

The 12th International Congress on
Mathematical Education
8 ~15 July 2012
Seoul, Korea

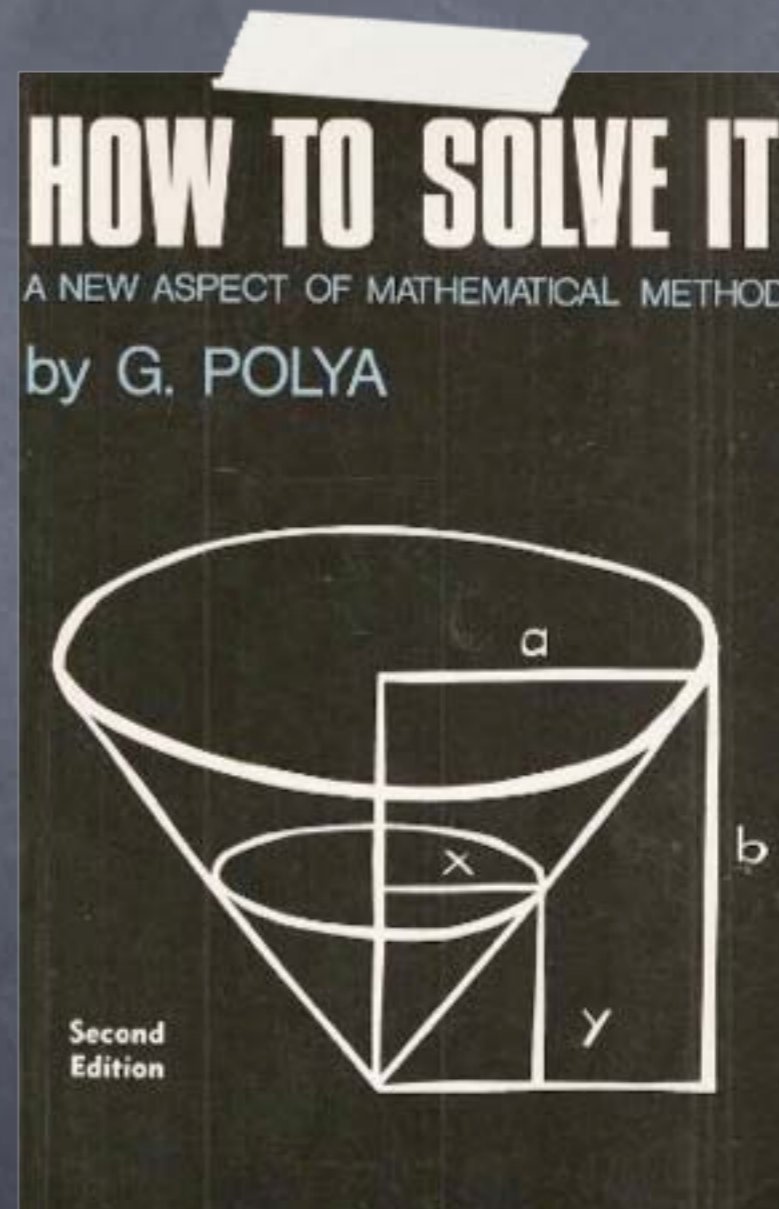
HOW TO iSOLVE IT?

Yahya Tabesh, Abbas Mousavi

Algorithms and Problem Solving Lab
Sharif University of Technology

Motivation

55 years after Polya's "How to Solve It", In the information era which through cloud computing, mobile devices and social networks we are connected anytime, anywhere, what improvement could be done in problem solving methodology and skills?



What is iSolve?

We intend to introduce a new system such as "How to **iSolve** It!" which develops problem solving over the net as a smart system.

What is iSolve?

- iSolve could be a search engine for the network of ideas and their relations.
- iSolve is a social problem solving platform. It saves, organizes and retrieves problems, ideas and solutions and the process of solving problems and lets people solve problems together.

What is iSolve?

- iSolve helps people understand the social nature of mathematics as a humanistic activity. It lets them work together to learn problem solving and solve problems.
- iSolve helps people learn by exploring the complex interconnected network of ideas, problems and solutions.

Solutes

- A Solute is The atomic unit of content in iSolve.
- It may be a simple idea, a problem, a definition, a solution to a problem, a generalization of an idea, a theorem or lemma, a proof or a proof sketch, a problem solving technique or trick or any other bit of knowledge.

Solute Forms

- A Solute may have different forms,
 - A piece of text,
 - A picture, video or voice,
 - A computer simulation or an interactive experience.

Solutes Graph

- In iSolve, Solutes are labeled vertices in a directed, labeled graph.
- Labels on edges show the type of relation between two Solutes that they connect.
 - “second Solute is a solution to the first”
 - “second Solute is a generalization of the idea in the first Solute”.

Solutes Categorization

- Tags on vertices show
 - Their type e.g. problem, solution, idea, ...
 - Their form e.g. text, video, simulation, ...
 - Their topics e.g. Geometry, Algebra, ...

Content Structure

An Example



How a problem from Polya's book will be solved on iSolve

How to Categorize?

- Labeling Solutes and edges will be done by users when creating or editing Solutes and by some smart algorithms using
 - Extra structures and patterns on the tags (e.g. the AMS classification tree structure on topic tags).
 - Relations between users and content.
 - Collected statistics from existing content.

Projects

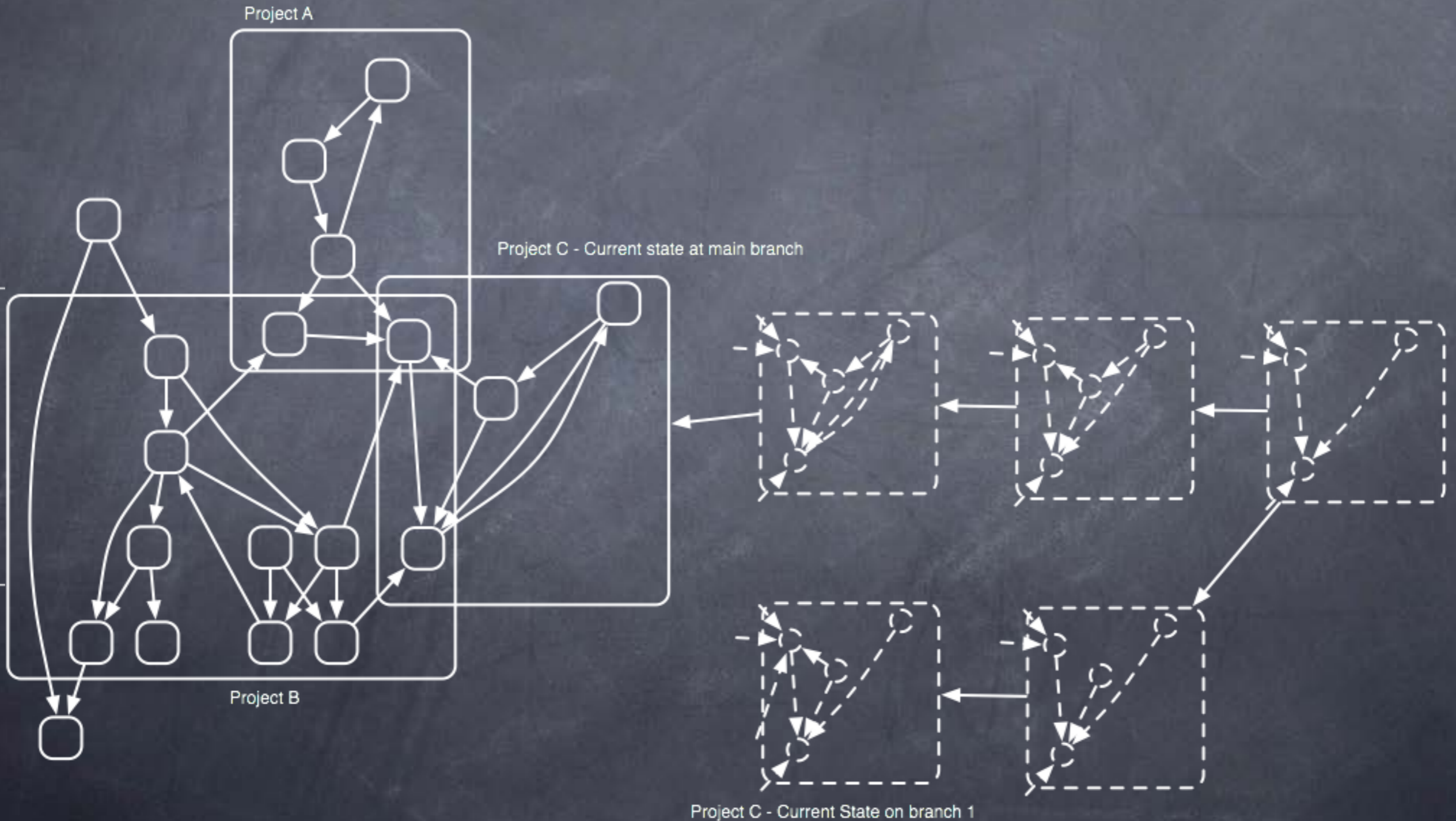
- A Project consists of some Solutes, grouped together via hand picking or automatically via some criteria, (e.g. all Solutes with specified tags that are connected to these Solutes through certain length).
- Projects allow their members to focus on a limited set of Solutes and manage the teamwork.

Version Control

- Projects have “Version control system” which manages group members collaborations on the Projects.
 - It keeps complete change history for Solutes and relations between them.
 - It lets making different branch of contents, working on branches and then merging the branches.
 - iSolve members can fork any project, a fork is a clone of the forked project initially. The fork owner can make changes in it independently. A request may be send to the owner of main project to apply changes (pull request) and changes could be merged in the main project.

Social Problem Solving

An Example



Engaging People

- Volunteers may join iSolve to develop it. Members of iSolve would have personal profiles, they can label themselves with some tags to show their fields of interest.
- They can follow other members and work with teams.
- To encourage contributions, iSolve assigns credits and reputations to members according to cooperations.

Searching and visualizing

- Solutes could be searched with criteria such as tags, relations, projects, authors and etc.
- iSolve can display a visual representation of Solute graph in different scales.
- iSolve can generate many information about Solute by performing different graph algorithms on the Solute graph.

Search

- iSolve is a search engine for ideas and their relations.
- It helps people explore the network of ideas and find ideas to solve their problems.
- It ranks ideas based on their importance.

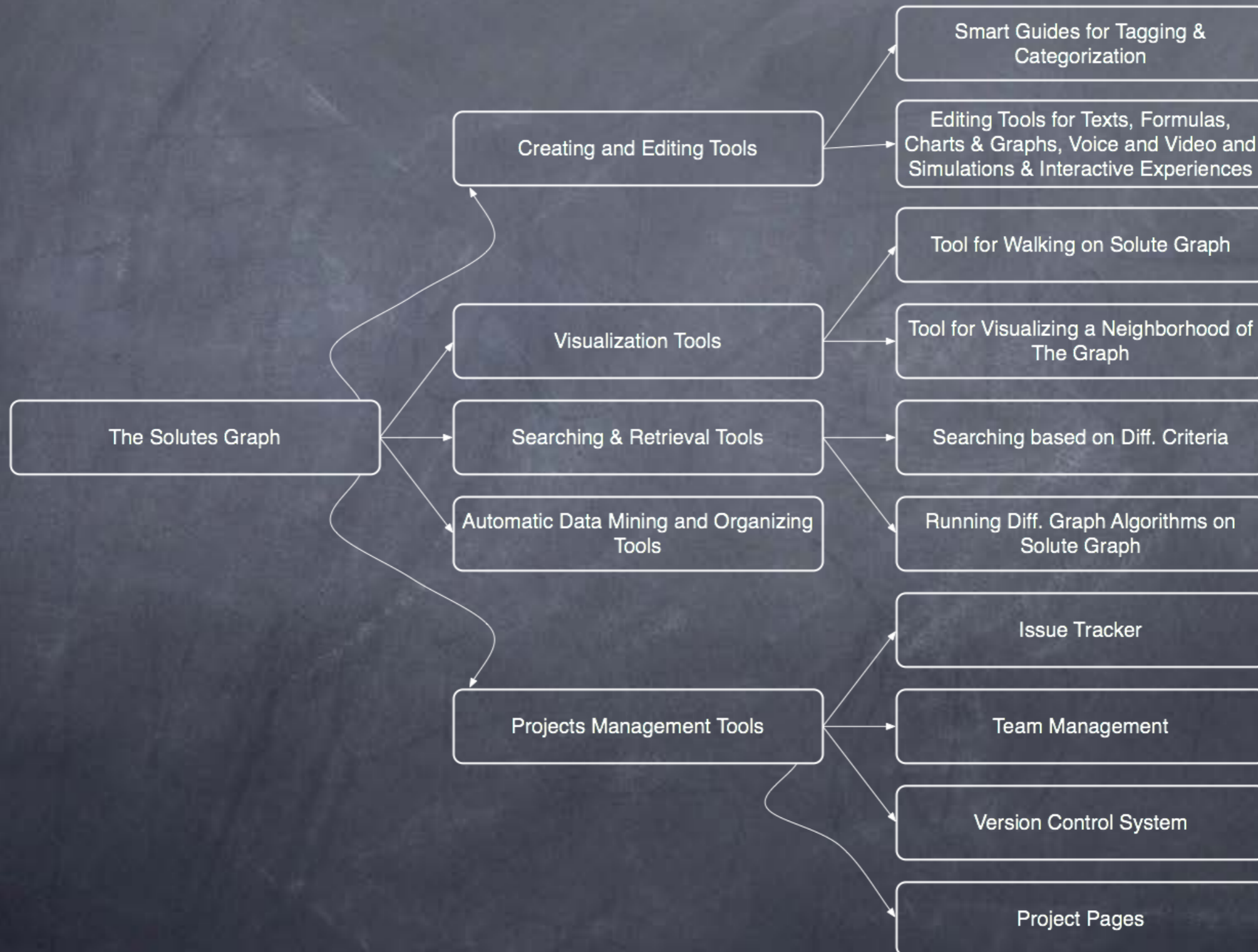
Visualization

- iSolve displays a visual representation of Solutes graph in different scales.
 - Zooming in to a Solute, one can see the Solute, its tags and neighborhood.
 - Different types of Solutes and edges are coded with different colors.
 - One can travel on graph by clicking on a neighbor Solute.
 - Zooming out, one can see a large scale picture of the graph
 - This visualization can be filtered by many criteria.

Information Retrieval

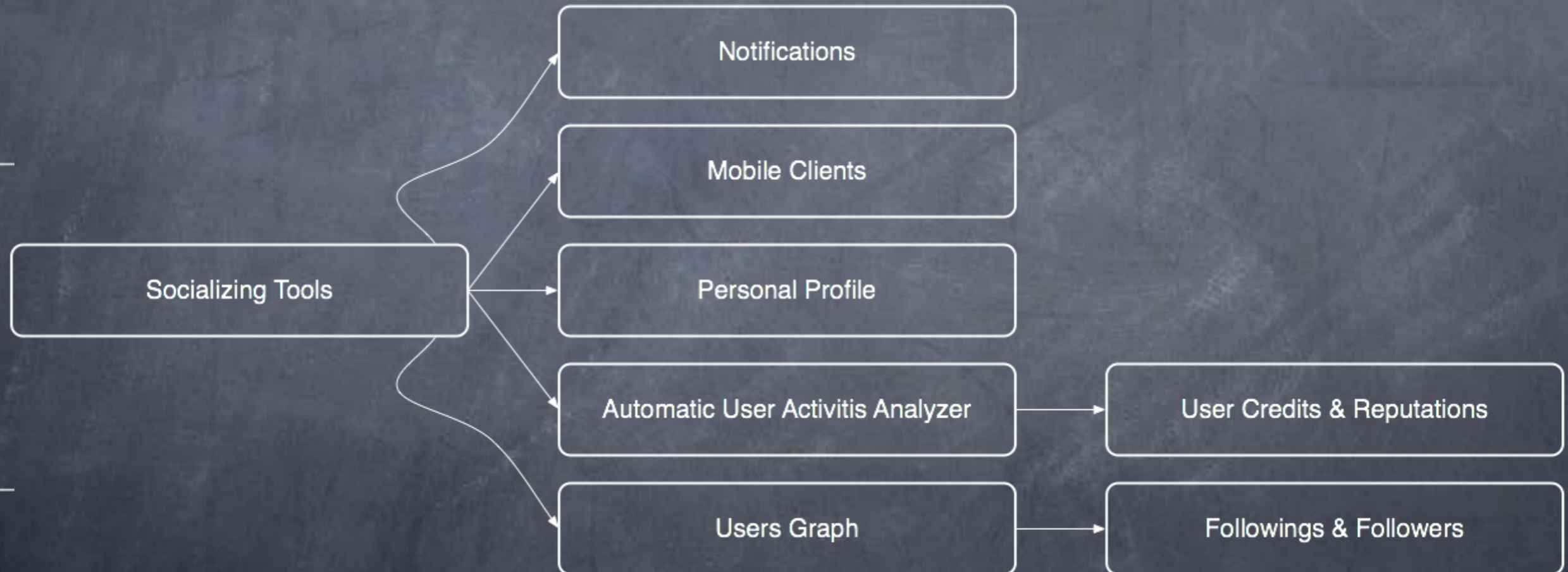
- iSolve can generate many information about Solutes by performing different graph algorithms on the Solute graph.
 - iSolve can find all the paths from one Solute to another Solute, shortest path between two solutes, Solutes with highest degree in a neighborhood and many other information.
 - iSolve helps math education researchers to extract statistical data about mathematical ideas and the process of problem solving.

iSolve Components



Implementation

iSolve Components



Development

- Implementation of alpha version of iSolve is in progress.
- We will invite potentially interested groups like high school students and IMO team candidates around the world to participate in iSolve and test it.
- The next step will be implementing the beta version and mobile clients and making iSolve publicly available.

Implementation

- If you are interested to join iSolve and participate in this challenge, please contact us.