

# Experiences with product line architecture

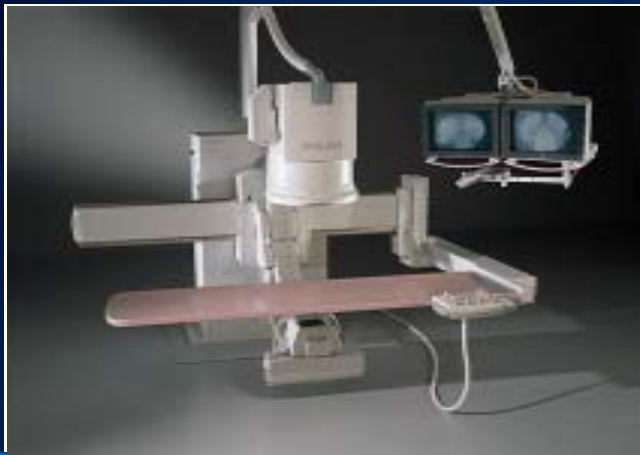
Ben Pronk

[ben.pronk@philips.com](mailto:ben.pronk@philips.com)

# Contents

- Product overview
- Main ideas and assumptions
- Technical set-up
- Organization and project problems

# X-ray Product Overview



*Let's make things better.*



**PHILIPS**

# X-ray Product Overview

- Biplane Cardio Vascular Neuro
- Monoplane Cardio Vascular Neuro
- Tilt-C
- Mid-end URF
- Low-end URF
- Surgery
- High end radiography
- Low end radiography

# Main ideas/assumptions

- Reuse as leading principle:
  - Share as much as possible functionality/infrastructure
  - The platform implements the common factor
  - Systems will be derived from it with limited extensions

# Main ideas/assumptions

- Re-implementation of current system(s) with new technology and small functional improvements
- Larger functional improvements later
- Reuse existing hardware subsystems
- Start prototyping fast

# Technical Approach

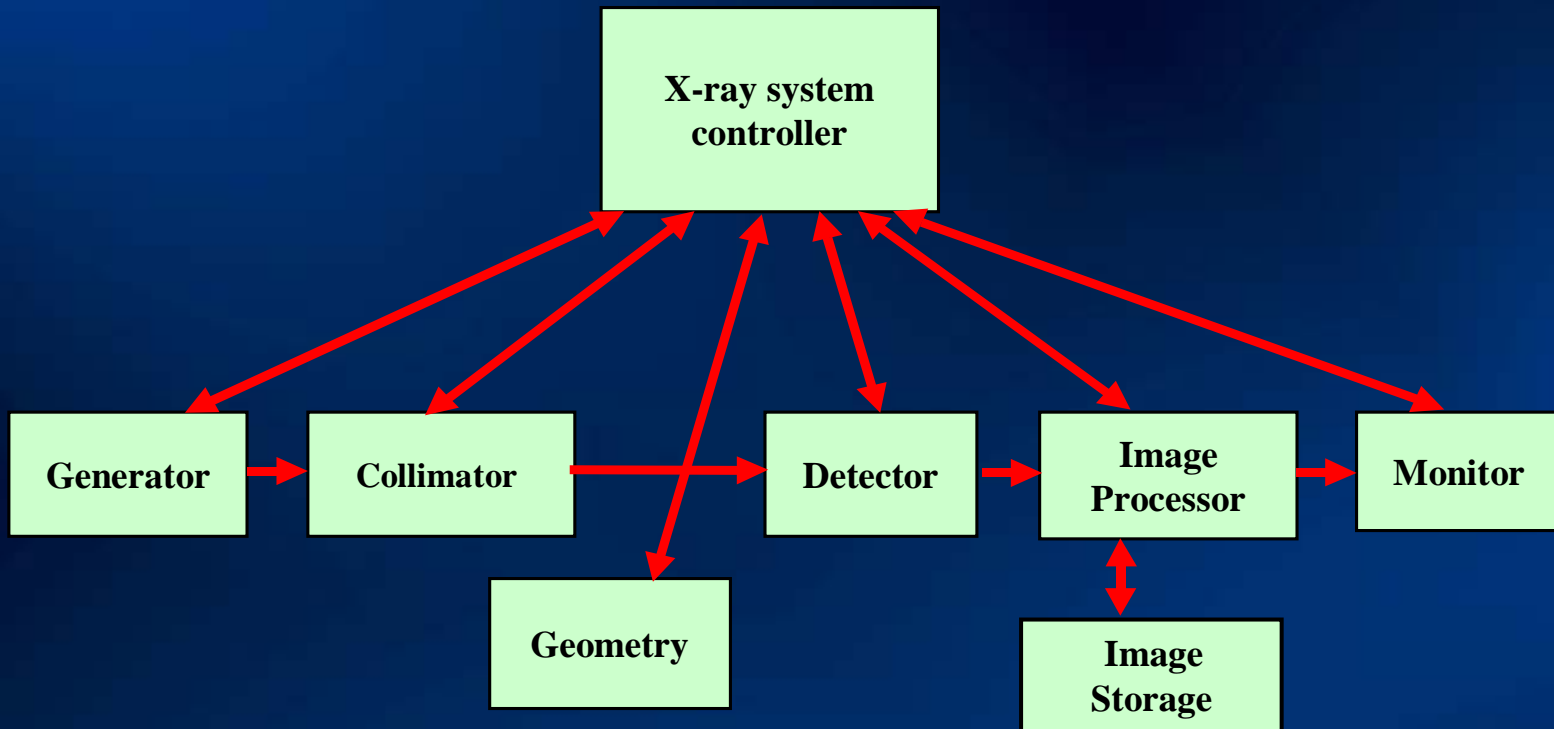
- Take advantage of of the law of Moore
  - Make new more cost-effective image processor/system controller
  - Integrate more cabinets to reduce costs/overhead
- Use of standard technology as much as possible:
  - Price/performance ratio + development
  - Available components
  - Productivity of tools/ environment
  - Available man-power, knowledge

# Technical Approach

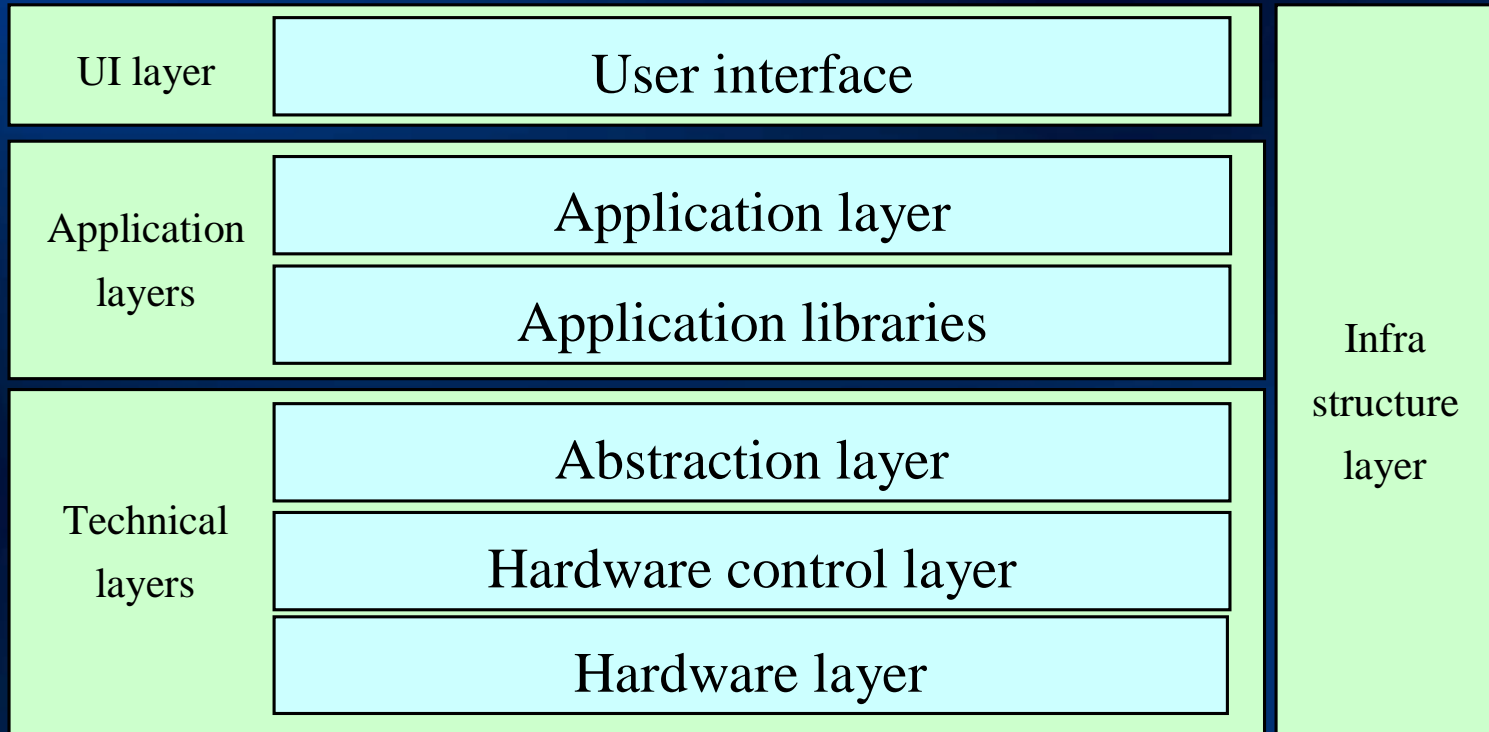
- Use more COTS:
  - PC-technology
  - Standard network, backplane etc.
  - Desktop Operating systems (Windows-NT)
  - Standard programming environment (C++/MFC/COM)
  - Normal Windows-GUI



# Technical Approach



# Technical Approach



# Technical Approach

- Application layer
  - One application for every main functional area (viewing)
  - Implement a model, view, controller pattern
- Technical layer
  - Examples: collimator, detection, geometry ...
  - Allow applications to virtually share devices (logical resource)
  - Abstract from hardware on their interfaces
- Infrastructure layer
  - Common infrastructure for all NT-software
  - Common Vxworks software infrastructure for all boards
  - Common field service infrastructure for all devices.

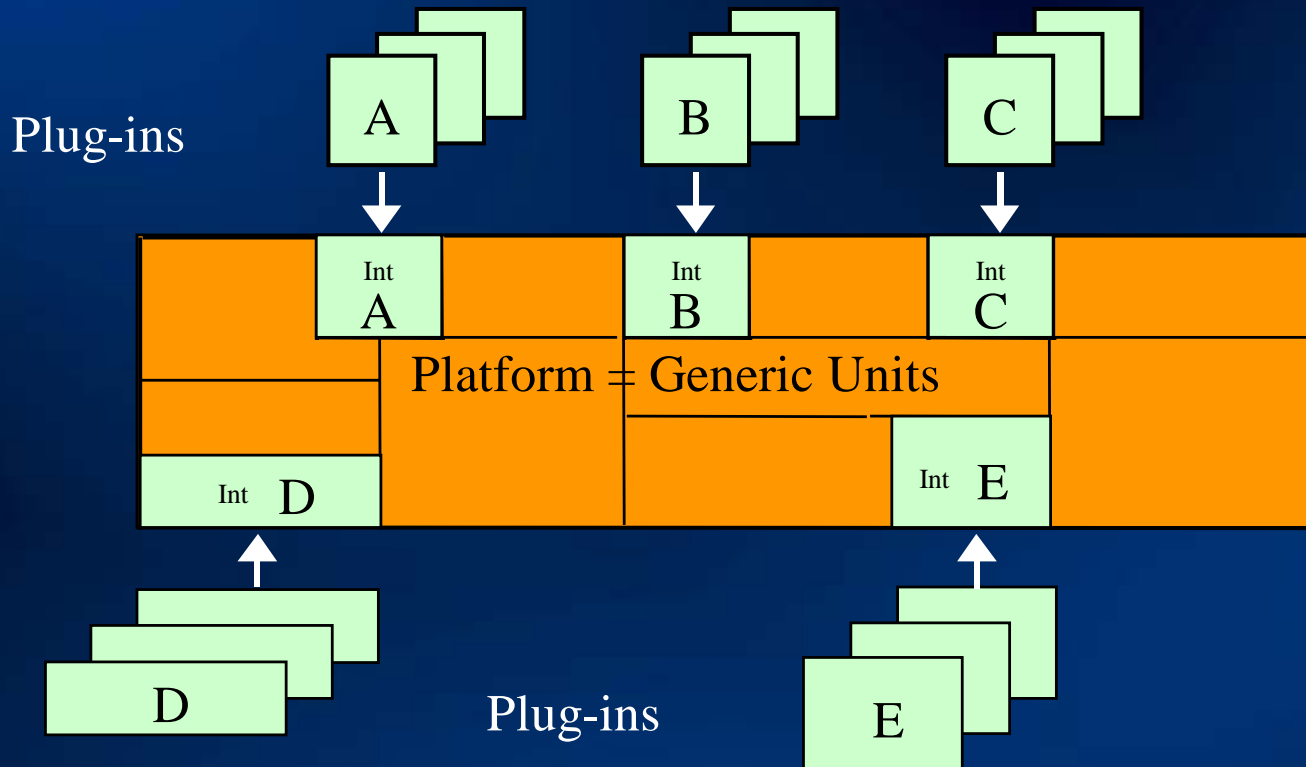
# Technical Approach

- The platform approach:
  - Reuse of core functionality over all family members
  - Parallel multi-site derivation of products
  - Regular development updates of central platform
  - Reuse of complete platform, no modifications
  - Binary reuse, no full testing effort

# Technical Approach

- Component frameworks as main element
  - A set of interfaces (provides + requires)
  - A framework with general functionality
  - A (variable) set of plug-in components
- One platform, reused as a single component
  - Platform implements all generic functionality
  - Binary reuse of platform
  - Platform defines variation points
  - Each variation point is a component framework
  - Specific functionality in separate components

# Technical Approach



# Organization and Project

- Organizational and Human aspects have been dominant:
  - This presentation only focuses on the product line issues
- Stretching the product line to far to early
  - Scope change mid project with remaining end date
  - A large number of systems to deal with directly
  - Stretching the product line to the low end (cost pressure)
  - Add new products to the product line with a lot of new requirements

# Organization and Project

- Organization was not adapted to new reality
  - A multi business line project
    - Users from different groups
    - Resources from different groups
  - Multiple everything
    - Multiple resource owners, multiple procedures multiple cultures
    - Multiple marketing groups, service groups ...
    - Priorities and choices to be made, who decides what
  - Yet specification phase progressed reasonably well, champions



# Organization and Project

- The scope change worsened the situation to the extreme
  - New groups to be linked in into a running train
  - A larger distance, new cultures
  - Organizations were in two complete different project phases
  - New requirements had to be taken into account
  - Champion model did not work anymore
  - Top management was aware but wanted to wait

# Organization and Project

- The work distribution between groups was changed
  - All major design work now done in one group
  - Very few did realize this from the start
  - Partly solved by reallocation of key people
  - No full acceptance of this situation, very lengthy battles
  - Alternatives, assessments, discussions on and on
  - This was mainly controlled with force by top management

# Organization and Project

- Again technologically the product line works well
  - After the prototype the second cardio system is being build
  - Transfer to another system type runs smoothly
  - With only limited changes a completely different application will be delivered