A Portfolio Approach to Technical Debt Management

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Overview

• Effects of Technical Debt
• Goals of Managing Technical Debt
  ▫ Balance short-term benefit with long-term cost
  ▫ Make better decisions on what technical debt items should be incurred or paid?
  ▫ When to incur or pay them?

• Perspectives
  ▫ Technical debt is a software risk
    • Potential loss – requires extra effort in the future (interest)
    • Uncertainty – may or may not incur interest
    • Risk management
  ▫ Technical debt is an asset
    • Short-term benefit
    • Variable returns through different investment strategies
    • Investment approaches, e.g., Portfolio Management
Portfolio Management

- **Portfolio**
  - Combination of different types of assets
  - Risk reduction strategy
  - Decision making process
    - Determining the types and amounts of assets

- **Principle**
  - Different volatility and performance patterns
  - Reduced investment risk through diversification

- **Modern Portfolio Theory**
  - Mathematical model of the diversification problem
  - Mean-variance analysis model
    - Portfolio return
    - Portfolio risk
  - Constrained optimization problem
    - Minimize the portfolio risk
    - Maximize the portfolio return

\[
\text{weighted sum of the expected returns of the constituent assets}
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\[
\text{standard deviation of the portfolio return: a function of asset risk and correlations of assets}
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Portfolio Approach

• **Measurement of Technical Debt Items**
  ▫ **Principal**
  ▫ **Interest**
    • Expected interest amount
    • Interest standard deviation
  ▫ **Relationship with other debt items**
    • Correlation Coefficient [-1, 1]

• **Transformation to Portfolio Management**
  ▫ **TD item -> Asset**
  ▫ **Principal – interest (net benefit) -> Asset return**
  ▫ **Interest standard deviation -> risk of asset return**

• **Process**
  the estimated principal for all items that belong to $A'$
Discussion

• Evaluation
  ▫ Use past releases of software projects
  ▫ Simulate decision making
  ▫ Compare with other approaches
  ▫ Determine the effectiveness of the approach

• Questions
  ▫ What are the benefits of incurring technical debt?
    • Principal?
    • What if the technical debt is finally paid off?
  ▫ How can the benefits be measured on the project level?