



Sample Transport Tool

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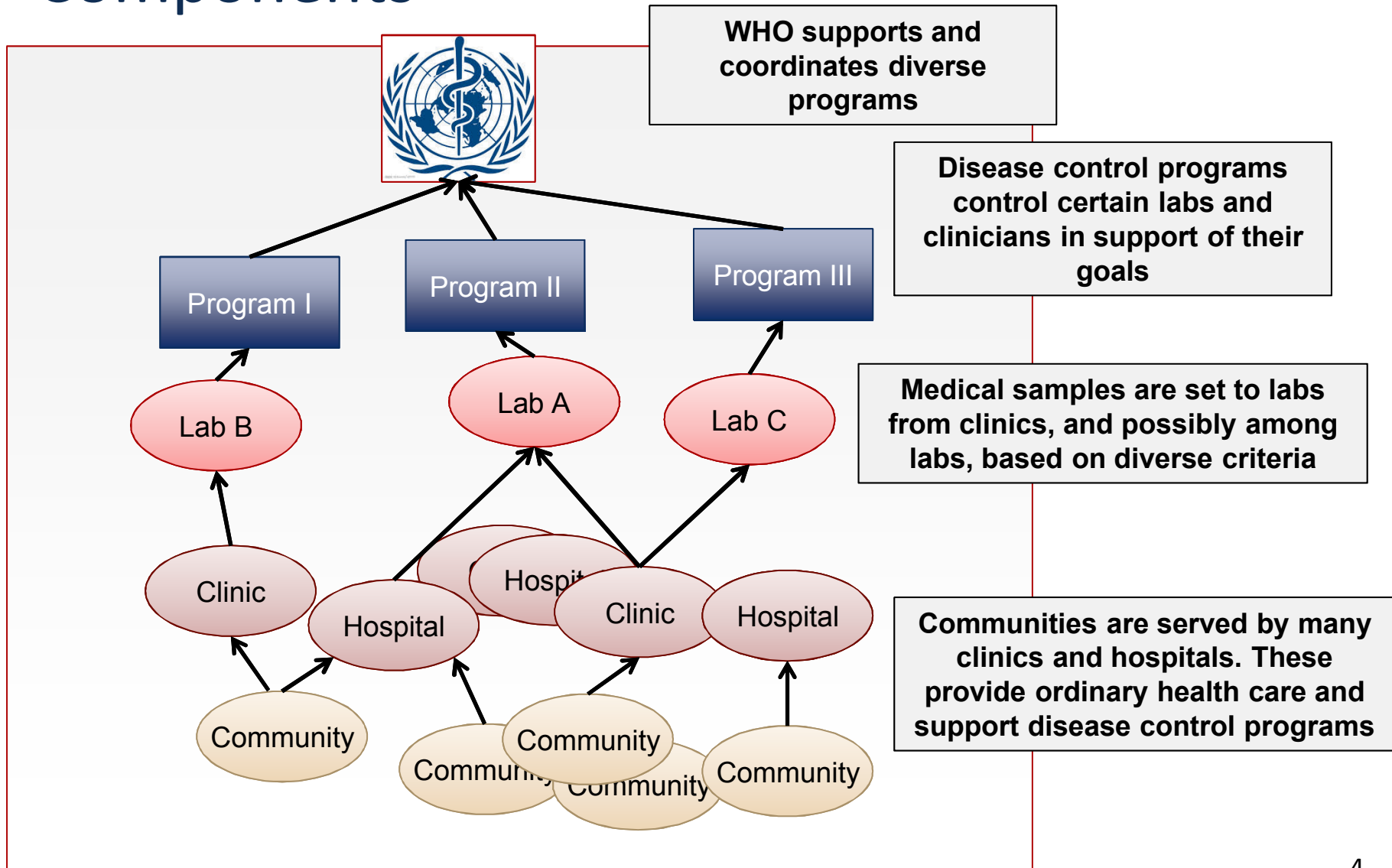
Overview - I

- Use a broad system-level representation to evaluate the outcomes of many alternative course of action
- Summarize possible outcomes in a format tailored to help users make risk-informed decisions
- Many kinds of decisions can be evaluated in this way
 - Operational decisions about sample transfer
 - Routing and scheduling of couriers
 - Planning for capacity expansion and placement
 - Resource sharing among independent programs
 - ...

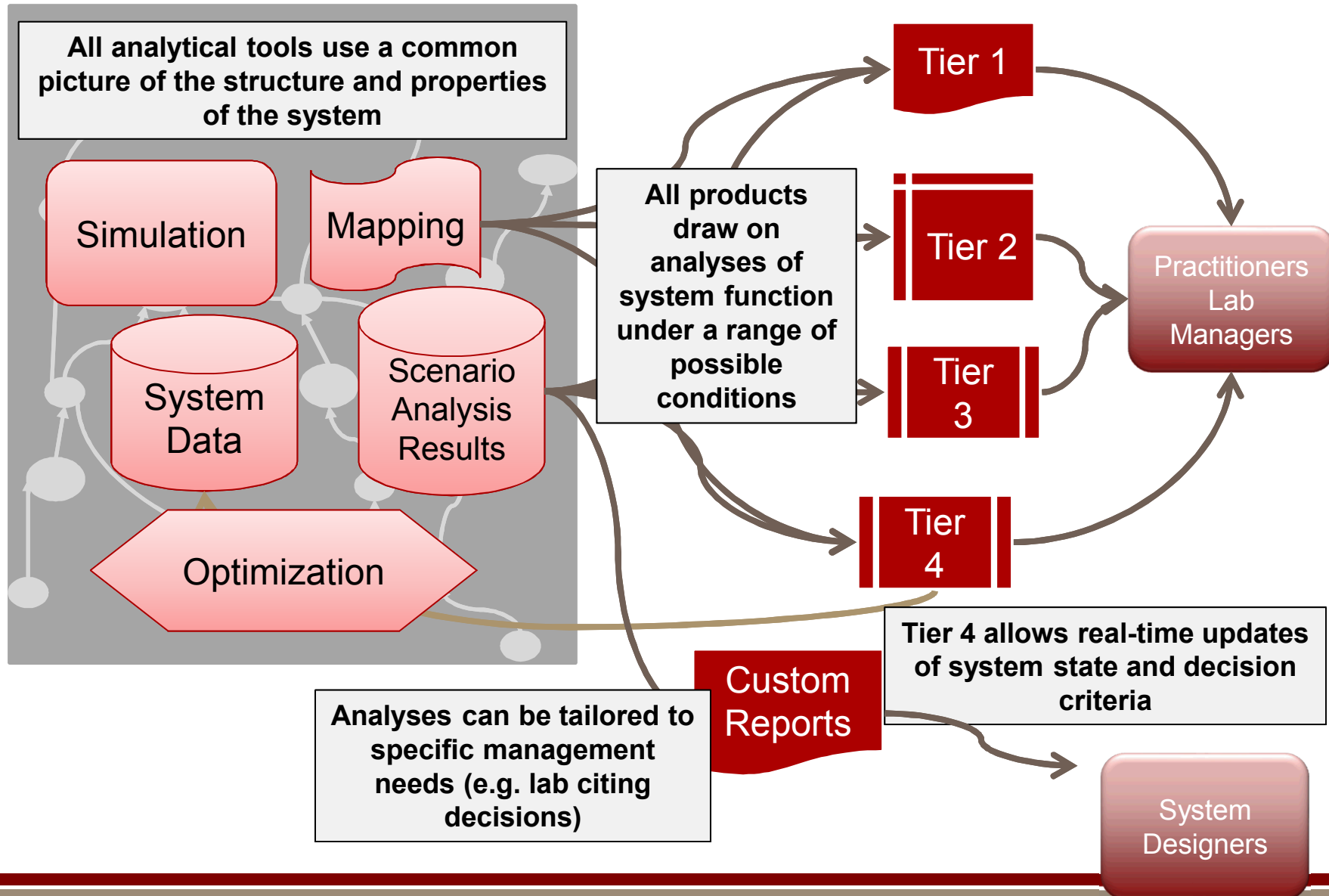
Overview - II

- Different kinds of decisions require different processes to be included in the model
- The most appropriate decisions and tool formats...
 - May not be known immediately
 - May change over time
 - May be multiple
- ... so we recommend beginning simply

Our Understanding of System Components

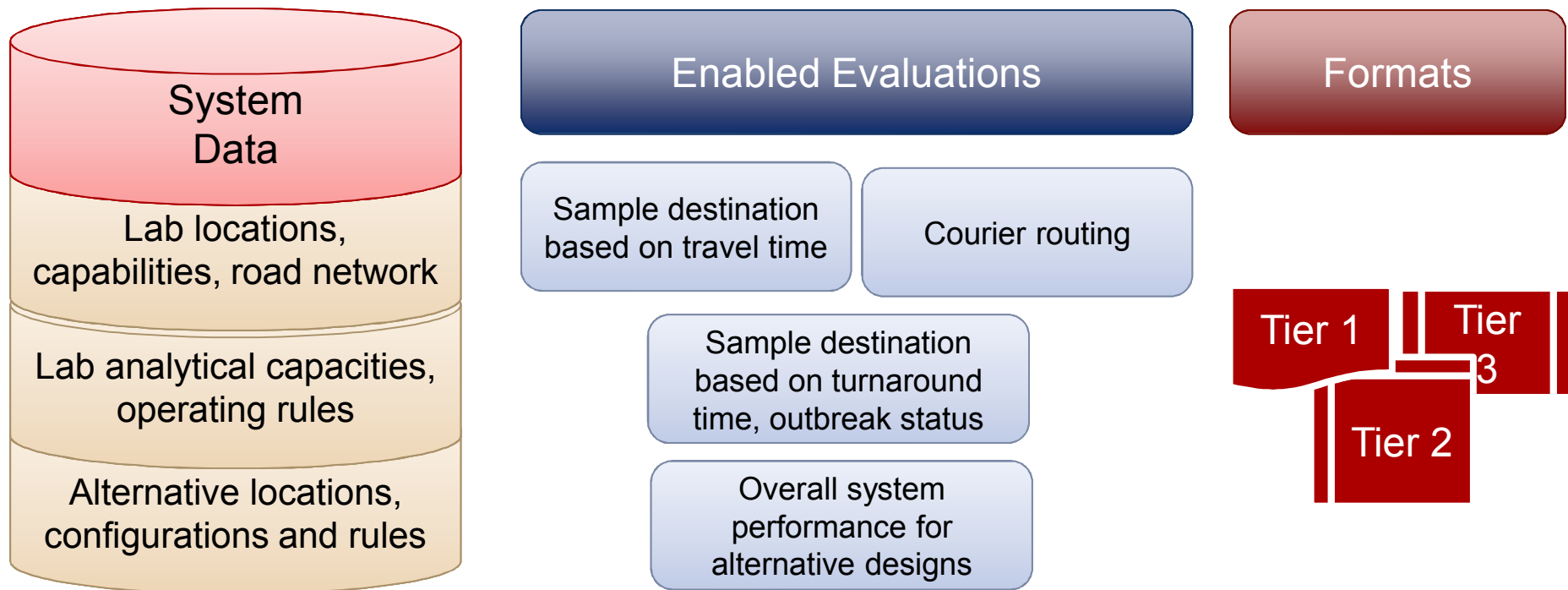


Common Analytical Resources underpin the Tool Types

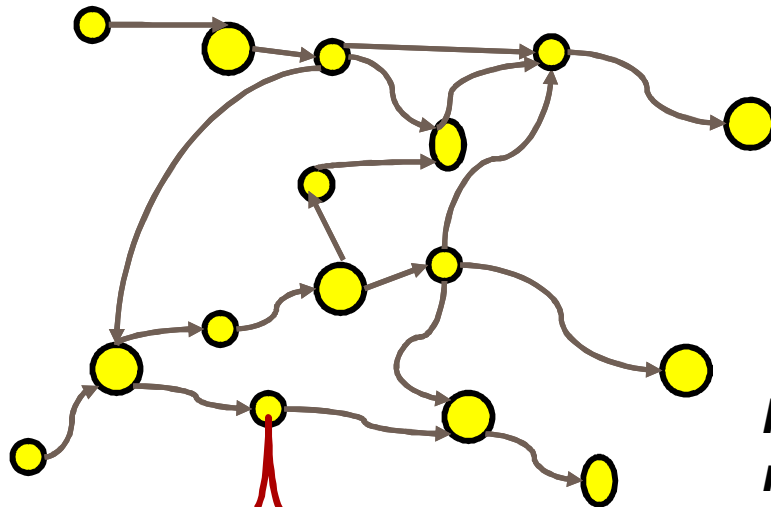


Building the appropriate system

- Different kinds/amounts of data enable different evaluations using different criteria



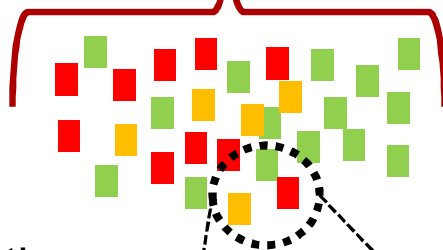
Model Structure - I



Space is described by a *network*

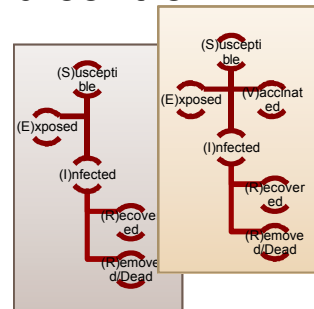
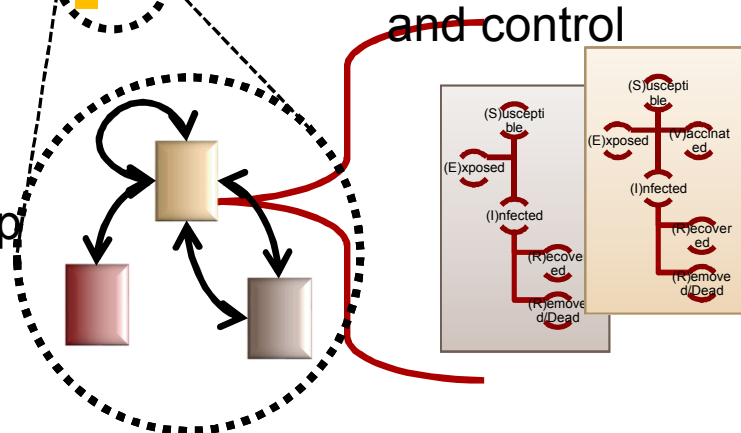
- Links represent significant physical separation that prevents direct transmission
- Nodes are locations where individuals can interact

People and resources move on the network



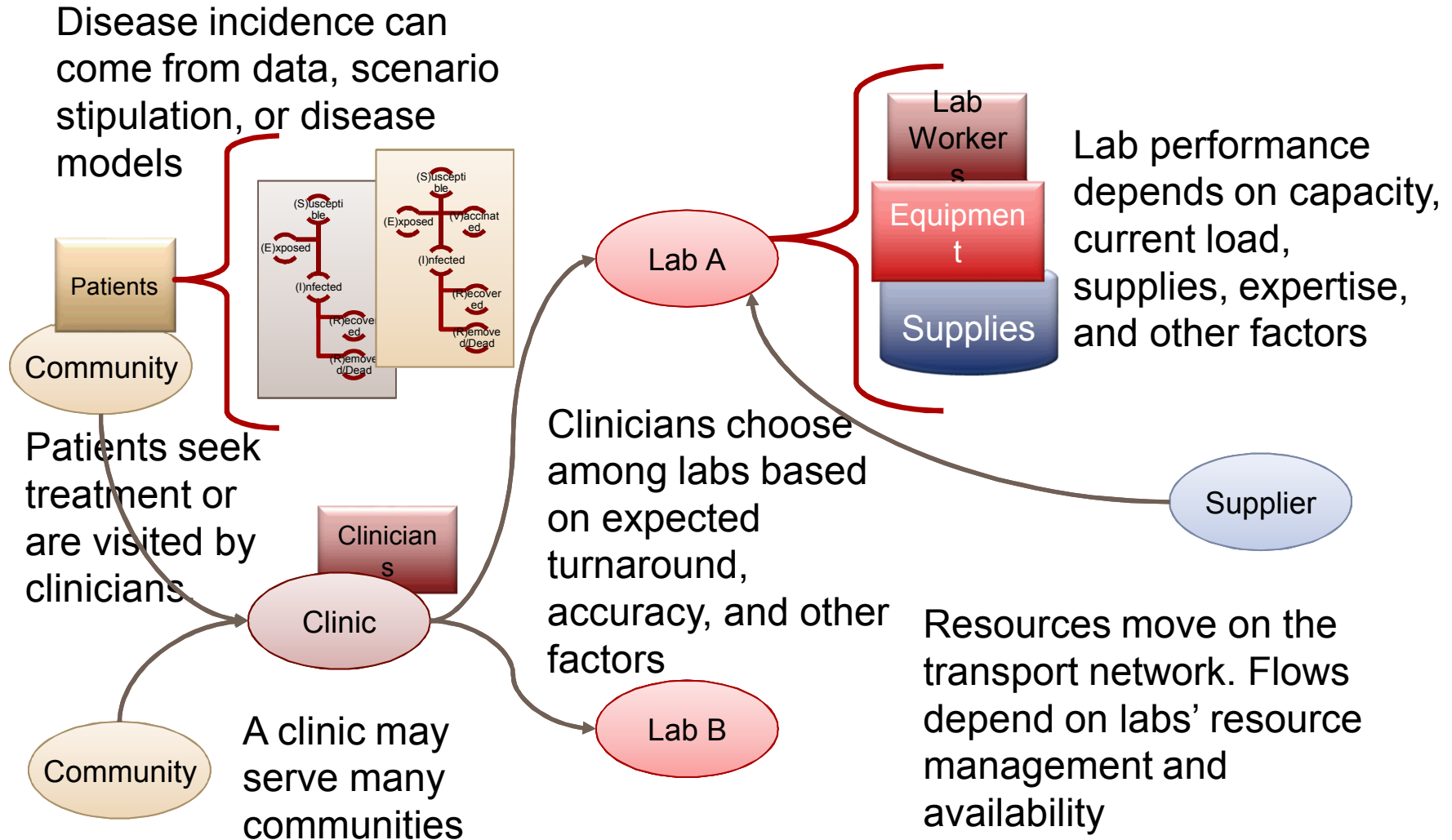
- Individuals at a node are grouped in *Populations*
- Populations model distinct behavioral and institutional roles relevant for disease transmission and control

Populations have rules for within- and between-group interactions, including disease transmission interactions



A population is described by the number of individuals in each disease state. Multiple diseases lead to a multi-dimensional state space

Model Structure for this Work



Processes

- Drivers for sample collection
 - Reconnaissance
 - Periodic check-ups
 - Illness
- Collection and handling and samples
 - Problems with draws
 - Problems with preservation, contamination
 - Problems with labeling
- Selection of analytical lab
 - Uncertainty about turnaround, load, accuracy
 - Batching – requirements for capacity/breadth
 - Conflicting motivations
- Transport to lab
 - Weather, traffic and other disruptive factors
 - Loss, preservation failure en route
- Analysis at lab
 - Queuing and priorities
 - Supply shortage/quality
 - Equipment failure
 - False positive/negative
 - Transcription error

Metrics

- Health-based
 - Deaths
 - QALY's
- Lab metric based
 - Latency (distribution of times, by clinic, etc.)
 - Accuracy/Specificity (by lab, by clinic, by community)
 - For each diagnostic goal considered

Inputs

- Drivers for sample collection
 - Community sizes and location
 - Incidence of relevant conditions
 - Data/Scenario/Model
 - Methods of reaching clinicians
 - Probability of seeking care
 - Surveillance protocols
- Collection and handling and samples
 - Kinds of samples collected for each presenting condition
 - Probability of collection problem
 - Probability of preservation problem or model for the process
 - Probability of mislabeling
- Selection of analytical lab
 - Model of decision process: What information do clinicians use?
 - Are suites of tests treated differently?
- Transport to lab
 - Road/transport network of possible routes
 - Distributions of possible travel times, as a function of weather, traffic, season and other relevant factors
 - Probability of loss and of preservation failure en route

Inputs - continued

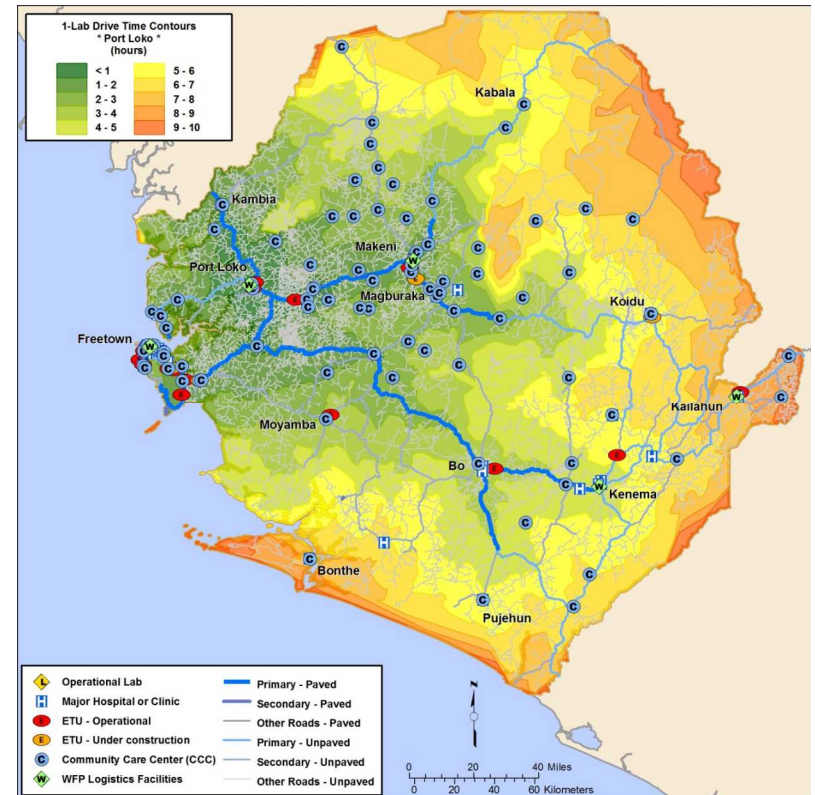
- Analysis at lab
 - Capacity for each kind of test
 - Functional description
 - Equipment-based dependency model
 - Prioritization rules
 - Hours of operation
 - For each kind of test
 - Probability of sample loss during preparation
 - Supplies required
 - Personnel required
 - Probability of false positive/negative
 - Probability of reporting error
 - Probability of equipment failure

Note that any of these inputs can be described by uncertainty distributions, or can be assigned alternative possible values to explore their relevance for making robust decisions.

Current Status



We're assimilating Cambodia Data



... working toward drive-time maps

Logistics of Disease Control

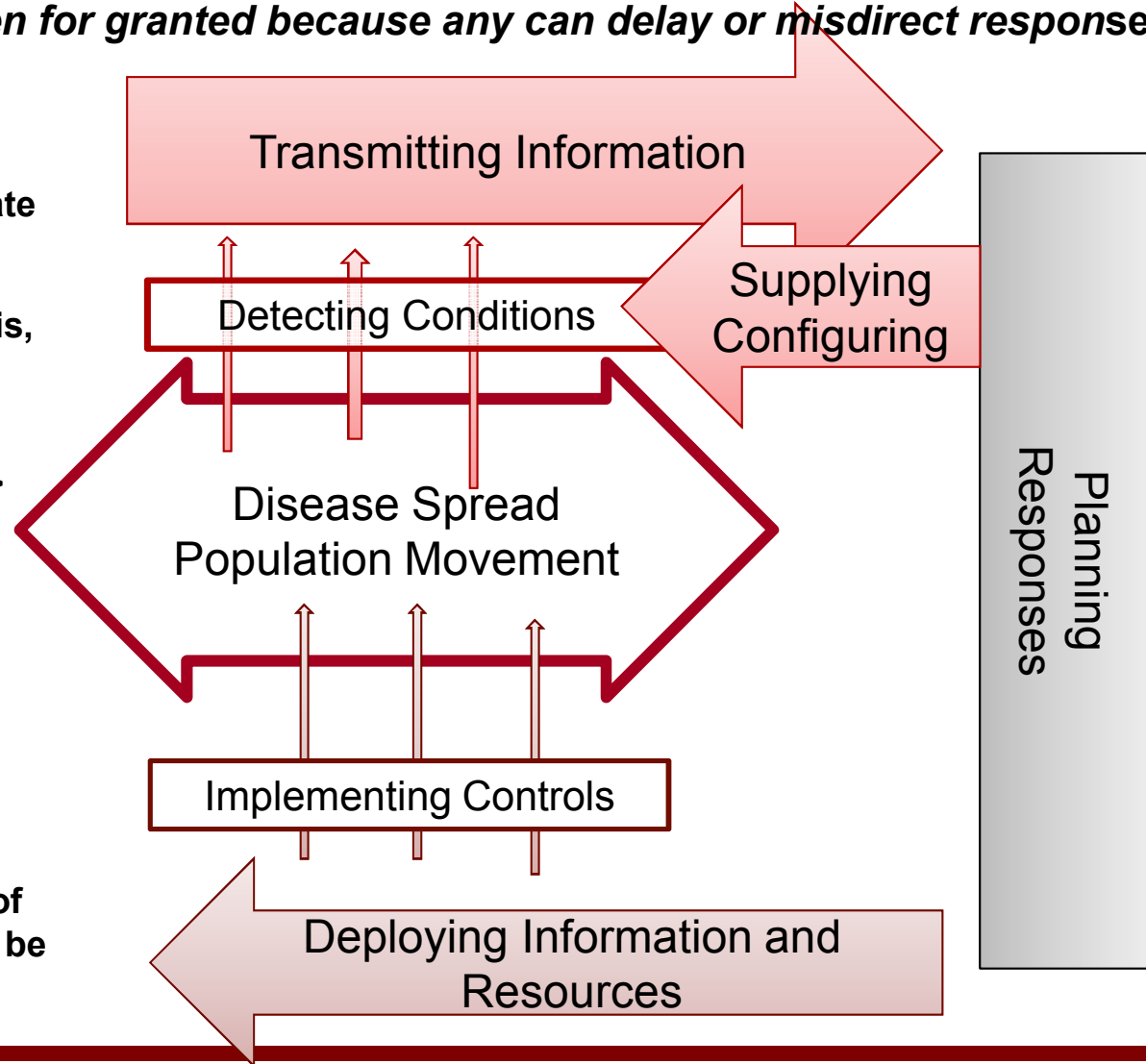
***Effective control depends on many processes working well and working together
None should be taken for granted because any can delay or misdirect response***

Incidence of disease at
various locations
May be partial, inaccurate

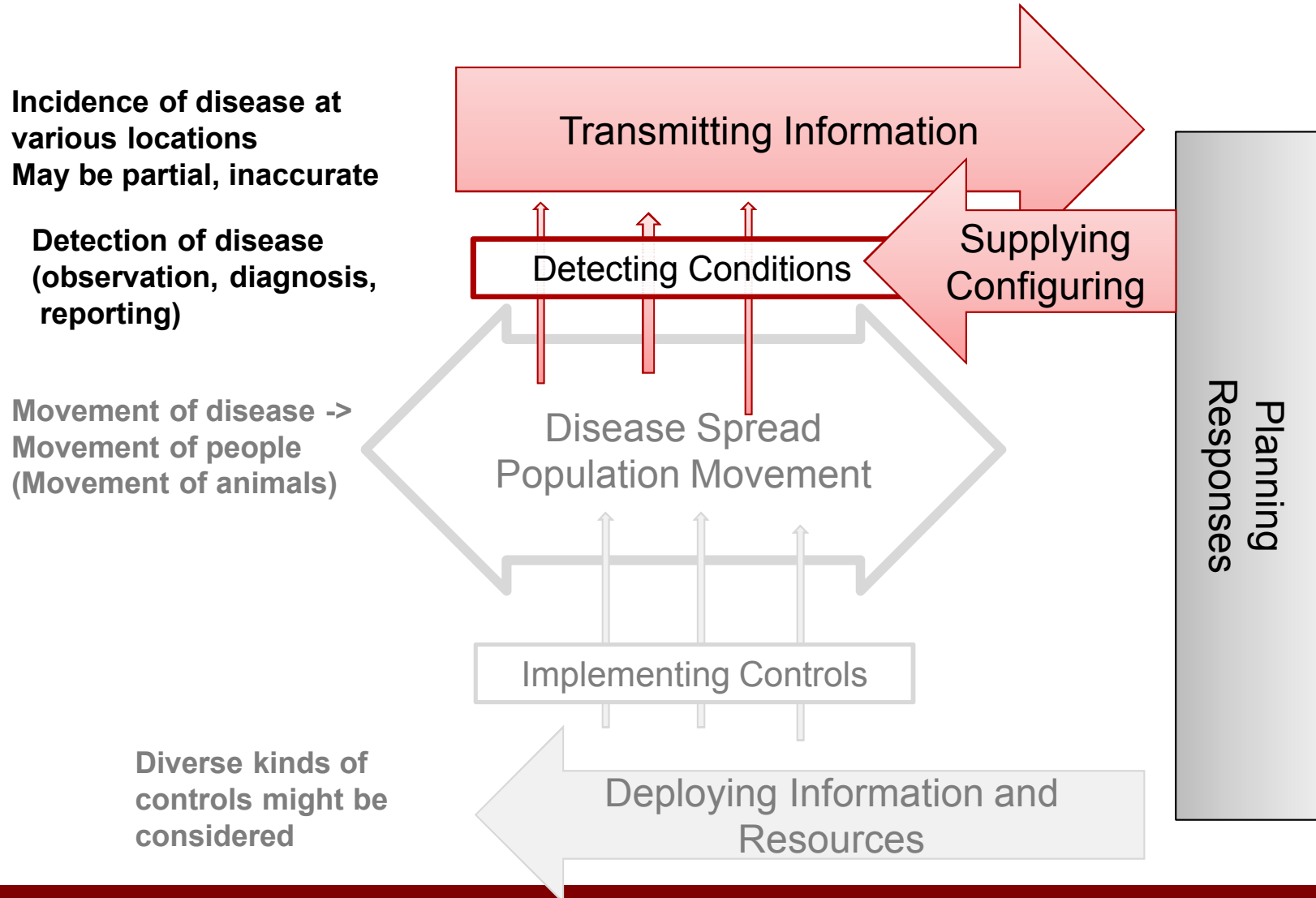
Detection of disease
(observation, diagnosis,
reporting)

Movement of disease ->
Movement of people
(Movement of animals)

Diverse kinds of
controls might be
considered



Focal Processes for this Work



Suggested Formats, Decisions, and Users

Approach	Implementation	Decisions	Users
Tier 1 - Printed Guidelines	Decision charts developed for each lab, including some conditioning on important system features that may change between the time of analysis and the time of use	Best location/mode for sending samples	Clinicians, Lab operators
Tier 2 - Spreadsheet Guidelines	Spreadsheet macros. Allows for a richer set of conditioning information and some “what-if” analyses by users	Best location/mode for sending samples; Richer set of conditions	Clinicians, Lab operators
Tier 3 - Interactive Decision Support	Interactive browser-based tool with mapping and forms; no persistent internet connection required	Best location/mode for sending samples; Richer set of conditions; More intuitive and controlled input	
Tier 4 - Integrated into Lab information management system	Interactive browser-based system similar to Tier 3; current lab/road/ status acquired from a central server	Best location/mode for sending samples; Richer set of conditions	