Challenges in Porting Scientific Software

- Scientific and engineering software often outlives the current generation of hardware, and in turn needs to be modified to execute on newer classes of hardware architectures. [Carver et al.]
- Program comprehension is commonly the most time consuming task during software maintenance. [Ko et al.]
- During a software maintenance task, the quality of program comprehension impacts the quality of the result program change. [Robillard et al.]
- Scientific software is often conservative in the use of external libraries, limiting the impact of software engineering tools that require long-term “buy in”.
- Few software engineering tools are capable of executing on platforms and for languages relevant to scientific software.

Key Research Questions

- How can examples of API use, for the purposes of comprehension, be extracted from libraries and other relevant code?
- How can the cost and benefit of API migration be estimated automatically?
- What is the code relevant for comprehension and modification in a particular porting scenario?
- What are relevant natural languages summaries of APIs and their use that can aid rapid comprehension?
- Are existing natural language dictionaries appropriate for scientific and engineering codes?
- Does code with very poor natural language content (in identifiers or comments) lend itself to statistical natural language models?

Combined Textual and Structural Analysis of Software Artifacts for Program Comprehension in Porting

- Source Code Structural Analysis (for C, C++, Java, C#)
  - SrcML.NET – https://github.com/abb-iss/SrcML.NET
  - Constructs call graphs, def-use chains, and allows for easy querying of AST
- Natural Language Analysis of Source Code
  - Software Word Usage Model (SWUM) – https://github.com/abb-iss/Swum.NET
  - Generates natural language semantic information from code
- Existing Comprehension Tools
  - Sando – Feature Location (Code Search) – https://sando.codeplex.com
  - Prodet – Call Graph Navigation and Exploration Tool

References