



ECSA/ECMFA/ECOOP
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The State of the Art and Future Perspectives in Systems of Systems Software Architectures

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Program

- Introduction
- The State of the Art of SoS Software Architectures
- Perspectives of Research in SoS Software Architectures
- Conclusion and Future Work



Introduction

- SoS
 - Independent, useful systems integrated into larger systems that deliver unique capabilities
 - Examples:
 - Information systems
 - Critical embedded systems
- Software architectures
 - Backbone for software-intensive systems
 - Fundamental in determining the system quality
 - Considerable amount of research, mainly regarding their design, representation, and evaluation.

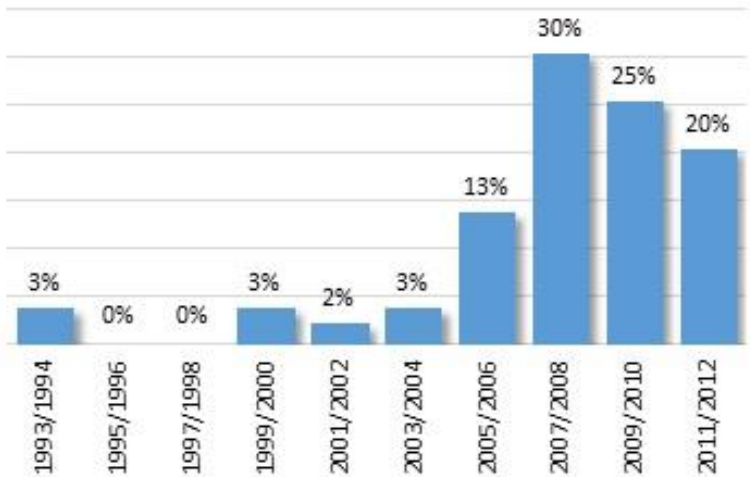
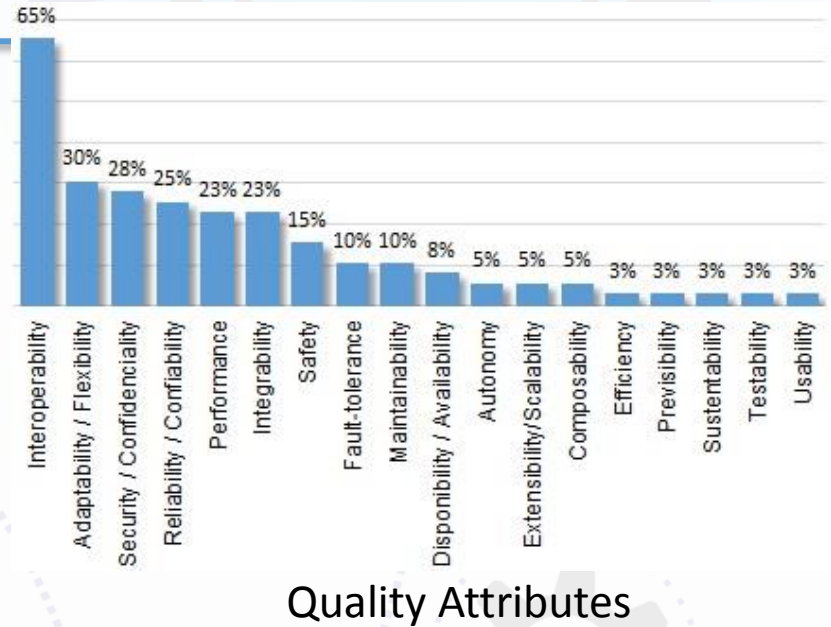
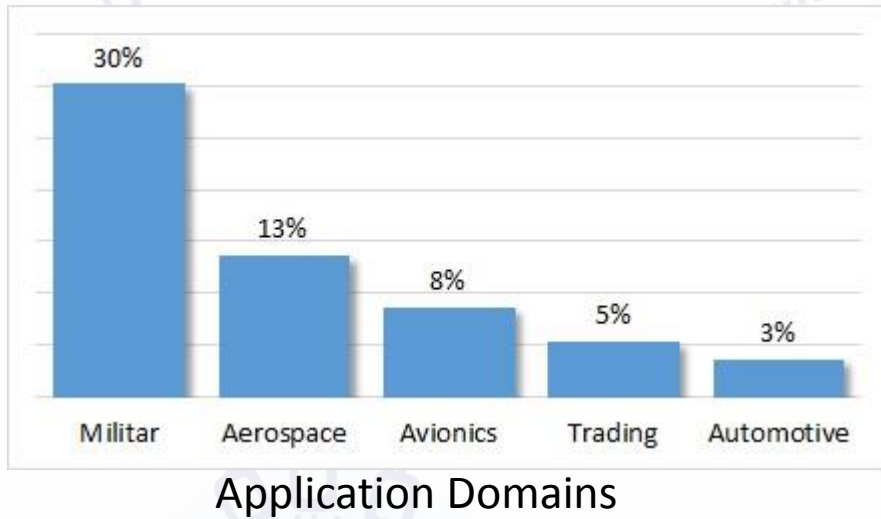
Introduction

- Motivation:
 - Software architectures for SoS is a new, important research area!!
- Objectives:
 - To present the state of the art on software architectures of SoS
 - To delineate open research issues regarding architectures of SoS

The State of the Art

- Systematic review:
 - RQ 1: Which are the characteristics (features and quality attributes) of SoS architectures?
 - RQ 2: How have SoS architectures been represented?
 - RQ 3: How have SoS architectures been evaluated?
 - RQ 4: How SoS software architectures have been built and for which application domains?
 - RQ 5: How SoS software architectures have been evolved?
- Results:
 - 60 primary studies
 - http://www.icmc.usp.br/~elisa/2013_SESoS

The State of the Art



Publication Distribution through Years

Research Topics on SoS Software Architecture

The State of the Art

- Design of SoS Software Architectures
 - 34 publications
 - 4 related to architectural design processes/methods
 - Lack of a complete, mature processes and methods
 - 17 related to SOA
 - Other initiatives:
 - MDA (Model-Driven Architecture), CMMI, object orientation, aspect orientation, agile method, reference architecture, and architectural pattern

The State of the Art

- Representation of SoS Software Architectures
 - 25 publications
 - 16 = semi-formal representation
 - 5 = formal representation
 - 7 = informal representation
 - Architectural views
 - Mainly structural and behavioral views
 - Techniques:
 - UML sequence diagrams, UML state diagram, Message Sequence Charts (MSC)
 - DoDAF and its views are widely used
 - Are existing ADLs sufficient?
 - Are new ADLs necessary?

The State of the Art

- Evaluation of SoS Software Architectures
 - 11 publications
 - Around half part has explored ATAM or SAAM
 - Other are isolated initiatives
 - Lack of consensus
- Evolution of SoS Software Architectures
 - Main characteristics of SoS: evolutionary development
 - Only two publications :
 - Initial proposal of an environment that intends to manage all systems involved in the SoS evolution
 - Key characteristics that could become an SoS architecture as an evolutionary one

Perspectives of Research in SoS Software Architectures

- SoS architectural design approaches
- SoS software architecture representation
- Evaluation of SoS software architectures
- Evolution of SoS software architectures
- Reference architectures for SoS
- Development of SoS for diverse domains

Conclusion and Future Work

- Several initiatives to deal with SoS software architectures
- Not enough mature, adequately adapted, and widely adopted
- Trends:
 - Use of SOA
 - Reuse of previous experience
- Several lines of research to investigation
- Future work:
 - Update of this systematic review



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