



Insurance & Actuarial  
Advisory Services

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 **ERNST & YOUNG**

*Quality In Everything We Do*

ERM Tools & Techniques

2007 ERM Symposium ERM Essentials Workshop

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# What are we trying to measure?

- Risk

- Across the enterprise, products and businesses

- Across all risk types

- Caveats

- Recognition that legal entity risk measurement is important

## What risks?

- o Interest rate
- o Equity
- o Credit
- o Catastrophe
- o Mortality
- o Morbidity
- o Underwriting
- o Operational
- o .....

## What do we need to capture?

- (Reasonably) accurate assessment of the enterprise's risk exposure (distribution)
  - Inherent risk
  - Correlation across risks and businesses
    - Tail
    - Main distribution

## In an ideal world we'd have.....

- A simulation model that reflects:
  - Our business including its unique characteristics
  - All of the inherent risks as manifested in asset and product liability outcomes
  - The capital markets
  - All of our business related risks (i.e. operational risks)
  - Outcomes across a universe of possible scenarios
  - The inherent correlation of risks in good times and in bad

## Aggregation/Diversification

- Getting it right is an important consideration in addressing the tools and techniques agenda
- The mega-model although ideal is impractical
  - Too complex
  - Technology and hardware limitations
  - Impractical control environment
  - Etc.

## In the absence of the “mega-model” how do we get there?

- This is the MOST IMPORTANT question that needs to be answered !!!!!!!
- Implications of not thinking it through.....
  - Having to re-engineer the entire process
  - Credibility of results – internally & externally
  - Complex and inefficient processes
  - Complex and ineffective control environment
  - Difficult model validation process

## In the absence of the “mega-model” how do we get there?

- Design the end-state goals before building the tools and techniques to support the risk measurement process
  - What are the various uses and what are the requirements of each?
    - Risk measurement & management
    - Economic capital
    - Capital management
    - Valuation
    - Strategic decision making
    - Performance measurement

## In the absence of the “mega-model” how do we get there?

- Recognize that there should be a balance between model framework complexity and:
  - Assumption uncertainty
  - Risk measurement methodology uncertainty
  - Correlation

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## Addressing aggregation/diversification

- Three common approaches:
  - Common scenarios
  - Correlation matrices
  - Copulas

# Diversification through common scenarios

(why correlation & copulas have limited appeal)

## ■ Primary Attributes

- Permits scenario specific correlation across products and risks
- Inherently adjusts for shifts in risk relationship
- Permits adjustment for cash flow effects
- Allows for calibration of correlations to different parts of the distribution

## What techniques?

- Integrated scenarios & product models
  - Interest rate, equity, credit, mortality/morbidity
  - Additive scenarios across products
  - Scenario generation process can adjust risk correlation dynamics
  - Cash flow effects captured
  - Ops risk integration?

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## What techniques?

- Other approaches
  - Representative model points
  - Replicating portfolios both assets & liabilities
  - Approximation techniques
  - Scenario selection

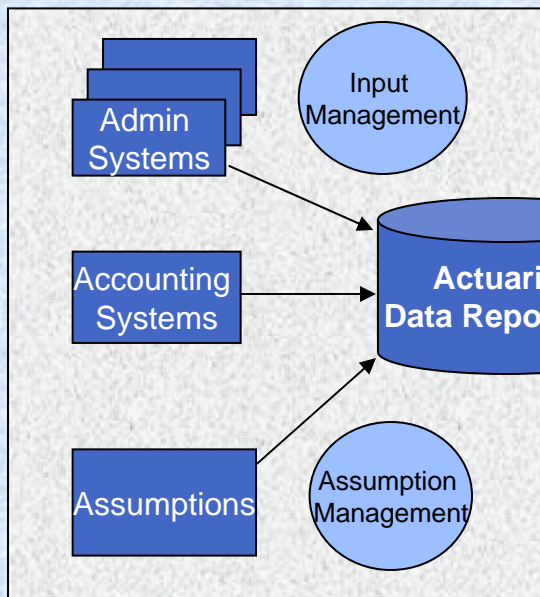
## Building the infrastructure

- In designing the tools and techniques we should recognize that:
  - Complex models are difficult to build, maintain and validate
  - Therefore design the process so that it:
    - Anticipates the techniques that are going to be used
    - Allows for efficiency in building and maintaining the models
    - Supports a robust control environment
    - Meets timing requirements
    - Leverages technology

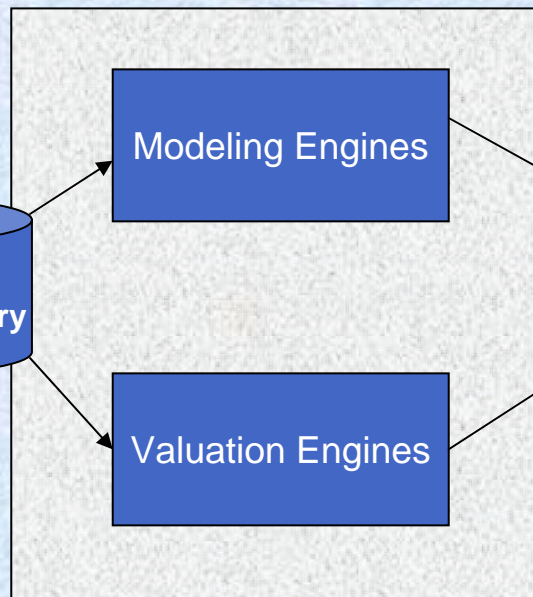
# Actuarial Transformation™

## Technology Supported Actuarial Environment

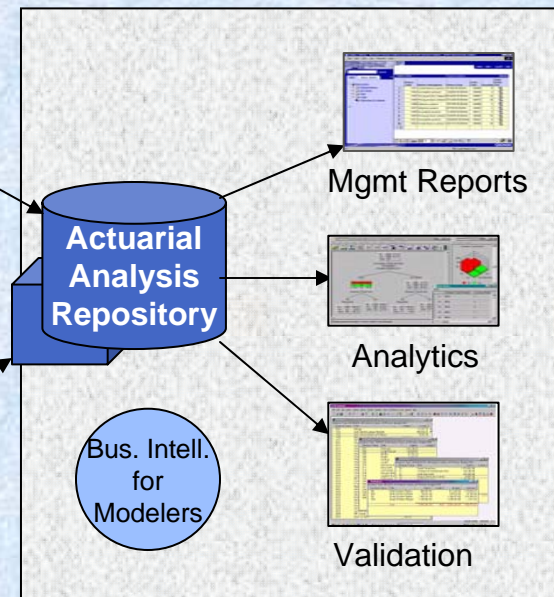
### Data Integration and Improvement



### High Performance Computing



### Advanced Decision Support



Automated and Controlled Environment

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## Tools & Techniques

- Implementing the right framework requires:
  - Understanding
  - Ingenuity
  - Revolution
  - Credibility

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Questions?