

# Optimise

Special Edition  
July 2018

6 Optimising Software & Systems Engineering Projects with CLM

8 What is the Purpose of Verification & Validation?

10 Getting Certified - As a Systems Engineer are your capabilities recognised?

*Published by SyntheSys  
for the Software & Systems  
Engineering Community*





## Our new SyntheSys Systems Engineering LinkedIn Showcase page is now live

To see useful content and interesting updates from our Systems Engineering group, such as best practices in Collaborative Lifecycle Management, Requirements Management, and Verification and Validation, please follow our new page - <https://bit.ly/2JAC2Ls>

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# Letter from the MD

## Editorial

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**Summer 2018: Special Edition**

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## Spreading the Word

Dear colleagues and customers,

Greetings and a warm welcome to our special issue of OptimiseSE. We are very pleased to offer this industry magazine that presents a collection of articles about all aspects of Software and Systems Engineering from Requirements Management to Verification and Validation. We also include insights and updates from our Systems Engineering business group which we hope our colleagues and customers throughout the Software and Systems Engineering community, will find both interesting and useful.

For those of you who are new to us, SyntheSys is a tele-working company that has been operating from our head office in the UK since 1988. We provide services to government and industry on design, testing, delivery and maintenance of systems. Our consultancy and support services focus on the role that Systems Engineering plays within an organisation and how this can be developed and improved to achieve wider commercial objectives.

Within this first issue, you can expect to read best practices about how Collaborative Lifecycle Management (CLM) can optimise Software and Systems Engineering projects. You can meet our Systems Engineering trainer, Mark Williamson on Page 8, who also gives us his top tips for effective Verification and Validation.

We are continuing to expand our work into new markets, where our systems engineering training is enjoying particular success. Our clients now include professional UK engineering institutions and leading international motor manufacturers. We are also seeing success with our cloudbaSE product- a comprehensive suite of software to support the systems engineering processing that is accessed through the Cloud and can be rented on a monthly basis.

Finally, I welcome any feedback that you may have on our magazine, and encourage you to share any ideas about the types of articles you would like to see in future issues. We also welcome individuals and organisations to contribute articles to future publications. To contribute contact: [info@synthesys.co.uk](mailto:info@synthesys.co.uk)

Very best regards,  
John Hartas



**Dr J S Hartas Managing Director**

# Contents

## News & Industry Events

---

- 5 SyntheSys News  
The latest news from us
- 10 Training Schedule  
The outlook for 2018

## Features

---

- 8 Ask the Trainer  
Meet our Systems Engineering Business Group Manager and training guru, Mark Williamson
- 10 Getting Certified  
As a Systems Engineer are your capabilities recognised and does it matter?

## Technical Knowledge Bank

---

- 6 Optimising Software and Systems Engineering Projects with CLM

## Resources

---

- 12 Continuous Engineering for Dummies  
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# SyntheSys News

## SyntheSys on a High Having Attained IBM® Gold Business Partner Status

***SyntheSys is delighted to announce that we have attained IBM® Gold Business Partner status in the IBM Watson Internet of Things (IBM Watson IoT™) Continuous Engineering Competency. Achieving the Gold Status is no mean feat, and is something we are extremely proud of, having gone through a series of stages and assessments to demonstrate our expert knowledge of IBM® tools, how satisfied our IBM® licence customers are, and our ability to reach new customers.***

The Partner status was achieved following our restructure during 2017, which saw the formation of a new subsidiary, SyntheSys Direct. The group handles all licensing, transactional and technical matters connected with software distribution and is led by Managing Director, Su Ross.

Su comments “2017 has been a momentous year for us, so to come into the New Year on such a high note only adds to the positivity we have for 2018. For us, achieving Gold status has always been about ensuring we are consistently developing our business in a way which benefits and adds value to our customers. We feel there is no better ‘stamp of approval’ than IBM® awarding us with Gold status. We will continue to assist our customers to achieve success in their new and existing development projects by continuing to deliver flexible software and solution options, unrivalled consultancy services and unique training packages.”

Software licence sales is just one element of what we do here at SyntheSys, our offerings stretch much further than deployment of technology. We facilitate organisations to be able to develop and implement proven management and software and systems development strategies that cut capital investment costs related to Information Technology (IT) purchases. Our consultancy services are always job-specific and we offer advice on best-practice application of IBM Watson IoT™ tools to real-world development projects. Our support services include deployment, training, maintenance, and enhancements. We offer a service where we will work as part of a project team and complete integration, management and development work on behalf of customers.

We welcome discussions around your current and future development projects to understand where SyntheSys Direct can be of assistance and how we may be able to service your development software requirements.

Please contact Su on:  
+44 (0) 7484 915743 or visit the  
SyntheSys Direct website at:  
[www.synthesys-direct.co.uk](http://www.synthesys-direct.co.uk)



## SyntheSys Wins Contract for Transport for London

Transport for London (TfL) have been utilising Software as a Service (SaaS) for a number of years to support the requirements management of systems engineering projects on the transport network in London.

As specialists in IBM® Rational® DOORS® and with a cloudbaSE SaaS capability, SyntheSys tendered and won the contract to provide this service for the next operating period. SyntheSys provisioned the new SaaS environment and worked with TfL to mitigate conflicting network requirements and ensure access from multiple

domains. All current and relevant DOORS® data and users were migrated to the new service with minimal down time in the migration process.

The service also provides access to Microsoft Office applications in conjunction with the IBM® applications DOORS® and Rational® Publishing Engine.

The service is managed in compliance with a service level agreement. Help desk and administration support is provided.

# Optimising Software and Systems Engineering Projects with Collaborative Lifecycle Management (CLM)

***The engineering life cycle as applied to both software and systems projects has remained fairly stable for many years. This is because the concept and mechanisms are effective in the design and delivery of a product.***

## ***Why change something that works?***

The recent developments in Collaborative Lifecycle Management (CLM) do not aim to alter the life cycle as such, but to optimise and accelerate the development process within the framework of the life cycle. By making development and process data available to all relevant parties and adding workflow control, projects are accelerated and product quality improved.

## **Traditional Development**

With software or systems development in a manual environment, even within a strictly process controlled life cycle, there is an incredible waste of resource particularly in the review and approval stages.

A typical scenario is as follows: Requirements are raised by the user and a User Requirement Document (URD) produced in a generic Office document.

A meeting is then convened with stakeholders from all departments getting around a table and discussing the URD.

This may be approved or reworked before convening another meeting.

Once approved the development team can then work on the design and produce a Design Document (DD).



Another meeting is convened to discuss and approve or rework this document. The process continues with the test team producing manual test procedures and going through a formal approval process for this.

Does this sound familiar?

## **CLM**

There are considerable efficiencies to be made by implementing a solution where all stakeholders are able to dynamically comment on

project artefacts with the information held in a central repository. Approval can be made by authorised personnel in the system rather than gathering in a physical meeting.

Workflow control can be applied to support process and project planning with task tracking integrated to provide a single view of the project at all stages.

The economies and efficiencies made through not having to search for the current version of a document, and not having to hold regular or unscheduled meetings, are clear.

The quality of the product is also increased as there is engagement with stakeholders throughout the life cycle.

The test team can raise issues earlier in the life cycle where it is much more economical to address.

There are a number of vendors producing solutions that enable this collaborative approach. One of the most intuitive is the IBM® Rational® CLM solution built on the Jazz™ platform.

The IBM® Jazz™ platform provides the single repository of project related artefacts and crucially provides seamless traceability between all applications in the CLM solution.

In-Context Collaboration is the ability to share related information across the life cycle. The test team can link tests to requirements and the requirements team can easily see that all requirements have a corresponding test.

User Requirements are linked to Design Requirements and all discussions and comments related to the artefacts are visible in a single one stop dashboard and not lost in the traditional email system.

Real-time planning is possible because all the effort recording and progress is available from the repository at any given point.

Predictability is enhanced by the availability of real-time project data

and costs are reduced through continuous development. Global Configuration Management provides the capability to develop product variants as separate streams of development.

### Conclusion

The IBM Watson Internet of Things (IBM Watson IoT™) CLM solution eliminates the traditional element of isolated project stakeholders working independently to deliver a product.

Information sharing is key to effective collaboration, and combined with a framework for effective planning and workflow control, configurable to support the internal process flows for review and approval, project success is improved with reduced effort.

✓ **Maximise Product Value with In-Context Collaboration**

✓ **Accelerate Time to Delivery with Real-Time Planning**

✓ **Improve Quality with Life Cycle Traceability**

✓ **Achieve Predictability with Development Intelligence**

✓ **Reduce Costs with Continuous Improvement**

**SyntheSys Direct** serves a growing demand for software and systems development tools which manage and enhance your development programmes.



We supply world-class development tools and offer flexible and cost effective licensing options for leading IBM Watson Internet of Things (IBM Watson IoT™) tools. We then add value through our unique mentoring and consulting services.

We equip you to release the full value from your software investment by teaching you how to quickly and effectively adopt the software, mentor you on best practices and identify where tools can enhance your current development programmes.



Verification & Validation Tools



System Design & Development Tools



Requirements Management Tools



Project Management Tools



# Ask the Trainer

Mark Williamson

## What is the Purpose of Verification and Validation?

**Mark Williamson BSc (Hons), CSEP MINCOSE leads the Systems Engineering Business Group, responsible for the delivery and support of IBM Watson IoT™ solutions and associated services.**

Mark has an engineering background with 23 years' service in the Royal Air Force, providing both direct and support roles for airborne radar systems on a variety of aircraft. He also served on software teams in both test and software maintenance roles.

Since joining SyntheSys in 2005, he has gained significant experience with IBM® solutions for software and systems engineering, and is a certified IBM® Rational® DOORS® professional.

This experience enables Mark to support clients in identifying the ideal IBM® solutions that meet their engineering requirements, implementing the solution, and providing mentoring for the products. His systems engineering credentials have been recognised by the International Council for Systems Engineering via the Certified Systems Engineering Professional (INCOSE CSEP) certification in 2013. He is now delivering Systems Engineering and CSEP preparation training to future candidates.

### **Verification and Validation within the Systems Engineering Life Cycle**

Verification and Validation, as separate systems engineering processes are often confused with each other, depending on the functional domain. They are also frequently bundled together as 'testing'. In my role delivering systems engineering training and client consultancy, I am often asked 'What are your top tips for effective Verification and Validation?'

The first point of order is to establish the definition of each process. With a clear understanding of the purpose it is possible to address how to best achieve that purpose.

The ISO/IEC 15288:2015 as incorporated in the INCOSE Handbook V4.0, defines Verification as providing objective evidence that a system or system element fulfils its specified requirements and characteristics. Essentially, has the system or product been built right.

Validation however is defined as providing objective evidence that the services provided by a system when in use comply with stakeholders' requirements, achieving its intended use in its intended operational environment. Have we built the right product in line with the stakeholders need?

It may come as no surprise that both processes are dependent to a large degree on definition and management of requirements. How do we know if we have built the right product or to the right specification if these are not captured and accessible?

#### **Tip 1**

Engage with the system stakeholder(s) and capture the high-level stakeholder requirements in a database where they can be reviewed, revised and traced through the development life cycle effectively. As the life cycle progresses through system and sub-system requirements then traceability back to the stakeholder requirements is key to validating that the stakeholder vision is being realised. Start by validating requirements, continue by validating the engineering design and finally validate the complete system.

#### **Tip 2**

Requirements and design reviews at decision gates along the life cycle provide an opportunity to assess and validate if the correct product is being built. Don't be tempted to skip these to reduce effort and budget.

From a verification perspective, when defining requirements consider verification criteria at each level of requirement. This does not necessarily have to be a complete test case or script at this stage, but a scenario in which if the condition is met, confidence is high that the requirement has been met.

**Do not leave system verification to later in the life cycle, where rework can be costly.**

### Tip 3

There are several candidate verification actions that can be executed through the systems engineering project. These often parallel with the validation actions; verification of stakeholder and system requirements, verification of system architecture, verification of design and of the entire system. Ensure that the actions taken reflect the entire life cycle and are carried out incrementally as the project progresses.

### Tip 4

Dependencies between specifications, design and associated verification artefacts can be extensive on all but the smallest projects. Create and maintain a Requirements Verification and Traceability Matrix (RVTM). Completion of this will provide confidence for system acceptance.

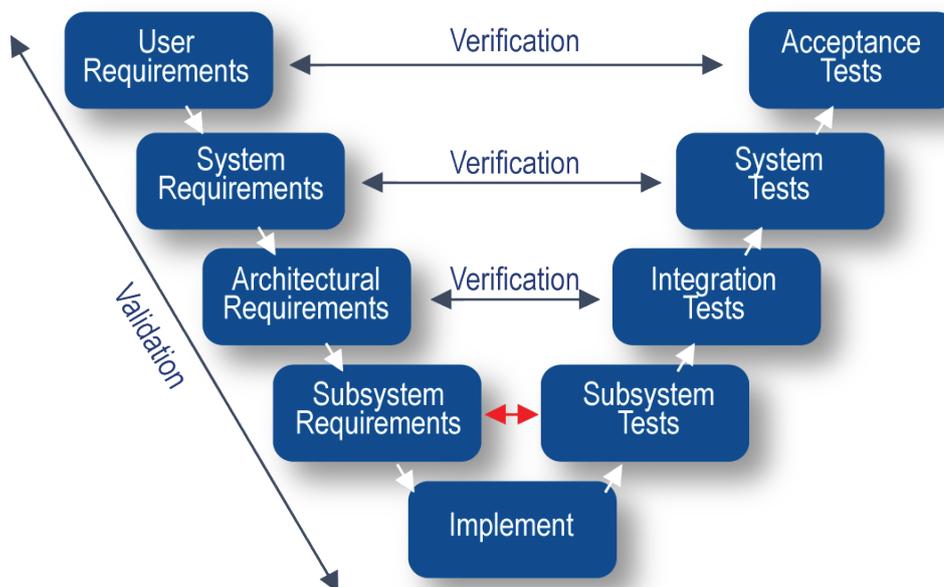
### Conclusion

From concept to delivery, the development of systems, and in extension, systems of systems are becoming ever more complex. With that complexity comes cost.

To mitigate the cost of re-work within the development, or worse - the reputation damage due to a product recall, it is critical that verification and validation are addressed at an appropriate level for the project in hand. It is also important that verification and validation is carried out in a coordinated manner with other technical processes such as Transition, Implementation, and Integration.

These processes have dependencies on, and are dependent on, other elements within the life cycle. Verification and Validation are key processes but should not be addressed in isolation.

Mark Williamson



# Getting Certified

As a Systems Engineer, are your capabilities recognised and does it matter?

**Certification within any industry sector is a sure-fire way to accelerate one's career, yet there are many Systems Engineers, Developers and Managers who do not tap into the benefits of certification.**

## Certification Options

There are a plethora of organisations and societies across IT and systems engineering domains that aim to support recognition of skills and ability for the benefit of the practitioner and for the employer, who typically funds the process.

The International Council for Systems Engineering (INCOSE) has a certification scheme that extends from Graduate's level, who often leave University with lots of theory but little engineering experience, through to Expert, with significant levels of experience and input to systems engineering principles.

Associate Systems Engineering Professional (ASEP) and Certified Systems Engineering Professional (CSEP) both require study of the INCOSE Systems Engineering Handbook and passing of a challenging examination. The Expert Systems Engineering Professional (ESEP) is an interview-based assessment.

## Benefits of Certification

So how do the advantages of CSEP accreditation benefit applicants?

Certification adds considerable value to you as a Systems Engineer because the accreditation formally recognises your systems engineering technical capability. The certification provides a portable Systems Engineering qualification which is recognised across industry. Finally, the certification demonstrates your commitment to continuing professional development. In addition, the certification adds value to your organisation in many different ways.

## Multi-Level Base Credentials

The base ASEP, CSEP and ESEP credentials cover the breadth of systems engineering at increasing levels of leadership, accomplishments and experience



Certified Systems Engineers can be a big selling point and a discriminator for your company's proposals. It can be used as part of the hiring and promotion process and it encourages employee participation in continuing education. It is also a useful tool for promoting professional competence and provides an independent internal and external assessment.

**Whilst working in competitive, growing markets it is not only imperative that individuals continually develop knowledge via certification, but crucial that organisations invest in employee development.**

**Certification programmes not only benefit individuals, but also organisations. Programmes such as the ones provided by INCOSE ensure that the overall Systems and Software Development environment remains innovative and progressive.**

## Training Schedule 2018

Our Certified Systems Engineering Professional (CSEP) course is available on the following dates:

**10 -14 September**

**10 -14 December**

Our Systems Engineering Foundation course is available on the following date:

**10 -11 October**

Contact us at: [training.sys-eng@synthesys.co.uk](mailto:training.sys-eng@synthesys.co.uk) - or phone: +44 (0) 1947 821464 for details



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## SyntheSys Systems Engineering Services

Here at SyntheSys, we provide systems engineering services, products and training to government and industry, to establish efficient and economic processes that, in turn, enable them to deliver the highest quality products to their respective customers and end-users.

✓ Systems Engineering  
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Training & Mentoring

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or Callout  
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# Free Resource



## Continuous Engineering for Dummies

Courtesy of IBM®, we are able to offer readers this foundation level publication which aims to explore what is meant by 'Continuous Engineering' and the merits of continuously improving complex product designs. The useful E-BOOK shares methods for anticipating and responding to markets and clients and suggests ways of getting the most out of your engineering resources.

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