UNIVERSITY OF AMSTERDAM

Informatics for a complex world

A research focus of the Informatics Institute

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A complex world

- Large numbers of interacting components: agents, cells, sensors, data, processors, machines, users, …
- Emergent behavior: self-organizing and difficult to anticipate from the knowledge of the individual components' behavior
- Collective intelligence: shared or group intelligence that results from the collaboration and competition of many individuals

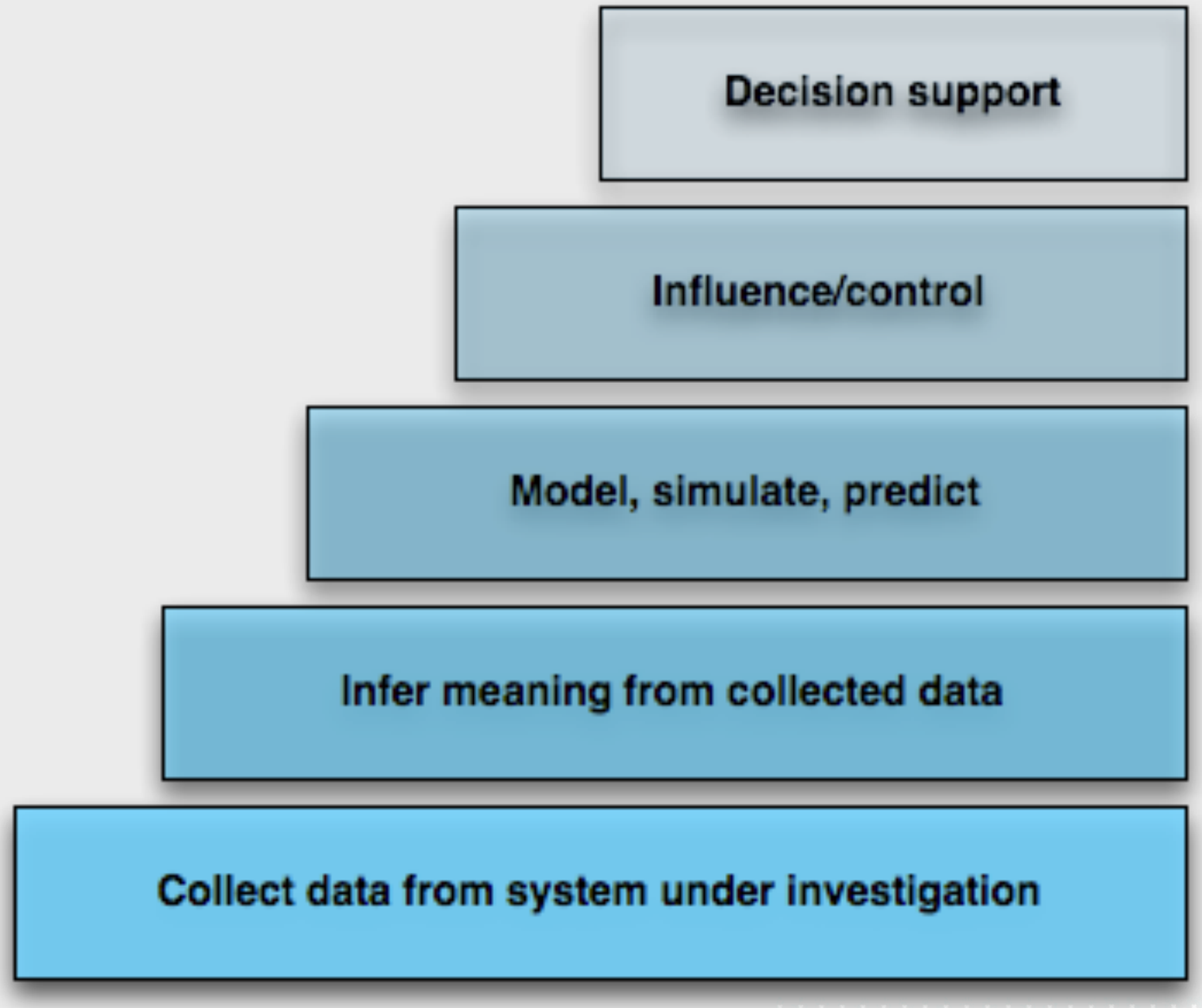
A complex world: man-made and natural

- Man-made
  - Cities, Countries, Continents
  - Transportation and communication systems
  - Internet, Google, Wikipedia, YouTube, Twitter, FaceBook, Linked Open Data cloud, …
  - Socio-economic systems
- Natural
  - The immune system
  - Biological networks
  - Climate, weather, earthquakes

I4CW:

- To understand the behavior of man-made and natural systems in a complex world from the behavior of, and interactions between their components
- Deeply embedded in informatics theoretical, methodological and experimental tradition
- Strongly connected to cross disciplinary and societal links

I4CW: Overall approach



I4CW: Starting strengths

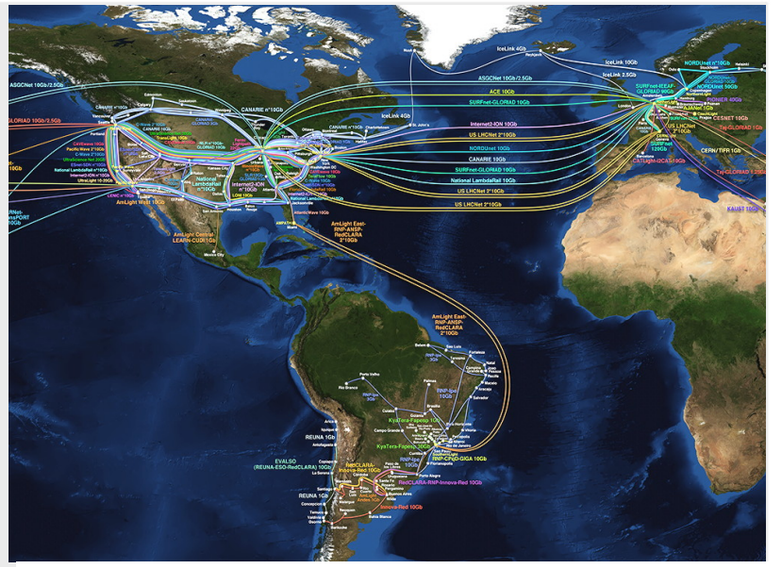
- Systems and Network Engineering (De Laat)
  - Complex cyber infrastructure spanning continents
  - Secure, sustainable, robust, collective behavior and control
- Intelligent Systems Lab Amsterdam (De Rijke, Welling)
  - Semantic analytics for textual, visual, social, sensory data
  - Search, classify, recommend, predict at very large scale
- Section Computational Science (Sloot)
  - Theory of complex systems
  - Model and simulate complex systems

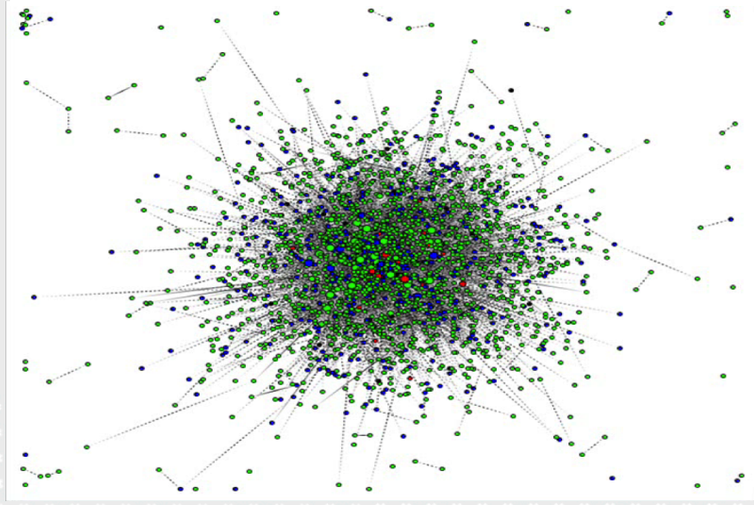
I4CW: Dots on the horizon

- Sustainable robust secure Future Internet
  - Smart Cyber Infrastructure using semantic approach
  - Protect the integrity of the human in digital world
- Self-learning interpretation of complex data streams
  - Unsupervised, real-time
  - Complement with cognitive signals
- Information theory of complex systems
  - Is multi-scale an emergent aspect of Complex Systems?
  - Can we predict and control Complex System Behavior?

Informatics for a complex world

- Unified informatics view on man-made and natural complex phenomona
- Ambitious aim to cross stack from data collection to decision support
- Addresses challenges in reliability, interpretation and modelling



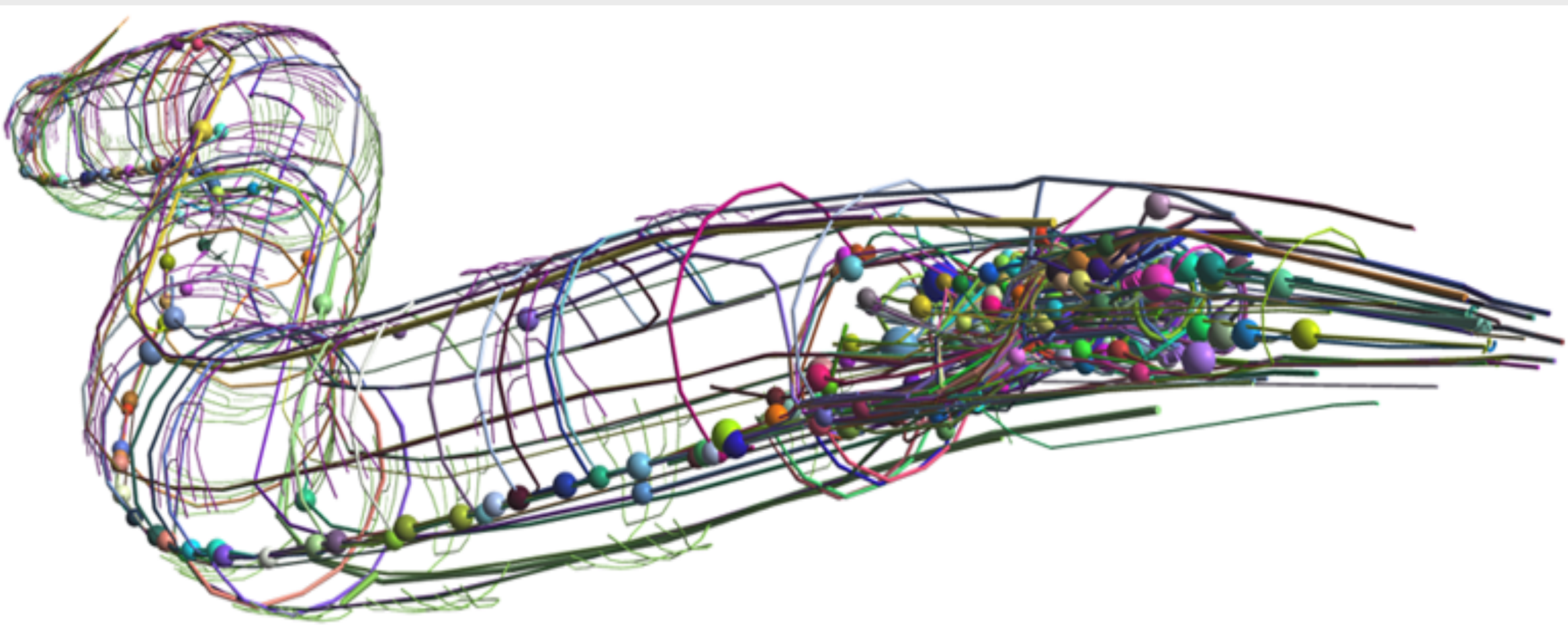


Inspirational:
Rick Stevens (ANL) @ GLIF2012 last week in Chicago:

OpenWorm

This is not simply a 3D model.

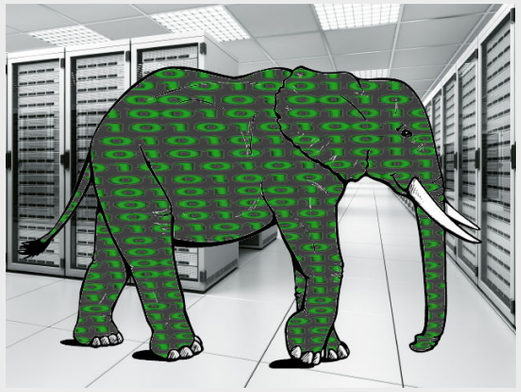
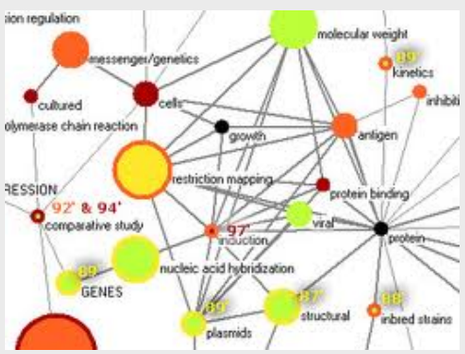
Help us build the first artificial life form.



Take Away Message: A-B-C

- A – Analytics

- B – Big Data



- C - Complexity