DEFENDING THE SPIRIT OF THE WEB: CONFLICTS IN THE INTERNET STANDARDS PROCESS

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ABSTRACT

The creation and adoption of standards is often modeled as a game between large corporate players. Alternatively, the standards process can be modeled as the actions of a set of actors in a network. A third perspective is also possible – standards can be seen as the outgrowth of the technical ideas of the participants and the technical community they consider themselves part of. This work focuses on applying all three perspectives on the development of web services choreography standards. A model is developed, and the three methods are applied. All three are shown to be intertwined, in the sense that ideas from one method can feed another. Evidence is presented which suggests that the technical culture of the participants is a strong driver of standards development – and of migration between standards groups. The role of standards bodies are analyzed – given the fast movement of technical architects between companies and standards groups, the bylaws of the groups themselves may be important in encouraging or frustrating the creation of successful standards.

Keywords: standards development, standards adoption, decision making, web services, workflow, choreography, software architecture, aesthetics.

INTRODUCTION

The creation and adoption of a technical standard has a large effect on our society – economically, a standard can impact the rate at which new products can be developed, and socially, it can determine who can produce and control these products. So understanding the process of standards creation and adoption is important to our overall understanding of our society. Such an understanding can ideally help us facilitate the development of effective standards. In the rapidly growing literature on standards research, there are a number of cases oriented toward particular standards, as well as research into horizontal similarities across different efforts.

This paper is the outgrowth of a case study the authors recently completed on the development of web services choreography standards. In the paper related to the case, we detail the history and explain in depth the technological arguments surrounding the standards (zur Muehlen, Nickerson and Swenson). We went into the study expecting to explain a technical battleground. What we found was that the battles were not purely technical. For example, for all the debate on one solution versus another in 11 different groups, no one suggested actually testing the proposed technologies to verify claims and counter-claims.

Here, we build a model for standardization, and look at our previous case from three perspectives. The first perspective is social – we follow the people involved in the

standards process, an approximation of more complex approaches such as actor-network theory (Latour 1987). The second is cultural – we look at the ideas of the participants, particularly ideas about technology. Our approach is a simple form of text analysis as practiced in cultural anthropology (Bernard 2002). The third approach is economic, utilizing decision theory (Keeney and Raiffa 1993).

These three approaches are intertwined. In general, economic theories are helpful in understanding how individuals with a given set of utilities will interact. It has been observed before that economic theories are not good at determining where the utility comes from; social theories are better for understanding how an individual's utility gets formed (Kling, Kraemer, Allen, Bakos, Gurbaxani and King 1992). Consistent with their work, this study can be seen as providing more evidence that standards study calls for multi-method approaches. More specifically, this study focuses on technological culture as a determining factor in standards creation.

The economic approach is well-understood by all standards participants – often one will impute game-playing motives on another. But the imputation itself is connected to beliefs of the participants, as a careful reading of running newsgroups surrounding standards will show. And, in analyzing the decisions to be made in a standards committee, a look at the social networks revealed that the decision to quit and reform a standards group is an important option in the game. So, depending on one's perspective, one can say that the social research allows us to build and calibrate a better decision model, or the decision research helps us probe backward into the ideas that form an individual's utility function. Fomin and Keil (2000) have applied a multi-method approach to standards before, utilizing 8 different approaches – while their study focused on the political aspects of their cases, ours focuses on the cultural aspect.

First, before examining each perspective in turn, we present a diagram in figure 1.

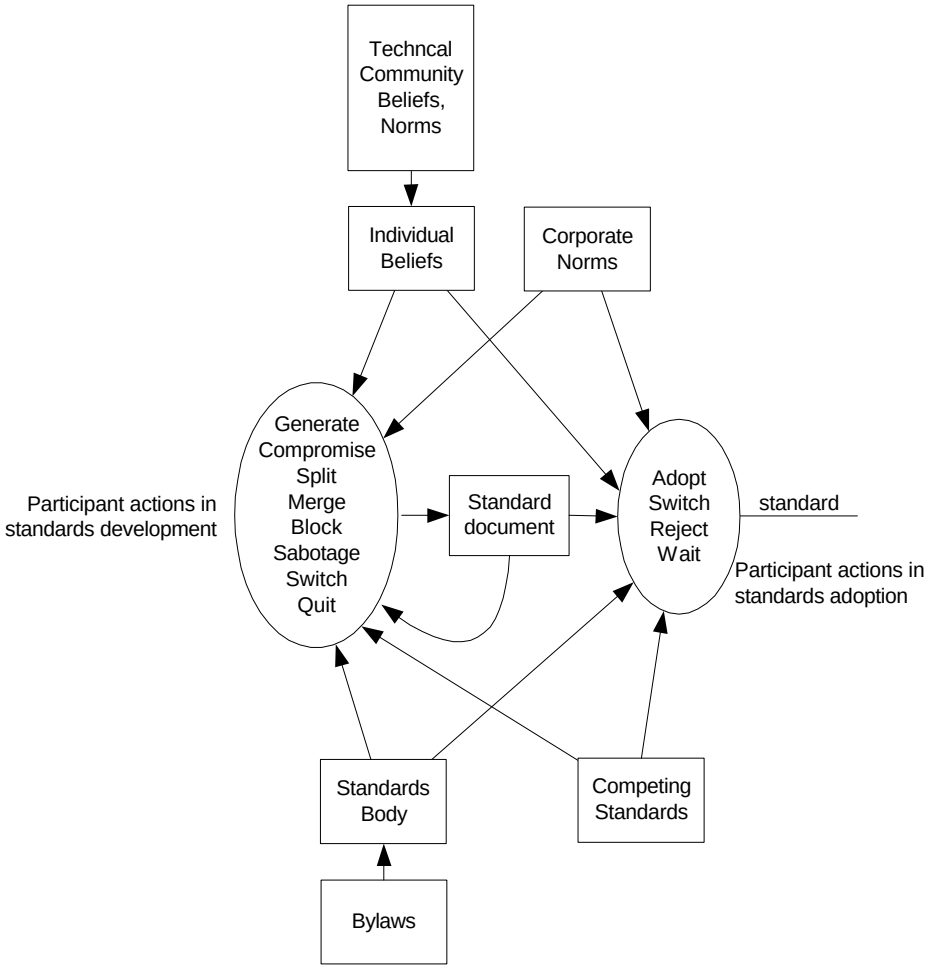

Figure 1: Standards Process

The diagram describes the standards process as consisting of two decision processes, development and adoption. In the development process, the participants in a standards body create and debate the standard. Notice the number of different actions that take place in the development stage. Originally, we assumed that the generation and compromise would be the major moves, but in analyzing what happens we came to realize that many more options besides compromise are possible. Part of the pressure on a standards group is an external factor – there are often other competing standards. So, in true game playing fashion, a player who favors an outside standard may either suggest merging with that standard, or block or sabotage a standard, much the same way a congressional committee can block or sabotage a bill. Unlike a congressional committee, those who object to such moves can switch to another standards group without incurring large switching cost. If the standards development goes well, they produce a standard document, which is often refined until it is presented to a wider community for acceptance.

The wider community considers both the standard and other competing standards, and may adopt the standard, reject it, switch to another one (a different form of rejection), or simply refuse to make a decision. This latter process has been the subject of much economic analysis (Farrell and Saloner 1985; Besen and Farrell 1994). It has been

observed that the game-theoretic techniques employed are more suited to the adoption than the development process (Fomin and Keil 2000).

Having presented the model, we give some detail on the domain we will use as an example throughout this study.

Web services choreography describes the coordination of long-running transaction between business partners using standard Internet protocols, such as HTTP, SOAP, and WSDL (all acronyms are defined in a glossary at the end of this paper). It can be applied in a variety of domains, ranging from supply chain management to media content solicitation. The origins of web services choreography can be found in workflow management technology, which has been commercially available since the middle of the 1980s.

In the early 1990s large workflow users became aware of the possibility that they would be confronted with the existence of several workflow solutions from different vendors. These users chartered workflow vendors with the definition of interoperability standards for workflow technology. These standards were first created within the scope of the Workflow Management Coalition (Hollingsworth 1995; WfMC 1999), but they are increasingly being defined by competing standardization groups, such as BPMI, OASIS, and W3C. In parallel to this development, the use of Internet technology for application integration became feasible through the introduction of value-added standards on top of the basic HTTP protocol used for the World Wide Web. These standards, WSDL for the description of externally accessible operations and SOAP for messaging using XML, allow application designers to open their applications for access over the Internet. However, SOAP and WSDL only provide support for simple request-response message exchanges. More powerful mechanisms are required for the coordination of long-running transactions, such as the subsequent exchange of Quotes, Purchase Orders, and Delivery Notes.

THE SOCIAL PERSPECTIVE: FOLLOWING THE PEOPLE

Latour (1987) writes that we should "follow all the actors whoever they may be and wherever they may go". First we start with the institutions, and then look at the people.

The goal of creating a web services choreography standard has already generated 11 different standards, and is not yet concluded. Figure 2 shows the complex interweaving of standards groups just around the formation of choreography standards – groups form, argue, splinter, and create new standards. In this particular case, we can identify a repeated pattern – enthusiasm over a standard turns into conflict over architectural issues, a group espouses a purer, simpler architecture, breaks off the main standards stream and forms another standard in a different standardization organization. In this process the rogue group merges with another group. Then the cycle repeats. Most of the standards backed, discussed, and even completed are never implemented, but instead dead end as their champions jump onto a new one.

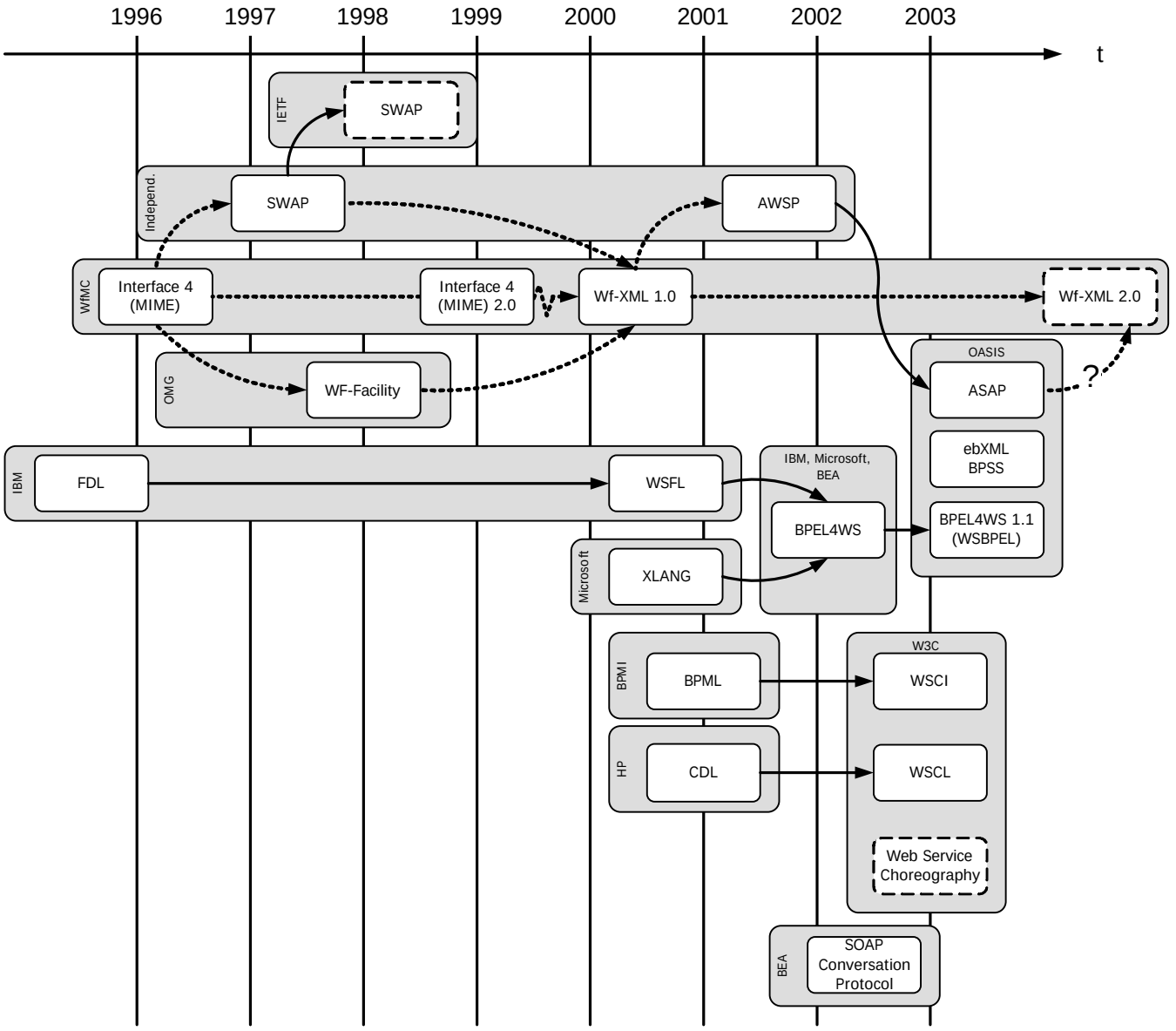

Figure 2: Timeline of Workflow and Web Service Standards

In looking at this diagram, one is struck by the migratory nature it implies. For it not really the standards themselves that are moving – it is the participants in the standards process who are packing up, leaving, and reassembling with a different standards organization. In our case, we traced several of the participants through their hops across different standards bodies. To help conceptualize what is happening, we present a set of diagrams which show the process taking place.

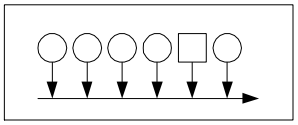

Figure 3.

In figure 3, a group forms, with slightly different beliefs (circles and squares).

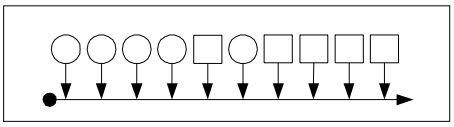

Figure 4.

The group expands, and the initial group ends up in conflict over the direction of the standards with newcomers with different beliefs.

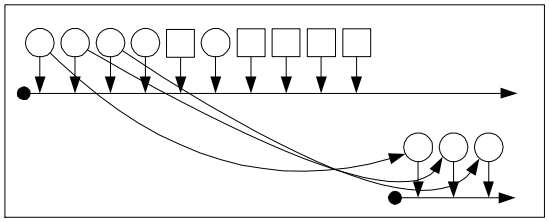

Figure 5.

Several members of the founding group break off, and form a new standards group in a different venue (the second parallel line).

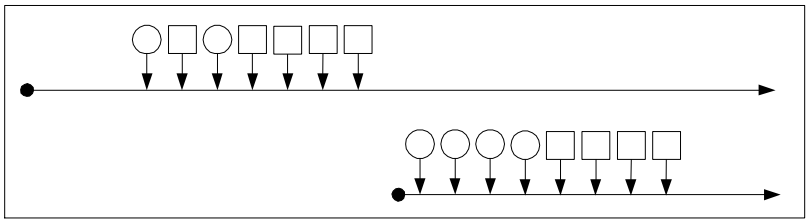

Figure 6.

More members join this new group – they happen to have a different set of beliefs.

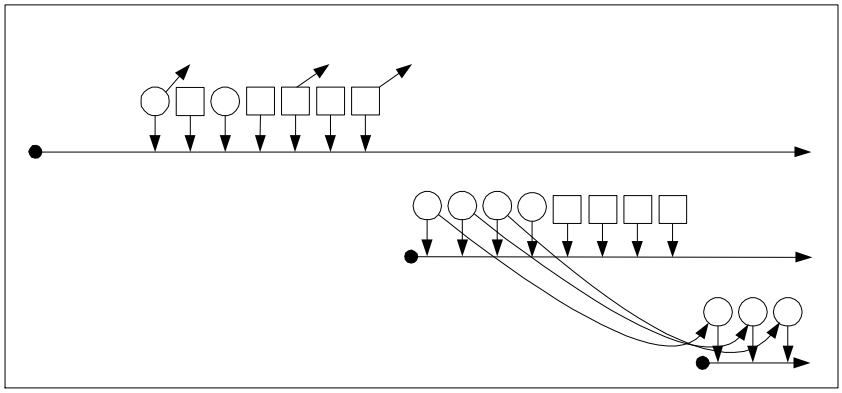

Figure 7.

The initial group finds the direction of the new standards committee is not to their liking, and they quit and form a third standards group. Note that some of the members of the first group start to move elsewhere. There are a finite number of people active in the standards process, and as a group loses momentum, some of the members will inevitably move to a livelier group.

The participants in the standards process in the case we looked at were truly searching for a venue in which they could offer a standard that was technically excellent. When they felt like the group they were in was foundering, they simply jumped to another group. From following the people, we gained insight into a movement pattern. But it leaves us wondering exactly why a group would leave. For that, we need to look at the ideas.

THE CULTURAL PERSPECTIVE: FOLLOWING THE IDEAS

In following the movements of the standards participants, we noted that the primary reason for moving to another group was disenchantment with how the work was going in the group. And this disenchantment can be described as a growing sense that the actual standard was becoming too complex.

Someone quitting a standards process because the standard is too complex doesn't appear to fit into a game-theoretic model, where players are usually described as seeking to dominate each other in order to fulfill the interests of their sponsoring corporation. Instead, the participants in this case are engaged in something that looks a lot like a process of aesthetic evaluation of the standard.

The participants in technical standards committees often consider themselves architects. They design systems. And as with the members of many design communities, they as designers have a certain aesthetic sense which has been built up over years of formal education, informal understudy, and personal experience. This aesthetic sense can in many ways stand in for more thorough technical testing – an architect in a corporate environment may claim to know that a certain messy design will result in a poorly performing system, without needing to build a prototype.

Aesthetic judgments can be part of a strong value system. For example, building architects are taught to understand when a design feels appropriate for its setting, and when it doesn't. Graphic designers of the modern school are taught to avoid that which

does not contribute to the meaning of a page. And programmers are likewise taught about clean vs. kludgy code.

There is a remarkable comment in the specification of the newest version of SOAP:

> *"The use of a SOAP body to carry the request for the state, with an element of the body representing the object in question, is seen as counter to the spirit of the Web because the resource is not identified by the Request-URI of the HTTP GET." (Mitra 2003)*

The standard is explicitly disapproving of a potential use of SOAP because it is counter to the spirit of the Web. It is not that the potential use will not work – it will work. But it purportedly violates the design aesthetic of those who have built the web protocols.

The phrase "the spirit of the Web" is interesting from two perspectives. First, the phrase is understandable to anyone who has studied the protocols – there does appear to be a certain style in the way TCP/IP, FTP, and HTTP are designed. This style is closer to an aesthetic than a rule, for there are myriad different ways to define a protocol and myriad different ways to build on top of them. Fielding (2000) has attempted to articulate what is built into the spirit of the web – but it takes his full Ph.D. dissertation to explain the differences between the web architecture and other alternate architectures.

Second, it suggests that the Web has a spirit – in the same way we speak of a city having a spirit – and that this spirit is to be defended. In contrast, it is hard to imagine someone defending the spirit of EDI in the same way.

The way most of the standards have grown is through an RFC process; it is officially described in the following way:

> "The goals of the Internet Standards Process are:
> - technical excellence;
> - prior implementation and testing;
> - clear, concise, and easily understood documentation;
> - openness and fairness; and
> - timeliness." (Bradner 1996)

What is interesting is the emphasis – on technical excellence, conciseness, openness. There is no mention of the ability to fulfill a user requirement.

This general issue of design aesthetics was discussed by Richard Gabriel in an article on LISP, in which he differentiates between strategies which seek completeness, and strategies in which "simplicity is the most important consideration in a design" (1989). Gabriel argues that those who choose simplicity of implementation usually win the market battle against more complete and complex systems. A similar argument is made by Guy Steele, who argues that "The Java programming language has done as well as it has up to now because it started small. It was not hard to learn and it was not hard to port. It has grown quite a bit since then. If the design of the Java programming language as it is now had been put forth three years ago it would have failed - of that I am sure" (1998).

Table 1: Length of Standards

Group	Standard	Year	Version	Pages
W3C	WSCL	2002	1.0	22
DAMLSC	DAML-S	2002	0.9	26
W3C	WSDL	2002	1.2	30
NIST	PSL	1998	0.98	32
OASIS	ASAP	2003	0.1	34
WfMC	Wf-XML	2002	1.1	57
W3C	XML	2000	1.0	59
IETF	HTTP	1996	1.0	60
IETF	FTP	1980	1.0	70
IETF	HTML	1995	2.0	70
WfMC	XPDL	2003	1.0	87
OMG	Wf-Facility	1997	1.0	95
BPMI	BPML	2002	1.0	103
IBM	WSFL	2001	1.0	108
W3C	SOAP	2003	1.2	128
OASIS	BPEL	2003	1.1	136
OASIS	BPSS	2001	1.01	136
RosettaNet	RN Implementation Framework	2002	2.00.01	143
ISO	SGML	1986	1.0	155
IETF	HTTP	1999	1.1	176
OASIS	BTP	2002	1.0	188
OMG	UML	2003	1.5	736

In table 1, we show the length of various standards documents. While brevity may not correspond to simplicity, there is a probably a correlation. We observe two things. First, standards tend to be getting longer – notice that HTTP grew from 60 to 176 pages between versions. Second, the standards body itself may be a determining factor – the vendor-driven and user-driven standards are longer than the research-driven ones. We will return to this observation in the section on economics.

Simplicity is not the only principle that gets discussed. Feeling can become heated in online discussion groups:

> *"SOAP-based services are called "Web Services" because their proponents wish to partake of the Web's success -- yet they don't build on its core technologies, URIs and HTTP...What we need to do is gather together a fellowship of like-minded Hobbits, Dwarves, Elves and men and go on a quest to educate the world about the limitations of SOAP-RPC interfaces." (Prescod 2003).*

The quest of Hobbits, Dwarves, Elves, and men in Tolkien is to defeat the forces of darkness. In the discussion boards, there are multiple examples of how the debate between two architectures, say REST and SOAP, becomes much larger. Here is a table of polarities that are often intertwined in discussions:

Table 2: Polarizations

One side	The other side	Notes
SOAP (Web Services)	REST	(Fielding 2000)
Functional	Object Oriented	(Swenson (in press))
Hard and Crunchy	Soft and Stringy	(Barr 2003)
Corporation	Developer	(Dumbill 2002)
[Forces of Darkness]	Hobbits, Elves, Dwarfs, Men	(Prescod 2003)
Complete	Simple	(Gabriel 1989)
Closed source	Open source	(Raymond 1999)
Hierarchy	Market	(Raymond 1999)
Strongly typed	Weakly typed	(Barr 2003)

It is as if participants in conversations either unconsciously confuse cues, or confuse them on purpose for rhetorical effect, much as politicians paint their rivals with the most extreme labels. For there are valid technical arguments for web services, and all of the advocates of web services are not corporate forces of darkness.

In figure one, we show that the participants in the development of web services are influenced by both the norms of the corporations they serve, and the beliefs of the technical community they consider themselves part of. For insight into this, we look at open source developers. Our use of open source analysis makes a certain amount of sense – Fielding not only coined the term REST but was also responsible for the development of several open source projects, including Apache.

Open source developers often develop source while working on the job, sometimes without the employer knowing. Perhaps most telling, 41% of the time, they define their identity in terms of their membership in a hacker community (Lakhani and Wolf 2003). It may be the case that standard participants are similar – that their allegiance to a community of like-minded architects is greater than their allegiance to their sponsoring institution.

THE ECONOMIC PERSPECTIVE: FOLLOWING THE MONEY

While we have been looking at standards in terms of people and ideas, it is clear we can learn a lot about standards by evaluating the potential benefits to the players involved in making the decisions. A host of economic theories have been applied, and the results are interesting. In light of our conversation about culture, it is especially interesting to look at developer's attitudes about economic analysis.

> *"SOAP is something completely different; lots of additional complexity, but very few additional benefits. Some people love complexity (especially if they see a chance to make a living out of it...). But I don't." (Lundh 2003)*

The imputation is that vendors want to make money on standards, and by making the standard more complex, they increase the chance of selling products. Another example:

> *"This is why the decision to pursue or reject the SOAP route is so critical, and why developers should be very careful. The choice is between open and established technology on which the Web is built, and the direction proposed by*

> *large corporations, whose existence depends on making money from their strategies." (Dumbill 2002)*

In a similar vein, the open source community literature contains similar comments:

> *"The utility function' Linux hackers are maximizing is not classically economic, but is the intangible of their own ego satisfaction and reputation among other hackers." (Raymond 1999).*

The last comment is interesting, because it hints that we actually can evaluate a programmer's utility, as long as we look at a different criterion than money. The development stage can be described as a stage of collective invention (Meyer 2003), and as part of this invention, new ideas are continually evaluated.

In academic literature, architectures are commonly evaluated with some variation of multi-objective decision making. These techniques involve eliciting values and preferences (Keeney and Raiffa 1993). Illustrative of this kind of approach applied to systems is a technique called the Cost Benefit Analysis Method (Kazman, Asundi and Klein 2001). The benefit of an architectural alternative becomes

$$Benefit(AS_i) = \sum_j (Cont_{ij} \times QA_j)$$

where *AS* represents architectural strategy, *Cont* represents contribution, and *QA* represents a quality attribute score. The quality attributes are often criteria such as reliability and scalability.

Standards groups do not explicitly use such models, but the dialogues captured in their discussions often concern the weighting of different attributes. So in a fight between REST and SOAP advocates, one might predict that the different groups will have different weights in mind for a similar set of attributes. It is easy to see how this can lead to an impasse. As we have pointed out, in many political situations, impasses are followed by compromise. But in standards groups, labor is voluntary, and switching costs are low, so quitting one standards body and reforming in another is a viable option.

There are two points to be made here – in modeling the standards creation process, one possible result of an impasse may be migration to a different standards committee. The second point is methodological – the social perspective, in this case study, helped inform the economic perspective.

In considering the game further, if one wished to model standards generation, one would need to model the nature of the different standards committees. In our case, one of the jumps was explained in the following way:

> *"OASIS has a very liberal policy about starting a TC [Technical Committee] ... anyone can start one. W3C on the other hand has a lengthy review process before you are allowed to start one. Simply put: it was easier to start an OASIS group." (Swenson 2003b)*

The bylaws of the groups may determine the allowable jumps, so that the movement between groups may be less random than it appears.

Adoption in general, and more specifically the adoption of standards, has been studied extensively from an economic perspective (Katz 1994, Farrell 1985). And the actual strategies of high-tech companies have been studied (West 2003). In our case, two theories provide a possible explanation for the current state of web choreography standards. The first is research on network externality – a simulation shows that latecomers to a market area will have to buy their way in (Buxmann 2001). But until we near a tipping point we won't see bandwagoning effects (Oliva 1994). Work on EDI diffusion provides empirical evidence that the herd instinct is a factor in adoption (Damsgaard and Lyytinen 1998). These ideas together suggest that vendors will want to serve on multiple standards committees so they don't come late if one takes off. But they also suggest that users may have little motivation to adopt any of these standards if the herd hasn't started moving. Options theory as it relates to IT investment can be invoked to suggest that, in conditions of high uncertainty, waiting may be the best strategy (Sullivan, Chalasani, Jha and Sazawal 1999).

What we do see in the case of web services choreography is an absence of user adoption – and participation by vendors on multiple committees, as shown in table 3.

In looking at different standards and their participants, one can categorize standards as being driven by three different groups. The first two groups are self-evident. Some standards are clearly driven by vendors. And some standards are clearly driven by users – for example, RosettaNet is driven by a set of companies in the manufacturing industry. But there is a third set of specifications such as TCP/IP and HTTP where representatives of corporations are involved, but the standard does not appear to be driven by corporations. We refer to these standards as research-driven. Often, those engaged in their creation are financed by government research funding organizations such as DARPA, NSF, and CERN. The representatives of corporations involved in these standards are often individuals who maintain a strong link with the research community. And these standards are sometimes created in standards groups that are strongly identified with the research community, such as the IETF and W3C.

In understanding the economics of standards development, it may be important to look at the funding sources – and also the sympathies – of those on the committees.

Table 3: Relationship between Standards and Contributors
(● = submitter or contributor)

	ASAP OASIS	BPML BPMI	BPEL OASIS	BPSS ebXML	RosettaNet RosettaNet	SOAP W3C	SWAP IETF	Wf-XML WfMC	WSCI W3C	WSCL W3C	WSDL W3C
BEA									●		
CSC		●						●			
Chevron				●							
Cisco					●						
CommerceOne				●							
DHL					●						
E2Open				●	●						
FedEx					●						
Fujitsu	●				●			●			
HP					●					●	
IBM			●		●	●		●			●
Intalio		●							●		
Intel					●						
iWay	●										
Izar, Inc.	●										
Lucent				●							
Microsoft			●		●	●					●
Netscape							●				
Netfish				●	●						
Oracle					●		●				
SAP		●	●		●			●	●		
SeeBeyond		●									
Siebel			●								
Staffware								●			
SUN		●		●	●				●		
Telcordia				●							
UPS					●						
Versata		●									

The quotes that began this section bemoaned the vendor push into this area of standardization. And there are other case studies that show that vendors sometimes win. In the browser wars, Microsoft pushed for the adoption of its particular browser product (Shapiro and Varian 1999). To draw a parallel, most software vendors are pushing for SOAP-based coordination standards. In contrast, the dispute between different standards for railroad track widths was resolved through the wishes of an important customer, the federal government. So in some cases customers can overcome the wishes of vendors (Shapiro and Varian 1999). For REST advocates, or the advocates of any standard facing off against powerful vendors, the case would suggest they should lobby a large customer – such as the government – to adopt their standard first.

In a case related to workflow standards, we observe an example of a fight between research-oriented and vendor oriented standards. In 1996 the Object Management

Group decided to adopt existing WfMC standards, and initiated an RFC process. But a research-oriented member of the group objected (Schulze, Böhm and Meyer-Wegener 1996), forcing OMG into a longer request for proposal process (OMG 1997). The process resulted in a competition between a proposal backed by 19 vendors, and a proposal backed by Nortel and the University of Newcastle. The vendor proposal won – against the recommendation of the research-oriented group member (OMG 2000). Interestingly, in the OMG, vendors who propose a standard are required to implement it within a year after the adoption of their proposal (OMG 1998). But in this case they did not implement their own standard. One participant in the process remarked that the vendors actually did not want interoperability, and the three-year effort was doomed from the start, since the vendors controlled the entire standardization process.

It has been noted that vendors will often use the standardization process toward their own ends (West 2003) – and, in game-theoretic terms, that is what they should do. Accusations against vendors for conspiring to sabotage standards may be correct – or they may be an example of paranoia. What is clear is that there is often a tension between the proposals of research-oriented participants and those who more conscientiously represent the interest of their sponsoring firms. From a global perspective, the research-oriented standards often do well – TCP/IP and HTTP being strong examples. With increased participation from vendors on standards committees, we wonder if the tide might someday turn against the research-backed standards. It may also be the case that the user, vendor, and research community balance each other throughout the standards process in a way that is not immediately obvious.

CONCLUSIONS AND FUTURE WORK

The standards process is complex, and multiple perspectives, applying both social and economic techniques are more likely to yield insights than single techniques. This general conclusion has also been reached by others (Fomin and Keil 2000).

More specifically, we have pointed out that there is ample evidence in the texts associated with Internet standards developments that the decision making of the participants in standards development is very much influenced by the technical culture the participants identify with, perhaps more so than the culture of the corporations sponsoring the participants. The technical culture may manifest in the aesthetic evaluations of design made during the course of standard development. These evaluations are often used as heuristics for examining the technical effectiveness of the standards. Clashes over these evaluations may provoke participants to jump to a new standards body, rather than compromise.

Our observations have been qualitative, and on a small sample size. In anticipation of future research, we have provided a model. It might be used to evaluate the effects of different variables on the development and adoption of standards. Such an effort would face obstacles – the number of standards processes that have been analyzed in depth is low, and the standards processes and the participants change over time. Some studies may be easier than others. In order to gain more insight into the aesthetic heuristics of standards developers, the relative complexity of adopted versus abandoned standards might be examined. The standards process definitely affects the standard, and the standard itself, along with the public commentary from the surrounding technical community, may give us further insights into the process.

An implication of our observations about the movement of participants for standards bodies is that their bylaws may either encourage or frustrate such jumping. Future research might analyze how the field of standards bodies functions. It could be the bodies are functioning as competitors. Or it could be that different bodies are fulfilling functional niches. Either way, the research might suggest ways of preserving or improving the overall functional landscape of standards bodies.

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GLOSSARY

ASAP	Asynchronous Service Access Protocol
BPMI	Business Process Management Initiative
BPML	Business Process Modeling Language
BPEL(4WS)	Business Process Execution Language (for Web Services)
BPSS	Business Process Schema Specification
BTP	Business Transaction Protocol
CDL	Conversation Definition Language
DAML	DARPA Agent Markup Language
DARPA	Defense Advanced Research Projects Agency
EbXML	Electronic Business XML
EDI	Electronic Data Interchange
FDL	Flowmark Definition Language
FTP	File Transfer Protocol
HTTP	Hypertext Transport Protocol
IETF	Internet Engineering Task Force
NSF	National Science Foundation
OASIS	Organization for the Advancement of Structured Information Standards
OMG	Object Management Group
REST	Representational State Transfer
RFC	Request for Comment
RFP	Request for Proposal
RosettaNet	Named after the Rosetta Stone, which led to the understanding of hieroglyphics
SGML	Structured Generalized Markup Language
SOAP	Simple Object Access Protocol
SWAP	Simple Workflow Access Protocol
TC	Technical Committee
TCP/IP	Transmission Control Protocol/Internet Protocol
WfMC	Workflow Management Coalition
Wf-XML	Workflow XML
W3C	World Wide Web Consortium
WSCI	Web Services Choreography Interface
WSCL	Web Services Conversation Language
WSDL	Web Services Description Language
XML	eXtensible Markup Language

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