Using AgenaRisk to visualise risk and model uncertainty

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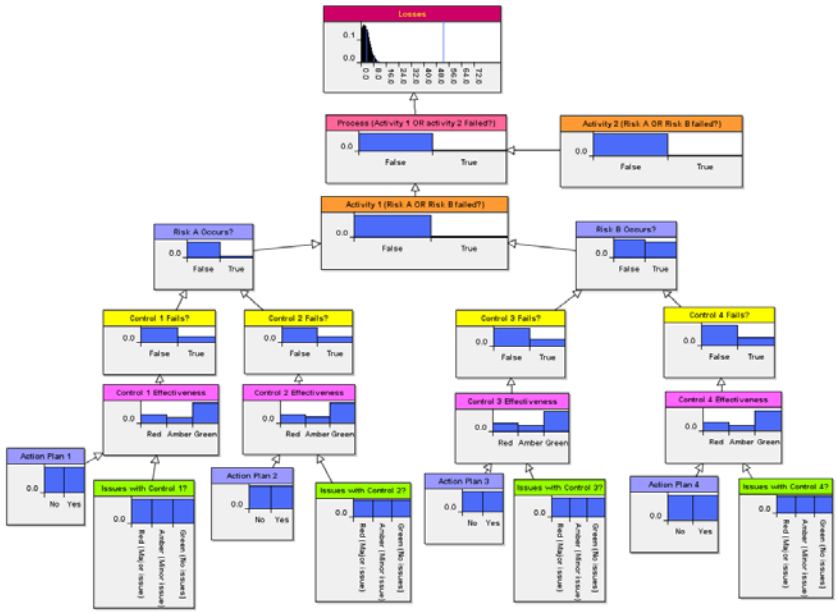
What is AgenaRisk?

- Helps you model risk, analyse uncertainty and make better decisions
- Combines the benefits of Bayesian networks, statistical simulation and spreadsheet-like analysis
- Is visual, easy to use, intuitive and powerful



Who should use AgenaRisk?

- Risk and quantitative analysts

  Currently using spreadsheets wishing to model uncertain variables using probability distributions

- Bayesian network researchers and designers

  Looking to handle continuous variables for diagnosis in object-based and dynamic models

- AI researchers and practitioners

  Interested in expert systems and machine learning

- Statisticians

  Wishing to estimate unknown parameters, from data, using Bayesian inference

- Engineers and scientists

  Interested in incorporating risk and uncertainty into their models

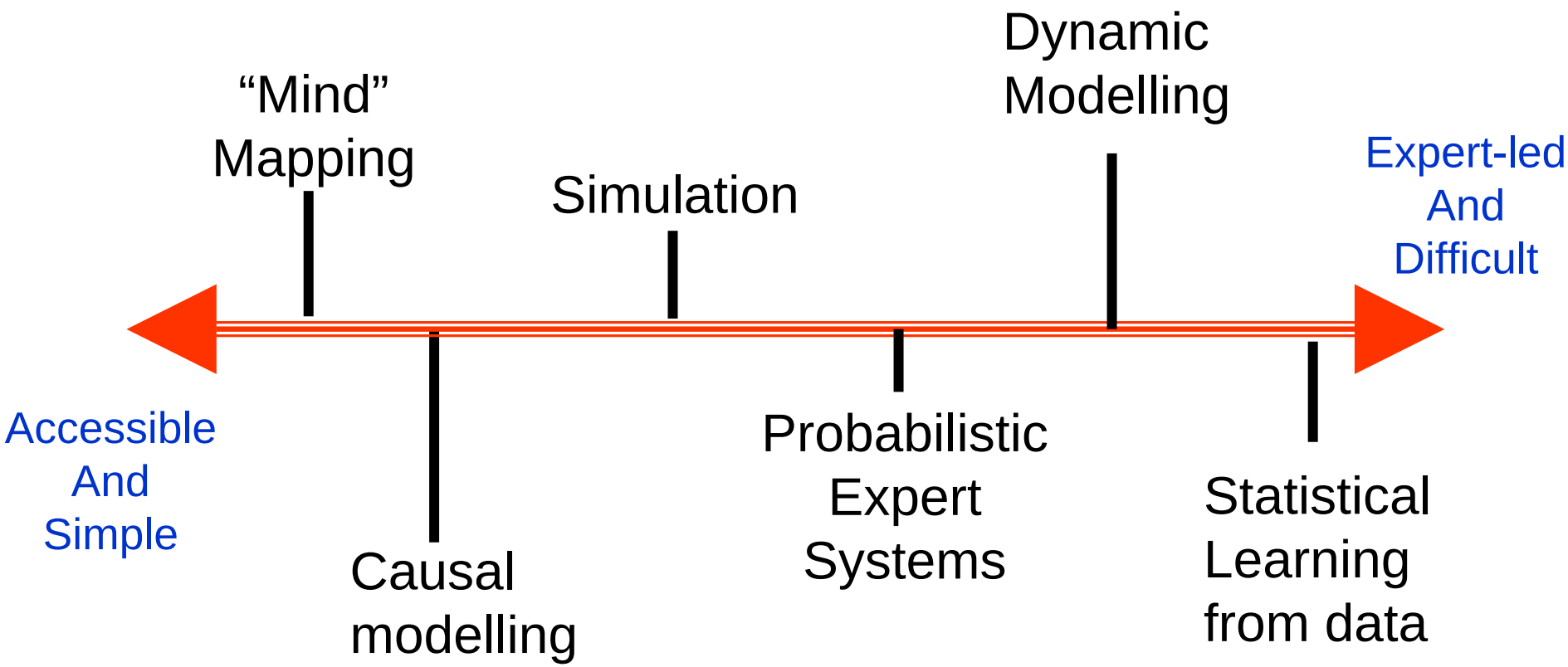
- Quality and reliability engineers

  Looking to calculate system or process reliability using fault trees, expert judgement and failure data

- Academics

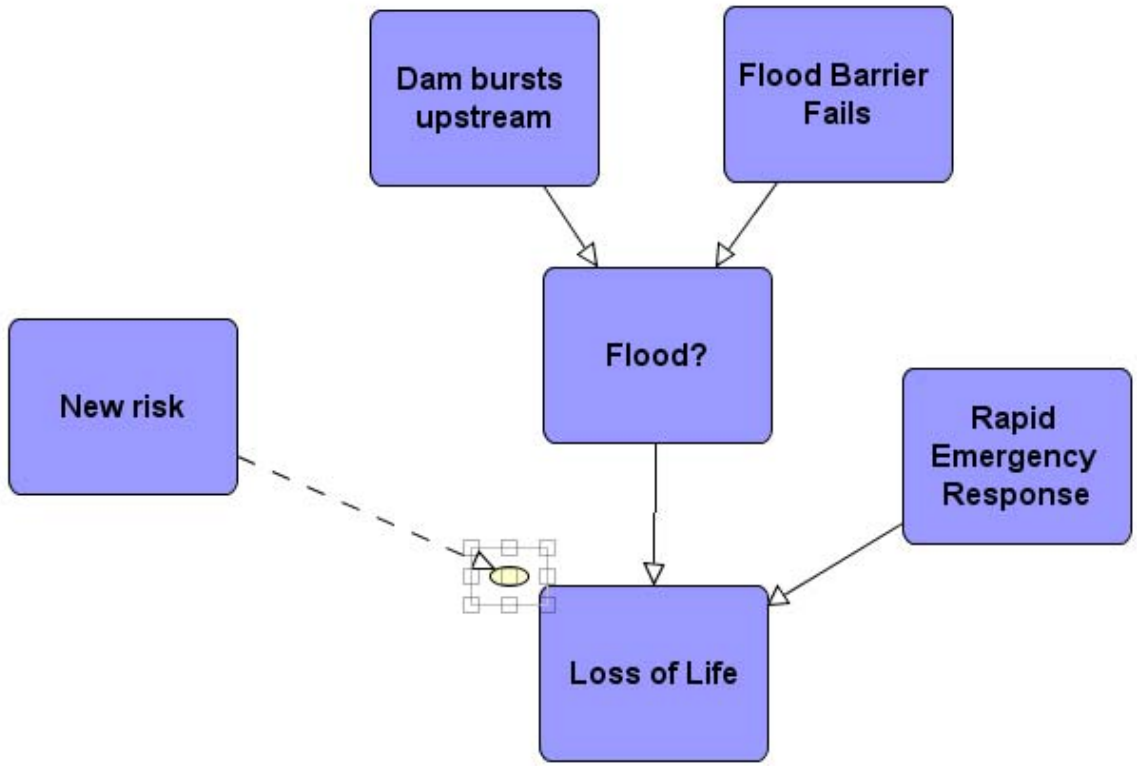
  Probability theory, Statistical simulation, Bayesian networks and AI, Risk assessment, Decision analysis, Quality and Six Sigma and Reliability Engineering

AgenaRisk Modelling Spectrum



Risk Map*

- Nodes represent
  - variables
  - events
  - quantities
- Links represent relationships
  - relevance
  - causality
- Easy to support and understand



* Also know as causal model or Bayesian network

Measuring Scales

- Risk Node Types
  - Boolean (Yes/No, True/False)
  - Labelled (Red, Blue, Green)
  - Numeric (Integer, Continuous, Discrete)
  - Ranked (High, Medium, Low)

Discrete Probabilities

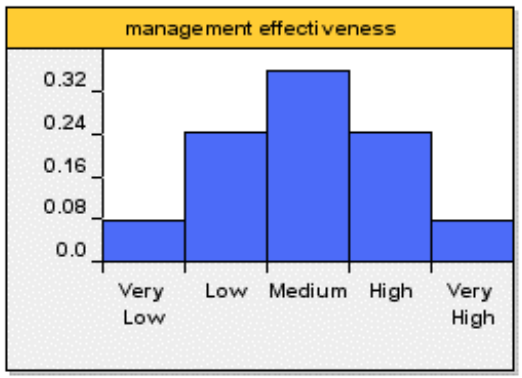
- Prior probabilities

No	0.9
Yes	0.1

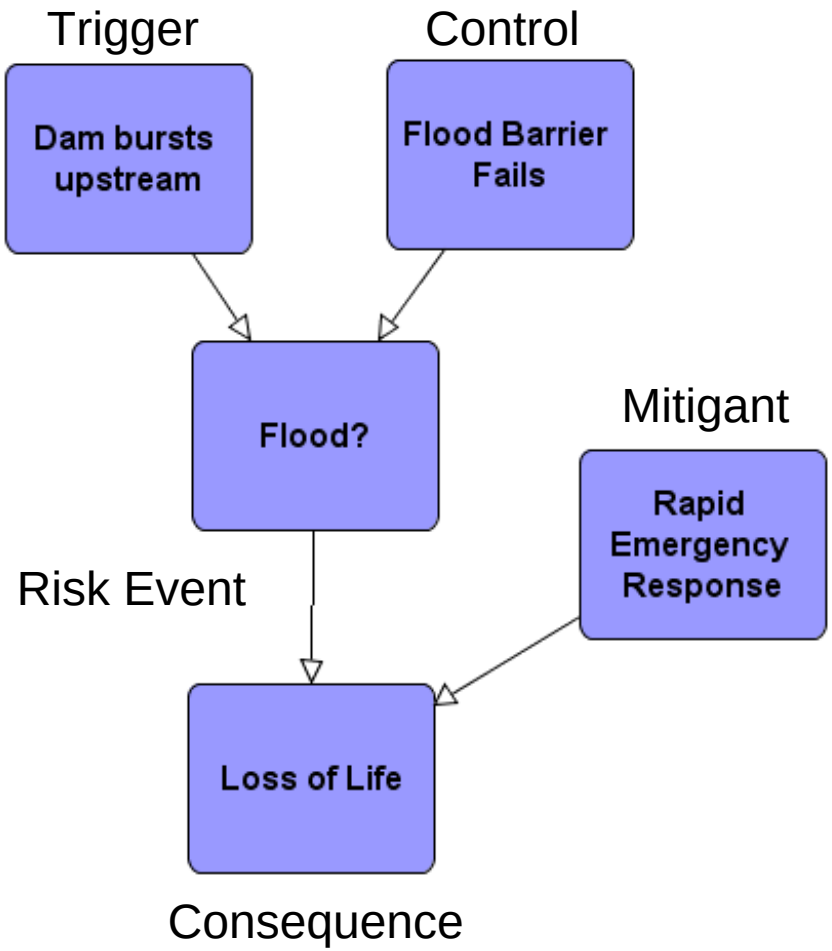
- Conditional Probabilities

Dam bursts...	No		Yes	
Flood Barri...	No	Yes	No	Yes
No	1.0	0.8	0.9	0.0
Yes	0.0	0.2	0.1	1.0

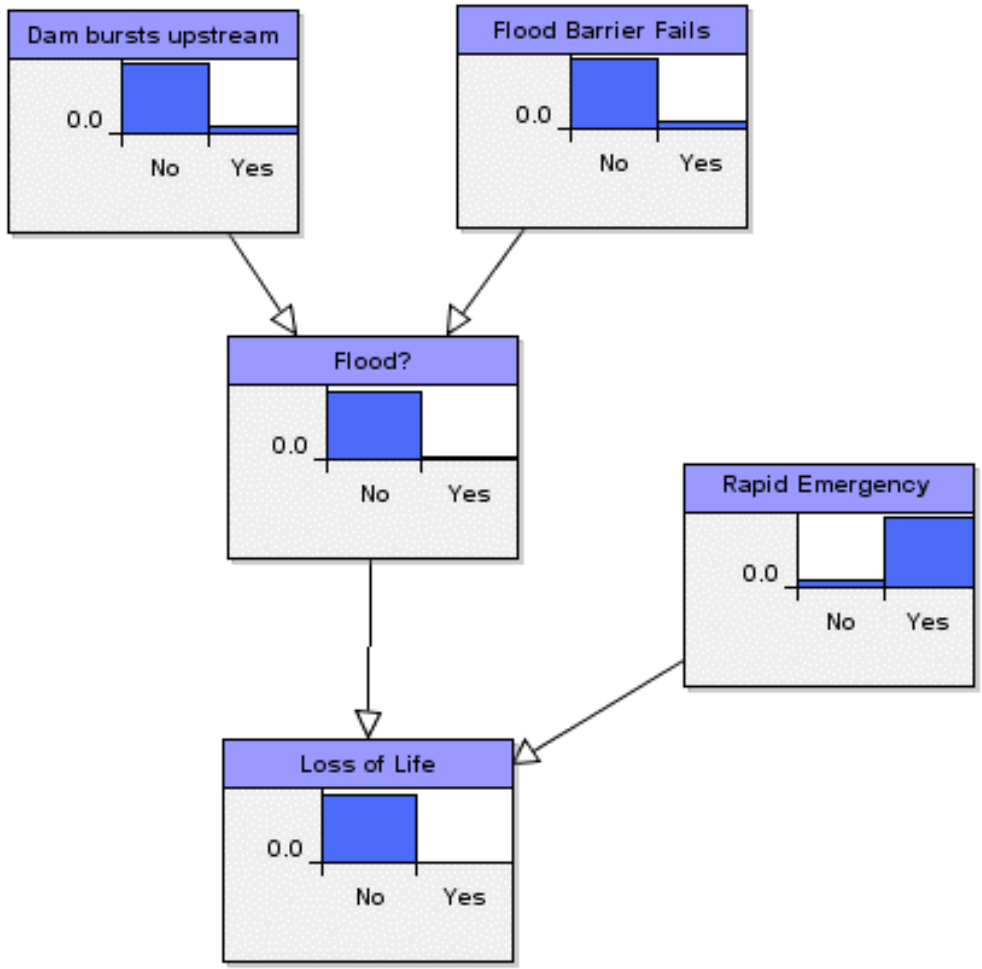
- Result viewed as marginal probability distribution



Town Flood Example

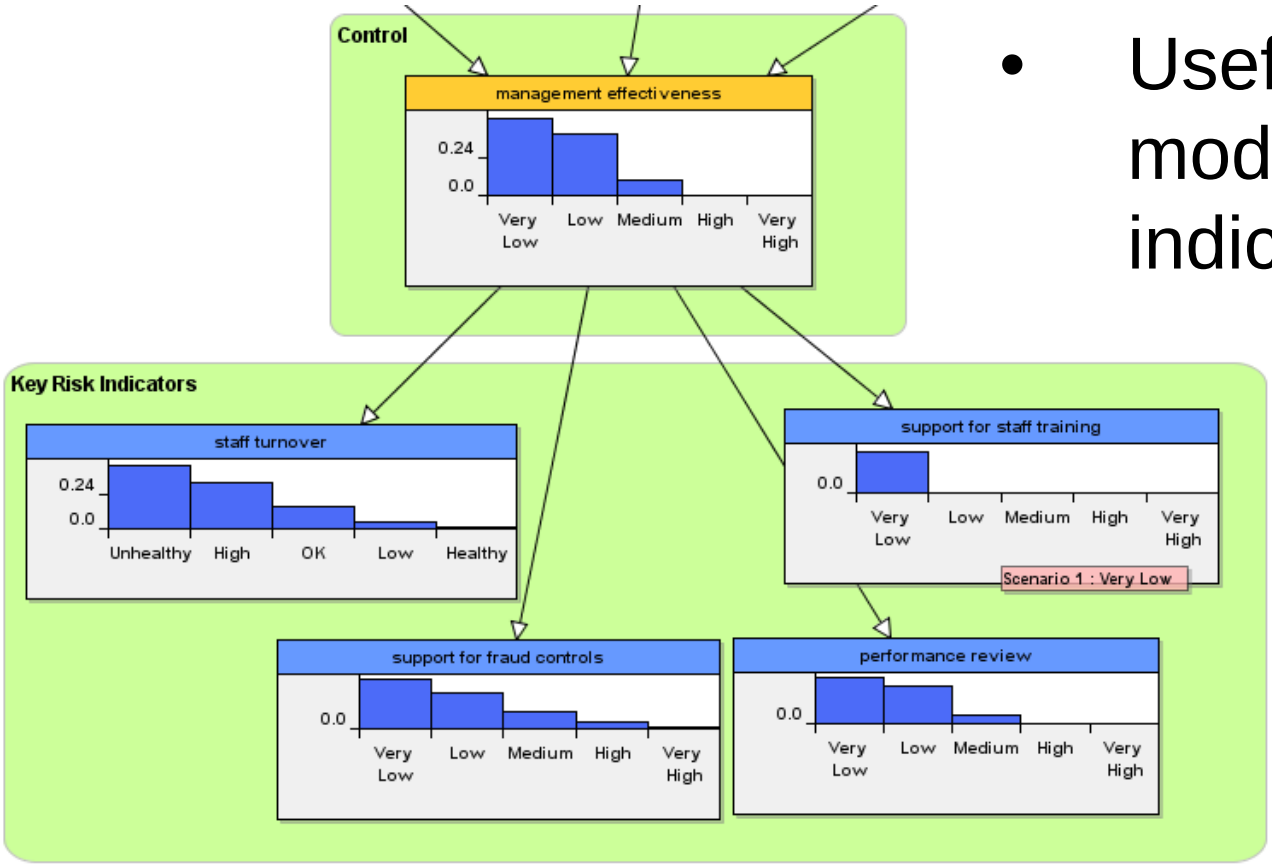


Calculation of Town Flood Risk



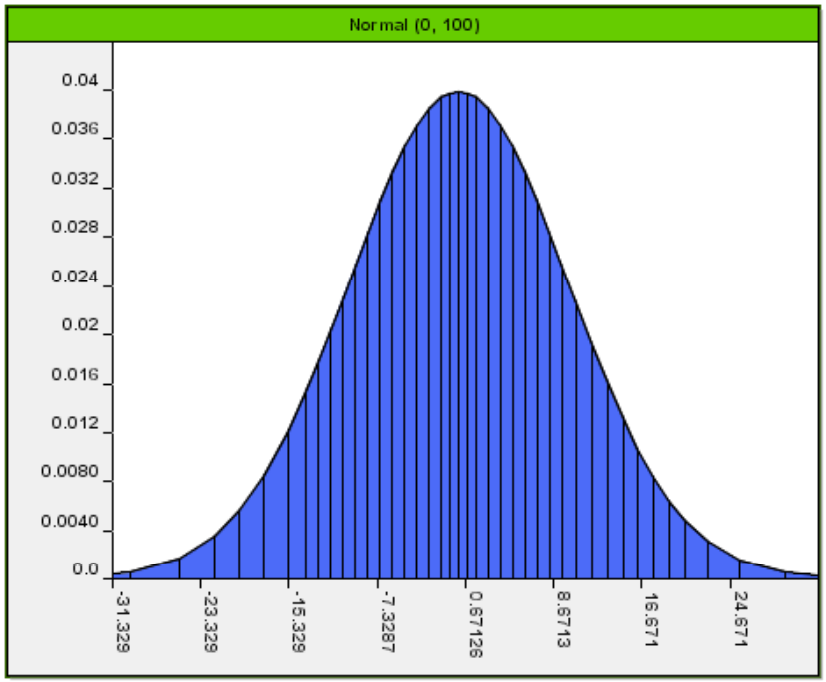
Backwards Reasoning

- Estimate causes from effects!
- Useful way to model uncertain indicators



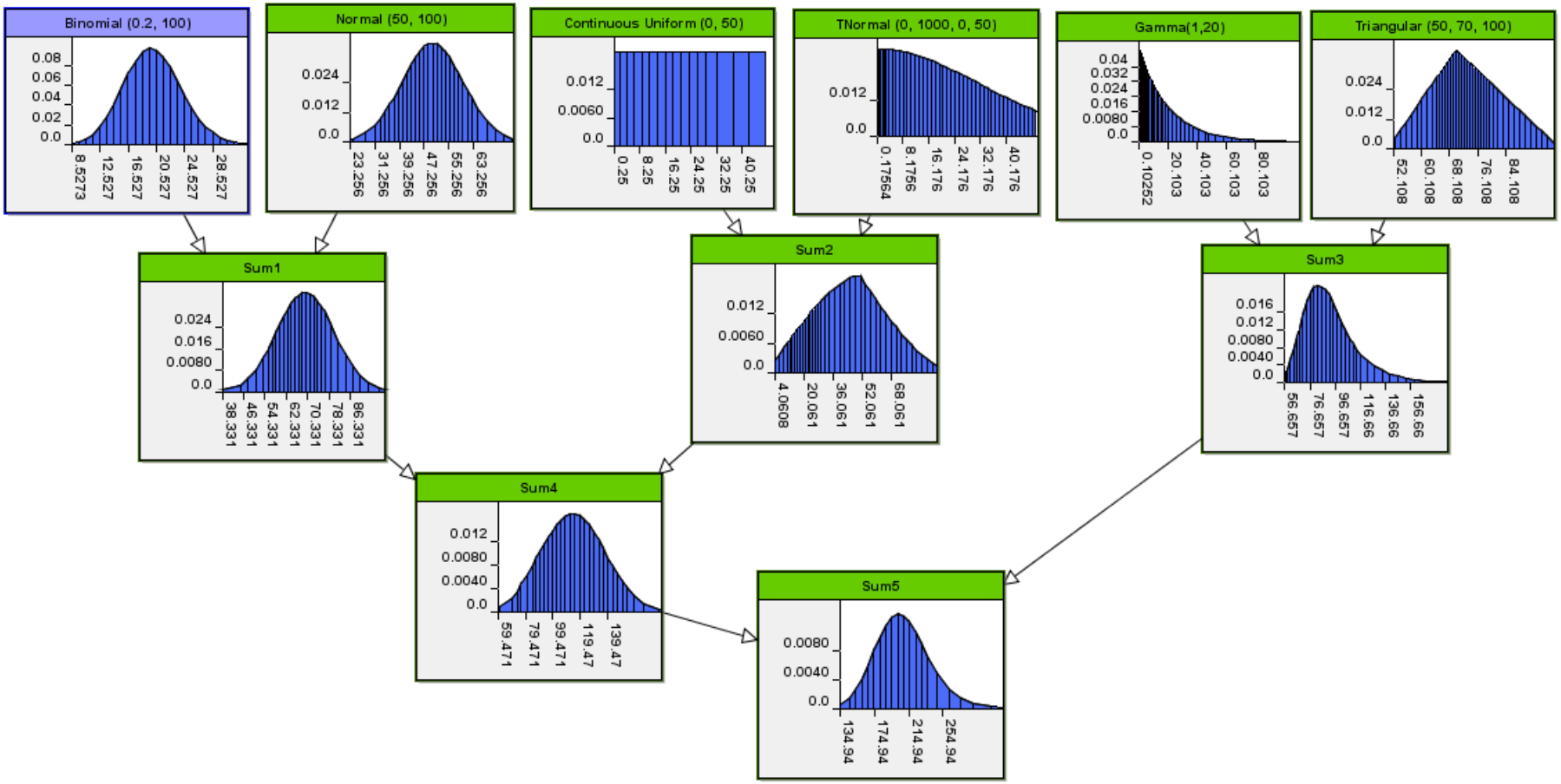
Continuous Probabilities by Simulation

Model Statistical Distributions E.g. Normal



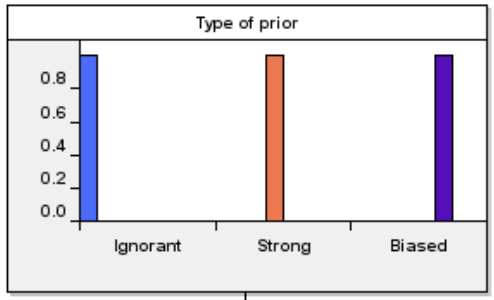
$$p(X) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/(2\sigma^2)}$$

Simulation Model Example



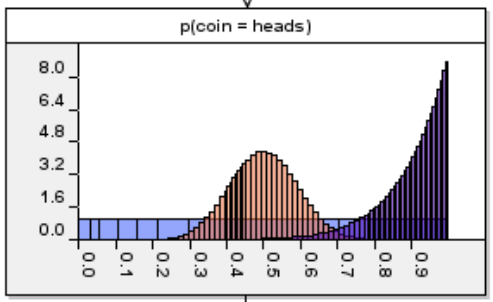
Beta-Binomial Example

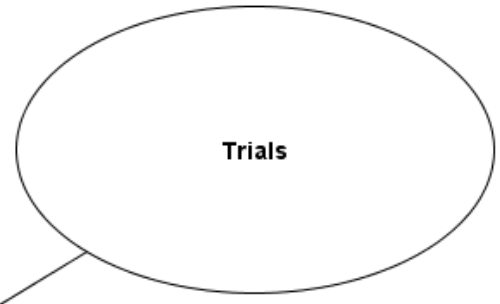
Beta prior = belief in fairness of coin

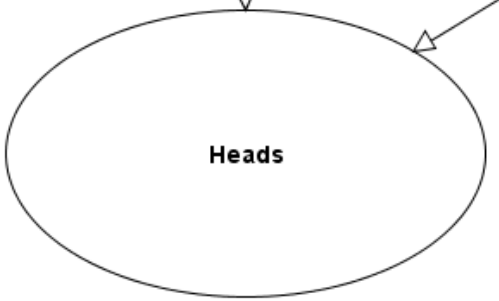


Number of trials = (10, 100)

Probability of head

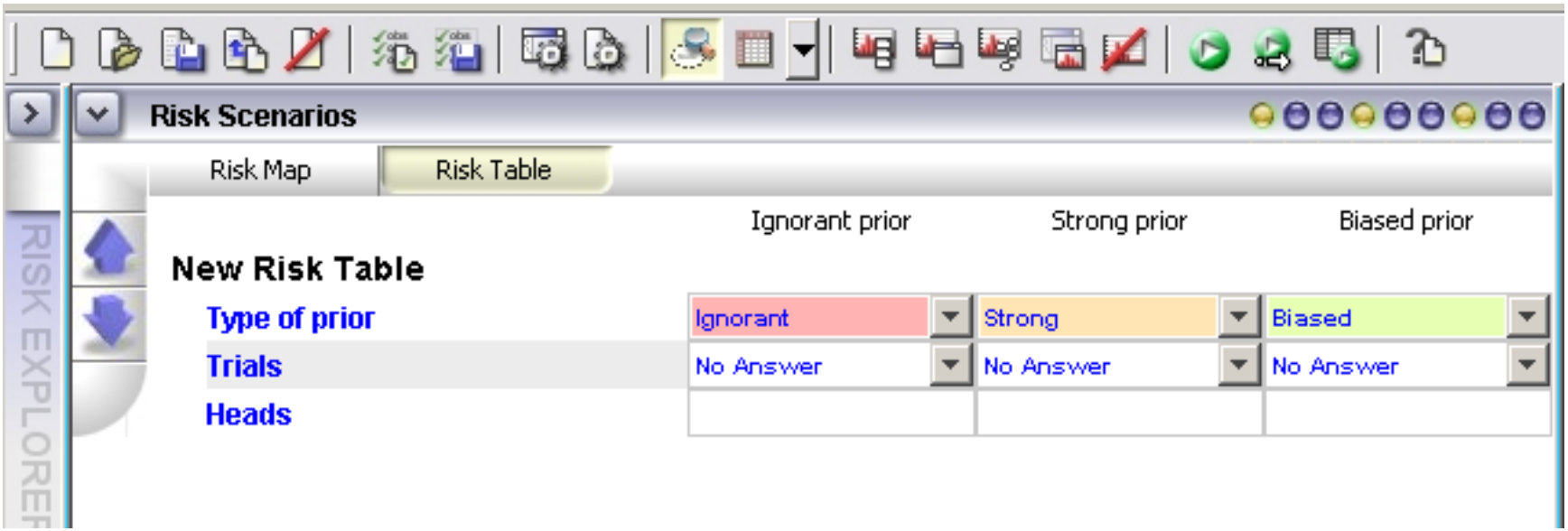




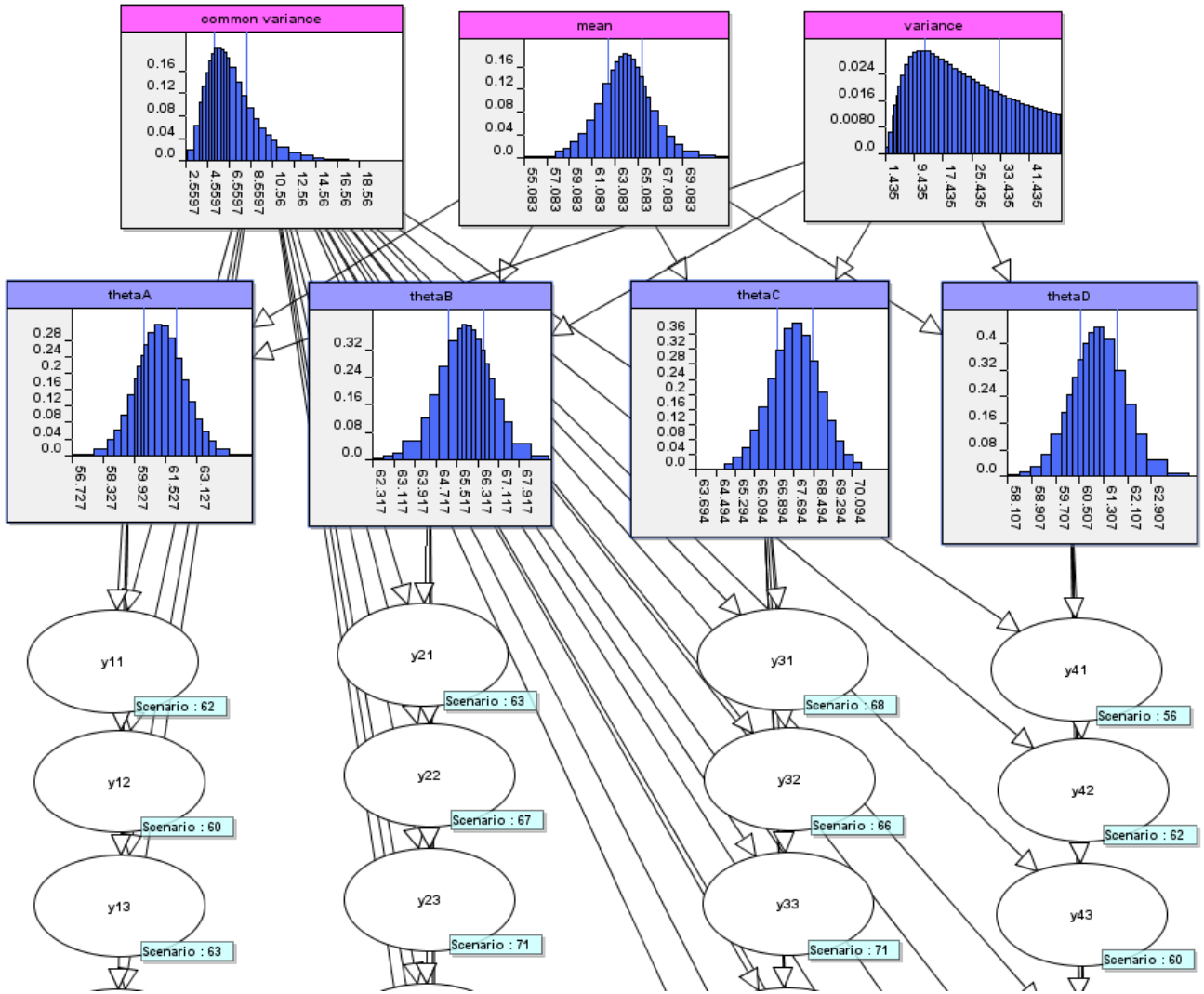


Number of heads observed

Sensitivity analysis and fast comparison using scenarios

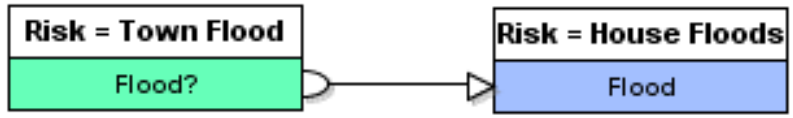


Statistical Learning Example

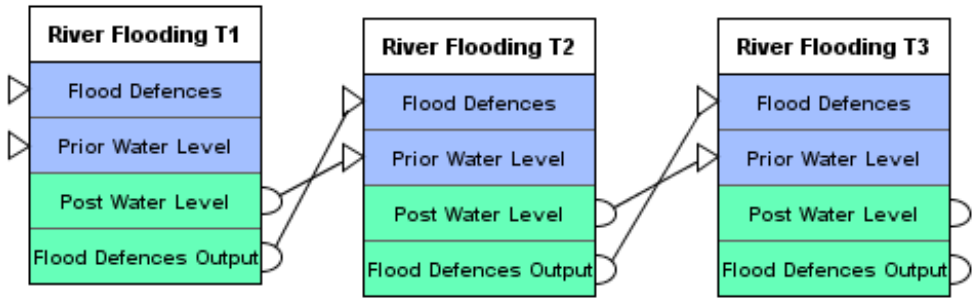


Connecting Risk Maps using Building Blocks

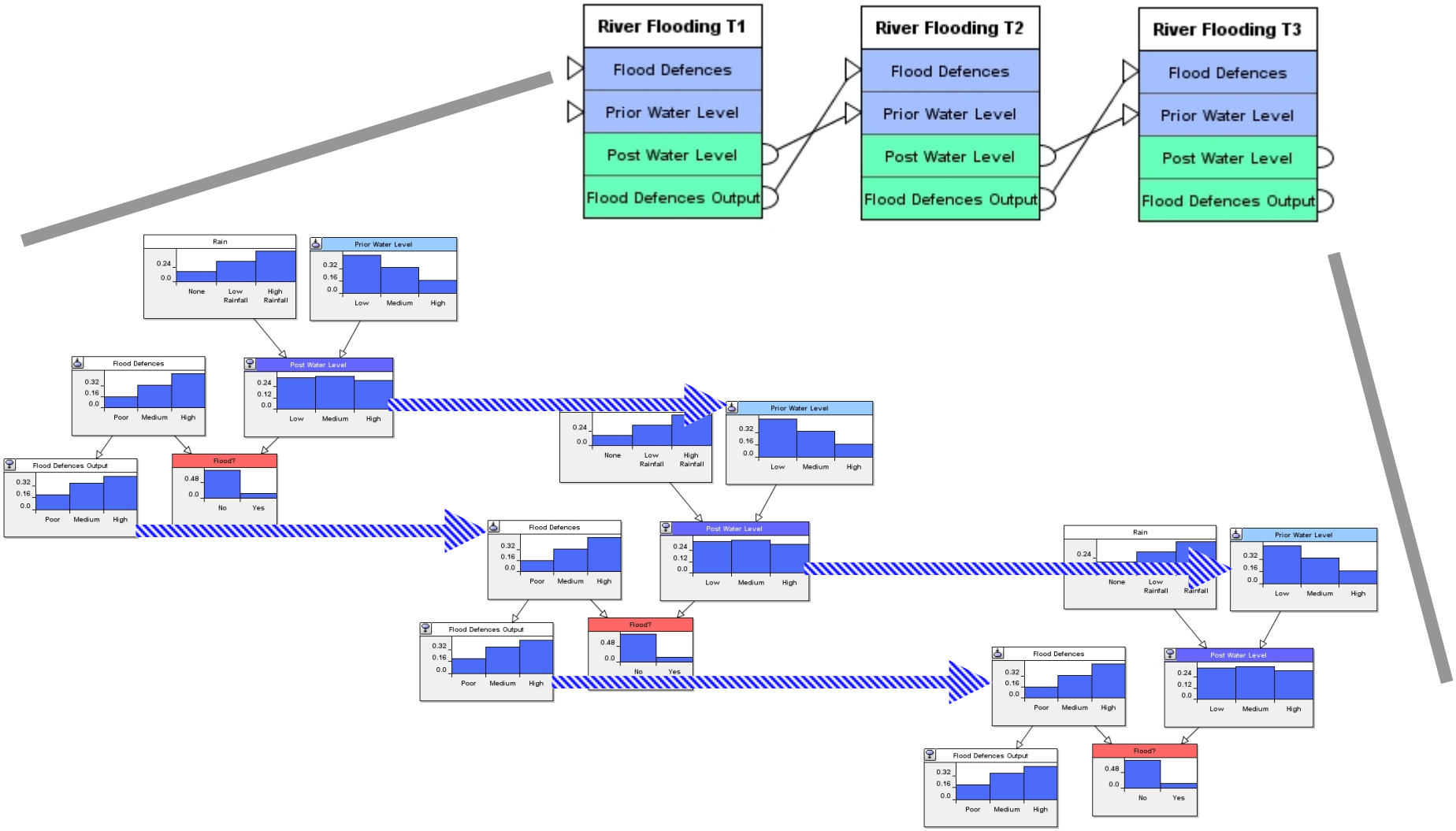
- Connect risk maps via input/output risk nodes



- Create complex time based or complex structural models

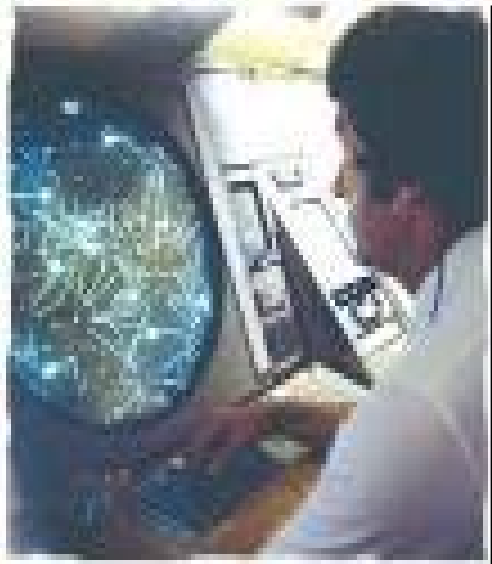


Dynamic Flood Example

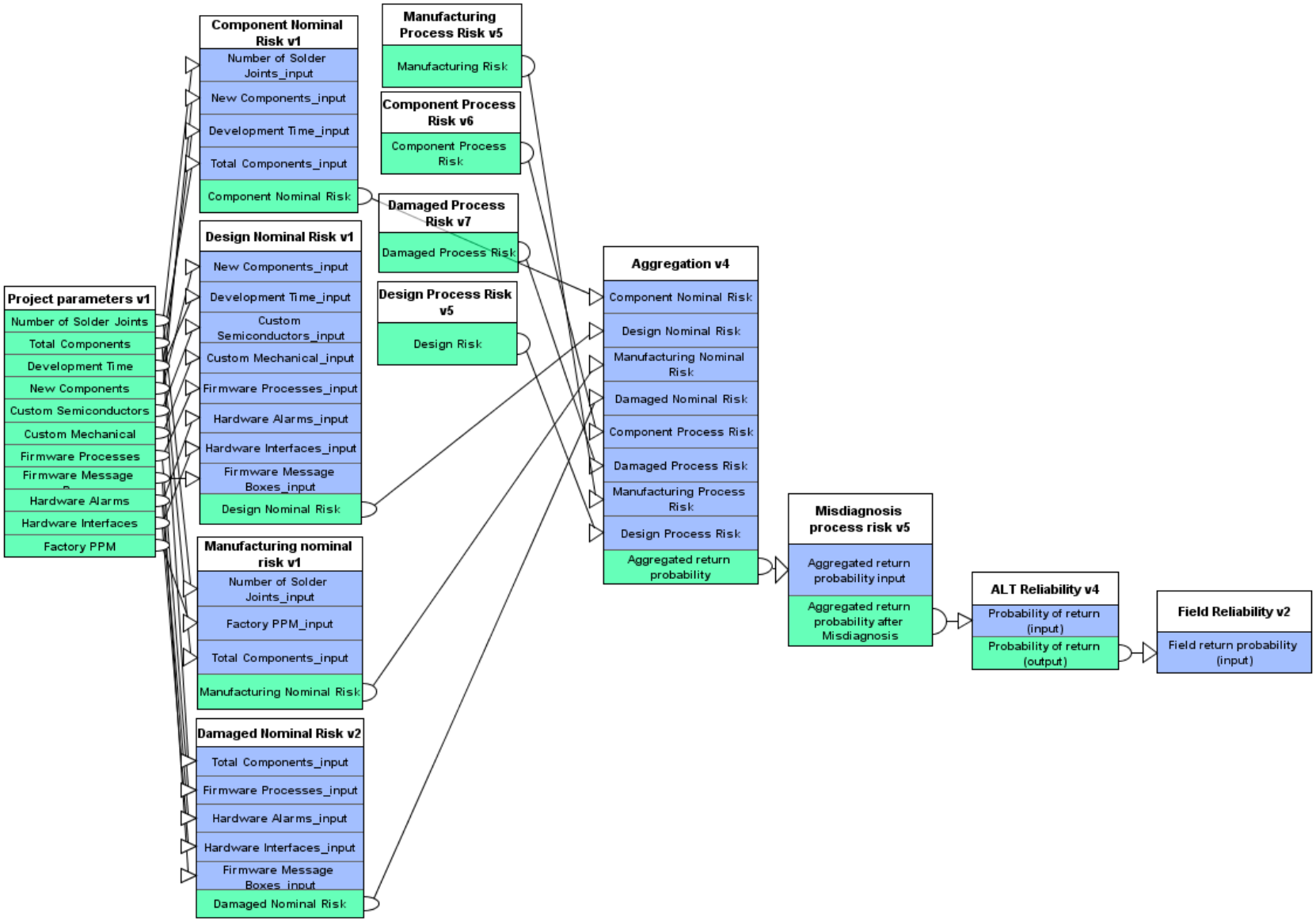


“Risky” Applications

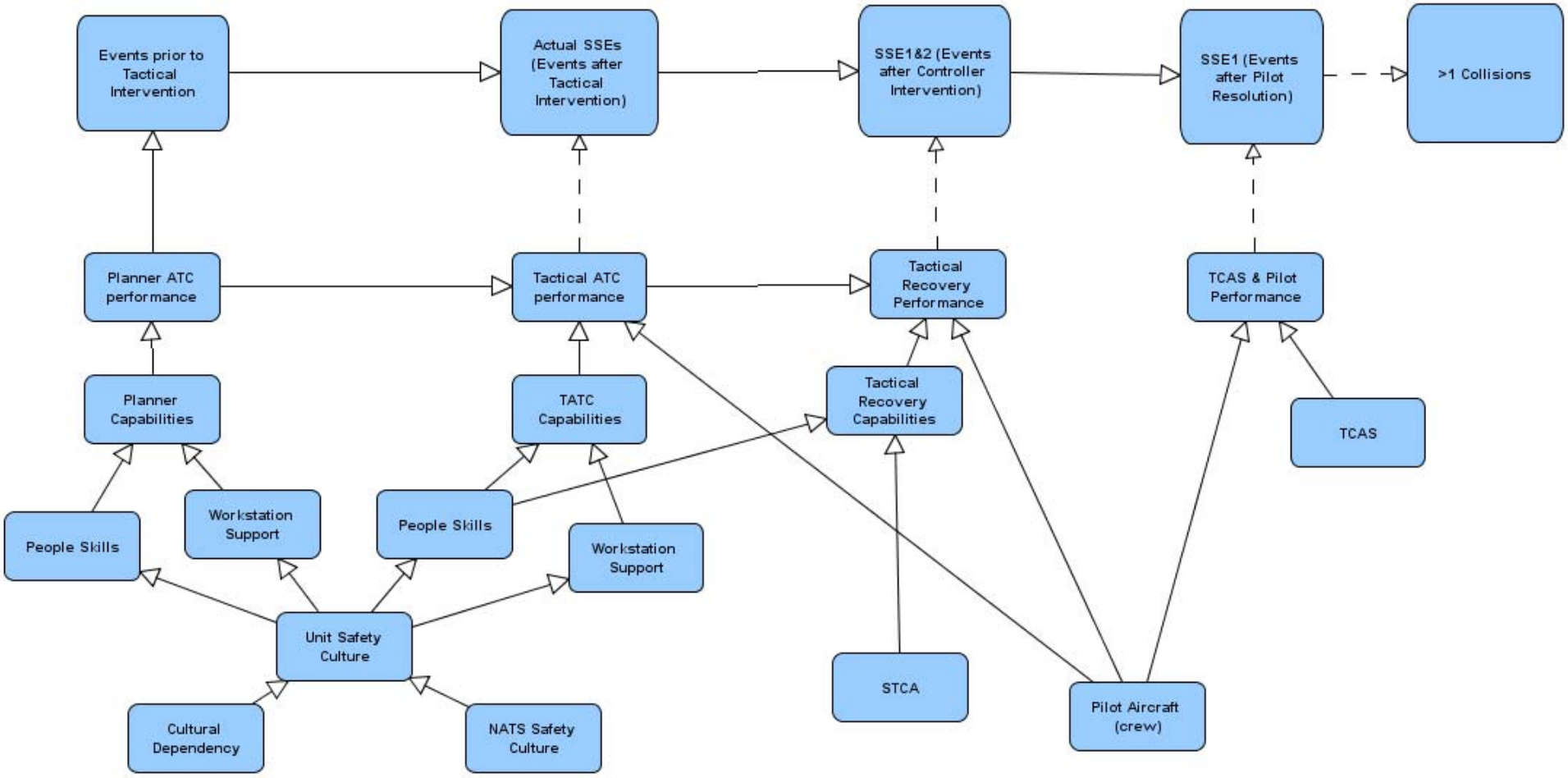
- Aircraft Mid-air collision
- Software defects
- Systems reliability
- Warranty return rates of electronic parts
- Operational risk in financial institutions
- Predict hazards in petrochemical industry
- Project portfolio risk profiling



Six Sigma Quality Control



Mid Air Collision Prediction



Final Remarks

- Structured Method
  - Based on 300 year old proven Bayes' theorem
  - Enabled by modern computer power & technology
  - Beyond current statistical & Monte Carlo techniques
  - Combines subjective judgements with data
- Risk Maps enable Visual Communication
  - Managing risk through pictures
  - Useable by risk novices as well as experts
  - Makes complex risk problems easily communicable
- AgenaRisk is Industrial Strength
  - Enables scalable, reusable & auditable risk models
  - Integrates easily with DBMS & Excel
  - Enables professional developers to build end-user applications

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