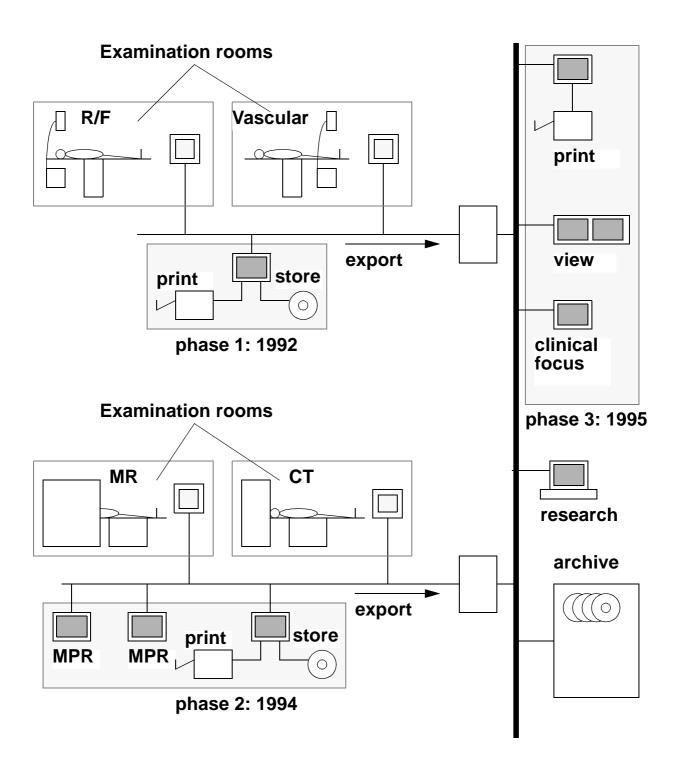
MR lezing

Re-use in Workstation Products

 $\mathbf{B}\mathbf{y}$

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

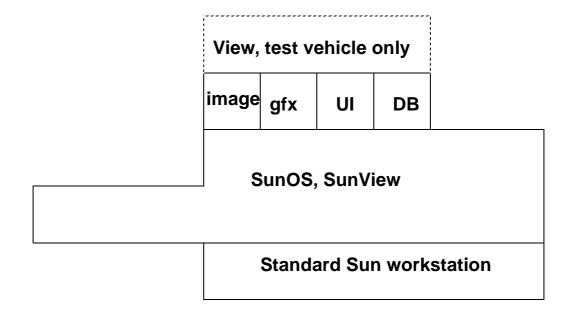
street price ca 100 k\$, very high added clinical value; sales limited to specialist areas

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

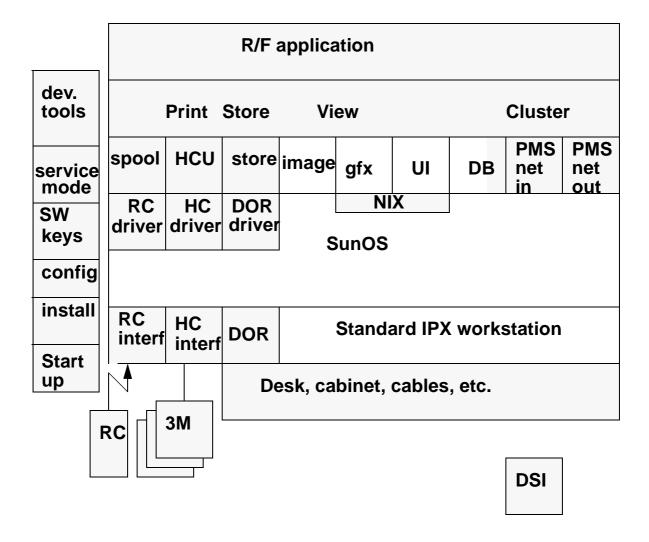
street price ca 25 k\$, low added value, low margin; sales potentially very high

september 1991

Re-use in workstation products



september 1992



june 1994

	EasyVision CT/MR					EasyVision R/F						
	specialized app (dental, etc.)				S	peciali						
dev. tools	MR		СТ			RF	Vascu	lar Ca	rdio	PCR		
	Compose Print Store MPR View Export C							Clust	er			
remote access customi- zation	spool	pool HCU		store	image	gfx	UI	DB	PM net in			
service	CDSpack											
sw keys config	RC dials dri			DOR driver Solaris								
install	RC interf	HC inte	erf C	OOR	Sta	andard	IPX or	LX+ w	orks	tation		
Start up				Desk, cabinet, cables, etc.								
dia		new HCU		N	/IR	СТ	DS	i D	CAS	PCR		

june 1994

					EasyVision						
	spec (den		ed appl.	sp	specialized appl.						
dev. tools	MR		СТ		RF	Vascu	lar Caı	rdio	PCR		
	Compose Print Store MPR View Export Cluster										
remote access customi- zation	spool HCU		J store	image	gfx	UI	DB	PMS net in	S PMS net out		
service	CDSpack										
sw keys	RC HC driver										
config											
install	RC interf	HC inte	DOR	Sta	ndard	IPX or	LX+ w	orkst	tation		
Start up	Desk, cabinet, cables										
RC 3M											
L		new		MR CT DSI DCAS							
		HCU									

1995/1996

Back-ends				IGS EV mmrs						EV ct/mr		EV R/F	
			ialized tal, bo	l appl. lus chase, cardiac, etc.) interfaci RIS, etc.									
dev. tools		MR		СТ		RF		Vascular		Cardio		PCR	
		Compose Print Store MPR View Export Cluster											
customi-		spool	HCU	store	imag	gfx	ι	ונ	DB ne		_		
se	ervice	CDSpack										July	
S	node W eys	RC HC drive		DOR driver		Solaris	IIX						
	onfig			HP-UX									
ir	nstall	RC dials interf	HC interf	DOR	Standard SS5or SS6 workstation or HP 712++							on	
	tart p			Desk, cabinet, cables, etc.									
	RC dia	; als	3M				7 [[
v v a		onitor n out rator	new HCU	N	/IR	СТ		DSI		DCAS		PCR	

Process structure

system monitor

UI process

DB

Job queueing and status persistent via database

Import

Export

Optical store

Print

Compute

How to extend

New modality:

- Data model (storage and access structure)
- Import mapping and conversion
- Configuration definitions
- presentation:
 - + data base
 - + image selection
 - + image annotation (monitor & film)
 - + info/text page

New clinical application:

- facility (User Interface)
- protocol print

How to extend, other vendors

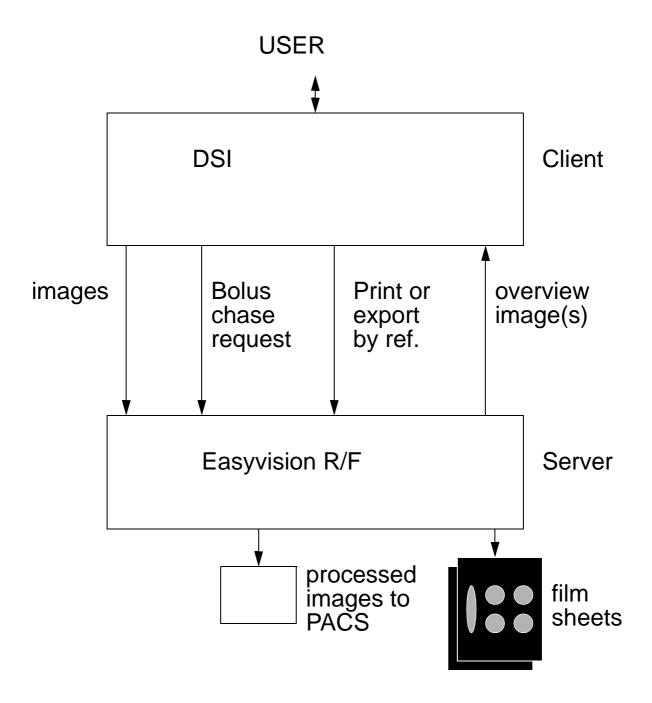
New modality vendor (via DICOM):

- Customization data element semantics
- Validation

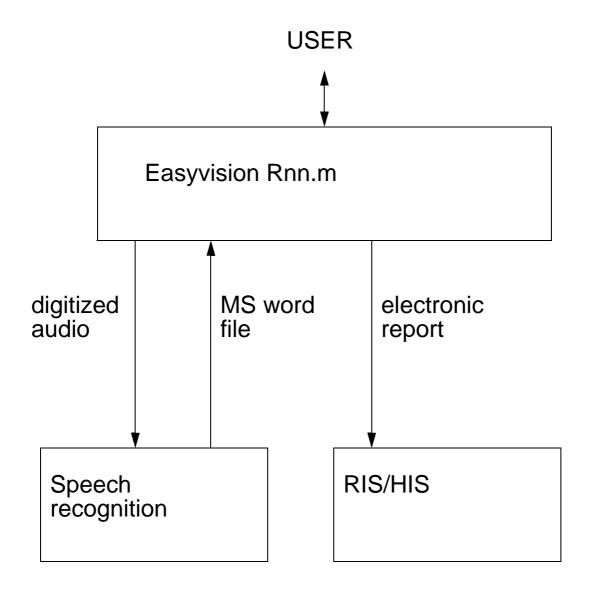
New "PACS" vendor (via DICOM):

- Customization data element semantics
- Customization export:
 - + matrix size
 - + nr of bits
 - + processing
 - graphics representation
- Validation

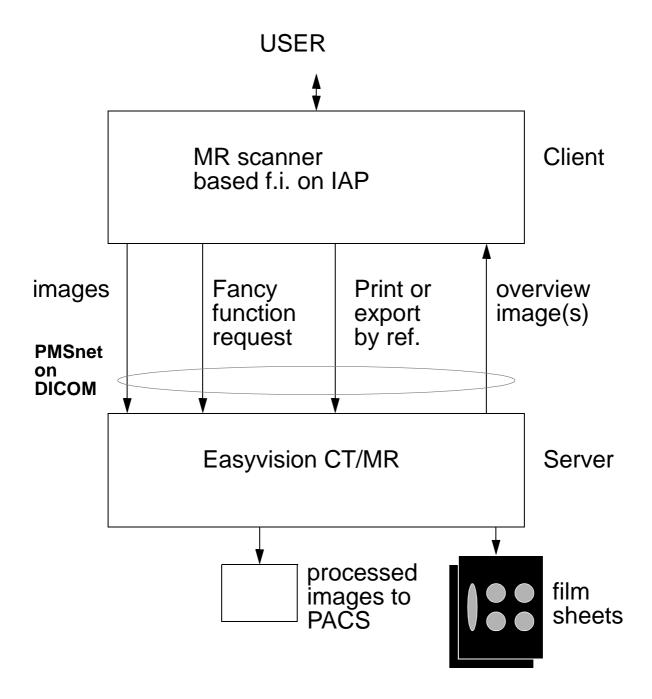
Distributed applications



Distributed applications



Distributed MR&CDS applications



PMSnet, DICOM

PMSnet, DICOM =

network + protocol + data dictionary + services + model

Services are:

- world wide standardized (store, query, etc.) multivendor
- PMS standardized (print, file, export) multi-modality
- Bi lateral agreed (CT: print via port number and fixed data elements)
- Unilateral supported (for instance: Muller! -> print)

Services in PMSnet/DICOM

Uni- and Bi-lateral services:

- simple
- fulfill many demands
- low implementation effort
- low functionality

Standardized services:

- allow for full model:
 - + Film low
 - Print Job Muller finished
 - + Feedback on film output
- client side needs more code to benefit from full model.

PMSnet on DICOM =

DICOM +

PMS services +

detailed data dictionary +

detailed model

Status CDS:

- Transition from sequential development to parallel development
- Technology Improvement Plan: start phase 2
 Interfacing, further manageability
- Software Process Improvement:
 - Strive for improved manageability, maintain innovation rate
 (requirement management, planning, etc.)
 - + SW development environment (DDTS, Clearcase?)
 - + Quantification (Metrics)(QAC?, project TU Delft)
 - + Documentation

Major phases

- Phase 1 (modularization):
 - + Cleanup most obvious modules
 - + First division in separate packages
 - Equalization of internal data model and PMS
 Data Dictionary
 - + PMSnet, PMSdor, complete new
 - + analysis (modularity, notifications, properties)
- Phase 2 (Interfacing):
 - + Further modularity restructuring
 - Prototyping interface
 - Advanced development interface
 - + Prepare external interface
 - + Explore real time extensions(e.g. Threads)

Major phases 2

- Phase 3 (Internal benefit, standardization)
 - + Explore C++
 - + Explore X
 - + Implement 1D viewing
 - + Use external interface
- Phase 4 (external benefit)
 - + Decide on C++, X use
 - + Use platform by non CDS clients

Status june 1994

- Modularity
 - + CDS pack independent of rest SW
 - + SW archive divided in "groups", dependencies are analyzed and reduced
- Property management
 - file structure streamlined
- SPI support library
 - + Implementation finished
 - + Increased performance and functionality
 - + Much less code
 - + Configuration simpler
- PMSdor, PMSnet redesigned
- Solaris 2
- HP: viewing ported, plan for product porting

- Cardio graphics:
 - additional functionality
 - + "cold" graphics removed
- Data representation:
 - + XDR based self describing object format
- Data base:
 - + improved performance
 - + support for spooled services
- Process structure:
 - import and export servers-> network server
 - spoolers and UNIX command server removed
- Memory usage:
 - + ASW: 20% reduction (UNIX 20% increase)
- Documentation:
 - + System level OK