Newsletter Issue 2

September 2014

Intelligent Systems Configuration Services for Flexible Dynamic Global Production Networks

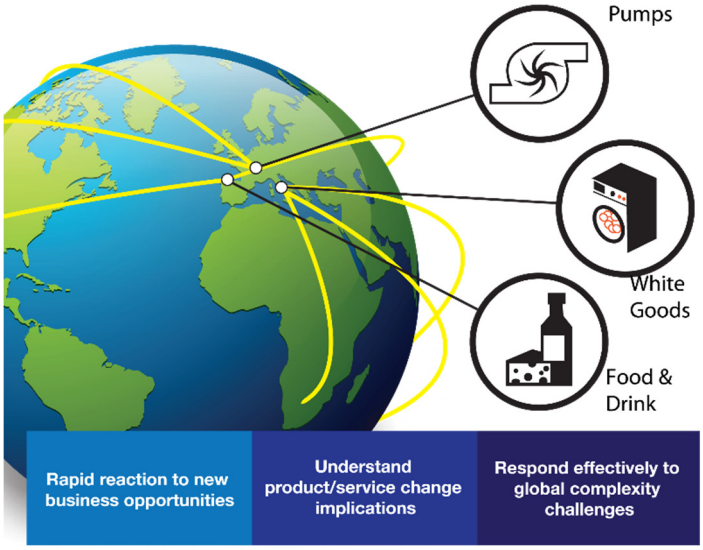
The FLEXINET Project No. 608627 is funded by the European Commission under the Seventh Framework Programme, call FP7-2013-NMP-ICT-FOF (RTD)

FLEXINET Project Progress and Highlights

By Bob Young, FLEXINET Co-ordinator

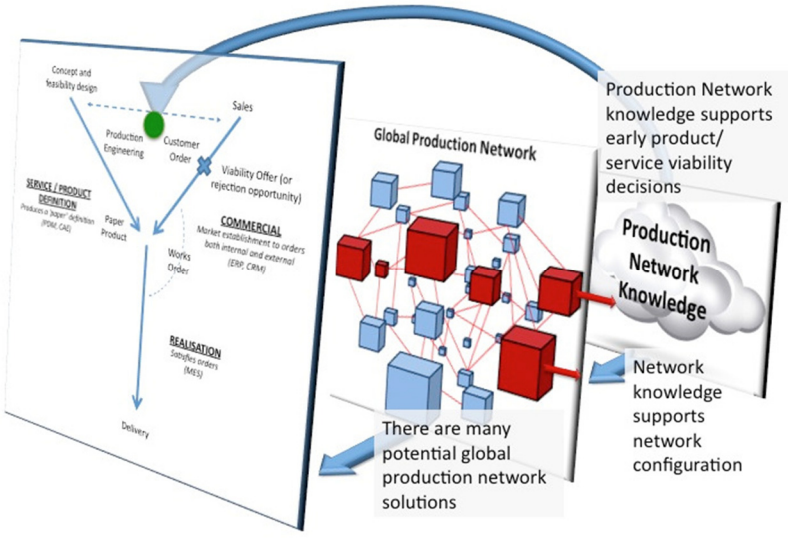
Welcome to the second newsletter of the FLEXINET project.

FLEXINET is a European Union Seventh Framework Programme FP7-2013-NMP-ICT-FOF (RTD) funded under grant agreement no 608627. It started on 1st July 2013 and runs until the end of June 2016. We are now more than a third of the way into the work and have a clear view of how to provide improved services for our end-users in the configuration of their global production networks. Now we plan to deliver these services and show how FLEXINET offers real definitive benefits.



Background:

The provision of three key areas of software service are under investigation, underpinned by a set of reference ontologies to ensure a consistent understanding of product-service production knowledge. These packages of software services are aimed at supporting strategic and tactical business decisions, related to global product networks, where new ideas for product-services must be assessed against their business potential taking into account the many global external factors that influence their potential success. The first package of services is for strategic business model evaluation, considering strategic business interdependencies for product-service manufacture in order to provide cost comparisons and risk evaluations. The second package of services supports tactical production network configuration that can support the design and evaluation of the required organisational and process structures. The third package is for product-service co-evolution that can support design teams in their move towards product-service design, especially with the identification of compliance issues of proposed network changes in the product-service-production systems.



The underpinning reference ontologies will provide a standard foundation from which industry sector specific solutions can be adapted. These software services, adaptable to suit multiple industrial sectors, will provide an understanding of the implications for the business of potential alternative production network configurations made necessary by product-service changes or new product-service requirements.

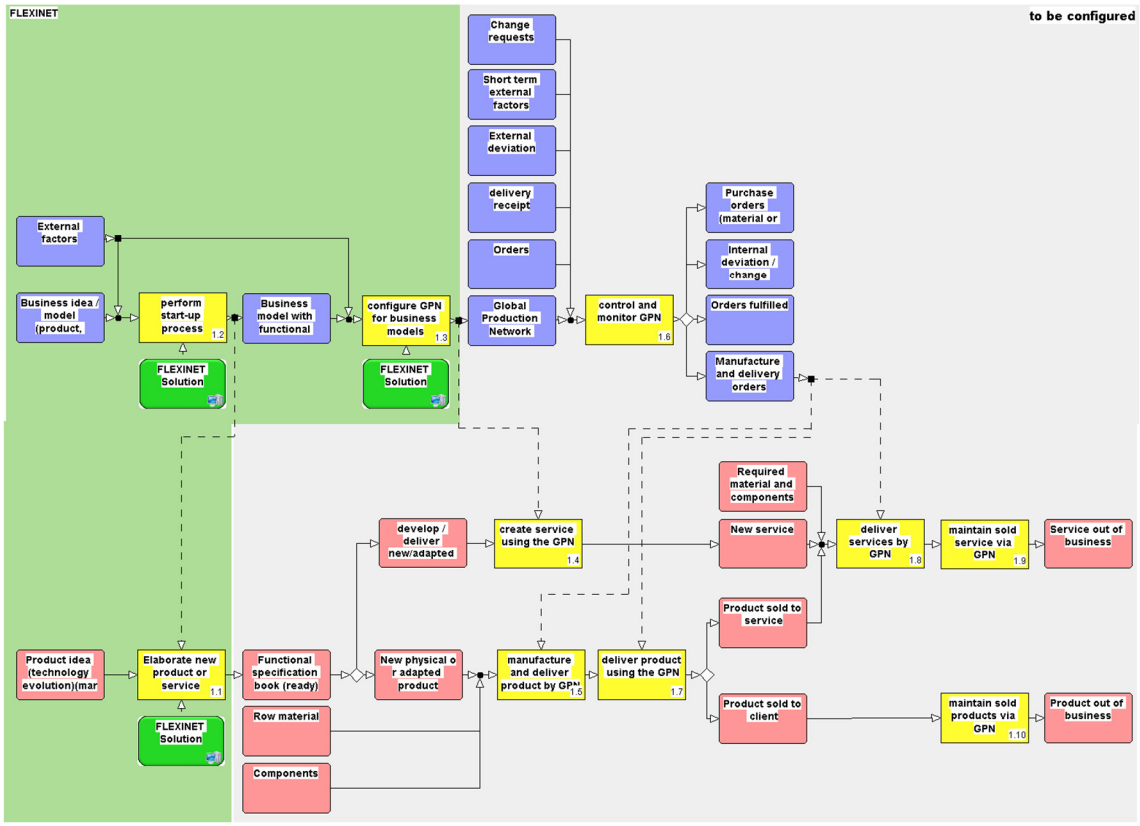
Highlights:

- End-user process models have been defined and their requirements analysed.
- A conceptual model for business model innovation, taking into account the external factors that impinge on business decisions, has been developed to enable "what-if" comparisons of costs, risks and configuration evaluations.
- Use cases for each of our three industrial sectors have been developed for managing external factors in a Global Production Network.
- The outline of the FLEXINET product-service production reference ontology is now defined.
- The initial FLEXINET architecture on which our solutions are being developed has been defined and initial software development is underway.

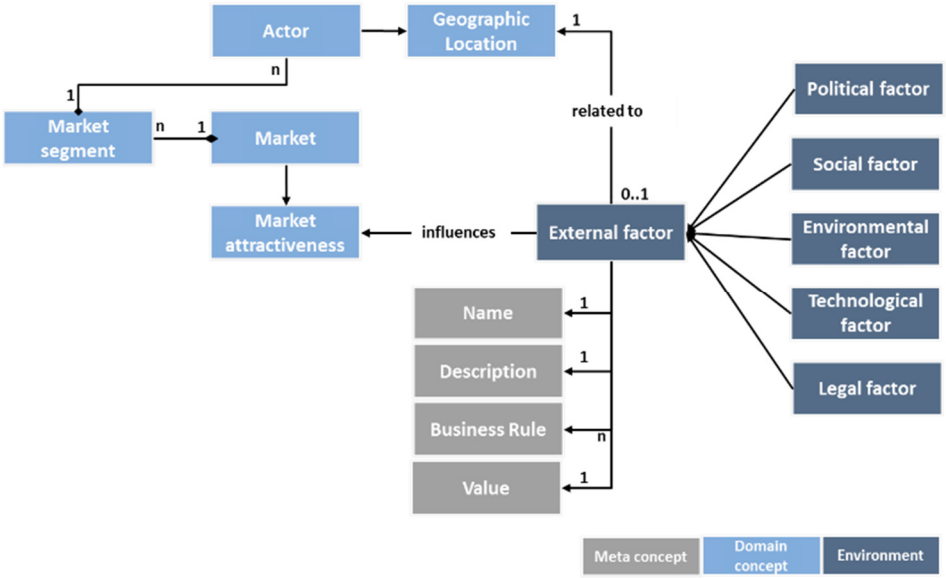
Progress:

The diverse nature of our end-user sectors and the complexity of the factors that impinge on their product-service business models and their global production network configuration decisions have led to us to spend considerable time in building a clear understanding of how best to develop FLEXINET services to support our end-user needs. We now have three well developed process models for each of our end-user companies, showing their "as-is" processes along with their requirements including environmental factors, and exemplar use cases for "to-be" models.

A generic view of business processes related to Global Production Network activities is illustrated in the figure below. This shows the relative positioning of FLEXINET solutions as being focused on the early decisions related to performing start-up processes, configuring GPNs for new business models and elaborating new product-services.

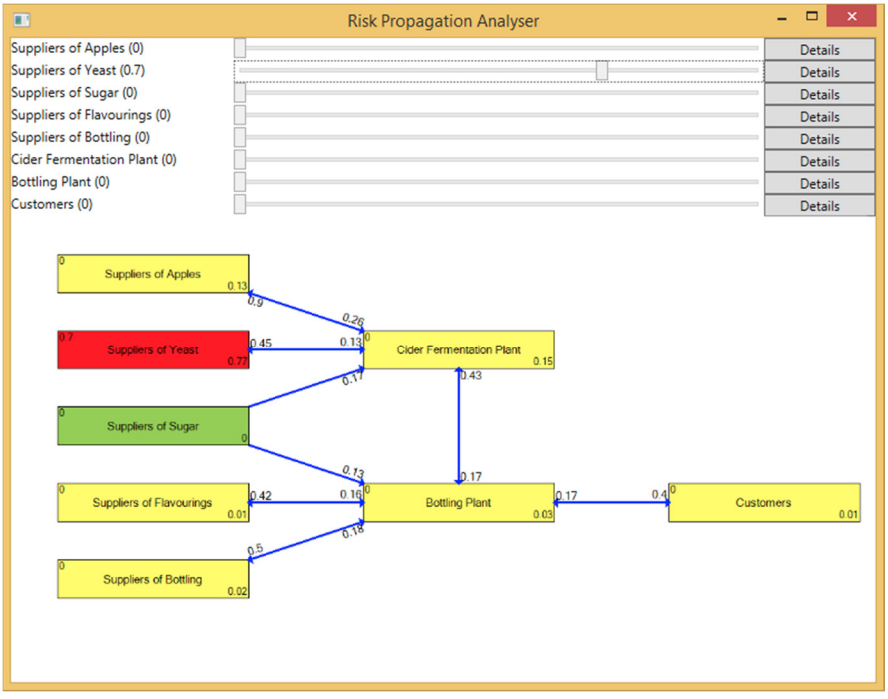


The FLEXINET conceptual model for business model innovation is focused on the strategic decisions during the start-up process and is strongly related to external factors that influence these decisions. The model consists of six main interrelated components which are environment, domain, risk, value creation, value and financial. Here environment means the environment for the business, which includes important external factors such as political, social, environmental (in the sense of climate), technological and legal. An excerpt of the model showing the influence of these external factors on other model concepts are illustrated in the figure above.

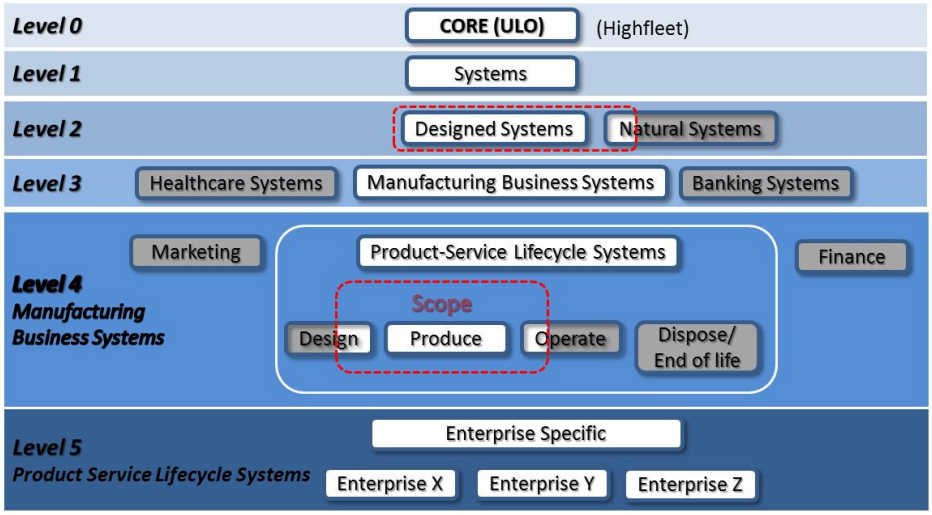


The risk component is also a significant consideration in FLEXINET and the risk model for strategic risk assessment of GPNs is based on inoperability models. Inoperability models deal with the risk in a network in terms of the inoperability that is caused to each individual node in a network directly and also as a result of the propagation of inoperability through the network. The risk model considers the dynamics and resilience of the network and allows users to define risk scenarios that include expected disruptive events, resulting in an expected inoperability and an estimated economic loss for different risk scenarios.

A simple prototype demonstration of a stand-alone risk assessment application has been produced based on a simple fictional cider production and bottling network. The illustration below presents an example of the relative output inoperabilities for a set of user defined perturbation values. The colour of each node indicates the level of inoperability with green for low, yellow for medium, orange for high, red for very high and purple for disastrous.



The underlying FLEXINET ontology aims to support the various external factors as well as the end-user GPN requirements through the provision of a standard reference ontology that can be configured to suit each end-user's needs. This will be built in a Common Logic based knowledge environment provided by our Highfleet partner. Significantly this knowledge environment provides not only the ontological base for FLEXINET but also the knowledge base in which specific use case facts can be populated and queried.

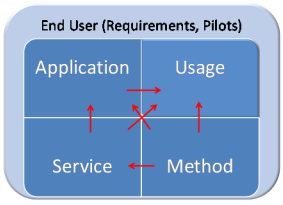


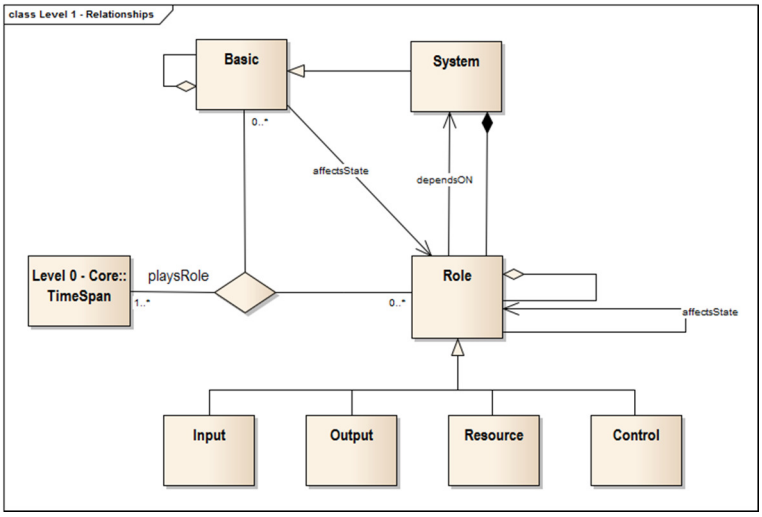
The FLEXINET premise is that for ease of construction, effective inter-operability and flexible re-use, enterprise ontologies must be built from a common base that utilises a common reference ontology wherever possible. To enable the management of complexity within the ontology and to facilitate re-use across domains the FLEXINET reference ontology is organised into five levels, as illustrated in the figure alongside. Each level inherits concepts from, and provides additional concepts to, the level above, the ontology becoming more domain specific with each level.

Five levels were found to be necessary to specialise FLEXINET concepts. Level 5 provides enterprise specific concepts for the product-service production domain for each of the three enterprises; above this level 4 provides concepts which would apply to any enterprise in the Product-Service Lifecycle Systems domain. The area generalising Product-Service Lifecycle Systems, covering more areas within an enterprise or network, was considered to be Manufacturing Business Systems (level 3). The super domain for level 3, encompassing all engineering and enterprise systems, was rationalised as Designed Systems (at level 2).

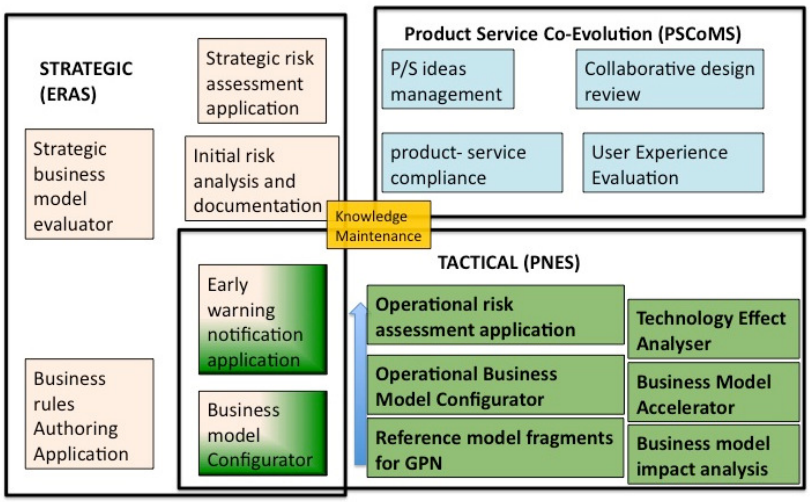
The domain above Designed Systems is Systems at level 1 which contains the few key concepts necessary to model any system which is the fundamental basis for any product-service production system. A system at level 1 transforms inputs into outputs and is defined as "a combination of interacting elements organised to achieve one or more stated purposes". Level 0 was required to capture core foundation ontological concepts. A lightweight UML version of the level 1 ontology is shown alongside.

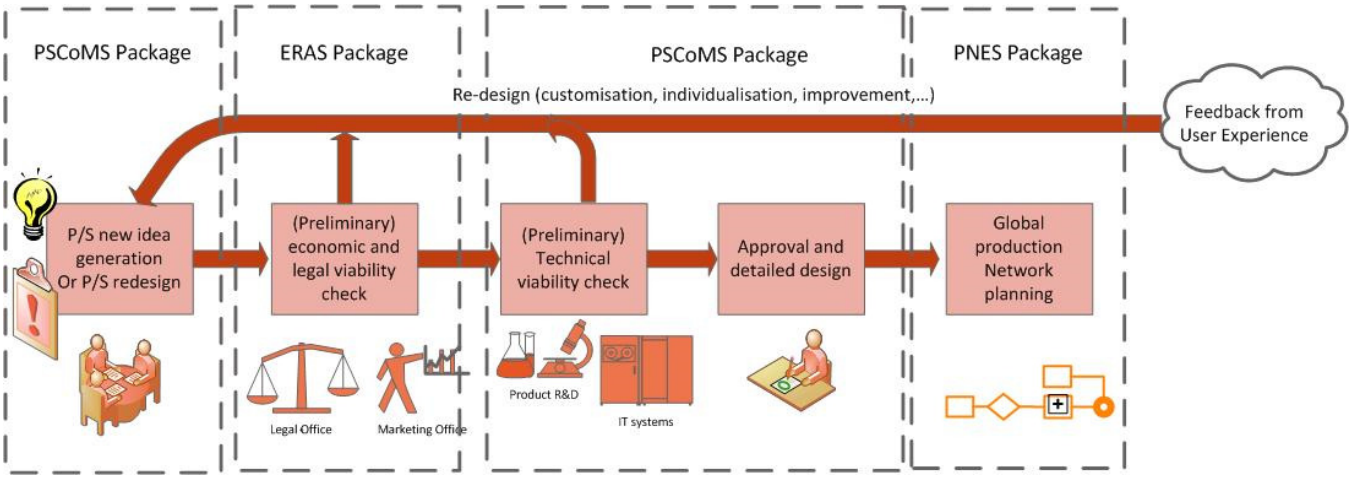
The FLEXINET general architecture that brings these multiple elements together has been defined in terms of Methods, Service, Applications and Usage, as illustrated, where: Methods consists of approaches, concepts, reference models, ontologies; Service is a support feature programmed in a (web) service which can be orchestrated to build bigger web-services which can in turn be directly applied by an end-user or integrated in larger applications; Application is a set of (web) services including interface services with a specific scope which supports the end-users in their work but is still independent from a specific area or company; Usage is the real use in the enterprise processes to realise specific workflows in the enterprise. Each of these aspects of the general architecture have been developed and most especially the relationships identified between them i.e. the relationships illustrated by the red arrows as illustrated.





The applications that are planned to be supported by the FLEXINET software services have been defined in relation to the Strategic, Tactical and Product-Service Co-evolution packages of services that FLEXINET will provide. These are illustrated as shown here with strategic applications focused on business model and risk evaluations, tactical applications focused on the configuration of the GPN and product-service co-evolution applications providing support to the management of the design of new product-services in the context of global production. This provides an important link between the software services that FLEXINET will provide to support the end-users via these applications. These applications and services will be used in different combinations by different end-users to suit their own specific needs. An example of this is illustrated below in terms of an abstract product-service ideation and design process utilising services from each of the three FLEXINET application packages.

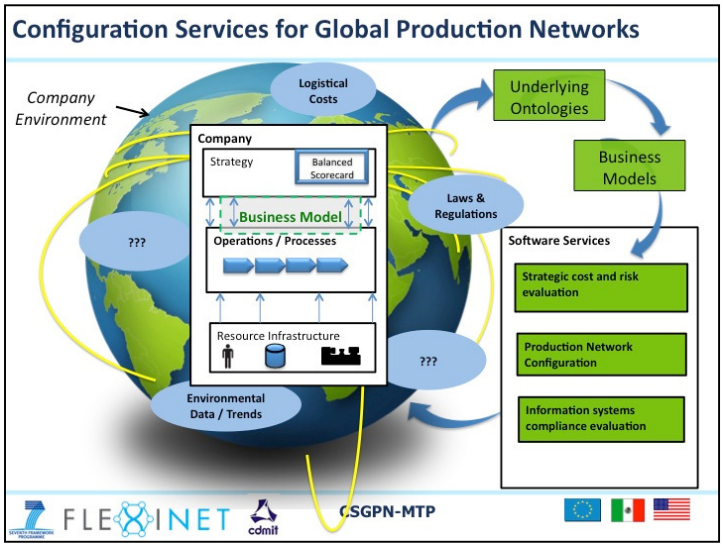




FLEXINET and Intelligent Manufacturing Systems (IMS)

By Bob Young

IMS is an industry-led, international business innovation and research and development (R&D) program established to develop the next generation of manufacturing and processing technologies through multi-lateral collaboration. FLEXINET partners have a project under IMS in collaboration with the Centre for Mechanical Design and Innovation Technologies at the National Autonomous University of Mexico (UNAM). This IMS Manufacturing Technology Platform entitled "Configuration Services for Global Production Networks (CSGPN-MTP)" runs alongside FLEXINET



from July 2013 to June 2016. The concept is very much in line with the FLEXINET concept as show in the figure, but with the added contribution from UNAM in the development of sustainability evaluation methods in the design of global products.

Our project has been presented at an IMS workshop in Barcelona in February 2014 and partners have also contributed to the prestigious IMS World Manufacturing Forum held in Milan in July 2014. It was especially pleasing to note that many of the keynote messages from the WMF were closely aligned with our research. Some examples are: "New ecosystems must be created to foster the development of critical supply networks"; "Manufacturing must add potential to the value chain through servitisation"; "Manufacturing must constantly adapt to the changing digitalisation levels of operations"; "need for global re-composable production systems"; "only through seamless support by software tools can the ever increasing complexity of industrial value-add processes be managed safely and professionally".

FLEXINET Partner Profile: Control 2K Limited

By Melissa O'Connor

General business Information

Based in South Wales, UK, the Waterton Technology Centre is located in the industrial town of Bridgend. In this centre, Control 2K Limited primarily offers Control Systems training to the manufacturing sector.

Our story begins when Managing Director, Gash Bhullar, initially established GSB Services in 1991 when winning a major contract with Ford Motor Company and in turn provided exclusive Electrical CAD systems training on EPLAN software to a wide range of businesses all around the UK.

In 1997, the Waterton Technology Centre was built in front of the Bridgend Ford Engine Plant. Supported by Ford Motor Company, it was to become a Centre of Manufacturing Excellence in partnership with the Welsh government. GSB Services was incorporated on the 5th February 1999 to become Control 2K Limited with Gash Bhullar, Simon Osborne and Denise Bowen as directors, to found a truly unique company.

15 years later and the business continues to expand its service range into future internet software and industrial application software with training remaining a core service to its customers. Control 2K is marketed as a 'Total Solutions Provider' with many of its services available through the trading portal SMECluster.com. This approach allows Control 2K to team up with other core businesses and truly provide a wide portfolio of services primarily for the SME Marketplace although larger companies are attracted by the cost and scope of the service offerings.

Business Details

Control 2K Ltd is largely focused on the manufacturing world with the majority of the core business supporting customers from the shop floor right through to the Director's office. For ease of management, the company divides its service range across three disciplines of training, design and systems.

Training

From Electrical, PLC, Health & Safety, Business & Management and Quality methods training courses; Control 2k asserts a diverse portfolio that is up-to-date with accurate and relevant courses to offer their customers what they need, when they need it. Many bespoke courses are developed by the highly skilled team of in-house trainers and subcontractors as Control 2K recognises the importance of training and continuous improvement. Control 2K offers extraordinary flexibility with the ability to deliver courses wherever and whenever the customer needs. Accommodating all business sizes, from a sole trader to a large organization, the customer

reach extends throughout the United Kingdom and includes names such as Rockwool, Panasonic, IQE Europe, Amazon and of course the Ford Motor Company.

Control 2K additionally delivers government schemes to improve the skill set of the unemployed. The ReAct scheme provides funding for training for those made redundant and Control 2K is proud to be involved in such initiatives to provide these individuals with quality training to secure them new employment.

Control 2K also plays an active part in the local youth community providing extra-curricular clubs for 15-17 years-olds who possess a keen interest in a career in engineering, with their own Facebook page.

Systems

With so many systems providers out in the marketplace such as Siemens, Rockwell Automation, Schneider Electric and many others, it's easy to see why so many organisations struggle to integrate their processes. Although larger systems providers can offer a complete solution, Control 2K has identified that often what is required is a more integrated approach linking systems from different providers together.

Control 2K offers a suite of products under its "Industreweb product suite" (www.industreweb.com) and offers data collection, data display, energy monitoring, supply chain integration and error proofing services. The Industreweb Suite provides a uniquely comprehensive set of tools that can be applied to a process, a single line, an entire plant or a complete global organisation. Industreweb links data collection devices (including Smart Objects) to a wide range of databases, allowing the data to be presented in the most appropriate way for its customers. It combines the data available from Industreweb Collect and HMI units and allows the data to be presented on a browser so that it is available anytime, anywhere and to the personnel that need it. Industreweb helps improve skills, reach production targets, monitor plant performance and so much more. Associated services allow improvements to increase efficiency through systems integration, network support, legacy system upgrade and product development.

Design

Control 2K has recognised the huge growth of the Internet and offers a complete solution to their clients web needs. The web design can include logo design, branding and printing whilst the web services offer e-commerce, content management and custom development. Control 2K offer ongoing web support and web promotion services including SEO, social media strategy and email marketing.

This sector of Control 2K is continuously undergoing re-design to refresh and captivate a greater audience and embraces a widespread clientele including the ever popular Hatton Boxing (www.hattonboxing.com) and the Welsh Automotive Forum (www.welshautomotiveforum) with the full portfolio available on its website.

European Funded projects

Control 2K has always recognised the importance of continuous improvement and research to develop its product range and look at future trends. Control 2K has been involved in several EU projects directly and via its membership of Technology Application Network (TANet), a unique network of co-operating Universities, Technology Centres and Key Business Partners providing the most comprehensive support for the SME Manufacturing sector for the whole of the UK. Control 2K continues to be engaged in the latest Horizon 2020 programmes.

Some of the previous projects include:

COSPACES - Collaborative Working Environments

(Project Identifier: IST-5-034245 - IST-2005-2.5.9)

The CoSpaces project addresses three scientific and technological objectives:

- Evaluate collaboration at individual, team and enterprise levels, and develop collaboration models emphasising applications of problem solving, creativity, participatory and knowledge

based design in innovative collaborative work environments;
- Create an innovative distributed software framework that will support easy creation of collaborative work environments for distributed knowledge workers and teams in collaborative design and engineering tasks;
- Validate the distributed software framework for creating different classes of collaborative working styles required for collaborative design and engineering in the Aerospace, Automotive and Construction sectors.

http://www.cospaces.org/

STASIS - Software and Services / ICT for Networked Business (FP6 Call 5 STREP [FP6-2004-IST-5])

SMEs often find it difficult to trade electronically due to differences in languages and terminologies, although currently complex, semantic techniques could potentially be used to address this problem. Consider the following statement: *"If I have information in my format, and it is integrated into my systems, I want to put minimal effort into mapping this into any format (standardised or not) to do electronic business with another party."* The project aims to allow SMEs to participate in the e-Economy by offering a coherent set of semantic applications. These will allow easy access to analyse, view, compare and distil semantics in an efficient environment to more effectively relate the business concepts of one organisation with those of another.
http://stasis.sunderland.ac.uk/

SYNERGY - ICT in Support of the Networked Enterprise
(Project Identifier: FP7 [ICT-2007-1-1.3])

Focusing on the sharing of knowledge within a Virtual Organisation (VO) to the mutual benefits of all VO partners, the SYNERGY project envisages the delivery of Collaborative Knowledge services through trusted third parties offering web-based, pay on demand services, exploitable through interoperability service utilities (ISUs). The overall aim of SYNERGY is to enhance support of the networked enterprise in the successful, timely creation of, and participation in collaborative VOs by providing an infrastructure and services to discover, capture, deliver and apply knowledge relevant to collaboration creation and operation.

ADVENTURE - Adaptive Virtual Enterprise Manufacturing Environment (FoF-ICT-2011.7.3)

ADaptive Virtual ENTerprise ManufacTURing Environment (Adventure) is Small or Medium-Scale Focused Research Project (STREP) funded by the European Seventh Framework Programme in Virtual Factories and Enterprises. The goal of the project is the creation of a framework that provides the tools to combine factories in a pluggable way to manufacture a particular product. This includes the creation of manufacturing processes, finding partners as well as real-time monitoring of the processes that are put into play.
http://www.fp7-adventure.eu/project/

CADIC - Cross-Organisational Assessment and Development of Intellectual Capital

With a growing need for SMEs in Europe to engage and collaborate in networks and clusters, the European research project Cross-Organisational Assessment and Development of Intellectual Capital (CADIC) will help a large number of SMEs to set up and strengthen own clusters and engage in existing and suitable clusters on a much easier and more cost-efficient basis. The CADIC Benchmarking system enables SMEs to compare their own intangible resource base with other organisations in order to find suitable partners to collaborate and manage value-adding IC flows in SME-clusters. The CADIC framework provides methods and tools to support IC-based collaboration between SMEs, including a training programme for the roles "Cluster Facilitation".
http://www.lml.lse.ac.uk/cadic/page1/page1.html

FITMAN – Manufacturing Use Case scenarios and early trials (Project Identifier: FP7 [FI.ICT-2011.1.8])

FITMAN is one the 5 Use Case Trials projects selected in the 2nd phase of the FI-PPP programme.

FITMAN provides the FI/PPP Core Platform with 11 industry-led use case trials which test and assess the

suitability, openness and flexibility of Enablers while contributing to the STEEP (social-technological-economical-environmental-political) sustainability of EU Manufacturing Industries.

The FITMAN use case trials belong to several manufacturing sectors such as automotive, aeronautics, white goods, furniture, textile/ clothing, LED lighting, plastic, construction, machinery for wood, and manufacturing assets management. *http://www.fitman-fi.eu/*

FLEXINET – Rapid Re-configuration of Global Production Networks *(Project Identifier: FP7 [FoF.NMP.2013-9])*

This project is investigating the feasibility of providing software services to support decision makers in configuration and especially rapid reconfiguration of Global Production Networks. With end-user partners from diverse manufacturing sectors … consumer white goods, industrial pumps, and food products.

FLEXINET is grounded in real user requirements for development of new product-services, and the production networks needed to deliver these competitively. FLEXINET will develop prototype applications to support user decision making, based on an architecture delivering services based on novel modelling methods to encompass all aspects of network configuration, including economic and risk assessment and management, built on a novel global production network ontology.
http://www.flexinet-fof.eu/Pages/FlexHome.aspx

Business Capacity

In a climate in which many companies are downsizing and narrowing their products and services, Control 2K continues to expand and grow with the same unique business ethos and values it started with in 1999. Employing a diverse skill set of 10-15 employees and many highly skilled sub-contractors the business remains resilient in today's economic climate and with its SMECluster partners can operate at a much higher capacity range.

The company remains financially stable and has the capacity for further business and project opportunities. This is partly due to its diversity and flexibility of its business model. Control 2K possesses a strong and diverse skill set in terms of qualifications, certifications and contacts which enables the company to react effectively to new opportunities that present whilst maintaining the current workload and executing all to the highest of standards.

Future Events

We list here a few events in the near future which may be of interest to readers:

IFIP Working Group 5.7 - International Conference on Advances in Production Management Systems (APMS2014), September 20-24, 2014, Corsica, France, http://www.apms-conference.org/index.php

PRO-VE'14 – 15th IFIP working conference on virtual enterprises, 6-8 October 2014, Amsterdam, Netherlands, http://www.pro-ve.org/

APMS 2014, Advances in Production Management Systems, 20-24th September 2014, Corsica, France, http://www.apms-conference.org/ (Paper accepted from FLEXINET on "Reference Ontologies to Support the Development of New Product-Service Lifecycle Systems".)

Joint Workshop on FLEXINET, MSEE, CAPP-4-SMES, FITMAN and Smarter FP7 Projects, 8th October 2014, Coventry, UK, http://www.coventry.ac.uk/smartermanufacturing (Includes session on FLEXINET.)

KMIS 2014 – 6th International conference on knowledge management and information sharing, 21-24 October 2014, Rome Italy, http://www.kmis.ic3k.org/ (Paper accepted from FLEXINET on "Reference Ontologies for Global Production Networks".)

Digital Food Factories of the Future, 29th October 2014, Valencia, Spain. (Organised by FLEXINET partner)

Note: if you are organising an event which may be of interest to the FLEXINET community, and would like us to include it in a future issue of this Newsletter, please contact the editor at the address below.

In the Next Newsletter Issue

The next FLEXINET Newsletter will be published in December 2014/January 2015, and planned content will include:

- FLEXINET project update.
- Configuration of Global Production Networks: a user perspective.

Contact Points

FLEXINET Co-ordinator	Prof. Bob Young Loughborough University	Email: r.i.young@lboro.ac.uk Telephone: +44 1509 227662
Newsletter Editor	Prof. Keith Popplewell Coventry University	Email: K.Popplewell@coventry.ac.uk Telephone: +44 7557 425324