



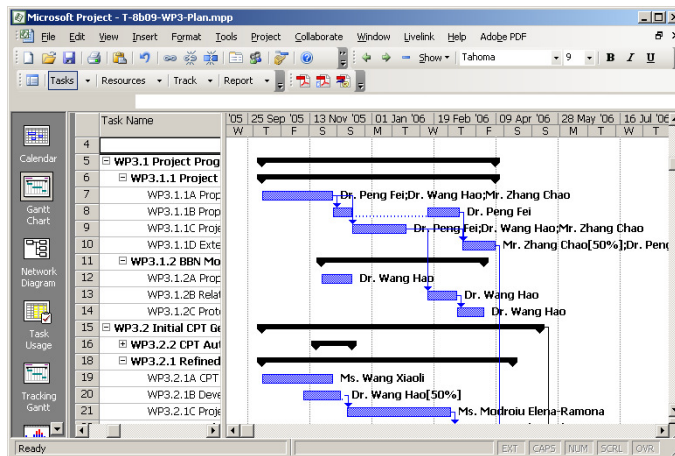
## Software Project Level Estimation Model Framework based on Bayesian Belief Networks

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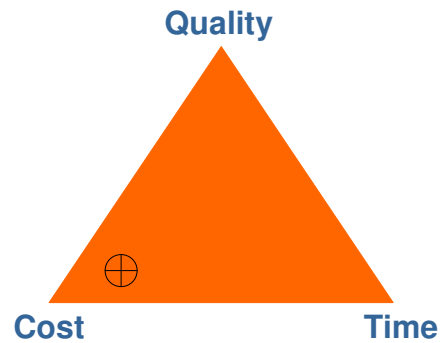
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## Traditional Approach to Estimation and Project Controlling



## The “Magic” Triangle of Software Development



## Challenges for Software Estimation Models

- It's difficult to incorporate the relationship of scope, effort, schedule and quality into estimation model
- The diversity of factors and their quantitative contribution to these three aspects are still under investigation
- Wealth of data that is needed to get parameters for regression based model
- It's difficult to make trade-off analysis and what-if analysis
- How to use refined information for next phase estimation of an evolving project is another challenge for decision makers
- Most of models can not support different development methodologies

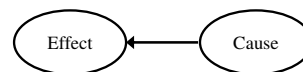
## BBN Overview

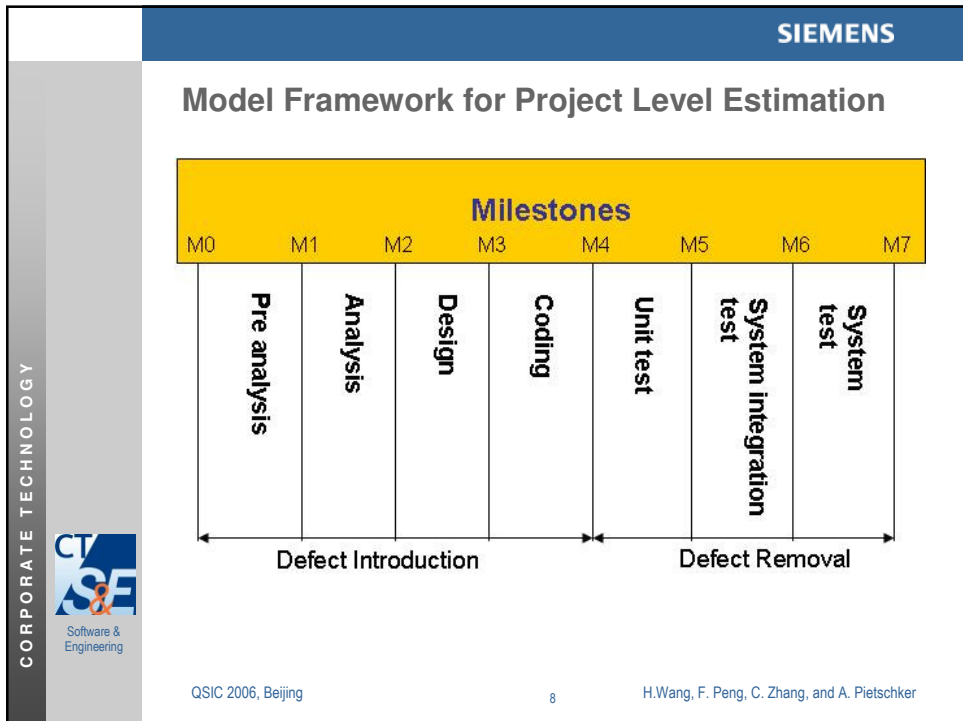
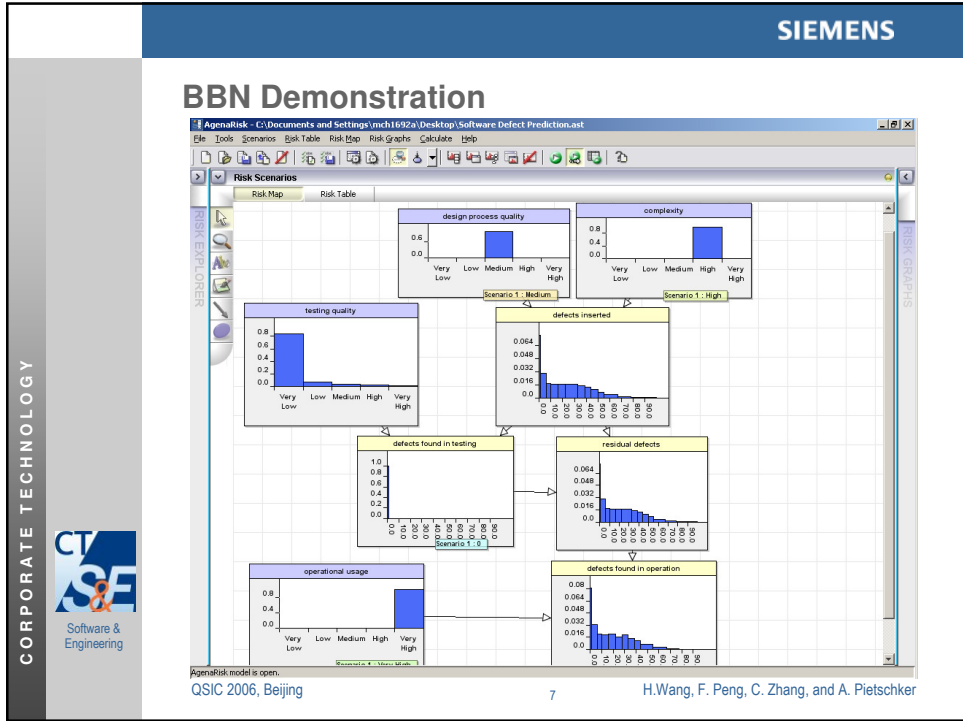
- Network of connected conditional probabilities
- Divide-and-Conquer approach for local properties
- Mathematically rigorous way to model a world, one which is flexible and adaptable to whatever degree of knowledge you have
- Their strength is that they are very robust to missing information, and will make the best possible prediction with whatever information is present
- Good tool to manage uncertainty



## Benefits of using BBN

- specification of complex relationships using conditional probability statements
- use of “what-if” analysis and forecasting of effects of process changes
- easier understanding of chains of complex and seemingly contradictory reasoning via the graphical format
- explicit modeling of “ignorance” and uncertainty in estimates
- use of subjectively or objectively derived probability distributions
- forecasting with missing data





## Basic Estimation Models for Development and Testing

- **Component Estimation Model**

- Contains variables related to component development activities which cover defect introduction, development effort, duration estimation and resources allocation.

- **Test Effectiveness Estimation Model**

- Contains variables related to test activities which mainly cover test effectiveness estimation.

- **Residual Defect Estimation Model**

- Contains variables which are used to estimate the number of residual defects after defect removal activities have taken place.

- **Test Estimation Model**

- Contains variables related to test effort, schedule estimation and resources allocation.

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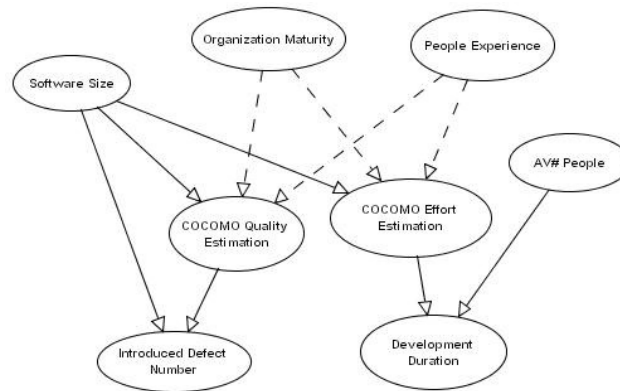
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## Example: Component Estimation Model

- Contains variables related to component development activities which cover defect introduction, development effort, duration estimation and resources allocation.



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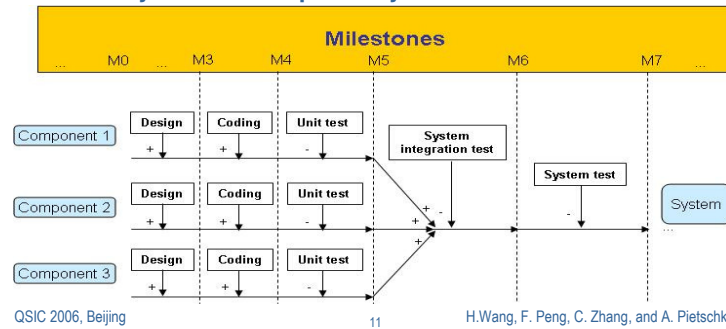
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### Example Project

- A software system development project with three components
- Each of the components is developed independently by a development team, and unit test is executed for each component separately
- The three components are integrated into the complete software system, which will then go through the integration test and system test respectively.



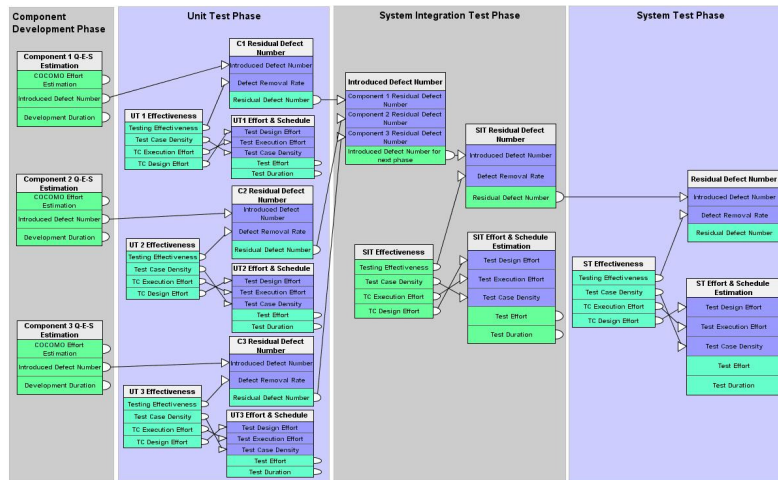
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### Project Level Estimation Model based on BBNs



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## Conclusion

- Our models represent the combination of experiences from past projects and the expert knowledge of an entire organization
- The project level model is constructed from sub-models, so the estimation and analysis of quality, effort, and schedule can be carried out at both
  - project level and
  - specific project phase level
- New and fruitful way of approaching estimation in software projects



Thank you for your attention!

Question?

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