SHRP2 C10: Jacksonville

Partnership to Develop an Integrated Advanced Travel Demand Model and a Fine-grained Time-sensitive Network

Key Agency Partners:

- Florida Department of Transportation
- North Florida Transportation Planning Organization

Presented by:

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An Integrated Model: Proposed Approach

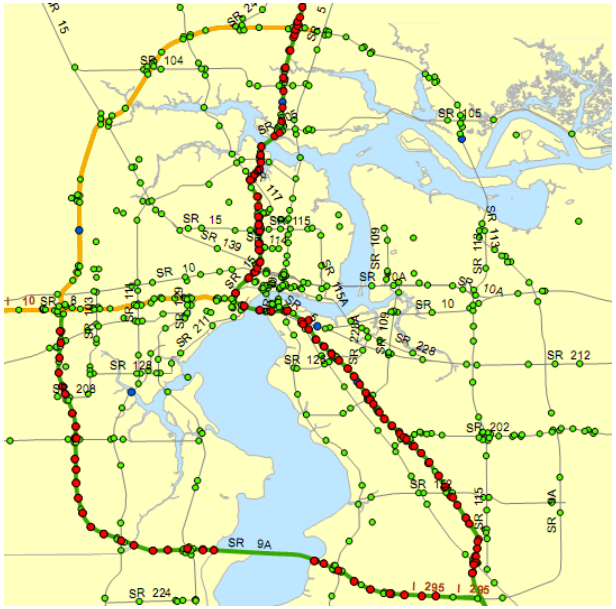
- Develop a fully integrated model in Jacksonville, FL
  - DaySim (demand)
  - TRANSIMS (supply)
  - MOVES
- Features of integrated model
  - Spatial and temporal disaggregation
  - Fully open source
  - Policy sensitive
  - Transferable
  - Scalable
- Build upon exiting efforts
  - Previous implementations of DaySim and TRANSIMS
  - DaySim-TRANSIMS integration initiated in Sacramento

Enhanced Policy Sensitivities

- Traffic shifts by time-of-day
  - Peak spreading
  - Peak shifting
- Tolling and pricing impacts
  - Tolling
  - Congestion pricing
- Travel time reliability effects
- Operations impacts
  - Signals and coordination
  - ITS
- Travel Demand Management
  - Flexible work schedules
  - Work / shop at home

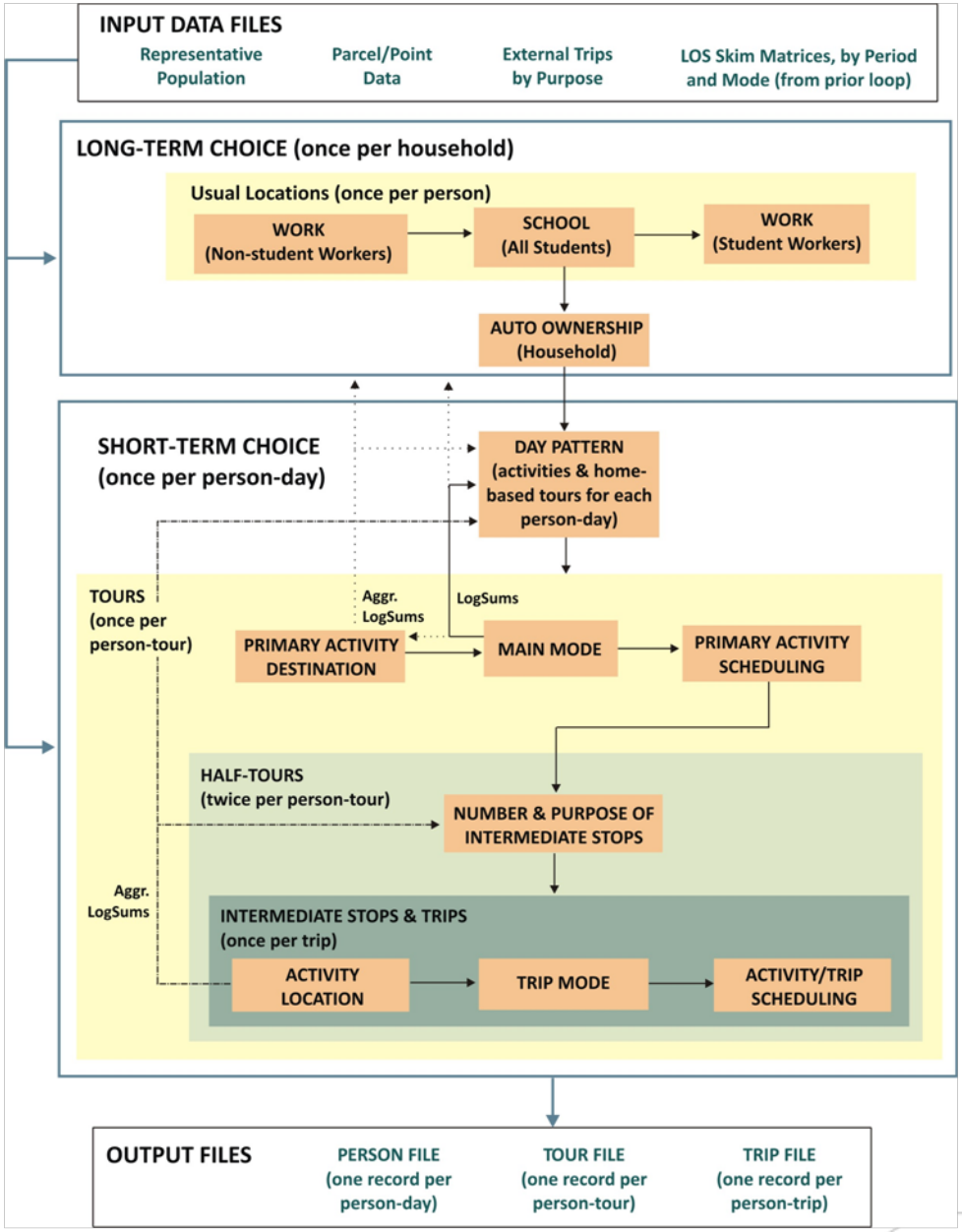
Jacksonville Overview

- Congested, urban context
  - Challenging traffic dynamics
  - Complex route and time-of-day choices
- Tractable
  - Isolated from other large urban areas
  - Transferable to other MPOs
- Metropolitan Area
  - Regional population = 1.2 million
  - Jacksonville population = 800,000
  - 1800 square miles
  - Significant population growth



Daysim Features

- Detailed travel demand forecasting microsimulation
- Implemented in multiple regions
  - Sacramento (SACOG)
  - Seattle (PSRC)
- Extensively tested and peer reviewed
- Open source
- Features
  - Simulates 24-hour itineraries
  - 30 Minute temporal resolution distributed to minute-by-minute
  - Parcel-level spatial resolution
  - Tour-based / trip-chaining
  - Captures effects of time and cost on <u>all</u> travel choices



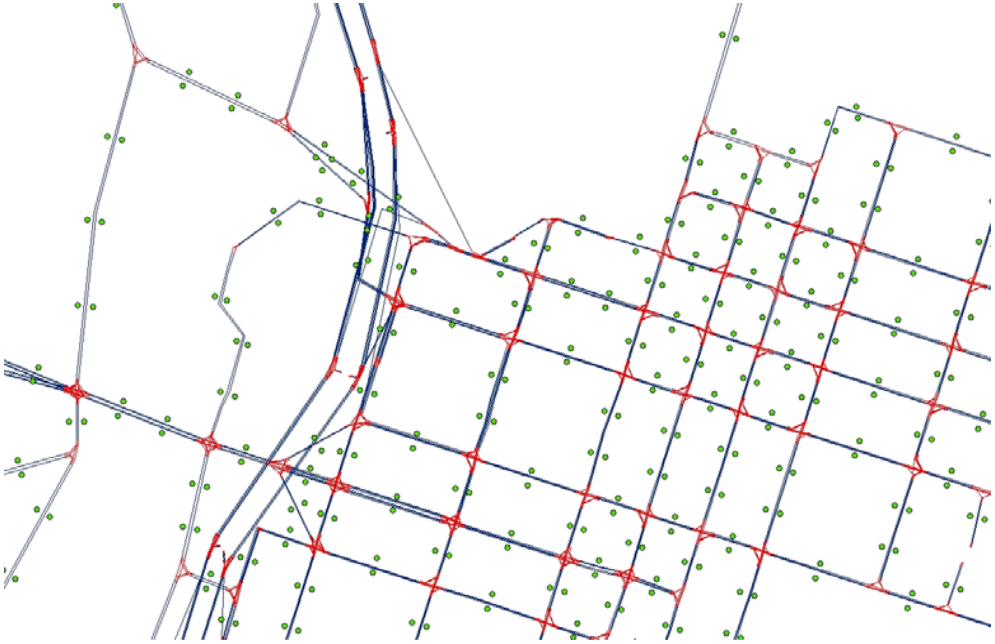
RSG INC. RESOURCE SYSTEMS GROUP, INC.

Daysim Features

- Enhanced behavioral sensitivities
  - Distributed values of time (VOT)
    - Each person has individual value of time drawn from observed distributions
    - Sensitive to income, purpose, schedule pressure
  - Intra-household coordination
    - Across household members (ex. stay at home)
    - Sharing rides and escorting others (ex. school)
    - Joint participation in activities (ex. shopping)
- Multiple, flexible output formats
  - Activity list for use by TRANSIMS traffic simulation
  - Trip list similar to household survey data
  - Matrices for aggregate assignment
  - Person, parcel, TAZ, other

TRANSIMS Features

- Advanced traffic assignment and simulation capabilities
  - Dynamic Traffic Assignment (DTA)
  - Microsimulator
- Implemented in multiple regions
  - Chicago
  - Portland
  - Sacramento
  - Burlington
  - Washington DC
- Extensively tested and peer reviewed
- Open source
- Features
  - Simulate 24-hour travel plans reflecting controls, restrictions, geometries
  - Second-by-second temporal resolution

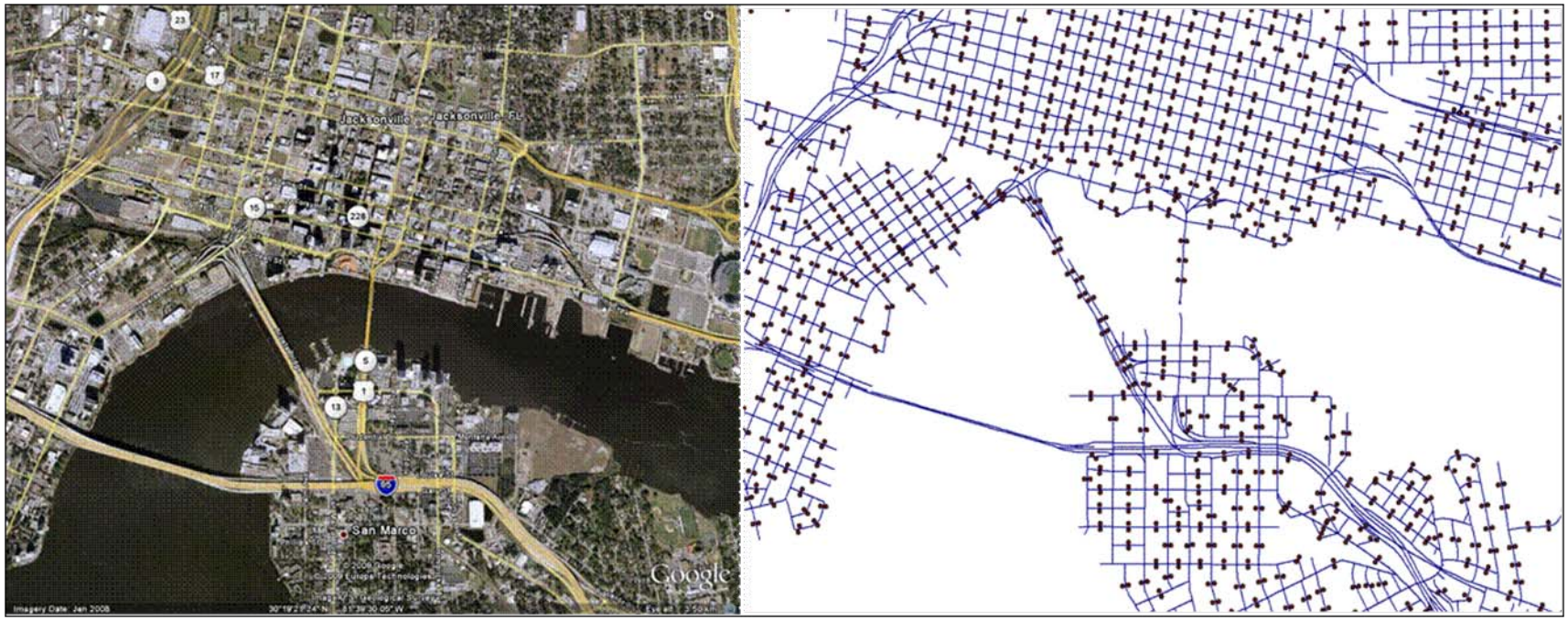


TRANSIMS activity locations & network

TRANSIMS Features

- General Structure
  - Geographically correct networks
  - "Activity Locations" represent loading points (often block front loading)
  - Intersection geometry (# of approach lanes, lane connectivity, pocket lanes, on street parking)
  - Intersection control (signalized intersection timing)
- A suite of tools – C10 will use traffic assignment and simulation components:
  - Router – develops routing "plans" to satisfy activity participation
  - Microsimulator – uses Router plans to perform a regional microsimulation of traffic on a second-by-second basis
- Disaggregate simulation tracks:
  - Individuals
  - Households
  - Vehicles
- Spatial resolution for assignment
  - Significantly finer-grained than TAZs
  - Larger than parcels

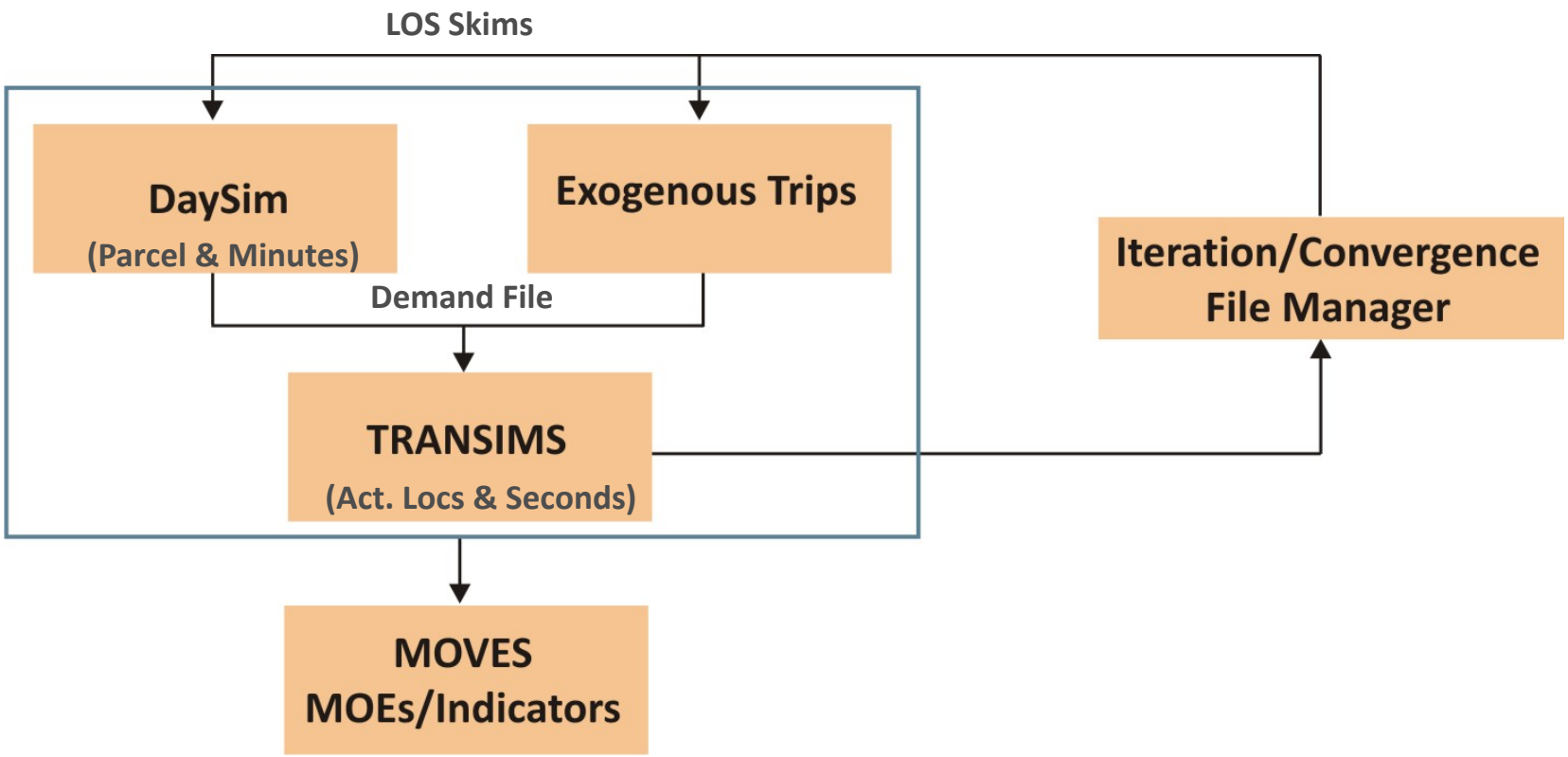
TRANSIMS Network Build - Jacksonville



Initial Jacksonville TRANSIMS Network

- Built using TRANIMS tools
  - GISNet
  - TransimsNet
  - ArcNet
- Based on GIS centerline file
  - 75,000+ links
  - 56,000+ nodes
  - Up to 100,000 or more activity locations

DaySim - TRANSIMS Integration



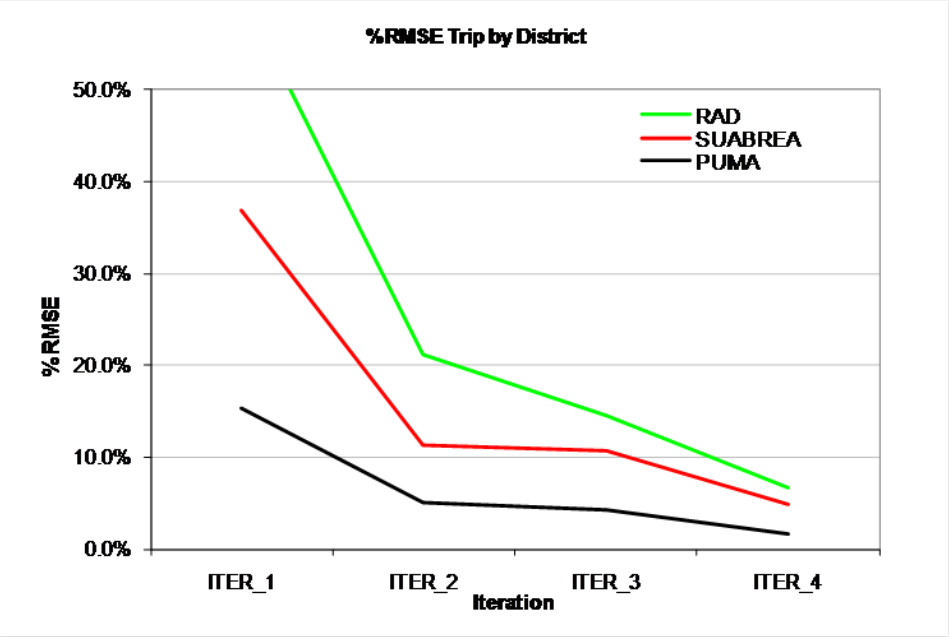
- Daysim: Provides detailed estimates of travel demand
- TRANSIMS: Provides detailed estimates of network performance
- MOVES: Provides detailed estimates of air quality

DaySim/TRANSIMS Integration

- Daysim → TRANSIMS
  - Produce TRANSIMS activity and other required files
  - Explicit treatment of drivers vs. passenger when sharing rides
- TRANSIMS → Daysim
  - Provide network level of service measures
  - Spatial and temporal detail preclude developing skims matrices a priori
  - "on demand" LOS measures as DaySim simulates travel behaviors
- "Conservation of Demand"
  - All trips must be assigned in order to derive full benefit from integrated model system
  - In past TRANSIMS implementations, a share of trips were allowed to go unfulfilled

Model Convergence

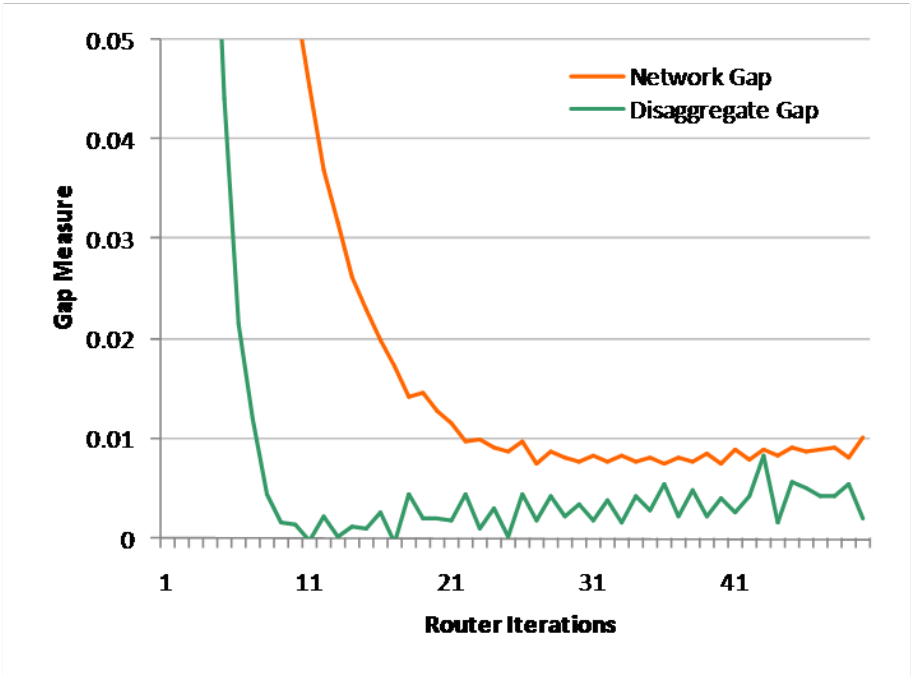
- Two convergence considerations
  - Assignment convergence
  - System convergence
- Attained through feedback within:
  - Iterations within TRANSIMS
  - DaySim-TRANSIMS iterations
- Defining convergence measures
  - Link / network based
  - Aggregate district-based
  - New disaggregate trip-based
- Parameterized to allow adjustment for different applications



Sacramento DaySim-TRANSIMS system convergence measures

Convergence & Disaggregate Gap

- Convergence Issues:
  - Criteria / thresholds to identify travelers to re-route
  - % of travelers to re-route
  - # of iterations required
  - DaySim-Router-Microsimulator iterations
  - Reasonable runtimes
- 3 phase implementation
  - 1. Achieve assignment convergence within the Router and Microsimulator
  - 2. Achieve system convergence (between DaySim and TRANSIMS
  - 3. Optimize / coordinate to reduce runtimes



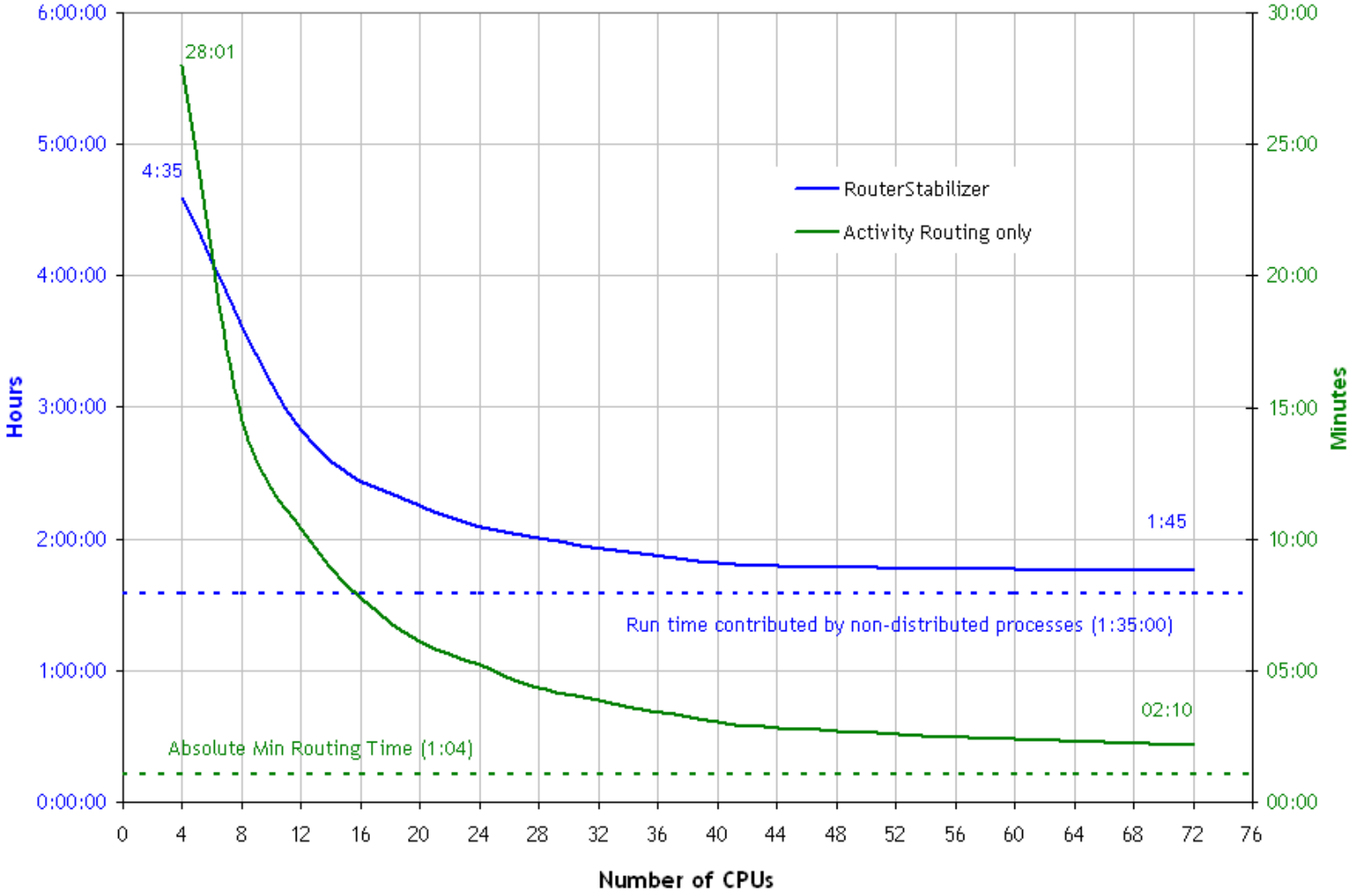
Disaggregate Gap Measure

$$\frac{\sum_s (c_{xs}(\{c_{at}\}) - c_{ys}(\{c_{at}\}))}{\sum_s c_{xs}(\{c_{at}\})}$$

where:

- s indexes trips
- $\{c_{at}\}$ is an updated set of time-dependent link costs after combining new trip routes for a subset of household with pervious iterations' routes for the other households
- c_{xs} is the cost of the trip s along the path that was used for the calculation of $\{c_{at}\}$
- c_{ys} is the cost of the trip s along its shortest path, assuming $\{c_{at}\}$

SACOG Case Study - TRACC Cluster Performance



Jacksonville C10A Challenges

- Further spatial and temporal disaggregation of level-of-service
- Continue evaluation of convergence methods
- Continue network calibration/validation
- Policy Testing & Model Application
- Introduction of Network Microsimulator
- Share information with other MPOs

Contact Information

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