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Hyper-Networking of Customers, Providers, and Resources Drives New Service Business Designs: e-Commerce and Beyond

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What drives new service business designs? More precisely, what could be a generic strategy to grow value cocreation among persons? The emerging network science and service science may offer an answer: comprehensively ***connecting, or hyper-networking,*** the customers, providers, and resources via digital means. This connectionist perspective has led to the Digital Connections Scaling (DCS) theory, which suggests that new service business designs arise from thrusting the connections up to span the population, deepening down to facilitate individual persons' life cycle needs, and cutting across business designs and domains to transform them. This paper develops the DCS theory into a generic ***strategy*** for designing new service businesses and justifies the strategy with empirical evidence taken from the field of e-commerce and social networking. The study then applies the proposed strategy to analyze what new models and paradigms may come next. An information systems design framework for implementing the strategy is also proposed.

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1. The Hyper-Networking Postulate for Service Scaling: the Proposed Strategy

Using the Internet to assist business and enterprising has long been considered a hallmark of new service business designs (Glushko et.al. 1999, Normann 2001, Cambridge Papers 2008, Zhao, et.al. 2008, Hsu and Spohrer 2009, and Maglio, et.al. 2010). However, what is ***intellectually new*** about these new service business designs other than the new analytic tools and information technologies they used? More importantly, will the field continue to synthesize and transform its paradigms, and to where is the progress heading?

The hardcore of e-commerce, online retailing, is evidently going strong. A recent report by comScore, Inc. (comScore 2011) shows that U.S. online retailing spending has gone up 12 % in the first quarter of 2011 from a year ago to reach $38B, continuing a long streak of positive year-over-year growth trend (except during the 08-09 recess). The top-performing product categories were Video Games, Consoles & Accessories; Books & Magazines; Computers/Peripherals/PDAs; Consumer Electronics; and Computer Software (excl. PC Games). Across the categories, the top 25 online retailers accounted for 67.7 percent of dollars spent online, while the number of buyers went up 7 percent. The Cyber Monday of 2011, the Monday following Thanksgiving, is stronger than ever.

The e-commerce sphere continues to expand with ever more intriguing innovations. The so-called Arab Spring of 2011 offers new dramatic proofs of the transforming power of direct human connections using, especially, social networking. These movements also demonstrate the unlimited potential for human connections and hence the business promises of providing and facilitating such connections as new services. However, do we have a common explanation to the analytic nature of human connections in the cyberspace? The previous literature of e-commerce does not seem to provide such analyses, and hence has missed strategies that explore human connections.

The emerging network science, on the other hand, has renovated many traditional research paradigms in scientific subjects related to human connections (Watts and Strogatz 1998, Barabasi and Albert 1999, Watts 2003, and Newman 2005). What will happen if network science collides with service science? Can it shed new light on service value networks since cocreation is a human connection, too? One reason for the renaissance of network science is the fact that human networking by digital means leaves unprecedented evidence for the researchers to review, and thereby reconstruct the processes and dynamisms of interactions. Another reason which may even be more important is the possibility of design: cyberspace networking holds more promise to transcend races, classes, and other traditional restrictions to human connections, and hence is more amenable to design and growth.

Attempts have been made in this direction (see, e.g., Hsu 2009b, and Chan and Hsu 2009, 2010). Among the first results is the Digital Connections Scaling (DCS) theory (Hsu 2009a and Hsu and Spohrer 2009). It proposes that the connections of customers, providers, and resources by digital means can and will scale in a hyper-networking manner to inflate value propositions. Chan and Hsu (2009, 2010) then developed the analytic properties of the hyper-network model presented in Hsu (2009a). The DCS theory begs a proof using evidence in e-commerce, which is the quintessential new service field, to show how it may better explain the evolution of new service business designs. The previous e-commerce literature, incidentally, focuses primarily on e-commerce acceptance and performance (including advertising) and lacks analytic studies on its unique intellectual properties.

Therefore, this paper continues the above work to establish the DCS theory by showing that it uniquely explains the evolution of e-commerce models, and suggests how the evolution may continue in a manner beyond what the previous generic strategies (e.g., Porter 1998a, 1998b) prescribe. In addition, it derives an Information Systems (IS) design method from the analytic properties of the DCS theory for implementing this DCS concept in practice, and thereby provides concrete accountability to the proposed strategy. The design principles so derived add to the previous results in the field of IS (e.g., Delone and McLean 2004, Levermore et.al. 2010). Combined, they constitute empirical evidence to support the DCS theory as a contribution to service science.

On this basis, we say that the paper develops the DCS theory into a generic strategy (postulates) for new service business designs. For simplicity, we refer to the proposed strategy **the Hyper-Networking (Service Scaling) Postulate***: New service business designs come from hyper-networking of customers, providers, and resources in pursuit of value cocreation, in a DCS manner*. The scope of the paper is the analysis, calibration, and justification of the strategy in the context of e-commerce.

The phrase "DCS manner" in the strategy refers to hyper-networking via digital means (e.g., wired and wireless devices and the cyber-infrastructure) to ***thrust up*** to span the population, ***deepen down*** to facilitate individual persons, and ***cut across*** applications to ***transform*** business designs and domains. Hyper-networking seeks to connect the multi-roles that a person or an organization plays in his/her or its life cycle, in the pursuit of reducing transaction cost and cycle time for the tasks involved. As will be discussed below, a person, similar to an organization, can be both a customer and a provider.

The rest of the paper develops the proposed strategy. The next section, Section II, analyzes the intellectual properties of the hyper-network postulate, using results taken from both network science and service science. Section III presents the new analysis of e-commerce practices to verify the proposed strategy. Section IV derives a set of DCS propositions from the analytic properties of hyper-networking, to facilitate planning for the implementation of the proposed strategy, with Section V elaborating an IS design method for this implementation. Section VI concludes the paper with additional remarks on the new research.

2. Analytic Properties of the Hyper-Networking Postulate: the Newness

The newness of the DCS theory resides in service scaling, or the hyper-networking postulate. A hyper-network is a network of networks; or more precisely, a semi-regular community of inter-connected single layer networks in multi-dimensional space (Hsu 2009a), whose analytic properties, including average distance, evolution, and degree distributions are provided in Chan and Hsu (2009 and 2010). These results also show that randomly adding new nodes to a single network, or connecting new single networks to existing ones, creates hyper-networks.

Since networking using the Internet is subject to the availability of the Internet, which makes any Internet-based networking semi-regular, we now briefly review the basic properties of this class of networks. Two well-known genres of semi-regular (single layer) networks are the small world networks and the scale free networks. The former, which acquired the name by presumably exhibiting the so-called six degree separation phenomena, features "long connections" between largely separate lumps of nodes (see, e.g., Watts and Stragatz 1998). The scale free networks, on the other hands, demonstrate a degree distribution that follows some decay power law (see, e.g., Barabasi and Albert 1999). Both types of networks are found to be pervasive on human habitats, regardless of their nature's being physical (e.g., cities) or cyber (e.g., social networking).

It is interesting to note that the decay power law (Newman 2005) is consistent with many well-known phenomena in, e.g., engineering, economics, and management, under the labels of Pareto distributions and the 80-20 laws – examples include inventory controls, income distributions, and the size of human habitats/congregations. Thus, one may argue that this propensity to concentrating values on a relatively small proportion of all works/members/parts reflects a basic property of human behaviors. That is, humans do choose their associations by preference (e.g., following the leaders/successes) when they can, and hence hyper-networking can further facilitate

this choice by offering more channels to concentrate. In fact, service scaling may require promoting proactive engineering of preferences as a strategy, rather than relying on random chances alone.

Small world networks appear to be "normal" in human congregation, such as habitats constrained by tangible needs (e.g., blood, natural resources, and means for travel/making a living). These constraints seem to reflect the natural tendency of herding by proximity - be it logical (value, profession, etc.) or physical (blood, habitat, etc.). Since exceptions usually exist to any constraints, outliers from the norm of close herding will emerge who become the agents of connection across the "natural" congregations. This observation applies to both "virtual" clustering (interest groups, professional communities, and social networking sites) and physical environments (tribes, ghettos, neighborhood, towns, and of course nations). The connection laws of small world networks may be described as connection by kinship and certain centrality measures such as in-betweenness.

The moral is that network science has exposed some basic laws about how humans network, which can help design new service businesses. However, connection laws for single networks are not sufficient. The hyper-network postulate suggests that human networking, such as service scaling, is a multi-dimensional phenomenon, resulting not in just one single network of this or that type, but in multiple such networks that overlay – or, hyper-connected together to become a multiplex whole. We further submit that the additional ***connection laws for hyper-networking*** are driven by ***the roles that humans play in their life cycles and by the tasks that these roles bestow on them***.

In this sense, the hyper-networking postulate is an extension to traditional network analysis. In the previous literature, researchers tend to base their analyses on just one particular attribute by which members (nodes) connect, such as collaboration in movies or citations in scholarly papers. However, these attributes are just some particular roles and tasks that the members play in their lives. There are many other roles that breed many other tasks for the members to network, too; such as being a parent, child, spouse, knowledge worker, citizen, customer, supplier, employer, and much more. All these role-based tasks and hence networks overlap for the persons conducting them.

In a similar way, service enterprises are but some multi-layered networks constituted fluidly on the basis of feasible connections of demand chains, supply chains, and intra-enterprise entities and resources. Furthermore, enterprise networks all decompose to individual stakeholders. Therefore, combining both people and organizations, a service system is a set of inter-connected, ***role-based multi-dimensional networks*** that overlay on the persons common to all networks. We now turn the hyper-networking postulate into a unique action plan:

The Hyper-Networking Strategy for Service Scaling: *Identify possibilities and develop value propositions for the facilitation and integration of multi-dimensional life cycle role-based tasks, and connect them by hyper-networking their customers, providers, and resources.*

To the extent that it explains the evolution of e-commerce models, this unique strategy contributes to shaping new service business designs. Theoretically speaking, since service is commonly defined to be the cocreation of value between customers and providers using resources (see, e.g., the Cambridge Paper 2008, Maglio, et.al. 2010, and Zhao et. al. 2008), service is by definition an economic activity of human networking. Therefore, new service business designs are naturally reflected on designs for networking.

How does the hyper-networking strategy differ from traditional business strategies? Foremost is the fact that enterprises did not have the ability to perform DCS at the time when many of the traditional strategies were developed. Now that they do, they can take the new advantage and add hyper-networking to any traditional generic strategies they may employ. For example, since they have the choice to scale up, down, or transformationally by multi-dimensional inter-connections to pursue innovative value propositions along both demand chain and supply chain, then, why should they not to explore this new strategy?

More specifically, hyper-networking has the potential to break down the traditional divisions of strategies, such as the well-known dichotomy of Michael Porter's 2x2 matrix: low cost vs. product uniqueness on the one dimension, and broad vs. narrow business space on the other dimension (Porter 1998a, 1998b). With DCS, one may pursue both choices simultaneously; i.e., service scaling by hyper-networking may abridge Porter's divisions with relative ease. Many traditional stores (e.g., Buffalo chicken wings and New York cheese cakes) have used the Internet to do just that: they sell globally, buy globally, and network customers globally (with blogs and other connections) to align with businesses in other domains.

The search engine enterprises and social networking sites offer another powerful evidence of the hyper-networking postulate: These enterprises have the entire Web for their business scope and build their core competences from accumulating customers and resources throughout the entire Internet (scale up). They compete on striving to personalize their products and attend to their individual customers' needs, leveraging the population-oriented assets that they accumulated to create these personal products and services (scale down). In the same time, they respond, proactively as well as reactively, to the customer needs (business opportunities) revealed by how the customers have commented on the products and used the population resources in performing their tasks in life (the life cycle roles that users demonstrate), to combine or transform their business designs (scale transformationally).

The story of simultaneous pursuit of accumulation (scaling up), personalization (scaling down), and life cycle integration (transformation) is a story of multi-dimensional hyper-networking, played out perhaps in an iterative, spiral expansion process. This hyper-networking process describes Yahoo (from a search engine to retailing portal), Google (from a search engine to all-encompassing person business provider), Facebook (from social networking to business applications), Apple (iPod, iPhone, iPad, and iCloud, which integrates hardware with software for person-centered life cycle needs), and other major new service enterprises and business designs.

In a nutshell, hyper-networking leads to accumulation of resources and facilitates their reuse, and thereby lowers cost for new applications. In the same time, digital connections allow for fluid switching and collection across individual applications and networks to enable collaboration and acquisition, giving rise to ever broader scope of business design innovation. This is the DCS advantage that successful Internet enterprises have demonstrated, regardless of how they frame their business designs – e.g., exchange (Glushko, et. al.1999), globally integrated enterprises (Palmisano 2006), and application services provider (Tao 2001).

Go back to the Porter 2x2 matrix mentioned above: A business may pursue product uniqueness by pushing differentiation down all the way to cater to individuals, and thereby effectively turn any product into service; while conversely, it may also go for low cost by the benefits of scaling all the way up to cover the entire population of the domain. These two strategies are in fact two sides of the same hyper-networking design: pursuing personalization to accumulate common requirements, resources, and infrastructure; and reusing and sharing them to enable low cost personalization. Rather than being mutually exclusive, these two strategies are mutually supportive. Generally speaking, the proposed strategy may enhance traditional strategies by adding a hyper-networking dimension to them.

The next section reviews the proven e-commerce models to recognize their hyper-networking nature. Again, hyper-networking makes the difference between broad and narrow vanish, and low cost and product uniqueness converge, in the simultaneous pursuits of scaling up to the population and down to the individuals. The varying degrees of simultaneity lead to new types and domains of value cocreation, including transformation.

3. Confirming Hyper-Networking in e-Commerce Models: the Evidence

We now analyze how the practices of e-commerce confirm the hyper-networking postulate. The question to ask is whether the pursuit of hyper-networking of customers, providers, and resources explains new business designs in the field. To start our analysis, we consider the entire Internet community to be a hyper-network for value cocreation, whose customers, providers, and resources (including persons/knowledge workers) may come from connecting such elements in any member networks.

3.1 Internet Commerce: Hyper-Networking Providers with Customers

This category includes B2C (business-to-customer: individual business sites for direct sales and marketing); B2B (business-to-business: business procurement and supply chain activities); and Collaborative/Aggregate B2C/B2B (shopping malls, portals, marketplaces/exchanges, etc.). The B2C and B2B models share common properties, although company customers may present more transaction costs to the provider than persons do. Amazon.com exemplifies B2C and shopping mall, and Alibaba.com B2B and marketplaces. Often, the hyper-networking here exhibits the small world topology: clustering around some prime organization with some members connecting to different networks, such as in the cases of marketplaces and industrial exchanges.

The hyper-networking postulate suggests that enterprises in this category can benefit from hyper-networking customers to grow network effects for them, such as facilitating comments and providing blogs (comparable to social networking) to users to help them connect. Indeed, the field has witnessed such practices evolving over the years for enterprises ranging from simple B2C/B2B models such as online bookstores to portals and auctioning. Their common ***defining hyper-networking character*** is the ***recognition of individuals*** to practice ***personalized marketing***, such as own homepage and online recommendation, and peer-review for promoting self-policing. In contrast, traditional marketing aggregates customers into classes to lower the cost, leaving individualized advertising to upscale and unique products only. The DCS ability makes it possible to differentiate while maintaining low cost.

The hyper-networking postulate also indicates that the B2C/B2B design does not have to be confined to any traditional business space. Rather, businesses can move in and out of different spaces to pursue complementary value propositions revealed by customers' life cycle tasks. In other words, a B2C/B2B site can sell anything and buy anything on demand with affordable transaction cost due to the Web. Equally significantly, the digital nature of the Web allows ready embedment of B2C/B2B into any business designs, including social networking and personal communications devices. For example, a news article on New York Times about a book that Amazon.com sells can provide a clickable on the book to link the reader of the article to the precise homepage selling the book at the online

bookstore. This idea extends the original concept of hyperlinks from linking homepages to also linking online businesses on the Web in a completely on-demand manner – i.e., hyper-networking customers and providers along the connections of their life cycle roles. This is happening on the Web.

The B2C/B2B business design scales up, down, and transformationally, too. Scaling up is shown in the many aggregate B2C and B2B models on the Internet that hyper-network across individual businesses. They include collection of like-minded sites for one-stop shopping; jointly developed online consortium/communal cooperatives; integration of B2C systems to conduct assortment of transactions in auction/marketplace style; integration of B2B systems for on-demand supply chains as industrial exchanges; aggregated information services as portals for general or particular life cycle tasks; and aggregated transaction services as portals for particular or general life cycle tasks.

For scaling down, a person offering skills for hire, or acquiring services, or soliciting any activities related to his/her life cycle tasks, is a person engaging in personal B2C to sell as well as to buy on the Web. That is, a person is both a customer and a provider; and his/her social networking activities can turn into personal B2C at any time – and vice versa. By extension, organizations are tied to social networking, too, to the extent that customers, knowledge workers, and other stakeholders are all persons. In this sense, the hyper-networking postulate consistently explains the evolution from simple B2C to embedded B2C and all the way to the inclusion of business implications into social networking – all these models demonstrate service design by scaling transformationally.

The big picture is that such hyper-networking can continue to expand and breed new business designs. Not only can one hyper-network the provider base with their customer base, but can also connect the resources of service systems and the cross-sectional integration among them. As we will see below, the story of e-commerce did evolve along this line of hyper-networking. Furthermore, they clearly reflect an integration of the ***life cycle tasks*** and value chains for persons and enterprises (e.g., the life cycle and value chain of the book business: reader/customer, retailer, wholesaler, publisher, writer; and that of traveling: airlines, hotels, cars, restaurants, attractions…). The hyper-networking postulate expects eBay, Google, Facebook, Foursquare, YouTube, Groupon… to realign and compete in the same boundary-less business space.

3.2 Internet Enterprising: Hyper-Networking Resources for Providers

This category includes practices of Intranet and B2E/B2M (Business-to-employee, business-to-management, or company portal for administration activities); e-Enterprise (digitization of pro forma enterprise processes and core business); e-Extended Enterprise (e.g., Globally Integrated Enterprise/On-Demand Business for consulting; and real time custom production and co-production by customer orders). Internet Enterprising is the narrow definition of e-business, which "applies the Internet to a company itself" – i.e., connecting enterprise processes, knowledge workers and other resources, and immediate suppliers for the providers. The hyper-networking postulate points out that this connection needs to cultivate pervasive inter-personal relationships among employees as a foundation to facilitate their collaboration on the job, to accumulate and share work experience (scaling up and transformational). Furthermore, it advocates connections of knowledge workers with customers and the customers' knowledge workers, in a value cocreation, service extended enterprise manner. Indeed, this is happening.

Evidently, the casual notion of "applying the Internet to the company itself" is too simplistic to offer any insight of design, compared to the hyper-networking postulate. The latter opens up all possibilities of connecting resources, within and across enterprises and extended enterprises, using the logic of seeking the synergism of employees' life cycle tasks at work with the life cycle tasks of the enterprise. Hyper-networking places knowledge workers at the center of e-enterprising: knowledge workers should be better networked to enhance the accumulation of knowledge from them, and the accumulated knowledge may be shared among them to support their life cycle tasks on job. An e-enterprise is a federation of knowledge worker-centered virtual enterprises. Generally speaking, this concept fits especially well for the consulting industry. The hyper-networking postulate uniquely captures this promise of cascading value cocreation along the demand chain and supply chain via knowledge workers for e-enterprising.

3.3 Internet Utilities: Hyper-Networking Resources with Customers

This category includes ISP (Internet Service Provider: basic utilities for persons and organizations to join the Web); ICP (Internet Content Provider: leasing information resources to other sites); and Internet Computing/Resources Provider (leasers of Web resources including technology, hardware, and transaction systems). The sheer size of the Internet community means the sheer size of its collective users, information resources, and enabling systems; and hence the sheer size of opportunities to make them available for all to use in any imaginable ways of application. Business designs have arisen from hyper-networking the users, resources, and systems for on-demand sharing and reusing of them for clients. Some of the most celebrated accumulations on the Web happen to come from social

networking sites. Again, they prove the versatile nature of business designs on the Web: a social networking provider becomes an Internet utility provider with relative ease.

We recognize that these versatile applications and business designs are life cycle role-based. That is, they all target on the same persons (and enterprises) to provide different products, resources, or customers for their life cycle tasks, as the hyper-networking postulate predicts. The network providers (e.g., Google) and users (all members of Google) tend to exhibit a star-structured small world topology, where users also networking among themselves. The user networking may include B2C/B2B, Internet enterprising, and/or social networking, depending on the users' own practices. Each of these "member networks" may organize according to common types of life cycle tasks, or different roles that a person plays in life. As such, each may be a single layer network (small world or scale free) with the whole being a hyper-network. In fact, each Internet resources provider may inadvertently serve as a hyper-hub, or a "wormhole" to connect these otherwise isolated networks on different layers of roles and life cycles. This category exemplifies hyper-networks as much as the Internet itself does.

Practically speaking, hyper-networking tends to start with gathering Internet users by free services. For example, the early ISPs and user portal sites, including AOL.com, Yahoo.com, and hotmail.com, have all taken off from giving users free access to the Internet (use, memory, and tools), along with a search engine and an email account. Even eBay.com started with free email tools which amassed the initial customer base for it to enable the ensuing auctioning business. Google, Twitter, Facebook and all later social networking sites followed suit.

Obviously, free services and for-fee business are just two sides of the same coin because fee-paying customers and free users are just two different roles of the same persons who can switch between them in a split second. The concept of life cycle tasks helps identify these roles and design the embedded B2C (or any other business models) to generate revenues. On this note, we wish to stress that customers and knowledge workers are also just two roles of the same persons who can switch between them as easily.

The big picture here is that ***all people are potential providers***. Any owner of original digital contents: writings, documents, images, videos, drawings, music, movies, etc. is a potential ICP, as well as a B2C, and the threshold of entry is as low as subscribing to an ISP. The same goes to free-lance writer, consultant, artists, and even casual commentators; and goes to organizations, as well. Social networking practices, again, can be a very fertile field for developing ICP values, as they hyper-network information resources from virtually all people.

A generalization of ISP and ICP leads to Internet Computing/Resources Provider. Examples include IBM as a cloud computing provider (running on-demand virtual PCs, etc. on their Internet servers), and companies offering heavy-duty IT systems of data storage, processing, and communications for significant Internet-based enterprising. These heavy-duty systems are best described as shared components for extended enterprise information systems (e.g., Internet data storage to support globally distributed application systems). Sometimes, the notion of a (resources) portal is also used to describe the concentration of such resources for versatile customers. The design allows specialization to gain on scale, and helps user businesses leverage on the scale. Again, the hyper-networking postulate fully describes these concepts, from previously to possibly.

3.4 Enterprising Services: Hyper-Networking Resources with Providers

This category includes Online Vendor (providers and consultants of technologies, software systems and solutions); ASP (Application Service Provider: leasing solutions online to clients as their enterprise processes and applications); SaaS (software as a service) and On-Demand Service. Similar to Internet utility providers (IUP), enterprising service providers work in the background of their clients to enable their systems and provide hyper-networking. However, unlike the IUPs, who lease resources to organization customers, the providers in this category lease or sell solutions (enterprise processes, applications, and information systems) to Internet enterprises (who maybe providers themselves). Vendors practice hyper-networking as consulting firms do on their resources and clients to accumulate, reuse and share them and thereby gain the benefits of scale. They practice onto themselves what they sell in order to excel. For example, IBM preached globally integrated enterprises (GIE); thus, the company itself is also expected to be an exemplary e-GIE. The same comment applies to traditional IT vendors who profit on Web technologies: e.g., Microsoft, Oracle, Softbank, Apple, Dell, Cisco, and AT&T are also leading Web users themselves.

The ASP model hyper-networks, too. An example is the airlines ticketing engine provided by Sabre.com, which is connected to many travel sites as well as to airlines sites. The ASP model also enjoys the advantages of possible domination: being able to hyper-network with a population orientation. Retrospectively, the ASP model (Tao 2001) made a leap of business design from sales (software products) to service, and this leap applies to manufactured products, as well. In essence, any online vendor can readily become an ASP if sufficient technology exists.

The original practices of ASP tend to be confined to routine applications and fixed processes. However, newer business designs featured agile and on-demand ASP, such as Software as a Service: on-demand development and

operation of reconfigurable enterprise processes and applications. The newness, on-demand reconfiguration, is made possible by the progress on open technologies and generic enterprise software solutions, to meet the needs of the versatile service providers who meet the needs of their versatile customers. The SaaS class includes Web services, which focuses on software objects.

The big picture here is that these service businesses provide hyper-networking and hence have the ability to "manage" directly the population of their customers. This leads to a population orientation of business desing. For example, Security vendors (e.g., Symantec) install security software on PCs and connect them to their global servers, so that they can monitor the population and execute the controls (e.g., the black lists and blacklisted keywords) based on this ***real time population information***. The global security servers can take control of the local PCs, just like hackers and zombie servers try to do. The difference is of course the legal accountability. Similar practices are found in Microsoft and many other solution vendors where they update their software, remotely and virtually at will. Such a population orientation also allows Microsoft to gather performance information real time and online from the whole population. Hyper-networking uniquely recognizes this population orientation as a design strategy.

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3.5 Social Networking: Hyper-Networking Customers and Resources, with Potential Connection to Providers

This category includes P2P (peer-to-peer: individual "walled gardens" of socializing activities); Business on P2P (business use of P2P practices); Business Resources from P2P (Internet utilities: covert or overt customer base and information resource base); and Social Networking at Businesses (P2P as an integral part of regular B2C, B2M, etc.). In a sense, the stellar stories about the Internet can all be traced to innovations in this category, with, e.g., YouTube, Twitter, and Facebook being some the most-known examples. Social networking on the Internet is by definition multi-dimensional. Just ask any user how many social networking sites he/she participates and this fact becomes clear. Strictly speaking, social networking per se is not a business design. However, it inherently supports persons doing business on the Internet, as well as connecting businesses to the general public at large.

Social networking has been incorporated into B2M and other enterprising practices, too. For example, companies practice P2P to link customers, employees, and/or suppliers. This is a natural extension of, for example, the vendor networks discussed above in Section 3.4. A company portal (intranet) with a full P2P embedded in it can facilitate its knowledge workers collaborating and hence enhance the enterprise's agility. In fact, the expansion of the previous e-enterprising by further connecting itself in all aspects is a clear testament to the validity of the hyper-networking postulate.

The big picture here is a ***person-centered*** view of the digital world: we the people employ and deploy everything we have access to on the Internet to conduct our life cycle tasks, be it making a living or living our lives. Our business activities and social activities are but different renditions of the same life cycle we live. Indeed, social life and business have always intertwined. All social networking sites on the Internet provide free services to build customer base and accumulate resources, and compete on this basis. They all have the potential to provide these accumulated resources for business use. Some have overtly linked up with business (e.g., SecondLife.com, MeetUp.com, and LinkedIn.com), and the full potential awaits innovative and ethical exploration.

To elaborate a little more, advertisement has been the primary means for social networking sites to generate revenues. However, advertisement can compromise users' trust on the host. Thus, more advanced practices seek to synthesize business interests into the socializing activities themselves, such as embedded B2C and participatory promotion. The latter include exposure, extracting business intelligence, and experiments with massive multi-player online role playing games (MMORPG). Ultimately, the ultimate business value of social networking sites resides in the customer bases and information resources they gather. Hyper-networking opens up more possibilities of accumulating customers and resources than through the traditional business acquisition. It also makes them sharable and reusable by many, as potential "utilities" that bear business values.

The value of these utilities is clearly tied to the life cycle roles and tasks of persons: The persons at walled gardens are the customers at the businesses they patronage, and the knowledge workers on their jobs. Thus, the information resources about them from social networking are immediately applicable to all these businesses and employers. The social networks they formed within the gardens are similarly useful to activities outside, e.g., for them to seek professional contacts, and for businesses to market and recruit. The hyper-networking postulate indicates this evolution.

Indeed, business designs in this category all come from providing peer-to-peer tools such as search engine, email and instant messaging, and socializing homepages to persons, and then hyper-networking. They digitize information resources (text, music, and video), scale them up (joining and uploading), down (downloading), and transformational (e.g., connection to business) for persons and organizations. Particular models tend to be driven by particular networking tools, such as blogs, personal tasks/resources management, and group bonding activities.

Social networking and e-commerce converge in, e.g., the realms of gaming (e.g., MMORPG and gambling), mating, and job hunting. In fact, social networking has taught businesses a lot about business: how quickly and with relative ease grass roots value propositions can hyper-network and reach the population – we the people.

The best example of hyper-networking that involves physical products is perhaps the transformational business designs undertaken by Apple. This IT hardware vendor provides the world with the iPod, iPhone, iPad, and iCloud, which not only integrate personal digital hardware (PC, cell phone, and PDA) with personal application software (e.g., Apps, digital music and books, and e-commerce sites), but also deploy these new personal service tools to proactively enable social networking and personal business transactions across the entire cyberspace.

In sum, we submit that the evolution of e-commerce has exhibited a common denominator to all the innovative practices and business designs that it effects: the person-centered integration along person life cycle roles and tasks by hyper-networking customers, providers, and resources. On this basis, we move next to implement the hyper-networking strategy of Section 2. Since the strategy requires open and scalable enterprise information systems (IS) to enable it, or to bring about the dynamics that it calls for: to swiftly broadens, deepens, and transforms business designs by fluidly connecting customers, providers, and resources across business practices and domains, successful practices all predicate on such enabling systems. Therefore, we analyze in the next section how to link the hyper-networking strategy to a design science that guide the development of the required hyper-networking IS.

4. Realizing the Hyper-Networking Advantage: Strategic Planning

Hsu (2009) and Hsu and Spohrer (2009) suggest that hyper-networking has three basic types of benefits:

- **Accumulation Effects**: collection of resources, knowledge workers, customers, suppliers, etc. for possible integration, sharing and reuse: growth potential *O(n)*.
- **Networking Effects**: direct connection of persons and organizations for value cocreation: *O(n(n-1)/2)*.
- **Ecosystem Effects**: inflation of multiple layers of intertwined networks from pursuing the connection by roles and types of life cycle tasks for persons and organizations: *O(n!)*.

In addition, Hsu (2009) identifies a set of basic strategies for implementing the DCS theory, following the analytic properties of the hyper-networks model:

- **The First Generic Strategy of DCS**: Build Digital Connections to Reduce the Transaction Cost and Cycle Time of Performing Life Cycle Tasks (integration of life cycle role-based tasks)
- **The Second Generic Strategy of DCS**: Gain Economies of Scale on Customers, Knowledge/Resources, and Values and Value Propositions (population orientation)
- **The Third Generic Strategy of DCS**: Develop Business Design for Concurrent Integration of Applications and Application Domains along demand and supply chains (extended enterprises integration)
- **The Fourth Generic Strategy of DCS**: Facilitate Global Knowledge Economy by the Provision of DCS to Service Sector and Non-Service Sectors (the collaboration mode of production)

We now derive specific strategies from these guidelines to implement and promote hyper-networking connection laws discussed above by using open and scalable information systems (IS). First, we develop a set of propositions to link the hyper-networking postulate to IS guidelines and then discuss their implications, as follows:

- **Proposition 1: concerning accumulation by information systems**
  A basic method for accumulation is to make enterprise information systems open and scalable, to embed them into persons, organizations, and resources and to make the accumulation available as online assistance to customers and knowledge workers.
- **Proposition 2: concerning achievement of openness and scalability by cyber-infrastructure**
  A basic method for making information systems open and scalable is to build them on or connect them to common societal cyber infrastructure, including all open sources and open technologies, as well as the Internet and the Web.
- **Proposition 3: concerning acquisition of benefits through information systems**
  A basic source of benefits from open and scalable accumulation is the reuse and sharing of common service enterprise information systems for concurrent cocreation of value; which decreases the marginal cost and cycle time of cocreation.
- **Proposition 4: concerning promotion of hyper-networking by information systems**:
  A basic approach to hyper-networking customers, providers, and resources is to connect the information systems along the demand chain and supply chain, either by integrating the IS elements involved (see next section) or by connecting them.

How to put them to use? The ecosystem concept implies that the divides between all e-commerce business designs and spaces may be an illusion. They may ultimately be fused into a common portal of online retailing. While many small businesses are selling heavily at both eBay and their own B2C sites, what inherent reasons exist to perpetuate this separation? Merging these business designs can benefit from common themes across life cycle tasks, such as a one-stop habitat for all customers, person or company. In fact, a person is an employee/employer, too, and do see the Internet as a whole that satisfies his/her every need. Could Apple Store, for instance, be developed into some person-centered ecosystem of applications along these lines?

Furthermore, any individuals may become a service provider and engage in B2C or ICP via social networking, as discussed above. Thus, information portals, transaction portals, and any other forms of collective or collaborate models may simply converge to support a dedicated habitat for persons and enterprises, to conduct their life cycle tasks. Possibilities for the further development of transaction portals (such as financial processing of incomes, payments, and taxation at online banking), traveling, and person-to-person publication are some visible examples. Could the next iPad be based on habitat hyper-networking (an "iHab" or "iWeb")? Both differentiation (on services) and accumulation and standardization (on resources) promise to occur for the habitat.

The Third Strategy of DCS implies, among other things, the possibilities of such traditional IT hardware vendors as IBM, Dell and Microsoft, and Cisco to become some global Internet computing server or hyper-networking provider. For example, in the spirit of scaling up (managing the population), down (personalization), and transformational (integration), they may reinvent their product designs and marketing to connect all hardware function via, e.g., cloud computing, and change their business models from sale-based to leasing-based. They may provide enterprising apps of particular life cycle roles and tasks, for all persons, organizations and the society, as Apple have done for personal apps. Would the computer become free of charge, to lull customers?

In a similar way, Proposition 3 may imply that large B2C can offer P2P as free information services to customers and gain on building the customer base. Small B2C may join force and/or leverage what the walled gardens have to offer. The resultant population and population knowledge promise to contribute beyond marketing per se and facilitate the cocreation of value itself. Therefore, a full circle of connection from Internet Commerce to Enterprising habitat maybe effected through hyper-networking of persons as the customers, the providers, and the resources, at the level of individual life cycle tasks. Ultimately, the whole Internet may become a personalized habitat, with businesses scrambling to provide on-demand hyper-networking to fulfill individual roles and tasks.

Again, central to all the above analyses is the concept of life cycle roles and tasks. New business designs hyper-network to provide person-centered differentiation of products and services. They scale up by grouping such tasks for persons and organizations, and thereby enjoy the benefits of accumulating and reusing resources, from the population concerned. Finally, they create new value propositions for the integration of tasks along and across life cycles for persons and enterprises.

Next, we develop an IS design framework from extending the previous results by Levermore, et.al (2010) and Hsu (2009), to support the proposed hyper-networking strategy. To the extent that any persons may conduct business on the Internet, the design framework is relevant to both persons and enterprises.

5. The Hyper-Networking Enterprise Information System: a Design Framework

The four propositions of Section 4 suggest that a hyper-networking IS needs to embed its elements into societal cyber-infrastructure, to the extent practical, to achieve maximum openness and scalability. The embedment has a pivotal, signature aspect which differentiates this approach from any others in the IS field (e.g., DeLone and Mclean 2004): the proposed approach calls for incorporating the usual activities on the Web (e.g., the use of search engines and Web sites) into the system, as needed.

The basic logic is formalized as follows:

The Model of Digitization: digitizing IS elements and embedding them into social cyber-infrastructure (the basis for DCS)

The DCS enterprise starts with digitization of IS elements, including both the representation of elements (for e.g., persons and physical production factors) and the elements themselves (e.g., shared information resources, IT, and institutions). We define five basic types of IS elements from the perspective of system development.

Person: customers and knowledge workers at either side of service cocreation; including both the physical entities and their digital representation in the IS, complete with security, interface, and embedded tools for interaction with each other as well as with other IS elements; collectively, they are the human users of the IS.

Process: software enterprise process resources; including tools, process libraries and application software for or of the digital representation, storage, and processing of service resources (production factors), the embodiment/implementation of the process of cocreation, and the interaction of the persons (customers and knowledge workers) with the processes with security control; collectively, they are the process users of the IS.

Information: sharable information resources; including repositories of data and knowledge, digital representation of persons and physical production factors, and the standards and protocols that define them (e.g., ontology and embedded intelligence, business component models, and Modelbase).

Computing: digital hardware resources; including the physical IT components of the computing capacity of the cyberspace for the processing and storage of software resources and information resources, and connection of persons to the infrastructure - e.g., personal digital connection (server) devices, computer, collaborating computation platform, and shared facilities providing utilities of computing.

Infrastructure: digital connecting resources; including networks (private or public) of all levels, telecommunications (wired or wireless), and built-in protocols and network management systems that connect computing elements and administer the infrastructure; collectively they include the usual public cyber-infrastructure and proprietary enterprise cyber-infrastructure.

The model reveals a roadmap for developing a DCS enterprise IS, focusing on building and connecting these IS elements:

The Roadmap of DCS Enterprise Information Systems Development

Overarching Objective: Hyper-network the IS elements across the customers, providers, and resources of the service enterprise, both within each category (i.e., customer-customer, provider-provider, and resource-resource) and across categories (user-provider-resource), for maximum sharing of them to support concurrent value cocreation and reduce transaction cost and cycle time. In addition, when appropriate, seek maximum embedment of the IS into societal cyber-infrastructure (e.g., ***open source technology***) to achieve maximum embedded assistance, openness, and scalability.

Step 1. **Digitization:** Recognize ***paper trails*** (paper workflows and workflows that require paper documents), ***file trails*** (workflows that require multiple isolated, perhaps even duplicated files), and ***decision trails*** (workflows that require multiple, perhaps even overlapped chains of decision makers); identify barriers to the connection of business processes for new and old value propositions; and build/expand IS elements to simplify the trails and remove the barriers by digital connections – e.g., convert paper-based data resources and manual processes into (stand-alone) digital enterprise systems, using application-level (dedicated and proprietary) models, designs, and technology.

Step 2. **Intra-Enterprise Scaling (Transformation):** apply the DCS model to the whole spectrum of enterprise IS elements – i.e., connect and configure these elements to accumulate them as service resources and share/reuse them for (concurrent) value cocreation to reduce cocreation transaction time and cycle time; using (proprietary) models, designs, and technology as needed to supplement societal cyber-infrastructure.

Step 3. **Inter-Enterprise Scaling (Collaboration):** apply the DCS model across collaborating enterprises (the extended enterprise) – i.e., connect the corresponding IS elements throughout the extended enterprise value chains (e.g., supply chain and demand chain), and configure them to accumulate resources for sharing/reusing in (concurrent) value cocreation to reduce transaction cost and cycle time; using primarily societal cyber-infrastructure to achieve the collaboration in an embedded manner.

We now present two examples to illustrate the roadmap. The first, shown in Figure 1, shows a commercial bank transforming its previous loan application process, from being a collection of standalone systems into an integrated one where the previously separated IS elements are hyper-networked. All files are consolidated into an enterprise database capable of supporting all previous applications – i.e., the previous application software and loan specialists continue to operate from the new integrated database. Open source technology makes the connection to allow for seamless evolution, while proprietary solutions constitute the bulk of the controls for the application workflow.

The second example is provided in Figure 2, to represent a supply chain integration effort between a retailer and a manufacturer. This collaboration is accomplished on the basis of the Internet and open source software, although some proprietary solutions are employed to provide private controls. The vision here is really to formulate the entire supply chain as an extended enterprise, and design the IS for the extended enterprise as a whole. In the figure, CFAR signifies common software resources for the community of supply chain, and VAN the proprietary network used previously. The dashed line shows direct connection which replaces and thereby simplifies the previous connections shown as solid lines on the bottom. Both examples are inspired by real cases reported in the media.

Figure 1 Intra-Enterprise Scaling for a Commercial Bank

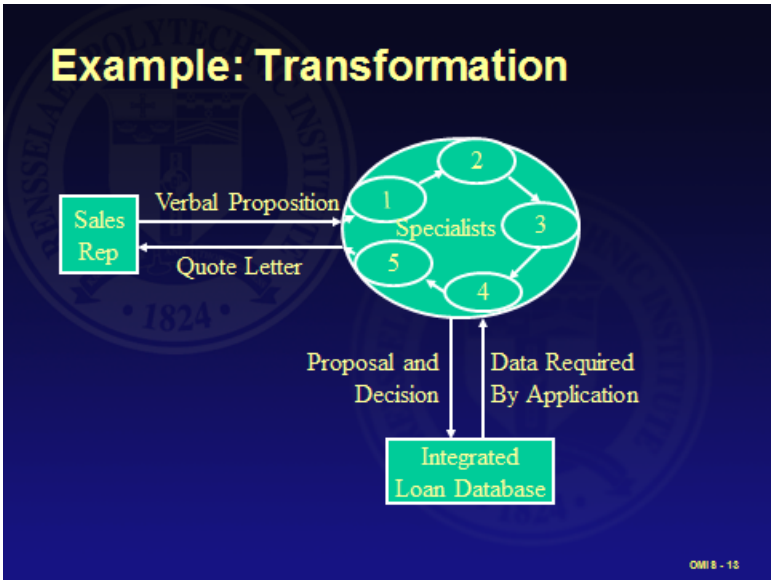
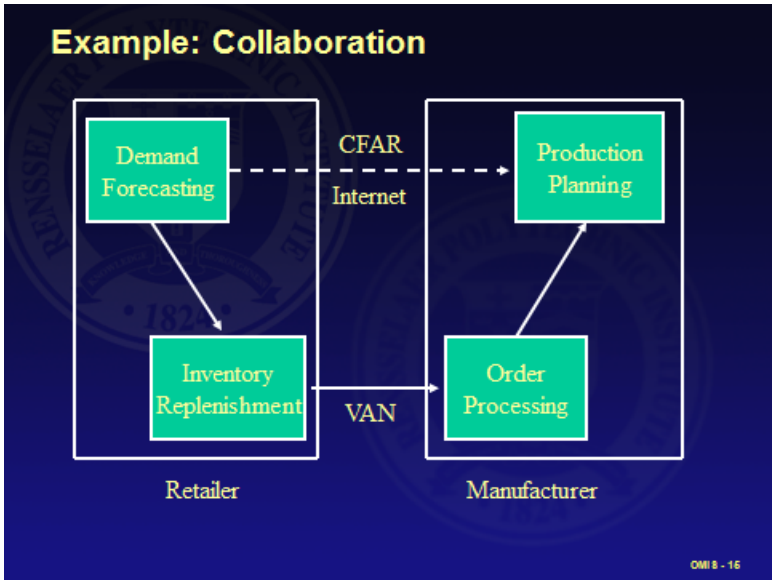


Figure 2 Inter-Enterprise Scaling for a Supply Chain



6. Conclusion: Hyper-Networking is a Form of Innovation

A new strategy for designing service businesses is presented in the paper. The strategy is complete with an analysis for its theoretical properties and an empirical calibration on the previous practices of e-commerce. The paper also establishes the accountability of the strategy by examining its possible implementation in practice and its implications for the future e-commerce. In addition to developing the strategy, the new analysis of the e-commerce practices in the paper also represents a contribution to the field. An IS design framework is presented to support the proposed strategy, and thereby helps verify its feasibility.

The paper concludes that the evolution of e-commerce has confirmed the hyper-networking postulate: First, the Web itself is the walled garden for all to play in it. People can exchange, share, and accumulate virtually any

digitized contents that each owns, for any life cycle tasks that each faces, regardless of the business nature of these activities. Second, the value of connecting the life cycle tasks of persons and organizations across different roles they play drives hyper-networking. Third, hyper-networking results in accumulation of customers and information resources, allowing for reuse and sharing.

The ultimate goal of the research is to improve our understanding of service scaling: What drives the service economy (or knowledge-based economy)? The paper proposes that it is the hyper-networking of customers, providers, and resources to better fulfill the life cycle roles and tasks of persons and enterprises. This postulate requires further research to substantiate it beyond the analysis of e-commerce practices per se. In addition, analyses of empirical data, including social networking cases, are needed to establish the specific assertions of the proposed strategy, such as the connection laws for service hyper-networking.

In a broader sense, we submit that service may be a new basic mode of production that features collaboration for value cocreation. This new mode may define knowledge-based economies. In this view, value cocreation by extended enterprises is not exception but the norm, and by extension hyper-networking may be the main mechanism of growth. This research represents merely a humble step towards understanding this big picture.

Finally, we submit that a new ***connectionist analysis*** approach is illustrated in this paper. This new perspective of analysis combines network science with service science to offer unique possibilities of revealing the basic properties of contemporary service enterprises and thereby facilitating innovation in service business design. The connectionist approach has potential to contribute more in the future: understanding the (business) power of human connections. For example, when pervasive digitization of resources becomes a reality, and ubiquitous connections of all persons and all organizations to these resources become achievable by public cyber-infrastructure, then massive connection of consultants may rival IBM and a mom and pop store may equalize to a Google in terms of its ability to hyper-network and innovate.

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