (b) formal and consortium standards. These distinctions, which may seem very important from the standardisation standpoint, take on a different meaning in the light of compatibility aims. In this light, both standardisation and software development are specification processes, and ownership and property issues (open source/ proprietary) are in principle irrelevant. The primacy of standards' implementations and compatible technologies then comes back into focus. For example, a proprietary multi-party specification (e.g. Java) and a standard stemming from a consortium led by a 'benevolent dictator' (XML from W3C) can be at least as effective in fostering compatibility as a formal standard. A gap appears to exist between outcome-oriented market practices and process-oriented governance ideals, which standards policy will need to address. Compatibility can only be measured as an aspect of the market, and not as an aspect of the specification process.
In addressing standardisation, current policy should not overemphasise standards development activities; it should focus more on standards implementation and market co-ordination. Furthermore, it is recommended that companies and governments re-assess their standardisation policy from the *de facto* compatibility standpoint.

Whether or not the European Commission should involve itself in other compatibility strategies than standardisation (e.g. licensed software specification processes) - or even as little as possible in standardisation - is a matter for debate. For the moment, this debate should be kept open. It should not be closed beforehand with reference to the danger of reinforcing monopolies. The Java case study suggests that in certain circumstances, the public's primary interest is in solutions that prevent unnecessary fragmentation of the market. Since there are few legal means to safeguard the public interest in compatibility, if the latter coincides with a company interest, proprietary solutions deserve consideration. At the same time, we should not overemphasise the idea of compatibility control: the case also shows that even tightly controlled compatibility strategies (e.g. licensing combined with IPRs) cannot prevent incompatible developments (Microsoft's use of Java).

Institutionalisation of public compatibility interests: coordination of demand and legislation. In particular in the current immature state of the ICT field, the supply-side of the market often lacks the necessary incentives to prioritise compatibility. What mechanisms does the public, the demand-side of the market, have at its disposal to advance collective compatibility interests? This question has arisen in two different contexts: (a) while comparing the effectiveness of different compatibility strategies, and (b) in relation to Microsoft's attempts to fragment the Java platform.

(a) *Comparing the effectiveness of different compatibility strategies.* The standardisation and open source software strategies suffer from the same problem: whether they lead to compatible products is not clear. Taking the example of standardisation, compliance to (voluntary) standards cannot be enforced. Demand-driven conformance to standards is needed if standardisation is to lead to actual compatibility. However, in the post-standardisation phase there are no mechanisms that coordinate shared consumer interests in compatibility. This contrasts strongly with the diversity of coordination mechanisms used on the supply-side of the market. Discussions about supporting users and user coordination *during* the standards process should be extended to include the *post-standardisation phase* with the aim of fortifying demand-side interests in compatibility.

(b) *Maintaining the integrity of a platform.* A regulatory asymmetry exists between IPR interests and compatibility interests. Current regulation anchors the primacy of IPR ownership and market competition in law, but it hardly recognizes the societal significance of compatibility interests (i.e. technical interoperability). Would it be desirable to legally anchor compatibility interests in a way similar to intellectual property interests?

Much research remains to be done. Among other things, the actual compatibility effects of - formal and consortium - standardisation and the open source approach remain uncertain. For example, little is known about (a) the participatory specification process of Open Source Software, which could contain leads for improving or diversifying standards development; and (b) whether the process and outcome of developing open source software involve problems of compatibility (e.g. upward compatible or stable source code). Case studies are needed to throw light on these issues.

A second area of research which this study points to, is the effectiveness of different compatibility strategies. A more systematic inventory of the compatibility implications of market strategies is needed to supplement the findings of the Java case. Of interest is which other means exist to enhance compatibility and how their contribution can be measured (i.e. quantify effectiveness).

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Appendix I: Interviewees

Java case
Jan van den Beld (ECMA, Secretary General)
Carl Cargill (Sun, Director of Standardisation)
Roger Martin (Sun, Standardisation Strategy Manager)
Wim Vree (Delft University of Technology)
Informal interviews were held with participants to the ECMA Technical Committee 41 meetings.

XML case
Arjan Loeffen (Salience B.V.)
Pim van der Eijk (eXcelon Nederland B.V.)
Diederik Gerth van Wijk (Kluwer B.V.)
Charles Goldfarb (SGML inventor/ XML expert)

General
Willem Wakker (ACE Consulting)

Appendix II: List of Publications on the Project

Egyedi, T.M. (2000a). Compatibility strategies in licensing, open source software and formal standards: Externalities of Java 'standardisation', *Contribution to the 5th Helsinki Workshop on Standardisation and Networks, 13-14 August 2000.* Revised versions published as:

- Egyedi, T.M. (2000b). 'Compatibility Strategies in Licensing, Open Sourcing and Standardisation: The case of Java™'. In: H. Coenen, M.J. Holler & E. Niskanen (Eds.), *5th Helsinki Workshop on Standardisation and Networks, 13-14 August 2000*. Government Institute for Economic Research, Helsinki, VATT-Discussion Papers 243, pp. 5-34.
- Egyedi, T. (2001a). 'Strategies for *de facto* Compatibility: Standardization, proprietary and open source approaches to Java', *Knowledge, Technology and Policy,* 14 (2), pp.113-128.

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