International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 4 Issue 12, December-2015

An Investigative Study of Systems Engineering Concepts and Traits

Tanushree Sharma[1], Mamta Sukpal Surve[2], Dr. Madhu Sharma[3]

[1]M.Tech. Scholar, Global Institute of Technology, Jaipur
[2]Assoc. Prof., Global Institute of Technology, Jaipur
[3]Assoc. Prof., S.S. Jain Subodh P.G. (Autonomous) College, Jaipur

ABSTRACT

It is clear that our everyday lifestyle is driven by the technologies and technology enabled systems. Most of our every day functionality is reliant on large scale man made systems that offer useful technological capabilities. The arrival of these systems has created the need for systems thinking and thus gives a way towards systems engineering. Systems Engineering is concerned with creating and executing an interdisciplinary process to ensure that the customer and stakeholder needs are satisfied in a high quality, trustworthy, cost efficient and schedule compliant manner throughout a system's entire life cycle. In this paper, System Engineering and its relevant concepts has been presented with its importance from industry and academia viewpoint.

Keywords: Systems Engineering, Software Engineering, Testing, Size Drivers, Cost Drivers, Cost Estimation.

I. INTRODUCTION

Systems Engineering advancement concentrates on defining client's needs and requirements relevant to the functionality, usually at the early stages in the development cycle, documentation of requirements, then designing and then system verification and validation along with the consideration of the entire problem's Operations, Cost & Schedule, Performance evaluation, Onsite Training, Support Servicing, Testing and other activities relevant to the implementation or system manufacturing [1][6]. Systems engineering incorporates all the disciplines and groups into a team endeavor forming an ordered development procedure that begins from concept to production and then production to operation.

In this paper, Section II depicts fundamentals of System Engineering, Section III presents a basic difference between software and systems engineering, Section IV depicts the scope of system engineering in industry and academia and Section V concludes the paper.

II. FUNDAMENTALS OF SYSTEMS ENGINEERING

Systems engineering is a systematic, disciplined way for design, understanding, technical management, operations, and implementation of a system. It is an interdisciplinary field of engineering that focuses on how to design and manage systems especially, complex engineering systems through their life cycle.

Systems engineering is concerned with creation and execution of an interdisciplinary process to make sure that the customer and stakeholder needs are satisfied in a high quality, cost effective and schedule compliant manner throughout the system's life cycle. Systems engineering is a multi-interdisciplinary procedure to enable the realization of successful systems. It mainly focuses on defining customer requirements and the needed functionality in the early phases of the development cycle with a confined documentation stating requirements, and then proceeding with design production and system validation along with the consideration of the absolute problem, keeping its value based approach with them [5].

Systems engineering engages the development of software components as in software engineering, but systems engineering also includes the specification, building, maintenance and support to the required technical infrastructure like building, testing of the production environments that is used to convey Software as a Service, and the systems or software or hardware used to supervise the performance of the implemented software solution system.

(A) SYSTEM ENGINEERING TASKS

Systems engineering tasks depicted by Raytheon's are as shown in figure 1.

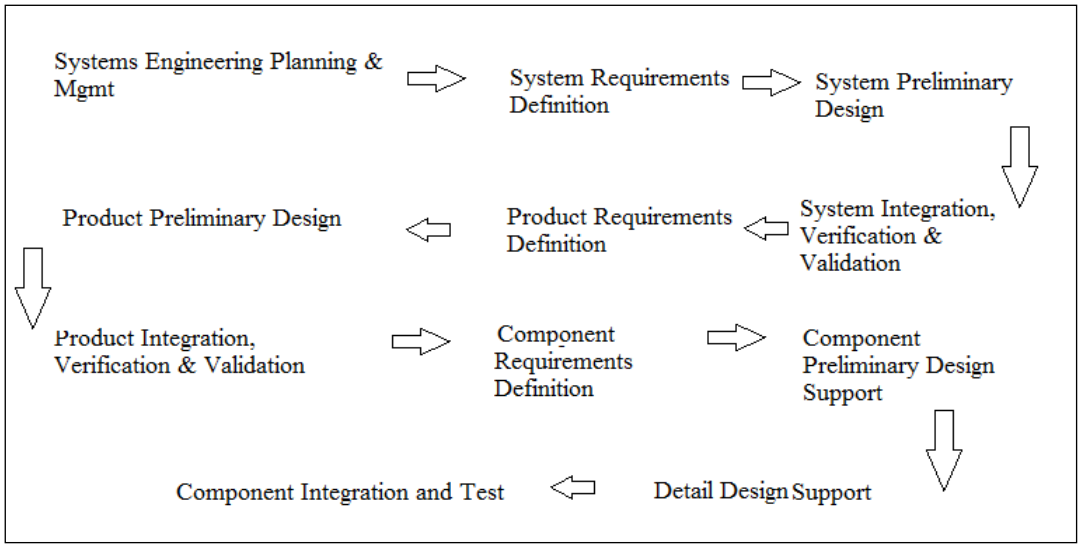

Figure 1: System Engineering Tasks

Here, each System Engineering task consists of several levels of sub tasks.

(B) SYSTEM ENGINEERING COST ESTIMATION

Cost estimation or approximation for system engineering project is a necessary activity for an advance vision for the budget decisions. Since effort estimation for a system development directly contribute to the cost estimation of any candidate system under development proposal, it is good to find or predict the effort requirement for the same. COCOMO II, SLIM, SEER-SEM, SEER-H, PRICE-S, PRICE-H, RSERFT etc., are few of the cost models with system engineering components that have been proposed and implemented in the practical world [2][3][4].

III. SOFTWARE ENGINEERING VERSUS SYSTEM ENGINEERING

Engineering is the discipline that deals with the implementation of science, mathematics and other types of acquaintance to design and develop products and services that advances the value of life. Engineering can be broken down in to several sub disciplines, which focuses on numerous domains using diverse types of technologies. Software Engineering and Systems Engineering are two sub disciplines of such technologies. Software Engineering involves with design & development of software of the utmost quality, while Systems Engineering is the sub discipline of engineering, which involves the overall administration and supervision of engineering projects during their entire life cycle.

The difference between Software and system engineering is not easily comprehensible. System Engineering is that the sub discipline of engineering that pacts with the organization of engineering projects throughout their life cycle, with an additional emphasis on physical aspects. It deals with logistics, team synchronization, automatic machinery management, work processes and analogous tools. Very often, System Engineering overlaps with the ideas of industrial or commercial engineering, control engineering, structure and project management and software engineering. Thus, System Engineering is known as associate degree knowledge domain engineering field. System Engineer might perform system planning, developing necessities, validating necessities, system testing and different engineering studies.

It has been identified by researchers that, there is a good abstract relationship between software engineering and Systems Engineering concepts, because of the well-built linkages in their products and processes. Despite the well-built coupling between software and systems they remain very dissimilar in activities in terms of maturity, logical advancement and influences regarding cost.

IV. SYSTEMS ENGINEERING SCOPE IN EDUCATION AND INDUSTRY

Systems engineering directs the requirement for specialized engineering disciplines to be able to work jointly. They focus on making diverse components; produced by specialty engineers, work as a cohesive and competent system. Systems engineers also repair and advances upon existing systems as new technologies.

A degree in Systems Engineering offers the necessary skills needed to act together with professionals engaged in an expansive field of disciplines. Systems engineers must sense holistically, taking into account each aspect of a project, including the costs, environmental apprehensions, timeframes, and life anticipation of equipment.

The demand for systems engineers is ascending, as all kinds of systems become increasingly complex and companies' requirements can't be met by engineers focusing in definite discipline, such as electronics, manufacturing, or computers. The gradually increasing global financial system also has stimulated the want for systems engineers, as foreign and domestic platforms are often unsuited [5].

Few examples of the roles or responsibilities, systems engineers might play or bear in different industries are as a:

- Petroleum Systems Engineers
- Industrial Systems Engineers
- Environmental Systems Engineers
- Software Systems Engineers
- Electronic Systems Engineers

V. CONCLUSION

Here, it could be concluded that, Systems Engineering concept has vast application in terms of any project development as well as from career prospective. It has been configured that Systems Engineering incorporates all the disciplines and groups into a team endeavor forming an ordered development procedure that begins from concept to production and then production to operation.

REFERENCES

[1]. De Lucia A., Pompella E., Stefanucci S. (2003), "Assessing the maintenance processes of a software organization: an empirical analysis of a large industrial project", The Journal of Systems and Software 65 (2), 87–103.
[2]. Gerlich R., and Denskat U. (1994), "A Cost Estimation Model for Maintenance and High Reuse, Proceedings", ESCOM 1994, Ivrea, Italy.
[3]. Kemerer, C. (1987). "An Empirical Validation of Software Cost Estimation Models." Communications of the ACM Vol. 30(No. 5): pp. 416-429.
[4]. Chulani, S., Boehm, B. W. and Steece, B. (1999). "Bayesian Analysis of Empirical Software Engineering Cost Models", IEEE Transactions on Software Engineering: pp. 513-583.
[5]. Faisandier, A, Lake, J., "Harmonization of Systems and Software Engineering", INCOSE INSIGHT, Vol. 7, Issue 3, October 2004.
[6]. Rechtin, E. (1991), "Systems Architecting: Creating & Building Complex Systems", Prentice Hall.
[7]. Pandikow, A. and Törne, A. (2001). "Integrating Modern Software Engineering and Systems Engineering Specification Techniques", Proceedings of 14th International Conference on Software & Systems Engineering and their Applications.