intrinSIM

The Changing Role of Simulation

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The Changing Role of Simulation

- The use of Simulation has seen continual double digit % growth annually for about 30 years until 2008
- This cumulative growth now means that Simulation is a significant portion of the Engineering Software Market and a driver for future growth
- This has resulted in increased focus and investment in simulation by major PLM software vendors

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The Changing Role of Simulation

- This growth is coupled with increasing awareness of business benefits
  - Innovation is a major key to Competitiveness
    - Simulation is a key to innovation
  - Risk management is a major key to Competitiveness
    - Simulation is a key to understanding and managing risk
  - Reducing cost is a major key to Competitiveness
    - Simulation is a key to reducing material & prototyping cost
- **Simulation is** the key enabler to **Increased Competitiveness**

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The Changing Role of Simulation

- The changing role of simulation is more about it's role in business than the changes in technology
  - Changes in technology enable and are necessary to support the business related changes
- Let's explore the Simulation as it relates to perceived Business Value and breadth of applicability

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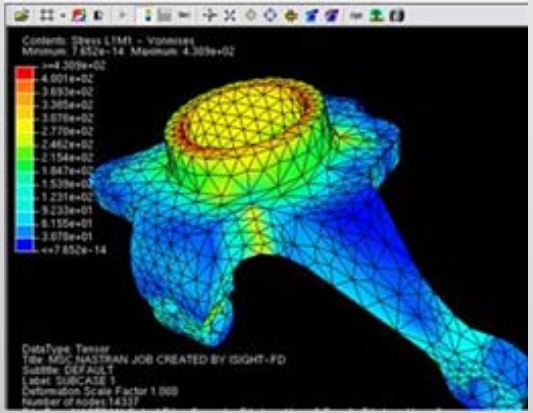
Failure Analysis



Business Value

Failure Analysis

Breadth of Applicability

- This is where it begins
  - Understanding "why it failed"
- Run by a few "experts"
- Dominated by test vs analysis comparisons

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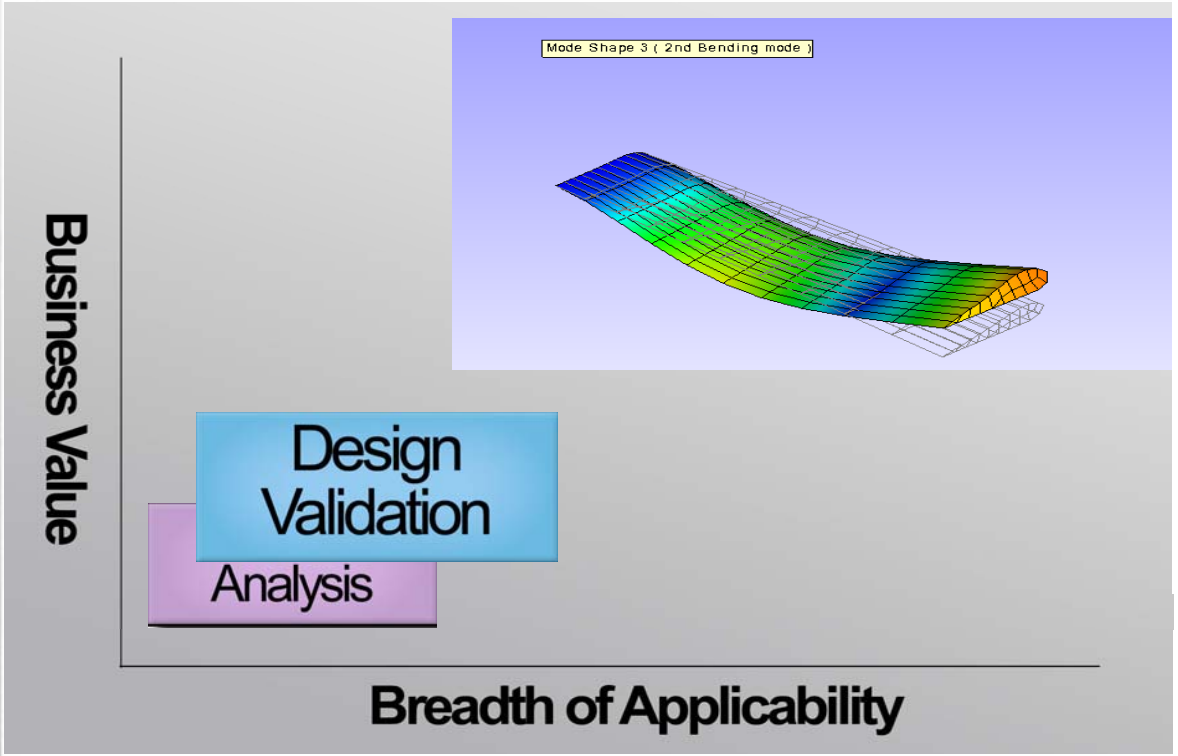
Design Validation



- Checking before it fails
- The dawn of Virtual Prototyping
- Broader use of simulation

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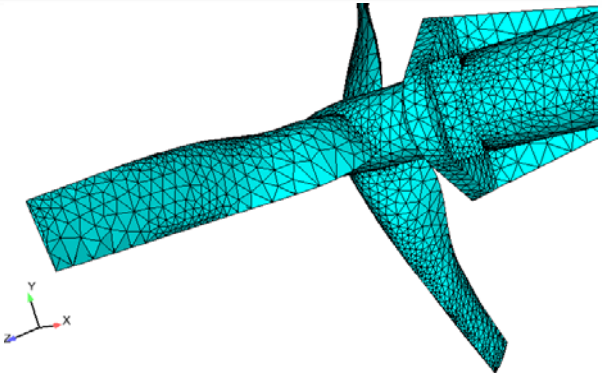
Design Validation

- Drove significant improvements in automation/integration and expanded analysis capabilities
- Simulations became interesting to design
  - but still run by analysts
- Exposed the CAD/CAE interoperability dilemma



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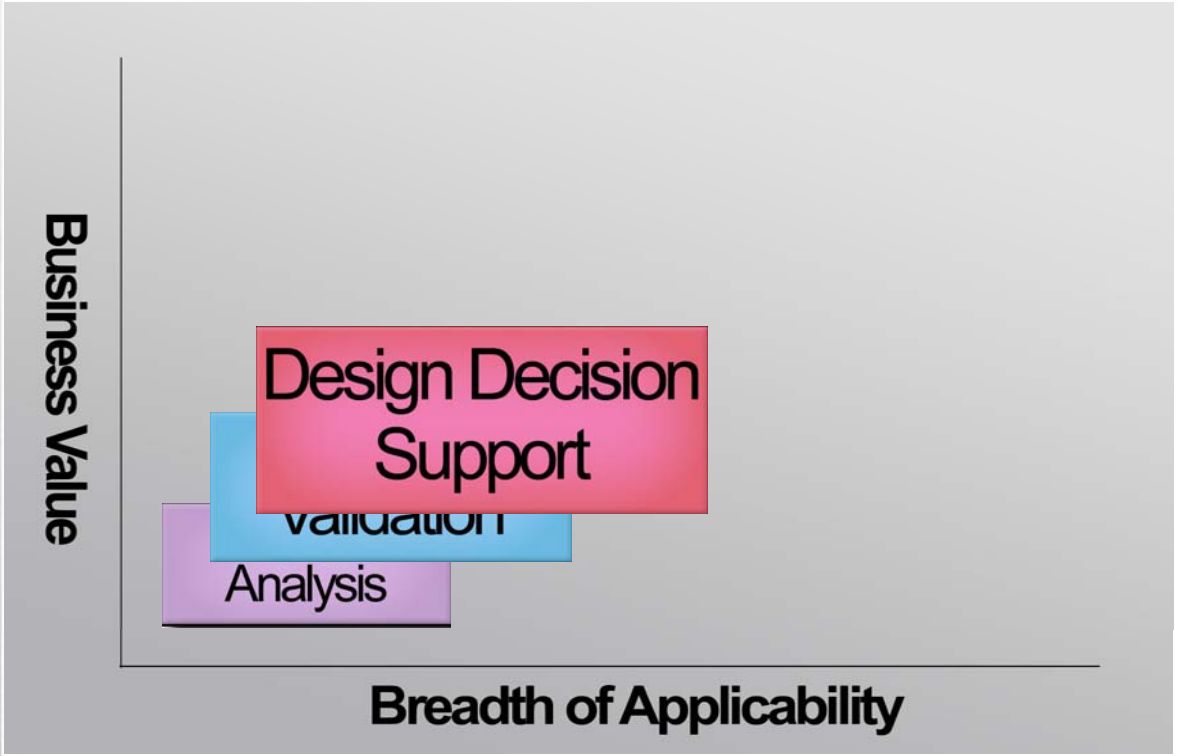
Design Decision Support



- Why not use simulation to make better design decisions
- Why not ask designers to run simulations

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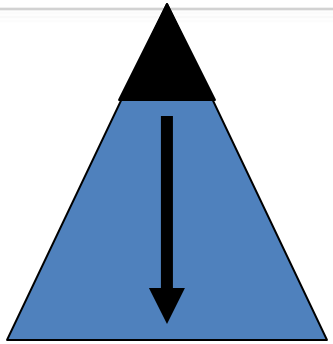
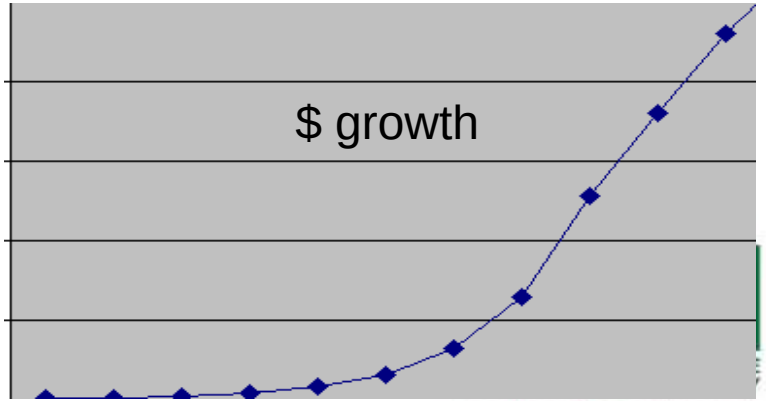
Design Decision Support

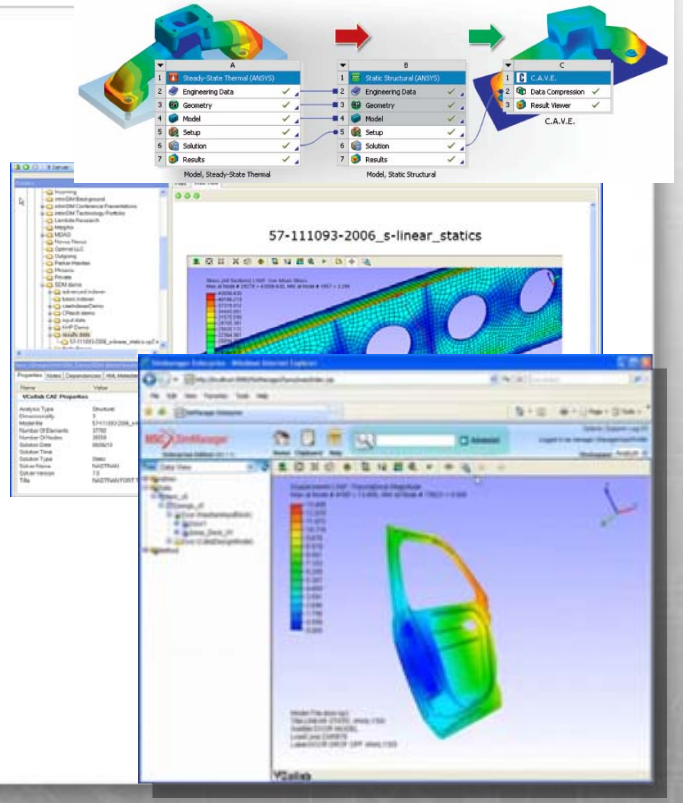
- Simulation Software vendors saw visions of "the promised land" for broader distribution to the bottom of the pyramid
  - However, multiple attempts at trying to spread simulation to simulation non-experts consistently failed



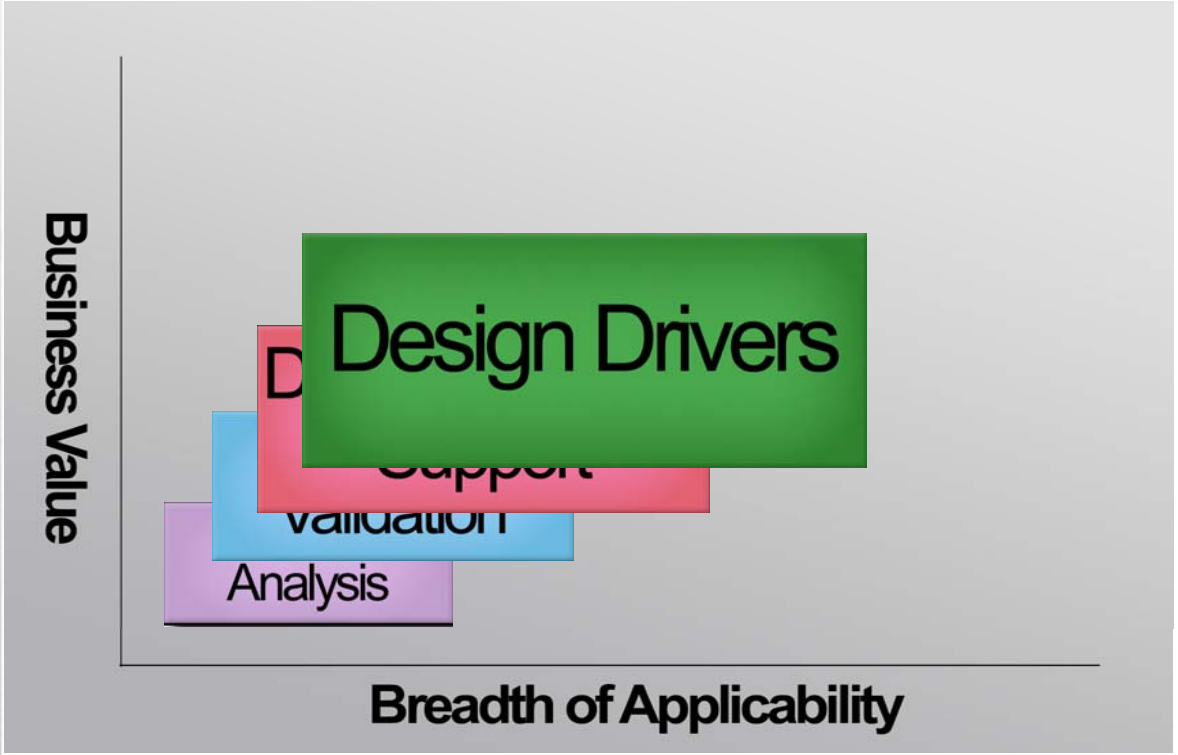


Design Decision Support

- Emergence of design related tools for Analysts
  - CAD integrated analysis
  - Design Space Exploration
  - Workflow approaches with multi-physics
  - Stochastics
  - Robust Engineering
- More analysts running more simulations on more designs more often
- Much more data ➔ Simulation Data Management to track data and basis of design decisions
  - SDM is considered “interesting but not compelling” by most



Design Drivers



- Simulation Driven Design
- Simulation making design decisions

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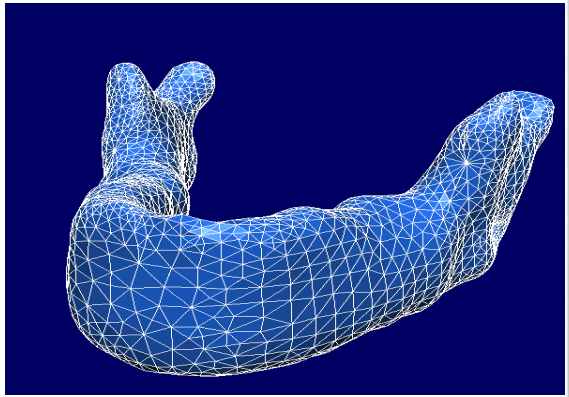
Design Drivers

- **"We are only at the verge of the era where simulation generates, rather than evaluates, geometry."**
  - Keith Meintjes, CIMdata



- Emergence of design drivers for Analysts
  - Expanded use of Design Space Exploration
  - Topology Based Shape optimization
  - Analysis at concept stage
- Simulation Data Management becomes much more interesting

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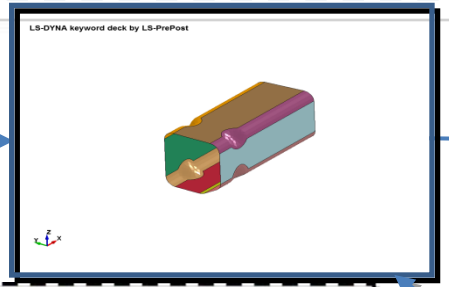
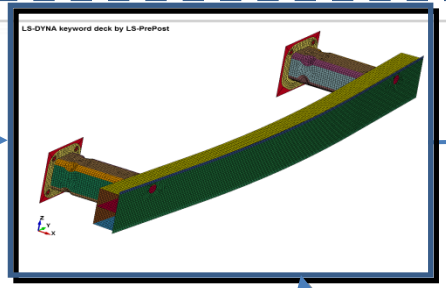
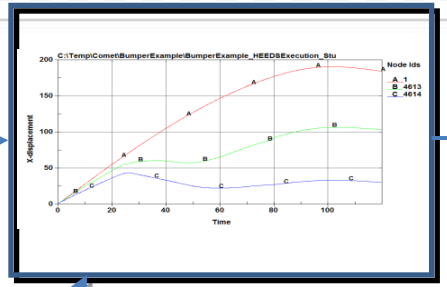
Design Drivers – Optimization (minimize mass)

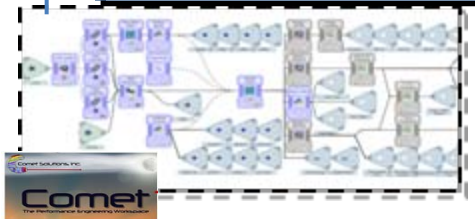




Optimized Design



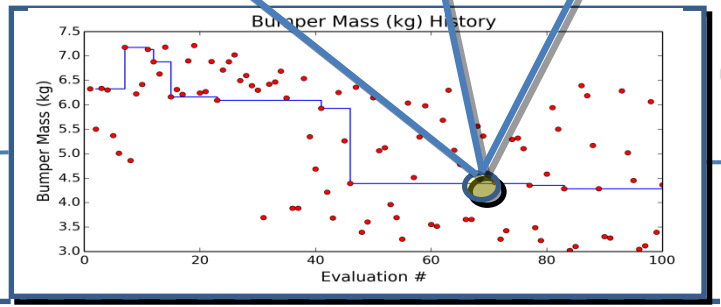
Response



Comet

Change design variables

SHERPA



HEEDS

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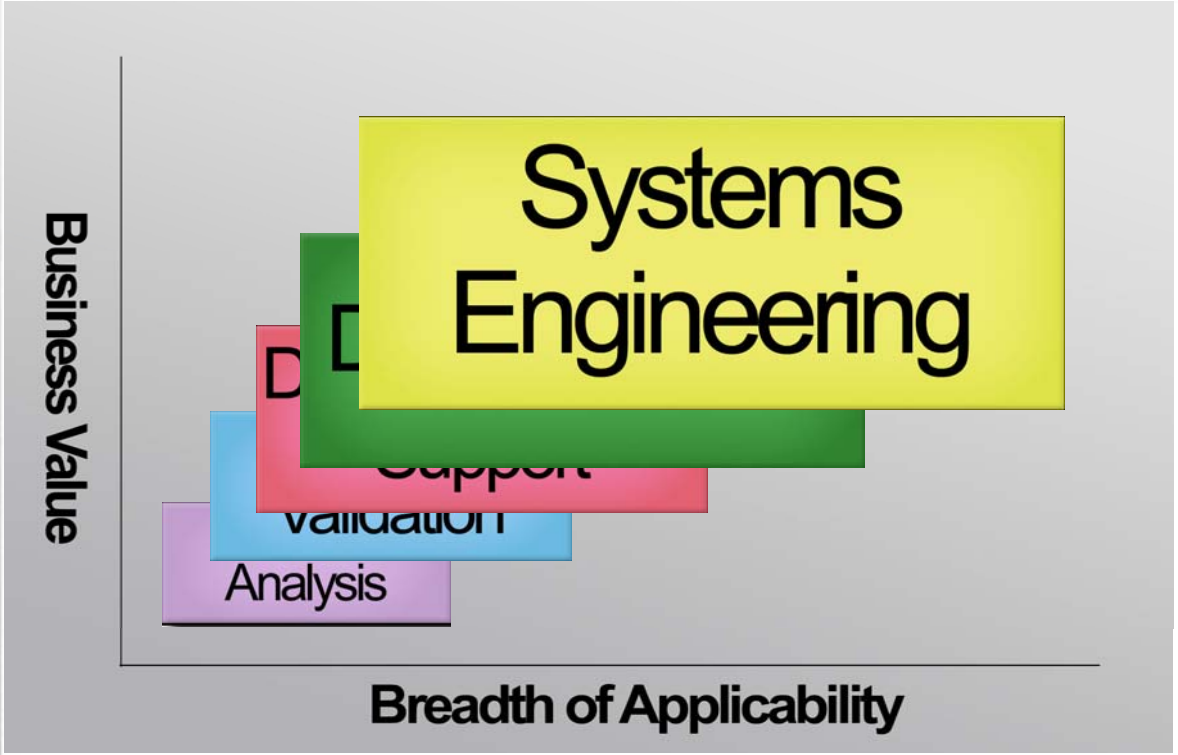
Systems Engineering



- Driven by growth of embedded software
- Heavily used in EDA world
- Design drivers extended to systems

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Systems Engineering

- Exciting and promising – but path forward is unclear
  - 1D simulations are effective
  - How do we incorporate high fidelity 3D models
    - Response surfaces
    - Abstract modeling for analysis
    - Very active area of investigation
- Limited to a small number of “thought leaders” who can apply this to current simulation practices and experience
- Simulation Data management becomes necessary

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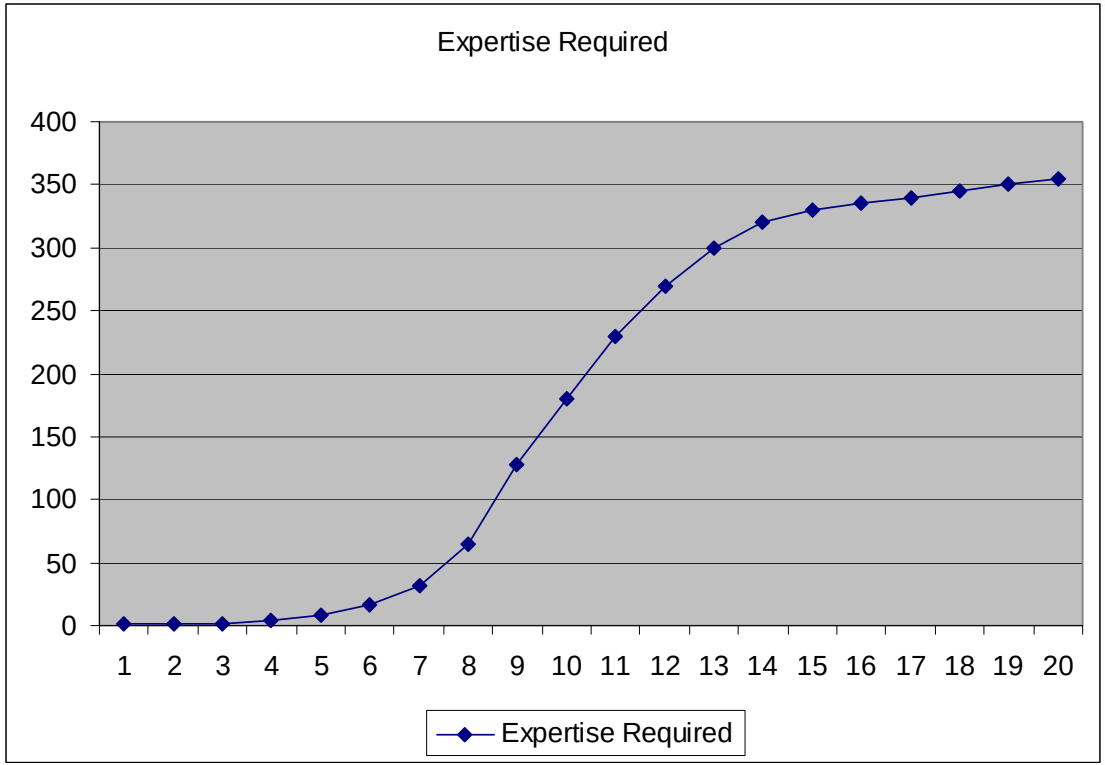
Business value drives broader demand



- Demand could be increasing on a classic S curve
- Is simulation at an inflection point to break through ?

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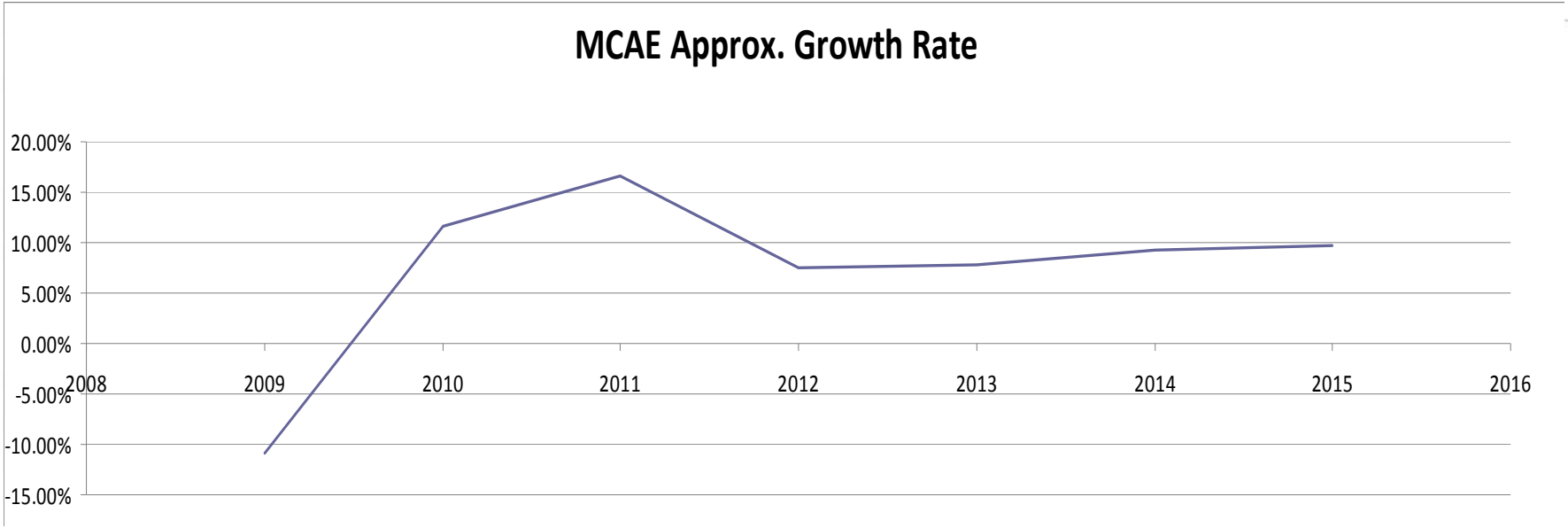

- intrinSIM looked at actual & projected MCAE Market growth since 2009 (Courtesy of Cambashi data observatories)

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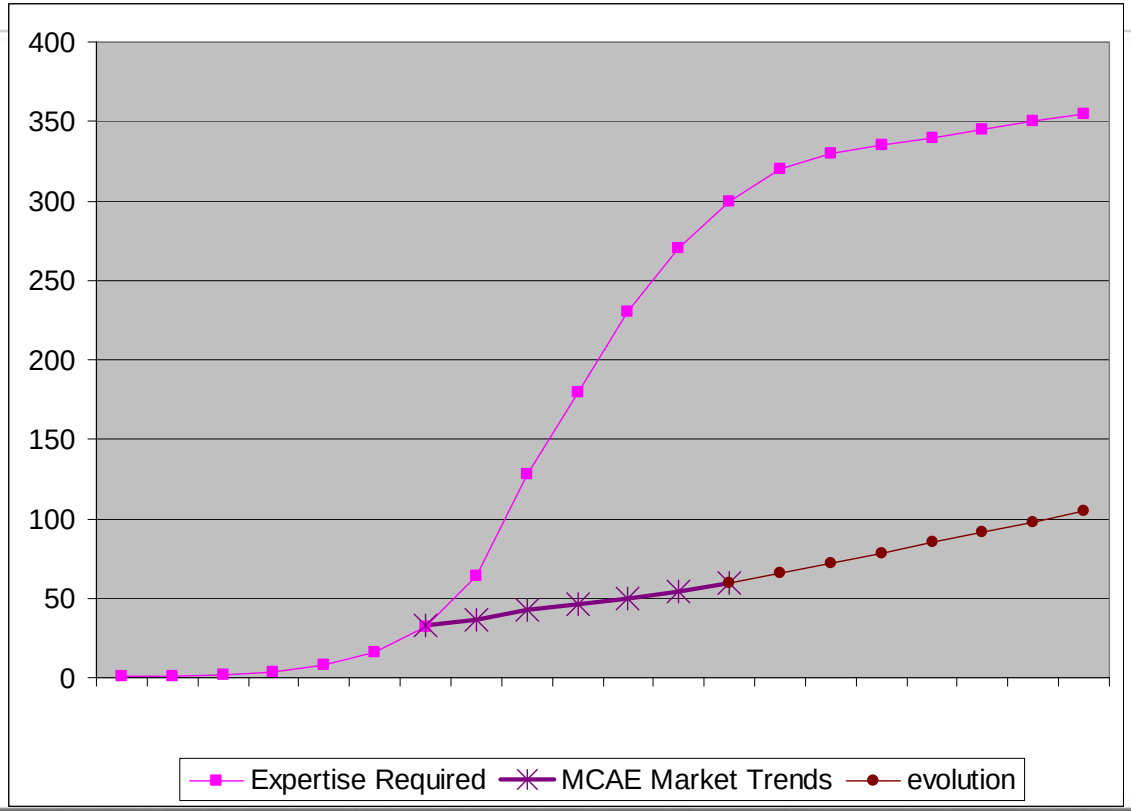
Business value drives broader demand?



- Inserted MCAE growth and evolution based outlook
- This does not look like an inflection point
- What happened?

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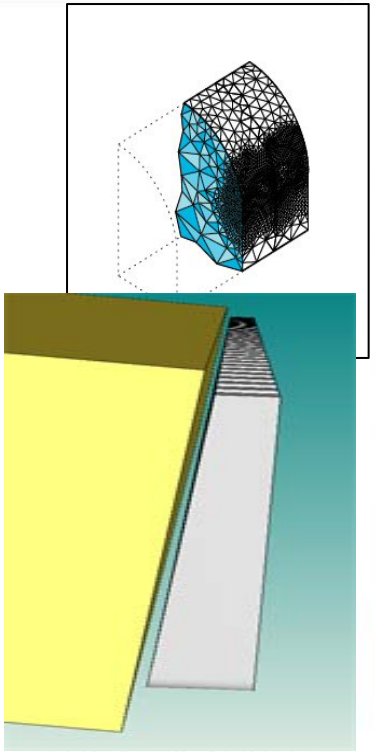
Enabling the evolution

- Focus on improved automation
- Focus on improved integration
- Focus on Simulation throughout the entire product lifecycle as a key performance indicator



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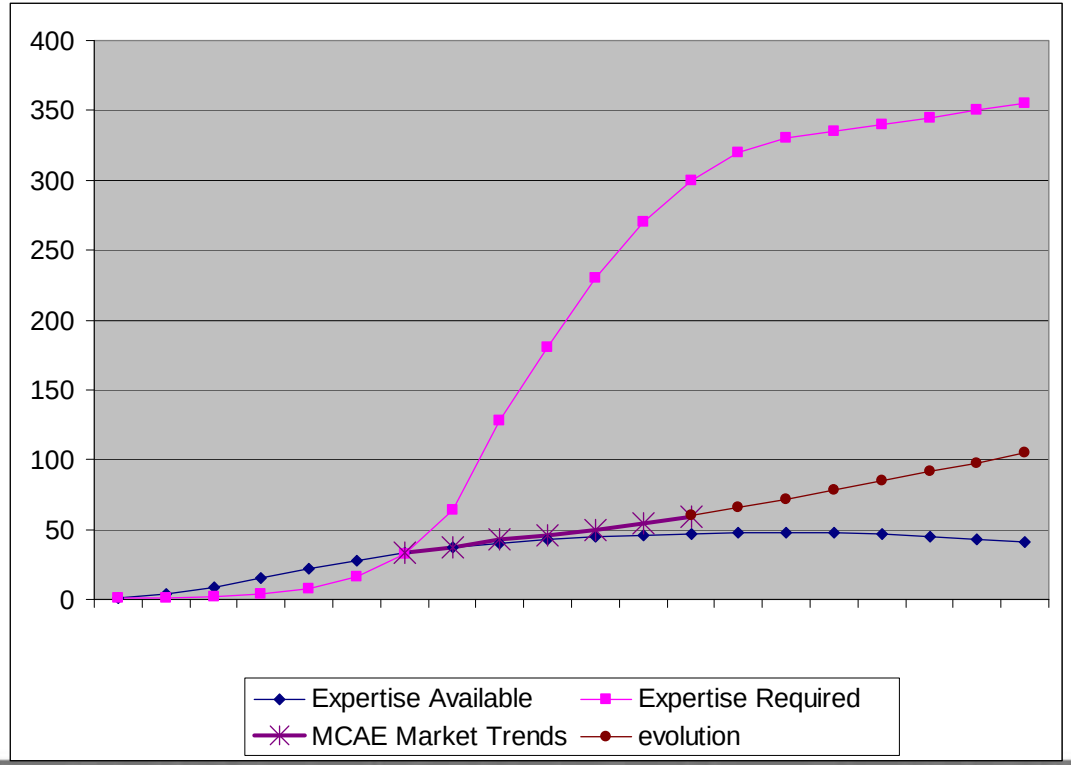

- Simulation is still done primarily by specialized Analysts
- Growth of MCAE market is tempered due to lack of expertise available

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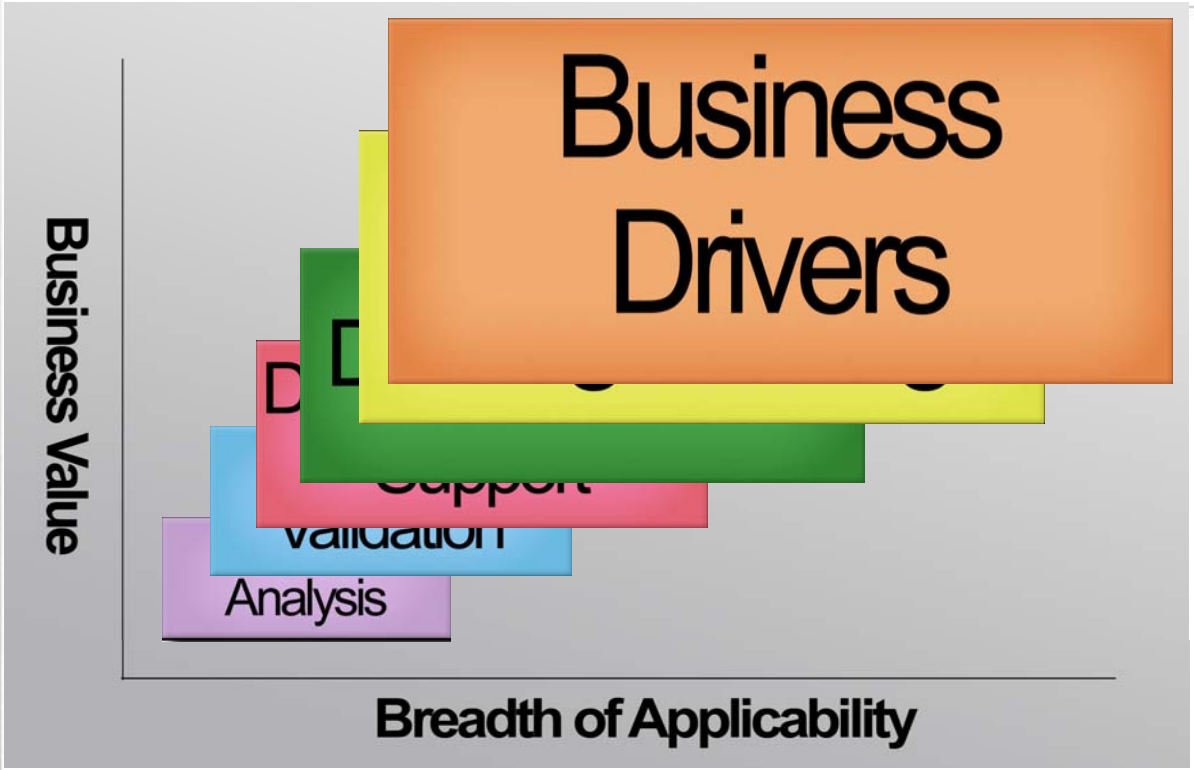
Business Drivers



- Business Drivers are going to force a "**revolution**" to overcome the expertise based limitation
- Simulation will be forced to find a way

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Business Drivers

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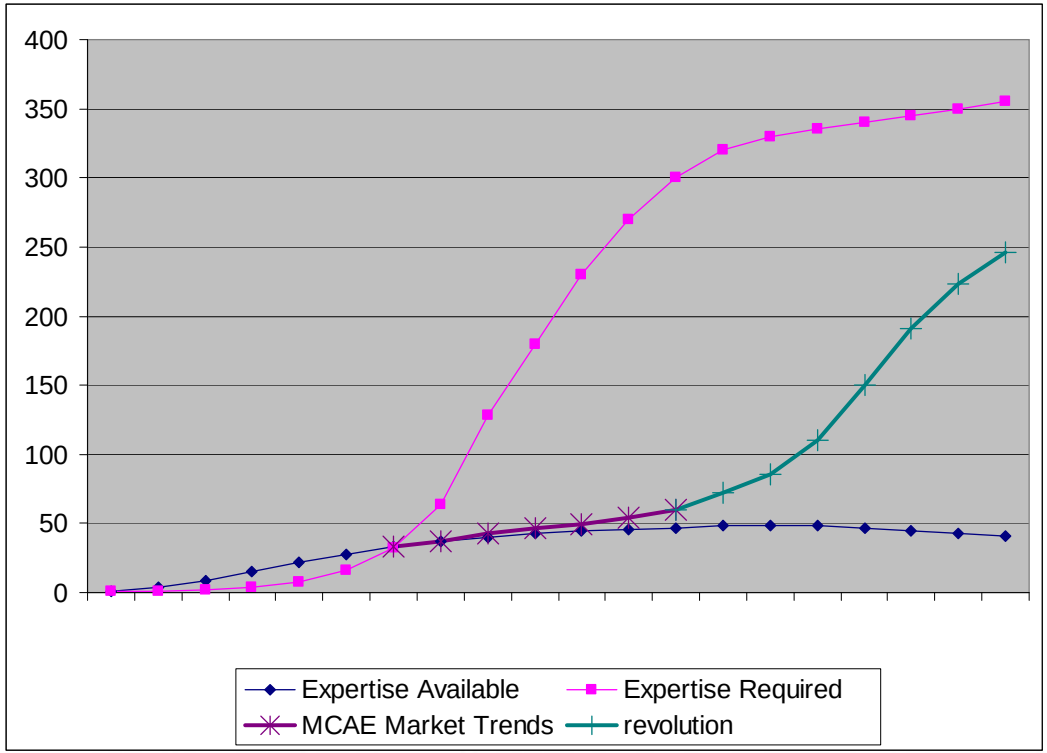
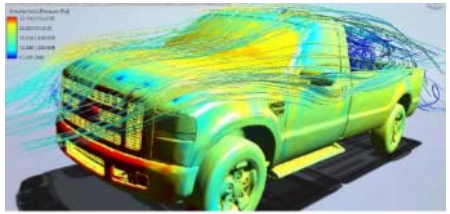
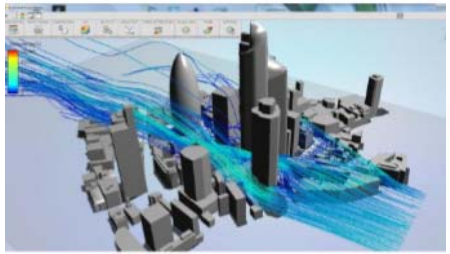


- The demand is not going away
- A Simulation revolution will occur:
  - "Fit for purpose"
  - "Smart"
  - "Integrated"
  - "Transparent"

Enabling the revolution

- Increased emphasis on purpose built applications
- Increased emphasis on Systems Engineering
- Emergence of simulation knowledge capture & reuse
- Emergence of near real time / near physics approaches





Enabling the revolution

- Unlimited access for the appropriate “performance” evaluation needed
  - “Cloud” based simulation is the enabler but not the goal

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THANK YOU!

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