Enabling in-situ visualisation of large-scale scientific simulations

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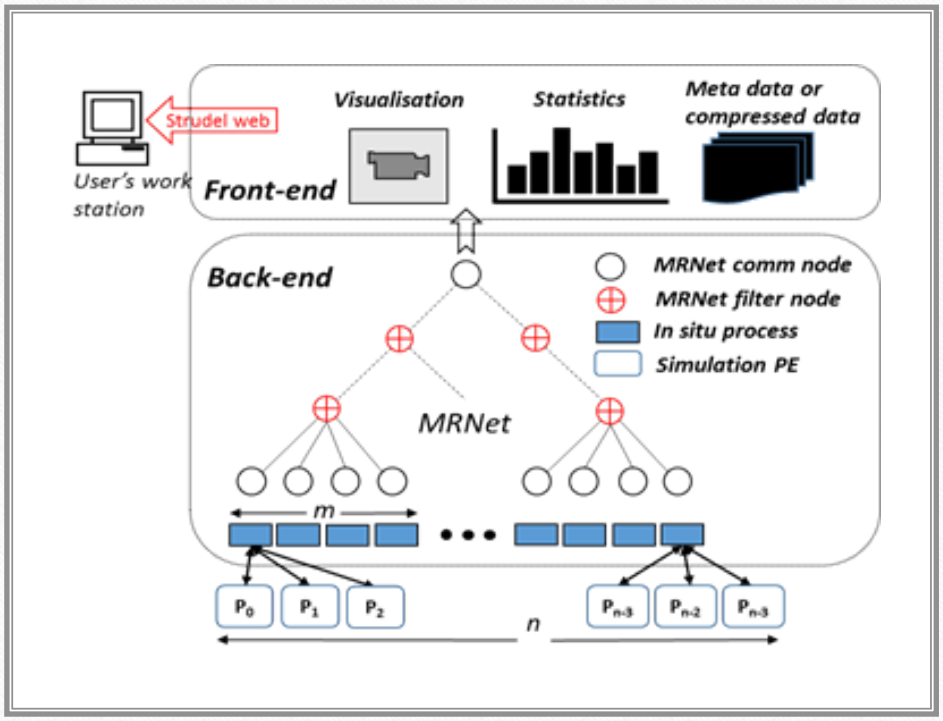
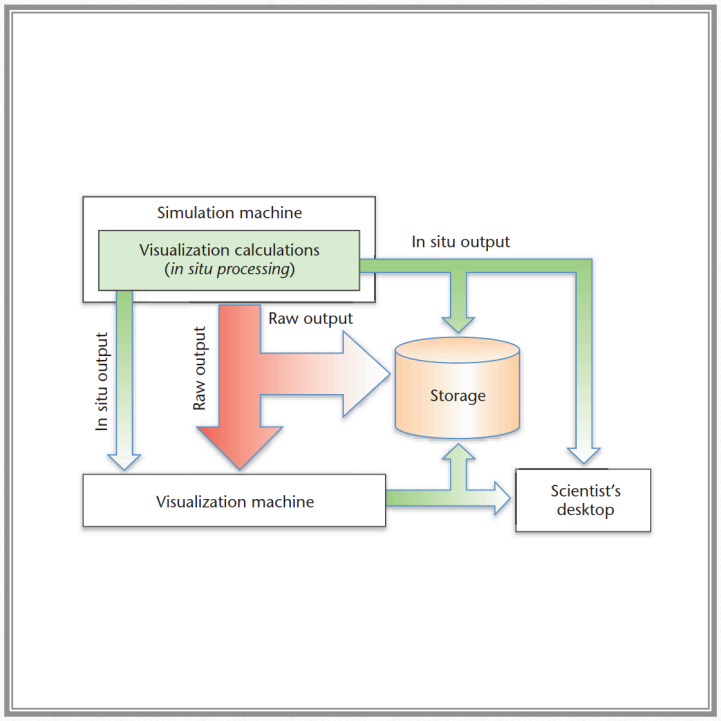
What is ISV and why is it important?

- Data visualised in real time
- Simulation of data in parallel
- No need to store data + overcomes data transfer issues
- Avoid data discarding
- Runtime monitoring
- Steering analysis
- Efficient computation of large scale projects (exascale and up)



Procedure + Guard

- General debugging commands
- Own unique commands
- Comparative debugger



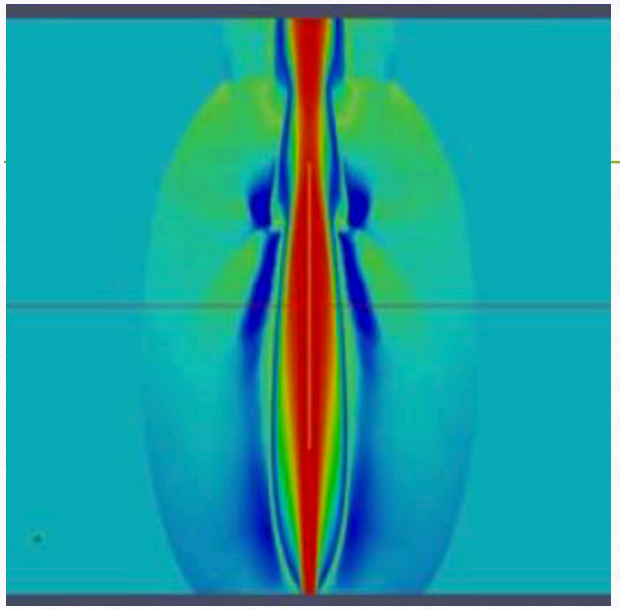
"Standard Method"

- Linear process
- Raw data → analysis→ store data → offline visualisation
- Can be saved for later use
- Lots of data generated → some needs to be discarded

Loosely Coupled ISV

- Data of simulation → network → visualiser
- Simulator and visualisation run on different resources
- Faults on one end will not cause affect the other
- Data access limited to network capabilities

Radiative shockwaves from Young Stellar Objects



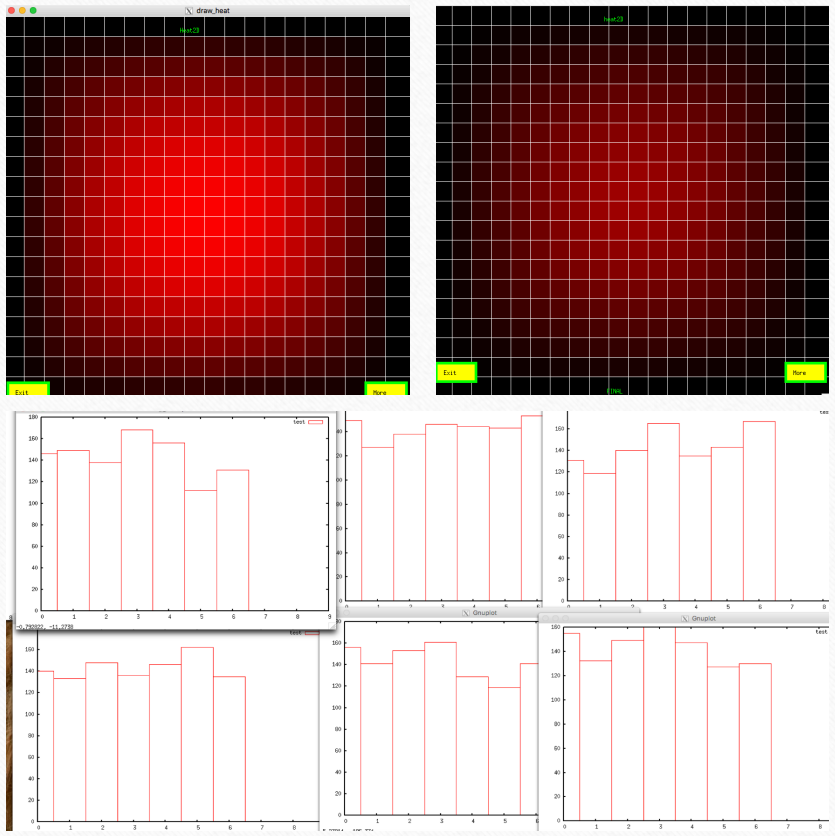
Childs, H., 2013., In Situ Processing, Lawrence Berkeley National Laboratory

Visualisation Tools - ParaView

- Controllable by python scripts
- Runs parallel on distributed and shared memory using MPI
- Dedicated visualisation library: ParaView Catalyst
- Integrated VTK to support 3D graphics and visualisation
- Suitable for small and large scale projects

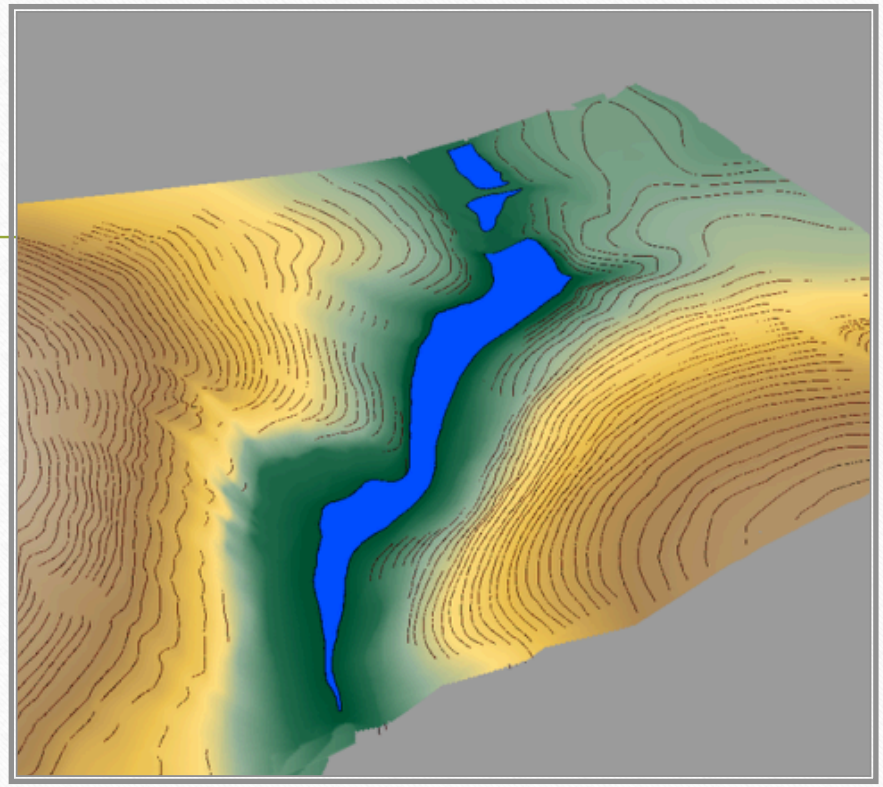
Heat equation

- Initially:
  - only two time steps = two visuals
- After:
  - 100 times steps = 100 visuals
- Concurrent visualisation of runtime states



Final Outcome

User + HPC + Guard = Visualisation of large amounts of data



http://www.50northspatial.org/terrain/