

SimApps: Simulation for Everyone

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- Problems the status quo
- SimApps: What are they? Who can use them safely? What are their limitations?
- SimApps in Use: What is the ROI?
- Key ingredients of useful SimApps
- Use Case: SimApps on The Cloud
- Concluding remarks:
 Simulation <u>Is</u> Being Democratized



spdm Comet Solutions: Our Mission

To significantly increase the impact of our customers' CAE investments by providing software which simplifies the complex process of engineering product systems and expands the impact of CAE on product development.

Make CAE activities more efficient

- "Lights-Out" Automation that works across a family of products
- Elimination of rework & repetition engineers can focus on engineering when model preparation goes from hours/days/weeks to minutes

Make CAE more impactful to business

- Useful to more people <u>including those with little knowledge of the CAE tools</u>
- Results in time to support decisions rapid response to design changes

Simplify the complex process of engineering "systems"

- Integrated multidisciplinary environment treat the product as a whole system
- Build system dependencies into the multidisciplinary models
- Create transparency across disciplines facilitate concurrent engineering and "systems thinking" across the globally-distributed team



spdm The Problems

1. Simulation in the hands of too few for too long

- Simulation can be safely used only by experts
- Yet, all engineers & designers in the PD process could use simulation to answer questions and optimize designs during all design phases
- This is a huge, mostly untapped market
 750,000 experts → >20 million potential users!
- 2. Simulation is highly inefficient, especially when experts from multiple groups are involved
 - 5 days to "clean up" geometry and create a single "perfect" mesh??
 - 4-6 weeks to complete a single analysis??

How can we get complex simulation *safely and effectively* to all PD engineers & designers?



spdm Attempts to Solve These Problems

- Use "Excel", early and often (750M active users!!)
- Use CAD-embedded simulation tools
 - Limited simulation capabilities
 - Haven't garnered widespread usage except in simple cases
 - Experts continue to use different tools
- Make simulation environments easier to use
 - Ongoing process, with huge progress over the last 20 years
 - However, these tools are still limited only to experts
- Use Vertical (solution-specific) Applications

- Scripted, expensive to create/maintain, limited & brittle



spdm SimApps: Engineering Calculators

Simple, targeted, web-deployed Simulation Apps.



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- **Targeted/Solution-Specific** Answer specific questions about the design of a particular product at particular levels of fidelity
- **Dirt Simple & Available Anywhere/Anytime Think Apps!** Easy to use, speak the users' language, and globally web-accessible
- Useful Across a Wide Range of Product Designs Work across significant design changes and also across a product family whose members share a common functional architecture

Safe To Use – Expert-Certified! Have the expertise of the experts embedded in them – company best practices are captured and enforced

- Harness the Full Power of the Expert Tools Expert-Blessed! Use the same, underlying, validated expert CAE tools
 - And Fast All the Compute Power You Need Provide access to the required compute hardware on the Cloud



spdm Examples of SimApps



Plastic Bottle Design



Heavy Equipment Design



Vehicle Suspension Design



Space-Borne Optical Systems with Thermal Controls

E-Seals Calculator

Aircraft Metallic Seal Design

Automotive subsystems Off-Road vehicles Plastics & containers Consumer appliances Aerospace subsystems Optical Imaging systems Laser systems Electronics PCBs



Automotive Driveline Design



Automotive Spring Design



Automotive Bumper Design



Engine Connecting Rod Design



Laser Systems Design



Electronics Board Reliability







Let's look at some real examples:

SimApps driving Templates



spdm American Axle NVH Whitepaper



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AAM Sees Dramatic Productivity Gains, Cost Savings from Automating NVH Analysis Process with New Comet NVH Driveline SimApp

By Bruce Jenkins, Principal Analyst, Ora Research LLC

American Axle & Manufacturing, Inc. (AAM) is a leading global Tier-One automotive supplier of driveline and drivetrain systems and related components for light trucks, SUVs, passenger cars, crossover vehicles and commercial vehicles. The company has a long history of successfully using FEA to master the many NVH (noise, vibration and harshness) challenges in any driveline engineering project – gear whine, gear rattle, shudder/moan/chatter, clunk, progshaft instability and others. Nevertheless, its traditional simulation methods had limitations:

- Constraints on engineering productivity and resources made it a challenge to compete on costcompetitiveness without sacrificing innovation.
- Manual processes and dependence on CAE experts resulted in lengthy cycles of two to three hours per analysis iteration.
- Errors in analysis were a risk due to manual work, impacting reliability and cost.

To attack these limitations, AAM decided to implement Comet Solutions, Inc.'s NVH Driveline SimApp – a new software application that lets users set up and utilize libraries of parameterized 3D, 2D, 1D and OD (mixed-fidelity) representations of propshafts, axles and related components to fully automate the configuration and NVH analysis of driveline systems. The result is a single environment for driveline NVH analysis that allows quick and easy evaluation of any geometry, without the manual effort of traditional approaches.



Teamcenter

Glen Steyer, American Axle's Executive Director of Product Engineering, reports major benefits from the new tool:

- Average 75% time reduction for each analysis iteration.
- Approximately \$130,000 in annual cost savings at a single engineering site.
- Improved quality through globally enforced modeling and NVH standards/practices which minimizes opportunity for human error.
- Ability to run many more NVH analysis iterations, leading to more design decisions, earlier.
- <u>Ability to redeploy resources as less experienced engineers are now able to safely run</u> simulations.

Comet Solutions, Inc.

spdm SimApps: Key Ingredients

- Expertise, expertise, and test results for validation Capture and leverage best practices & rules across the global org.
- Rapid Template Development Environment Capture the model & the rules – single, integrated data model, minimize scripting & programming, days not months!
- Rules based on Functional Architecture
 Works across geometry, topology & configuration changes,
 and across a Family of Products
- Libraries of Parametric Analysis CAD & Systems Overcome the tyranny of "CAD for Manufacturing"
- Rapid Web GUI Development Environment (EASA)
 Create SimApps that drive the templates



Simulation for <u>Anyone</u> Who Needs It? <u>Use Case:</u> Global plastics container manufacturer





Drop Tests Crush Tests



No internal CAE expertise or resources

- Create Simulation Templates for Lights-Out Automation Capture & deploy CAE expertise + validate with test results
- Create SimApps
 Web GUI's for remote access

~10-15 days Mostly validation/testing

- Deploy SimApps on The Cloud "Infinite computing" for Design Space Exploration
- Affordable & On-Demand pay-by-the-drink licensing Lots of work to be done here!

Product Designers able to run complex simulations to evaluate designs



spdm Simulation <u>Is</u> Being Democratized!

- The original promise of simulation is here: Simulation-Driven Design for the *whole* product development team
- General-purpose simulation environments that are easier to use are not the solution for non-experts
- To make SimApps safe for non-experts, expertise must be embedded within them – enforces best practice
- These Apps must work across a Product Family
- Rapid Template & SimApp development platforms are a requirement to make them economically feasible
- The advent of The Cloud makes it feasible and cost effective to access huge computing resources, as needed

"Lights-Out Automation" facilitates Automated Design Space Exploration for Experts & Non-Experts



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Thank You

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