A Generic, Multi-Period and Multi-Partner Cost Optimizing Model for Cloud-Based Supply Chain

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ABSTRACT

Cloud technology in a multi-enterprise, collaborative context is one of the most promising topics at IT-Supply Chain (SC) intersection. Cloud comes with well-proven advantages and cost savings; enabling collaboration and business intelligence. Cloud transition is still on-going with individual enterprise-level transitions. However, collaborative paradigm dictates that entire network well-being is to be considered over enterprise-level concerns. Thus, handling the transition of a single enterprise is not sufficient for strategic network leverage. Planning and managing across multiple enterprises is required, taking into consideration various cost items and budget constraints. In this study, a multi-period multi-partner cost-optimizing model is developed for network-level management of cloud transition for a SC. The model produces an optimal transition plan, indicating timing of the transition for each partner to obtain the maximum cost savings across network over a specified planning horizon. The model proposed is generic, flexible and customizable for different sectors/settings.

KEYWORDS
Cloud Computing, Costing, Generic Model, Optimization, Supply Chain

1. INTRODUCTION

Cloud technology in Supply Chain (SC) context is one of the most recent and interesting research topics. Based on recent Gartner Research findings, Supply Chain Management (SCM) applications are reported to play a sizable role in the overall growth of cloud computing, and the interest in cloud-based supply chain solutions is actually growing dramatically (McCrea, 2012). Analysts report that cloud-based adoption increased 40 percent in 2012 in the SC software sector. Adoption rates are reported to be the highest in the areas of collaborative sourcing and procurement, demand planning, global trade management (GTM), and transportation management systems (TMS). In many cases, cloud has become a preference for the enterprises.

There is little question about the advantages and attractiveness of the technology from an enterprise (chain partner) perspective (Akyuz & Rehan 2013). Companies like the idea of having their software served up via the web. There are no servers to maintain, no IT infrastructures to set up, no upfront licensing fees, and no software programs to install and maintain on premise (Buyya, Broberg & Goscinski, 2011; Sagawa, et al., 2009; Sterling & Stark 2009; Sosinsky, 2011). In fact, according to a recent cloud computing tracking survey, 84 percent of organizations are currently using at least one cloud application during the course of the business day (McCrea, 2012). Many of those applications are accessed via the ‘public cloud’, where the software is offered up on a subscription
basis to a wide range of users. ‘Private clouds’, on the other hand, comprise internal data centers for specific organizations and are not available to the general public.

Making cloud computing especially attractive is the fact that applications are sold on a ‘pay-as-you-go’ model in which users are billed like a utility based on subscription and they pay only for the services that they use, instead of investing in a fixed-capacity IT infrastructure (Sterling & Stark, 2009; Hodges, 2011; Sosinsky, 2011). Since they are paid for on an ongoing basis, the cloud-based solutions can be budgeted as predictable operating expenditures over time rather than bulk capital investments. This is one of the most critical issues that make the technology attractive from costing perspective.

There is no doubt that the technology comes with challenges, the most critical of which are: privacy, vendor lock-in, security, governance, loss of IT ownership/control, compliance, enterprise/user inertia, business continuity, data ownership, as well as the issues with vendor management and service-level agreements (opengroup.com; Sosinsky, 2011; Sterling & Stark 2009; Connor et al. 2014; Harvard Business Review, 2011). Especially within a multi-enterprise context, all these issues become more pressing, and they appear to be the most critical barriers from implementation perspective.

With these basic advantages and challenges in mind, transition of multiple partners to the cloud is in question. Leverage of the entire network is needed; and from a collaborative network perspective, time-phased planning and cost optimization across multiple partners are to be managed in relation to the cloud transition. Thus, the issue is beyond the cost savings and successful implementation experienced by a single partner. Network-level budgetary constraints and overall cost savings are also to be considered for the entire network. It is important to highlight that this has to be a true cost reduction, not cost transfer across partners.

To address this problem, this study develops a generic, multi-period and multi-partner cost optimization model to plan the cloud transition of chain partners. As to our knowledge, the extant literature does not contain a generic model dealing with multi-partners, transition to cloud and costing simultaneously. With these characteristics, this study is a contribution at the intersection of the SC, Cloud computing and costing topics.

The remainder of the paper is organized as follows: Section 2 puts forward costing perspective in relation to supply chain cloud utilization. Section 3 develops a generic, time-dynamic and 0-1 integer model to maximize the cost savings over a time horizon of T periods across n enterprises. Section 4 provides a comprehensive discussion related with the model, including its various flexibility characteristics, importance and value, as well as its limitations with possible suggestions for further research. Section 5 concludes.

Addressing the costing, cloud and supply chain perspectives, this manuscript is of value for researchers and practitioners from supply chain, cloud computing and costing areas.

Figure 1. Business reasons for turning into cloud, based on http://www.opengroup.org/cloud/cloud/cloud_for_business/why.htm

<table>
<thead>
<tr>
<th>Business Performance Resourcing (e.g. computer services)</th>
<th>Improved Employee and Partner Productivity through Collaboration</th>
<th>Remote/mobile access from everywhere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid ‘go-to’ market</td>
<td>Information Services and Assurance (QoS, Security)</td>
<td>Self-service and on-demand IT Service Delivery</td>
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<tr>
<td>Business Agility (adaptability and simplicity)</td>
<td>Reduce/optimize costs (Total Cost of Ownership)</td>
<td>Unlimited capacity</td>
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<td></td>
<td>Operational Excellence</td>
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<td>Reduced Complexities</td>
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