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Multiple Views of System Specifications

connecting a distributed project

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Problem

Eliciting and Managing Feature Specifications,

- Hardware and Software product
- Marketing Requirements approved
- Architecture and design in progress
- Distributed teams
  - 5 locations, trans-Atlantic
  - English- and German-speaking cultures
  - Multiple system development cultures

Hardest Parts

- Multiple audiences – by location and role
- Loose coupling to architecture
- Frequent reorganization of features

Solution: Hierarchical System Feature Model, with Tool Support

A Monitoring System

- Sensor Network
- Response Network: (Actuators and alerts)
- Automated responses
- Human-commanded responses
- Multiple markets with different drivers
- Key processor board is custom
- Second market package of product
  - Big additions to response hardware
  - Much more software than before
  - Porting to IP Network

Artifacts and Owners: a Document Dependency Diagram

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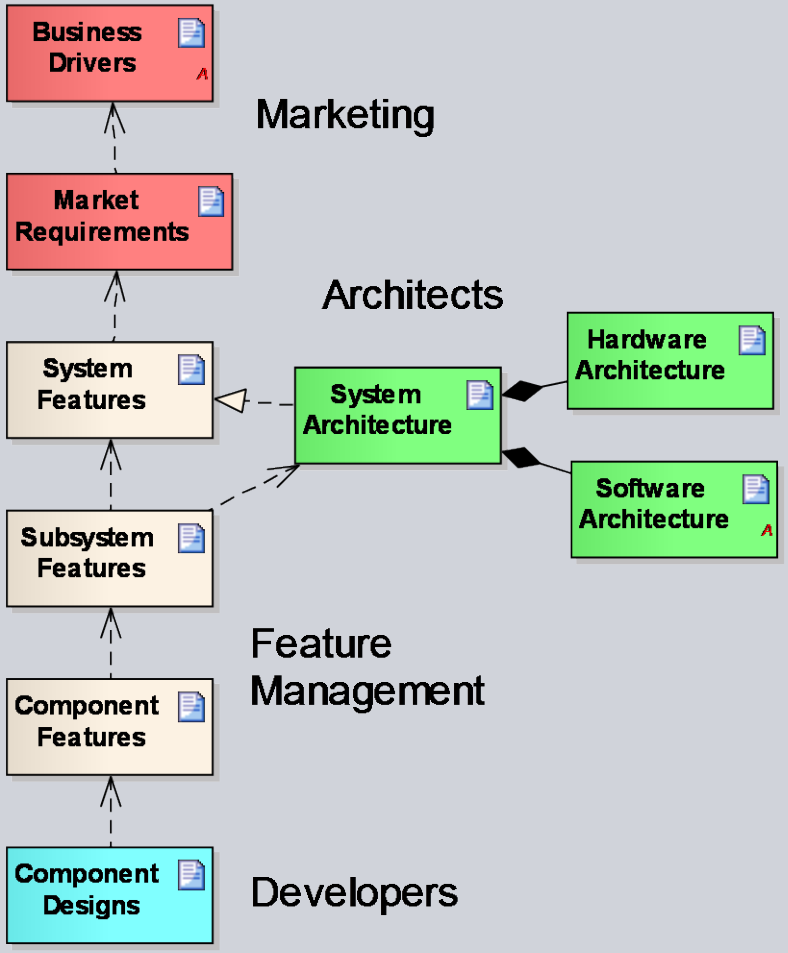
Each artifact ***depends on*** "preceding" artifacts.

System Features
- Push back on MR's
- NOT architecture-dependent.

Decomposed features
- VERY architecture dependent
- No push-back because same owner

Component designs
- Different owners, different locations
- MAY push back on features



Structure Among Features: Use Case Hierarchies

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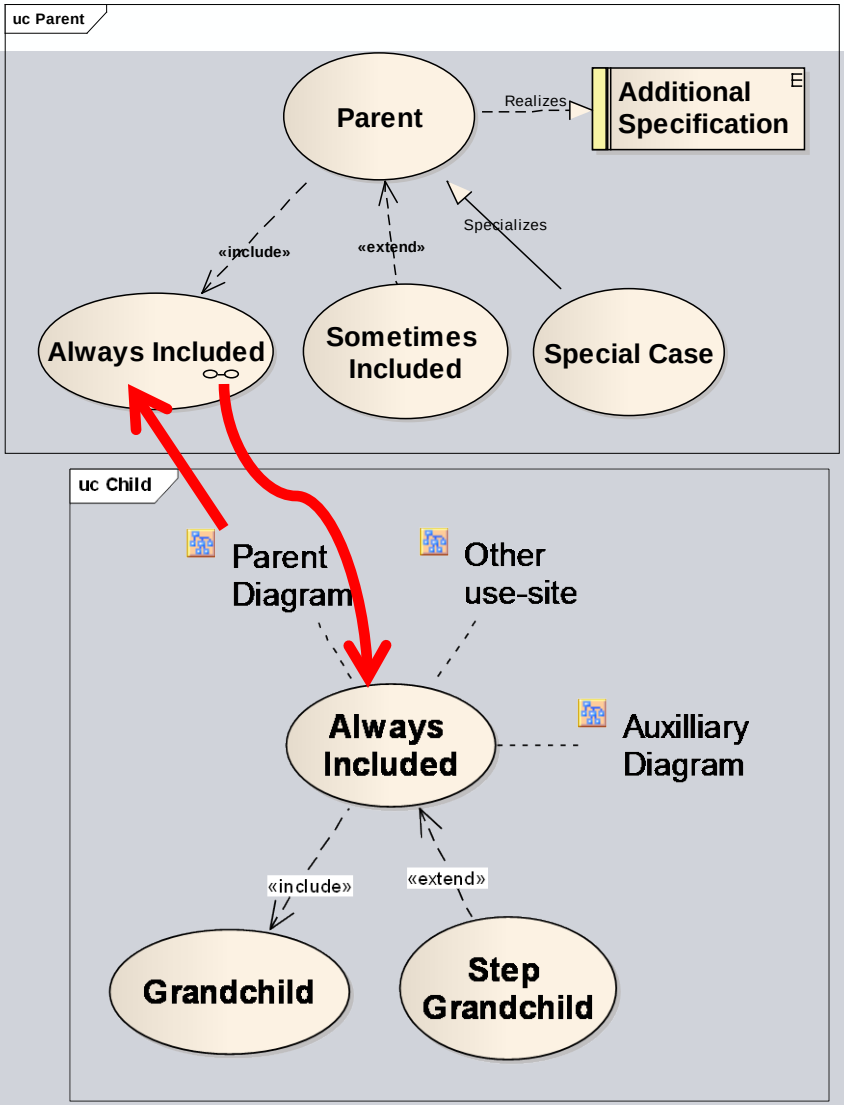
Feature = Use Case or Requirement

***Use Case* as Abstraction**

- [Large] **category** of behavior
- **Title** and 1-2 sentence specification
- "The system will perform this category of behavior."
- Control sequence unimportant

Motivation for Modeling

- Standard associations betw. features
- Gives meaning of "tree" (**hierarchy**)
- **Breadth-first** navigation for "**big picture**" and "**wholeness**".
- **Graphical presentation** for meetings
- Easy to **re-organize**
- Modeling tool helps maintain **integrity**.



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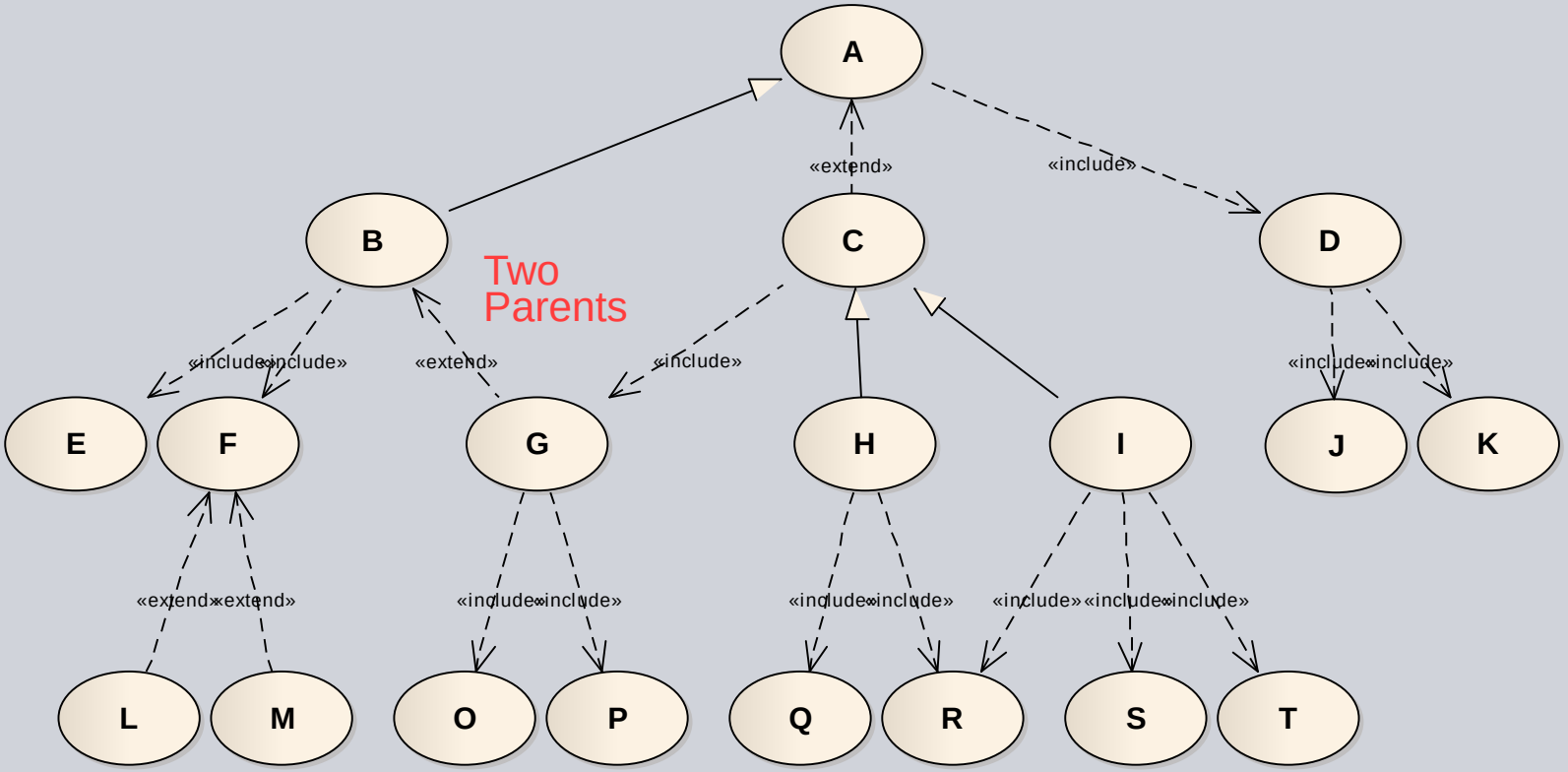
A Use Case Hierarchy



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Overview of the Modeling Process

1. **Elicit expert knowledge** by showing the model, relaxing the rules
2. **Decompose** the “external” System Features into “internal” component features.
3. Refactor to **align with architecture** – where known.
4. **Architects** design **iterations**
5. Allocate **features to iterations**
6. Refactor again to **reduce fragmentation**
7. **Tag each feature** with the views in which it belongs.
8. Use tool filtering capabilities to **generate views as documents.**

Aligning Features with Architecture

Goal: Assign sub-features to sub-systems

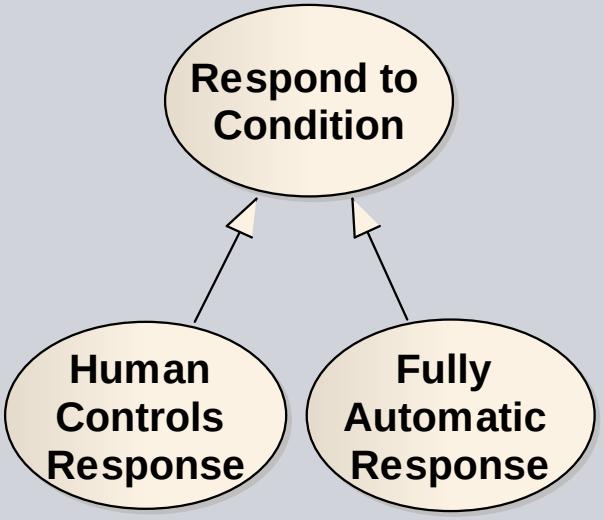
- Feature decomposition **must** depend on architecture decomposition.
- Architecture not ready at beginning
- Early elicitation just captured two subclasses of responses

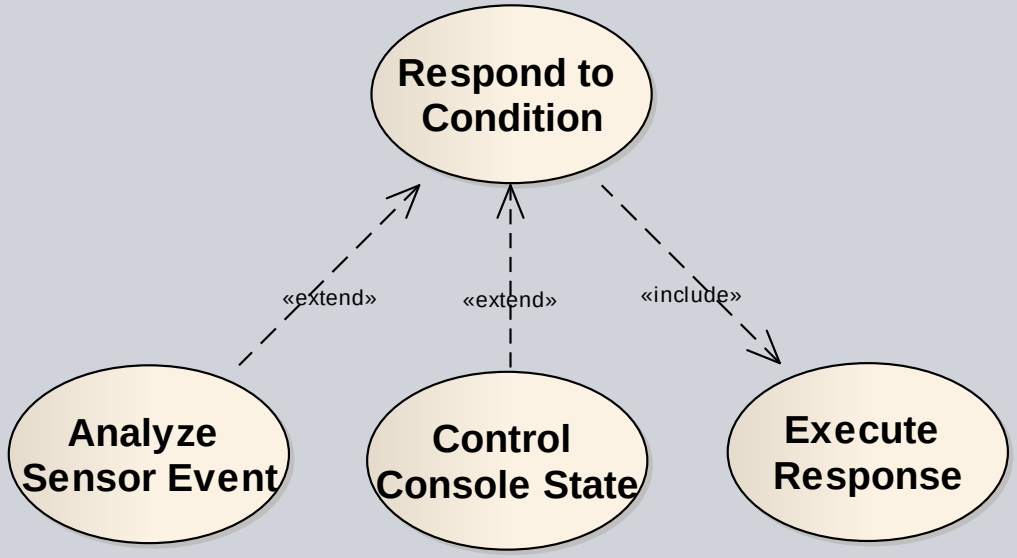
Architects chose

- State machine model for console
- Same responses initiated two ways

Alignment

- Refactored to separate initiation from response





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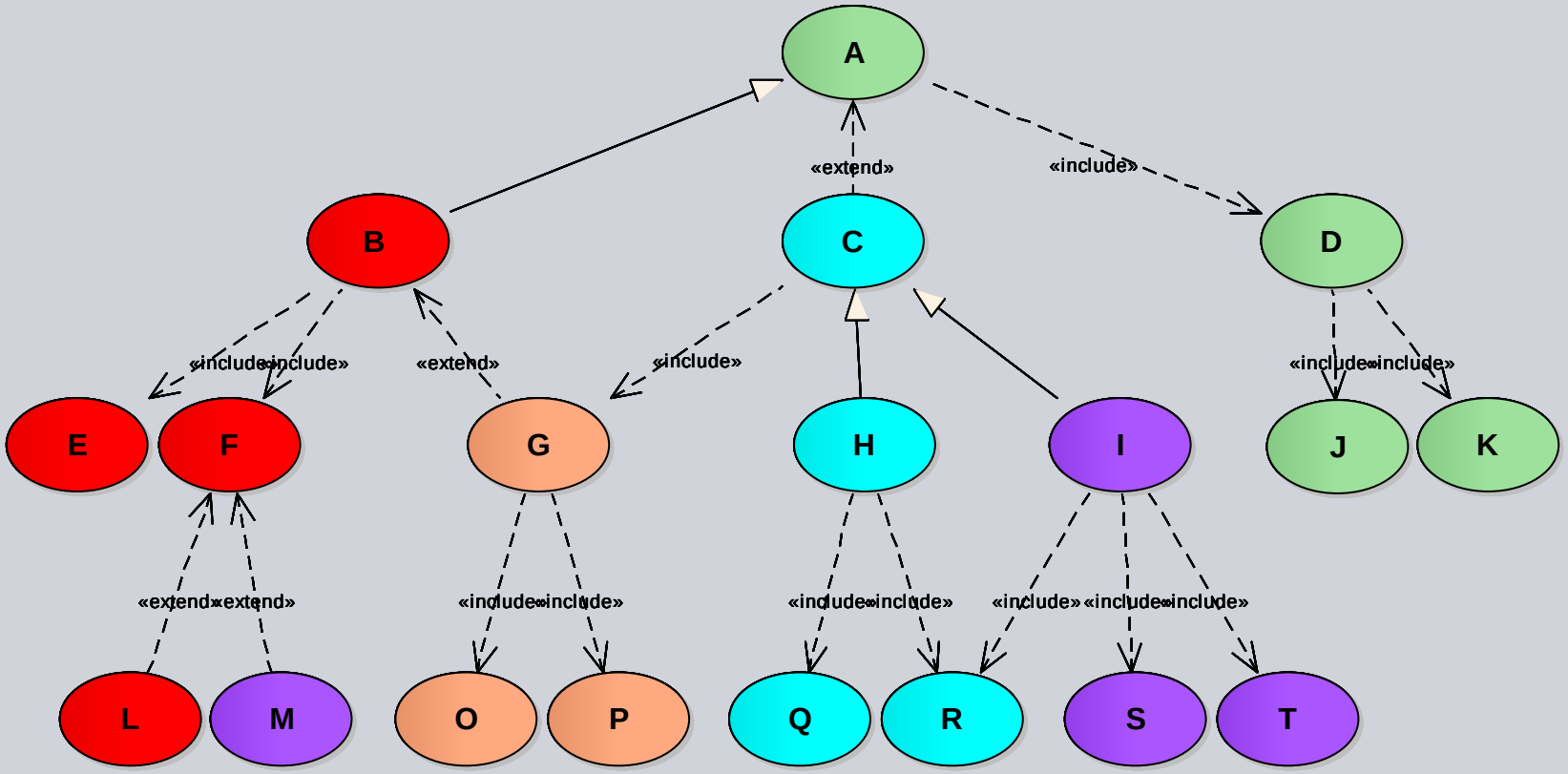
Assigning Features to Iterations



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Four Views of Feature Specifications

Master View
- All Features
- Hyperlinked diagrams
- Spreadsheet Interface
- Filters
- Issues and Action Items

Marketing View
- Product Structure Overview
- Readable by non-developers
- Features that trace to MRs (Marketing Requirements)
- Clarifications of MR's
- Rejected and Deferred MR's
- No unnecessary detail

Architecture View
- Feature ↔ Subsystem Map
- add Engineering Requirements
  - Design decisions that affect many components
  - Not derived from specific external features
  - e.g. communication infrastructure

Development View
- Product features
- Assigned to components
- Assigned to interfaces, iterations
- Checklist for estimation
  - Complete
  - No duplication or overlap ???

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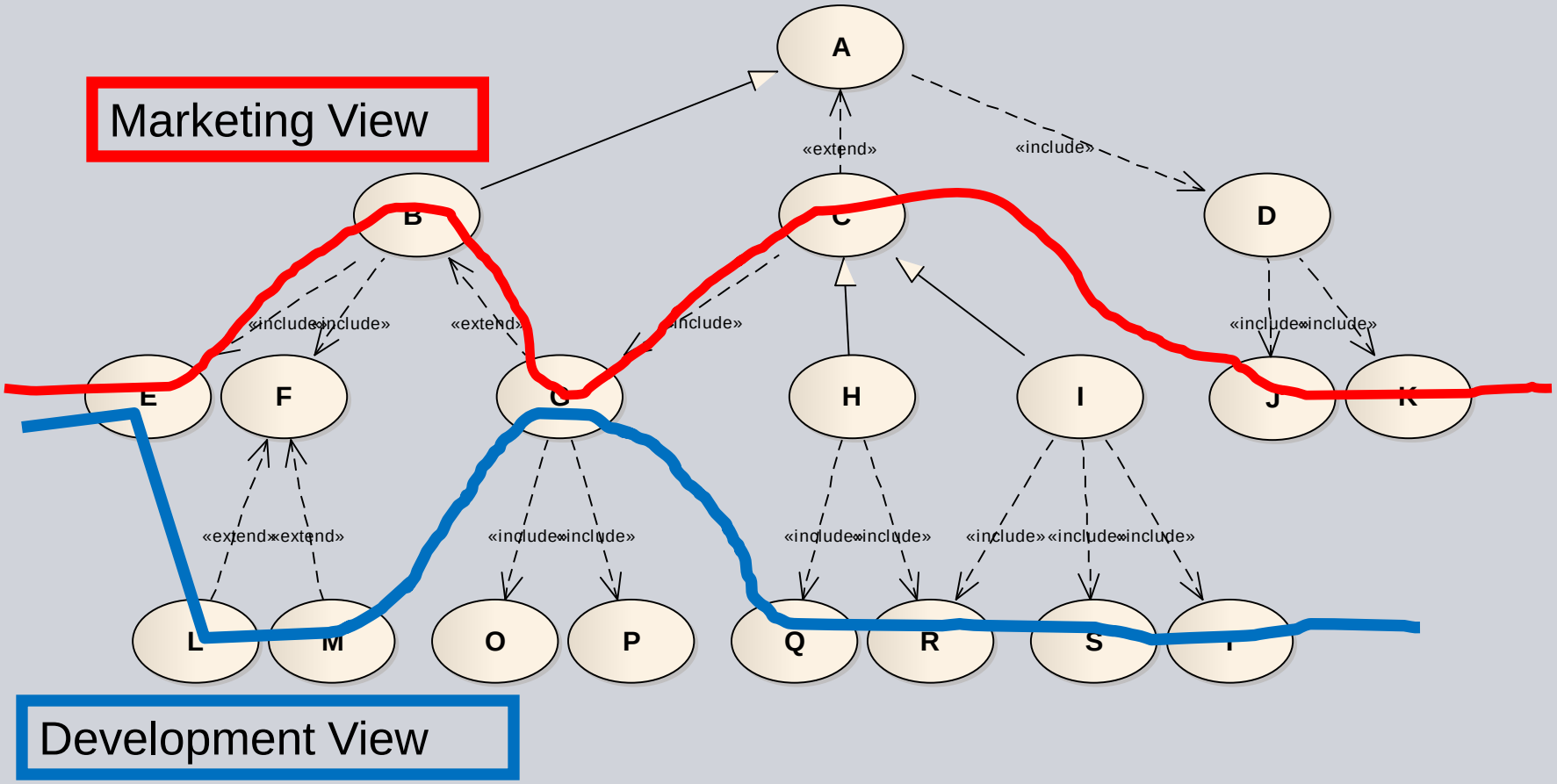
Views of the Model



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Tips

1. **Refine to granularity of decisions (approval, schedule)**
2. **Re-use MR wording where feasible**
3. **Mark up Marketing Requirements with clarifications**
   a. You own the mark-ups, “they” still own the base document
   b. Ask Marketing to validate your mark-ups
   c. You can proceed while they revise their document.
4. **Subject Matter Expert “initials” each feature.**
5. **SME’s can edit, validate as spreadsheet, without special tool**
6. **Modeling the MRs early, saves time later.**
7. **Plan on doing a little scripting**

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Summary

- **Use Case Hierarchy decomposes System Features into Component-level Product Features**
  - Three types of parent-child relationships
  - Child can have multiple parents
  - Attach additional specifications to use-cases
  - Example: 479 Use Cases, 267 Requirements
- **Modeling Tool helps with**
  - Breadth-first analysis → Check ‘wholeness’
  - Frequent re-organization of features during elicitation
  - Edit pictures in meetings with subject matter experts
  - Classify features along several dimensions
    - Iteration
    - Market Segment
    - View
  - Report generation for different audiences

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Experience with Modeling Tool

Many good ideas, including

- Model-centric (not diagram-centric)
- Import/Export as Spreadsheet
- Diagram hyperlinking
- Drill-down
- Diagram filtering
- Scripting (Visual Basic)
- Custom queries in SQL
- SysML support (e.g. Components)
- Multi-user support
- Document generation
- Virtual documents
- Accidental deletion is hard
- Very rarely crashes

Still immature

- Advanced features sometimes incomplete
- Document template tools clumsy
- On-line help is weak
- Limited requirements catalog functionality
- No multi-valued attribute support
- Hard to query on links
- Can’t “round trip” to a better RE catalog