Platform & Modular Design

Development
Of
Subsystems and Interface
Architecture
Product Platform - Definition

• An Architecture of a set of Subsystems (Modules) and their Interfaces the Form a Common Structure from Which a Stream of Derivative Products (or Services) can be Efficiently Developed and Produced over a Period of Time
Product Family - Definition

• A Product Family is a Set of Individual Products (or Services) that Share Common (Modules and Interfaces) & Technology and Address a Related Set of Market Applications
Platform Extensions – Definition

- Product Derivatives with one or more Common **Subsystems (Modules) and Their Interfaces** that are Substantially Improved with New Technology
New Product Platform - Definition

• A new Architecture, i.e., a New Combination of **New Subsystems (Modules)** and Their **Interfaces** Linked with Some Prior Generation **Subsystems and Interfaces**
Product Platform -
System Architecture (Shared)

Product Platforms

A
B
C
D
E

$D_N$ = Derivative

$D_N$
Product Platform - System Architecture (Shared)

Product Platforms:

- A
- B
- C
- D
- E

Shared Systems / Subsystem Architectures:

- N₁
- N₂
- N₃
- N

Dₙ = Derivative
(Power Tool) Product Platform - System Architecture (Shared)
(Power Tool) Product Platform - System Architecture (Shared)

Product Platforms
- Drills
- Jig Saws
- Sanders
- Edgers
- Hedge Trimmers

Shared Systems / Subsystem Architectures
- Motors
  - N 1-1
- Housing
  - N 2-1
- Gear Boxes
  - N 3-1
- Auxil.
  - N N-1

DN = Derivative

D = Derivative
N = Number
(Power Tool) Product Platform - System Architecture (Shared)

Product Platforms:
- Drills
- Jig Saws
- Sanders
- Edgers
- Hedge Trimmers

Shared Systems / Subsystem Architectures:
- Motors
- Housing
- Gear Boxes
- Auxil.

Components:
- Motors:
  - Fields
  - Armatures
  - Shafts
  - Brushes
  - Insulators
  - Wire

- Housing:
  - Housings
  - Labels

- Gear Boxes:
  - Gears
  - Bearings
  - Shafts
  - Spindles

- Auxil.:
  - Switches
  - Cord Sets
  - Fasteners
  - Packaging

Derivative Notation: $D_N = \text{Derivative}$
Scania - Modular Design & Product Platforms

*Modules* - Elements of Product Architecture

*Scandia Truck Modules*

- Engines - generate power
- Cabs - comfortably carry and protect driver
- Transmissions - transmit power
- Chassis - carry loads
Scania - Modular Design & Product Platforms
Platform Success

Platform product management builds success by:

Creating powerful, elegant solutions that set the standard for product excellence.

Building families of products that leverage market understanding and common technologies.

Designing a product architecture from which derivative products can be efficiently created.

Encouraging teamwork — working together on product elements that can serve many different products and markets.
Platforms and Renewal

Renewal products based on platform development:

- 1 mulling system
- 1 sash profile
- 1 common sightline
- 1 standard extension jamb
- 1 fixed window profile

Compared to comparable product lines in Bayport:

- 14 different mulling systems
- 7 different sash profiles
- 13 sightlines
- 32 extension jambs
- 9 fixed window profiles

Cars on a Platform

Case for Change

Success and Growth

Platform Success

Platforms and Renewal

Benefits
Cars on a Platform

Benefits

Case for Change

Minimizes unique parts

Success and Growth

Improves time to market on derivative products

Platform Success

Improves quality by using proven components

Platforms and Renewal

Allows for more product configuration flexibility

Benefits

Common look and feel of products

Lets the customer drive product development
Cars on a Platform

Case for Change

Success and Growth

Platform Success

Platforms and Renewal

Benefits

Platform = Chassis
Cars on a Platform

Case for Change

Success and Growth

Platform Success

Platforms and Renewal

Benefits

Subsystems = Drive Train
Cars on a Platform

Case for Change

Success and Growth

Platform Success

Platforms and Renewal

Benefits

Interfaces = Steering wheel and brakes
Cars on a Platform

Case for Change

Success and Growth

Platform Success

Platforms and Renewal

Benefits

Derivative Products = Body, color, shape
Cars on a Platform
Case for Change
Success and Growth
Platform Success
Platforms and Renewal
Benefits

Derivative Products
Subsystems & Interfaces
Platform
Cars on a Platform

The Volkswagen Group — Shared Platforms

Case for Change

A7 Chassis — Front wheel drive mid-sized compact platform designed in Germany for use worldwide.

Success and Growth

Platform Success

Platforms and Renewal

Benefits

Volkswagen (Mfd in Mexico)
New Beetle GL
Front Wheel Drive
2.0 liter Inline 4
$15,900

Volkswagen
Jetta GL
Front Wheel Drive
2.0 liter Inline 4
$16,700

Volkswagen
Golf GL
Front Wheel Drive
PROJECT STRATEGY

Cars on a Platform

Case for Change

Success and Growth

Platform Success

Platforms and Renewal

Benefits

Volkswagen
Bora 2.0 SE
Front Wheel Drive
2.0 liter Inline 4
$14,900

Volkswagen
Audi
A3 1.6 SE
Front Wheel Drive
1.6 liter Inline 4
$26,290

Audi
TT Base Coupe
Front Wheel Drive
1.8 liter Inline 4
$27,850

Audi
TT Base Coupe
Front Wheel Drive
1.8 liter Inline 4
$30,500
Cars on a Platform

Case for Change

Success and Growth

Platform Success

Platforms and Renewal

Benefits

SEAT
Toledo s 1.8 20V
Front Wheel Drive
1.8 liter Inline 4
$24,125

Skoda
Octavia GLXi
Front Wheel Drive
1.6 liter Inline 4
$22,545

Skoda
Octavia GLXi Estate
Front Wheel Drive
1.6 liter Inline 4
$21,430
A Product Family is a Set of Individual Products (or Services) that **Share Common Technology** and Address a Related Set of Market Applications.
Centurian
Fandial

Lumea
Skylark
Nova
Glyder

Ariandi

Diva

Maestro
Vario

Rotary
1961

Slider
1971

Toggle
1991

Rocker
1992

Touch Tap
1995

$D_N = \text{Derivative}$
Product Family Evolution – Dimmer Switches

Product Platforms

- Rotary 1961
- Slider 1971
- Toggle 1991
- Rocker 1992
- Touch Tap 1995

Shared Systems / Subsystem Architectures

- Housing
- Yoke-Heatsink
- Circuit Board
- Switch Knob

- Common Housings?
- Common Yoke-Heatsink?
- Common Circuit Board?
- Common Switch Knobs?

D_N = Derivative
Modular Design Non-collaboration

Division A
3788 Part Numbers

Division B
1032 Part Numbers

Division C
3413 Part Numbers

- 53 Common Parts
- 100 Common Parts
- 88 Common Parts

Less than 2% Inter-Divisional Use of Common Parts
Functional Platform Architecture
In Product Design
Definition: “Functional Platform”

*Functional Platform Architecture in Product Design*

- A discrete functional element of a composite and/or complex system that provides a specific contribution to the whole system.
Functional Platform Architecture in Product Design

• Aphorisms* procedural steps in architecture development or product design analysis

* Aphorisms: concise statement of principle

Source: Rules and Methods
Aphorisms and Procedural Steps in Architecture Development or Product Design Analysis

• Strive to design interface architecture that is elegantly simple, reliable, cost effective, and will be a long lived design architecture. A “standard” geometry that could persist for years. (Example: 35mm film cartridges, electric outlets, lamp sockets, telephone jacks, QWERTY keyboard.)

• Avoid “domino effect” of functional element platform designs or evolutionary changes that violate interface architecture. Platform designs should not bridge or leak to other platforms across interfaces.
Procedural Steps in Architecture Analysis or Development

Aphorisms and Procedural Steps in Architecture Development or Product Design Analysis

- Isolate and reduce each functional element of the total system to a singular function
- Identify and specify each interface (linkage), essential and nonessential, of each functional element to another
Procedural Steps in Architecture Analysis or Development

Aphorisms and Procedural Steps in Architecture Development or Product Design Analysis

• Decouple as many interfaces as possible - strive to max out at two (2) interfaces. (Avoid complexities of four (4) or more interfaces.)
Procedural Steps in Architecture Analysis or Development

Aphorisms and Procedural Steps in Architecture Development or Product Design Analysis

Functional Interfaces—Impact on Design Freedoms

Design Freedoms
- High
- Medium
- Low

Functional Platform Interfaces
1 2 3 4 5 6 N

Simple Complex Very Complex
When a functional platform transitions from “generic” to a “unique” state, restrict functional platform architecture to two (2) interfaces: one (1) generic and one (1) unique interface. (Avoid coupling multiple functional architectures to unique systems.)

Within each functional platform architecture allow for many degrees of freedom and latitude, i.e. capability, variety of functions, materials, hierarchy of capability, etc.
Procedural Steps in Architecture Analysis or Development

Aphorisms and Procedural Steps in Architecture Development or Product Design Analysis

- At end user interfaces, provide architectures to enable a rich variety of capabilities, forms, visuals, and features for the product’s evolutionary life cycle extensions, competitive advantages, and future product line developments and multiple product platforms.