3.4.2 Domain Definition

The domain definition model specifies the nature and extent of the product family represented by the domain. This model has five elements: a synopsis that characterizes the capabilities that all encompassed products provide, a glossary of relevant terminology, a catalog of legacy knowledge, assumptions of commonality and variability that characterize the diversity in the product family, and a set of deferred decisions that express a resolution of variabilities that corresponds to a customized instance product.

The domain definition serves three purposes:

- As an informal medium for developers to achieve a shared understanding of what sort of products can be built with the domain;
- As criteria for customers to understand what types of capabilities potential products will be able to provide;
- As a conceptual framework for creating a product family from which appropriate customized instances can be derived.

Synopsis

The domain synopsis element is a defining description, using terminology defined in the domain glossary, of all products that fit within the scope of the domain. This is a concise expression of an abstraction that characterizes the product family. The synopsis is sufficient as a description of any individual product that is within the scope of the domain. Any product that fails to adhere to the synopsis in every aspect is excluded from the product family but the synopsis can be modified if the membership of the family is found to be too limited. The synopsis is elaborated in detail as commonality assumptions that are applicable to all instances of the product family.

Glossary

The domain glossary element specifies a common terminology for a coherent market and associated problems and solutions that a product family addresses. This

terminology supports a shared understanding of how customers perceive their endeavors. This terminology may both establish a uniform market terminology and translate among different terms customers use in expressing their needs.

Legacy

The domain legacy element identifies relevant sources of information that are the foundation on which the domain is built. The initial motivating basis for creating a domain, beyond the existence of a perceived market for its products, is accessible competence (i.e., knowledge, expertise, or experience) that informs the development of the envisioned product family. Legacy content includes any relevant scientific, technical, or market references, any previously developed products or components that fall within the scope of the product family, and any material that may be useful in understanding capabilities that future products may need.

Assumptions (of Commonality and Variability)

The domain assumptions element elaborates the domain synopsis to provide a market-specific description of how products that belong to the domain-defined product family are similar. Assumptions of commonality informally characterize how all products in a set are alike whereas assumptions of variability informally indicate how any two products in the set may differ from each other. A set of products is informally characterized as a product family by associated commonality assumptions that define how its instances are alike and associated variability assumptions that define how these instances may differ. These informal characterizations are formalized in the domain decision model.

A commonality assumption is a property that is true for every member of the set; from this perspective, any member of the set is equally good for the general purpose for which the products in the set are considered useful. The basis for deciding which member of the set is best for a specific purpose is reflected in a collection of “variability” assumptions. A commonality assumption describes a way in which a set of products are alike. For such a set of products, a variability assumptions describes a way that those products differ from each other.

Assumptions concerning a product family can be organized into an alternating hierarchy of commonalities and associated variabilities. The variability assumptions partition the product family into subsets of one or more instances each. For products in a subset, having the same resolution of those variability assumptions extends the assumptions of commonality with assumptions that apply only to the products in that subset. For each subset, there may be additional variability assumptions that distinguish among the instances of that subset. Instances of a set that cannot be purposely distinguished are considered equivalent and effectively interchangeable (i.e., being alternative realizations of effectively identical behavior).

As an elaboration of the domain synopsis, the domain assumptions provide a still informal but more detailed basis for determining the feasibility of deriving a product that will fit a given customer's specific needs. A potentially feasible product is one that satisfies the commonality assumptions of the domain's product family (or a subfamily) and can be distinguished from other instances of that family entirely by reference to variability assumptions associated with that family. For a given set of assumptions, this analysis can be performed in a matter of a few days to determine whether initiating a product manufacturing effort is warranted. In some cases, the analysis may conclude that such an effort is not justified or may expose a need to refine the domain, such as adding new variability assumptions, for the product to be considered a feasible effort for the given domain.

Decision Model

The decision model element is a formalization of deferred decisions that must be resolved to determine a specific instance of the product family. It specifies the uncertainties that a developer must resolve with a customer to determine what product (i.e., which instance of the product family) is to be built. Uncertainties are expressed as specific decisions that will allow variability assumptions to be sufficiently resolved to distinguish a specific instance of a product family. A decision model defines a partial ordering in which decisions can be resolved to partition the product family into subfamilies, repeated iteratively until a singular subfamily is characterized. The decision model that characterizes a product family is the primary organizing medium

for domain engineering and the framework for building a product by product manufacturing.

(decisions tied to customer needs and quality/technology tradeoffs; decisions correspond to resolution of variability assumptions, indicating how the best product will differ from other instances of the family; best match is product that satisfies the decisions)

The conceptual structure of a decision model generally derives from the domain's commonality assumptions with decisions associated with a concept being derivative of associated variability assumptions. The possible resolutions of each decision partition a product family into subfamilies of similar derivable products each. A multi-instance subfamily will have additional associated decisions that can be resolved to further partition that subfamily. The culmination of decision resolution is a unitary subfamily whose only instance is a product that can be concretely derived from an appropriate decision-based representation of the product family.