Grand Challenges Track

Chairs: Ram D. Sriram, Ernie Lucier, Alden Dima

Goals For Grand Challenges Track

- For a domain
  - Summarize current state of the art on ontology use: academic and industry
  - Determine gaps that hinder real-world ontology applications
  - Enumerate the actions that need to be taken to overcome these gaps
- Brainstorm ideas for a grand challenge problem

Speakers

- Christopher Welty (IBM)
  - Grand challenge for Watson-like Systems
- Ramesh Jain (UC – Irvine)
  - Social Life Networks – Ontology-based Recognition
- Eliot Siegel (UMD, School of Medicine)
  - The Dr. Watson Project: Clinical Perspective
- Christopher Chute (Mayo Clinic)
  - Relationships among Biomedical Ontologies and Classifications
- Nabil Adam (Department Homeland Security)
  - Ontology Applications in Homeland Security
- Christopher Frangione (X Prize)
  - Revolution through Competition: Designing Effective Incentive Prizes

Domains Identified

- Health Care
- Social networks
- Homeland security

Health Care

- Watson-like system for medical education (Siegel, Welty)
  - Text retrieval (Harrison, Merck, etc..)
- Automated chart reviews (Siegel)
  - Learning
- Diagnosis and Treatment (Siegel)
  - Expert Systems

IBM'S Watson

- Built by IBM to advance QA (question-answering) techniques
- Won against two previous Jeopardy champions (but lost to Rush Holt)
- Its DeepQA components uses the "Hypothesize-Score-Rank" strategy
- Scoring (Evaluating) uses non-linguistic, ontology and background algorithms.

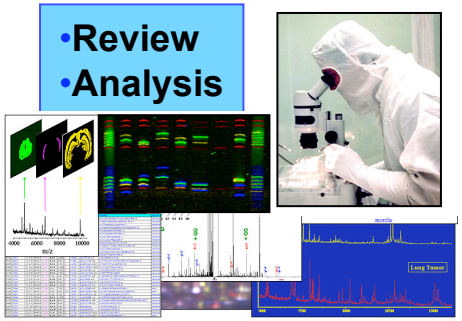
A Scenario

- Hantavirus cardiopulmonary syndrome details
- Eradication and treatment plan

Presentation

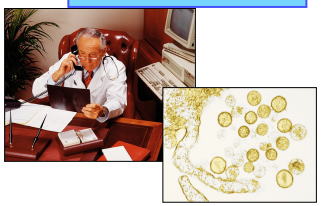
- Electronic health records
- Blood samples

Review
Analysis



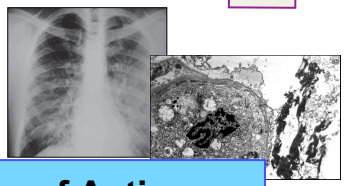
- DNA and homologues
- Possible pathogens

Agent ID
Disease ID



- Mice/insects carriers
- Sin Nombre Virus
- Pathways of pathogen action

Plan of Action
Disease Characterization



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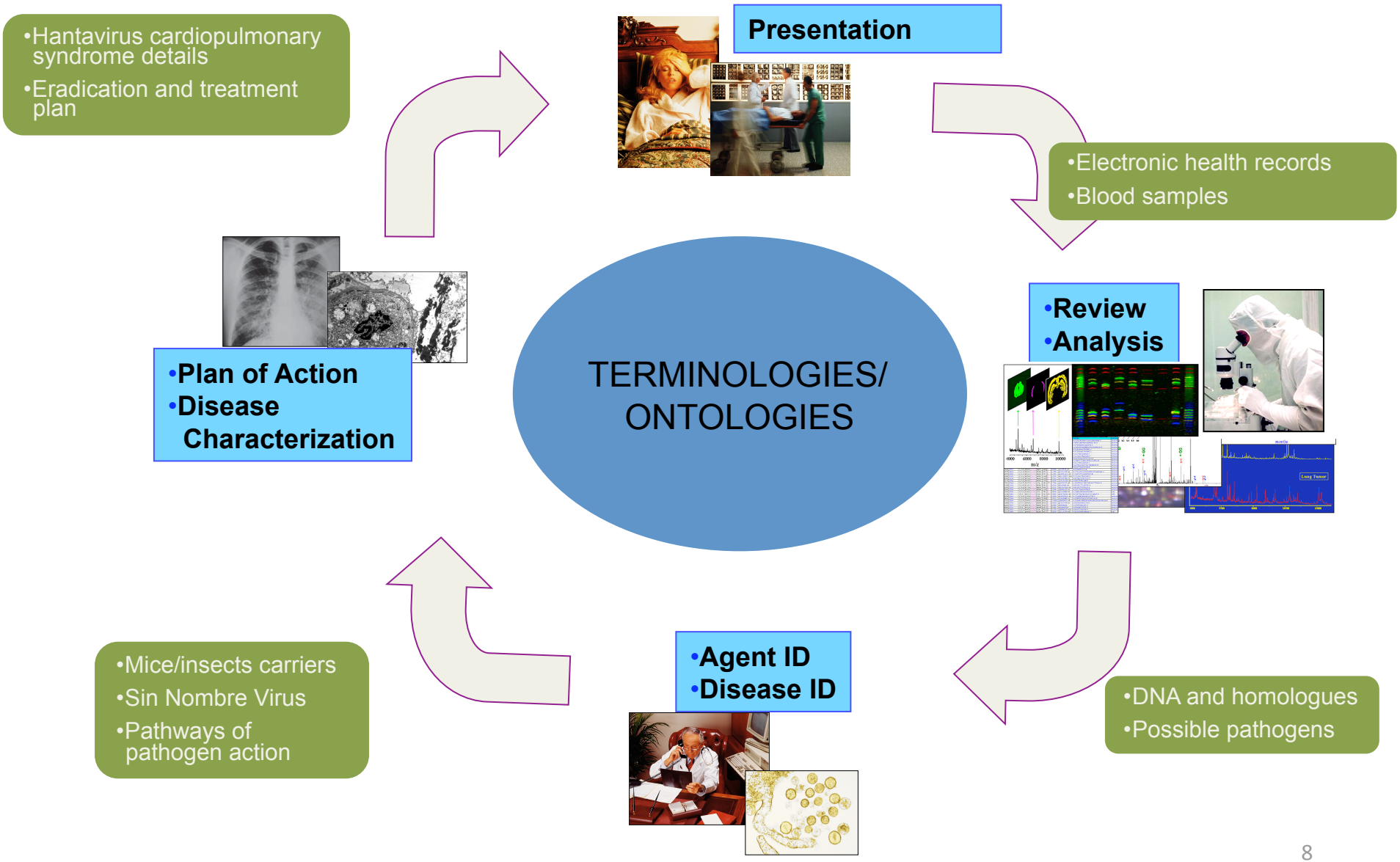
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Advances Making Future Health Vision Attainable

Courtesy: Jack Corley

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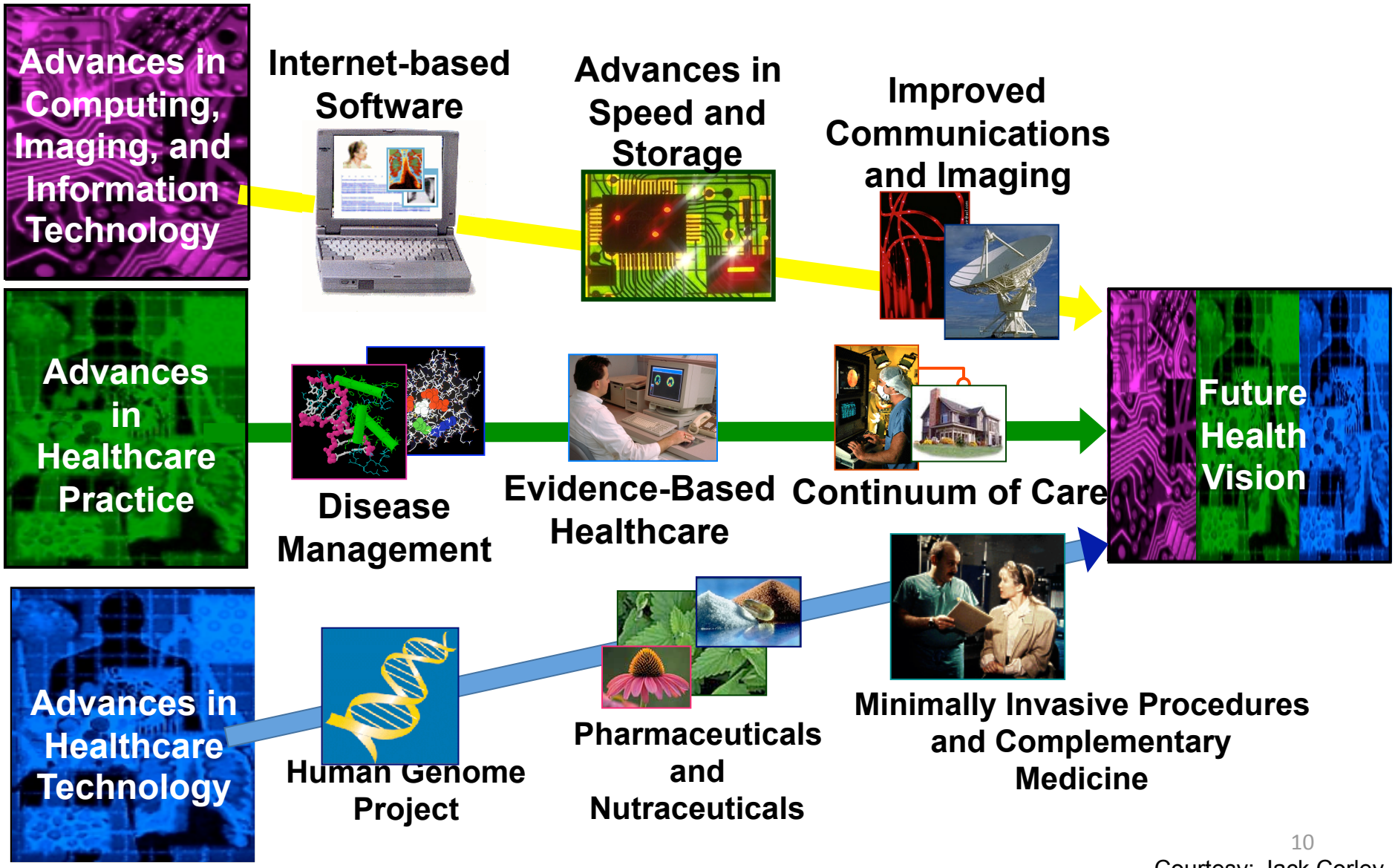

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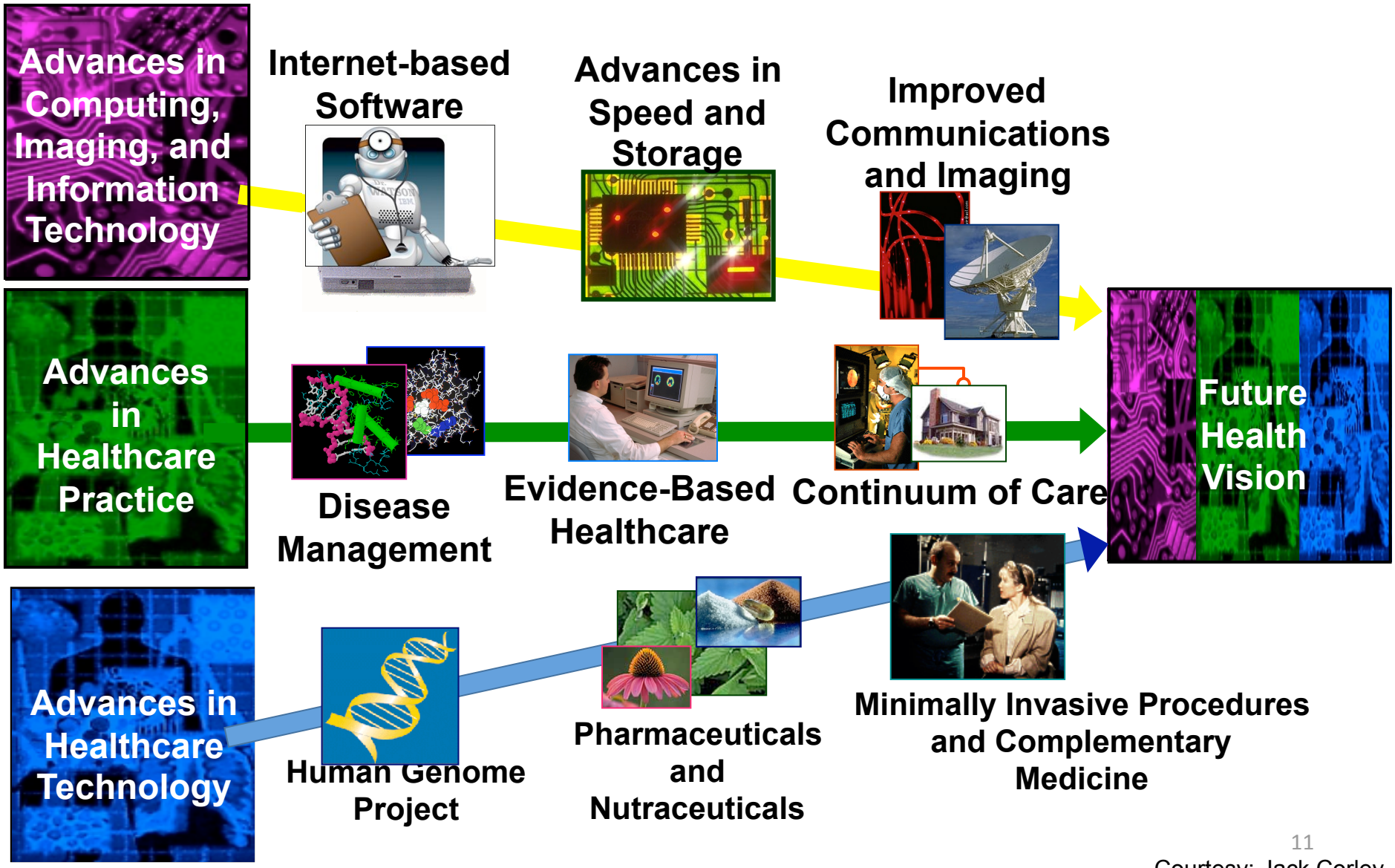
Advances Making Future Health Vision Attainable



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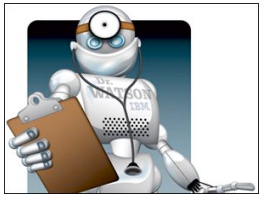


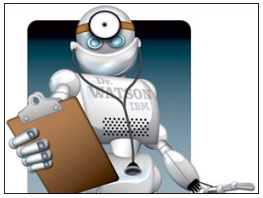
Diagnosis: Case Study

A 44-year-old African American woman presented to the emergency department with constipation of 4 days' duration. She also complained of a sticking sensation in her throat over the past year and dysphagia to solids but not liquids. Over the past 2 years, she had an unintentional 40-lb weight loss, which she attributed to decreased appetite.

Two months earlier, the patient began to have shortness of breath on exertion; she had to rest after walking a few blocks and became dizzy when she rose quickly from a sitting position. She denied chest pain, orthopnea, and paroxysmal nocturnal dyspnea. Her menstrual history was significant for menorrhagia of 1 year's duration.

The patient had pale conjunctivae, bilateral angular cheilitis (**A**), glossitis (**B**), and bilateral spoon-shaped nails (koilonychia) (**C**). The white blood cell count was 7300/µL; hemoglobin level, 5.7 g/dL; platelet count, 555,000/µL; mean corpuscular volume, 55 fL; red blood cell distribution width, 22%; and ferritin, 6 ng/mL.

A pelvic ultrasonogram showed an enlarged uterus and multiple fibroids; the largest lesion was 5 cm. An upper GI barium study disclosed a cervical web on the anterior part of the esophagus (**D**). Upper endoscopy revealed thickening of the esophageal mucosa and a web, which was ruptured with the scope.



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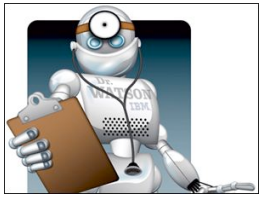
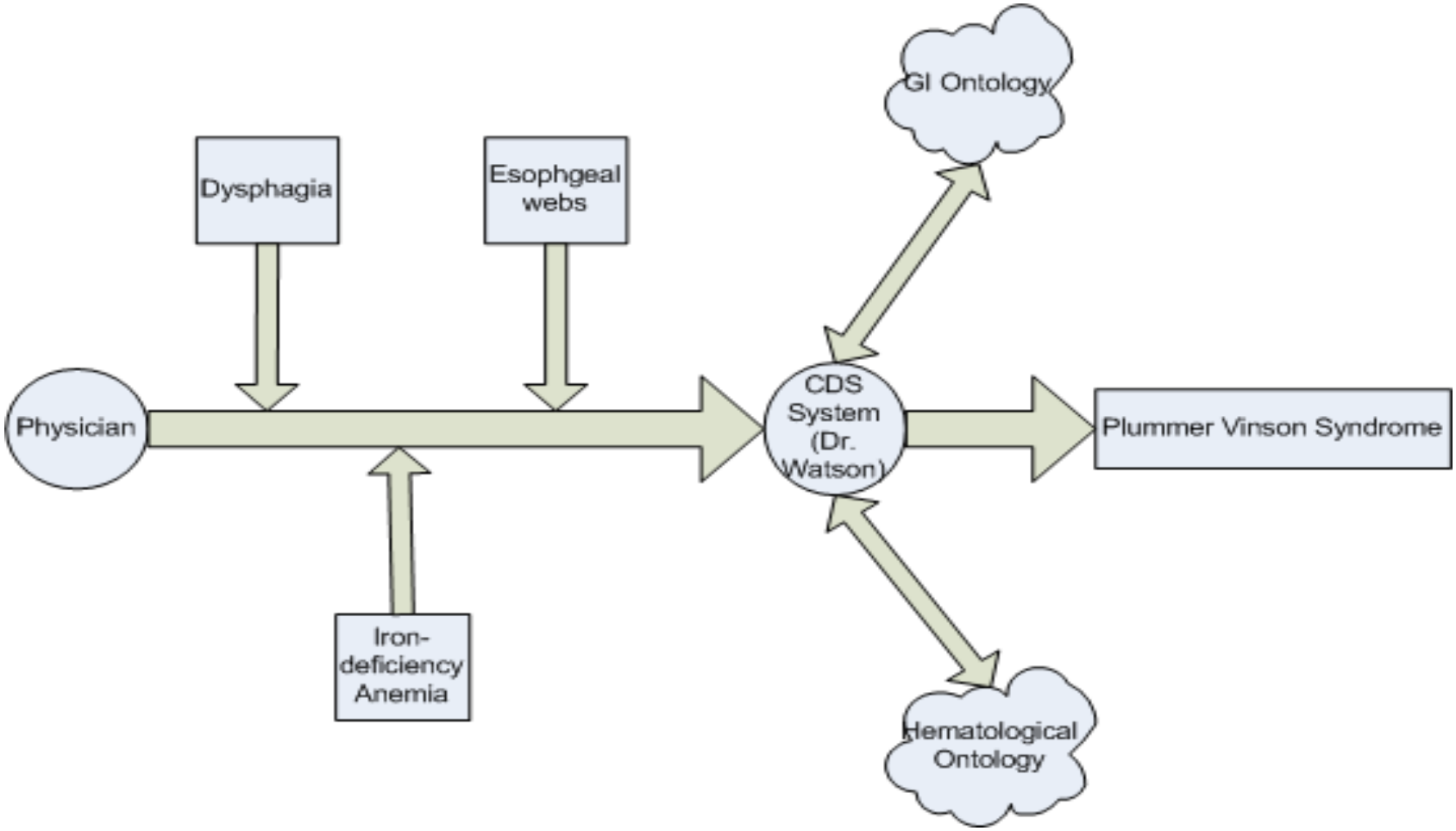
DIAGNOSIS: PLUMMER-VINSON SYNDROME



Clinical Decision Support with Information Exchange



Challenges

- Mining and molding knowledge
- Machine Learning
- Systems Medicine (integrating genomics and clinical systems)
- Image analysis and interpretation
- Medical vocabularies (too many??)

Social Networking: Jain

- Internet of things emerging
- Situational Analysis and Recommendation
- Interpreting images and text (context-based)

Relevant Trends

- Social Networks and their role in communication
- Micro-blogs becoming major source of News.
- Internet of Things is emerging.
- More than 75% of the world population owns a mobile phone.

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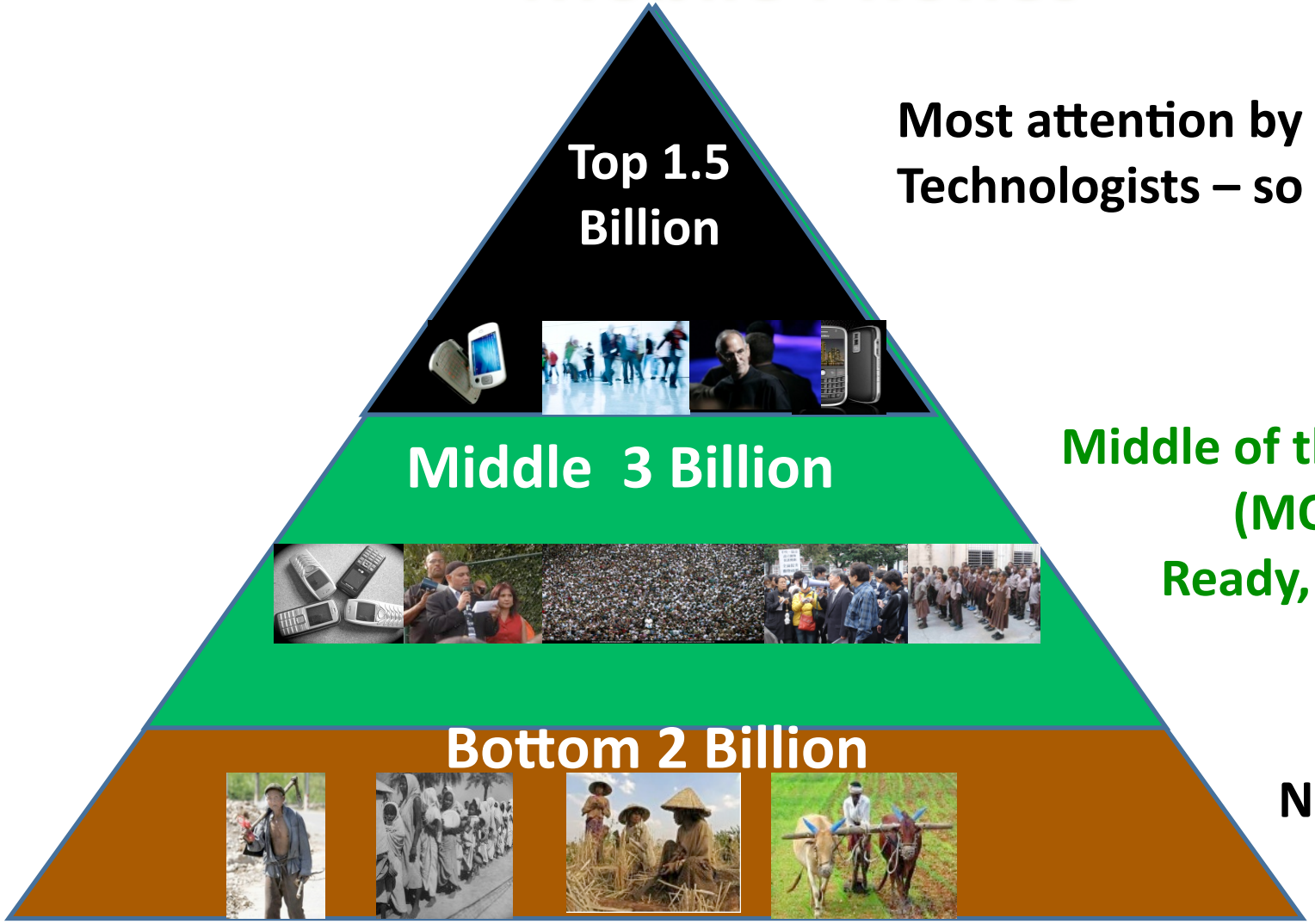
The World as seen through Mobile Phones



Most attention by Technologists – so far.

Middle of the Pyramid (MOP): Ready, BUT …

Not Ready

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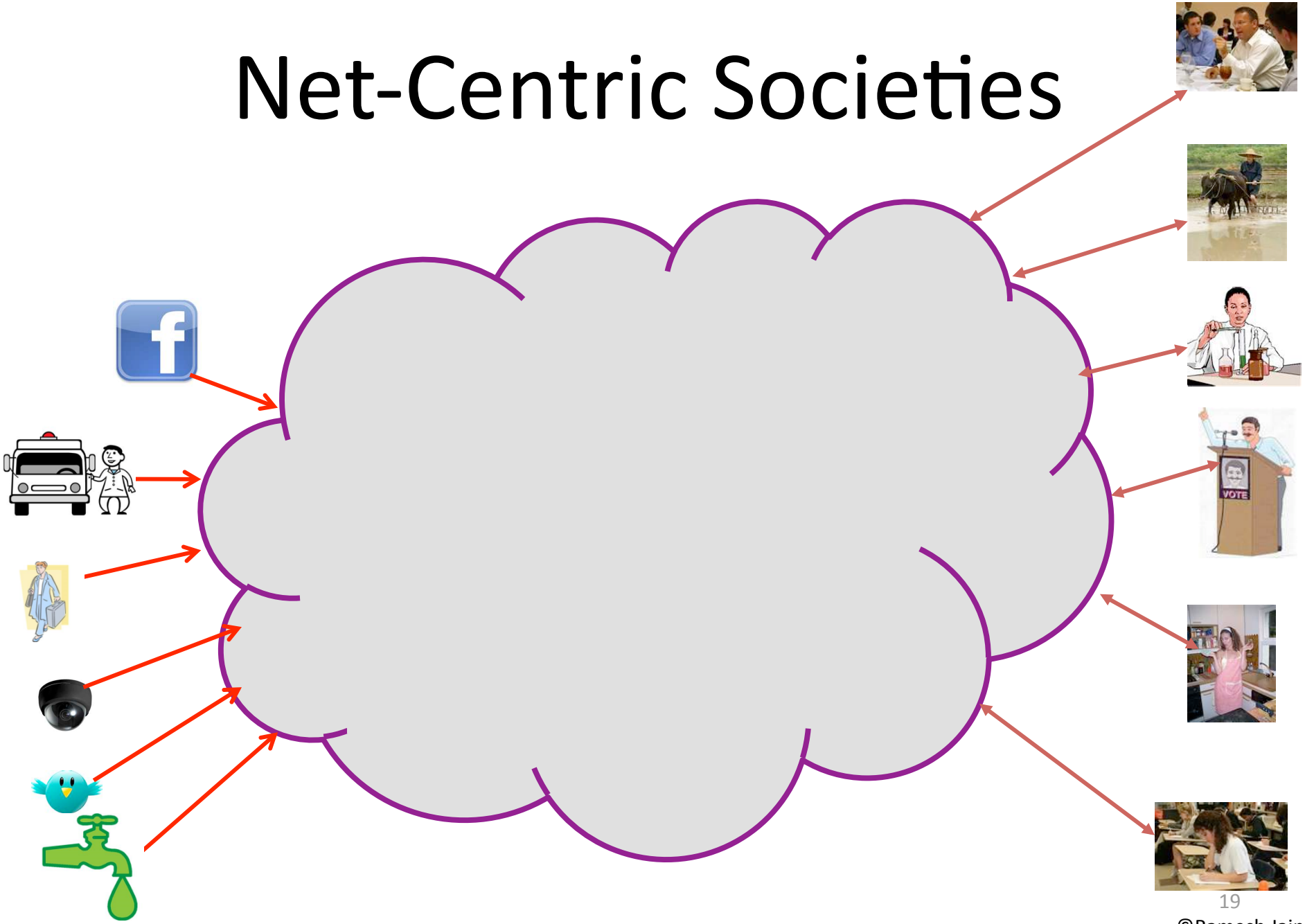
Net-Centric Societies



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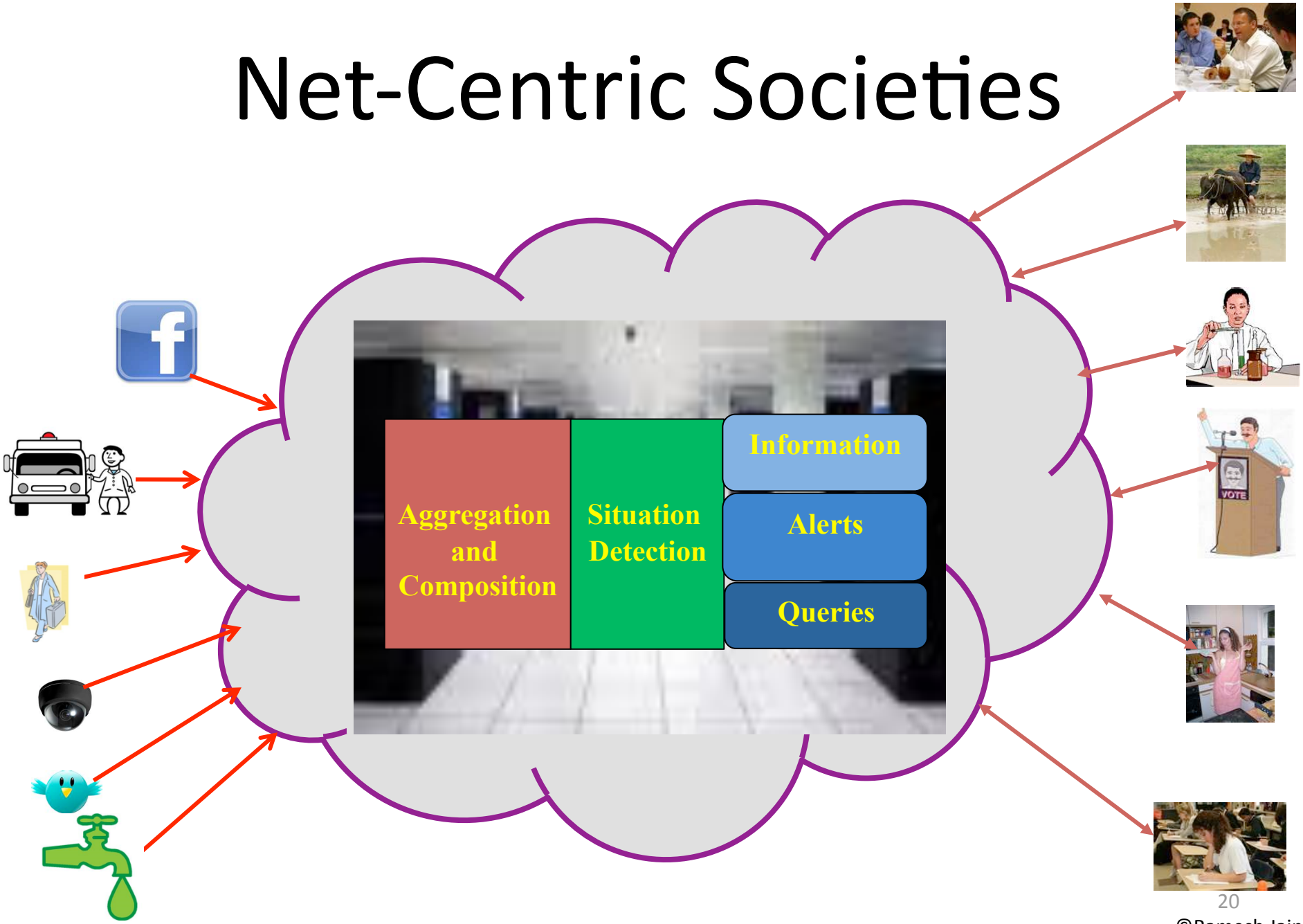
Net-Centric Societies



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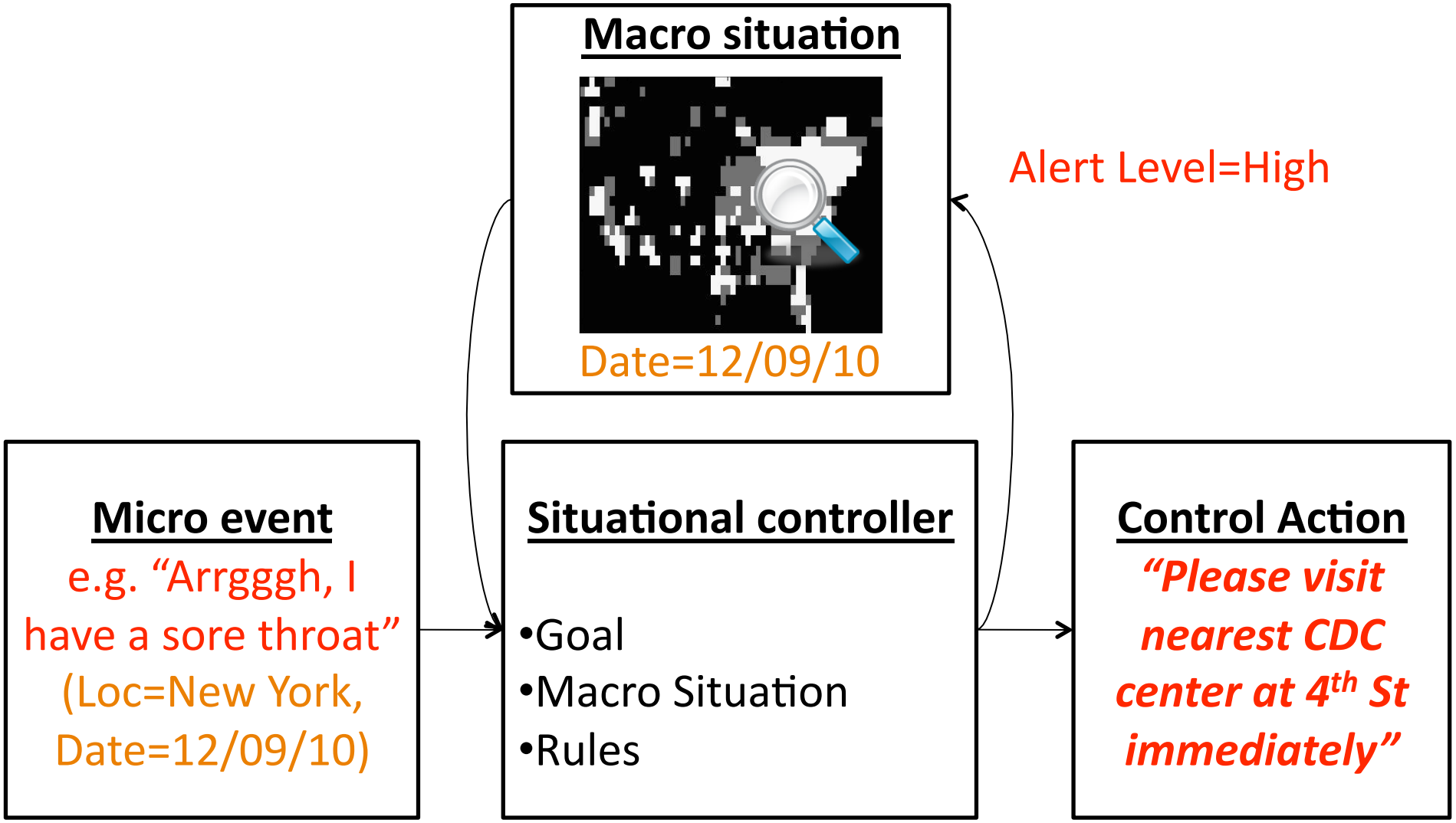
Situational Recommendation System



Level 1 personal threat + Level 3 Macro threat -> Immediate action

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Challenges

- Security of information
- Making sense of data/information
- Multimodal sensor integration
- System complexity

Ontologies are crucial to address above

Homeland Security (Adams)

- DHS Infrastructure
- Modeling, Simulation, and Analysis
- Challenge: Development, validation, acceptance, update, and integration of ontologies

What About Other Domains?

- Sustainability
- Natural Disasters
- Financial

Finally: The X Prize (Frangione)

- Attributes of X Prize
- How do prizes deliver change
- Developing a prize
  - Goal setting, Prize strategy, Design, Execute, Life Cycle
- Various models of prize
  - X prize is incentive model
- Designing a prize
- The Ansari (X) Prize
  - Human space flight – A reality for all
- Thoughts about X Prize
  - Domain, funding, management, etc..

Ansari X PRIZE

$10M to first privately-financed team to fly a spaceship capable of carrying 3 people to 100km twice in 2 weeks

26 Teams from 7 Nations spent over $100M