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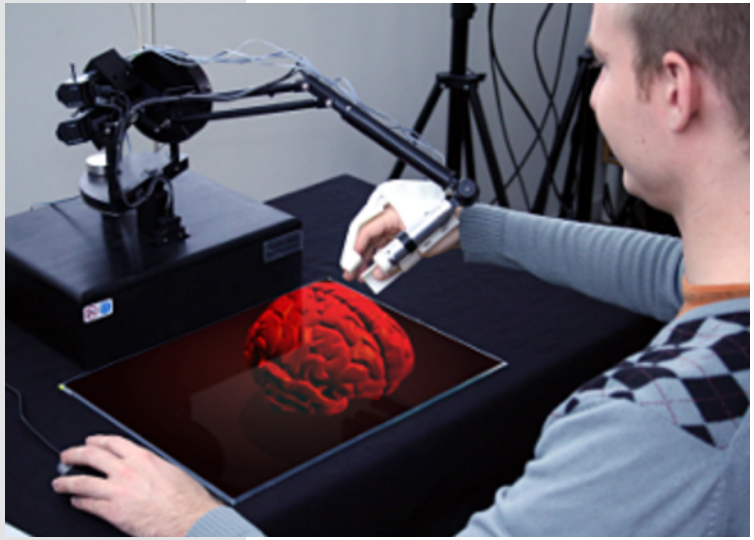
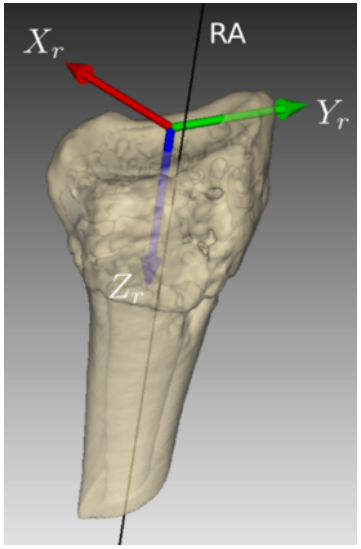
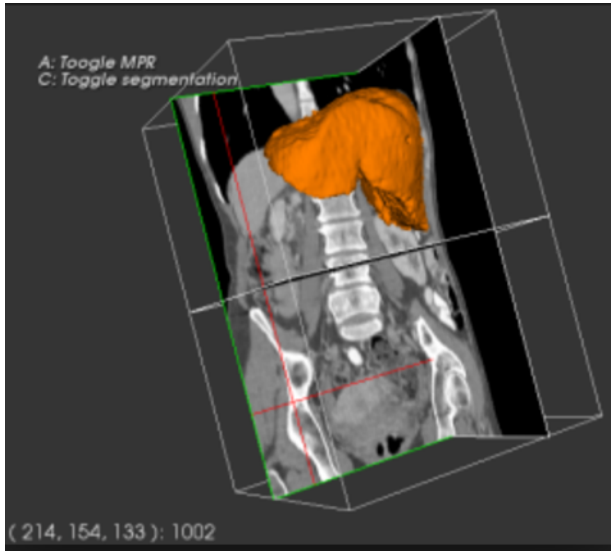
Department of Information Technology

Visual Information and Interaction

SeSE/SNIC-UPPMAX: Scientific Visualisation Workshop 2014







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Teachers

Anders Hast, Associate Professor
Computer Graphics/Visualisation

Stefan Seipel, Professor
Computer Graphics

Johan Nysjö, PhD student

Pontus Olsson, PhD Student

Fredrik Nysjö, PhD student

Schedule

Thursday 27 November
09:15-09:30, Introduction to to SeSE and Visualisation, Anders
09:30-10:15, Introduction to Python, Johan
10:15-10:45, Coffee break and presentation of participants and stereo examples, Fredrik
10:45-11:30, Introduction to VTK, Johan
11:30-11:45, Introduction to the Tutorial.
11:45-13:15, Lunch on your own
13:15-16:00, Exercises Python and VTK, with coffee break at 14:30
Friday 28 November
09:15-09:45, VTK and Paraview, Johan
09:45-10:15, Visualisation Techniques, Anders
10:15-11:00, Coffee break and live stereo presentations, Pontus
11:00-11:45, Introduction to stereo, Stefan
11:45-13:15, Lunch on your own
13:15-16:00, Exercises VTK with coffee break at 14:30

- Uppsala Multidisciplinary Center for Advanced Computational Science
- Is Uppsala University's resource of
  - High-performance computers
  - Know-how of high-performance computing
  - Storage
- The center was founded in 2003
- One of six centers of SNIC: Swedish National Infrastructure for Computing

Experts

- System Experts
  - Hardware, Compilers etc
- Application Experts
  - Algorithm and Code Development
  - Bioinformatics
  - Theoretical Material Physics
  - Scientific Visualisation

Computing Resources

- **Tintin** provides 2560 cores in the form of 160 dual CPU (AMD Opteron 6220) Supermicro nodes with 64 GByte RAM per node.

- Milou provides 3328 cores in the form of 208 dual CPU (Intel Xeon E5-2660) HP ProLiant SL230s Gen8 nodes with a default memory configuration of 128 Gigabyte.
  17 nodes are "medium nodes" with 256 Gigabytes of memory
  17 nodes are "fat nodes" with 512 Gigabytes of memory

  UPPMAX have a number of different storage systems offering a total of circa 7 PB of storage, roughly equal to store the DNA for half the worlds population.

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Informationsteknologi

Visualization at UPPMAX

- 3DIS4U
  - Three Dimensional Image Studio For Uppsala
  - A visualization lab with a stereoscopic display for true 3D visualizations
- Workshops
  - 19,20 March: Python and VTK for Visualization
  - Will also be held in the autumn
  - Python for HPC, to be held...
- Helping researchers in any area with their visualization problems

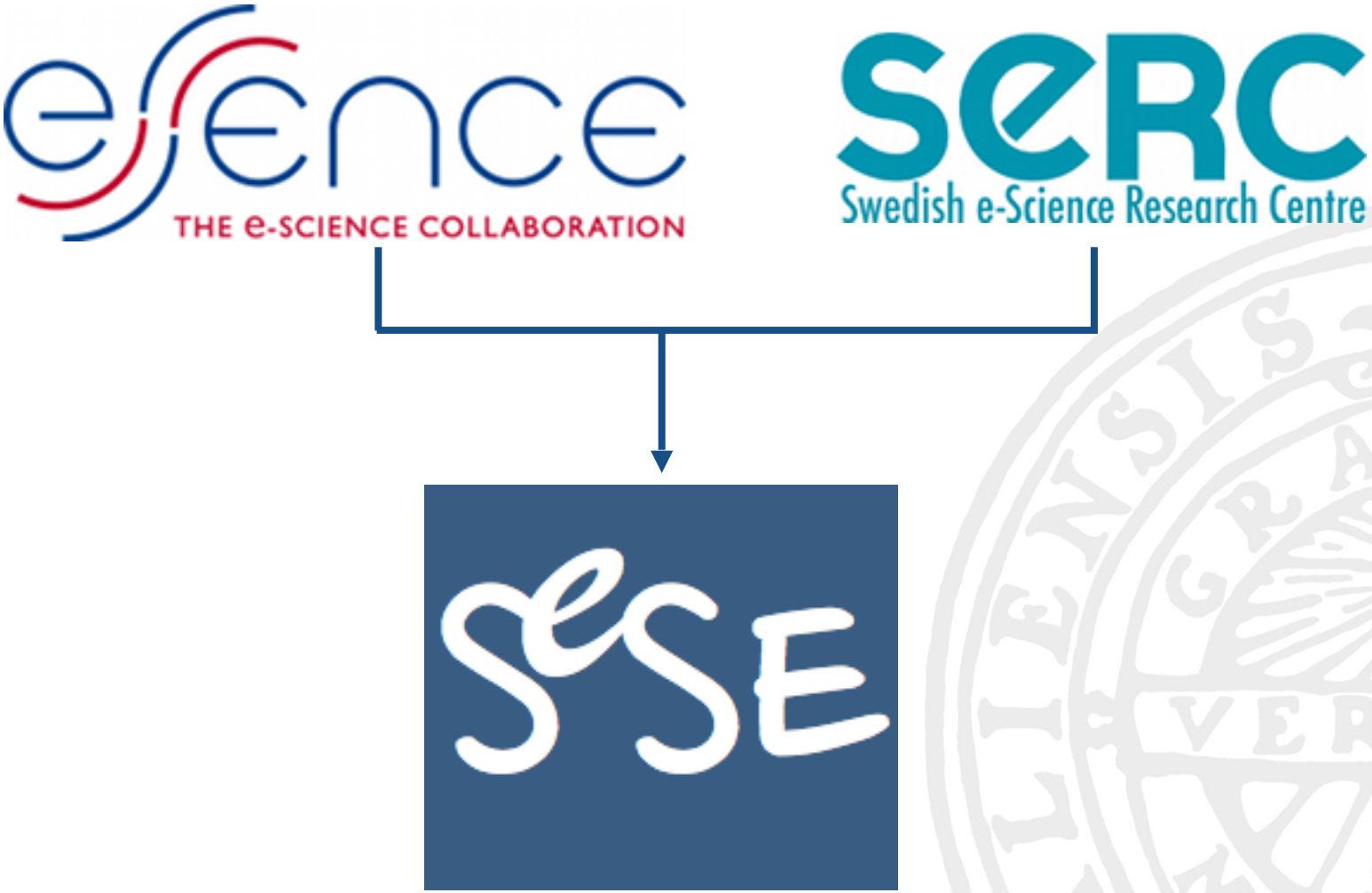
Two Research Schools become ONE

1996

2007

2013

Collaboration between Two Research Initiatives



LUNDS UNIVERSITET

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Umeå universitet

SeRC
Swedish e-Science Research Centre

People

Hans Karlsson

Michael Hanke

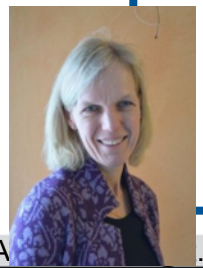
Pavlin Mitev

Anders Hast

Elias Jarlebring

Dan Henningsson

Ingela Nyström



Mission

To give basic training in fields where the use of e-Science is emerging

A meeting place for graduate students using e-Science tools and techniques

Identify areas where courses within e-Science are needed

What is eScience?

System Experts

HPC

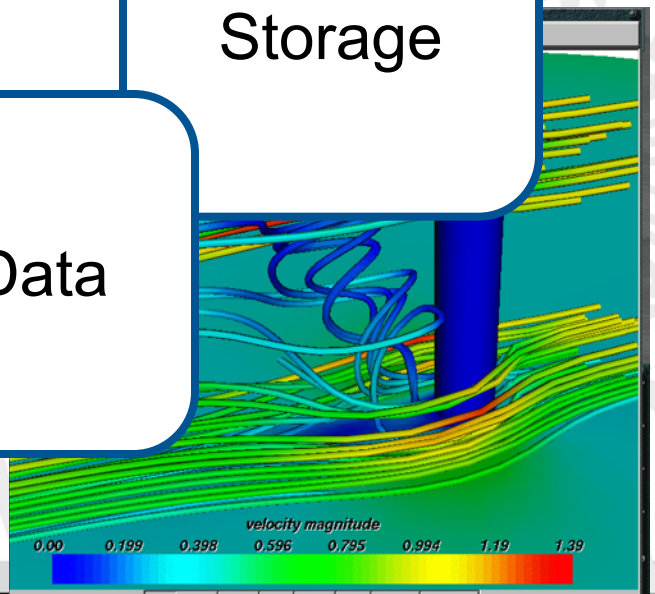
Application Experts

Storage

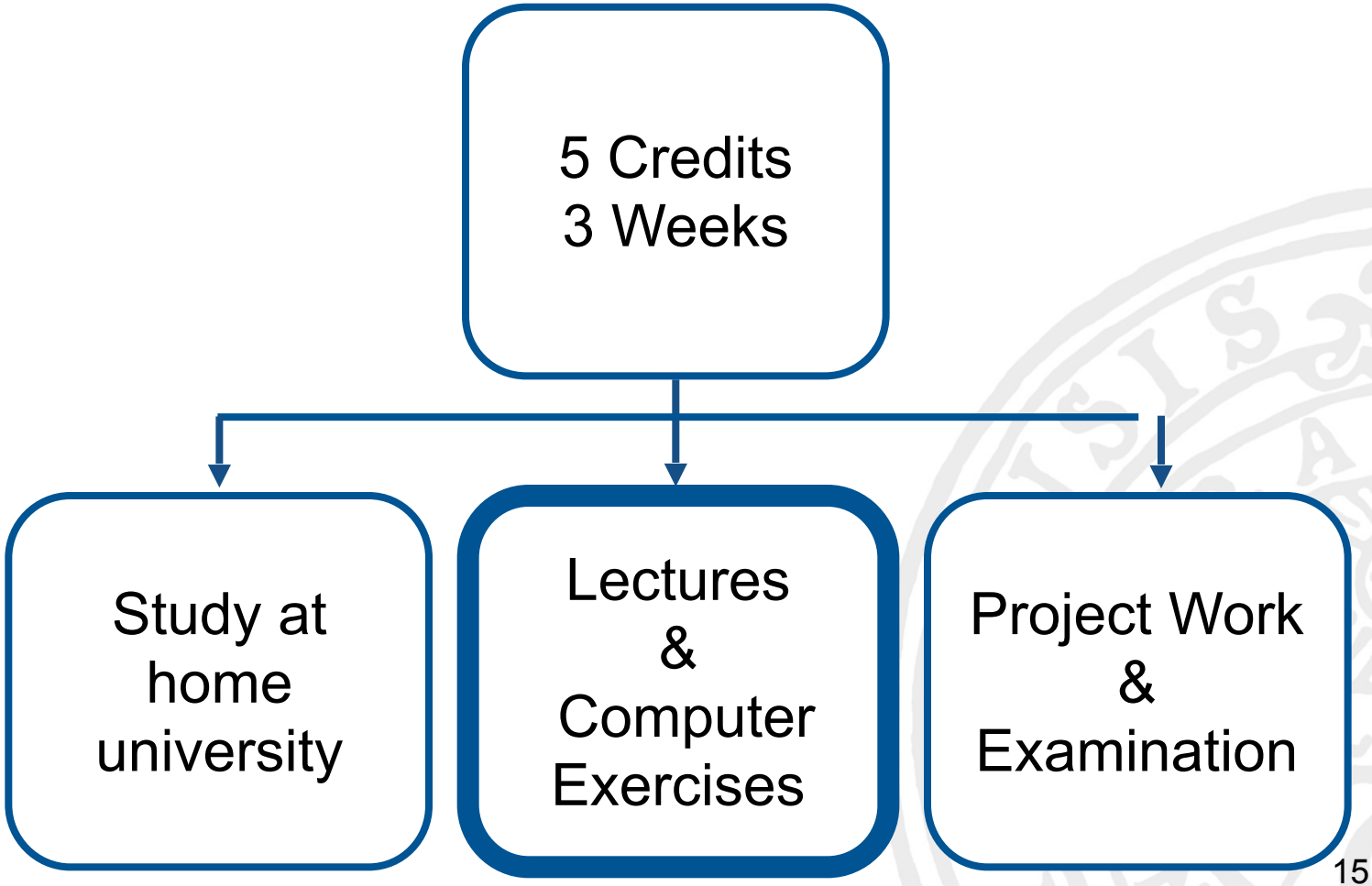
Applications

Big Data

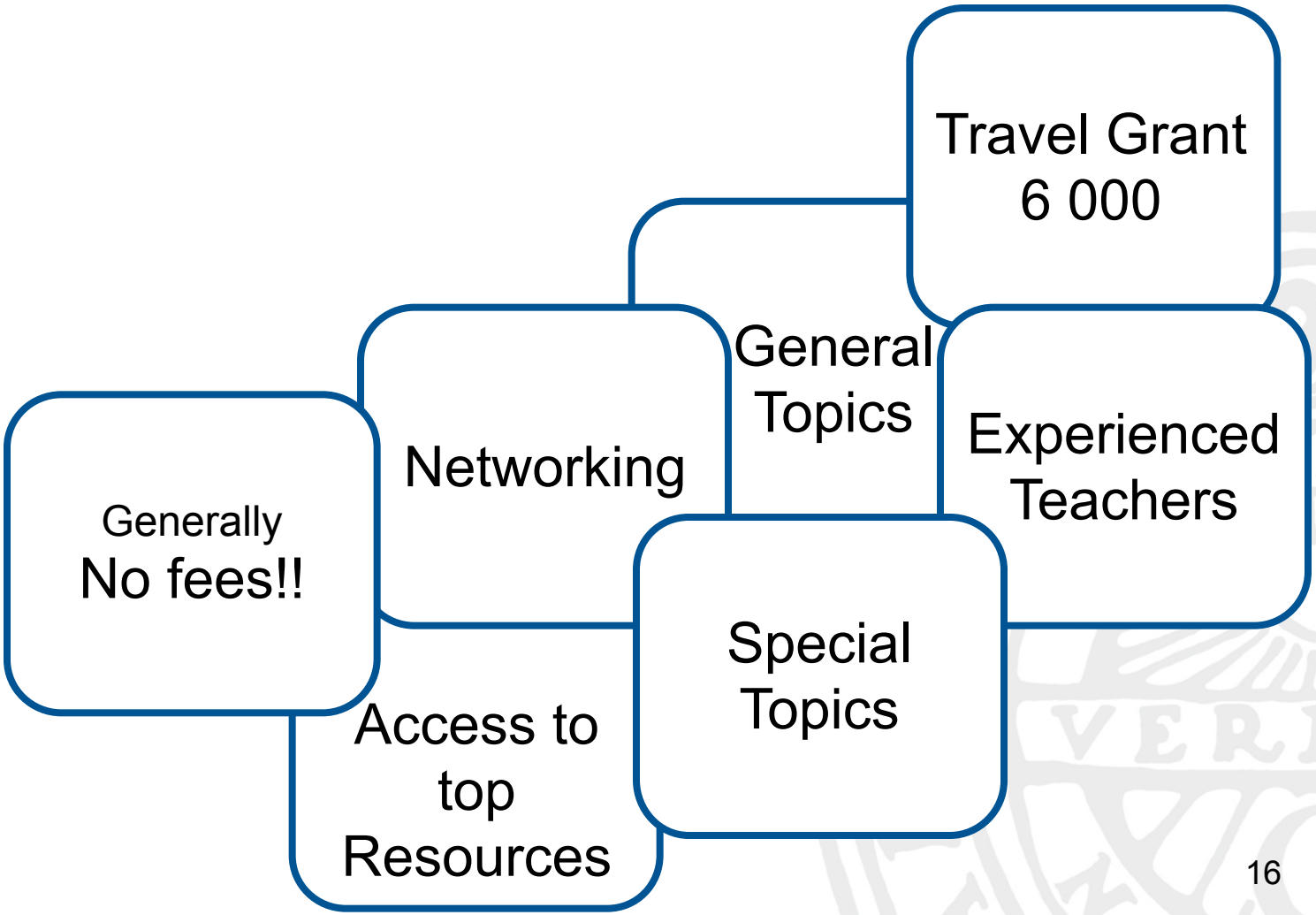
Visualisation



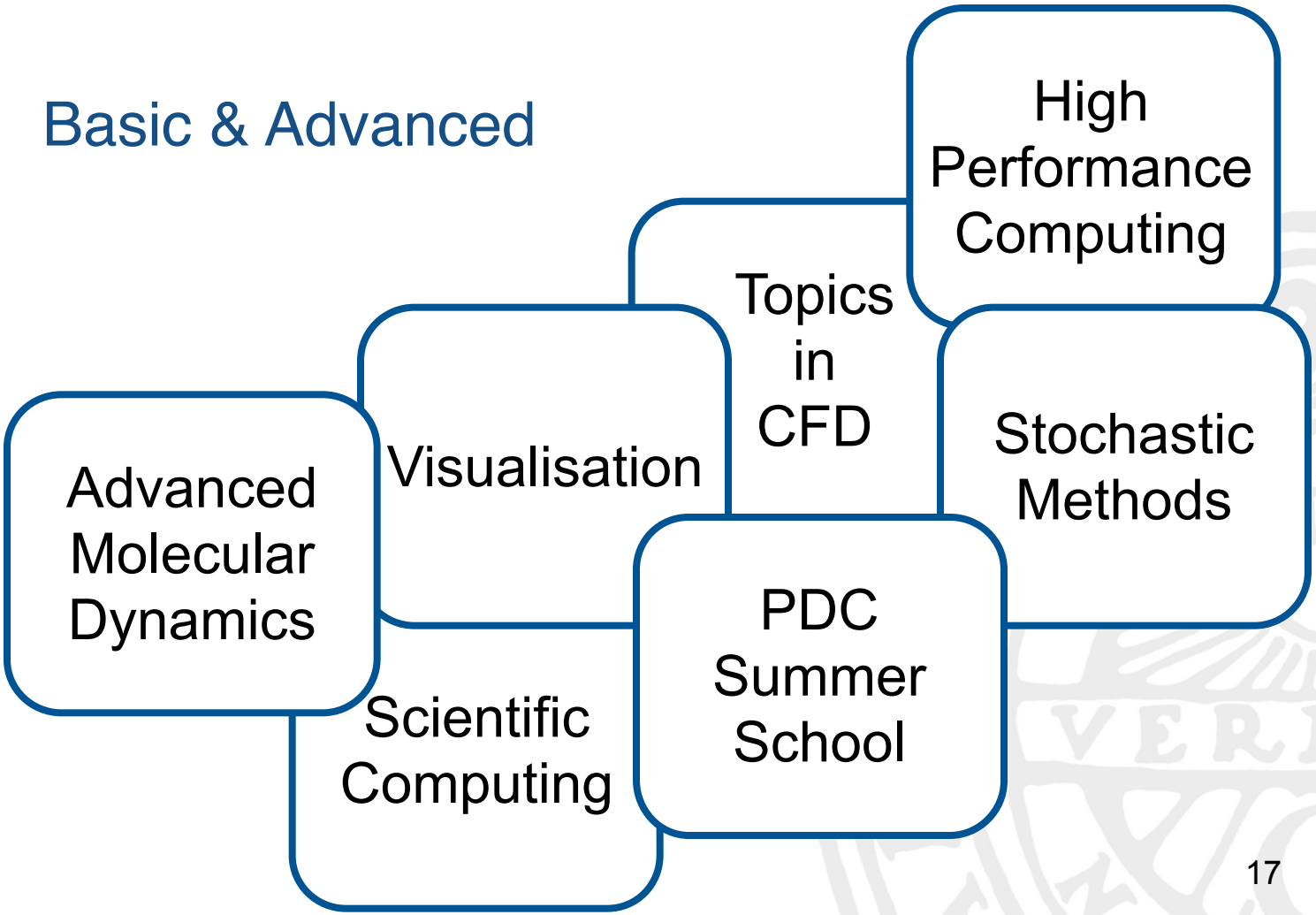
A Typical Course



Benefits for Graduate Students



Some Courses



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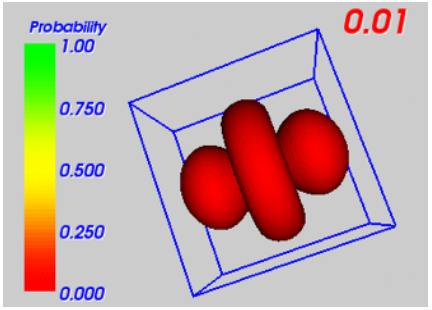
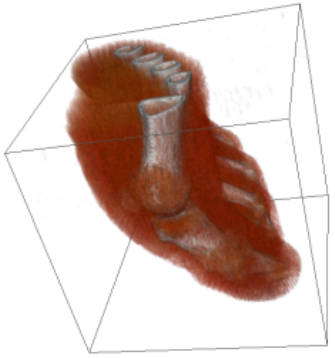
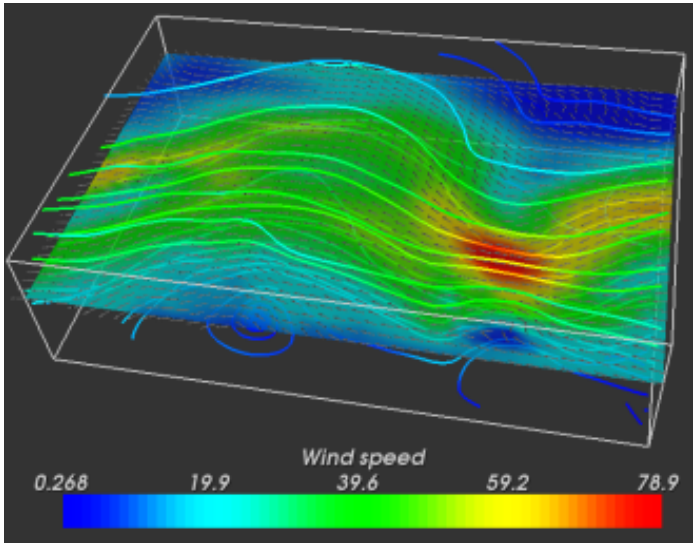
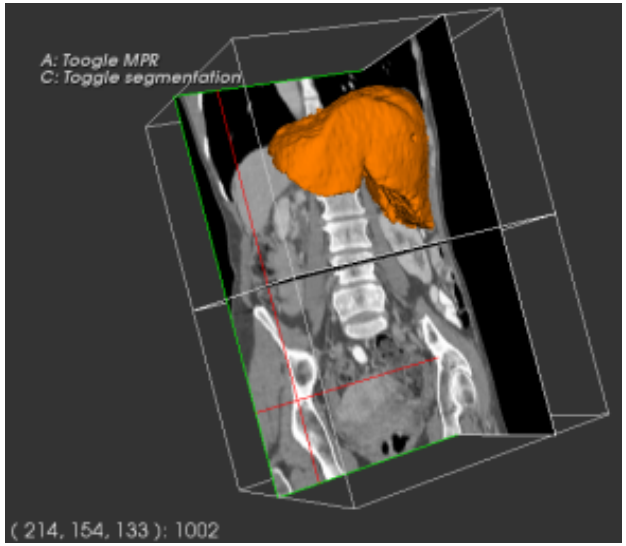
Practicals

Use the Tutorial!









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"A picture is worth a thousand words"

When **large** and **complex** data sets are resulting from experiments and computations, visualisation is a way to give deeper **insight** and **knowledge**.

A focus will be on using script programming: Python in combination with VTK (the Visualisation Toolkit).

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Graphs are one type of visualisation

Example:
Which Swedish town(s) have warmer than 20 C and less than 10 mm of rain?

	Temp.[C]	Rain [mm]
Gävle	18,5	3,1
Göteborg	24,1	11,7
Halmstad	19,8	10,3
Karlskrona	19,9	4,8
Kiruna	13,7	5,4
Lund	22,1	13,3
Malmö	23,2	14,8
Mora	17,8	6,1
Stockholm	19,9	6,3
Sundsvall	16,5	6,7
Umeå	14,3	13,2
Uppsala	19,4	9,7
Västerås	17,8	13,1
Örebro	21,1	7,6
Östersund	13,8	15,3

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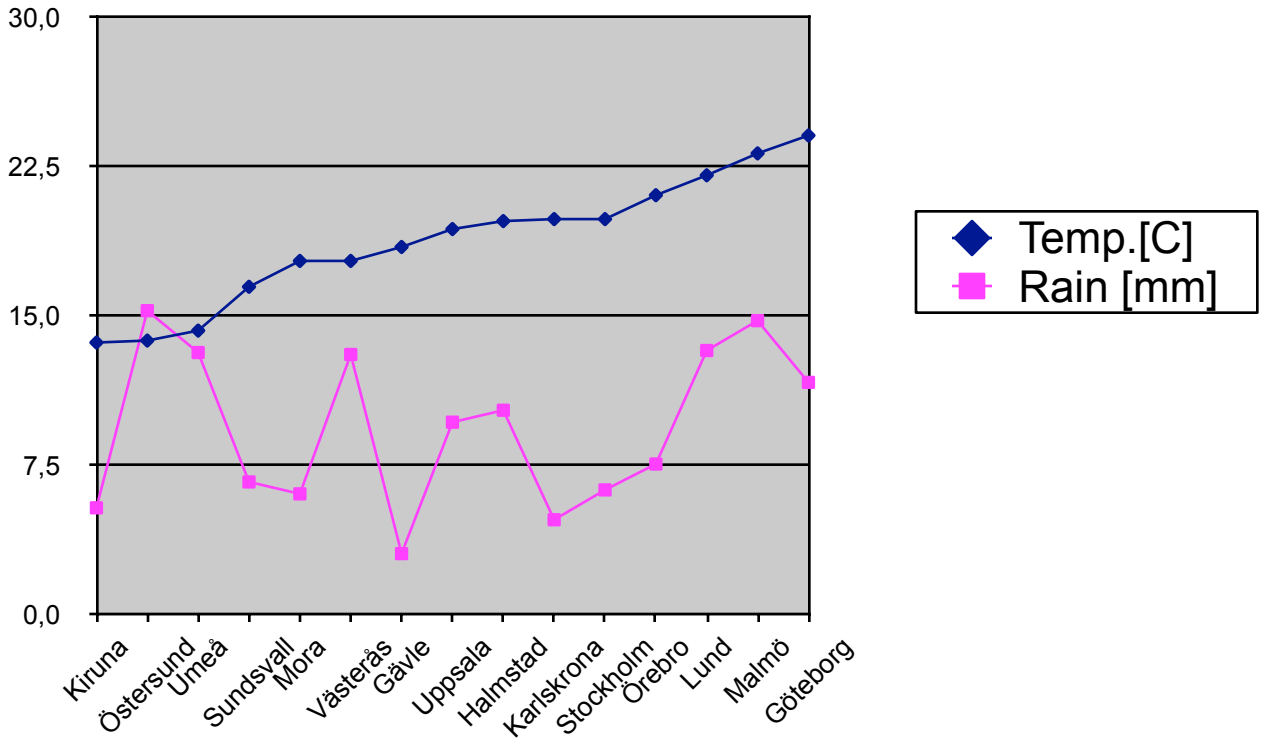

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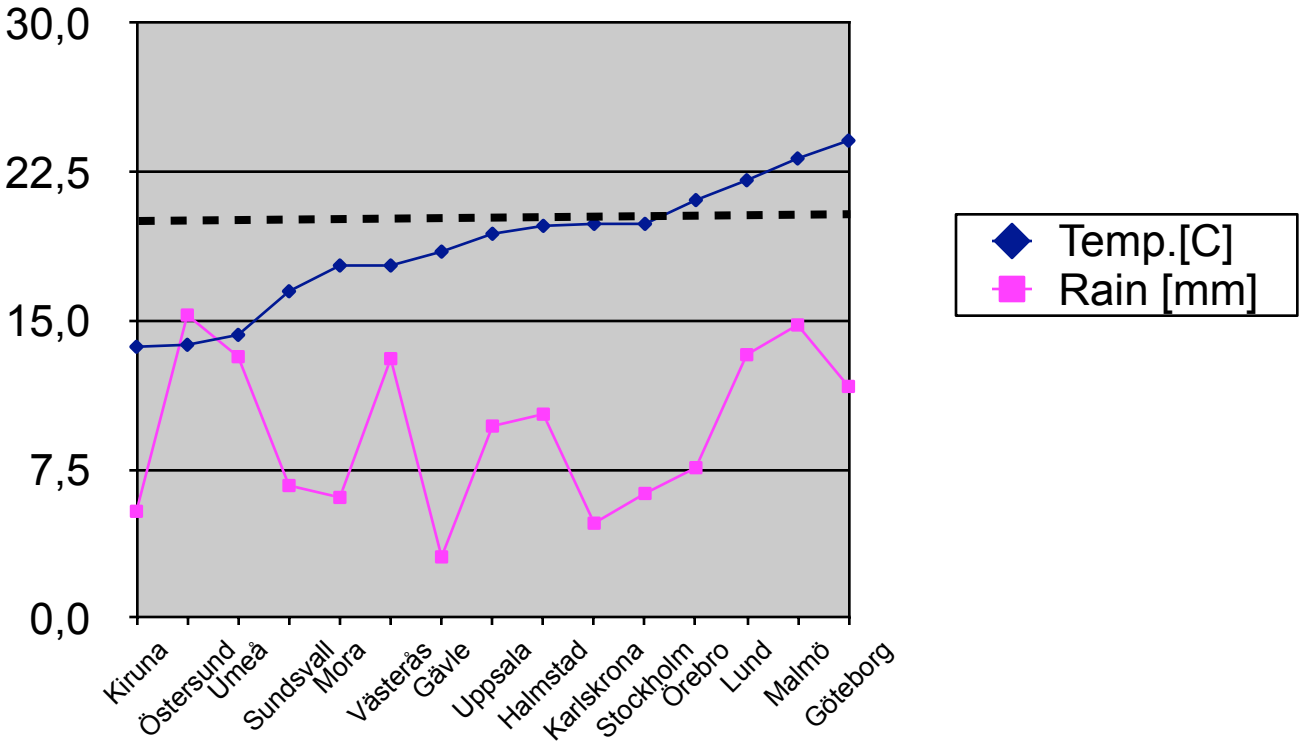

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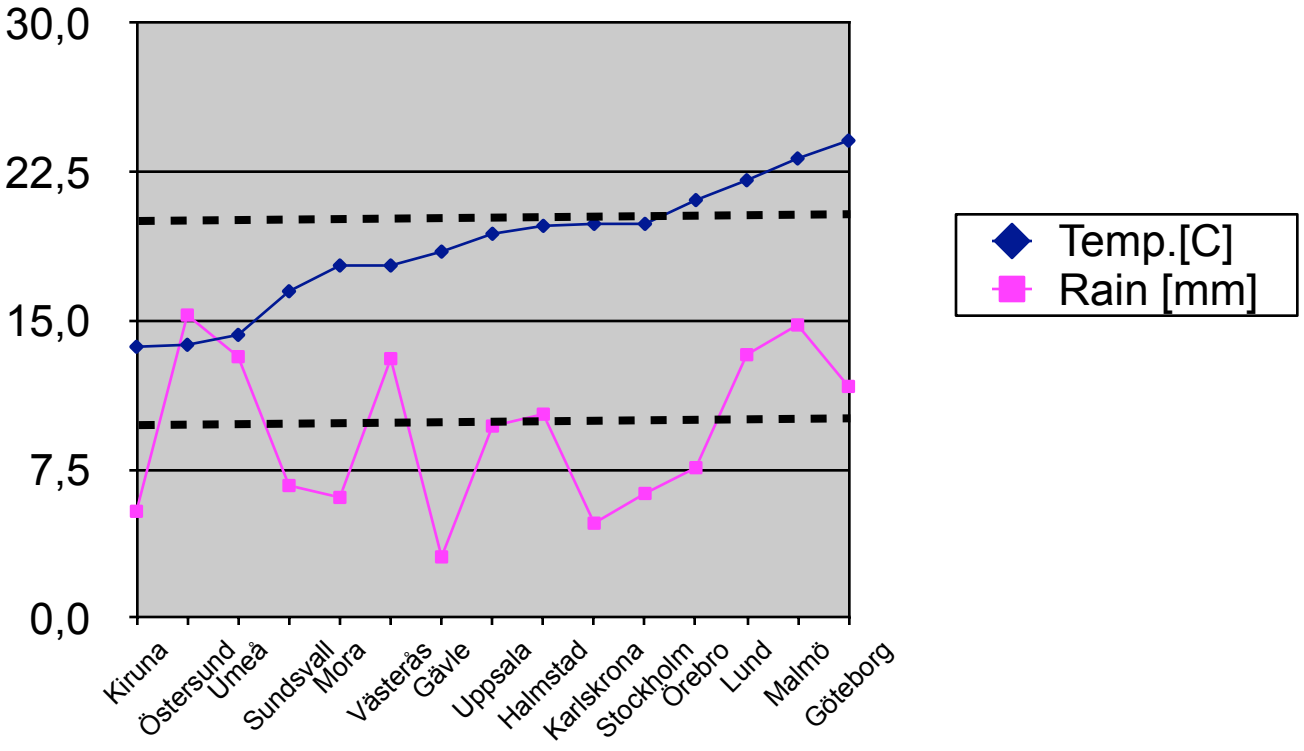

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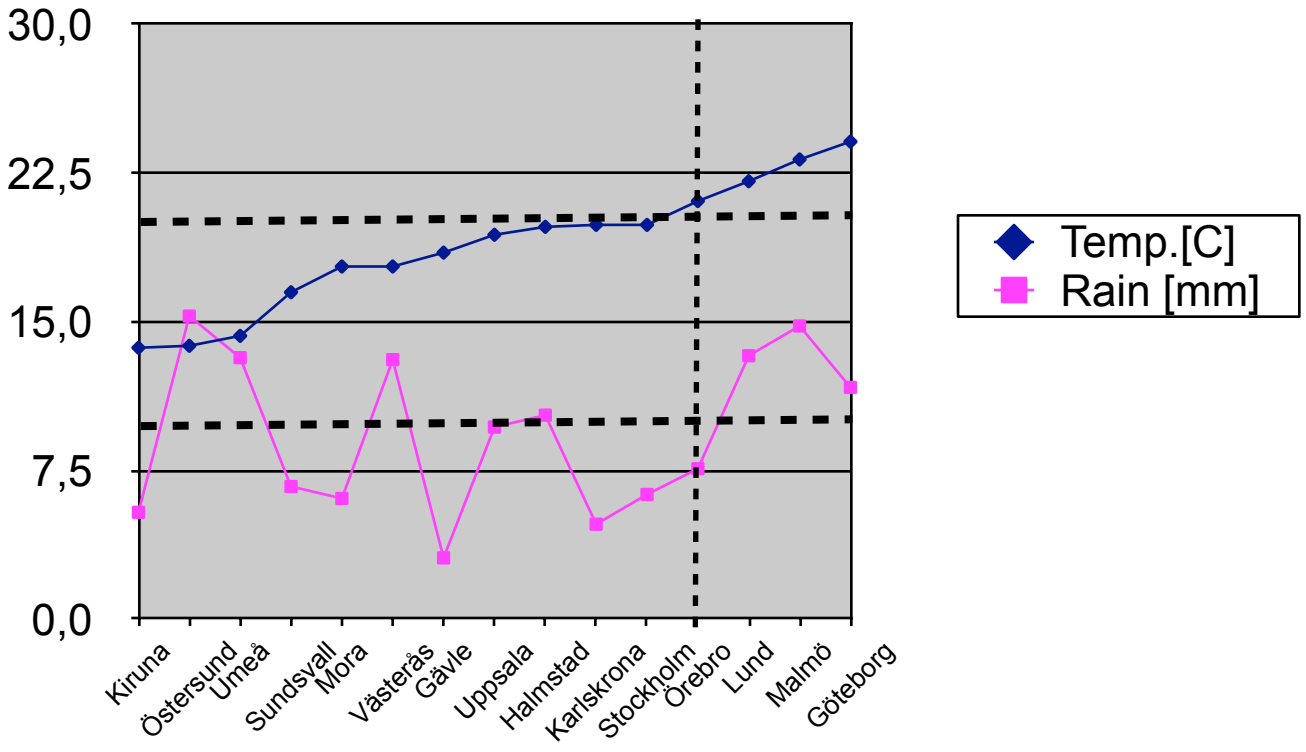

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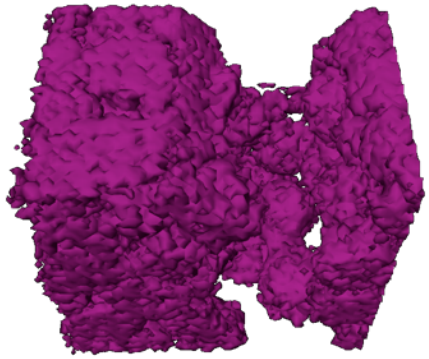
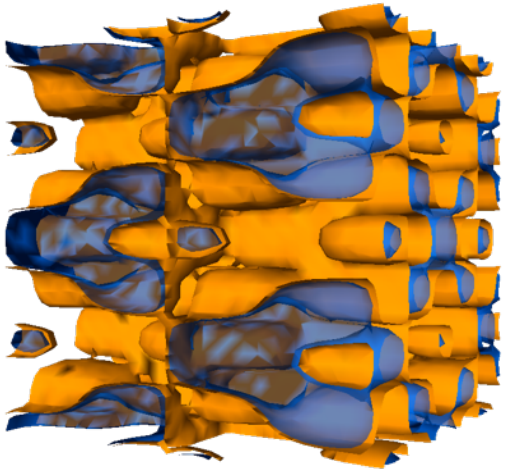
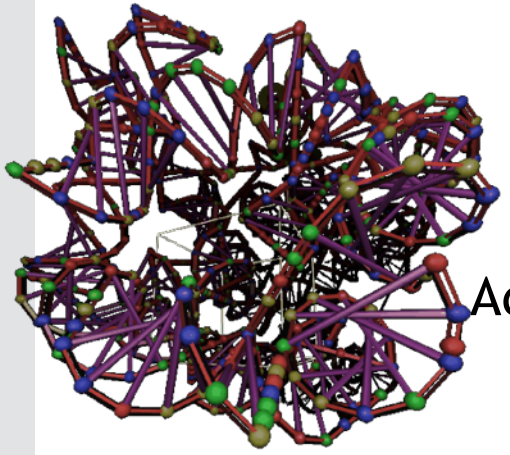
Some more sophisticated examples



Nuclear, Quantum, and Molecular Modeling



Structures, Fluids, and Fields



Advanced Imaging and Data Management

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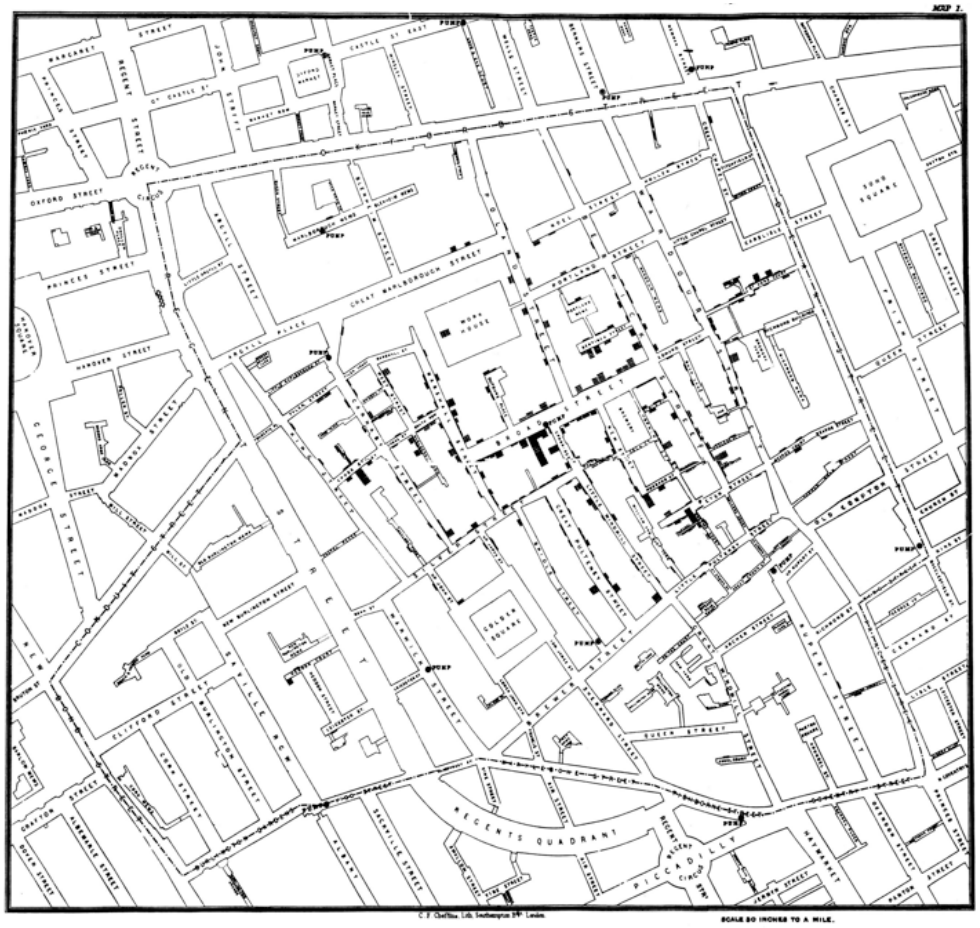
Some classical examples

Dr. John Snow; The Cholera Epidemic in London 1854



Used *spot-map* to graphically depict cholera incidents.

Spatial clusters *led to him to the hypothesis* that cholera was communicated through contaminated water.

Identification and removal of contaminated pump led to reduced mortality and partly confirmed his hypothesis.

Note: The visualisation did not prove anything. But was influential to the development of the novel hypothesis which was later proved true.

OXFORD STREET
REGENT CIRCUS
PRINCES STREET
HANOVER STREET
GEORGE STREET
MADDOX STREET
ARGYLL STREET
ARGYLL PLACE
GREAT MARLBOROUGH STREET
WORK HOUSE
BROAD STREET
PORTLAND STREET
NOEL STREET
CARLISLE STREET
SOHO SQUARE
FRITH STREET
QUEEN STREET
OLD COMPTON STREET
GREAT PULTENEY STREET
GOLDEN SQUARE
BREWER STREET
RUPERT STREET
CLIFFORD STREET
SAVILLE ROW
OLD BURLINGTON STREET
NEW BURLINGTON STREET
PUMP

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Florence Nightingale

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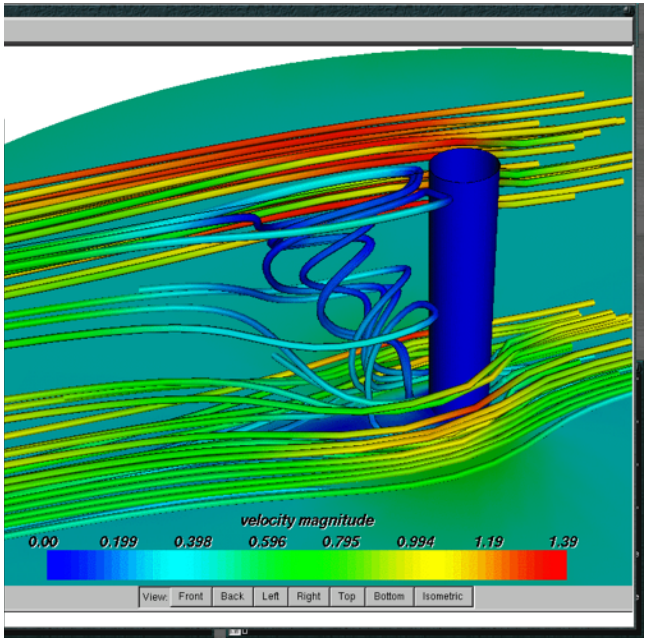
Scientific Visualisation

- Scientific visualisation is the process of ***exploring***, transforming, and viewing data as images
- Often observed (measured) or simulated data
- Visualisation is often interactive



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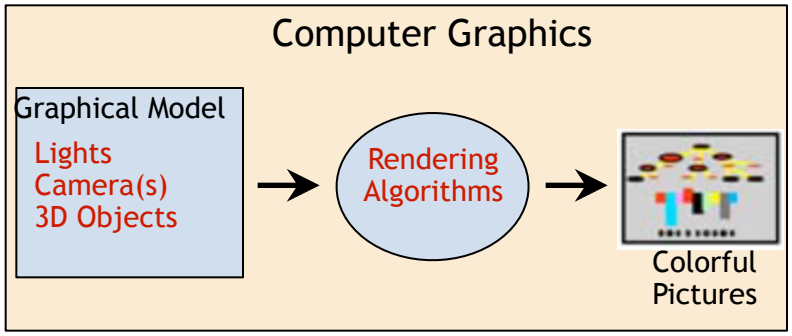
Computer Graphics & Visualisation

Graphical rendering is **one** pillar of

Scientific/Information Visualisation



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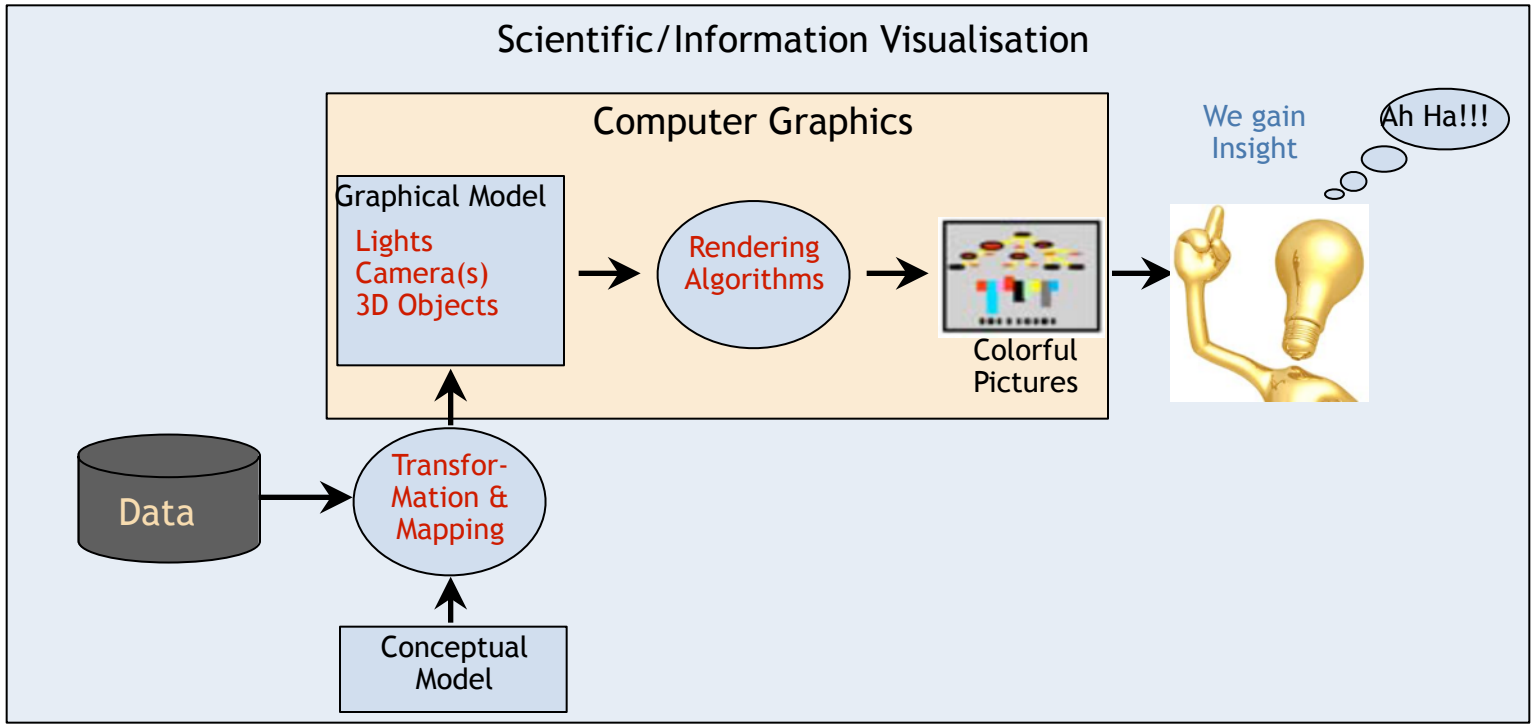

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Conclusion

Visualisation helps to *understand* the data and get *insight* on the data

It also is a *research tool* to discover the data and find “hidden truths” in the data

Visualisation use Computer Graphics