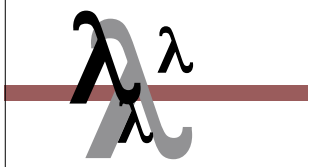


formal methods in HCI

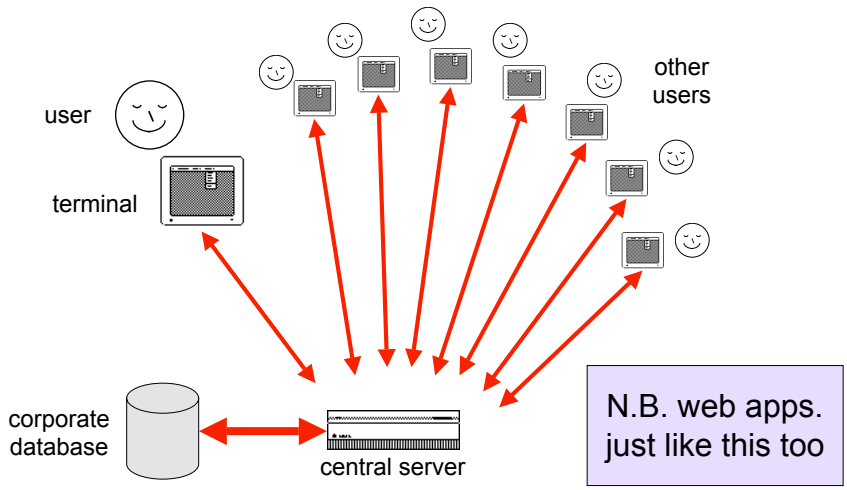
a success story

From Formalism to Physicality, Alan Dix, UPC North, 30 April 2008

problem

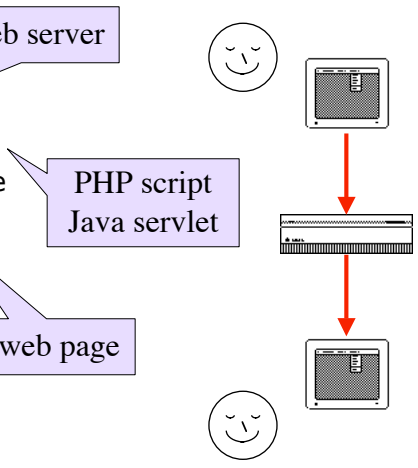
- context
  - mid 80s
  - local authority DP dept
- transaction processing
  - vast numbers of users
  - order processing, pos systems etc.
  - COBOL!
- existing programs ... didn't work

TP physical architecture

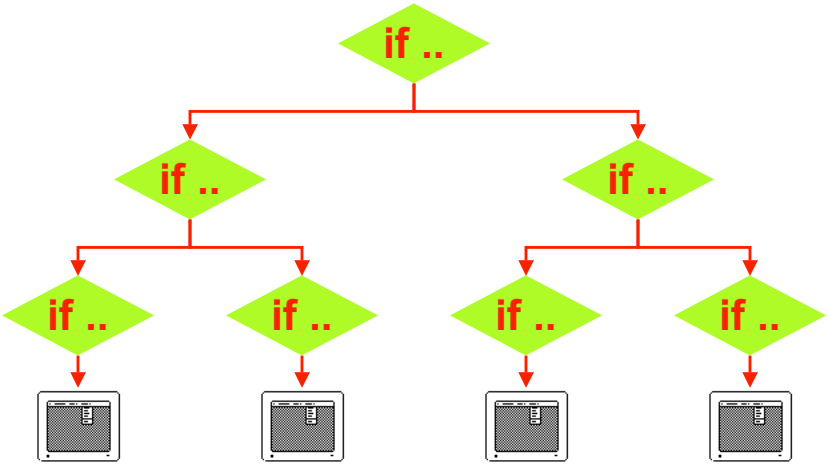


what happens

user edits form
message goes to TP engine
passed to application module
which processes the message
and prepares new screen
which is sent to the user
....



structure of programs



why?

program is trying to work out
what is happening!

- standard algorithm
  - program counter implicit
- TP, web, event-based GUI
  - need explicit dialogue state

mixed up state

- many users – one application module

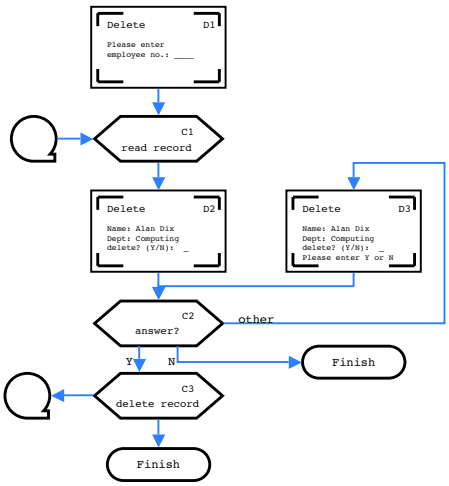
  user A starts multi-screen search list
  application stores value 'next_record'
  user B starts multi-screen search list
  application overwrites value 'next_record'
  user A selects 'next screen' ...
  ... and gets next screen of B's search!

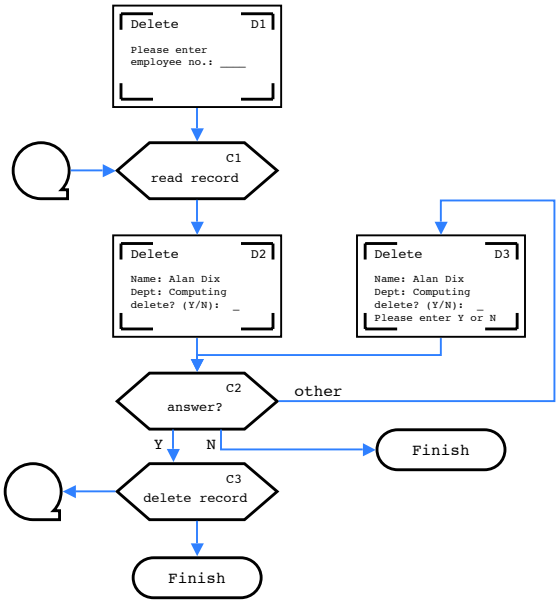
state is hard

- recent MSc course
  - CS and psych
  - exercise – state of 4 function calculator
  - difficult for both
- why?
  - in real life state is implicit
  - in standard CS state is implicit too!

solution?

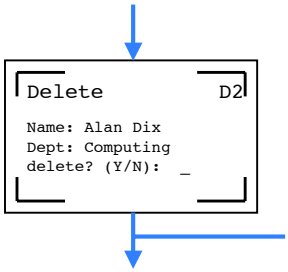
- flowchart!
- not of program
  … but of dialogue
- a formal dialogue specification!

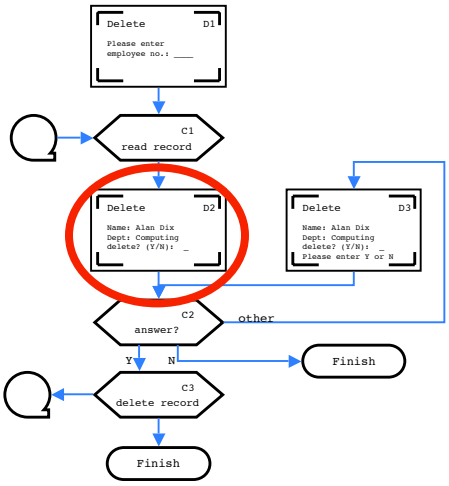




details ...

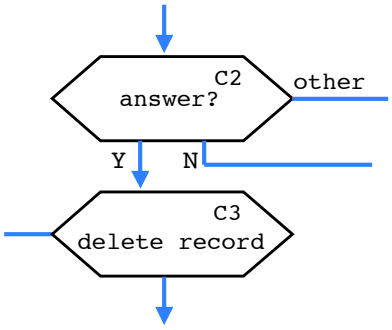
- miniature screen sketch

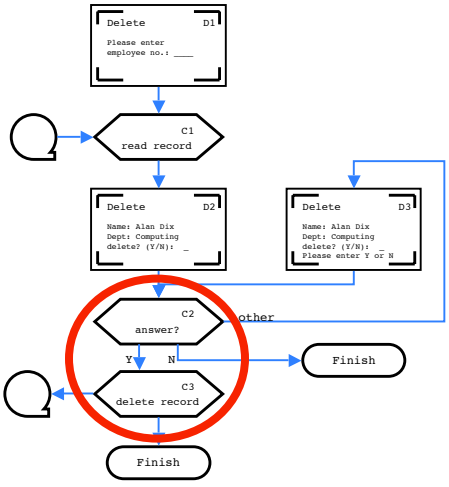




details ...

- minimal internal details





and then ...

- hand transformation to boiler plate code
- store 'where next' for each terminal
  - in 'session' data
- code starts with big 'case'
- do processing
- set new 'where next' ... send screen

lessons

useful	– addresses a real problem!
communication	– mini-pictures and clear flow easy to talk through with client
complementary	– different paradigm than implementation
fast pay back	– quicker to produce application (at least 1000%)
responsive	– rapid turnaround of changes
reliability	– clear boiler plate code less error-prone
quality	– easy to establish test cycle
maintenance	– easy to relate bug/enhancement reports to specification and code

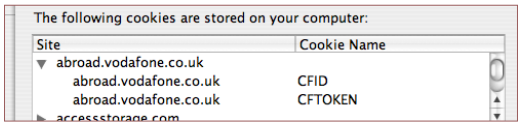
states in web applications (inter alia)

- persistent (deep) state
  - the things you are really interested in
    e.g. an order, images in an album, facebook profile
- temporary interaction state
  - part-created or part-edited objects
    e.g. new cracker setting decoration, joke, etc.
- placeholder in interaction
  - current state/mode/location in dialogue

pretty clear in database or similar

less clear and often confused

where state is stored



(a) cookies

(b) hidden form variables
- `<input type="hidden" name="sid" value="A378F9E6B2" />`

(c) encoded in URL
- `http://mysite.com/processapp.jsp?sid= A378F9E6B2`

(d) session variables
- session/transaction id stored using (a), (b), or (c)

(e) database or persistent store
- as (d) needs identifier or token

what goes where?

interaction issues:

- multiple windows on same app?
- privacy and security
- 'back' button? … and bookmarks
  danger of 'resubmitting' same data

implementation issues

- 'garbage collecting' session data
- restarting server

} why 'stateless' often regarded as good … but *not* necessarily best for interaction!

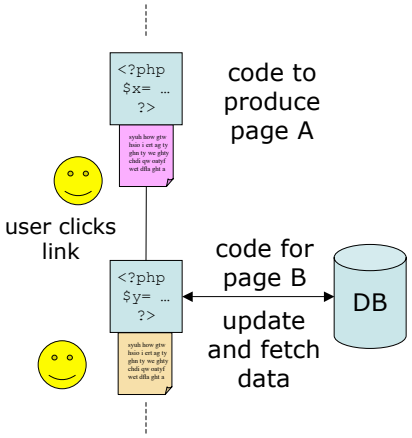
often 'hacked' not considered

lesson – clearly specify the state
… and only then map into implementation!

dialogue too … the way it often is …

initial prototype linear
A then B then …

at most one path
for each link/button



… and the way it goes …

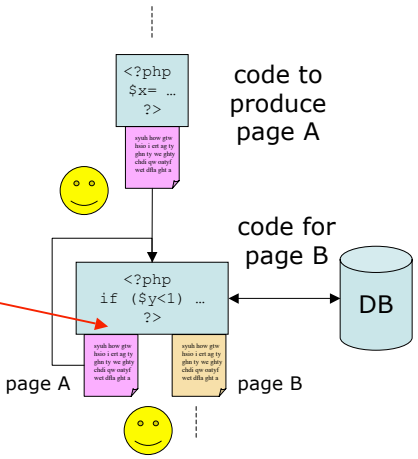
initial prototype linear

but …

later add validation

if validation fails
page B code needs
to produce something
'like' page A

… and it just keeps
getting worse



separate dialogue and presentation

model dialogue

- take into account both
  user and system branches

three kinds of code

- gather data for page
  access database
  but no updates except logging
- format page
  only code to produce HTML
  maybe use template engine
- post-page process actions
  validation checks
  update persistent data
  choose next page to show

view /
presentation

dialogue &
semantics