BoF-PSS Simulation Seminar
25-26 August 2011

financial
network
analytics

Visualizing Complex Financial Networks

New understanding of the financial system and implications for policy makers

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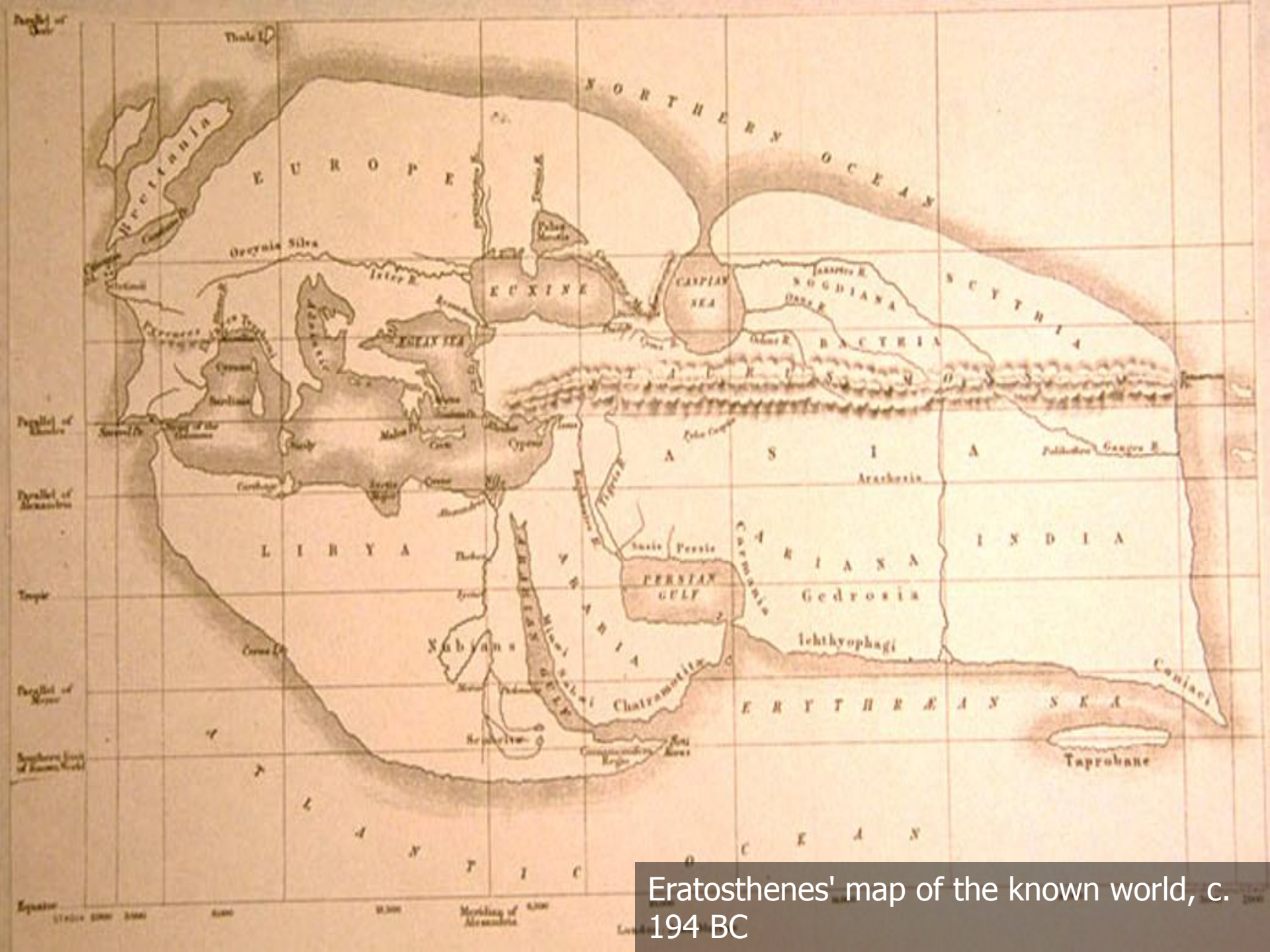
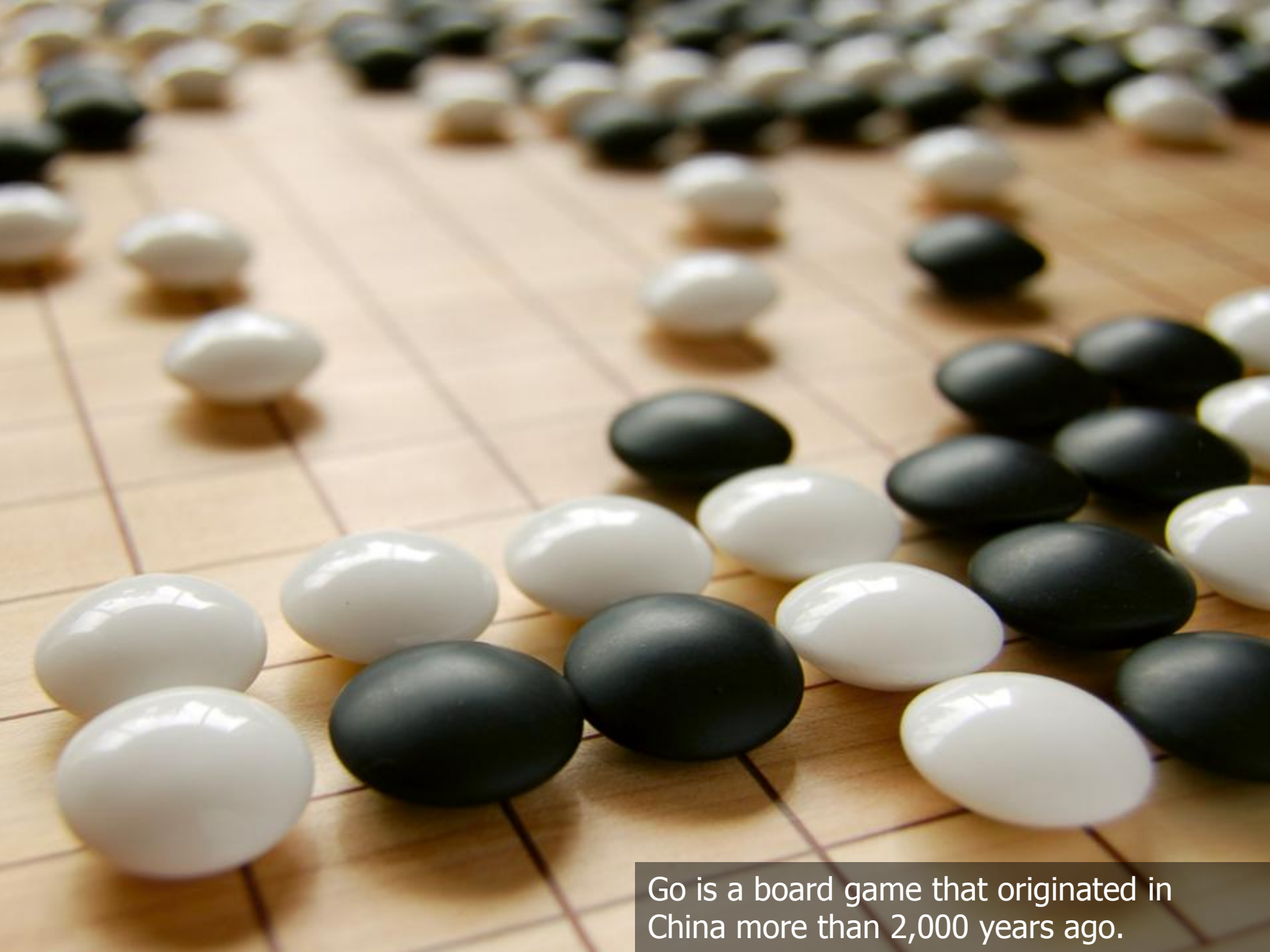
Katsushika Hokusai. The great wave off Kanagawa ~1830



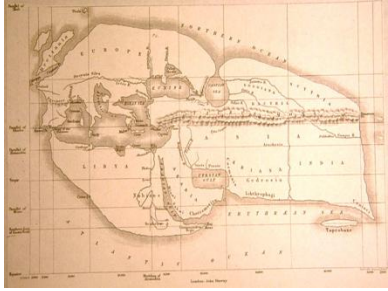
Eratosthenes' map of the known world, c. 194 BC


Go is a board game that originated in
China more than 2,000 years ago.

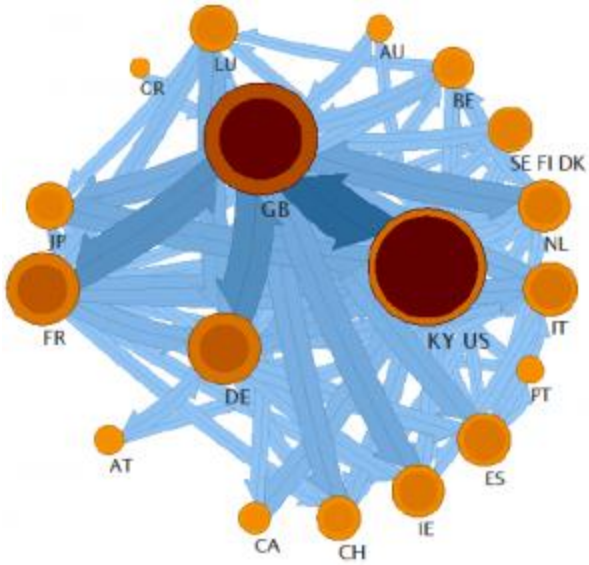
Data tsunami

- Digital information is doubling every 1.2 years
- Regulatory response to recent financial crisis was to strengthen macro-prudential supervision with mandates for more regulatory data
- The challenge will be to understand and analyze the data (public, commercial and regulatory)
- Data enables "Analytics based policy", i.e. the application of computer technology, operational research, and statistics to solve regulatory problems

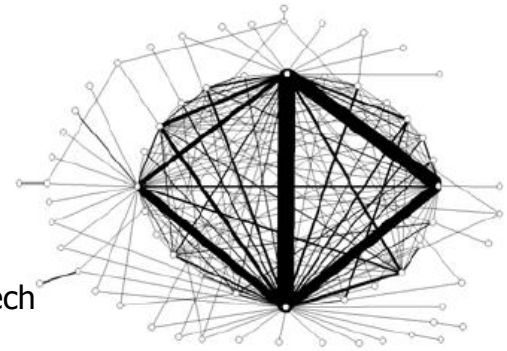
Network maps



- Recent financial crisis brought to light the need to look at links between financial institutions
- Way to present data. Mapping of the financial system has only begun
- Reduce uncertainty about interconnections



Garrett, Mahadeva and Svirydenska (2011)



Soramaki, Bech et al (2006)

Intelligence

- Financial crisis are different and rare
- Pattern recognition is hard for computers -> the best Go programs only manage to reach an intermediate amateur level
- The patterns to be recognized must be frequent enough for computers to learn
- A solution is to augment human intelligence
  (in contrast to AI)

Main premise of network analysis: Structure of links between nodes matters

- The properties and behaviour of a node cannot be analysed on the basis its own properties and behaviour alone.
- To understand the behaviour of one node, one must analyse the behaviour of nodes that may be several links apart in the network.
- Bottom up approach. Generalize and describe.
- Financial context: network of interconnected balance sheets
- Should we let the next Lehman fail?

New Paradigm

Visualizations:

Infographical **and** Analytical

> Qualitative and Quantitative

> Static Output and Explorable Interface

> Cross-referenced reading - Connected (networks)

> Real time reading

Implications in representation
but also in institutional behaviour
(monitoring and policy making)

New Paradigm

In the face of the crisis, we felt abandoned by conventional tools. In the absence of clear guidance from existing analytical frameworks, policy-makers had to place particular reliance on our experience. Judgement and experience inevitably played a key role.

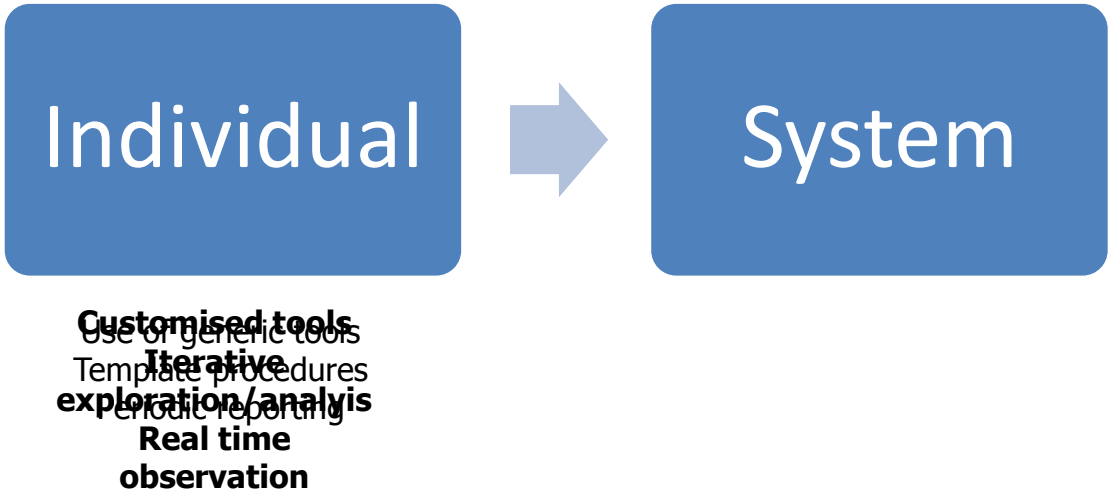
Jean-Claude Trichet, President of the ECB,

Opening address at the ECB Central Banking Conference,

Frankfurt, 18 November 2010

New Paradigm

MONITORING

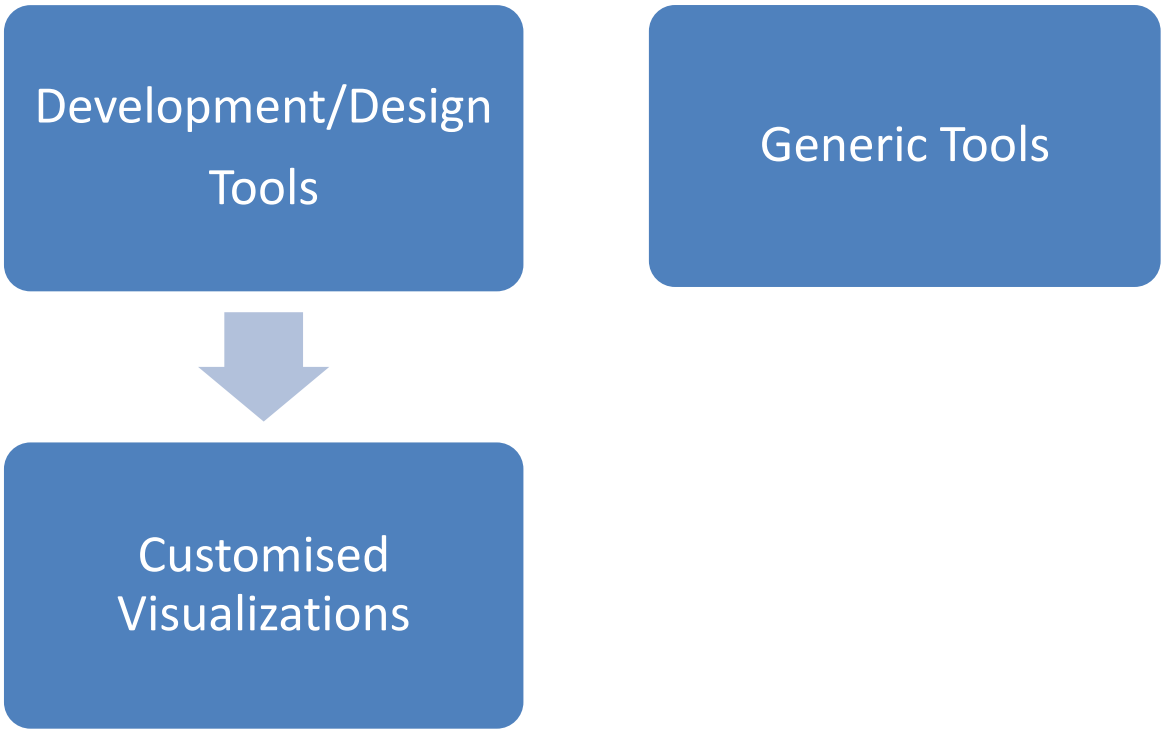


New Paradigm

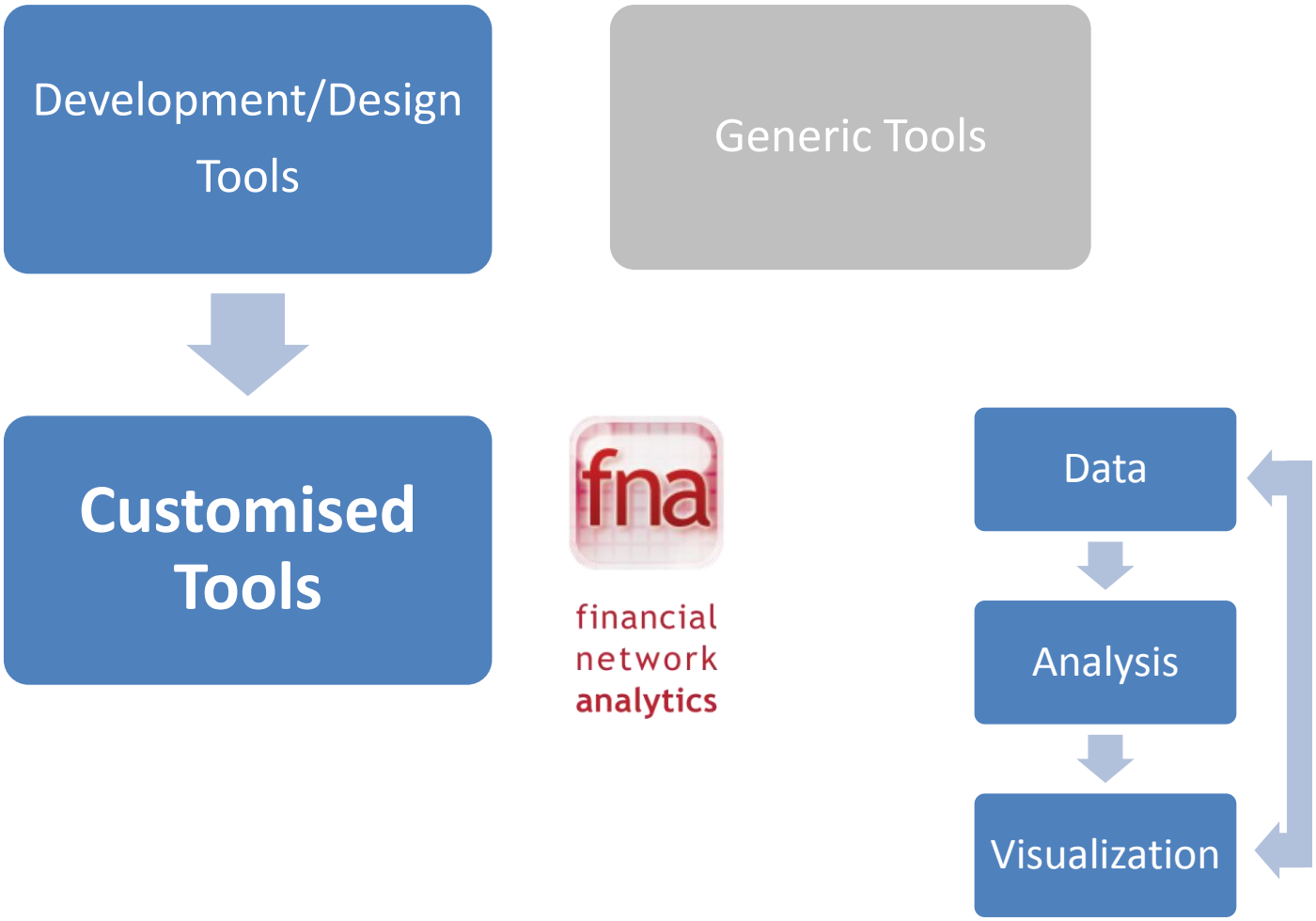
Policy Making and Regulation

Information/Data Driven (Active)

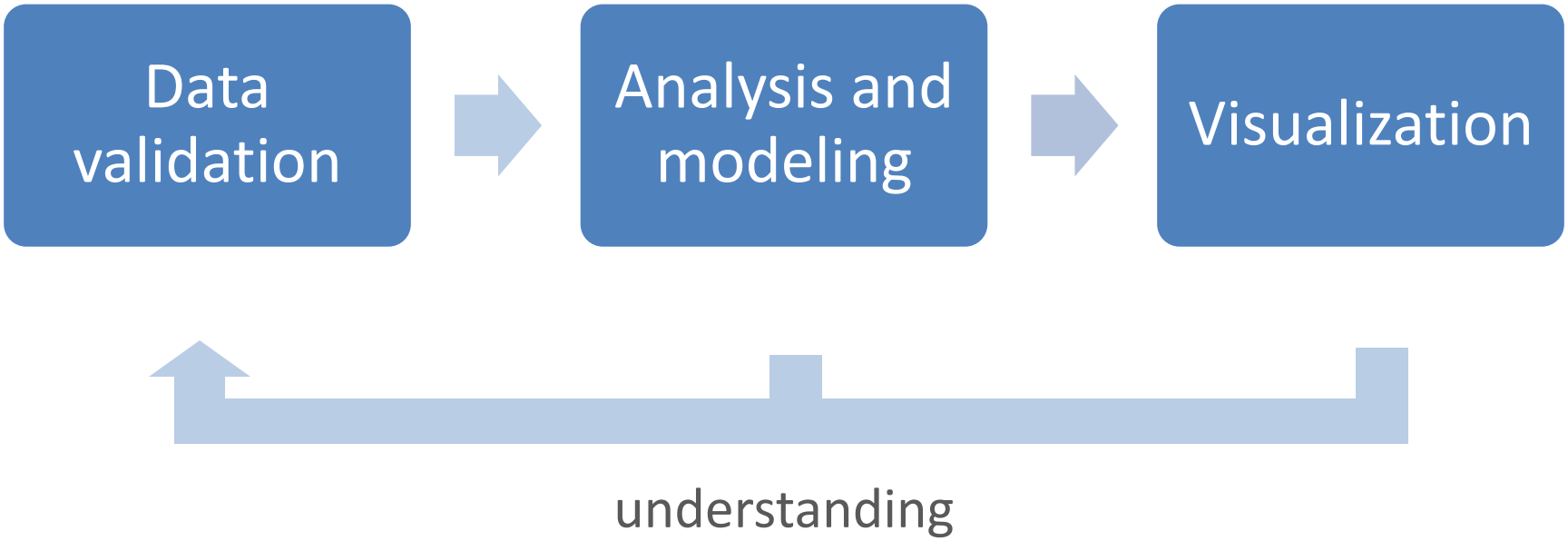
New Paradigm



New Paradigm



New Paradigm



New Paradigm

(Namely In a complexity science context) visualization is

Evidence

Validation

Model Output

Springboard for Inquiry (feeding further analysis)

source:
Anil Bawa-Cavia, Fowprints/Urbagram

Implementation

- Objective 1: provide a tool for exploration, analysis and visualization of regulatory financial data
- Objective 2: Provide a extendible platform for custom functionality, and agent based and simulation models
- Objective 3: Make advances in research available to policy

Roots of the work

- Bof-PSS2
  - Bank of Finland, 1997-
  - Payment system simulator used in ~60 central banks
- Loki
  - NISAC at Sandia National Laboratories, 2004-
  - Toolkit for network analysis and ABM
- FNA
  - December 2009 -
  - Sponsored by Norges Bank, collaborative efforts with other central banks

The platform

Base

- High-performance graph model, integration to corporate IT
- Intuitive to use, flexible GUI, dashboard

Modules

- Models for financial stability, (agent-based) simulation, visualization, …
- Can be developed by third parties, saves development time

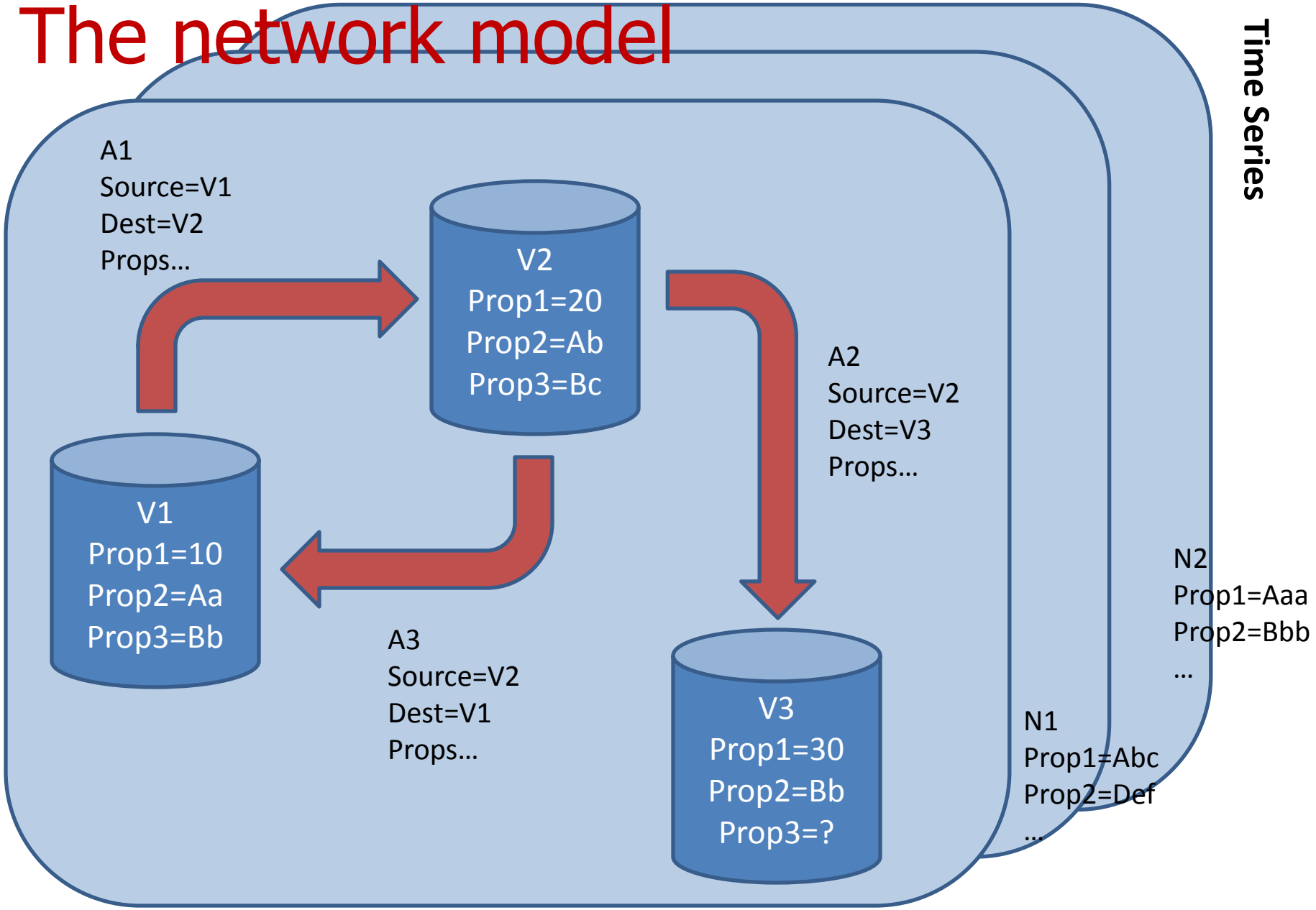
Network

- Same tool is shared among several regulators leads to robust models
- Knowledge transfer over organizations and time

Current modules

- NET – Network analysis, network metrics, Network operations
- VIZ-HIGHCHARTS – Common chart visualizations
- VIZ-PROTIVIS – Interactive network visualizations
- DATA – Tools for working with large CSV files
- MATCH – Algorithm for identifying overnight loans from payment data
- FLOW – Interbank payment system simulator

The network model



Screen

Access via browser in intranet, or desktop

Result panel shows command output

Files and database connections are in file panels

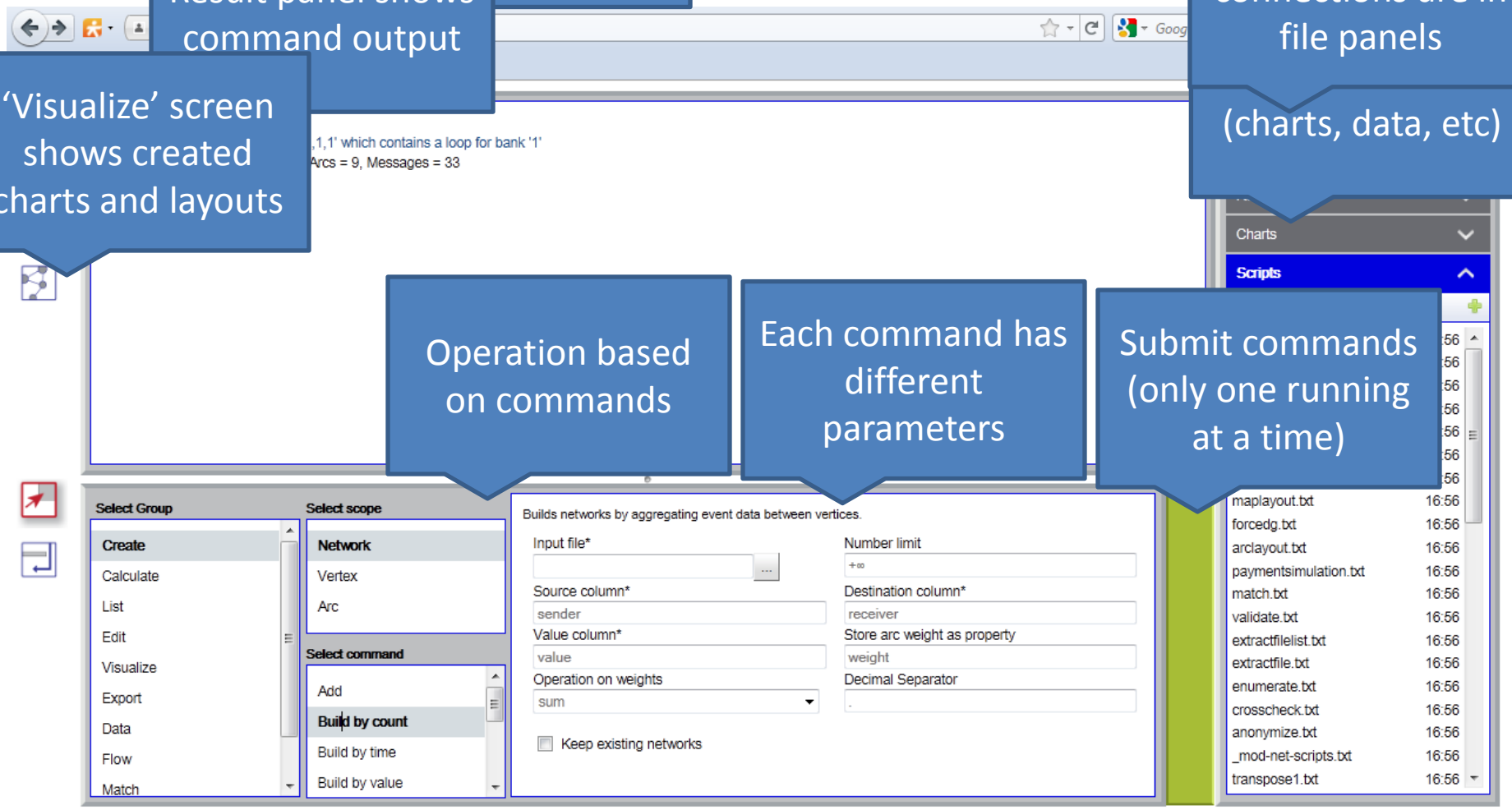
(charts, data, etc)

'Visualize' screen shows created charts and layouts

Operation based on commands

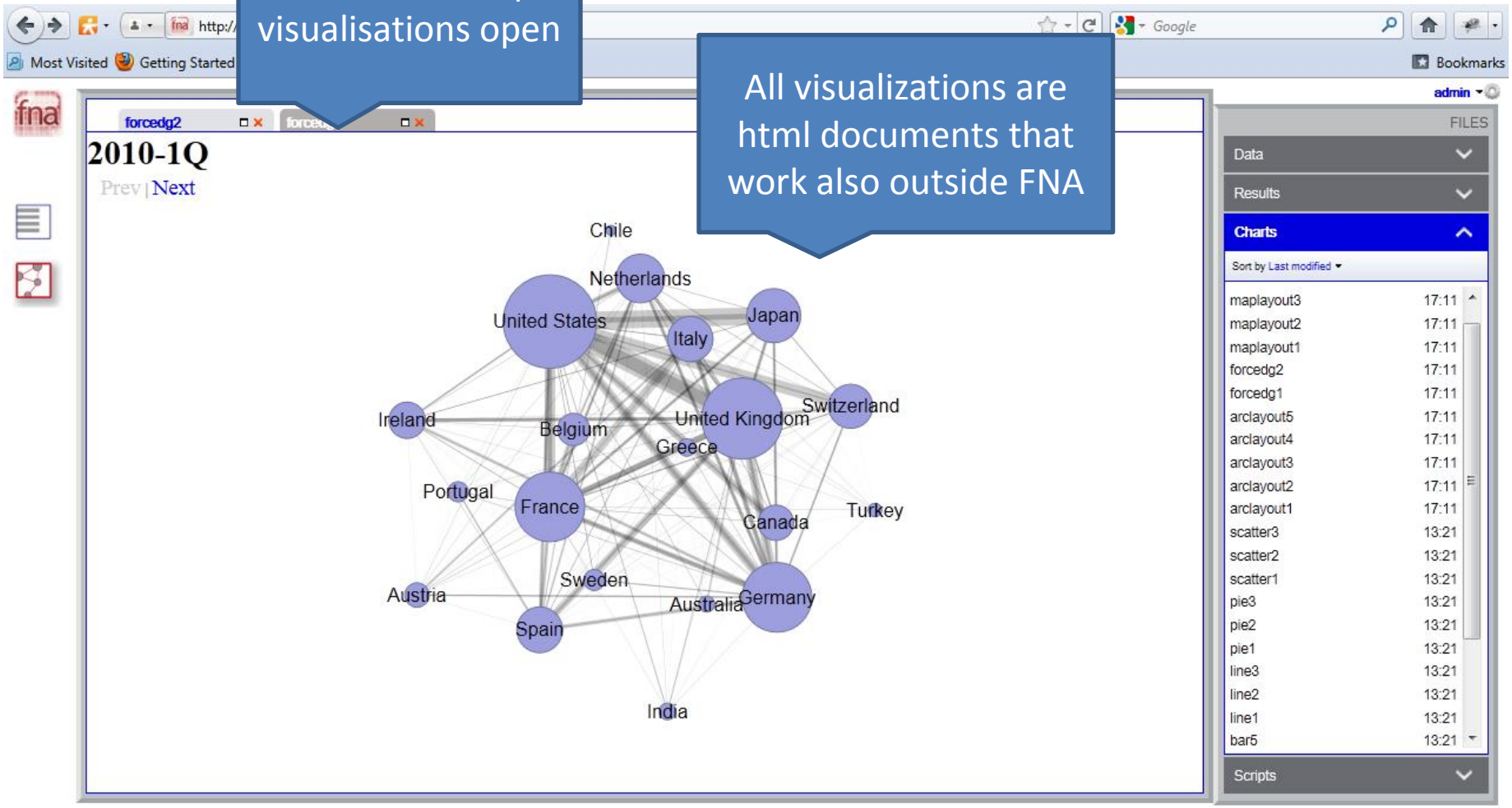
Each command has different parameters

Submit commands (only one running at a time)



Tabs allow multiple visualisations open

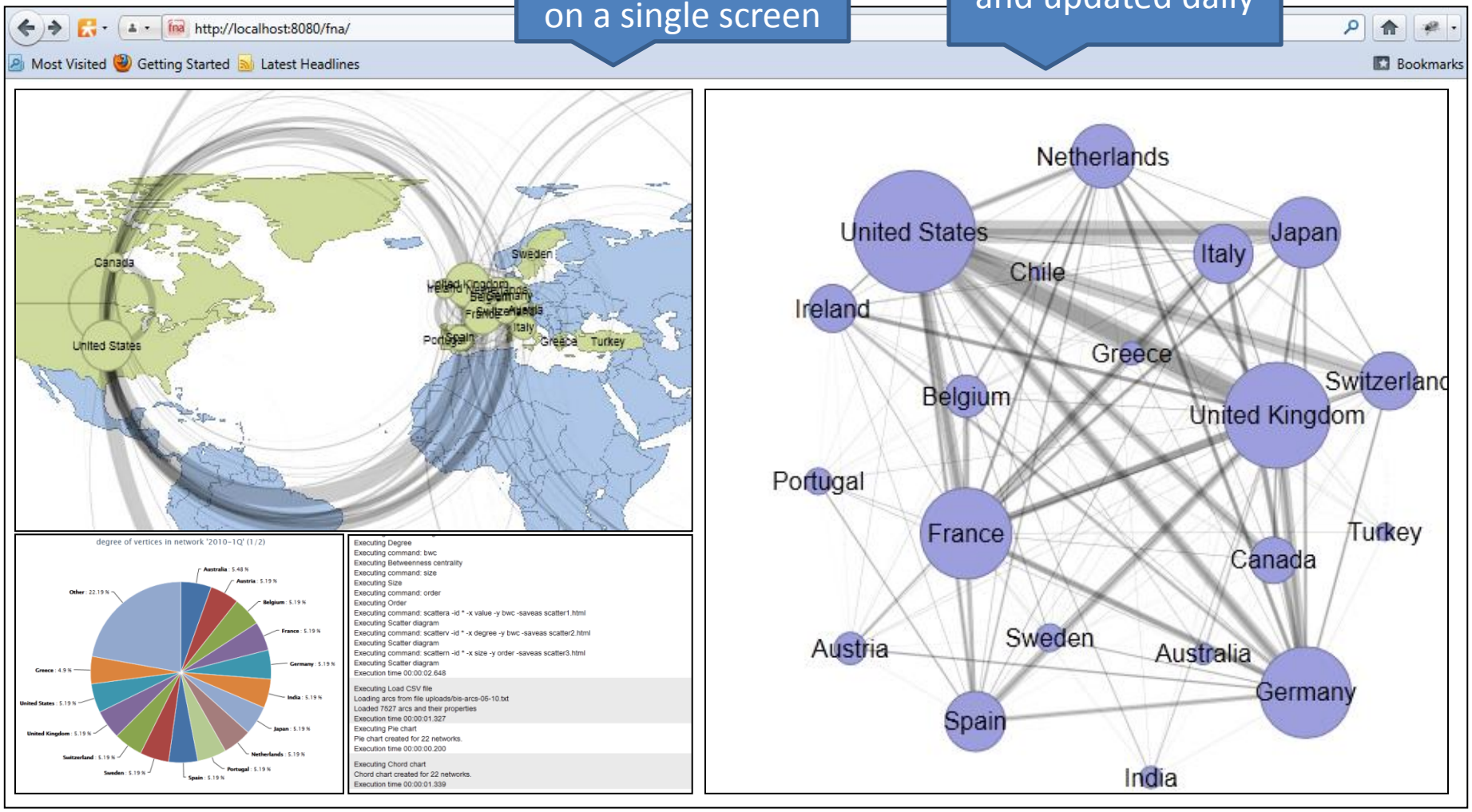
All visualizations are html documents that work also outside FNA



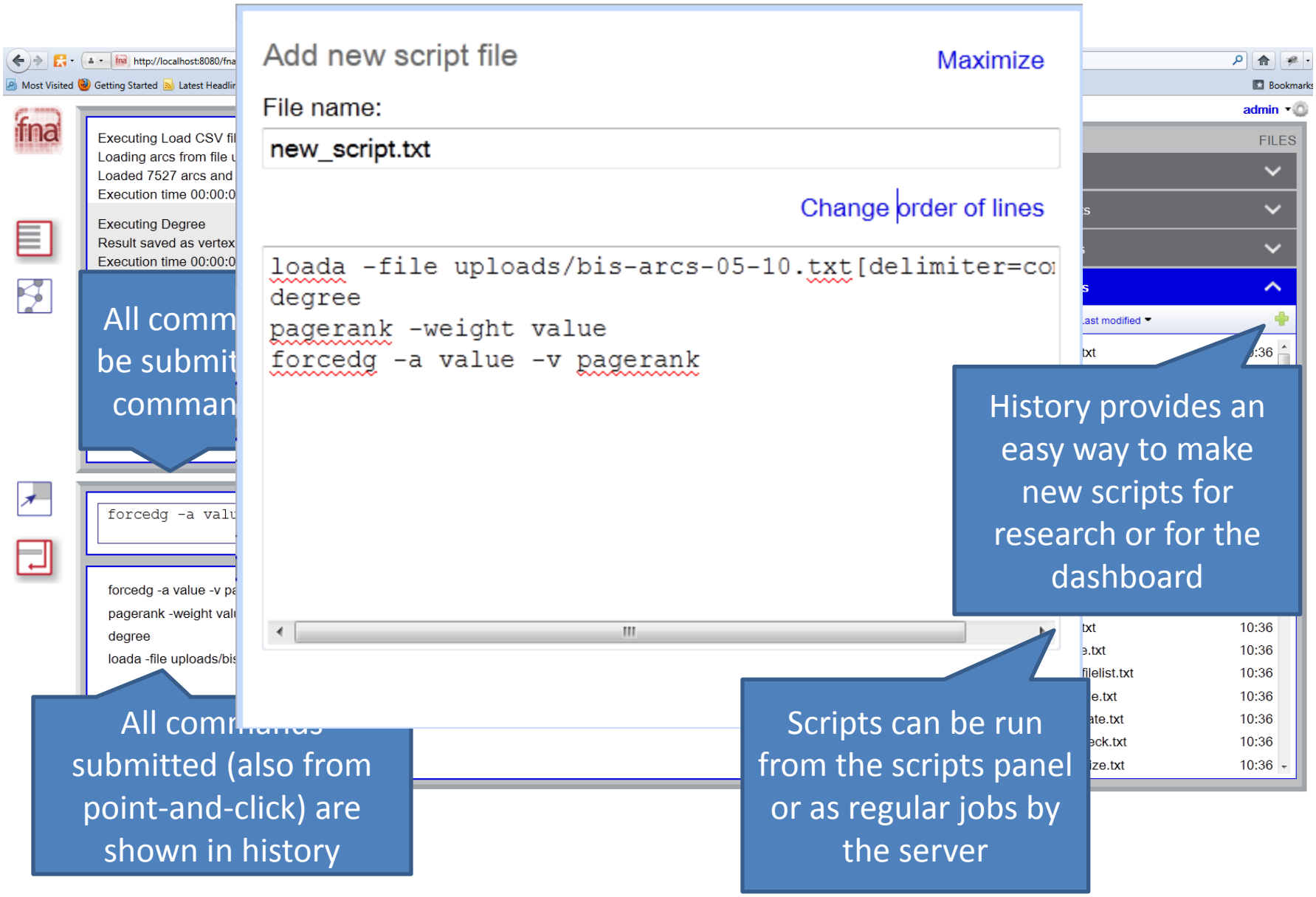
Dashboard (

The dashboard can combine multiple views to the data on a single screen

It can be available e.g. on the intranet and updated daily



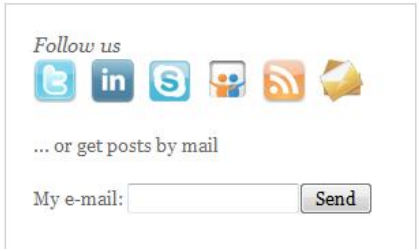
Command line



DEMO

More information

www.fna.fi



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Thank you!