



THE UNIVERSITY OF AUCKLAND

www.auckland.ac.nz

An E-whiteboard Application to Support Early Design- Stage Sketching of UML Diagrams

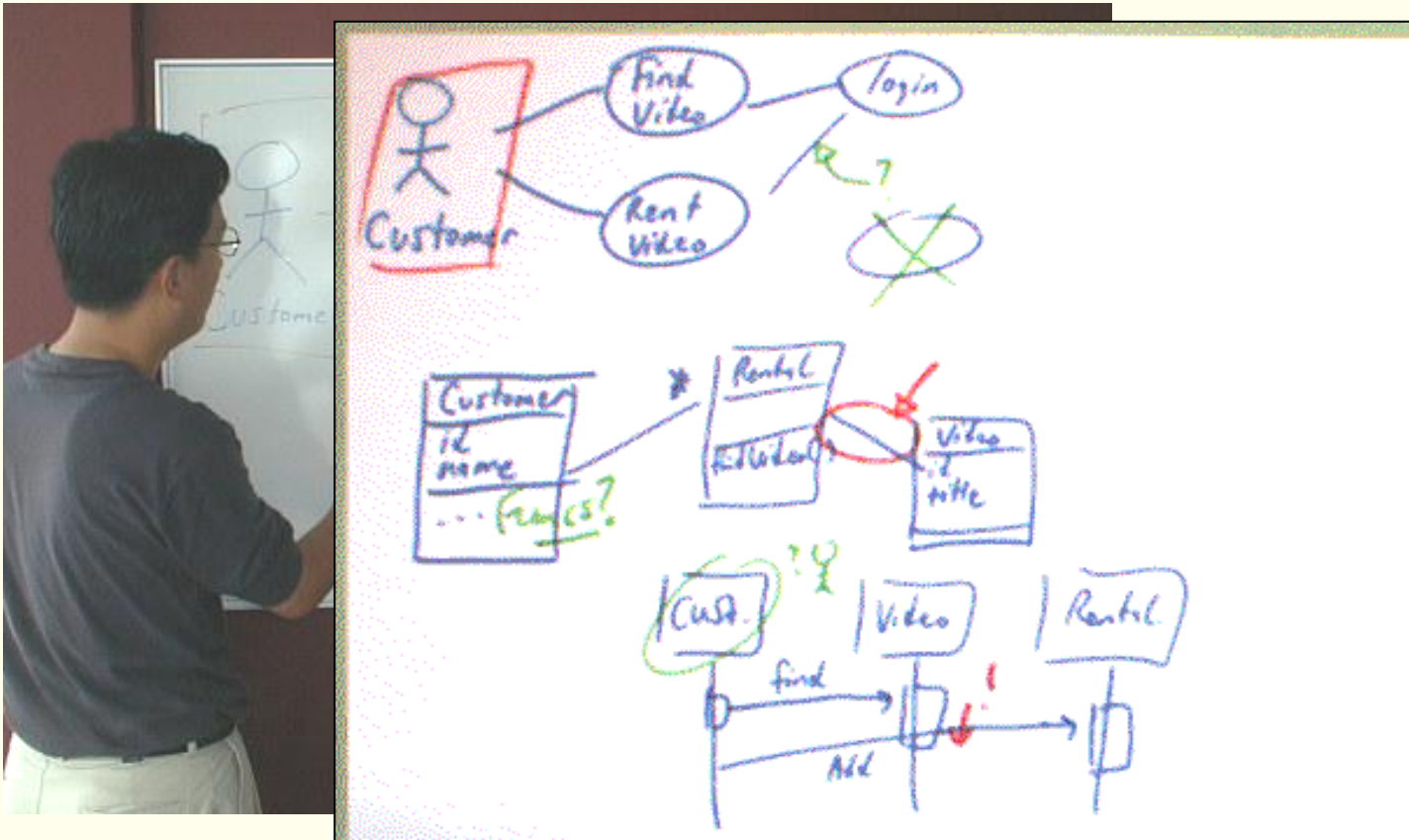
Qi Chen, John Grundy and
John Hosking



Outline

- ❖ Motivation for this work
- ❖ E-whiteboard for early phase UML design
- ❖ Examples of SUMLOW in use
- ❖ Architecture
- ❖ Evaluation
- ❖ Future work
- ❖ Conclusions

Motivation: Use of Whiteboards in Design



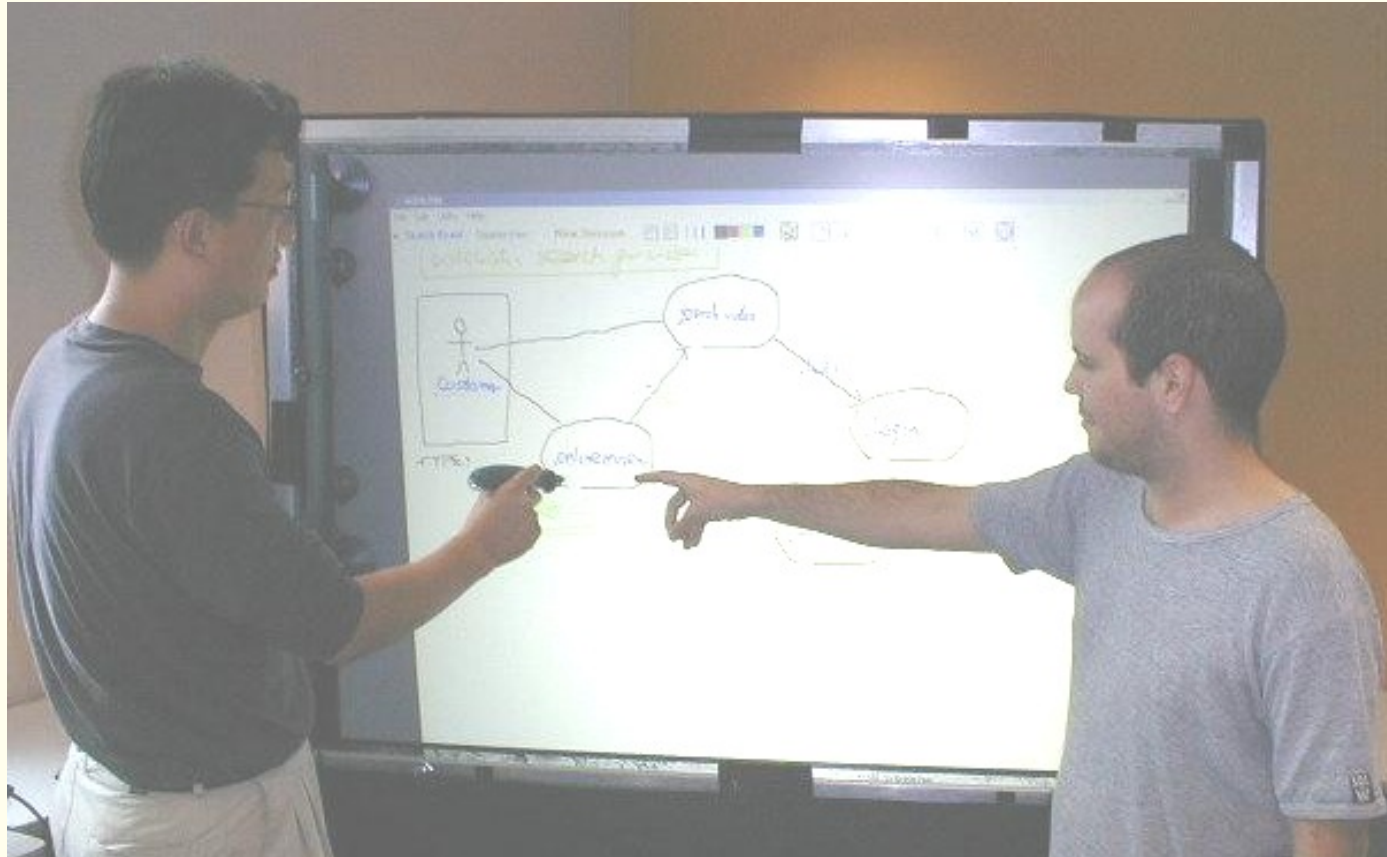
Motivation: Use of Whiteboards in Design

- ❖ Availability – pervasive; no boot time; no crash 😊
- ❖ Flexibility – draw anything, anyway
- ❖ Collaboration – multiple people can see, interact
- ❖ Non-persistent – hard to save, digitize to other tools
- ❖ Non-distributed – single time/place
- ❖ Viscous – hard to change some things e.g. drag-drop?

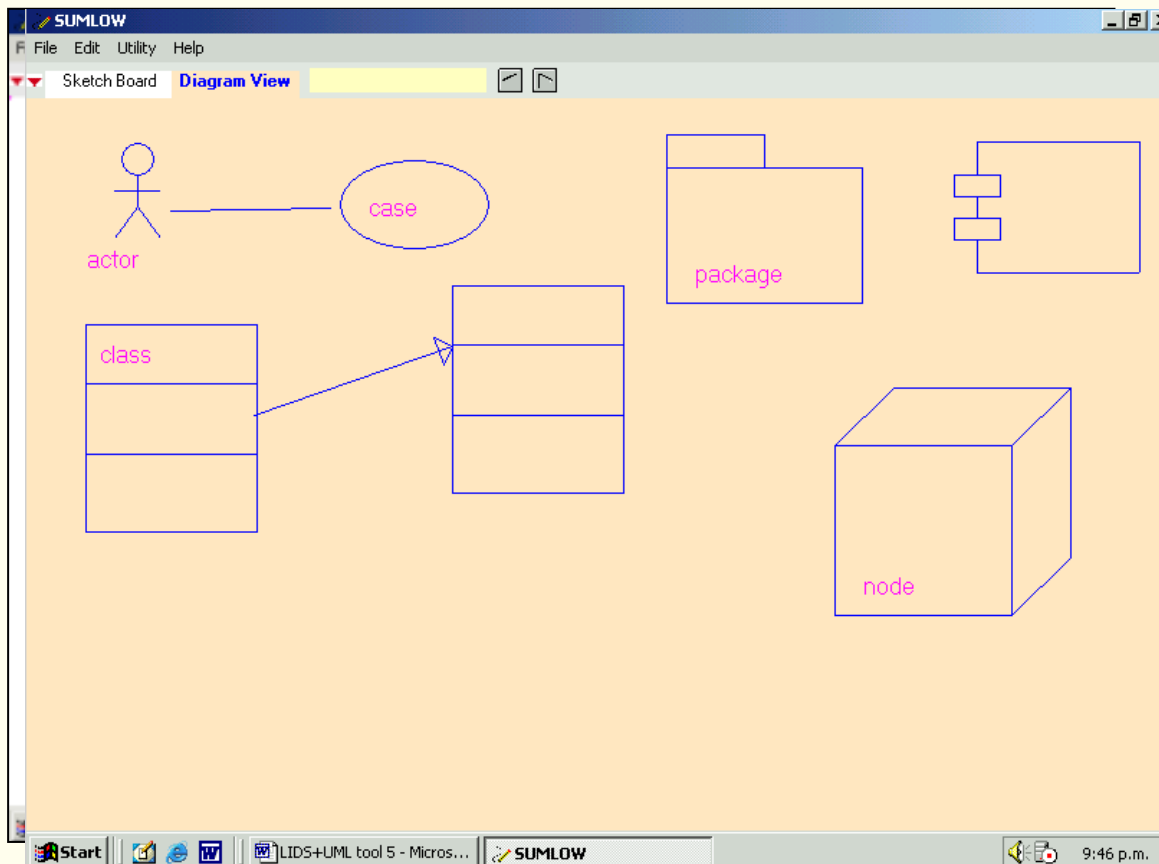
Enter the E-whiteboard...

- ❖ Idea: provide UML sketching-based design tool on an “E-whiteboard” system
- ❖ Combine advantages of whiteboard: flexibility, pervasiveness, power, collaborative work support...
- ❖ ...with advantages of digital pen-based drawing: persistent, translatable data, distributed computing, enhanced digital manipulation of content
- ❖ Using AUT “Large Interface Display Surface” device

Example: SUMLOW in use



SUMLOW Interface



Draw with a digital pen (using MIMIO device to capture)

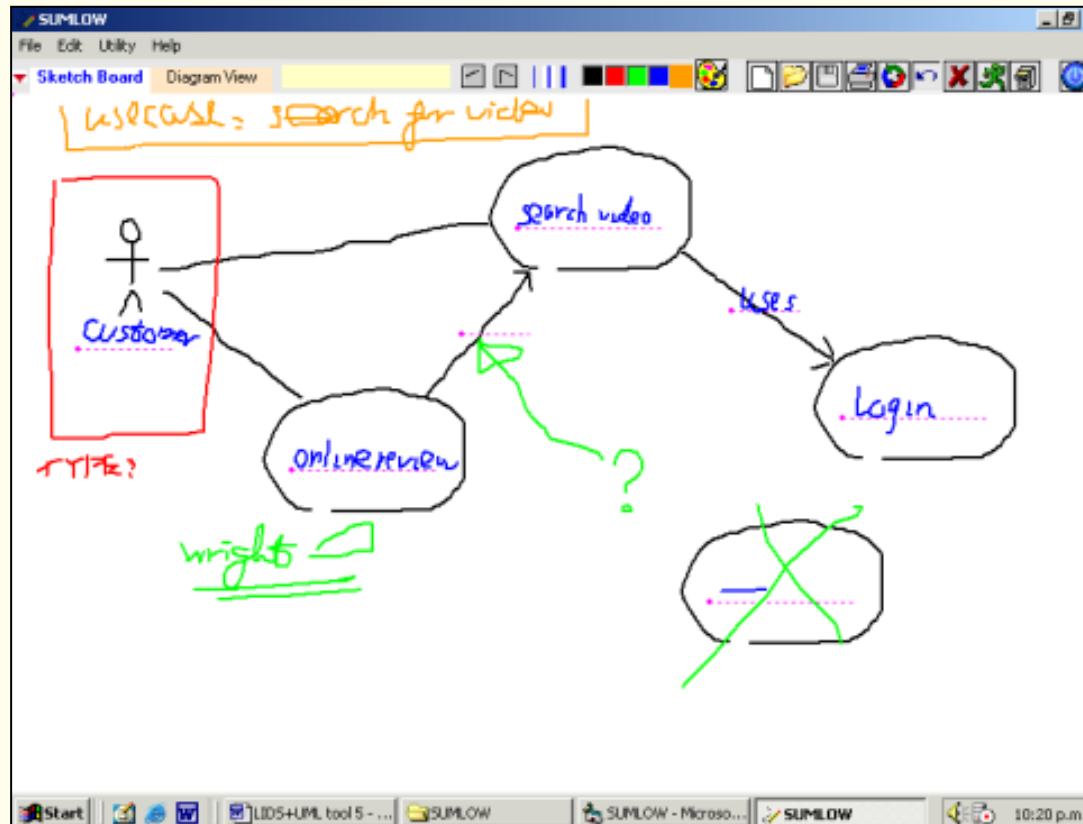
Recognises shapes, text as drawn

Preserves hand-drawn UI during early design work

Variety of UML diagrams supported

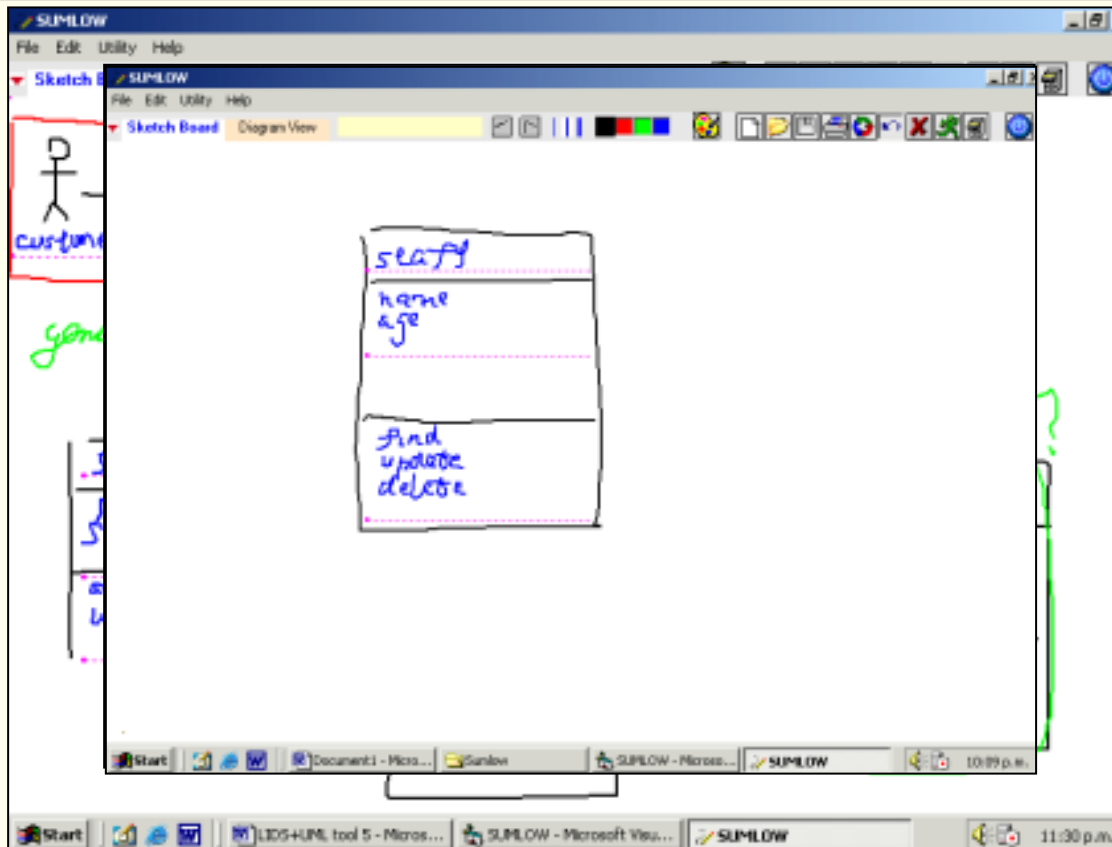
Conversion to “formal” UML...

Example (1): Use case diagrams



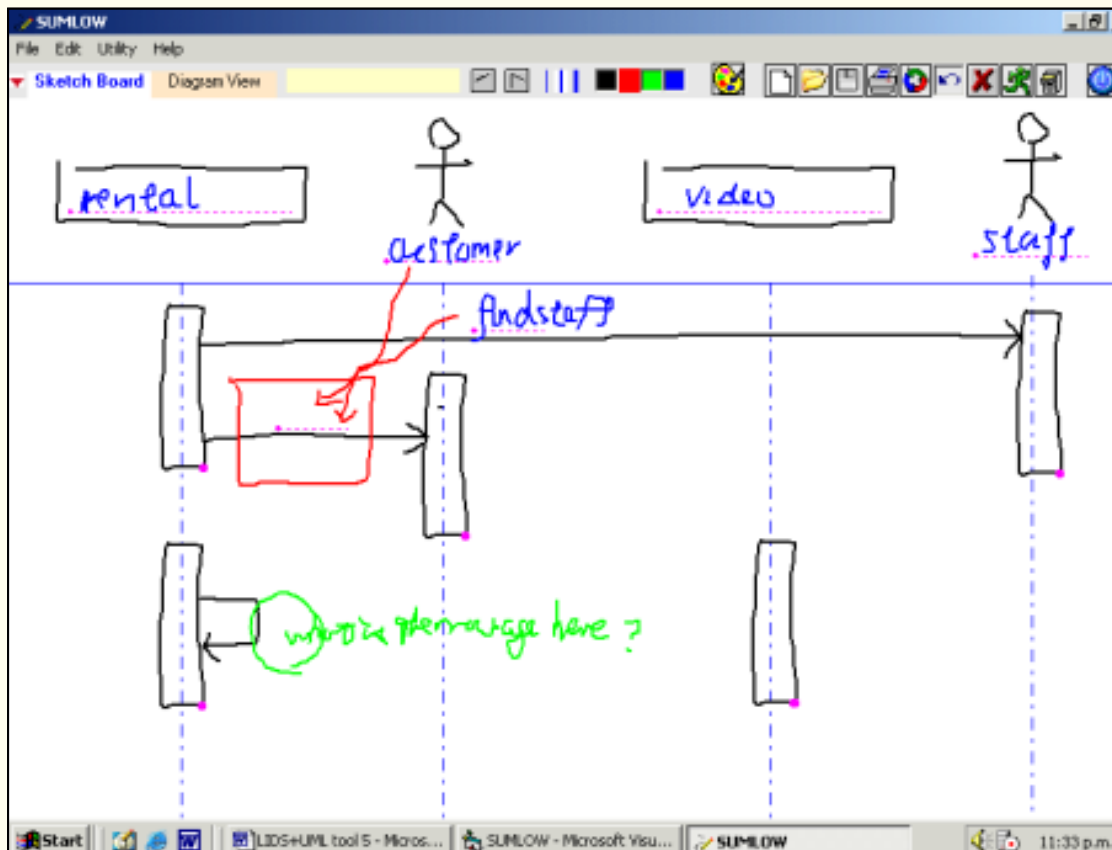
- ❖ Sketch actors (stick figures) and use cases (ovals)
- ❖ Connect with lines
- ❖ Sketch text (input areas automatically added)
- ❖ Add annotations

Example (2): Class diagrams



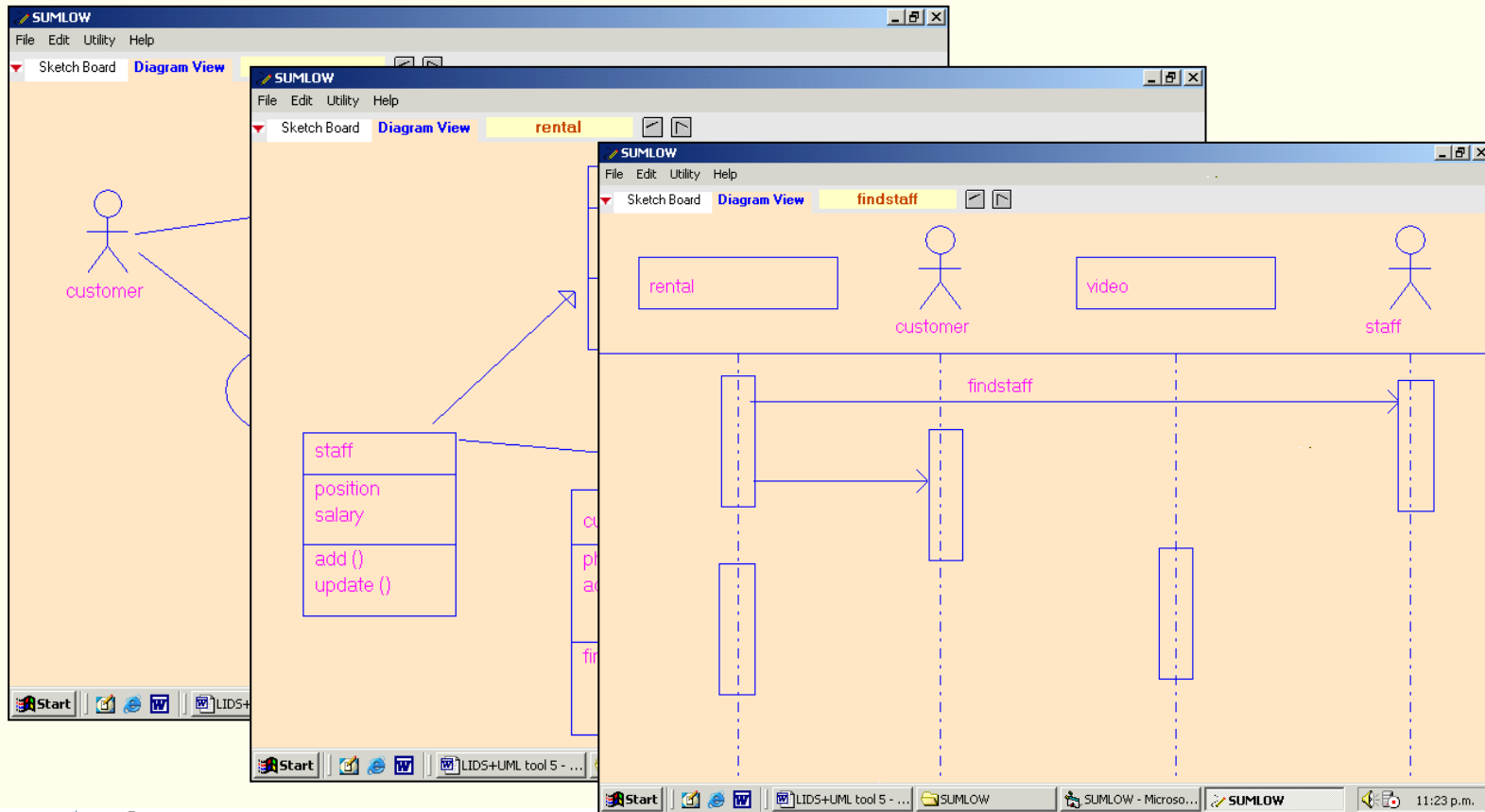
- ❖ Sketch class shapes (rectangles with lines)
- ❖ Add text, relationships
- ❖ Annotations
- ❖ Other UML constructs e.g. actors
- ❖ Manipulating...

Example (3): Sequence diagrams

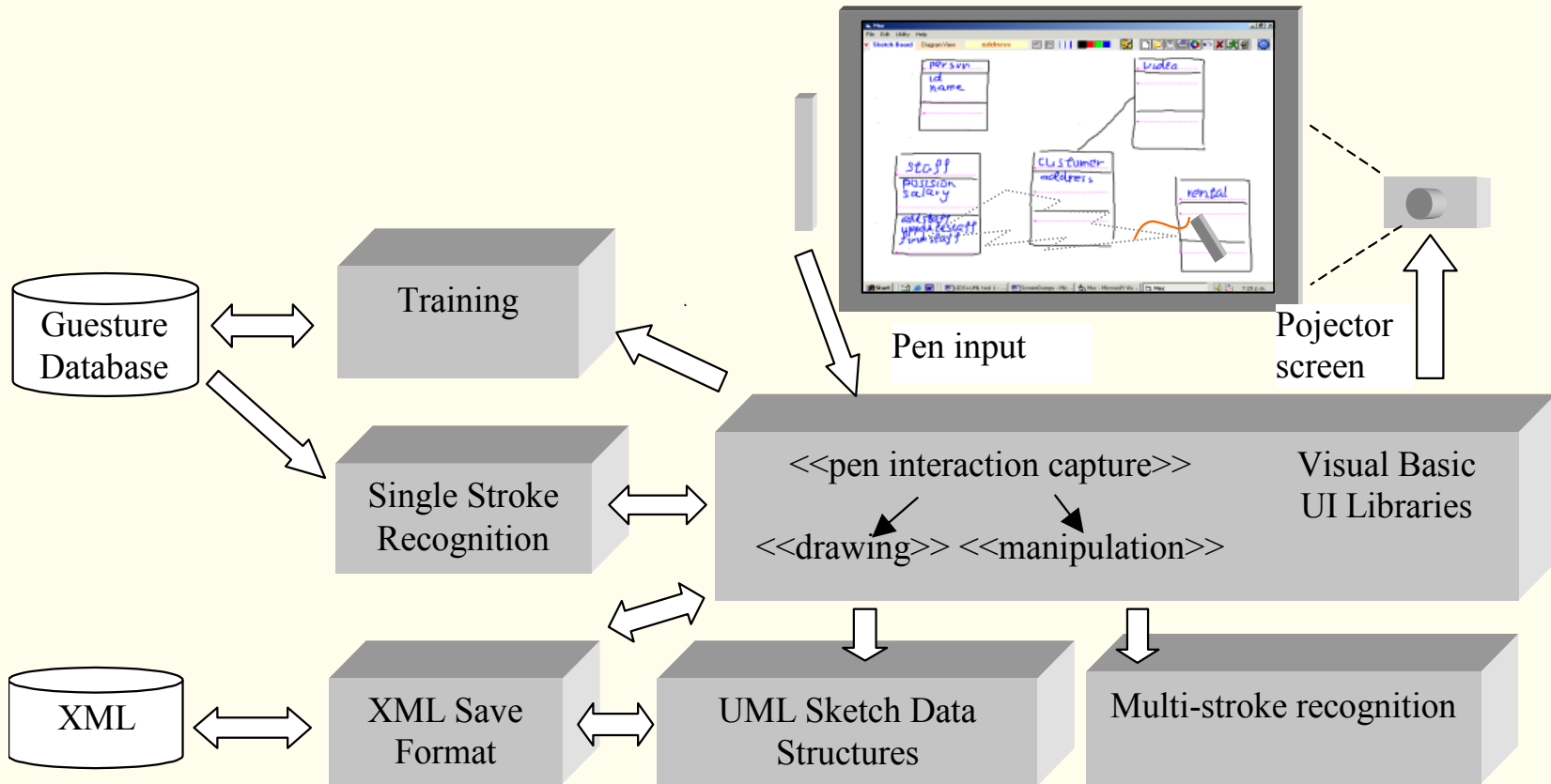


- ❖ Draw line across – sets “mode”
- ❖ Add objects (rectangles) – auto-aligned to top of drawing
- ❖ Add message invocations
- ❖ Add annotations
- ❖ Can mix UML notations

“Formalized” UML Diagrams



Tool Architecture



Evaluation of SUMLOW

❖ Usability:

- Group of experienced UML designers
- Carry out (fairly simple) design tasks, Questionnaire, Recognition %
- Excellent feedback on usefulness and usability
- Need to improve text recognition, diagram manipulation

❖ Cognitive Dimensions:

- Various dimensions (see paper)
- Great flexibility, mixed notations, 2ndary notation, view support
- Viscosity +ve/-ve, recognition sequencing, manipulation operations

Future work/Conclusions

- ❖ Improved UML facilities, recognition
- ❖ Collaborative editing – distributed whiteboards
- ❖ Meta-tool extensions so generate such editors

- ❖ E-whiteboards offer interesting visual language platform
- ❖ SUMLOW = flexible UML tool for E-whiteboard
- ❖ Preserve sketching UI; mixed notations; annotations

References

- ❖ Chen, Q., Grundy, J.C. and Hosking, J.G. An E-whiteboard Application to Support Early Design-Stage Sketching of UML Diagrams, In Proceedings of the 2003 IEEE Conference on Human-Centric Computing, Auckland, New Zealand, October 2003, IEEE CS Press.
- ❖ Chen, Q., Grundy, J.C., and Hosking, J.G. SUMLOW: Early Design-Stage Sketching of UML Diagrams on an E-whiteboard, Software – Practice and Experience, vol. 38 , no. 9, Wiley, July 2008, pp. 961-994.
- ❖ Blagojevic, R., Plimmer, B., Grundy, J.C. and Wang, Y., Using data mining for digital ink recognition: Dividing text and shapes in sketched diagrams, Computers & Graphics, vol. 35, no. 5, Oct 2011, Elsevier, 976-991.
- ❖ Blagojevic, R., Plimmer, B., Grundy, J.C. and Wang, Y. A Data Collection Tool for Sketched Diagrams, In Proceedings of the 5th EUROGRAPHICS Workshop on Sketch-Based Interfaces and Modeling, Annecy, France, June 11-13, 2008.
- ❖ Grundy, J.C. and Hosking, J.G. Supporting generic sketching-based input of diagrams in a domain-specific visual language meta-tool, In Proceedings of the 2007 IEEE/ACM International Conference on Software Engineering (ICSE'07), Minneapolis, USA, May 2007, IEEE CS Press.
- ❖ Blagojevic, R., Plimmer, B., Grundy, J.C. and Wang, Y, Development of techniques for sketched diagram recognition, In Proceedings of the 2008 IEEE Symposium on Visual Languages and Human-Centric Computing, 2008, pp 258-259.