Standardization as a Business Ecosystem Enabler

Paul L Bannerman and Liming Zhu

Managing Complexity, NICTA, Australian Technology Park, Sydney, NSW, Australia
School of Computer Science and Engineering, University of New South Wales, Australia
{Paul.Bannerman; Liming.Zhu}@nicta.com.au

Abstract. This paper reports research-in-progress that considers standardization as an enabler in business ecosystems. Based on issues encountered, we propose that: standards can sequester competition from cooperation; business model design is critical for performance; effective standards are non-prescriptive; and requirements specification and compliance checking are essential. We illustrate these propositions using a standards body with which we have been working.

Keywords: standardization, business model, SOA, business process

1 Introduction

As service-oriented computing permits individual businesses to expose their business function more widely, a business ecosystem forms around the exposed services. To foster efficient collaboration between the stakeholders (many being competitors), a standardization body or industry consortium is often formed to improve interoperability within the ecosystem through standards. This is particularly the case in vertical industries. Examples include HL7 in health, ACORD in insurance and MISMO in the US mortgage industry. This type of standard can be difficult to develop and implement as an existing industry structure is often entrenched and a new e-business standard may challenge that structure. Change may impact existing business models requiring its equilibrium to be rebalanced. It is important, therefore, to consider how such standards can be enablers of the business ecosystem.

NICTA (nicta.com.au) has been working with a leading Australian e-business industry standardization body, LIXI (Lending Industry XML Initiative; lixi.org.au), which serves the lending industry in Australia. LIXI initially developed a XML-based data-centric standard, later complemented by a process model described in BPMN (Business Process Modeling Notation) developed by NICTA. To further bridge the gap between business standards and technical implementation, and promote technical interoperability, NICTA also helped devise a Reference Architecture and associated Reference Implementations to supplement LIXI's e-business standards [9, 10]. During this process, we encountered a number of business and technical issues:

1) *Process openness and funding model*. Striking the right balance in the standards organization's own business model involves trade-offs between being open to as many industry players as possible (large and small) and sourcing adequate funding to finance the operations of standards organization.

2) *Intellectual Property Rights (IPR) and commercial liability*. Policies relating to in-bound and out-bound IPR can significantly impact members' participation in standardization processes, their ability and willingness to adopt developed standards and the commercial risk they may face if they implement the standards.

3) *Consistency and variety balance*. There are tradeoffs between prescriptive guidance and flexibility, immediate technical needs and long term evolution. This balance has a major impact on the diversity and efficiency of the business models in the business ecosystem.

4) *Interpretation of standards*. Multiple interpretations of a standard can result in reduced interoperability between systems. The risk is that an application will have to be changed significantly whenever it needs to interact with a new system, even though both parties could reasonably claim to be in compliance with the e-business standards. Such hindrance to genuine mass interoperability can reduce the efficiency of the whole business ecosystem.

In this paper, we analyze these issues and outline propositions that relate to the business of a standards body (addressing issue 1 and 2) and the nature of the standard itself (addressing issue 3 and 4). On the business side, we consider openness, funding and IPR. On the standards side, we advocate non-prescriptive requirements specification and strong compliance checking. The propositions help use standards to better enable interoperability within a business ecosystem of diverse business interests and models. We develop the propositions in Section 2 and illustrate them against the LIXI case in Section 3 before making concluding comments.

2 Issue Analysis

Existing research is very limited in addressing these issues. For issues 1 and 2, while some work has been done in open communities and IPR (e.g., [3]), theory remains under-developed. Standards organizations adopt different strategies, but the principles underlying decision option and criteria are unclear. Yet it is clear that these decisions can impact the efficiency and performance of stakeholders and the ecosystem at large. For issue 3, our early work has shown that a rule-based rather than structure-based architecture approach may alleviate the problem of balancing flexibility for future evolution against prescriptive guidance to meet short-term technical needs [11]. However, the connection to business models is not fully considered. For issue 4, due to the nature of standards, the solutions to standard compliance checking vary widely. At one extreme, an Application Programming Interface (API) standard may have an automated and comprehensive compliance testing tool kit. At the other, a process standard may rely on subjective assessment through checklists, interviews and documentation. One challenging issue comes from data format standards. Superficially, "schema validation" seems to be the answer. However, schemas cannot usually capture all the rules and constraints between data elements that must be satisfied. Also, a flexible data format exacerbates the problem by rendering schema validation a weak form of compliance checking.

2.1 The business of a standards organization

Standards organizations typically operate within a business ecosystem. A business ecosystem is an interacting population of business entities in a bounded environment.

Each has its own agenda but must interact with others to survive and prosper. In the ecosystem, companies co-evolve capabilities that enable them to work cooperatively and competitively in pursuit of their objectives [7]. Standards can be an important capability in this ecology. A standard can demark boundaries between cooperation and competition, enabling industry stakeholders to coexist and thrive.

Resource-based theory [2] tells us that organisations comprise a variety of resources including: ordinary capabilities that are necessary for daily operations (and which may be common to other firms); and unique capabilities that can generate distinctive value for the firm. These latter capabilities enable innovation [1] and competitive advantage [2]. For firms that need to interoperate within an ecosystem, *a standard can be a common operational capability that permits firms to interact, as necessary, through their business processes, in a non-threatening manner*. This sequesters interoperation from the exploitation of strategic capabilities and the competitive side of the industry.

A business model is an organization's fundamental design for creating value. It comprises a business's value proposition, target market(s), how it will generate revenue, its cost structure, and activity value chain [4]. An e-business model, for example, is optimised around transacting business through electronic media such as the web. In conjunction with capabilities, these variables permit great diversity in business models. There is no single 'right' model for an industry. Indeed, competition drives differentiation in the business models of industry participants. However, *for optimum performance, the business model design must be logically consistent*. The parts must fit together harmoniously, otherwise inefficient integrating mechanisms will evolve to overcome the misfit [6].

The challenge for a standards organization in formulating its appropriate business model within a business ecosystem can be greater than that of the business operatives. By definition, a standards organization serves a diverse range of industry stakeholder interests. Striking the right balance between those interests – that is, establishing its dominant operating logic – may be a process of co-evolution with its members. Key decisions include: Should it engage in commercial for-profit activities or restrict itself to providing not-for-profit services to members? How will it fund its operations; at the front-end from membership fees or at the back-end from standards licensing and publication fees? How open should it be in inviting input to standards development and access to completed standards [5]? Should it tightly control IPR to published standards or push it out to the industry, and how should it approach IP from others [8]? Finding the right balance in answering these questions will fundamentally shape the business model and internal consistency of the standards organization.

2.2 Nature of a non-prescriptive but compliance-checkable standard

Our experiences working with the Australian lending industry show that the cost of pair-wise integration can be prohibitively high even when both sides claim to be data standard "compliant". From a service-oriented computing perspective, problems in integrating multiple parties are not new. Some degree of control, centralized coordination and using SOA/WS-* standards can alleviate many of them. However, these problems are significantly different in the context of a whole industry, which is

essentially an ultra-large-scale business ecosystem. Too much prescription (especially beyond data format) in industry-wide standards may dictate particular business model designs or behavior and constrain innovation. The challenge is to determine what to standardize, beyond data and leveraging service-oriented computing, so that a right balance between too much and not enough prescription can be reached. We advocate two elements when connecting service-related standards with business data standards:

1) *Use rule-centric architectures*. In Service Oriented Architecture (SOA), the notion of architecture traditionally implies an arrangement of structural components and connectors. An industry-level SOA cannot prescribe too much structure as it may prevent new business relationships/models between parties and adoption of new technologies. We advocate a rule-based approach. An architectural rule is defined as principles that need to be followed by structures within a system. An architectural rule may serve several potential structural architectures. This approach is consistent with other IT-related industry practices such as open API and mashup (e.g., Google's OpenSocial). We illustrate this rule-based approach in Section 3.

2) *Support standard requirements specification and compliance checking*. Often, there are two difficulties in standard compliance checking. First, standards bodies do not provide a consistent way of checking standard compliance. As argued earlier, mechanisms like schema validation are inadequate. Second, compliance checking may fail because a standard does not sufficiently capture the requirements. The implementer faces a trade-off between losing must-have features and not complying with a standard. These difficulties are usually caused by a weak standard requirements elicitation phase without a compliance checking tool kit. Thus, we propose that:

1. Standard requirements should also be subject to an open process with voting as a form of quality control. Currently, most standardization bodies only consider the standard itself to be subject to the standardization process.
2. All standard specifications should be "testable" for compliance checking. Non-testable specifications will cause downstream interoperability problems.
3. A compliance testing toolkit must be released with the final draft of the standard before voting and after standard publication to facilitate interpretation of the standard.
4. A reference implementation that has passed the compliance testing toolkit should also be released.

Items 3 and 4 have been adopted in a small number of standards bodies such as Java Community Process (JCP). However, the JCP standards are all Java APIs which are easily testable. The challenge is to find a suitable way of testing other types of standards. For items 1 and 2, many standards bodies do vote on a new standard proposal. However, the proposal usually only covers high level purposes rather than detailed standard requirements, let alone testable requirements in conjunction with a compliance testing toolkit.

3 Case Illustrations

Application of these propositions is illustrated from the LIXI case.

3.1 The business of a Standards Organization

In an effort to encourage broader industry participation, especially from small and medium enterprises, LIXI recently changed its business model. Previously, standards were free to members and funding was sourced from memberships. In the change, membership fees were reduced to a nominal annual figure and a schedule of licensing fees was introduced for different bundles of standards. This increased the openness of the standard development process in terms of broader participation.

However, two challenges emerged: management of IPR and commercial liability (how can LIXI avoid legal liability if a standard beaches another organization's IPR, and how can it avoid being sued by members if their business suffers as a result of using a LIXI standard?). Elements of these challenges are purely legal, for which exemplars exist in other successful standards organizations. Others affect the business models within the ecosystem and the interplay between openness and IPR control, and cooperation and competition. Based on the above theory, these challenges need to be considered in the context of LIXI's purpose and business model. An open flexible IPR model could be adopted to allow individual IP negotiations. And a clear inbound IPR policy with due processes could greatly reduce commercial liability risk.

3.2 Nature of a non-prescriptive but compliance-checkable standard

The following are example rules from a list of 40 applied in the LIXI context [10]:

Use Minimal Service Interface. A LIXI-compliant system should use message-centric (rather than operation-centric) interfaces. That is, service interfaces should not expose abstractions in the form of remote procedures. Essentially, we advocate the use of a single operation on a service (ProcessLIXIMessage), but allow more complicated interfaces to exist. Messaging behaviors are specified by LIXI content structure and LIXI message exchange protocols. This rule encourages maximum flexibility in the face of constant evolution. Ever-changing shared contexts are carried within LIXI messages. Message processing logic can either be hidden behind the service or exposed as protocol-related metadata.

Avoid Explicit Intermediaries. We do not introduce the role of an intermediary explicitly in the reference architecture. However, we allow such intermediaries to organically appear in the overall ecosystem. This is very different from existing e-business meta-standards such as ebXML, which have an explicit concept of central registry and repositories through which companies post business processes, capability profiles and collaboration protocol agreements. Technically, this is appealing and simplifies some business scenarios. However, we found it very difficult to introduce such a structure within LIXI because of complex business issues such as who the intermediaries should be, legal issues such as confidentiality concerns, and practical issues such as the difficulty of semi-automated agreement negotiation. Thus, in our reference architecture, interacting directly with another business or indirectly through an intermediary is treated as the same general mechanism. Local intermediaries within certain areas can be introduced. Dynamic binding and proxy solutions can help achieve various relationships in practice.

Regarding testing compliance, we provided a number of reference implementations with data checking beyond the basic schema validation [9, 10]. The use of RELAX-NG and Schematron are proposed for better compliance checking.

Finally, we are currently developing a more systematic compliance testing toolkit strategy and standard requirements elicitation/voting process.

4 Conclusions

This paper has considered the role of standards and standardization bodies as enablers in business ecosystems and developed theoretical business and technical propositions with practical application. In addition to the basic function of enabling interoperation between industry stakeholders, we have proposed that: standards are useful in demarking a boundary between cooperation and competition; the effectiveness and performance of all industry stakeholders is a function of the internal consistency of their business model; effective standards are non-prescriptive, and; standardization processes must include requirements specifications and compliance checking.

NICTA continues to work with LIXI to research and apply these principles.

Acknowledgments. NICTA is funded by the Australian Government as represented by the Department of Broadband, Communications and Digital Economy and the Australian Research Council through the ICT Centre of Excellence program.

References

1. Bannerman, P.: Smoothing Innovation Discontinuities, Proceedings of the IEEE International Conference on Communications (ICC '08), Beijing, 5458-5462, (2008)
2. Barney, J., Clark, D.: Resource-based Theory: Creating and Sustaining Competitive Advantage, Oxford University Press, (2007)
3. Blind, K., Thumm, N.: Intellectual Property Protection and Standardization, International Journal of IT Standards & Standardization Research, 2(2), 61-75, (2004)
4. Chesbrough, H., Rosenbloom, R.S.: The Role of the Business Model in Capturing Value from Innovation, Industrial and Corporate Change, 11(3), 529-555, (2002)
5. Krechmer, K.: Open Standards Requirements, International Journal of IT Standards and Standardization Research, 4(1), 43-81, (2006)
6. Miles, R., Snow, C.: Organizational Strategy, Structure, and Process, Stanford Business Classic, (2003)
7. Moore, J.: Predators and Prey: A New Ecology of Competition, Harvard Business Review, 71(3), 75-86, (1993)
8. Pisano, G.P., Teece, D.J.: How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture, California Management Review, 50(1), 278-296, (2007)
9. Zhu, L., Thomas, B.: LIXI Visible Loans: Reference Architecture and Implementation Guide, Lending Industry XML Initiative (LIXI), (2007)
10. Zhu, L., Thomas, B.: LIXI Valuation Reference Architecture and Implementation Guide 1.0, Lending Industry XML Initiative (LIXI), (2007)
11. Zhu, L., Staples, M., Tosic, V.: On Creating Industry-Wide Reference Architectures, in The 12th IEEE International EDOC Conference (EDOC'08), Munich, Germany, (2008)