Research in Integrated Development Environments (IDEs)

presented by Gene Fisher
What Is an IDE?

• Integrated collection of tools.

• Basic components are:
  
  o source code editor
  
  o compiler/interpreter
  
  o debugger
Advanced IDE Features

- multi-language support
- code browsing
- graphical views
- testing
- integrated version control
Earliest IDEs

• Lisp environments of the 1970s.

• First terminal-based, then GUI.
The Lisp IDE Experience, Then and Now

> (defun avg (l)
    (/ (sum-list l) (length l)))

AVG

> (defun sum-list (l)
    (if (null l) 0
        (+ (car l) (sum-list (cdr l)))))

SUM-LIST

> (avg '(1.0 2 3 4 5 6 7 8))

4.5
The Lisp IDE Experience, cont’d

> (bye)

Bye.
Research Heyday

• Mid-1980s.

• Pioneering environments like
  o PECAN -- the original Eclipse
  o BALSA -- algorithm animation
  o Daisy II -- mixed language environment
  o Demo -- programming by demonstration
PECAN -- The Original Eclipse

• Provided multi-window viewing and editing.

• An command-line execution window.

• A GUI debugger.

• Stack and data views.

• Syntax-directed editor.

• Incremental compilation.
Figure 8: An execution view
BALSA -- Pioneer in Algorithm Animation

- Provided a wide variety of ways to visualize program behavior.
- E.g., watch as the elements of a list are sorted.
- Visualize complex data structures dynamically.
- E.g., next page shows animation of a compiler.
procedure expression;
  procedure term;
    procedure factor;
    procedure expression;
    procedure expression;
    procedure term;
    procedure factor;
  begin
    if p[j] = '(' then
      begin
        j := j + 1;
        expression;
        if p[j] = ')' then j := j + 1 else
      end
    else if letter p[j] then
      if p[j] = '=' then j := j + 1;
    end;

(A*B+A*C)*D

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z
Daisy II -- mixed language environment

- Allowed development in a combination of different languages.
- Provided BALSA- and PECAN-like viewing features.
- Also provided visual input devices.
- And a graphical dataflow tool.
Block Diagram Tool

Language-Sensitive Editor

Multi-Language Command Interpreter
Demo -- programming by demonstration

• Allowed graphical demonstrations of GUI behavior.

• General behavior inferred from demonstrations.

• Expert system used to make inferences.

• Code generated.
mouse pointer that xeyes "watches"

xeyes display

background screen
Demo 1:
STIM: move pointer
RESP: reshape tracking line, move pupil onto line and guide ellipse

Demo 2:
STIM: move pointer farther
RESP: reshape tracking line, move pupil onto line and guide ellipse

Demo 3:
STIM: move pointer inside ball
RESP: move pupil onto pointer

Demo 4:
STIM: move pointer inside ball
RESP: move pupil onto pointer
Productization

• 1990s and 2000s have seen many commercial and open source products.

• Eclipse is noteworthy.

• It has essentially nothing new compared to earlier research environments.

• Does provide a production-quality environment.
Latest Research

• Focus on expanding IDE scope.

• Areas include:
  
  o hypermedia (Chimera)
  
  o collaborative work (Jazz)
  
  o cooperative ubiquitous computing (iRoom)
Figure 3 The iMedia application in the iRoom