

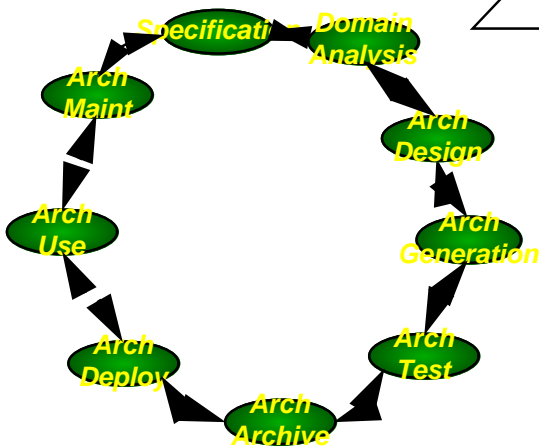
Product-Line Development Metrics

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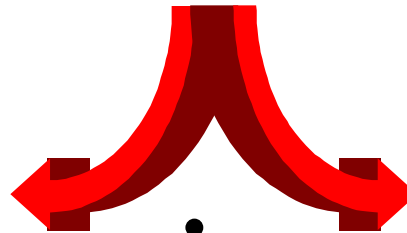


New View: A Dual Lifecycle

Domain Engineering

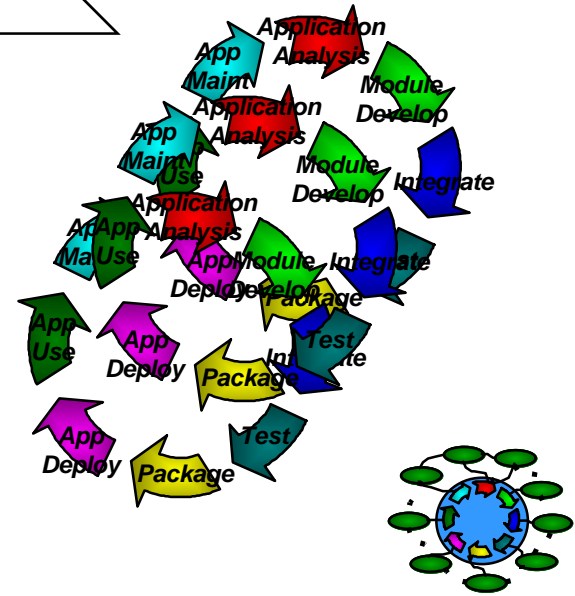


Enterprise Wide Technology Strategy



Develop
Generate
Integrate

Application Engineering



Key Issues

Organizational

- Operational strategy linking business goals to technical approach
- Designated architecture group
- Strong CM group
- Reuse team*
- Requirements arbitration method with targeted product-line reuse goals

Managerial

- Success criteria for profitability, domain definitions, business discriminators
- Decision criteria for PL prioritization
- Negotiation acceptance criteria
- Metrics definition, collection and analysis to control and inform product and process decisions

Technical

- Domain selection (criteria)
- Systems and software architectures
- Reuse strategies
- Domain modeling
- Architecture specification
- Product line asset analysis
- Product line process definition
- Rationale capture and technical negotiation support
- Domain analysis
- Product line reuse analysis
- Validation and verification of artifact consistency
- Metrics collection, analysis, and dissemination
- Product line process enactment and analysis
- Process fragment reuse



Product - Process - Resource Metrics

Product Metrics: The typical focus has been on product *size* a measured by source lines of code, (SLOC). This applies well to application engineering but does not provide a basis for measurement of domain asset usage, such as architectures.

Process Metrics: The typical focus has been on events occurring over time. This is typically a measure of *duration* of activities or event sequencing based on a traditional approach to software development. The dual life cycle perspective with enterprise level strategic planning is not captured. For instance, a proposed benefit of product-line practice is cycle time reduction, thus the collapsing of sequences of tasks to concurrent processes must be measured as well.

Resource Allocation Metrics: The typical focus has been on number of *labor* units expended. This approach is based on labor comprising the single input of resources to the development project. The efficacy of this assumption must be evaluated in context of the domain assets developed and reused across product-lines.



Old Metrics: Application Level

Resource

- Labor: Person Months(PM)
- Re-Use: % SLOC
- Productivity: SLOC/PM

Product

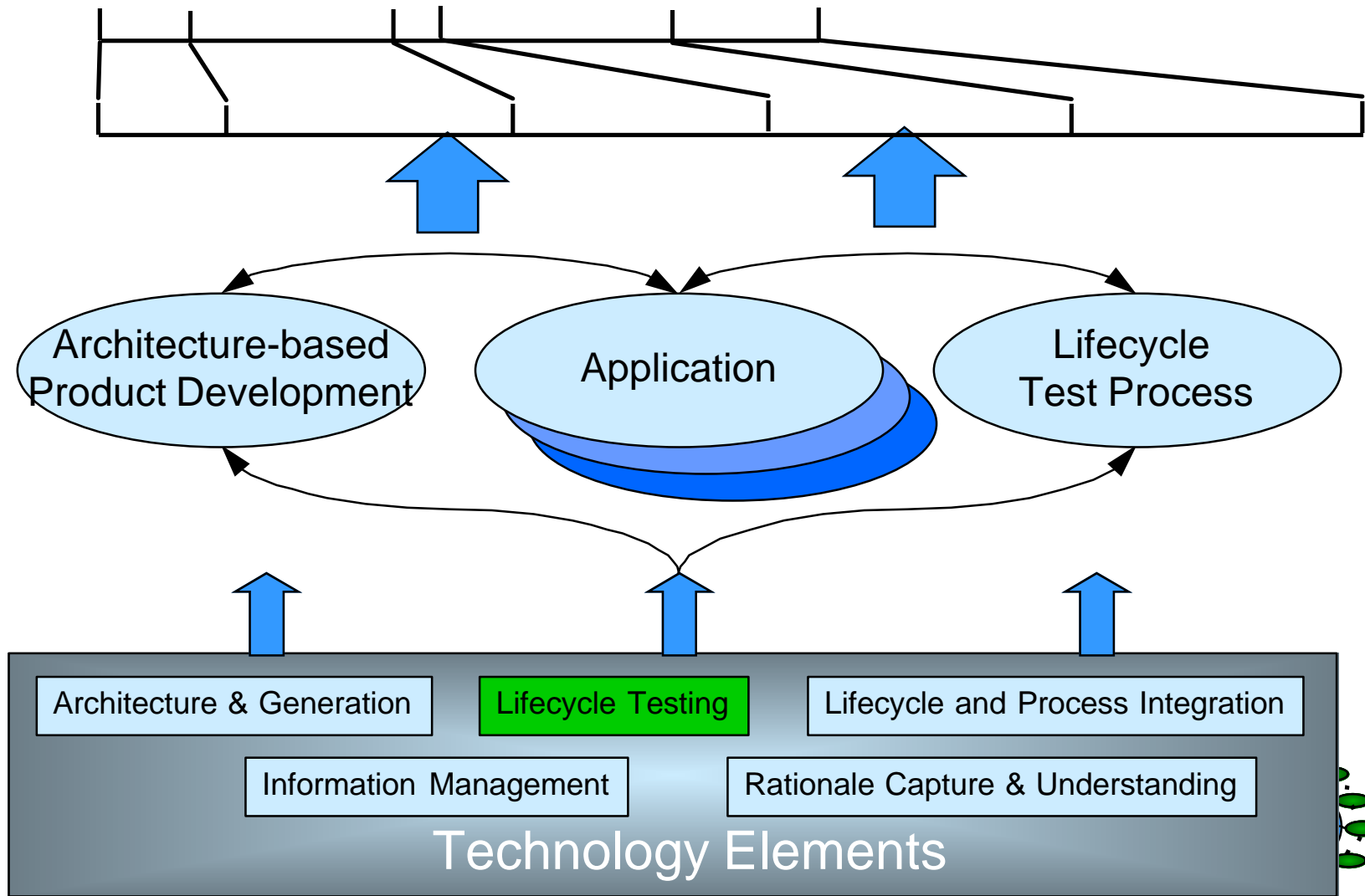
- Size: SLOC, FP, OP
- Defect density: #defects/1000 SLOC

Process

- Event sequences - cycle times: duration in time
- Progress tracking: configuration items completed, number of STRs (total, open)
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Architecture-based Lifecycle Compression



Product-Line Metrics

Architecture

Resource:

- Number of times the asset is (re)used in the PL

Product:

- Domain variability
- Economies of Scope
- Defect Propagation Potential

Process:

- Legacy-mining cycle
- Asset retrieval and integration cycle
- defect identification/resolution cycle

Application

Resource:

- Labor/Reuse Ratio
- Productivity (Reuse/PM) DeMarco

Product:

- Number of products buildable from the PL assets

Process:

- Project cycle time
- “Build and synch” cycle time
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Critical Product-Line Metrics

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- economies of scope: are the savings or profit from building a greater diversity of products with the same or less inputs, and is measured by
- quantity of effort
 - cost per unit of effort
 - number of assets in portfolio
 - number of planned products
 -
 -
- degree of domain variability: implementation diversity for a core set of services.
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How to Apply the Metrics...

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- Determine the Span - % of system covered by the asset
- Determine the Scope - % of potential products using asset
- Determine the Impact - % of total software effort replaced by asset
- Determine the Robustness - covariance of product attributes to product flexibility (flexibility is the number of product attributes an asset can accommodate for a given product family)
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Beyond Systematic Reuse...

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- The rigorous definition and quantification of these metrics for product-lines would support the objective evaluation of domain suitability for a product-line development approach.
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- It would also enable the quantification of the amount of architectural drift introduced through evolutionary substitutions. Evaluation of the trends in economies of scope for the domains of the product-line should provide rich characterizations of domain assets in the context of architecture-based reuse.
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