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# **Using Gaming Tools to Train Disease Surveillance Professionals and Investigate Next-Generation Capabilities**

**Timothy Dasey, Ph.D.**

**ISDS Webinar**

**27 October 2011**



# Serious Games vs. Conventional Exercises

## Defining Game Features\*

- Goal
- Rules
- Feedback system
- Voluntary participation

### Serious Games

- Define allowable types of actions
- Surprise for all but game designers
- Focus on decisions
- Injected pressures (e.g. time)
- Feedback on performance

### Conventional Preparedness Exercises

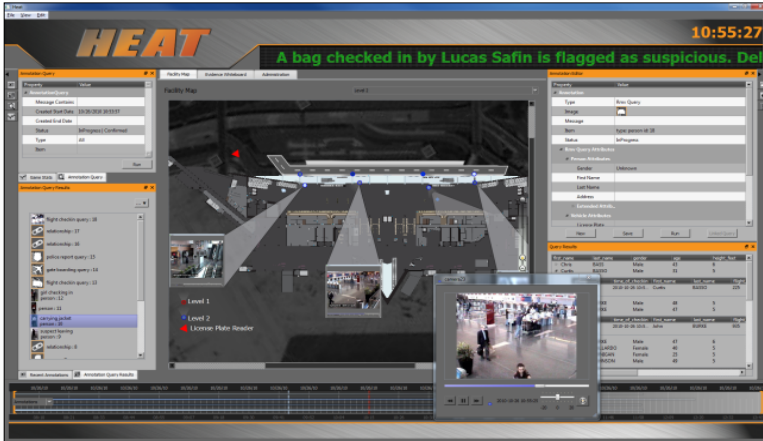
- Scripted actions
- Lack of surprise
- Focus on responsibilities and process
- Often lacks forcing pressures
- Lack of feedback on solution

\* Jane McGonigal, "Reality is Broken: Why Games Make Us Better and How They Can Change the World", The Penguin Press, 2011.

**Games are complementary preparedness tools that  
exercise dynamic decision making skills**

# Serious Game Example in Another Domain: Homeland Enhanced Attribution Testbed (HEAT)

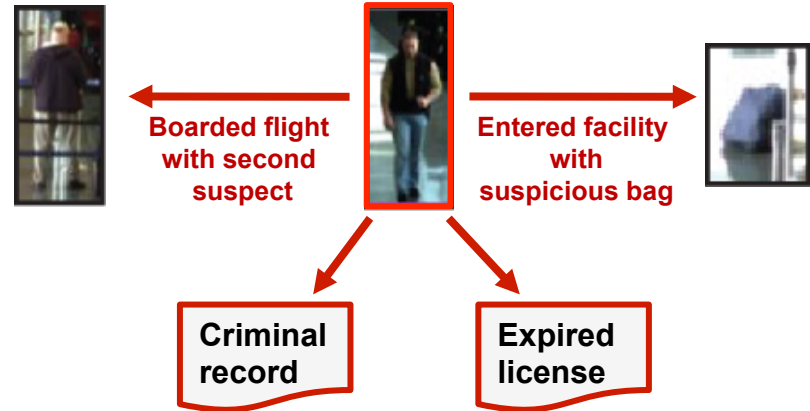
**OBJECTIVE:** Develop game-based simulations to explore technology, strategies, and tactics for enhancing attribution through the efficient mining of multiple data sets.



User Interface Screen Shot



Collaborative Game Play



Evidence Management Tools

## Game Player Tasks

- Determine suspicious activity, and the relationship between those activities, based on multiple data sets.
- Quickly and accurately nominate individuals who should be detained for questioning.

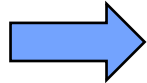




# Outline

- **Rationale for incorporating gaming in the disease surveillance community**
- **Initial development of the Epidemiological Disease Investigation Game (EpiDIG)**
- **Future disease surveillance game development**

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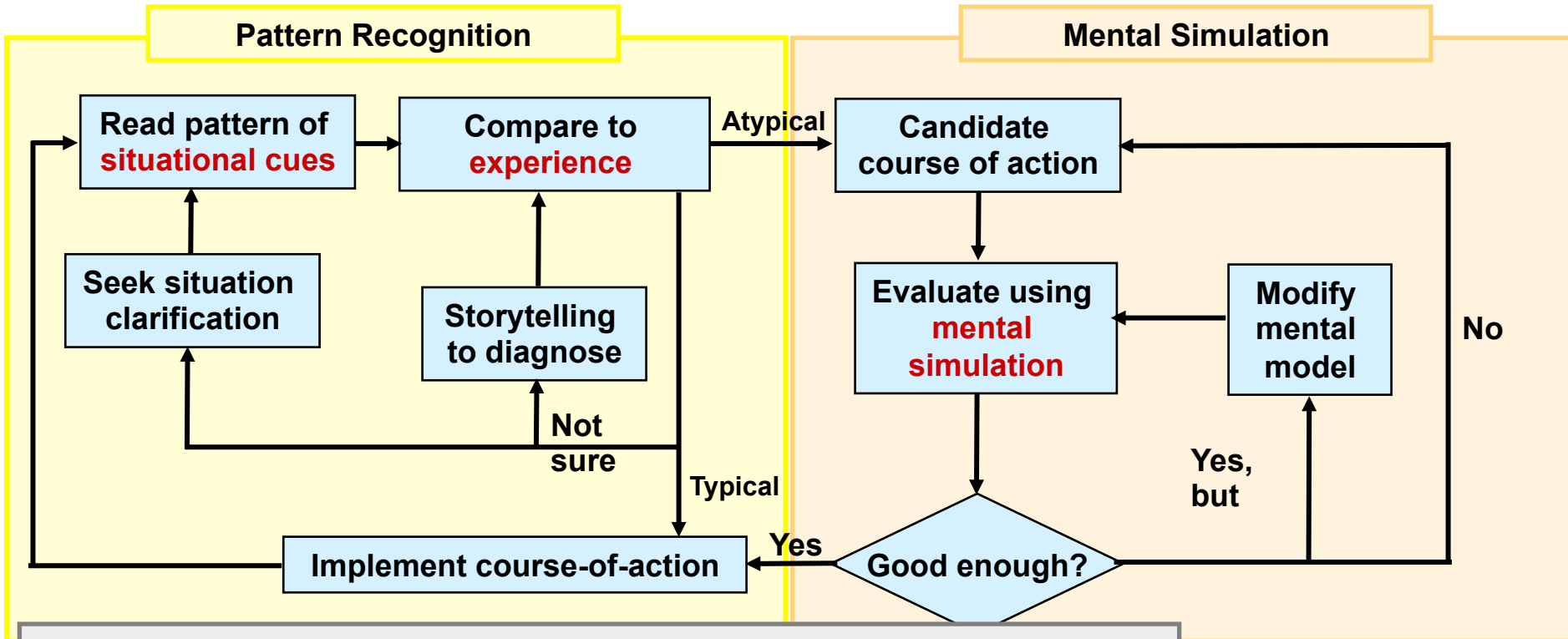


# Important Roles for Games in Disease Surveillance

- **Improve individual and group decision making effectiveness**
- **Test candidate technology (data sources, analytics, visualizations) in a human-in-the-loop environment**
- **Improve preparedness for unusual or large-scale events with complex interdependencies**

# Rationale for Gaming:

## Improve Decision Making Effectiveness



Dasey's Interpretation of the Recognition Primed Decision Making Model\*

\* Klein, G., "Sources of Power: How People Make Decisions", MIT Press, 1998

- Decision support technology must fit human decision processes for acceptance
- Experience is necessary for situation recognition and improvisational skills

### Appropriate Settings

- Time pressure
- Ill-defined goals
- Dynamic conditions
- High stakes
- Uncertain information



# Existing Experience May Be Insufficient

- **Wide experiential variability (career length, disease outbreak disparity)**
- **Existing experience may negatively bias performance in some situations**
  - **Forensic analysis vs. crisis/consequence management**
  - **Comfort level with novel data sets or technologies**
  - **“Cry wolf” effect from false positives**
- **Group decision making skills less developed**

**Games can be used as a training tool that provides pseudo-experience for less practiced decision-making situations**

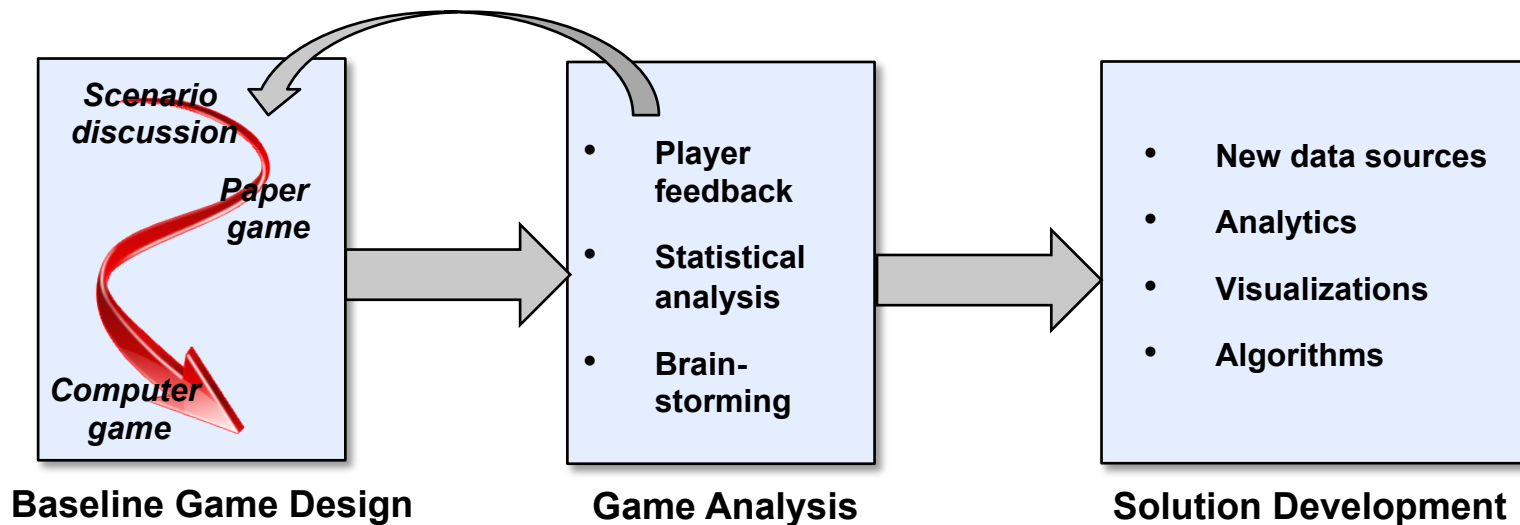


# Rationale for Gaming:

## Test Candidate Technology

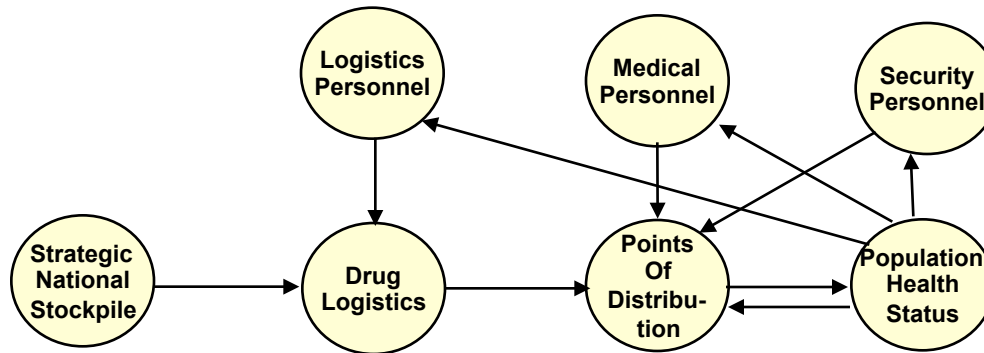
- Even expert decision makers can have difficulty articulating detailed technology needs and anticipating value
- Developers do not typically understand the domain issues in sufficient detail

Conventional development and acquisition processes do not work well for decision support systems



# Rationale for Gaming:

## Preparedness for Unusual or Large-Scale Events

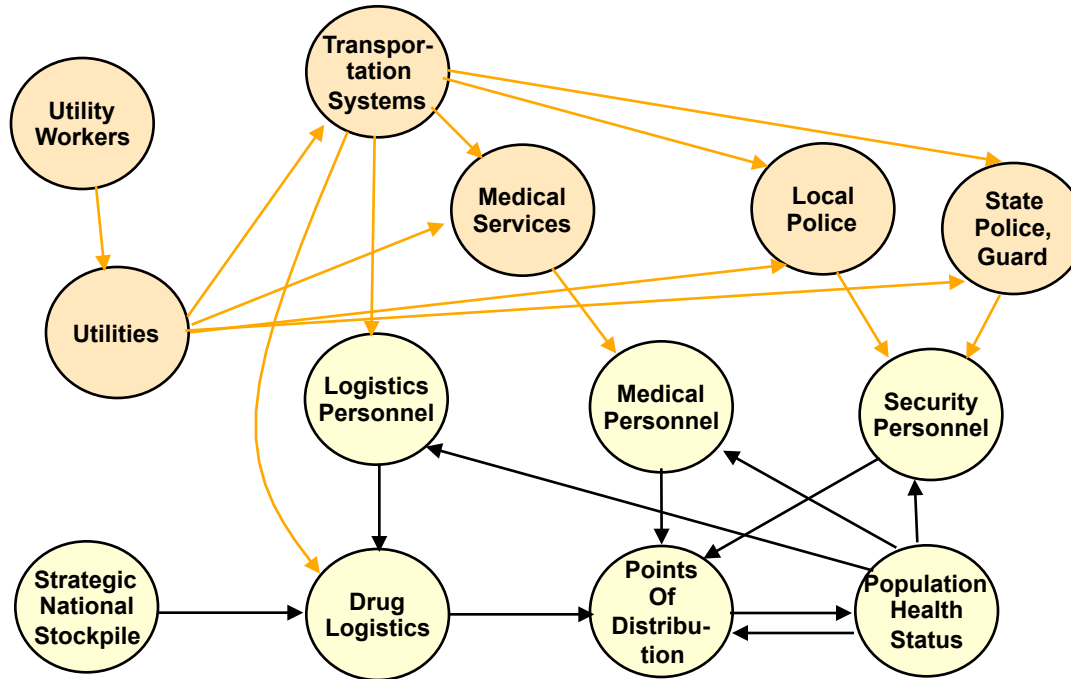


**Post Bio-Attack Drug Distribution Example**

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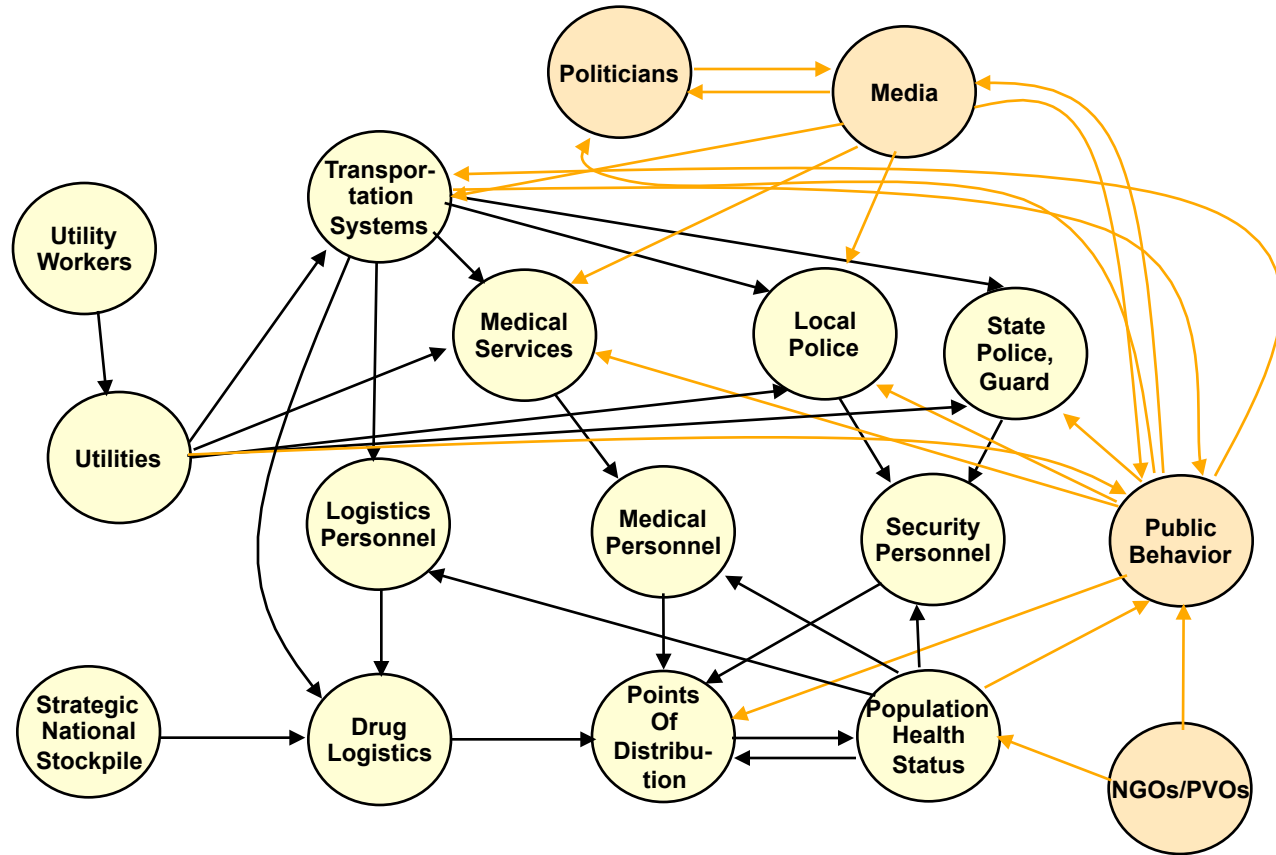
→  
Impacts



**Post Bio-Attack Drug  
Distribution Example**

# Rationale for Gaming:

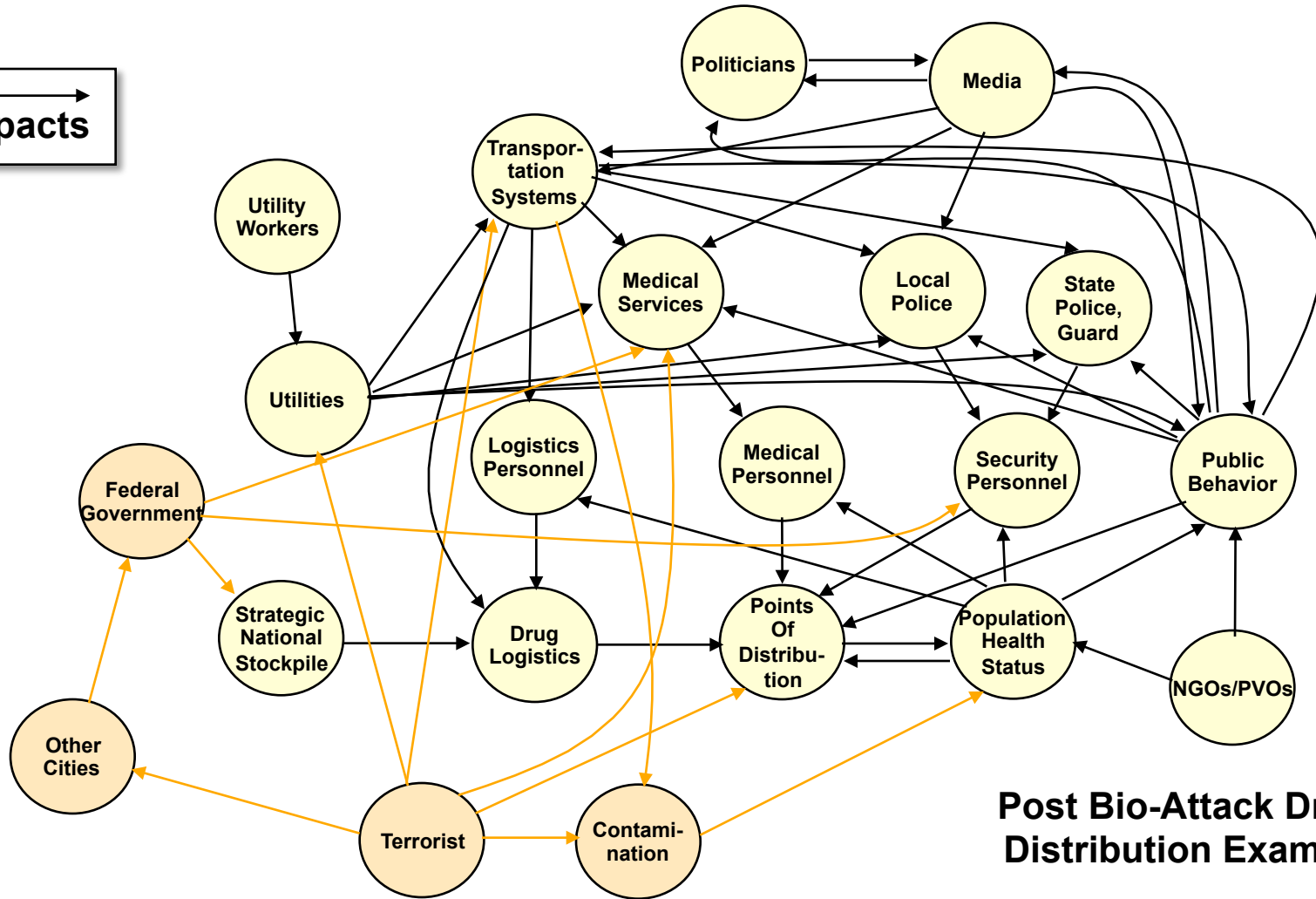
## Preparedness for Unusual or Large-Scale Events



**Post Bio-Attack Drug Distribution Example**

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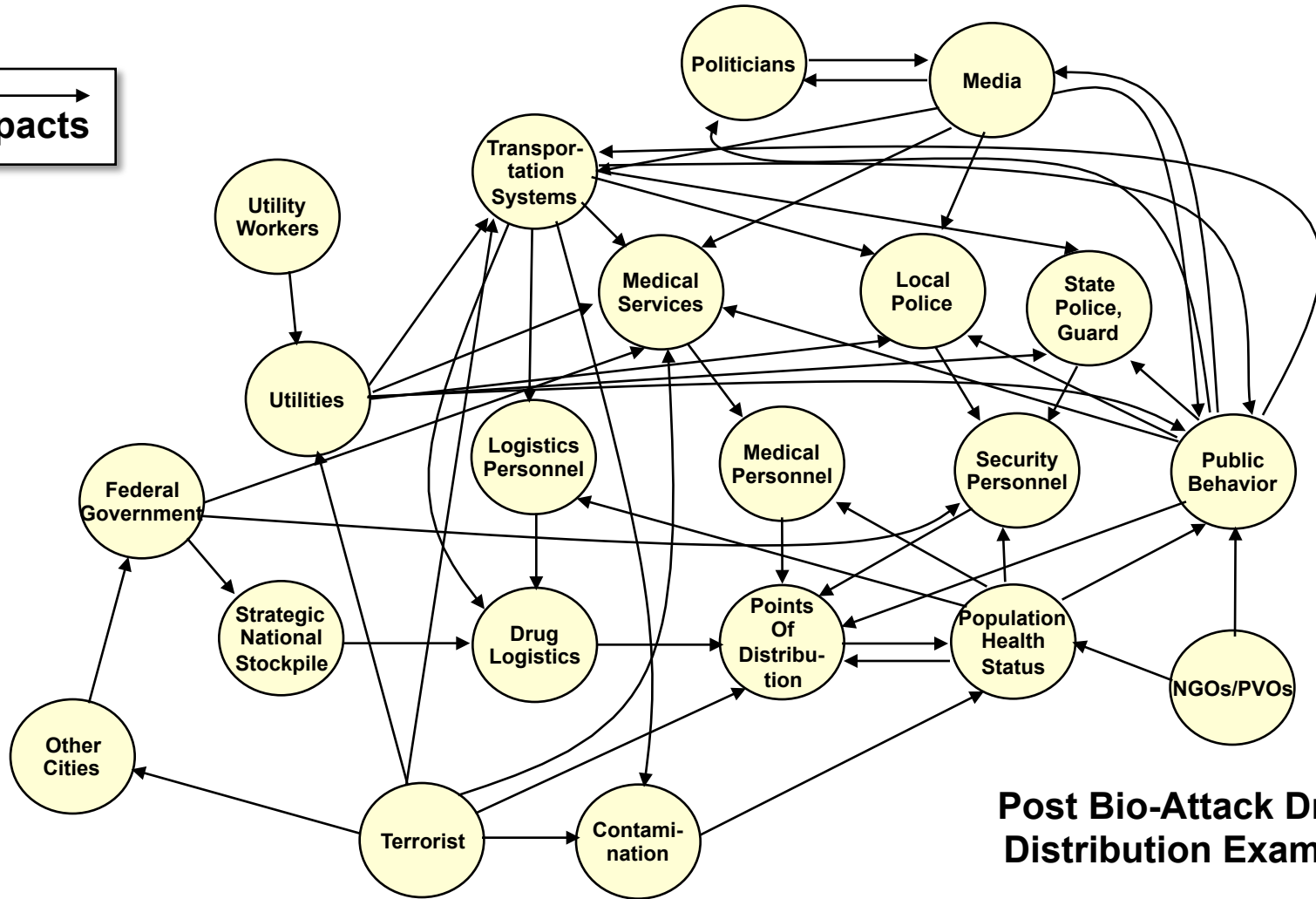
## Preparedness for Unusual or Large-Scale Events



**Post Bio-Attack Drug Distribution Example**

# Rationale for Gaming:

## Preparedness for Unusual or Large-Scale Events



**Post Bio-Attack Drug Distribution Example**

- “System” complexity impedes anticipation of response effectiveness
- Environments that include feedback on system outcomes can aide preparedness



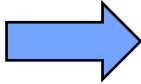
# Rationale for Gaming:

## Preparedness for Unusual or Large-Scale Events

**Key to the development of large scale response games:  
Intimate stakeholder involvement in the design**

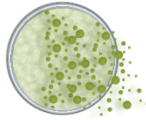
- **Develop individual and collective knowledge of the complex interdependencies in a large-scale response**
- **Develop views on desirable outcomes**
- **Define key “tipping point” indicators**
- **Develop improvisational skills through intentional insertion of “monkey wrenches” into scenarios**

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# Epidemiological Disease Investigation Game (EpiDIG)



## EpiDIG

**Objective:** *Develop game-based simulations to exercise disease outbreak decision-making skills*

### Ten Steps of a Field Investigation<sup>1</sup>

1. Determine the existence of the epidemic
2. Confirm the diagnosis

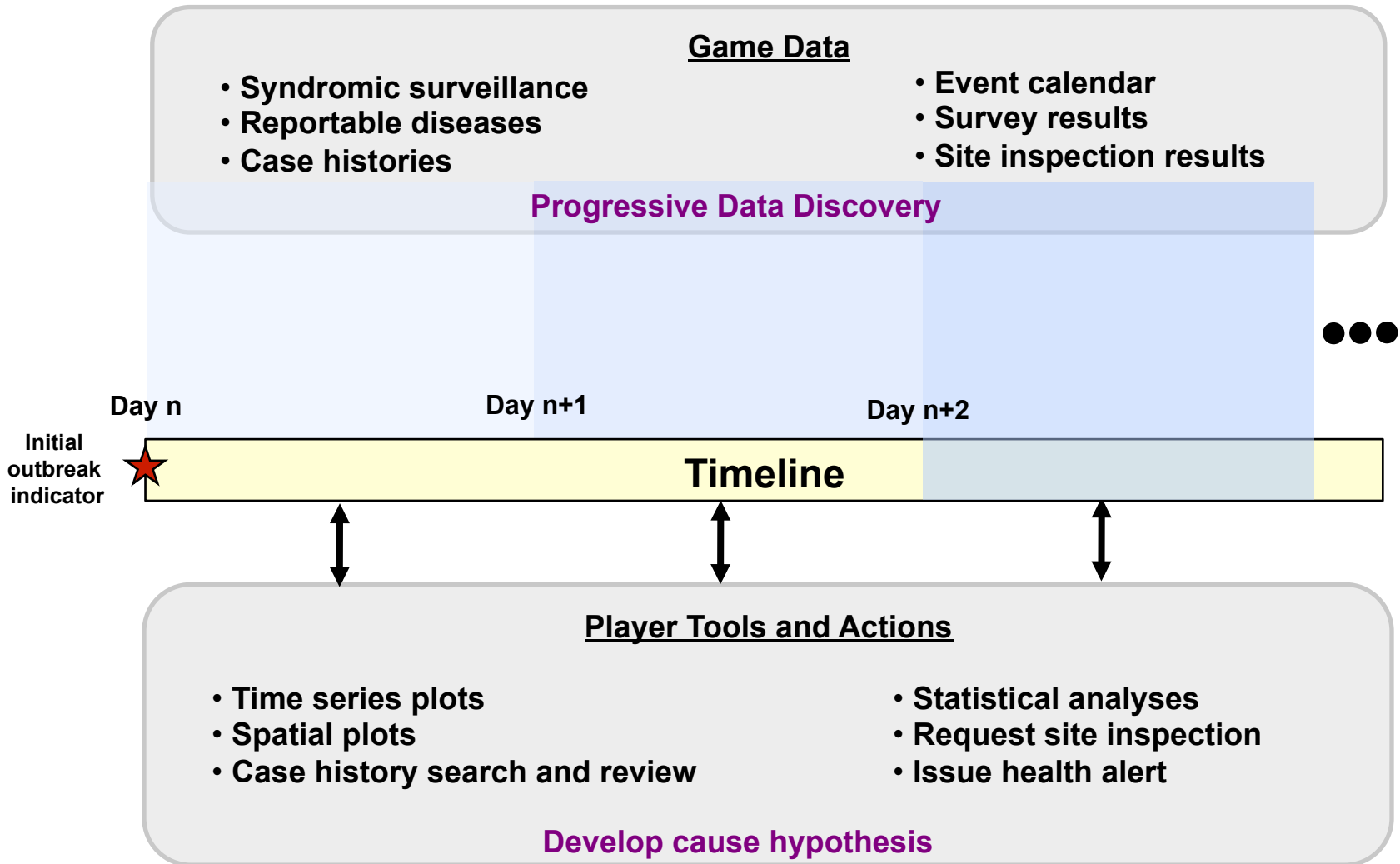
*Focus  
of  
EpiDIG*

3. Define a case and count cases
4. Orient the data in terms of time, place, and person
5. Determine who is at risk of becoming ill
6. Develop a hypothesis that explains the specific exposure that caused disease and test this hypothesis by appropriate statistical methods
7. Compare the hypothesis with the established facts

8. Plan a more systematic study
9. Prepare a written report
10. Execute control and prevention measures

1. Gregg, Michael B., "Conducting a Field Investigation," in *Field Epidemiology, 2<sup>nd</sup> Edition*, Edited by Michael B. Gregg, 2002

Initial scenario: Common metropolitan-scale outbreak





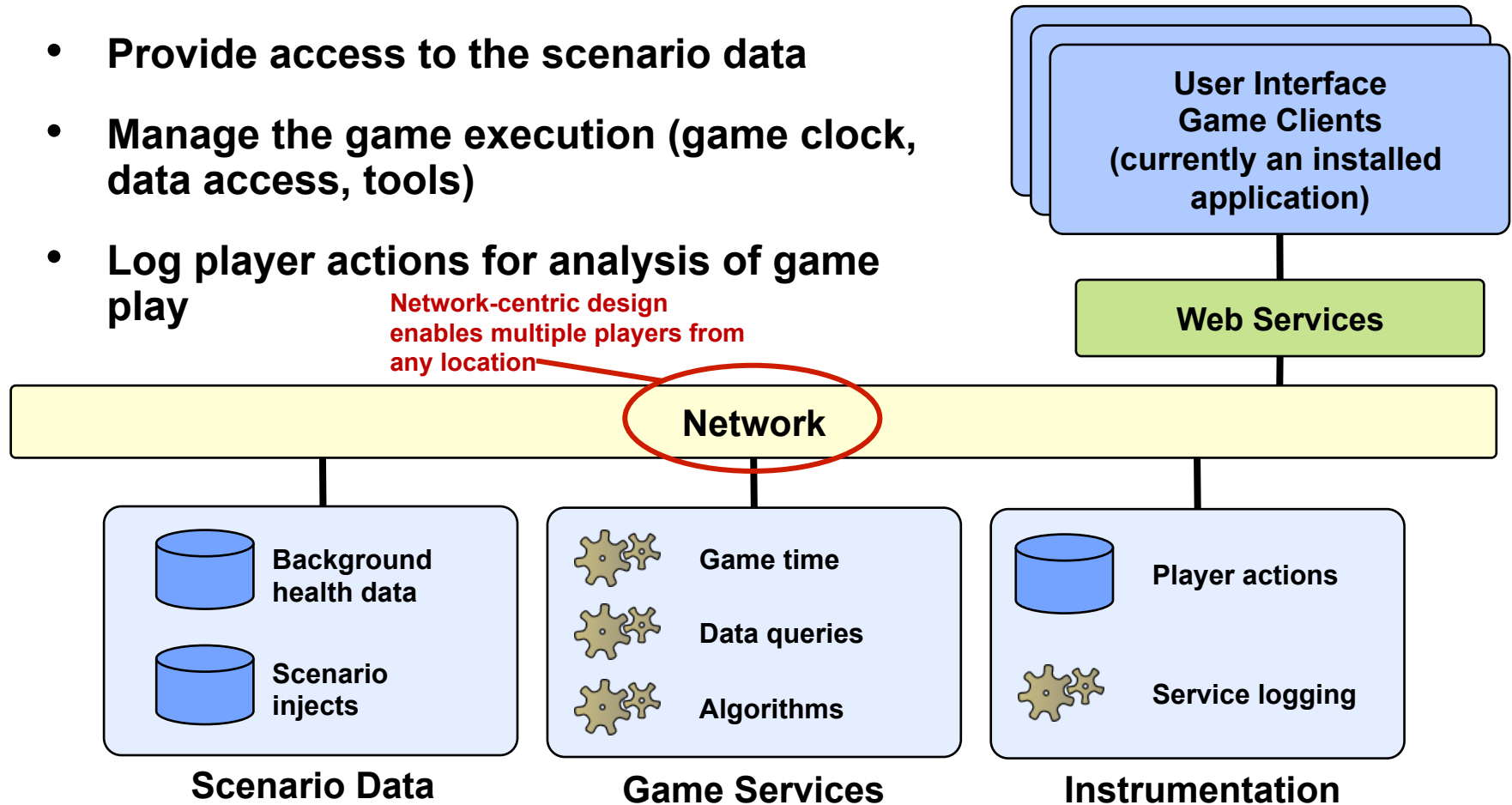
# EpiDIG Design Considerations

- **Widely variable analysis tool experience for players**
  - Provide new analytics and visualizations rather than emulate existing system
- **Compressed timeline (< 2 hours game time vs. days of outbreak)**
  - Data is available via central database when timeline allows visibility
  - Small teams of decision makers
- **Game difficulty hard to anticipate during development**
  - Spiral development process (build and play)
  - Difficulty can be increased by increasing disease background, information uncertainty, disease source complexity

## Key Capabilities

- Provide access to the scenario data
- Manage the game execution (game clock, data access, tools)
- Log player actions for analysis of game play

Network-centric design  
enables multiple players from  
any location



Current:

Hand-crafted

Actions at local jurisdiction level

Limited game play analysis



INTERNATIONAL SOCIETY FOR DISEASE SURVEILLANCE

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## 2011 Pre-Conference Workshop - December 6, 2011

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Space is limited in the Pre-Conference Workshop track sessions. All tracks will also feature access to the *Swap Meet* session - an opportunity for informal discussion and demonstrations on surveillance topics of interest.

### Concurrent Pre-Conference Tracks

#### **Track 1: Public Health Syndromic Surveillance Systems Training and Demonstrations**

*Target audience:* Healthcare and public health professionals new to syndromic surveillance.

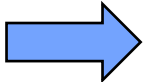
*Description:* This workshop will begin with an overview of syndromic surveillance that is designed to introduce public health professionals to syndromic surveillance. It will be followed by a series of interactive demonstrations of how select syndromic surveillance systems are being utilized (systems include, ESSENCE, BioSense, NCDTECT - North Carolina, and EpiCenter - Ohio). The latter half of the workshop will provide an opportunity for users of the demonstrated systems to provide an introduction to those unfamiliar with the systems.

#### **Track 2: Using Gaming Tools to Train Disease Surveillance Professionals and Investigate Next-Generation Capabilities**

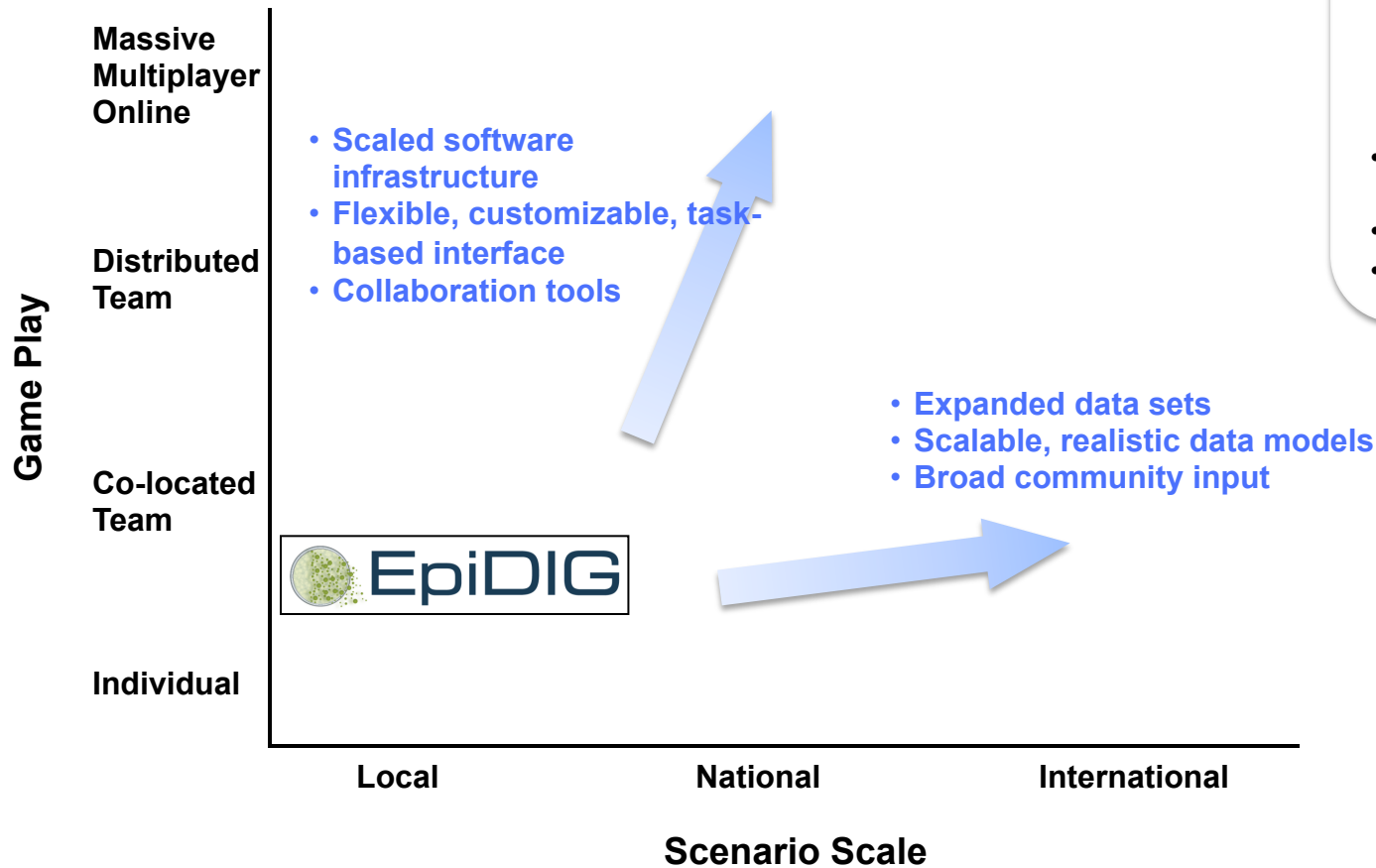
*Target audience:* Healthcare providers, researchers, and public health practitioners.

*Description:* This workshop will provide an overview of game-based tools for training and technology evaluation. The philosophy and methods of "serious gaming" will be presented through case studies and interactive examples developed by MIT Lincoln Laboratory in collaboration with the Boston Public Health Commission. Workshop participants will also have an opportunity to play through a public health game, Epidemiological Disease Investigation Game (EpiDIG).

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# EpiDIG Future Directions



## Game Difficulty



- Data accuracy and availability
- Data access model
- Visualization tools



# Roadmap for Future Disease Surveillance Games

- **Disease model**
  - Incorporate infection control courses-of-action
- **Social and behavioral models**
  - Allow simulation of novel data inputs
- **Multi-scale / agency collaboration**
- **Web-based games**
- **Multiple difficulty levels**
- **User-designed games**



# Summary

- **Disease surveillance games can be a valuable addition to the community**
  - Training enhancement
  - Hypothesized technology evaluation environment
  - Exercise platform for large-scale events
- **EpiDIG, a new outbreak investigation game, is being unveiled at the 2011 ISDS Pre-Conference Workshop**
- **Future directions include**
  - Multi-scale/jurisdiction games
  - Web-based multi-player game