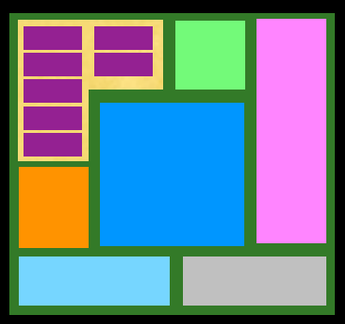
Development of Virtual Power Plants

We are working in the emerging intersection between information, computation, and complexity

- Design
- Environmental modeling
- Controls with massive, heterogeneous sensor nets
- Training
- Engineering analytics
- Merged environments



Applications

MIT Media Lab ...

“... one of the world’s top computing science laboratories”

New York Times, April 26, 2011

Today we cannot model the richness, fullness, or complexity of engineered, human, or natural systems.

These problems are process rich ...

.... but our current models are process poor

Process rich?

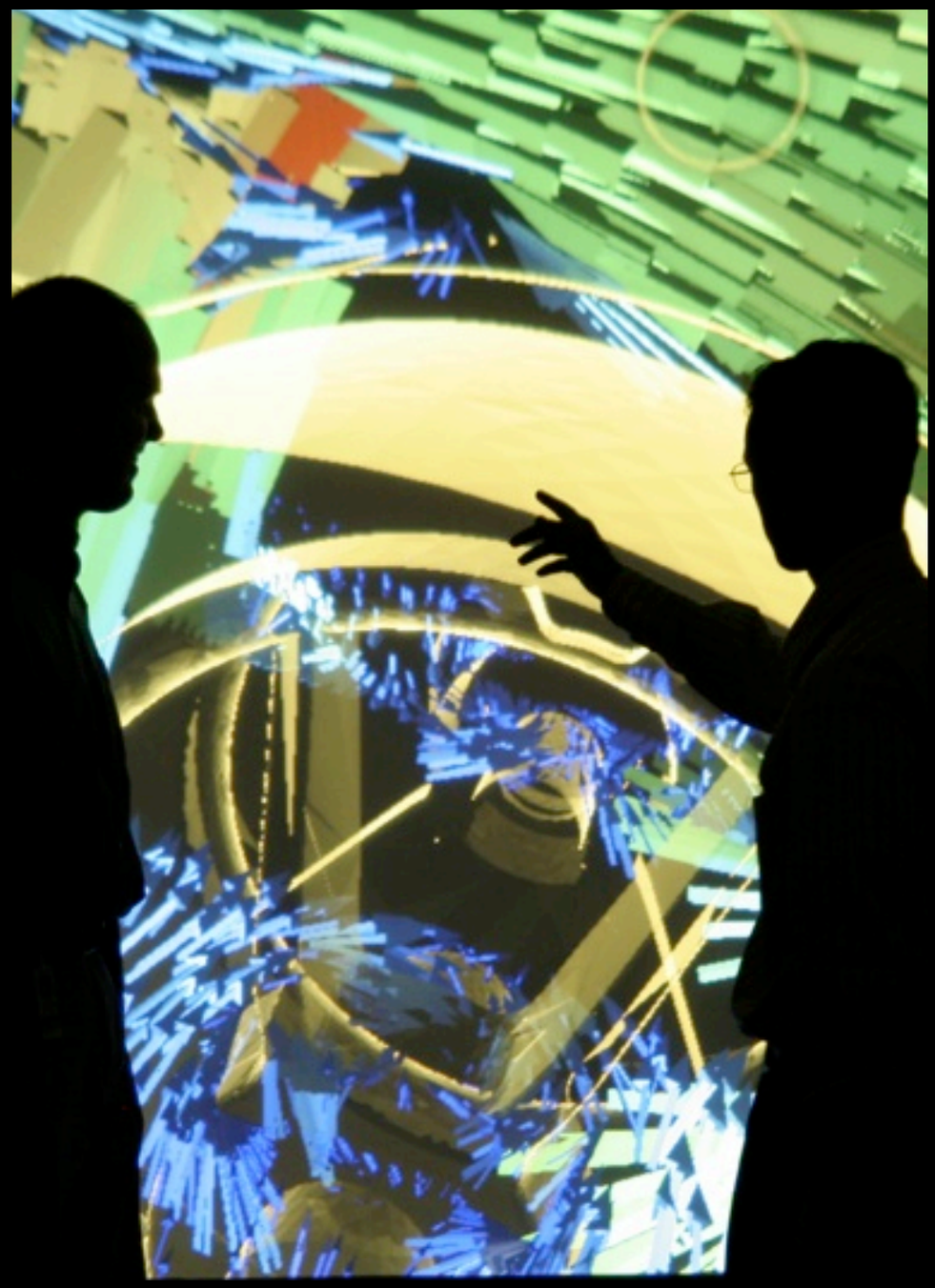
- Coupled linkage across scales
- Coupled linkage across systems
- Self organization & emergence
- Complexity
- Conflicting payoff matrices

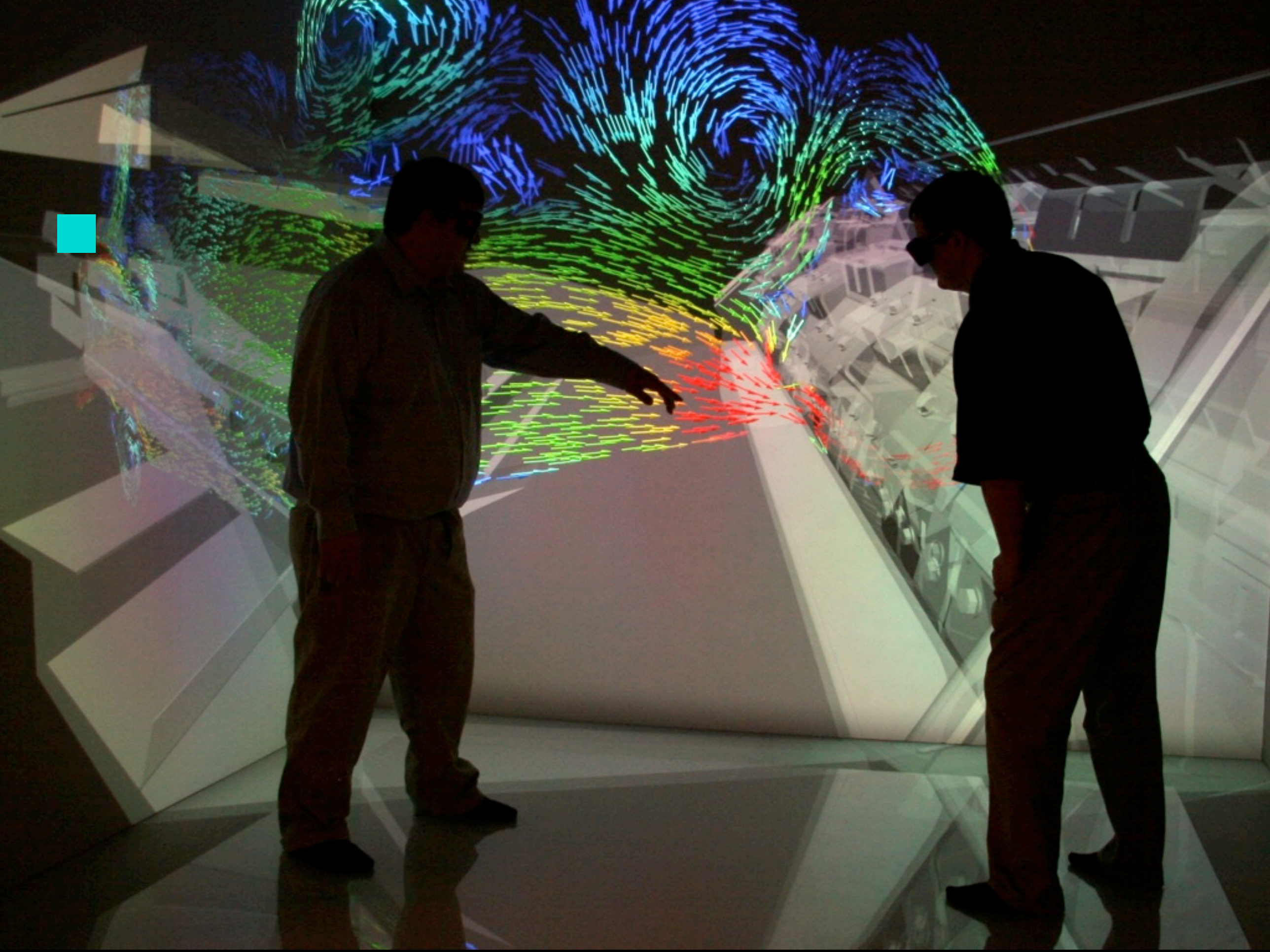
We are seeking ...

A simple, straight forward way to make better decisions for the complex of systems in our world

VE-Suite:

Creating a common decision space





National Excellence in Technology Transfer Award

2009

2006

2009

2010

Analytics

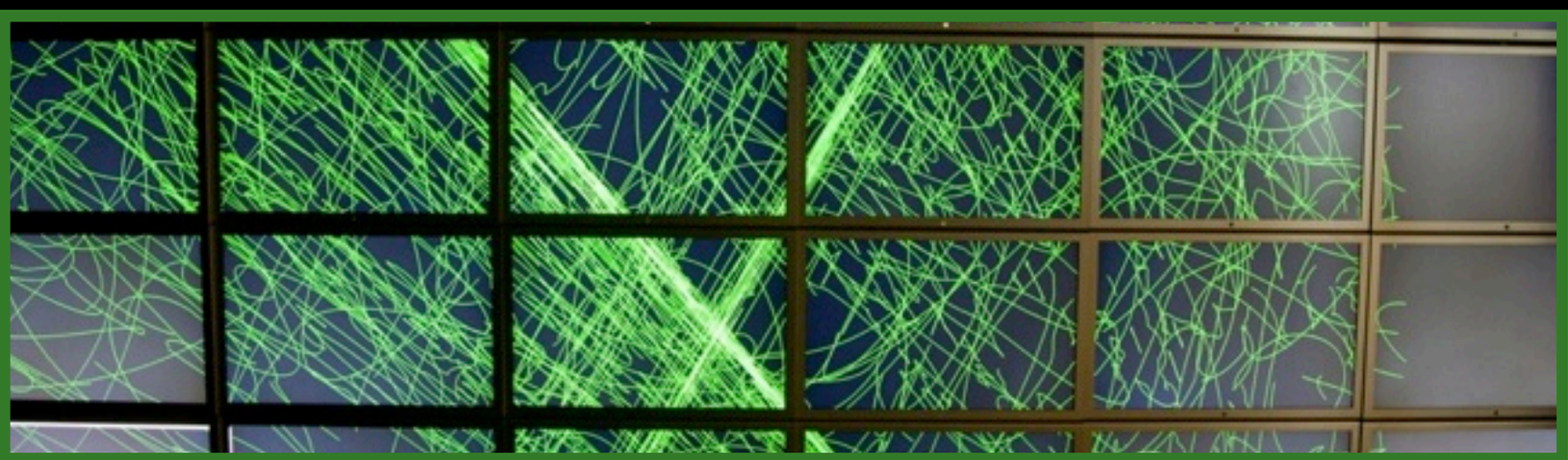
Visualization

VE-Suite

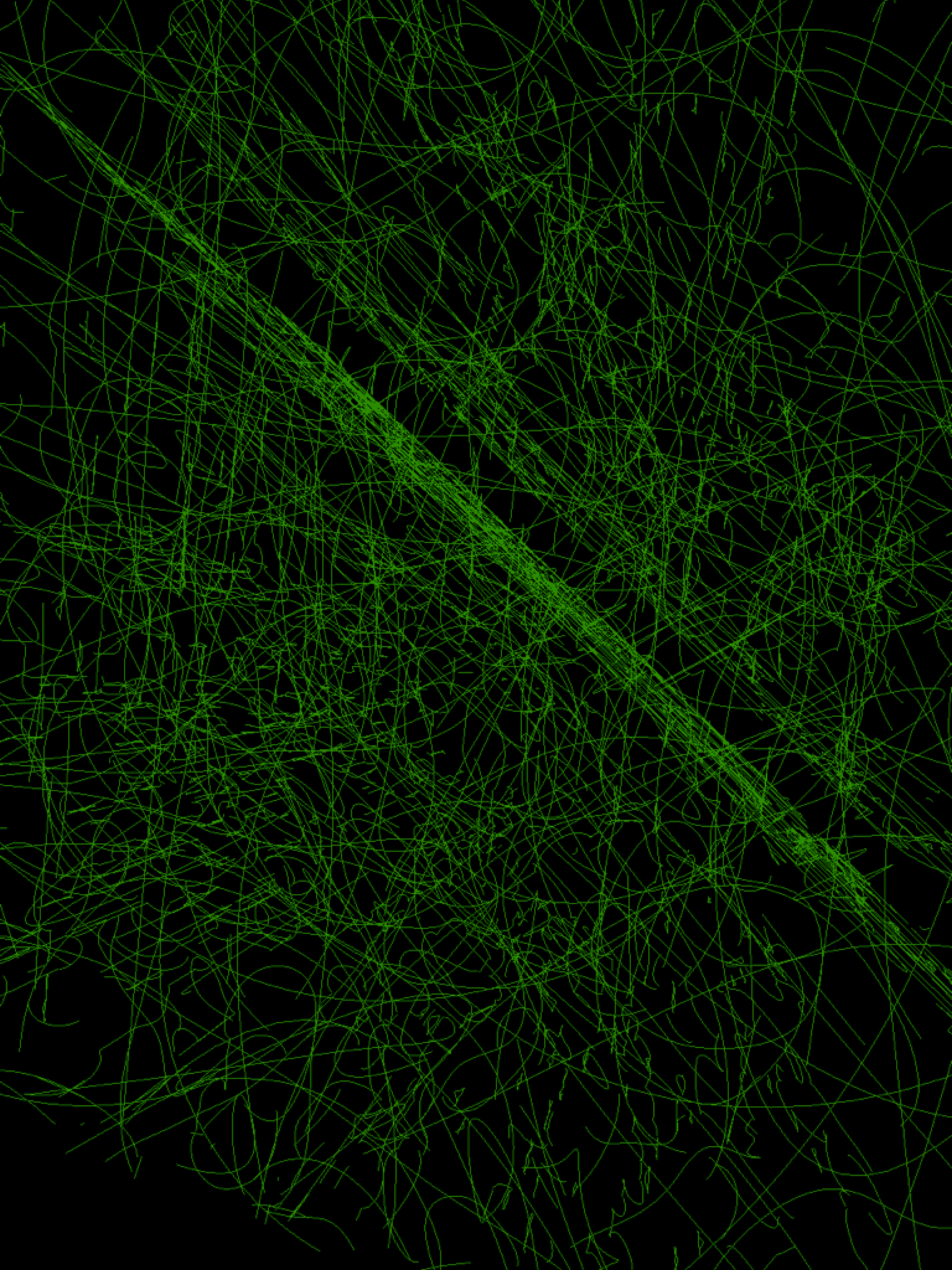
Analysis

Design

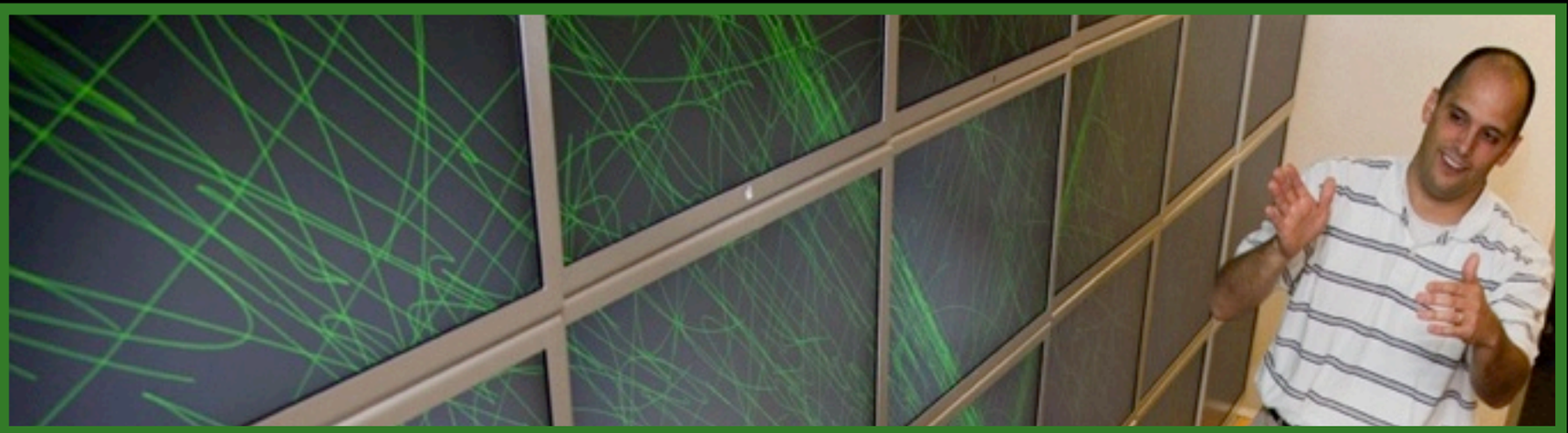
Visualization



- 100+ million points
- Any data source
- Any visualization platform
- Any compute platform
- Realtime sensor visualization

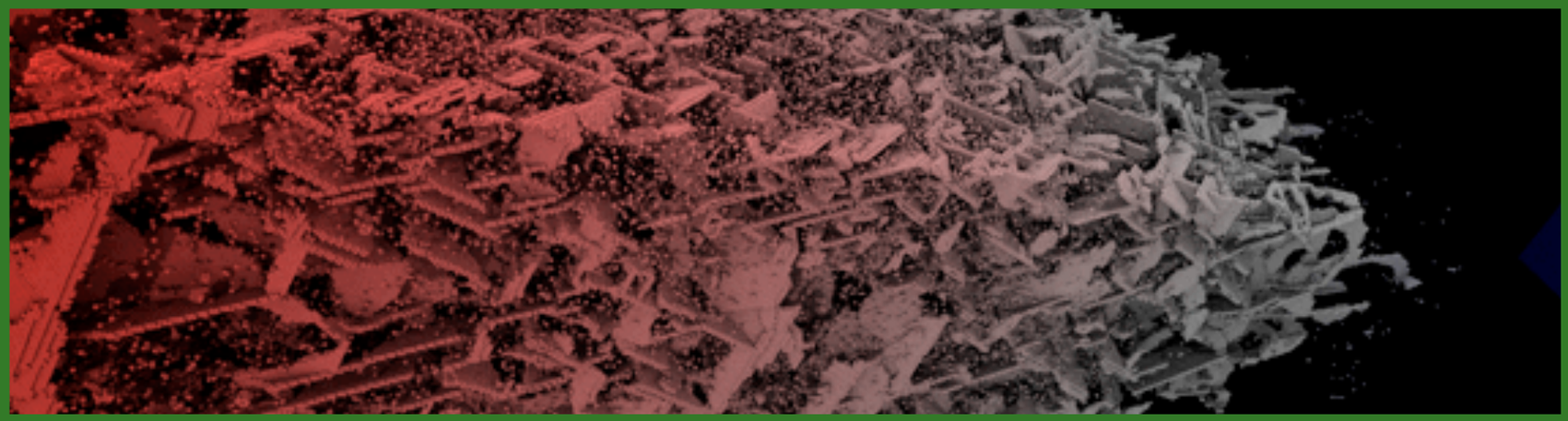


Interaction



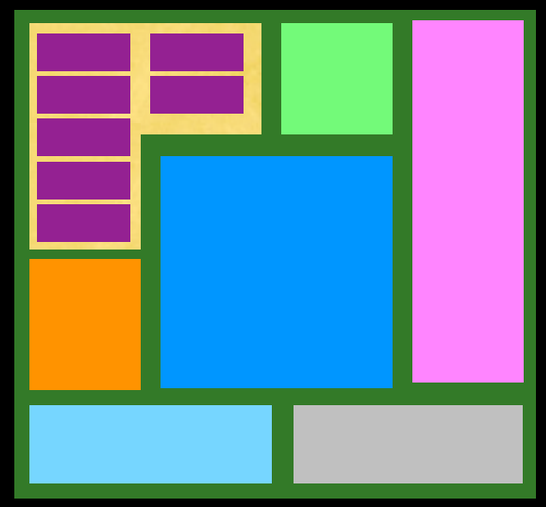
- Realtime interaction
- Any user interface
- Physics engine (interferences)
- Information management
- Interactive design and optimization

Analysis & Analytics



- data bases + models + simulation

- Realtime power plant dynamic simulation
- Today - many software packages
- Possible - any software package
- Future - from atom to power plant



Fluent

StarCD

Ensight

ABAQUS

ANSYS

ProE

JT

AutoCad

Bentley

MSC/Patran

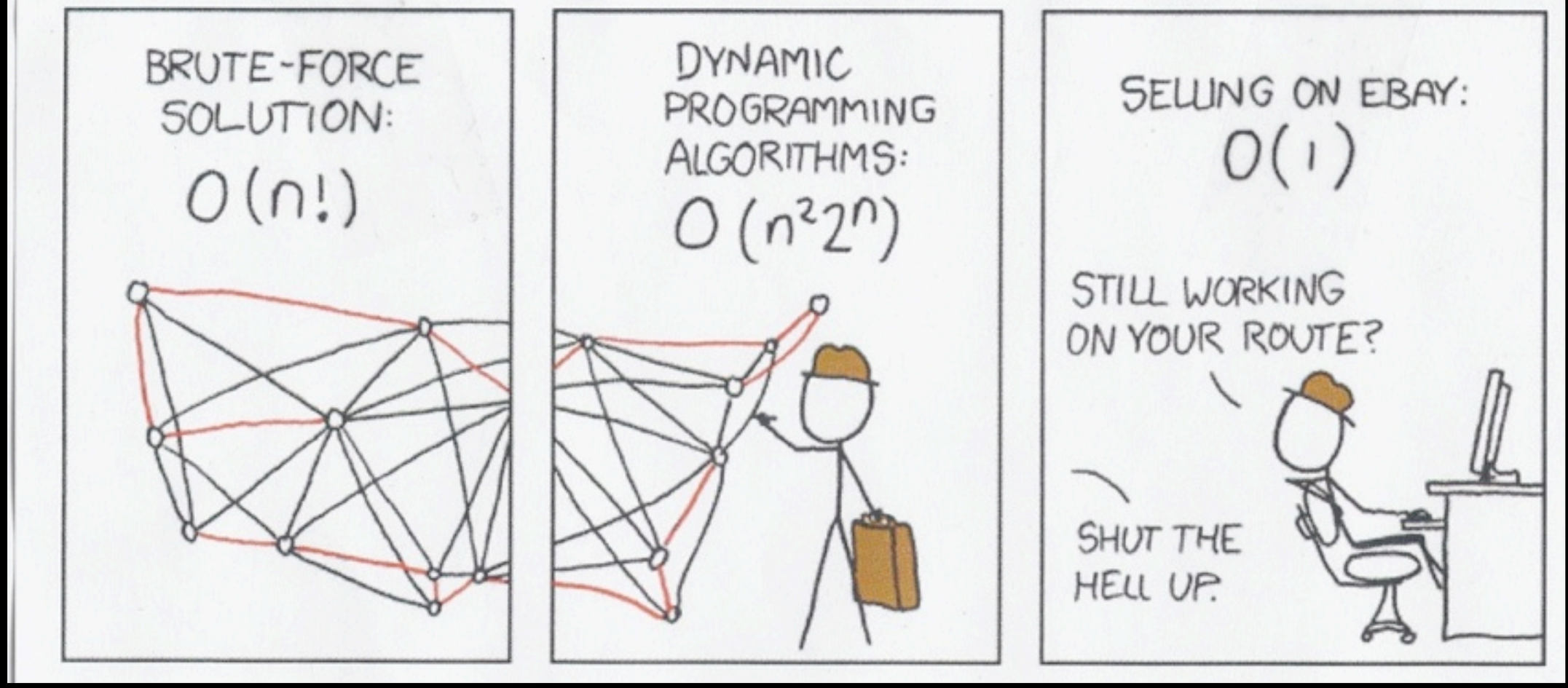
Aspen

DynSim

MSC/NASTRAN

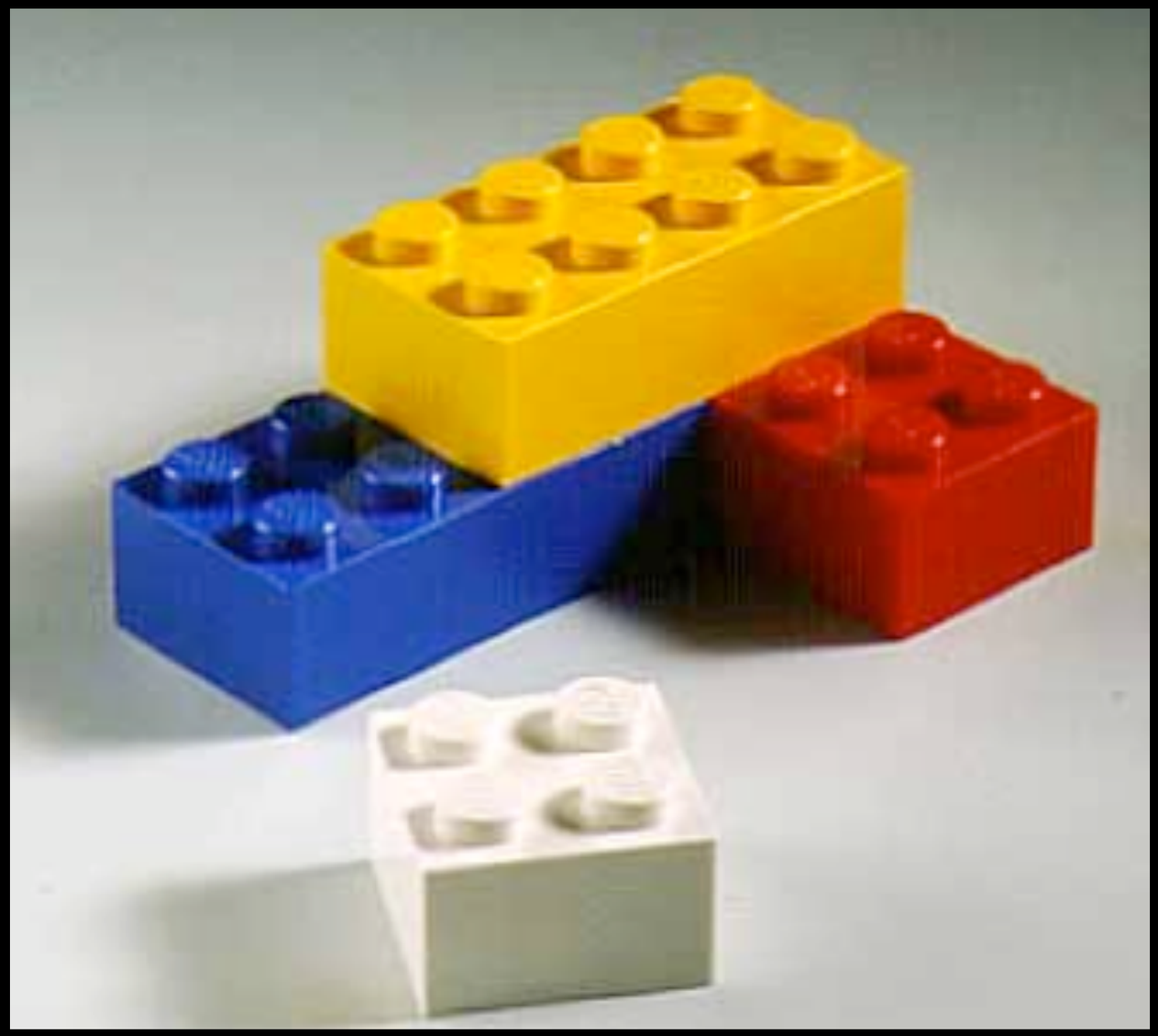
...

Design

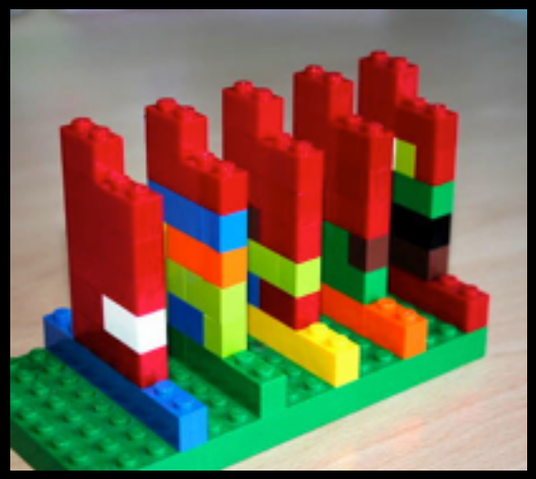


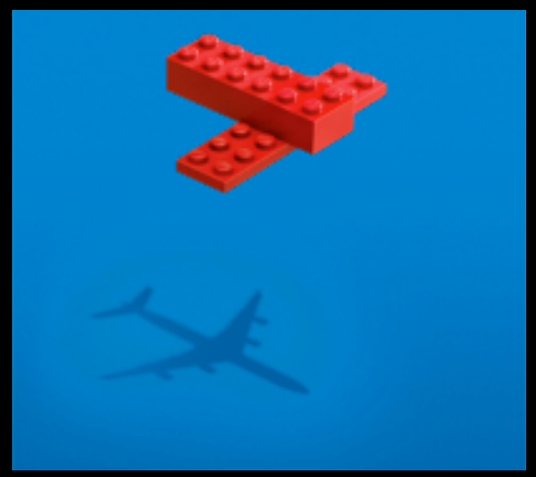
The traveling salesman problem

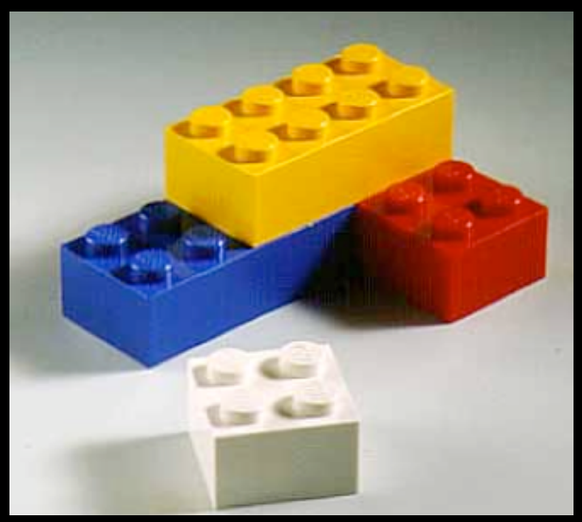
Our approach



Building Blocks (objects)

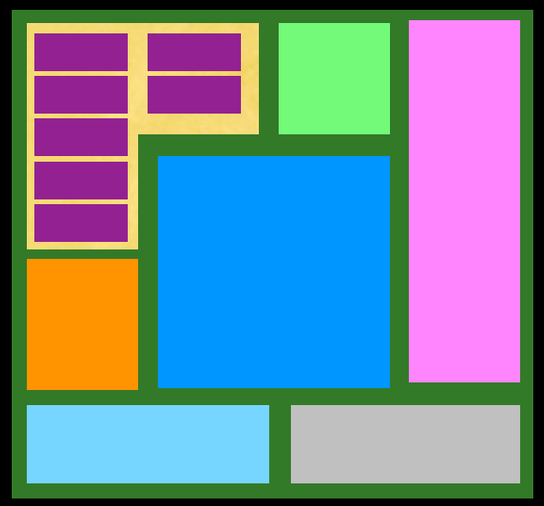






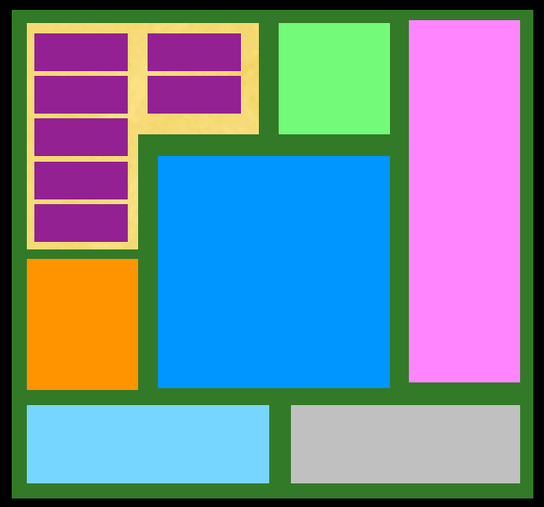
Fully coupled, complex system management

- Sparse matrix theory
- Hierarchical networks
- Combinatorial graphs
- Information theory



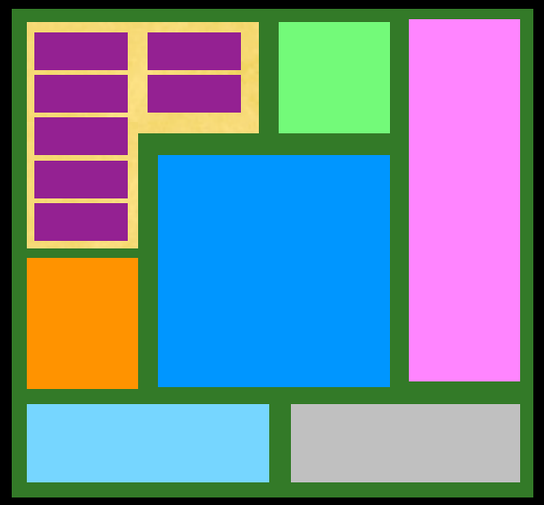
Create an object (block)

- Models and information to be linked
- Define coupliing
- Define common “spatial” frame
- Define information needs



Create an object of objects

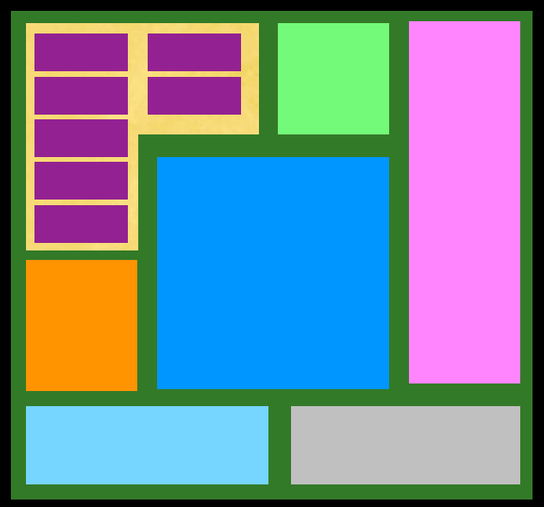
- Blocks and information to be linked
- Define coupliing
- Define common “spatial” frame
- Define information needs



Repeat

- …
- …
- …

Hierarchical Networks



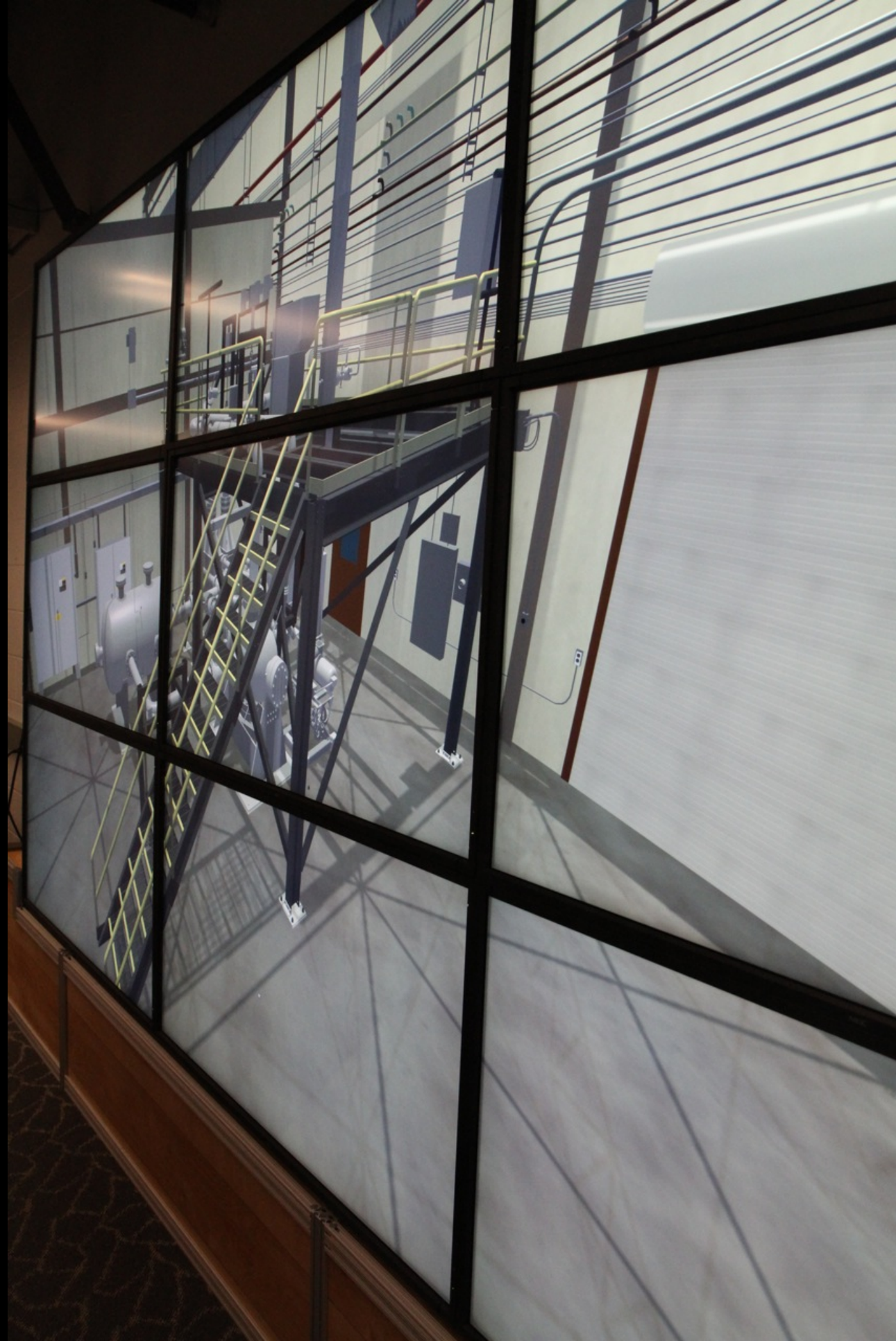
Integration

- Computational building blocks that can be used to easily build complex systems
- Intuitive engineering decision support tools
- One computational platform from concept to product

2000+ downloads

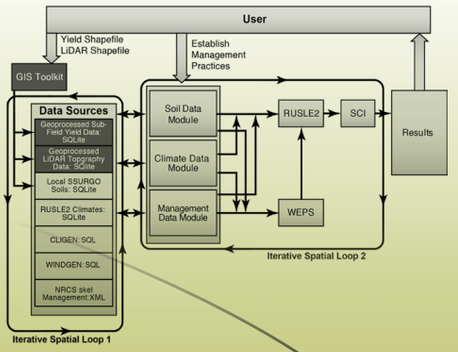
osgBullet & osgWorks

Sensor Project

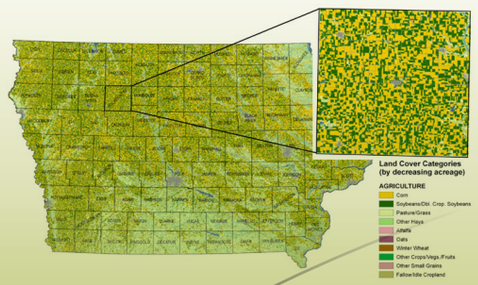


MultiScale Design Project

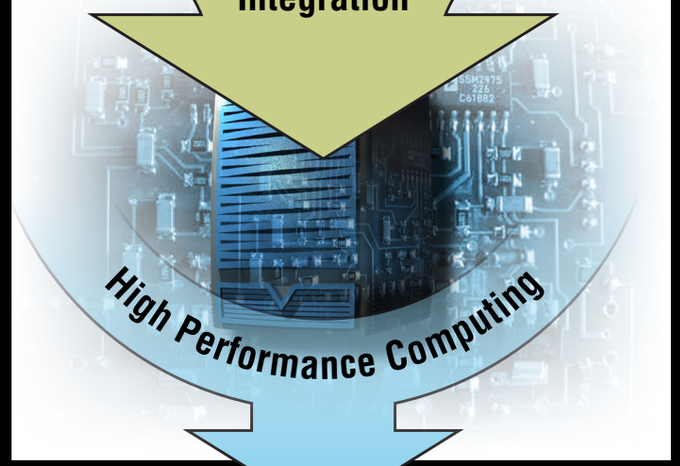
Environmental Process Models and Datasets



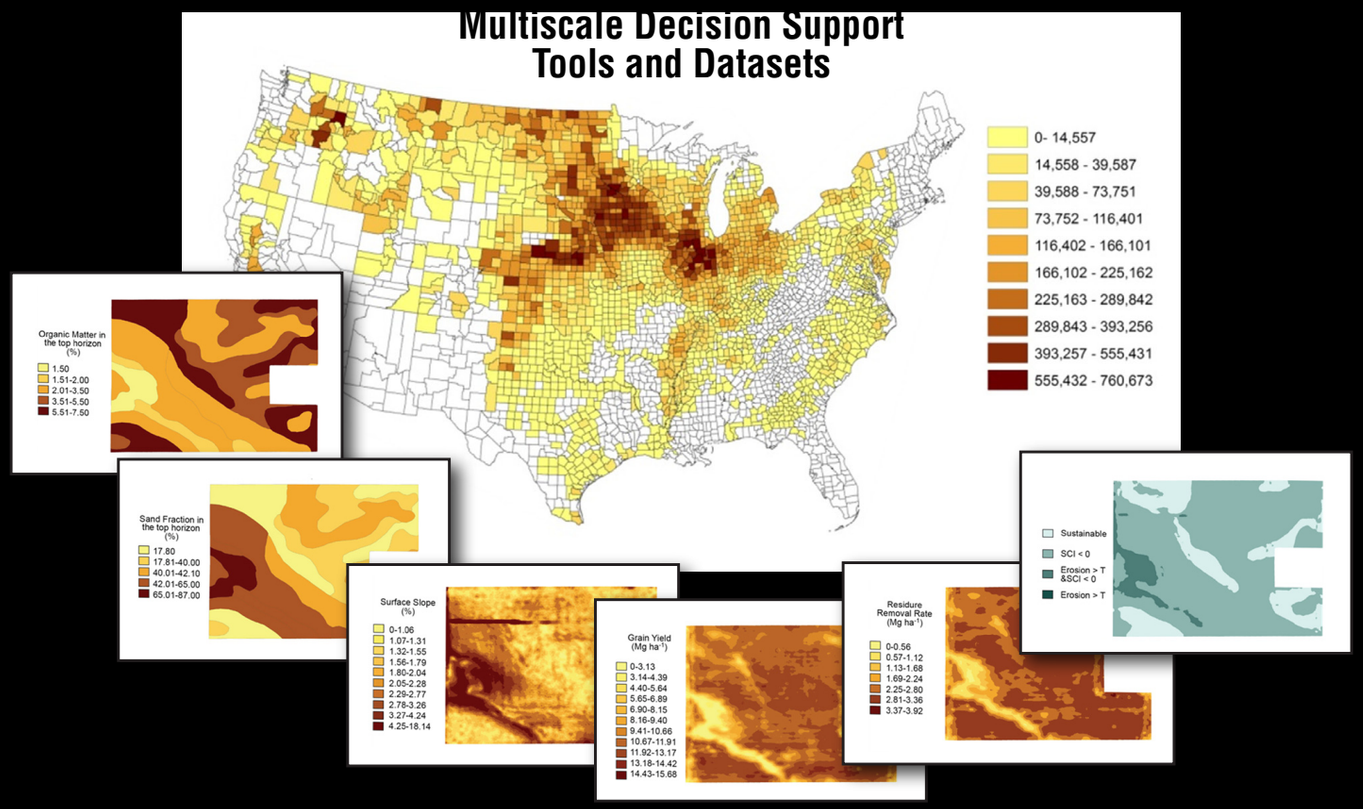
High Resolution Land Management Data

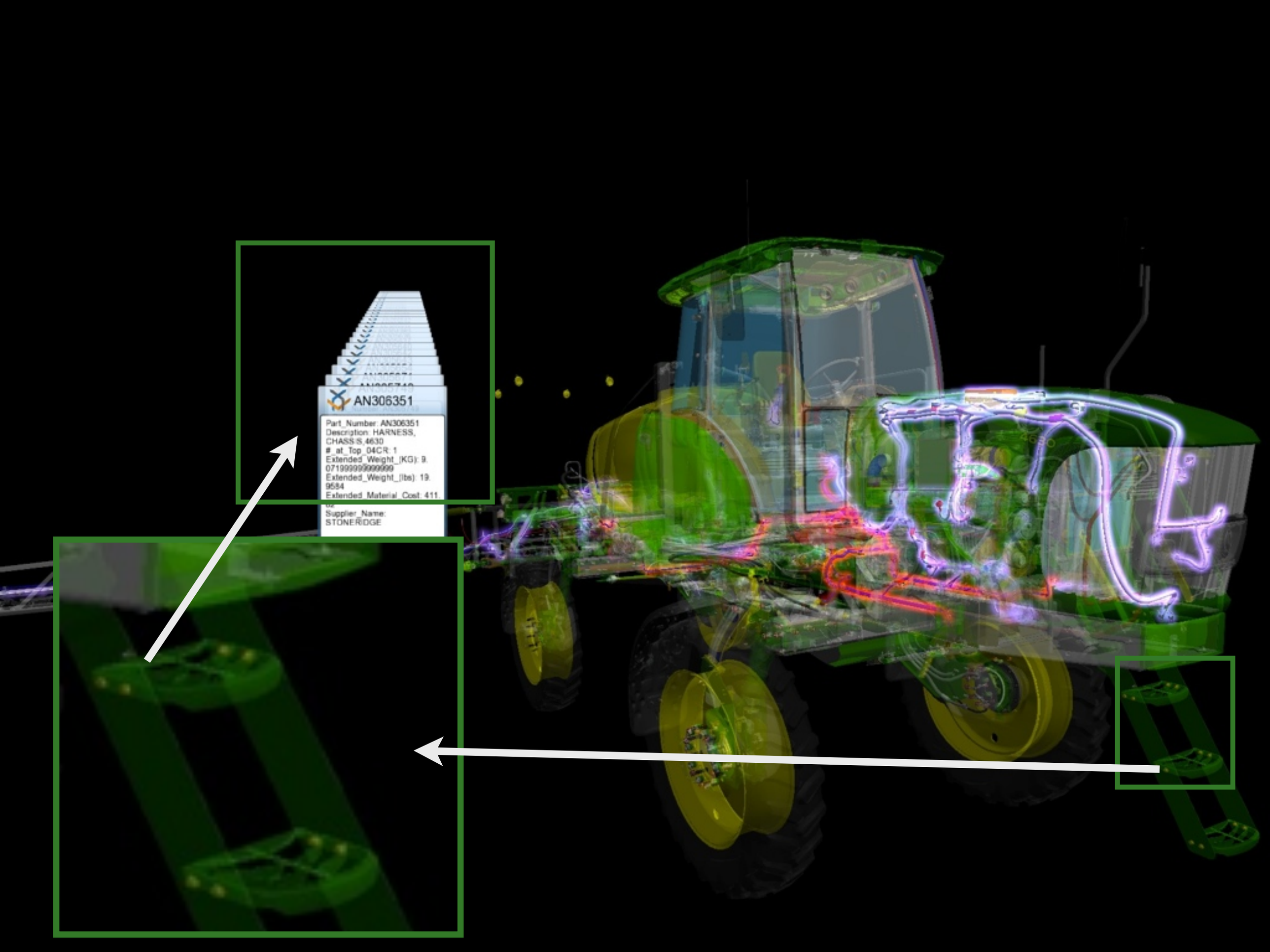


Model and Data Integration



Multiscale Decision Support Tools and Datasets

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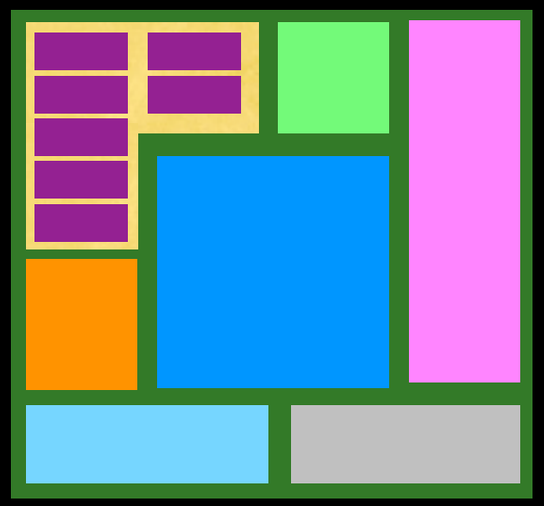
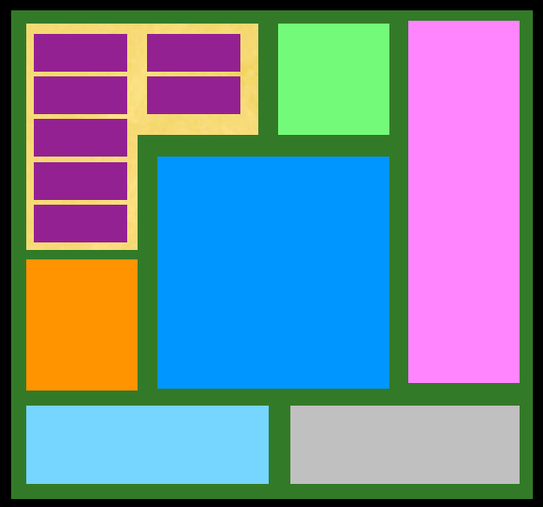


Simple tools for complex systems



Three interests

- Use of the VE-Suite open source package
- Development of new applications
- Research focused on new understandings in simulation, modeling, and decision science