

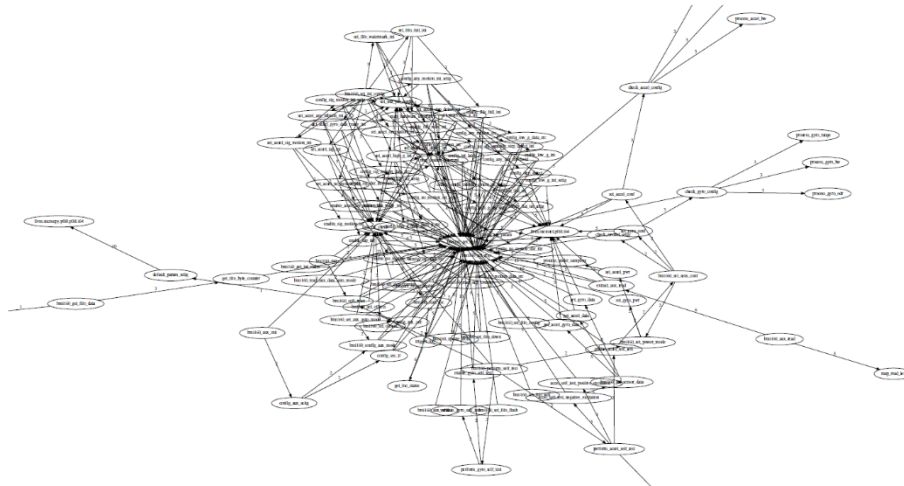
Title: Partitioning Programs for Software Verification based on Call Graphs

Topic:

The autonomous cars of the future will have approx. 300 MLoC and are thus too large for state-of-the-art solvers to be analysed. The aim of the analysis is to find errors in a program or prove their absence. A promising approach is to partition the program into smaller modules and analyse them separately. Therefore, we need an algorithm that separates the program such that the verification approach can verify the modules individually while losing the minimal amount of information.

In this project, we want to partition the program based on call graph information. With function as nodes and function calls as edges, we can represent the program as a graph and can apply our algorithms. In graph theory, the problem is often titled *k-partitioning*, describing the partitioning of a graph into modules of size *k* while minimizing the number of cut edges. Our problem is related but brings specific requirements from the software verification domain (like a single entry-point). Additional to the call information, the graph can be enriched by dataflow information, allowing a more detailed approach.

Simple Call Graph: (shows part of Bosch's BMI160 sensor driver)



Possible Task Description:

- Gather information about software verification requirements and call graph partitioning
- Design own algorithm to partition the call graph based on requirements
- Create call graph for given program (easy with LLVM) and apply algorithm
- Add dataflow information to enrich the graph and adjust algorithm if necessary
- If the approach works, we can apply the approach and verify real-world applications from the automotive sector

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Additional Information:

Please do not hesitate to contact us with questions. Furthermore, we are currently supervising three PdF-students in two projects. If you have questions for them, we can pass on contact information.

Possible Number of Participants: 1 to 2 persons (if a group of more than two persons want to work on this project, the scope can be lifted with our consultation).