Abstract

Many companies struggle to benefit from similarities between products they sell. The challenge is to find these commonalities that can be shared between products, while the product value for different customers is not (too much) compromised.

We will discuss a method understand the playing field both in marketing and technology, and we discuss a process to quickly explore this playing field by workshops and fast iteration over views and considerations.
Exploring Product Line Opportunities

Introduction
Product Line Considerations
Analysis Method
Workshop Approach
Product Lines in Practice
Summary

version: 0.2
March 6, 2013

Gerrit Muller
The “CAFCR” model

What does Customer need in Product and Why?

Customer
What
- Customer objectives

Customer
How
- Application

Product
What
- Functional

Product
How
- Conceptual

Realization

drives, justifies, needs

enables, supports
CAFCR can be applied recursively

- **Consumer**
  - Drives
  - Enables
  - Customer's Business
    - Drives
    - Enables
    - Value Chain (larger scope has smaller influence on architecture)

- **System (producer)**
  - Drives
  - Enables
  - Customer Business
    - Drives
    - Enables
CAFCR+ model; Life Cycle View

Customer objectives

Application

Functional

Conceptual

Realization

Life cycle operations

maintenance

upgrades

development

manufacturing

installation

sales, service, logistics, production, R&D
Multiple Markets

Customer
What
Customer
How
Product
What
Product
How
C
ustomer
objectives
A
pplication
F
unctional
C
ceptual
R
ealization

Multiple markets:
different customers
different applications
different products
electron microscopes:
material sciences
life sciences
manufacturing, e.g. semiconductors

Shared platform:
shared concepts
shared technology
electron microscopes:
e-beam sources, optics
vacuum
acquisition control

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Complementing Systems for Same Market

Customer Objectives

What

How

Product Conceptual

What

How

Functional

Realization

Single market:
different stakeholders
different applications
interoperable products

health care, e.g. cardiology:
analysis
diagnosis	
treatment
administration

Shared components:
shared concepts
shared technology

health care, e.g. cardiology:
patient support
patient information
image information
storage & communication
user interface
# Scope Analysis

## Market Segmentation

<table>
<thead>
<tr>
<th>Customer</th>
<th>Application</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong></td>
<td><strong>What</strong></td>
<td><strong>What</strong></td>
</tr>
<tr>
<td><strong>How</strong></td>
<td><strong>Function</strong></td>
<td><strong>How</strong></td>
</tr>
</tbody>
</table>

### Customer Objectives
- shared functionality
- analyse characteristics
- analyse differentiators

### Functionality
- conceptual
- realization

### Market Taxonomy
- customer classification
- stakeholder classification
- inventarization applications

### Functions
- inventarization
- applications
- features
- performance

## Synergy Analysis

### Exploring Product Line Opportunities

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**Date:** March 6, 2013  
**Author:** Gerrit Muller
Exploring Product Line Opportunities

**Roadmapping: Impact of Future Technology**

### Market

- **Customer**
  - What
  - How
  - Objectives

- **Application**
  - Commercial
  - Financial
  - Legal
  - Social
  - Social
  - Domain Specific
    - (e.g. clinical)
  - Managerial

### Technology

- **Product**
  - What
  - How
  - Conceptual
  - Realization

- **Trends**
  - From gradual to disruptive

- **Technology Paradigm Transition**
Criteria and Forces for Synergy

unification
- development cost
- development effort
- logistics cost

market share
- time to market
- installed base evolution
- future (potential) value
- market approach
  - (luminary sites, price fighter)

fit to customer
- fit to stakeholder
- fit to application

dedication
Possible Levels of Sharing

**intangible assets**
- vision, objectives
- specifications, interfaces
- designs, concepts

**tangible assets**
- realized components
- integrated (sub)systems
- test suites
- processes
- tools
- infrastructure

*Not everything that can be shared should be shared!*
Analysis Method

Introduction

Product Line Considerations

Analysis Method

Workshop Approach

Product Lines in Practice

Summary
<table>
<thead>
<tr>
<th>Approach to Platform Business Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>explore markets, customers, products and technologies</strong></td>
</tr>
<tr>
<td><strong>share market and customer insights</strong></td>
</tr>
<tr>
<td><strong>identify product features and technology components</strong></td>
</tr>
<tr>
<td><strong>make maps:</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>discuss value, synergy, and (potential) conflicts</strong></td>
</tr>
<tr>
<td><strong>create long-term and short-term plan</strong></td>
</tr>
</tbody>
</table>
Explore Markets, Customers, Products and Technologies

market segments
- Asian country
- Asian city
- African
- US private
- US social
- EU

customers
- Won Lan
- JJ express
- Pretoria national
- Johnson
- Columbia
- EU

products
- P1800
- P1900
- P2200
- P2600

technology
- feeding
- buffering
- cleaning
- power
- heating
- cooling
- fast imaging
- imaging
- cooling
- cleaning
- buffering
- feeding

brain storm and discuss time-boxed
Study one Customer and Product

**What** does Customer need in Product and **Why**?

**Customer**
- Customer objectives

**Application**
- Key drivers
  - Safety
    - Reduce Accident rates
    - Enforce law
    - Improve Emergency Response
  - Effective Flow
    - Reduce delay due to accident
    - Improve average speed
    - Improve total network throughput
    - Optimize road surface
    - Speed up target groups
  - Smooth Operation
    - Ensure Traceability
    - Ensure prop
    - Ensure sys
- Environment
  - Reduce emi

**Product**
- What
- How
- Requirements
  - Early hazard detection with warning and signalling
  - Maintain safe road condition
  - Classify and track dangerous goods vehicles
  - Detect and warn non-compliant vehicles
  - Enforce speed compliance
  - Enforce red light compliance

**Conceptual**
- Functional
- Configuration
- Realization

**Physical model**

**Key drivers**
- Derived application drivers
  - Early hazard detection with warning and signalling
  - Maintain safe road condition
  - Classify and track dangerous goods vehicles
  - Detect and warn non-compliant vehicles
  - Enforce speed compliance
  - Enforce red light compliance

**Derived application drivers**
- Automatic upstream accident detection
- Weather condition dependent control
- Automatic counter flow traffic detection
- De-icing
- Traffic condition dependent speed control
- Enforce speed compliance
- Enforce red light compliance
- Enforce weight compliance

**Requirements**
- Speed up target groups
- Optimize road surface
- Reduce emissions
- Ensuring safety
- Effective flow
- Smooth operation
- Enforce law

**Product How**
- Excluding options
- Option dependency

**Configuration**
- Functional model

**Note:** The graph is only partially elaborated on drivers and requirements.
Work Flow Analysis for Different Customers/Applications

- patient
- nurse
- physician
- admin

stakeholders

Where

(workflow)

What

walk from dressing room to table
sit on table and position patient
move table upwards
position coils and connect
move table and patient into magnet
make plan scan

preparation workflow
1 get patient
2 patient on table
3 get RF coil
4 position RF coil
5 move patient in magnet
6 plan scan

How

sketch

2D map

When

time line

14:15
14:20

Who

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EPLOworkFlowAnalysis
Make Map of Customers and Market Segments

- Many changes and variations
- Mature sales
- Price functionality
- Performance
- P1800
- P1900
- P2200
- P2600
- Niche

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Identify Product Features and Technology Components

- **features**
  - basic
    - 1800k/hr
    - 2100k/hr
    - 3000k/hr
  - buffer
  - sunp.
  - feeder
  - hf feeder

- **hardware**
  - driver
    - drivers
    - store
    - climate subsystem
  - handling subsystem

- **services toolboxes**
  - buffering
  - cooling
  - heating
  - cleaning
  - feeding
  - drivers
  - conveyor
  - robot

- **applications**
  - adjust
  - prepare
  - packing
  - process
  - workflow
  - browse
  - networking
  - fast imaging
  - file-system
  - OS
  - CPU
  - RAM
  - etc
  - control subsystem
  - power
  - domain specific
  - generic

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  - Gerrit Muller

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  - March 6, 2013
Example Criteria for Determining Value

- Value for the customer
- (dis)satisfaction level for the customer
- Selling value (How much is the customer willing to pay?)
- Level of differentiation w.r.t. the competition
- Impact on the market share
- Impact on the profit margin

Use relative scale, e.g. 1..5 1=low value, 5 -high value

Ask several knowledgeable people to score

Discussion provides insight (don't fall in spreadsheet trap)
## Determine Value of Features

### Products

<table>
<thead>
<tr>
<th>Features</th>
<th>P1800</th>
<th>P1900</th>
<th>P2200</th>
</tr>
</thead>
<tbody>
<tr>
<td>satisfaction</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>sales price</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>market share</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>feeder</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>hf feeder</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>buffer</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>sunpower</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

### Exploring Product Line Opportunities

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*March 6, 2013*
Example Platform Scoping

heterogeneous domains and application

- intelligent buildings
- motorway management
- railway stations
- airport terminals

shared core technology
- Closed Circuit TV
- audio broadcasting
- access control
- networking
Workshop Approach

Introduction

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Analysis Method

Workshop Approach

Product Lines in Practice

Summary
Foundation must be in order

- Multi-site
- Multi-supplier
- Multi-vendor

**Mono-disciplinary Engineering**

- Mono-system design
- Mono-system architecting
- Mono-disciplinary engineering

**Product Family Architecting**

- User context
- Product life cycle
- Stakeholders

**Evolvable Product Family Architecting**

- Value propositions
- Market segmentation
- Portfolio management
- Synergy

**Responsiveness**

- Anticipated trends
- Disruptive change

**Repositories**

- Baselines
- Change procedures
- Release management
- Quality assurance

**Multi-disciplinary Abstraction Synthesis**
Jojo over Views

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PFproductFamilyJojo
Iterations During M&A Course

bottom-up  top down
shared overview

second iteration
improved overview

story -> use case
depth insight 1st big picture

day 1 day 2
Product Lines in Practice

- Introduction
- Product Line Considerations
- Analysis Method
- Workshop Approach
- Product Lines in Practice
- Summary
Experiences with reuse, from counterproductive to effective

**bad**
- longer time to market
- high investments
- lots of maintenance
- poor quality
- poor reliability
- diversity is opposed
- lot of know how required
- predictable too late
- dependability
- knowledge dilution
- lack of market focus
- interference
- but integration required

**good**
- reduced time to market
- reduced investment
- reduced (shared) maintenance cost
- improved quality
- improved reliability
- easier diversity management
- understanding of one base system
- improved predictability
- larger purchasing power
- means to consolidate knowledge
- increase added value
- enables parallel developments
- free feature propagation
Successful examples of reuse

- Homogeneous domain:
  - cath lab
  - MRI
  - television
  - waferstepper

- Hardware dominated:
  - car
  - airplane
  - shaver
  - television

- Limited scope:
  - audio codec
  - compression library
  - streaming library

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SWR successful

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Limits of successful reuse

struggle with integration/convergence with other domains

TV: digital networks and media
cath lab: US imaging, MRI

poor/slow response on paradigm shifts

TV: LCD screens
cath lab: image based acquisition control

software maintenance, configurations, integration, release

MRI: integration and test
wafersteppers: number of configurations

how to innovate?
Summary

Introduction

Product Line Considerations

CAFCR: relate customer and system

Market variety and trends harvesting synergy

Analysis Method

Facts and Figures breadth and depth

Workshop Approach

Iterate fast time-box

Product Lines in Practice

successes and failures

Summary

Exploring Product Line Opportunities

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EPLoSummary
Links

CAFCR background
www.gaudisite.nl/ArchitecturalReasoning.html

key driver graph paper
www.gaudisite.nl/KeyDriversHowToPaper.pdf

key driver graph slides
www.gaudisite.nl/KeyDriversHowToSlides.pdf

roadmapping

Gaudí site
www.gaudisite.nl