SIMDAT

Data Grids for Process and Product Development using Numerical Simulation and Knowledge Discovery

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Grid-based Systems for solving complex problems – IST Call 2

Integrated project

SIMDAT

Public Deliverable

D4.2.2 Collaboration Patterns

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Executive Summary

This document is public deliverable D4.2.2 “Collaboration Patterns” of the EU IST-2002-511438 SIMDAT project. The purpose of this document is to provide an analysis the different approaches to business collaboration taken by industrial partners within the SIMDAT application sectors. The document examines each sector to understand the business needs underlying decisions to participate in Grid-based business partnerships and shows how these business drivers impact the infrastructure choices that are adopted. Each application sector has distinct business drivers that are forcing companies to work together, however, the characteristics of each business dictates how the collaboration is manifested.

- In the automotive sector, Audi remains a powerful controlling party in all collaborative relationships, whereby, Renault is more open and willing to include suppliers and their resources within collaborative partnerships.
- The aerospace sector is largely controlled by a small number of OEMs that work together in strategic alliances due to the high technical cost of product development, whilst incorporating a large number of design suppliers
- The meteorology sector is largely influenced by the WMO, which defines policies for free and unrestricted exchange of basic data and information to members
- The pharmaceutical sector is facing many of the challenges that aerospace companies have been dealing with for some time and is expected to increasingly participate in alliances and partnerships with biotechnology providers.

The collaboration patterns provide the high-level use cases for the development of security infrastructure by outlining where ownership and management reside. NEC and IT Innovation are working together to create a common vision and dynamic trust and security components to support the flexible business needs of SIMDAT application sectors.

1 Introduction

1.1 Purpose

This document is the public deliverable D4.2.2 “Collaboration Patterns” of the EU IST-2002-511438 SIMDAT project, as specified in the Annex 1- “Description of Work” [**Fehler! Textmarke nicht definiert.**]. The purpose of this document is to provide an analysis of the different approaches to business collaboration taken by industrial partners within the SIMDAT application sectors. The document examines each sector to understand the business drivers underlying decisions to participate in Grid-based business partnerships and shows how these business drivers impact the infrastructure choices that are adopted. The security and management technology developed within SIMDAT to support collaboration are then described with a final section outlining a strategy for deploying Grid technology.

1.2 Scope

The SIMDAT project is developing and deploying Grid technology to support industrial business partnerships within key economic sectors; aerospace, automotive, meteorology and pharmaceuticals. An important characteristic of Grid technology is its ability to support inter-domain collaboration allowing organisations share a wide range of business assets within the constraints of commercial polices for security and protection of IPR.

In the SIMDAT virtual organisation (VO) work package, we are exploring how industrial partners can use Grid technology within their business to improve their ability to produce complex products such as aeroplanes, cars, drugs and weather forecasts. The work package is analysing collaboration models, operational security best practices and developing underlying security technologies that can support collaboration within SIMDAT. There are many different collaboration models ranging from business cooperatives to market-based services. The appropriate model largely depends upon the underlying business drivers that dictate the level of power each party has in the partnership and their ability to influence policy decisions. In this document, we discuss each application sector to understand the business drivers that influence policy decisions and extract common collaboration patterns that are more widely applicable.

The collaboration patterns provide the high-level use cases for the development of security infrastructure by outlining where ownership and management reside. IT Innovation and NEC are developing dynamic trust and security components to these requirements. The developments will extend the work achieved within NextGRID [[1]], and delivered in GRIA 5 [[2]], to include a more flexible and standardised approach to dynamic access control. The document outlines the starting point for this analysis by describing the existing dynamic policy components within GRIA and the proposed DAC architecture from NEC.

Finally, participating within Grid-based collaborations requires industry to deploy a new technology, which potentially poses many challenges. Many businesses do not allow external access to their assets across perimeter boundaries and some do not even allow employees to have Internet access. Clearly, in such cases introducing a Grid will require policy changes and this will involve a wide range of people from relationship teams to network security management. In the final section

[1] “Dynamic resource allocation and accounting in VOs” from the NextGRID project, 2005, http://www.gria.org/docs/NextGRID%20P5.4.3%20v1.0.pdf

[2] GRIA, www.gria.org

of this document we outline a strategy for assessing the security risks associated with deploying Grid technology. Many industrial organisations will have existing strategies for the evaluation of the security risks associated with new technology deployments, however, we have provided the outline so that partners' employees within SIMDAT have an insight into the process, which many of them may not be aware of because it is unrelated to their current job function.

2 Business Drivers for Collaboration in SIMDAT

2.1 Overview

With rapidly changing markets collaboration provides businesses with strategic organizational flexibility to access research, technology, and markets. The motivation for collaboration can be varied. In some situations, research collaborations are created to share costs and risks associated with the research, as well as expanding the pool of resources available to widen the research focus. Alternatively, relationships are created whose primary purpose is to get products to new markets quickly and efficiently. Each collaboration classification forms part of the overall production process and is summarised below:

- Research-oriented collaboration allows businesses share resources with other businesses and research institutions without having to employ a "critical mass" of researchers deemed necessary to develop new products or processes;

- Technology-oriented alliances may be formed for the development of specific products and processes with specialized suppliers; and

- Market-oriented collaboration provides flexibility, as businesses are able to enter markets that they otherwise may not have had the resources to enter into without substantial investment and uncertainty.

SIMDAT is largely concerned with research and technology oriented collaborations, for example, BAE acting as a prime contractor for the multi-disciplinary design optimisation across sites or GSK accessing specialist technical capabilities from a bio-technology company or research institution.

Short-term agreements provide more flexibility than long-term agreements because most short-term agreements have a built-in escape clause that enables businesses to dissolve the relationship (albeit with some financial penalty). This would be typical of market based service provision within the engineering or pharmaceuticals industries. However, longer-term agreements often have joint governance structures developed to control the venture and commitments by the partners that, if broken, may result in substantial financial penalty. For example, collaboration between aerospace companies for the design of a new aeroplane would represent a long-term agreement, as would the policies defined by the WMO that underpin the meteo V-GISC, although in this latter case it is most likely that financial penalties will not usually be incurred. In some cases, the flexibility of the collaboration is not balanced especially when one party is in a powerful position, for example, Audi's suppliers would have to conform to policies defined by Audi, if they are to participate within a partnership.

The phases of the production process (research, technology, and markets) may be used to classify the variety of collaborative relationships that businesses develop. As businesses seek to gain access to other companies' resources, they may choose between merging their operations, acquiring other businesses, or developing collaborative relationships. With collaboration, various elements of the production process are externalised, although the commitment does not involve the complete sharing of operations that would occur with a merger. The externalised resources would remain under the control of the partnering organisation.

Increasing technological specialization is creating new market opportunities and allows many suppliers to collaborate with their larger customers. The larger companies use the innovative skills and technologies of the smaller, specialized subcontracting organisations. This is typical of the pharmaceutical industry where hundreds of specialist biotechnology companies exist and sell services to big pharma.

The following sections describe the specific business drivers for the SIMDAT application activities

2.2 Aerospace

The aerospace industry is one of the largest high-technology employers in advanced countries. By 2000, there were 1,220,000 aerospace employees in the world, of whom 49 per cent were in the USA, 35 per cent in the European Union, 7.5 per cent in Canada, 2.7 per cent in Japan and 5.7 per cent in the rest of the world. Within this industry, the civil aviation manufacturing sector is the most important: in 2000, 66 per cent of European aviation manufacturing employees were in civil production and 33 per cent in the military sector. The figures in the USA were 59 and 41 per cent, respectively.

The global industry is comprised of a wide range of businesses involved in the production of parts, components, systems, and subsystems for the airframe, engine, space, avionics, and defense subsectors. The industry is characterized by continuous technology development and high capital intensity, as products are made in small production runs with long development times and high costs. The industry is regulated by the GATT Agreement on Trade in Civil Aircraft, which, as of 1980, had abolished all customs duties on aircraft and aircraft parts and components.

The primary focus of collaboration in the aerospace industry is technology. With increasing costs and complexity associated with the research and development of new materials, avionics, and communications technologies, businesses do not have the financial and technical resources to develop these technologies independently. Many of the OEMs are participating in risk- and cost-sharing alliances as they design and develop very large passenger aircrafts. In addition, the OEMs have increased their outsourcing to suppliers of subassemblies (such as engines, structures, and landing gear) and concentrating on their core competencies of design, assembling and marketing aircraft.

For example, the aerospace and defence industries leading companies (BAE SYSTEMS, Boeing, Lockheed Martin, Raytheon and Rolls-Royce) have created an initiative called Exostar to establish an open and secure network connecting manufacturers, and A&D companies all over the world. Exostar is mainly focused on the supply chain rather than design collaboration but demonstrates the industries drive for collaboration. Exostar has connected over 300 procurement systems in 20 different countries, and has registered more than 16,000 trading partners worldwide. More than 100 companies are actively using Exostar’s online business-to-business collaboration and distributed product development solutions.

In SIMDAT, the aerospace activity is using Grid-technology to support partnerships between engineers researching and developing aerospace components across organisation boundaries. The scenario simulates the multi-disciplinary collaborative configuration design of a low-noise, high-lift landing system. The scenario is typical of sub-system design problems in the context of, say, future-concept, unmanned cargo vehicles that require an ability to use airfields in noise-sensitive locations. The scenario is one use-case selected from many possible alternatives in the product lifecycle that is driving the development of Grid technology.

2.3 Automotive

With 8.8 million direct jobs among automakers and their suppliers, the automotive industry accounts for 15% of the world's gross domestic product. It will continue to be one of the most important economic sectors over the next 11 years, as value creation represented by light vehicle engineering and production (excluding sales, replacement parts, and service) should grow at an annual rate of 2.6%, to €903 billion in 2015. During this period, the automotive industry as a whole will invest €2 trillion in capital spending in order to increase light vehicle production from the current level of 57 million units to 76 million units in 2015. And the industry will add a total of 3 million jobs. New technology for comfort, safety, communication, and entertainment will be introduced, mainly based on electrical systems and electronics [[3]].

The automotive industry has seen a rapid change over recent years with serious consolidation within the sector. Businesses are increasingly focusing on the brand as a way of differentiating themselves from their competitors. Collaboration within the automotive industry is increasing but the extent to which an OEM collaborates with suppliers and service providers depends on companies willing ness to incorporate suppliers and resources into their design processes. Renault, Citroën, and Nissan tend to collaborate more than BMW, Mercedes-Benz, and Audi.

As automotive companies move downstream, more engineering and production will shift to suppliers and service providers for engineering or assembly. In some cases, automotive companies will turn into suppliers by offering components and services to other automotive companies and suppliers.

In SIMDAT, the automotive activity is deploying Grid technology in application prototypes at Renault and Audi. The Audi prototype will demonstrate sharing engineering information between CAE and CAT teams for the purpose of comparing results calculated during the engineering design process (CAE) and results measured during physical testing (CAT). The scenario focuses on crash testing the SAMD car for regulatory compliance and comparing the associated NVH results generated by each team. Engineers within the CAE and CAT teams want to query for crash test information associated with specific test objects (in this case the SAMD car) and transparently browse the query results generated by both teams. The CAE and CAT teams use different problem solving environments (MSC.SimManager, LMS Tec.Manager) and database structures for information management to support their respective processes.

The Renault prototype will demonstrate an OEM/Supplier integrated crash simulation where different organisations collaborate for the purpose of designing a car that conforms to safety regulations [[4]]. In the scenario, the OEM (Renault) is developing a car which consists of parts from many suppliers. The crash simulation needs to be executed with an assembly that includes all of the parts designed by suppliers to ensure that the simulation is comparable to physical tests. During the connectivity phase, a single supplier (IDESTYLE) collaborated with Renault for the designing a Pedestrian Cross Member (PCM).

2.4 Meteorology

The World Meteorological Organization (WMO) is a Specialized Agency of the United Nations. It is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its

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[3] J. Dannenberg and C. Kleinhans, "The Coming Age of Collaboration in the Automotive Industry", Mercer Management Journal 17

[4] D.11.1.5 Description of Technology, Implementation and Evaluation of Automotive Prototypes

interaction with the oceans, the climate it produces and the resulting distribution of water resources. The WMO is an intergovernmental organization with a membership of 187 Member States and Territories [5].

As weather, climate and water cycle knows no national boundaries, international cooperation at a global scale is essential for the development of meteorology and operational hydrology as well as to reap the benefits from their applications. WMO provides the framework for such international collaboration. Since its establishment, WMO has played a unique and powerful role in contributing to the safety and welfare of humanity. WMO facilitates the free and unrestricted exchange of data and information, products and services in real- or near-real time on matters relating to safety and security of society, economic welfare and the protection of the environment. It contributes to policy formulation in these areas at national and international levels.

In SIMDAT, the meteorology activity is developing a common infrastructure for the collection and sharing of distributed meteorological data: the Virtual Global Information Systems Centre (V-GISC). Some key elements of the development are:

- Improve visibility and access to data through a comprehensive discovery service based on metadata development,
- Add value to existing datasets by enabling diverse databases to be used as a unique virtual resource,
- Offer a variety of reliable delivery services,
- Provide a global access control policy managed by the partners and integrated into their existing security infrastructure.

2.5 Pharmaceutical

The pharmaceutical industry in faces many challenges in the development of new drug products. New drug discovery is a complex long-term scientific endeavour with many development phases involving people from various disciplines accessing rich and diverse information sources under the constraints of external factors such as regulations and strong competition. The rewards for companies successfully filing new “blockbuster” drugs are massive but the investment required is equally huge. The top eight pharmaceutical companies spend $30 billion annually on new product development R&D, which is on average 20% of the $150 billion they receive in product sales [6].

The drug development process is generally referred to as a pipeline which includes distinct phases of development from generic research through to clinical trials, project lifecycle management and finally dollars in the bank. The challenge for pharma companies is to power the drug discovery pipeline with innovation throughout all development stages enabling them to generate new products and meet the demands of share holders. The health a company’s pipeline is a key measure of performance that is used to attract new investment. Companies must show that new compounds targeting important medical conditions are in development from pre-clinical to late stage clinical trials. Bottlenecks and gaps within the pipeline are indicate a down turn in a company’s ability to produce results.

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5 World Meteorological Organization, http://www.wmo.ch/web-en/about.html

6 “Pipeline Challenges”, Modern Drug Discovery, Oct 2004, downloaded from http://pubs.acs.org/subscribe/journals/mdd/v07/i10/pdf/1004feature_filmore.pdf

The top pharma companies are adopting various strategies (bioinformatics, cheminformatics, pharmacogenetics, high throughput screening, outsourcing, co-development partnerships, specialisation, performance based innovation, etc) to help ensure that future drug development continues to produce results in a cost effective way. Some strategies are general productivity solutions which have been adopted by most complex design industries (aerospace, automotive) over the last 20 years in the drive for better performance. Only recently have pharma companies focused on the need for improved pipeline productivity as new drugs become more difficult to develop and competition increases.

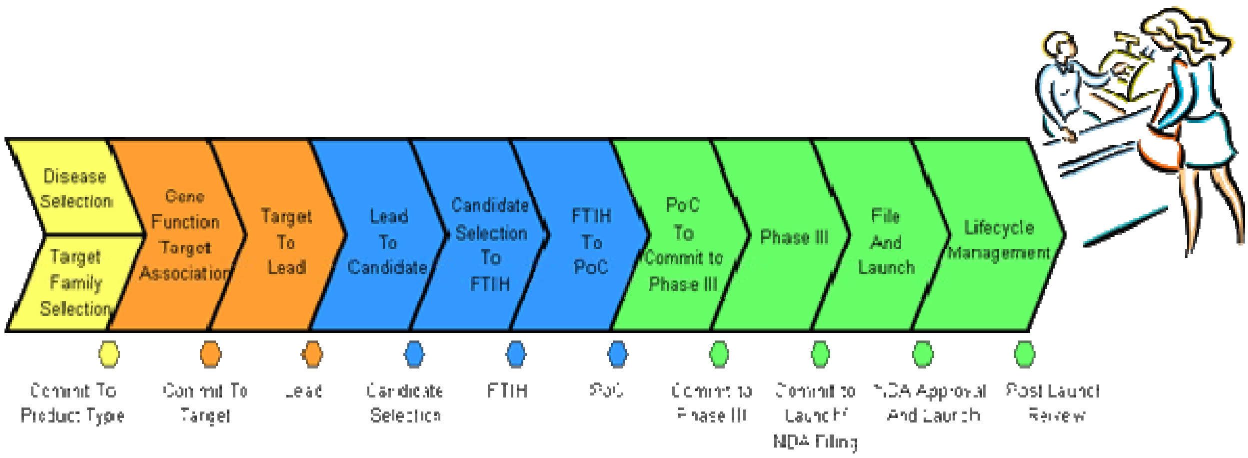

Figure 1: The Drug Discovery Pipeline

An important objective for productivity is to support scientists in making accurate design decisions earlier in the development process therefore reducing the risk of lost investment during late stage clinical failures. This is very similar to other complex design disciplines such as the engineering sector where simulation plays an important role in validating design decisions before anything is physically manufactured and tested. Although, the principles of “right first time” design decisions are the same, drug discovery is somewhat more challenging, as the overall global model and behaviour of a human system is more complex and less understood than for an aircraft or car. Aerospace engineers will typically have some idea which design parameters can be modified to obtain changes in specific performance objectives whereas scientists are often faced unknown consequences and brute force searches through the design space.

Recent advances in technology and the dramatic increases in biological information resulting from initiatives such as the human genome project have not translated into an increased ability to develop new drugs. The problem is that companies are only just beginning to understand how to process the vast amounts of information meaningfully and to some degree the information increase has hindered rather than helped new drug developments in the short term. Companies are faced with the challenge of adopting new approaches and technologies for the distribution, integration, discovery, searching, visualisation, annotation and validation of information so that value can be provided to scientists making design decisions.

The SIMDAT contribution to the drug discovery pipeline is described in deliverable D14.3.1 [[7]]. The focus of the scenario is using bioinformatics in the collaborative development of new drugs through Grid-enabled partnerships during the target identification phase of the pipeline. The

[7] D14.1.3 V1.3 Test report and statement of requirements for phase 2 technology developments from Pharma application area

scenario explores the potential of business-to-business (B2B) and business-to-academic (B2A) collaborations within the pharmaceutical industry. GSK, as a big pharma company, requires access to specialist analysis capabilities and Bioinformatics information to help scientists within the target identification phase. Inpharmatica is providing a high-value service based on Bioclips product that provides detailed annotation of protein data supporting similarity searching based on structure, ligand binding sites and annotations. The service will potentially allow GSK to identify targets more efficiently. GSK also see the potential for utilizing research undertaken by academic institutions and SIMDAT is exploring how service providers can broker B2A relationships for data provision and analysis with academics such as ULB.

3 Business Collaboration Patterns in SIMDAT

3.1 Contextual Collaboration: Virtual Employee

The virtual employee is the simplest means for collaborating with business partners as it does not require sharing resources between domains. In this scenario, a single powerful partner exercises control over the policies, resources and partnerships within the collaboration. The controlling party owns all of the resources used within the partnership such as application licenses, compute resources, storage and generated knowledge.

Typically, the controlling party would set up a project a specific purpose and would create a project team by adding users. The team would consist of employees of the controlling party and also employees of suppliers they wish to collaborate with. The external employees are regarded in a similar way to internal employees and would usually access the same information systems either using a portal or a VPN login.

In SIMDAT, the virtual employee can be seen within Audi and this is consistent with the collaboration analysis on premium automotive brands described in section 2.3. Much of Audi's collaborative working is based on external project engineers joining design projects and accessing Audi's resources through their collaboration portal. At this stage, the Audi scenario focuses on data integration between teams (CAE/CAT) within Audi rather than collaboration between Audi and external organisations.

3.2 Extended Enterprise Collaboration: Business Cooperative

The business cooperative represents a strategic alliance between companies and is a manifestation of a long-term agreement to collaborate for some purpose. In this scenario, there is typically a central controlling party (a prime contractor) who is responsible setting up, maintaining and dissolving the partnerships within the collaboration. The central party is considered the operator and may run centralised services to support the collaboration. A business cooperative is synonymous with the virtual organisation concept commonly used within Grid computing, where by a set of (legally) independent organizations share resources and skills to achieve a goal. Partners within the business cooperative may share a wide range of business assets but the each partner owns and controls access to those resources in accordance with either policies defined and agreed centrally or their own policies depending upon the nature of the collaboration.

In a business cooperative, is a high-level of trust and dependency exists between the participants. The relationships are long-term and have a large initial barrier to instantiating them. Part of this barrier is establishing the necessary trust and policies for operation. Therefore, the trust relationships within business cooperatives are fairly static; however, dynamics still exist in terms of access control permissions for each user.

Many of the collaborations within SIMDAT can be considered to be business cooperatives. Certainly, the aerospace and automotive all have long-term collaborative relationships within prime contractors representing the OEM. One might consider the meteorology activity to be a classic business cooperative, however, the characteristics of the collaboration dictate that there is no centralised controlling party and the management of trust and security needs to be controlled by each participant. Therefore, the business cooperative model is not suitable for the meteorology.

3.3 Extended Enterprise Collaboration: Business Partnership

The business partnership model provides a fully decentralised approach to management, with minimal dependency between collaborating partners. Each partner offering services makes its own business decisions about which users to trust and on what terms, and is responsible for enforcing its own access policies. Each business partnership is represented by a bi-lateral agreement between two parties. Businesses can collaborate with each other, but this is driven by their common consumers, and those consumers are responsible for managing the resulting dependencies. There are no global agreements to set up, no virtual organisations need be established and resulting centralised management services.

Business partnership can be set-up very quickly and are good for short and long term agreements where decentralised management is required. In SIMDAT, business partnerships are relevant to all sectors especially where service provision (engineering, bioinfomatics) is required.

4 Operational Deployment Strategy

The approach to the deployment of ICT based business collaborative systems described in this section is a summary of information and processes gathered under the Transatlantic Secure Collaboration Programme (TSCP) [[8]]. This programme has put together a Design Framework aimed at reducing the overall business risk and cost of collaboration based on ICT technologies of which Grid is a key component for service based collaborations. The IT Security focused business challenges addressed by the Framework and approach are detailed below.

The Design Framework is based around a four stage approach shown in Figure 2. The first stage involves establishing the programme and to collectively set up governance model and agree operating protocols. The key stakeholders apart from company representatives will be support staff from business functions like legal, human resources, IT and Security.

The second stage identifies the requirements to collaborate in a multi-jurisdictional programme. The partners will determine the level of capability maturity required and the corresponding Conceptual Technical Architecture (CTA) for each organisation based on the assessment of the overall programme complexity risk. Finally, the partners need to agree on the appropriate level of information assurance that mitigates security risks in the system.

[8] http://www.tscp.org/

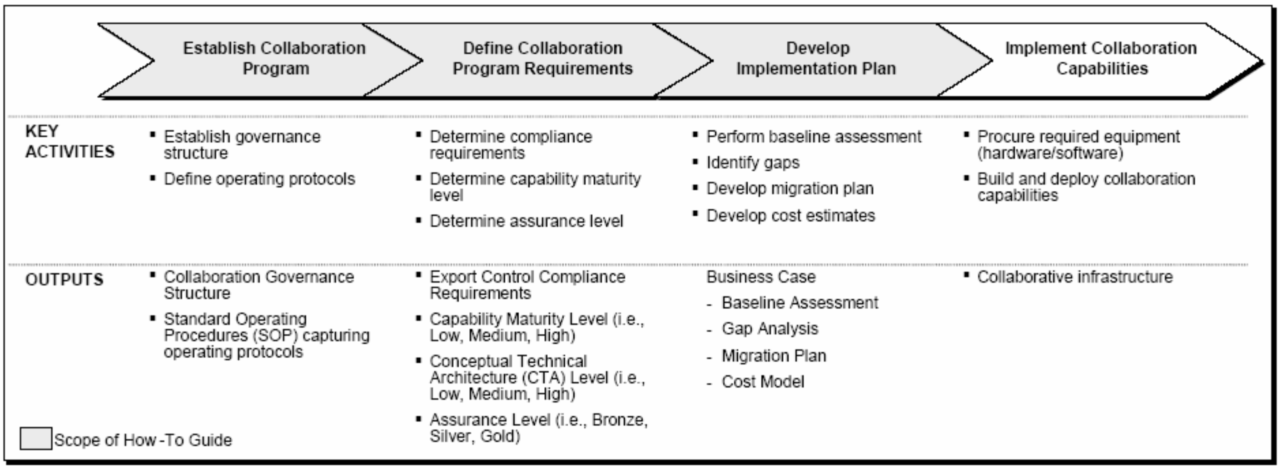

Figure 2: TSCP Design Framework approach (source TSCP How-To Guide)

The capabilities required for these types of systems are driven by the desired depth of interaction between participants. A tiered model is adopted to gauge levels of collaboration maturity between business participants.

- Level One – Productivity-Centric Collaboration
- Level Two – Collaborative Commerce
- Level Three – Contextual Collaboration
- Level Four – Extended Enterprise Collaboration.

The collaboration maturity classifications defined by TSCP match directly on to the collaboration patterns derived from SIMDAT requirements (See Section 3). The Virtual Employee model is equivalent to Level 3, where participants use technologies such as portals to collaborate. However, SIMDAT is largely focused on developing capabilities to support Level Four, which are described by TSCP as:

> *"Level Four, extended collaborative commerce, represents the highest level of collaboration between business participants. The goal of extended collaborative commerce is to dramatically improve the depth of knowledge sharing between participants to reduce product life-cycle design and development time, ensure data reuse across the product life cycle, and improve end-to-end program life-cycle process efficiency. Level Four capabilities include product life-cycle management; collaborative product design (e.g., CAD, virtualization); test and evaluation (e.g., modelling and simulation and data modelling/business intelligence); and interorganisational service integration (e.g., Web services and business process management)."*

The SIMDAT collaboration patterns Business Cooperative and Business Partnership are sub-classifications of Level 4.

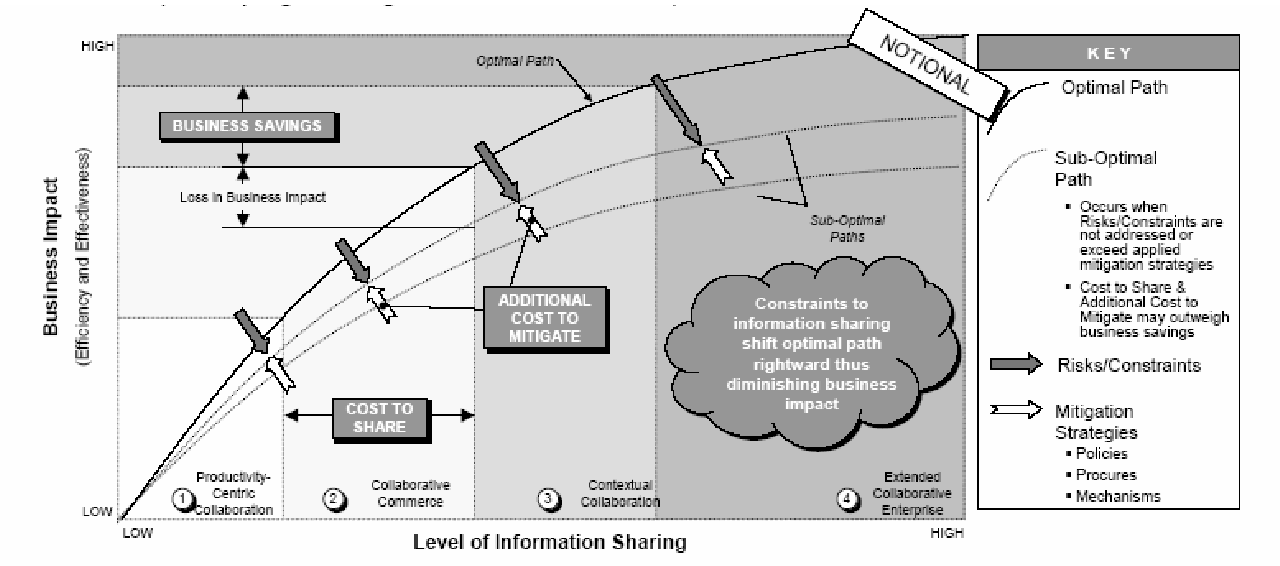

Figure 3: Information Sharing Growth Path (source TSCP – Framework for Secure Collaboration)

An IT security risk management methodology has been created which is based on determining the level of assurance required for 14 distinct policy areas and their implementation by 17 security services.

The policy areas[9] are:

- Information Security
- Identity Management
- Export Control
- Data Purging
- Privacy
- Encryption
- Risk Models
- Computer Network Defence
- Physical Security
- Enterprise Configuration Management
- Personnel Security
- Certification and Accreditation
- Marking and Handling Information

[9] See TSCP Framework for Secure Collaboration for more details

- Verification

These security policies represent internal 'standards' that must be followed and enforced to enable information to be protected according to a commonly understood terms. Each policy has associated risk mitigations and procedures to support the management of each risk.

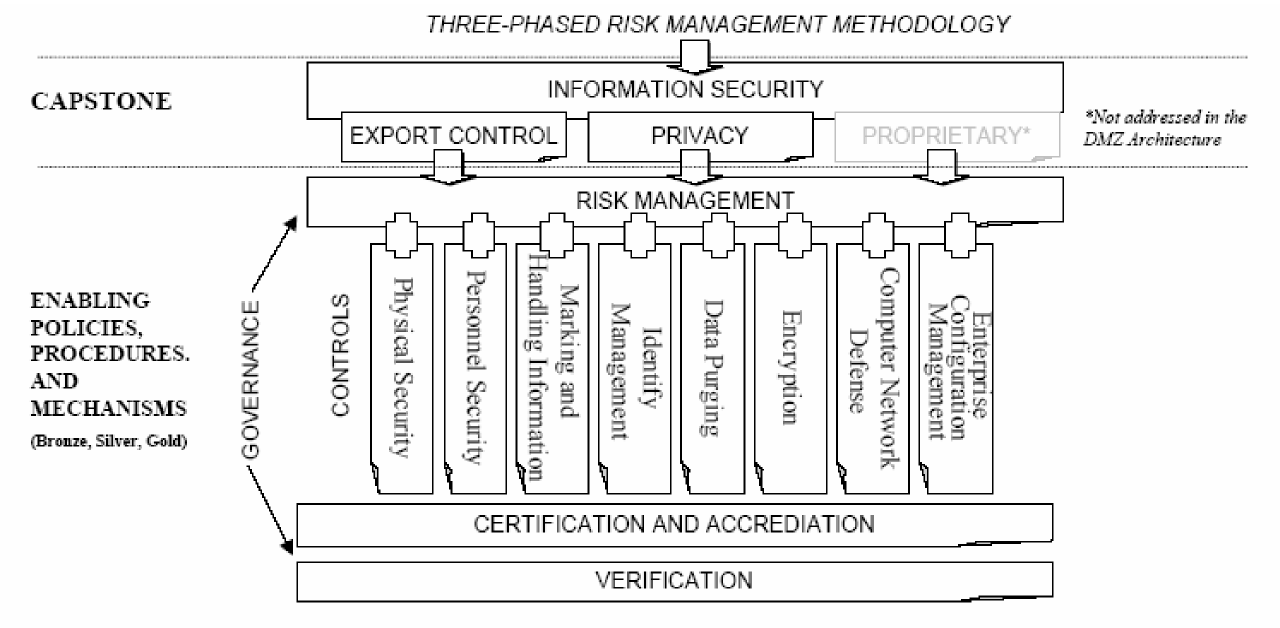

Figure 4: TSCP Policy Framework (source Framework for Secure Collaboration)

The primary business challenge is to determine the level of assurance required based on three key security drivers:

- To Protect Government Controlled Data – Export Control Acts
- To Protect Personal Data – EU Directive 95/46/EC
- To Protect Corporate Sensitive Data – Company specific

The starting point for determining what assurance levels should be used for each policy and mechanism at both the corporate and program level is the risk methodology[10]. Using this methodology, an organization can determine which policies and mechanisms should be implemented and at which assurance level. Where a conflict exists between a corporate risk profile for a Secure Collaboration Environment (SCE) and a program risk profile, the implementing organisation must determine the appropriate response to resolve the conflict. The possible responses are:

a) Implement additional policies or mechanisms to mitigate the higher risk element

b) Implement existing polices or mechanisms at a higher assurance level to mitigate the higher risk element

c) Accept the additional risk.

[10] See TSCP Framework for Secure Collaboration

The TSCP defined security services map to the policies as shown in Figure 5:

SECURITY SERVICES	Information Security	Export Control	Identity Management	Marking & Handling	Data Purging	Computer Network Defense	Configuration Management	Encryption	Privacy	Personnel	Physical
Directory Services	X		X	X	X		X			X	X
Authentication	X	X	X			X	X	X	X	X	X
Authorization	X	X	X	X		X	X	X	X	X	X
Certificate Management	X		X	X		X	X	X			X
Web Single Sign On Policy	X	X	X			X	X	X	X		
Accounting & Logging	X	X	X	X	X	X	X	X	X		X
Network Encryption	X	X		X		X		X	X		
Application Encryption	X	X		X		X		X	X		
Data Encryption	X	X		X		X		X	X		
Infrastructure Security Management	X		X	X		X	X				
Security Monitoring	X			X		X	X				
Virus Scanning	X					X	X				
Electronic Mail Filtering	X	X			X	X	X				
Firewalling	X	X			X	X	X				
Application Proxying	X	X				X		X	X		
Virtual Private Networking	X	X				X		X			
Network Segmentation	X	X				X		X			

Figure 5: Security Services to Policies mapping

There are several security services listed above that have a direct impact on Grid technologies that could used as part of an SCE. The capability requirements for Grid based services will be driven by the assurance levels required by the partners. Using identity management as an example the different assurance levels defined by the framework are shown in Figure 6.

POLICY	BRONZE	SILVER	GOLD
Identification	Identity management controls must be utilized with a unique identifier for all devices, users, and applications.	All devices, users, and applications must have a globally unique distinguished name that defines them in the collaborative environment and across the enterprise.	All devices, users, and applications must have a globally unique distinguished name that defines them in the collaborative environment across the federated environment.
Authentication	Collaborative partners must utilize access control techniques employing an appropriate combination of stringent processes and procedures and strong passwords.	At a minimum, strong passwords must be used for user authentication. If possible, token-based authentication should be used for devices and applications.	Two factor authentication with X.509 digital certificates must be used for user authentication
Authorization	Authorizations are contained within individual applications	Authorization for web and database applications must be granted through a web single sign on (WSSO) infrastructure.	All authorization for application access must be granted and managed using RBAC.
Provisioning	Provisioning of accounts must be performed in a controlled manual process that is documented and logged	Provisioning of user accounts must be automated through simple delegated administration and workflow	Provisioning of device permissions, device parameters, or user accounts must be automated through N-level delegated administration and workflow
Workflow	Identity information must be stored centrally so it is available to multiple sources easily yet securely. A directory (X.500 or LDAP-based) is not required.	An enterprise directory must be used to store identity information. This directory must be standards-based (X.500 or LDAP) to enable interoperability and integration.	A federated collaborative directory must be used to store identity information including distinguished names, device addresses, roles, and PKI certificates.
PROCEDURES	**BRONZE**	**SILVER**	**GOLD**
Privilege Granting	Access forms required for all access granting	Users self register through delegated administration tool and are electronically granted credentials.	
User Administration	Access must be approved by user's manager or device owner and by collaborative partner data owner or assignee. Device, user, or application granted or denied access and delivered credentials securely	Devices, users, and applications are granted roles by delegated administrator for OU and role is approved by collaborative partner data owner	
Replication		Replication protocols agreement	
Workflow			Accounts and access is provisioned through workflow system
Certificate handling			Certificate is delivered via approved delivery mechanism

Figure 6: Different levels of assurance for identity management

This mapping enables the partners to perform a technology gap analysis based on the agree assurance level for the environment. These tables are provided for all policy areas.

This summary has only covered a very small aspect of the TSCP developed approach for the Aerospace and Defence industry but this illustrates the magnitude of the task of developing an implementing plan for a DMZ based collaboration environment using current tools and technologies. The TCSP Design Framework provides the basis for implementing these types of environments and is in active use within the A&D industry in Europe and the USA.

In the SIMDAT project the main challenge has been for the company representatives to identify the appropriate support staff from key functions like IT security and to elaborate the business case in sufficient detail to enable a TSCP like analysis for be performed. These types of engagements need to occur a long time before they are required because the individuals required will be engaged in live deployment projects in the company and a research project like SIMDAT will be low on their priority list. The planning and stake holder engagement for the demonstration phase should begin now so that the last phase of the project has a successful outcome

5 Conclusions

This document has presented an analysis the different approaches to business collaboration taken by industrial partners within the SIMDAT application sectors and the technologies being developed to support them. Each application sector has distinct business drivers that are forcing companies to work together, however, the characteristics of each business dictates how the collaboration is manifested.

- In automotive sector, Audi as a premium brand remains a powerful controlling party in all collaborative relationships, whereby, Renault is more open to including suppliers and their resources within the collaboration.

- The aerospace sector is largely controlled by a small number of OEMs that work together in strategic alliances due to the high technical cost of product development, whilst incorporating a large number of design suppliers

- The meteorology sector is largely influenced by the WMO, which defines policies for free and unrestricted exchange of data and information

- The pharmaceuticals sector is facing many of the challenges that aerospace companies have been dealing with for some time and is expected to increasing participate in alliances and partnerships with biotechnology providers.

The document provides an outline strategy for deploying Grid technology supporting Extended Enterprise Collaboration (Business Cooperative and Business Partnerships). The process requires many company representatives who should be engaged early in the project lifecycle so that the necessary internal processes can be executed. The planning and stake holder engagement for the SIMDAT demonstration phase should begin now so that the SIMDAT project can achieve a successful outcome.