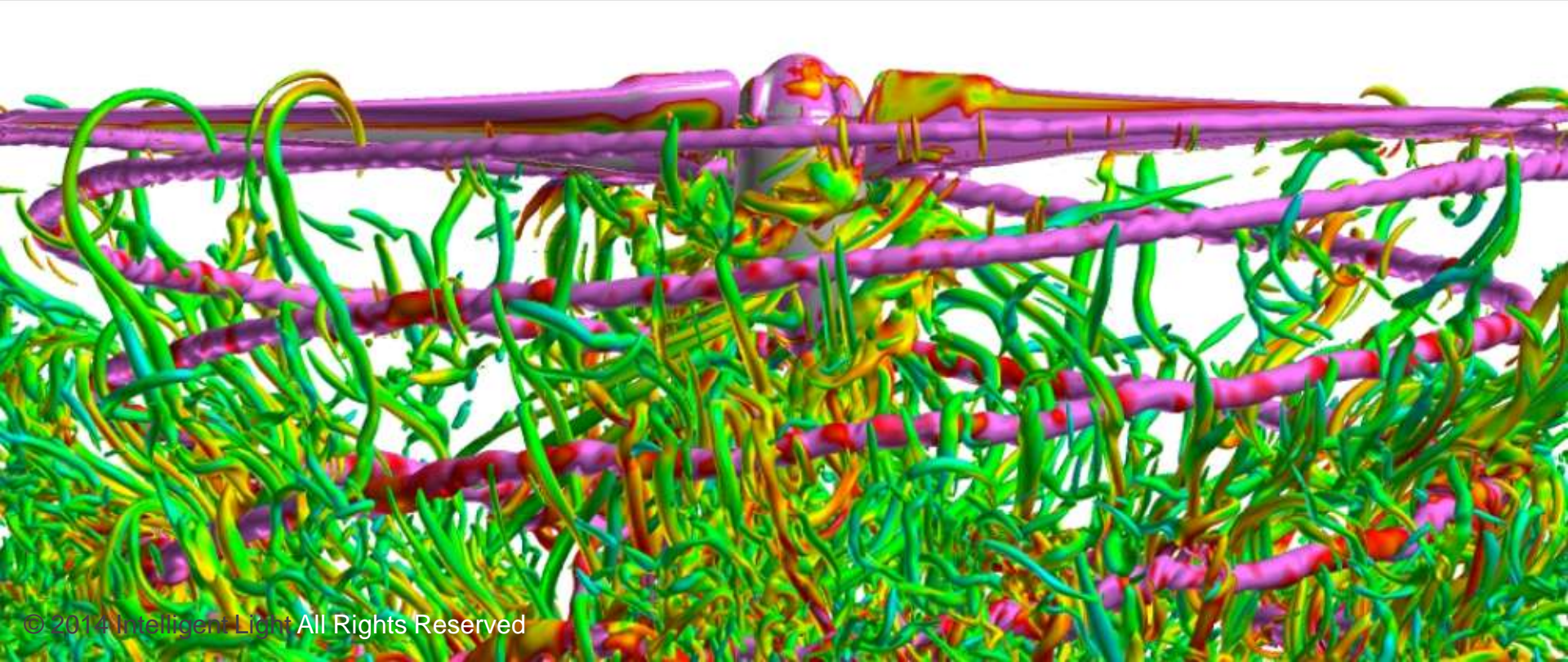


# Intelligent Light



Steve M. Legensky  
Founder and General Manager  
Intelligent Light

# REVOLUTIONIZING INNOVATION WITH ON-DEMAND HPC

# Intelligent Light

- Established in 1984
  - Three decades in the software & services business
  - FieldView launched in 1990
  - Global Customer Base
- We provide CFD solutions
  - Meshing and solver independent
  - Multiple CFD practitioners on staff, active in publication
- Our Mission:
 

**To help our customers using CFD to do more with less and make better decisions**

## Aerospace & Defense



## Automotive & Transport



## Consumer & Heavy Industry



## Energy & Environmental



# FieldView Evolution Driven by HPC

- 1990-2000, Visualization on the desktop
  - Files copied to or accessed from local workstation
- In 2000, true client-server delivered
  - Direct post-processing of remote data
- 2004, MPI-based parallel, remote or local
  - Take advantage of partitioned results files
- In 2005, extract-based workflows via XDBs (extract database)
  - Remove the need for direct connection
- Since then, push automation & batch features
- 2013, integration of DOE's open source VisIt
  - Use *in-situ* extraction to directly produce XDBs




Stand  
alone



Connected



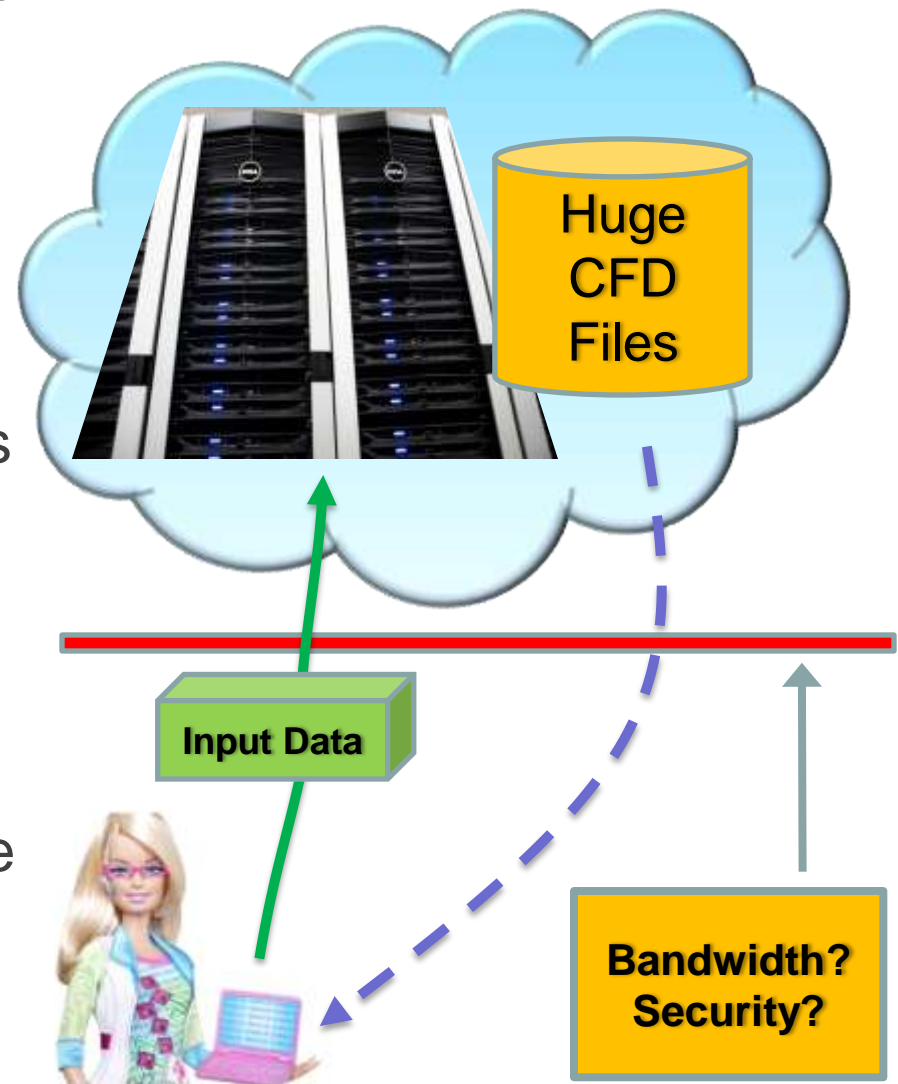
Data  
Management



Direct  
Extract in  
Solver  
(in situ)

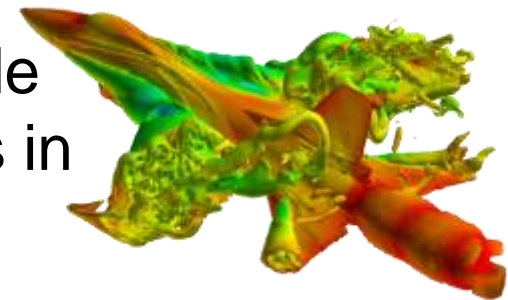
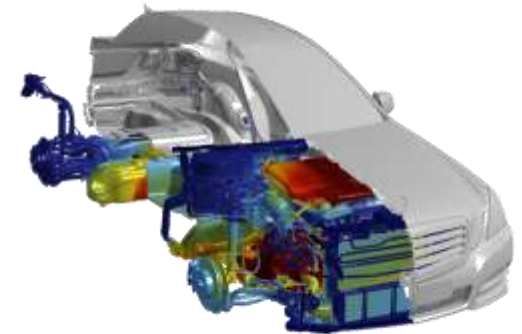
# CFD in the Cloud...

- CFD Solver Codes are well suited
  - Parallelize nicely
  - Input data is usually small
  - Jobs run from a day to weeks
- But, results files can be very large and there can be many
  - Analyzing these files is how the user gains understanding
  - Unsteady cases need one file for each instant of time (1 to 1000GB per time step)



# Three examples

- ZIPP Speed Weaponry
  - Zero to Parallel HPC enabled by cloud resource
- Daimler (Mercedes Benz)
  - Automation and XDBs enable multi continent 'cloud' workflow
- DoD CREATE program
  - *In-situ* extract creation in the solver code enables compute in Maui, post-process in to Pax River, Maryland



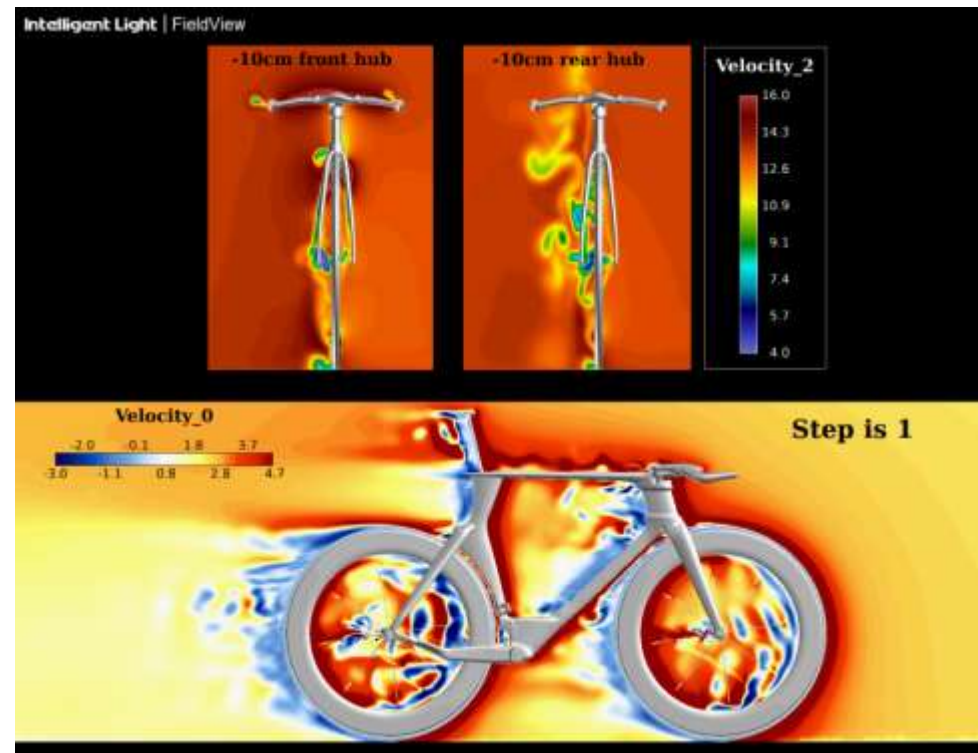
# ZIPPER Speed Weaponry



- Designer & producer of the world's most advanced bicycle racing wheels
- The only remaining U.S. manufacturer of high performance cycling components
- New state of the art facility in Indianapolis, Indiana
  - Keeps design and production under one roof, giving the company a strong edge
- *Design via windtunnel, not CFD*

# From ZIPP's Perspective

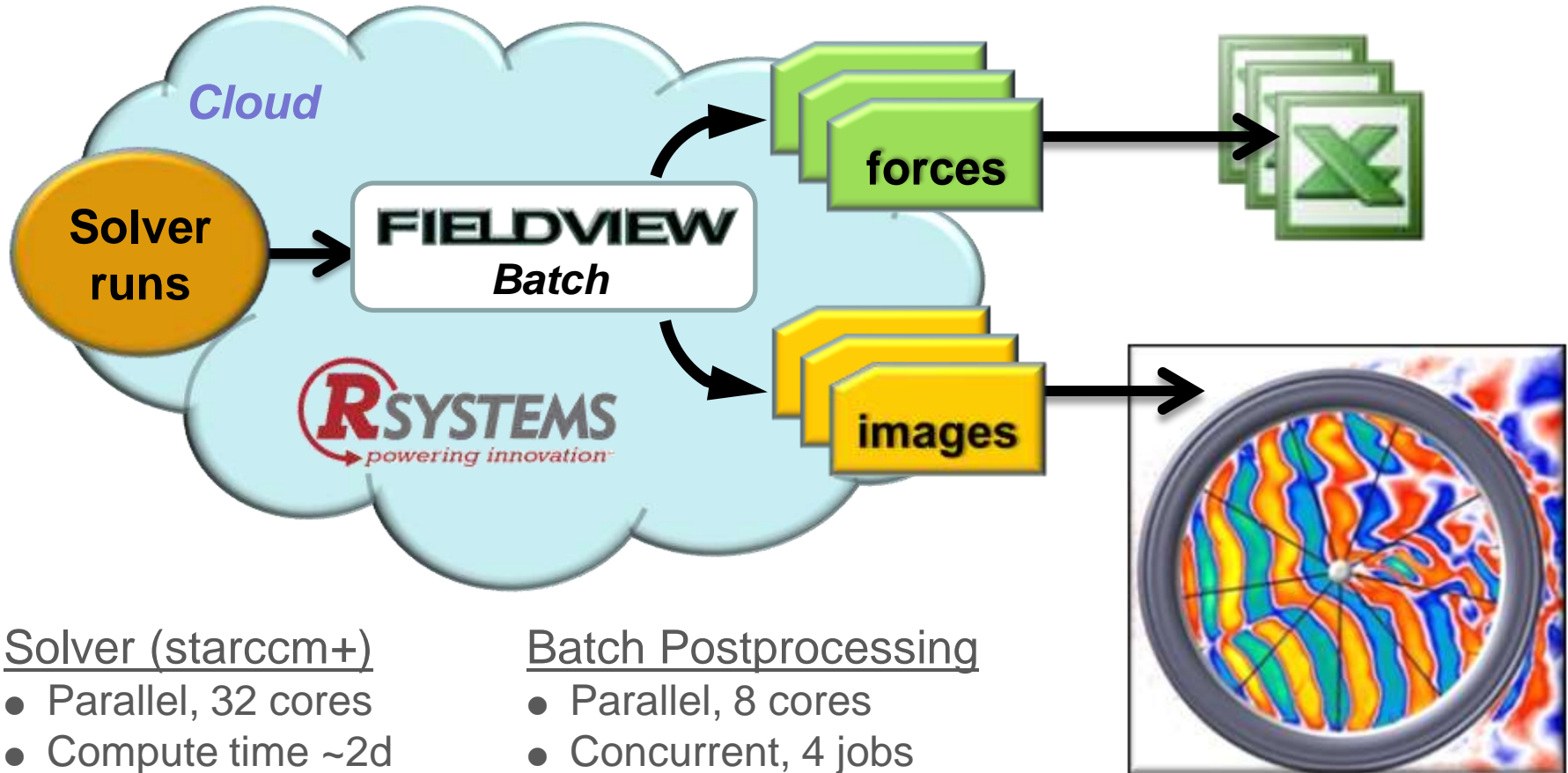
- Risk of an investment was prohibitive
- Need highly reliable results (trusted!)
- Unsteady effects are important for them – this is “*big CFD*”
- Fast turnaround time on demand



They turned to Intelligent Light and we formed a team to solve ZIPP's problem using cloud computing and our advanced remote workflow tools.



# Typical Batch Workflow



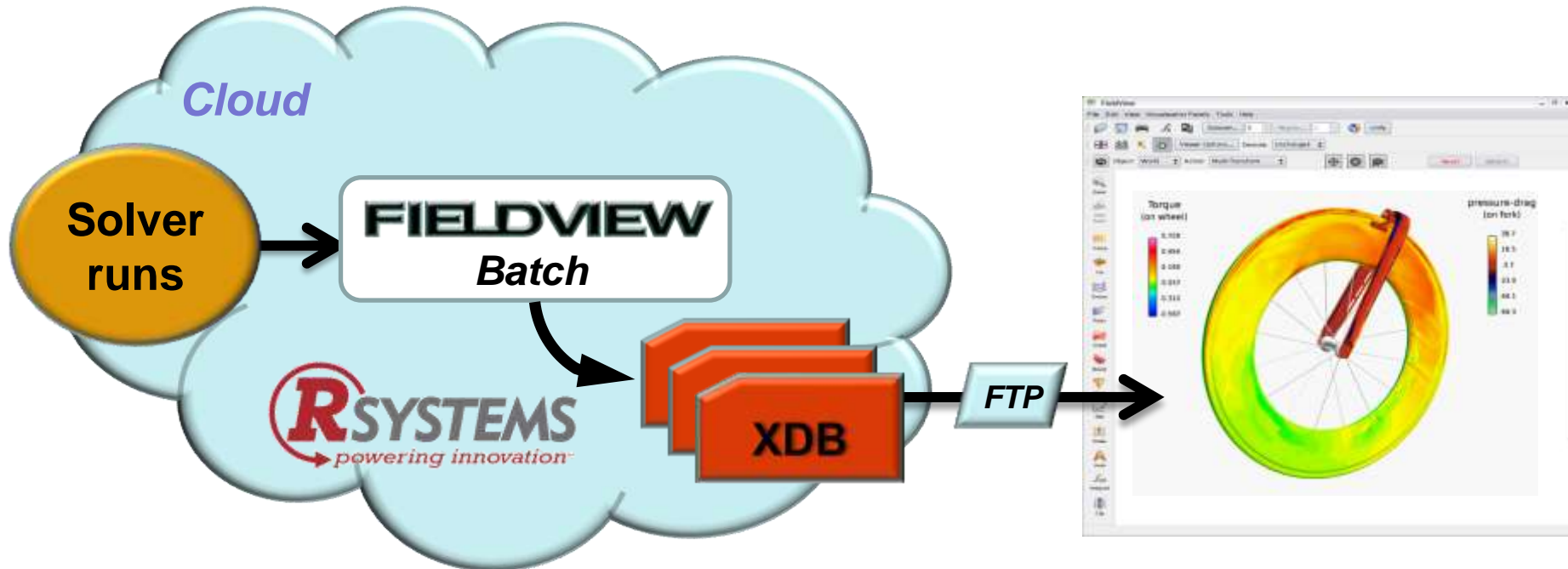
## Solver (starccm+)

- Parallel, 32 cores
- Compute time ~2d
- 16GB/step (1 Tb total)

## Batch Postprocessing

- Parallel, 8 cores
- Concurrent, 4 jobs
- Compute time ~few hours
- FVX™ scripts used

# FieldView XDB Workflow



## Solver (starccm+)

- Parallel, 32 cores
- Compute time ~2d
- 16GB/step (1 Tb total)

## Batch Postprocessing

- Parallel, 8 cores
- Concurrent, 4 jobs
- **FVX™** scripts used
- Computing XDB files takes a few hours

## FV XDB Data Reduction

- **46X** smaller files
- Full numerical fidelity
- FTP to local desktops for interactive postprocessing
- Used just like original data

# Results for ZIPP

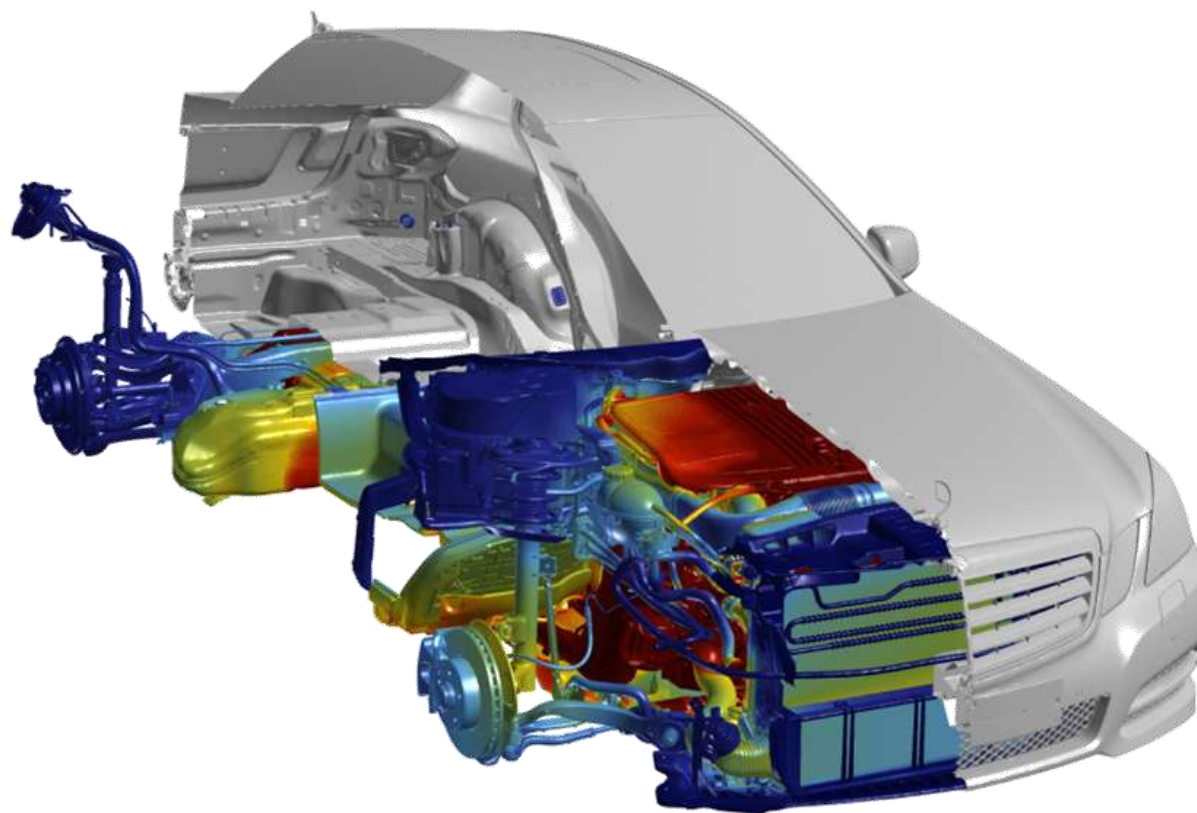
The return upon the investment included 100% category revenue growth, created 120 new U.S. manufacturing jobs, and extended Zipp's industry leadership and reputation for technical innovation.

“Ultimately we still can't replace the wind tunnel with CFD but the ability to understand and predict so many aspects of performance and handling is pretty awesome! And that's just the beginning...”

*Category Manager  
ZIPP Speed Weaponry, Indiana*



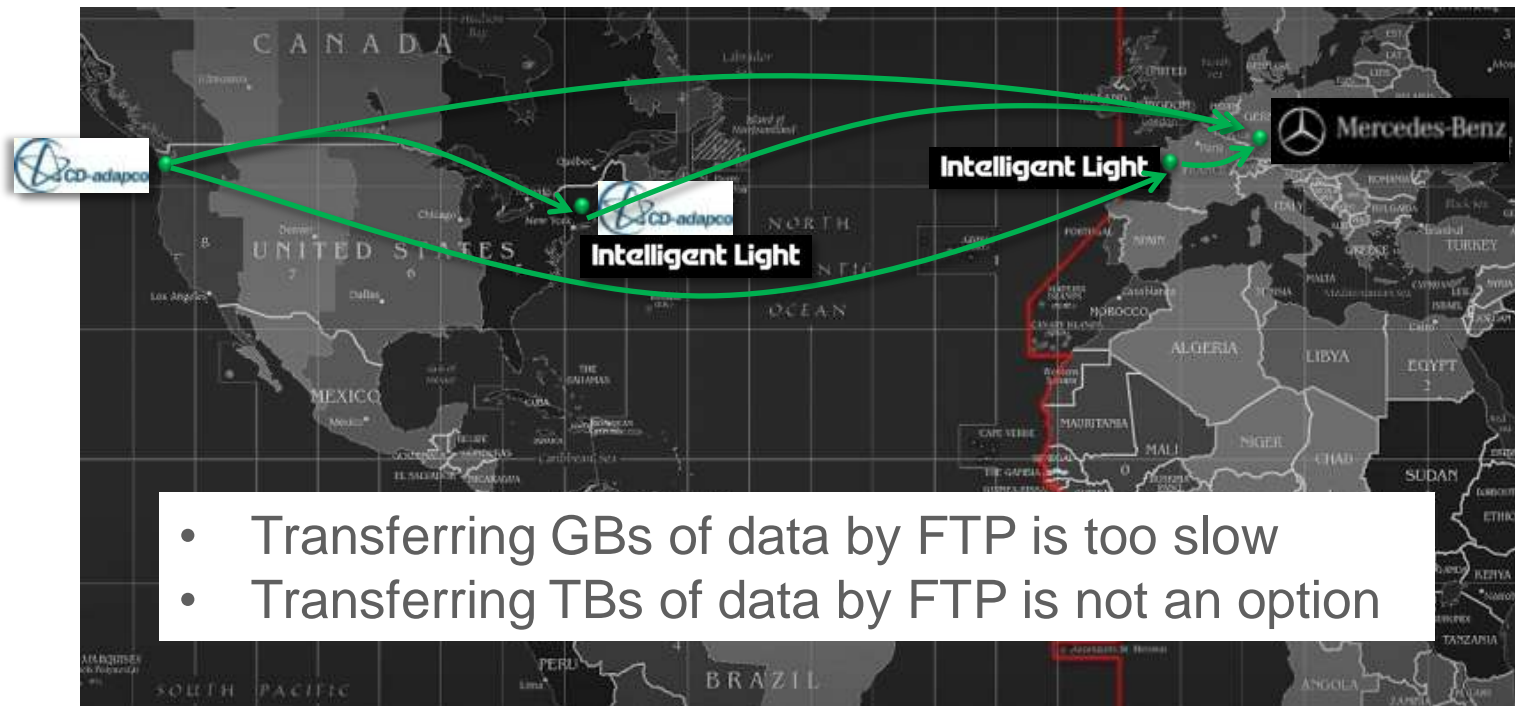
# Daimler (Mercedes-Benz)



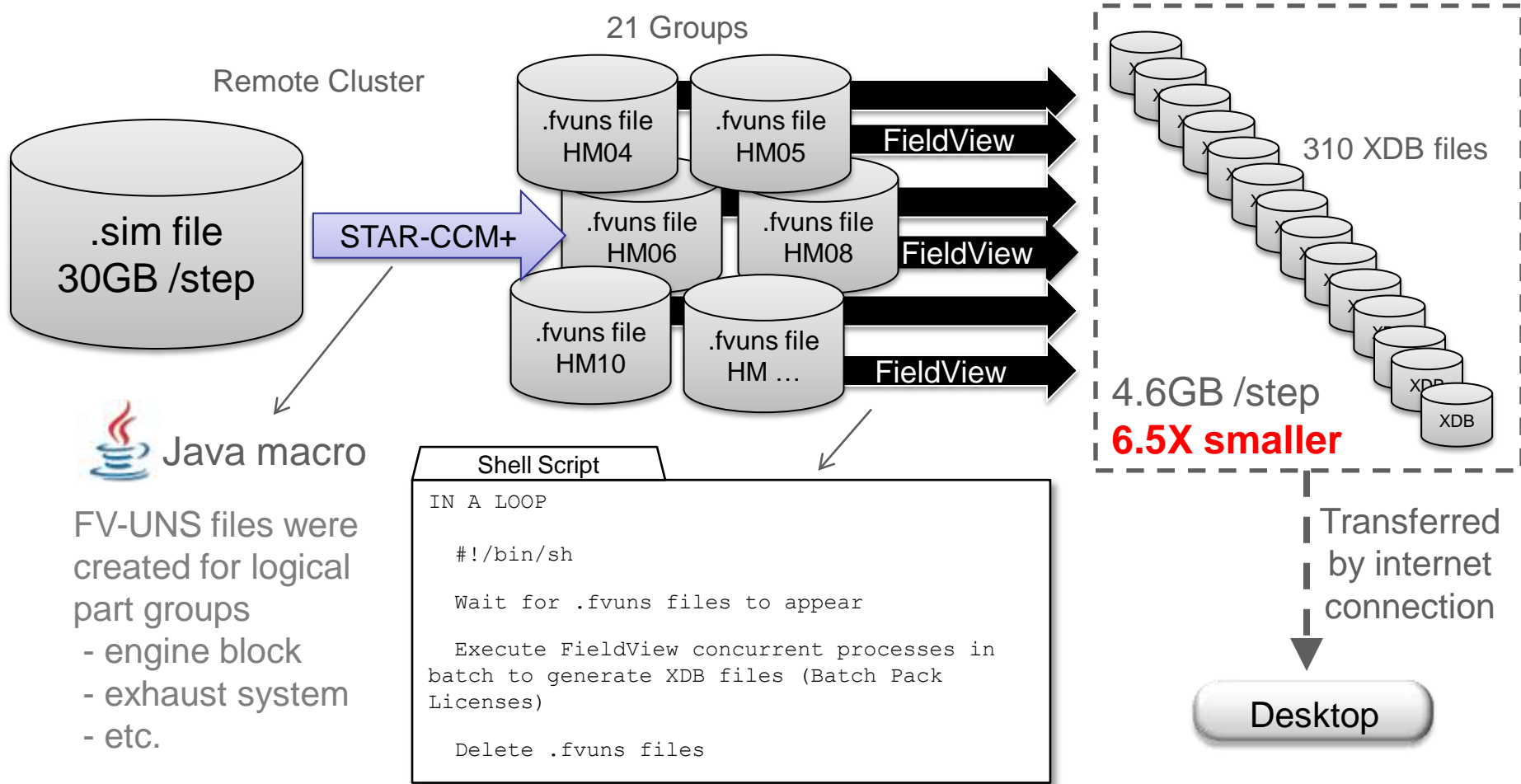
# Vehicle Thermal Management at Daimler

## V.T.M. Simulation Data is **Remote**

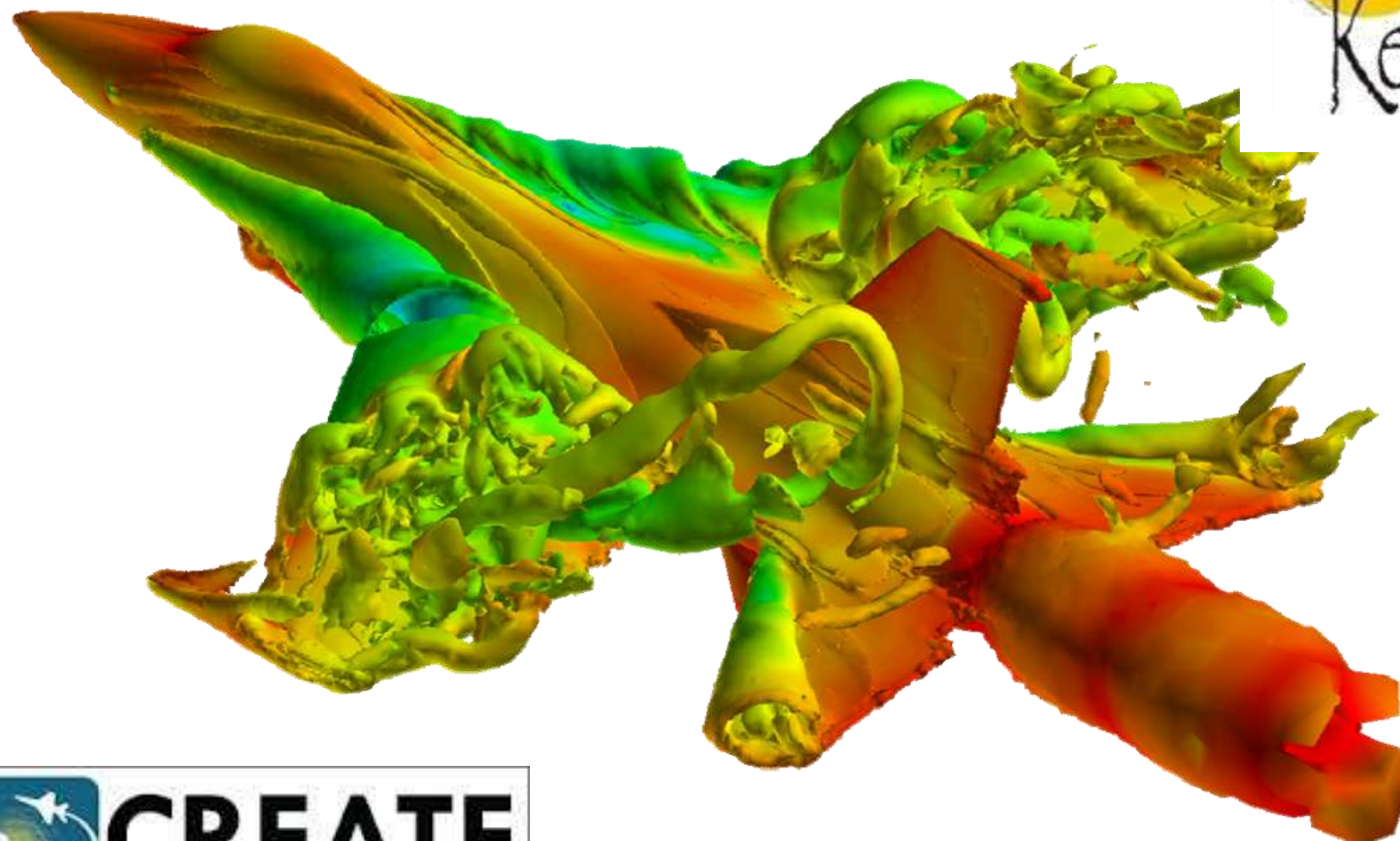
- Simulation running on CD-adapco's clusters (West Coast, US)
- Mercedes-Benz engineers working from Sindelfingen (Germany)
- Intelligent Light teams in US (East Coast) and France



# Partition Big Data into XDBs Remotely

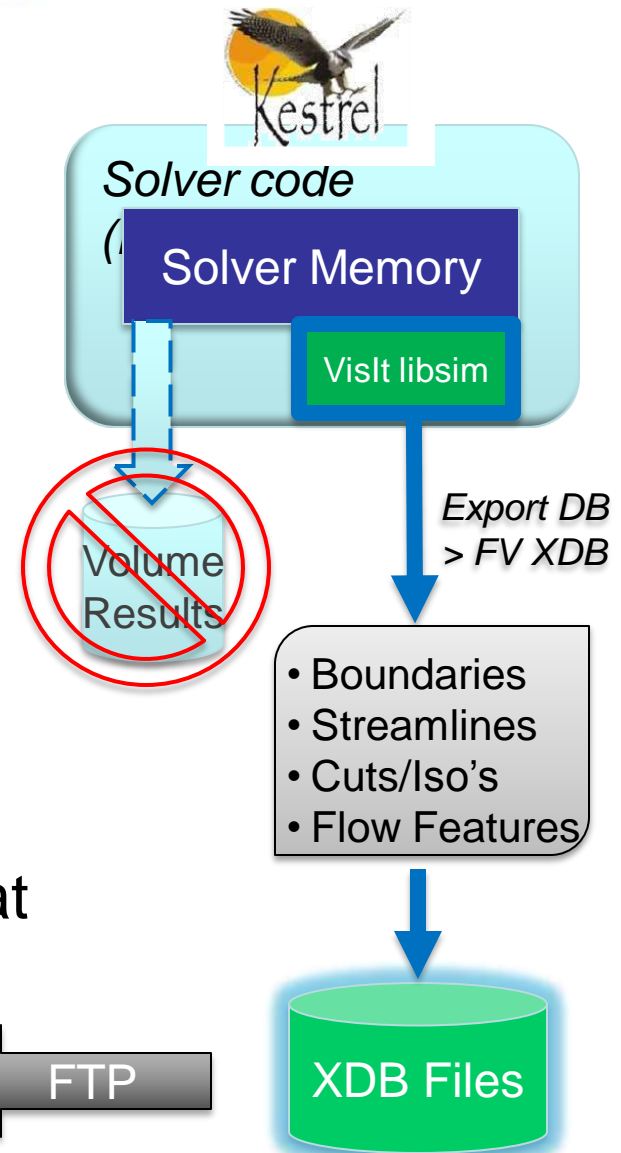


# DOD CREATE/AV



# In-situ workflow

- User's mission is to qualify aircraft handling with stores
- Many timesteps of unsteady data are computed at Maui HPC center
- Intelligent Light supported the integration of *VisIt libsim* into Kestrel
  - ZERO license fees on HPC solver side!
  - No cost XDB export in VisIt 2.8 release
- Post-processing via FieldView (interactive and movie making) done at Pax River, Maryland



## FIELDVIEW





# Conclusions

- Companies that have not used HPC and even CFD before can leverage cloud computing to get started
- Whether a beginner or seasoned expert with HPC, easing data management is a key enabler
- Intelligent Light has the tools in the FieldView suite to get the job done!

