



ARC's Experience Using its CT-RAMP Activity-Based Model

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Atlanta Regional Commission



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Planning

Why an Activity-Based Model @ARC?

Purpose:

- Enhance Theoretical Integrity of Regional Travel Demand Modeling System

Goals:

- Provide Greater Sensitivities to: Demographic Shifts (Aging of the Population, etc...) & Roadway Pricing Policies
- Improve Visualization of Model Results
- Better Representation of Trip Chaining & Intra-Household Interactions

ARC Strategic Plan for ABM Development

Work Methodically & Incrementally

Maintain a Dual-Track for Model
Development & Implementation

Improve Trip-Based Model (TBM)

Develop ABM

Ensure On-Going Quality Assurance &
Quality Control of ABM Results

Acknowledgements

Over the Years, the Following Firms & Individuals Have Assisted ARC in Developing its ABM:

- Parsons Brinckerhoff
- Atkins
- John Bowman
- Mark Bradley



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Historical Perspective: Why Did it Take ARC so Long?

- **2001**: System Design for 13-County Model Domain
- **2002**: Preparatory Work & Analysis of SMARTRAQ Household Travel Survey Data
- **2003**: Debut of Population Synthesizer (birth of “PopSyn”) with Emphasis on 1990 Backcasting
- **Early 2004**: TMIP Model Peer Review Recommended Early Deployment of Population Synthesizer
- **Late 2004**: EPA Designated 20 Whole Counties & 2 Partial Counties Within Metro Atlanta as Non-Attainment under PM 2.5 (Fine Particulate Matter)
- Result of this Non-Attainment Designation:
 - ARC Initiated Effort to Expand **4-Step Trip-Based** Model from 13 to 20 Counties in order to Meet Federal Requirements for Performing Conformity Analysis

Historical Perspective: Why Did it Take ARC so Long?

- **2005**: Expansion & Calibration/Validation of 4-step Trip-Based Model
 - ABM Model Development Slowed Down
 - ABM Model Development Efforts Dispersed
 - ABM Model Development Progress Impacted
- **2006**: Expanded 13-County Population Synthesizer to 20-County Model Architecture
 - 13-County PopSyn Presented at May 2006 TRB Austin Conference
 - JAVA-based PopSyn
- **2007**: Long-Term Choice Models Implemented:
 - Workplace Destination/Location Choice Model
 - School Destination/Location Choice Model
 - Automobile Ownership Model

Historical Perspective: Why Did it Take ARC so Long?

2008: Core (Short-Term) Choice Models:

- Coordinated Daily Activity Patterns for all Households
- Joint travel / activity, including generation and participation sub-models
- Tour destination choice for all travel purposes
- Tour mode choice for all travel purposes
- Tour time-of-day choice for all travel purposes
- Stop frequency for all tour types
- Stop-location for all tour types
- Trip departure choice for all tour types, trip purposes, and trip placement in tour chain
- Parking choice for auto trips to CBD
- All implemented using the UEC (Utility Expression Calculator) for logit model specs, from spreadsheets to JAVA
- ABM Uses Cube Voyager / TP+ Graphical User Interface



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Historical Perspective: Why Did it Take ARC so Long?

2009-2010:

- Zonal & Network Data, Assignment & Skimming for Highway & Transit
- Model Shell Application for PopSyn, Core Models & Auxiliary Models (Trucks, Externals)
- Structural Calibration Targets Sources: Household Survey, Traffic Counts, CTPP, Transit Ridership
- Validation & Comparisons to Existing 4-step Model
- Software & Custom Hardware with Distributed Cluster Processing
- ABM VIZ for Results Visualization

2011-2012:

- Thorough QA/QC, Cloud Computing & Internal Use of ABM for Model Evaluation & Sensitivity Testing



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What's on Tap for ARC in 2013 and Beyond?

Transition from TBM to ABM

- “Just When You Think You’re Done, It’s Time to Do It All Over Again”
 - Fold in TBM’s Recent Improvements into ABM (see next slide for more details)
 - Revisit ARC’s CT-RAMP ABM Estimation
 - Integrate ARC’s Recently Completed Household Travel Survey
 - Recalibrate / Revalidate
 - Integration with PECAS land use model
 - Integration with DTA & Microsimulation?



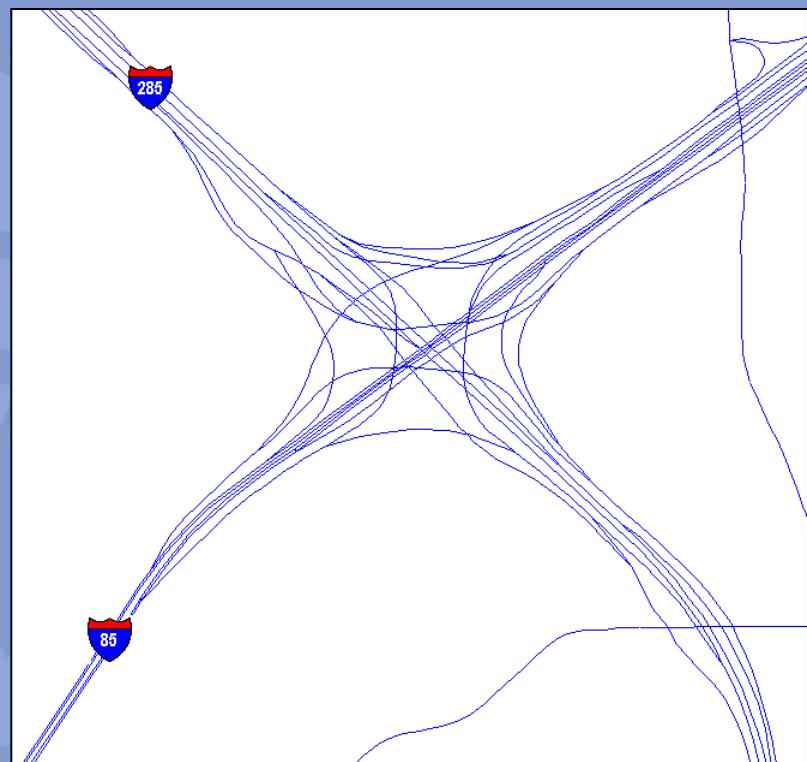
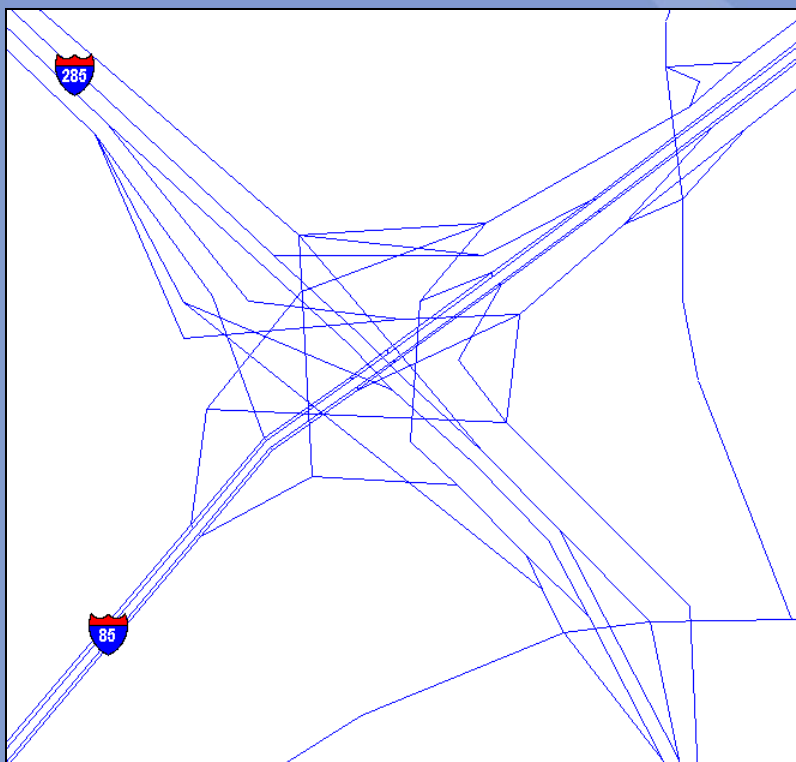
4-Step Trip-Based Aggregate Model: Recent Improvements

- Utilize Conflated Networks
- Consolidate Facility Types
- Update Speed/Capacity Tables
- Revise VDF Curves
- Revise Time-Of-Day Factors
- Revise Heavy-Duty External Trucks
- Incorporate Mode Choice Refinements
- Revise Highway Assignment Closure
- Convert emissions post-processor to utilize MOVES output

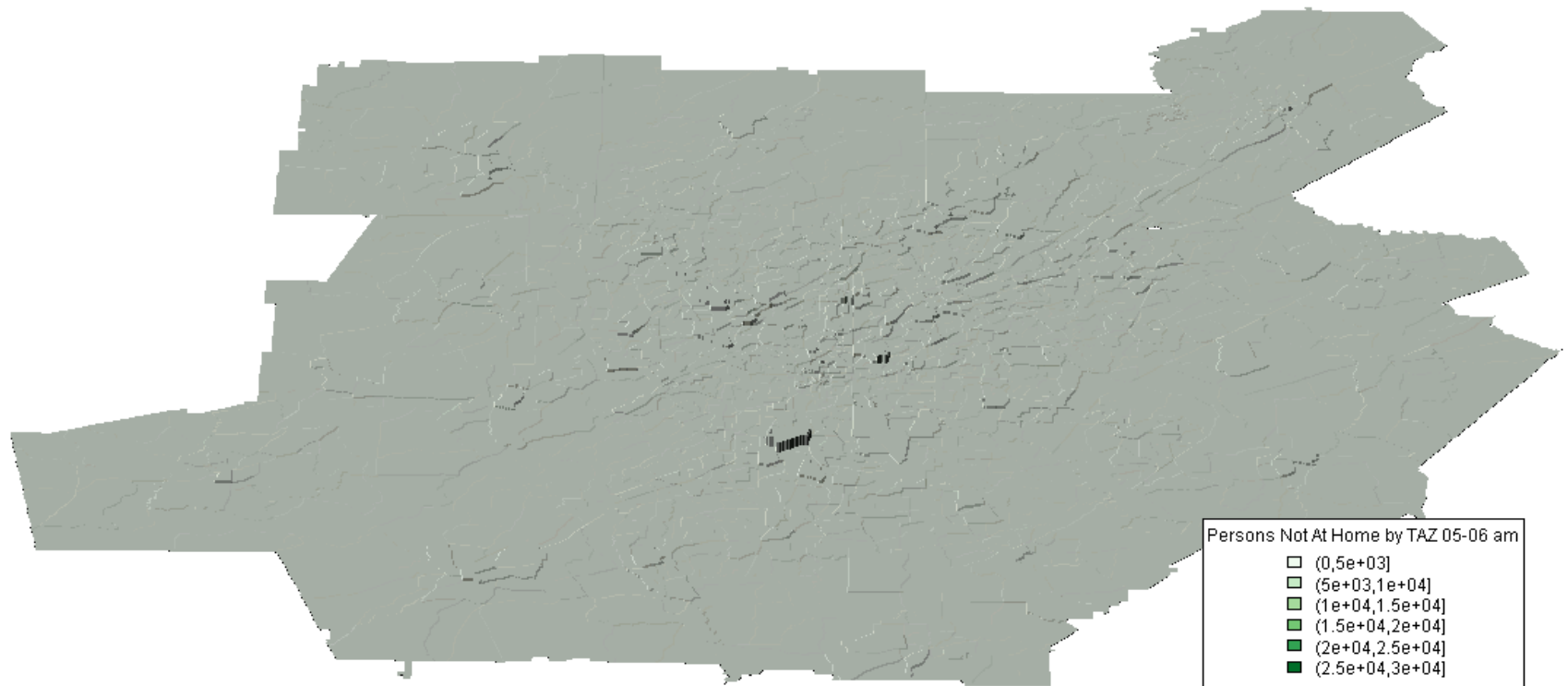


Conflated Networks

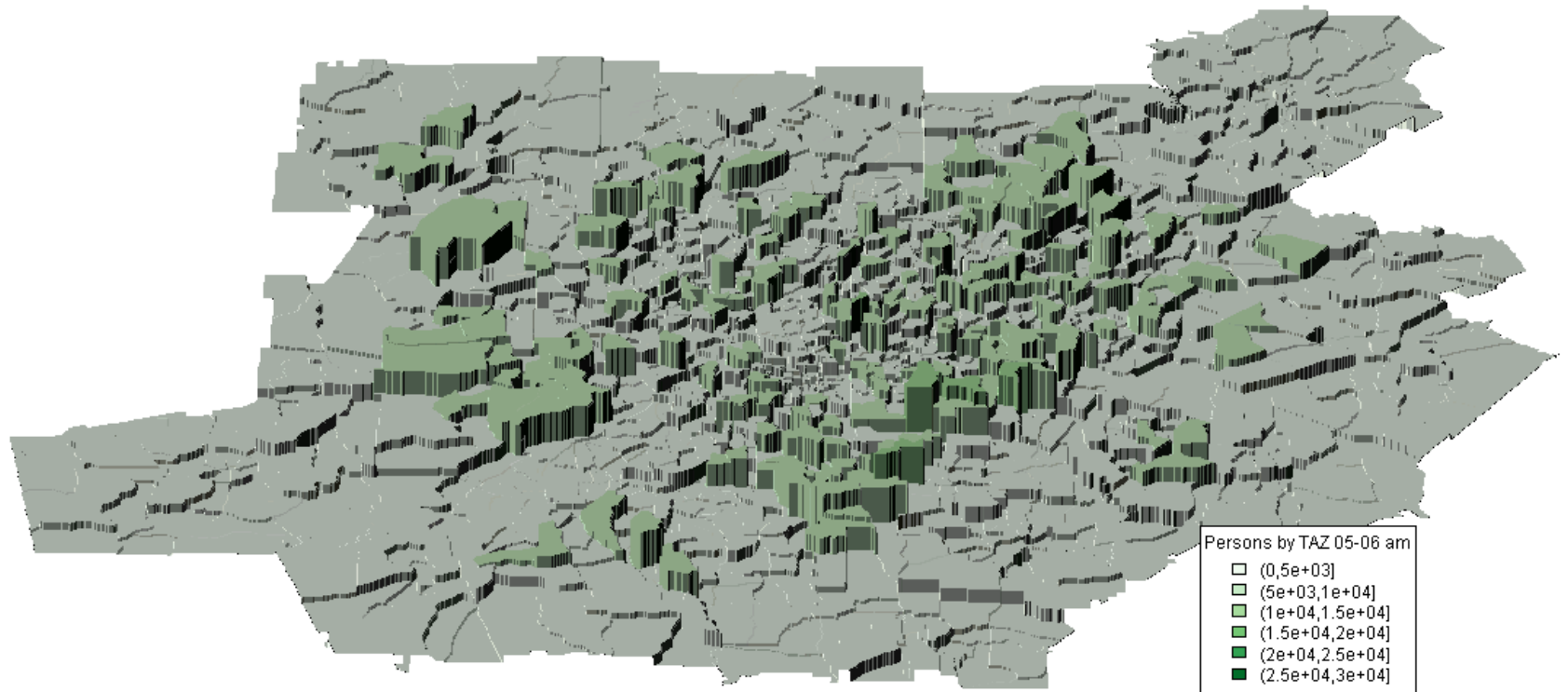
- **True Shape Display**
- **Based on modified NAVTEQ data**
- **Modify network with highway shape file**



Persons Not At Home By TAZ and Hour

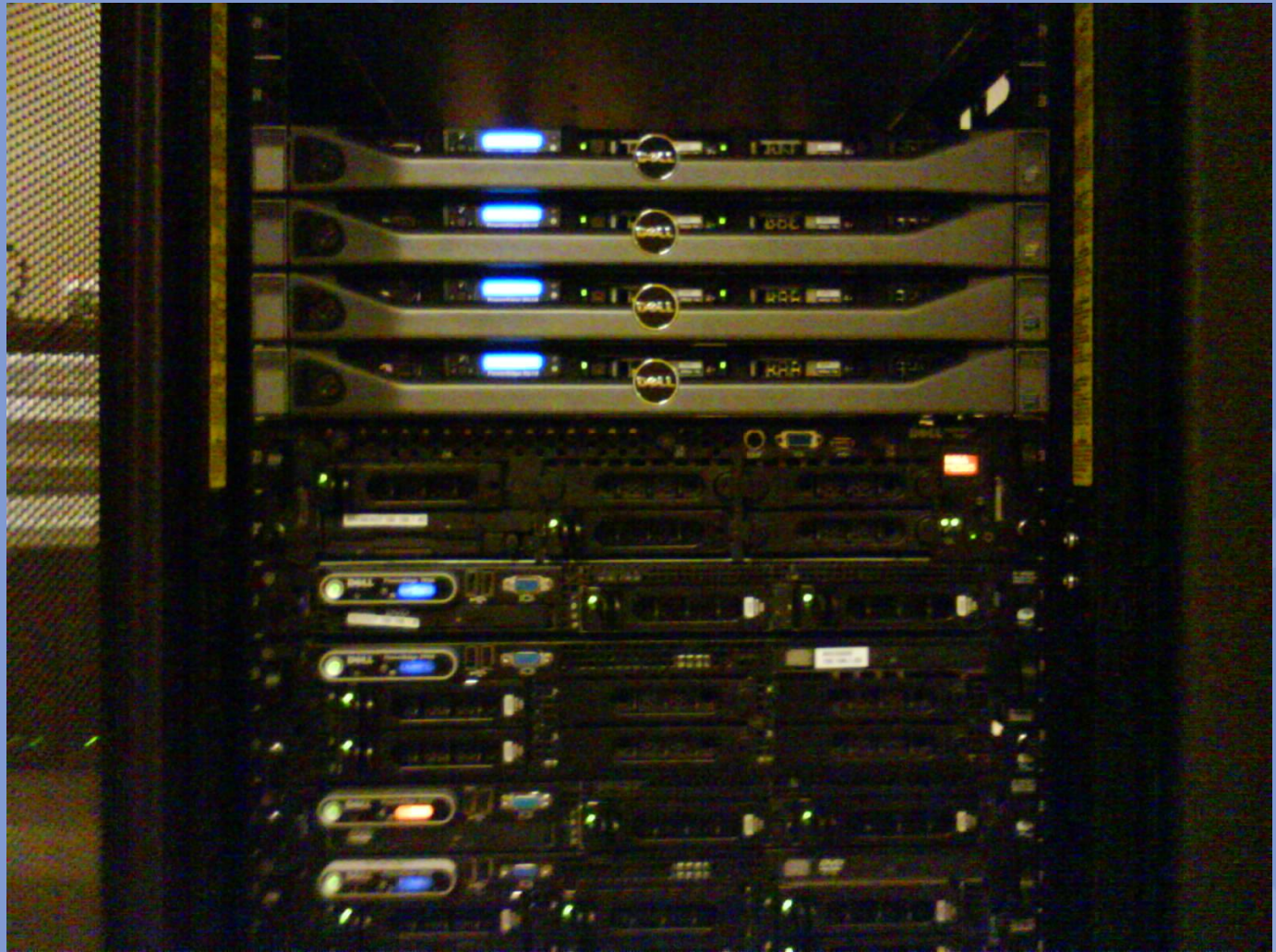


Persons By TAZ and Hour



The ARC CT-RAMP Cluster

4 8-processor dual-core Dell servers with 32 GB RAM each



Cloud Computing: the ARC ABM is now “on the Cloud”

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Models Scenarios Analysis Data Admin Contracts

Status | Edit Scenario | Delete Scenario | Schedule Scenario | Create Child Scenario

ARC-CTRAMPT
Base

Scenario Manager

Model: ARC-CTRAMPT
Scenario: Base

ARC Tour Based Model

General Settings

year
05

Total Zones (w/Externals)
2118

Range of Internal Zones
1-2027

Last Internal Before Externals
2027

First External Station
2028

Last External Station
2118

Airport Zone Number
1322

Dobbins Zone Number
803

Maximum External County ID
2162

Cube Cluster Process ID
ARC

Extra CPUs Available for Cube Cluster
255

Modules to Run

- ☒ Model Preparation
- ☒ Commercial Vehicle and Truck Model
- ☒ Feedback Loops (includes CTRAMP)
- ☒ Transit Assignment
- ☒ Time of Day Assignments

Feedback

Max Assignment Iterations
200

Number of Feedback Loops
10

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Models Scenarios Analysis Data Admin Contracts

logged in as CitilabsAdmin

CUBE CLOUD SERVICES

Maps | Charts

AM Peak Congestion

Model: ARC-CTRAMPT
Scenario: Base

Maps: AM Peak Congestion

Select Basemap

Terrain with Labels Light Gray Canvas

National Geographic Oceans

OpenStreetMap

Save as Default Basemap

ARC-CTRAMPT
Base

Volume Over Capacity Ratio

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 10

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User interface – <http://www.planthecity.com>



Cube Cloud Services Setup

- Includes management of multiple scenarios & simultaneous runs



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[Models](#) [Scenarios](#) [Analysis](#) [Data](#) [Admin](#)

[Status](#) | [View Scenario](#) | [Delete Scenario](#) | [Schedule Scenario](#) | [Create Child Scenario](#)

▼ ARC-CTRAM

▼ Base

- ☒ Core_16
- ☒ Core_32
- ☒ Core_64
- ☒ Core_128
- ☒ Core_256
- ☒ Core_512

▼ APPLICATIONS



Scenario Manager

Model: ARC-CTRAM

Scenario: Core_512

Scheduled Runs

Scenario	Status	Start Time	Elapsed Time
Core_512 cancel Step 75: MATRIX (v.01/22/2012 [5.1 Pre]) Tue Feb 07 17:35:08 2012 Step 74: HWYNET ReturnCode = 0 Elapsed Time = 00:00:00	Running	2/7/2012 2:10:55 PM	0:15:20
Core_64 cancel Step 88: write java properties file for CTRAMP MATRIX (v.01/22/2012 [5.1 Pre]) Tue Feb 07 17:27:46 2012	Running	2/7/2012 2:09:46 PM	0:21:17
Core_256 cancel Step 88: write java properties file for CTRAMP MATRIX (v.01/22/2012 [5.1 Pre]) Tue Feb 07 17:32:03 2012	Running	2/7/2012 2:09:11 PM	0:18:06
Core_128 cancel Step 88: write java properties file for CTRAMP MATRIX (v.01/22/2012 [5.1 Pre]) Tue Feb 07 17:27:45 2012	Running	2/7/2012 2:08:06 PM	0:21:17
Core_32 cancel Step 88: write java properties file for CTRAMP MATRIX (v.01/22/2012 [5.1 Pre]) Tue Feb 07 17:22:13 2012	Running	2/7/2012 2:05:54 PM	0:26:30
Core_16 cancel Step 88: write java properties file for CTRAMP MATRIX (v.01/22/2012 [5.1 Pre]) Tue Feb 07 17:23:06 2012	Running	2/7/2012 2:04:25 PM	0:26:43
Base cancel	Pending	2/7/2012 2:01:50 PM	

Completed Runs

Scenario	Start Time	Time	Status	Files	Report
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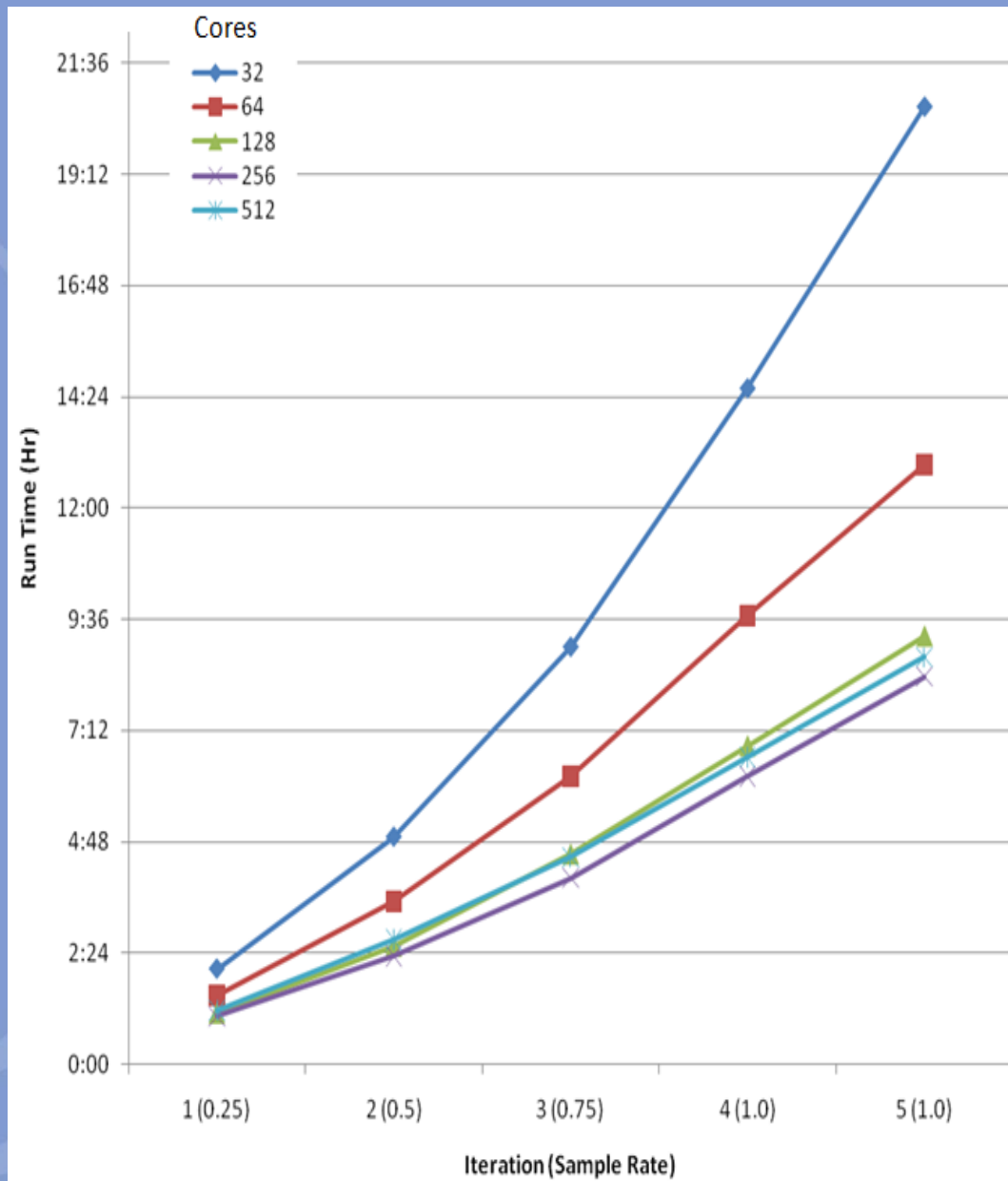
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Cloud Run Times

Diminishing returns observed around 128 cores (or 16 instances) with current setup

The household data manager is a likely bottleneck since it handles a significant amount of data I/O



Visualization in Modeling

See:

<http://www.youtube.com/ARCModeling>

Social Networking Sites & Modeling

YouTube - ARCMoeling's Channel - Windows Internet Explorer provided by ARC

http://www.youtube.com/ARCMoeling

File Edit View Favorites Tools Help

YouTube - ARCMoeling's Channel

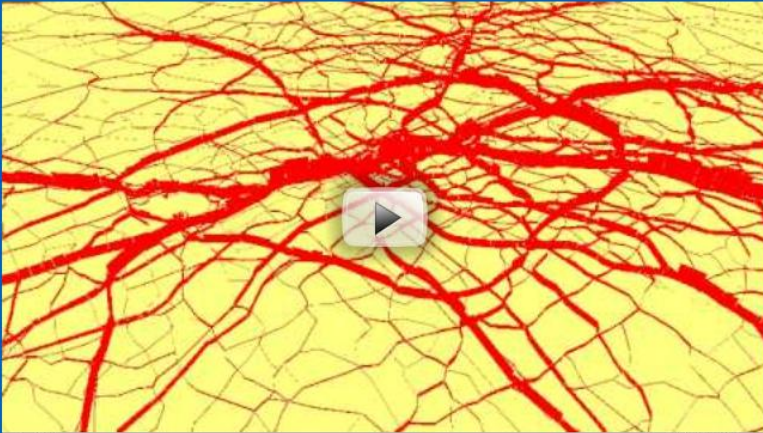
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Subscriptions History

ARCMoeling's Channel All Uploads Favorites



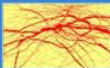


0:00 / 0:51

Atlanta Router 2 0 ratings ★★★★★

From: ARCMoeling | September 16, 2009 | 21 views
second by second traffic pattern from 12h01 through 12h59

View comments, related videos, and more

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21 views · 1 week ago
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70 views · 2 weeks ago
-  **ARC downtown atlanta**
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ARCMoeling

Channel Comments

There are no comments for this user.

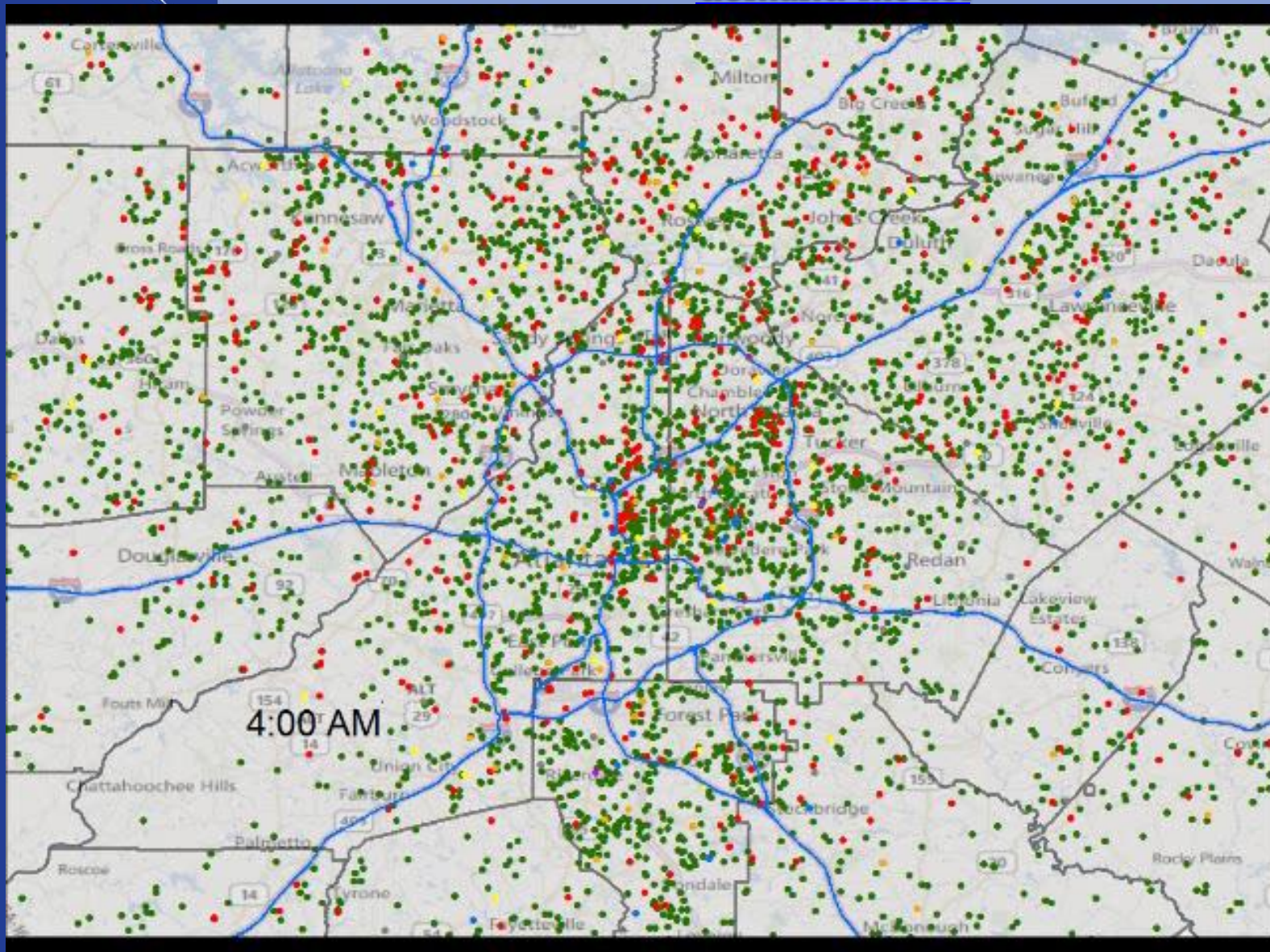
Done

start | Inbox - Microsoft ... | It's time to check-l... | Re: AMPO Travel ... | 2009_Non_Staff_... | My Documents | Microsoft PowerP... | YouTube - ARCMo... | 11:54 AM 4M



Household Travel Survey

Video featured on: www.atlantaregional.com/transportation/travel-demand-model



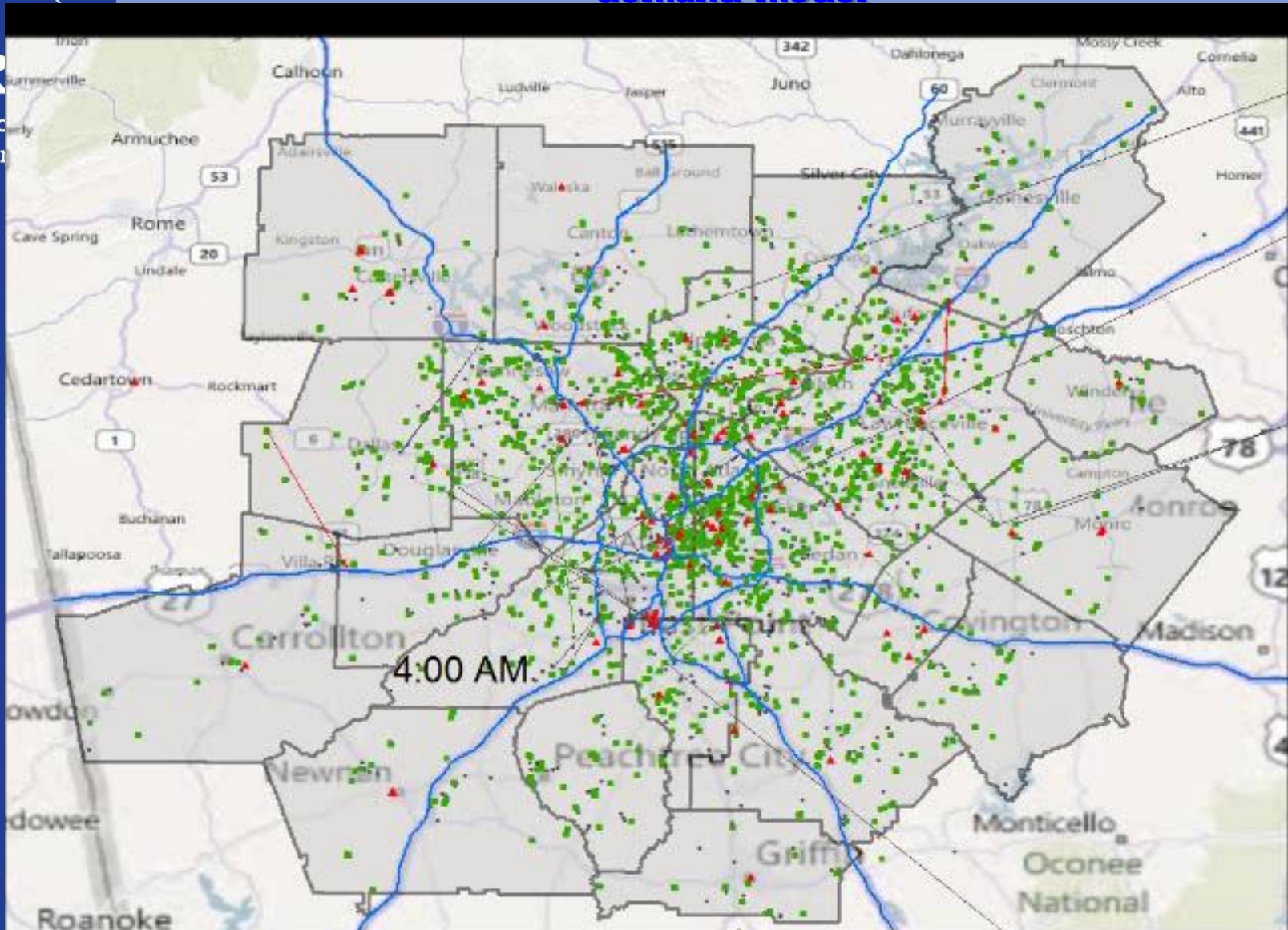
work
home
school
shop
personal
recreation
other



GPS: Putting it all together!

Video featured on: www.atlantaregional.com/transportation/travel-demand-model

4:00 AM
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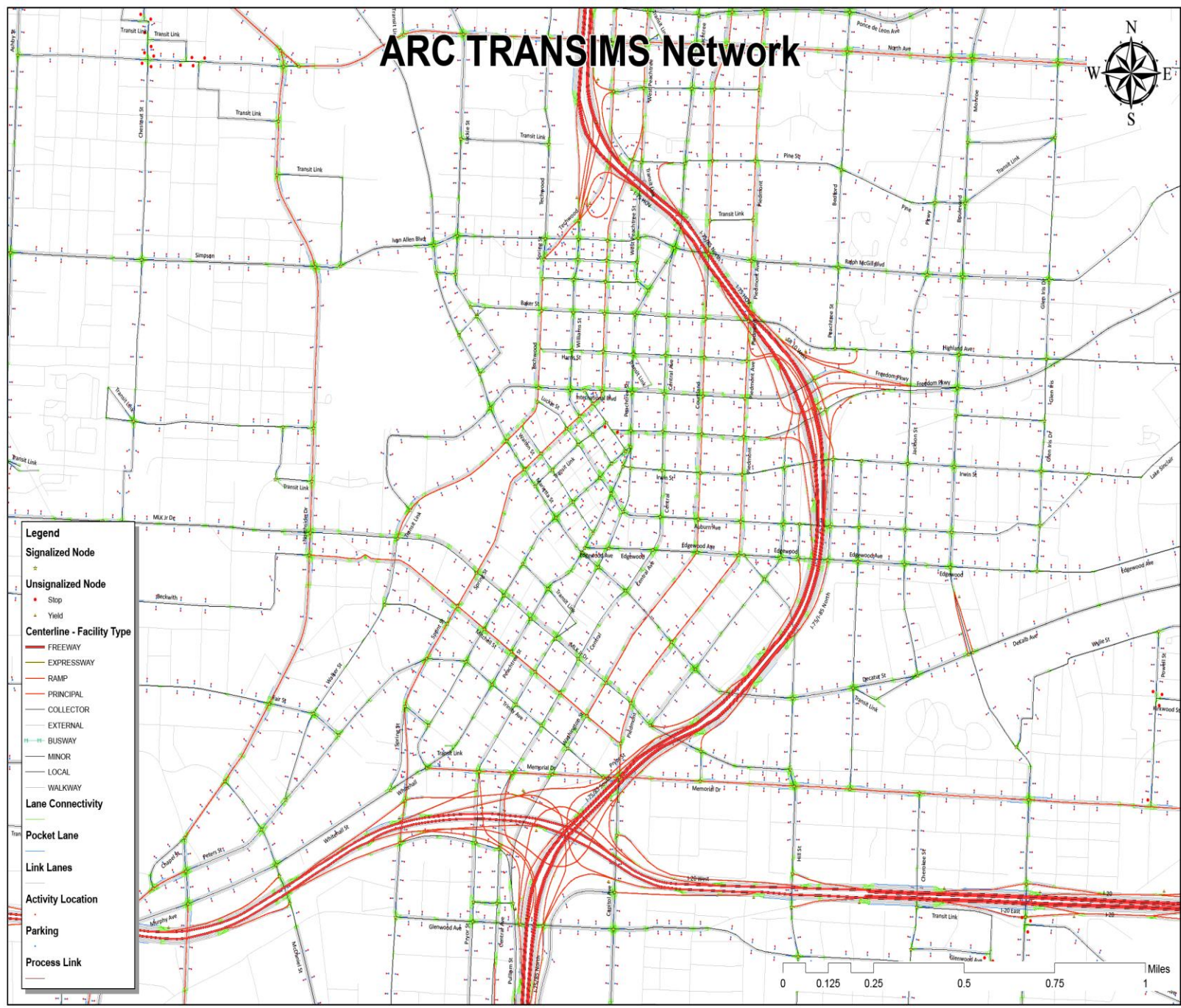


work
home



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ARC TRANSIMS Network



- Legend**
- Signalized Node**
 - Stop
 - Yield
 - Unsignalized Node**
 - Stop
 - Yield
 - Centerline - Facility Type**
 - FREEWAY
 - EXPRESSWAY
 - RAMP
 - PRINCIPAL
 - COLLECTOR
 - EXTERNAL
 - BUSWAY
 - MINOR
 - LOCAL
 - WALKWAY
 - Lane Connectivity**
 - Pocket Lane
 - Link Lanes
 - Activity Location**
 - Parking**
 - Process Link**

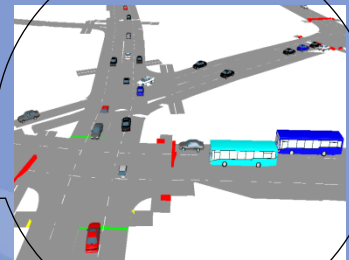
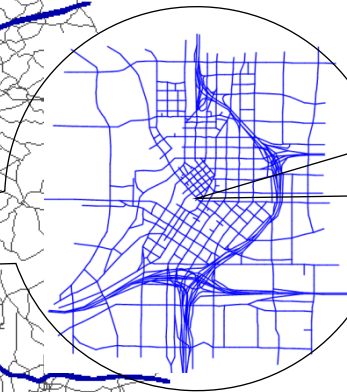
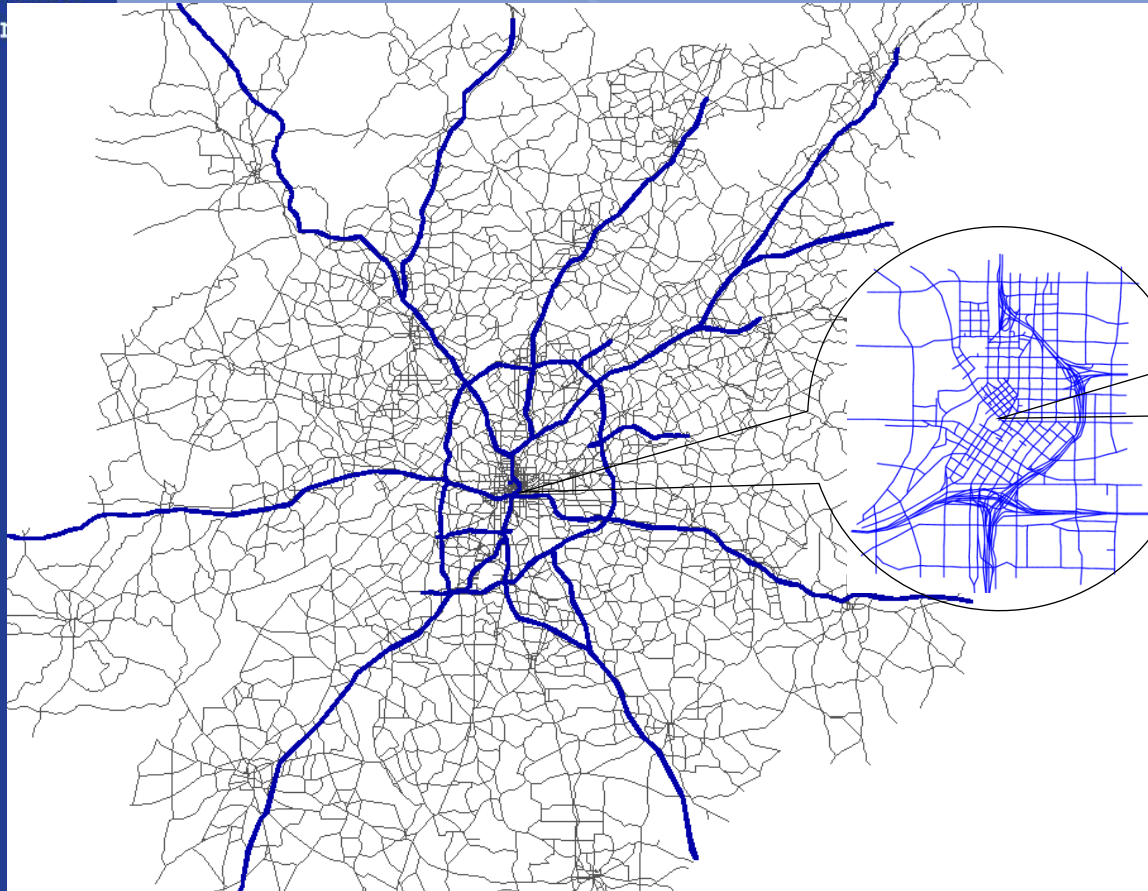
0 0.125 0.25 0.5 0.75 1 Miles



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Integrated Subarea Modeling





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Conclusions & Lessons Learned

- ABM Requires Detailed & Thorough QA/QC
- Design & Conceptualize your Household Travel Survey with an ABM Model System in Mind
- Maintain a Parallel Model Development Track with your 4-Step Trip Based Model
- Like Anything Else, ABM Requires Lots of:
 - Dedicated Staff Resources & On-Going Training
 - DATA (Surveys and/or “AirSage” O-D types)
 - Computer Resources (Servers or Cloud Computing?)
 - Consultants Assistance
 - Programming Expertise
 - GIS & a True Geo-Database for Project-Level Planning
 - \$,,\$\$\$,\$\$\$.\$\$\$

Atlanta's Most Crucial Step: Moving ARC's ABM into Practice & Official Production Mode

- Thus far ABMs are being Developed and Applied mostly in Regions where 4-step Models had been Abandoned or never Developed
- Rigorous Practical Testing and Cross-Comparisons of ABM & 4-Step Trip-Based Model (both in good shape!) is Finally Possible in Atlanta



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Questions & Comments?

THERE IS TOO MUCH TRAFFIC
FOR BILLY TO WALK TO SCHOOL ;
SO WE DRIVE HIM.



Traffic Inducing Traffic

For more info: www.atlantaregional.com/transportation/travel-demand-model