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Optimize NIH: Applying Computer Simulation to Improve Efficiency and Effectiveness in Federal Government

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Overview

- Background
- Research Support Applications
- Clinical Research as a System
- “Optimize” NIH
- Conclusions
- Next Steps
- Q&A

Background

NIH Background

- The National Institutes of Health (NIH) is the steward of medical and behavioral research for the Nation.
- The mission of the NIH is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burden of illness and disability.
- The NIH is a part of the U.S. Department of Health and Human Services. The NIH is comprised of the Office of the Director and 27 research institutes and centers.

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NIH ORS and ORF

- NIH Offices of Research Services (ORS) and Research Facilities (ORF)

- Support the efficient and safe operation of the largest biomedical research facility in the world
  - Scientific and regulatory activities
  - Public safety and security
  - Services to enrich the NIH community
  - Facilities management


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Research Support Applications

Purpose

- To drive mission-based improvement effort using primarily computer modeling and simulation.
- Model integrates various subsystems and provides a framework for future extensibility
- Utilize model to experiment with changes in services to ensure enhancement of overall mission performance.

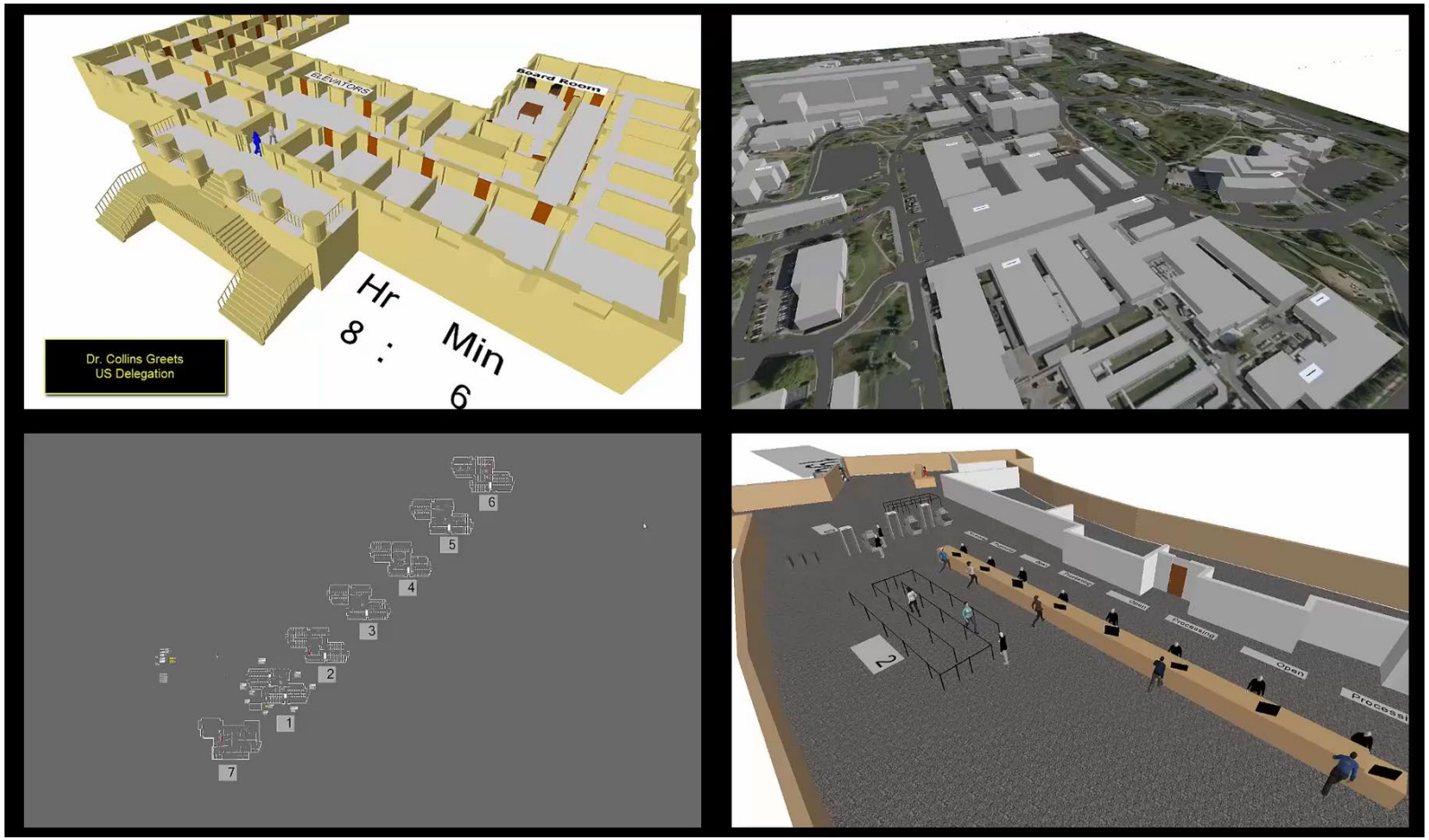
Modeling Approach

- Drive shift from interest in studying a particular campus function or subsystem to improve overall system.
- The modeling approach will be informed by this principle, so the model is built in a way that is flexible and adaptable to changing needs.
- A “modular” approach will be used so that particular subsystems can be included at both a high granular or more detailed level as interests and needs arise.
- The approach will provide an adaptable base model that can be added to and modified as needs change.

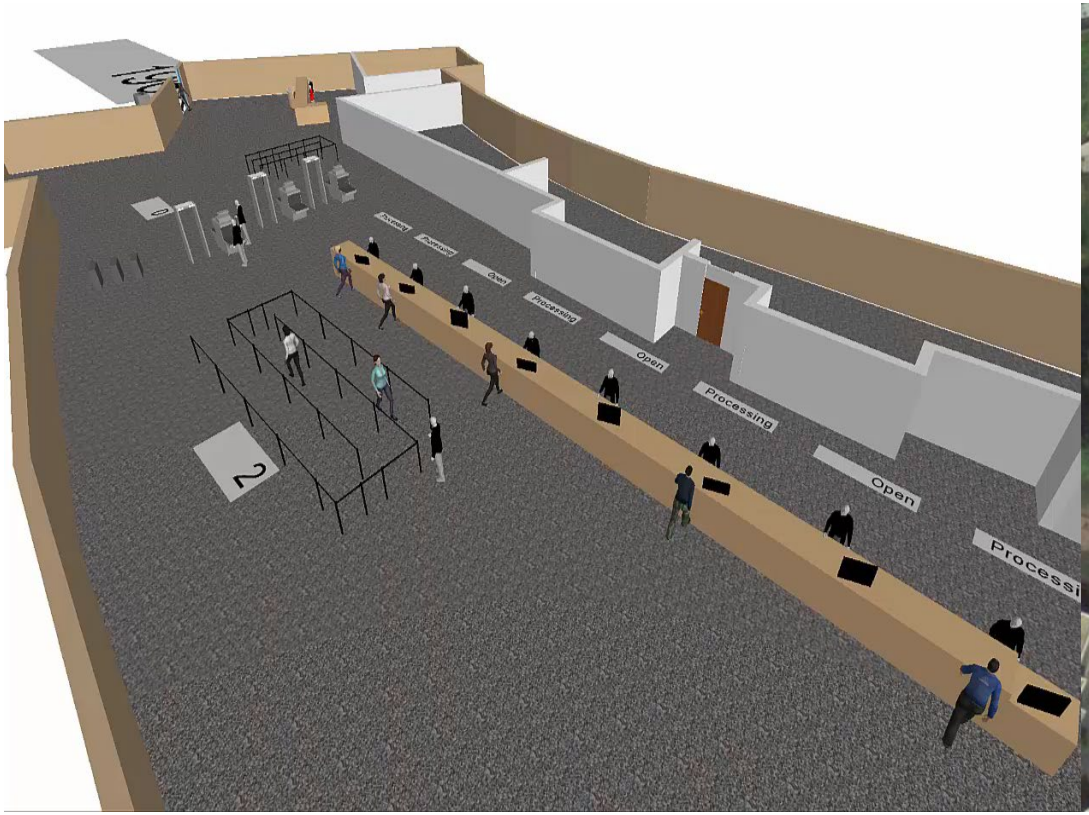
Scope

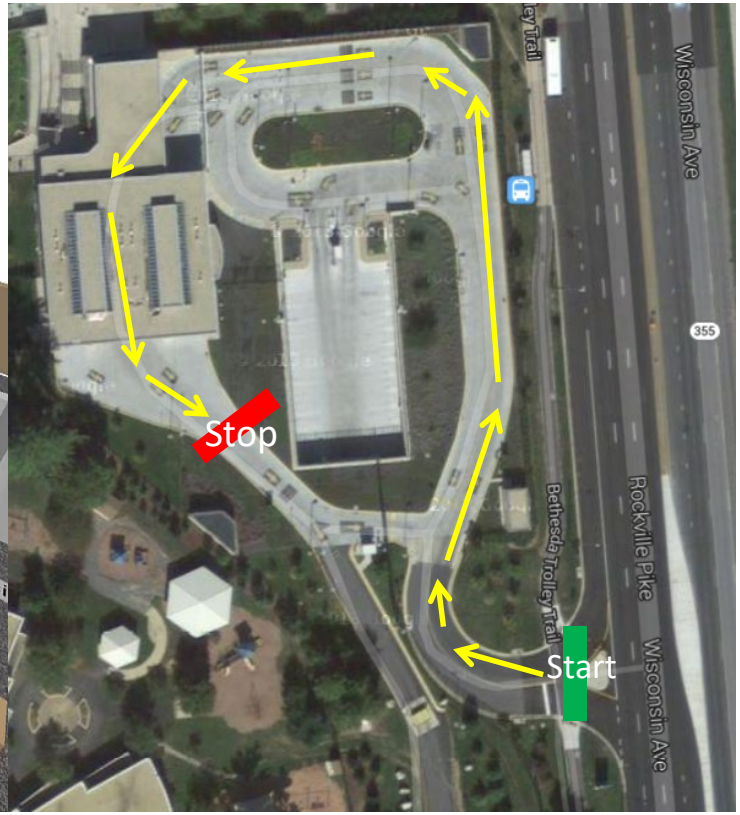
- Integrate overall model with campus subsystems developed previously as independent models
- Subsystems include:
  - Campus access (staff, visitors, conventional and commercial vehicles)
  - Campus vehicular circulation network
  - Campus pedestrian circulation network
  - Campus mass transit (i.e. shuttle bus system)
  - Vehicle parking
  - Building or campus partial or entire evacuation (pedestrian and vehicle)
  - Active Shooter Scenario (both at a campus level and inside of a building.)
- Subsystem models provide input to main model.

Sample of Models and Simulations

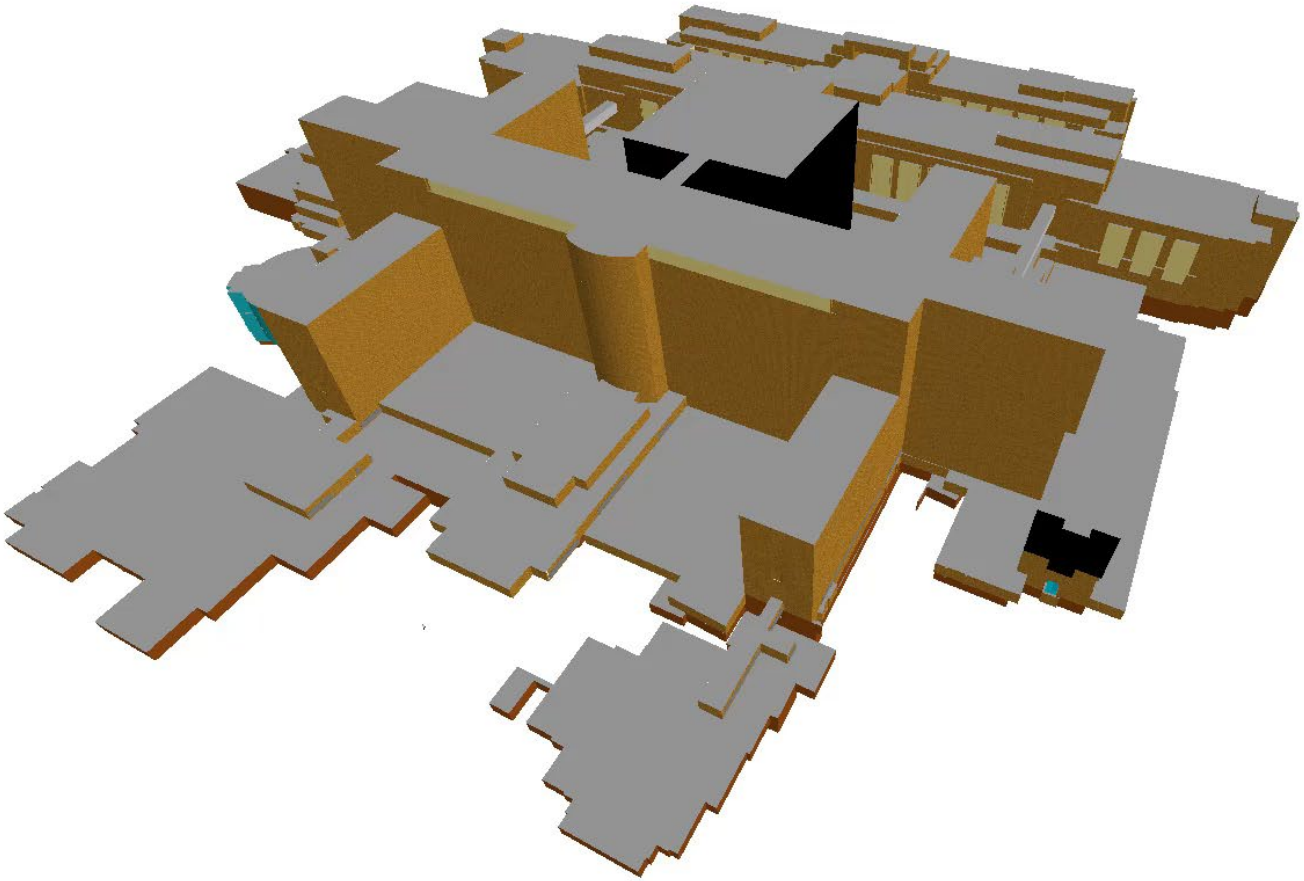


Gateway Visitor Center





Clinical Center Active Shooter



Disaster Recovery Logistics

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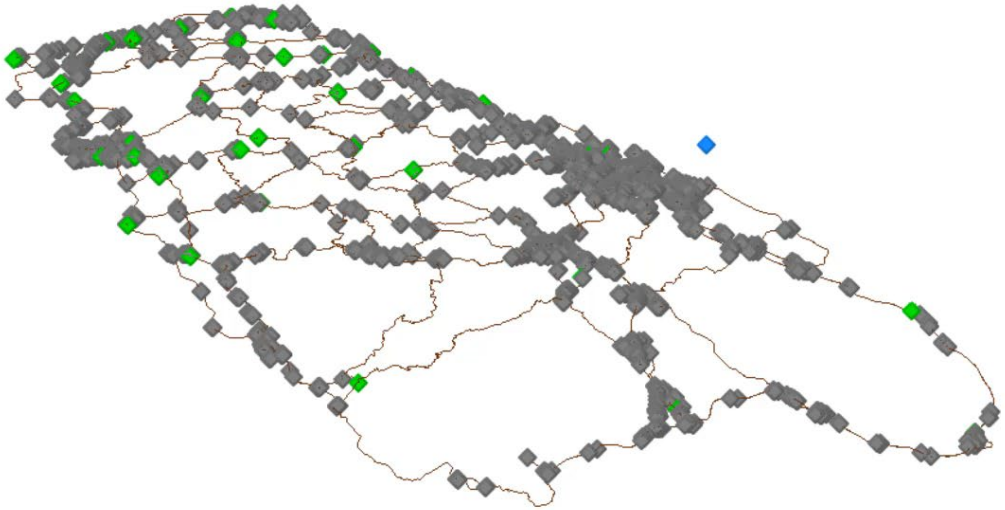

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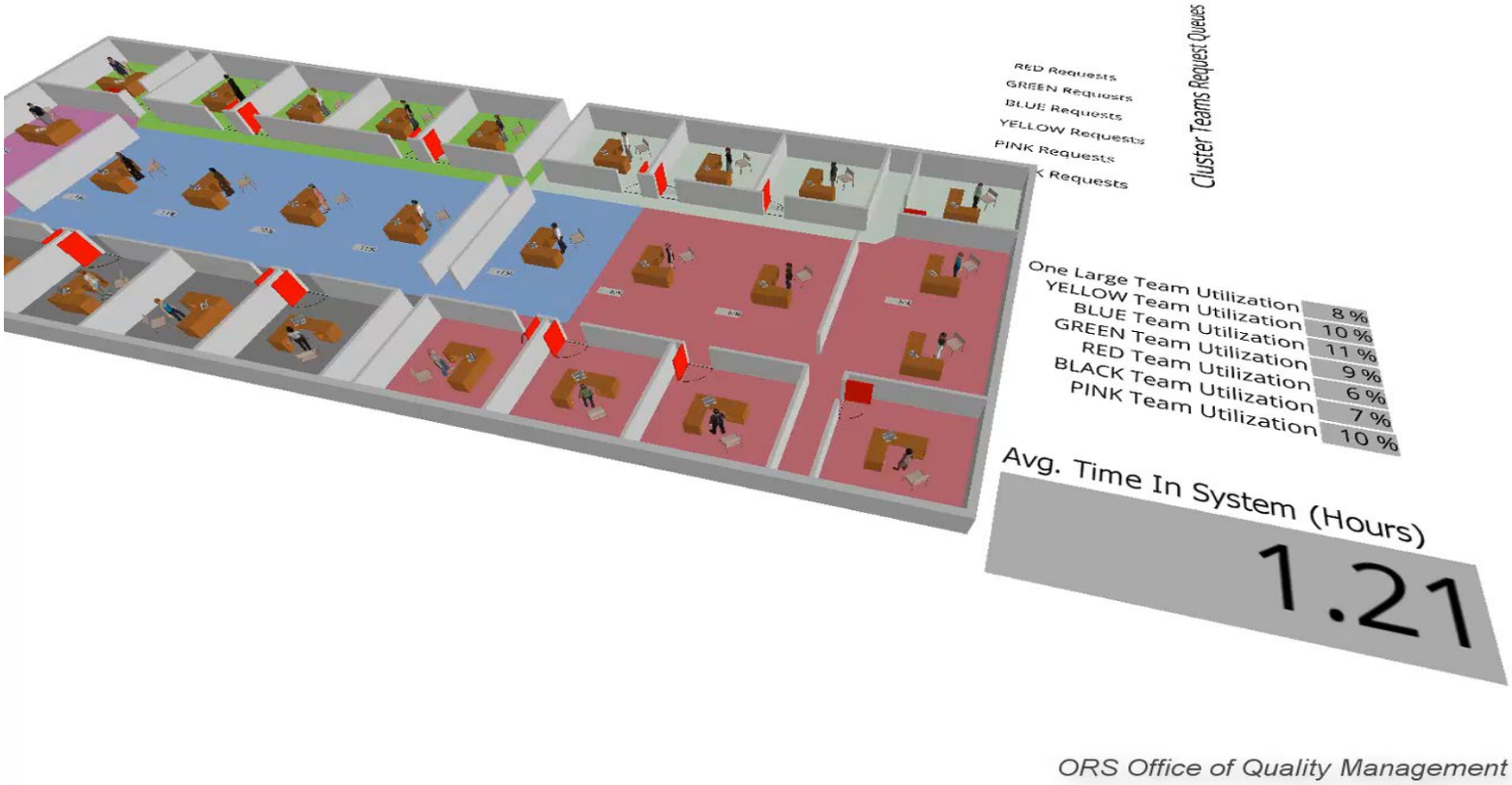
Service Cluster Simulation Model



ORS Office of Quality Management

Clinical Research as a System

Clinical Research (Context)

- Clinical research is medical research that involves people like you. Different types include:
  - **Epidemiology**, which improves the understanding of a disease by studying patterns, causes, and effects of health and disease in specific groups.
  - **Behavioral**, which improves the understanding of human behavior and how it relates to health and disease.
  - **Health services**, which looks at how people access health care providers and health care services, how much care costs, and what happens to patients as a result of this care.
  - **Clinical trials**, which evaluate the effects of an intervention on health outcomes.

https://www.nih.gov/health-information/nih-clinical-research-trials-you/basics

Types of Clinical Trial (Context)

- **Prevention** trials look for better ways to prevent a disease in people who have never had the disease or to prevent the disease from returning. Approaches may include medicines, vaccines, or lifestyle changes.
- **Screening** trials test new ways for detecting diseases or health conditions.
- **Diagnostic** trials study or compare tests or procedures for diagnosing a particular disease or condition.
- **Treatment** trials test new treatments, new combinations of drugs, or new approaches to surgery or radiation therapy.
- **Behavioral** trials evaluate or compare ways to promote behavioral changes designed to improve health.
- **Quality of life** trials (or supportive care trials) explore and measure ways to improve the comfort and quality of life of people with conditions or illnesses.

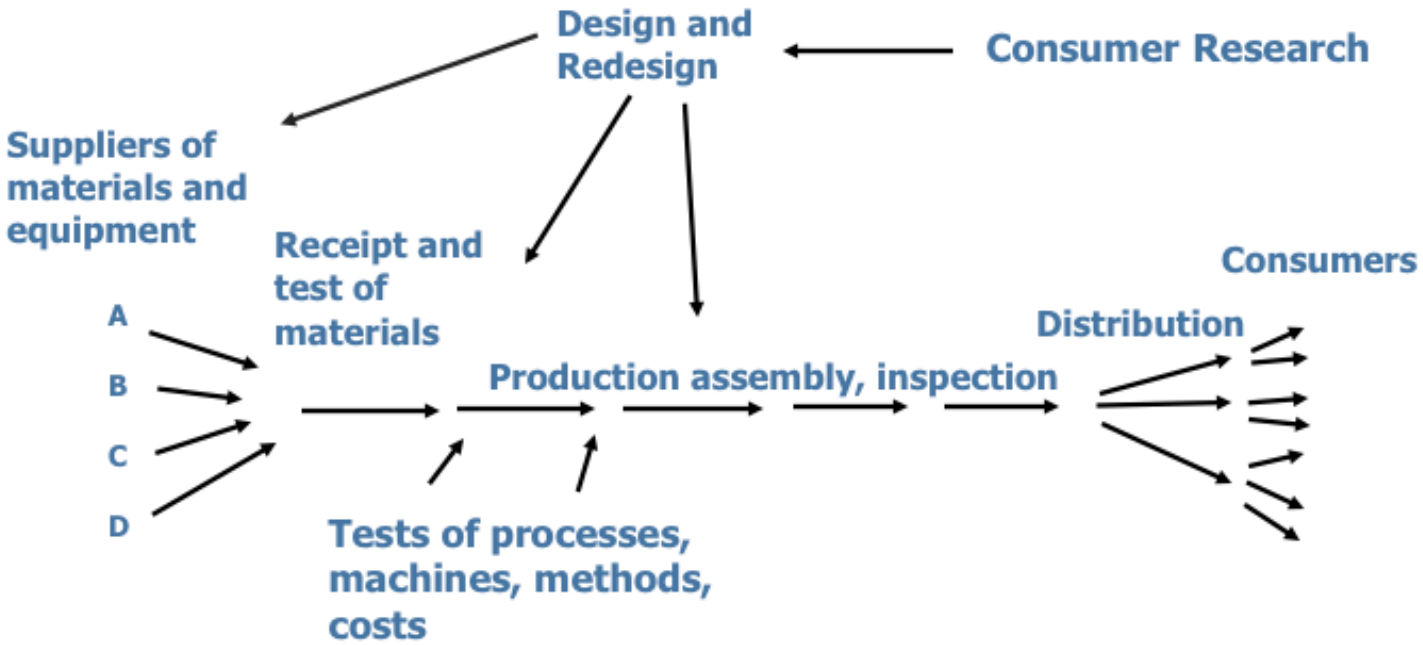
Clinical Trials – Phases (Context)

Clinical trials are conducted in a series of steps called "phases." Each phase has a different purpose and helps researchers answer different questions.

- **Phase I trials**: test a drug or treatment for the first time in a small group of people (20–80) to study the drug or treatment to learn about safety and identify side effects.
- **Phase II trials**: involves a larger group of people (100–300) to determine its effectiveness and to further study its safety.
- **Phase III trials**: even larger groups of people (1,000–3,000) to confirm its effectiveness, monitor side effects, compare it with standard or similar treatments, and collect information that will allow the new drug or treatment to be used safely.
- **Phase IV trials**: After a drug is approved by the FDA and made available to the public, researchers track its safety in the general population, seeking more information about a drug or treatment's benefits, and optimal use.

https://www.nih.gov/health-information/nih-clinical-research-trials-you/basics

A System View of the Organization



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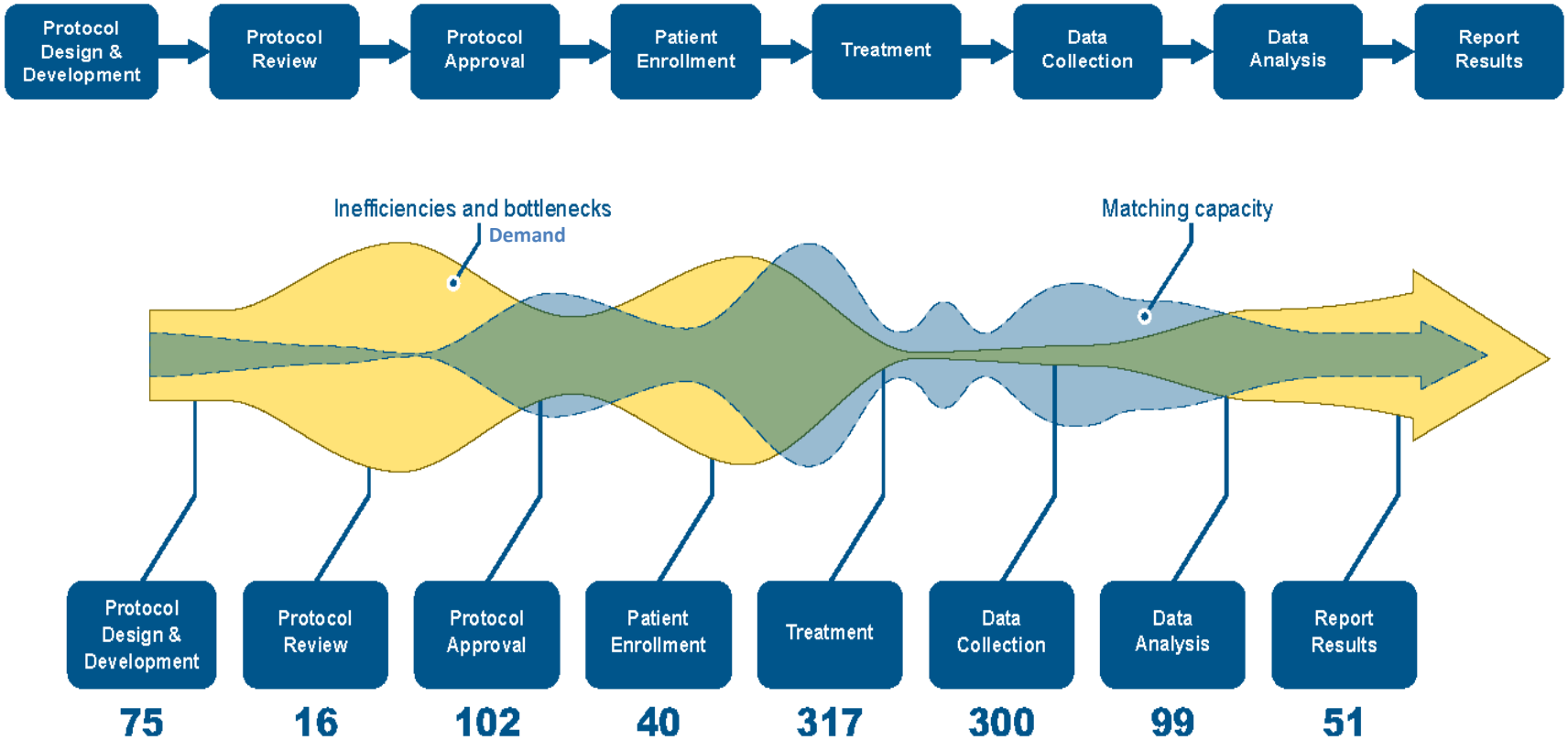
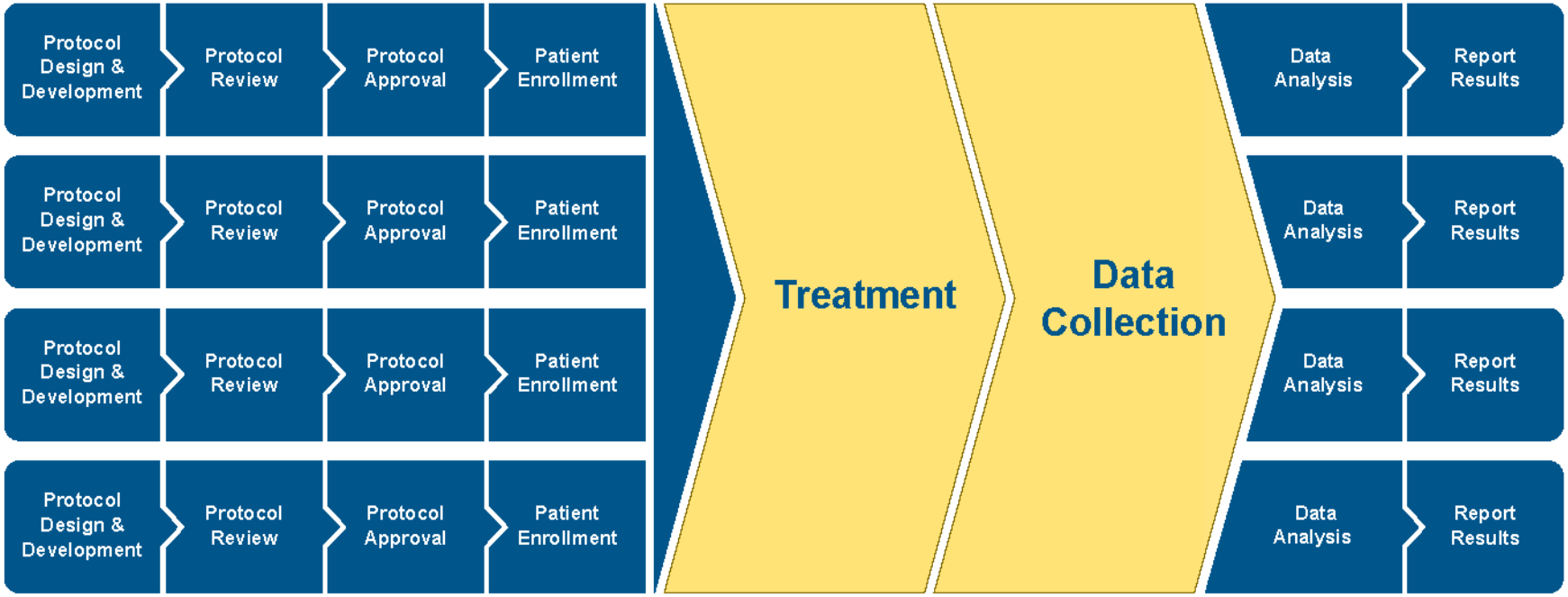
Clinical Research – Systems View



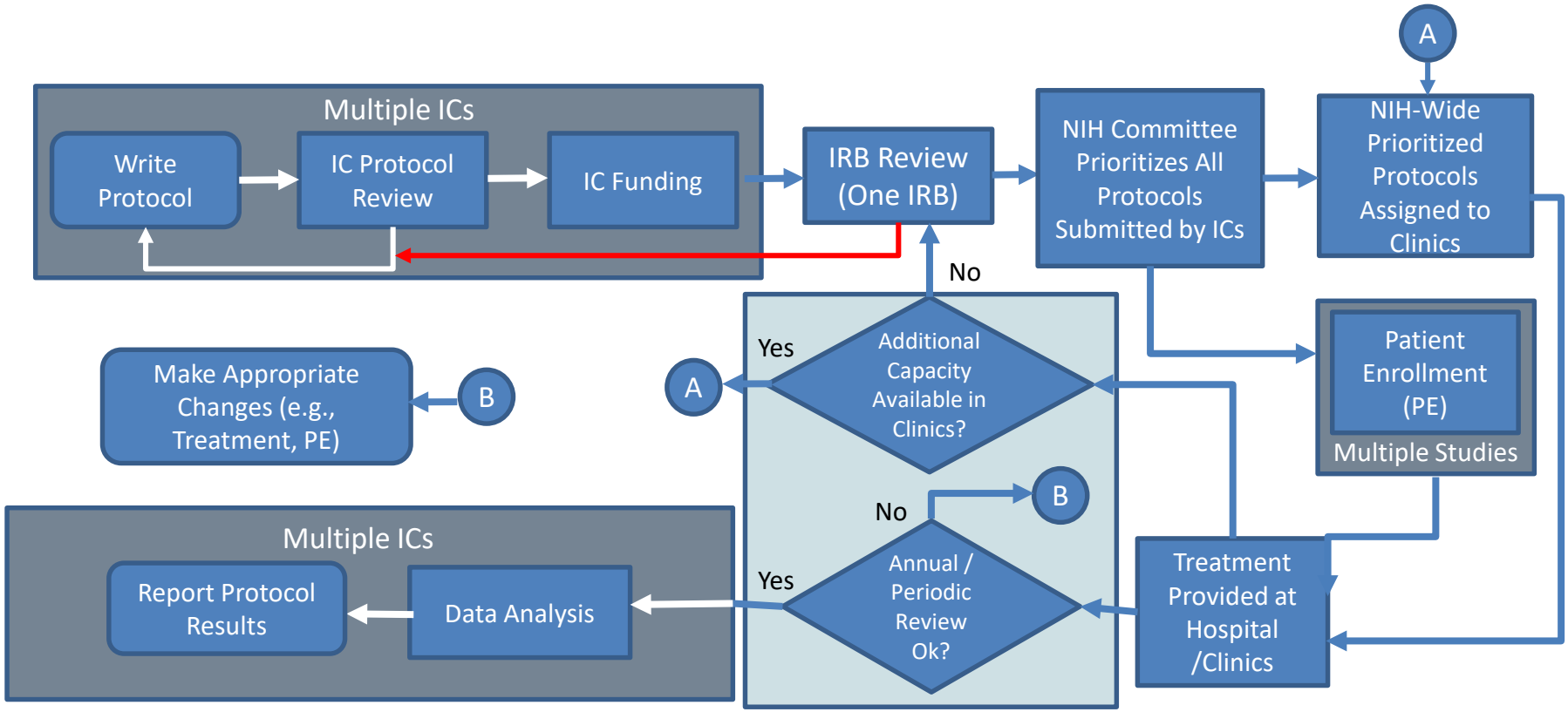
(Dagalar 2016)

Multiple Specialized Sources



NIH Interventional Clinical Research Model

Office of Research Services
Serving the NIH Community



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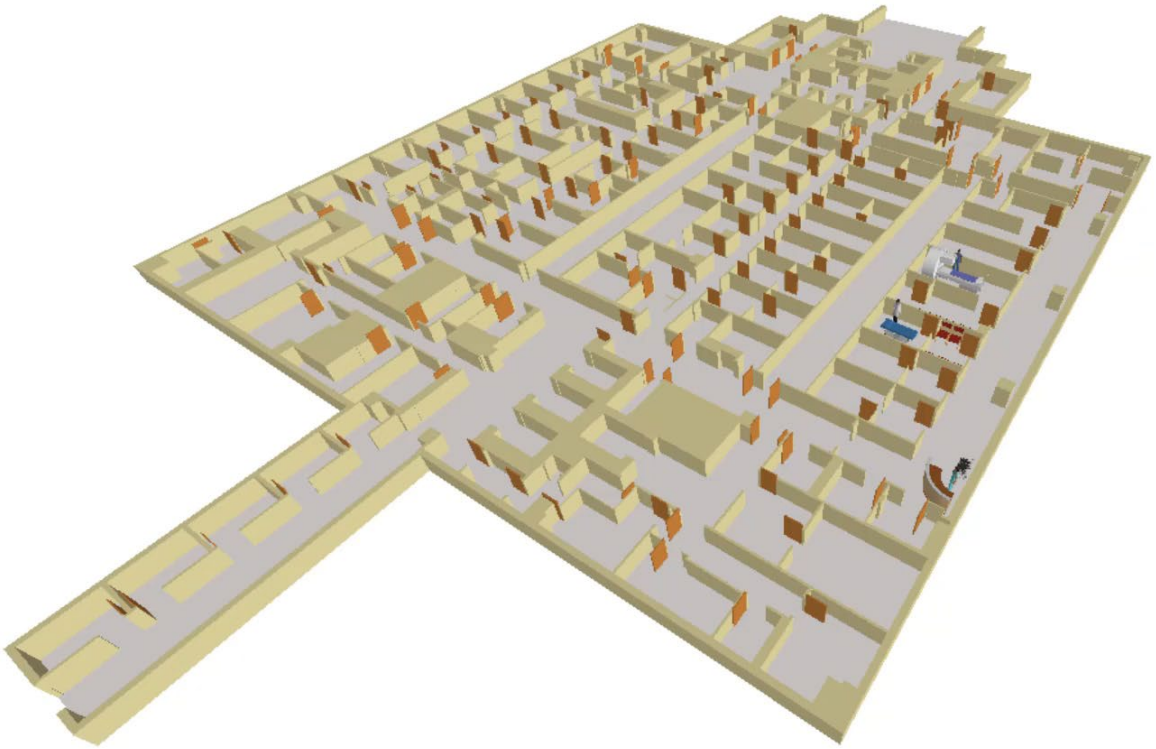
Clinic Level Detail



“Optimize” NIH

Background

- Improve efficiency and effectiveness of 3 Enterprise wide services:
  - Freedom of Information Act Requests (FOIA)
  - Committee Management
  - Ethics Support
- Limited or non-existent data and documentation of processes
- Electronic systems for document management but lacking in process metrics
- Paper/electronic processes with limited “visibility”

Approach

- Process Mapping
  - Over 40 processes documented in Visio
- Developed Data collection template
  - Used Visio “Shape Report” feature
- Data Collection
  - Demand
  - Resources
  - Various process time metrics
- Developed Computer Simulation
  - Utilized four processes
  - Data Driven approach
- Utilized Model to evaluate proposed future state changes.

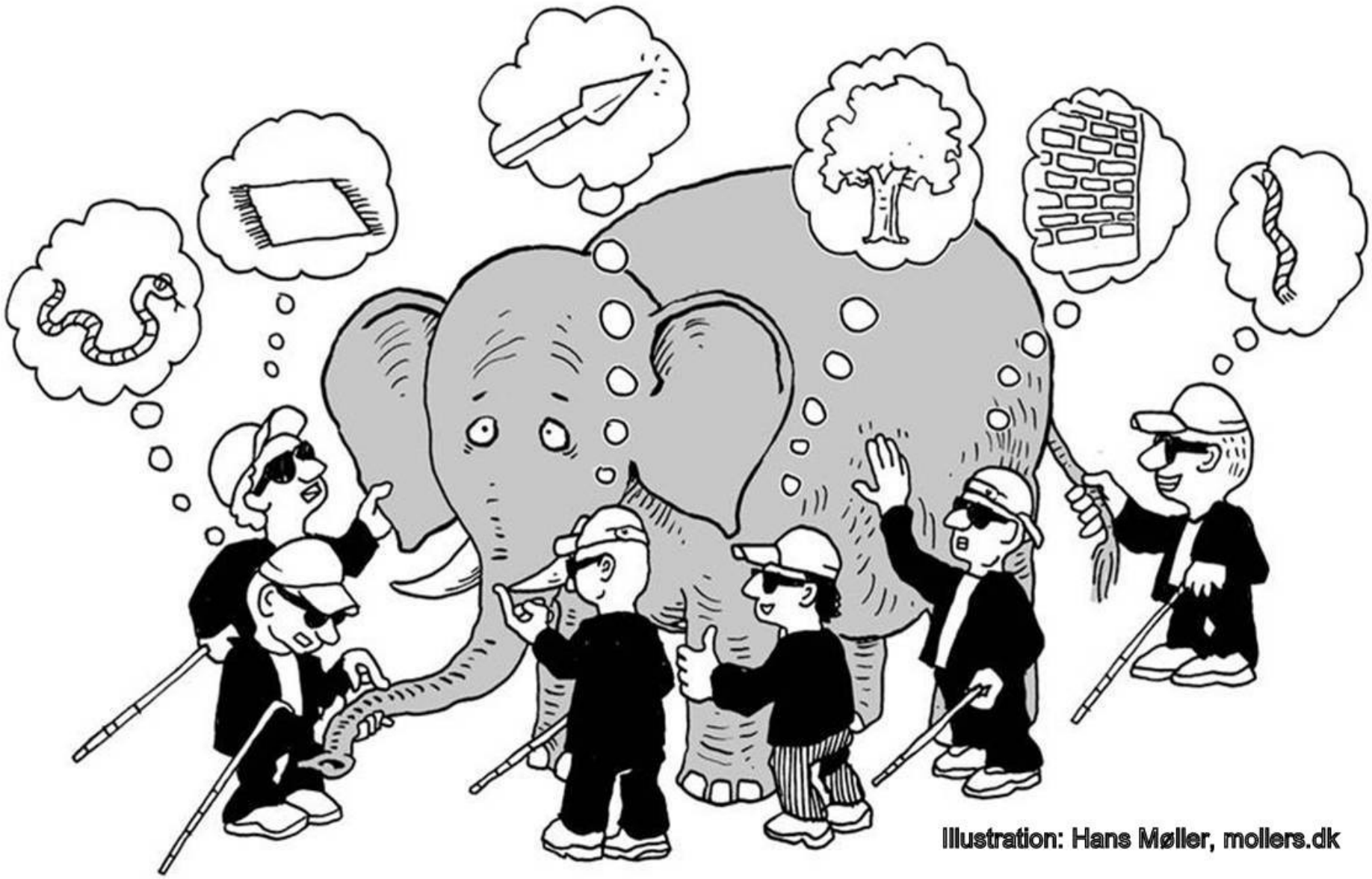
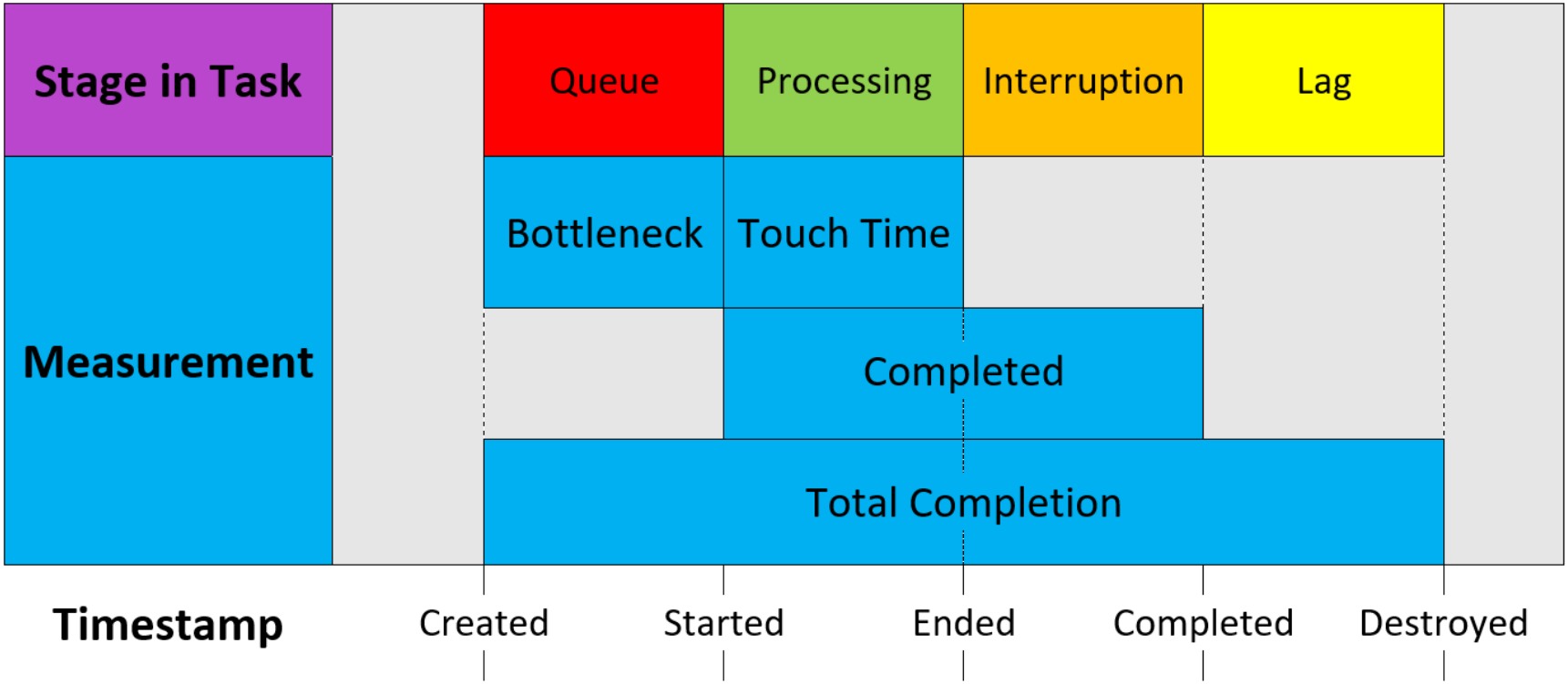


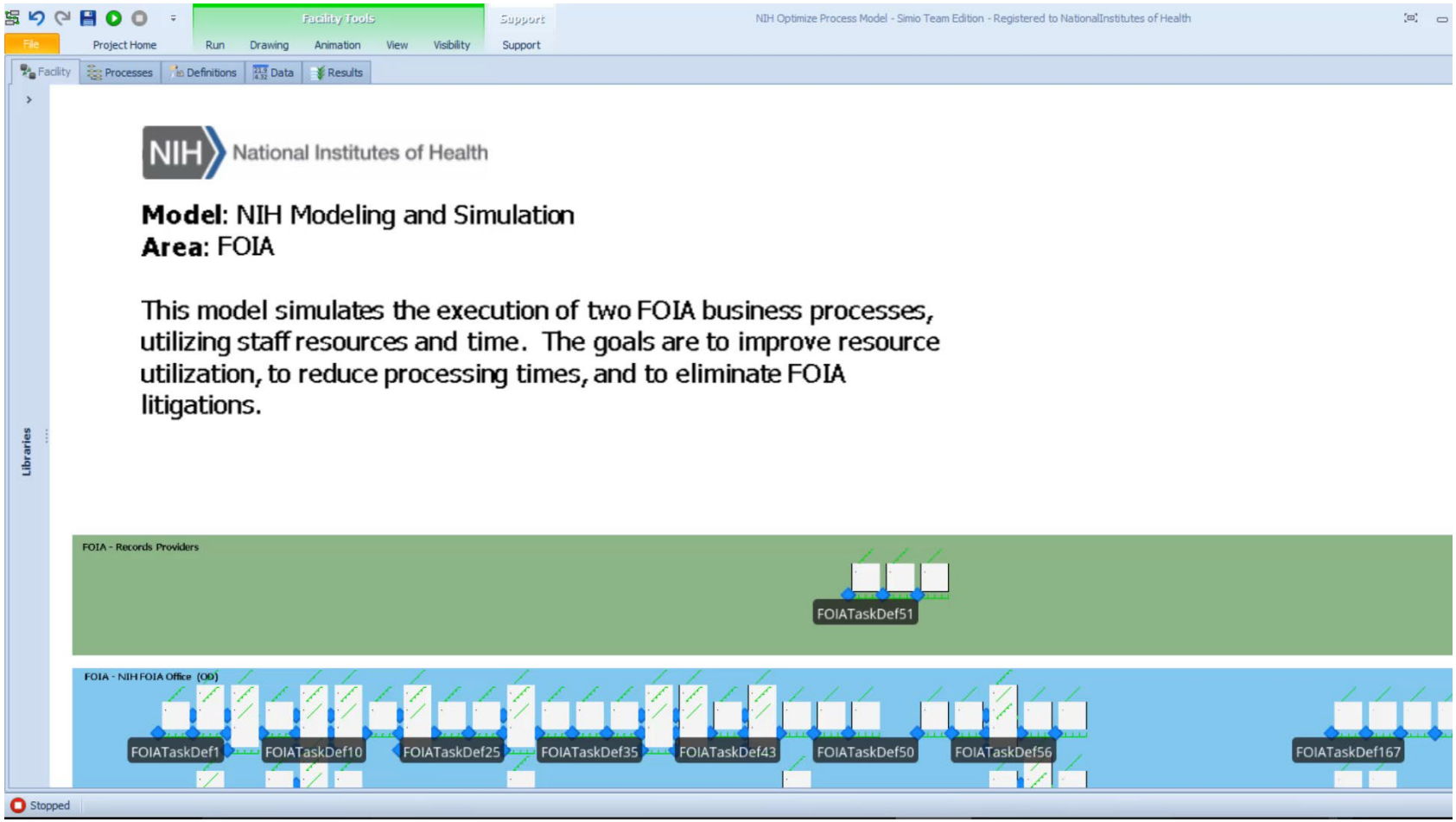
Illustration: Hans Møller, mollers.dk

General Time Usage Model



Source: Mosimtec, LLC

FOIA Process



Conclusions/Next Steps

Conclusions

- Cost-avoidance throughout the NIH
- Enhanced emergency planning efforts impacting NIH life and well-being
- Used to minimize research disruptions
- Enables experimentation with the wide range of scenarios
- Potential for integrating campus operations and research to better understand how systems interact and impact broader objectives
  - Through use of scalable/modular approach,

Next Steps

- Continue to refine and augment models
- Develop recommendations for improving/maintaining the data inputs required
- Other agencies/organizations can leverage these approaches to solve related challenges