



ICT for Global Systems Science

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- HPC: parallel, scalable, high-level, visual, correct
- Big Data: trust?, privacy?, open?, understanding?
- Programs, Tests, and Proofs: find faults, avoid failures
- Narratives of Hope: conviction, communication, global participation

High Performance Computing (HPC)

Why: GSS needs

- large or accurate simulation (for informed speculation, possible futures),
- analysis (to understand the past and the present)

ICT:

- parallel computer architecture and parallel software
- distributed computing
- computing, modelling, analysis, programming “in the large”
- scalable models, programming tools, visualisation methods (for results and models)
- high-level modelling (DSL’s and functional programming)
- verification and validation to avoid “mindless computing”

Classical definition: 3Vs = high Volume, Velocity and Variety.

GSS adds: trust?, privacy?, open?, understanding?

ICT:

- sift through, analyse, visualise
- algorithms, statistics, optimization
- agent based modelling and synthetic populations

Programs, Tests, and Proofs

“Global systems, if they fail, may fail big”

ICT: we need a science of faults

- metrics (from harmless to fatal)
- semantics and coupling (to avoid cascading faults)
- formal languages to distinguish right from wrong
 - big data \Rightarrow big faults
 - HPC \Rightarrow many faults, fast
- specification, test and proof (of core components, functions)

Narratives of Hope

Most decisions are made with a large degree of uncertainty \Rightarrow we need conviction

Conviction can be build from narratives (based on scientific results)

Narratives for exploration and communication of complex issues.

ICT:

- visualisation tools
- computer linguistics, language technology (ontologies, knowledge representation, translation, summarization)
- be careful: narratives can hinder clear thinking (the world is flat, for example)
- internet (in a broad sense) for creating collective narratives: often global but also often narrow

