C.5. Digital Transformations

Digital Transformations. This stream invites submissions from all domains that explore efforts to transform systems engineering towards digital engineering, including the adoption and/or adaptation of digital practices, methods, applications & tools; the digitalisation of existing products/systems/solutions, and; emergent digital products/systems/solutions & corresponding challenges (eg safety assurance, end user skills, etc)

Lead: Kerry Lunney, Thomas Manley
Domains: All domains welcome

Submissions Summary:

1. Modular image recognition on the edge and digital twin: A case study in accessibility auditing (Full Paper)
2. Is the Journey to the End of the Rainbow a Minimal Viable Capability (MVC)? (Paperless Presentations)
3. Practical Approach to Generation Site Using Digital Transformation Technology for Data Driven Monitoring (Full Paper)
4. Digital Engineering Illustrated: Moving beyond Lofty Promises and Acronym Soup to Understanding and Value (Tutorials)
5. The A to Z for Implementing a Digital Transformation on a Systems Project (Paperless Presentations)
6. Making requirements accessible, when you are tempted by spreadsheets but need an application. (Paperless Presentations)
7. Pathway to Success - Digital Engineering in Defence (Paperless Presentations)
8. Embracing AI in Digital Engineering: A Holistic Approach to Managing Work, Workforce and Workplace (Panels and Workshops)

20901 Modular image recognition on the edge and digital twin: A case study in accessibility auditing

Nick Pickering 1, Tim Young 2, Thomas Carnahan 3, University of Waikato, Hamilton, Waikato, New Zealand, Smart Access, Hamilton, Waikato, New Zealand, Pollin8 Ltd, Cambridge, Waikato, New Zealand

Keywords: Digital Twin,Image Recognition,System of Systems,Smart Cities,Accessibility auditing

Type: Full Paper
Stream submitted: B.6. Systems of Systems Engineering Applications

Currently, disabled people and older people cannotplan a safe journeyaround ourbuilt environment and transport hubs.Smart Access has a solution based on accessibility audits covering 38 features. The solution, available online or via mobile, provides geospatial information thatsupportssound decision-making for commuters andcouncil planners. The manual data capture of featuresempowers people with impairments toengage moreinthe community but is labour-intensive and not scalable. Custom development of high-accuracynavigation and image recognition systemson the edgearenot typically financially viablein manysocial and environmental applications. This is especially true in scenarios where system utilisation is low, supply chain costsfor highavailability are high and the recruitment and retention of a widespectrumof human capability ischallenging. This paper undertakes thedesign, implementation and evaluation ofmodular edge units that can perform common high-accuracy navigation, sensor fused with image recognition on the edge, communicated over a common data standard into a reusable digital twin for affordabilityof research, development and operation. The resultsdemonstrate the benefit ofa modularHardware As A Service (HaaS)andSoftware As A Service (SaaS) modelto break down the traditional barriers associated withthe adoption of industry 4.0 solutions, with thecapabilitybeing leveraged acrossnumerousapplications ranging from traffic counting and on-truck recycling audits in smart cities, to autonomousground vehicles, human-assisted robotic harvesting and fruit condition monitoring in horticulture. Future work will focusonexpanding the data capture to enhance the reliability of neural network artificial intelligence models for existing use case validation, expand use cases across other domains andperformSystem of Systems modelling to validate the financial viability, incorporating the life cycle costassociated withhuman capability, spares holding, availability andutilisation to optimise emergent properties.

20724 Is the Journey to the End of the Rainbow a Minimal Viable Capability (MVC)?

Kerry Lunney 1, Thales Australia, Sydney, NSW, Australia

Keywords: minimal viable capability (MVC),digital transformation,agile,systems of systems (SoS),complexity

Type: Paperless Presentations
Stream submitted: C.3. Capability Engineering for Industry 4.0

Overview - With the growing interwoven dynamics of the world, speed to deployment is becoming more crucial. However, we often strive to deliver a perfect solution, sometimes warranted, sometimes not, potentially leading to cost and/or schedule overruns, and the introduction, or the appearance of poor quality systems at initial deployment. Adopting a Minimal Viable Capability (MVC) addresses this challenge, or does it? To understand the complexities for realising a successful MVC a number of interacting factors will be presented. Context - A MVC approach supports the delivery of needed capability as soon as possible with further capabilities being incrementally incorporated. It is not however just about "descoping a project". MVC requires a lot of change and flexibility both in acquisition and sustainment. Development lifecycles, contracting models, operational scenarios, mission threads, agility, to name a few, all require to be modified under MVC. These impacts are often not understood resulting in sub-optimum MVC deliveries. Purpose - To avoid/minimise the same problems preventing successful delivery of needed capability under a MVC, a holistic view must be taken. From this viewpoint,impacts of delivering MVCon development lifecycles, checkpoints, tailoring of practices, framework and tools, and technology evolutions must be addressed. Likewise, the importance of model-based engineering approaches increases. Underpinning these factors is being agile, particularly if speed to deployment is critical. This presentation provides the necessaryguidance to deliver a MVC. Approach - A combination of government-industry discussions, workshops, and industry experience with real life examples are used to illustrate this topic. The adaptations identified in this presentation can be readily applied to both the acquirer and supplier. Insights - The takeaways for participants are 1) understanding the value of MVC; 2) recognising the blockers; 3) steps needed to successfully adopt a MVC approach.

20783 Practical Approach to Generation Site Using Digital Transformation Technology for Data Driven Monitoring

Ahmad Taufiq AT Abdullah Thani 1, Origin Energy, Spring Mountain, QLD, Australia

Keywords: IIOT,Digital Transformation,Smart Grid,SCADA

Type: Full Paper
Stream submitted: C.5. Digital Transformations

The increase in available digital transformation technologies and applications has introduced new methods for intelligent asset monitoring and real-time data collection. This has led to digitalization in energy industries using Industrial Internet of Things (IIoT) which will improve intelligent asset monitoring through real-time models with more emphasis on communications, modern protocols, and Artificial intelligence (AI) as the underlying requirements. Traditionally, generation sites have been slow adopters in implementing digital transformation technologies. Thispresentation will look at how a traditional generation site has attempted to use digital transformation technology for data driven monitoring. The presentation will also look at how the generation site has addressed different issues associated with adopting digital transformation technologies, specifically evaluation criteria for IoT devices, interoperability and different architectures implemented on site. Thepresentation will alsoshow a completed end to end example of a practical install on a generation site.

21216 Digital Engineering Illustrated: Moving beyond Lofty Promises and Acronym Soup to Understanding and Value

David Long 1, Blue Holon, Blacksburg, VIRGINIA, United States

Keywords: Digital Engineering,MBSE,Digital Thread,Digital Twin

Type: Tutorials
Stream submitted: C.5. Digital Transformations

Format The tutorial is conducted in classroom format using PowerPoint slides with discussion throughout to improve learning and comprehension. Overview This tutorial explains and illustrates the foundations, concepts, and potential of digital engineering. We will move beyond the marketing, myth, and misconception to a practical understanding of what digital transformation means for systems engineering, the fundamentals we need to know, and the value we expect to achieve. After establishing the case for change and the opportunity represented by the power of digital, we will explore a connected set of models descriptive and analytic; mission, system, and detailed design to communicate the concepts, opportunities, and challenges of digital engineering. In the process, we will highlight the myriad of concepts (model-based systems engineering, digital thread, digital twin, digital engineering), how they interrelate, and what they mean for practitioners, their organizations, and the greater practice of engineering. Audience Participants should have a foundational understanding of systems engineering concepts. A basic understanding of MBSE concepts is beneficial but not required. Line-up David Long.

20723 The A to Z for Implementing a Digital Transformation on a Systems Project

Kerry Lunney 1, Stephane Bonnet 2, Thales Australia, Sydney, NSW, Australia Thales Avionics, Bordeaux, France

Keywords: digital transformation,digital engineering,agile,systems thinking,capability

Type: Paperless Presentations
Stream submitted: C.5. Digital Transformations

Overview - Digital Transformations (DT) continue to change our products, systems, services, and the way we work. Will we be ready for this future? To tackle the challenges we will present the "A to Z" guide for DT, including the digitalisation of SE practices. Context - In a global context, we will be moving towards model-based approaches, knowledge sharing will be exponentially increasing, digital technologies such as AI, autonomy and digital twinning will be incorporated into the various engineering disciplines as they better evolve to adjust to a dynamic world with increasing complexity. Collaborations and interactions will be paramount, largely through the management of the digital thread, enabled through the tools and environments of the digital ecosystem. To do this, the enterprise workforce will need to be diverse, agile, efficient, possibly distributed, and more strongly recognise knowledge as an asset. This level of transformation can be confusing, difficult to identify and even harder to implement. Purpose - To navigate a DT, guidance is required from behaviour adoption, technology evolutions,tonew/tailored practices and tools, balancing the need to change with the constraints of the enterprise. This guidance must be tailorable to apply to different system projects. Approach - A combination of workshops, and industry experience across multiple domains and countries with real life examples are used to illustrate this topic. Many of the guidance points will resonate with participants whether in industry, academia or government, as we all undertake a DT at some level in our enterprises. Insights - The takeaways for participants are 1) understanding of what is involved in a DT; 2) A to Z guide on DT, that is completely tailorable, to add to an engineer's toolkit; 3) mapping examples of the guide to 30 common SE practices.

21209 Making requirements accessible, when you are tempted by spreadsheets but need an application.

Piotr PP Pytka 1, Andrew AP Pitsiakkos 1, KBR, Melbourne, VICTORIA, Australia

Keywords: Requirements Management Application,Verification and Validation automation,API based communication,Requirements Data Exchange Methodologies

Type: Paperless Presentations
Stream submitted: C.5. Digital Transformations

Systems Engineers devote significant time to requirements management, which can detract attention from the valuable activity of requirements analysis. The issue stems from repetitive data exchange activity which requires systems engineers familiar with using requirements management tools such as IBMs DOORS NG to produce exports of requirements into excel for discipline engineers to action. This often results in reporting of stale data, and misinformation when managing requirements using spreadsheets. In order to solve this problem KBR looked at ways of digitally transforming the way discipline engineers interact with requirements managed by systems engineers. Learning to use specialist requirements management tools can be time consuming and an entry barrier for discipline engineers deployed onto Projects. We found that users were comfortable with the simplicity of spreadsheets but had no way of pushing verification and validation evidence directly into the database without knowing how to use the specialist tool. KBR have taken the simplicity of spreadsheets to present pertinent requirements in a format familiar to discipline engineers using a dedicated web application as an exchange to push verification and validation evidence data directly into the requirements management tool. This is achieved using IBM DOORS NG RESTful application programming interface (API) which is based on the Open Services for Lifecycle Collaboration (OSLC) standards. Integration proved to be quite challenging, not only in designing an intuitive user interface which streamlines efficiency and supports real time data interactions, but also how to make the application accessible by external users, as well as preserving user authoring permissions for historical audit purposes. The important lesson here is that digital transformation does not have to be complex, its the large volume simple repetitive tasks that we should be aiming to automate first, leveraging simple solutions for maximum gain, before embarking on elaborate complex automations.

21289 Pathway to Success - Digital Engineering in Defence

Asha Mathew 1, Capability Acquisition and Sustainment Group (CASG), Director, Directorate of Digital Transformation and Systems, Adelaide, SA, Australia

Keywords: Digital Transformation,Digital Engineering,Defence,Digital Engineering Strategy

Type: Paperless Presentations
Stream submitted: C.5. Digital Transformations

Placeholder for a potential talk on the "mission computing subsystem of the Block 2 Boxer, with its DDS approach, and how they simulate their digital solution in their software development environment".

21180 Embracing AI in Digital Engineering: A Holistic Approach to Managing Work, Workforce and Workplace

Ren S King 1, Project Performance International, Lilydale, VIC, Australia

Keywords: fuse,future of systems engineering,AI,MBSE

Type: Panels and Workshops
Stream submitted: D. Other

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