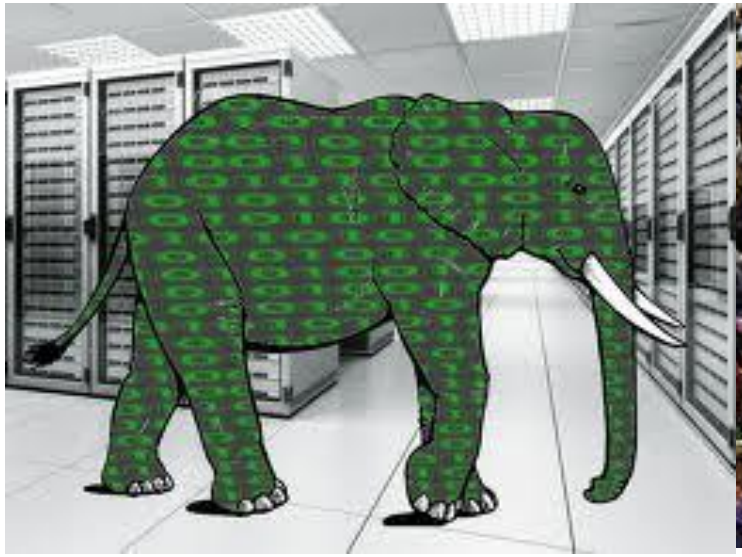
Towards Smart Social Systems



Ramesh Jain

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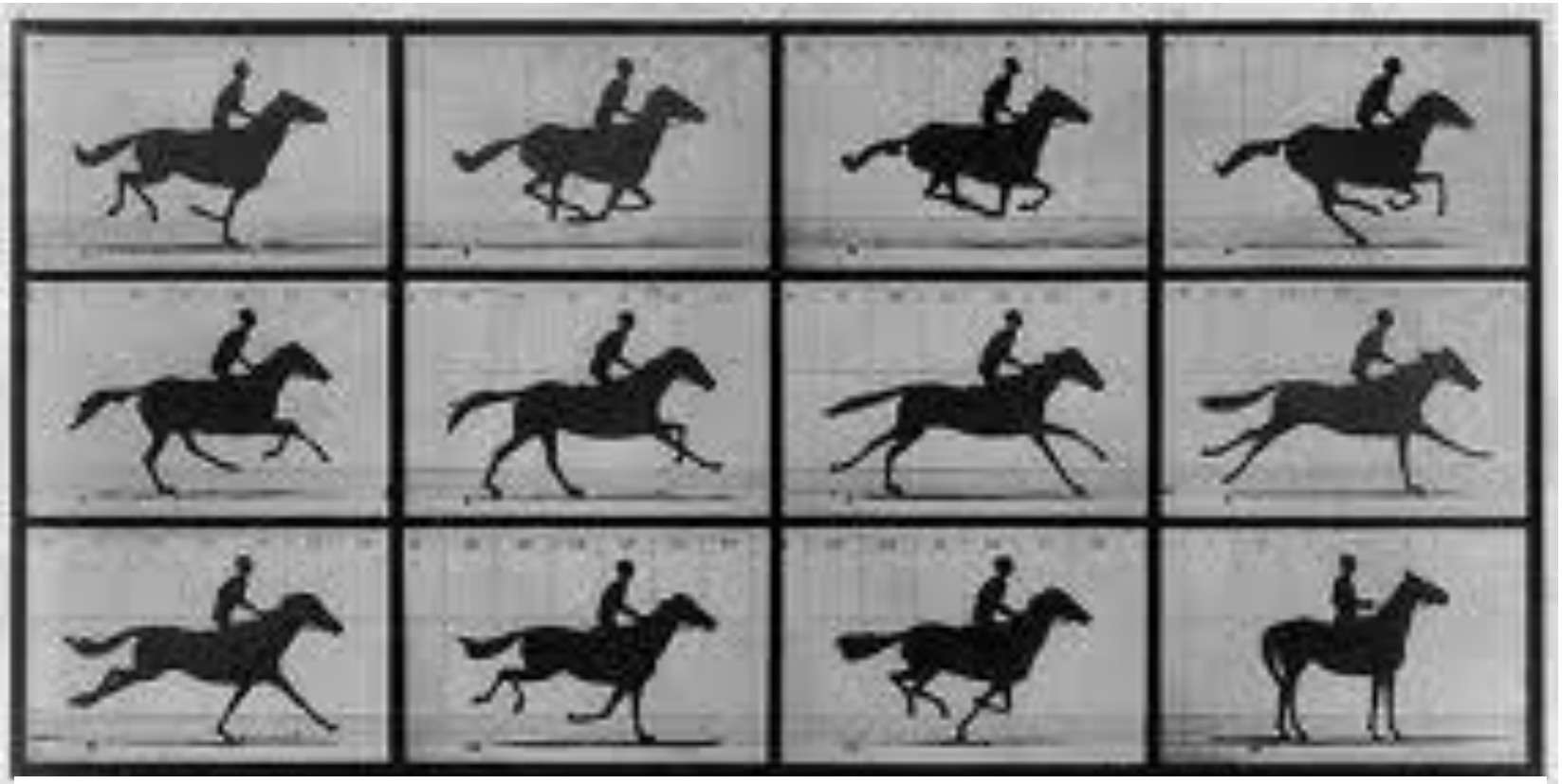
With Several Collaborators

Today

- **Why am I excited and optimistic?**
- **What is my ‘global group’ doing?**
- **What are the challenges?**

What is First: Video or Photos?



Video: 30 photos/second.

Photo: Frozen Moment in a video.

Computer Science: Modeling the World

- Data
- Objects
- Events

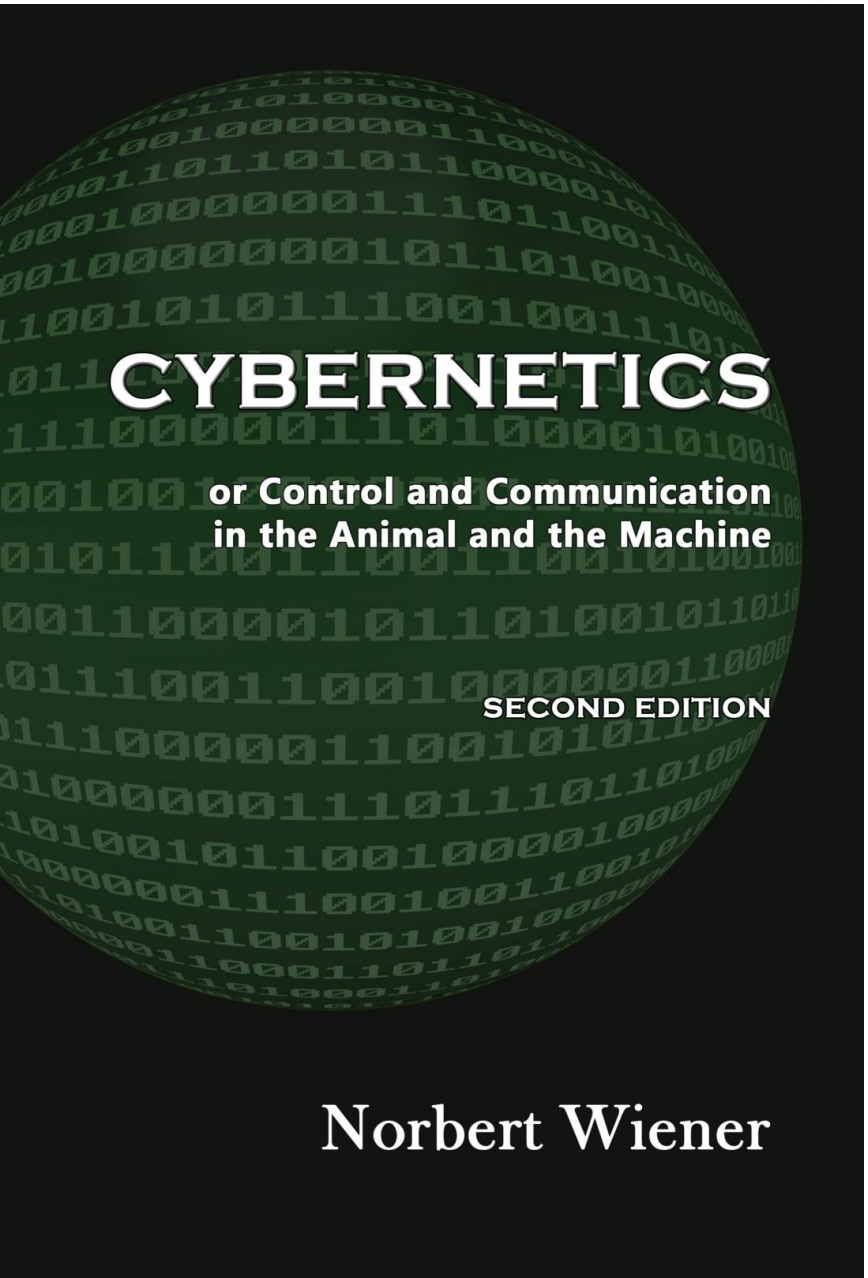
Events and Entities Exist in the real world.

The New York Times

YouTube

Events and entities result in Data and Documents

Extending Cybernetetics



Animals

Machines

Societies

Where do most data scientists apply their machine learning magic?

As we move into a targeted world, **advertisers** need efficient ways to sift through the volume of data.

For a CHANGE, should we think of using BIG Data to solve Big PROBLEMS?

Smart Systems:

Systems that are capable of describing and analyzing a situation, and taking decisions based on the available data in a predictive or adaptive manner, thereby performing smart actions.

Social Systems:

Social systems are the patterns of behavior of a group of people possessing similar characteristics due to their existence in same society.


Many small changes
equal one great change
"One touch of nature
makes the whole world kin."
- William Shakespeare


THINK GLOBALLY • ACT LOCALLY

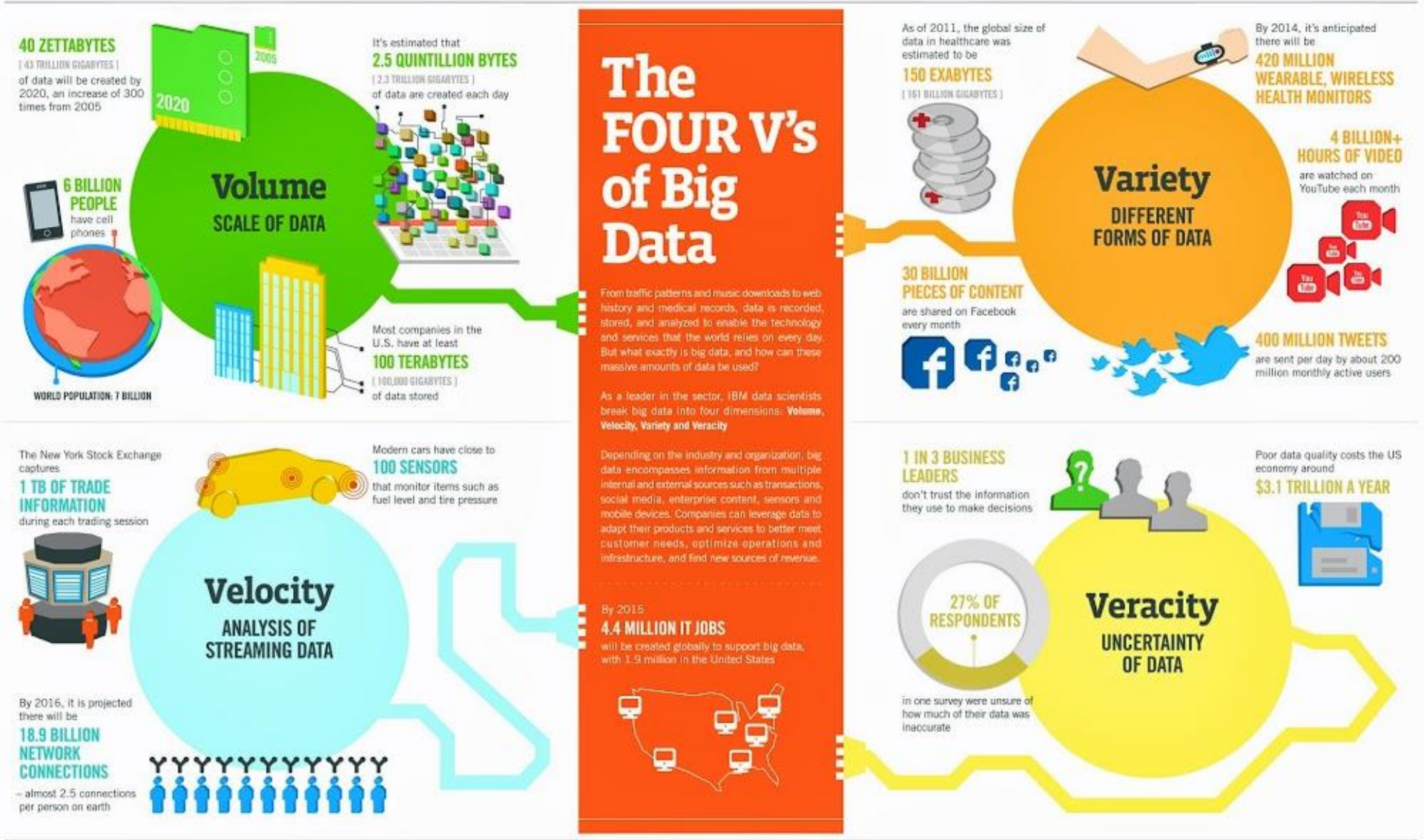
Smart Social Systems:

Social systems displaying smart behavior in response to unexpected and emergent situations.

We Live in Dynamic World.

Events are always happening.

What is Important in ‘modern data’?



Sources: McKinsey Global Institute, Twitter, Cisco, Gartner, EMC, SAS, IBM, MEPTEC, QAS

IBM

Different Situations are Norm

What is Different in ‘modern data’?

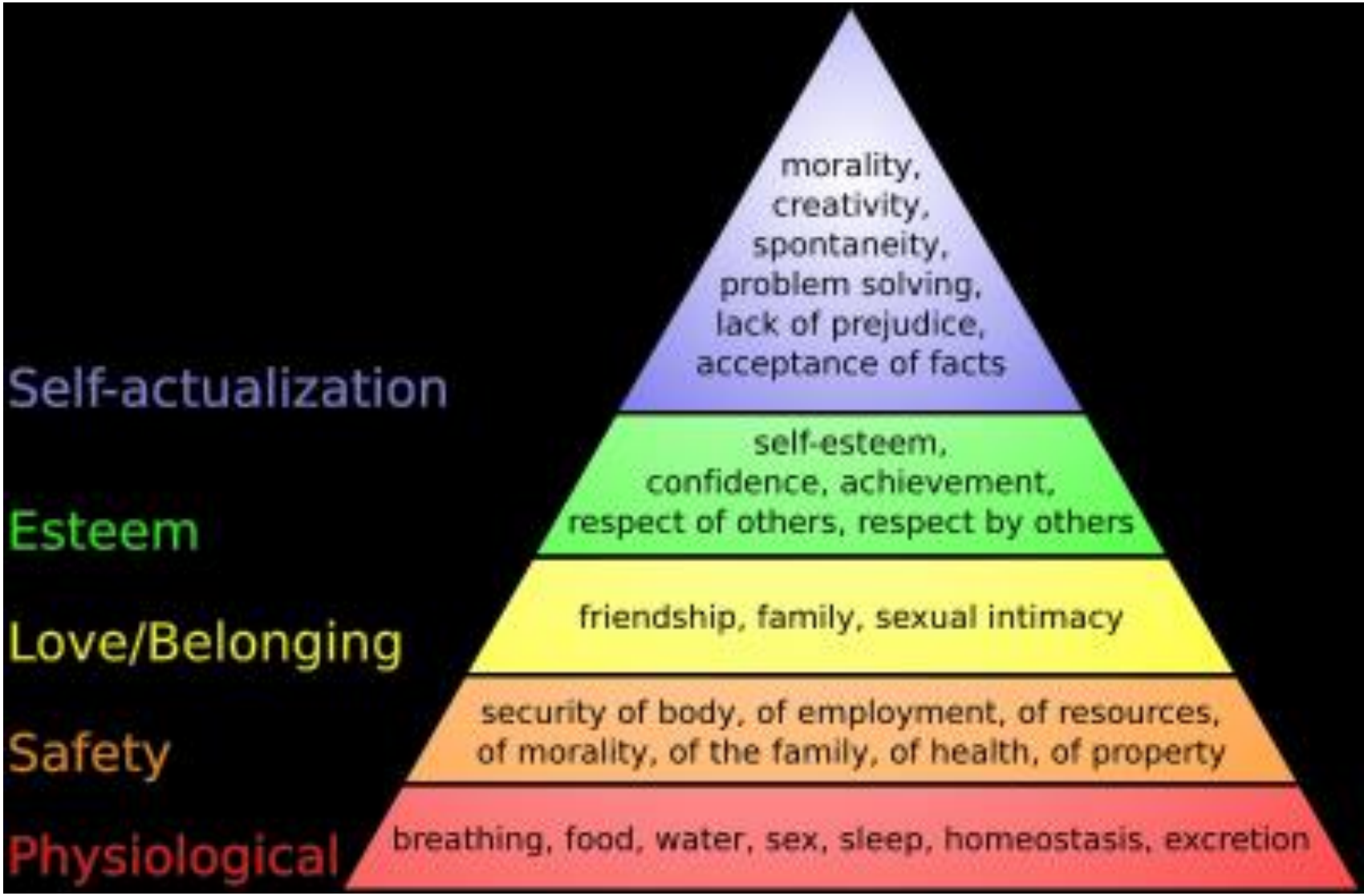
- Data is mostly Data Streams.
- Location is not just meta-data.
- It is heterogeneous and multimodal.
- Most of it is used to capture and understand evolving nature of the world.
- Control is more desirable than planning.

WHAT IS THE MOST FUNDAMENTAL PROBLEM IN SOCIETY?

Connecting People to Resources
Effectively, Efficiently, and Promptly
in given Situations.

Hint: Economics, Health Care, Politics, Computer Science, Operations Research, …

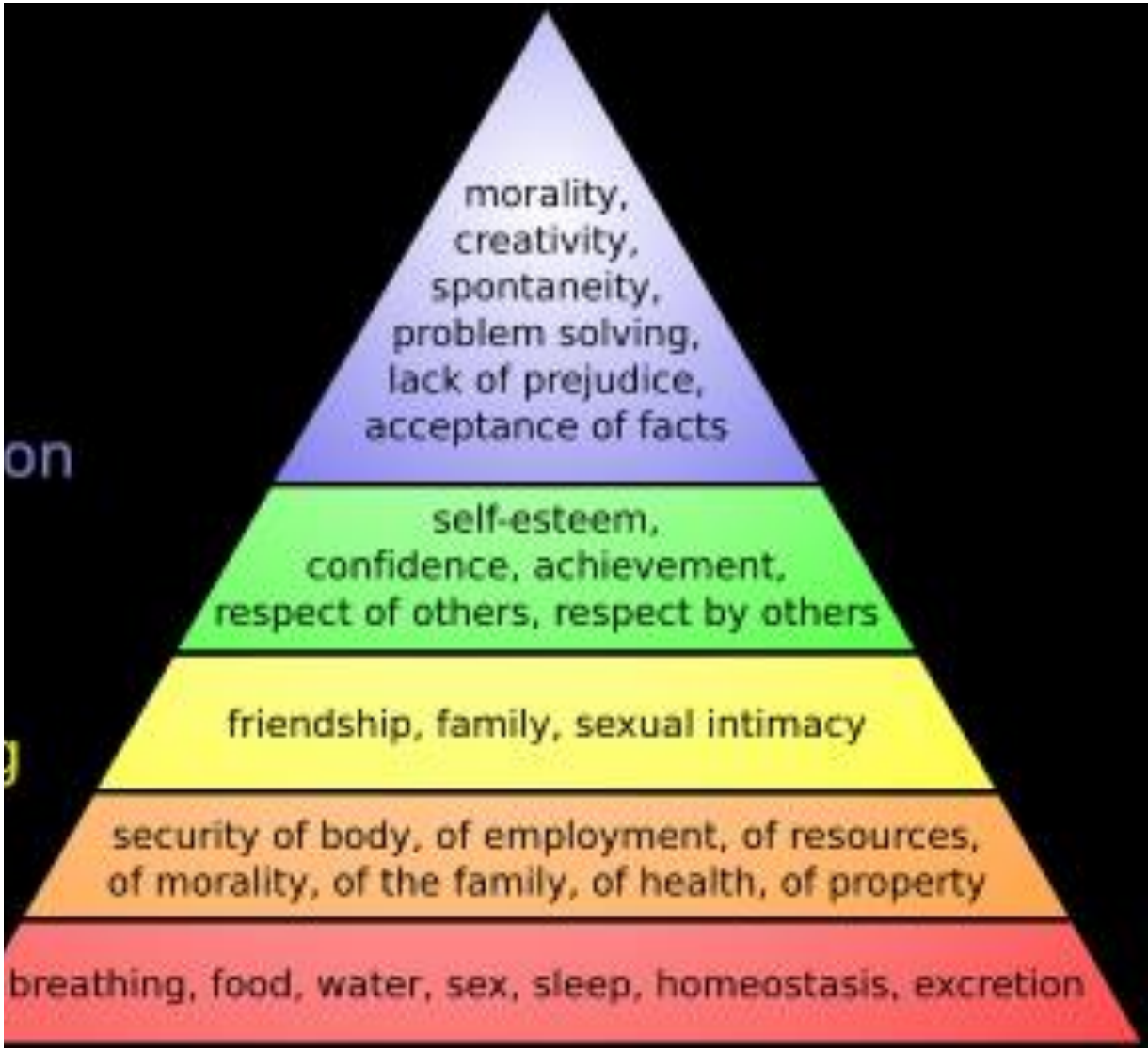
Maslow: Basic Needs



http://www.theappgap.com/collaboration-whats-in-it-for-me.html

Maslow: *Needs and Resources*

- Financial
- Natural (Food)
- Human Skills
- Health
- Rescue
- Transportation
- Education
- Production
- …



http://www.theappgap.com/collaboration-whats-in-it-for-me.html

Social Networks

Connecting People

Social Media and Maslow's Hierarchy

Current Social Networks

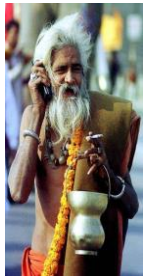
Important Unsatisfied Needs

Social Life Networks



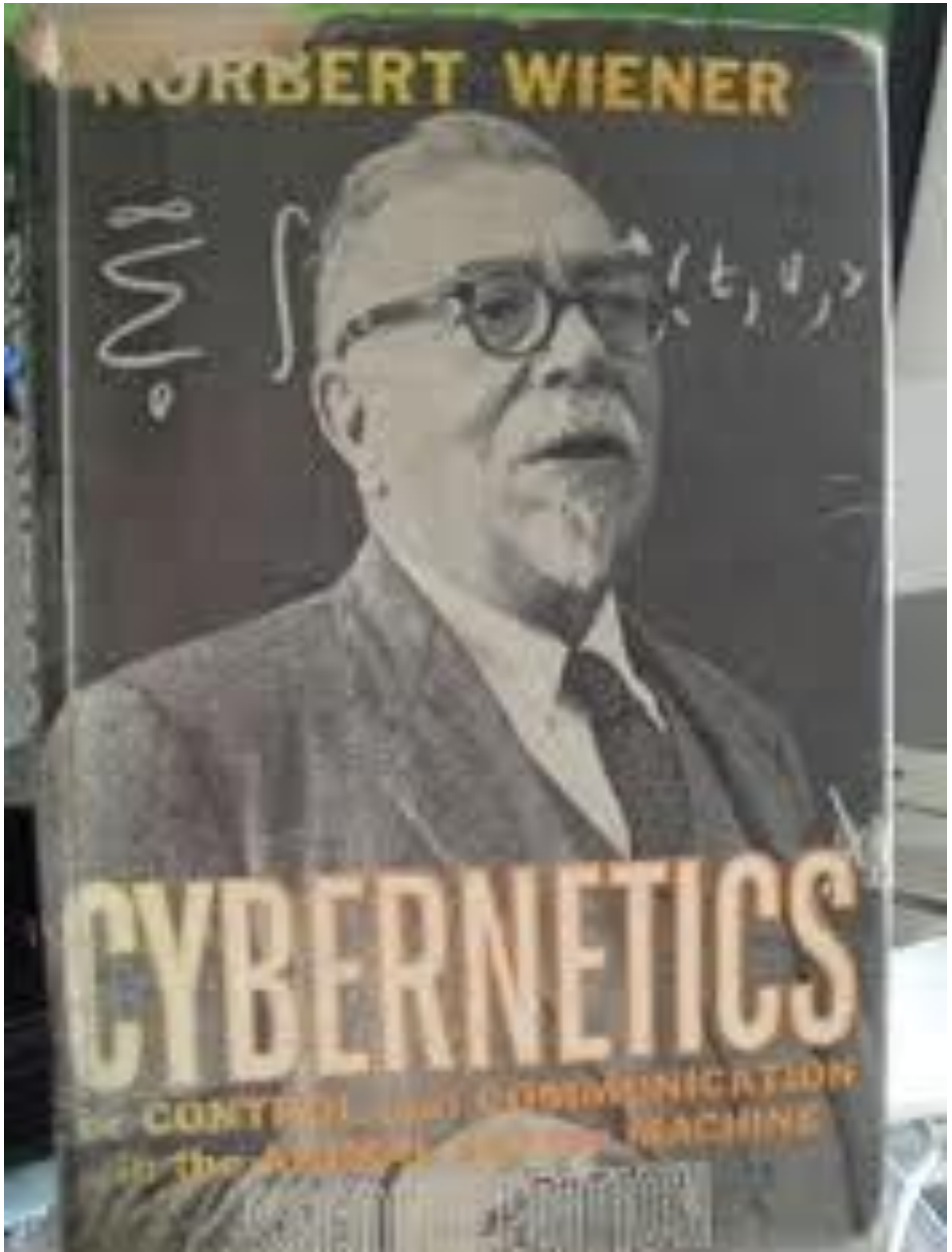
Connecting People to Resources



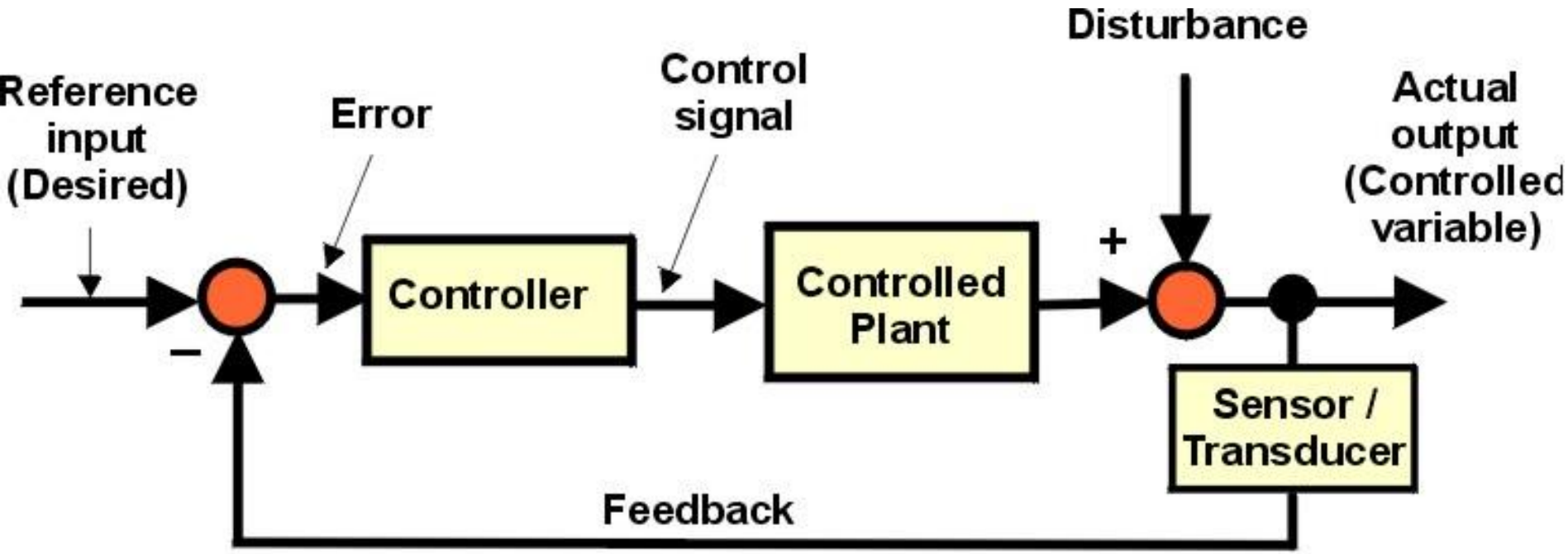


Designing Complex Systems
Using Simple Principles

Feedback Results in Smart Behavior

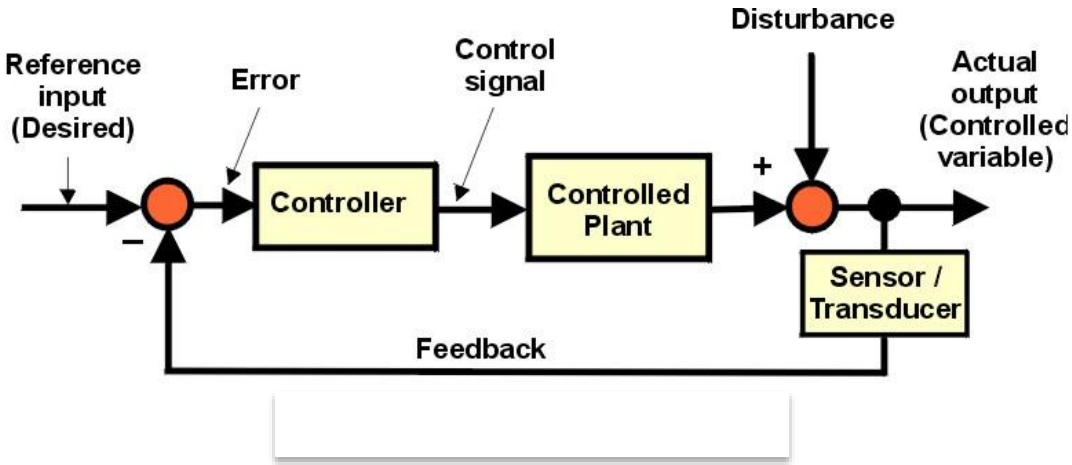


Simple Principle



Key Factors

- Desired state (Goal)
- System model and Control Signal (Actions)
- Current State (for Feedback)



Observations to Situations

Measurements to attribute information

$$a_i = f_i(m_i)$$

State at a point

$$S = [a_1, a_2, \ldots, a_N]^T$$

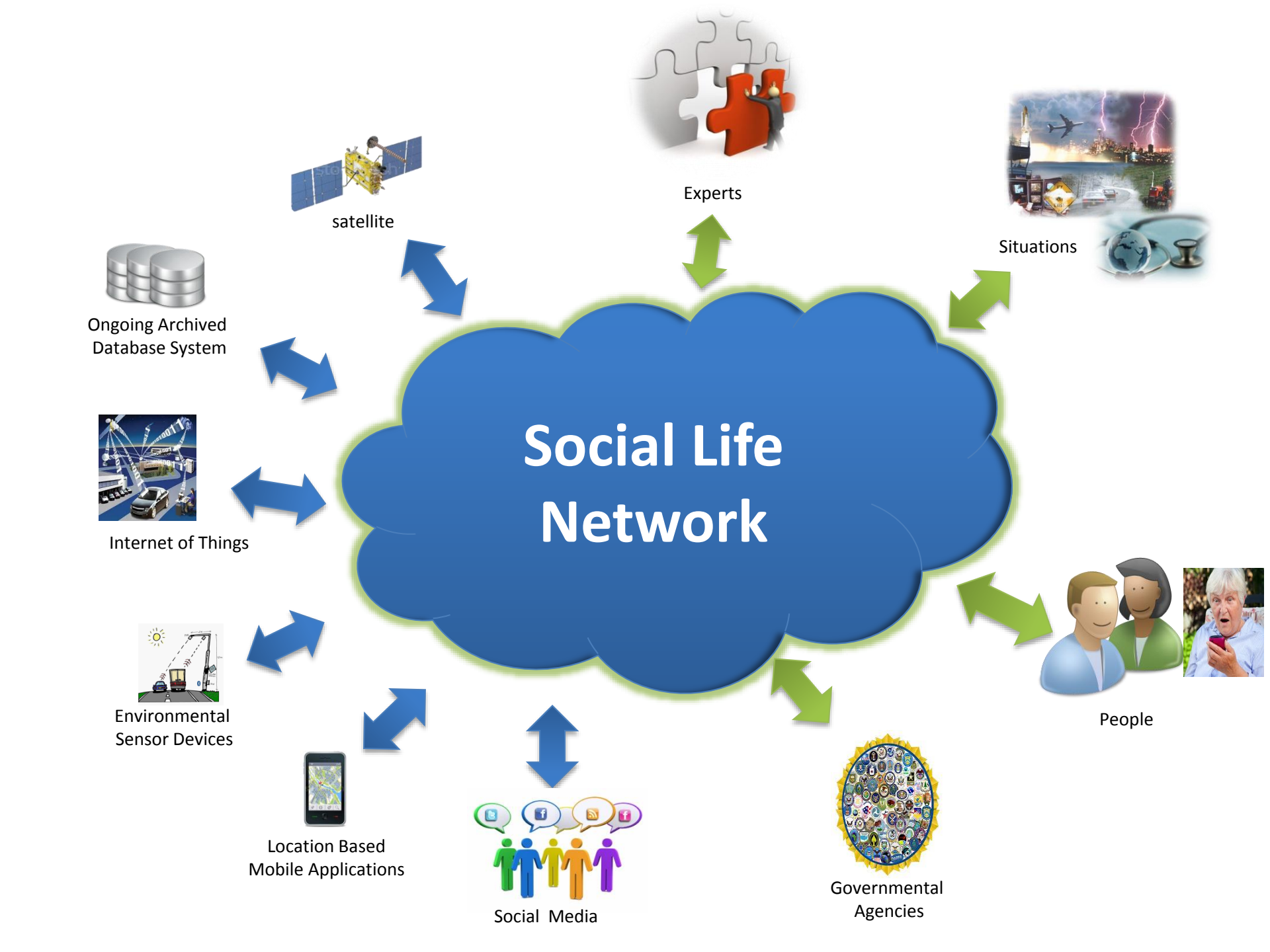
Situations

$$L = F\{[a_1, a_2, \ldots, a_N]^T\}_{Space}$$

CAN WE APPLY CYBERNETICS IDEAS TO SOCIAL SYSTEMS?

Emerging Social Systems

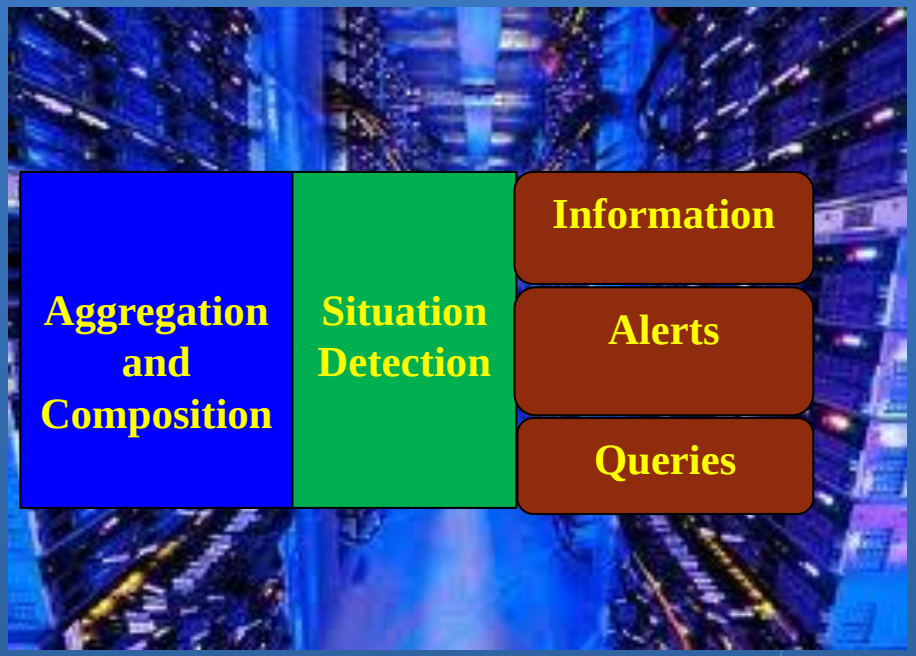
- **Social observations are now possible with little latency.**
- **We can design social systems with feedback.**
- **Situation Recognition and Need-Availability identification of resources is a major challenge.**


Social Life Network
Experts
satellite
Situations
Ongoing Archived Database System
Internet of Things
Environmental Sensor Devices
Location Based Mobile Applications
Social Media
Governmental Agencies
People

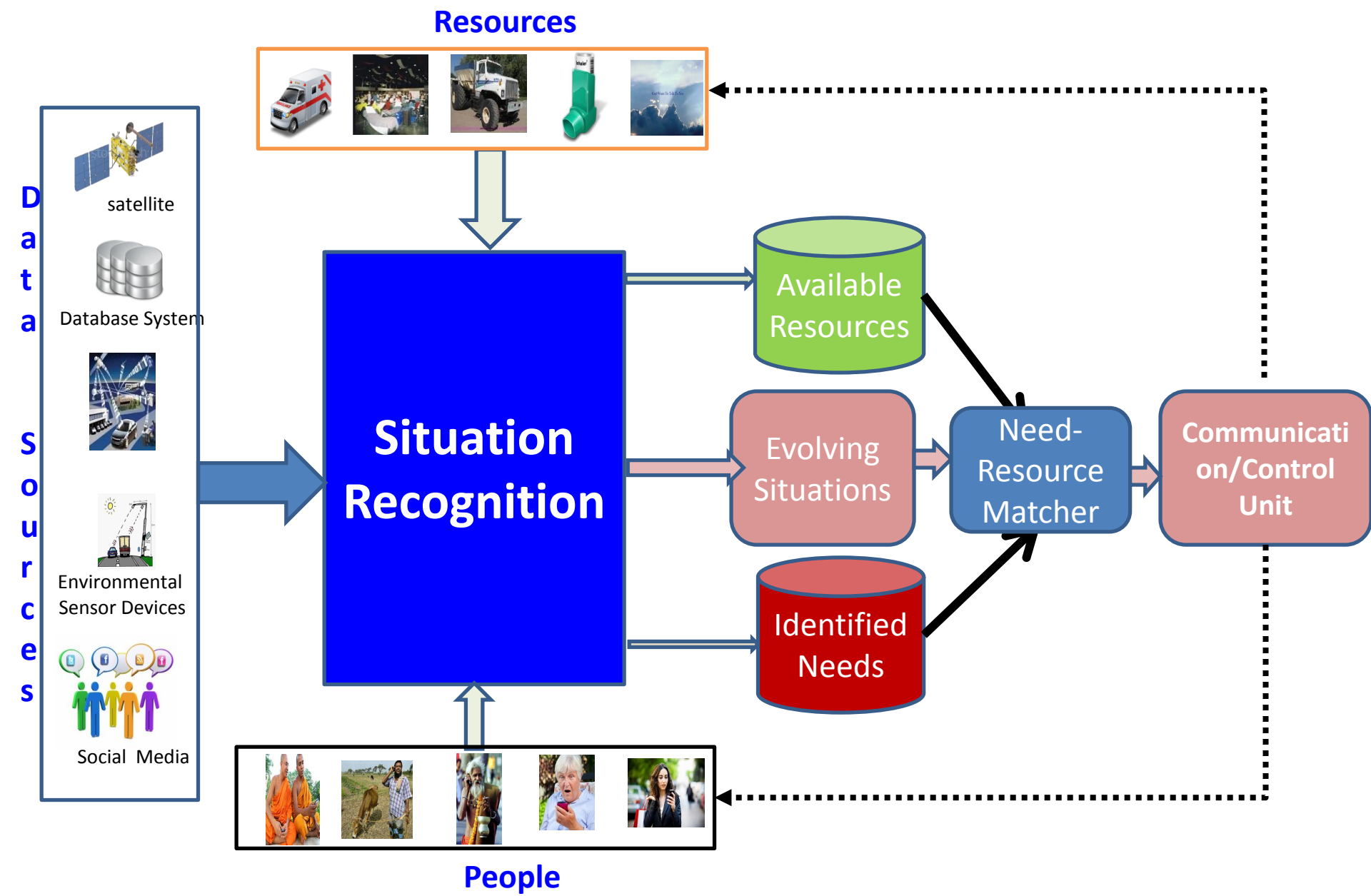
Fundamental Problem

Connecting People to Resources
effectively, efficiently, and promptly
in given situations.

Social Life Network



Smart Social Systems Architecture



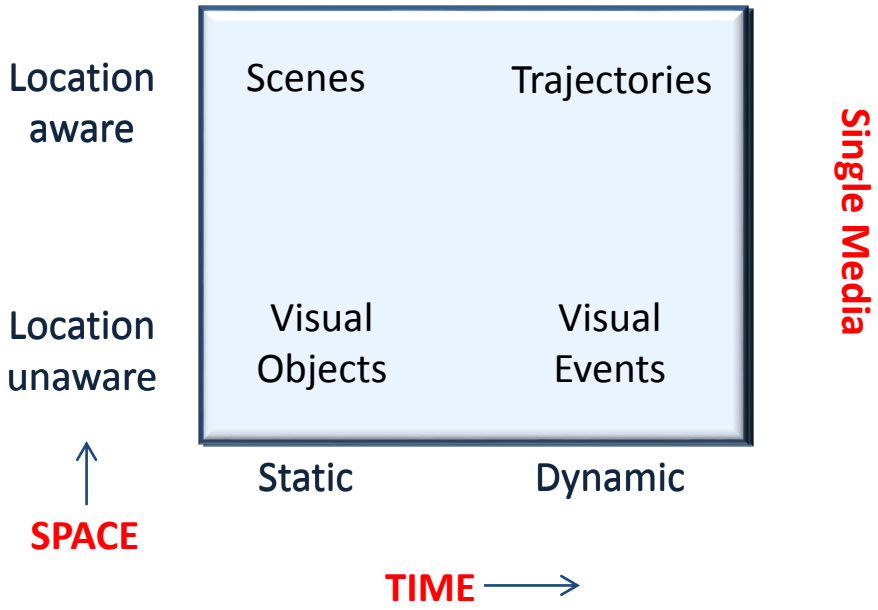
Key Steps

1. Identify Situation
2. Determine Needs
3. Determine Resources
4. Develop best resource management approach
5. Communicate/Actuate decisions
6. Go to 1.

Big Challenges

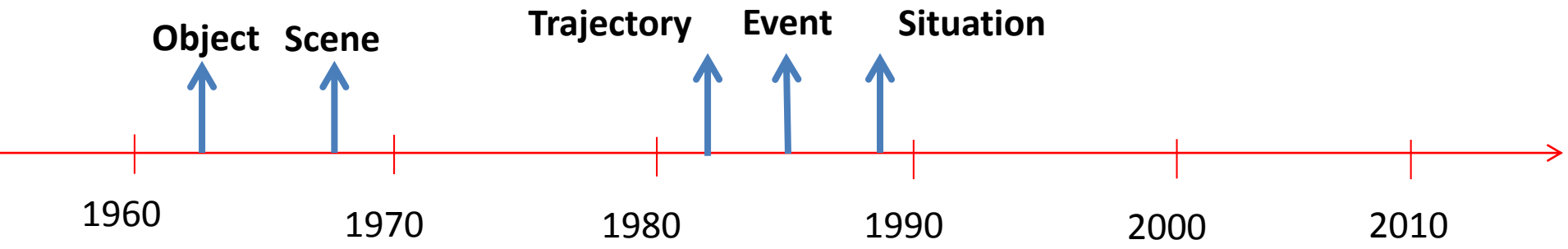
- **Data Ingestion** to efficiently extract data from the Web and make them available for later computation is not-trivial.
- **Stream Processing Engine** to bridge the semantic gap between high level concept of situations and low level data streams.
- **Situation Recognition** as the next step in concept recognition.

Concept Recognition: ***Last Century***



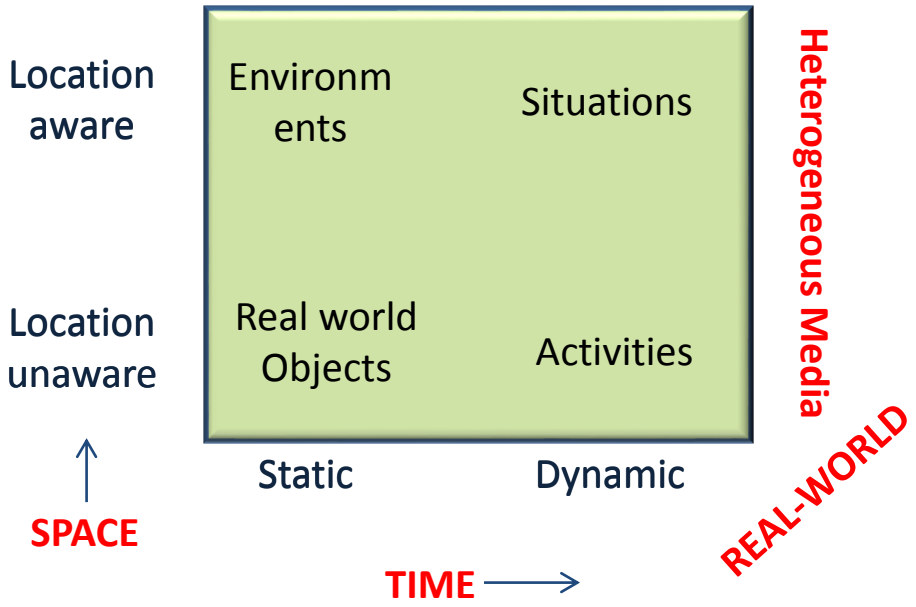
Data = Text *or* Images *or* Video

Visual Concept Recognition: Quick History



- **1963: Object Recognition [Lawrence + Roberts]**
- **1967: Scene Analysis [Guzman]**
- **1984: Trajectory detection [Ed Chang+ Kurz]**
- **1986: Event Recognition [Haynes + Jain]**
- **1988: Situation Recognition [Dickmanns]**

Concept Recognition: ***This Century***



Data is just Data.

Medium and sources do not matter.

Situation

- **relative position or combination of circumstances at a certain moment.**
- **The combination of circumstances at a given moment; a state of affairs.**

Situations: Definition

An *actionable abstraction* of *observed spatio-temporal* characteristics.

SITUATIONS

From Events to Situations

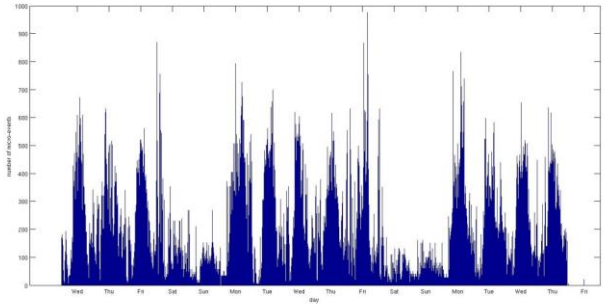
- Example 1:
  - A person shouting.
  - 1000 people shouting.
    - In a contained building
    - In main parts of a city
- Example 2:
  - One person complaining about flu.
  - Many people from different areas of a country complaining about flu.

Micro-events: Sensors detecting and *CHIRPING* (broadcasting) events

- Billions of disparate kinds of sensors being placed everywhere.
- Each sensor detects ‘basic events’ and broadcasts it in a simple form.
- Develop a system to process these micro-events and make them useful.

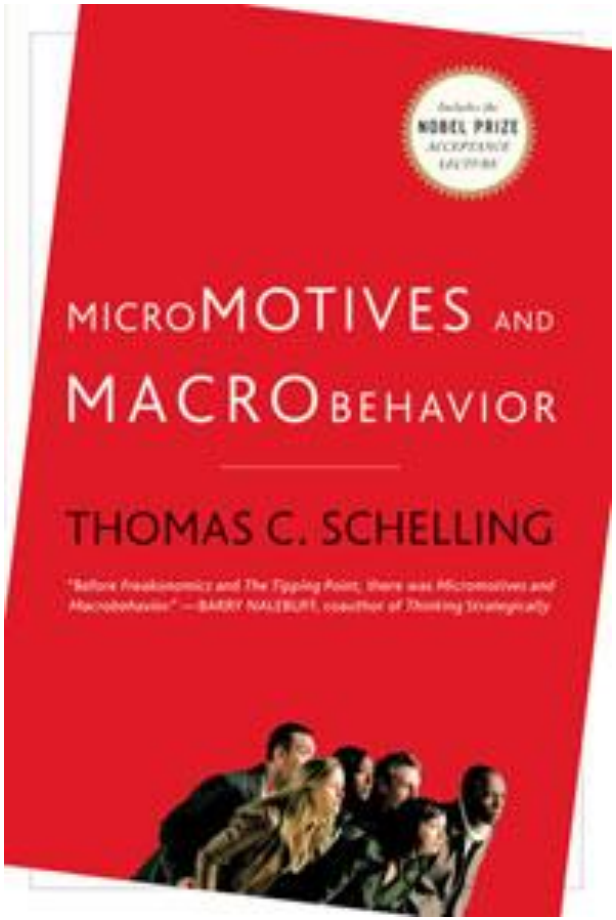
Example: Cameras in a city

- ‘Chirps’ could be of different types
- Define behaviors like:
  - Heavy traffic
  - Popular event going on
  - People leaving X area
  - Violence starting
  - . . .



- Use for Macro-behvior analysis

From *MICRO EVENTS* to *SITUATIONS*



Thermodynamics

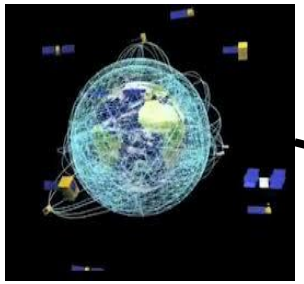
provides a framework for relating the microscopic properties of individual atoms and molecules to the macroscopic or bulk properties of materials that can be observed in everyday life.

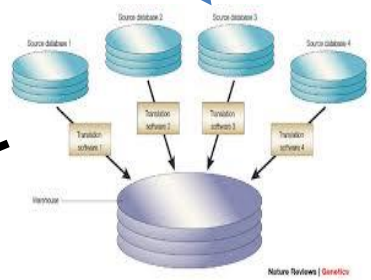
Social Networks

Phone Apps

Internet of Things

Global Sensors

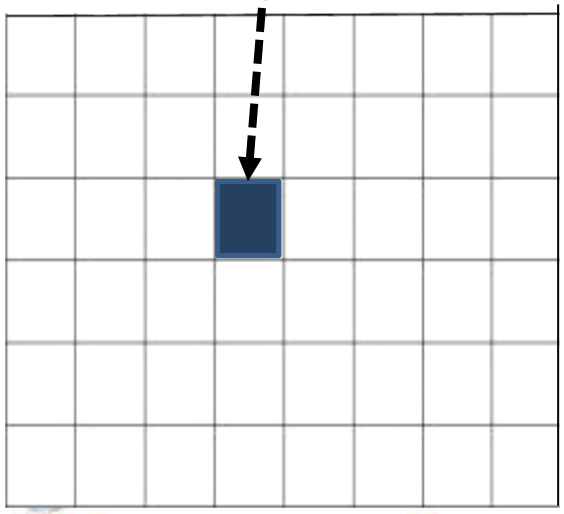




Database Systems

Σ

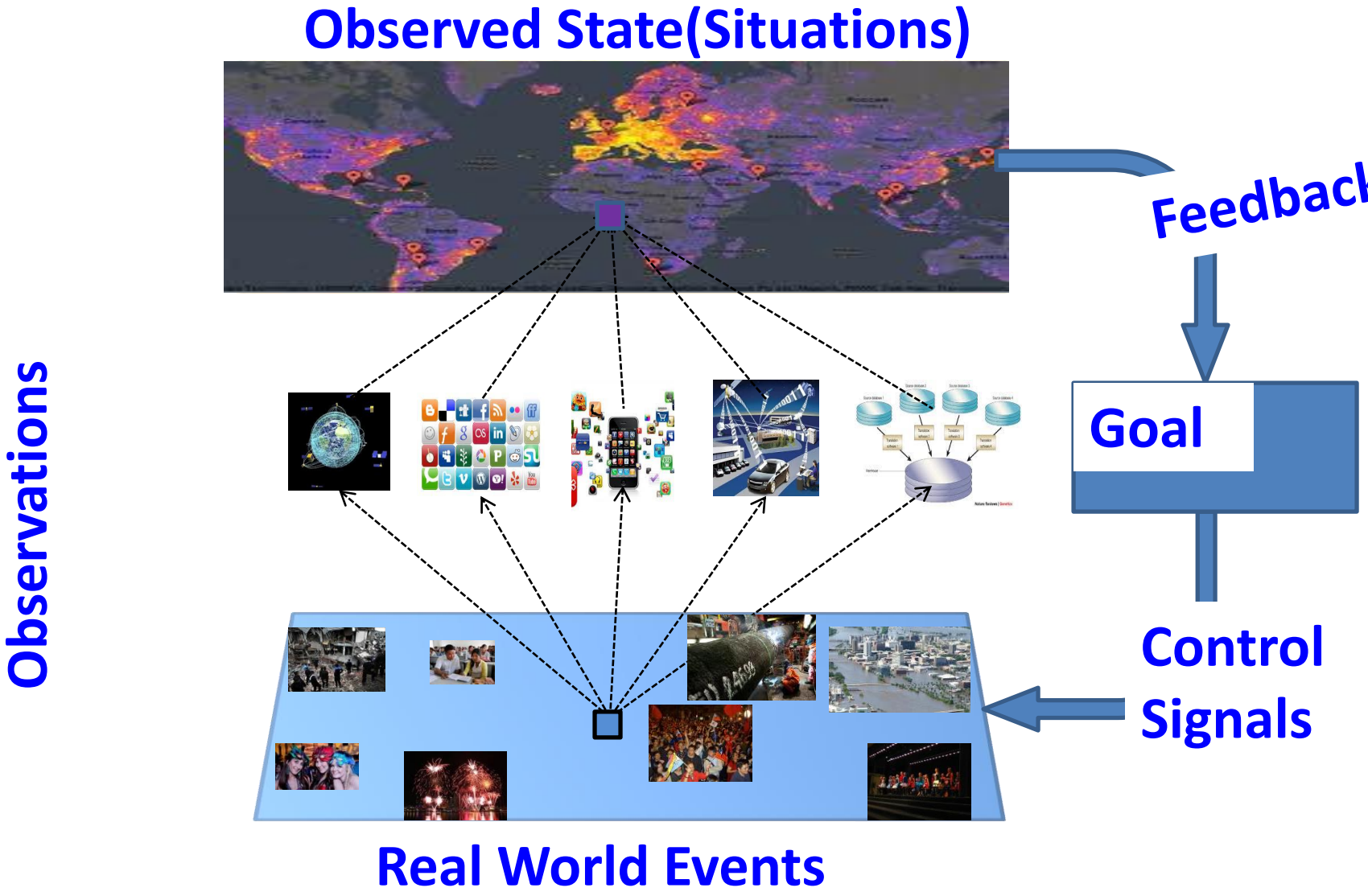
(S, T, T)



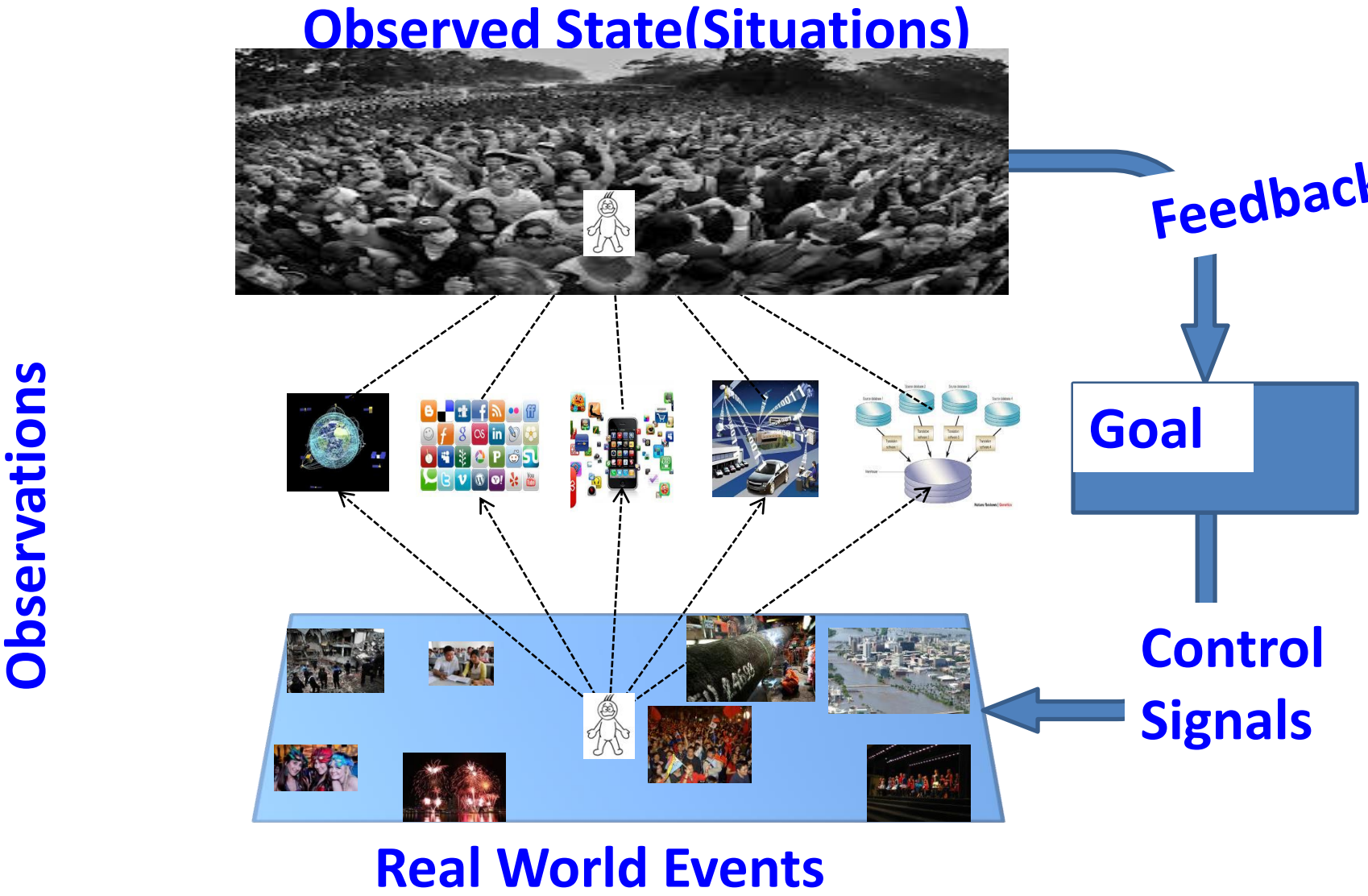
2-D spatial Grid at time T

Σ Uses Application semantics to combine different data items.

Intelligent Social Systems: Spatial Perspective



Intelligent Social Systems: People Perspective



Eventshop

Inspiration: Photoshop

Billions of data sources.

Environment for

Selecting, and

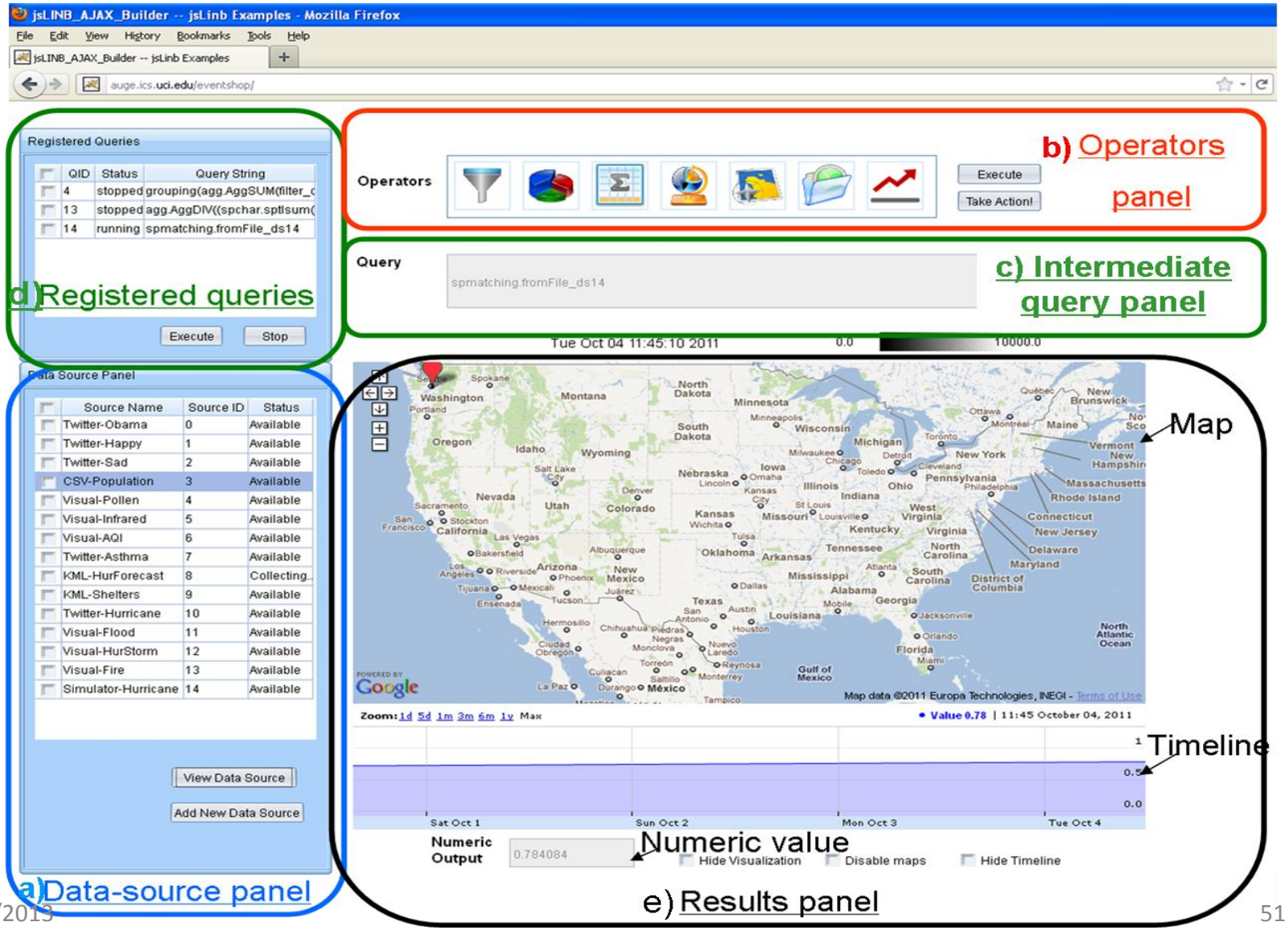
Combining

appropriate sources to detect situations.

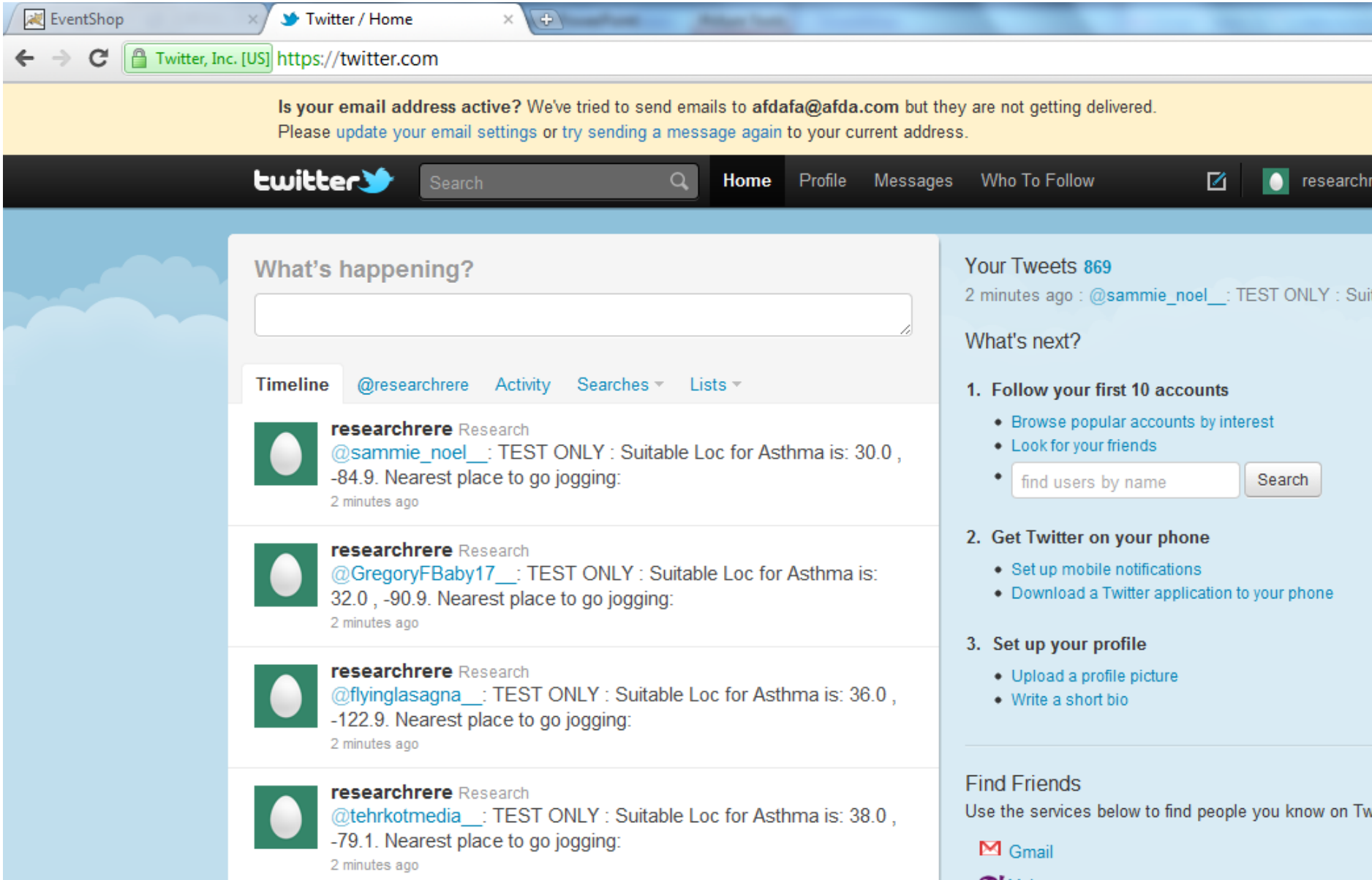
Prediction for Pro-active actions

Interactions with different types of Users

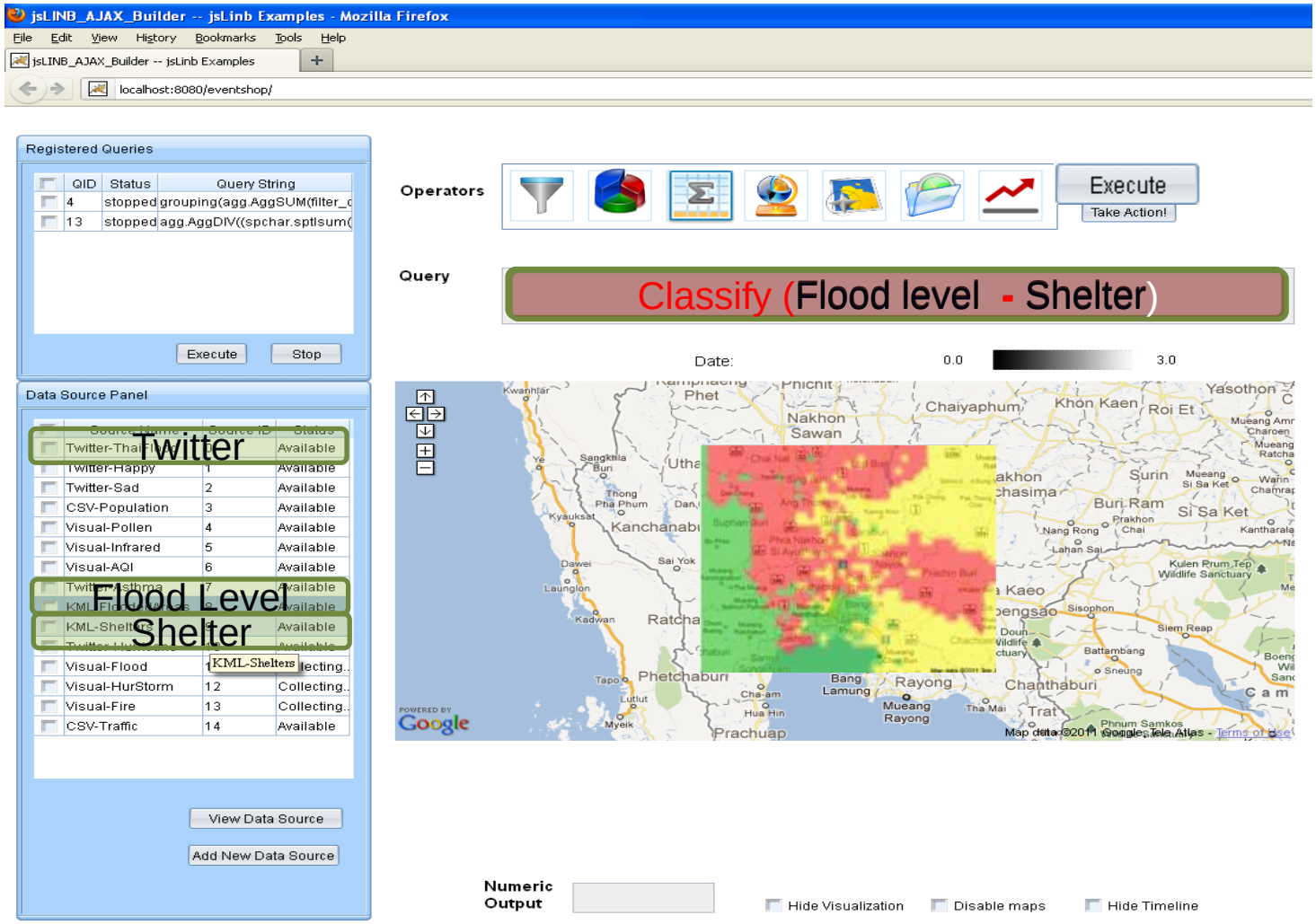
Eventshop: Interaction Environment



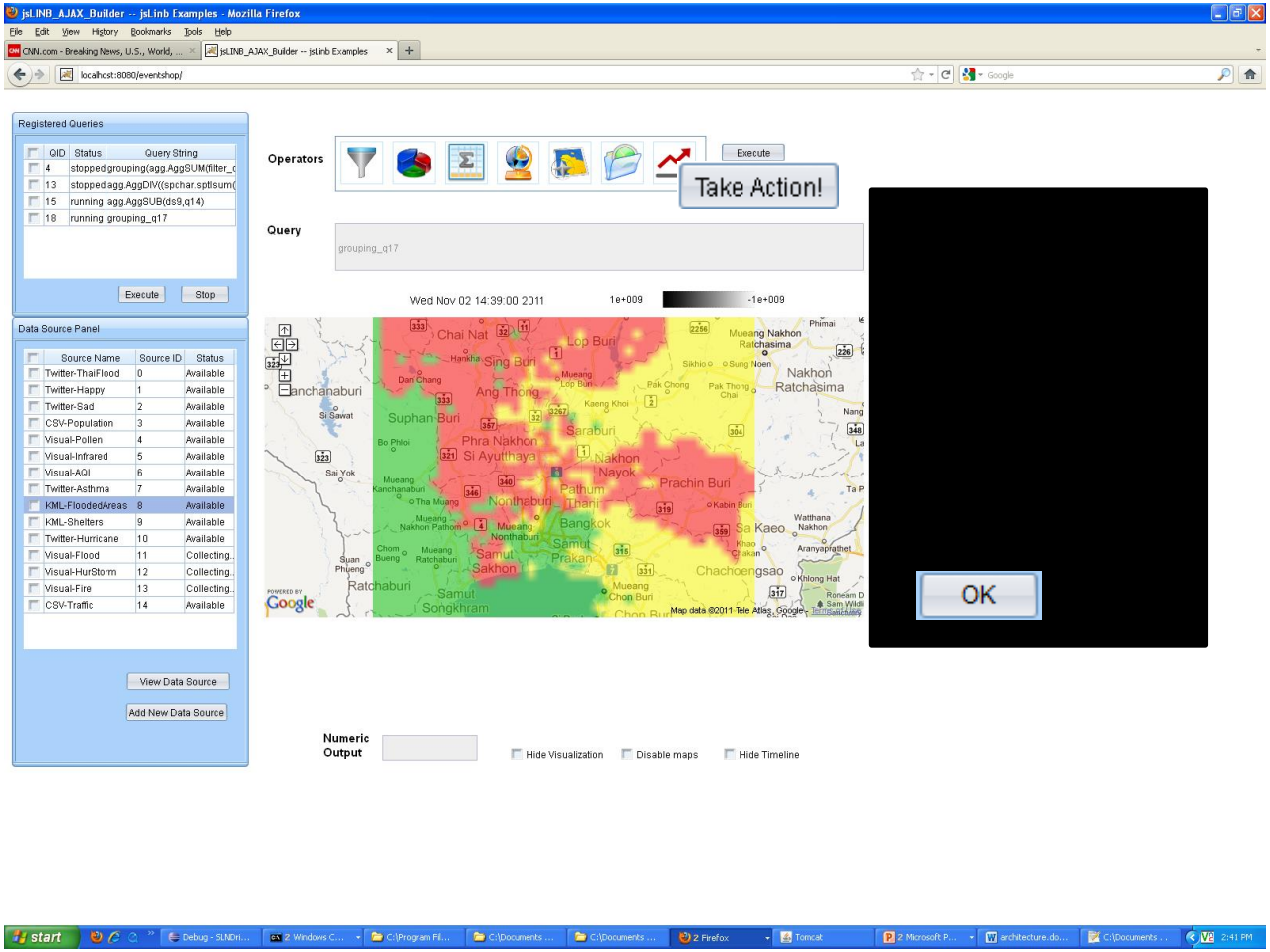
EventShop: Allergy Threat classification

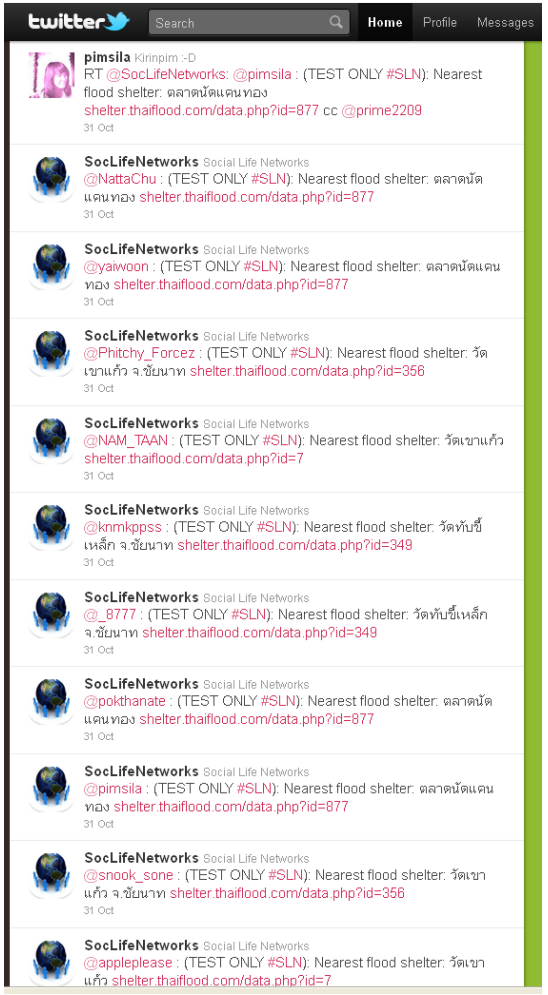


EventShop: Thai Floods

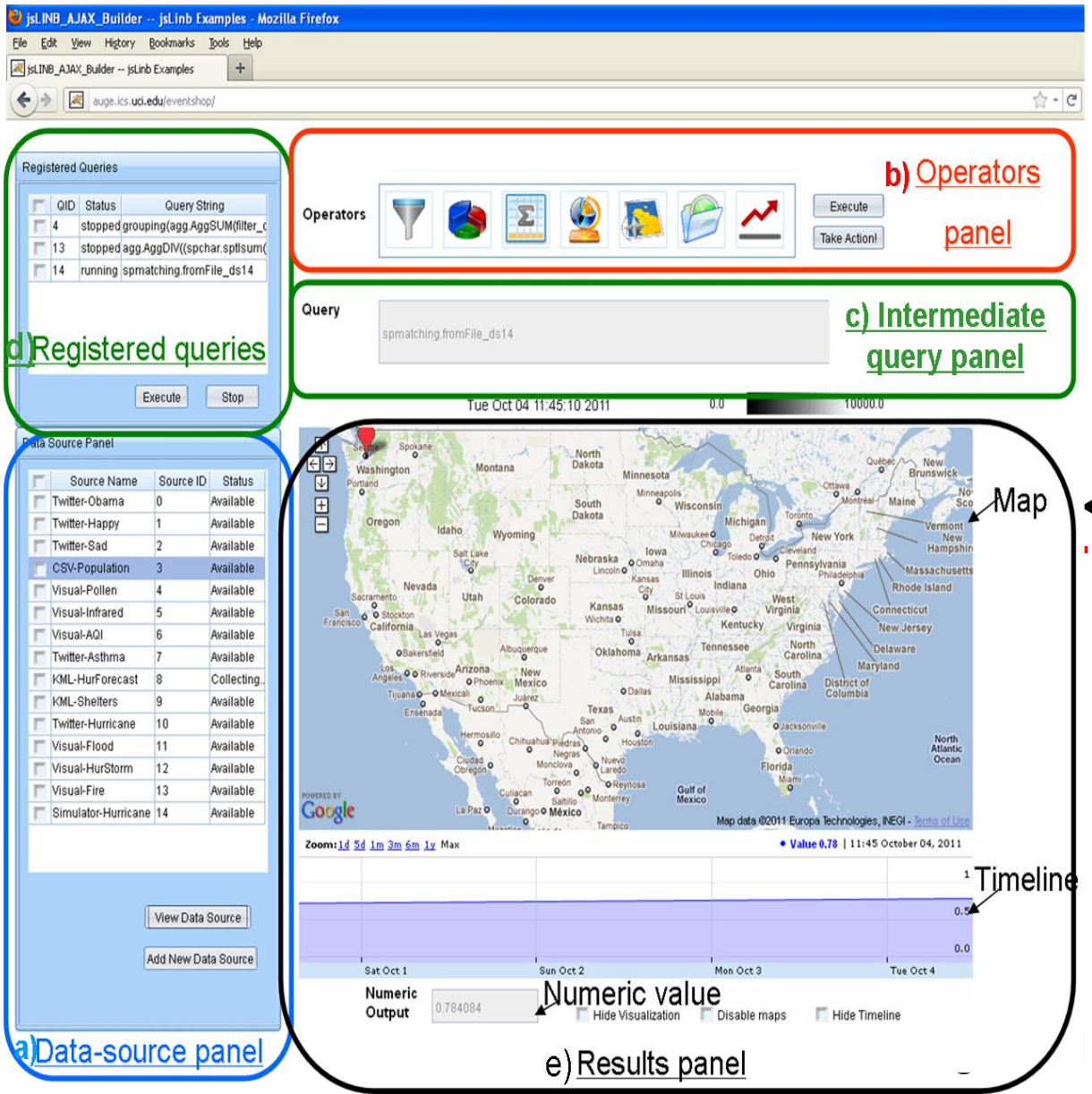


Taking personalized actions

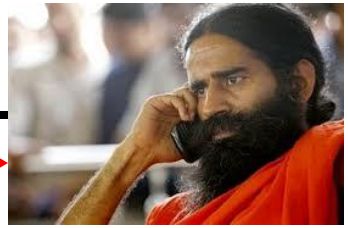




Personalized Alerts

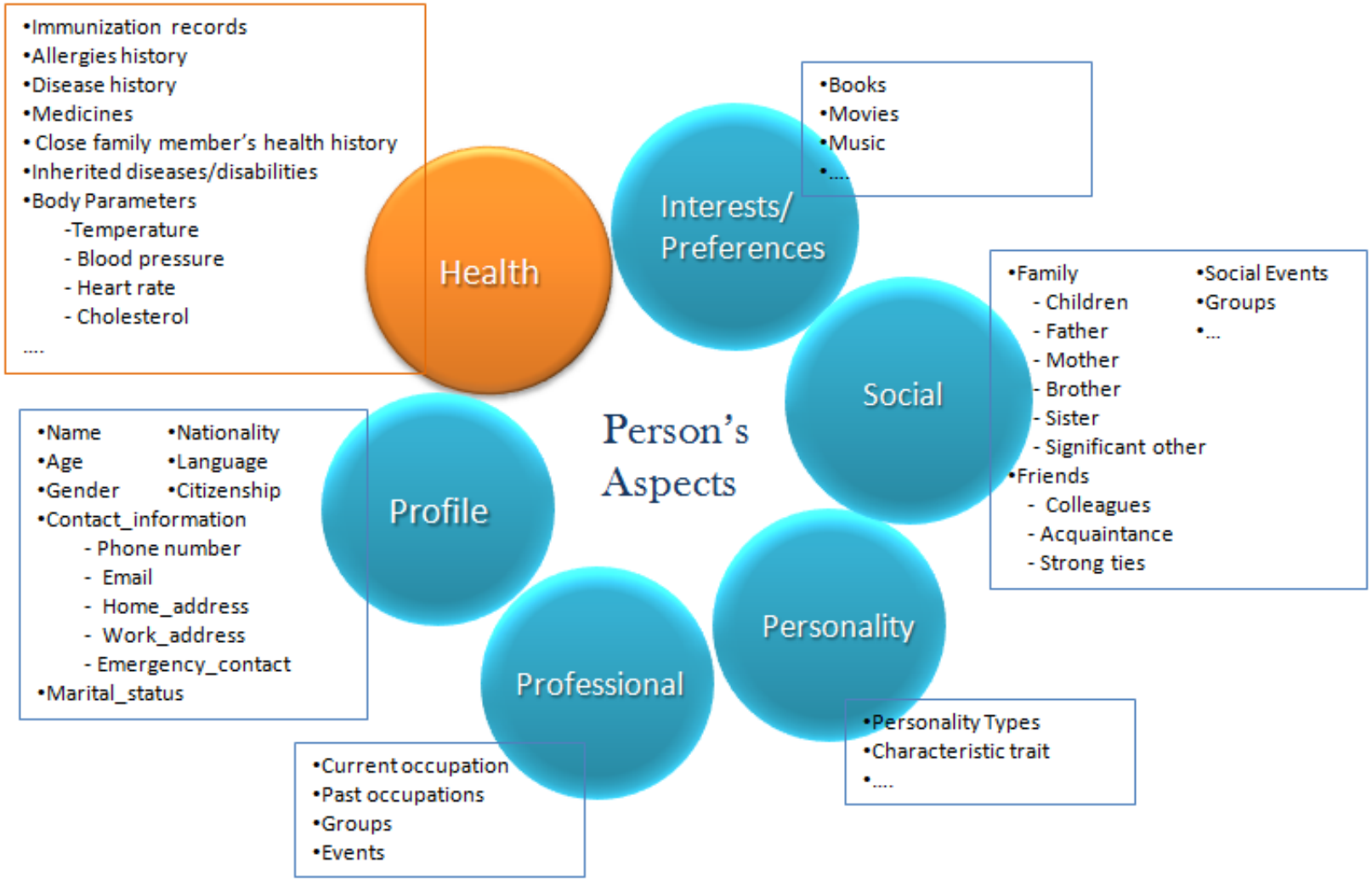


Users



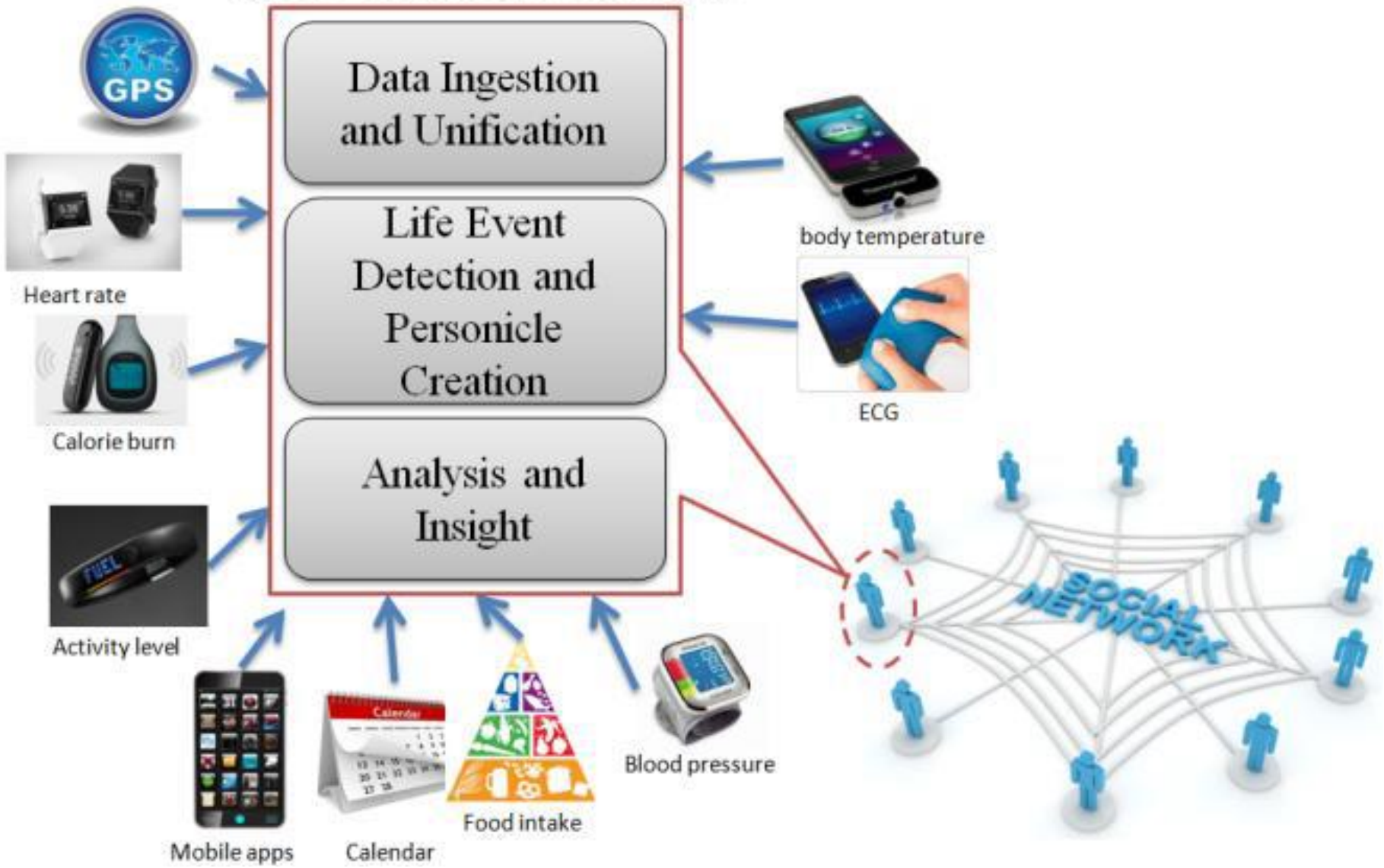
All Users are not EQUAL.

What defines a person?

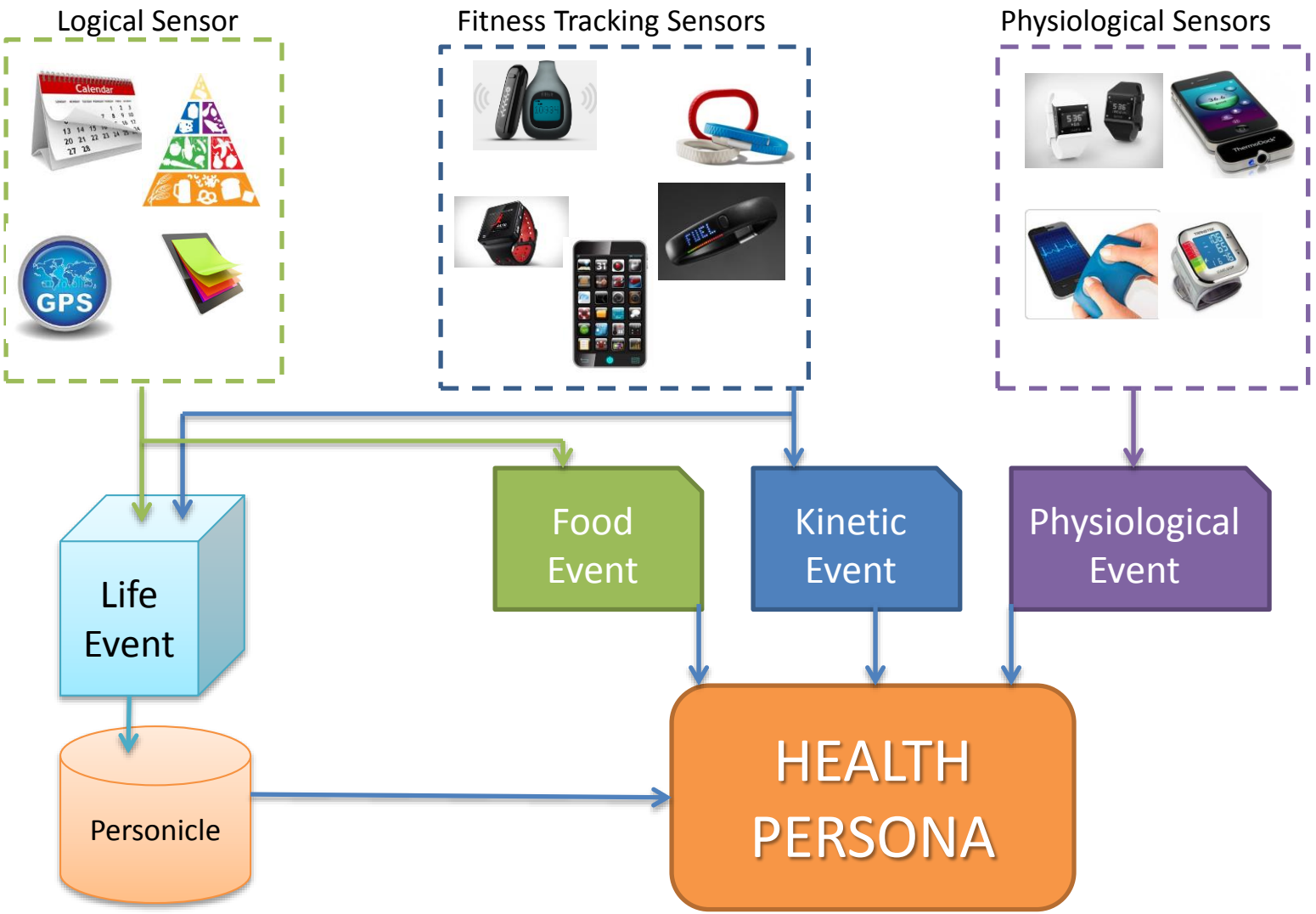


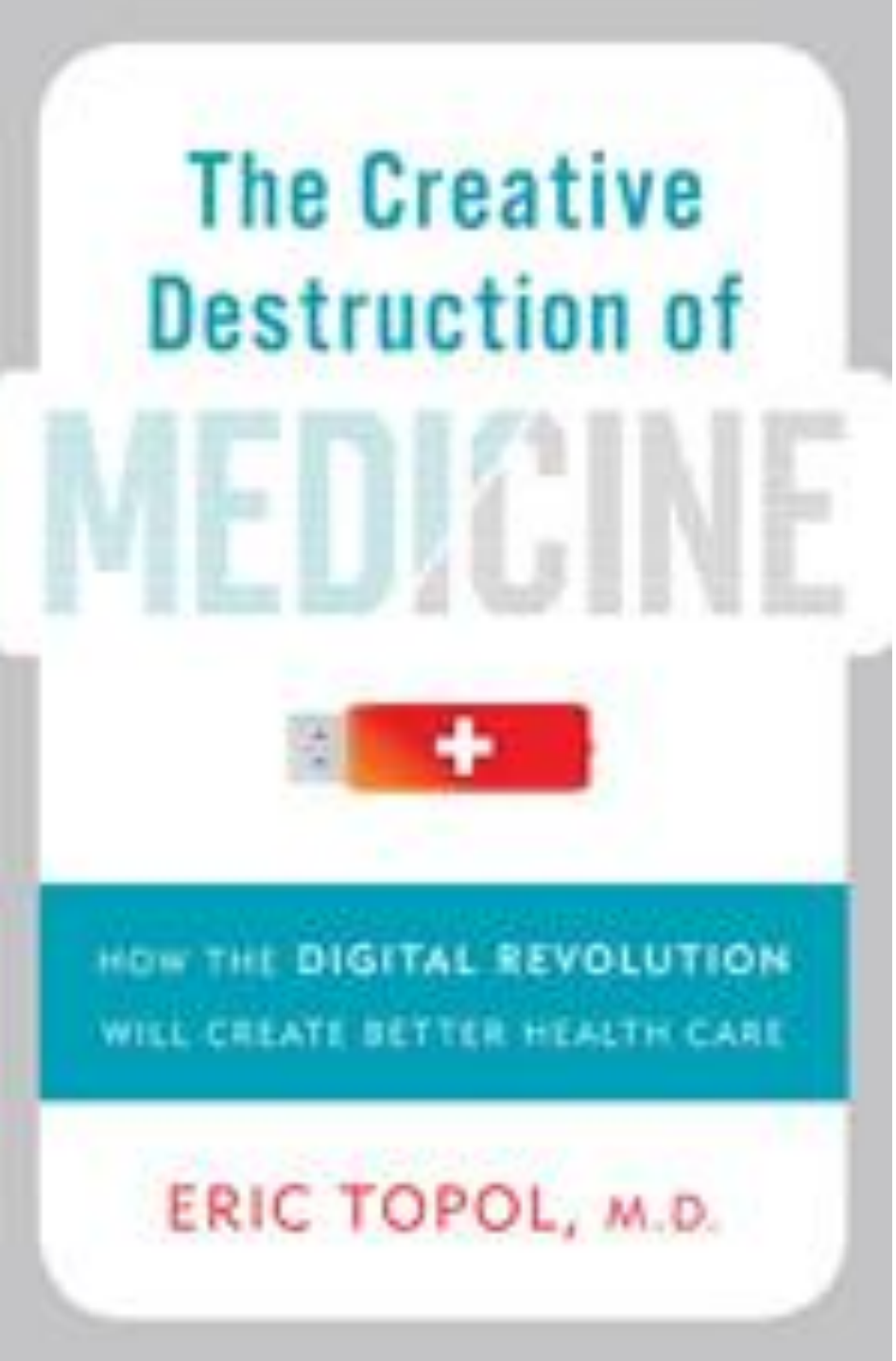
Persona: Turning Disassociated Data into *Meaningful* Information

Personal EventShop: Micro Situation Detection



Health Persona Framework





Personal Health

=

Personal Genome

+

Personal Lifestyle

Research Challenges

- Situation Recognition
- Persona and Personal Context
- Chronicle Analytics and Visualization
- Massive Geo-Spatial Heterogeneous Stream Processing
- Dynamic Need-Resource Optimization

Situation Recognition

- Next Frontier in Concept Recognition
- Heterogeneous Geo-spatial Dynamic Data
- Social data and IoT become a key element
- Application and domain semantics
- Model definitions
- High dimensionality
- Unification of data: Social-Cyber-Physical

Persona and Personal Context

- **Not only Logs of Keyboard and Surfing.**
- **You Log and explore every thing.**
  - **Entity resolution on TURBO**
- **Many new data processing and unification challenges.**

MicroBlogs and Twitter: LIMITATIONS

- **Very LOW Signal-to-Noise ratio: *High Noise-to-Signal ratio***
- **Difficult to extract SIGNAL from limited text.**

Solution: Tweeting Applications

- **Develop focused Apps: *Focused MicroBlogs***
- **Get all information from ‘motivated’ and collaborative users.**
- **Help them solve their problem.**

WAZE: Outsmarting Traffic, Together

Chronicle Analytics

- **Enterprise Warehouse were for late 20th Century – Planetary Warehouses are defining this century.**
- **Big data is important because it collects everything that happens to build 'Prediction Machines'.**
- **Machine learning and visualization are the key tools.**

Massive Geo-Spatial Heterogeneous Stream Processing

- **Why does the DATA become so BIG?**
- **And it will keep getting BIGGER.**
- **We have to go beyond Batch Processing as primary computing approach.**
- **Should be of great interest to Social Media researchers.**

Dynamic Need-Resource Optimization

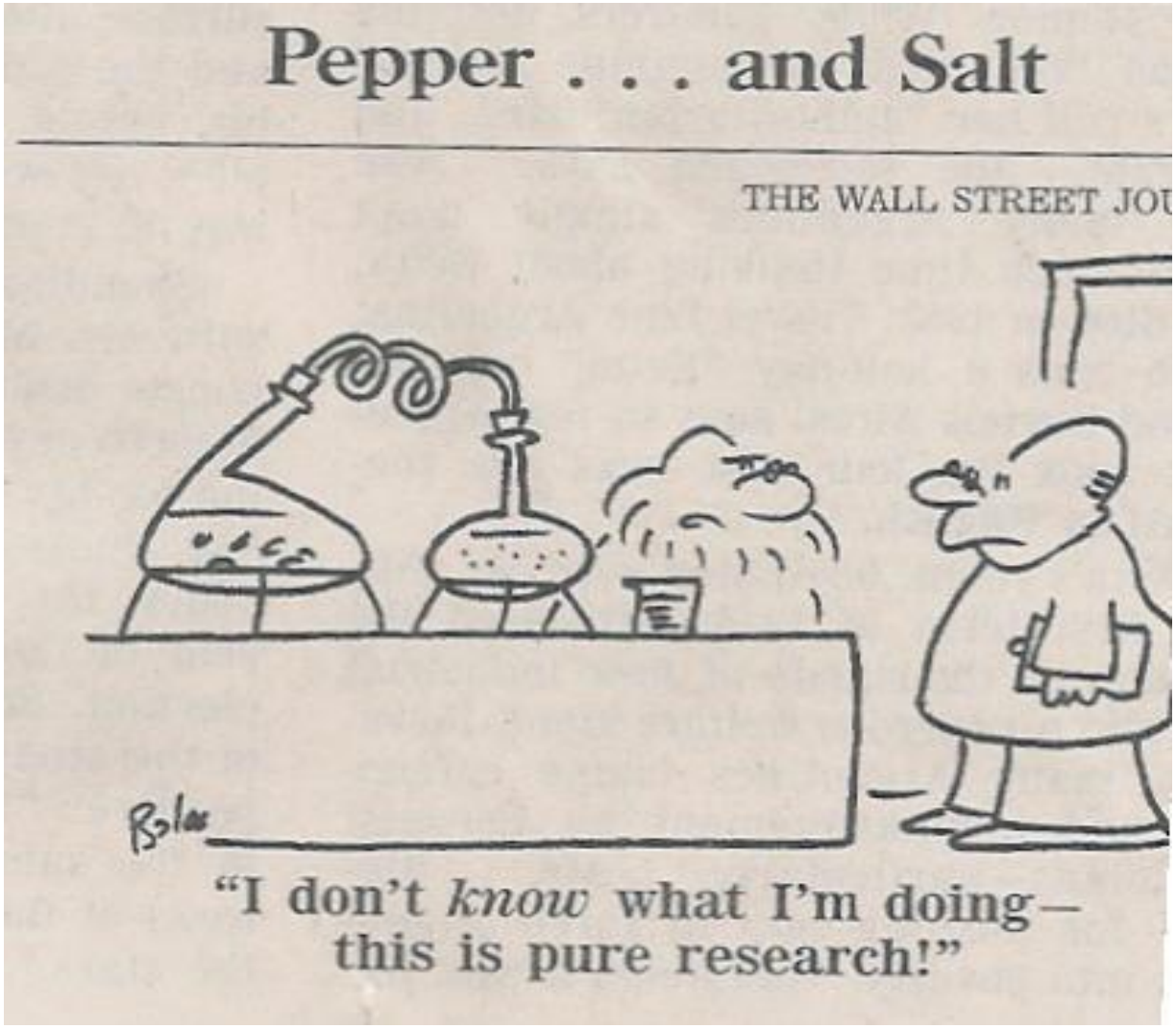
- **What are the fundamental problems in Computer Science?**
  - **Time and memory compexity**
  - **Operating systems, networks, storage management, algorithms, …**
- **What is the main concern in**
  - **Economics?**
  - **Healthcare?**
  - **Politics?**
  - **…**

Live EventShop and Collaboration

- Live EventShop Demo
  - http://auge.ics.uci.edu/eventshop/

- Current Collaborators & Plan
  - Cyber-Physical Cloud Computing Project
    - NICT, NIST
  - SLN4MOP Project
    - Sri Lanka Farmers; Prof. Ginige in Sydney leading
  - Open Source EventShop by end of 2013
    - HCL

Thanks for your time and attention.



For questions: jain@ics.uci.edu