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# An Empirical Analysis of Development Processes for Anticipatory Standards

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# An Empirical Analysis of Development Processes for Anticipatory Standards[1]

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Abstract:

There is an evolution in the process used by standards-development organizations (SDOs) and this is changing the prevailing standards development activity (SDA) for information and communications technology (ICT). The process is progressing from traditional SDA modes, typically involving the selection from many candidate, existing alternative components, into the *crafting* of standards that include a substantial design component (SSDC), or "anticipatory" standards. SSDC require increasingly important roles from organizational players as well as SDOs. Few theoretical frameworks exist to understand these emerging processes. This project conducted archival analysis of SDO documents for a selected subset of web-services (WS) standards taken from publicly available sources including minutes of meetings, proposals, drafts and recommendations. This working paper provides a deeper understanding of SDAs, the roles played by different organizational participants and the compliance with SDO due process requirements emerging from public policy constraints, recent legislation and standards accreditation requirements. This research is influenced by a recent theoretical framework that suggests viewing the new standards-setting processes as a complex interplay among three forces: sense-making, design, and negotiation (DSN). The DSN model provides the framework for measuring SDO progress and therefore understanding future generations of standards development processes. The empirically grounded results are useful foundation for other SDO modeling efforts.

**Keywords**: antitrust, design, intellectual property rights, negotiation, sense-making, standardization, standards development organizations,

## *I. Introduction*

This research empirically analyzes the new standardization processes that underlie much of the standards-making activity related to internet technologies [David and

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Greenstein 1990, Fomin et al. 2003, Lyytinen and Rose 2003]. Unlike traditional processes, modern SDO activities for ICT standards are not carried out under the umbrella of a government-controlled agency as typified by telephony standards set by the Federal communications commission (FCC) [Lemley 1999]. Instead, there is a manifest trend towards developing and setting standards in SDOs, whose members are for-profit and not-for-profit organizations, at least some of which may be competing in the marketplace but must cooperate during the SDO process [Weiss and Cargill 1999]. Another significant element that distinguishes modern SDA for ICT standards is that there is generally a significant design component contributed by SDO member organizations. SSDC developed in such settings are anticipatory in that products, software, infrastructure and supporting services are, at most, anticipated by the SDA and do not emerge into the market until the SDO is successful in approving and reporting out the applicable standard.

SDOs are private and public sector bodies that declare, command or prohibit functionality interoperability [Lowell 1999]. Documents archiving the SDO development process are the primary and most authoritative source of the reasons for particular design strategies [Berners-Lee and Bratt 2003]. While missing links in these documents can be the subject of speculation about SDAs outside the official processes, nevertheless, these definitive documents are often supplemented with views found in the popular and industry press including industry news, editorial reporting and voluntary, independent commentary (BLogs, wiki) concerning SDO's planning, coordination, development and establishment of rules. In this sense, standards development processes closely parallel the development of public policy in laws and regulations [Reagle 1998].

There are basic requirements emerging from public policy sources to constrain the conduct of standardization efforts. Nevertheless, our understanding of exactly how these processes are carried out is woefully inadequate. One recent effort that has attempted to understand this process is the design/sense-making/negotiation (DSN) model [Fomin et al. 2003, Virili 2003]. This model provides a generic framework but has not heretofore provided empirical validation. The model also does not provide a clear understanding of how member organizations participate in the standards development process, specifically, the roles they may play (e.g. as deep designers, facilitators, public interest representative). This project examined a specific subset of the web service standards to understand how the standards have been or are being developed for this subset. The results of analysis of publicly available W3C documents on SOAP and Addressing were analyzed to confirm the emerging and general model of standards development consistent with DSN.

Achieving this understanding is important because standards development processes are changing from the traditional, de jure, governmental-controlled mode of selecting the best from the alternatives available to another mode achieving a consensus that is managed by SDOs, whose members actively engage in crafting and designing the standard [Economides 1993, Mowery and Simcoe 2005]. The organizations participating in this process, thus, find themselves cooperating through this process even as they compete in the marketplace. This mode of engaging with one another, co-opetition [Kretschmer and Muehlfied 2004] is played out in different ways at different times during the standards development process and different organizations play substantially different roles during the process. The domain in which these standards development

modes are prevalent are Internet standardization processes [Bradner 1996], where they continue to be severely under-researched [West 2003]. Our exemplar, therefore, comes from this domain: we use web services standardization processes in W3C as an exemplar to develop an empirically grounded model of standards development processes.

## *II. The Public Policy Environment Constraining SDA*

Standards are a form of law or regulation covering performances ranging from professional conduct to technical interoperability. Standards may be arbitrarily set by some, include hidden agendas and technical complexity, may be driven by underlying intellectual property (IP), ostensibly transparent yet arguably may not always expose all stakeholder interests. Standards are relatively under-researched, raise great political and antitrust questions and standards are central to just about everybody's work these days.

New policies are needed to ensure broad participation and sufficiency of rewards while assuring checks and balances to ensure fair outcomes in SDO processes. Standards are critically important to pervasive information technologies because they can significantly (a) alter the direction of current and future research and development of products, (b) can have a considerable impact on practice and work lives, (c) can allow/prevent new entrants into an industry, and (d) consolidate/challenge existing businesses. Traditional standards-*setting* processes are giving way to standards-*making* or development because of the non-trivial *design* component in modern technical standards. As a consequence, this increasingly important role is being handed over to non-governmental SDOx such as the W3C, OASIS and others, who operate as consortia of businesses, trade associations, non-profits along with participation from private citizens

and some government agencies. The development of standards is an open process with significant participation from consortium members.

Traditional conceptualizations of standards-setting processes are excessively influenced by legacy government agency practices such as FCC standards regulations. The federal government is encouraging the more widespread use of private consensus standards rather than the legacy, governmentally-directed, standards setting. Indeed, there are developing industry consortia that increasingly act as collaborative standards development organizations (SDO), also commonly known as standards-setting organizations (SSO). De jure SDA were anchored by the government's role in facilitating a more objective selection from existing technologies that would assure interoperability. In recent years, particularly for Internet standards, the SDA processes have involved both (1) proposing a solution (e.g., WSDL, UDDI) created from scratch and (2) accepting, adopting, and standardizing this proposed solution as a new design. Herein, such standards are called **standards with a substantial design component** (SSDC), also called "anticipatory standards." Internet standards-setting consortia develop SSDC more now than was present in legacy, government or de jure processes.

Due process criteria in SDO policies and contextual or normative constraints on SDA combine to constrain acceptable processes used in SDA, theretofore considerably more diverse than is the norm today t. Today, there are three direct sources of public policy that constrain SDA with due process restrictions and at least two or more broad bodies of public policy that indirectly restrict participants in SDA.

The American National Standards Institute (ANSI) requires adherence to its due process requirements before successful SDO activities can result in American National

Standards (ANS).[7] SDOs setting ANS must adhere to various principles of due process, consistent with democratic principles generally followed in legislative and regulatory activities that prevail in many nations and as recognized by international treaties.[8] First, SDOs accredited by ANSI must comply with due process requirements that are implemented in the U.S. in various ways. Second, SDO activities that comply with OMB circular A-119 are favored for federal agency adoption and federal agencies are encouraged to participate in these SDA's. Third, the Standards Development Organization Advancement Act of 2004[9] (SDOAA) may exempt some SDA from some antitrust scrutiny. Finally, there are contextual and normative constraints that interplay, notably the conflicts between intellectual property (IP) rights and antitrust law. IP rights either embodied in standards or necessary to practice standards raise antitrust questions that may conflict with strategies used by some IP rights owners in their SDA participation. In addition, there may be an ongoing role for private contracting that respects all these constraints both inside and outside the SDA context.

## ANSI Due Process Requirements

ANSI due process requires "equity and fair play" in "activities related to the development of consensus for approval, revision, reaffirmation, and withdrawal of" ANS. SDO procedures must afford such due process rights to any affected[10] person[11] permitting them to participate by considering their position and providing them a right to appeal.

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[7] *See* ANSI ESSENTIAL REQUIREMENTS: DUE PROCESS REQUIREMENTS FOR AMERICAN NATIONAL STANDARDS, (January 31, 2005); http://www.itl.nist.gov/biometrics/Requirements0405.doc (*hereinafter* ANSI - ANS DUE PROCESS REQUIREMENTS) (replaced ANSI Procedures in March 2003).
[8] URUGUAY ROUND AGREEMENT, Agreement on Technical Barriers to Trade, World Trade Organization Marrakesh, 1994.
[9] Pub. Law No: 108-237, 118 Stat. 661, (H.R. 1086).
[10] Under ANSI - ANS Due Process Requirements §1.0, participation rights must be afforded persons with a direct and material interest.
[11] *Id*. "person" includes various organizations, companies, government agencies, individuals, etc.

ANSI requires adherence to eight generalized but essential due process requirements (see list in Table 1), and requires other contextual compliance with the normative policies[12] and administrative procedures[13] established by the ANSI Executive Standards Council or its designee.

**Table 1 - ANSI Essential Requirements:**

**Due process requirements for American National Standards**

| |
|---|
| (1) openness |
| (2) lack of dominance |
| (3) balance |
| (4) notification |
| (5) consideration |
| (6) consensus |
| (7) appeals |
| (8) written procedures |

First, the **openness** requires open participation opportunity,[14] without undue financial barriers or voting eligibility based on organizational affiliation or technical qualifications.[15] Second, the SDA must demonstrate a **lack of dominance**[16] in the fair

[12] Accredited SDOs must comply with the ANSI normative policies, ANSI - ANS Due Process Requirements §1.9, *see* ANSI - ANS Due Process Requirements §3.0 (normative policies). The normative policies include the ANSI patent policy, ANSI - ANS Due Process Requirements §3.1 discussed infra., commercial terms and conditions, ANSI - ANS Due Process Requirements §3.2, recordkeeping to provide evidence of normative policy compliance, ANSI - ANS Due Process Requirements §3.3, and have on file with ANSI a metric policy, ANSI - ANS Due Process Requirements §3.4 as well as an interpretation policy, ANSI - ANS Due Process Requirements §3.5.

[13] Accredited SDOs must comply with the ANSI administrative procedures of the ANSI Executive Standards Council, ANSI - ANS Due Process Requirements §4.0 (normative administrative procedures).

[14] Timely and adequate notice is required that clearly describes the SDA purpose and makes relevant information available. Notice is needed to facilitate participation and it must identify details of all participants; *See* ANSI - ANS Due Process Requirements §2.0, which provides implementation details and declares normative policies and administrative procedures. Accredited SDOs must comply with the ANSI normative policies and administrative procedures of the ANSI Executive Standards Council. ANSI - ANS Due Process Requirements §1.9, *see* ANSI - ANS Due Process Requirements §3.0 (normative policies) & §4.0 (normative administrative procedures).

[15] ANSI - ANS Due Process Requirements §1.1.

and equitable consideration of viewpoints by any single interest – a category, individual or organization. Third, there should be **balance** among interests from diverse "interest categories" depending on the proximity of impact the standard under development might have to their interests.[17] Fourth, there must be **notification** of standards development and coordination "appropriate to demonstrate an opportunity" for effective participation and the notice must explain the SDA project and identify stakeholders likely to be impacted.[18] Fifth, the SDO must give prompt **consideration** of participant's views and objections including notice to all affected parties if a view is accommodated or is not accommodated.[19] Sixth, a democratic consensus process, usually by a **vote**,[20] must be taken according to election procedures for accredited standards developers.[21] The voting procedures are complex and their considerable respect to the content and quality of objections implies recursive negotiations. Seventh, there detailed directives for **appeals** from SDO or ANSI actions that result in complaints or concerns for the protection of

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[16] **Dominance** is defined as a position or exercise of dominant authority, leadership, or influence by reason of superior leverage, strength, or representation, ANSI - ANS Due Process Requirements §1.2. No ex ante test for dominance is envisioned but written (or electronic) ex post claims of dominance should be considered.

[17] ANSI - ANS Due Process Requirements §1.3. Various quantitative thresholds of imbalance were historically used in some SDA depending on the nature of the standard under development. However, the ANSI Benchmarks now permit consideration of various constituencies called "interest categories" at a minimum considering producers, users and the general public interest. Depending on the circumstances, other constituencies may potentially include: i) consumers, ii) those directly affected among the public, iii) distributors and retailers, iv) industrial and/or commercial interests, v) the insurance industry, vi) labor, vii) manufacturer, viii) professional societies, ix) regulatory agencies, x) testing laboratories and xi) trade associations, ANSI - ANS Due Process Requirements §2.3.

[18] ANSI - ANS Due Process Requirements §1.4. ANSI Benchmarks require use of the Project Initiation Notification System (PINS) form to facilitate announcement in the ANSI publication, *Standards Action*, http://www.ansi.org/news_publications/periodicals/standards_action/standards_action.aspx?menuid=7. There are certain exceptions for revisions to the maintenance of current standards.

[19] ANSI - ANS Due Process Requirements §1.5. Notice must be given to each submitter of an unresolved objection including the opportunity for appeal under the SDO's rules.

[20] ANSI - ANS Due Process Requirements §1.6.

[21] Under ANSI - ANS Due Process Requirements §2.6 several democratic processes are required including, e.g., all members must be eligible to vote, members must have an opportunity to change votes, the SDO must record comments accompanying votes, written or electronic proxy/absentee balloting must be accommodated and final results must be reported.

directly and materially affected interests of participants.[22] These should be fair, unbiased and readily available tribunals for the impartial handling of procedural complaints that are addressed promptly with the participation of all concerned parties. Finally, SDOs must use and make available their procedures in writing.[23]

## Federal Standards Policies

Three sources of federal policy are significantly influencing the migration of many standards from design (or prescriptive) standards[24] to performance standards[25] as well as another migration from government agency-imposed **de jure** standards[26] to private consortia-developed **voluntary consensus standards** (VCS).[27] First, the National Technology Transfer and Advancement Act of 1996 (NTTAA)[28] requires all Federal

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[22] ANSI - ANS Due Process Requirements §1.7.
[23] ANSI - ANS Due Process Requirements §1.8.
[24] OMB Circular A-119, 63 Fed.Reg. 8,545 (February 19, 1998) at §3(c) (*hereinafter* OMB Cir.A-119). Design standards are defined obliquely: "performance standard may be viewed in juxtaposition to a **prescriptive** standard which may specify **design** requirements, such as materials to be used, how a requirement is to be achieved, or how an item is to be fabricated or constructed," (emphasis added). Note OMB Cir.A-119 applies only to **technical standards**, and not to behavioral standards used to regulate professional responsibility, under §3(b):

> "The term "standard" does not include the following:
> (1) Professional standards of personal conduct.
> (2) Institutional codes of ethics."

[25] *Id.* "Performance standard" … states requirements in terms of required results with criteria for verifying compliance but without stating the methods for achieving required results. A performance standard may define the functional requirements for the item, operational requirements, and/or interface and interchangeability characteristics.
[26] OMB Cir.A-119 articulates a preference for voluntary consensus standards, as discussed hereinafter, rather than "government-unique" standards - generally those developed by the government for its own uses.
[27] National Technology Transfer and Advancement Act of 1996 (NTTAA), Pub. Law 104-113, 110 Stat. 775 (*hereinafter* NTTAA). NTTAA §12(d) Furthermore, federal agencies must consult and participate with voluntary, private sector, consensus standards bodies when in the public interest and is compatible with agency missions, authorities, priorities, and budget resources. Narrow exceptions permit agencies to justify exceptions in reports to the Office of Management and Budget (OMB) necessitating the development of standards outside the VCS context if the VCS approach would be inconsistent with applicable law or otherwise impractical. The VCS approach is most appropriate when they are immediately useful or are adaptable to government use and may help to accomplish other important goals: reduce government development costs for de jure standards, decrease government procurement costs, incentivize SDA consistent with national goals, harmonize standards that promote efficiency and competition and encourage government procurement from the private sector.
[28] Pub. Law 104-113, 110 Stat. 775.

agencies and departments, in carrying out agency policy, whenever possible, to use[29] technical standards developed or adopted by voluntary consensus standards bodies, particularly for procurement and regulatory activities. Federal agency participation in SDO is encouraged because Congress found that the standards they develop will better serve both public and private needs.[30] Second, the NTTAA is implemented by most executive federal agencies[31] and these disparate efforts are supervised by the Office of Management and Budget (OMB).[32] OMB coordinates this dispersed compliance under its

[29] OMB Cir.A-119 §6(a). Executive agencies must "use" VCS in its regulatory and procurement activities. "Use" means incorporation of a standard in whole, in part, or by reference for procurement purposes, and the inclusion of a standard in whole, in part, or by reference in regulation(s). Executive agencies may use government-unique standards when VCS are "impractical" (e.g., fail to serve the agency's program needs, infeasible, inadequate, ineffectual, inefficient, or inconsistent with agency mission; or would impose more burdens, or would be less useful, than the use of another standard).

It is very important to note that VCS are not required when the agency's authorities and responsibilities are to make independent regulatory decisions as authorized by statute. It is likely improper for an agency to adopt VCS in safety or environmental protections situations where the statute requires stricter standards than are typical under current industry practice (perhaps as stated in VCS). For example, executive agencies are not bound to follow VCS in "determining the level of acceptable risk; setting the level of protection; and balancing risk, cost, and availability of technology in establishing regulatory standards," OMB Cir.A-119 §6(c). Instead, in such "risk protection" situations, the agency should confine the use of VCS "to determine whether established regulatory limits or targets have been met, [for, e.g.,] test methods, sampling procedures, or protocols." *Id*.

[30] Agencies should use VCS because, "when properly conducted, standards development can increase productivity and efficiency in Government and industry, expand opportunities for international trade, conserve resources, improve health and safety, and protect the environment.) OMB Cir.A-119 §6(e).

Agency participation in SDA is encouraged but constrained. While agencies must consult and participate with VCSB, this involvement is limited to activities "in the public interest" and compatible with the agencies' missions, authorities, priorities, and budget resources. There are further constraints on the form of support permissible, the agency's authorization of particular participants, the agency's explicit or implied endorsement of VCS arising from SDAs, limits on agency involvement with VCSB internal management (e.g., avoiding domination), the number of agencies participating in any particular VCSB OMB Cir.A-119 §7.

Nevertheless, agency participation in SDA must be as a peer with other participants particularly in matters such as establishing priorities, developing procedures for preparing, reviewing, and approving standards, and developing or adopting new standards. This includes full involvement in discussions and technical debates, registering of opinions and, if selected, serving as chairpersons or in other official capacities. Agency representatives should be given full voting rights unless prohibited by law or agency policy. *Id*.

[31] Under OMB Cir.A-119 §5 "Agency" means "any executive department, independent commission, board, bureau, office, agency, Government-owned or controlled corporation or other establishment of the Federal Government. It also includes any regulatory commission or board," but not independent regulatory commissions because there are separate statutory requirements on the use of voluntary consensus standards, nor does it cover legislative or judicial agencies.

[32] OMB's authority to require VCSB participation and VCS use are derived from 31 U.S.C. §111 (authority to establish policies to improve management of executive branch). Under OMB Cir. A-119, the Secretary

own guidance found in OMB Circular No. A-119.[33] Third, the Standards Development Organization Advancement Act of 2004 (SDOAA)[34] further incentivizes SDA that result in VCS by endowing SDOs with limited antitrust immunity.[35]

## OMB Circular No. A-119

OMB Cir.A-119 requires a due process approach closely parallel to the ANSI - ANS Due Process Requirements. Federal agencies are encouraged to participate in SDA and use the standards developed by **voluntary consensus standards body** (VCSB). Under OMB Cir.A-119, a VCSB is defined in terms of its due process "attributes:" (i) openness, (ii) balance of interest, (iii) due process, (vi) an appeals process and (v) consensus. Therefore, OMB Cir.A-119 requires executive agencies to participate in VCSB activities and use the VCSs produced therein but only when the SDO has due process attributes similar to the ANSI Due Process Elements. The OMB's attributes for VCSB are listed in Table 2.

**Table 2 - Attributes of a Voluntary Consensus**

**Standards Body (VCSB) under OMB Cir. A-119**

| |
|---|
| (i) openness |
| (ii) balance of interest |
| (iii) due process |

of Commerce must coordinate implementation and provide guidance including the identification of VCSBs and VCS (e.g., through databases of standards maintained by the National Institute of Standards and Technology (NIST), VCSB, other federal agencies, standards publishing companies. OMB Cir.A-119 §6(l)). An Interagency Committee on Standards Policy (ICSP) is chaired by NIST to consider agency views and advise the Secretary and agency heads on the Circular and reports to the OMB Director on implementation. The heads of other executive agencies must implement OMB Cir.A-119, insure agency compliance, designate a senior level official as the agency's Standards Executive who implements OMB Cir.A-119, represents the agency on the ICSP and prepares an annual report through NIST to OMB, OMB Cir.A-119 §15.

[33] OMB Cir.A-119 was previously revised on October 20, 1993. The currently effective version of OMB Cir.A-119 reflects the expansion of OMB authority in the NTTAA.

[34] Pub. Law No: 108-237, 118 Stat. 661 (H.R. 1086).

[35] *See infra* discussion of the antitrust and intellectual property conundrum.

| |
|---|
| (vi) an appeals process |
| (v) consensus |

The fifth OMB due process attribute, "consensus," is the most detailed, actually a complex collection of due process rights analogous to several from the ANSI regime.[36] For example, the OMB vision of a "process for attempting to resolve objections" compares closely with the ANSI concept of "appeal." The OMB requirements for an opportunity to submit "comments [to have them be] fairly considered" closely parallels the ANSI "consideration" element. OMB's requirement that each objector be "advised of the disposition of his or her objection(s) [including] the reasons why" combines components from the ANSI elements of "consideration" and "notification." Finally, the OMB requirement that VCSB must offer participants with an "opportunity to change their votes after reviewing the comments" comports quite closely to the ANSI "appeals" element.

## Standards Development Organization Advancement Act

The Standards Development Organization Advancement Act of 2004 (SDOAA) recognizes the societal contributions of standards by approving the SDO due process attributes in OMB Cir. A-119. The SDOAA renames and restates these as Standards Development Principles in the SDOAA findings:

> "notice to all parties known to be affected by the particular standards development activity, the opportunity to participate in standards development or modification, balancing interests so that standards development activities are not dominated by any single group of interested persons, readily available access to essential

[36] OMB Cir.A-119 §4(1)(v).

information regarding proposed and final standards, the requirement that substantial agreement be reached on all material points after the consideration of all views and objections, and the right to express a position, to have it considered, and to appeal an adverse decision."[37]

These principles are summarized in Table 3.

**Table 3: SDOAA Standards Development Principles**

| |
|---|
| Notice of particular SDA to affected parties |
| Opportunity to participate in SDA |
| Balancing interests to avoid SDA domination by any single group |
| Ready access to proposals and final standards |
| Consideration of all views and objections |
| Substantial agreement on all material points before reaching final standards |
| Right to express positions in SDA |
| Right to consideration of positions by SDO |
| Right to appeal adverse SDO decisions |

The SDOAA also recognizes that the SDA of government agencies is protected by antitrust immunity not available for private-sector VCSBs making SDOs vulnerable to antitrust claims even though SDOs are unlikely to directly benefit from collusion.

[37] SDOAA §102(5).

Therefore, the SDOAA grants limited antitrust immunity for SDOs to incentivize their benefits for society and government[38] through application of the rule of reason to qualifying SDO activities, both domestic and international, rather than per se analysis. The SDOAA also limits treble damages and encourages SDOs to disclose their various SDAs for review by the antitrust enforcement divisions of the Department of Justice (DOJ) and the Federal Trade Commission (FTC).

SDOs risk antitrust law exposure from allegations of various forms of anticompetitive collusion, including, price fixing, concerted refusals to deal, or other practices that barriers to entry by competitors or alternate technologies.[39] The SDOAA is intended to reduce the uncertainties of SDO antitrust exposure by limiting situations that use the **per se** analysis.[40] Instead, SDOs can partially immunize their SDAs by filing notice with antitrust regulators and this is more likely to result in antitrust scrutiny under the **rule of reason**.[41] To qualify for rule of reason treatment, the SDO must file "original"

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[38] SDOAA, Pub. Law No: 108-237, 118 Stat. 661, §102.

[39] *See e.g., Allied Tube & Conduit Corp. v. Indian Head, Inc.*, 486 U.S. 492 (1988) (SDO meeting packed with new recruits favoring steel conduit to defeat permitted use of PVC as electrical conduit in National Electrical Code violates Sherman Act prohibition against concerted refusal to deal).

[40] *See e.g.,* Bagby, John W., ECOMMERCE LAW, (West Pub. Co. 2003) at 542-44.

> "Courts have encountered many types of agreements that are almost always unjustifiable. The rule of reason is an inefficient use of judicial and regulatory resources. Some business agreements, such as price-fixing, are designated illegal per se and so they are never justified. This means that the inquiry ends if a per se violation is proven. Trials are shortened and simplified by avoiding unnecessary attempts to justify the restraint. The **per se rule** provides business managers with clearer guidance. Per se offenses include price-fixing, division of markets, group boycotts, concerted refusals to deal and tie-in relationships. The courts first determine whether the conduct in question falls within one of these per se categories. Thereafter, no further analysis is necessary because unlawful anticompetitive effect is presumed."

[41] Overly strict, literal application of the Sherman Acts prohibition against "every contract, combination . . . or conspiracy in restraint of trade" could make nearly every contract illegal because most contract restrain trade at least in some small way. To avoid this misinterpretation, the courts encourage free markets and through the conduct of in-depth economic analysis of the alleged restraint's procompetitive benefits, in the SDA context, the pro-competitive rationales for standardization, the SDO's procedures and the actual behaviors of all participants in a particular SDA.

*See e.g.,* Bagby, John W., ECOMMERCE LAW, (West Pub. Co. 2003) at 541: "The rule of reason developed to prohibits contracts that will reduce competition, if intended to unreasonably restrict competition, the parties have the power to implement their scheme and/or had no less restrictive alternative

notice with DOJ and the FTC before 90 days elapse after SDA is commenced; including the SDO's name and principal place of business and documents showing the nature and scope of the SDA.[42] The SDOAA grants no immunity to SDA participants. Furthermore, the SDOAA makes the qualified immunity under the rule of reason inapplicable for SDA that engage in price fixing, market allocation and certain information exchanges,[43] and SDOs remain subject to state-court-based and private rights of actions. The public policy framework and due process principles applicable to SDOs and VCSB engaged in developing VCS now constrain SDA sufficiently that research methods like those employed here are now enabled.

## *III. Research Methods*

The research method used for this work was an archival analysis of documents related to standards development processes for the selected subset of web service standards listed in Appendix A. This included detailed analyses of documents such as

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to the scheme. In 1918, Justice Brandeis announced the rule of reason analysis in *Chicago Board of Trade v. United States*, 246 U.S. 231 (1918):

> "The true test of legality is whether the restraint imposed is such as merely regulates and perhaps thereby promotes competition or whether it is such as may suppress or may even destroy competition. To determine that question, the court must ordinarily consider the facts peculiar to the business to which the restraint is applied; its condition before and after the restraint was imposed; the nature of the restraint and its effect, actual or probable. The history of the restraint, the evil believed to exist, the reason for adopting the particular remedy, the purpose or end sought to be obtained, are all relevant facts."

[42] *See* Filing Notification Under the NCRPA (DOJ Antitrust Div.) Supplemental filings to update and/or revise are needed when the SDA makes an addition to or change in the standards setting activities such as convering new subject matter not covered in the original filing, http://www.usdoj.gov/atr/public/guidelines/ncrpa.htm

[43] 15 U.S.C. 4301(c), "The term 'standards development activity' excludes the following activities:

> (1) Exchanging information among competitors relating to cost, sales, profitability, prices, marketing, or distribution of any product, process, or service that is not reasonably required for the purpose of developing or promulgating a voluntary consensus standard, or using such standard in conformity assessment activities.
>
> (2) Entering into any agreement or engaging in any other conduct that would allocate a market with a competitor.
>
> (3) Entering into any agreement or conspiracy that would set or restrain prices of any good or service.''

minutes of meetings, either face to face or via phone, informed by knowledge of outcomes of these meetings such as proposals, drafts and recommendations. These documents are available as public sources at the W3C website.[44] There are a number of web service standards at various stages of completion reported on the W3C web site are listed in Appendix A. Each standard captures extensive activity, often lasting over multiple years. The standards are grouped in three categories. The first set includes standards recommended by W3C, that is, for which the standardization process has been completed. The second includes standards, which are in working draft mode, that is, where the standards-setting process is still ongoing. The final category includes standards, where the standards-setting process has been abandoned.

For the purpose of this project, one significantly large example, SOAP Messaging Standards, was selected. This choice was informed by the level of activity as well as for the completeness and availability of the public documents. The analysis was informed by the DSN model that considers standards development as an iterative process of design, sense-making along with negotiation [Fomin et. al. 2003]. Standardization, as design, focuses on the cognitive tasks of how alternatives are articulated, chosen, and evaluated under conditions of bounded rationality. For Internet standards the participants' activities anchor the standards-setting process much like the government agency's role as the neutral arbiter in legacy processes. Sense-making perspectives suggest that actors create and enact new frames of reference and significance that are attached to the emerging standards [Weick 1995]. The negotiation perspective emphasizes how the actors work through conflicting and divergent interests. Both sense-making and negotiation serve as precursors to reaching agreement. The DSN model falls short because its focus on

[44] *See* http://www.w3c.org.

industry participants does not explicitly recognize consortia SDO responsibilities or market influences.

Content analysis presumes that many official SDO documents reveal faithful accounts that permit interpretation of the standards design details in light of the influences of deeply engaged participants. Content analysis [Krippendorff 2004, Neuendorf 2002] is an effective vehicle for the comparison of SDO processes, for their particular experience with particular standards and should inform the building of models that optimize SDO procedures. There are a wide variety of SDO structures including industry organizations or trade associations (e.g., Industry alliances, closed and open consortia), governments, nationally accredited SDOs (e.g., ANSI) and internationally accredited SDOs (e.g., ISO) each with different participation models, membership profiles, incentive and governance structures. This content analytic approach is analogous to legislative history analysis and will parallel its methods as adapted to non-governmental organization (NGO) policy setting because standards setting contexts are highly parallel to the legislative process. There are several reasons for this analogy. First, standards development is a political process [Weiss 1993]. Understanding such processes during their development stages (real-time and mid-stream) afford unique insights into the methods used by certain groups to influence the final standard's details. In the past, many technical standards were the product of legislation and expert regulation but are now evolving to development by voluntary organizations that operate through consensus processes with significant political overtones [Mowery and Simcoe 2005]. Second, SDO processes are closely analogous to the legislative process for statutes and the administrative process for regulatory rulemaking because standards are rules of conduct

established under the authority of an established organization. Standards are common and repeated use of rules, conditions, guidelines or characteristics for products, processes and/or production methods, and may include related management systems practices. Standards are intended to permit inter-operability of hardware, software and network communications that processes compliant structures [Mowery and Simcoe 2005]. Third, official documents are unlikely to reveal all the participants personal agendas, the full nature of unrecorded pressures, compromise incentives or secret caucus results. Nevertheless, the record reveals the essential and basic structure that form the basis for further inference and explanation of process outside the SDO official meetings and correspondence and to evaluate the influence of particular players.

## *IV. A Theoretical Perspective: D-S-N Model applied to SDOs*

To investigate the standards development process, we follow the theoretical perspective suggested by Fomin et al. (Fomin, Kyle and Lyytinen, 2003). They suggest an integrative model that combines three perspectives: design (D), sensemaking (S), and negotiation (N). The combined model D-S-N provides a "dynamic process model of standardization." Each component in the model i.e. D, S and N is the result of different theoretical strands, i.e. each conveys a specific meaning of the terminology used. These strands have not been combined before to explain complex phenomena such as the development of standards with a substantial design component. This section describes the D-S-N perspective by first outlining the individual components, followed by a discussion of the integrative possibilities suggested by the D-S-N model.

### *Design*

The development of standards with a substantial design component, sometimes termed anticipatory standards setting [Cargill 1989], requires significant design contributions from participants to the development process. For example, working groups at consortia such as W3C dominated overwhelmingly by vendors of software products, who have the capability to participate in this process. The term ‘Design,’ thus follows the view suggested by Simon [Simon 1981] with specific occurrences such as the actors planning and committing to a specific, new innovative course of action, which can include small design steps, broad trajectories, and strategies such as design and conquer. The design activity can also include a requirement analysis followed by creation of an artifact. This process of creating the artifact or parts of it constitute the design (D) perspective that is part of the D-S-N model. When multiple companies cooperate on the design, they have to design the pieces of the artifact such that those can be integrated together to create one consistent standard. During a standards development process, it is possible that the software vendors ‘design’ the standards in-house, either singly or in conjunction with allied companies, and then present the standards to the committee as a proposal for acceptance. ‘Designing’ the standard, therefore, involves substantial technical input from software engineers, marketing personnel, sales and customer representatives, and other interested parties in the organization. Because design represents a choice, the organization designing the standard may attempt to steer the outcome to one that provides the organization with a competitive edge. This requires the other two components, S and N to be part of the overall model.

## *Sense-making*

The process of sense-making involves understanding the proposed design. This process may take place outside the committee meetings or even during the committee meeting if the standard document is first produced in the committee. The term 'sense-making' (S) is attributed to Weick (Weick, 1995), who describes it as "the process of invention or creation of a sense". His work, which has been seminal for understanding organizations, suggests that sensemaking is a process that participants engage in to create a 'sense' that results from an individual's (or a community's) response to changes in environment. His original description, which is mostly re-active (actors try to make sense of outcomes of past events and situations to become oriented with current environment) needs to be expanded for anticipatory standards-making. Sense-making in this context includes proactive sense-making i.e. attributing meanings to a not-yet-invented technology. Because of the substantial design component of the standards, the participants in the standards development process need to understand the (proposed) standard and all its features fully. Sense-making, thus, is a prerequisite for acceptance or rejection of a standard, its features, and its implications for the participant. The process of sense-making, thus, involves an assessment by a participant of the features included in the design e.g. its potential benefits to the organization he or she is representing. For example, software components following a standard may facilitate or hinder organization from offer plug-and-play components that can work with other, existing offerings. During the sense-making phase, a participant assesses how the proposed design of a standard may fits with other existing software or even business strategies that his/her organization may be pursuing. In few cases, such sense-making can lead to complete

acceptance or rejection of a standard. A more likely consequence is negotiation, the third component in the D-S-N model.

## *Negotiation*

Negotiation involves interactions among participants to resolve differences and coming to an agreement with respect to the standard. The negotiation (N) element recognizes that standardization as a form of social interaction within a network of actors in which technology becomes introduced and stabilized (Latour 1995; Callon and Law 1989). This element draws from the socio-technical stream in standardization research (Hanseth, Monteiro, Bijker). In particular, negotiation suggests a processual perspective of the building of socio-technical network related to the standardization process. During Negotiation, actors bargain the distribution of future inputs and outputs to reach an agreement such as choosing one of many designs (Latour 1995). The entire standard need not be decided and accepted during one negotiation cycle. Instead, a negotiation may result in an agreement on changes required in the design and an assignment of tasks of who should perform the design change. A recursive approach to negotiation may follow, with negotiations of increasingly detailed design specifications. A broad definition of negotiation, however, can include negotiating for a membership in the committee, negotiating for the responsibility of designing a feature in the standard, negotiating the acceptance of a feature into the standard to negotiating a future enhancement to the standard at hand. It also includes compromises affected in order to reach an agreement as well as the division of labor and assignment of design tasks.

### *Inter-dependencies among D, S, and N*

It is important to note that an activity may include two or all three of the D, S and N elements. For example, while an actor may individually commit to a design, different mechanisms can govern how multiple actors coordinate and negotiate to arrive at this commitment. This links design continually with negotiation because there are specific arrangements and negotiation tactics that can help reach and enforce agreement on designs. Sense-making that may emerge during standardization requires that the actor create and enact novel frames of reference and meaning in relation to potential and produced designs, processes and actors. This, in turn, continually links in design and sense-making, emphasizing the interpretive flexibility of a design. The idea of mindful deviation from established frames of reference suggested by Garud et al (2000) offers a more specific formulation of this linkage. Finally, actors, via negotiations, continually rethink (i.e. make sense of) their relationships with others so that the actor network implied by the standard permits mobilization. That is, sense-making creates the negotiation space in which they relate designs to actors and to their different interpretations of the technology. In other words, mobilizing the actor-network as part of the sense-making process creates the negotiation space, in which the actors attempt to enroll and assign roles to others. The cycles and recursion with design (D), sense-making (S), and negotiation (N), therefore, provide a *prima facie* explanation of the complexities involved in the processes for developing standards with a substantial design component. One study (Virili, 2003) that has, so far, used this theoretical framework provides early evidence of the applicability of the D-S-N model to such standardization processes. However, that research lacks a substantial systematic and empirical treatment of the

theoretical perspective to understand how the underlying standards development processes unfold. The current study provides this contribution.

## *V. Standards with a Substantial Design Component: Web Services*

Standards for web-services, like SOAP, WSDL, etc. have a substantial design component. Prior efforts on standardization, primarily in domains other than information technology(IT) and telecommunications, involved choosing among existing solutions and adapting them slightly. However, setting standards in the information technology domain involve designing the standard and standardizing it first before it is implemented and deployed in the real world. In this section, we provide a brief overview of web services standards.

The web services framework intends to provide a standards-based realization of service-oriented computing. Web services are designed to enable "application-to-application communication and interoperability"[45] among applications distributed over the Internet. Standards are an important component for web services because of the manner in which they facilitate interactions among applications within and across organizations. Web Services seek to enable interoperability. Enabling interoperation among information sources has been a goal for several technologies that have failed because of competing implementations. A case in point is CORBA. Microsoft's COM family of products and OMG standard did not interoperate. Consequently, CORBA cannot be used to interoperate over the web. For the vision of interoperability across any

[45] Web Services Architecture: Available at 2005http://www.w3.org/TR/2002/WD-ws-arch-20021114/ on 11th November, 2005.

machine or platform to be realized, there needs to be one standard for web services. Thus, standardization of web services is not an academic exercise nor is it an exercise, which will merely cause systems to improve. In this domain, standardization is vital for the very existence and realization of interoperation.

Standardizing the web-services technology is no easy task. These standards attempt to resolve a wide array of concerns. For example, web services must adhere to standards-based definitions of a messaging protocol, service description, service discovery, service composition, service choreography, service transactions, service management, contract establishment and several others. Security, efficiency, appropriate functionality, and ease of use are important considerations. These concerns clearly demonstrate the enormous difficulties associated with constructing a single, monolithic standard that encompasses all aspects of web services. Ongoing work on web service standards reflects this perspective. The core standards related to *publish*ing the web services (WSDL [WSDL 2001]), *find*ing the web services (UDDI [UDDI 2005]), and *bind*ing the web services (SOAP [SOAP 2003]) have been developed as separate, yet interdependent standards. Such interdependencies make standards development in this space a complex process.

In particular, the instantiation of web services is occurring via three different initiatives. The first represents a major effort from the World-Wide Web Consortium (W3C), which builds on the premise that web services may be defined in a programmatic manner so that companies can use them to integrate their operations [WS Arch 2005]. The second represents an effort that is backed by the research community interested in realizing a vision of the Semantic Web in a machine-readable and machine-interpretable

way [Berners-Lee and Miller 2002, Paolucci and Sycara 2004]. The third represents an effort put forward by the international consortium Organization for the Advancement of Structured Information Standards (OASIS) as a way to build upon existing EDI standards infrastructure and facilitate global trade [ebXML-Req 2001]. Over the years, these three initiatives have interacted with one another. For example, W3C now includes a working group on semantic web services [WS SWSIG 2002]. The Universal Description and Discovery Integration (UDDI) standard, initially developed by OASIS [OASIS 2005], is now foundational to the W3C efforts [WS Activity 2005]. The eBusiness XML (ebXML) standard put forward by OASIS [ebXML 2005] is also being integrated within the W3C efforts [WS Activity 2005]. These demonstrate cross-fertilization of ideas across these three standards-making initiatives, which started as distinct endeavors. They also highlight important similarities across the initiatives that go back to the basic concepts of SOC. Each initiative, thus, can be seen as a different instantiation of these basic concepts including the operations of publish, find and bind; and the roles of the service provider, the service discovery agency, and the service requestor [Manes 2003; Papazoglou and Georgakopoulos 2003].

### *Alternative instantiations*

The following presents a brief review of how each initiative instantiates these basic concepts i.e. how it establishes the relationship between the roles and operations of SOC. We explain and contrast the three initiatives through an example for online travel agent:

> "A customer [WSClient] who is registered to service discovery agent queries for online travel agent. Service discovery agent return list of online travel agent services. Customer [WSClient] will select a service which is most fitting to its requirement from search result, and then bind to that particular service. For our example scenario, we will assume that [WSClient] selects [TAService] service.

***The W3C initiative***

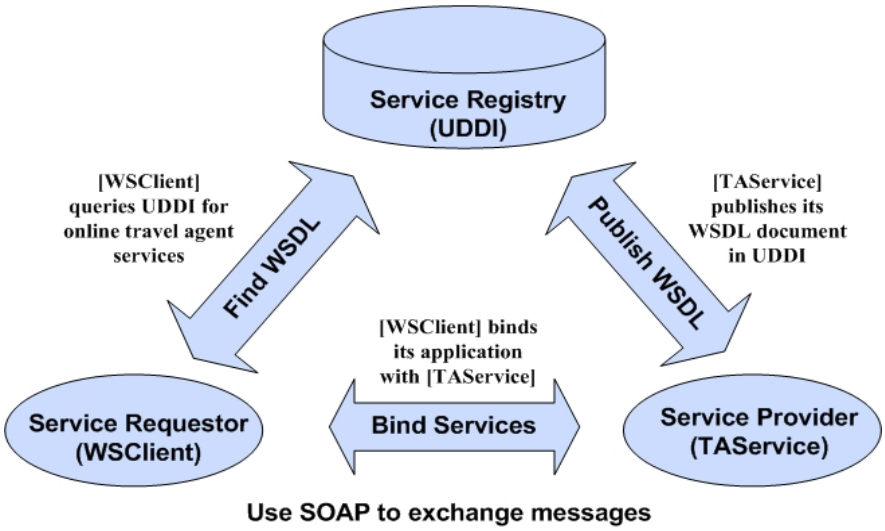


**Figure 1: The travel agent scenario with the W3C initiative**

To realize our example scenario using the W3C initiative (see Figure 1), [TAService] would have to create a Web Services Definition Language (WSDL) document [WSDL 2001] to describe its service interfaces and publish it in the Universal Description, Discovery, and Integration (UDDI) registry [UDDI 2005]. [WSClient] will query the UDDI registry for services, which provide online travel agent capabilities. [WSClient], a potential customer, would select a service that meets its requirements. Assuming that [WSClient] selects [TAService], it would then bind its application to [TAService]. [WSClient] will generate Simple Object Access Protocol (SOAP) [SOAP 2003] messages conforming to [TAService]'s WSDL document and invoke [TAService]. Both [WSClient] and [TAService] will now exchange SOAP messages to communicate.

***The semantic web services initiative***

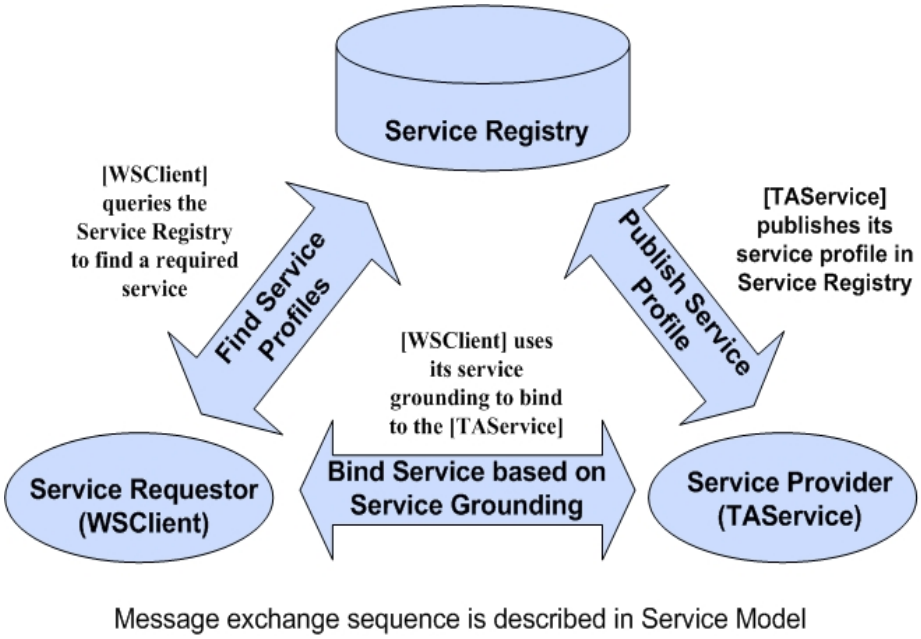


**Figure 2: The travel agent scenario with the Semantic Web Services initiative**

To realize our example scenario using Semantic Web Services (see Figure 2), [TAService] creates a service profile of its capabilities using the OWL based Web Services Ontology (OWL-S, formerly known as DARPA Agent Markup Language for Services (DAML-S)) [Ankolekar et al. 2001], which emphasizes semantic descriptors of capabilities. The service profile contains a service model that describes how to interact with the service, and a service grounding that maps the information exchanges described in the service model into actual messages [Ankolekar et al. 2001; Paolucci et al. 2003]. The service profile is then published in a Service Registry, which allows searches following these semantic descriptors. [WSClient] will query the Service Registry to find a required service, and when found, use its service grounding to bind the selected service. Assuming that [WSClient] selects [TAService], both services can generate messages to communicate. The key difference between the W3C initiative and the semantic web

services initiative, therefore, is that the first depends on a syntactic description of web services, whereas the second utilizes more semantic descriptors derived from OWL-S.

***The ebXML initiative***

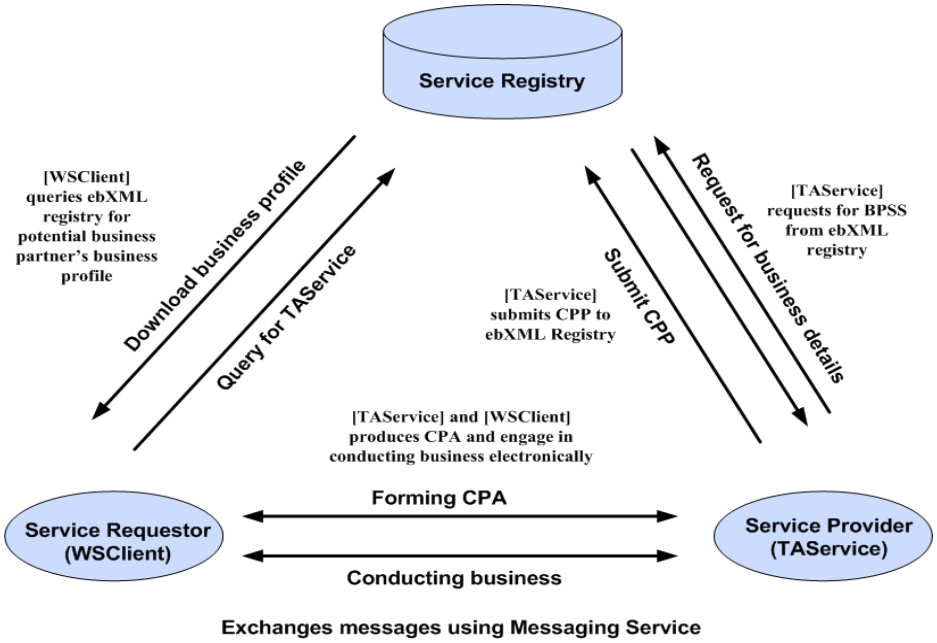


**Figure 3: The travel agent scenario with the ebXML initiative**

Unlike the first two, the ebXML initiative builds on existing Electronic Document Interchange (EDI) standards [ebXML 2005] to specify the ebusiness XML (ebXML) language that globally distributed business partners can use to signify their compliance with minimum requirements for trading and conducting business [ebXML 2005]. The example scenario is realized following the OASIS initiative (see Figure 3) in the following manner. [TAService] will request the Business Process Specification Schema (BPSS) [ebBPSS 2001] from an ebXML registry [ebRS 2002] and populate it with its own capabilities that describe its implementation of an online travel agent service along with a Collaboration Protocol Profile (CPP) [ebXML-CPPA 2002] that specifies the electronic interactions it can participate in. [TAService] will then submit the BPSS and

CPP i.e. its business profile to the ebXML registry. When [WSClient]'s query returns [TAService] as a potential business partner, it can download [TAService]'s business profile from ebXML registry. Both [TAService] and [WSClient] can then come to an agreement on conducting business (using their CPP), before negotiating and producing a Collaboration Protocol Agreement (CPA). Once the CPA is in place, [TAService] and [WSClient] are said to possess the required trading partner information, and may engage in conducting business electronically using a messaging service that is part of the ebXML specification [Rawlins 2002]. The key difference between the OASIS initiative and the first two is its focus on facilitating B2B commerce. Originally, the ebXML standard was suggested under the auspices of the United Nations with the interest of promoting participation from global trading partners instead of specifying implementation-level details.

## *VI. Data Analysis Procedures*

The content analysis methodology applied in this research utilizes analysis procedures that enable researchers to make categorical inferences about large volumes of textual data in systematic and replicable manner (Stemler 2001). In this section we explain the data analysis procedures followed in this research.

### *Data source*

The specific standard selected for this research is SOAP version 1.2. Standards related to SOAP version 1.2 was developed under XML Protocol Working Group in W3C. Proposal for development of SOAP standards was submitted to W3C on April 2000 and it became a W3C recommended standard on June 2003. Figure 4 shows the timeline of the standardization process of the SOAP version 1.2. There are about 120

meeting records that are available under XML Protocol Working Group in W3C which are related to development of SOAP 1.2 standards. These meeting records are the transcripts of the telephone conversation and face to face meetings held for development of SOAP 1.2 standards. For this work-in-progress study, we have coded and analyzed first 60 documents in chronological order of the meeting. Following are list of standards are part of SOAP 1.2

1. SOAP Version 1.2 Part 0: Primer: Recommendation. 24 June 2003
2. SOAP Version 1.2 Part 1: Messaging Framework: Recommendation. 24 June 2003
3. SOAP Version 1.2 Part 2: Adjuncts: Recommendation. 24 June 2003
4. SOAP Version 1.2 Specification Assertions and Test Collection.

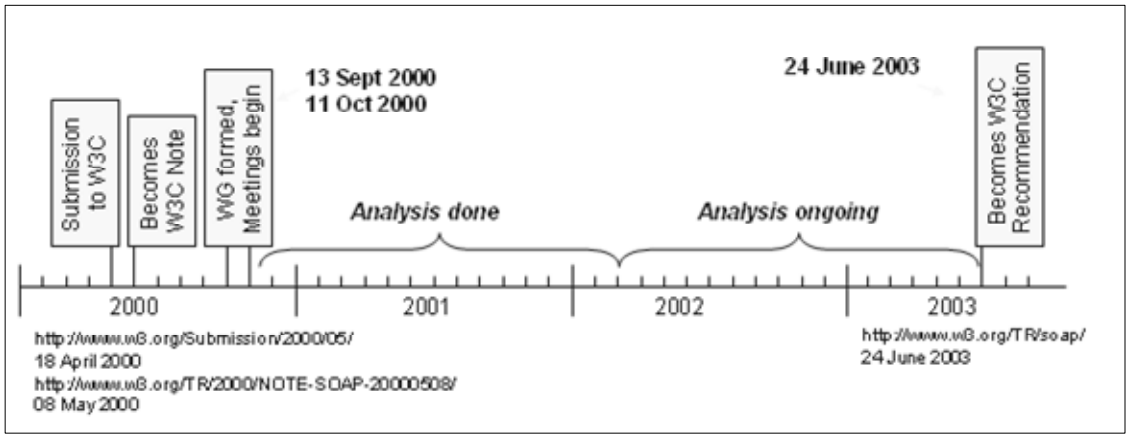


**Figure 4: Timeline of standardization process of SOAP version 1.2**

## *Content Analysis Software*

Atlas ti qualitative analysis software was utilized in this research to facilitate recording of all steps of analysis of all the interpreters in order to perform comprehensible analysis. The software assists you in reading through the document, adding comments to respective passages (note-making/annotating), and coding selected passages and also provides a comprehensive overview of the codes as well as rapid search, retrieval, and browsing functions. Figure 5 shows a screenshot of the Atlas ti

software that includes some of the data from a document being analyzed (left window pane), and the codes assigned to it (right window pane).

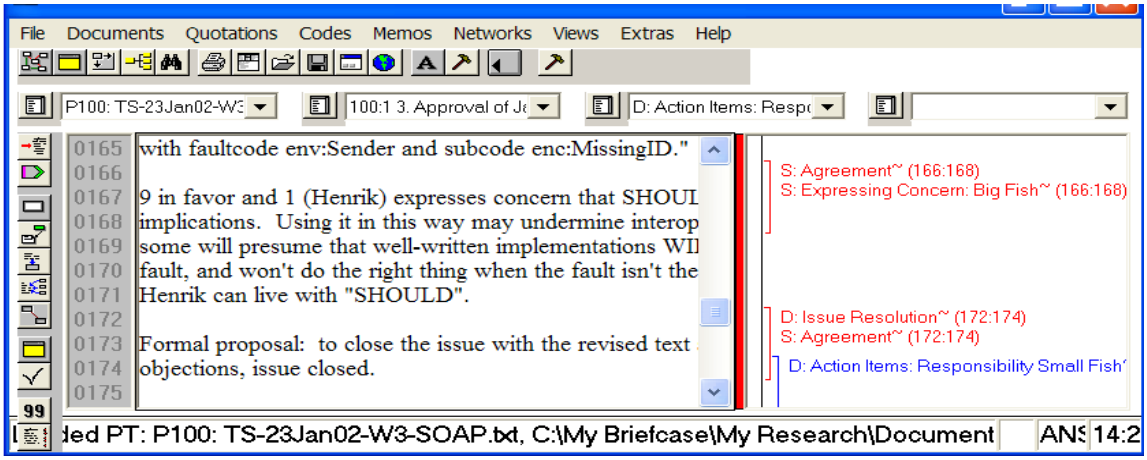


**Figure 5: Document editor and coding window in the Atlas ti software**

## *Coding process*

The coding process was used to generate elements that explained roles and activities of participants engaged in the standards development process. This required assigning meaning to text fragments in the documents (which require reading and re-reading i.e. a hermeneutic approach). Such exploratory and emergent coding process consists of reflexive movement between concept development, texts in the documents, data analysis and interpretation (Altheide 1987). To reduce the bias in the results, the coding process was performed by two independent coders, who conducted a systematic examination of the documents that involved ongoing discovery and comparison of concepts, codes, situations, interpretation and other nuances. The research method we adopted explicitly recognizes the difficulties of this nature in the process, and suggests that the biases of coders and the research team be acknowledged. For this research, the team of researchers included participants, whose backgrounds included engineering, management, computer science and law ensuring the interpretations will not be restricted

to a single disciplinary perspective. Primary work for the coding was performed by researchers, whose backgrounds were in management and engineering with oversight provided by the other researchers. In order to further reduce the bias and in particular, to limit problems of reliability of the emerging categories, the two independent coders engaged in process of establishing inter-coder reliability (Neuendorf 2002). Inter-coder reliability checks the extent to which independent coders evaluate a passage in the document and reach a similar interpretation. Achieving such a consistent inter-coder agreement is useful because it validates the emergent coding scheme, and allows researcher to divide the coding work among many different coders.

The process for assessing and establishing inter-coder reliability involved establishing consistency among coder on unit of analysis for coding and emergent coding schema. The following procedure was used to establish a consistent unit of analysis among coders

- Step 1: Both coders (coder A and coder B) code the documents independently. Coding would consist of marking up the text into units and labeling each unit with a code.
- Step 2: For each document, units and respective assigned codes were noted down for coder A and coder B.
- Step 3: For each units coded by coder A and coder B was compared. If the units coded by coder were same then it was marked as “Exact match”. If the units coded by coders have some overlap, then it was marked as “Partial match”. If the units coded by coders have no match, then it was marked as “No match”.

The units, which were exact match were noted as an agreed conventions i.e. a coding rules. For units that indicated partial or no match, the coders negotiated to arrive at conventions for units of analysis and their interpretation in the following manner:

- Step 1: For the each established unit of analysis through above given procedure, code assigned by the coders was compared. If both coders have agreement on interpretation the text in the unit as well as assign code, then it was marked as “Hit”. If both coders have agreement on interpretation of the text in the unit, but

has assigned different code, then it was marked as "Miss-code". If both coders do not have agreement on interpretation of the text in the unit as well as code assigned, then it was coded as "Miss".

- Step 2: The number of hits, miss-codes, and misses was counted and tallied.
- Step 3: Codes, which were marked as hits were added to the coding scheme. Codes marked as misses and miss-codes, coders had discussion and come to agreement on the interpretation of the unit and assignment of code to it. After reaching agreement, coding rules are created and agreed code is added to the coding scheme.

Coders assessed their inter-coder reliability after completion of coding process on the selected three documents. Documents were selected randomly in order to reduce any bias that may involve with selection process. Two kinds of inter-coder reliability statistics were measured, as shown in table 4. The first measure is inter-coding reliability measure based on hits (IR (hits)) and second is inter-coding reliability based on hits and miss-codes (IR (hits+miss-code)). Both measures reflect the percentage of agreement among coders as reliability measure (Neuendorf 2002). Formulas for above two measures are given below. Three iterations of inter-coder reliability was performed, therefore totally nine random documents were used. Inter-coder reliability was performed until satisfactory measure 77% for IR (hits) and 81% for IR (hits+miss-code) was reached. Although coding scheme emerged through inter-coder reliability process initially guide the study, other codes are allowed and expected to emerge throughout the study.

Inter-coding reliability measure based on hits (IR(hits)) = $\frac{\text{Number of hits}}{\text{No. of hit + No. of miss-code+ No. of miss}}$

Inter-coding reliability measure based on hits and miss-codes (IR (hits+miss-code) ) = $\frac{\text{No. of hits +No. of miss-code}}{\text{No. of hit + No. of miss-code+ No. of miss}}$

**Table 4: Inter-coder reliability measure statistics**

| Date of the coded document | No. of Hit | No. of Miss-code | No. of Miss | Total | IR(hits) | IR(hits+miss-codes) |
|---|---|---|---|---|---|---|
| **Round 1** | | | | | | |
| 21-Oct-04 | 8 | 8 | 21 | 37 | 21.62% | 43.24% |
| 3-Nov-04 | 8 | 38 | 39 | 85 | 9.41% | 54.12% |
| 8-Nov-04 | 16 | 31 | 72 | 119 | 13.45% | 39.50% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Average | 32 | 77 | 132 | 241 | ***13.28%*** | ***45.23%*** |
| **Round 2** | | | | | | |
| 29-Nov-04 | 33 | 8 | 26 | 67 | 49.25% | 61.19% |
| 13-Dec-04 | 24 | 2 | 29 | 55 | 43.64% | 47.27% |
| 20-Dec-04 | 13 | 2 | 15 | 30 | 43.33% | 50.00% |
| Average | 70 | 12 | 70 | 152 | ***46.05%*** | ***53.95%*** |
| **Round 3** | | | | | | |
| 14-Feb-05 | 32 | 2 | 15 | 49 | 65.31% | 69.39% |
| 10-Jan-05 | 38 | 3 | 8 | 49 | 77.55% | 83.67% |
| 9-May-05 | 36 | 1 | 2 | 39 | 92.31% | 94.87% |
| Average | 106 | 6 | 25 | 137 | ***77.37%*** | ***81.75%*** |

**Table 5: Example for coding scheme**

| **Codes** | **Definition** | **Example text** | **Coding rules** |
|---|---|---|---|
| Action Items: Responsibility Chair | This code refers to an action item that must be performed by the chair. | "….<br>Action Item: David F will be owner and draft a response by 3/7 teleconf<br>….." | This code should be assigned to set of lines where actions items that should be performed by Chair of the meeting are described. |
| Agreement | This code refers to an agreement that was reached by the participants. | "…<br><hugo> Hugo: I agree with Mark and it's one of the option I proposed; the other one is to basically state that addressing is as central as SOAP 1.2 in the WS architecture<br>…." | This code should be assigned to set of lines where there is explicit agreement between participants. Look for keywords with synonyms of agreement, and or symbols of "+". |
| Expressing confusion: Big Fish | This code refers to a participant(s) from a company with larger market value expressing his/her confusion. | "…<br>Gudge: doesn't understand example, doesn't make sense to have a security property there<br>…" | This code should be assigned to set of lines where a big fish participant explicitly expresses his/ her confusion on the on going discussion topic. |
| Issue Resolution | This code refers to resolution of an issue. | "….<br>Resolution: when serialized into SOAP message, all URIs must be absolute; editors agree<br>…" | This code should be assigned to set of lines which indicate that a design issue has been resolved. |

| Codes | Definition | Example text | Coding rules |
|---|---|---|---|
| Issue Overlap information | This code refers to information regarding overlap between issues. | "….<br>Jack: There are two issues: 30 and 163. Issue 163 will apply as well.<br>…." | This code should be assigned to set of lines where information about other overlapping issues is discussed. |
| Interaction between Big Fish and Small Fish | This code refers to interaction between participants from companies with larger market value and smaller market value. | | This code should be assigned to set of lines where participants from larger market value company and smaller market value company are discussing a particular topic. Their interaction could include questioning and clarification. |

## *A brief description of Codes*

In this work-in-progress, so far we have analyzed first 60 documents in chronological order of the meeting records of the SOAP version 1.2 standards. A total of 92 of codes emerged from analyzes of these documents, example of codes are given in Table 5. Examples of codes that emerged from the analysis include:

- **Big fish.** small fish interaction. This concept indicates interaction that takes occurs between participants from larger market value company and smaller market value company. These interactions usually involve participants proposing design, asking questions, clarifying, rejecting design and general discussion.
- **Action items**. This concept indicates assigned design task to the participants of the standardization process.
- **Providing design alternative**. This concept indicates that participant is providing design alternative to an open issue with the standard.
- **Suggesting design alternative**. This concept indicates that participant is suggesting another alternative design option to previously proposed design to an open issue with the standard.
- **Rejecting design alternative**. This concept indicates that participant rejected the proposed design alternative to an open issue with the standard.

## *Data analysis*

Codes that emerged from the content analysis of the SOAP standards meeting records were mapped against the design, sense-making, negotiation, design & sense-making, design & negotiation, sense-making & negotiation and design, sense-making & negotiation constructs of the DSN model explained in section 4. Each researcher as well as the coders individually performed this mapping, assigning each codes to one or more of the D, S or N meta-categories. and assigned one of those constructs. A simple model of was used to resolve these mappings i.e. if more than half the researchers agreed on a mapping, that mapping was retained. The large number of researchers (five) allowed us to operationalize this principle effectrively. Table 6 shows examples of these mappings, which did not preclude mapping a code to more than one of the D, S or N construct. .If multiple mappings were suggested, the dominant construct was also recorded.

**Table 6: Mapping Codes to the D, S or N Categories**

| **Code** | **DSN model construct *(dominant)*** |
|---|---|
| Action Items: Responsibility Chair | *Design* & Negotiation. |
| Agreement | Negotiation |
| Expressing confusion: Big Fish | Sense-making |
| Issue Resolution | Design |
| Issue Overlap information | *Design* & Sense-making |
| Interaction between Big Fish and Small Fish | Sense-making & *Negotiation* |

Using Atlas ti software report features, each coded document coded units and respective assigned codes were extracted. Programs were written to perform data mining to extract information such as document date, starting and ending lines numbers of each marked unit, code assigned to the each marked unit and the assigned DSN construct. Further analysis performed and findings found from this extracted data set are discussed in next section.

## *VI. Results*

This section shows a subset of these analyses along with our initial interpretations following the Design – Sensemaking – Negotiation theoretical framework. The purpose of this analysis was to provide an initial understanding of micro-level behaviors that would help us to construct process theoretic characterizations of the standardization process. As described in section IV (Research Methods) earlier, this analysis was focused on a portion of the W3C standardization process, that is, on phases that lead from the formation of the working group (following the submission of the proposal for standardization) up to the creation of the generation of the W3C recommendation.

Codes that resulted from the content analysis were mapped to D, S, and N elements of the DSN framework. The first set of analyses focuses on the frequency of Design (D), Sense-making (S) and Negotiation (N) over the meetings. Figure 6 below shows the total number of D, S, and N codes that occurred at each meeting, with the meetings plotted in chronological order along the x-axis. In this graph, each code was recognized as being mapped to only one of the D, S or N constructs i.e. the dominant construct (see Table 6 in the previous section).

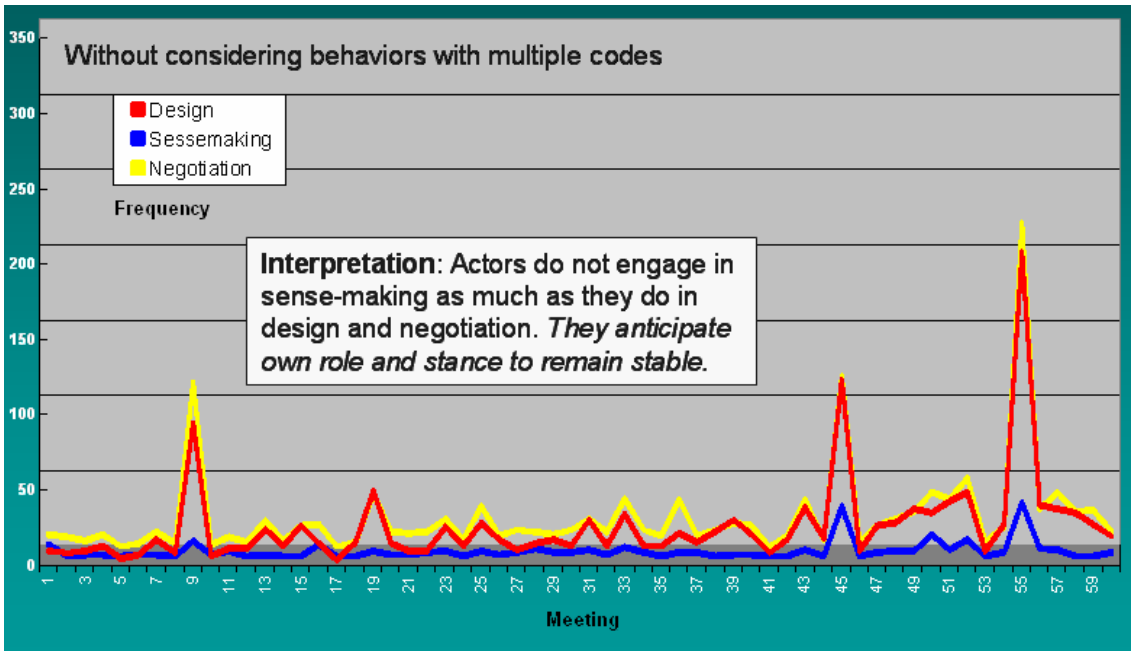


**Figure 6. Occurrences of D, S and N in each meeting**

The figure shows three significant spikes, which indicate the intensity of design activities occurring in three meetings. It also shows the significant number of design activities (in light grey or in red in color) and negotiation (in dark grey or in yellow in color) that overshadow the trivial number of occurrences marked as sensemaking (in black or in blue in color). For example, for meeting 9 (the first spike), there were 92 occurrences of design, 111 occurrences of negotiation, and only 10 occurrences of sense-making. Only some of the early meetings, where significant groundwork was being laid out for the working group to begin functioning, and meeting 17 were aberrations to this general pattern. The data, thus, supports the conjecture that design is a substantial component of the standards development process for anticipatory ICT standards. The small number of occurrences for sense-making may be interpreted in at least two different ways. First, it is possible that the intricacy of designs that participants face in these meetings requires them to engage in sense-making outside the meetings. The

complexity of technology specifications makes this interpretation a possibility. If this interpretation is accepted, sense-making may be seen as an activity that requires much deliberation, which would therefore require that it take place outside the meetings. Another interpretation is possible as well. If, it is expected that participants either bring to the meeting and articulate the results of this sense-making exercise,; then a different interpretation emerges. This, second, interpretation suggests that participants engage in the standards development process with a relatively stable stance about their role during the process i.e. they engage in the standards development process in a manner that does not lead to changes in their preconceived positions. Their stance or role is not affected by the complex design decisions and negotiation processes. This is clearly a more tenuous, yet probably more contentious interpretation. It is possible, however, to tie this interpretation to the notion of organizational inertia, which in turn, may be caused by the significant investments in technology designs that participants in the standards development process may make before they engage in the standardization process.

This analysis was extended by conceding that some of the codes may be coded with multiple categories. For example, the code Interaction among big fish and small fish may be mapped as both S and N. Others may be mapped against two or even all three of the categories. Each code was, then, potentially open to mapping against multiple categories (instead of only the dominant one in the previous figure). The frequency of D, S and N by including such multiple mapping was clearly higher than the previous figure. Figure 7 below shows these frequencies.

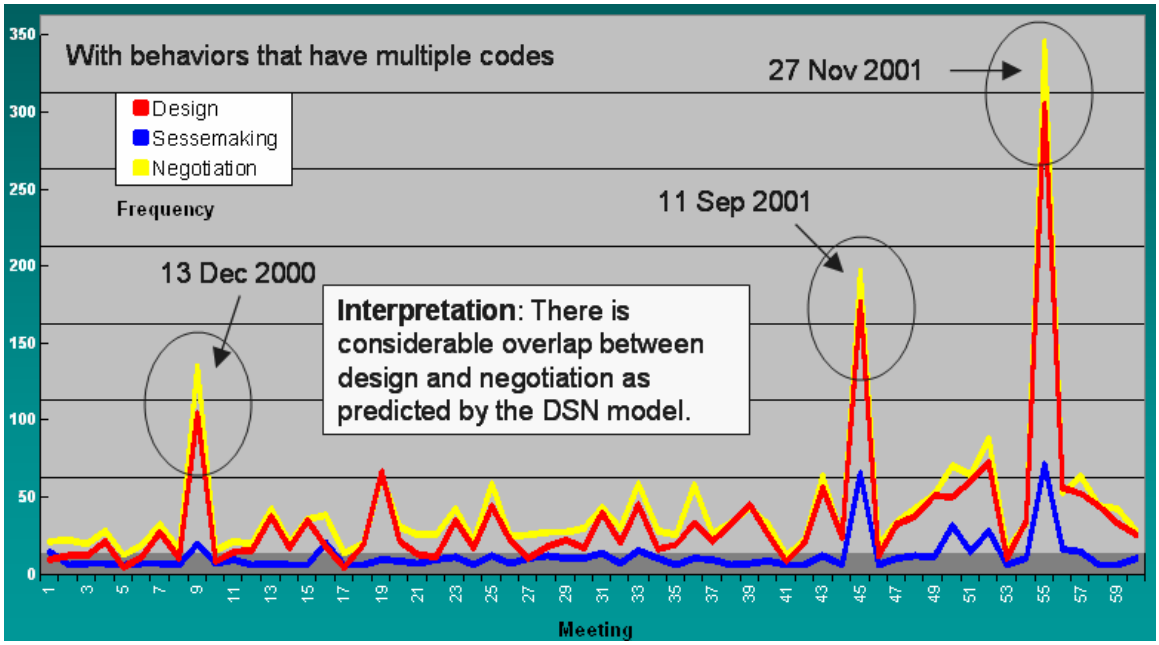


**Figure 7. Occurrences of D, S, N allowing for multiple mappings**

This figure is similar to the previous one except that it shows a greater number of occurrences of D, S and N codes. The relative number of codes still appears to be the same. Here also, we see a trend that design and negotiation codes are considerably more than sense-making codes. An interesting observation here is the sudden sharp increase in codes related to all three DSN components in meeting on 27$^{th}$ Nov, 2001. The reason for this was traced via looking at other W3C documents and was discovered to be the fact that this meeting took place just before the submission of the working draft. Since the participants were working to meet a deadline, there seems to have been a significant amount of activity at this meeting. Another possible interpretation that follows from both figures 6 and 7 is the significant overlap between activities in the categories D and N. While this can be investigated at the micro level as well to understand it further, the frequencies indicate a significant overlap between these two categories.

To further understand whether this overlap exists, the data was further analyzed to view codes, which were mapped either to category D or to category N or both. Figure 8 below shows the number of design codes, negotiation codes and codes assigned to both design and negotiation at each meeting.

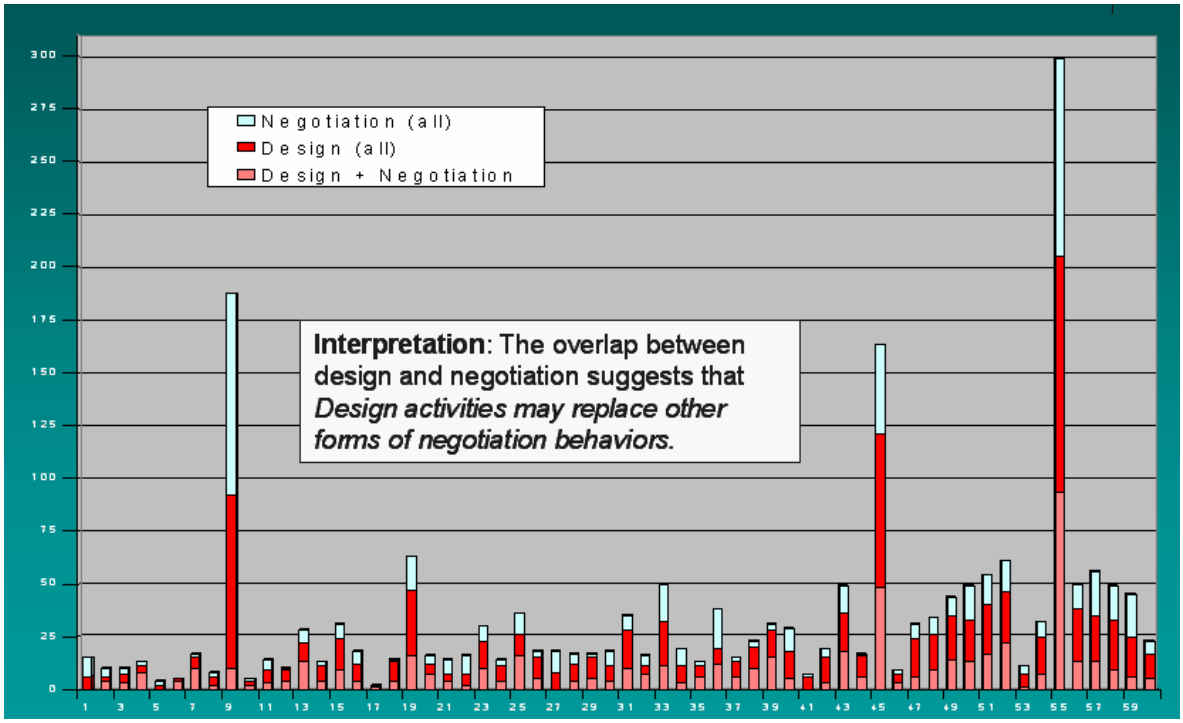


**Figure 8: Overlap between categories D and N**

Figure 8 shows that design and negotiation were often close in terms of the number of activities. The design activities did show non-trivial overlap with the negotiation activities, that is, the D and N elements were often assigned simultaneously to a text segment. While this overlap does not extend to a all text fragments marked as N, the fraction marked as both is sufficiently strong to suggest one possible interpretation. This interpretation suggests that participants may be using Design as one form of Negotiation, for example, by suggesting design alternatives or rejecting design changes suggested by others. This use of Design as Negotiation requires a greater understanding

of the intricacies of the design suggestions and their relationship to the innovation and marketing trajectories followed by the participants.

Another important analysis of the data was in terms of players who participated in the process. The design contributions in the meetings came from four major sources – participating large companies like IBM, Sun, Microsoft etc; participating small companies like Systinet, Iona, Sonic etc; W3C representatives who were involved with development of the SOAP v1.2 standard and the Chair of the working group. These were mapped to understand their relative strengths as shown in figure 9 below.

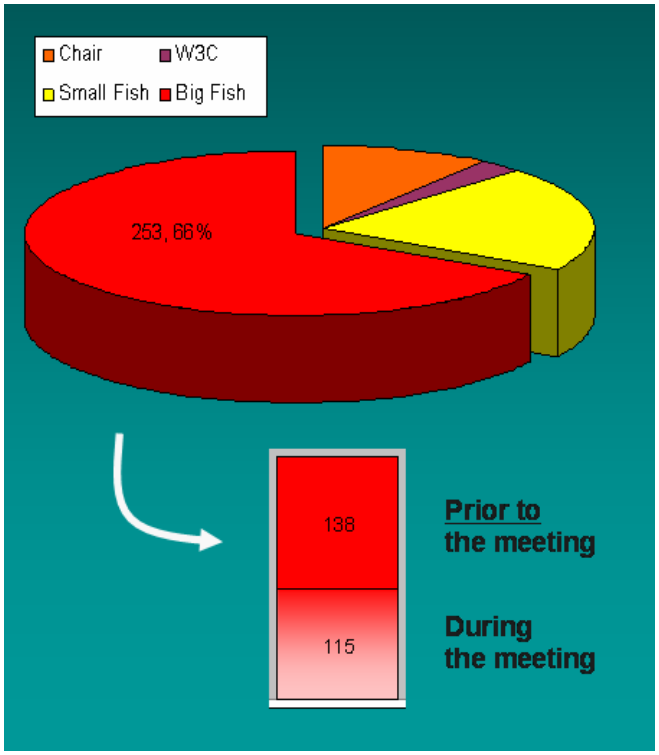


**Figure 9. Design contributions by participants**

The figure shows the percentage contributions (design suggestions made) by these four major sources. The largest number of design contributions were made by large companies, in our terminology, the so-called ‘Big Fish.’ As many as 2/3rd of the total

design contributions came from this group. To understand whether these contributions represented design decisions being made at the meeting or prior to the meeting, the codes were analyzed. Specifically, a distinction was made between “providing designs,” and “suggesting designs” with the former indicating designs completed by participants prior to the meeting and brought to the meeting and the latter being design contributions in the meeting. Further, of these contributions, more than half reflected design efforts that these companies had already completed prior to reaching the meeting. The results were similar for rejection of suggested design items. Big players rejected designs brought to the table six times more often than did small players. The numbers are small, 18 and 3 respectively, for rejection of design items by big and small players.

To further analyze whether a significant amount of design was taking place outside of the W3C meetings, the ‘action items’ at each meeting were compared to ‘designs suggested/provided’ in the following meeting. The ‘action items’ were often design-related tasks to be completed by a participant and brought to the table by the next meeting. This led to participants suggesting or providing design solutions at the next meeting. We took the ‘action items’ code to, therefore, be a quantitative measure of the design happening ‘within’ meetings, and the codes ‘suggesting design’ and ‘providing design’ to be a quantitative measure of design happening outside of meetings. We then compared the number of action items at a meeting with the number of designs suggested/provided at the next meeting and the results suggested that participants often brought designs meetings that were beyond what they were assigned. This could mean that a significant amount of design was taking place outside of meetings.

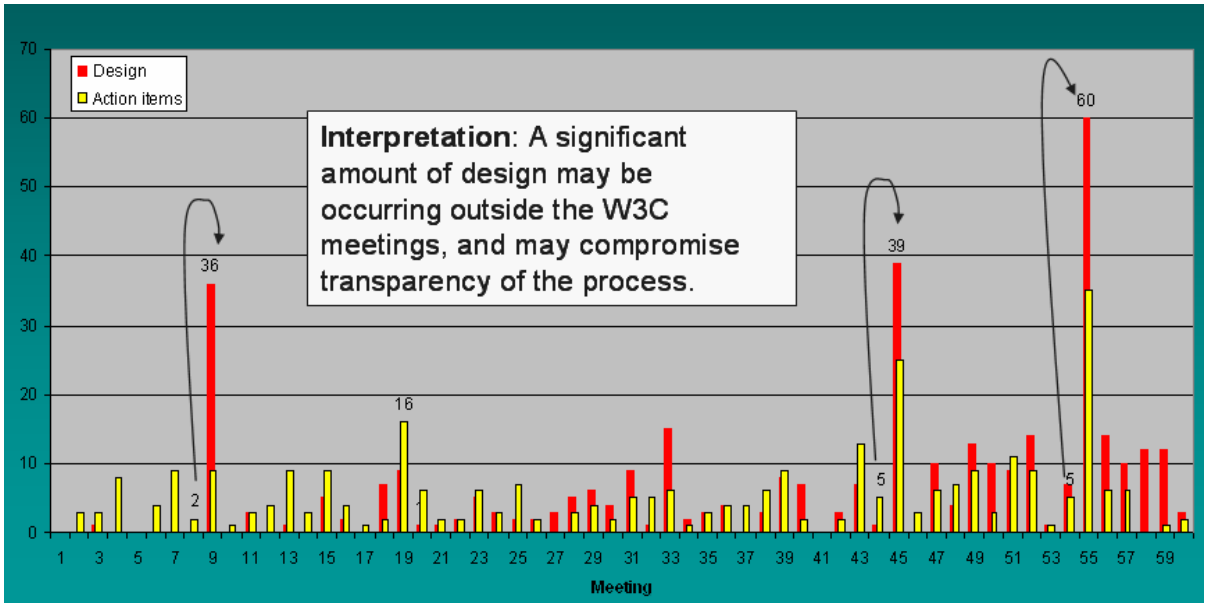


**Figure 10. Inferring design occurrences outside meetings**

**Other observations from the data**

Some other observations from the data were as follows. As to the cycles of DSN, as suggested by (Fomin et al., 2003), our data shows that the standardization process most often proceeds in cycles of D, S and N. As to the interaction among participants, in order to analyze the comparative roles played by big and small companies involved in the process, we assigned codes to discussions only among big players, only among small players and among big and small players. See Table 7 for a tally of these occurrences.

**Table 7: Occurrences by size of SDO "player"**

| **Code** | **Number of occurrences** |
|---|---|
| Interaction between big fishes | 56 |
| Interaction between small fishes | 14 |
| Interaction between big fish and small fish | 20 |

This data suggests that a significant amount of the discussion was dominated by

exchanges between big players. This raises the question whether small players have as much say in the process and the decisions as do big players.

As to the agreement and disagreement, we assigned the code ‘agreement’ to sections of text where participants agreed on design or process issues and the code ‘disagreement’ to sections of text where objections were raised against proposals being discussed. The 202 instances of agreement as opposed to the 34 instances of disagreement suggests that most decisions found the support of the majority of players. As to the expression of a particular participant’s interests, we noted instances of participant’s expressing a specific interest in the development of the standard – such as their personal opinions or their expectations of design or process outcomes. These often reflected personal motivations of the players and the organizations that they represented. Again, the motivation was to examine how far the process was dominated by interests of big players, and we found that there were 28 instances of big players expressing their personal interests as opposed to 1 instance of a small player expressing his personal interests. It was also interesting that there were no instances of W3C committee members expressing their interests. Finally as to the strategic decision to engage in procrastination, we coded instances of participants delaying the discussion of issues or delaying taking action on issues discussed as ‘procrastination’ and found 37 instances of these. This suggests that perhaps procrastination is used by participants as a negotiation strategy.

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# Appendix A: W3C web services standards available

**Recommended Standards (Process completed)**

1. SOAP Version 1.2 Part 0: Primer: Recommendation. 24 June 2003
2. SOAP Version 1.2 Part 1: Messaging Framework: Recommendation. 24 June 2003
3. SOAP Version 1.2 Part 2: Adjuncts: Recommendation. 24 June 2003
4. SOAP Version 1.2 Specification Assertions and Test Collection.
5. SOAP Message Transmission Optimization Mechanism. 25 January 2005

**Working Drafts (document published for review by the community)**

*In last call mode*

1. Web Services Addressing 1.0 – Core. Ends - 11 May 2005
2. Web Services Addressing 1.0 - SOAP Binding. Ends - 11 May 2005
3. Web Services Choreography Description Language V. 1.0. Ends - 31 Jan 2005

*In development*

4. Web Services Description Language (WSDL) V. 2.0 Part 1: Core. 10 May 2005
5. Web Services Description Language (WSDL) V. 2.0 Part 2: Adjuncts. 10 May 2005
6. Web Services Description Language (WSDL) V. 2.0 Part 0: Primer. 10 May 2005
7. Web Services Description Language (WSDL) V. 2.0 SOAP1.1 Binding. 10 May 2005
8. Web Services Addressing 1.0 - WSDL Binding. 13 April 2005
9. SOAP Optimized Serialization Use Cases and Requirements. 8 June 2004
10. WS Choreography Model Overview. 24 March 2004
11. Web Services Choreography Requirements. 11 March 2004
12. Web Service Description Usage Scenarios. 4 June 2002

**Standards development abandoned**

1. Web Services Internationalization Usage Scenarios. 30 July 2004
2. SOAP 1.2 Attachment Feature. 8 June 2004
3. Web Services Architecture. 11 February 2004
4. Web Services Architecture Usage Scenarios. 11 February 2004
5. Web Services Glossary. 11 February 2004
6. Web Services Architecture Requirements. 11 February 2004
7. Web Service Management: Service Life Cycle. 11 February 2004
8. SOAP Version 1.2 Message Normalization. 8 October 2003
9. SOAP Version 1.2 Usage Scenarios. 30 July 2003
10. SOAP Version 1.2 Email Binding. 3 July 2002