OO experiences in Medical Workstation Products

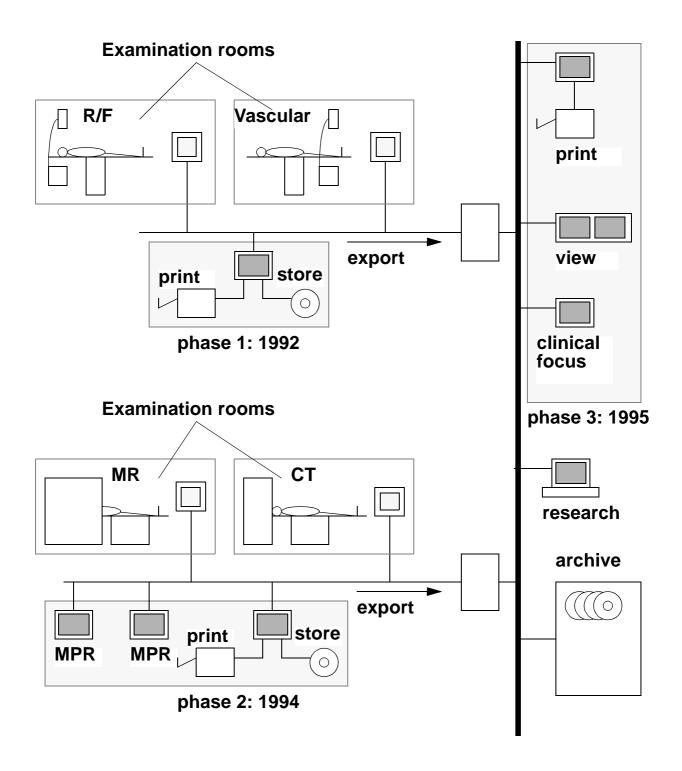
By

Gerrit Muller

Philips Medical Systems

Common Digital Systems

EasyVision family of products



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

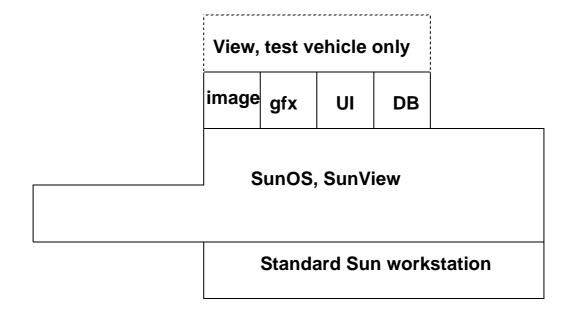
- Clinical Focus:
 - Neurovision
 - + Image Guided Surgery

street price ca 100 k\$, very high added clinical value; sales limited to specialist areas

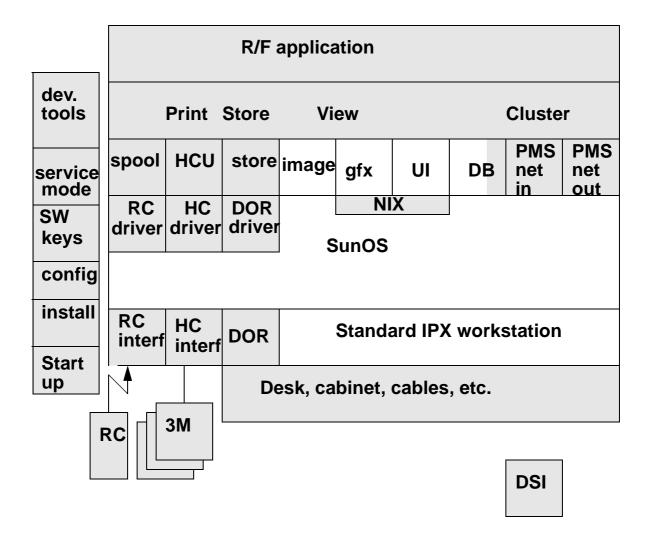
- "PACS" workstations
 - + Teleradiology Workstation
 - + Critical Care Workstation
 - + Multi modality review station

street price ca 25 k\$, low added value, low margin; sales potentially very high

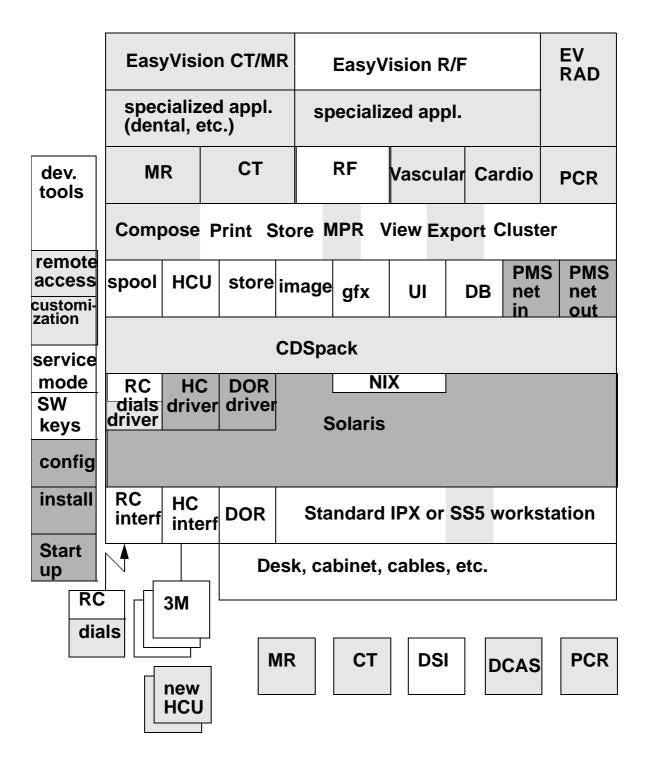
september 1991



september 1992



june 1994



june 1994

	specialized appl. (dental.)						EV PCR				
					sp						
dev. tools	MR		СТ		RF		Vascular Cardio		rdio	PCR	
	Compose Print Store MPR View Export Cluster										
remote access customi- zation	spool	НС	J store	im	age	gfx	UI	DB	PMS net in	S PMS net out	
service	CDSpack										
sw keys config	RC HC DOR driver driver Solaris										
install	RC interf	HC inte	DOR		Sta	ndard	IPX or	LX+ w	orks	tation	
Start up		D	Desk, cabinet, cables								
RC 3M MR CT DSI DCAS PCR									PCR		

1995/1996

	Back	ck-ends		IGS		EV mmrs			D m	/ ct/ r	E\ R/			
		-		d appl. s chase, cardio analysis, etc)						interfacing RIS, etc.				
dev. tools		MR		СТ		RF		Vascular		Cardio		PCR		
		Compose Print Store MPR View Export Cluster												
ac	mote cess stomi-	spool	HCU	store	imag	e gf	x	UI	DB	PM: net in	S	PMS net out		
se	rvice	CDSpack												
S	node W eys	RC driver	HC driver	DOR driver	•	Sola	NI) ris	(
	onfig			HP-UX			-UX?	?						
	nstall	RC dials interf	HC interf	DOR	Sta	anda		S5or S HP 7		vorkst	ati	on		
Start up							k, cabinet, cables, etc.							
2nd monitor video in video out accelerator MR CT DSI DCAS PCF								PCR						
	ig. filr													

Table 1: Efficiency through re-use

	1992	1993	1994	1995	1996					
number of products and applications										
products	1	3	5	9	13					
inputs, a.o.	1	5	10	15						
modalities										
applications	1	4	8	16	32					
people										
infrastructure			20+15	21+16	22+16					
application			27	35	41					
total		52	62	72	79					
efficiency										
people per		17	12	8	6					
product										

To OO or not to OO

Characteristics of the Easyvision application are:

- Large variety in input images
 - + 256², 480², 512², 1024², 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 00!

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