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### When

Wednesday March 21<sup>st</sup> 2018 from 11am-12pm EDT (3pm – 4pm UTC)

### Topic

A Conceptual Model of Systems Engineering

### Speakers

Dr Swaminathan Natarajan

Dr Anand Kumar

Subrojyoti Roy Chaudhuri



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## Abstract

The Systems Science Working Group has started a new project to devise a conceptual model of systems that is based on key principles and concepts from systems science. This webinar presents an early draft of such a conceptual model. While systems engineering has strong empirical guidance in the form of practices, methods and standards, it is lacking theoretical foundation in comparison to other engineering disciplines. One approach to address this problem is based on the simple insight that solutions in typical engineering disciplines depend on knowledge in their own discipline, but creating a good systems engineering solution depends on bringing together knowledge from many disciplines. As a result, to create theoretical foundations for systems engineering, it is necessary to inquire into how knowledge domains come together in systems.

This inquiry led to a distinction between domains that carry knowledge about types of wholes vs. domains that carry knowledge about aspects. Theoretical knowledge is built up in aspect domains, while type domains carry knowledge about how various aspects come together in a whole, and how wholes relate to each other. In such a case, Systems engineering can be looked at in terms of four worlds: real, system models, types knowledge and aspects knowledge worlds. Creating an engineering solution involves using type world knowledge to synthesize various aspect solutions, using systems knowledge to ensure compositionality, implementing the solution in real world, and closing gaps between model and reality.

We are in the early stages of this exploration, but would appreciate anyone who would like to join us in this journey. Please contact us for more information.

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Subhrojyoti Roy Chaudhuri, [subhrojyoti.c@tcs.com](mailto:subhrojyoti.c@tcs.com)

## Biography

Dr Swaminathan Natarajan (Swami) is a Chief Scientist with Tata Consultancy Services Research and has more than 30 years of Industrial experience in Systems architecture, Software architecture and Engineering. He obtained his B.Tech from IIT Madras in 1983 and Ph.D. in computer science from the University of Illinois in 1989. His background includes teaching software engineering at Texas A&M University and Rochester Institute of Technology, as well as applied research positions with Xerox and Motorola India. His work with TCS has focused on systems research, engineering and architecture, including a role as control systems architect for the SKA radio telescope project. He is the editor of ISO 30103, a systems engineering standard on product quality achievement and co-chair of the INCOSE systems science working group.

Dr Anand Kumar is a Senior Scientist with TCS Research and has more than 21 years of Industrial experience in Systems architecture, Software architecture and engineering. Anand is a member of the ISO JTC1 SC7 WG42 working group on architecture. He is the co-editor of ISO/IEC/IEEE 42020 standard on architecture processes and ISO/IEC/IEEE 42030 standard on architecture evaluation. Anand is the co-chair of INCOSE Architecture Working group, chair for INCOSE India

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Architecture working group and ISSS digital product-service systems working group. Anand has authored more than 40 papers in leading international journals and conferences. Anand has been granted 3 patents by US PTO and 2 patents by India PTO.

Subrojyoti Roy Chaudhuri (Subhro) is a Senior Scientist with TCS research and has around 20 years of experience. He has been instrumental in the research, design and development of many key capabilities produced by TCS such as MasterCraft and Ignio. Subhro represented the Indian team to participate and contribute in design and development of multiple international mega science projects such as the ITER and the Square Kilometer Array (SKA). He is a member of Telescope Manager (TM), an International Consortium and provider of one of the key capabilities of SKA. He currently leads the Telescope Management work package on behalf of the SKA TM consortium and is responsible for the overall design of the monitoring and control solution for SKA. His current area of research entails developing the architecture for the next generation of enabling platforms that would automate the realization of domain specific solutions utilizing robotics and IoT.

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Regards,

Andy Pickard  
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