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# A Portfolio Approach

## to Technical Debt Management

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# Overview

- Effects of Technical Debt
- Goals of Managing Technical Debt
  - Balance short-term **Short Term Effect** with long **Long Term Effect**
  - Make better decisions
    - What technical debt items should be incurred or paid?
    - When to incur or pay them?
- Perspectives
  - Technical debt is a software risk
    - Potential loss – re **Reduced time/effort** (extra effort to maintain (interest))
    - Uncertainty – may **Quality decline** (incur)
    - Risk management
  - Technical debt is an investment
    - 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

weighted sum  
of the **expected  
returns** of the  
constituent  
assets

standard  
deviation of the  
portfolio return  
: a function of  
**asset risk** and  
**correlations** of  
assets

# 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  $\rightarrow$  Asset
  - Principal – interest (net benefit)  $\rightarrow$  Asset return
  - Interest standard deviation  $\rightarrow$  risk of asset return
- Process



# 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?