

Aldo Dagnino, Will Snipes, Eric Harper, ABB Corporate Research – RA Software/SAM WICSA, April 7th of 2014

Metrics for Sustainable Software Architectures An Industry Perspective

Agenda

- Introduction
- Goal-Question-Metrics method
- GQM methodology to identify metrics for sustainable software architectures
- Measurement process
- Conclusions

Introduction

- Industry practitioners grapple with poor and degraded architectures that slow down the progress of software evolution and reduce profits
- Practitioners require architecture metrics that support sustainable software architectures
- What are the best metrics for tracking and enhancing architectures?
 - It depends. Metrics evolve specific to the industry and application domain.
 - Domain concepts like:
 - The business principles for the organization
 - The quality attributes related to these business principles
 - Can help refine the solution space

Principles

- Are there principles that can be used to select between alternative metrics?
- For example:
 - Metrics should be as simple and transparent as possible,
 - Metrics should be tied to business value
 - Etc.

Principles Discussion

- What principles do you consider important for architecture sustainability?



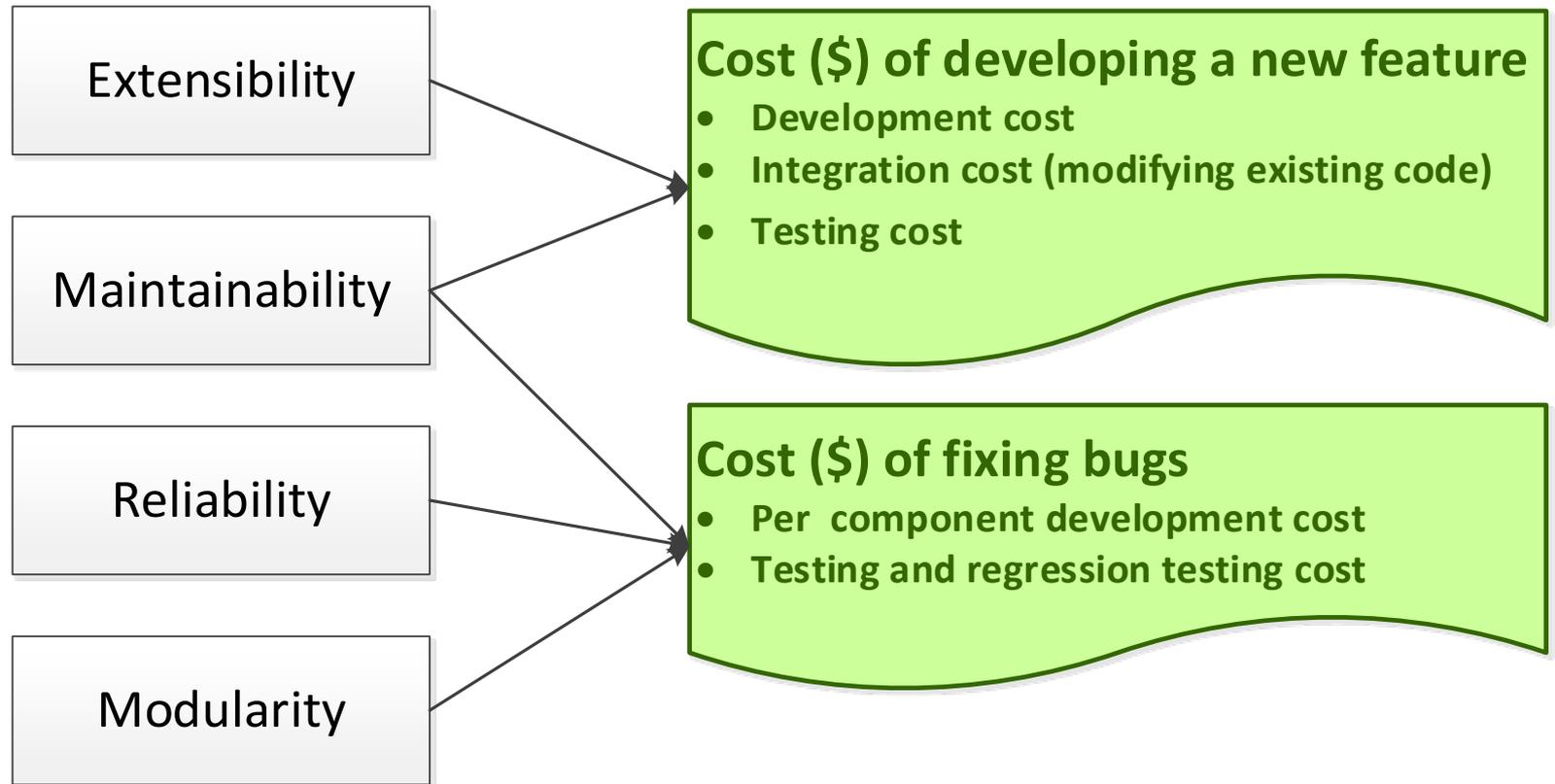
Quality Attributes

- Prioritized quality attribute scenarios and their response measures related to principles are a good place to start in our search for metrics.
- Quality Attributes such as:
 - maintainability
 - extensibility
 - reliability
 - modularity
- Each of these areas relates to principles that provide value to the product and the organization
 - We focus on the business value principle in this walkthrough

Business value for sustainable architecture

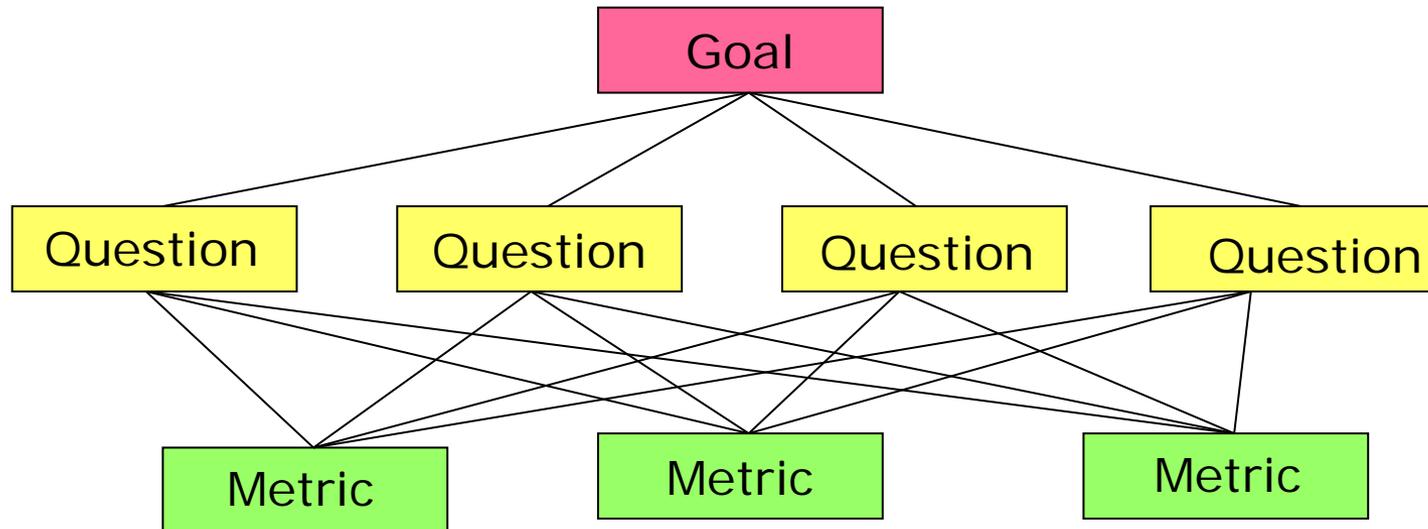
Quality Attributes

Business Value



Goal-Questions-Metrics method

- GQM is a framework for developing a metrics program
- GQM steps include:
 - Generate a set of organizational goals
 - What do you want to improve?
 - Derive a set of questions relating to the goals
 - Answers provide visibility into meeting the goals
 - Develop a set of metrics needed to answer the questions



GQM Definitions

- Define major goals behind evaluating the sustainability of a software architecture using quality attributes



- Questions derived from goals that must be answered to determine if the goals are achieved



- Measurements that provide the most appropriate information for answering the identified questions



Sustainability of the architecture of a software system

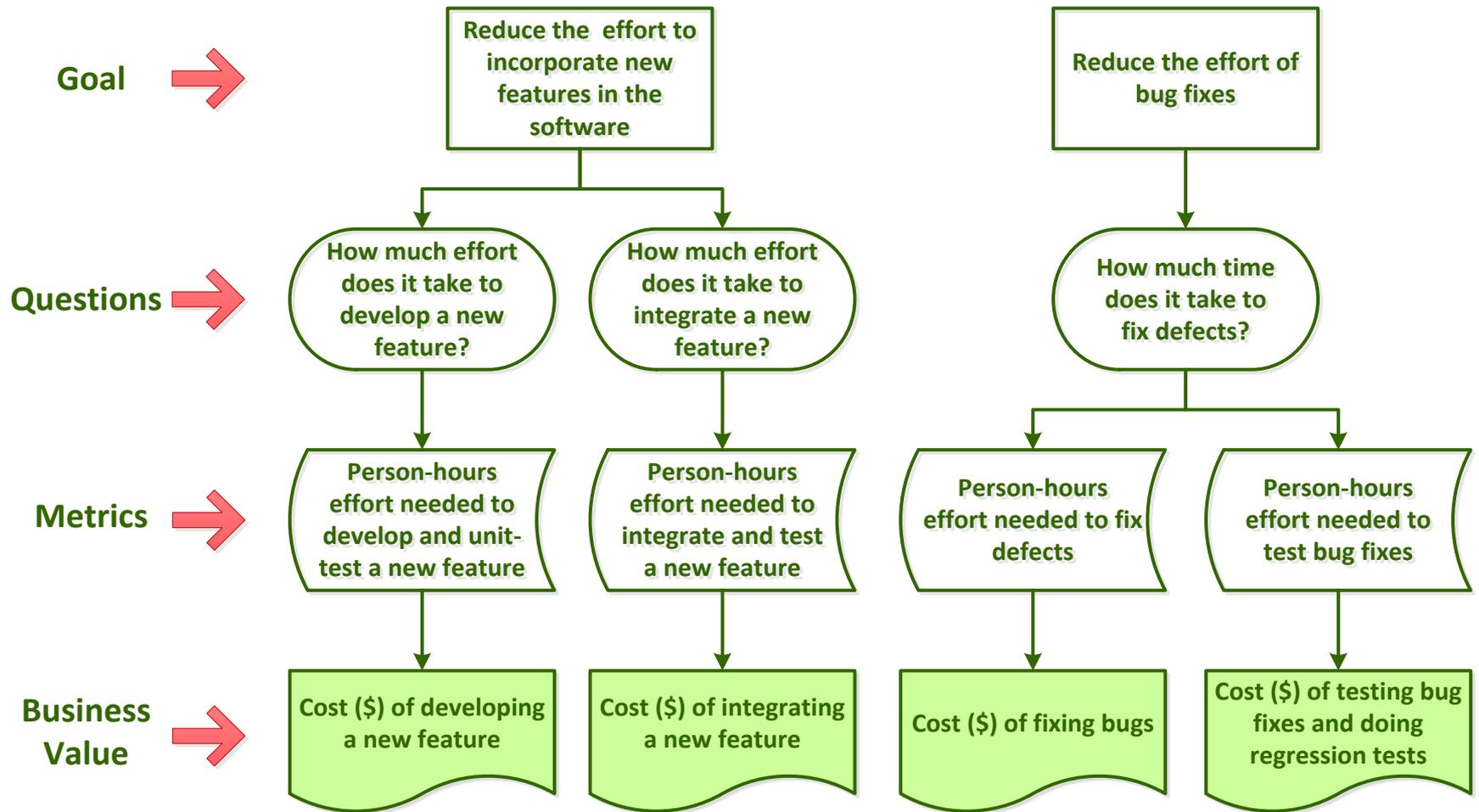
- Identify simple ways to measure the sustainability of a software architecture that considers metrics that measure maintainability, extensibility, reliability, and modularity
- Metrics should be connected to economic benefits
- Metrics should be as simple as possible
- Collection of metrics should be as transparent as possible

Maintainability

- “The ease with which a software system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment” (IEEE)
- “Maintainability is the ease with which a software system or component can be modified to correct faults, improve performance, or other attributes, or adapt to a changing environment” (Aldekoa, et al.)
- Improving **software maintainability** thorough architecture design involves guiding the dependencies of architecture components to their most optimal configuration.

Maintainability

GQM

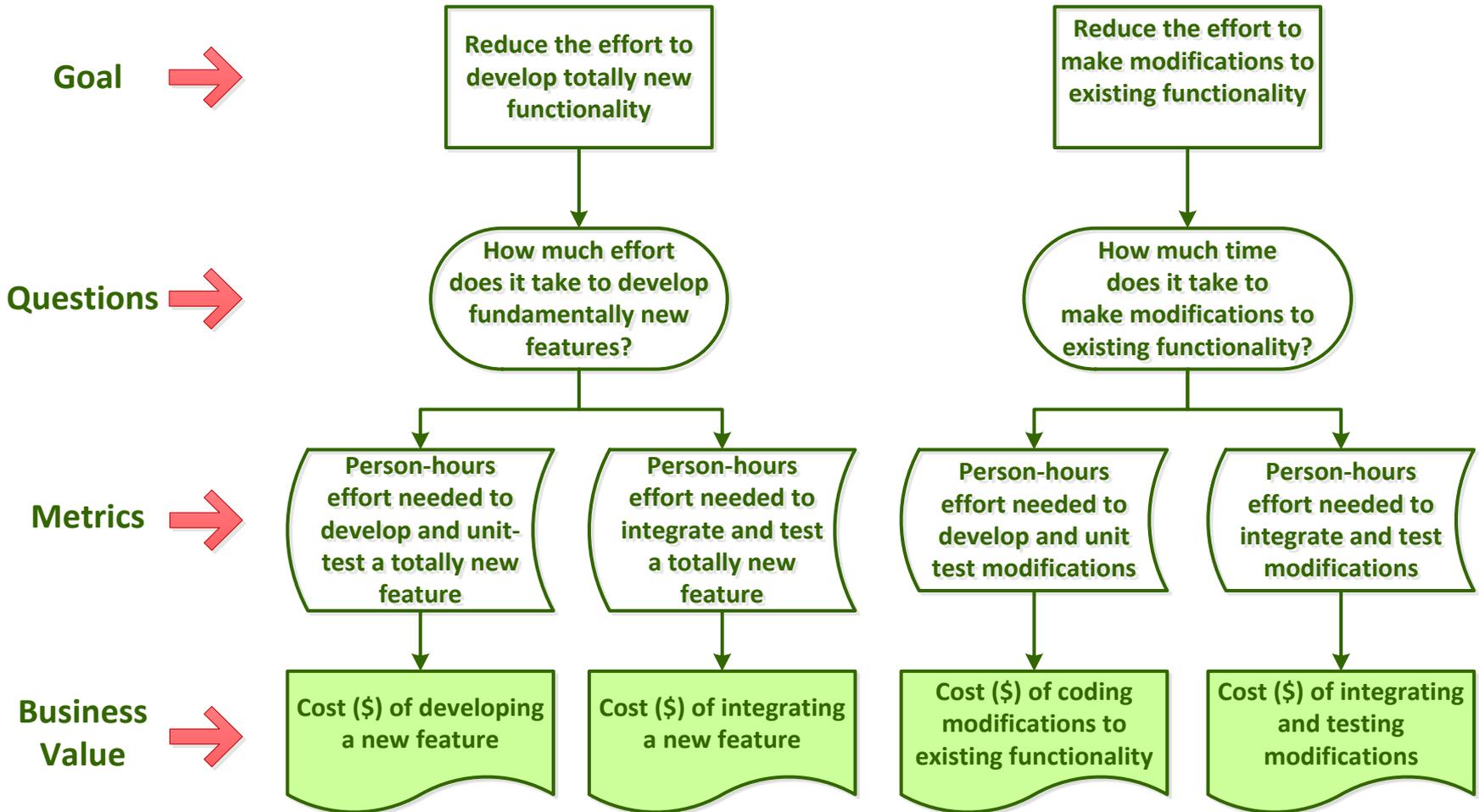


Extensibility

- Software extensibility is the ability that a software system has to be extended and the level of effort required to implement the extension
- Extensions are additions of new functionality, or modifications to existing functionality
- The main issue is to provide enhancements to the software while minimizing impact to existing system functions
- From the software architecture perspective extensibility means the system is designed to include “hooks” and mechanisms for expanding and enhancing the system without having to make major changes to the system architecture
- Extensibility can also mean that the behavior of the software system can be modifiable at run time, without having to recompile or change the original source code
- Not easy to find meaningful way to measure extensibility

Extensibility

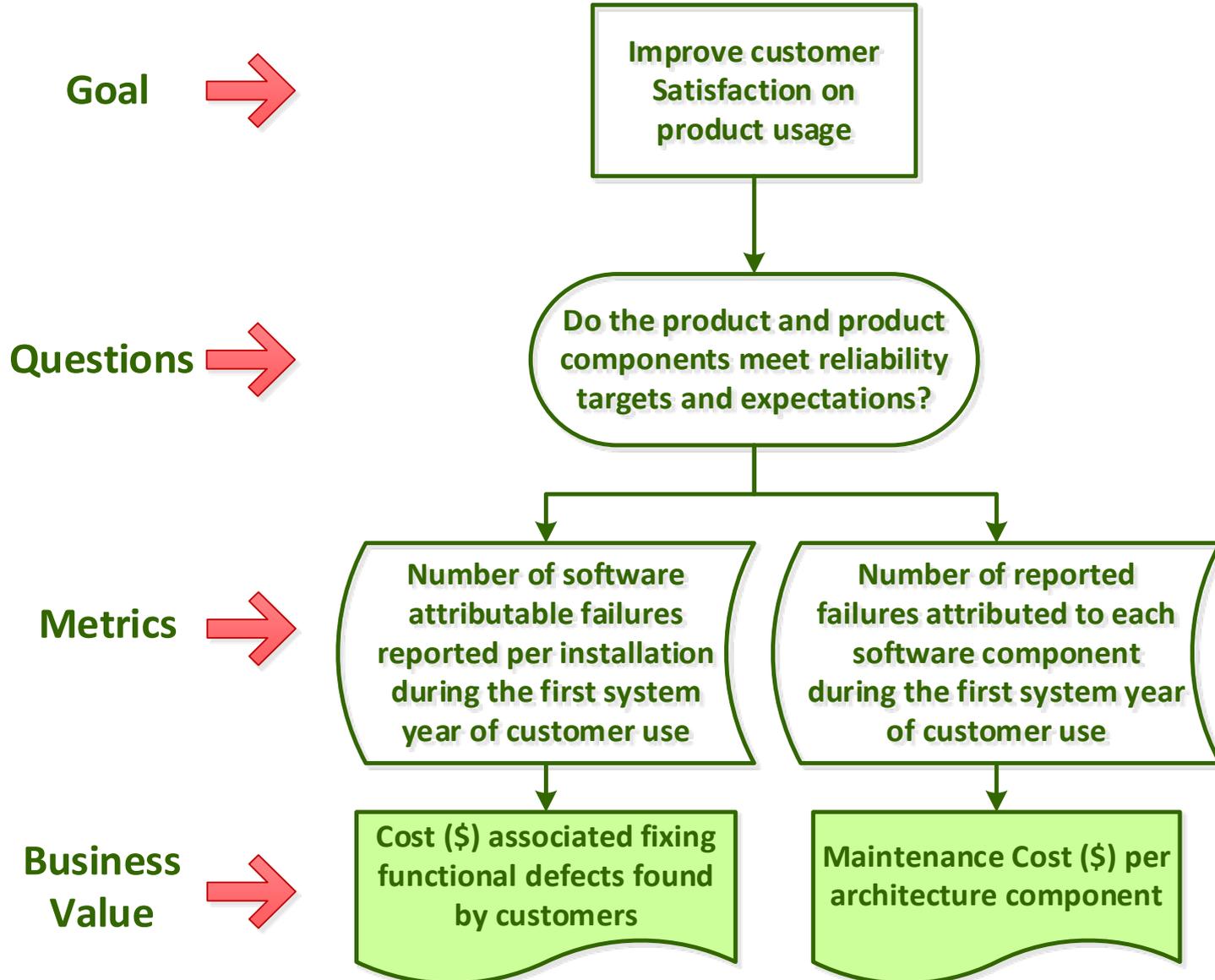
GQM



Reliability

- The reliability of a system is a measure of its ability to provide a failure-free operation.
- For many practical situations, reliability of a system is represented as the failure rate.
- We wish to apply reliability to software architecture by assessing the reliability on a component basis when possible and determining the impact of modularity on reliability.

Reliability GQM

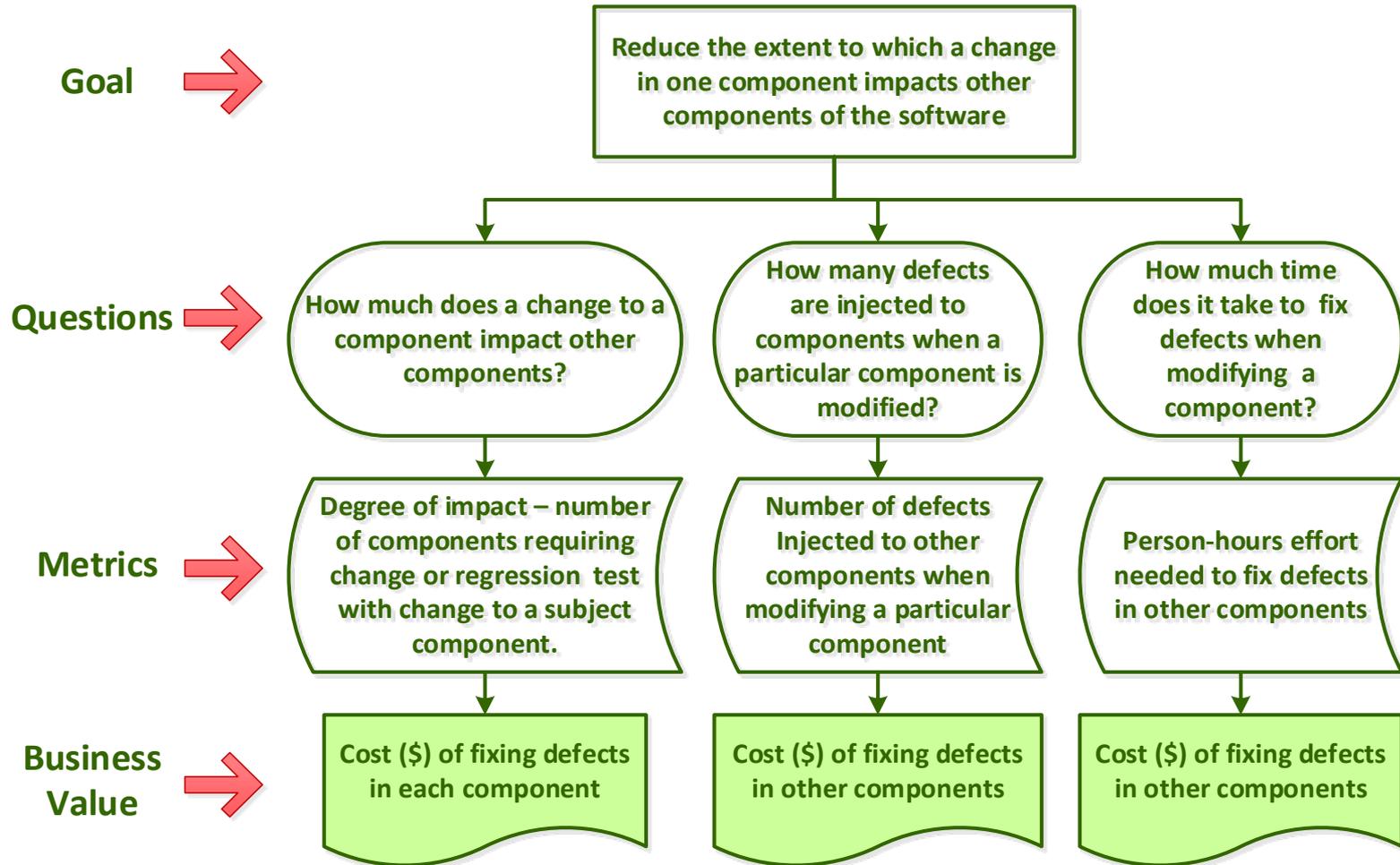


Modularity

- Modularity refers to the degree that a system has to allow its components to be separated or recombined.
- Software modularity refers to the logical partitioning of components or modules that allows complex software to be manageable for the purpose of development, implementation and future maintenance
- The logic of partitioning of modules may be based on related functions, implementation considerations, data needs, etc.

Modularity

GQM



Measurement process

- Define Measurement Goals/Objectives
- Specify questions
- Define metrics
- Specify data collection mechanisms
- Identify data storage procedures
- Specify data analysis procedures
- Provide measurement results

Conclusions

- Degraded architectures slow down the progress of software evolution and reduce profits
- Industry requires architecture metrics that support sustainable software architectures
- Proposed quality attributes that can serve as a basis for sustainable architectures, include:
 - Maintainability
 - Extensibility
 - Reliability
 - Modularity
- GQM is a methodology that can be utilized to derive metrics for software architecture sustainability
- Metrics should be simple and easy to collect
- Metrics should be linked to economic benefits