### Java based distributed processing on a Linux cluster and data visualization of a Metropolis algorithm for petroleum exploration

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- What facets of this strategy could cause it to succeed, what could cause it to fail and need to be changed?
- What part of this strategy could be applied to nuclear weapons design?
- What changes would need to be made to the strategy to apply it to nuclear weapons design?

### Outline



- Strategy
- Tactical plan
- Implementation
  - INTviewer
  - Configurable XML editor
  - DELIVERY (Metropolis model based seismic inversion)



- Java
  - 25% to 30% development time and cost
  - Easy to port to new hardware platforms
  - Extendable (10-20x more than C or Fortran)
  - Performance rivals that of C and Fortran
    - 400 Mflop/s performance per Linux processor (Colt dense matrix benchmark), 60 Mflop/s (Linpack benchmark)
    - CERN Colt library
    - Insignificant object oriented overhead, performance determined by FFT speed (same as optimized C and Fortran program)
- OpenSource maintenance
- Linux clusters with LSF
  - Low cost
  - Robust distribution



- Exploit superior knowhow
  - Increase the value of our assets
- Rapid technology development and onboarding
  - Maximize the rate of technology change



- 100% Java based development
- OpenSource maintenance whenever possible
- Seismic Unix backbone
- INTviewer
  - servlet-applet, multi-tier structure
  - Java, XML saveset of view
  - Multidimentional 2D viewer, 3D in future
- Linux cluster with LSF
- General XML editor for parameters and distribution
  - Behavoir determined by xsd
  - Servlet-applet infrastructure

## Software architecture supporting fast implementation





### Web page access to results – a picture that can be browsed





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### Synchronized viewer





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# XML distribution via the web interface with application specific Java help



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Java Applet Window

### XML explorer of parameter file





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### Distributed on Linux cluster using LSF



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# Metropolis based Baysian update is lynchpin of system





Use Metropolis method to get {m} distributed according to P(m|d), then < f > = S f(m)



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Models generated by a Metropolis algorithm that are consistent with measured seismic





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black trace = seismic data, red trace = synthetic seismic P50 model

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### Maps of statistical moments post inversion



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net sand (ft)





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