Abstract

Web service standards, like several other IT standards, are anticipatory, i.e., they are designed and codified in anticipation of actual adoption and use. As a result, the setting of web service standards takes on properties that resemble the designing of software artifacts. In contrast, the traditional perspective on standards views them as law-like systems that legislate modes of behavior, product structures or specifications. The two perspectives—‘design’ and ‘legislation’—can sometimes be at odds. In the software engineering community, the phrase ‘design by committee’ has come to symbolize designs that are not effective, not elegant and not addressing issues that are core to the original intentions. Current efforts and recent outcomes in web services standards appear to have overcome this taboo. We demonstrate, with the help of an empirical study, how the participants interact, and the roles they take on to produce web service standards.

1. Introduction

There is an evolution in the process used by standards-development organizations that is changing the prevailing standards development regime. Instead of selecting from a set of candidates, as the traditional processes dictated, the crafting of standards for emerging technologies (such as web services) includes a substantial design component. The very idea of “designing” makes these standards “anticipatory,” that is, they are created with the hope and expectation of actual use (Cargill 1989). Further, the development involves multiple stakeholders and organizations, often with a diversity of interests, working on the development for long periods of time (see, e.g. REF). Without a set of actual uses, the team developing the standards, therefore, often begins to rely on what are called projected ‘scenarios’ of use, which then drive the standards development process.

One criticism of this process, when seen from the tradition of design in software engineering and software development (Gasson 1998; Yoo and Ackerman 2005) can be that it can inevitably lead to Design by Committee, i.e. one where the resulting designs reflect a compromise with no clear goals satisfied, not producing an elegant solution nor addressing issues that are core to the original intentions.

With standards development organizations such as W3C, OASIS and others, we have been “practicing” these modes of standards development (WSDL 2002) without significant effort to understand how these work, why they may or may not produce effective standards, and what we may be able to do to increase the probabilities of more effective designs. Although the final determinant of success of these standards is likely to be market acceptance (affected by several extrinsic factors such as use, usability and network effects among several others), our understanding of observable aspects of these processes can contribute significantly to our efforts to produce more effective designs.

Towards this end, in this paper, we analyze the actual process of developing one specific standard, SOAP v. 1.2, developed by W3C (2001) with the help of a theoretical framework called Design-Sensemaking-Negotiation (DSN) proposed by Fomin et al. (2003). The analysis follows the tradition of archaeological research that includes coding and interpreting process data available in publicly available sources in the form of minutes of meetings, proposals, drafts and recommendations; and tying back to existing theories. Our work also benefits from an understanding of the public policy environment that constrains standards development activity, which provides a further source for interpretation of data. A key contribution of our paper is that the processes, as set up and practiced, allow overcoming, at least in part, the taboo of “Design by Committee.”

The paper first describes the background of our research: the public policy environment and the DSN theoretical framework (in section 2). Prior work on the Design by Committee taboo and W3C’s assertions about how they overcome are discussed next (in
section 3). We follow that with a description of the research methods followed (in section 4). Findings are presented next (in section 5). Our interpretations informed by prior work as well as a comparison with the CORBA standardization effort round out the paper (in section 6).

2. Background

Following a public policy perspective, standards are a form of law or regulation covering performances ranging from professional conduct to technical interoperability. They can include de facto and de jure standards, and 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 (Mitra et al. 2005). The idea of ‘due process’ is, therefore, considered important by bodies such as the ANSI (2003). The essential requirements for due process from ANSI can be inferred as: openness, lack of dominance, balance, notification, consideration, consensus, appeals, and written procedures. A similar set of requirements is suggested by OMB circular A-119 (OMB 1999) that requires executive agencies to participate in voluntary consensus standards bodies. These include: openness, balance of interest, due process, an appeals process and consensus. The circular is important because it requires not only participation but also use the resulting voluntary consensus standards produced when the process has such due process attributes. The Standards Development Organization Advancement Act of 2004 (SDA 2004) recognizes the societal contributions of standards by approving the due process attributes in OMB Cir. A-119. It renames and restates these as Standards Development Principles:

- Notice to affected parties
- Opportunity to participate
- Balancing interests to avoid 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
- Right to consideration of positions by the standards development organization
- Right to appeal adverse decisions

Few comprehensive theoretical descriptions are available to characterize the actual activities that may take place in the standards development process, as it relates to anticipatory technologies such as web services. A recent exception is the “mash-up” from three distinct bodies of research proposed by Fomin et al. (2003). It recognizes the important interplay among three factors that underpins standards development activities: design, sense-making, and negotiation (DSN). The combined model provides a “dynamic process model of standardization.” Each component is the result of different theoretical strands, i.e. each conveys a specific meaning of the terminology used. First, the term ‘Design’ follows the view suggested by Simon (Simon 1981) with 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 divide and conquer. Second, the term ‘Sense-making’ (Weick 1995) refers to a process that participants engage in to create a ‘sense’ that results from an individual’s or an organization’s response to changes in environment. Fomin et al. implicitly expand the original description (actors try to make sense of outcomes of past events) to include proactive sense-making i.e. attributing meanings to a not-yet-invented outcomes. Third, the term ‘Negotiation’ (Latour 2005) refers to bargaining about the distribution of future outcomes. It is intended to stabilize a network of actors in which the developed technology will be introduced. A key to understand how the three components work together is the idea of recursion. The theoretical model suggests several cycles, with each leading to increasingly detailed interactions among participants engaged in design, sense-making and negotiation.

These two perspectives: the public policy perspective with due process requirements codified in several venues and the meta-theoretical perspective that combines three previously unrelated strands in describing a recursive process provide important precursors to understanding and interpreting the actual development process of web service standards.

3. Design by Committee

As a contrast to the prescriptive and descriptive perspectives outlined in the previous section, consider the warnings that software engineering and systems development research has provided about ‘Design by Committee’ (Gasson 1998; Yoo and Ackerman 2005). The idea underlying these warnings is simple. Unlike a team-effort, where individuals subscribe to a common goal and purpose, and are aware of their specific roles and responsibilities, stakeholders who may come together to design an artifact with widely varied goals and interests is likely to lead to significant compromise, and in turn, produce designs that are (a) ineffective, (b) inelegant and (c) not responsive to the core concerns. An example of design by committee often pointed to – “a camel is a horse designed by a
committee” – reflects these dangers. More recently, commenting on methodologies for object-oriented systems, Ramsin and Page (2008, p. 83) describe this as: “integration is typically done through a design-by-committee procedure, and usually results in complex and unwieldy monstrosities.” The ills of design by committee are also acknowledged elsewhere, albeit briefly, in the context of information technology standards. Markwalter et al. (1991) describe this as a problem for UML standards. Henning (2006) acknowledges this as one of several concerns for CORBA. The W3C, arguably the most important body for web service standardization, provides the following exposition about Design by Committee, and how it is used for development of standards (W3C 2008). Much of this statement is reproduced below:

Nearly all specifications are created by a committee rather than by a single individual. The working groups of W3C typically consist of some 10 to 20 people, who work together on a new technology for a year or longer. "Design by committee" has a bad name (specs that are a patchwork of inconsistent solutions, often redundant, and thus too big and too hard to learn), but in reality it doesn't automatically produce bad results. "Two know more than one" is another proverb, and that is exactly why working groups exist: more pairs of eyes mean more checking for errors, more creativity in finding solutions to problems, and more experience in knowing what worked or didn't work in the past.

But the problems of "design by committee" still have to be avoided. Around 15 people seems to be the limit, larger groups tend to form (informal) sub-groups and lose too much time in communicating rather than developing. Smaller groups produce more consistent and easier to use specifications, but they may omit some things that they didn't know anybody needed. The solution seems to be to create a wider circle of interested people around them, in the form of a public mailing list.

That is how W3C develops its technologies: a working group recruited among experts, and a public mailing list for other interested people. There may be some there that have only interest in one detail or that only occasionally have time to discuss the developments. In the working group they would just have hindered the process, but on the mailing list they can give valuable contributions.

Of course, the two-level system assumes a willingness of the committee to listen to the outside. It takes some time to scan the mailing list for important messages and, when needed, to answer them. But most of all it requires openness on the part of the committee to discuss their reasons, even if they sometimes have to do with short-term company policies. And it requires a matching openness on the part of the public to accept those reasons as valid.

‘Design by Committee’ at W3C (W3C 2008)

To explore the interactions between the prescriptive underpinnings of standards development processes (as exemplified by the public policy environment), the descriptive accounts (as suggested by the theoretical framework) and the warnings about / avowed practices related to design by committee, we used an archaeological case study method.

4. Research Setting and Method

The research method used for this work was an archival analysis of documents related to standards development processes for a case (Yin 2003). The specific case we used was analyzing standardization of SOAP: Standard Object Access Protocol 1.2. SOAP is a part of the core set of standards (along with UDDI and WSDL) for web services. The choice of SOAP 1.2 for this study was considered appropriate because of the high level of design activity as well as the completeness and availability of public archives documenting the development of the standard (W3C-XMLWG 2000).

We performed an empirical analysis of documents related to the standardization of SOAP 1.2 by W3C. These documents, made publicly available on the W3C website, primarily included transcripts of meetings (either face to face or via the telephone) (W3C-XMLWG 2000). The results reported here were obtained from the analysis of 60 documents (in chronological order) out of a total of 120. We utilized content analysis (Krippendorff 2003), that allowed us to make ‘categorical’ inferences about large volumes of textual data in a systematic and replicable manner (Stemler 2001). To ensure high-fidelity, one of the authors participated in content analysis; the others examined and challenged but ultimately corroborated the interpretations suggested.

![Figure 1. An example of content analysis](image)
Practice of the research method required deciding on “text fragments” and “codes.” A text fragment was usually a text segment related to a significant event or activity performed by participants. A code was the label conveying the meaning attached to the identified text fragment. The analysis was supported by Atlas.Ti (ATLAS.ti 2005), which allowed the research team to assign codes to text fragments in the documents (see Figure 1).

To further improve internal consistency in conjunction with the interpretation of text, the analysis was initially performed independently by two researchers on the same documents. The results from both researchers were compared to ensure that they had established a common understanding of the specific manner in which text fragments were to be identified, and meanings assigned. From this common understanding, the researchers drew up a set of syntactic and semantic rules which informed further work. These rules ensured that interpretations of texts by the researchers were consistent. After establishing these rules, the two researchers independently coded additional documents.

For the case study, this exploratory and emergent process was used to identify codes. These codes were then categorized into groups and relations to identify concepts that explain the roles and activities of participants engaged in the standards-setting process. At least a part of the research team was sensitized to the framework suggested by Fomin and others (Fomin et al. 2003) that characterizes the standards-setting process as one consisting of Design, Sense-making and Negotiation (D-S-N). The activities coded, and the different avatars inferred are, therefore, at least partially influenced by our theoretical biases.

The analysis resulted in several concepts. Examples of concepts that emerged include: action items, cooperation, design suggestions, negotiation etc. We used Atlas.Ti to track text fragments, codes, families of codes, and to find connections among codes. Additional details about the methodology are available elsewhere (Mitra et al. 2005). The results we describe in the next section directly follow from the case study and the empirical analysis described above.

5. Findings and Discussion

We focus on findings that are directly related to our research concern in this paper: how are web service standardization processes able to overcome the Design by Committee challenge. Our discussion of findings begins with a set of roles that the data revealed. These were inferred by examining the coded text fragments that followed the DSN framework, aided by an examination of related documents (such as proposals, drafts, and recommendations) that made interpretation of behaviors easier. As an example, consider the hectic activity in certain meetings of the working group. It was noted that a W3C draft was published the following week. Table 1 describes the different roles. The examples are deliberately altered in the table to prevent tracing back to specific individuals:

<table>
<thead>
<tr>
<th>Role</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advocate</td>
<td>My primary goal for … When we have a spec, we need a way to sell to the community. The … will be the tool I use for that. We should not put it on the back burner.</td>
</tr>
<tr>
<td>Architect</td>
<td>Proposal: delete the box and replace it with … X: The envelope is the frame in which the headers hang, but the envelope is… Y: It’s a mistake to try to distinguish … from …</td>
</tr>
<tr>
<td>Critic</td>
<td>Raises issue of an xml file server which may not want to take responsibility for normalizing data it has received. Issue was raised that this happened because xml was used for the envelope—suggestion was made to not use the word header …</td>
</tr>
<tr>
<td>Facilitator</td>
<td>So there is a separate decision to be made about whether we need correlation ids and how and if we use our extensibility mechanism…. X: Let's take this to e-mail.</td>
</tr>
<tr>
<td>Guru</td>
<td>X: The envelope is the frame in which the headers hang, but the envelope is… Guru avatar: It's a mistake to try to distinguish … from …</td>
</tr>
<tr>
<td>Procrastinator</td>
<td>Chair: Postpone this agenda item due to X's (Procrastinator avatar) absence</td>
</tr>
<tr>
<td>Spectator</td>
<td>No manifestation</td>
</tr>
</tbody>
</table>

Table 1. Roles Observed during Standardization

The first three roles directly relate to several areas of self-interest, and how they are manifested. The first role, Advocate, was largely concerned with protecting personal or organizational interests. The advocate often campaigned to restrict or expand the boundaries of a standard (similar to the scope of a design artifact). The second role, Architect, performed activities such as providing and suggesting design options for a component of the standard. Although these actions may not be seen as self-interest, we surmise the Architect was able to do considerable work prior to the meeting, i.e. was able to forcefully present the interests of the organization he/she represented. The third role, Critic, was manifested in activities such as issues raised or questions posed for probing the appropriateness or
comprehensiveness of design proposals. Participants with significant insight into the standard under development, e.g. those who assumed the Architect role for another component could assume this role.

The next two roles are aimed at guiding the overall standards development activity. The fourth role, Facilitator, performed activities such as regulating discussion, editing specifications, and providing relevant information for discussion. Participants who assumed this role were often representing the standards development organization, i.e. W3C or the chair of the standards development working group, or an editor of the standard specifications. The fifth role, Guru, performed activities such as approving or rejecting a design based on its technical merits. The role required skills similar to those required of a Technical Evangelist in an organization. The insights provided by this role often reflected knowledge beyond the specific standard being developed.

The final two created obstacles in the standards development process. The sixth role, Procrastinator, deliberately delayed the process either by introducing concerns that were considered unwarranted by others or by being absent or uninvolved in a discussion where he/she was expected to contribute. Specific instances were, however, difficult to identify because it is difficult to characterize whether participants were simply being overly-cautious or had political reasons for delaying the process. The final role, Spectator, could only be discovered by perusing names of participants and comparing these against meeting transcripts. A participant assuming this role made few overt contributions, preferring instead to merely observe as the process unfolded. The only observable contribution from the Spectator, therefore, was his/her participation in the voting process for adoption of alternatives.

We emphasize that the roles described above represent prototypical bundles of actions that were assumed by different participants at different stages of the standards development process. For example, it is conceivable that a participant assumed the Advocate role during some phases of the development process, and in later phases was content to be a Spectator. A number of related findings such as the frequency with which each role was manifested, and the size of the organization that assumed each role are available elsewhere (Umapathy et al. 2007). For example, we found that participants who represented larger organizations were often Advocates (playing the role 27 times more often than participants from smaller organizations). This imbalance was much less for other significant roles, such as Architect (9 times), Gurus (6 times), Critics (4 times) suggesting that participants from smaller organizations were able to contribute and participate in these roles. These roles provide significant opportunities to understand whether and how the standards development processes are able to overcome problems related to design by committee. We interpret the findings towards this goal next: does our understanding of web service standardization (with the help of prescriptive public policy approaches and theoretical underpinnings) show us how standards development organizations overcome the ill-effects of ‘design by committee’?

From the data, we are able to surmise that at least a part of the explanation comes from the non-trivial influence exerted by participants from larger organizations who contribute to the standards development process. As an Advocate, they are able to direct the design effort towards a particular set of goals. Unless there are multiple larger organizations with significant agendas that are in direct conflict, such advocacy may, in fact, be beneficial because it will ensure that the efforts of the working group are channeled towards a common denominator.

A comparison against due process requirements (see section 2), however, may suggest a different outcome. For example, although the imbalance suggested by Advocacy from larger organizations helps to avoid too many compromises (i.e. keeps the group away from design by committee), it may be seen as a sign that one due process requirement is not fully met: “Balancing interests to avoid domination by any single group.” It is, however, possible to argue that the another requirement “Right to express positions” is, in fact, exercised by the roles of Architect and Critic, and that they can provide the necessary balance. Although we are able to report frequencies of these occurrences, it is difficult to capture the significance of each occurrence. A pair of other due process requirements, “Consideration of all views and objections” and “Right to consideration of positions” is, seen in the roles Critic and Procrastinator. The frequency with which the Critic role is played suggests that these requirements are indeed met. The role Procrastinator, however, was observed very few times, and the idea that this role brings to the table concerns that are considered unwarranted by others may suggest that “Consideration of all views” may be sacrificed to some extent in favor of efficiency. This bias towards efficiency can, however, provide a mechanism for overcoming design by committee. Interestingly, we did observe that another due process requirement “Substantial agreement on all material points” did not require significant compromise. Although it is difficult to characterize the outcome in this manner fully without examining the content of the standards themselves, we
can surmise this outcome by examining the roles Architect, Guru and Critic that allow significant examination of the proposals before reaching an agreement. Finally, another due process requirement “Ready access to proposals and final standards” was reflected in the Spectator role. Although the role may be criticized for being a non-contributor, its value may be seen in this manner.

Two aspects of the W3C position on how they attempt to avoid Design by Committee (see Sidebar in section 3) contributed to these outcomes. The first aspect refers to how the working groups consist of multiple experts that we see manifested in the ‘more pairs of eyes’ that the three roles bring: Architect (‘bring greater creativity’), Guru (‘bring experience related to what worked and did not work in the past’) and Critic (‘check for errors’). The roles above reflect what our data found, and the text in quotes represents corresponding beliefs from W3C. The second aspect is what W3C suggests and follows as a two-level system with a small working group supported by a wider and open mailing list of interested citizens. The role Spectator appears to epitomize the contributions of the larger mailing list in that they may be seen not only as lurkers or bystanders but also as watchdogs. The mere knowledge that the deliberations are open and subject to scrutiny may contribute significantly to effectiveness of the process.

The next comparison we make is against the theoretical DSN framework used to analyze the case and code the data. The comparison suggests that the theoretical framework performed adequately. We were able to analyze text fragments, infer roles and interpret the findings. Two further additions are, however, necessary. First, although the framework describes recursion, this is difficult to directly observe without intimate knowledge of the standards being developed. We propose analyzing key episodes of recursion. Second, the framework describes well the workings of the expert group assembled for the standards development process but is not able to directly account for the two-level process that W3C follows other than implicitly allowing for its inclusion via activities that are manifested. This may require an extension to the theoretical framework.

A final set of interpretations relates to comparisons of the web services standardization process we have analyzed against those for other technologies reported elsewhere. Specifically, these include the outcomes of the CORBA standardization (Henning 2006) and UML standardization (Kobryn 1999). We acknowledge that these two represent different domains; the reported examples we compare against do not provide a rich data set nor open up the process in the manner we have been able to with the help of examination and coding of meeting transcripts. Further, the scope of these reports is much wider in that they describe the entire set of standardization efforts in each domain as opposed to the focused inquiry we describe, which relates to one specific standard from the stack of standards developed and under development for web services. In spite of these differences, the post-mortem provided by these reports provides a good baseline to interpret and understand our results. In particular, the history, account and critique from Henning (2006) provides ample opportunity for such comparisons. In particular, Henning lists a number of interesting “procedural” issues that contributed to CORBA’s decline. We examine these, contrasting these with our findings and interpretations:

The first is a ‘lack of entry qualifications to participate in the standardization process.’ The web services standardization policy followed by W3C appears to have overcome this problem. The two-level policy allows recruiting from experts that provides a quality check, while retaining openness of the process by allowing contributions from a larger mailing list. This permits greater influence on the outcomes from the knowledgeable group of experts who act in the roles of Architect, Guru and Critic.

The second is ‘calling for proposals where the technology is still unproven.’ For CORBA, these proposals attempted to innovate without prior practical experience. Here as well, the web services standardization process has done better. Our findings suggest that the role of Guru is able to contribute expertise and insight by bringing experience related to what worked and did not work in the past.

The third is ‘vendors’ response to requests for proposals in spite of known technical flaws.’ Here, the roles of Advocate and Architect are important. By taking a stance related to a particular position and either expanding or restricting the boundary of the standard allows Advocates to argue for or against what may be included in the standard. The Architect contributes by bringing specific technical suggestions.

The fourth is ‘multiple draft specifications’ and the practice of merging these into a single specification. Of all the practices that Henning describes, this may directly and overtly contribute to outcomes that can be described as ‘design by committee.’ The complexities in the CORBA specification attest to these undesirable outcomes. The web services standardization processes have overcome this concern by focusing on a single draft specification, where different designs are
contributed at different points during the negotiation process by participants who assume the role of Architect, examined by participants who assume the role of Critic, and the process is shepherded by participants who assume the role of Facilitator.

The fifth is ‘lack of a reference implementation.’ Although we found that this sometimes resulted in questionable adherence to the principles of due process (allowing domination by some participants who performed designs prior to group meetings and contributed these to the meetings), such balancing between ‘due process requirements’ and ‘avoiding design by committee’ may be a necessary property of effective standardization processes. The designs and design suggestions contributed by the roles Architect and the balance provided by the roles Critic and Guru are likely to provide a better alternative to the desire for a fully democratic process that CORBA practiced.

Overall, our interpretations suggest that the undesired outcome of ‘Design by Committee’ that is to be feared in standardization was adequately addressed by several safeguards. The DSN framework we used to analyze the data allowed us a direct window into the standardization process to make these interpretations and comparisons against prior accounts. Although we cannot provide complete details here, we did observe several patterns of interactions and cycles that provide further support to the above analysis. For example, the roles Architect and Critic often interacted, with the former proposing designs, and the latter commenting on the proposals; often resulting in significant changes to the standard. An amplification of this was observed in the cycle of interactions between the roles Critic, Facilitator, and Architect. Following an issue raised by a Critic, the Facilitator assigned the issue to be investigated by an Architect. Other related findings from the study are available elsewhere (Mitra et al. 2005; Umapathy et al. 2007).

6. Conclusion

Few in-depth accounts following prescriptive or descriptive lenses exist to understand emerging standards development processes. In this paper, we have described a part of the findings from a project aimed at conducting archival analysis of documents that characterize development of web services. The data we used is available from publicly available sources, which provides minutes of meetings, proposals, drafts and recommendations. Our analysis of this data is driven by due process requirements emerging from public policy constraints and recent legislation; and a theoretical framework that suggests viewing the standards development processes as a complex interplay among three forces: design, sense-making, design, and negotiation. We have analyzed the data to infer roles that participants play in these development processes, and how these can potentially avoid the undesirable outcomes of Design by Committee.

The empirically grounded results provide a useful foundation to understand and improve web service standardization activity. Clearly, developing standards with a significant design component (Mitra, Purao et al. 2005) requires increasingly important roles from organizational players as well as standards development organizations. We have described in this paper how these roles may co-exist, co-operate, collaborate, compete and combine their expertise, time and efforts to produce effective standards. The long-standing taboo against Design by Committee and its tacit recognition as a significant obstacle by W3C (W3C 2008) notwithstanding, our in-depth analysis of this case suggests that the process appears to move forward relatively smoothly and does produce effective outcomes. Our analysis above also suggests possible strategies that smaller participants, citizens and organizations, may use to participate more effectively in the standardization process. For example, hiring Technical Evangelists, who may assume the role of a Guru during the standardization process, may be a possible approach to effective participation in the standardization process or smaller organizations. It may also be possible for participants from smaller organizations to assume the role of Critic more often, even with the limited resources available at their disposal. Further speculative analyses are possible, extending the interpretations suggested by the empirical analysis.

A final word of caution is necessary. The empirical analysis we have reported and the interpretations we have suggested rely on the assumption that the public documents reveal faithful accounts of the standardization process. Like other social processes, the standardization process may also include elements that are not amenable to an archaeological analysis such as ours. Subject to this caveat, the analyses we report along with comparisons we provide to public policy constraints, theoretical frameworks, and prior standardization efforts provide a rich interpretation of web service standardization efforts that has the potential to significantly improve our understanding of anticipatory web service standardization processes.

7. References

1. ANSI. 2005. ANSI Essential Requirements: Due Process Requirements For American National
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