SIG on Formal Methods

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SIG on Formal Methods:

Formal Methods (FM) has been in existence since 1940's, when Alan Turing proved the logical analysis of sequential programs using the properties of program states; and Floyd, Hoare and Naur used axiomatic techniques to prove program correctness against the specifications in 1960's.

These initial successes helped inculcate an interest in applying FM to the field of computer science.

Academia has been instrumental in bringing this field to the forefront, through continued research and development. The use of Formal Methods requires an expert skill-set expertise and therefore, its use is limited to those trained in the field.

Mission Statement:

Computer Society of India wants the field of Formal Methods to have a wider audience and more people to benefit from the application of these methods to all spheres of life. There is a need to use effective, correct and reliable approaches to design, develop and qualify complex, high assurance system software with the rigid schedules and budget. For this we need advanced tools, techniques and methods. Industry standards like RTCA DO-178C (Civil Aerospace), ISO 26262 (Automotive), IEC 61513(Nuclear), EN50126 (Railways) have recommended the usage of formal –method based approach to be used in the various phases of engineering process to achieve the required levels of safety and security.

Today there are proven techniques and tools that can be used in specification, design and verification & validation phases to assure correct requirement-capture, implementation, software functionality and security. This helps in developing high assurance software for applications such as cyber-physical systems, net-centric warfare systems, autonomous robots and Next Generation Air Transportation.

- **One day workshop on FM was conducted during April 2013**

Objectives of the Special Interest Group (SIG) are:

- To bring together scientists, academicians active in the field of formal methods and willing to exchange their experience in the industrial usage of formal methods
- To coordinate efforts in the transfer of formal methods technology and knowledge to industry
- To promote research and development for the improvement of formal methods and tools with respect to their usage in industry.
- To bring out practical engineering methods where formal methods will be integrated with current engineering methods

Some of the known applications of formal methods are:

- Formal verification, including theorem proving, model checking, and static analysis
- Techniques and algorithms for scaling formal methods
- Use of formal methods in automated software engineering and testing
- Model-based formal development
- Formal program synthesis
- Formal approaches to fault tolerance
- Use of formal methods in safety cases
- Use of formal methods in human-machine interaction analysis
- Use of formal methods in compiler validation and object code verification

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Big Data & Formal Methods

Compiled by Dr.Manju Nanda

Big Data is the Future. Big Data is used today to change our world. Some of the applications of 'Big Data' are:

- Understanding and Targeting Customers
- Understanding and Optimizing Business Processes
- Personal Quantification and Performance Optimization
- Improving Healthcare and Public Health
- Improving Sports Performance
- Improving Science and Research
- Optimizing Machine and Device Performance
- Improving Security and Law Enforcement
- Improving and Optimizing Cities and Countries
- Financial Trading

Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate. Challenges include analysis, capture, data curation, search, sharing, storage, transfer, visualization, and information privacy.

Challenges associated with the protection of sensitive information that, when mishandled or correlated with other pieces of data, can jeopardize user's privacy.

Enhanced formal approaches that will enable - (1) the creation of a customized, contemporary software lifecycle and framework for big data testing, (2) development of new approaches for automated test generation including approaches that leverage the efforts of crowds/social networks, and (3) development of algorithms for continuously ensuring privacy as ETL applications and data evolve.

As Big Data analytics continue to become prevalent in the operations of industry and government organizations, principle methods must ensure privacy at present time and as the data evolve. Aforementioned challenges require research coordination in the general areas of software engineering, data management, and machine learning.

Formal methods can be used to deploy techniques into software tools able to analyze large amount of data very reliably and efficiently adapting an application for exploiting the scalability provided by cloud computing facilities.

Formal data stream modeling and analysis can be used to better understand stream behavior, evaluate query costs, and improve application performance MEDAL, a formal specification language based on Petri nets, to model the data stream queries and the quality-of-service management mechanisms of RT-STREAM, a prototype system for data stream management. MEDAL's ability to combine query logic and data admission control in one model allows us to design a single comprehensive model of the system. This model can be used to perform a large set of analyses to help improve the application's performance and quality of service

Formal Concept Analysis (FCA) is an emerging data technology that has applications in the visual analysis of large-scale data. However, data sets are often too large (or contain too many formal concepts) for the resulting concept lattice to be readable.

CTL (Computation Tree Logic) is a branching-time logic which models time as a tree-like structure where each moment can be followed by several different possible futures. This finds its use in data analytics to study the data and develop algorithms for further analysis.

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