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RESQML Integration Demonstration

A Use-Case of a Cross-Vendor Reservoir Model Enrichment Workflow made Simpler and More Reliable with Industry-developed Data Transfer Standards

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Finding Petroleum

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Overview

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- Data Exchange challenges
- The Energistics Consortium
- Energistics Data Exchange Standards
  - RESQML
- The 2018 Kepler pilot project
  - The dataset
  - The software platforms
  - The “Polycloud”
- Conclusions

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Data Exchange Challenges

From platform-centric to peer applications

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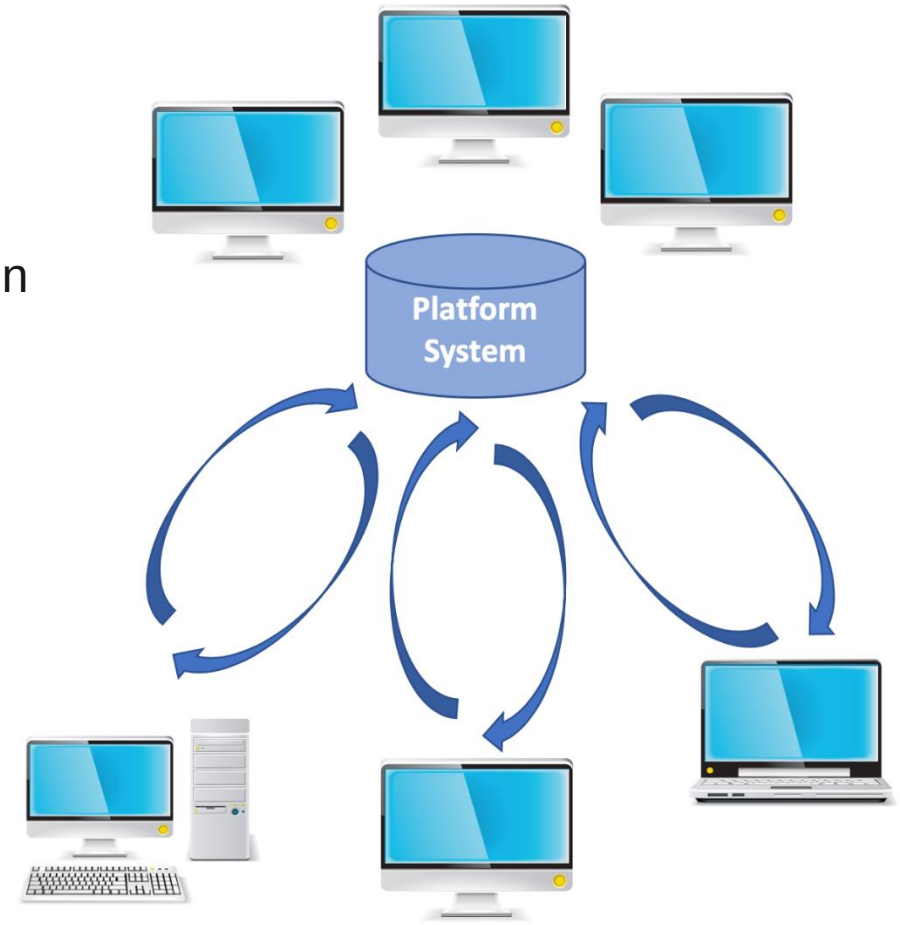
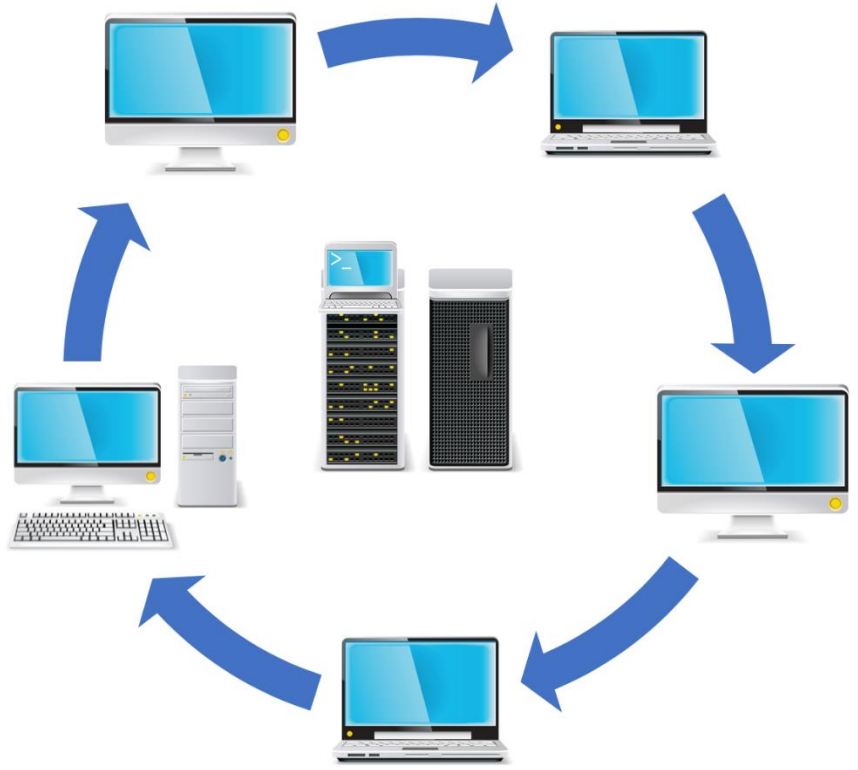
Legacy data lock-in

- Platforms monopolize most of the workflow
- 3rd party apps connect one-on -one with the platform

New paradigm

- Data must move easily from one app to another
- Workflows leverage most appropriate products and technologies to solve problems





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About Energistics

Energistics Consortium

- A non-profit organization, Energistics provides solutions to share data more efficiently
- Energistics was founded in 1990 (ex-POSC)
- 110+ members: E&P companies, oilfield service companies, software vendors, system integrators, cloud providers and regulatory agencies
- Our standards are the result of open collaboration between members
- The standards are created **BY** the industry and **FOR** the industry

Global Impact, Industry-Wide…

Energistics' Spectrum of Standards

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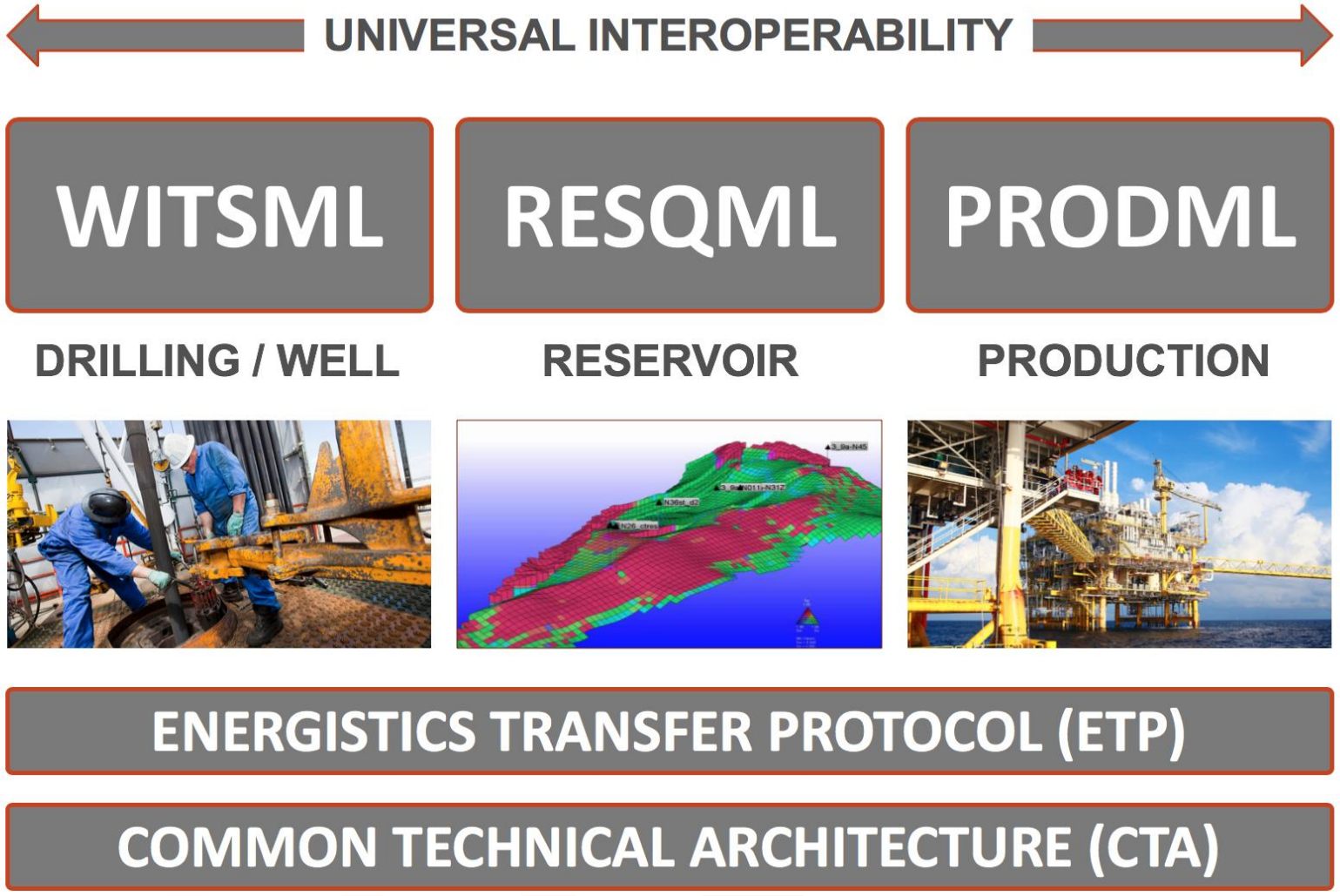
3 groups of standards:
- Drilling and well data
- Subsurface and reservoir models
- Production

They all share a common architecture
- Objects can be combined from all 3
- Same transfer protocols
- Same metadata framework



RESQML

Reservoir Standards

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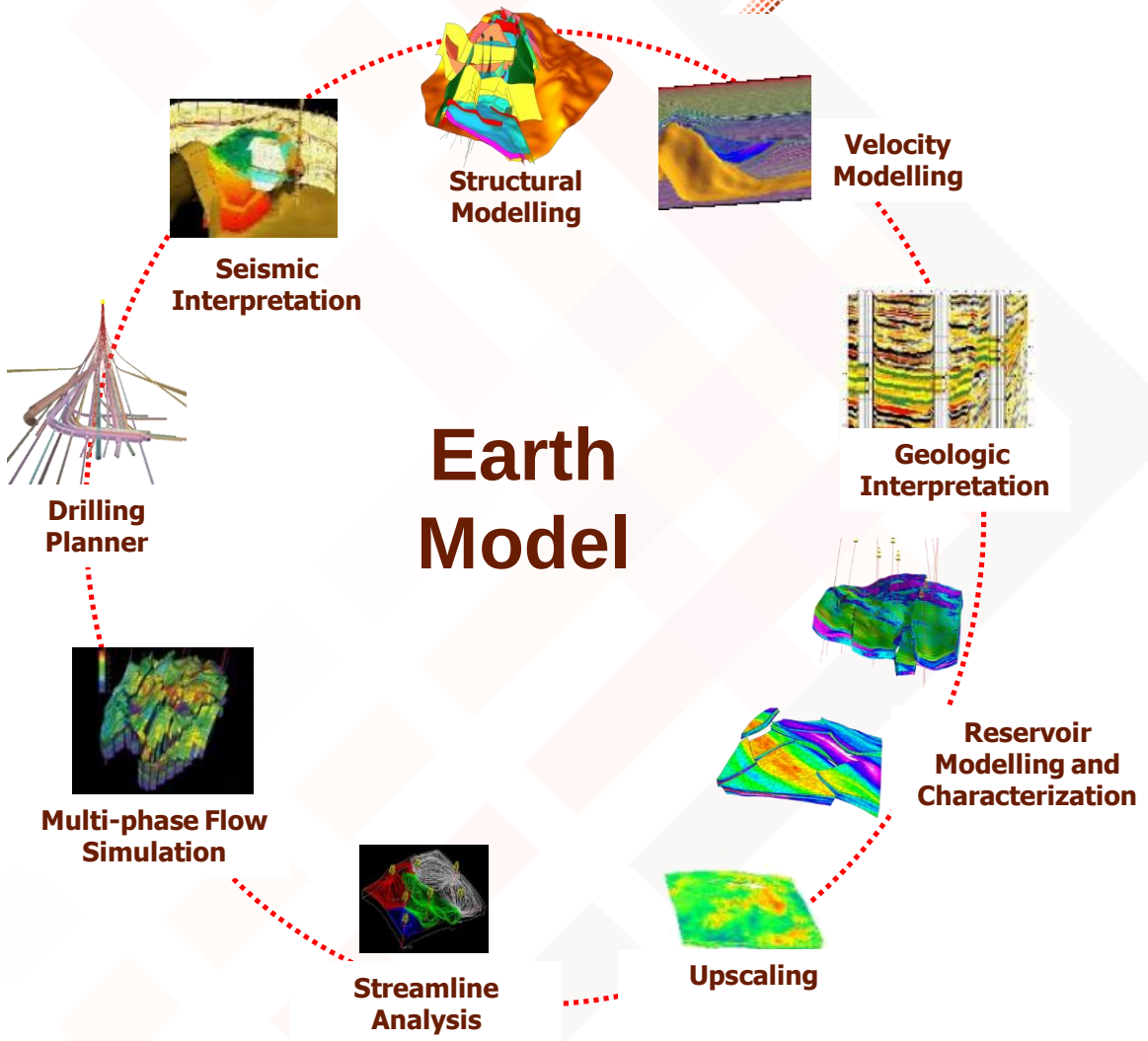
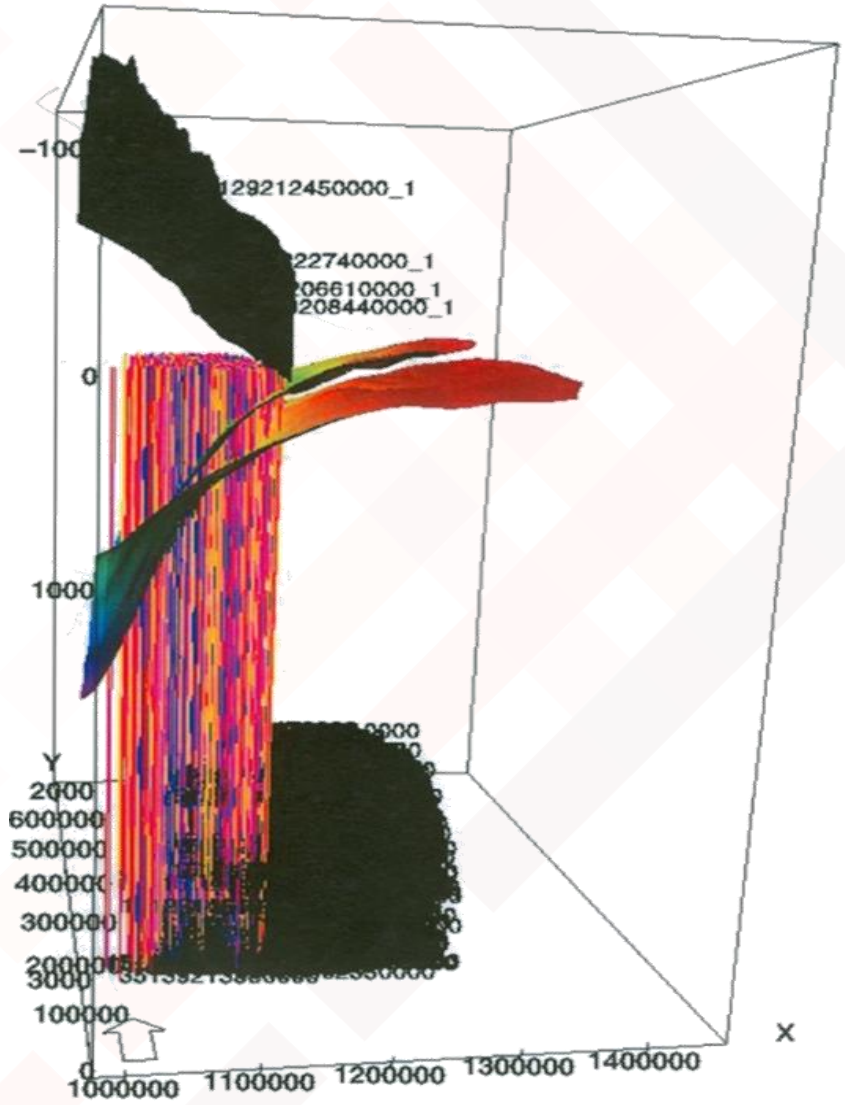
- Transfer of earth modeling data across multiple applications and vendors
  - Structural, rock & fluid properties, wells data, simulation grids, time-lapse data, etc..
  - Sharing earth model data across asset teams
  - Seismic to simulation workflows
  - File-format-neutral archival of earth model at key decision points



Before RESQML, ASCII files

- “Accidents happen”
- Horizon data was OK
- Damaged in transfer:
  - Horizon/well/grid positioning
  - Windows / Linux binary formats
  - Trajectories lost datum
    - 200+ onshore wells
  - 3D Grid depth/elevation inverted



RESQML v2.0.1 (not an acronym)

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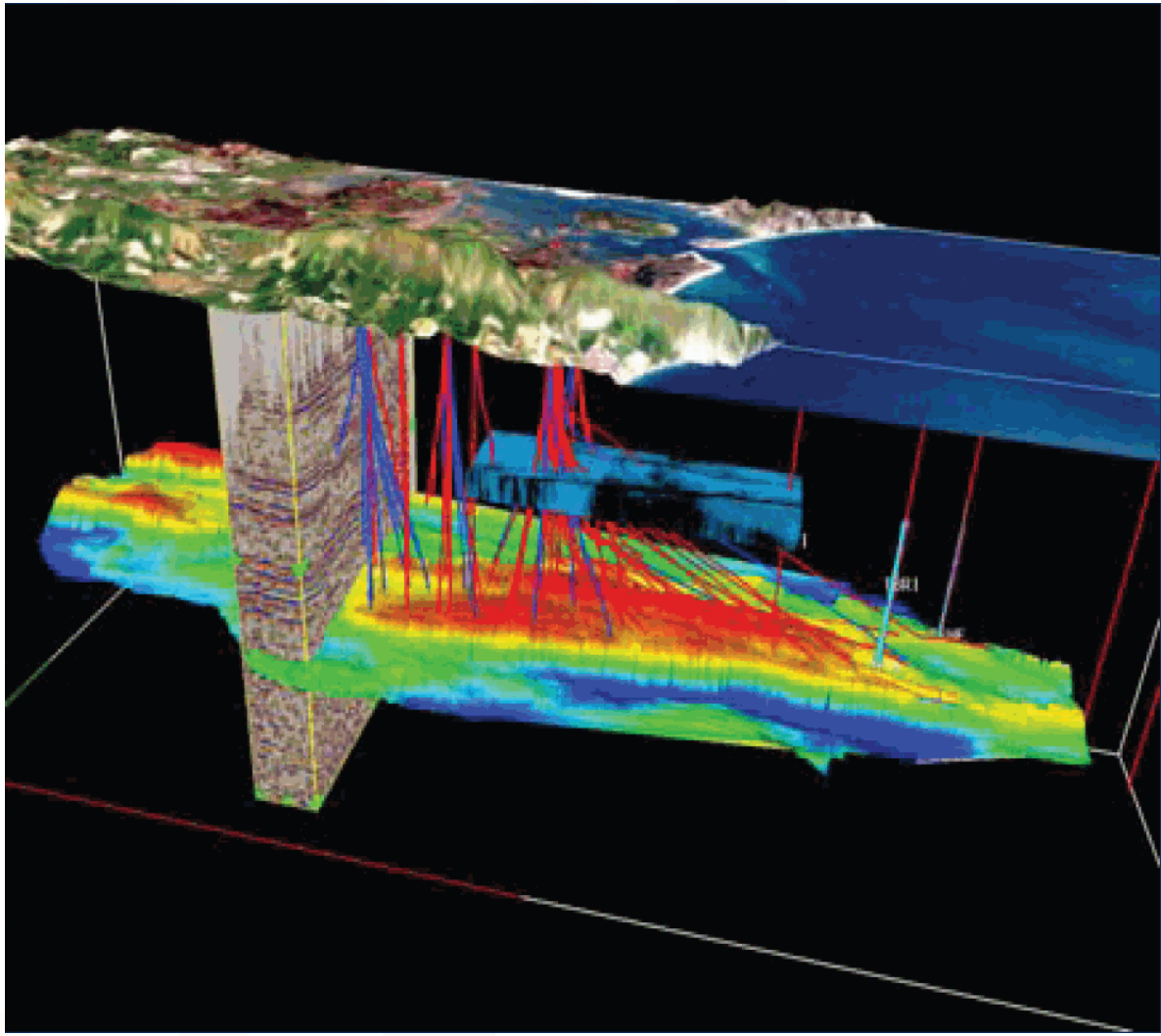
- Moves earth models
  - Each part individually
- From seismic to simulation
- In a vendor-neutral way
- Using modern technology
- Streamlines routine activities



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The Kepler Pilot -

A multi-client, multi-app, multi-cloud demonstration

Project background

- Multi-vendor pilot of RESQML to promote the value of standards in normal partner earth model data transfers
- Pilot participants:
  - Data and workflow: BP, Shell
  - Software systems: CMG, Dynamic Graphics, Emerson (Paradigm and Roxar), IFP/Beicip, Schlumberger and Energistics
  - Cloud resources: AWS, Google Cloud (Delfi*)
- Successful in demonstrating data exchange of real field data, across six different vendors using several applications

* Mark of Schlumberger

Data - Kepler Field, Na Kika, Gulf of Mexico

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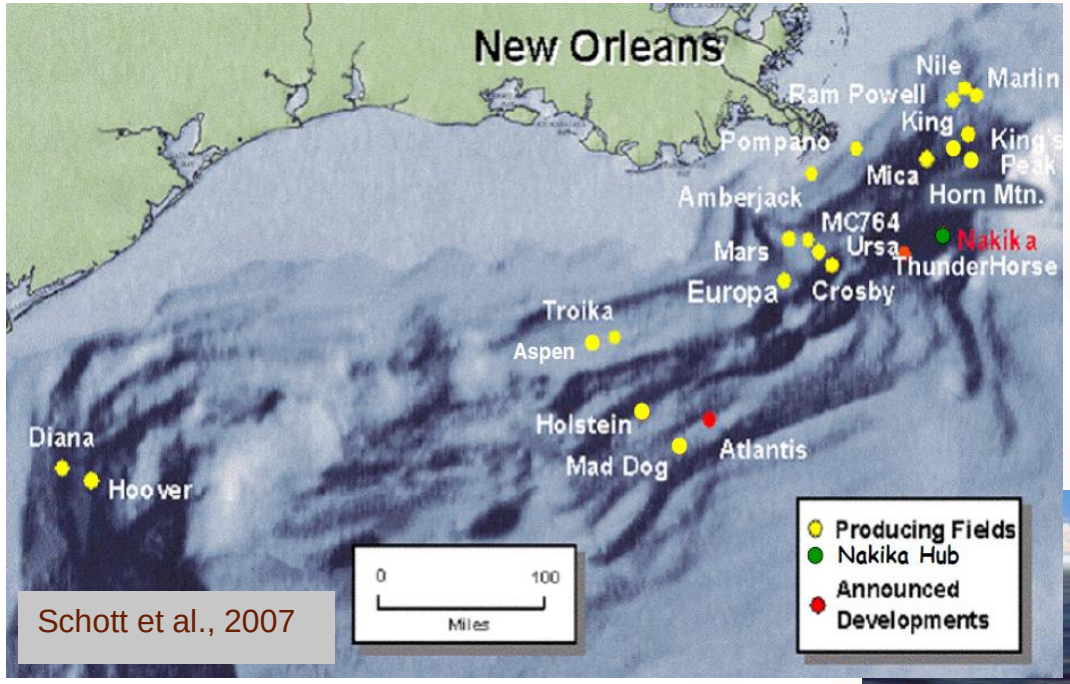
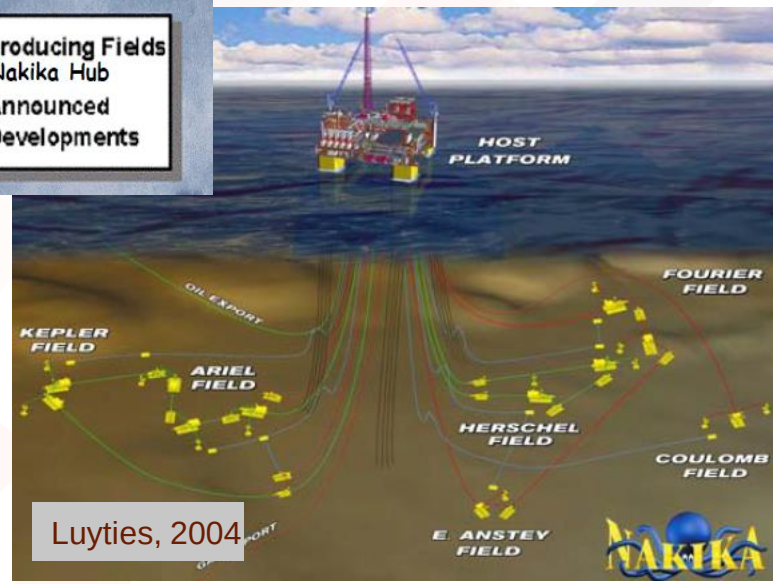
Data in project:

- Wells (trajectories, logs, picks)
- Faults
- Horizons
- Polygons
- 3D grid arrays (static)
- 3D grid arrays (dynamic time-stepped)



Schott et al., 2007



Luyties, 2004

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The Demo

Demo Scenario – Partner Data Exchange

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» The demo simulated a hypothetical workflow:

1. The operator sends a geological model to a partner
2. Who generates an alternative facies scenario
3. With an alternative porosity scenario
4. Which leads to an alternative pore volume estimate
5. Integrated back into the original model
6. Model used for reservoir simulation
7. Visualization of the time-stepped result

- The workflow:
  - Emerson - Roxar RMS: build a static model
  - Emerson - Paradigm SKUA: edit the static model
  - IFP Beicip OpenFlow: generate additional properties
  - Moved the files from AWS to Google (DELFI)
  - SIS Petrel: add other properties
  - Move files back to AWS
  - Emerson - Paradigm SKUA: map new properties to model
  - Computer Modelling Group: run IMEX simulation
  - Dynamic Graphics CoViz4D: view time-lapse results
- At each step RESQML was used to read and export the data

» It's important to note that each product can do much, but not all of this workflow

RESQML 2.0.1 Demonstration

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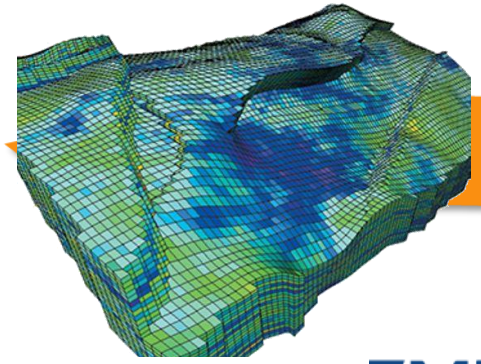
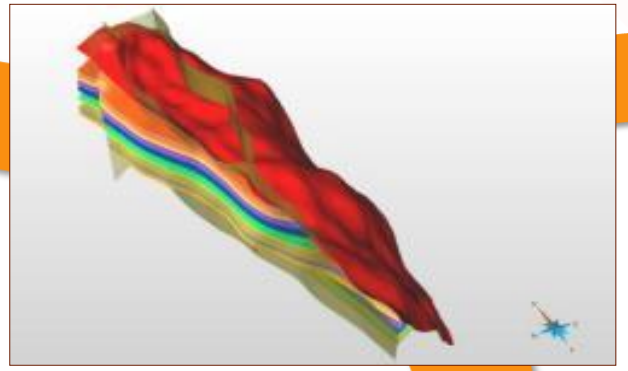
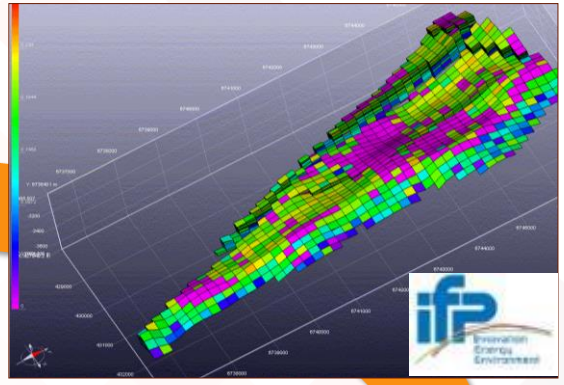


Grid creation
(Roxar - RMS)

EMERSON

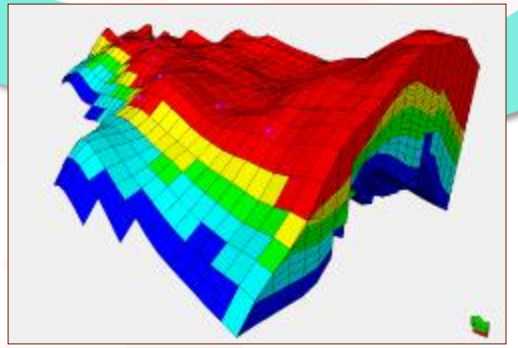


Facies modeling
(Paradigm - SKUA)

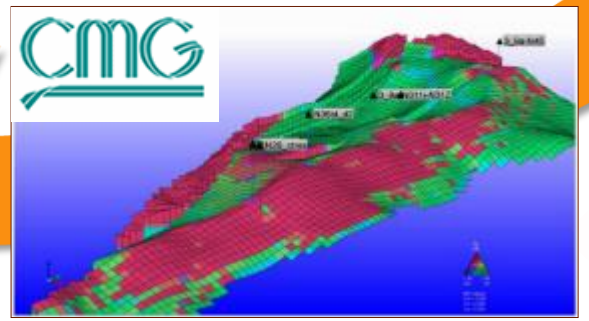


Fracture porosity
(OpenFlow)

Schlumberger



Property calculation
(Petrel on Delfi)

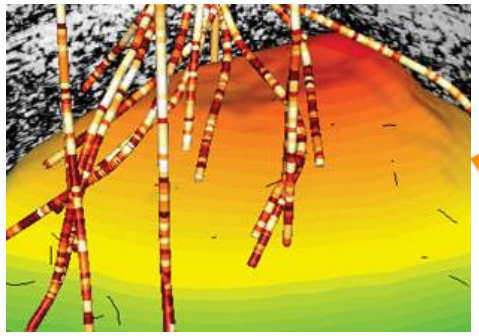


Reservoir simulation
(Builder, IMEX and Results)

CMG

amazon web services

DYNAMIC GRAPHICS, INC.



Results visualization
(CoViz 4D)

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Thank you, see me afterwards for any questions?

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