

SCHLUMBERGER-DOLL RESEARCH OLD QUARRY ROAD RIDGEFIELD, CONNECTICUT 06877-4108 203-431-5000

August 21, 1986

Reid Smith  
Schlumberger-Doll  
Research Old Quarry Road  
Ridgefield CT 06877-4108

Dear Colleague:

It is my pleasure to invite you to a workshop on object-oriented graphics and user interfaces. The workshop will be held September 29, 1986, in the Portland Marriot in Portland, Oregon, in conjunction with the OOPSLA'86 conference sponsored by the ACM. This will be an opportunity for researchers in object-oriented programming, user interfaces, and interactive graphics to share their experiences and ideas. The goals of the workshop include:

- **Assessing the State of the Art:** Surveying current work in object-oriented interfaces and graphics. What application areas have used object-oriented interfaces? What general frameworks have been developed for structuring object-oriented interfaces and graphics? What is the potential impact of this approach to interfaces?
- **Eliciting Design Principles:** How does an object-oriented approach support the structuring of graphics and user interfaces? What types of user interaction are easy (or hard) to support? What class of graphical display and interaction can be supported? What aspects of object-oriented programming are critical to user interfaces and graphics? What additions to object-oriented programming simplify interface design? What design principles support the extension, modification, and reuse of interfaces and graphics?
- **Sharing Implementation Techniques:** Discussing our experiences with specific object-oriented systems. How well do the systems support our designs? How useful are system-provided objects and methods? How are new object relationships (e.g. constraints) added to a system? What tools and techniques help manage complexity as a system grows? What techniques enhance efficiency and reusability? How are object-oriented interfaces integrated with traditional applications?

The structure of the workshop will be informal, focused discussion. You should be prepared to present a five or ten minute overview of your work in the context of these goals. The details of the final agenda will be determined by responses to the enclosed questionnaire. To accept this invitation, please reply to the questionnaire by September first.

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August 21, 1986

The workshop will be on the same day as the tutorials but will not interfere with the technical program. The workshop is scheduled to run the entire day. You must be registered for the OOPSLA'86 conference to attend the workshop. An advance program and registration form for the conference is enclosed.

Workshop size is limited, so please contact me before inviting additional colleagues. If you cannot attend but can recommend a suitable colleague, please forward this invitation and contact me at the address on the questionnaire.

A final agenda will be mailed to you just before the workshop. I look forward to seeing you there.

Sincerely,

Paul S. Barth  
Workshop Chairman

PSB/el  
enclosure

# Workshop on Object-Oriented Graphics and User Interfaces

## RSVP/Questionnaire

Please reply by September 1 to:

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(203)431-5510  
barth%slb-doll@csnet-relay

Name: .....

Address: .....

.....

.....

Phone: .....

Net Address:

Areas of Interest: .....

.....

Systems Built:

Brief Description: .....

.....

.....

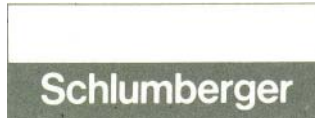
.....

OO Systems used: .....

AV equipment (VCR, 35mm, etc.): .....

Additional Comments: .....

.....



SCHLUMBERGER-DOLL RESEARCH OLD QUARRY ROAD RIDGEFIELD, CONNECTICUT 06877-4108 203-431-5000

September 19,

1986 Dear Participant:

Thank you for accepting my invitation to the Workshop on Object-Oriented Graphics and User Interfaces. There will be about 30 participants, and I am looking forward to a full day of active discussion.

Enclosed is a preliminary agenda for the day. I have selected six participants representing a variety of object-oriented systems to give short presentations during the morning. Each presenter has 15 minutes to describe the goals of his system and his use of object-oriented programming. The audience has 15 minutes for questions and discussion. I am hoping for lively interaction during these presentations.

Also enclosed is an interface problem I have asked all participants to address. I realize that there is not much time to work on it, but I encourage you to do as much as possible. The questions should not take too long to answer, and will provide a common framework for comparing and contrasting our systems. The first afternoon session is devoted to presenting and discussing our answers. Feel free to prepare transparencies describing your approach.

I have arranged for lunch to be served in the workshop room. The price is \$6, to be paid when it is served. Lunch will include vegetarian selections. If you cannot attend lunch, please let me know as soon as possible.

There will be U-matic and VHS video players in the workshop room. If there is sufficient interest, we will play tapes during lunch or coffee breaks. The players will also be available throughout the week, so I encourage you to bring a tape if you have one.

Thank you for your interest. I look forward to seeing you.

Sincerely

Paul S. Barth Workshop Chairman

Problem Session  
Workshop on Object-Oriented Graphics and User Interfaces

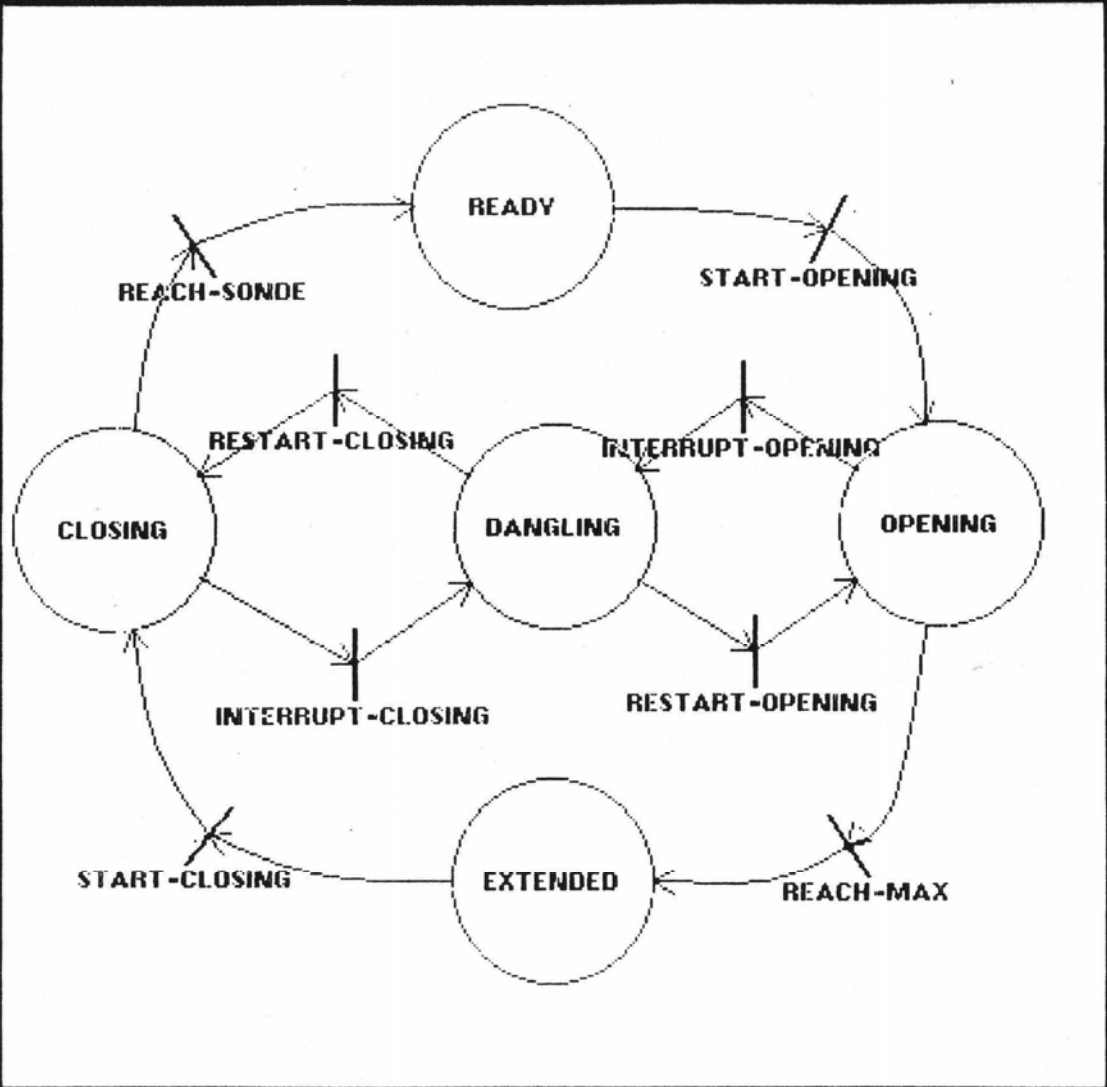
An Interactive Petri Net Editor

Describe how your system could support an interactive interface for creating, editing, and executing Petri nets. A Petri net consists of *states* connected by *transitions*. Assume that a Petri net simulation system already exists, and that the editor is able to send it messages to create, modify, and run Petri nets.

As an example, consider the editor on the following page (courtesy Sol Greenspan). A state is represented as a circle with a name in the center. A transition is a line with a name and arrows entering and leaving the transition. Interaction takes place through fixed and pop-up menus, type-in, and direct manipulation of the icons. States are created by selecting the *State* item in the *Create* menu, typing in the name of the state, and positioning the circle on the screen. Transitions are created by selecting with the mouse the states to connect, selecting the *Transition* item in the *Create* menu, typing the name of the transition, and positioning the transition line and arrows on the screen. States and transitions can be repositioned by selecting the icon and selecting *Shape* or *Move* from the *Edit Graphics* menu; the new position is selected with the mouse. While components are being repositioned, connectivity is maintained; i.e., the transition arrows lengthen and bend so that their endpoints always lie on the edge of a state. Annotations to the states and transitions (such as state invariants and transition triggers) are edited by selecting the component with the mouse, selecting the appropriate editing command from the *Edit Structure* menu, and using a standard text editor to edit the annotation. The simulation is run by selecting *Step* from the *Control* menu which fires the enabled transition(s). Transitions flash when they fire; states with tokens in them have their name inverted.

On the following pages, describe how your system could be used to create such an editor. Describe the leverage given by your system: how hard is this to implement? How do you support interaction management, graphics, and integration with the application? What is represented in objects? What is in code? What extensions would be easy or hard? Note that this problem (and the example described above) is meant to be a framework for comparing our systems. Don't worry if parts of the problem are not applicable to your system. Focus on the areas addressed by your system. Feel free to embellish the problem to highlight the strengths and weaknesses of your system.

<b>Control</b>
Reset
Step
<b>Create</b>
State
Transition
<b>Edit Graphics</b>
Clear
Shape
Move
Hide
Delete
Render
<b>Edit Structure</b>
Impulse
Delete Object
Attribute Editor
Edit Invariant
Edit Trigger
Edit Result
Edit CommandProc
Edit SendCondition
SetInitialState
<b>I/O</b>
Save
Load
Print



## Interaction Management

Describe how windows, menus, and type-in windows are defined. If they are in an object hierarchy, draw it. Is there an existing library of windows and menus? Describe window placement (i.e., overlapping, tiled) and interaction (i.e., shaping, scrolling). Are menus placed relative to the screen or the window? How are pop-up or pull-down menus specified and invoked?

Describe the implementation of the interaction protocol. Are there protocol objects? Describe them. Is the protocol defined by a sequence of messages? If so, describe the sequence of messages from the selection of a menu item to the type-in of a name. Is there a library of pre-defined protocols? Is there object-oriented support for mouse-tracking, mouse-sensitivity, or type-in (e.g. name completion, spelling correction, line editing)?

Describe how direct manipulation is handled. Do the states and transitions have mouse sensitive regions? How do menu commands access the selected states and transitions? Can the order of command/argument selections be varied (i.e., prefix, postfix, or infix)?

### Graphics

Describe how graphics are represented. If they are objects, draw the taxonomic hierarchy and/or part—whole relationships. What information does each graphics object contain? What messages do they receive and transmit? Is there a library of existing graphical objects which can be reused and specialized?

How is graphical connectivity supported? Is a general system (such as a constraint manager) used? How is connectivity represented and maintenance performed? Describe how the transition lines attached to a state are updated when the state is moved.

Describe how modifications to the graphics are initiated by the interface. What messages are sent to move or shape an object? Is the picture continuously updated during the modification? How is this achieved or avoided?



### Interaction with Application

Assume the Petri net simulator is object-oriented. How is the interface linked to the application? Is there an explicit model of the interaction between the simulator and editor (such as the Model-View-Controller paradigm in Smalltalk)? What messages pass between the simulator and editor? Is multiple inheritance used?

How does the simulator initiate behaviors in the editor (e.g., animation during execution)? Are active values used, or is the simulator modified to send the appropriate messages to the editor? What messages are sent?

Suppose the simulation were not an object-oriented program. How would the editor have to be modified? Would a significant piece of functionality or simplicity be lost?

### Extensions

Consider the following modifications and extensions to the editor:

Change a state from a circle to a square.

Add a new type of state which is identical to a normal state but is represented as a hexagon.

Change command/argument selection from prefix to postfix.

Add token animation: show tokens (small circles) which move smoothly from state to state along the transitions during execution.

Allow Petri nets to be hierarchically composed, e.g., allow states to contain entire networks. Display the hierarchy to any number of levels.

How easy or difficult are these extensions to make? Why?

Suggest additions or modifications to the editor which highlight your system's strengths and weaknesses.

## Agenda

### Workshop on Object-Oriented Graphics and User Interfaces

September 29, 1986  
Portland Marriot Hotel  
Portland, Oregon

8:15	Welcoming remarks	
8:30	User Interface Frameworks	
	Larry Rosenstein, Apple Computer	(MacApp)
	Pedro Szekely, Carnegie-Mellon University	
	Randall Smith, Xerox PARC	(Alternate Reality Kit)
10:00	Coffee & danish	
10:30	Graphics	
	Robert Duisberg, University of Washington	(Animus)
	William Lorensen, General Electric	(Oscar)
	John Uebbing, Hewlett-Packard	(Test & Measurement)
12:00	Lunch	
1:00	Problem Session	
2:30	Coffee & refreshments	
3:00	Summarizing Design Principles	

# **Workshop on Object-Oriented Graphics & User Interfaces**

*Paul Barth & Reid Smith  
Schlumberger-Doll Research*

- **Assessing the State of the Art**
  - Application Areas
  - General Frameworks
  - Potential Impact on Interfaces
- **Eliciting Design Principles**
  - Support from Object-Oriented Programming
  - Classes of Display & Interaction ... Easy vs Hard
  - Support for Extension, Modification, Reuse
- **Sharing Implementation Techniques**
  - Constraints
  - Management of Complexity
  - Efficiency & Reusability
  - Integration with Traditional Applications

# POINTS THAT CAME UP

ISSUE: SEPARATION OF GRAPHICS & APPLICATION?

YES

?

No

WHEN?

## HINTS

HOW TO GET 'THE BIG PICTURE' ?

WHAT IS THE RIGHT KERNEL OBJECT ?

TROUBLE

HIERARCHY ?

INTENDED USER COMMUNITY ? / GOALS ?

INTEGRATED VS SEPARATE APPLICATION

EXTENSIBILITY / GENERALITY

MODEL VS VIEW VS CONTROL ...

VS APPLICATION

DIFFICULTY OF MANAGING MULTI-PARADIGM  
SYSTEM?

## HINTS

\* SCALE?

TOOLS: TRADEOFFS - FUNCTIONALITY  
LEARNING TIME

**UNDERSTANDABILITY**

**MENUS / FIXED / POPUP / SLIDING**

**STANDARD PROTOCOLS**

**SET-PARAMETER**

**VALIDATE**

**ACTIVATE**

**EXECUTE**

**CANCEL**

**INTEGRATION WITH UNDERLYING WINDOW SYSTEM.**

# Discussions

## What Needs To Be Explicitly Represented?

Editor

Window

Menu

Graphical Objects

Inter-Object Relationships

Interaction ... Process

Communication with Applications

## Tradeoffs: Advantages/Disadvantages of Declarative Representation

Constraints     **LANGUAGE - DEPENDENCIES**

Inheritance

Encapsulation

Active Values

## What Needs To Be Done?

- SEPARATION THE GRAPHICS FROM ...

THE APPLICATION

THE DOMAIN MODEL

re-use; multiple perspectives

extensibility; generality; testing

separate optimization; interface ...

→ potential speed problems (CAD)

GRANULARITY?

not inline code

object?

attribute?



- **DECLARATIVE CONSTRAINTS ARE A GOOD IDEA**

but... **Language For Expression of Dependencies**

**Debugging ... Understanding**

**[non-local interactions]**

→ **Tools**

**Speed vs Generality**

**Acyclic?**

- **UNDERSTANDING LARGE, OO SYSTEMS IS**

**DIFFICULT!**

**WHAT EXISTS? ... CLOSEST JUMPING-OFF**

**POINT TO COPY / SPECIALIZE**

**VISUAL COMPLEXITY**

**several early ideas & tools ⇒ experiment**

# WORK TO BE DONE

- Simplification
- Language for Specification / Description of Graphical Interfaces
- Standard Components ... IC model
- [ • Managing Trouble ]

... EXPERIMENTATION IN A VARIETY OF SCENARIOS

## Attendees

Workshop Coordinator: Jed Harris  
(408)987-8815

User Interface Frameworks Panel: Brad Cox ✓  
426-1875

Local Technical Arrangements: Marco Cupidi  
(503)681-2475

Social Arrangements (lunch & coffee)  
Kathy Hammerstrom  
(503)690-1151

### Names and Addresses

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