Update-Metro's Transportation Models

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for

The Second Oregon Symposium on Integrated Land-Use and Transport Models

July 18th 2000

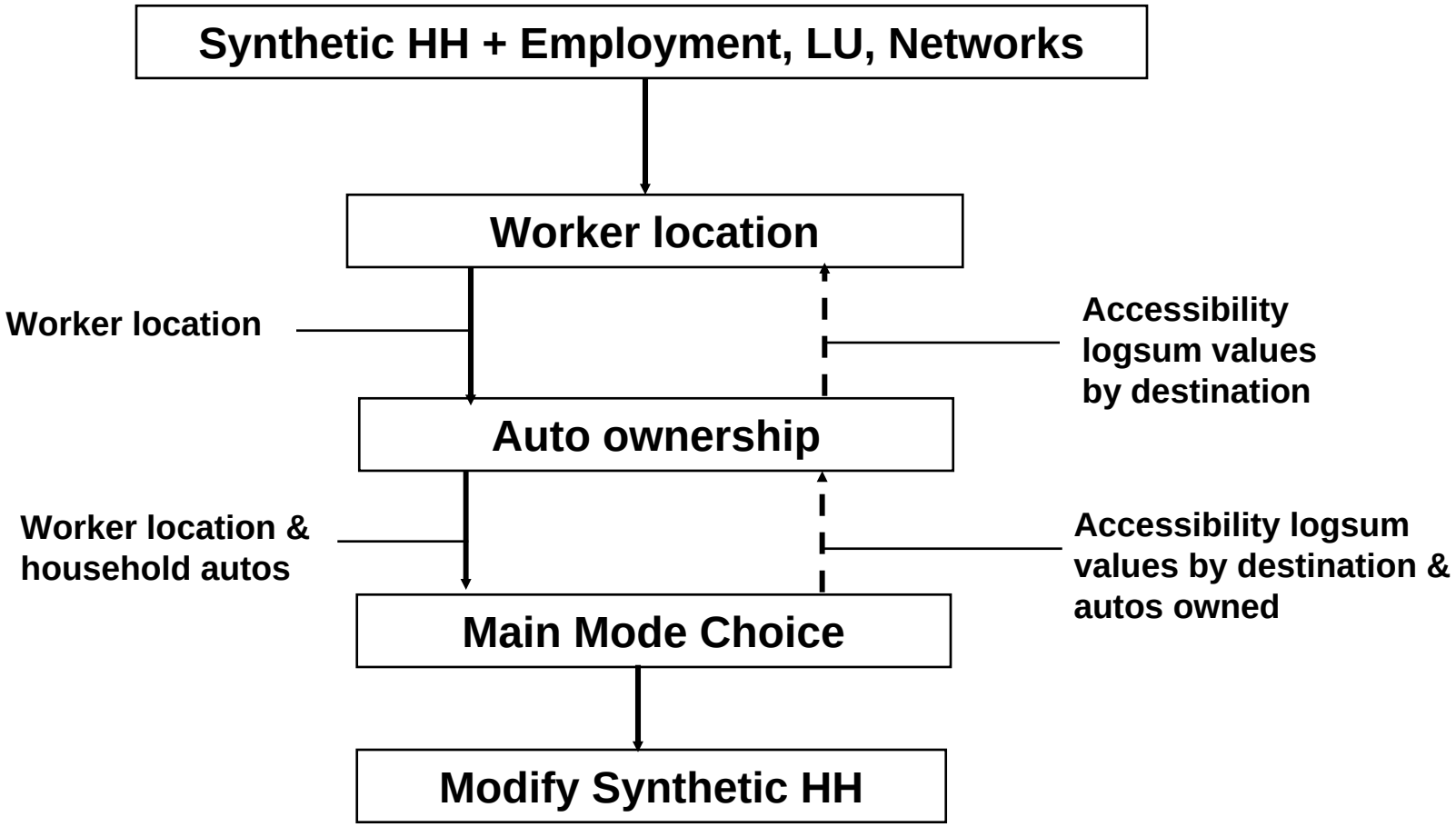
PresentationObjectives

- ***To describe Metro's activity model development***
  - *Follows previous model, but stochastic application*
  - *Benefits from San Francisco model development*
  - *Moves the bar higher*
- ***To describe the Transims model development***
  - *In general terms*
  - *Growing understanding during Portland Case Study*
  - *Method of calibration - Selector (as far as we understand it)*
  - *Use of data in calibration*

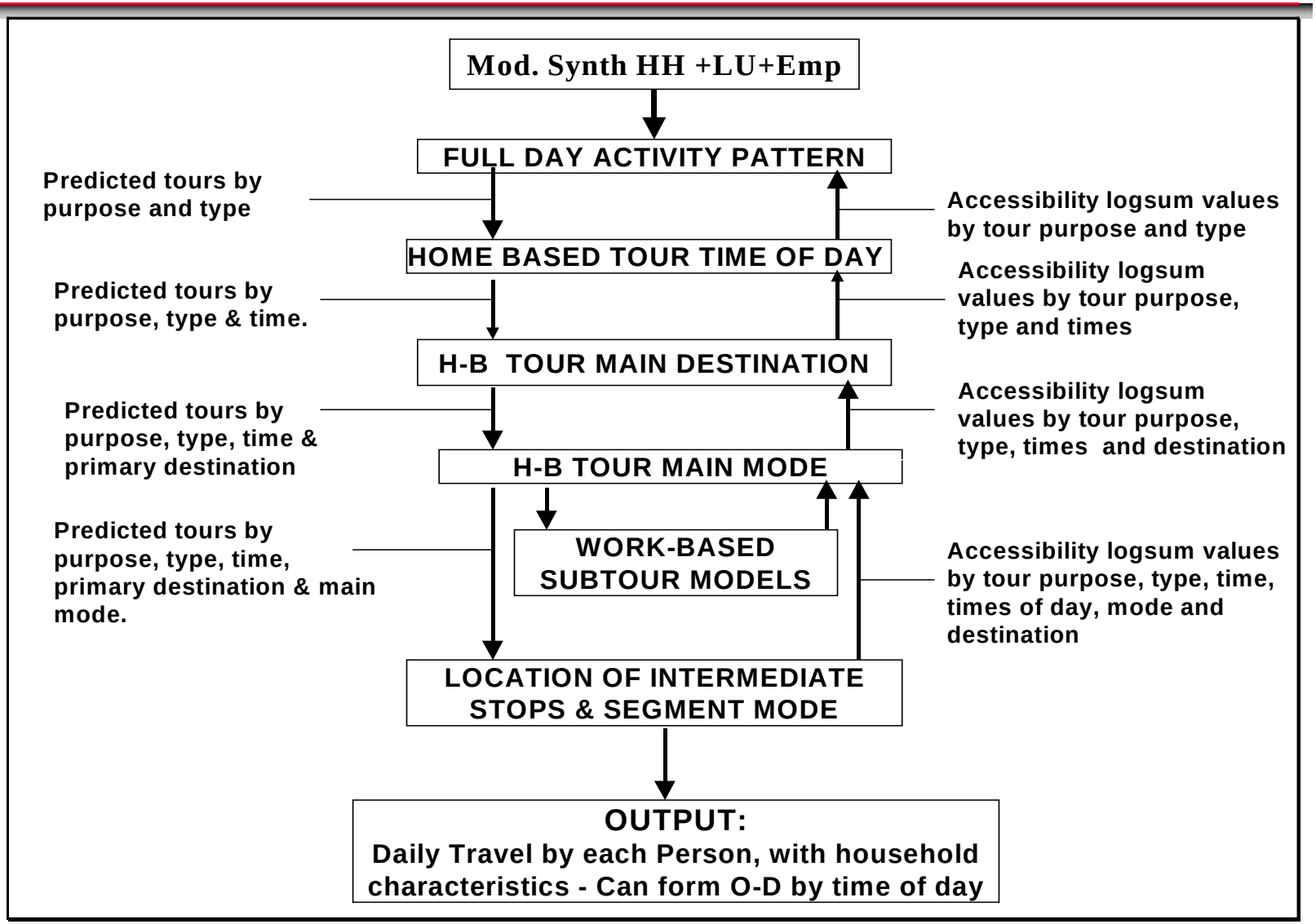
METRO ACTIVITY MODEL GEN II

- ***Disaggregate microsimulation application***
  - *either full or sample enumeration*
- ***Two stage - Work location then activity pattern***
- ***Auto-ownership endogenous***
- ***Requires synthetic population generation***
  - *same as transims*
- ***Link to link or zone to zone***
- ***Destination sampling***
- ***Handles mode shifts within a tour***

Metro - Activity Model - Stage I



Metro ActivityModel - Stage II



Workplace/School on Top

- Decisions with longest time frames at the top, at a similar level as residential location choice.
- This makes the structure suitable to integrate with a land use model that simulates residence and work locations for individual households (e.g. UrbanSim)
- Workplace location choice is sensitive to the mix of employment types in specific zones, and also to demographics and socio-economics: Different income groups are attracted to different types of employment.
- Work location choice is also sensitive to a wide range of accessibility variables, including parking prices and availability.

Workplace & Home Loc. - Autos Owned

- **The travel times and distances between home and work directly influence auto ownership for each household**
- **Other accessibility variables around the residence and workplace zones also affect the need/attractiveness of owning a car:**
  - Parking price and availability
  - Retail and service establishments within walking distance.
  - Traffic congestion in the area.
  - Transit service levels in the area.

Land Use at Residence and Workplace

- **Land use around the residence and work locations influence the number and types of tours that people make**
  - Access to retail and service establishments between home and work affects whether people make stops on the way to/from work, or else perform those activities during separate home-based tours (or maybe not at all).
  - Access to retail/service establishments around the workplace will cause people to make more tours during work (e.g. at lunchtime), substituting for stops they would make before or after work.
  - Some types of development may induce more trip-chaining for both work and non-work tours.

Non-Work Destinations

- **A wide variety of land use and accessibility variables influence the choice of destinations for non-work activities**
  - The mix of different types of employment
  - Densities and mix of housing and employment
  - The amount of land set aside for recreation
  - Parking prices and availability
  - Transit services
  - Facilities for pedestrians and cyclists (potentially, but hard to measure empirically)

TMIP Objective for Track C

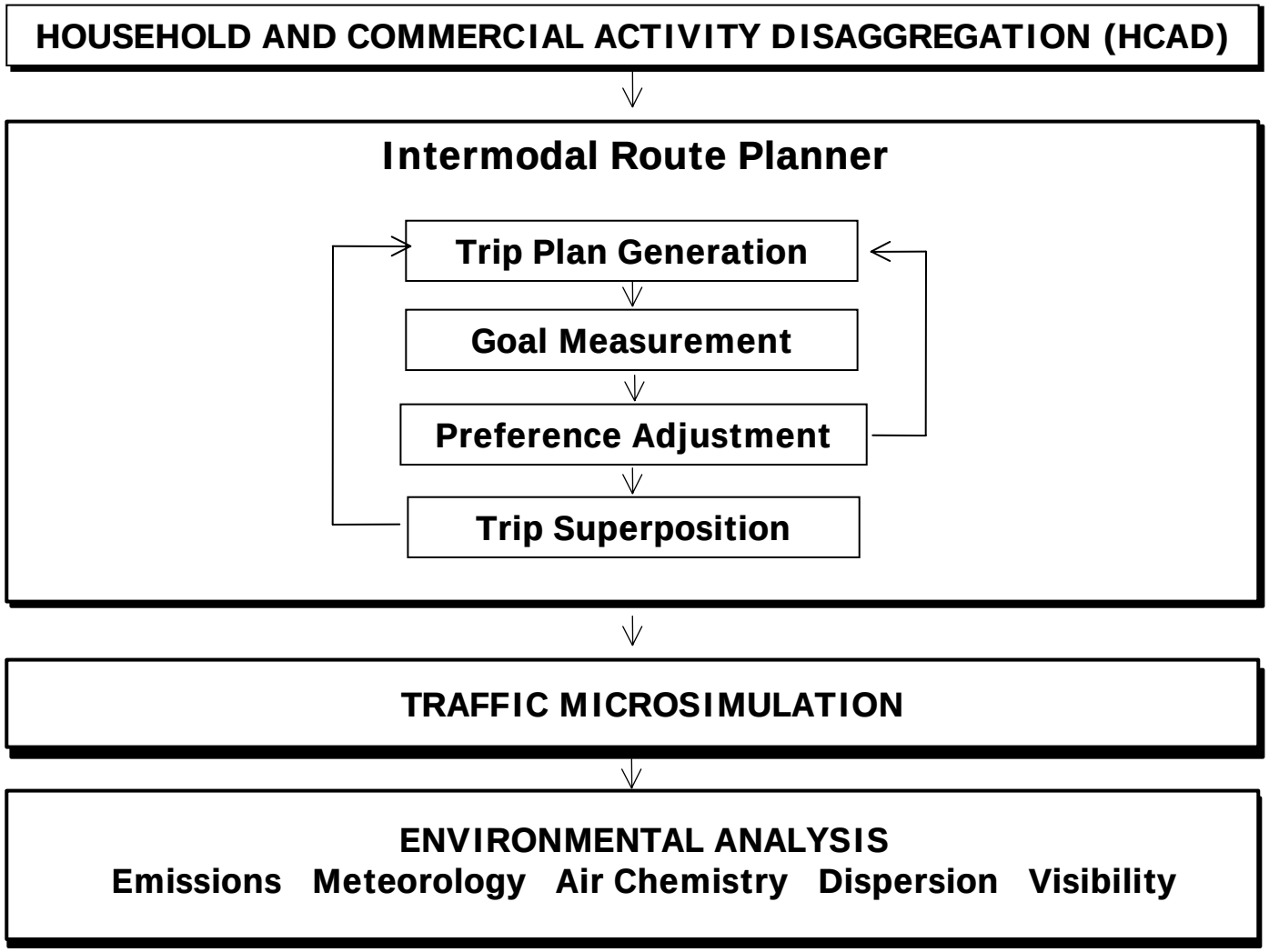
To upgrade the travel analysis and forecasting techniques of transportation planning agencies.....

TRANSIMS

TRANSIMS

- *Transportation Analysis and SIMulation System*
- *An integrated regional transportation systems analysis environment*
- *Los Alamos National Laboratory*

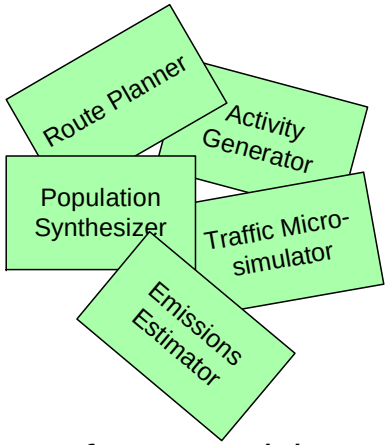
TRANSIMS


HOUSEHOLD AND COMMERCIAL ACTIVITY DISAGGREGATION (HCAD)
Intermodal Route Planner
Trip Plan Generation
Goal Measurement
Preference Adjustment
Trip Superposition
TRAFFIC MICROSIMULATION
ENVIRONMENTAL ANALYSIS
Emissions Meteorology Air Chemistry Dispersion Visibility

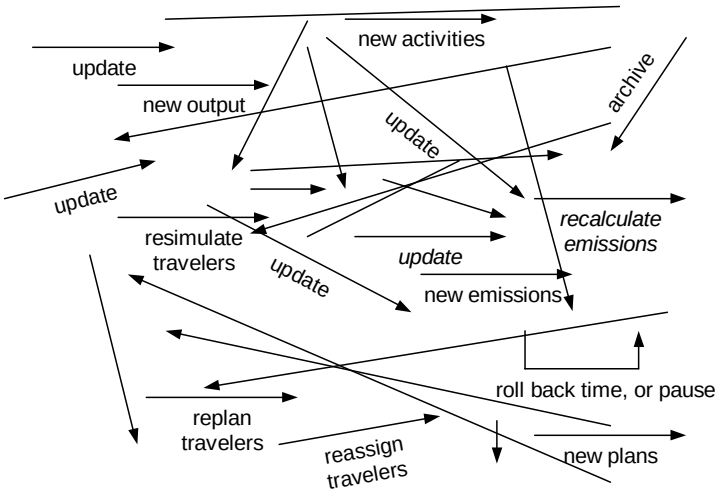
TRANSIMS

- *Synthetic Population and Households*
- *Activity Generation*
- *Multimodal Route Planner*
- *Traffic Micro-Simulation*
- *Feedback Mechanisms*
- *Air Quality Models*

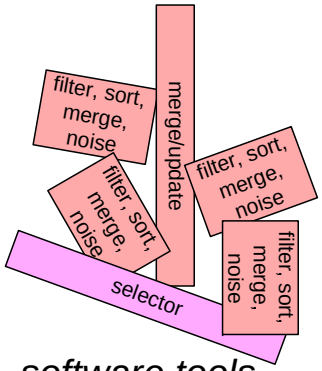
Some TRANSIMS Building Blocks



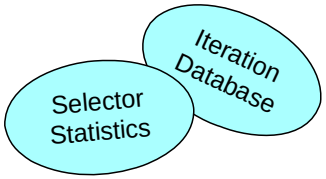
software modules



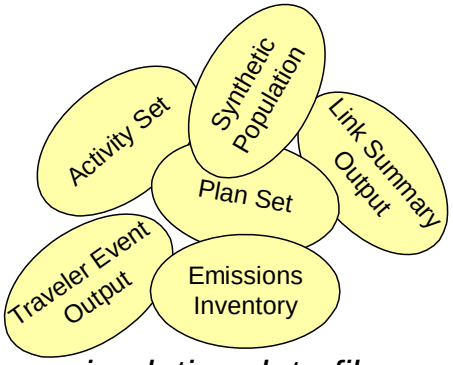
data flows



software tools



iteration data files

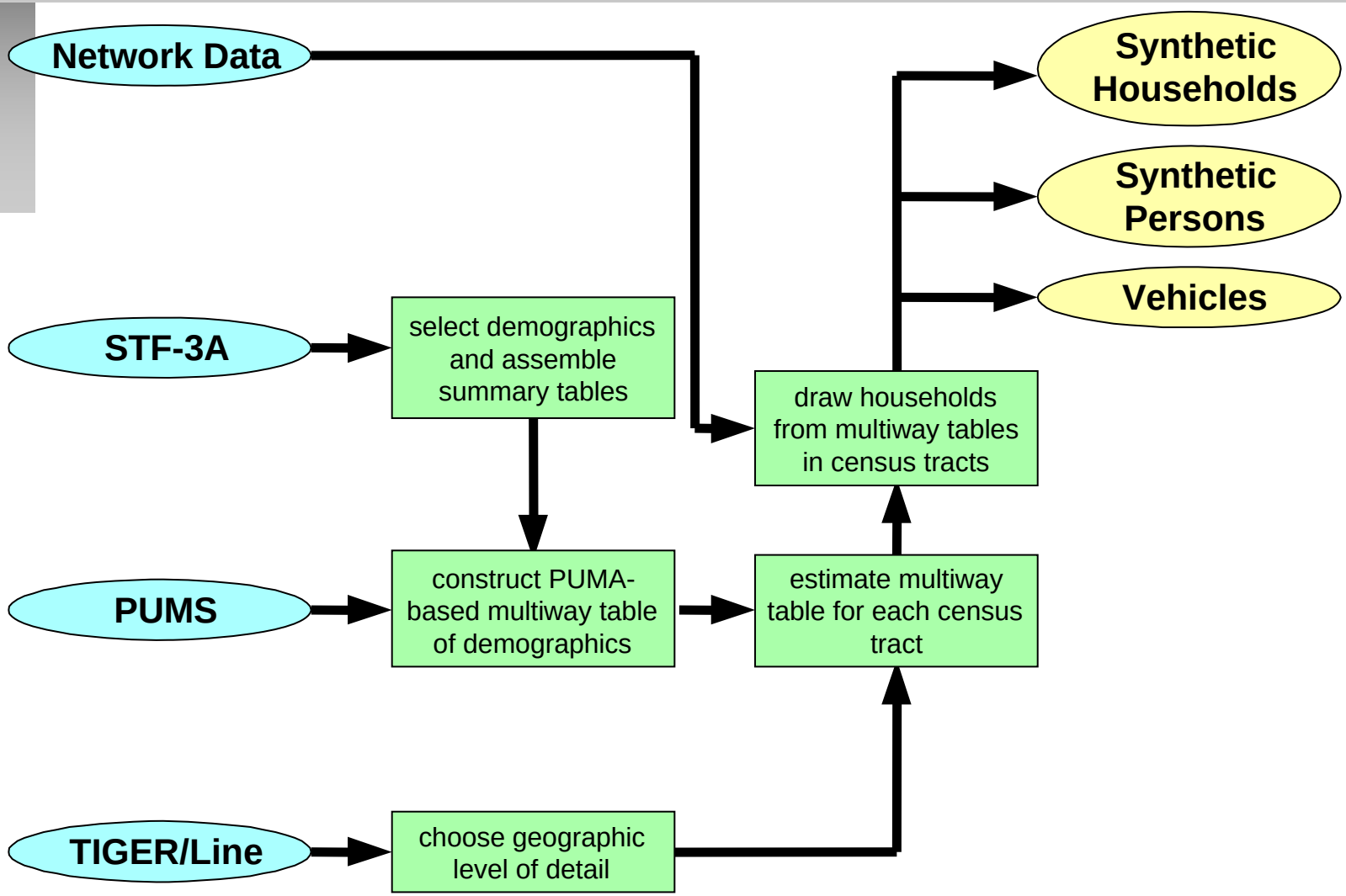


simulation data files

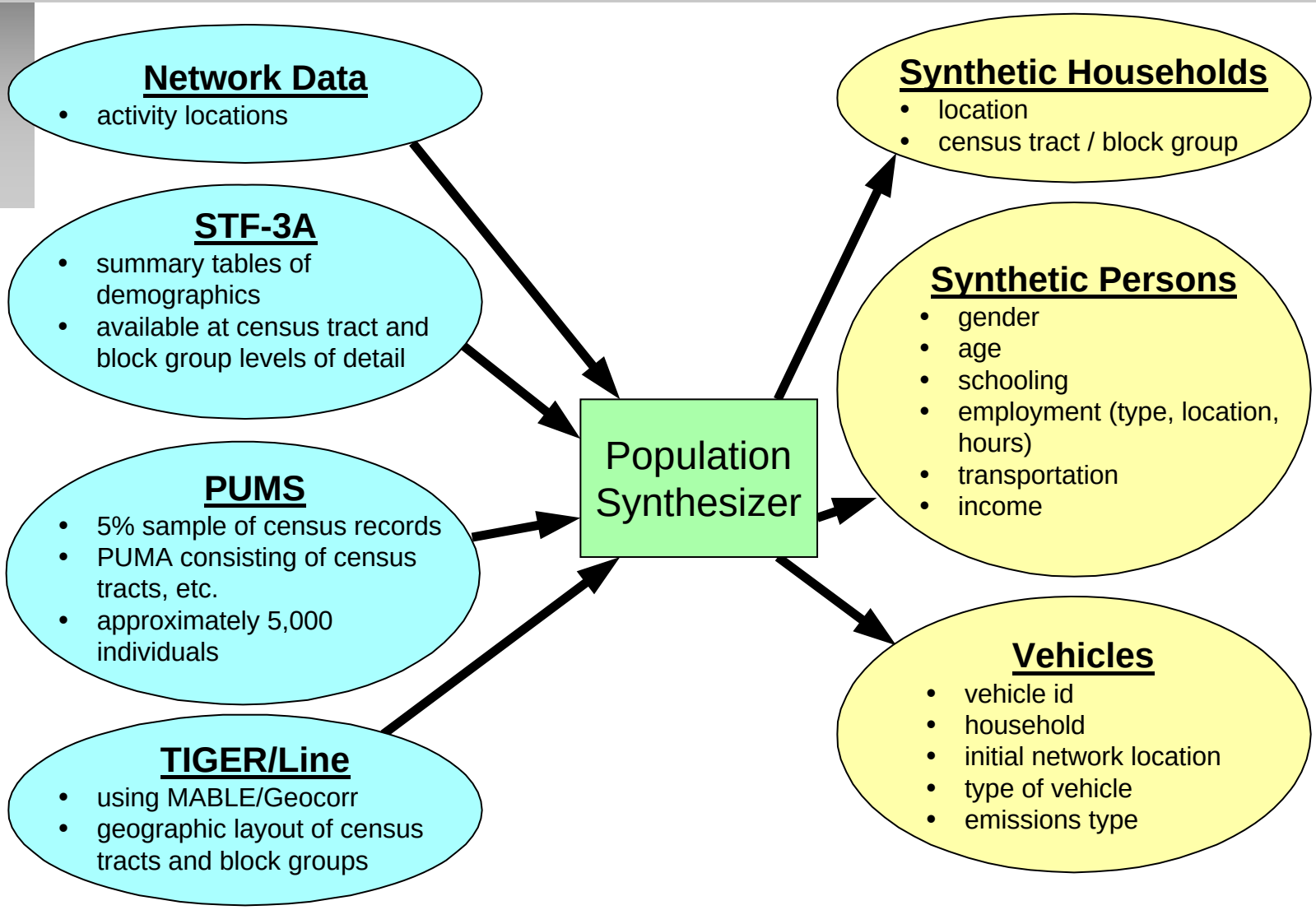
Population Synthesizer: Purpose

- *Creates a regional population imitation*
  - ***demographics closely match real population***
  - ***households are distributed spatially to approximate regional population distribution***
  - ***household locations determine some of the travel origins and destinations***
- *Synthetic population's demographics form basis for individual and household activities requiring travel*

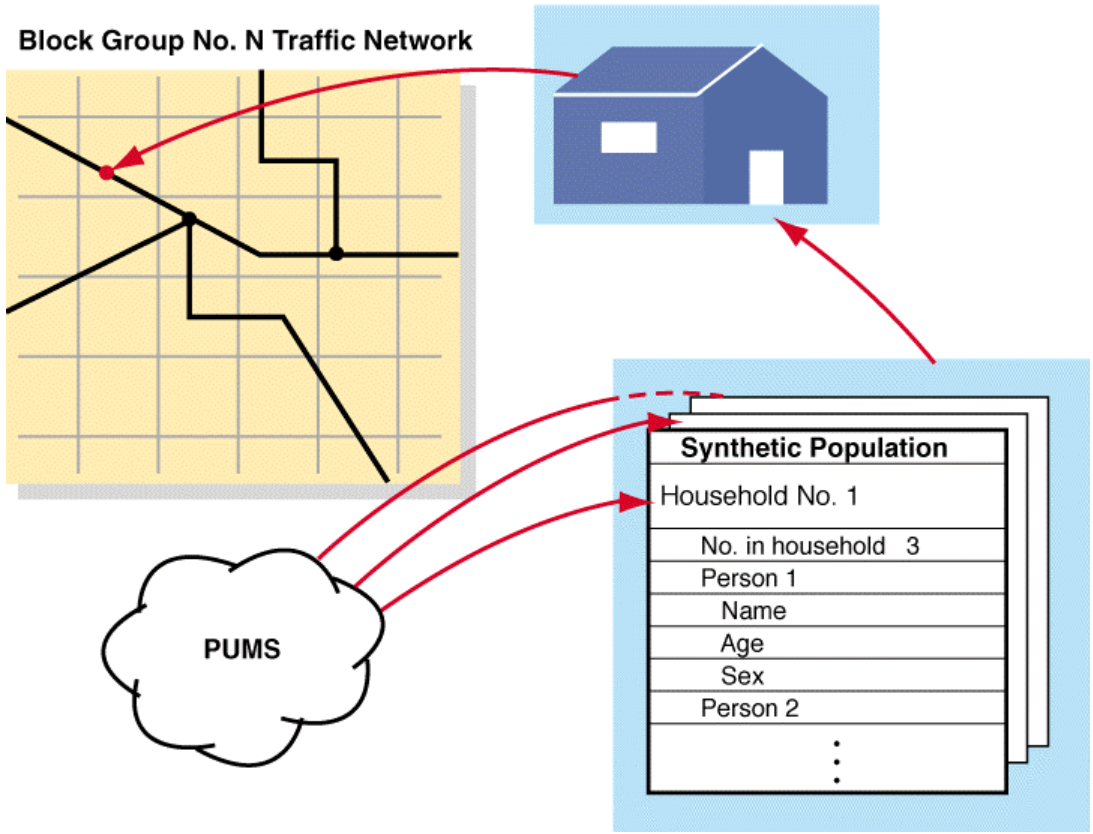
Population Synthesizer: Algorithm



Population Synthesizer: Data Flow



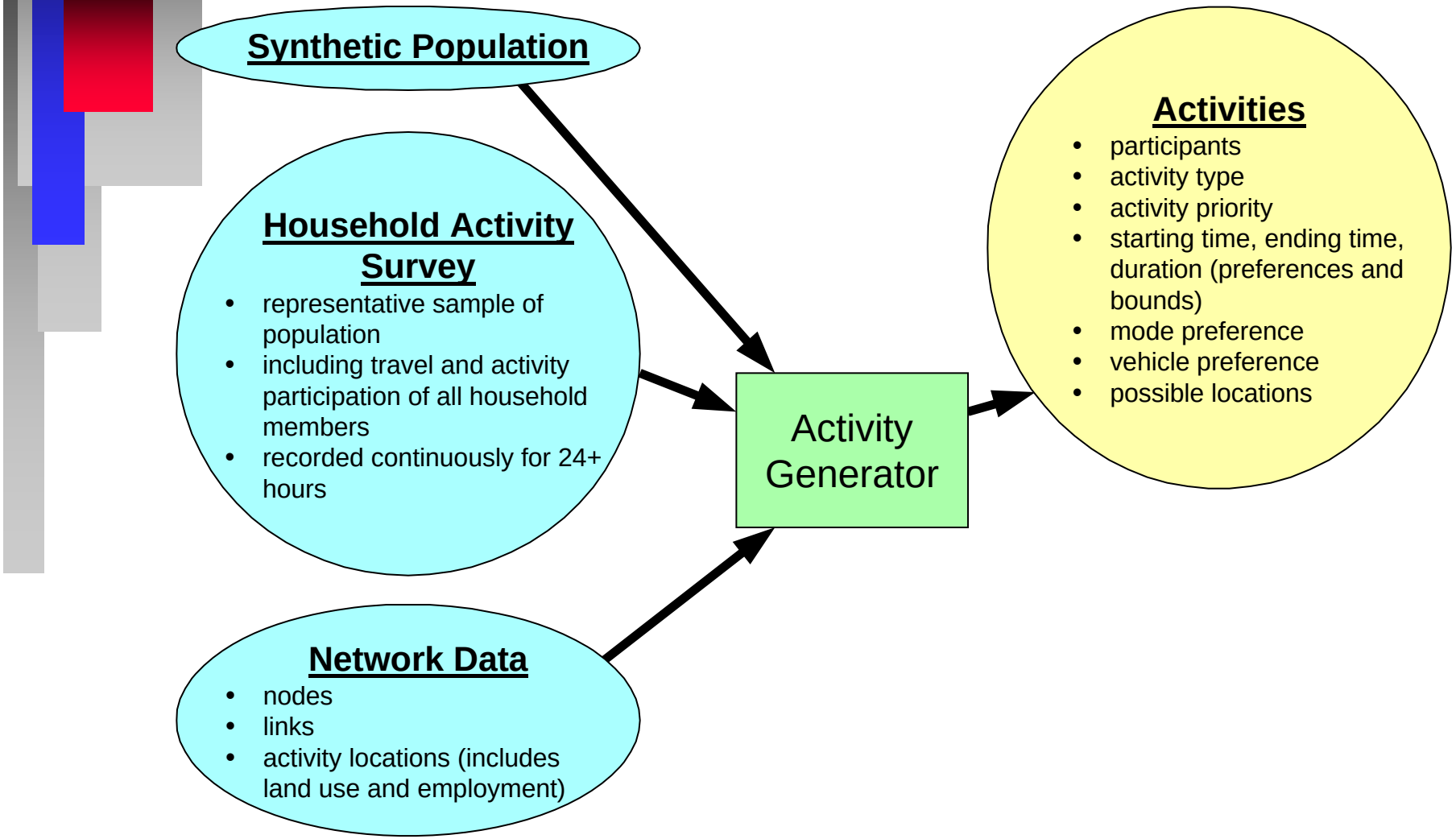
Population Synthesizer



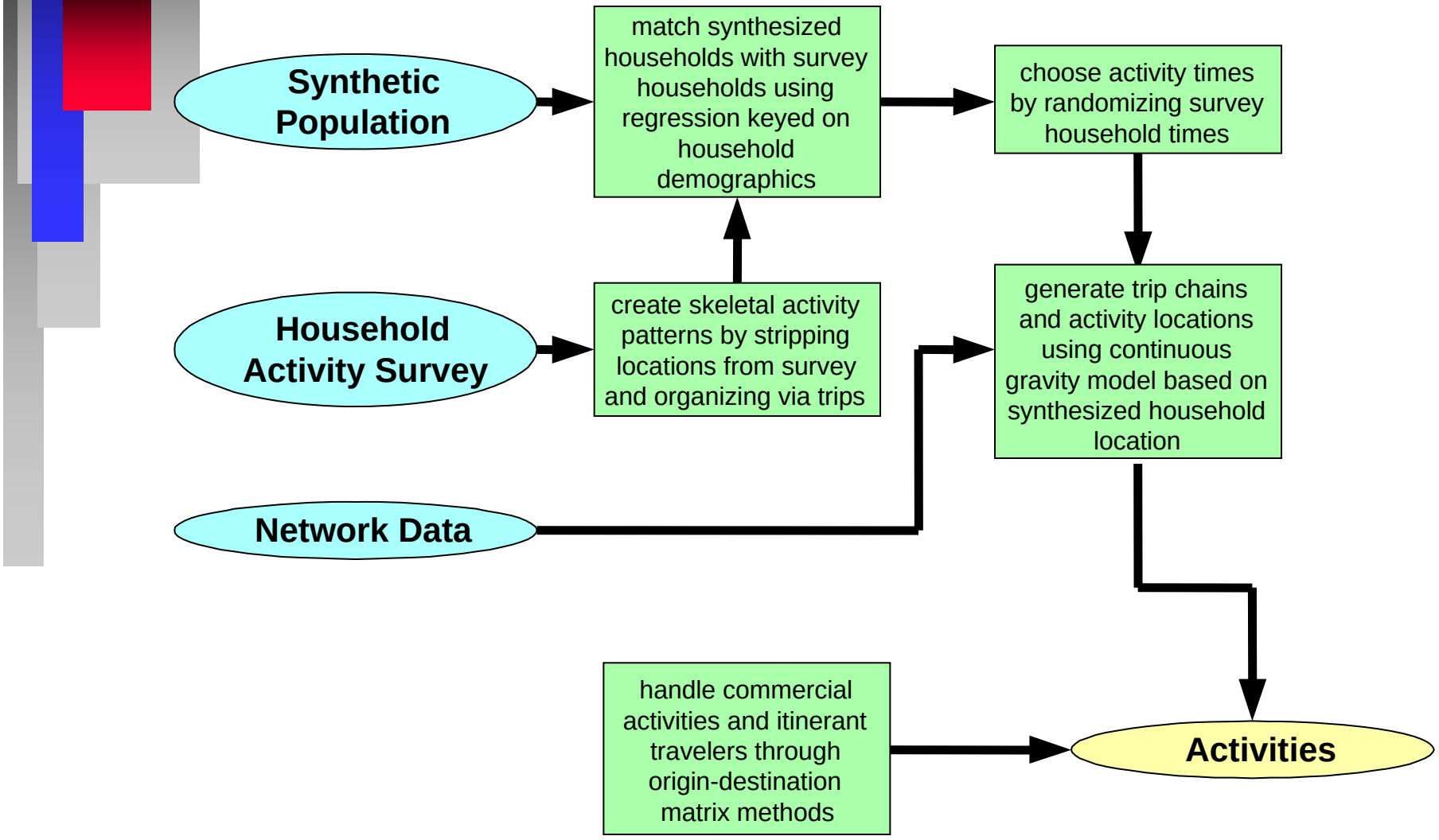
Activity Generator: Purpose

- *Creates . . .*
  - ***household and individual activities***
  - ***activity priorities***
  - ***activity locations***
  - ***activity times***
  - ***mode and travel preferences***
- *Generates travel demand sensitive to demographics of synthetic population*
- *Activities form basis for determining individuals' trip plans for the region*

Activity Generator: Data Flow



Activity Generator: Algorithm

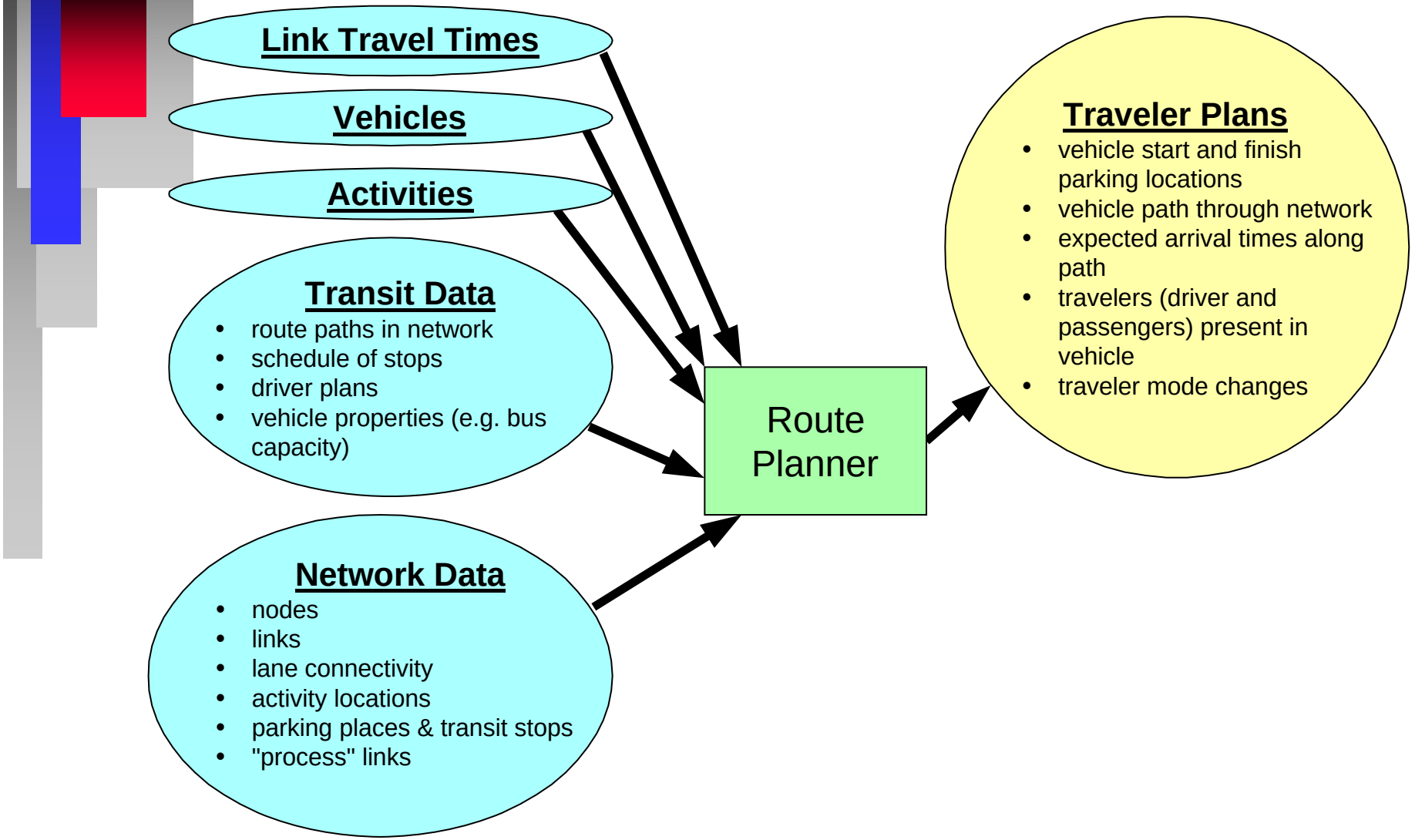


Route Planner: Purpose

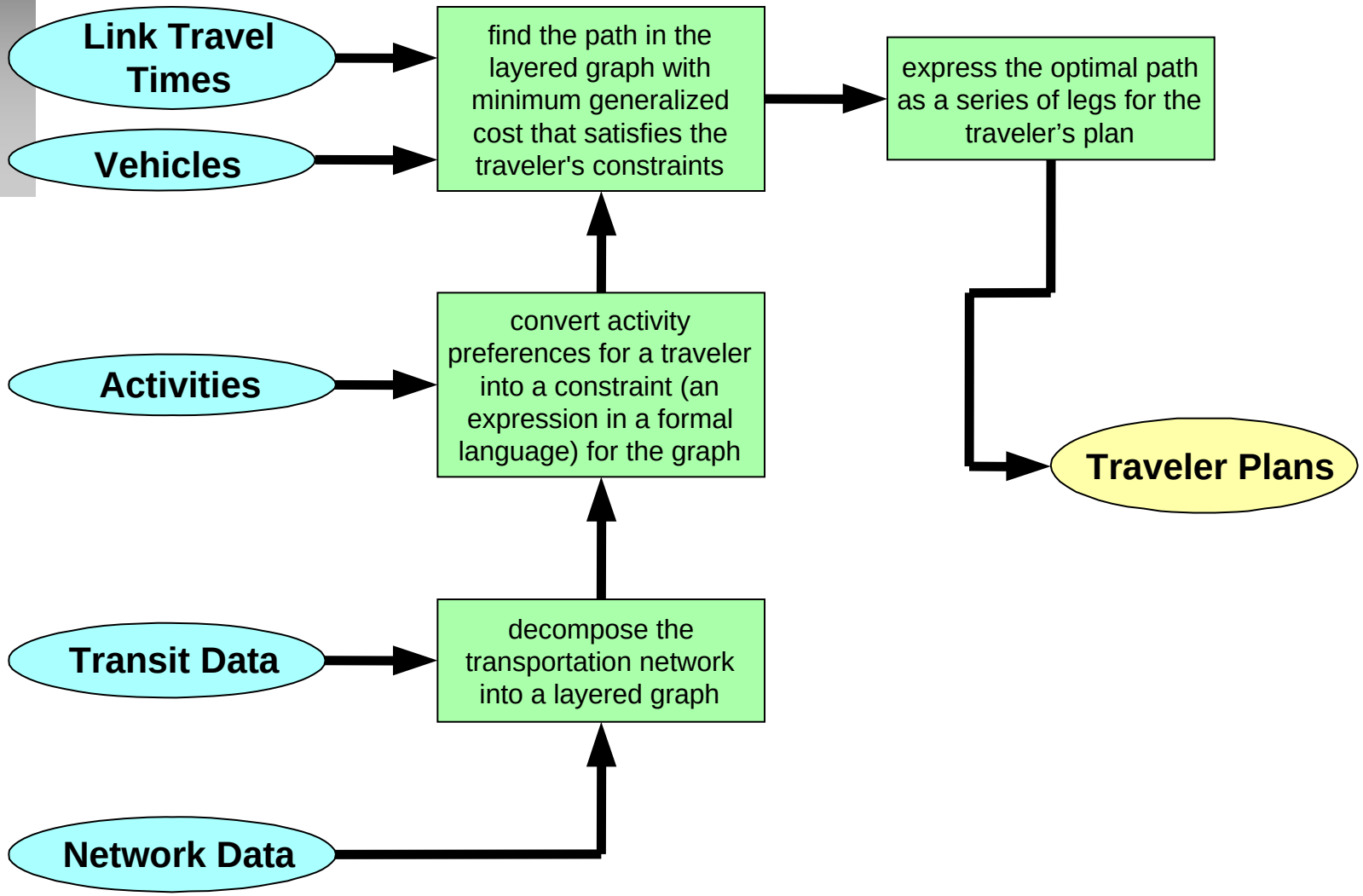
- *Generates regional individual activity-based travel demand by assigning . . .*
  - ***activities***
  - ***modes***
  - ***routes***

  to individuals in the form of trip plans
- *Trip plan is a sequence of . . .*
  - ***modes***
  - ***routes***
  - ***planned departure and arrival times at origins, destinations, and mode changing facilities***
- *Trip plan selection related directly to each individual's goals*
- *Individual trip plans form basis for traffic simulation that accounts for interactions among travelers*

Route Planner: Data Flow



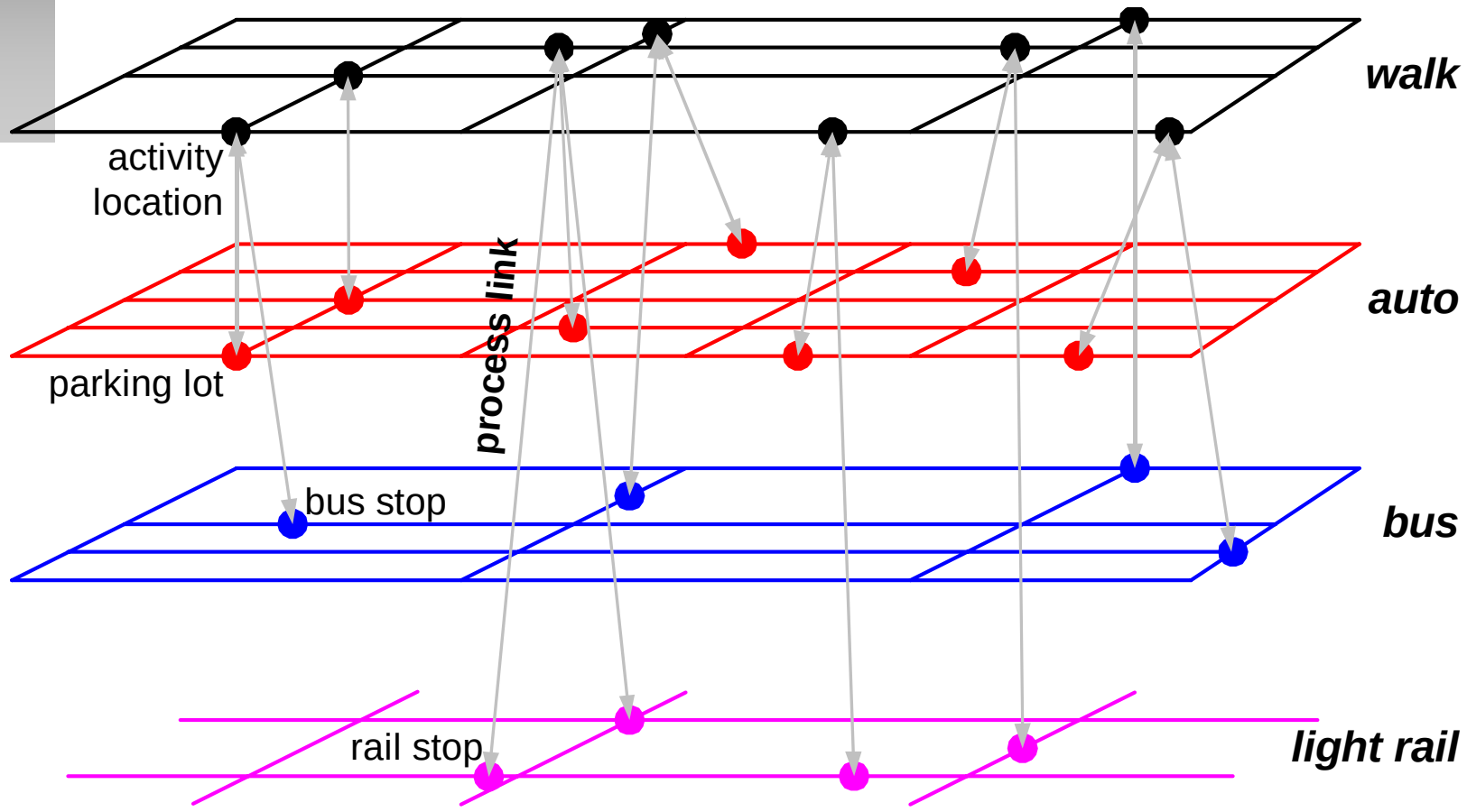
Route Planner: Algorithm



Route Planner Definitions

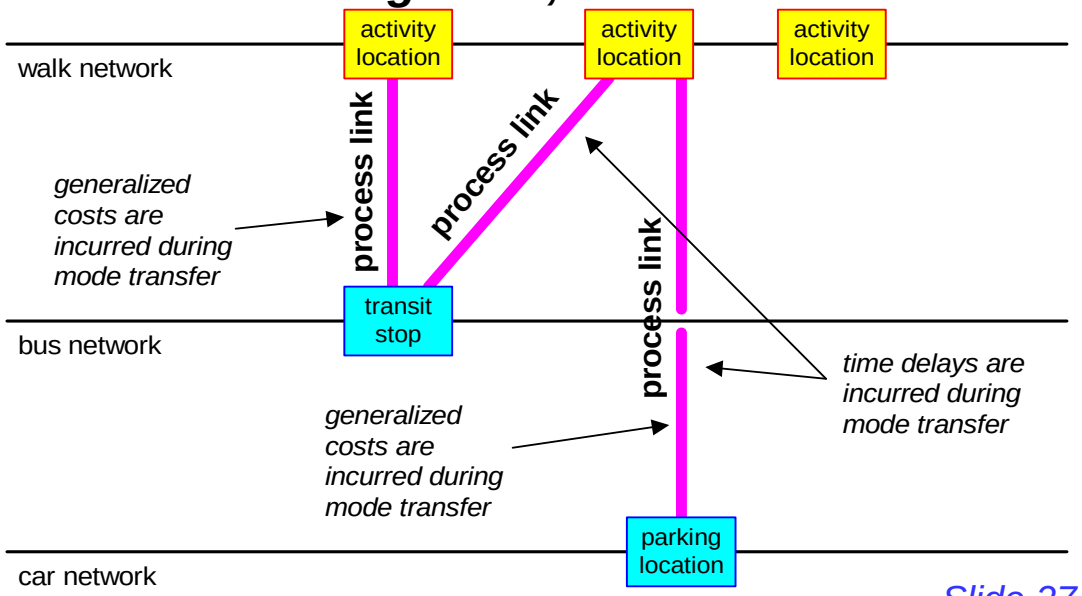
- *Traveler Plan*
  - ***The set of trips that carries the traveler through their desired activities***
- *Trip*
  - ***A set of contiguous legs***
- *Leg*
  - ***A set of contiguous nodes and links that are traversed with a single travel mode***

Example Layered Multi-Modal Network



Formal Language for Mode Preferences

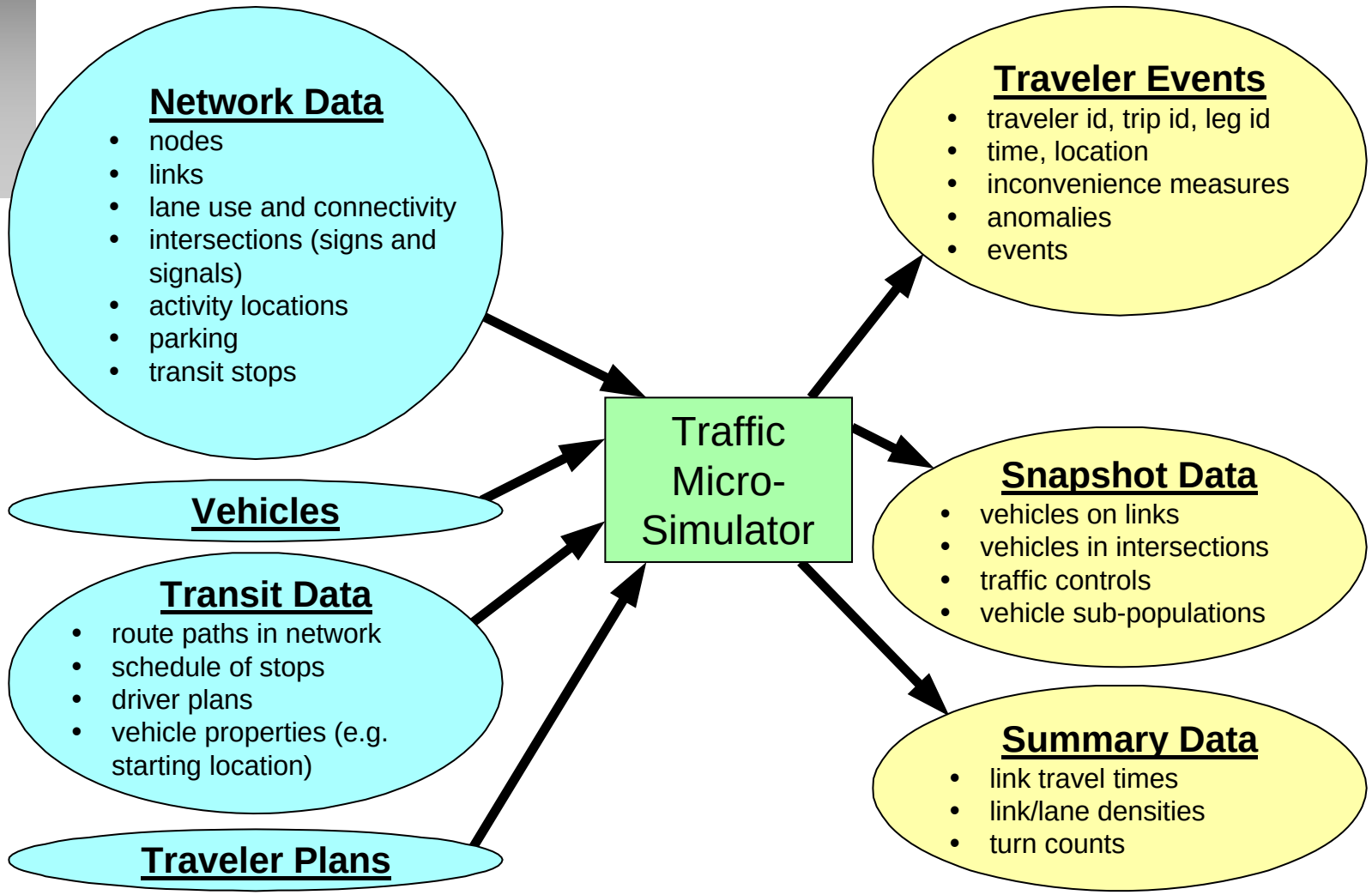
- *Symbols represent different modes:*
  - ***w* = "walk," *c* = "car," *b* = "bus," *l* = "light rail," *t* = *(b|l)* = "bus or light rail"**
- *A series of symbols expresses a mode preference:*
  - ***wcw* = "walk, then drive a car, then walk"**
  - ***wctw* = "walk, then drive to a transit stop, then take transit, then walk"**
  - ***blb* = "ride bus, then transfer to light rail, then ride bus"**
  - *w* = **"only walk"**
- *Each mode transfer passes through a process link where time and other costs are incurred.*



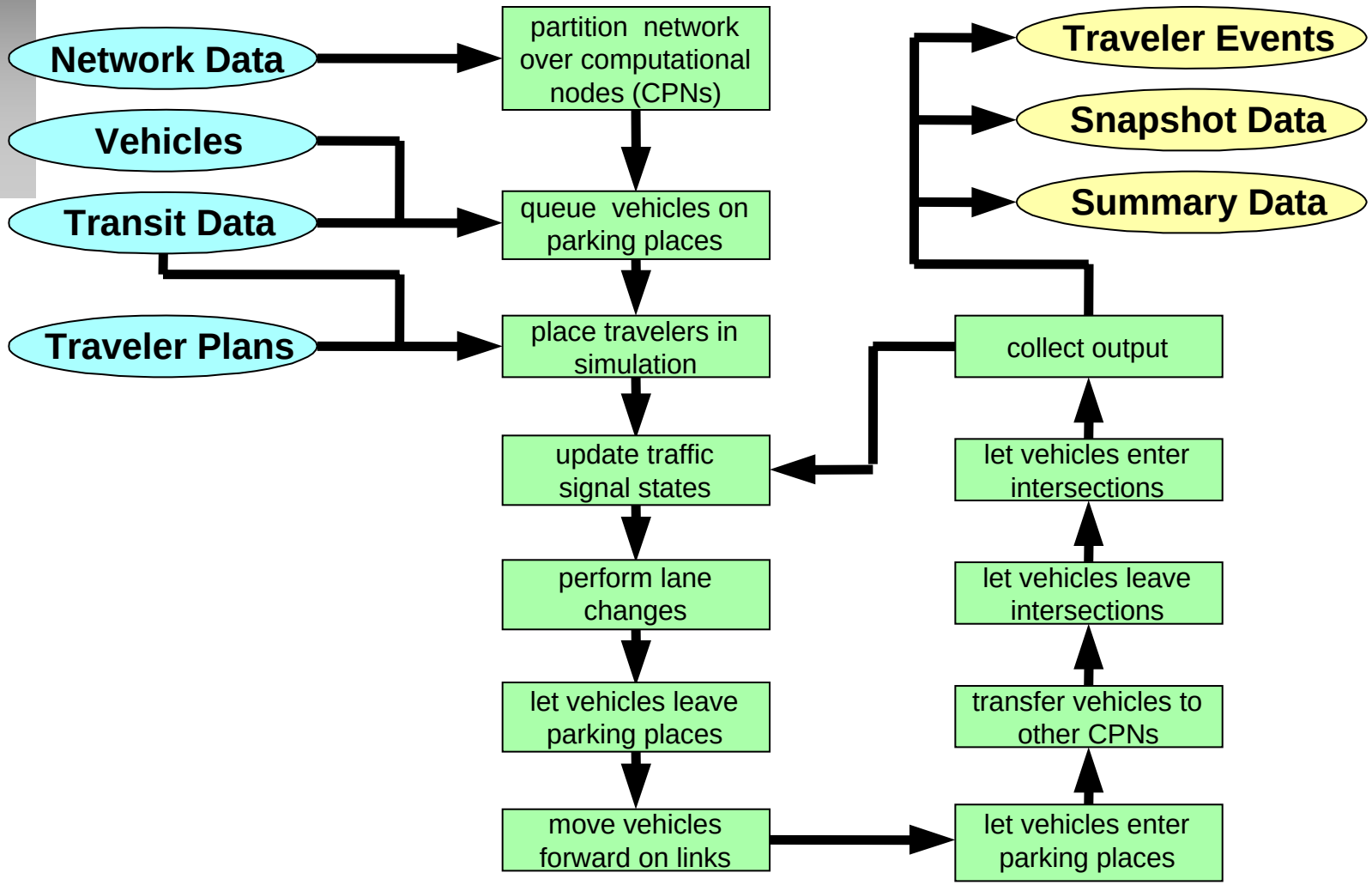
Traffic Microsimulator: Purpose

- *Simulates the movement and interactions of travelers throughout a metropolitan region's transportation system*
  - ***executes travel plans provided by the Route Planner***
  - ***computes the overall intra- and inter-modal transportation system dynamics***
- *Combined traveler interactions produce emergent behaviors such as traffic congestion*
- *Microsimulation output forms basis for environmental calculations and for iteration decision-making*

Traffic Microsimulator: Data Flow



Traffic Microsimulator: Algorithm



Traffic Microsimulator Questions

- *What is the effect on traffic Patterns from building a proposed highway?*
- *What is the impact of change in transit schedules on riders?*
- *Can changing signalization alleviate congestion?*
- *Are there common demographic characteristics of the subpopulation most affected by a particular infrastructure change?*

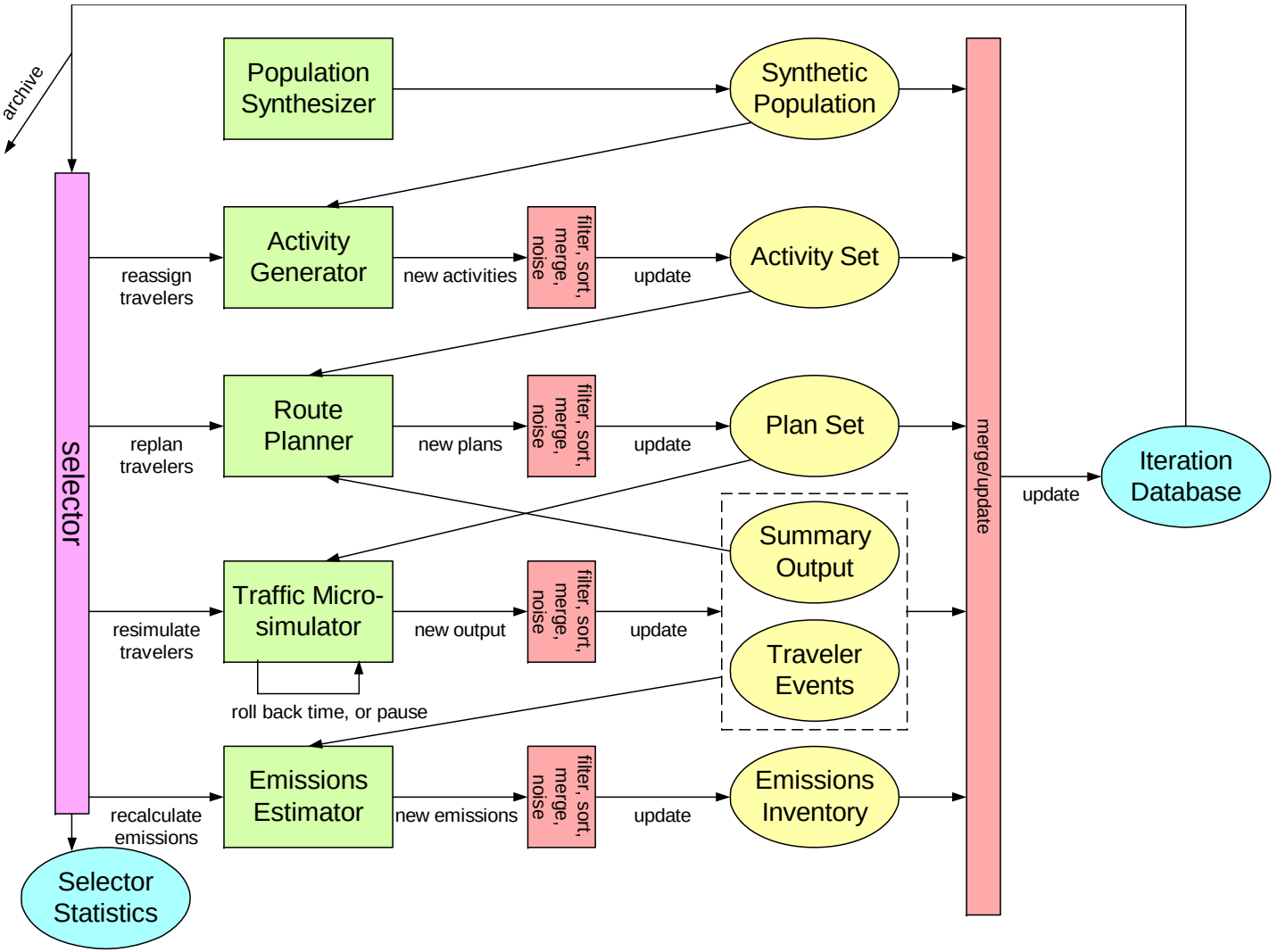
Single Trip Example

- *Leg 1: walk from activity location (work) to origin bus stop*
- *Leg 2: take transit route to destination bus stop*
- *Leg 3: walk to parking lot*
- *Leg 4: drive car to activity location (day care)*
- *Leg 5: drive, with one passenger, to home parking location*
- *Leg 6: walk to activity location (home)*

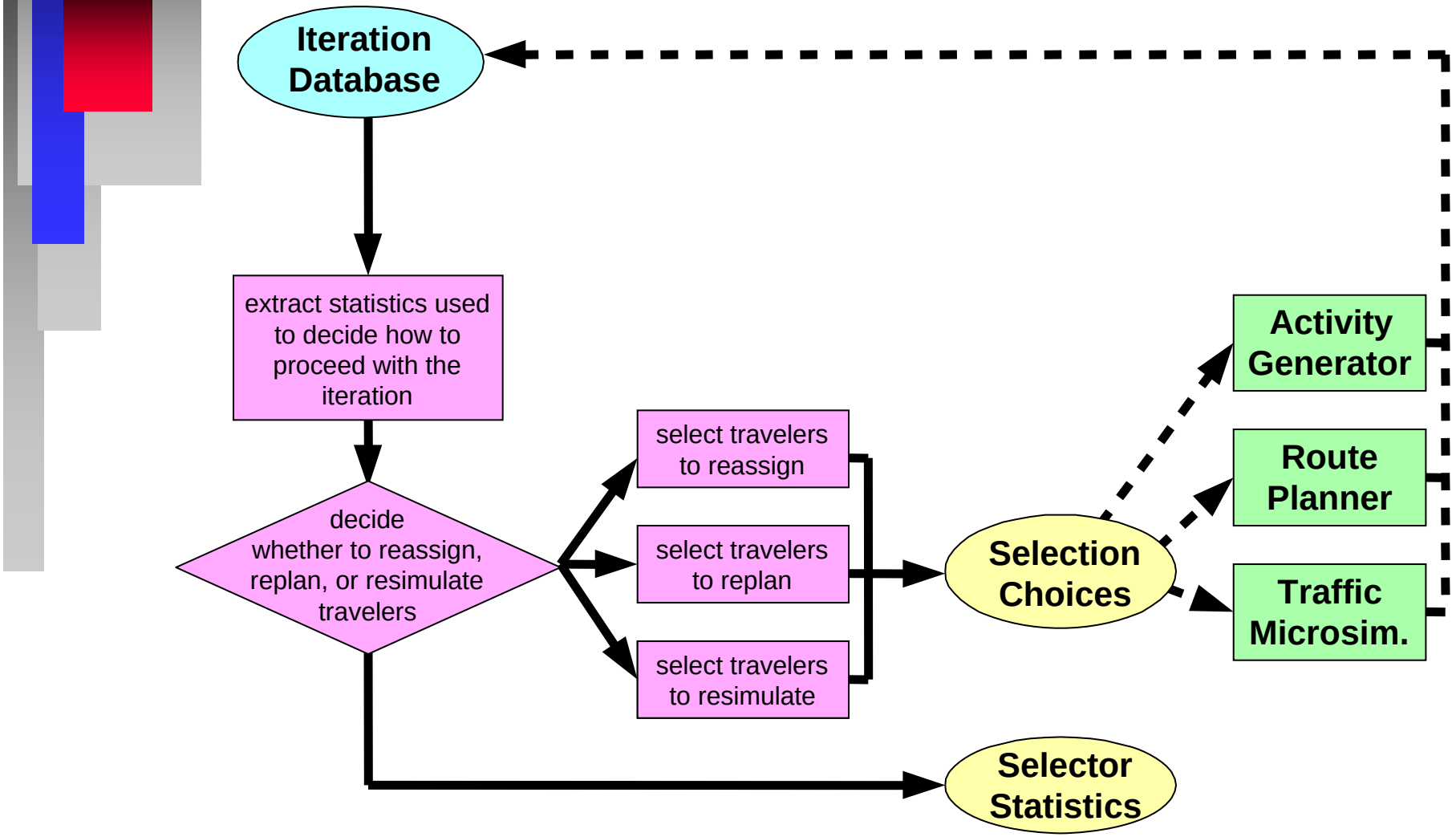
Selector: Purpose

- *Controls when modules are run and how the data are routed between modules*
- *Operates in conjunction with an "iteration script" that provides the top-level control for a series of TRANSIMS iterations*
- *No single, "standard" Selector component*
  - ***Different study designs involve different iteration schemes***
  - ***A variety of Selectors have uses in different studies or other contexts***

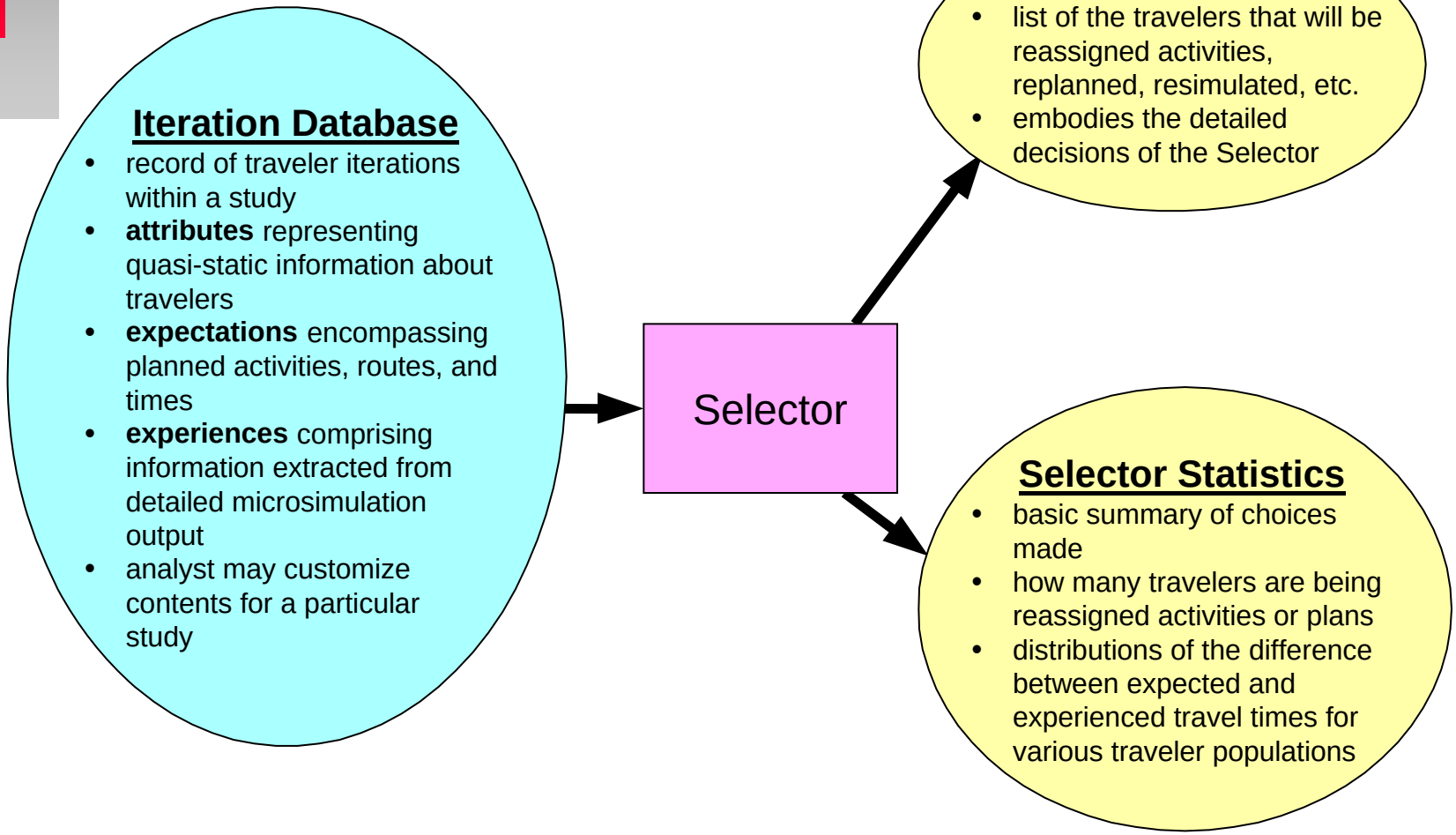
One Realization of TRANSIMS



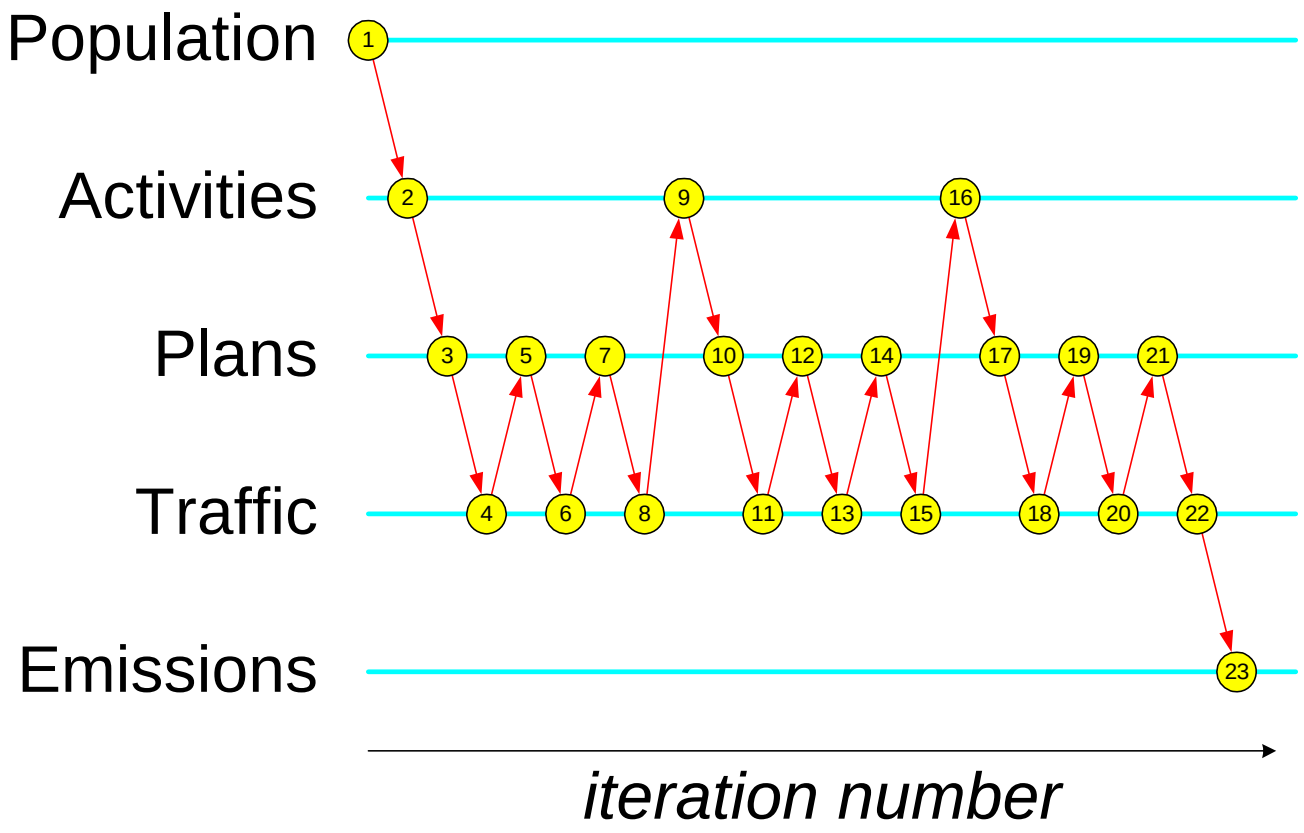
Selector: Generic Algorithm



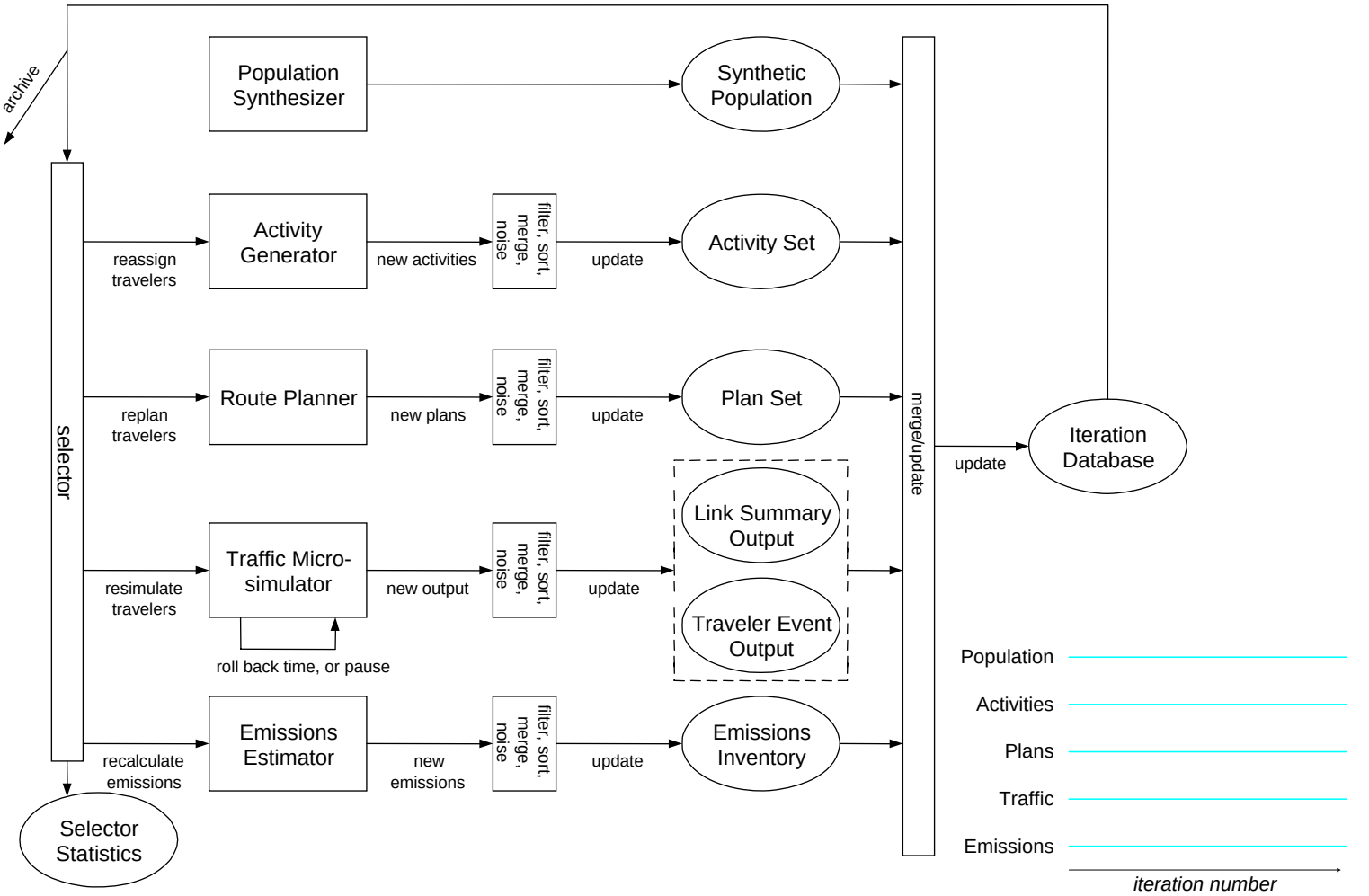
Selector: Data Flow



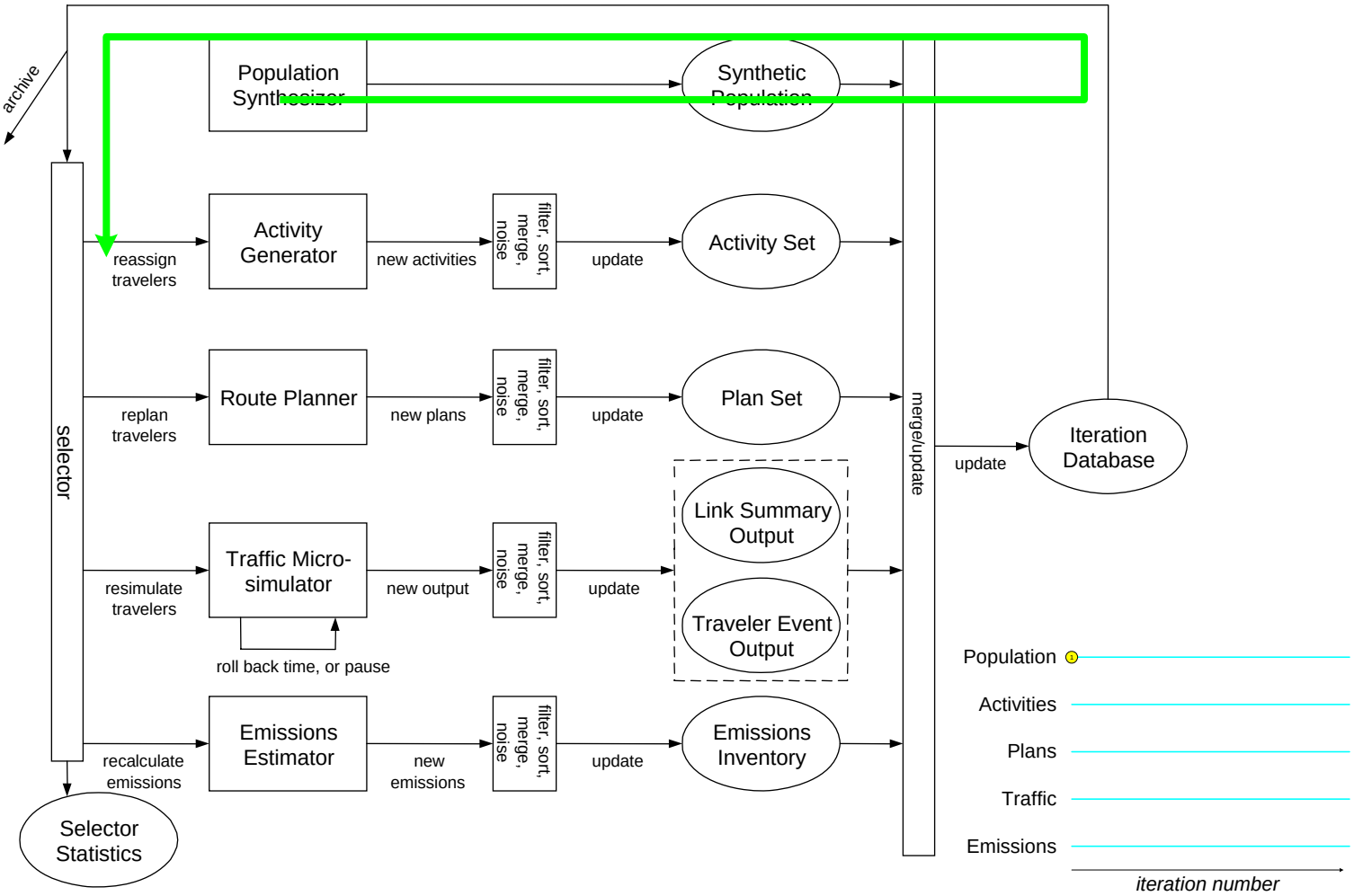
Example Study: Strategy for Iterations



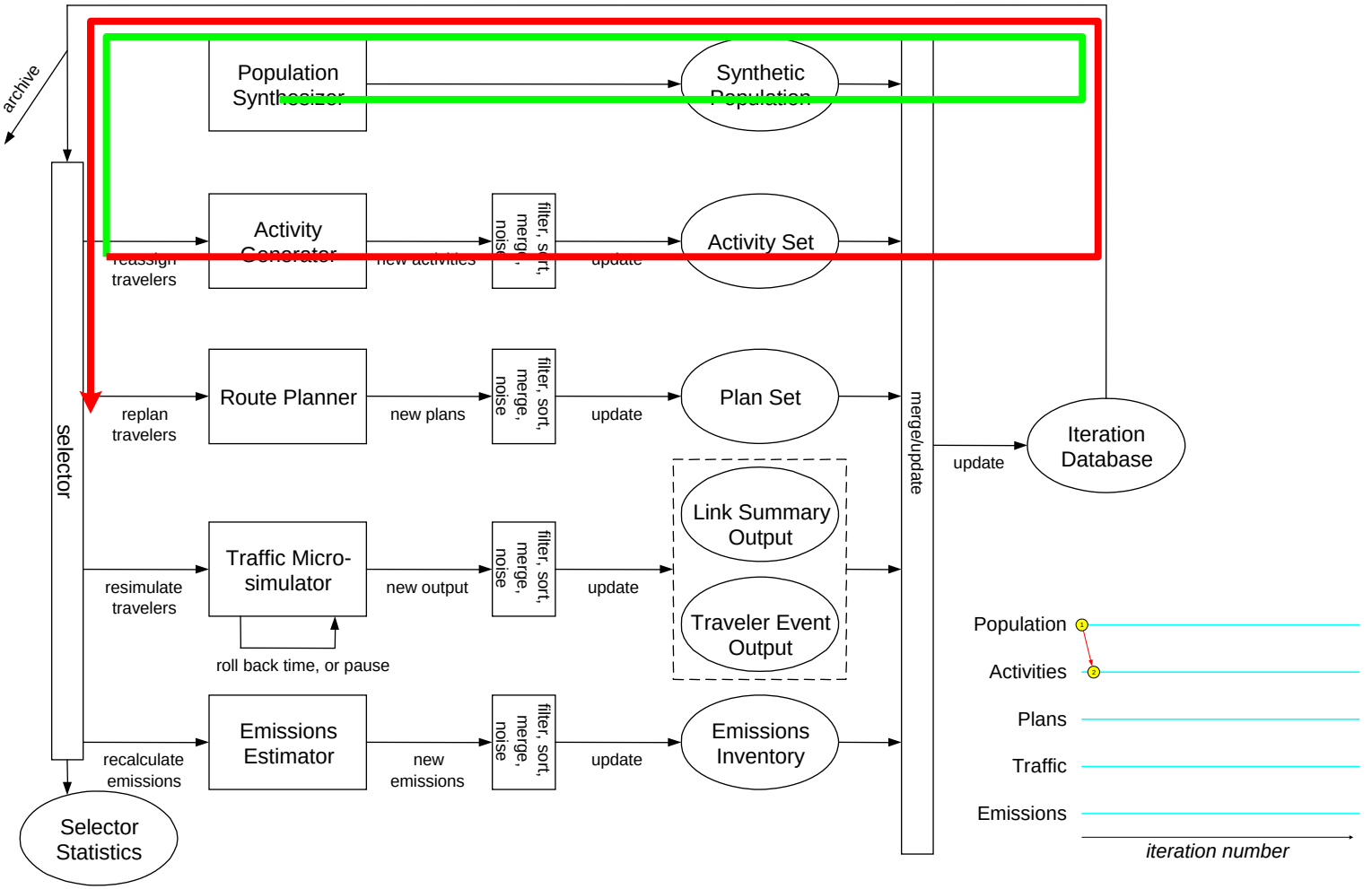
Example Study: Iteration 0



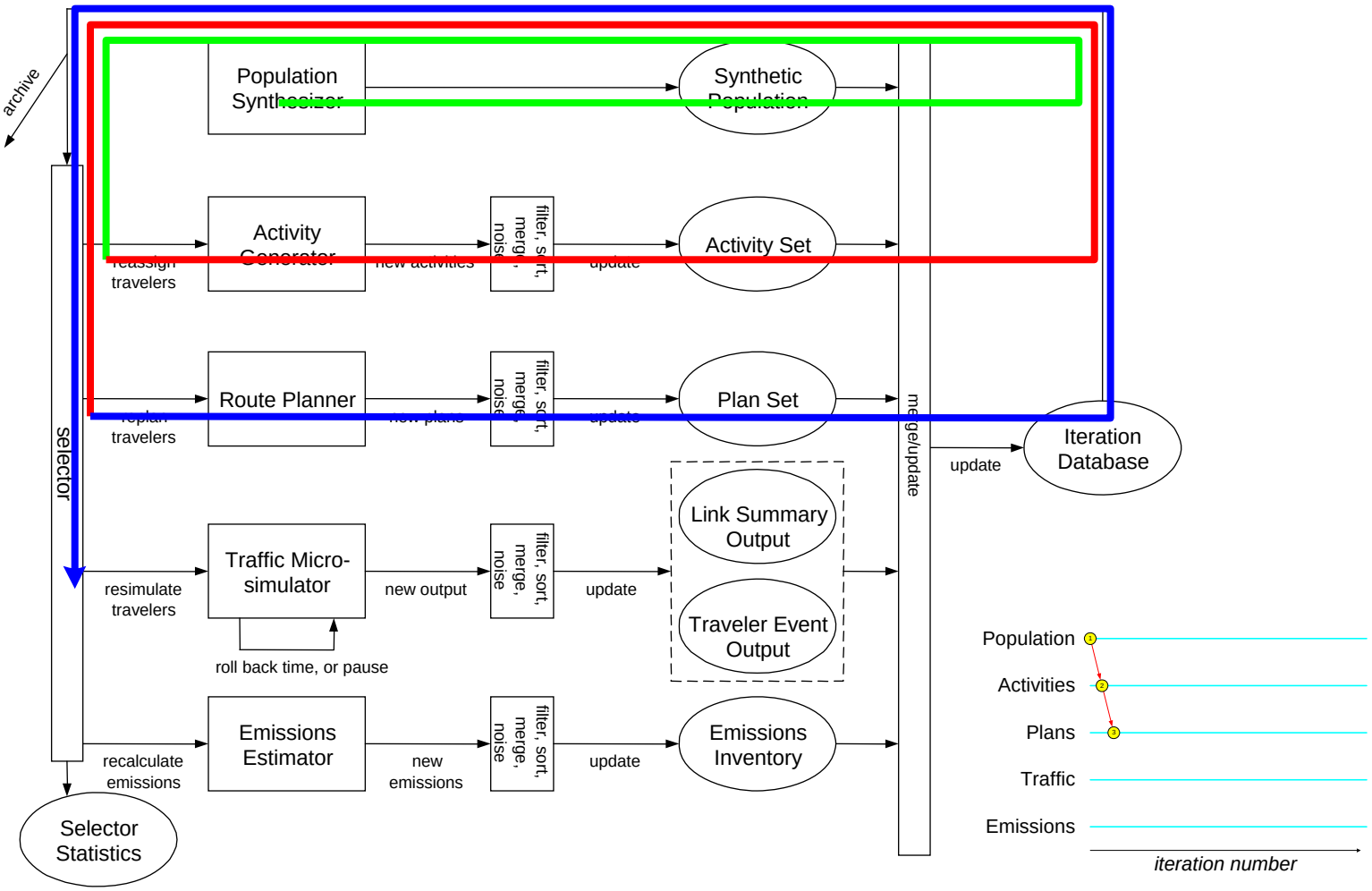
Example Study: Iteration 1



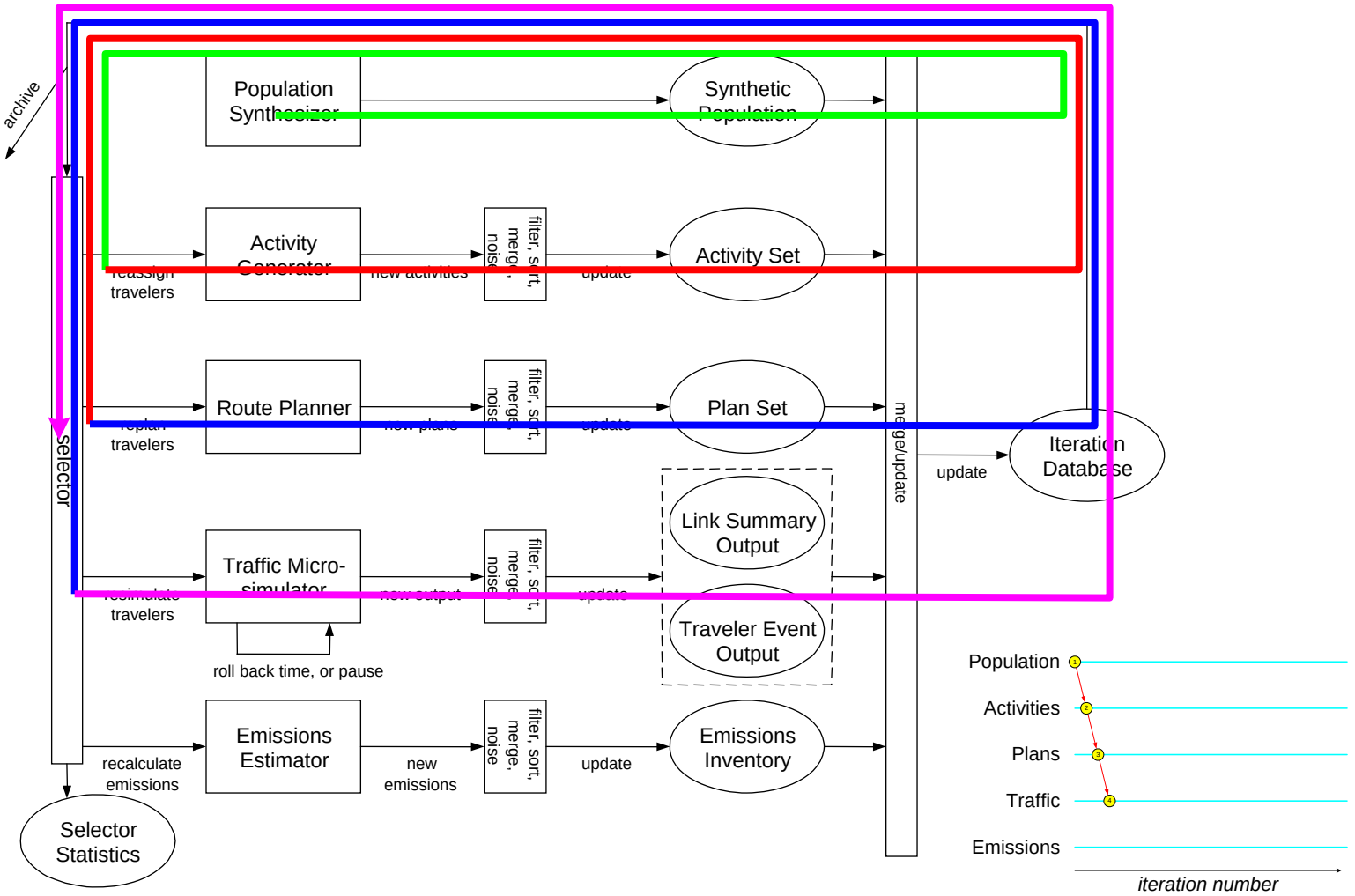
Example Study: Iteration 2



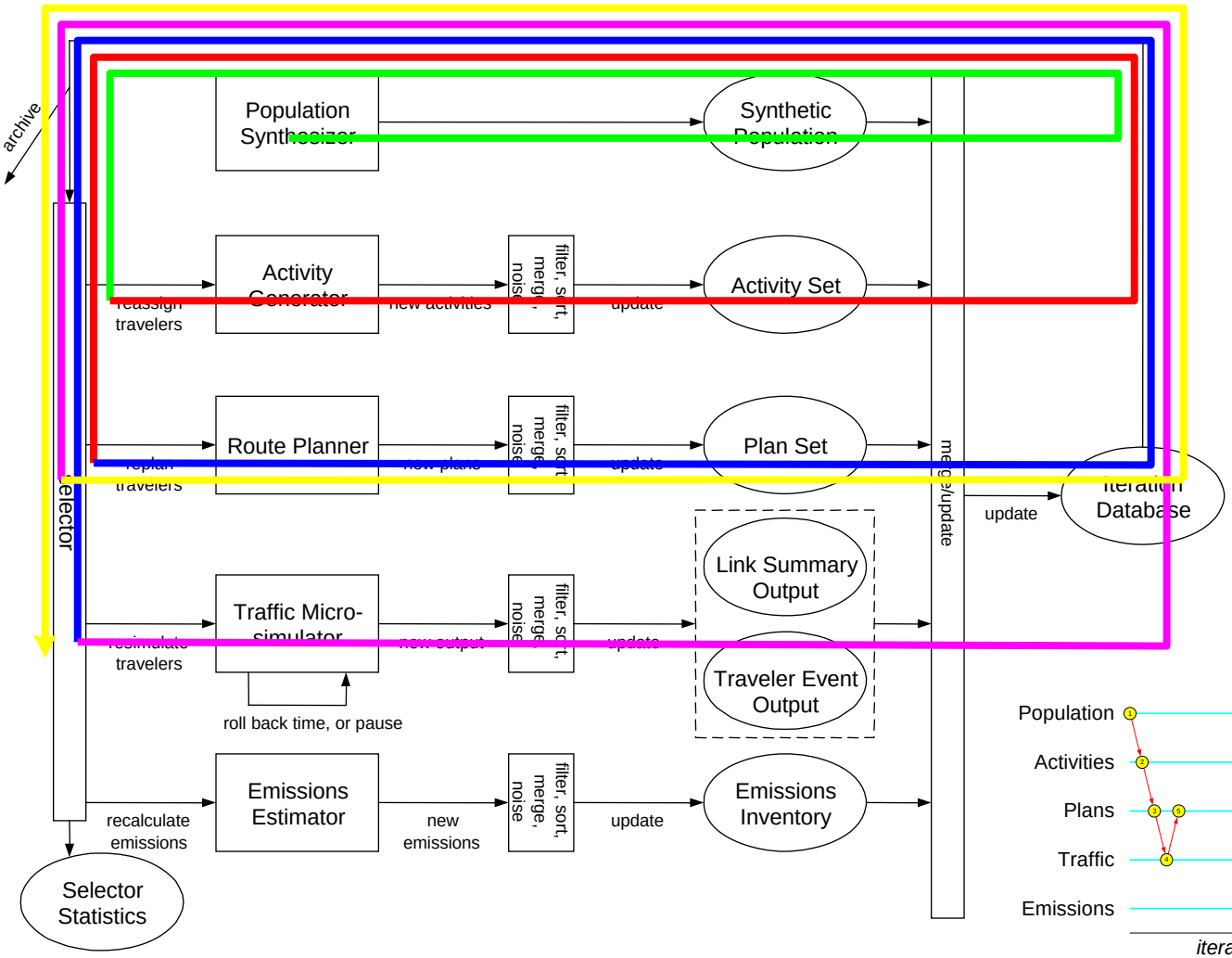
Example Study: Iteration 3



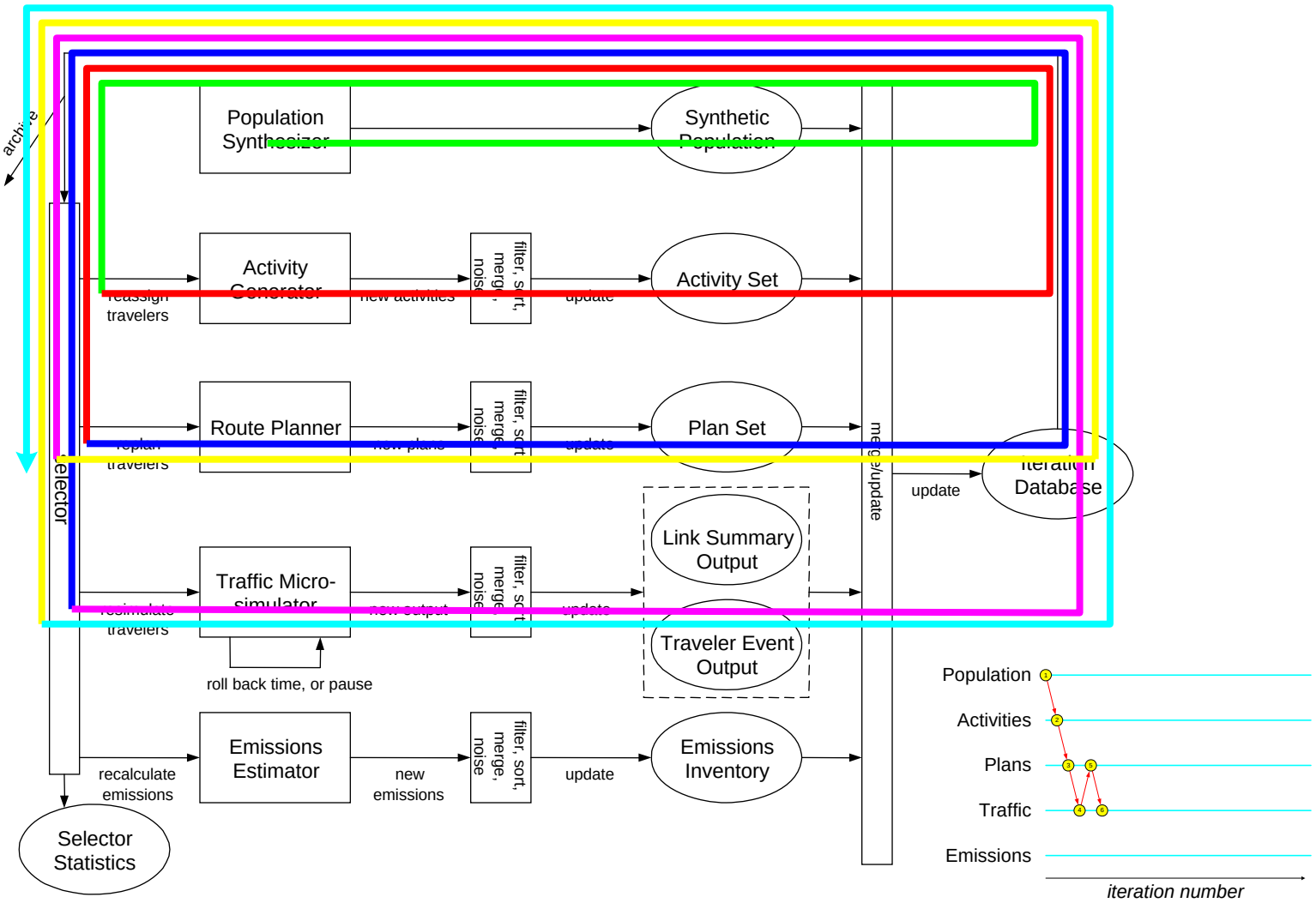
Example Study: Iteration 4



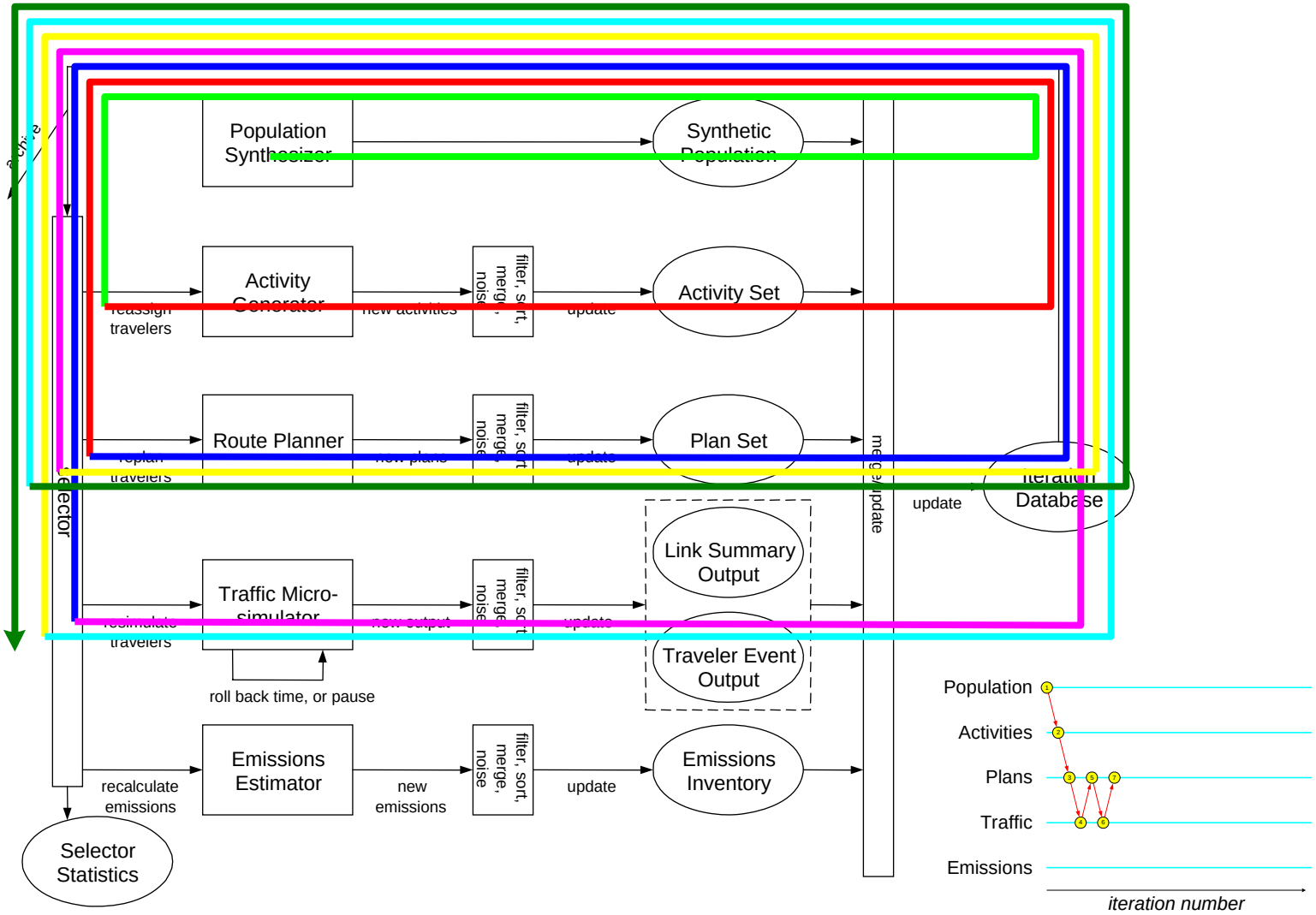
Example Study: Iteration 5



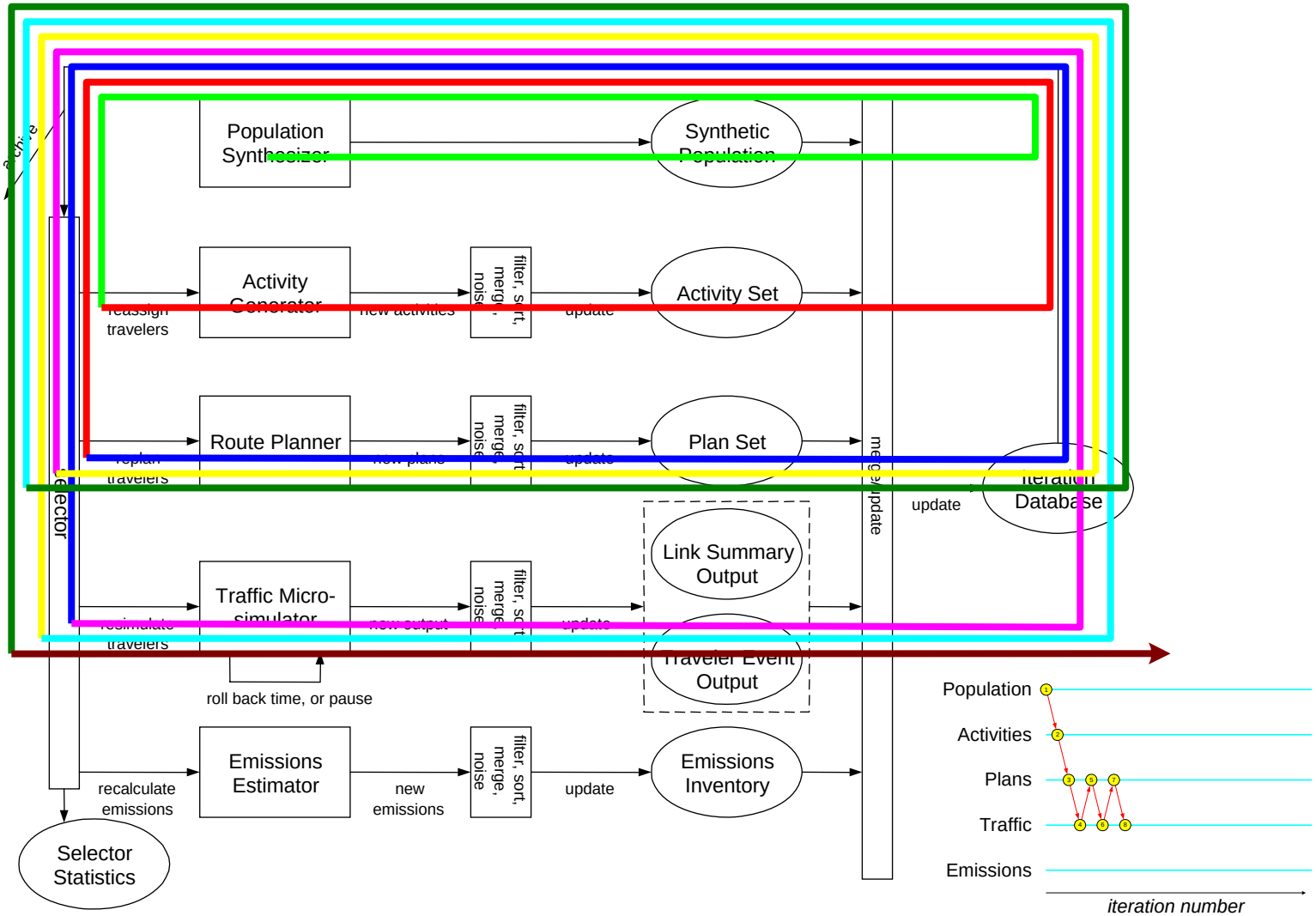
Example Study: Iteration 6



Example Study: Iteration 7



Example Study: Iteration 8



Data Considerations

- ***Transims can use much more data***
  - *More detail on counts/screenlines by time*
  - *More speed and delay detail*
  - *Much more transit information*
- ***New Transit Sources***
  - *Tri-Met Automatic Passenger Counter equipped*
  - *All buses now carry GPS*
  - *The APC data is coordinated with the GPS data*
  - *Metro staff is writing algorithms to create line loading and speed, link loadings, ons/offs by location, screenlines and cordons by time of day.*
- ***Highway Data***
  - *Counts compiled and checked - Arc-View shapefiles*
  - *New GPS link speed, and manual intersection delay carried out*

END