The Economic Value of Modularity in the IPQoS Network: The Real Options Approach (ROA)

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ABSTRACT

As uncertainty in the markets and technologies of the network industry increases, a flexible architecture is needed by network service providers to maintain a competitive advantage. Since complete replacement of existing networks is not practical, and since it is costly for one operator to manage everything in a network, modularity in network design may be an efficient approach. This article is to construct a theoretical framework to support the decisions of network service providers in network design, to modularize or not and, if so, by how much. We develop a model to show the extent of modularity in network design by combining two important concepts: modularity from management and complementarity from economics. This will show how the extent of modularity in networks affects the value of networks with complementary components under uncertainty. For empirical testing, a simple QoS service model network is designed and simulated.

Keywords: complementarity; IPQoS; modularity; real options

INTRODUCTION

Mass production (Milgrom & Roberts, 1990) has dominated modern society for several decades. But nowadays, mass customization (Pine, 1993) is emerging as a new way to provide goods and services. What exactly is mass customization? It is increasingly possible both to design products that have the ability to be configured to meet the preferences of individual customers and to produce those products at costs that do not differ significantly from the cost of mass producing a single product design. This trend of mass customization challenges network service providers in the telecommunication

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industry to increase their flexibility without losing their current economies of scale. Being flexible in this respect can be described as the ability to meet a wide variety of customer requirements in a short period of time. Therefore, a new service development recently has been recognized as an important factor for network-based service firms faced with highly competitive environments, as these normally have higher profit margins.

The surviving network service providers, whether ISPs, CLECs, ILECs, or even recent 3G wireless service providers, are facing an environment in which experimentation is needed to find viable business, cost, or service models. With the emerging trend of mass customization, customized and rapid service provisioning recently has been identified as an important source of competitive advantage in the network industry. Network service development is no longer about creating the service itself, but it is also about creating a platform. The notion of service architecture is no longer just a technical issue, but it is also a key concept in service development. Creating appropriate modular architectures to support new kinds of service strategies is now central to business strategies. Businesses need to create service and process architectures that are capable of providing the flexibility to customize services for individuals and that are upgradable when better components come along.

Traditionally, analyses of networks have been performed, assuming that they are characterized as centralized and monolithic systems. Many academic and field studies in network engineering and economics have focused on whole system replacement and often use a greenfield assumption for supporting their decision implicitly or explicitly, because they consider the existing facilities as a sunk cost. This ignores the reality of networks and the investment behavior of service providers. Although the notion of modularity has received much attention in modern network design as a strategy for managing the complexity of networks efficiently, its potential value still remains uncertain.

The main motivation for this article, then, is the development of a theoretical framework in order for network service providers to support their strategic design decisions: to modularize or not and, if so, by how much.

The remainder of this article is organized as follows: The second section explains how previous work relates to the issues of modularity considered here and provides the background knowledge of modularity and complementarity for this study. The third section presents the theoretical framework, including the research model, theory, and hypothesis. The fourth and fifth sections are the empirical tests and results analysis, respectively. The sixth section presents the future research work and expected contributions. Finally, concluding remarks are presented in the seventh section.

RELATED LITERATURE

Modularity

Modularity is not a new concept. It has been applied in many businesses