GOAL-ORIENTED DESIGN OF BUSINESS MODELS AND SOFTWARE ARCHITECTURES

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Abstract

E-business initiatives succeed when the business model and the deployed software architecture contribute directly to the firm's business goals. The design of e-business initiatives should elicit and evaluate alternative business models and software architectures in order to find the combination which best achieves the business goals. The elicitation and evaluation of alternatives requires effective communication between stakeholders with different skill sets.

In this paper, we introduce an end-to-end process which facilitates stakeholder communication throughout the development process. We leverage goal-modeling and scenario evaluation notations to compare alternative business models and software architectures and to select the alternatives which best satisfy the firm's business goals. We illustrate the process with a case study.

The process assists cross-functional stakeholders in documenting decisions made throughout the initial design and subsequent evolution of an e-business initiative.

Keywords*: goal modeling, scenario evaluation, business models, software architecture, patterns.*

1. Introduction

E-business initiatives are composed of an e-business model and an information technology (IT) implementation. E-business initiatives are initially conceived by business stakeholders in order to achieve specific business goals, given the firm's business context. The strategic vision of the business stakeholders can become blurred as it is communicated to the implementation stakeholders. Similarly, unforeseen positive and negative contributions to the business goals can emerge as the implementation of the e-business model is developed. Any such top-down or bottom-up misalignment between business goals and the implementation can impede the achievement of business goals. Even after deployment, the firm must continuously adapt the business model and software architecture to the changing environment in order to ensure that the business goals are being achieved.

The User Requirements Notation (URN) has been shown to offer useful tools for modeling business models and business processes [7], [8]. In this paper, we introduce an end-to-end process which leverages URN to model the development of e-business initiatives. The process uses URN's Goal-oriented Requirements Language (GRL) notation [4], to model the firm's business goals on a GRL diagram. Alternative business models and software architectures are compared on the same diagram to see how different combinations achieve the business goals. Business process modeling (BPM), using URN's Use Case Map (UCM) notation [5], are used to determine the contributions of the alternative business models and software architectures.

This paper illustrates the process by modeling a hypothetical e-business initiative for Seven-Eleven Japan (SEJ) in Section 2. Section 3 concludes the paper.

2. Case Study: Seven-Eleven Japan

2.1. The Business Context

SEJ began the year 2000 with a Value Net Integrator (VNI) atomic e-business model (AEM) already deployed [6]. The VNI model captures data about the activities of the participants in a supply network, including customers, suppliers, combined delivery centers and franchise stores. The captured data is used to track shipments, manage store inventories, recall poor-selling products and develop new products to address emerging customer needs. SEJ presents the data to the participants in the value net in order to improve their operational efficiency. SEJ receives a percentage of franchise store sales.

There are three business goals that firms should achieve in order to succeed with an e-business initiative: ownership of the customer data, ownership of the customer relationship and ownership of the customer transaction [6]. The VNI allows SEJ to own the customer data by monitoring customer purchases. But SEJ's decision to outsource retail operations hands ownership of the customer relationship and transaction to the franchise stores. In order to achieve these goals, SEJ can expand its current VNI model with a new e-business initiative.

In this paper, we evaluate alternative implementations of the Direct to Consumer (DTC) model [6]. DTC allows customers to send purchase orders directly to the firm. The firm ships orders directly to the customer. A purchase scenario using a web store architecture is described in Fig. 1 and evaluated in Fig. 2. A purchase scenario using an in-store terminal architecture is described in Fig. 3 and evaluated in Fig. 4.

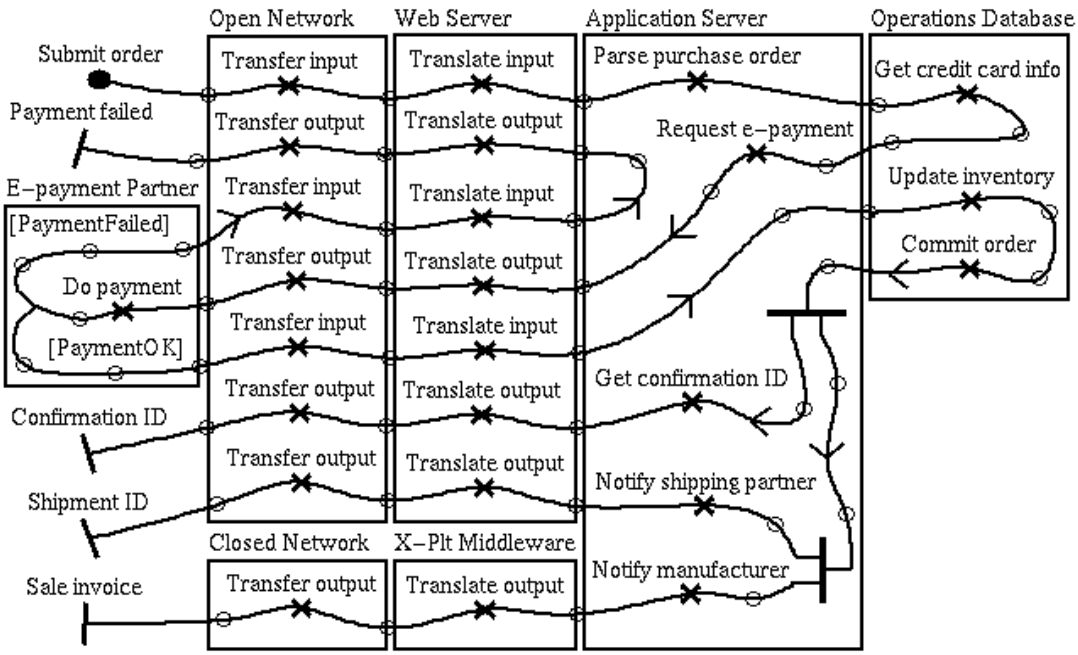

Fig. 1. Web store purchase scenario.

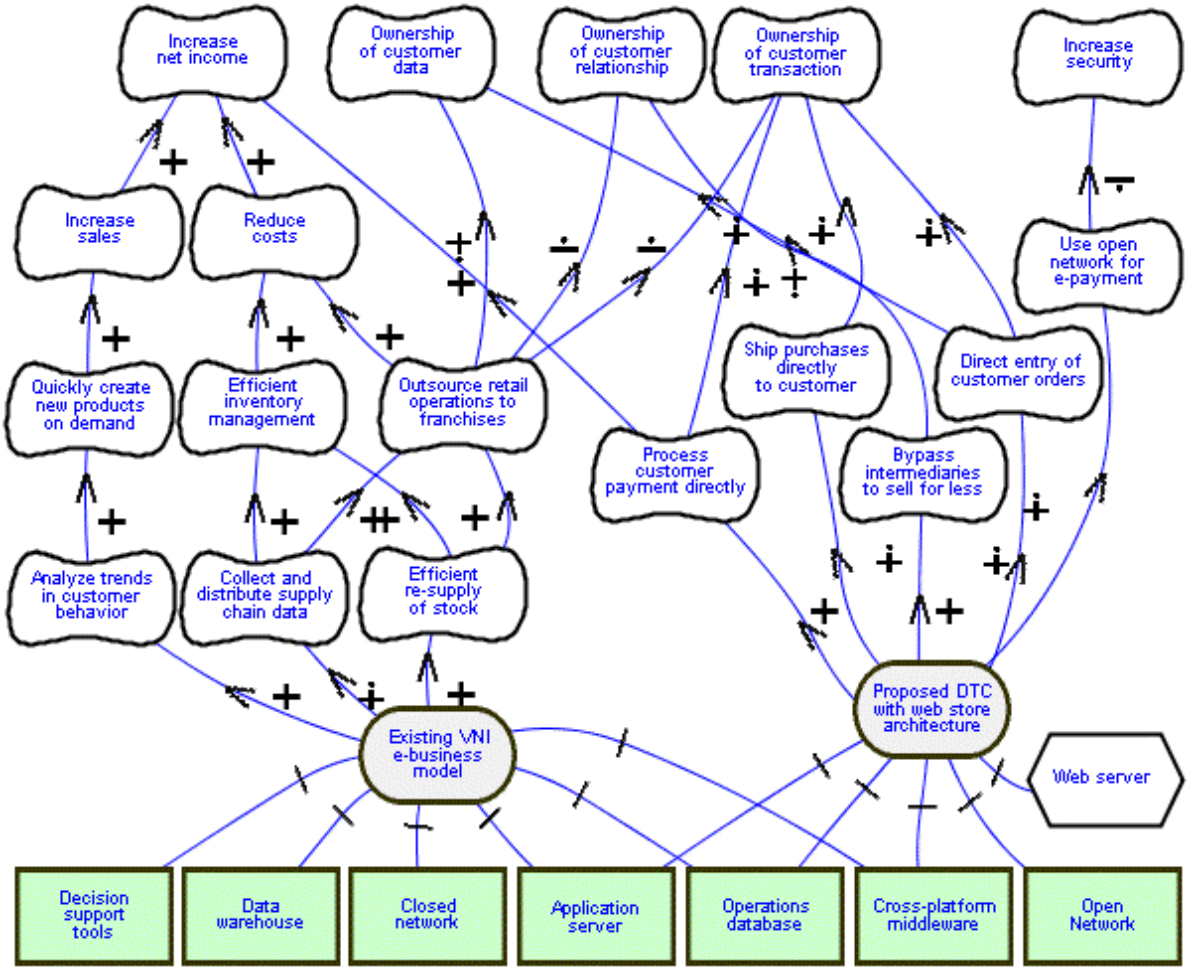

Fig. 2. Goal model for web store architecture.

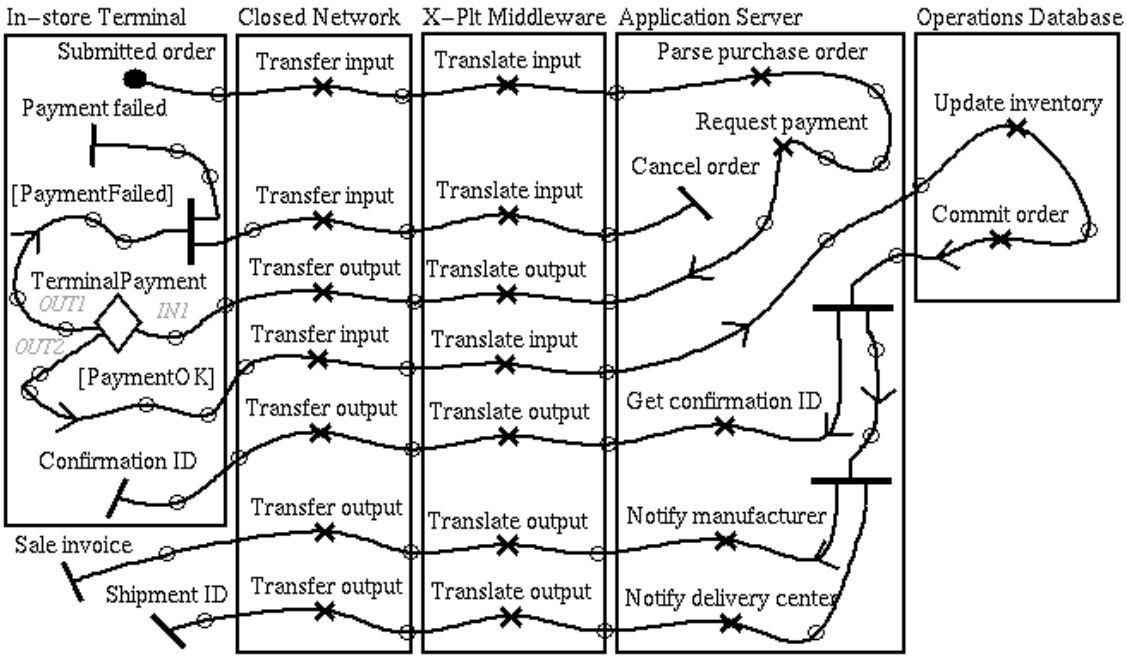

Fig. 3. In-store terminal purchase scenario.

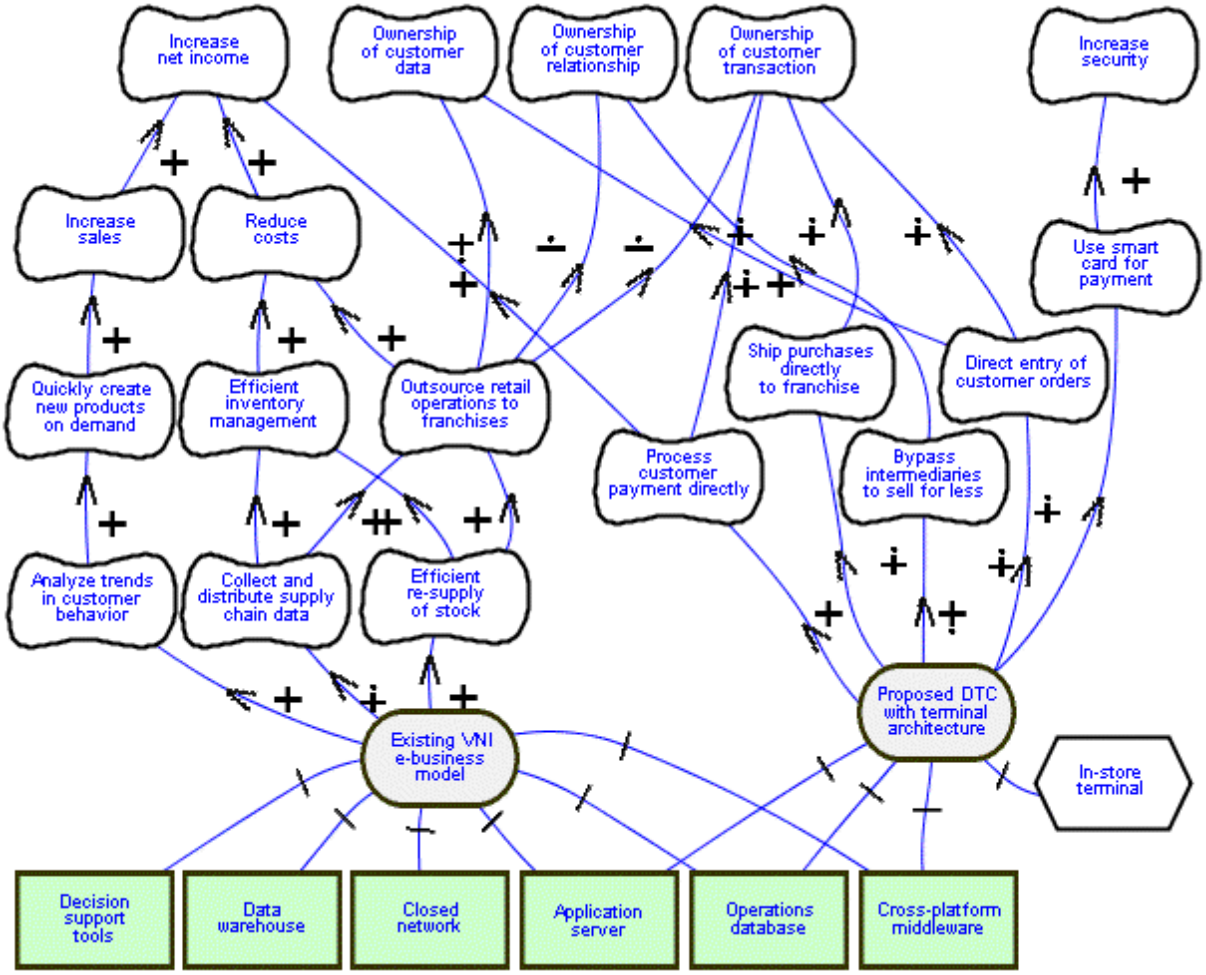

Fig. 4. Goal model for in-store terminal architecture.

2.2. The Web Store Architecture

The UCM in Figure 1 shows the components required to model a web store purchase. This implementation targets Internet-enabled customers. Payment is made by credit card over an open network (the Internet), with the help of an external e-payment partner. An external shipping partner delivers the items directly to the customer.

The GRL diagram in Figure 2 compares the existing VNI model to the web store implementation of DTC. The existing VNI, on the left, shows the business goals as GRL softgoals in the top row of the diagram. Other intermediate goals are modeled as GRL softgoals below the business goals. Contributions to the goal hierarchy extend from business models, which are shown as GRL goals. Previously deployed IT components are shown as GRL resources. New IT components required by a model are shown as GRL tasks. The costs and risks imposed by the development and integration of new components could also be shown on the GRL diagram.

The trade-off to the business goals imposed by the decision to outsource retail operations is modeled in the diagram. The open network used by the web store DTC negatively impacts a new business goal: security. The decision to use an external shipping partner imposes additional shipping fees on the consumers. This shipping fee weakens the contribution to the customer relationship because customers may look elsewhere to find better prices. The web store DTC contributes to the goals of owning the customer relationship and customer transaction.

2.3. The In-store Terminal Architecture

The UCM in Figure 3 models a purchase from a terminal located inside a franchise store. This implementation targets existing retail store customers. Orders are entered using an existing secure, closed network. Payment is made at the in-store terminal by using a smart card. Customer deliveries are piggy-backed onto store re-supply shipments delivered by the existing combined delivery center. SEJ must sell a different product line through the terminals than the product line sold by the franchise stores. A channel conflict would be imposed if SEJ sold the same goods as the franchise stores through a different channel and for a lower price.

The GRL diagram in Figure 4 compares the existing VNI model to the in-store terminal implementation of DTC. Smart card payment is more secure than credit card payment made over an open network. This payment scheme allows SEJ to achieve ownership of the customer transaction. The contribution to the goal of owning the customer relationship is stronger in this architecture, due to the elimination of the separate shipping fees. The customers can be offered lower prices if they do not have to pay separate shipping fees. The intermediate goal of bypassing intermediaries is only partly satisfied, because the customer must still order items from a franchise store. A terminal must be installed into each franchise store.

3. Conclusion

The case study showed how a firm can use URN to design an e-business initiative that addresses specific business goals. We compared two alternative software architectures which both implemented the DTC model. The comparison was done on two separate diagrams, due to limited space. The different alternative business models and software architectures could also be compared on the same diagram. The components on the UCM diagrams are linked to the GRL diagrams as resources and tasks. The contributions to the business goals made by alternative implementations were surfaced using the UCM scenario evaluations and documented in the GRL diagrams.

The first key insight in this paper is that the achievement of the business goals can be affected by the software architecture used to implement an e-business model. The selection and arrangement of components within the software architecture contribute to the satisfaction of non-functional requirements (NFR) [2]. Software patterns can be applied to generate additional software architecture candidates for fine-tuning the satisfaction of NFR goals [3]. The achievement of these NFRs can impact the firm's business goals.

The second key insight is that misalignment between stakeholders of diverse backgrounds can be minimized by documenting traceability and rationale on simple, accessible diagrams which links business and implementation concerns.

We would like to expand this work to include additional AEMs in the comparison. We would also like to improve the case study by applying patterns to the UCM architectures as documented in [1]. Specific implementation technologies for the architecture components could also be evaluated using UCMs and compared on the shared GRL diagram.

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