

The Riskit Method for Software Risk Management

**Vahid Hashemian
University of Waterloo
October 27, 2003**

Outline

- Introduction
- Characteristics of Riskit
- Risk elements in Riskit
- The Riskit process and steps
- Case studies

About the Author

- *Jyrki Kontio* is a professor of *Software Product Business* at the Software Business and Engineering Laboratory (SoberIT) in the Helsinki University of Technology.
- He proposed the Riskit method in 1996, when he was a Researcher in UMD.
- Some of his other research interests: process modeling, reuse and knowledge-based systems.

Introduction

- The necessity of risk management (RM) in software development
 - Missing deadlines
 - Exceeding budgets
 - Delivering less than satisfactory products
- RM deals with these threats before they occur.
- Several RM approaches exist.

Introduction

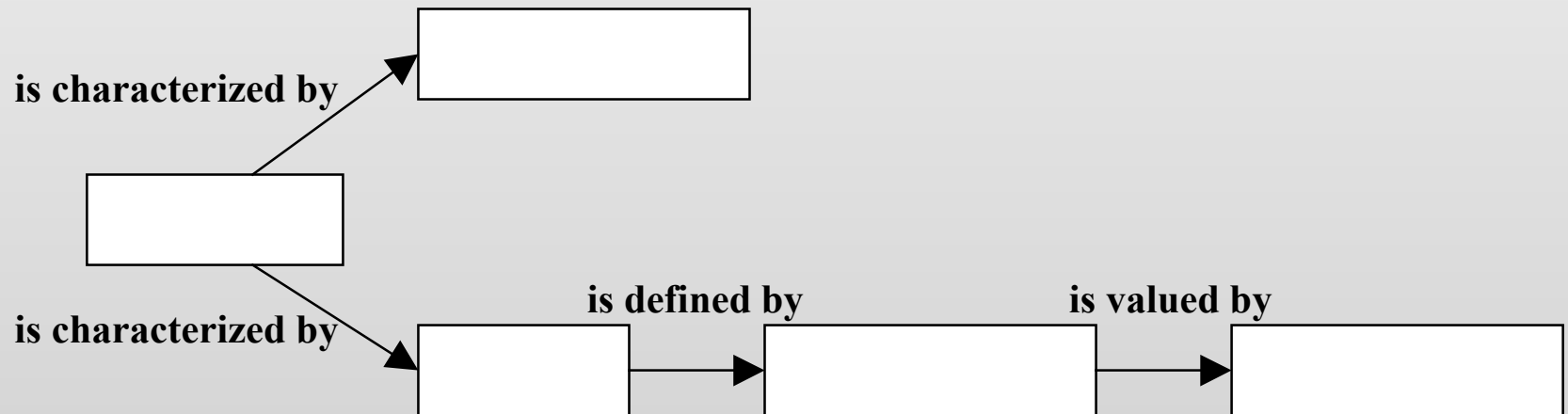
- Reasons for low usage of RM methods:
 - Risk is an abstract concept.
 - Providing accurate estimates for probability and loss is not usually easy.
 - Risks have different implications to different stakeholders.
 - Each risk may affect a project in more than one way.
 - Many RM methods are complex and costly to use.

Characteristics of Riskit

- Provides precise and unambiguous definition for risks.
 - Common definitions: a probability of loss, the actual loss, a factor associated with a threat,
 - Risk: a probability of loss, the loss itself, or any characteristic, object or action that is associated with that possibility.
 - Two main attributes of risk: probability and loss.

Characteristics of Riskit

- Loss: an outcome that falls short of what was expected. Its definition is influenced by stakeholders.



Characteristics of Riskit

- Results in explicit definition of objectives and constraints that influence the project.
 - This is because the way risk is defined in Riskit.
 - *goals*: recognized and defined expectations.
- Aimed at modeling and documenting risks qualitatively.
 - Provides conceptual and graphical tools to model different qualitative aspects of risks.
 - Quantitative estimations not required.

Characteristics of Riskit

- Can use both ratio and ordinal scale risk ranking information to prioritize risks.
 - It may be enough to identify the biggest risks and propose action to control them.
- Uses the concept of utility loss to rank the loss associated with risk.
 - Instead of using losses in some specific attributes, such as cost, time delay or quality metrics.

Characteristics of Riskit

- Models different stakeholder perspectives explicitly.
 - Utility losses in each case is evaluated.
- Has an operational definition and training support.
 - Can be applied easily and consistently.

Risk Elements – Risk Factor

- Risk factor: a characteristic that affects the probability of a negative event occurring.
 - Inexperience of personnel
 - Use of new methods
 - Use of new tools
 - Unstable requirements
- Should document main assumptions of project environment, and characteristics that are different from the assumed “normal” situation.

Risk Elements – Risk Event

- Risk event: a stochastic phenomenon that represents an occurrence of a negative incident.
 - A system crash
 - A key person quit
 - Extra time spent on learning a method
 - A major requirement change
- Uncertainty can be characterized by a probability estimate.

Risk Elements – Risk Outcome

- Risk outcome: represents the situation after the risk event has occurred and before any corrective action.
 - System out of operation
 - Personnel and competence shortage
 - Work behind schedule
 - New work required
- Comparing to risk event, it is a better criterion for deciding about reactions that can be considered.

Risk Elements – Risk Reaction

- Risk reaction: a possible action as a response to risk event and resulting risk outcome.
 - System operational after delay, backup data restored
 - Recruiting process initiated, staff reassigned
- One reaction → deterministic
- Two or more → alternative lines of actions

Risk Elements – Risk Effect

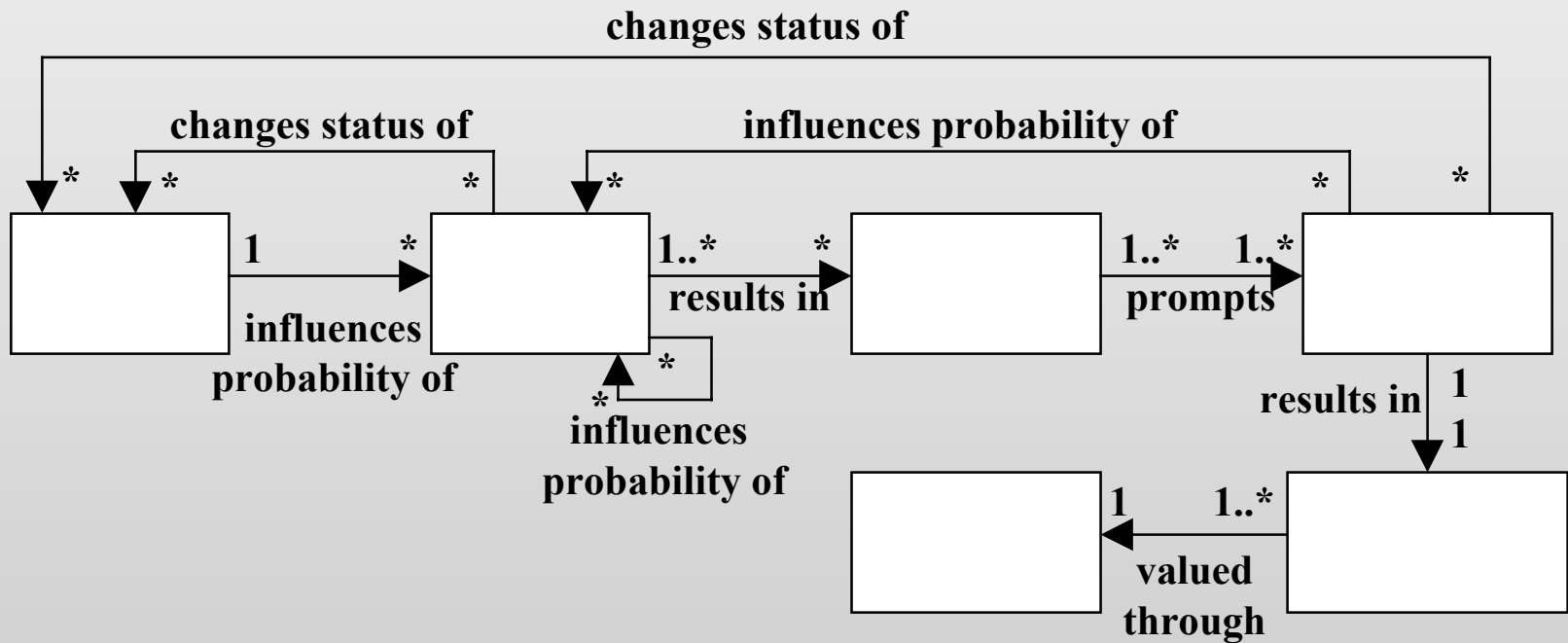
- Risk effect set: the final impact of a risk event to the project. Considering the impact of reaction, it describes characteristics which were affected.
 - Added cost \$50K
 - Two-month calendar delay
 - Some functionality lost
 - Reputation as a reliable vendor damaged

Risk Elements – Risk Effect

- Utility loss: captures how severe the overall impact of the effects is. It is based on the utility theory in economics and decision theory.
 - The perceived harm experienced by a stakeholder (e.g., the board of director, CEO, or personnel)
- Considers several stakeholders.
- Can be used as a synonym for “pain”.

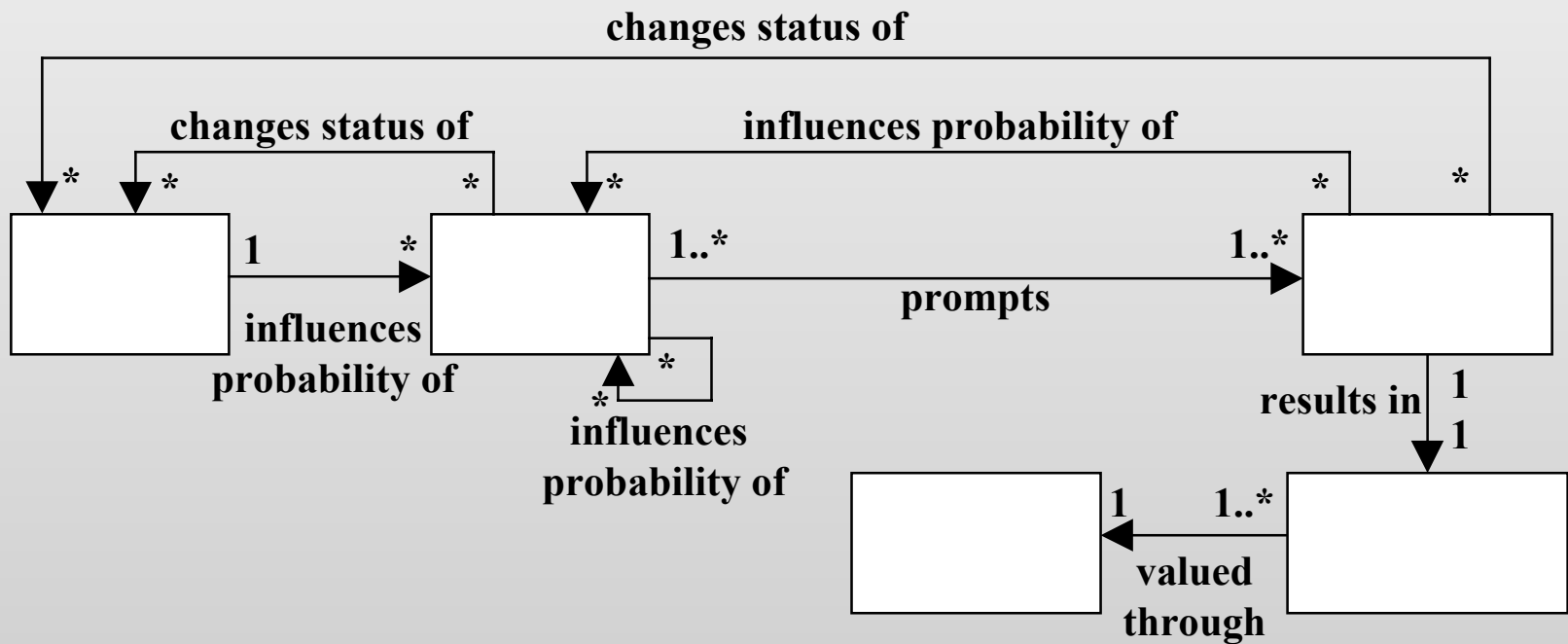
Decomposing Risk

- Riskit Analysis Graph: graphical formalism to define different aspects of risk.



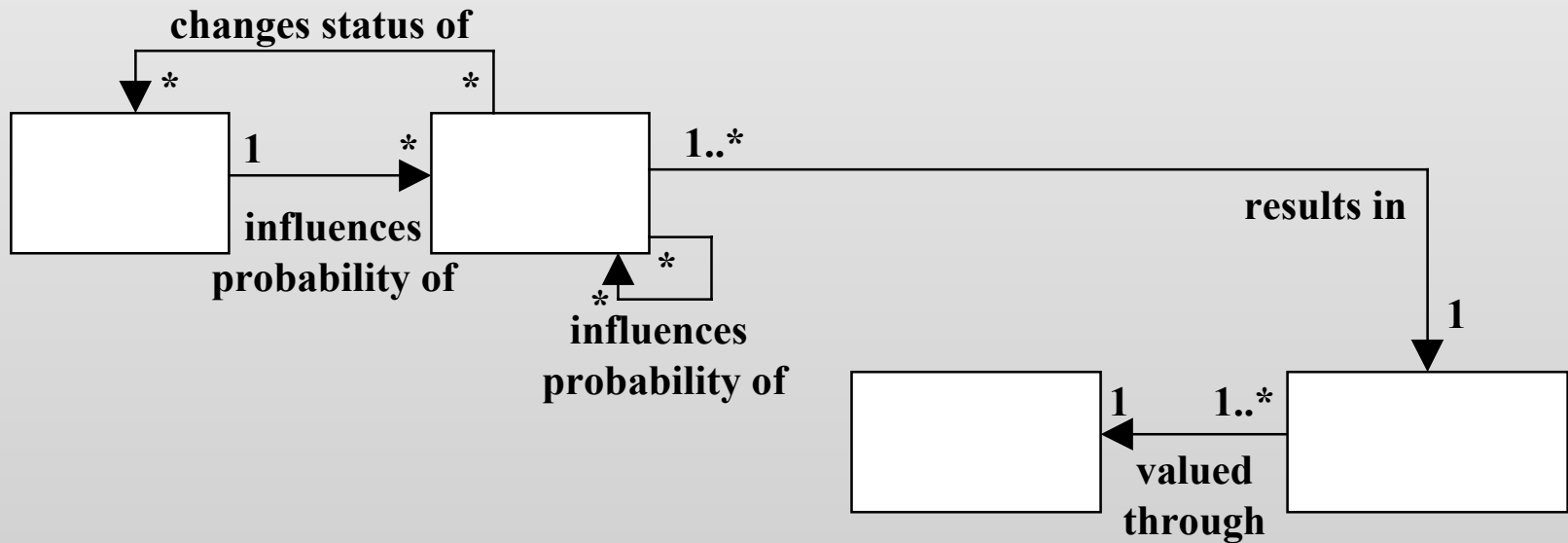
Simpler Forms of the Graph

- Normal Riskit Analysis Graph



Simpler Forms of the Graph

- Simple Riskit Analysis Graph



The Riskit Process

- Comprehensive risk management method based on theoretical principles.
- Has a comprehensive process definition that supports risk management activities.
- Main characteristics
 - Full operational definition of the process
 - RM mandate, scope, focus, authority and procedures defined together
 - A specific step for identifying and defining the goals of the project

The Riskit Process

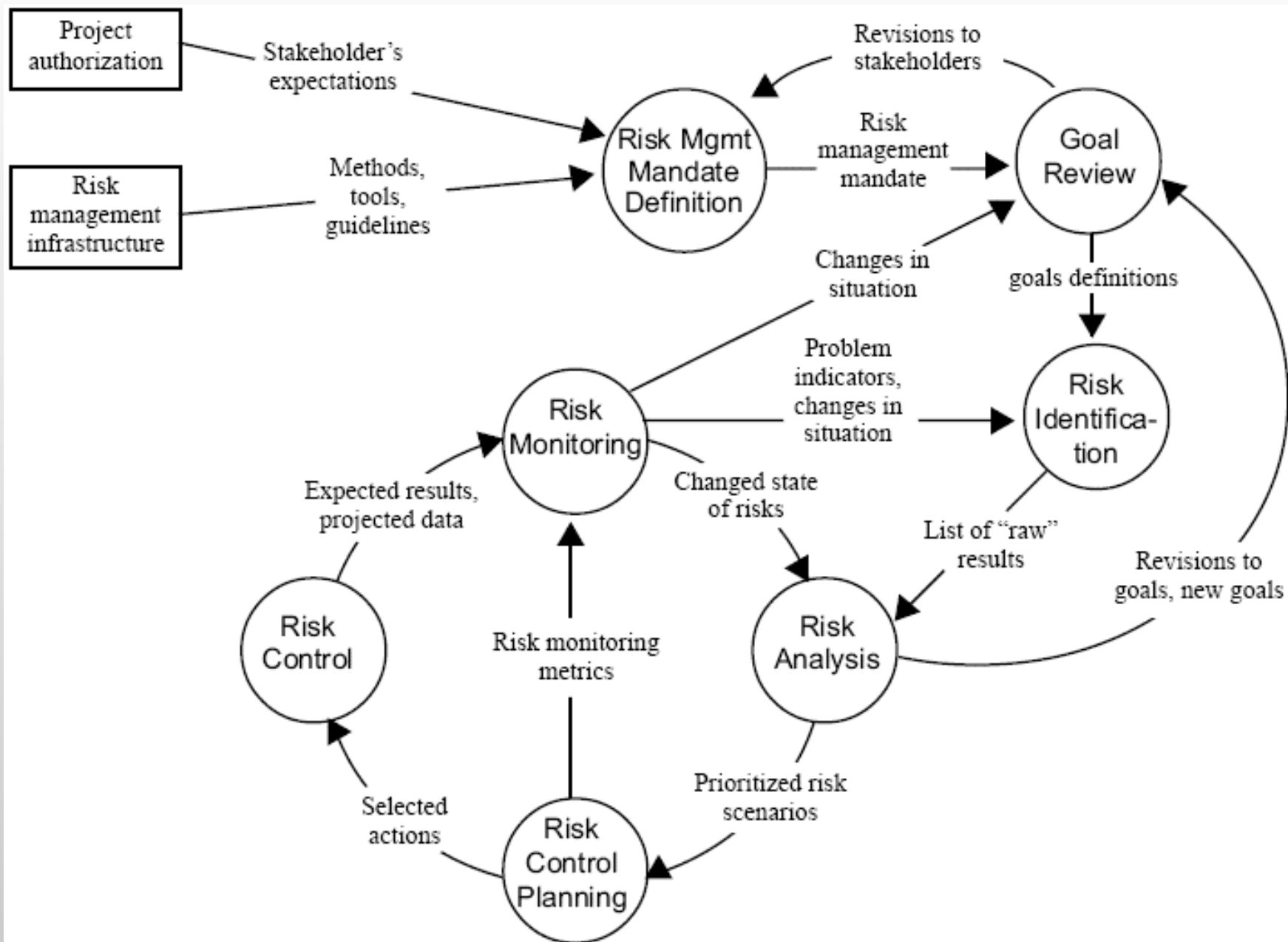
- Process and Sub-process definition template

Purpose	Purpose of the process
Description	Description of the process and approaches used in it
Entry criteria	The criteria that is used to initiate the process (may contain logical expressions)
Input	Input information required by the process
Output	Output produced by the process
Methods and tools	Methods and tools used by the process
Responsibility	A person or role that is responsible for the process
Resources	List of resource types that are used or participate in the process
Exit criteria	Determines whether the process has been concluded (may contain logical expressions)

The Riskit Process

Purpose	Providing accurate and timely information of the risks in a project. Defining and implementing cost efficient actions to control risks.
Description	Monitoring and managing risks continuously in a project
Entry criteria	Project planning has been initiated
Input	Project authorization information: goals, resources, schedule, budget. Context and history information about the organization and its process.
Output	Continually updated information about risks. Defined and implemented risk controlling actions. Experience and data about risks and risk management process.
Methods and tools	The Riskit process definition. Riskit documentation templates. Riskit analysis graph definition and drawing tools. Risk identification checklists. Multiple criteria decision making tools. Word-processing and spreadsheet software.
Responsibility	Project manager
Resources	Technical personnel. Stakeholder representative.
Exit criteria	Project has been completed or terminated.

The Riskit Process



Riskit Steps – RM Mandate Definition

- Risk management mandate definition
 - The scope and frequency of RM are defined.
 - All relevant stakeholders are recognized.
 - output
 - RM mandate (why, what, when, who, how and for whom)

RM Mandate Definition

Purpose	Defining the scope and frequency of RM.
Description	Defining the responsibility, authority, scope and focus of RM in a project.
Entry criteria	[project planning has been initiated] OR [stakeholders have changed] OR [project's overall risk level has changed] OR [stakeholder's risk tolerance has changed]
Input	Project authorization information: goals, resources, schedule, budget. Organization's RM policy and practice.
Output	RM mandate.
Methods and tools	NA
Responsibility	Project owner or project manager.
Resources	Project owner, project manager.
Exit criteria	[RM mandate documented and approved]

Riskit Steps – Goal Review

- Goal review
 - The stated goals of the project are reviewed and refined, and implicit goals and constraints are defined explicitly.
 - Stakeholders' associations with the goals are analyzed.
 - output
 - Explicit goal definitions

Riskit Steps – Goal Review

- Stakeholder goal priority table

	Stakeholder A priority: 1	Stakeholder B priority: 1	...	Stakeholder X priority: 2
Goal 1	1	2	...	4
...
Goal n	NA	2	...	1

Goal Review

Purpose	Defining project's goals explicitly. Recognizing all relevant stakeholders and their associations with the goals.
Description	Existing goal definitions are reviewed and refined (implicit goals are identified and defined). Different stakeholders are identified, their importance or priority defined, and their association and expectation levels with goals.
Entry criteria	[project planning has been initiated] OR [new goals or stakeholders are identified] OR [a change in goals or stakeholders has been recognized]
Input	Project authorization information: goals, resources, schedule, budget. RM mandate.
Output	Goal definitions.
Methods and tools	GQM.
Responsibility	Project manager.
Resources	Project owner, project stakeholders, project personnel.
Exit criteria	[goals are explicitly documented and participants agree with them]

Riskit Steps – Risk Identification

- Risk identification
 - Potential threats to the project are identified using multiple approaches.
 - output
 - A list of “raw” risks

Risk Identification

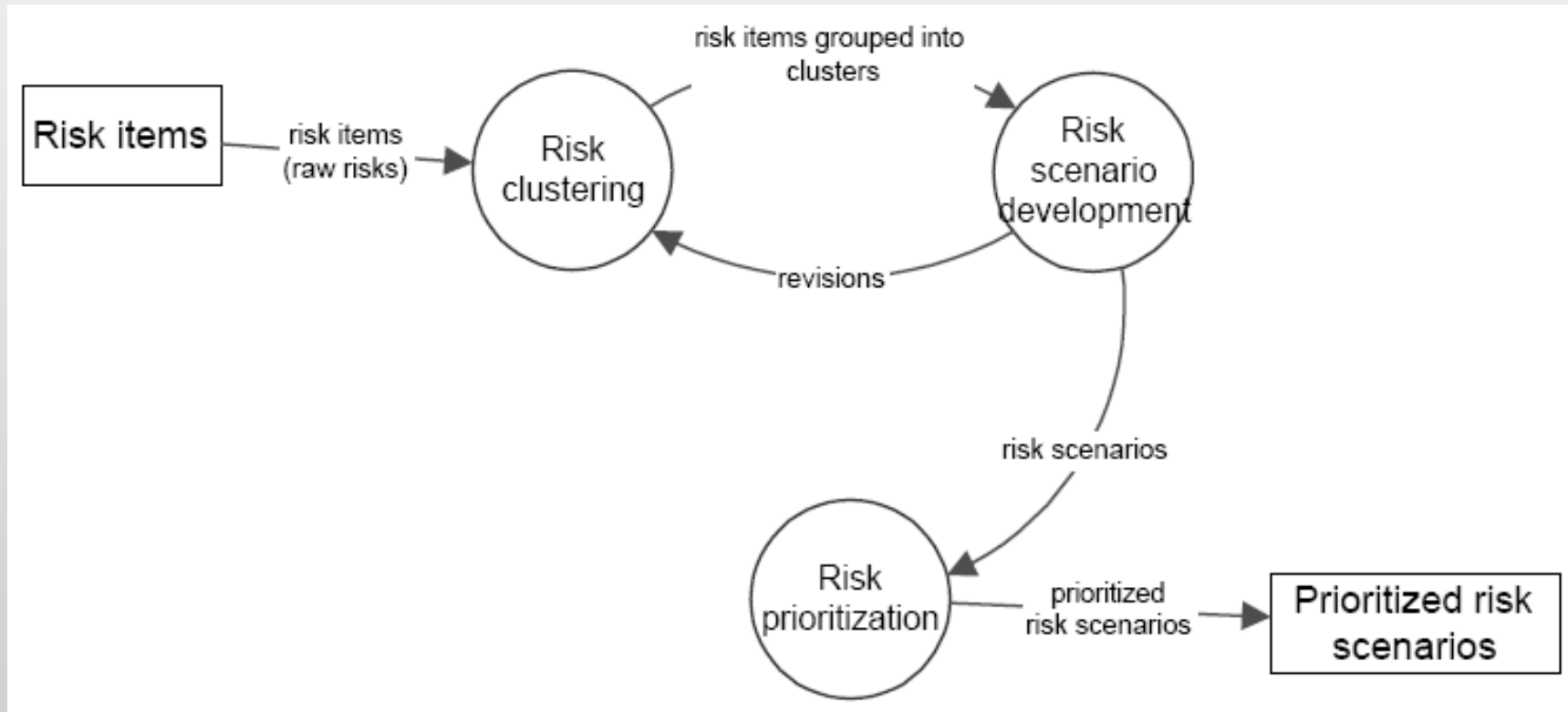
Purpose	Identifying potential threats to the project.
Description	Identifying a large number of possible threats to the project using multiple approaches.
Entry criteria	[project planning has been initiated] OR [new goals or stakeholders are identified] OR [a change in goals or stakeholders has been recognized] OR [the time interval stated in RM mandate has elapsed] OR [a significant change in project situation has been recognized]
Input	Project authorization information: goals, resources, schedule, budget. RM mandate. Risk checklists. Lessons learned reports from similar projects.
Output	A raw numbered list of risks.
Methods and tools	Brainstorming techniques. Goals and stakeholder driven identification approaches. Meeting aids. Interviews.
Responsibility	Project manager.
Resources	Project personnel, risk management facilitator.
Exit criteria	[the marginal yield of risk identification approaches zero] OR [time or effort allocated for risk identification runs out]

Riskit Steps – Risk Analysis

- Risk analysis
 - Risks are classified and consolidated.
 - Risk scenarios for main risk events are completed.
 - Risk effects for all risk scenarios are estimated.
 - Probabilities and utility losses of risk scenarios are estimated.
 - output
 - Completed risk analysis graph for all analyzed risks
 - Ranked risk scenarios

Riskit Steps – Risk Analysis

- Decomposed into 3 sub-processes



Riskit Steps – Risk Analysis

- Risk item clustering: grouping, decomposing, merging or deleting risk items into manageable clusters; based on type of risk, criticality or stakeholders.
- Risk scenario development: developing risk scenarios for main risks using the Riskit analysis graph.
- Risk prioritization: prioritizing scenarios wrt. their seriousness based on the estimates for probability and utility loss for each scenario.

Riskit Steps – Risk Analysis

- Ranking based on expected utility loss
 - $\text{exp. utility loss (RS)} = \text{probability (RS)} * \text{utility loss (RS)}$
- Pareto ranking technique for risk prioritization
 - results in a partial ranking of risk scenarios

	Risk scenario probability				
Risk scenario utility loss	rank 1	rank 2	rank 3	...	rank n
rank 1	scenario 1	scenario 2		...	
rank 2			scenario 3	...	
rank 3	scenario 4	scenario 5	scenario 6	...	
...
rank m		scenario 7		...	

Risk Analysis

Purpose	Understanding and prioritizing risks.
Description	Analyzing risks and their components so that their probabilities and impacts can be assessed and most important risks recognized.
Entry criteria	[potential new risks are identified]
Input	a list of risk items.
Output	A prioritized list of risk scenarios.
Methods and tools	Riskit analysis graph. Multiple criteria decision making tools. Riskit Pareto ranking technique.
Responsibility	Project manager.
Resources	Selected project personnel, RM facilitator.
Exit criteria	[participants agree on the priority of the most important risks]

Riskit Steps – Risk Control Planning

- Risk control planning
 - The most important risks are selected for risk control planning.
 - Risk controlling actions for those important risks are proposed.
 - Risk controlling actions are selected to be implemented.
 - output
 - Selected risk controlling actions

Risk Control Planning

Purpose	Proposing and selecting cost effective risk controlling actions.
Description	Defining, prioritizing and selecting risk controlling actions for the most important risk scenarios.
Entry criteria	[important risk scenarios have been identified]
Input	Partially prioritized risk scenarios.
Output	Selected risk controlling actions. Risk monitoring metrics.
Methods and tools	Riskit element review. Riskit controlling action taxonomy.
Responsibility	Project manager.
Resources	Selected project personnel, RM facilitator.
Exit criteria	[all selected risk scenarios have been addressed]

Riskit Steps – Risk Control

- Risk control
 - Risk controlling actions are implemented.
 - output
 - Reduced risks

Risk Control

Purpose	Implementing risk controlling actions.
Description	Implementing the risk controlling actions defined by the risk control planning process.
Entry criteria	[a risk controlling action has been selected for implementation]
Input	Selected risk controlling actions.
Output	Implemented risk controlling actions. Problems reports if problem arose in implementation.
Methods and tools	NA
Responsibility	Project manager.
Resources	Project personnel, external resources as needed.
Exit criteria	[selected actions have been implemented]

Riskit Steps – Risk Monitoring

- Risk monitoring
 - The risk situation is monitored.
 - output
 - Risk status information

Risk Monitoring

Purpose	Monitoring the project and risk situation.
Description	Continuously monitoring risk monitoring metrics and the possible changes in project situation.
Entry criteria	[project has started] (The process may be enacted on predefined frequencies)
Input	Definitions for risk monitoring metrics. RM mandate. Goal definitions. Riskit analysis graph.
Output	Status report.
Methods and tools	Organization measurement program or database.
Responsibility	Project manager.
Resources	Project personnel.
Exit criteria	[project has been concluded or terminated]

Case Studies

- Several case studies have been conducted for evaluating the Riskit.
 - Daimler-Benz
 - Nokia Telecommunication
 - NASA (Software Engineering Laboratory)

References

- Kontio J. and V. R. Basili, “*Riskit: Increasing Confidence in Risk Management*”, Software Tech News, 1998.
- Kontio J., “*The Riskit Method for Software Risk Management, version 1.00*”, Computer Science Technical Report, University of Maryland, 1997.
- <http://www.soberit.hut.fi/~jkontio/>