A Simulation Application Programming Interface for Traffic Modeling

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http://www.csm.ornl.gov/Internships/abstracts/kenroyWilliamson.pdf

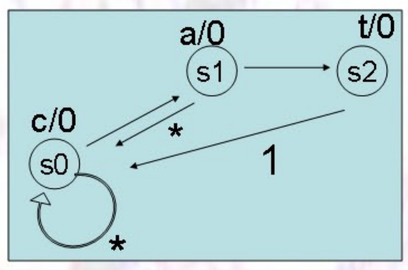
Introduction

This document describes an application programming library for constructing the dynamic pieces of a traffic simulation. It is meant to complement a complete traffic modeling tool set that includes data import and export capabilities, traffic routing algorithms, and visualization tools. This software library provides an abstract framework for constructing event driven models of traffic dynamics. It is based on the DEVS (Discrete Event System) modeling and simulation framework, and will be implemented using *ADEVS* (A Discrete Event System) simulation package. There are three basic elements of a traffic model and they are represented abstractly in the modeling framework. Traffic sources represent locations from which traffic can enter a road network. Traffic sinks are destination locations where traffic can leave a road network. Road segments represent traversable pieces of a road network. A road segment can represent an intersection, a one way street, a multi-lane highway, or any other navigable piece of the road system. The road system is navigated by population units. Population units are characterized by a size (e.g., number of people or number of vehicles) and a destination. Population units originate at traffic sources and are ultimately deposited at traffic sinks. They travel from source to sink through a road segment graph. The paths taken by the population unit, and the time required for a population unit to traverse a road segment, are determined by the user of the modeling framework. The modeling framework provides event scheduling, feedback for modeling congestion, and other time and structure related services that are needed to perform the actual simulation.

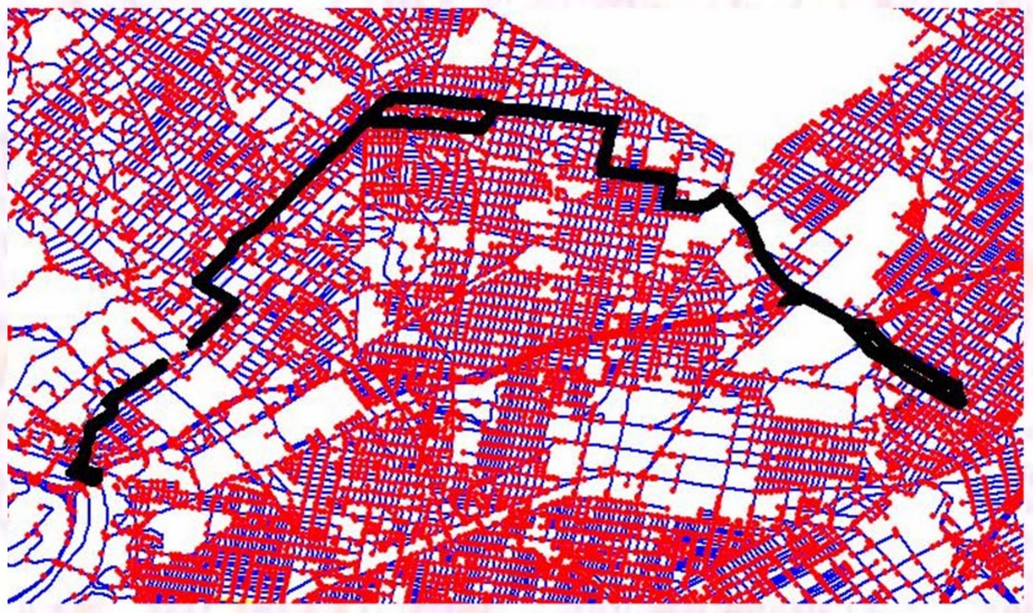
Approach

- **Learn** C++
- **Read** *Theory of Modeling and Simulation*
- **Implement** fire spread model in C++
- **Become** familiar with *ADEVS* library

State Trajectories Examples



X	C	A	T	T
S	s0	s1	s2	s0
Y	0	0	0	1



Map of Philadelphia, the black line is the bus route that is being used to detect movement, the blue lines are city streets and the red dots are nodes that illustrate intersections.

Software

- **Cygwin** – used to write program
- ***ADEVS*** – C++ library that program was built on
- **C++ –** Language used to write and execute program

Work in Progress

- **Development** of discrete event model that finds the shortest path through a graph

Predicted Results

- Program used to develop high-resolution population distribution model and databases for U.S. metropolitan areas
- Used by the Exposure Modeling and Research Branch (EMRB) at the U.S. Environmental Protection Agency (EPA)

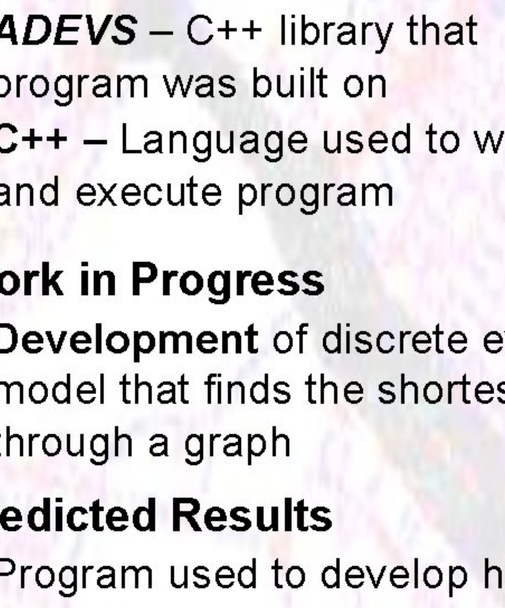
Project

- **Develop** a fire spread model using a generic, systems theory based cell space simulation framework
- **Write** a brief paper describing the principles behind the simulation engine

Research Objectives

- **Understand** the fundamentals of modeling and simulation
- **Apply** fundamentals to fire spread model
- **Develop** a software library for constructing the dynamic pieces of a traffic simulation
- **Design** software to be built on the *ADEVS* framework
- **Implement** the software as designed
- **Test** the implementation

Shortest Path Examples



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