Concept Location

1. Role of Concept Location
   1. Concept location is needed whenever a change is to be made
   2. Change request are most often formulated in terms of domain concepts
      1. E.g. Correct error that arises when trying to paste a text
      2. The programmer must find in the code the locations where concept paste is located
      3. This is the start of the change
2. Partial comprehension of a code
   1. Large programs cannot be completely comprehended
      1. Programmers seek the minimum essential understanding for the particular software task
      2. They use an as-needed strategy
      3. They attempt to understand how certain specific concepts are reflected in the code
   2. Analogy: visiting a large city
3. Concept triangle
   1. Name
      1. Naming Intension
      2. Annotation to Extension
   2. Intension
      1. Definition to name
      2. Recognition to Extension
   3. Extension
      1. Traceability to Name
      2. Location to Intension
4. Concept location
   1. The concept extensions are implemented as code fragment
      1. Variables, classes, methods, or other
   2. The programmer finds these code fragments
      1. Easy in small programs or in the programs that the programmer knows well
      2. Hard in large programs or programs that the programmer does not know
         1. Watchmaker anecdote
5. Search in the unknown parts of system
   1. Understanding the problem
   2. Selecting a search strategy
   3. Formulating a query
   4. Executing the search
   5. Analysis of result
6. Formulating a query
   1. Extract the set of concepts used in the change request
   2. Delete the concepts intended for the communication with the programmers
   3. Delete the concepts that are unlikely to be implemented in the code
      1. Concepts related to the things that are outside of the scope of the program
      2. Concept that are to be implemented in the future
   4. Rank the remaining concepts by the likelihood that they can be easily located
7. Concept location methodologies
   1. Human knowledge
   2. Traceability tools
   3. Dynamic search (execution trace)
   4. Static search
      1. Dependency search
      2. Grep (pattern matching)
      3. Information retrieval techniques
8. GREP search technique
   1. GREP is an acronym for global regular expression print
      1. GREP prints out the lines that contain a match for a regular expression
      2. Programmer iteratively formulates search query and then investigates the result
      3. If the results are too big to review, programmer either performs further search within these results of reformulates the search query
9. Concept Location by Dependency Search
   1. Use Class Dependency Graphs (CDG)
   2. Extracted from the existing code
   3. Technique
      1. Local functionality
         1. Consists of concepts that are actually implemented in the module and are not delegated to others
      2. Composite functionality
         1. As the complete functionality of a module combined with all its supporting modules
      3. Determined by reading code and documentation
      4. Process
         1. Find set of starting modules
            1. Select one module

Is the concept implemented in the module?

Yes

Stop

No

Is the concept implemented in the composite responsibility?

Yes 🡪 Find set of the supplier module🡪 back to select one module

No🡪 Find set of backtrack module🡪back to select one model

1. Comparison of the Techniques
   1. The grep-based
      1. Depend on the use of naming conventions
      2. Independent of class structure
         1. Grep tools provide just the list of search results
      3. Suitable for explicit concepts only
   2. The static dependency search technique
      1. Utilize the class structure
      2. Needs correct understanding of composite and local functionality
      3. Suitable for both explicit and implicit concepts
2. Change Request
   1. Record the author for each figure
   2. This change will make Voilet more versatile
      1. Support for cooperative work
      2. The author created a figure
         1. Author knows the semantics of the figure
      3. Name of concept: “author”
         1. Implicit concept extension
         2. The extension is not present in the current code
      4. Belongs to the set of the figure properties
3. Concept location by GREP
   1. Classical technique for concept location
      1. Based on pattern matching
   2. Programmer formulates a query
      1. Based on concept name
   3. Grep searches the files
      1. Finds corresponding lines of code
      2. Programmer investigates the hits
   4. If a search fails, new query is tried
      1. Programmer learns from failed search