Technology Transfer Aspects of Environment Construction

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The "Environment", a collection of tools to improve the software development process, has become a key concept characterizing the major trends of software engineering technology in the 1980's. Many experimental environment projects have been conducted both in the research community and in the industry. But to date, we have yet to establish the technology necessary for developing an ideal practical support environment.

For example, one of the critical issues in environment construction is how to ease the process of selecting and assembling tools for that purpose. Many unsolved problems still exist concerning tool decomposition schemes, tool integration approaches (including tool interfaces), use of meta (tool-building) tools, cost/benefit evaluation metrics, etc. Also, there are some difficulties in establishing fundamental process models and/or product models for software development.

Construction of a practical environment, presumes a fair amount of risky design decisions as well as various experimental activities. It is therefore necessary to set up a good communication mechanism between the developers and the users of the environment. From the manager's point of view, it seems to be of prime importance to promote active technology transfer among these people during the process of environment construction.

During the 1980's, I have been involved in a variety of environment-related activities such as:

1. Constructing a Unix-based distributed environment at SRA (since 1980)
2. Planning and/or managing a series of national projects (1981-89)
   - SMEF (1981-85)
   - FASET (1985-89)
   - SIGMA (1985-89)
3. Organizing annual "Environment Workshops" for SEA (since 1985)
4. Organizing an international environment research project: SDA (1986-89)

My model for technology transfer, which has emerged naturally from 10 years of personal experience, is the concept of "Playground".

It is widely recognized that there are paired roles of "Technology Push and Pull" in the process of technology transfer. Usually, Technology Push is working in the research community and Pull in the industry. But, environment developers (or care-takers) in a software development organization must play dual roles simultaneously. When they are looking for some new technology, they are functioning as Pull. Then, after importing some prototype tool into the organization, they must brush it up for production quality, and strongly PUSH its usage.

To assign these dual roles, we need to have a group of high quality technical staff with rich hardware and software facilities. I would like to call this "the Playground." In the case of our company, a group of technical staff called the STTG (Software Tools and Technology Group) is the Playground, and I myself take the responsibility of managing this group. In the case of the national projects which I managed, I organized them as industry-wide playgrounds and asked each participating company to send one of their best staff members to work at the project.

There is a hierarchical layer of the concepts as follows:

- Process Model
- Development Methodologies
- Environments
- Tools
- Corporate headquarter
- Divisions
- Projects
- Teams/Individuals

The impact of the Playground on the technology transfer activities depends upon which level within the above hierarchy it is located. If it operates within the tool level and interacts with each individual or team, speed and size of technology transfer will be very much limited. But if it operates within headquarters or the division level, it is possible to change the fundamental process model or development methodology and promote a very large scale technology transfer.

There are many historical metaphors in ancient Chinese history, especially in the period around the 5th century BC when hundreds of philosophers were traveling around the country to sell their political idea to the kings. The kings' courts in the countries (city states) were a kind of playground for philosophers with strange political ideas. Some of them were successful and some of them were not. I also have several experiences of both success and failure in my own efforts towards software engineering technology transfer.