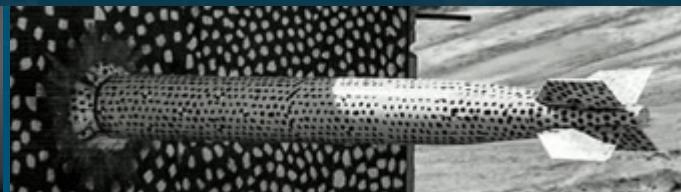
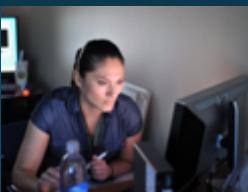




Sandia  
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# Computing Infrastructure



*PRESENTED BY*

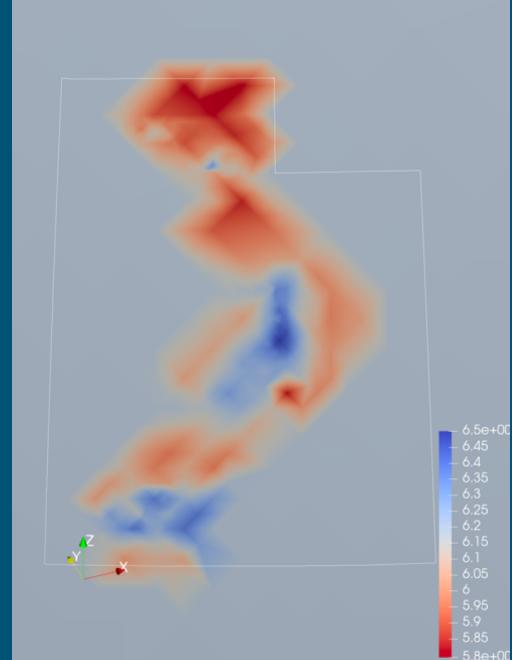
Patrick Hammond

# Salsa3D Refactor Overview

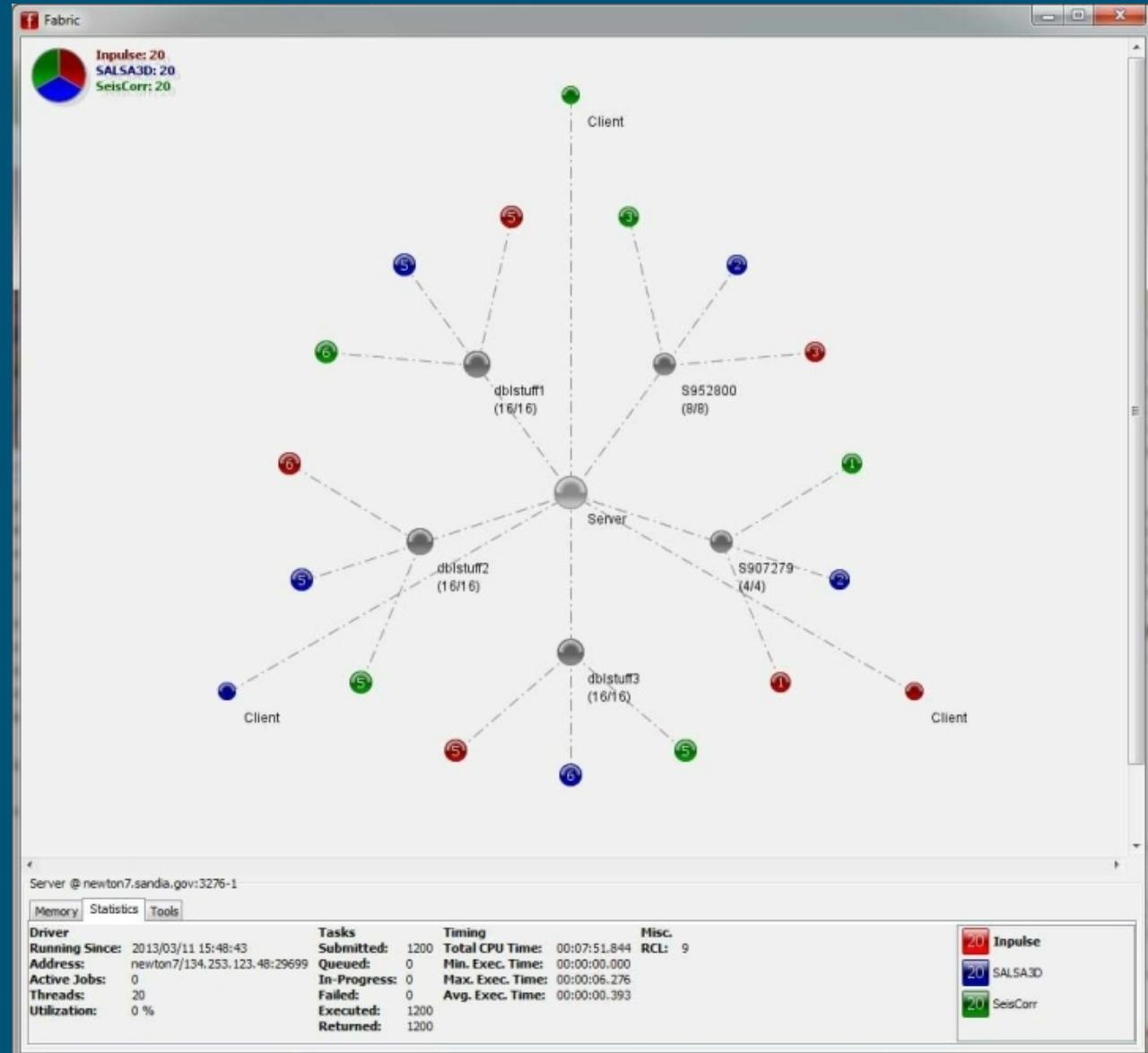


➤ We have further improved the Salsa3D Pipeline

- Upgraded runtime environment
- Improved code design and computational efficiency
- New use cases for pipeline



Velocity structure for Utah model at 10km depth

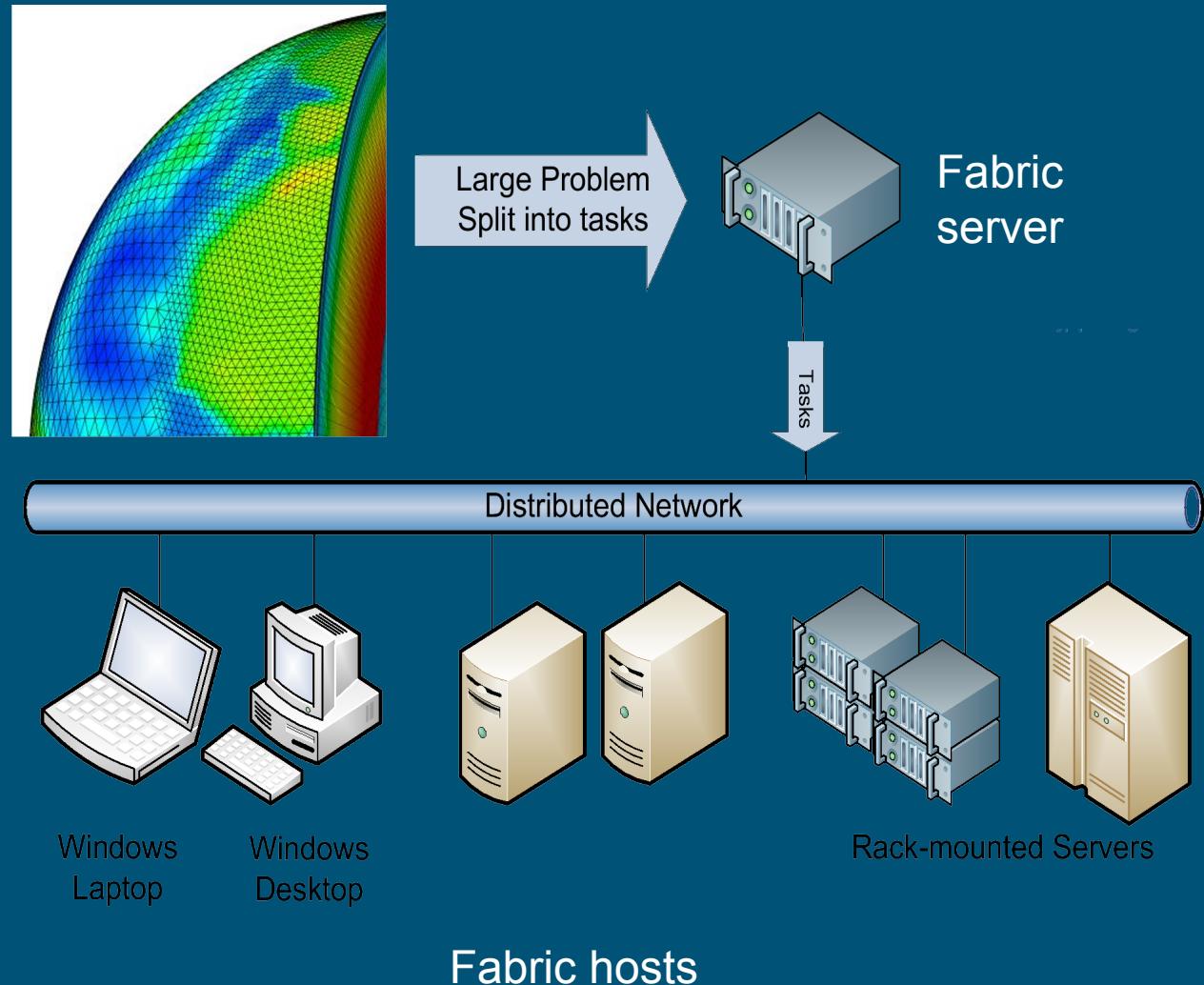


High-level view of an example distributed computing network using Fabric

# Parallel Computing Updates



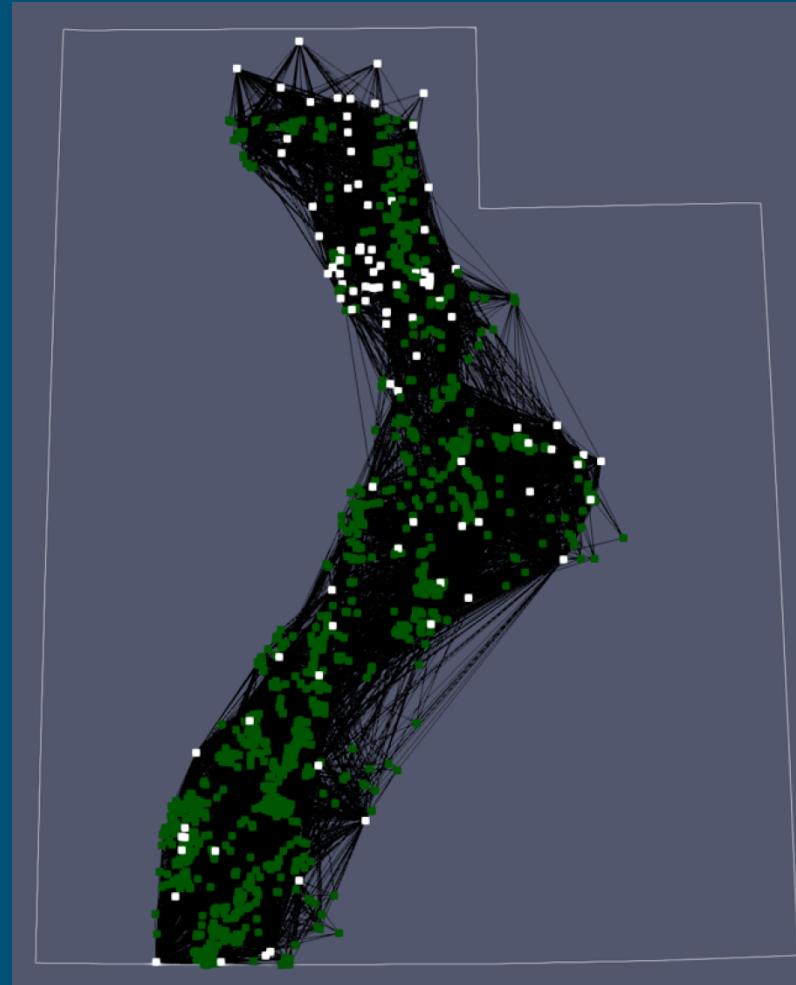
- Cloud-computing software but internal
- Updated Fabric to operate on JDK 10
- Optimized memory usage, able to access more threads
- Interface changes required  
Salsa3D updates



# Added Regional Capabilities to Salsa3D



- Needed to test refactors on a smaller dataset
- Added capabilities to restrict pipeline to a local region
- Constructed an experimental crustal model for Utah (more in a later presentation)
- Regional tomography is fast, may be used in regression testing

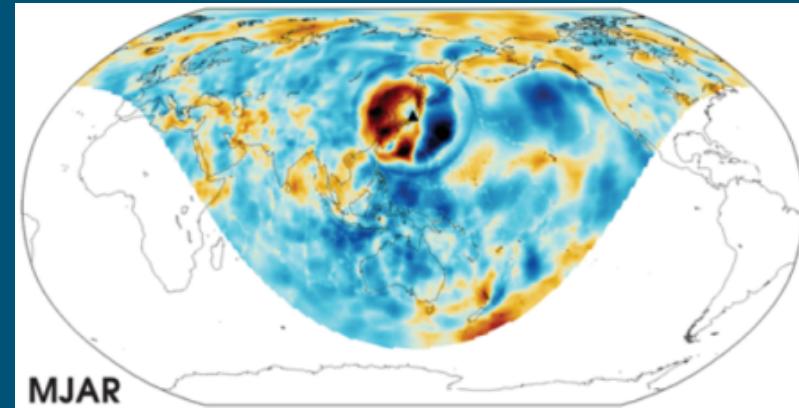


Event (green circles) and station (white squares) locations. Black lines represent the corresponding raypath coverage.

# PCalc Refactoring

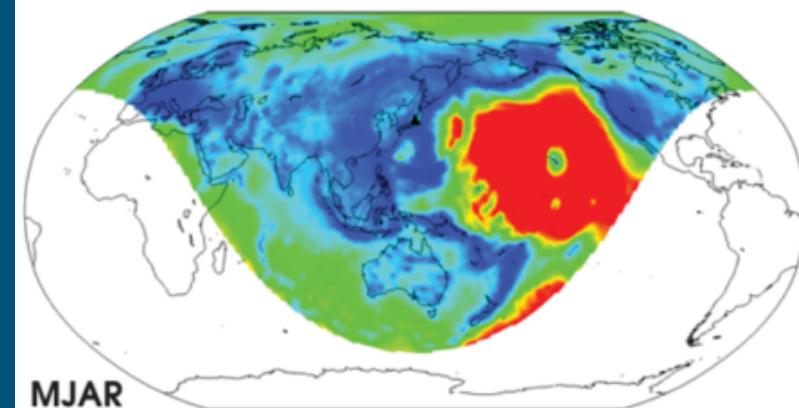


- Prediction Calculator (PCalc) supports raytracing for global models
- Shares features with travel-time correction software TT-Lookup
- Merged functionality to produce 3D lookup surfaces and ray-path uncertainty
- More efficient than TT-Lookup, uses Fabric for parallel computing



Travel-Time Change from ak135 (s)

-4 -3 -1.5 0 1.5 3 4



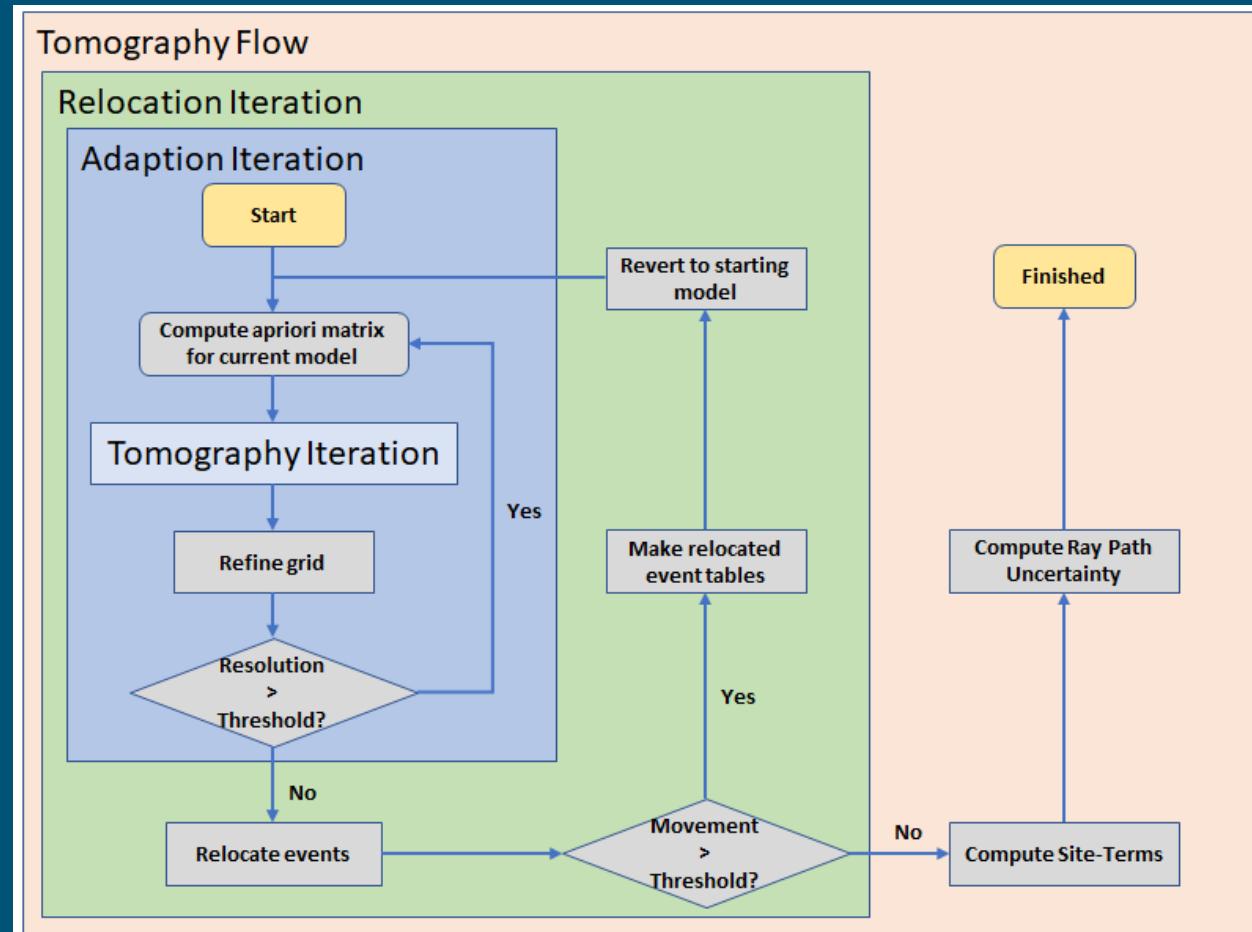
Travel-Time Uncertainty (s)

0.3 0.6 0.9 1.2 1.5 1.8 2.0

# Automated Pipeline



- Salsa3D pipeline has a logical flow
- Lots of knobs makes it prone to human error
- Simple to automate – reduces error and uses time more efficiently
- Platform agnostic



# Reduced Properties File



➤ Properties files are complex

➤ Most settings may be inferred through context

➤ Distills critical settings for experiments

➤ Allows fine-grained control where required

```
datestamp          = 210628
ioDirectory       = GMP
runsDirectory     = Runs
lsinvDirectory   = LSINV
propertiesDirectory = salsa3D_Properties
relocationIter    = 1
adaptionIter      = A
maxAdaptionIterations = 5

startingAPrioriMatrixPath = Data\\Models\\2016_11_29_covarianceConstraint_tomo_start_P_2016_07_18
startingPredictionModelFileName = Data\\Models\\prediction_start_P_2017_03_29.geotess
startingTomographyModelFileName = Data\\Models\\tomo_start_P_2017_03_29.geotess
polygonFileName    = Data\\Models\\polygon_global_mantle_only_new.dat
```

## Streamlined Pipeline Output



- New output scheme significantly reduces output size
- Supports collaboration with other labs
- Allows simplified inputs to PCalc and other software packages

## Summary and Future Work



- Upgraded Salsa3D and parallel computing software
- Generated a regional crustal velocity model for Utah
- Expanded raytracing software to generate correction surfaces and ray uncertainty
- Built proof of concept automated global tomography driver
- Will implement joint P and S-wave inversion in the future