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Visualizing and Enabling Information flow in Dynamic Circles of Trust

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A Collaboration Between





Visualizing and Enabling Information Flow in Dynamic Circles of Trust

Robert de Souza

Mark Goh

Miti Garg

Ridwan Kuswoyo Bong

V. Mathivanan

Tan Geok Hoon

Lee Kah Moon

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ABSTRACT

Dynamic circles of trust are representations of real world supply chains and collaborative networks in which members co-operate with each other to produce and distribute goods and services. Dynamic circles of trust may be permanent or temporary in nature.

In the dynamic circle of trust, in addition to the flow of materials and finances, the efficient and cost-effective flow of information is essential to ensure the success of the transaction.

While intra-organizational information flow can be achieved by using IT tools, difficulties arise when information has to be transmitted from one organization to another. At these touch points in the dynamic circles of trust; the information flow tends to stagnate. The disparity of IT systems used by firms in the dynamic circles of trust leads to the formation of 'information silos' or 'information islands'. Furthermore information flows from different sources in different formats which make it difficult to integrate the information.

As the dynamic circles of trust expand, new members who use different IT systems are added to the network. This makes the flow of information in the system more complicated. Issues related to trust formation and security of information may also arise.

Several IT solutions have been adopted to ensure the flow of information in dynamic circles of trust. To understand the evolution of this technology we explore some existing and emerging solutions which address this gap. Our study indicates that there is a growing and strong demand for technological innovations which enable the flow of information in dynamic circles of trust. Technological innovations are driven by the industry, gaps in existing technology and industry-government partnerships.

By exploring the problems in the flow of information in dynamic circles of trust we bring to light an interesting issue essential to ensure business continuity.

INTRODUCTION

Business transactions are usually conducted amongst firms that have established trusted partnerships amongst themselves. This initial group of trusted partners form a circle of trust. For each task, partners are usually chosen from this circle of trust. This dynamic formation of new “circles” consisting of existing participants from a circle of trust can be visualized as a **dynamic circle of trust**. While some dynamic circles of trust are formed on a permanent basis others are formed only for a specific transaction. The combination of partners in the dynamic circle of trust is as dynamic as the permutation.

For a transaction or series of transactions to be completed successfully, coordination between the various partners in that circle is essential. The more coordinated is the flow of relevant data and information, the more efficient and economically competitive will the interaction be.

As seen in the diagram, in the real world, supply chains can be better represented as a series of links of chains that are set in motion in multi-directions as transactions and goods pass through them:

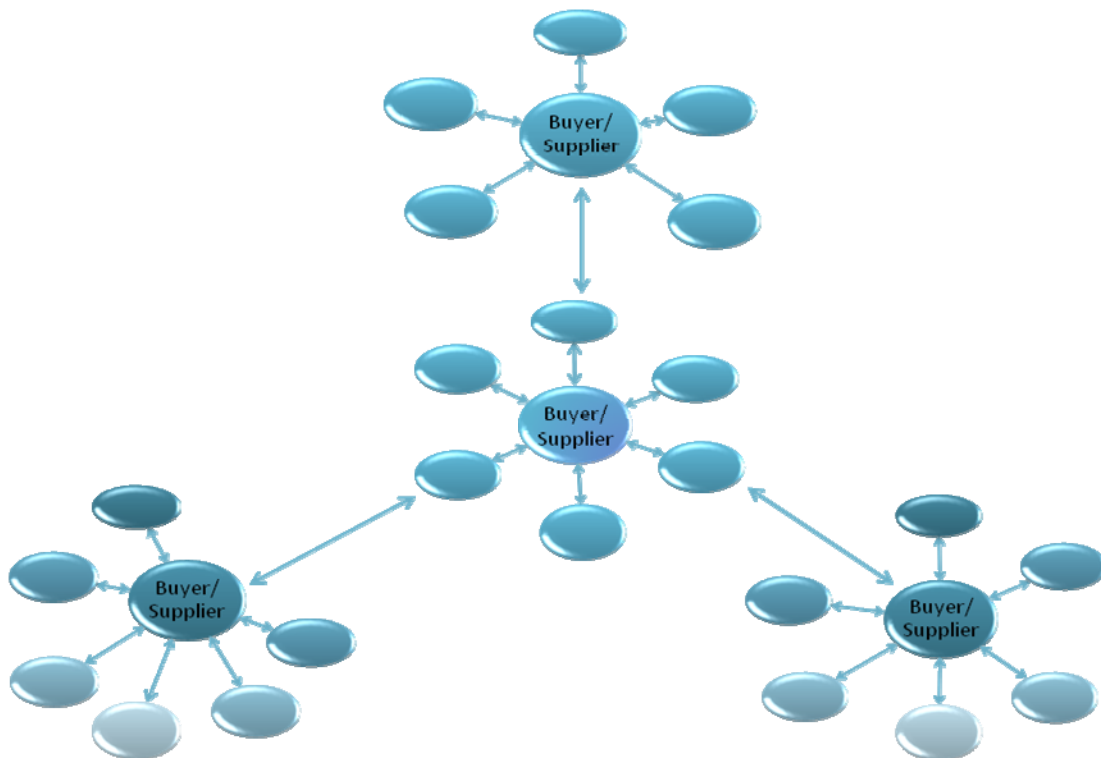


Figure 1: Dynamic Circles of Trust in Supply Chains

For each flow of the supply chain, there are several dynamic circles of trust in which players cooperate to exchange physical goods, titles, documentation and monies to facilitate the movement of

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goods and services from the supplier to the buyer. This circle is then joined to another circle of trust when commercial transactions are triggered by that one single player in the original circle.

Dynamic circles of trust are also observed amongst professionals such as lawyers, doctors and in trading communities. **Virtual teams** or geographically dispersed teams are also examples of loosely bound networks that are coordinated electronically.

INFORMATION EXCHANGE IN THE DYNAMIC CIRCLE OF TRUST

Whether it is Logistics Service Providers (LSPs), manufacturers, government agencies or financial institutions, information exchange is critical to ensure the smooth operation of organizations.



The more important information people have at hand, the more they can make transparent decisions. It's all about the velocity and visibility of information.

--- Mark Wettasinghe
Vice President, Technical Services
DHL AP DESC



In today's modern global economy organizations have become dependent on information technology as the means of communication. The efficient flow of information is essential for effective inter and intra-supply chain collaboration. Firms have become reliant on information technology to continuously operate and deliver services and products.



In our current global economic environment, the criticality of having integrated supply chains will be the differentiation factor for successful companies. In order to profitably and reliably deliver against demand, and not waste idle capacity, integrated data is essential to collaborate with customers and partners, to balance demand and supply across a distributed network, and have the optimum capacities and inventories at the right place at the right time to minimize and mitigate supply risks.

--- Rodney Strata
Industry Principal, Transportation & Logistics
SAP Asia Pte Ltd



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Information technology (IT) plays a vital role in coordinating activities in dynamic circles of trust. Efficient and cost-effective exchange of information within the different members of the dynamic circle of trust is critical to the success of a transaction.

VISIBILITY OF INFORMATION IN THE DYNAMIC CIRCLES OF TRUST

Usually firms in the dynamic circle of trust rely on some form of information technology to transmit information within their own organization. Information flows are created when organizations transact with each other in the dynamic circle of trust. When dynamic circles of trust touch, nodes are created. At the touch points problems of information flow from one circle to another may arise. This is because while within a particular circle of trust, there will always be certain players who can orchestrate that chain such that information is properly passed to the next party.

In cases of activities such as procurement, freight booking etc, the dominant partner is able to implement systems and processes with which the submissive partner will have to cooperate. But as the ripple of transactions flow outwards into secondary circles, the party position becomes weakened. At this edge or touch-point of the circle, the visibility of data and information by other related partners is weak or practically non-existent.

'Visibility' in the real world circle of trusts can be achieved by using information technology tools. However there are some drawbacks of using IT systems which can be summarized as follows-

- i) IT systems may not create sufficient efficiencies for information exchange between the enterprise and its trading partners. It may be inefficient to communicate using IT systems within and outside the dynamic circle of trust if members use disparate IT systems.
- ii) IT systems may not cater to security concerns.
- iii) IT systems may not be cost effective for communication with small, globally distant suppliers. These suppliers may not have substantial IT budgets comparable to those of large, well established global players. Some participants in the dynamic circles of trust may not have continuous internet access.

When IT systems are used, information exchange stagnates because-

- i) Data and information does not cross beyond the current periphery to the other outer layers of circles of trust.
- ii) The technology does not cater to dynamic changes and adaptations to the business requirements such as formation of partnerships and transactions i.e. dynamically changing trusted circles.

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- iii) Disparate and different systems are unable to “talk” to each other because of technology or cost issues.

Complexity arises when increasingly disparate IT systems are used within an organization. The situation becomes even more complicated when businesses transact with members in the dynamic circle of trust who may or may not use the same IT architecture. This makes it difficult for IT systems to communicate with each other. Commonly referred to as **‘the IT knot’** the challenge for IT companies is to innovate such that visibility of information amongst partners in the circle of trust is achieved.ⁱ

Visibility of information plays a critical role in enabling supply chain security.



Companies' global supply chain is becoming more vulnerable to any disruptions, risk or government regulatory requirements. There is greater dependency amongst the different parties to collaborate and share critical information with each other to create a secure and resilient supply chain. Consequently technology that offers event monitoring capabilities and complete visibility throughout the global supply chain become critical. With complete visibility and appropriate event management, organisations will be able to track the activities in the chain, alert the appropriate parties in the supply chain of any deviations, proactively managed the changes in the supply chain and evaluate appropriate actions to reduce the supply chain risk.

--- Philip Kwa
Director, Transportation Solution, Specialty Sales, ASEAN
Oracle Corporation



OVERVIEW OF THE DATA INTEGRATION TECHNOLOGY MARKET

Integrating data from simple spreadsheets, flat files and other formats used by different members in the circle of trust is a challenging task.

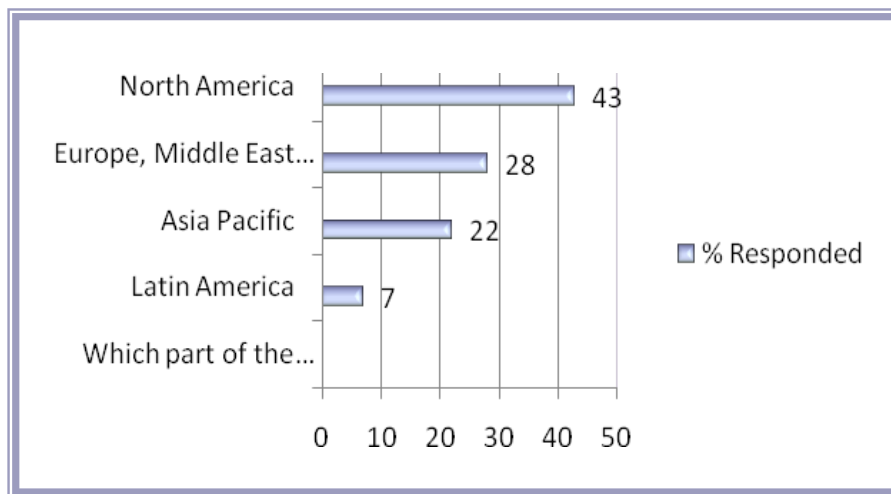
While some data integration and process management solutions focus on data integration alone, other solutions provide both process flow management as well as data integration capabilities. In the following section we present an overview of the data integration and process management market followed by a scan of the process flow management and data integration solutions provided by leading and emerging players in the landscape.

DATA INTEGRATION TECHNOLOGY

Though cutting costs is an important priority for CIOs, business analysts and IT practitioners, data integration has emerged as a critical IT goal. Data integration is the process of combining data from multiple sources into actionable, insightful information. Integrated data helps managers understand the business environment in which they operate and take better decisions. The data integration market has witnessed steady growth in the past few years.

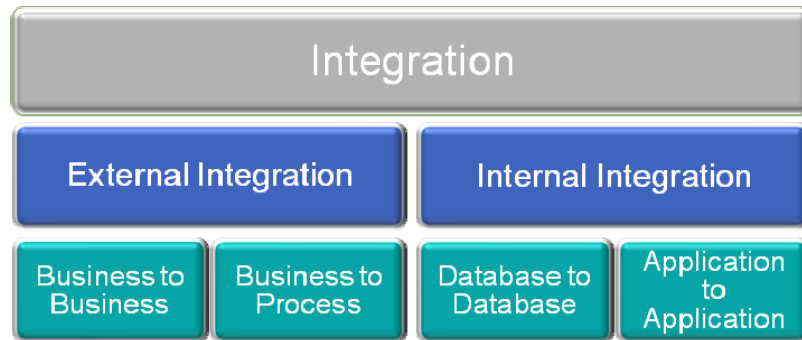
IDC has estimated that the worldwide data integration and access software market will grow to US\$3.8 billion in 2012, reflecting a compound annual growth rate (CAGR) of 8.7 percent from 2007 to 2012.ⁱⁱ

A study by Gartner indicates that “Initial 2007 market share estimates backed by strong fourth quarter and year-end earnings reports across the market landscape indicate solid performance for the worldwide data integration tools market in 2007, with record annual revenue growth of more than 24%.”ⁱⁱⁱ



Source: Adapted from “State of the Data Integration Market 2008-2009: An Oracle White Paper” (2008)

Integration of processes and data has several different aspects. These are internal integration and external integration. These are further subdivided into business to business, business to process, database to database and application to application integration.

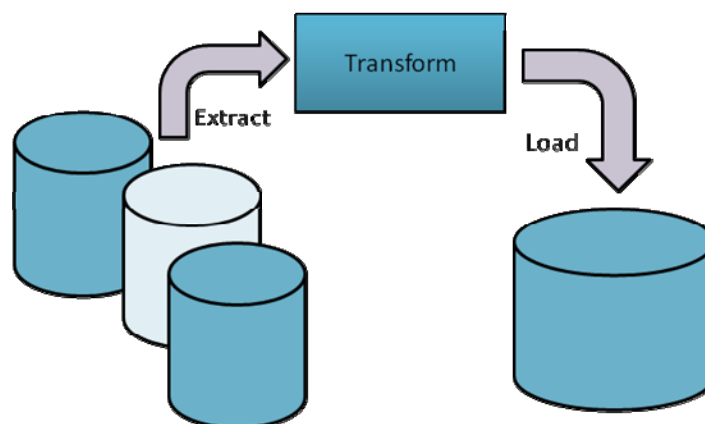


Source: Adapted from “Untangle the IT Knot Developing a Comprehensive Data Integration Strategy” (2008)

EXISTING TECHNOLOGIES

The traditional ETL tools operate by first **Extracting** the data from various sources, **Transforming** the data on a proprietary, middle-tier ETL engine, and then **Loading** the transformed data onto the target data warehouse or integration server.^{iv} **Extract, Transform and Load (ETL)** originated 10 years ago. The main drawbacks of using traditional ETL data integration technology is that it is a 2-step process where data needs to be moved twice - once between the data source and the ETL server and then between the ETL server and the target data warehouse after transformation. The transformation phase is computer intensive and requires a dedicated server. The transformation phase takes place line-by-line and therefore becomes the bottleneck. Another drawback of this technology is that the user needs to define how the process will take place.

Conventional “ETL” Architecture

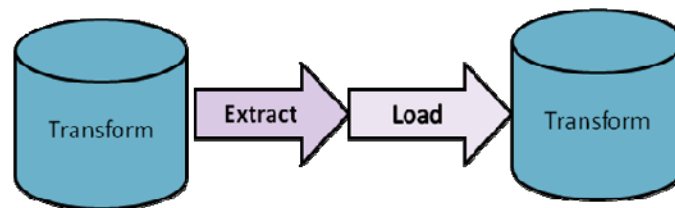


Source: Adapted from “Oracle Data Integrator Enterprise Edition A Technical Overview” (2009)

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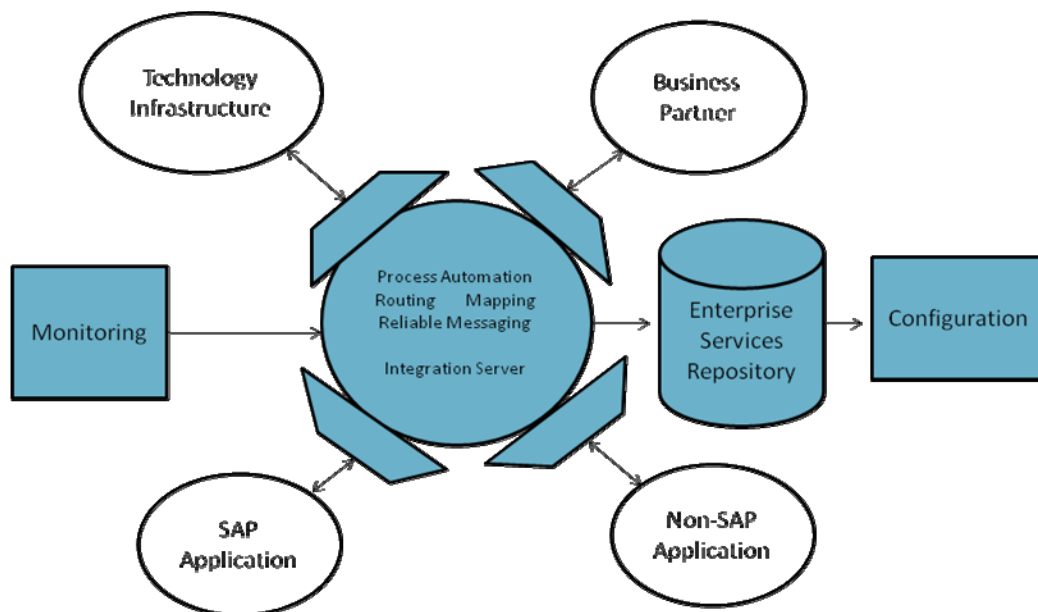
An improvement on the traditional technology, **Extract, Load and then Transform (E-LT)** uses both manual coding and ETL approaches in the same solution. It eliminates the need for an extra server, instead works by **Extracting** the data from the source tables, **Loading** the tables into the destination server, and then **Transforming** the data on the target RDBMS (Relational database management system) using manual coding. Therefore by using existing hardware and separate engine required, hardware and software costs are reduced. E-LT has been adopted extensively by Oracle Data Integrator Enterprise Edition.

Next Generation “E-LT” Architecture



Source: Adapted from “Oracle Data Integrator Enterprise Edition A Technical Overview” (2009)

The SAP NetWeaver platform provides both data unification and process integration technology. It allows SAP users to accumulate data from non-SAP users such as RosettaNet users and unify it into a single format. SAP NetWeaver uses the ‘hub and spoke’ architecture to address integration requirements.



Source: Adapted from “Solution in Detail - End to End Integration” with SAP Netweaver

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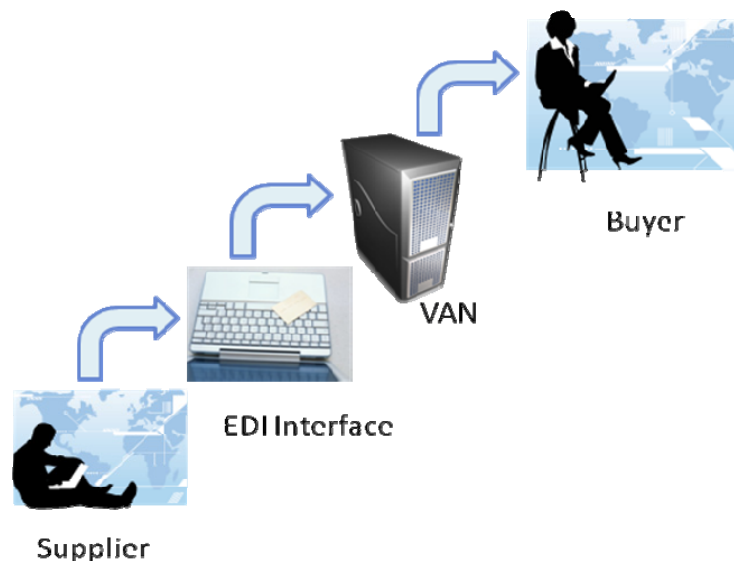
SAP's DNA has always focused on providing a business process platform with open standards (Enterprise Services Oriented Architecture) enabling synchronized data integration, visibility across multiple and complex supply chains. SAP Industry Solutions provide process integration the "ability" to react, respond and execute against the data across global supply chains as the differentiating "best practice" for becoming a best run business.

--- Rodney Strata
Industry Principal, Transportation & Logistics
SAP Asia Pte Ltd



Microsoft BizTalk Server, a business process management server uses "adapters" to communicate with different software systems in a large organization. It allows systems to automate and integrate exchange of business documents such as Purchase orders and invoices between disparate applications and across organizational boundaries.

Electronic Data Interchange (EDI) or the 'paperless' method for sending and receiving business documents has gained popularity amongst firms in recent years. EDI can be used to transmit information contained in paper-based Request for Quotations (RFQs) and Purchase Orders (POs) electronically. These documents are transmitted using certain standards such as EDIFACTS. The electronically transmitted dialogue between trading partners does not allow for human intervention except for error correction, quality checks or in specific situations.



Source: Functioning of Electronic Data Interchange

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Several types of EDI such as EDI through VAN (Value Added Network), EDI through Internet (Web based EDI), AS2 EDI (Internet based EDI) exist. Several organizations are migrating from VAN-based EDI to AS2 EDI to save costs. Once files are received through the VAN or the AS2, an EDI integration software or mapper is required to transfer the data into the companies Enterprise Resource Planning systems.

Among the several advantages of using EDI the most prominent are the efficiency, accuracy and speed achieved in data transmission. High costs of implementation, changes required in the business processes are a few of the deterrents.

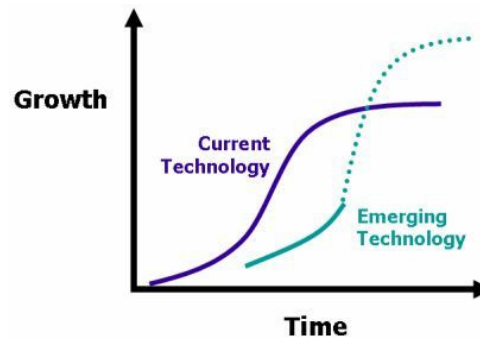
INNOVATION IN TECHNOLOGY

Innovation is defined as the 'adoption of an idea or behavior new to an organization'.^v Innovations can be of two types- product innovations which are defined as 'the introduction of new products or services that shift or expand an organization's domain and process innovations' defined as 'the introduction of new methods, procedures or responsibilities within existing domains'.^{vi} IT innovations may occur in both areas. Innovations are also classified as 'radical innovations' where the product introduced differs significantly from the previous product and incorporates several technological advances.^{vii} Companies that follow this path of innovation include Apple and BMW. Innovations are also classified as 'incremental innovations' where the product or service improves slightly upon the previous product. Toyota can be classified as an innovator of this nature.

In IT innovations, diffusion of the innovation or its adoption by the population over a period of time is a critical aspect. Innovation speed or the time taken from the first spark to the final product is crucial in gaining an edge over the competitor. Time-to-market plays an important role in determining the success of an IT innovation. Several companies adopt a 'castle building' approach to innovation spending millions of dollars perfecting an innovation while others introduce a product and improve it subsequently as per the customer's requirements.

The S-Curve innovation lifecycle seen in the following Figure displays the gap between the current technology and the emerging technology. It represents the lifecycle of technology adoption where in the beginning the technology is adopted slowly. After diffusion is successful, the return on investment starts improving. The Innovation Decision Process theory devised by Rogers states that innovation diffusion is a process that occurs over time through five stages: Knowledge, Persuasion, Decision, Implementation and Confirmation.^{viii}

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Source: Rogers, E. M. (2003), "Diffusion of Innovations," 5th ed. New York, NY: Free Press.

Innovation is a source of competitive advantage to firms. Firms innovate to provide the best-in-class solutions to existing problems so that they can succeed in winning customers and skim the market for profits. Technology innovations are usually industry driven, addressing gaps in existing technology, and seeking new solutions to old problems.

The institutional environment and government organizations also play a critical role in promoting innovation in technology.



IDA endeavors to create a conducive infocomm environment for businesses with a view to encouraging competition and innovation in Singapore. Our approach is to consult the industry and public and make timely policy decisions in order to respond to market developments and consumer needs.

--- RADM (NS) Ronnie Tay
 Chief Executive Officer
 Infocomm Development Authority, Singapore
 Source: <http://www.ida.gov.sg/insg/Aug08/inf.html>

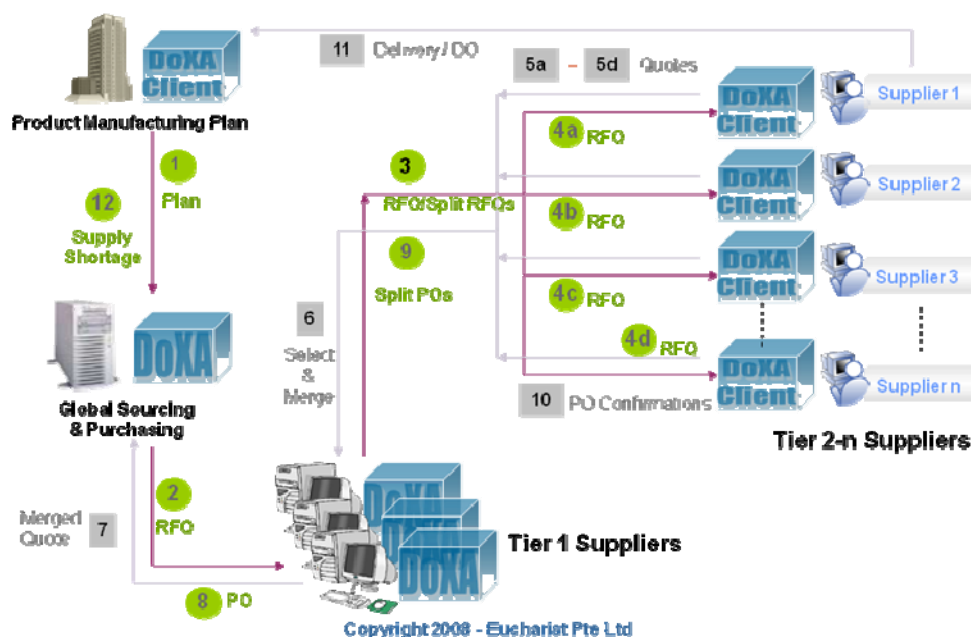


Data Integration and business process management are emerging areas which have attracted the attention of established firms and entrepreneurs alike. In the next section we discuss the innovations in the field of data integration and business process management and examine the underlying architecture of leading solutions.

EMERGING TECHNOLOGIES

Dynamism of Cross Arenas (DoXA), a process management and data integration software application addresses the problem of process management and integration of data from disparate sources used by different vendors. Developed by Eucharist-Tech Pte Ltd, a Singapore-based start-up, DoXA leverages on the defacto standard language for data integration, Extensible Markup Language (XML), to perform transformations on the data and formats the data in a readable and presentable document format. The most interesting concept introduced by Eucharist-Tech is the flexible and dynamic creation of circles of trust among business partners. One of the key principles driving DoXA is the concept of **‘dynamic circles of trust’ or DCOT**. Dynamic circles of trust deals with four essential elements in business transactions among business partners: trust formation, lifespan of business relationships, information security and importantly, the information being shared and/or exchanged. DoXA does not differentiate between intra-organisational or inter-organisational partners, and hence is available as a process and data integration tool both within an organisation, among organisations or a hybrid of both. As a business fundamental, this technology is basically business domain agnostic and is applied anywhere these 4 basic elements of business transaction exists.

In the context of the global sourcing and purchasing processes in supply chain, DoXA empowers supply chain owners with the ease and capability to invite Tier-1 suppliers to join their dynamic circle of trust. These Tier-1 suppliers, in turn can request their Tier-2 suppliers to download a DoXA client and participate in the dynamic circle of trust. This multiplier effect of inviting suppliers into the supply chain can be easily propagated down the chain.

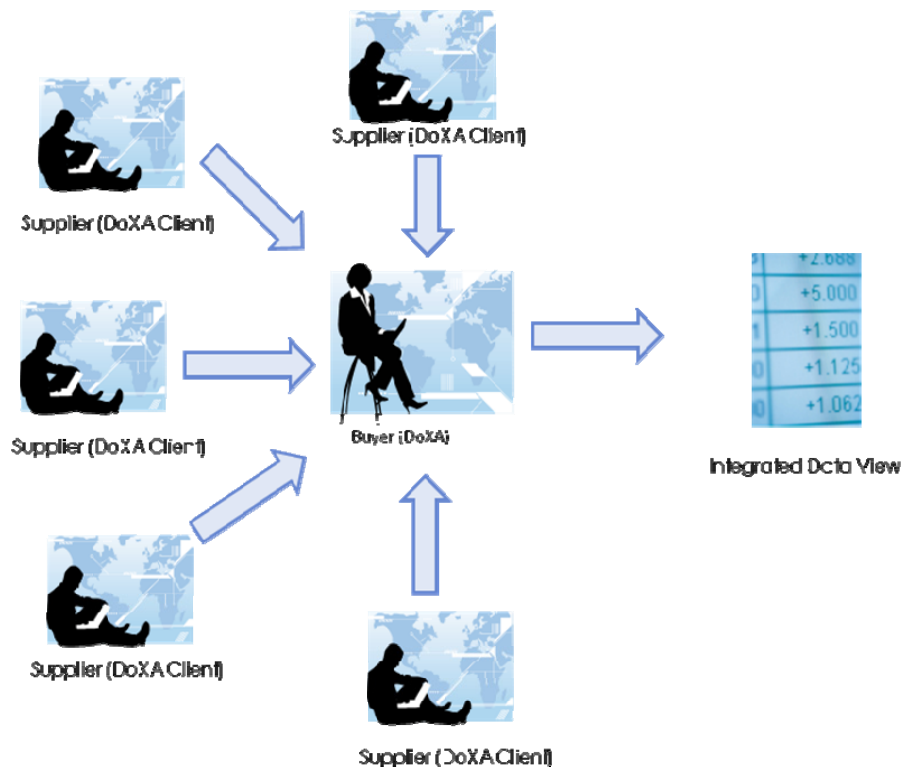


Source: Representation of the working of DoXA, Eucharist-Tech Pte Ltd.

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DoXA can be used to structure procurement workflows and generate forms which can be used for different purposes such as purchase orders (POs) and request for quotations (RFQs). Using the DoXA client, Tier-1 and Tier-2 suppliers can respond to these workflows and forms electronically.

DoXA extracts data from various formats, such as spreadsheets and flat files, and presents it in a simple and editable format, enabling intelligent decision-making possible for business users.



The notable difference between DoXA and existing procurement technologies is that DoXA is used to create (or to amend) and deploy transactions among the DCOT members even as the 4 basic elements continue to change in business.

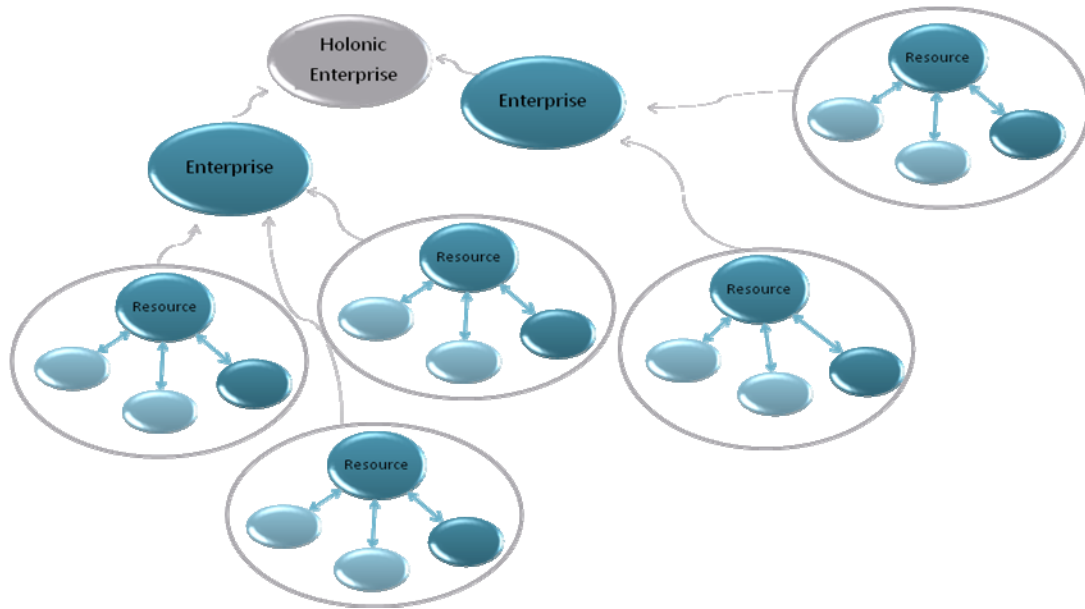
DYNAMISM OF CIRCLES OF TRUST

As networks globalize, new members are constantly being added and removed from the existing dynamic circles of trust. These members often grouped together to achieve a common business goal.

The dynamic circle of trust can be visualized as holarchies of collaborative enterprises in which each enterprise can be considered to be a holon (broadly speaking an entity, agent, system).^{ix} These organizations cluster into collaborative holarchies to produce a good or a service. A dynamic configuration emerges when the best partners for the collaboration are chosen to complete a task.

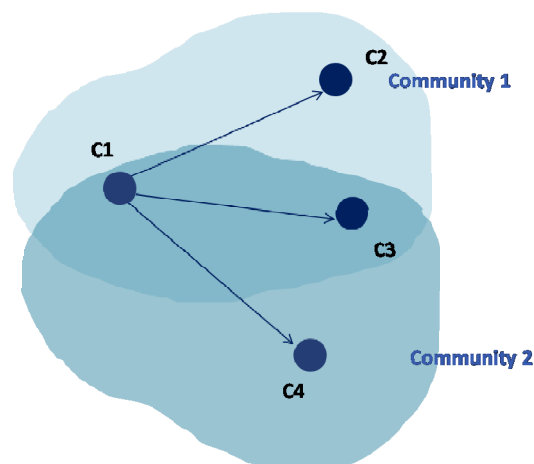
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However when the task is completed, the configuration changes, contributing to the dynamism of the cluster.



Source: Adapted from 'FIPA-enabled Holonic Enterprise', Ulieru M., 2001

The communities in the dynamic circle of trust are never static; rather they tend to be in flux. As shown in the following figure, a company (C1) could be a member of both Community 1 (together with C2) and Community 2 (together with C4) simultaneously. A new partner C3 could also join both Community 1 and Community 2, thus expanding the Dynamic Circles of Trust. Maintaining and updating profiles of the members in distributed, overlapping and networked communities can pose to be a challenging and complex task. Communications between the members in this dynamic business environment must be managed and tracked.



Source: Community Management, Eucharist-Tech Pte. Ltd.

LIFESPAN OF BUSINESS RELATIONSHIPS

In the real world, firms are constantly seeking new partners and establishing relationships with other firms. Conventional IT systems do not provide an easy method to reflect the new relationship dynamics. To establish strong relationships, members must continuously invest in IT systems which allow them to converse with the key company. This may hamper and restrict the lifespan of the relationship.

In the dynamic circle of trust, relationships are nurtured and maintained. Potential members join the circle of trust upon invitation by the community manager. Theoretically, the dynamic circle of trust has an infinite lifespan. New members can be added into the community. While some members in the dynamic circle of trust may not participate in transactions on a regular basis, they continue to be a part of the network. When the relationship stagnates, the community manager can remove members from the dynamic circle of trust.

INFORMATION SECURITY

Security of information is an essential requirement for online transactions. Although email is an easy and cost-effective method of exchanging information, it is a vulnerable form of communication channel unless encrypted or accompanied with digital signatures. Email phishing is an example of the security threat faced in using emails as a means of secure communication.

Public key infrastructure is often used to create a secure environment for online transactions. This infrastructure relies on the sharing of public keys to trusted members only, and only the intended audience of the encrypted information has the private key to decrypt the information. Public key infrastructure is one of the good practices to ensure secured information exchanges.

TRUST FORMATION

Firms usually transact with firms with whom they have established trusted partnerships. Trust is developed between two entities through frequent interactions, effective communications, goal congruence, sharing common values, cultural similarities and transaction-specific investments.

In the dynamic circle of trust, partnerships are established by adding organizations to the circle of trust. Trust is established through mutual sharing of information and through transaction-specific investments.

Trust is considered to be one of the most important ingredients for continuing a successful relationship. Having trust between the trading partners can help to improve performance and reduce the costs of transactions in a relationship.

CONCLUSION

Dynamic circles of trust are a representation of the network dynamics which exist in the real world business environment. In addition to the smooth flow of materials and finances, the efficient flow of information is a critical element of this network dynamics.

Information technology is the widely adopted tool which facilitates the flow of information within the dynamic circles of trust. However some questions arise in the use of information technology as the enabling mechanism for information flow in the dynamic circle of trust.

One of the questions that remain unanswered is how to ensure the smooth flow of information between IT systems which do not communicate with each other or in layman's terms 'do not talk' to each other. While several IT systems exist to ensure the intra-organizational information flow, achieving smooth and efficient exchange of information within the dynamic circles of trust continues to be a challenge. Unless the smooth flow of information is achieved within the organization, information 'islands' or 'silos' are created, which decrease the efficiency of the network.

Another challenge that companies face is the integration of data which flows in from different sources into a simple, consolidated format. Integrated data helps in improving decision making and the overall efficiency of the network. Innovators are constantly seeking answers to these problems, introducing new solutions which address these issues.

In this paper we shed some light on the different information technology tools which are being used to enable the flow of information in the dynamic circles of trust. We also explore the different data integration and business process management solutions which address this issue. The overview of the market indicates a strong and growing demand for solutions that try to solve these problems.

Furthermore, we explore the dynamism of the circle of trust. As the network expands, participants are constantly being added to the circle of trust, which complicates the communication issues in the dynamic circle of trust. Trust plays an important role in ensuring the success of a relationship. We explore some issues related to trust formation and information security in the dynamic circle of trust.

To conclude, this white paper attempts to highlight problems and solutions which exist in the smooth flow of information in the dynamic circle of trust. The objective of the paper is to enlighten the reader and invoke a thought provoking discussion on an issue of relevance to the dynamic business environment.

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Philip Kwa	Director, Transportation Solution, Speciality Sales ASEAN, Oracle Corporation.

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ABOUT THE AUTHORS

Robert de Souza, Executive Director, The Logistics Institute – Asia Pacific

Dr. Robert de Souza is the Executive Director of the The Logistics Institute - Asia Pacific (TLI – Asia Pacific). Robert is a Chartered Engineer and a distinguished writer, speaker, consultant and advisor in the area of supply chain management.

Prior to this appointment, effective May 1st 2004, Dr Robert de Souza served as Deputy Executive Director (Industry) and IT Director at TLI - Asia Pacific. Previously, Dr de Souza was Executive Vice President (Asia Pacific) for V3 Systems. His extensive tenure in the industry also includes serving as the Corporate Senior Vice President and Global Chief Knowledge Officer at Viewlocity Inc. and co-founder, Vice Chairman and CEO of SC21 Pte, Ltd., a Singapore-based supply chain software firm. As an educator, Dr de Souza is an Adjunct Professor in the School of Industrial and Systems Engineering at Georgia Institute of Technology in Atlanta and also a Senior Fellow in the Department of Industrial and Systems Engineering at the National University of Singapore and has previously served as a professor and in several senior positions in the School of Mechanical and Production Engineering at Nanyang Technological University in Singapore.

Dr. de Souza is a member of the Editorial Boards of the International Journal of Computer Integrated Manufacturing and the International Journal of Logistics Research and Applications. Dr de Souza also serves on the Advisory Panel of The Chartered Institute of Logistics and Transport, Singapore (CILTS), as a Council Member of the Singapore eSupply Chain Management (eSCM) Council and on the Boards of Directors/Advisors of several IT- based corporations.

Mark Goh, Director (Industry Research), The Logistics Institute – Asia Pacific

Associate Professor Mark Goh is a member of the National University of Singapore. A faculty of the Business School, he holds the appointments of Director (Industry Research) at TLI – Asia Pacific, a joint venture with Georgia Tech, USA; and a Principal Researcher at the Centre for Transportation Research. He was a Program Director of the Penn-State NUS Logistics Management Program. He was also Director of Supply Chain Solutions for Asia/Middle East with APL Logistics, responsible for crafting logistics engineering solutions for major MNCs in this part of the world. Other past appointments held by Dr. Goh include: Board Member of the Chartered Institute of Transport (Singapore), Chairman of the Academic Board of Examiners for the Singapore Institute of Purchasing and Materials Management, member of the Advisory Committee of the Transportation Resource Centre (NUS) and Vice President of the Operations Research Society of Singapore, Associate Senior Fellow of the Institute of Southeast Asian Studies. His other professional affiliations include membership of INFORMS, and the Academy of International Business. His biography appears in the

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Who's Who in Asia and the Pacific Nations, the Who's Who in the World, and in the Outstanding People of the 20th Century.

He has been involved in executive training and a consultant for organisations both in Singapore and overseas, such as PSA Corp, Siemens Nixdorf, CAAS, Fuji-Xerox AP, Hewlett-Packard Far East, DHL, and Cleanaway (China). He is currently on the editorial boards of the Journal of Supply Chain Management, Q3 Quarterly, Journal for Inventory Research, International Journal of Supply Chain Management and Advances in Management Research. His current research interests focus on supply chain strategy, performance measurement, buyer-seller relationships and reverse logistics. He has more than 130 technical papers published in internationally refereed journals and conferences.

Miti Garg, Research Engineer, The Logistics Institute – Asia Pacific

Miti graduated with M.Sc. (Management) by Research from the NUS School of Business in 2006. She obtained her Bachelors in Architecture (B.Arch) from the School of Planning and Architecture, New Delhi, India. Her industry experience includes working with the Retail and Leisure Advisory team for Jones Lang LaSalle Ltd., New Delhi, India. Her current research interests are in the field of global supply chain management, supply chain optimization, green computing and integration of multimodal transport networks. She is currently involved in industry and academic research and her work has been accepted for several Tier 1 conferences including AOM, AIB and INFORMS and Tier 2 conferences such as IMECS and ISL. She has also published academic work in internationally reviewed journals.

Ridwan Kuswoyo Bong, Research Engineer, The Logistics Institute – Asia Pacific

Ridwan graduated with a Master of Computing in Infocomm Security degree by Coursework from the NUS School of Computing in January 2008. He completed his undergraduate degree in Computer Science from the Faculty of Computer Studies in Indonesia. His previous research experience includes working on Neptune Orient Lines (NOL) project. His current research interests are in the field of multi-criteria time-dependent routing and scheduling problem, supply chain modeling and simulations, supply chain technological framework development using SCML, supply chain optimization, information technology infrastructure and architecture, and information technology security. He is actively involved in industry as well as academic research.

V Mathivanan, Director, Eucharist-Tech Pte Ltd

V Mathivanan, is currently the Group Senior VP in InfoWave Pte Ltd. and a director in Eucharist-Tech Pte Ltd., a company which he set up to provide Strategic Business and Technology Consulting

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covering infrastructure, master planning, strategic development, strategic marketing and market positioning.

Prior to InfoWave Pte Ltd, Mathi was the CEO of CrimsonLogic. Under his leadership, he has transformed the company from a largely Singapore-based EDI company to a global IT solutions and services provider with more than 500 employees worldwide, with offices in Australia, Canada, India, Malaysia, Mexico, People's Republic of China, the Philippines, Saudi Arabia, the UAE, Panama and Singapore.

Mathi started his career with the Port of Singapore Authority and had a distinguished career spanning 23 years in various capacities at PSA Corporation Limited. He handled diverse portfolios and played an instrumental role in shaping the national computerization programme within the shipping and port industry. In 1994, he was conferred the distinguished National Day Award for his outstanding efforts in developing the world-class mission-critical systems for port and container operations collectively known as the Computer Integrated Terminal Operations Systems, CITOS.

Tan Geok Hoon, Director, Eucharist-Tech Pte Ltd

Geok Hoon, Tan (Ms) is currently the Group VP in InfoWave Pte Ltd and a director in Eucharist-Tech Pte Ltd. She was Head and Vice President of the Trade and Logistics business of CrimsonLogic that developed the world renowned TradeNet system in Singapore. She led her team and transformed the aging Mainframe EDI based system into a powerful internet based TradeNet system. In addition, she pioneered the Electronic Certificate of Origin, another world's first nationwide implementation as well as several overseas nationwide Trade and Logistics systems.

Prior to CrimsonLogic, she led the development of conventional cargo port, logistics and distripark systems in PSA for Singapore. She also represented PSA Corporation in some of the committees during the development and implementation of the National Systems Portnet and TradeNet.

Lee Kah Moon, Director, Eucharist-Tech Pte Ltd

Prior to that, Kah Moon was Head and Vice President of the Legal, e-Government and Technology Development in CrimsonLogic. Among other major systems, he also led the development and implementation of end-to-end e-Judiciary services called Lawnet in Singapore and Land Title systems in India. Prior to taking up the VP role in CrimsonLogic, Kah Moon at PSA Corporation led several developments of container port operations as well as in leading the development and implementation of the port community system in PSA for Singapore and for the Dalian Port in China.

ABOUT THE LOGISTICS INSTITUTE – ASIA PACIFIC

Established in 1998 under the Global School House Program, The Logistics Institute – Asia Pacific (TLI – Asia Pacific) is a collaboration between the National University of Singapore (NUS) and the Georgia Institute of Technology (GT). Modelled after The Logistics Institute (now known as Supply Chain and Logistics Institute) at GT, the Institute’s vision is to be the premier institute in Asia Pacific nurturing logistics excellence through research and education. TLI - Asia Pacific was awarded the prestigious Asian Freight & Supply Chain Award (AFSCA) for Best Education Course Provider for six consecutive years, from 2003 to 2008.

The Institute provides postgraduate and executive education in logistics and supply chain management (SCM), notably the Double Masters Degree in Logistics and SCM and the Executive Certificate in SCM. It also undertakes leading-edge research and development in supply chain engineering, technology and management in collaboration with industry; and hosts a regular series of THINK Tables that brings thought leaders in research and industry to discuss contemporary SCM issues, challenges and solutions in a dynamic environment. The Institute’s key research themes include Supply Chain Intelligence, Supply Chain Optimization and Supply Chain Technology.

ABOUT EUCHARIST–TECH

Formed in 2007, the company’s objective is to provide consulting and technical services in the area of e-Governance, Port, Trade, Supply Chain Management and Logistics business domains. The principal directors of Eucharist have between them close to 80 years of solid hands-on experience with expertise in Technology, e-Governance, Port, Trade, Supply Chain Management and Logistics business domains. Besides Singapore, their consulting and technical experience covers as far as Australia, Canada, China, Ghana, India, Indonesia, Mauritius, Panama, Philippines, Saudi Arabia, UAE and USA.





A Collaboration Between



The Logistics Institute – Asia Pacific

National University of Singapore

E3A, Level 3, 7 Engineering Drive 1, Singapore 117574

Tel: (65) 6516 4842 · Fax: (65) 6775 3391

Email: tlihead@nus.edu.sg · URL: www.tliap.nus.edu.sg