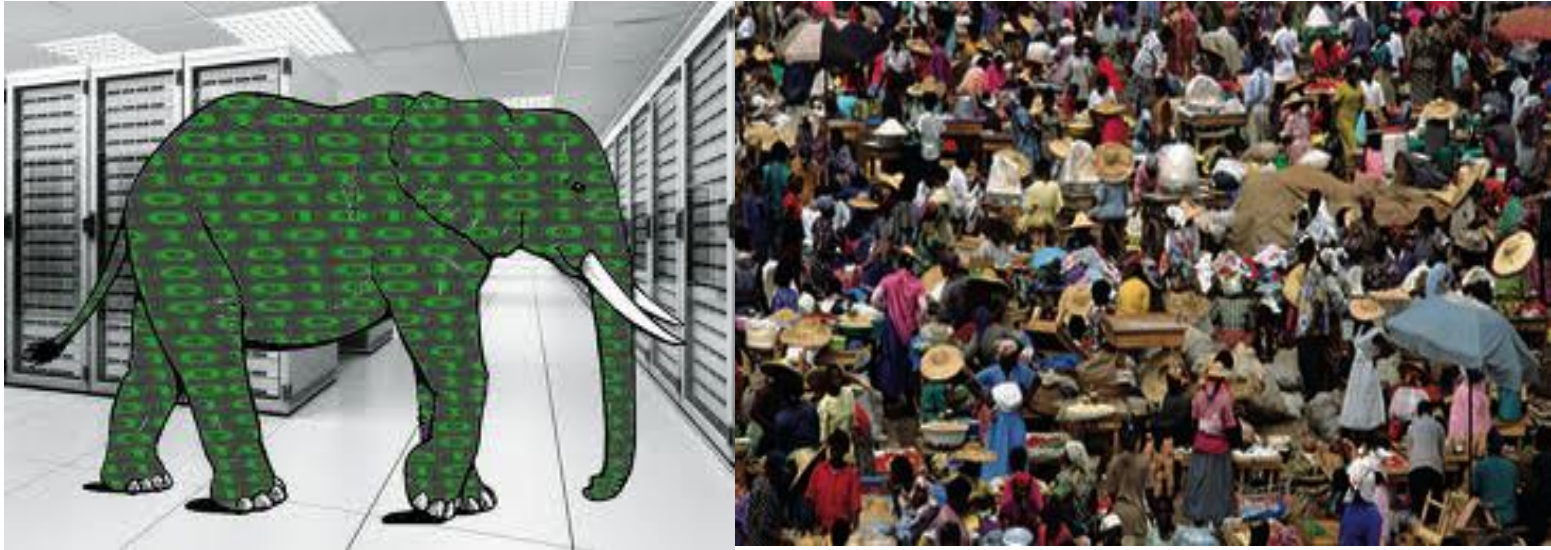


Towards Smart Social Systems



Ramesh Jain

jain@ics.uci.edu

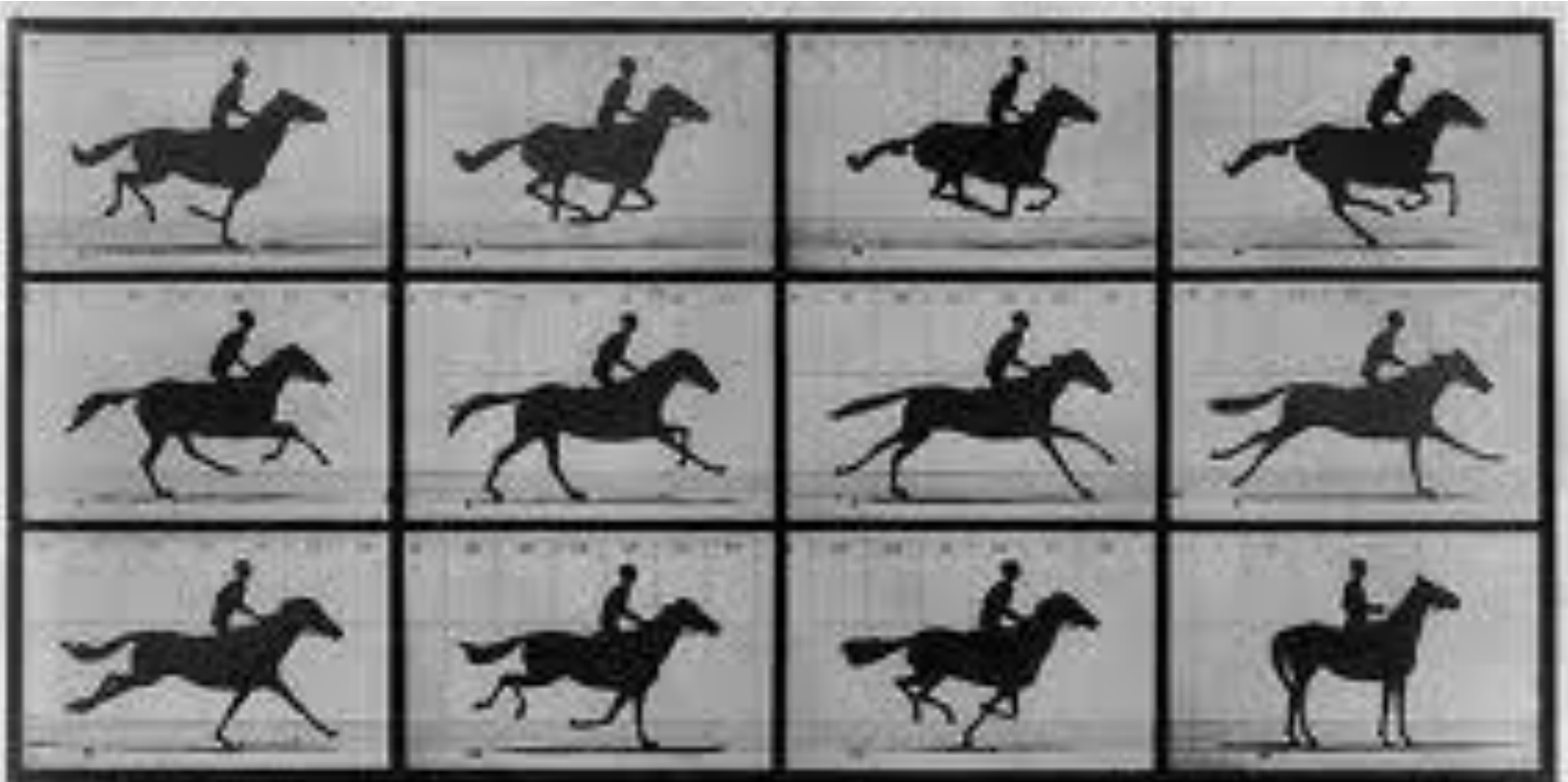
(FB, Twitter, G+, ...: jain49)

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.

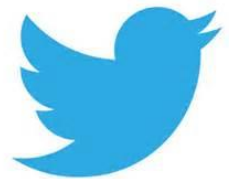
Computer Science: Modeling the World

- Data
- Objects
- Events

Events and Entities Exist in the real world.

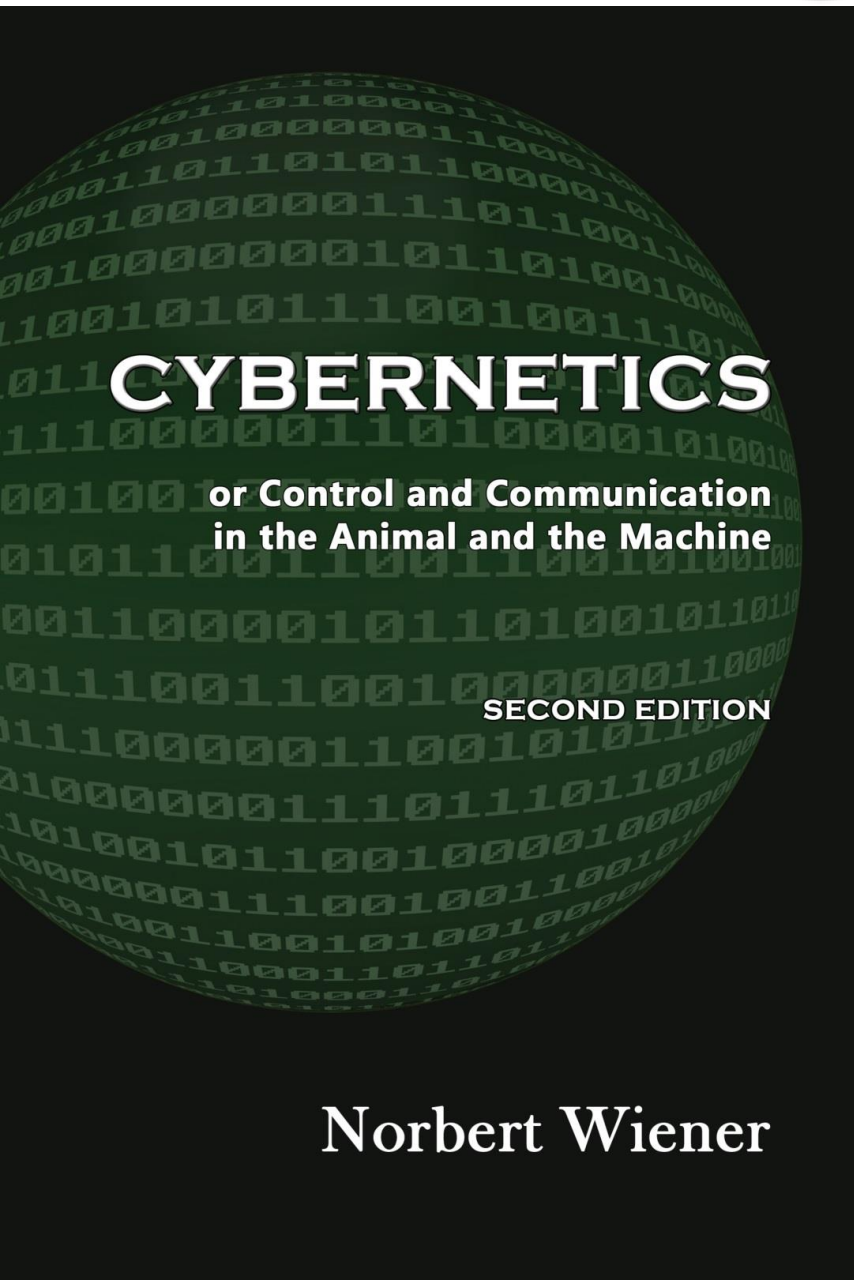


The New York Times



Events and entities result in Data and Documents

Extending Cybernetetics



Animals

Machines

Societies

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



Smart Social Systems:

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

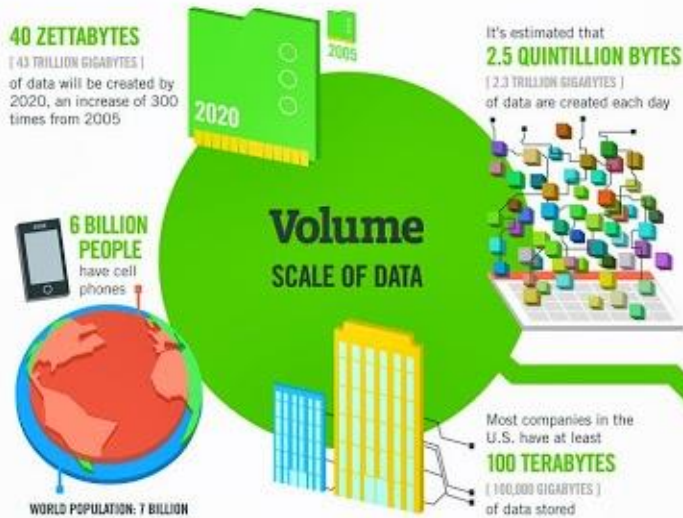


We Live in Dynamic World.



Events are always happening.

What is Important in 'modern data'?



The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015, **4.4 MILLION IT JOBS** will be created globally to support big data, with 1.9 million in the United States



As of 2011, the global size of data in healthcare was estimated to be **150 EXABYTES**
[161 BILLION GIGABYTES]



30 BILLION PIECES OF CONTENT are shared on Facebook every month



Variety DIFFERENT FORMS OF DATA



By 2014, it's anticipated there will be **420 MILLION WEARABLE, WIRELESS HEALTH MONITORS**

4 BILLION+ HOURS OF VIDEO are watched on YouTube each month



400 MILLION TWEETS are sent per day by about 200 million monthly active users



The New York Stock Exchange captures **1 TB OF TRADE INFORMATION** during each trading session



Modern cars have close to **100 SENSORS** that monitor items such as fuel level and tire pressure

Velocity ANALYSIS OF STREAMING DATA

By 2016, it is projected there will be **18.9 BILLION NETWORK CONNECTIONS** – almost 2.5 connections per person on earth



1 IN 3 BUSINESS LEADERS don't trust the information they use to make decisions



In one survey were unsure of how much of their data was inaccurate



Veracity UNCERTAINTY OF DATA

Poor data quality costs the US economy around **\$3.1 TRILLION A YEAR**



Different Situations are Norm



Abundance

What is Different in 'modern data'?

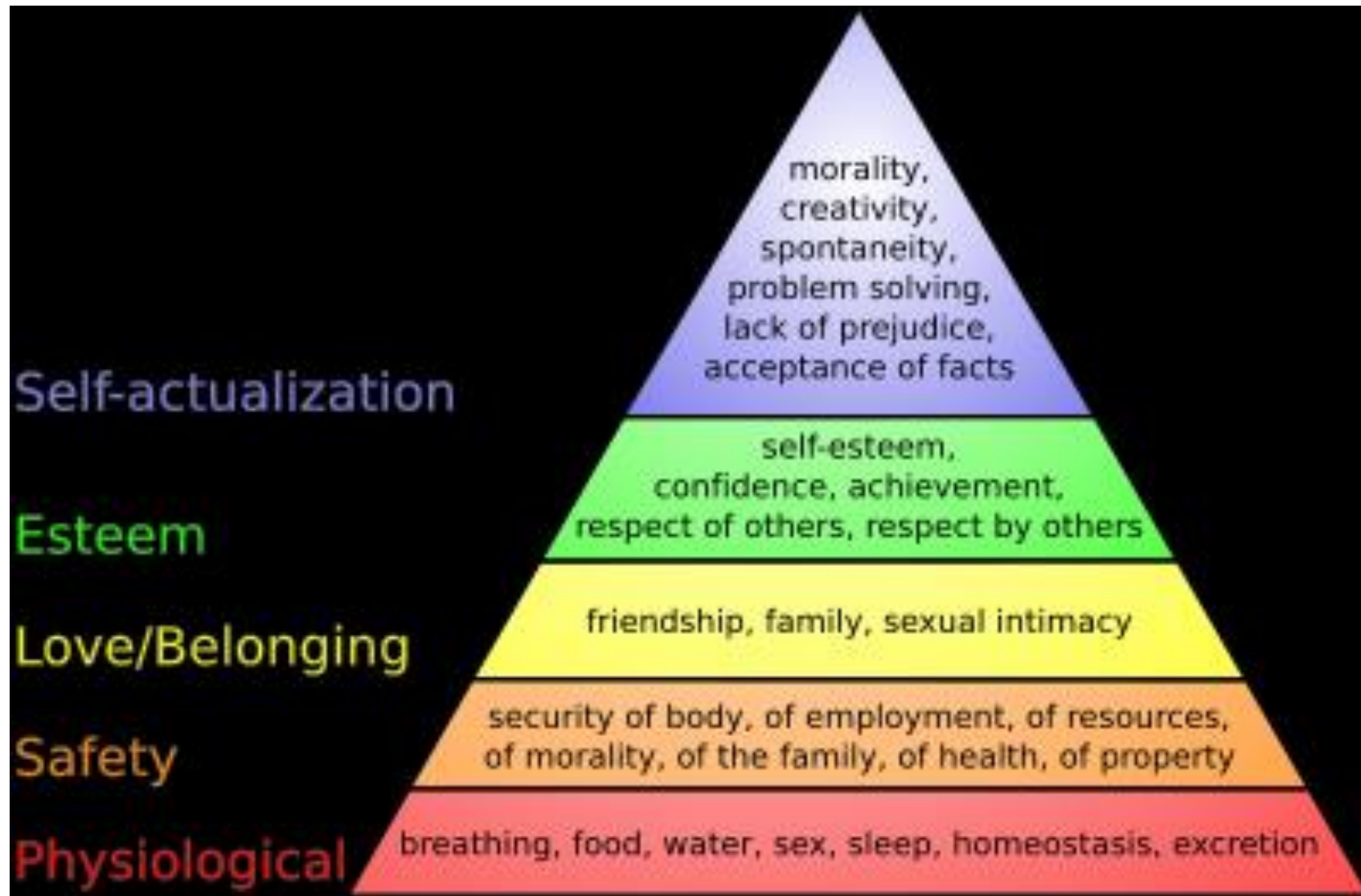
- Data is mostly **Data Streams**.
- **Location** is not just meta-data.
- It is **heterogeneous and multimodal**.
- Most of it is used to capture and understand **evolving nature of the world**.
- **Control** is more desirable than planning.

WHAT IS THE MOST FUNDAMENTAL PROBLEM IN SOCIETY?

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

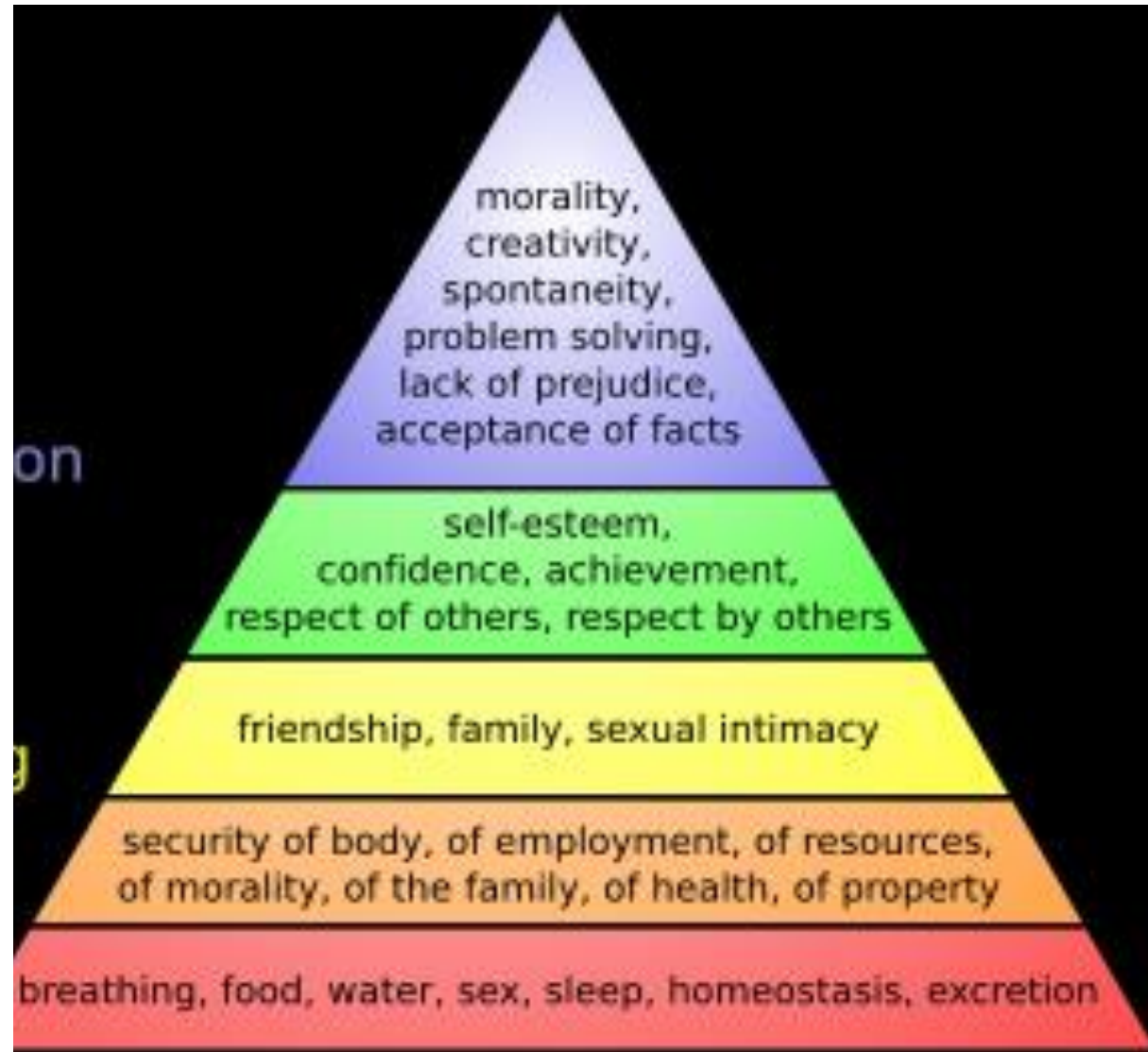
Hint: Economics, Health Care, Politics, Computer Science,
Operations Research, ...

Maslow: Basic Needs

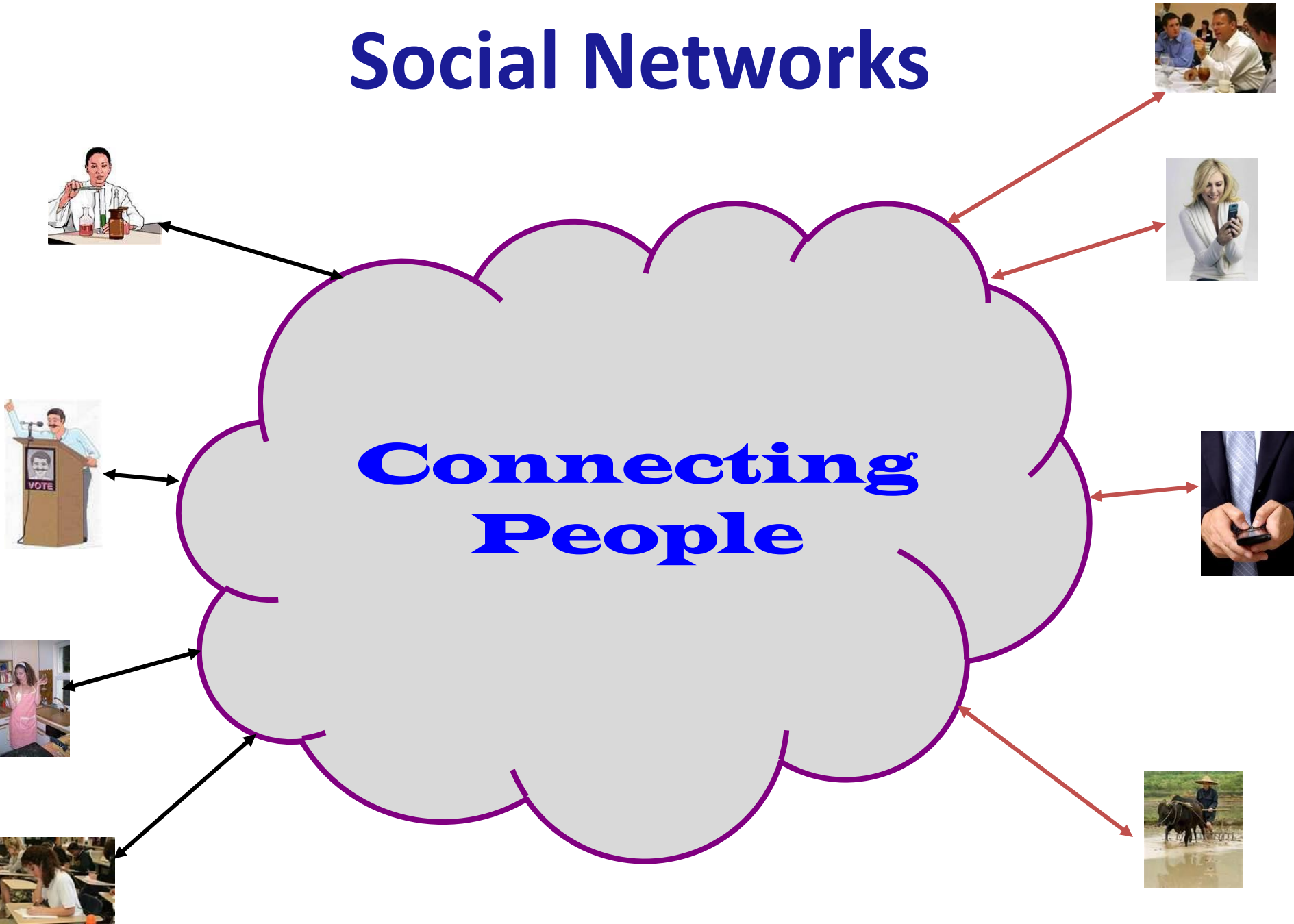


Maslow: *Needs and Resources*

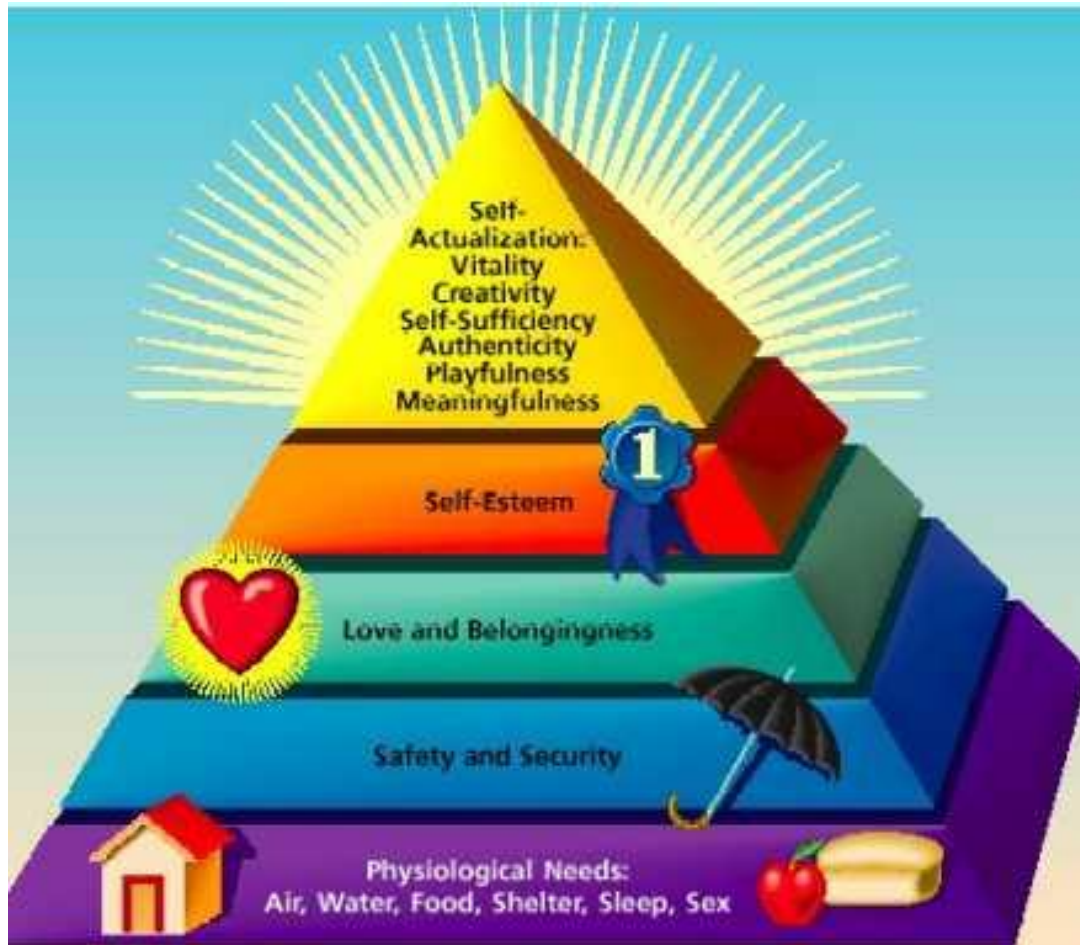
- Financial
- Natural (Food)
- Human Skills
- Health
- Rescue
- Transportation
- Education
- Production
- ...



Social Networks



Social Media and Maslow's Hierarchy



**Current
Social
Networks**

**Important
Unsatisfied
Needs**

Social Life Networks



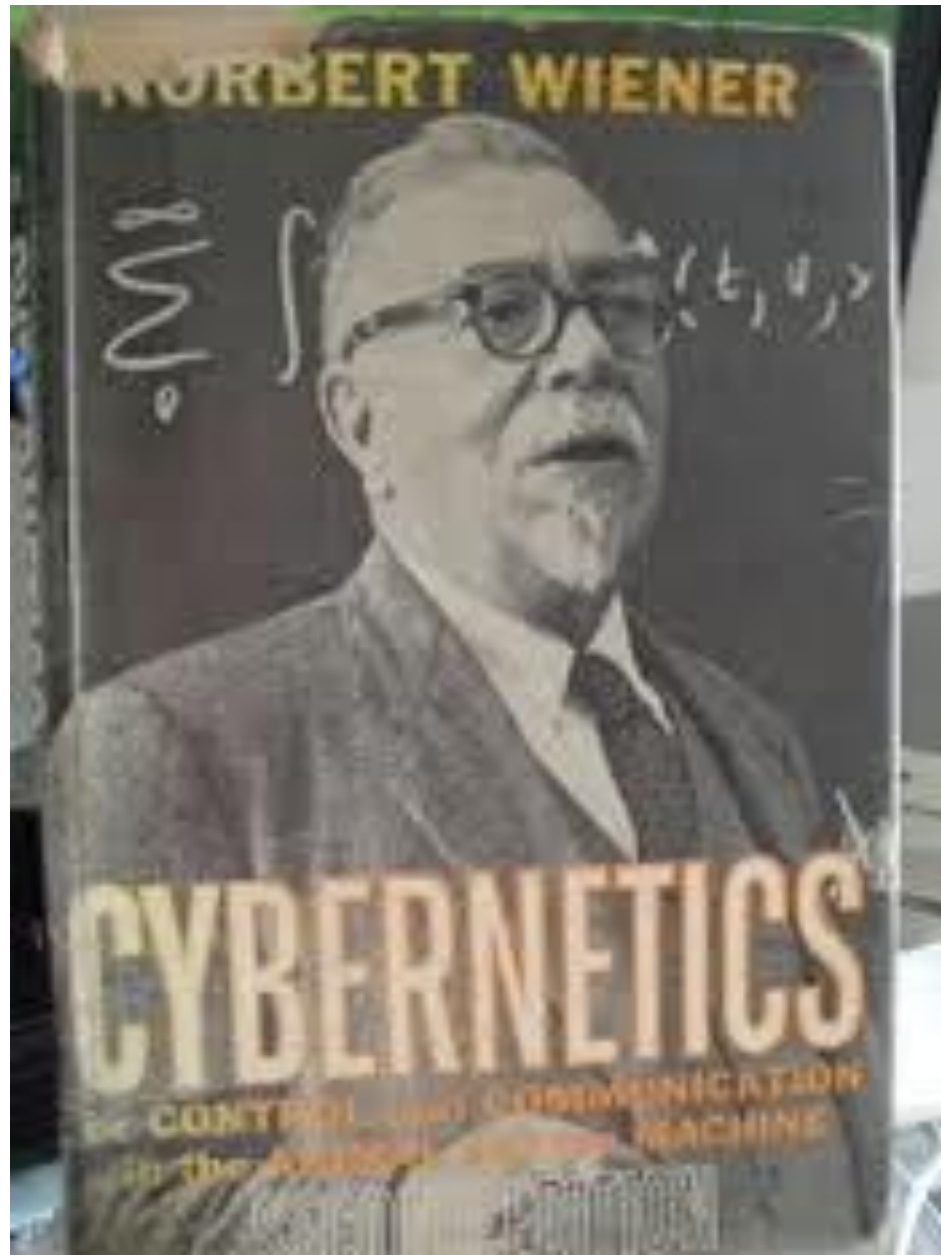
Connecting People to Resources



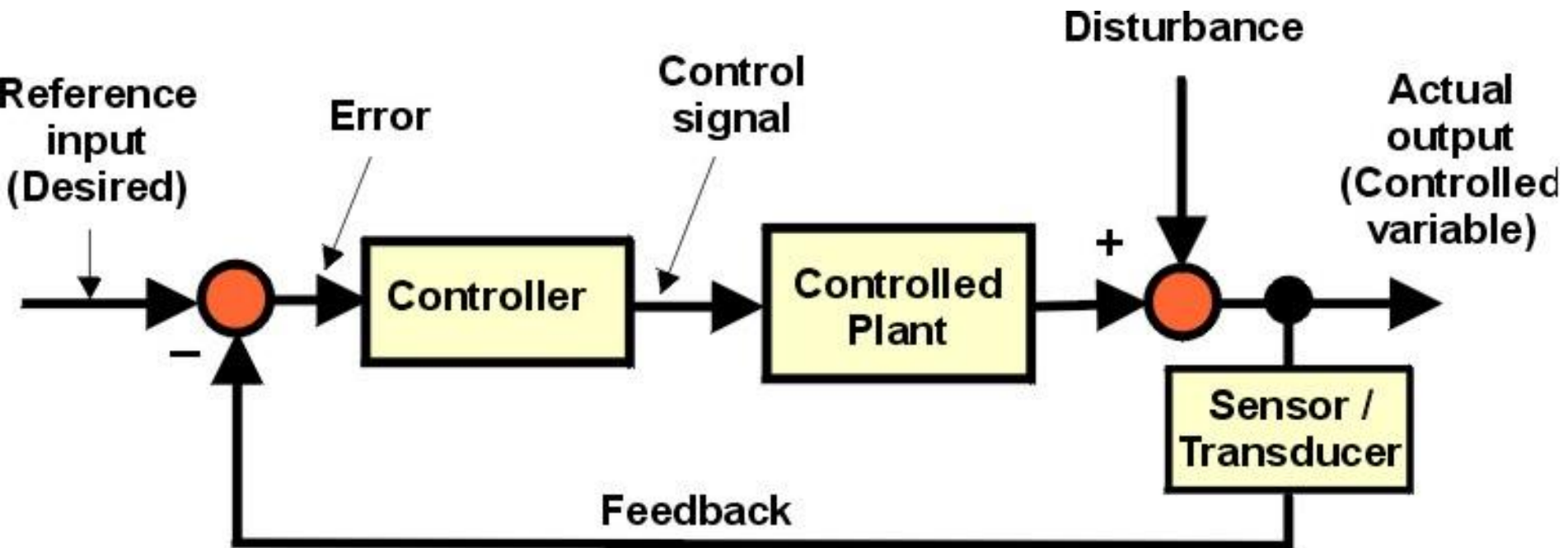
Designing Complex Systems Using Simple Principles



Feedback Results in Smart Behavior

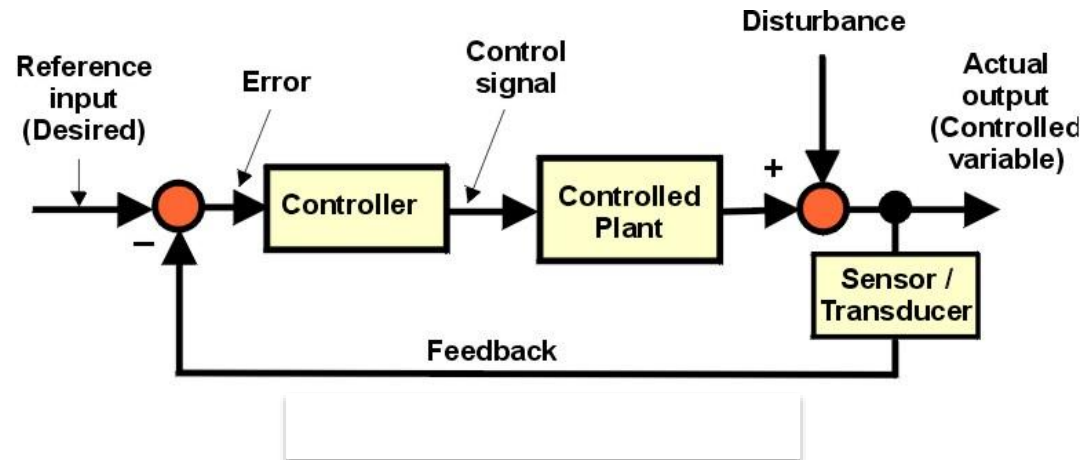


Simple Principle



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

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

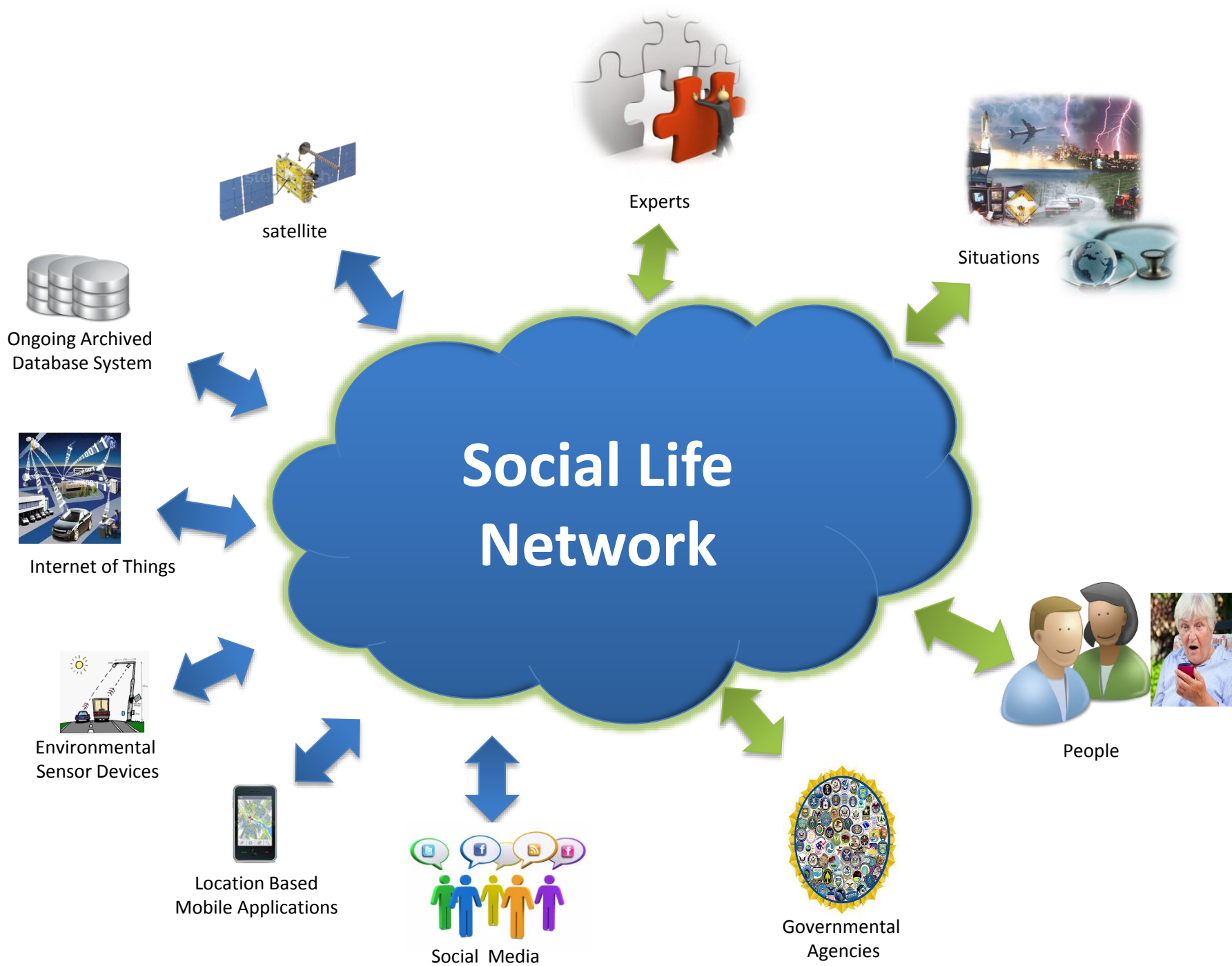
Situations

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

**CAN WE APPLY CYBERNETICS
IDEAS TO SOCIAL SYSTEMS?**

Emerging Social Systems

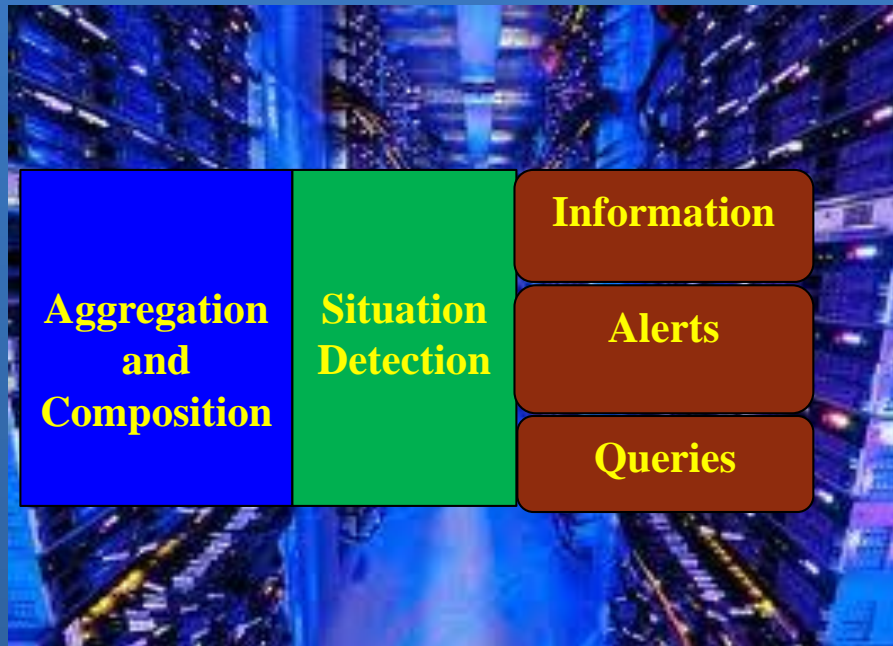
- **Social observations are now possible with little latency.**
- **We can design social systems with feedback.**
- **Situation Recognition and Need-Availability identification of resources is a major challenge.**



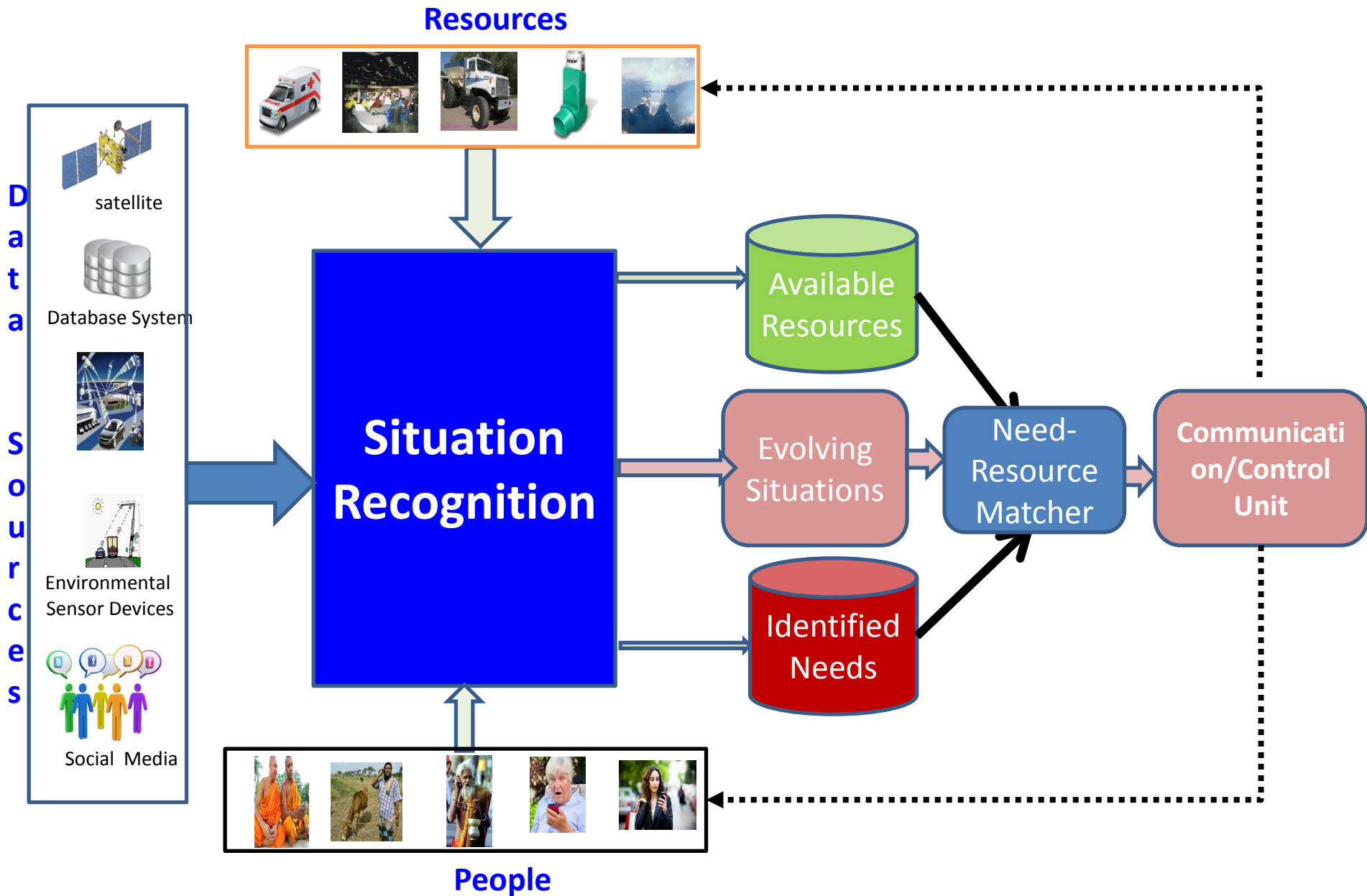
Fundamental Problem

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

Social Life Network



Smart Social Systems Architecture



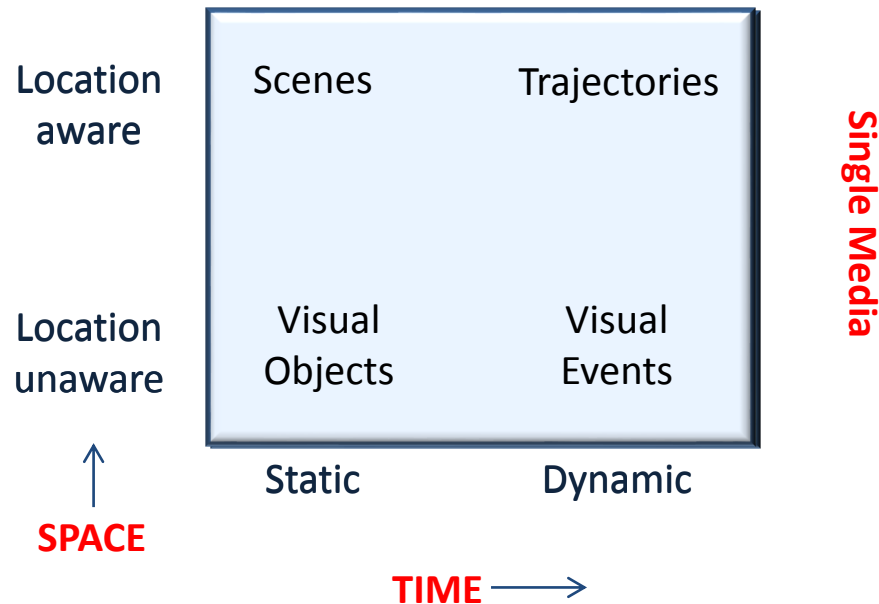
Key Steps

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

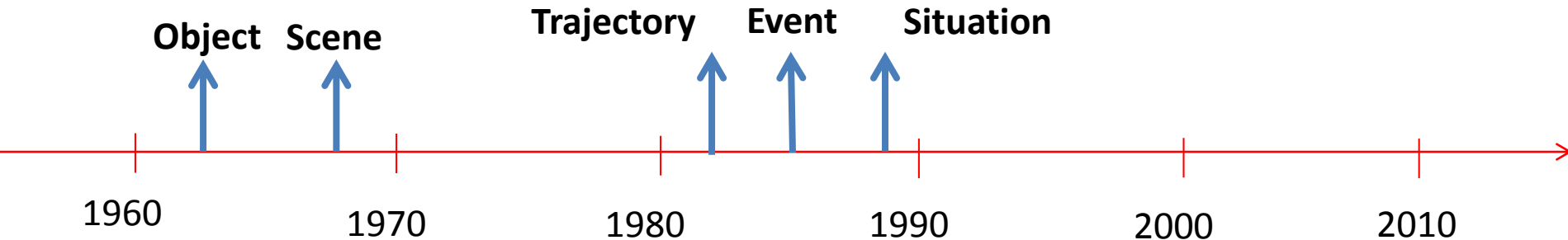
- **Data Ingestion** to efficiently extract data from the Web and make them available for later computation is not-trivial.
- **Stream Processing Engine** to bridge the semantic gap between high level concept of situations and low level data streams.
- **Situation Recognition** as the next step in concept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

Concept Recognition: *Last Century*



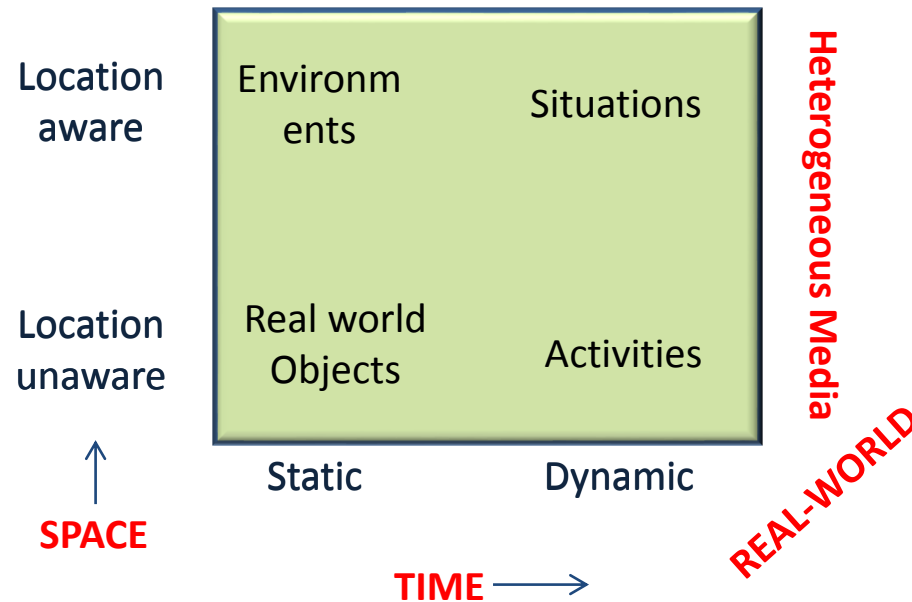
Data = Text *or* Images *or* Video

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



10/26/2013



From Events to Situations

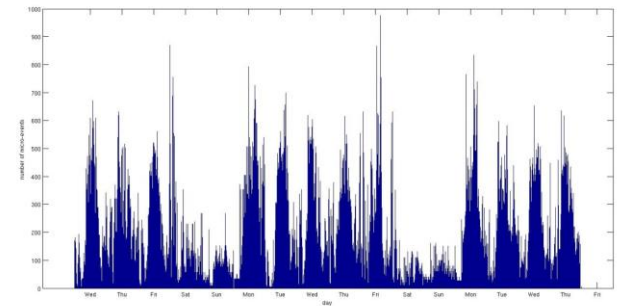
- Example 1:
 - A person shouting.
 - 1000 people shouting.
 - In a contained building
 - In main parts of a city
- Example 2:
 - One person complaining about flu.
 - Many people from different areas of a country complaining about flu.

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

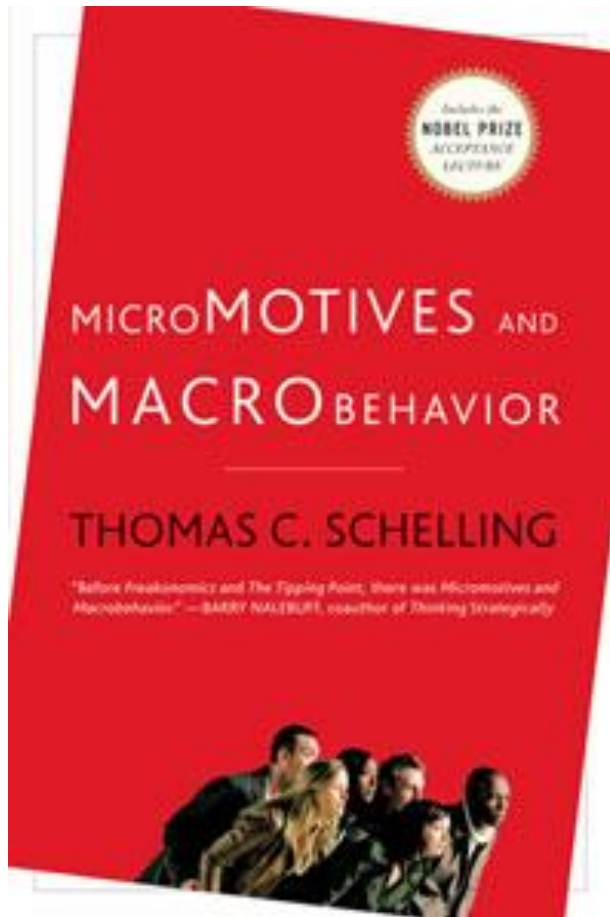
- Billions of disparate kinds of sensors being placed everywhere.
- Each sensor detects 'basic events' and broadcasts it in a simple form.
- Develop a system to process these micro-events and make them useful.

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-behavior 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**



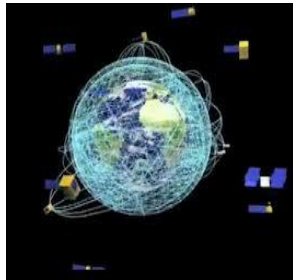
**Phone
Apps**



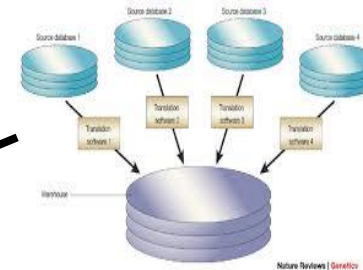
**Internet of
Things**



**Global
Sensors**

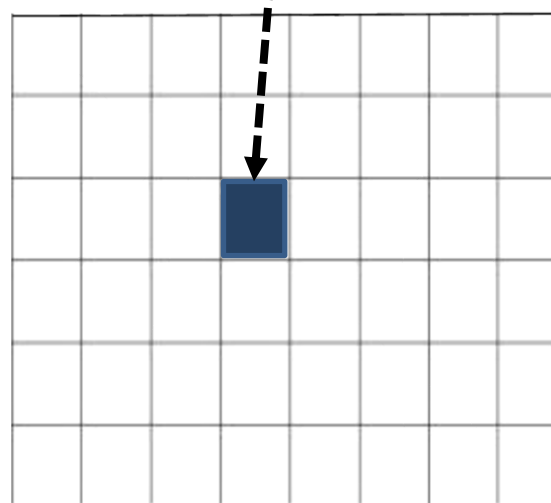


**Database
Systems**



(S, T, T)

**2-D spatial
Grid at time
T**

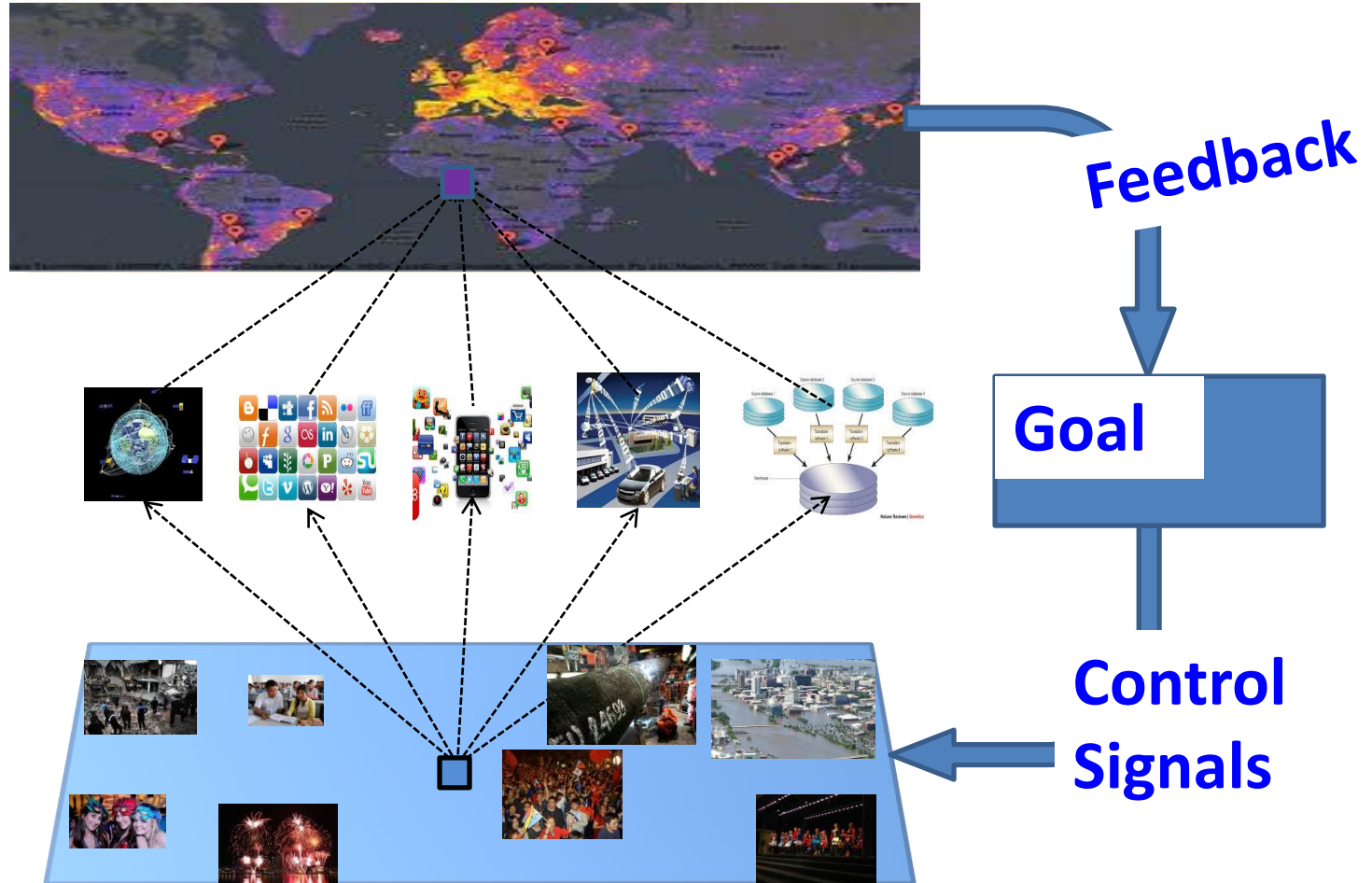


**Σ Uses
Application
semantics to
combine
different data
items.**

Intelligent Social Systems: Spatial Perspective

Observed State(Situations)

Observations



Real World Events

Intelligent Social Systems: People Perspective

Observed State(Situations)

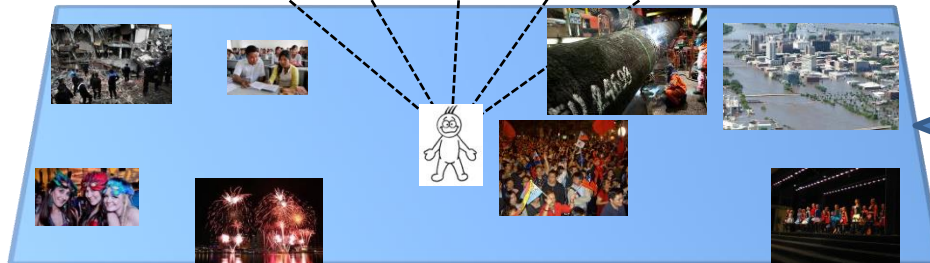
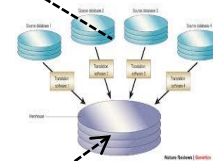
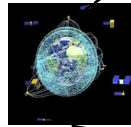


Feedback

Goal

Control
Signals

Observations



Real World Events

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

jsLINB AJAX Builder -- jsLINB Examples - Mozilla Firefox

File Edit View History Bookmarks Tools Help

jsLINB AJAX Builder -- jsLINB Examples

auge.ics.ucd.edu/eventshop/

a) Registered queries

QID	Status	Query String
4	stopped	grouping(agg.AggsUM(filter_c
13	stopped	agg.AggsDIV((spchar.sptisum(
14	running	spmatching.fromFile_ds14

Execute Stop

b) Operators panel

Operators

Execute Take Action!

c) Intermediate query panel

Query

spmatching.fromFile_ds14

d) Data-source panel

Source Name	Source ID	Status
Twitter-Obama	0	Available
Twitter-Happy	1	Available
Twitter-Sad	2	Available
CSV-Population	3	Available
Visual-Pollen	4	Available
Visual-Infrared	5	Available
Visual-AQI	6	Available
Twitter-Asthma	7	Available
KML-HurForecast	8	Collecting...
KML-Shelters	9	Available
Twitter-Hurricane	10	Available
Visual-Flood	11	Available
Visual-HurStorm	12	Available
Visual-Fire	13	Available
Simulator-Hurricane	14	Available

View Data Source Add New Data Source

e) Results panel

Tue Oct 04 11:45:10 2011 0.0 10000.0

Map

Timeline

Numeric value

Numeric Output 0.784084

Hide Visualization Disable maps Hide Timeline

EventShop: Allergy Threat classification

EventShop

Twitter / Home

Twitter, Inc. [US] https://twitter.com

Is your email address active? We've tried to send emails to afdafa@afda.com but they are not getting delivered. Please [update your email settings](#) or [try sending a message again](#) to your current address.

twitter

Search

Home

Profile

Messages

Who To Follow

researchrere

What's happening?


Timeline


@researchrere


Activity


Searches

Lists

**researchrere** Research
[@sammie_noel__](#): TEST ONLY : Suitable Loc for Asthma is: 30.0 , -84.9. Nearest place to go jogging:
2 minutes ago

**researchrere** Research
[@GregoryFBaby17__](#): TEST ONLY : Suitable Loc for Asthma is: 32.0 , -90.9. Nearest place to go jogging:
2 minutes ago

**researchrere** Research
[@flyinglasagna__](#): TEST ONLY : Suitable Loc for Asthma is: 36.0 , -122.9. Nearest place to go jogging:
2 minutes ago

**researchrere** Research
[@tehrkotmedia__](#): TEST ONLY : Suitable Loc for Asthma is: 38.0 , -79.1. Nearest place to go jogging:
2 minutes ago

Your Tweets 869

2 minutes ago : [@sammie_noel__](#): TEST ONLY : Suitable Loc for Asthma is: 30.0 , -84.9. Nearest place to go jogging:

What's next?

1. Follow your first 10 accounts

- Browse popular accounts by interest
- Look for your friends
-

2. Get Twitter on your phone

- Set up mobile notifications
- Download a Twitter application to your phone

3. Set up your profile

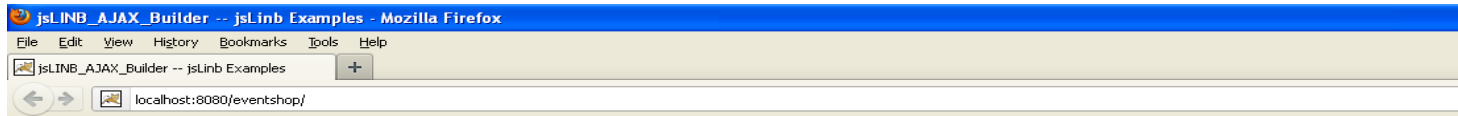
- Upload a profile picture
- Write a short bio

Find Friends

Use the services below to find people you know on Twitter

Gmail

EventShop: Thai Floods



Registered Queries

<input type="checkbox"/>	QID	Status	Query String
<input type="checkbox"/>	4	stopped	grouping(agg.AggsUM(filter_c
<input type="checkbox"/>	13	stopped	agg.AggsDIV((spchar.sptsum(

Execute
Stop

Data Source Panel

<input type="checkbox"/>	Source Name	Source ID	Status
<input type="checkbox"/>	Twitter		Available
<input type="checkbox"/>	Twitter-Happy	1	Available
<input type="checkbox"/>	Twitter-Sad	2	Available
<input type="checkbox"/>	CSV-Population	3	Available
<input type="checkbox"/>	Visual-Pollen	4	Available
<input type="checkbox"/>	Visual-Infrared	5	Available
<input type="checkbox"/>	Visual-AQI	6	Available
<input type="checkbox"/>	Twitter-Asthma	7	Available
<input type="checkbox"/>	KML-Flood	8	Available
<input type="checkbox"/>	KML-Shelter	9	Available
<input type="checkbox"/>	Twitter-Hurricane	10	Available
<input type="checkbox"/>	Visual-Flood	11	Collecting..
<input type="checkbox"/>	Visual-Hurricane	12	Collecting..
<input type="checkbox"/>	Visual-Fire	13	Collecting..
<input type="checkbox"/>	CSV-Traffic	14	Available

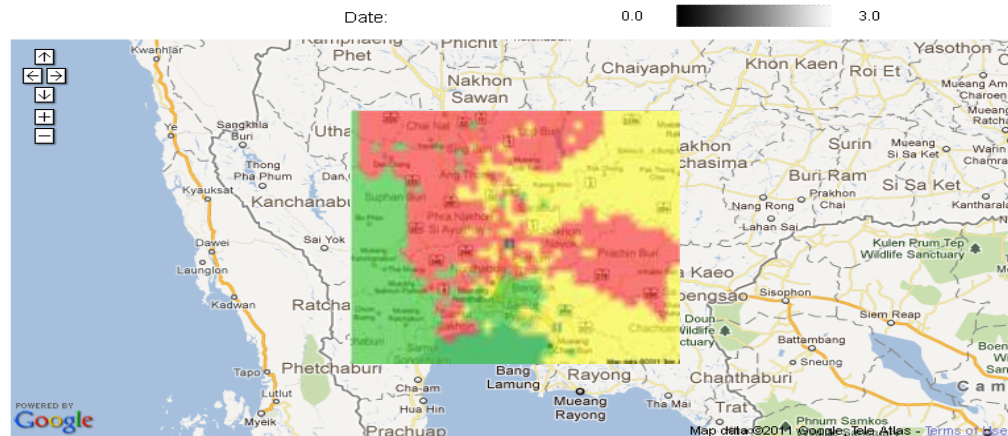
View Data Source
Add New Data Source

Operators

Execute
Take Action!

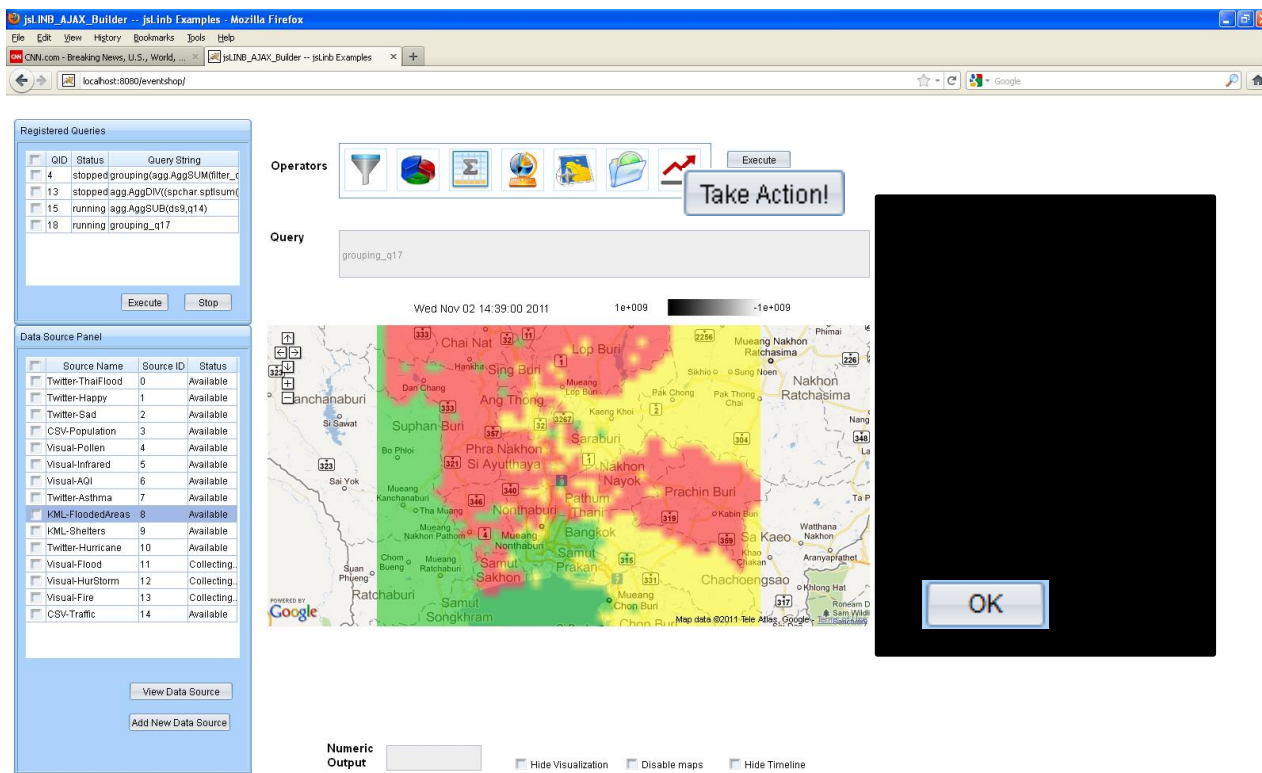
Query

Classify (Flood level - Shelter)



Numeric Output ☐ Hide Visualization ☐ Disable maps ☐ Hide Timeline

Taking personalized actions



Personalized Alerts

jsLINB_AJAX_Builder -- jsLinB Examples - Mozilla Firefox

File Edit View History Bookmarks Tools Help

jsLINB_AJAX_Builder -- jsLinB Examples

auge.ics.uci.edu/eventshop/

Registered Queries

QID	Status	Query String
4	stopped	grouping(agg.AggrSUM(filter_c
13	stopped	agg.AggrDW((spchar.sptsum
14	running	spratching.fromFile_ds14

Execute Stop

Operators

Execute Take Action!

Query

spratching.fromFile_ds14

Tue Oct 04 11:45:10 2011 0.0 10000.0

Data Source Panel

Source Name	Source ID	Status
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Visual-Infrared	5	Available
Visual-AQI	6	Available
Twitter-Asthma	7	Available
KML-HurForecast	8	Collecting...
KML-Shelters	9	Available
Twitter-Hurricane	10	Available
Visual-Flood	11	Available
Visual-HurStorm	12	Available
Visual-Fire	13	Available
Simulator-Hurricane	14	Available

View Data Source Add New Data Source

Map

Map data ©2011 Europa Technologies, INEGI - Terms of Use

Zoom: 1d 5d 1m 3m 6m 1y Max

Value 6.78 | 11:45 October 04, 2011

Timeline

Sat Oct 1 Sun Oct 2 Mon Oct 3 Tue Oct 4

Numeric value

Numeric Output 0.784084

Hide Visualization Disable maps Hide Timeline

a) Data-source panel

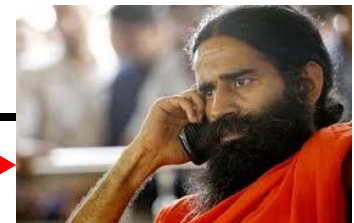
b) Operators panel

c) Intermediate query panel

e) Results panel

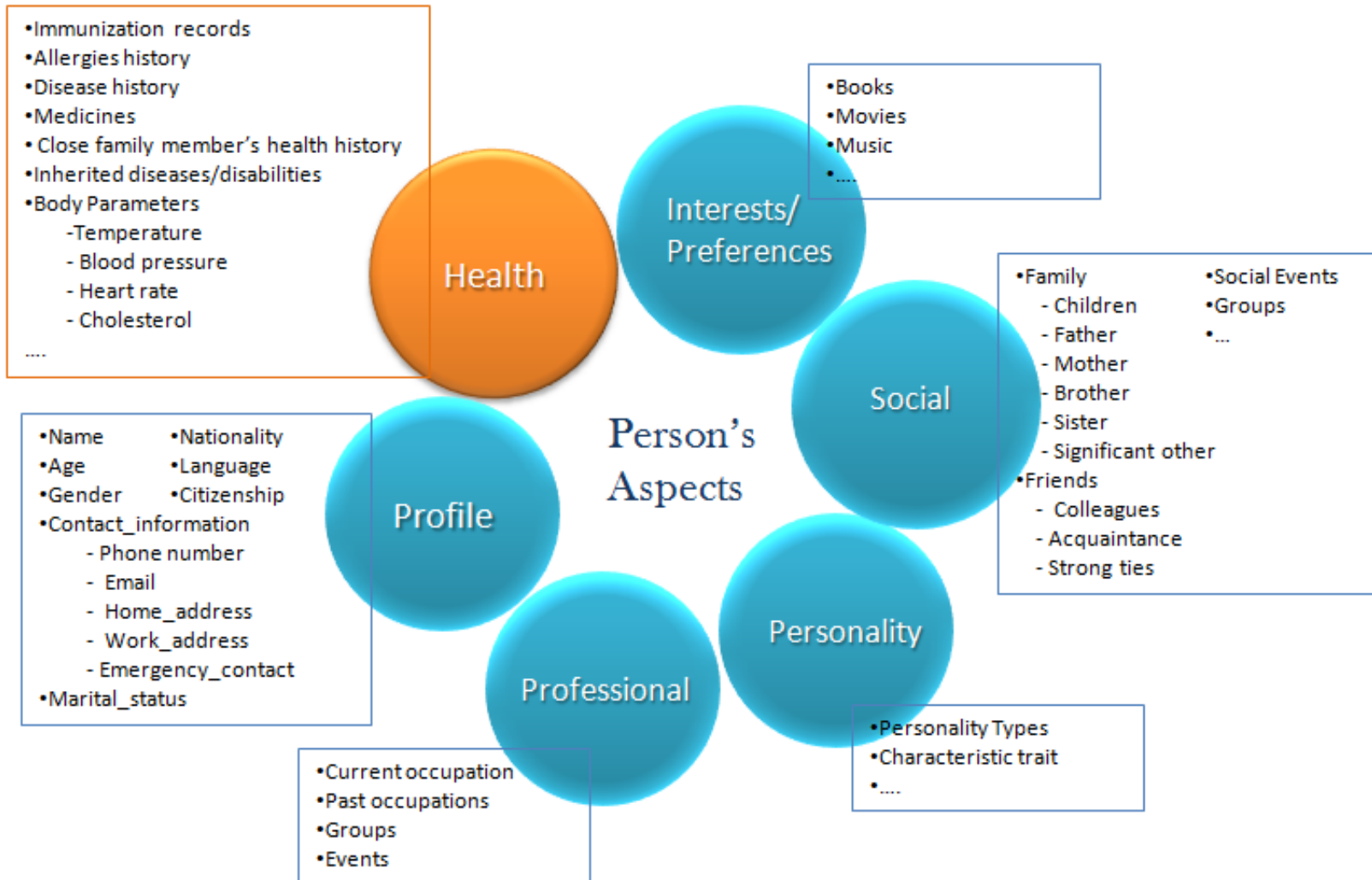


Users



All Users are not EQUAL.

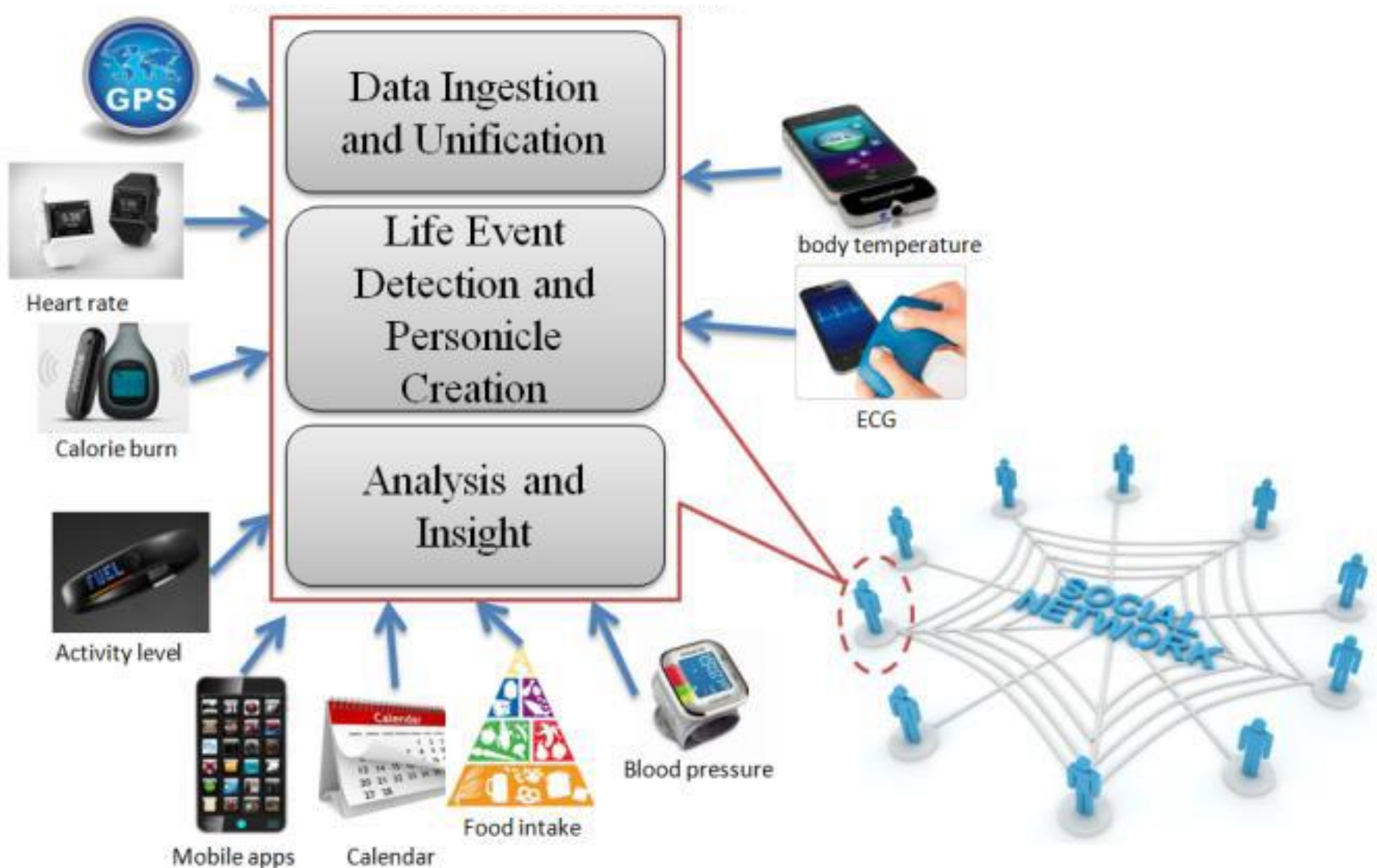
What defines a person?



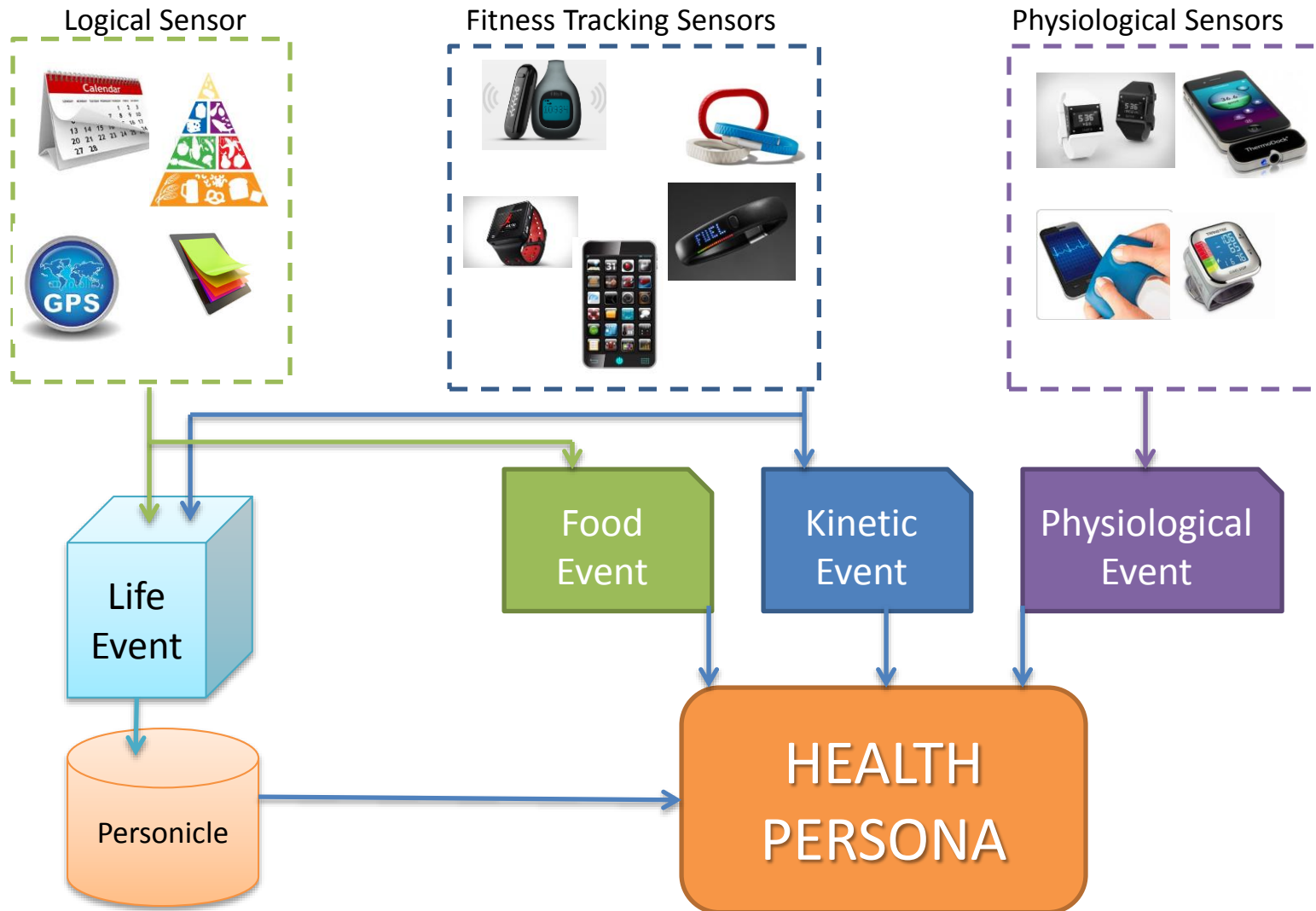
Persona: Turning Disassociated Data into *Meaningful* Information



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.**

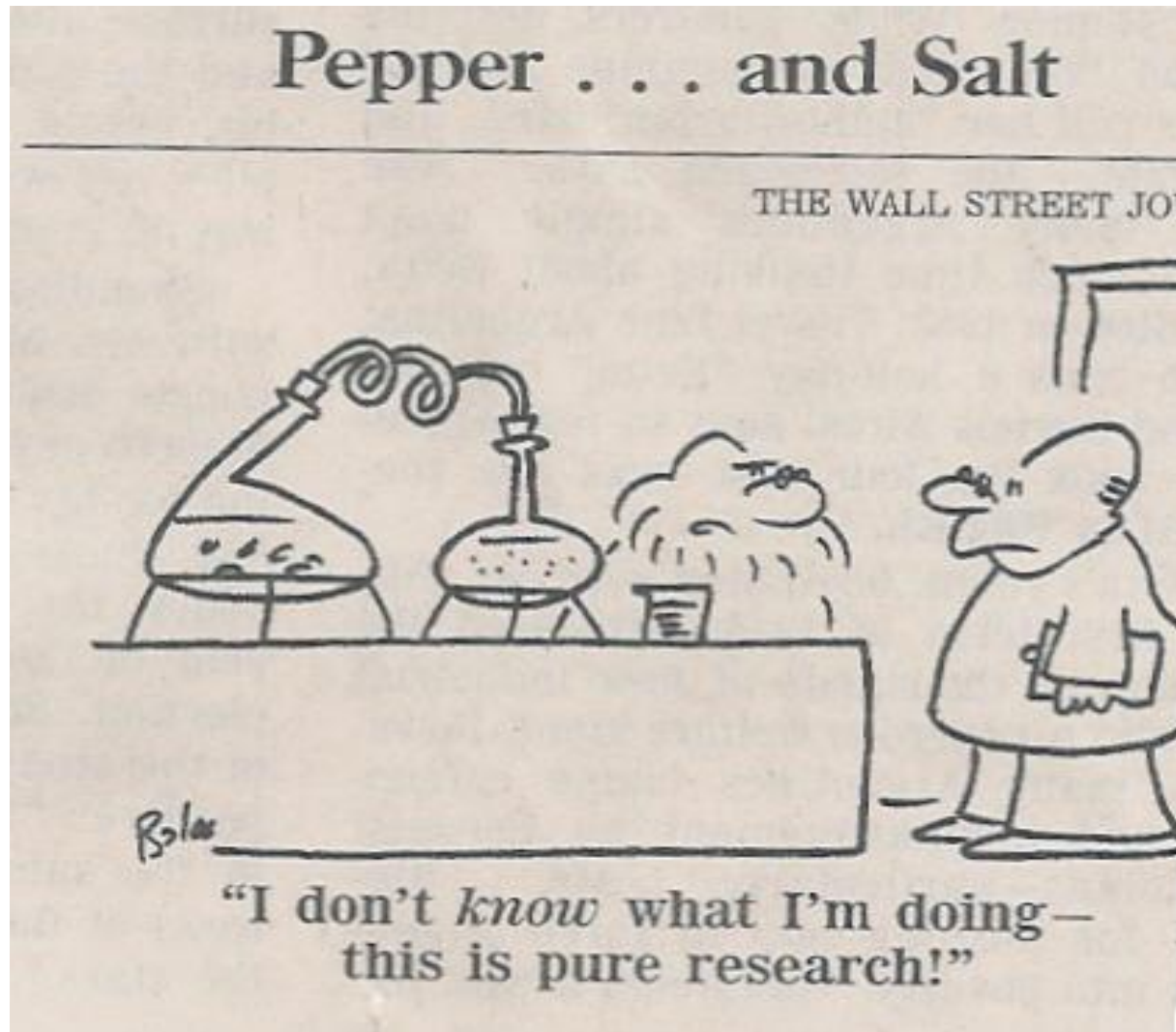
Dynamic Need-Resource Optimization

- **What are the fundamental problems in Computer Science?**
 - Time and memory complexity
 - 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