Some Points of “Where the Numbers Come Alive”
Basic Idea

- App scale and complexity increase
- Off-the-shelf visualization & DB sys, Unite!!!
EA-6B case

- crack length in a borehole → out of service
- FEA of polycrystal structures to predict future crack length/remaining life
Visualization System

- OpenDX + Microsoft SQL Server 2005 + Python

Visualization interface polycrystals FEA
Video Clip

- Polycrystal Viewer
- http://www.oxford-man.ox.ac.uk/~gheber/PView.wmv
Modeling Polycrystals

- topological, geometric, and mesh entities
- homogenous crystalline grains -> inhomogeneous Polycrystals

Part of a polycrystal ontology
Tessellate crystal as finite element mesh

A surface mesh for a grain geometry
polycrystal geometries
A Relational Data Model for Polycrystal Models

• Visualization view

Vertices $\rightarrow$ loops $\rightarrow$ faces $\rightarrow$ regions

Schema diagram of topology tables and relationships
However,...

- far from exhausting commodity hardware and software’ feasibility
- a substantial effort of various domain experts
- laboriously translated the concepts more or less one-for-one, while not “only the constituent parts of propositions are translated” (Wittgenstein, L.: *Tractatus Logico-Philosophicus*)
Mystery Data

• to import and visualize scientists’ data
  – Not completely/consistently specified
  – But data says, “…”
    • DX Data Prompter for “trail & error”
**Suggestion**

• *Cosmetic changes*
  – DX database Module
  – SQL embedded Python
  – .NET integration into SQL Server

• **Expressive Model to mimic app domain Onto**
  – Absence of formalized ontology, but Mystery Data
  – Web Ontology Language (OWL)
    • a larger vocabulary, greater machine interpretability
    • May be in RDF
    • Tend to be still hosted in relational DB
OWL

• 18 kinds of “is-a” (wikipedia)
• OWL avoid it through an explicit logical basis for the language, i.e. Description Logics
  – decidable fragments of 1st-order logic
  – more expressive than propositional logic