OO experiences
in
Medical Workstation Products

By
Gerrit Muller

Philips Medical Systems
Common Digital Systems
EasyVision family of products

Examination rooms
- R/F
- Vascular

phase 1: 1992
- print
- store
- export

Examination rooms
- MR
- CT

phase 2: 1994
- MPR
- MPR
- print
- store
- export

phase 3: 1995
- view
- clinical focus
- research
- archive
Product types:

• Modality productivity enhancers:
  + Easyvision R/F
  + Easyvision RAD
  + Easyvision CT/MR
  street price ca 50 k$, high added clinical value; sales directly related to modality sales

• Clinical Focus:
  + Neurovision
  + Image Guided Surgery
  street price ca 100 k$, very high added clinical value; sales limited to specialist areas

• “PACS” workstations
  + Teleradiology Workstation
  + Critical Care Workstation
  + Multi modality review station
  street price ca 25 k$, low added value, low margin; sales potentially very high
september 1991
september 1992

R/F application

<table>
<thead>
<tr>
<th>Print</th>
<th>Store</th>
<th>View</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>spool</td>
<td>HCU</td>
<td>image</td>
<td>gfx</td>
</tr>
<tr>
<td>RC driver</td>
<td>HC driver</td>
<td>DOR driver</td>
<td>DB</td>
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</tbody>
</table>

PMS net in | PMS net out

SunOS

Standard IPX workstation

Desk, cabinet, cables, etc.

device tools

service mode

SW keys

config

install

Start up

RC

3M

DSI

Philips Medical Systems

Common Digital Systems, Gerrit Muller
june 1994
june 1994

<table>
<thead>
<tr>
<th>EasyVision</th>
<th>EV PCR</th>
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<tr>
<td>specialized appl. (dental.)</td>
<td>specialized appl.</td>
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<td>MR</td>
<td>CT</td>
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<tr>
<td>Compose</td>
<td>Print</td>
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<tr>
<td>spool</td>
<td>HCU</td>
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<tr>
<td>CDSpack</td>
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<tr>
<td>RC driver</td>
<td>HC driver</td>
</tr>
<tr>
<td>NIX</td>
<td>Solaris</td>
</tr>
<tr>
<td>Standard IPX or LX+ workstation</td>
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<tr>
<td>Desk, cabinet, cables</td>
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**Phases:**
- dev. tools
- remote access customization
- service mode
- SW keys
- config
- install
- Start up
### 1995/1996

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<tr>
<th>Back-ends</th>
<th>IGS</th>
<th>EV mmrs</th>
<th>EV RAD</th>
<th>EV ct/ mr</th>
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<td>remote access customization</td>
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<td>HC driver</td>
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<td>HP-UX?</td>
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<td>dials interf</td>
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<td>MR</td>
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- Solaris
- HP-UX?
- Standard SS5 or SS6 workstation or HP 712++
Table 1: Efficiency through re-use

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<td>12</td>
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<td>6</td>
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</table>
To OO or not to OO

Characteristics of the Easyvision application are:

• Large variety in input images
  + $256^2, 480^2, 512^2, 1024^2$, non square, etc.
  + 8, 10, 12 bits
  + CT, MR, X-ray Image Intensifier

• Large variety in application requirements

• Large variety in use

Easyvision is impossible without OO
Learning Curve

Phase 1:

Make something in the OO way

Result: We understand OO!
Learning Curve

Phase 2:

Modify the something of phase 1

How ugly, lets redesign

Result: Now we really understand OO
Learning curve

Phase 3:
Modify the something of phase 2

Jeeee, it is still ugly, lets redesign

Result: Now we finally understand OO
Learning curve

• Do it

• Plan for a long learning curve
  + Do not sell (promise) re-use;
    If you are quite good you may see (controlled, reproducible) re-use after ca. 3 years

• Do not hesitate to throw away early implementations;

Plan (budget) these redesigns
Method

Easyvision development method:

- prototype
- evaluate
- engineering

No formal analysis/design/documentation method!

Formal methods:

- work for small projects only
- playground for academics :-)

C++ ??

Objective-C is:

- Much simpler
- More powerful

Conclusion: Use C++

- C++ is de facto standard
- all new tool developments are C++ based
OO is not so new after all...

• Many “conventional” designs use OO-like techniques by intuition

• OO languages support the OO mechanisms, hence
  + line count reduction

• Call back-scheduling idem
To OO or not to OO, TWO (2).

• It is not an easy transition

• The change will take years:
  + don’t wait with the start

• BUT, you don’t have a choice:
  + the projected growth of complexity in any
    system (TV or Numerical Control or medical
    imaging equipment) is too large for
    conventional methods