Java Activated Mathematics Laboratory

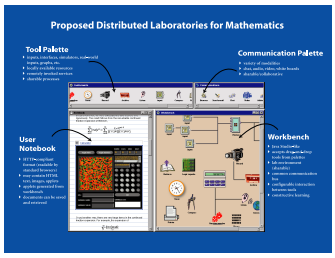
Theme 3.30.0 — By Jonathan Borwein, Jen Chang, Loki Jörgenson, and June Lester (CECM, SFU)

www.cecm.sfu.ca/TLRN/

Introduction

The objective of this project is to develop and deliver functional prototypes of interactive tools, environments and communications systems for teaching, communicating, and learning about mathematical knowledge via the networks. They are being developed in conjunction with other Telelearning groups, external researchers, and teachers to assure compatibility with the proposed next-generation systems.

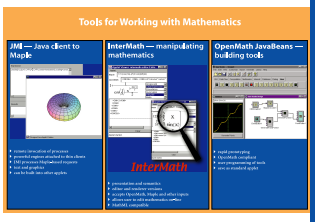
Next Generation Learning On-Line



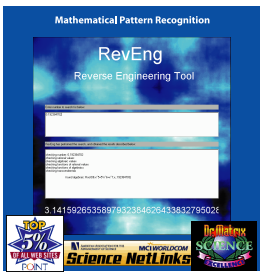
- tool-to-tool communications
- user-to-user collaboration
- remote services
- distributed resources
- on-line support and user help
- ubiquitous access
- scaffolded learning/use
- structured material with learning pathways

Next Generation Distributed Environment

- distributed user profiles
- reliable and secure systems
- unified access authorization
- wide area file system
- remote invocation
- mediated resource brokerage
- sharable work spaces
- a/synchronous communications
  - audio
  - video
  - chat
  - discussion lists



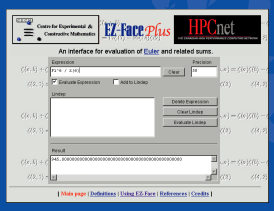
Next Generation Mathematical Telelearning Systems



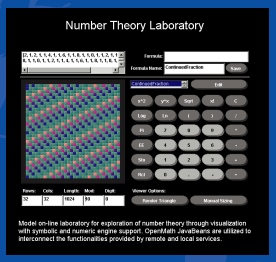
- mathematics presentation
- user interaction with mathematics
- user authoring of mathematics
- executable mathematical functionality / services
- reusable/exchangeable mathematical objects
- semantical content
- storage and archiving of mathematics
  - objects
  - documents
  - metadata

Prototypes

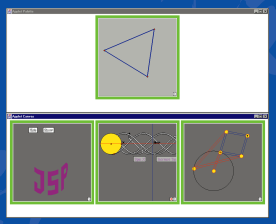
High Performance Computing



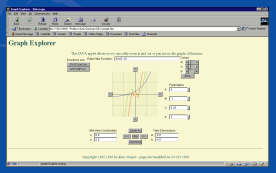
Visualization with Symbolic and Numeric Engine Support



Cut and Paste Applet



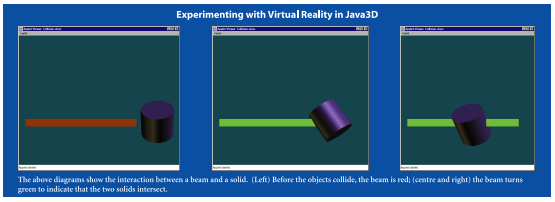
Graphing Applet



In Collaboration with Telelabs

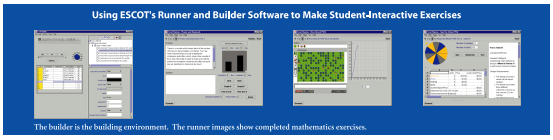
CECM's research in Java-based implementations such as the OpenMath Java library provides a universal protocol for the exchange of scientific knowledge. In providing a self-consistent representation of mathematics, the OpenMath library offers a foundation on which mathematical systems can be built. Systems based on OpenMath can collaborate by using a common communication language for mathematical semantics.

The Telelabs project, with its emphasis on engineering and mathematical sciences, offers an ideal context for implementing the CECM's mathemat-



In Collaboration with Educational Software Components of Tomorrow (ESCOT)

With common interests in component technology and middle school mathematics, the CECM and ESCOT have started working together. Work is underway to exchange technologies and develop a joint development program under the ESCOT umbrella. Based at Stanford Research Institute International, ESCOT has already had considerable success using components to make student-interactive exercises, including well-known tools like Java SketchPad, AgentSheets, and SimCALC. The CECM has been working primarily on the implementation of communications standards in components, such as their OpenMath JavaBeans toolkit. By joining forces, ESCOT and the CECM anticipate accelerating their progress towards an effective learning environment for middle school mathematics.



Preliminary Conclusion

The technology is now in place to provide all the functionality we wish to insert. But the "cost" of integration remains unreasonably high.

Until and unless commercial vendors provide cost and time effective, open architecture, secure and system independent solutions to many of the underlying communication problems, highly interactive viable mathematical or scientific laboratories remain out of reach.