UNITED STATES
DEPARTMENT OF TRANSPORTATION

Applications for the Environment: Real-Time Information Synthesis (AERIS) Transformative Concepts Workshop

Washington, D.C.

July 13, 2011

AERIS

"Cleaner Air through Smarter Transportation"

WELCOME

Workshop Overview

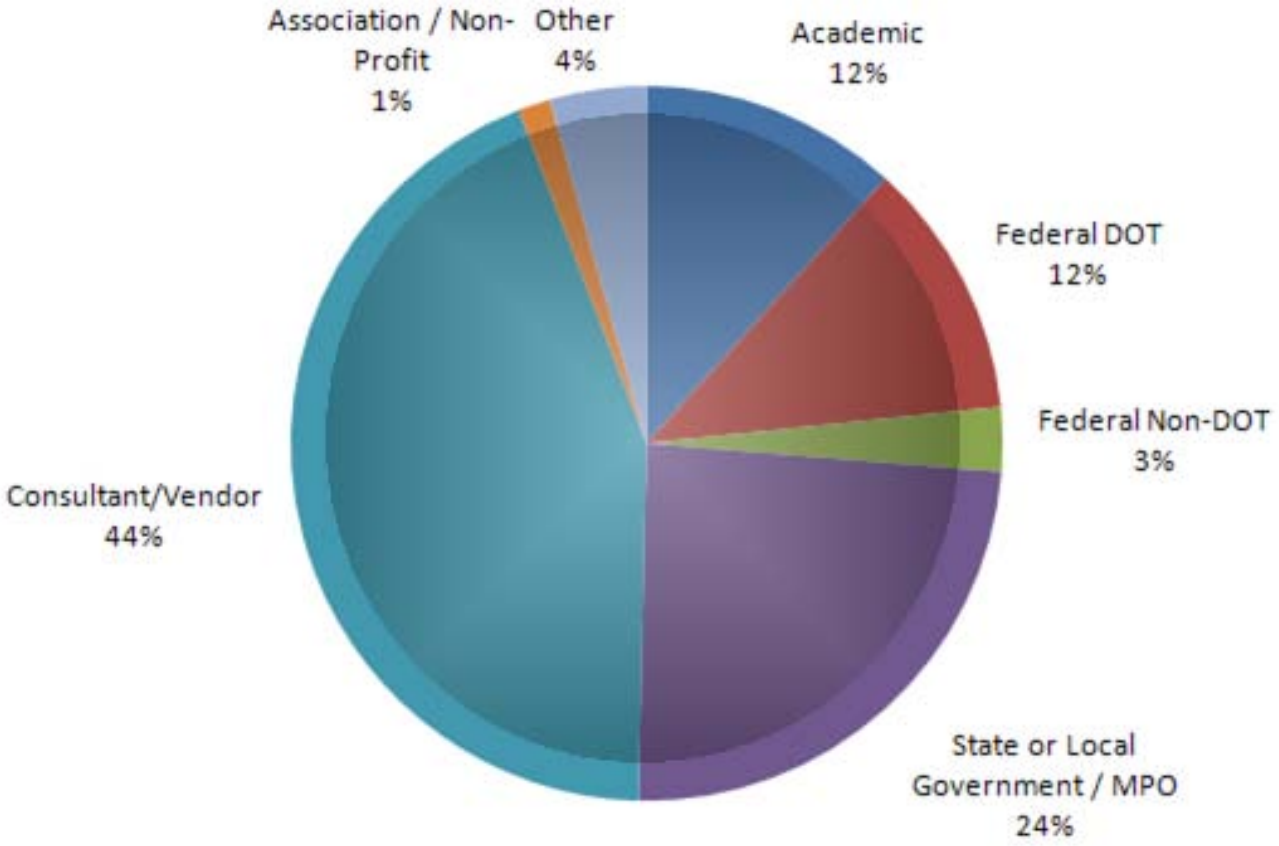
Workshop Agenda

▪ Welcome	9:00 am - 9:10 am
▪ Workshop Overview	9:10 am - 9:25 am
▪ AERIS Program Overview and Status	9:25 am - 10:00 am
▪ Vision for the Future	10:00 am - 10:30 am
▪ Break	10:30 am - 10:45 am
▪ AERIS Transformative Concepts	10:45 am - 11:20 am
▪ Break-out Sessions Overview and Logistics	11:20 am - 11:30 am
▪ Lunch	11:30 am - 12:30 pm
▪ Transformative Concepts Break-out Sessions (4)	12:30 pm - 3:30 pm
▪ Break	3:30 pm -3:45 pm
▪ Reports from Break-out Sessions (4)	3:45 pm - 4:25 pm
▪ Closing Remarks	4:25 pm - 4:30 pm

Housekeeping Items

- Restroom Locations
- Cell Phones
- Lunch Map
- Webinar Participants
  - Questions
  - Survey Forms

Who Is Here?



137 Total Participants

56 attending in-person

81 participating on webinar

Why Are We Here?

- To provide an update on the AERIS Program
- The AERIS Team developed six (6) Transformative Concepts—or innovative ideas to operate surface transportation networks, using connected vehicle technology, to reduce environmental impacts resulting from transportation-related emissions and fuel consumption
- To supplement the USDOT's thinking on new innovative ideas to reduce environmental impacts from transportation-related emissions and fuel consumption
- To '*imagine' and 'explore'* a connected vehicle future focused on the environment
- Input and feedback from this workshop will be used to refine the Transformative Concepts prior to an extensive modeling effort

What Are We Doing Here Today?

- We hope that you:
  - Are interested in what is happening with the USDOT's connected vehicle research
  - Want to minimize surface transportation's impact on our climate
  - Want to help shape the AERIS Program
  - Want to contribute to the thinking on Transformative Concepts
  - Want to ensure appropriate levels of attention are being paid to specific areas
  - Want to help

What is the Desired Outcome of the Workshop?

Workshop Participants

- Participants should have a greater understanding of the AERIS Program and the AERIS Transformative Concepts
- Participants should feel that they have contributed to the refinement of the AERIS Transformative Concepts
- Participants should understand how they can be involved in the AERIS Program

The AERIS Team

- The AERIS Team should gather information/feedback that will allow them to refine the AERIS Transformative Concepts
- The AERIS Team may identify other Transformative Concepts that should be considered
- The AERIS Team will have input on the following issues:
  - Subjective reactions to the Transformative Concepts
  - Objective reactions to the Transformative Concepts
  - Next steps with respect to the Transformative Concepts

AERIS Program Overview and Status

What is AERIS?

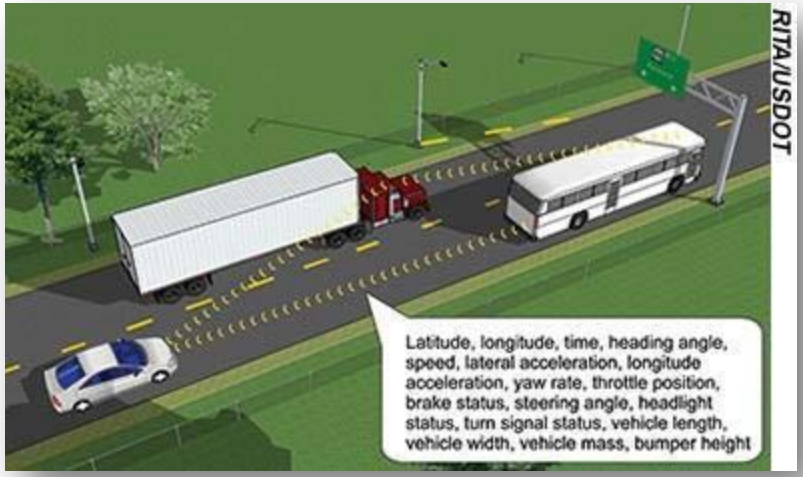
AERIS = Applications for the Environment: Real-time Information Synthesis

What is Connected Vehicle Research?

Connected vehicle research is a suite of technologies and applications that use wireless communications to provide connectivity:

- Among vehicles of all types
- Among vehicles and roadway infrastructure
- Among vehicles, infrastructure, and wireless consumer devices

To improve safety, mobility, and the environment.



RITA/USDOT

Dan Morin, Volpe Center/USDOT

What is Connected Vehicle Research?

The vision for connected vehicle research is to transform surface transportation systems to create a future where:

- Highway crashes and their tragic consequences are significantly reduced.
- Traffic managers have data to accurately assess transportation system performance and actively manage the system in real time, for optimal performance.
- Travelers have continual access to accurate traveler information about mode choice and route options, and the potential environmental impacts of their choices.
- Vehicles and traffic signals can communicate to eliminate unnecessary stops and help drivers operate vehicles for optimal fuel-efficiency.

Why Is Connected Vehicle Research Needed?

Connected vehicle research aims to tackle some of the biggest challenges in the surface transportation industry, in the areas of safety, mobility and environment

- **Safety |** In 2009, there were 5.5 million crashes, resulting in 33,808 fatalities and 2.2 million injuries. Motor vehicle crashes are the leading cause of death for people ages 3 through 34.
- **Mobility |** U.S. highway users waste 4.8 billion hours a year stuck in traffic – nearly one full work week (or vacation week) for every traveler. The overall cost (based on wasted fuel and lost productivity) reached $115 billion in 2009 – more than $808 for every U.S. traveler. Delays in truck operations alone resulted in $33 billion in wasted fuel and lost productivity.
- **Environment |** The total amount of wasted fuel topped 3.9 billion gallons in 2009 according to the Texas Transportation Institute. Equivalent to annual greenhouse gas (GHG) emissions from 6,798,235 passenger vehicles (Source: EPA GHG Equivalencies Calculator).

Connected Vehicle Research | Overall Structure

Applications

Safety			Mobility		Environment	
V2V	V2I	Safety Pilot	Real Time Data Capture & Management	Dynamic Mobility Applications	AERIS	Road Weather Applications

Technology

- Harmonization of International Standards & Architecture
- Human Factors
- Systems Engineering
- Certification
- Test Environments

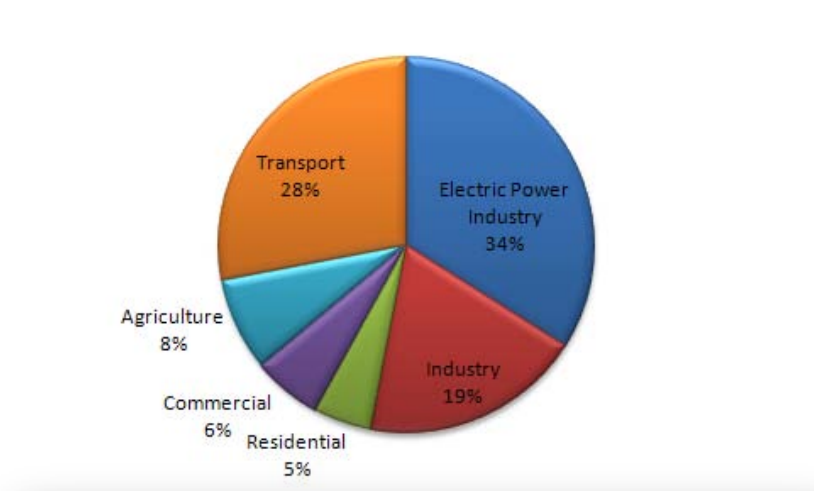
Policy

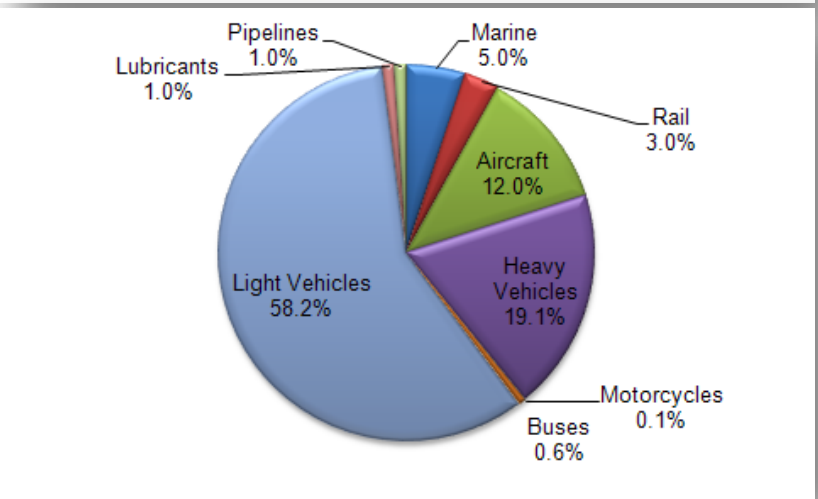
- Deployment Scenarios
- Financing & Investment Models
- Operations & Governance
- Institutional Issues

Why Is the AERIS Program Doing this Research?

The Environmental Problem:

- 3.9 billion gallons of wasted fuel each year
- The transport sector accounts for approximately 28% of GHG in the United States
- Vehicles represent almost 80% of the transport sector GHG



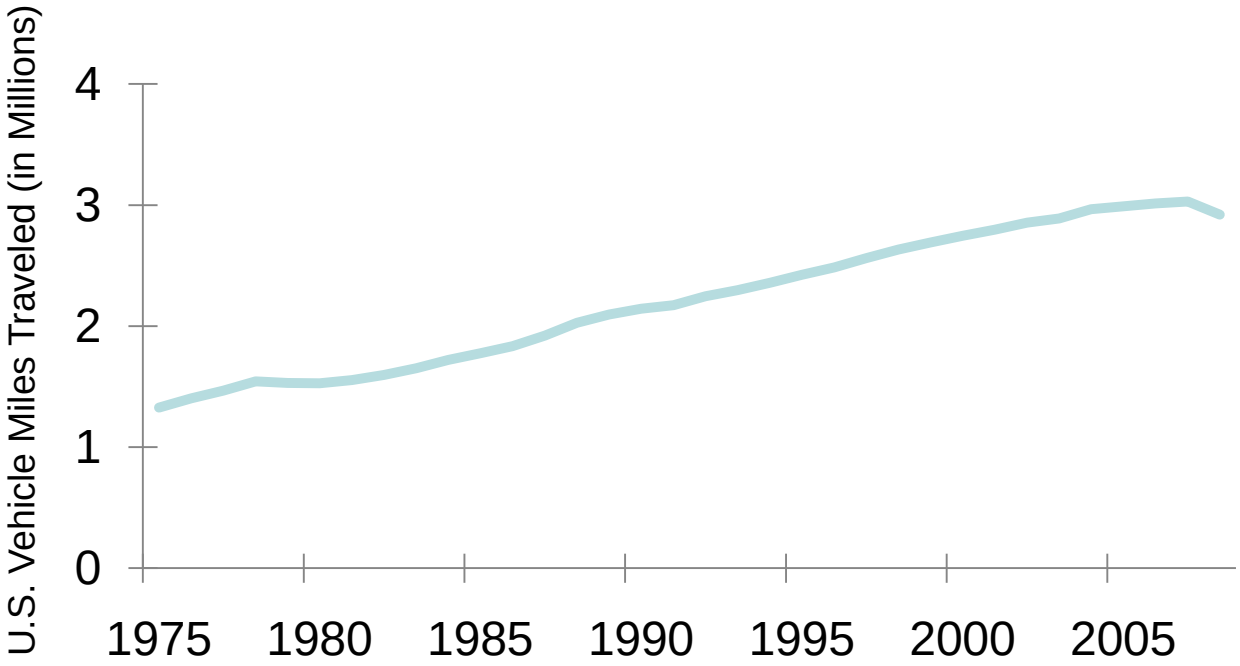


Source: EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990 to 2006.* 2008.

VMT Trends | 1990-2006

Light vehicle emissions have increased by 24%

But emissions from heavy vehicles have increased 77%



Source: Bureau of Transportation Statistics. National Transportation Statistics.

Setting Some Context

- There are several strategies available to reduce fuel consumption, decrease transportation's contribution to GHG levels, and improve air quality
- Intelligent Transportation Systems (ITS) and connected vehicle research may contribute to these reductions
- The AERIS Program is focused on assessing how ITS and connected vehicle research may contribute to reductions in fuel consumption, criteria air pollutants, and GHG emissions
- The AERIS Program will investigate a handful of applications (and groups of applications) to determine if they provide significant environmental benefits

NOTE: *Research is underway by many, but much more needs to be understood, modeled, tested and evaluated, especially in real-world, large scale test beds*

AERIS Program Vision

AERIS

"Cleaner Air through Smarter Transportation"

AERIS Research Objectives

- **Objectives** | Investigate whether it is possible and feasible to:
  - Generate/capture environmentally-relevant real-time transportation data (from vehicles and the system)
  - Use this environmental data to create actionable information that can be used by system users and operators to facilitate “green” transportation choices for all modes
  - Assess whether doing these things yields good enough environmental benefits to justify further investment by the USDOT

TRANSFORMATIVE and INNOVATIVE

Basic Research Questions

Data

- What environmentally-relevant vehicle-based data is available, and what is its quality and validity? (All vehicle types)

Information/Connectivity

- How can vehicle-based data be used, transmitted and then integrated with existing transportation system operation and other data (such as road weather data, for example)?

Benefit

- What cross-modal applications/strategies are available, or could be developed, and what are their expected benefits?

Guiding Principles

- Leverage existing and future research, data sets, and technologies to develop, enhance and, eventually, model and demonstrate Transformative Concepts that are proven to reduce the negative impacts of transportation on the environment
- Explore how AERIS data sets may improve/validate assumptions of environmental and other models (such as EPA's MOVES)
- Explore a wide variety of communication technology options, not just one
- Research will:
  - Include all surface modes
  - Focus on GHGs and air quality
  - Cultivate a new set of champions
  - Be undertaken in cooperation with international counterparts, as appropriate
- Research on other environmental impacts (water, noise, soil) is out of scope for now

AERIS Research Program

- Five Years, Six “Tracks”
- Multimodal Approach
- Working with Data Capture and Management Program and Dynamic Mobility Applications Program

Track 1: Foundation	Track 2: Identification	Track 3: Analysis	Track 4: Recommend	Track 5: Policy	Track 6: Stakeholders
• Establish the foundation by reviewing the state of the practice	• Identify initial candidate strategies, scenarios and applications that appear to improve environmental decisions by public agencies and travelers	• Analyze and evaluate candidate strategies, scenarios and applications that make sense for further development and evaluation	• Recommend strategies, scenarios and applications	• Develop the facts and evidence needed to inform and respond to possible future policy and regulatory issues/needs	• Stakeholder engagement and technology transfer

Track 1: Establishing the Foundation

State of the Practice Assessments

- **Applications** | Results of research on the state of the practice of ITS applications that have shown environmental benefits
- **Evaluation Techniques** | Overview of the state of the practice for techniques that could be used to evaluate the environmental impacts of applications enabled by connected vehicle communications
- **Activity-Based Models** | Scan of behavioral and activity-based models and their ability to predict traveler choices and behavior in response to implementation of ITS strategies and the suitability to use the behavior changes to quantify air quality impacts
- **Environmental Models** | Scan of environmental models to estimate environmental impacts (emissions, fuel consumption, etc.) due to traveler behavior and trip choices in response to implementation of ITS strategies
- **Data Acquisition Techniques** | Overview of environmental data acquisition technologies including vehicle-based technologies and infrastructure-based technologies

Track 1: Establishing the Foundation

Broad Agency Announcement (BAA) Research Projects

- **An Evaluation of Likely Environmental Benefits of Lowest Fuel Consumption Route Guidance in the Buffalo-Niagara Metropolitan Area** | University at Buffalo
- **Developing and Evaluating Intelligent Eco-Drive Application** | Virginia Tech
- **Developing Eco-Adaptive Signalized Intersection Algorithms** | Virginia Tech
- **Preliminary System Development Plan for an AERIS Data Capture and Management System** | Mixon Hill
- **Eco-ITS** | University of California – Riverside (UCR)
- **Assessment, Fusion, and Modeling of Commercial Vehicle Engine Control Unit Data** | Calmar and UCR
- **Engaging the International Community** | University of California Partners for Advanced Transit and Highways (PATH) Program

Track 2: Identifying Candidate Transformative Concepts and Applications

- The AERIS Team developed initial Transformative Concepts that will form the basis for analytical and modeling work
- Transformative Concepts are focused on truly innovative approaches to transforming the environmental footprint of the transportation system
- The six (6) Transformative Concepts are:
  - Eco-Signal Operations
  - Eco-Lanes
  - Low-Emissions Zone
  - Support Alternative Fuel Vehicle Operations
  - Eco-Traveler Information
  - Eco-Integrated Corridor Management
- Stakeholder input will be used to refine the Transformative Concepts

AERIS Transformative Concepts Down Selection

TRACK 1
Establish Foundation

TRACK 2
Identify Transformative Concepts & Applications

TRACK 3
Analyze & Evaluate Transformative Concepts and Applications

TRACK 1 | Deliverables

- State of the Practice Assessments (5)
- BAA Research Reports (7)
- Performance Measures White Paper
- Standards White Paper

TRACK 2 | Deliverables

- Initial Transformative Concepts (TCs)
- TCs/Applications Tech Report
- Initial Benefit/Cost Analysis Report
- Selected TCs/Applications Tech Report

TRACK 3 | Deliverables

- TCs/Applications Evaluation Plan
- Model Development Tech Report
- Baseline BCA Tech Report
- Prototype Evaluation Report
- Final Evaluation Report

TC Down Selection Questions

- Does the TC utilize connected vehicle technologies (i.e., V2V, V2I)?
- Are the environmental and transportation data required to model the TC readily available or could data be easily collected?
- Are algorithms in place – or could algorithms be developed with minimum to moderate effort – to model the applications identified in the TC?
- Could the TC be accurately modeled using existing behavioral, traffic simulation, and/or environmental models?
- Does the TC have the potential to yield significant environmental benefits?
- If research indicates that significant environmental benefits can be achieved, what is the likelihood that the TC would be deployed in the future?
- What is the role of the USDOT and state/local government in implementing the TC?
- Would 'good' modeling results justify further USDOT research investments in the TC?

Contact

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Vision for the Future

“A lot can change in 30 years…”

Do You Remember…

Do You Remember When You… (1980)	Now You… (2010)
▪ Went to the library, used the Dewey Decimal System, and paged through an encyclopedia for a research paper	▪ Perform an internet search over the internet on your computer and have information instantly
▪ Used a pay phone to contact someone while away from home	▪ Text, email, or use social media on your smart phone from a coffee shop
▪ Played video games using a keyboard or joystick with one button	▪ Play video games without any controllers against someone in England
▪ Flipped through a paper television guide to find out when a program would air	▪ Use the guide built-in to a digital video recorder to record television programs and update your recordings from your smart phone
▪ Went to the record store to buy a vinyl album and played it on your record player	▪ Download the latest album and listen to it on your mp3 player
▪ Used a map to determine how to get somewhere	▪ Use your navigation system in your car, equipped with real-time traffic information

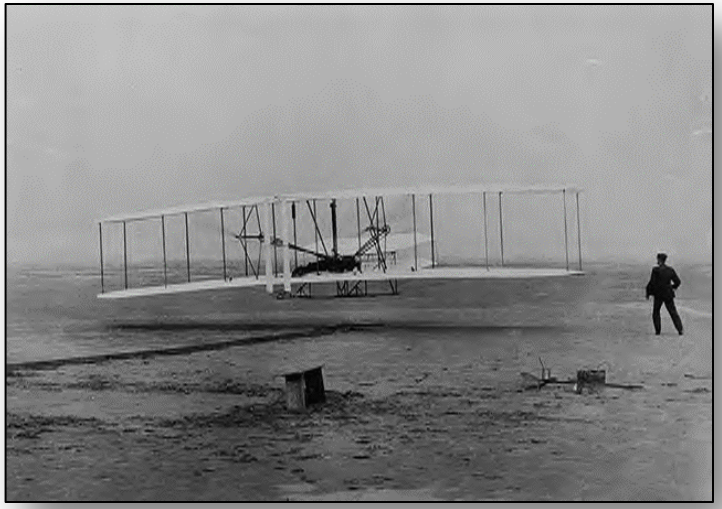
Mobility in the Future

Over the past century, science fiction has proposed some pretty cool forms of mobility:

- Jet packs for human flight
- Flying cars
- Transporters for human travel
- Space ships traveling between Universes

The Impossible

There have been times where we have taken on the impossible and surprised ourselves…



The Wright Brothers (1903)[1]

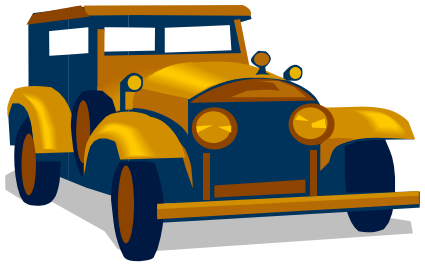
Man Walks on the Moon (1969)[2]

It took only 66 years to go from the Wright Brothers' first flight to Man walking on the Moon

Source: (1) http://www.nasa.gov/images/content/206308main_image_976_946-710.jpg
(2) http://www.nasa.gov/centers/marshall/moonmars/apollo40/apollo11_moonwalk.html

The Automobile Over Time

The automobile has had the same fundamental design for over 120 years



1930s

1960s

1950s

1980s

2000s

Source: © 2011 Microsoft Corporation

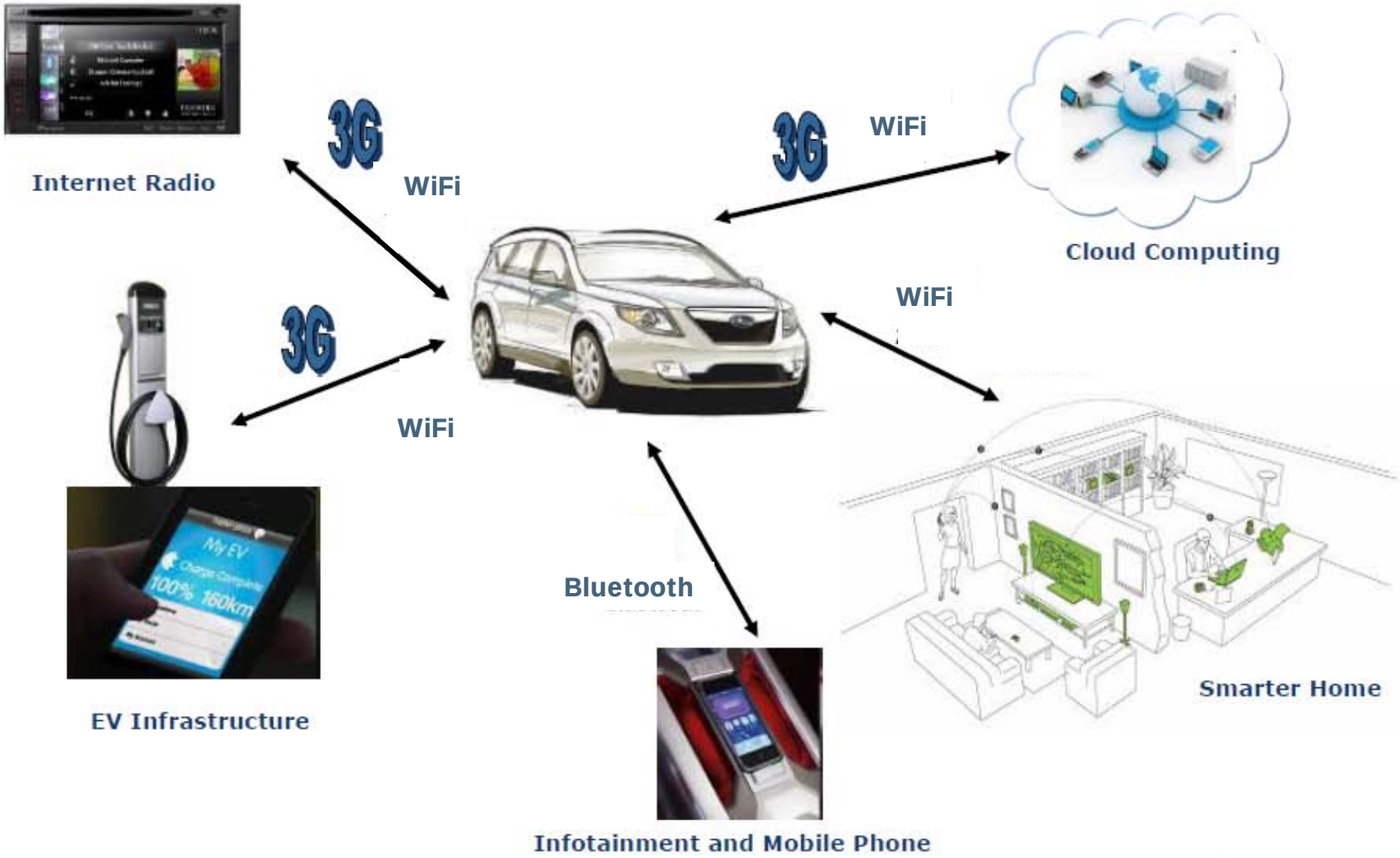
“Cars of the Future” are Here Today

- **Nissan LEAF** ™
  - 100% Electric, Zero Emissions Vehicle
  - LEAF = Leading, Environmentally friendly, Affordable, Family car
  - Introduced in Japan and the U.S. in December 2010
  - Produces no tailpipe pollution or GHG emissions during operation

- **Toyota Prius** ™
  - Hybrid Electric Vehicle with a gasoline engine and an electric motor
  - First sold in Japan in 1997 and introduced worldwide in 2001
  - Sold in more than 70 countries
  - Rated as among the cleanest vehicles sold in the U.S.

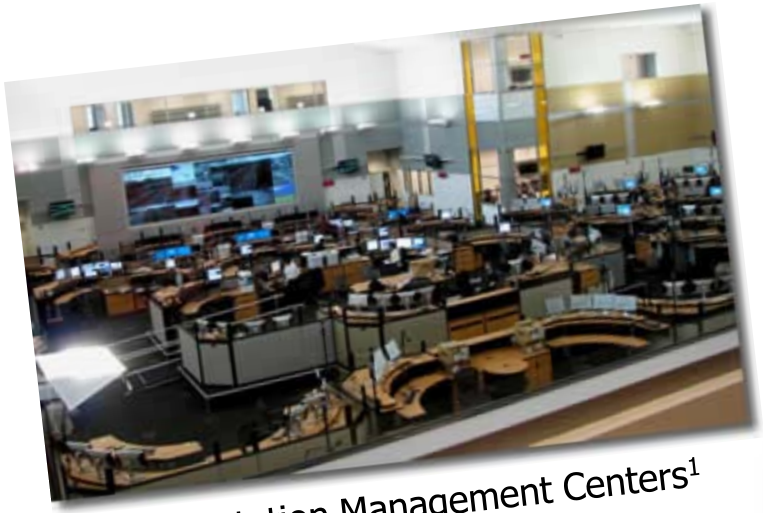
- **Chevrolet Volt** ™
  - Plug-in Hybrid Electric Vehicle that utilizes rechargeable batteries and a gasoline engine
  - On the U.S. market since December 2010
  - Regenerative braking contributes to on-board electricity generation
  - Rated as the most fuel-efficient compact car sold in the U.S.

Connected Mobility

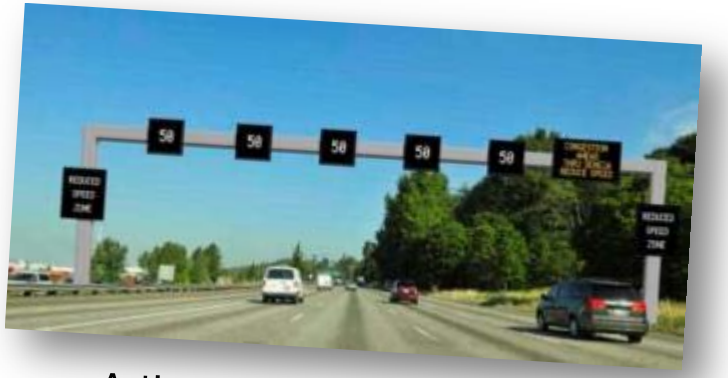


Source: Adapted from Frost & Sullivan's - EDTA Presentation, April 19, 2011

Intelligent Transportation Systems



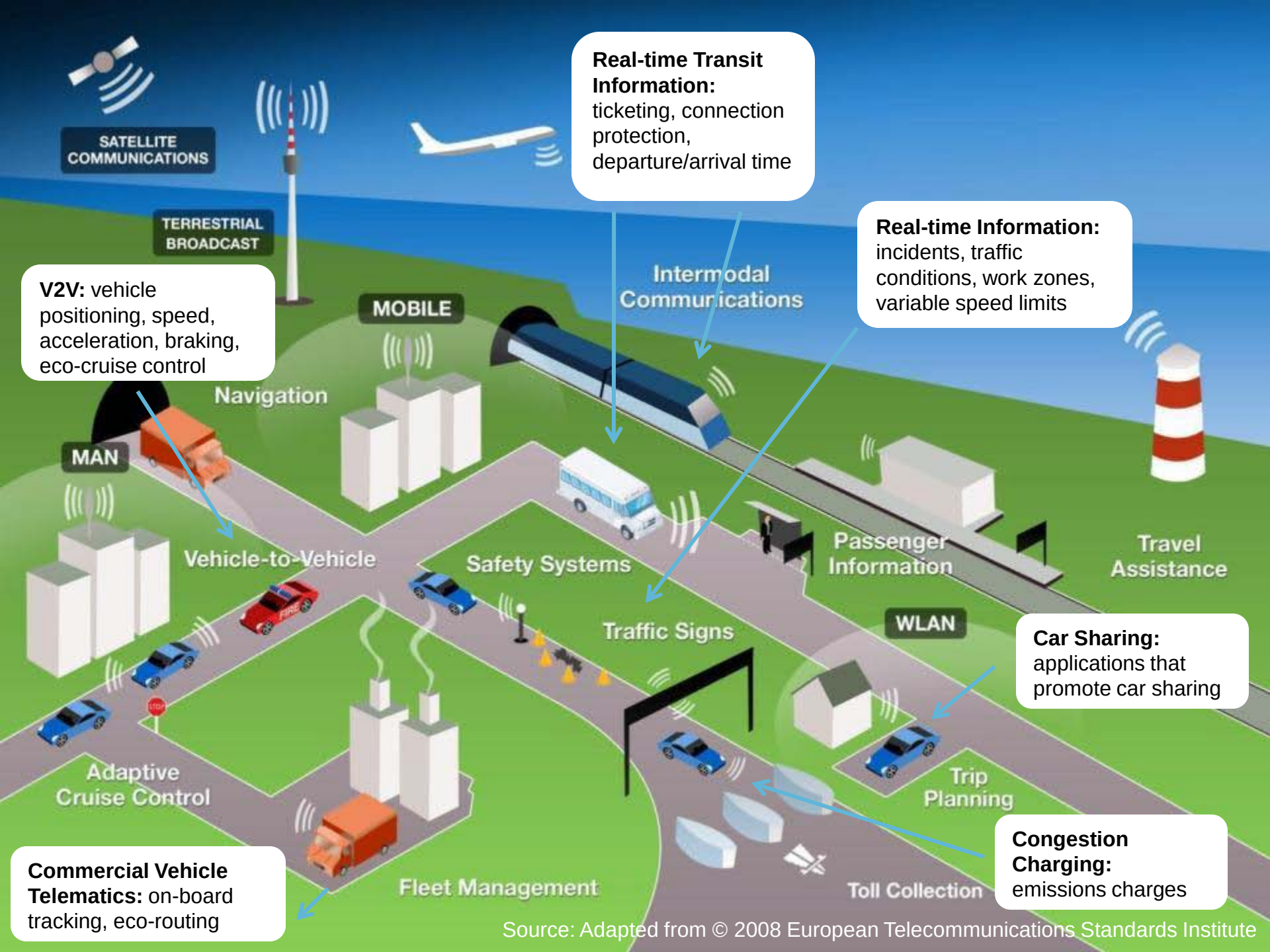
Transportation Management Centers[1]



Active Traffic Management[2]

Electronic Toll Collection[3]

Source: (1) http://www.openroadsconsulting.com/images/pstoc.jpg
(2) http://www.wsdot.wa.gov/NR/rdonlyres/EF056266-AC13-4A6A-B8B1-07D0E88E8129/0/ATM_1ststep.jpg
(3) http://www.its.dot.gov/image_gallery/images/Image10.jpg



Source: Adapted from © 2008 European Telecommunications Standards Institute

Green Transportation + Technology = ?

Where can we go in the next 30 years?

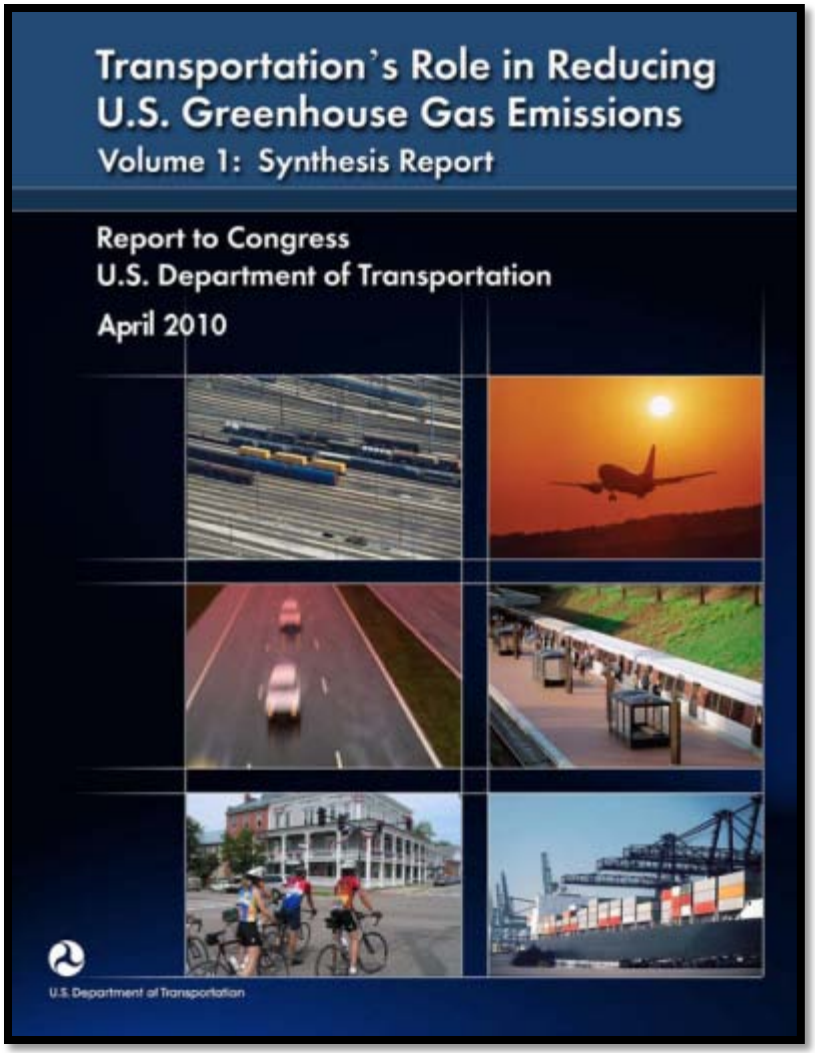
BREAK

AERIS Transformative Concepts

U.S. DOT Report to Congress, 2010

- Optimize design, construction, operation, and use of transportation networks for GHG emissions reductions

- Benefits:
  - Reduced congestion
  - Reduced travel time
  - Reduced travel costs
  - Economic benefits



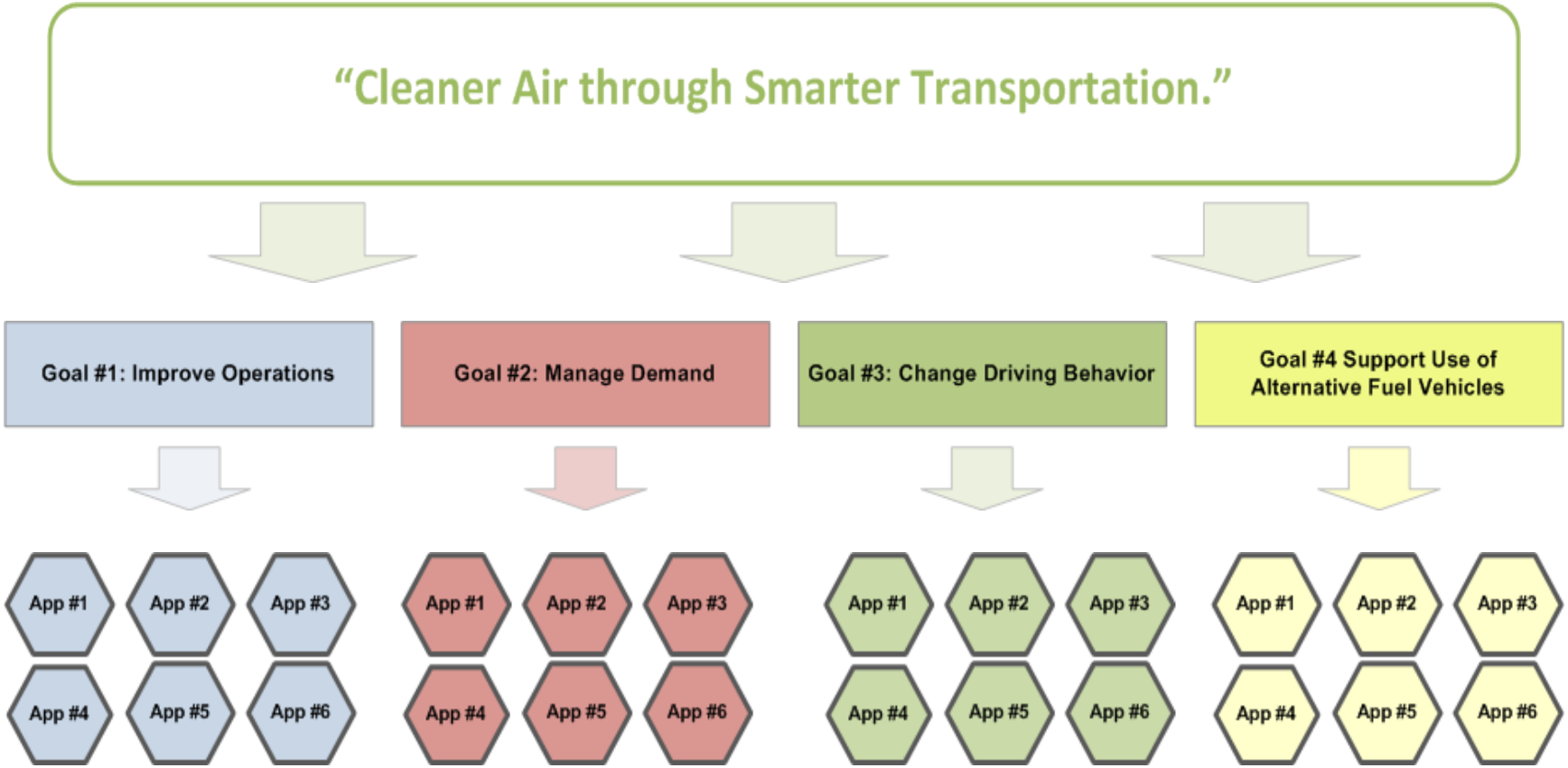
System Efficiency | Combined 3-6% GHG ↓

Strategy	2030 Reduction	Key assumptions
Traffic management	<0.1-0.5%*	Signal coordination, faster clearance of incidents, ramp metering
Real-time traveler information	<0.1%*	Electronic message boards, 511, web
Highway bottleneck relief	<0.1-0.3%	Improve top 100-200 bottlenecks by 2030
Reduced speed limits	1.1-1.8%	55mph national speed limit
Truck idling reduction	0.1-0.2%	26-100% of sleeper cabs with one board idle reduction tech
Freight rail and marine operations	0.1-0.5%	Reduce rail chokepoints, shore-side power for ships, reduce VMT in intermodal terminal, limited modal diversion
Air traffic operations	0.3-0.7%	Airport efficiency, direct routing, reduced separation, continuous descents
Construction materials	0.7-0.8%**	Recycled material in cement, low temp asphalt
Other	0.3%	Truck size and weight, freight urban consolidation centers, transportation agency energy efficient buildings, alt fuel fleet and construction vehicles
Combined Strategies	3-6%	

Travel Activity | Combined 5-17% GHG ↓

Strategy	2030 Reduction	Key Assumptions
Pay as you drive insurance	1.1-3.5%	Require states to allow (low) Require companies to offer (high)
Congestion pricing	0.4–1.6%	LOS D on all roads (avg 65c/mi for 29% of urban and 7% of rural VMT)
Public transportation	0.2-0.9%	2.4-4.6% annual increase in service
Non-motorized travel	0.2-0.6%	Comprehensive urban bike/ped improvements 2010-2025
Land use	1.2-3.9%	60-90% of new urban growth in approx. >5 units/acre
Parking management	0.2%	Downtown workers pay for parking ($5/day avg. for those not already paying)
Commuter / worksite trip reduction	0.1-0.6%	Widespread employer outreach and alternative mode support
Telework / compressed work week	0.5-0.7%	Doubling of current levels
Individualized marketing	0.3-0.4%	Reaches 10% of population
Eco-driving	0.8-4.3%	10-50% of drivers reached, half implement
Combined Strategies	5-17%	Does not include interactive effects. Includes induced demand.
VMT fee (not included above)	1.1-3.5%	2 to 5 cents per mile

How We Got Here



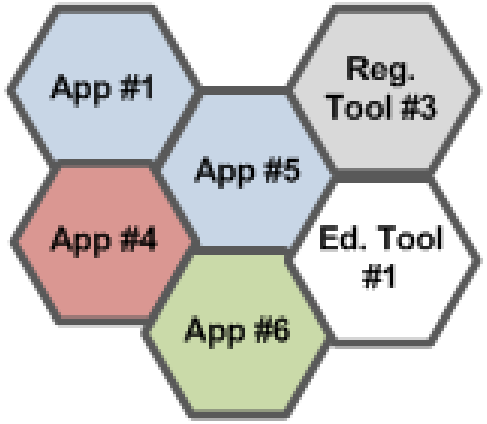
We need truly innovative approaches to transform the environmental footprint of the transportation system

AERIS Transformative Concepts

- Integrated operational concepts that use vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and other data and communications in **innovative ways** to operate surface transportation networks **to reduce environmental impacts resulting from transportation-related emissions and fuel consumption**.

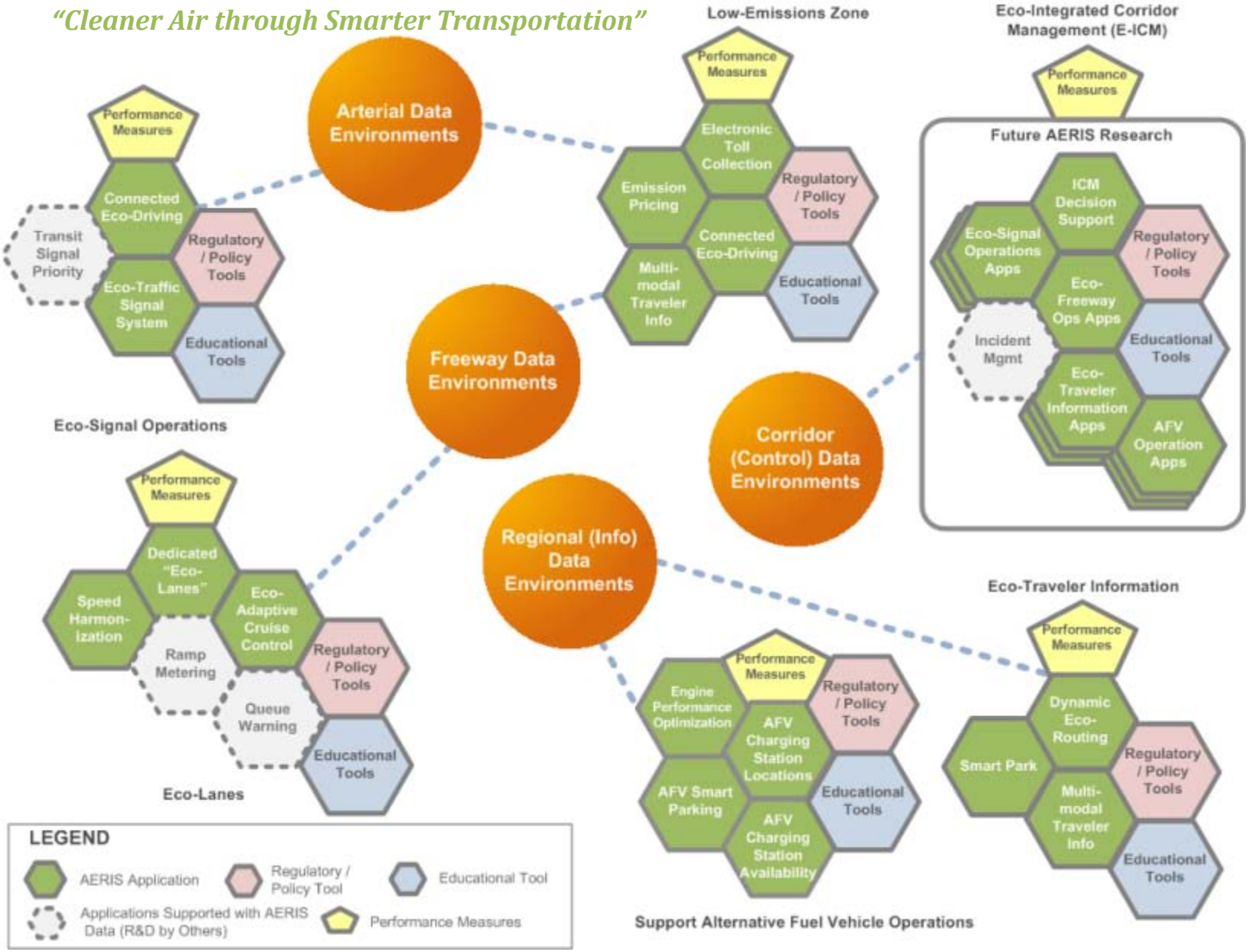
- Transformative Concepts are intended to change the way transportation systems operate, with an emphasis on **combining applications to provide significant environmental benefits** to surface transportation networks.

AERIS Transformative Concept



AERIS TRANSFORMATIVE CONCEPTS

"Cleaner Air through Smarter Transportation"



AERIS Transformative Concepts | Context

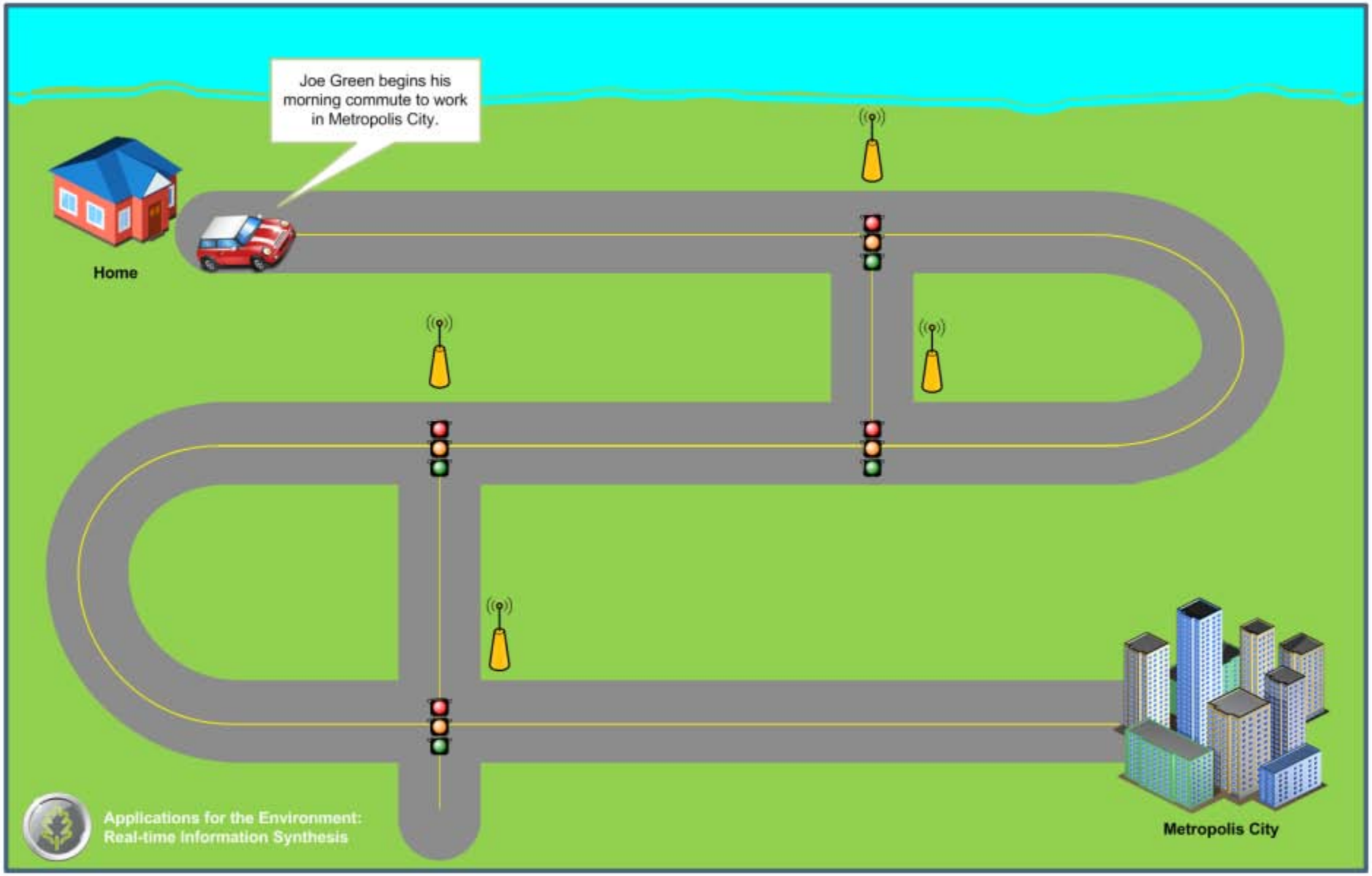
- AERIS Transformative Concepts are scalable; varying in complexity, geographic limits, and deployment timeframes (30+ years in some cases).
- AERIS Transformative Concepts consider multi-modal applications understanding that significant environmental benefits can be achieved by transit and freight communities.
- AERIS Transformative Concepts include technical, policy, and other issues.
- At this time, AERIS Transformative Concepts are not recommendations for deployment.
- AERIS Transformative Concepts are “modeling scenarios” developed to: (1) determine potential environmental benefits, (2) understand mobility trade-offs, (3) assess data needs and availability of data within a connected vehicle environment, and (4) facilitate development/enhancement of environmental algorithms.

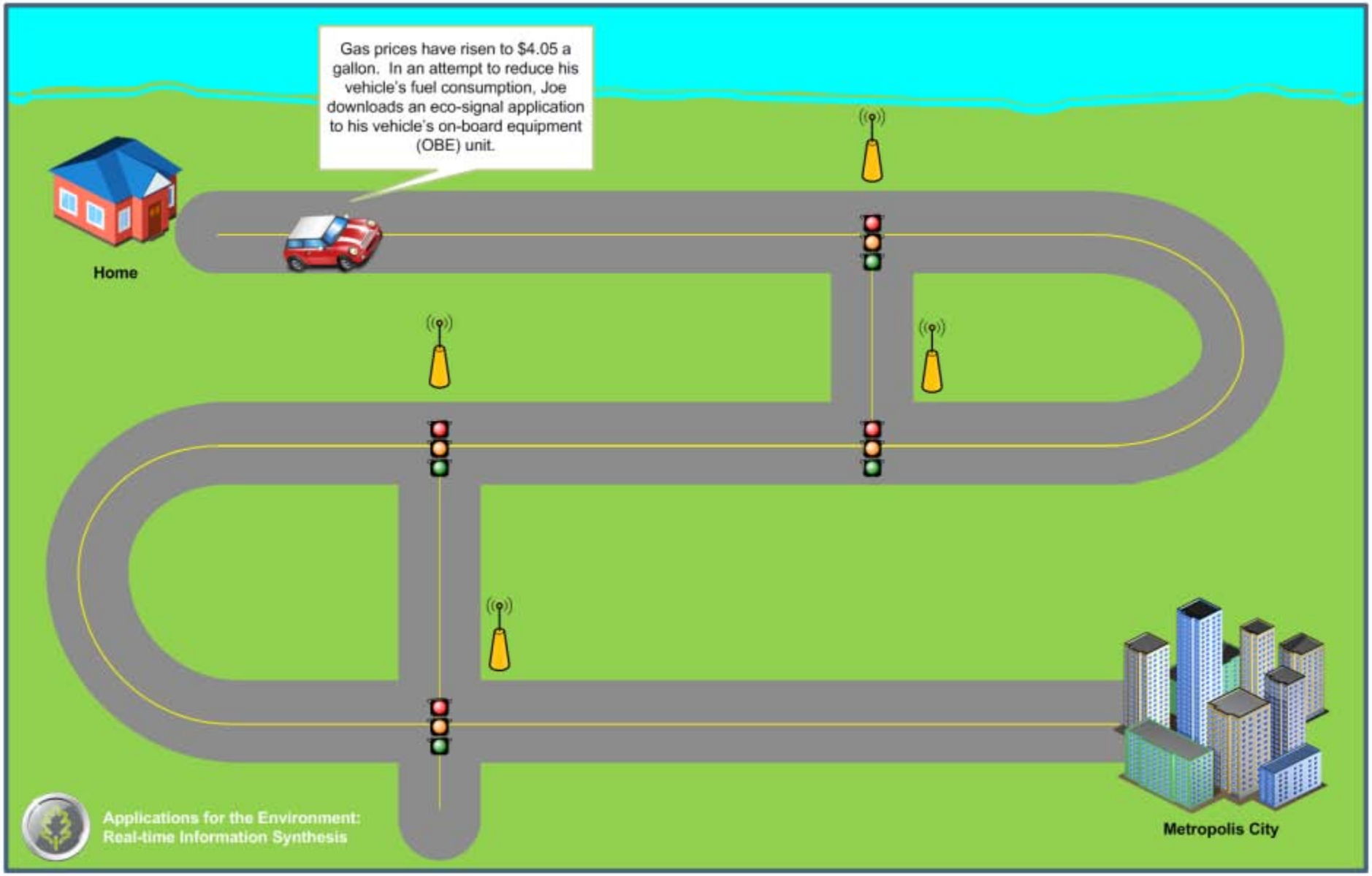
ECO-SIGNAL OPERATIONS

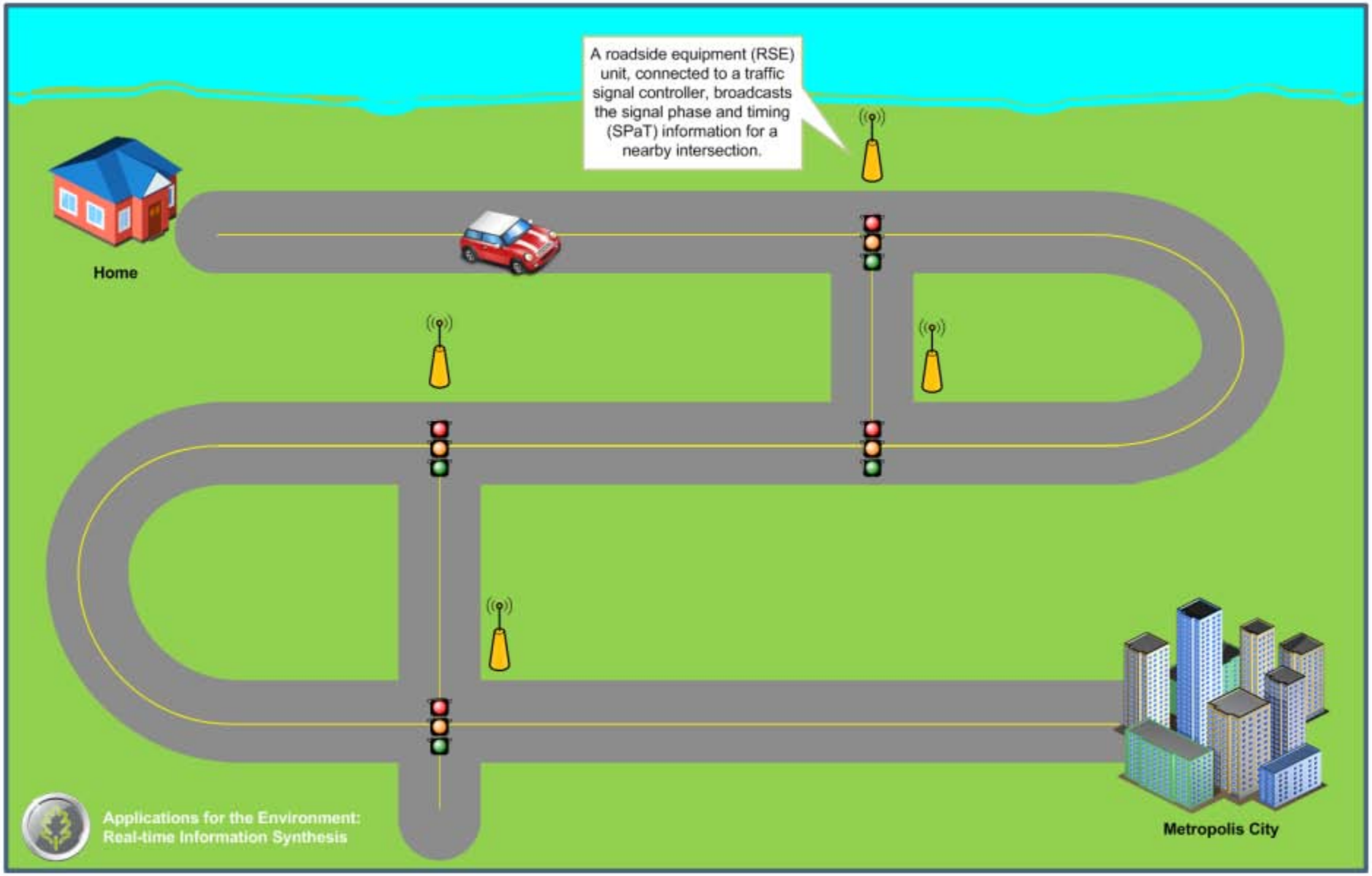
Transformative Concept | Eco-Signal Operations

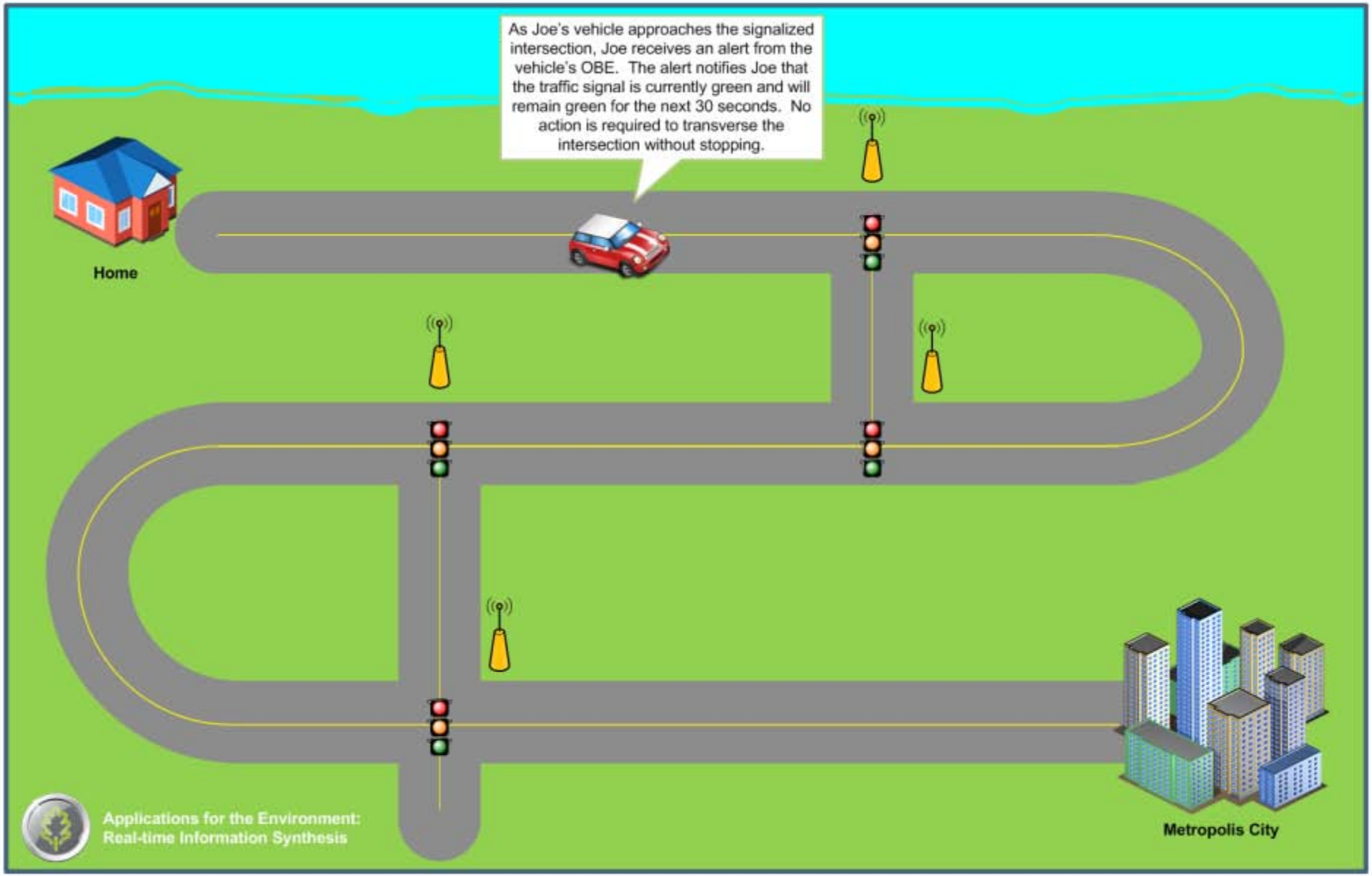
- This Transformative Concept includes the use of connected vehicle technologies to decrease GHGs and criteria air pollutant emissions on arterials by **reducing idling, reducing the number of stops, reducing unnecessary accelerations and decelerations, and improving traffic flow at signalized intersections.**

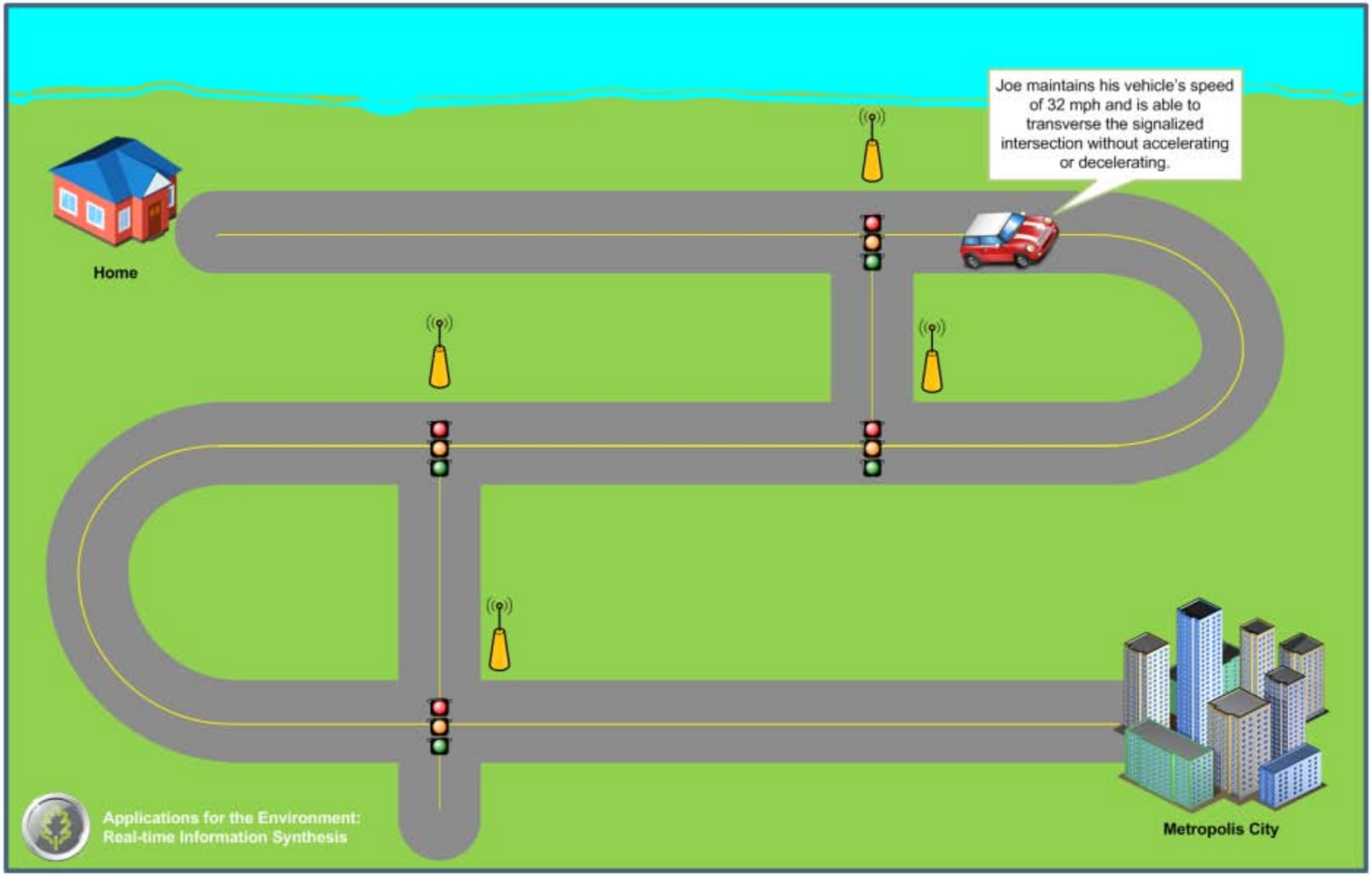
- This Transformative Concept:
  - Utilizes Dedicated Short Range Communication (DSRC) among enabled vehicles and roadside infrastructure.
  - Includes broadcasting **signal phase and timing (SPaT)** data to vehicles.
  - Includes **eco-traffic signal system** applications that would use real-time data collected from vehicles **to optimize traffic signals for the environment**.
  - Supports transit signal priority (TSP) applications.

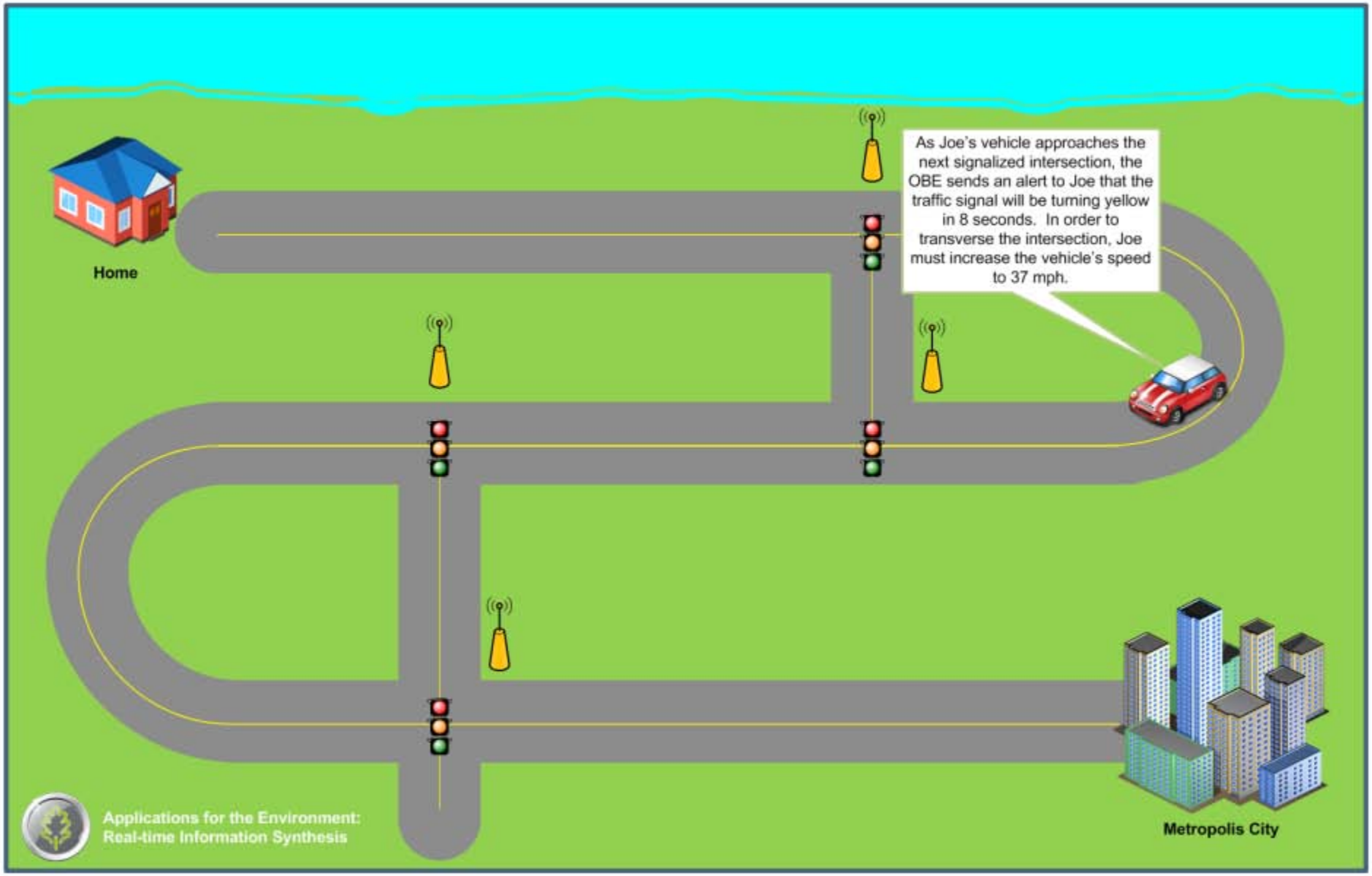

Joe Green begins his morning commute to work in Metropolis City.
Home
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

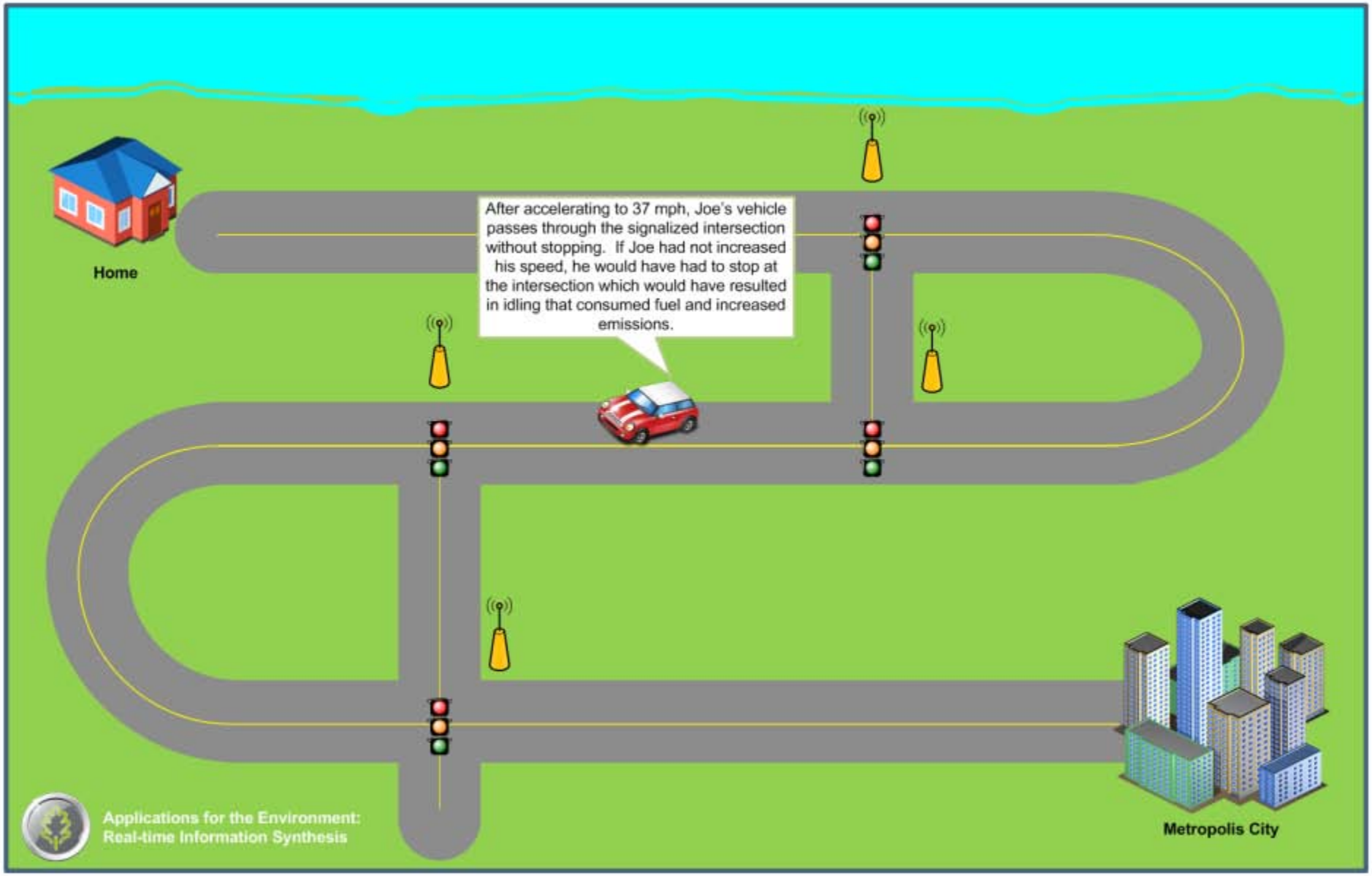

Gas prices have risen to $4.05 a gallon. In an attempt to reduce his vehicle's fuel consumption, Joe downloads an eco-signal application to his vehicle's on-board equipment (OBE) unit.
Home
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

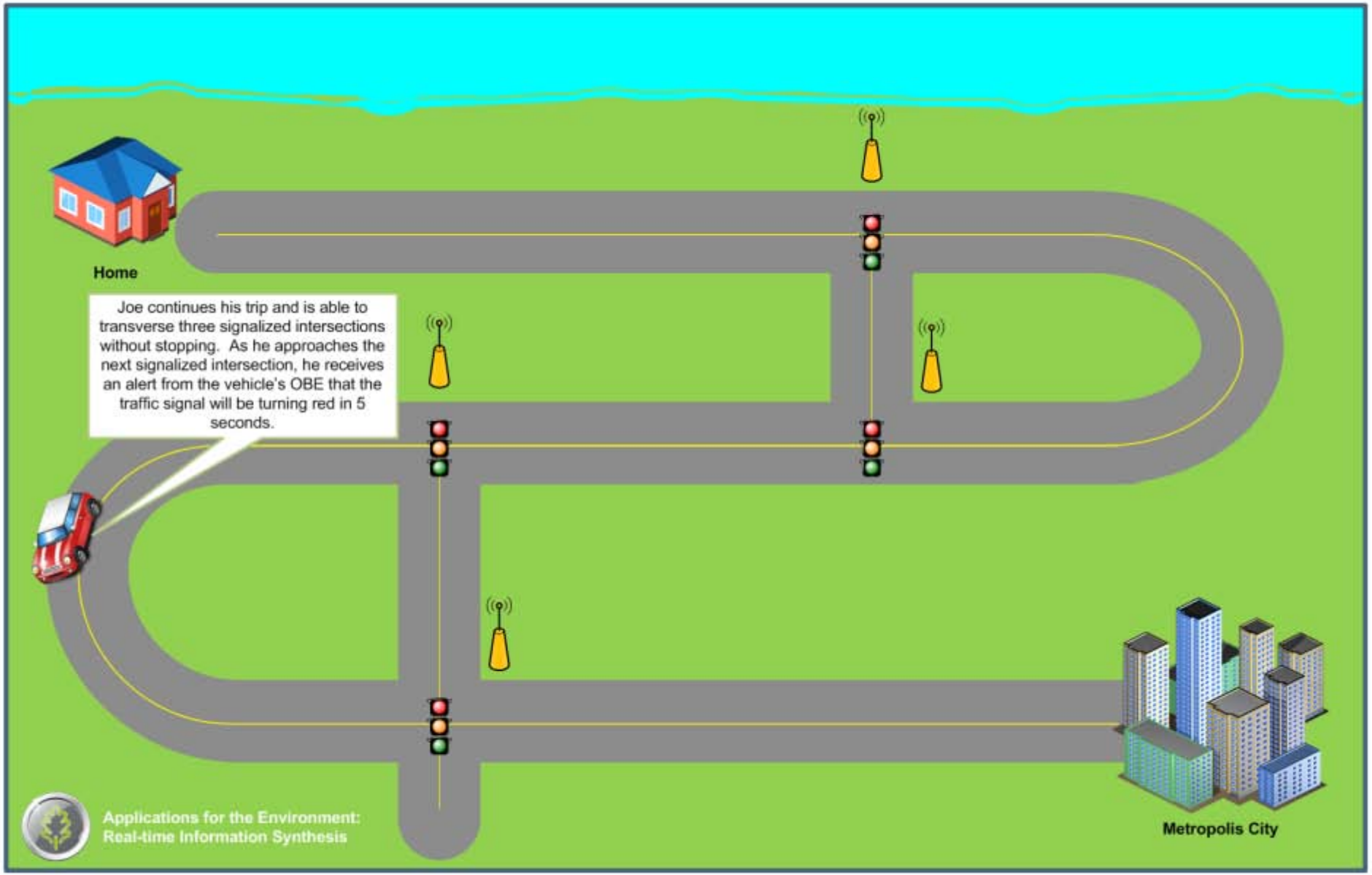

A roadside equipment (RSE) unit, connected to a traffic signal controller, broadcasts the signal phase and timing (SPaT) information for a nearby intersection.
Home
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

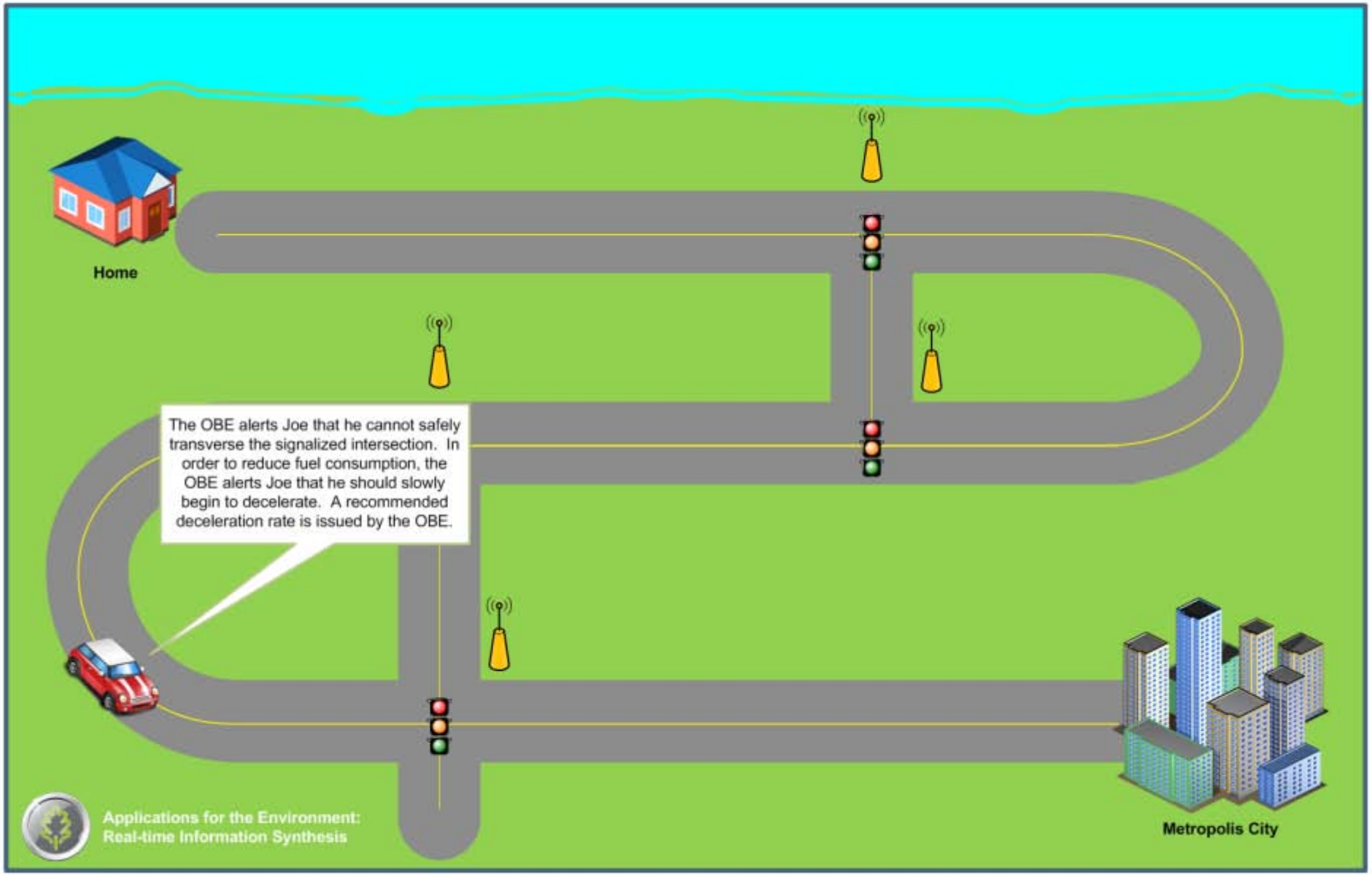

As Joe's vehicle approaches the signalized intersection, Joe receives an alert from the vehicle's OBE. The alert notifies Joe that the traffic signal is currently green and will remain green for the next 30 seconds. No action is required to transverse the intersection without stopping.
Home
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

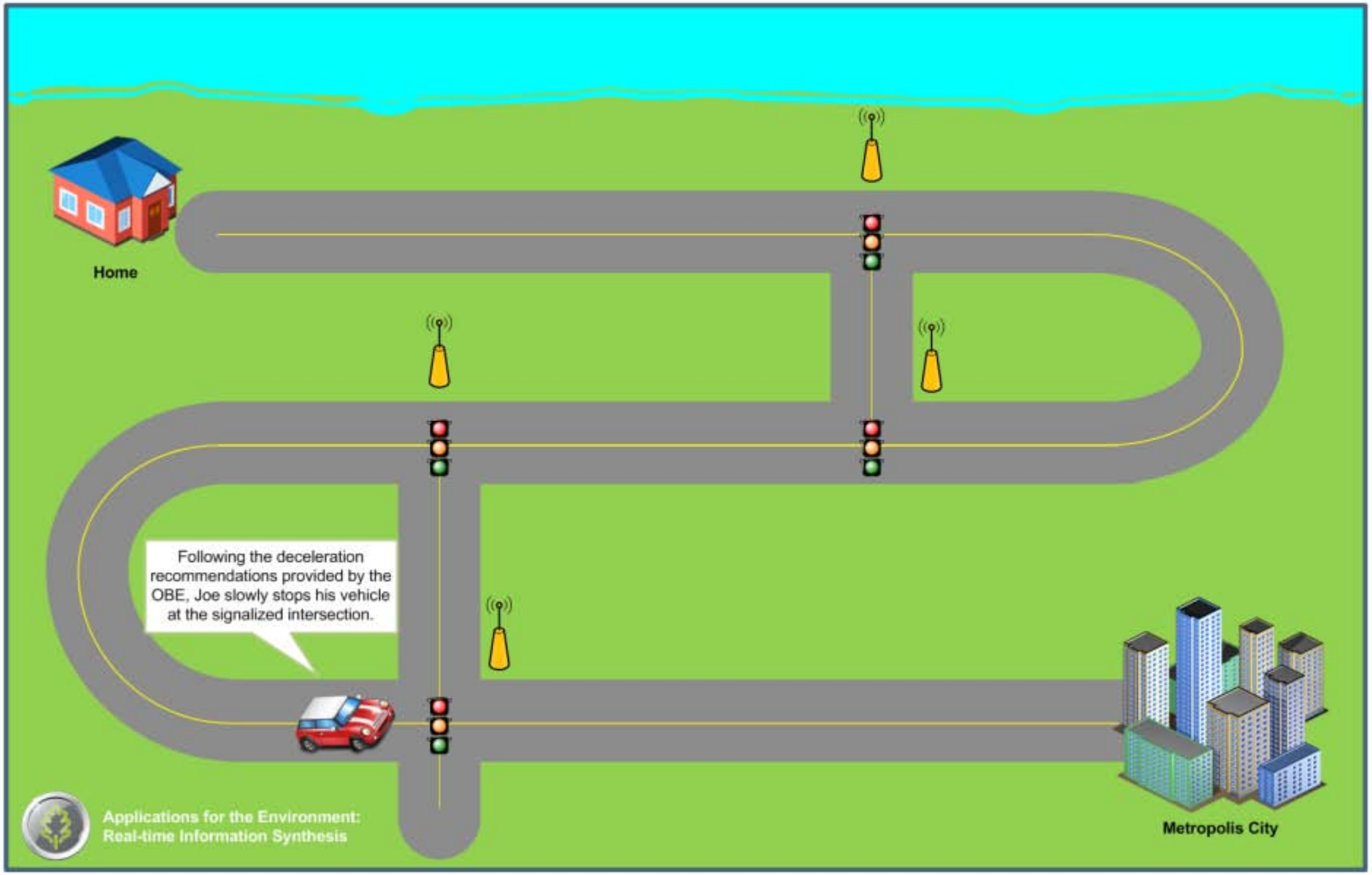

Joe maintains his vehicle's speed of 32 mph and is able to transverse the signalized intersection without accelerating or decelerating.
Home
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

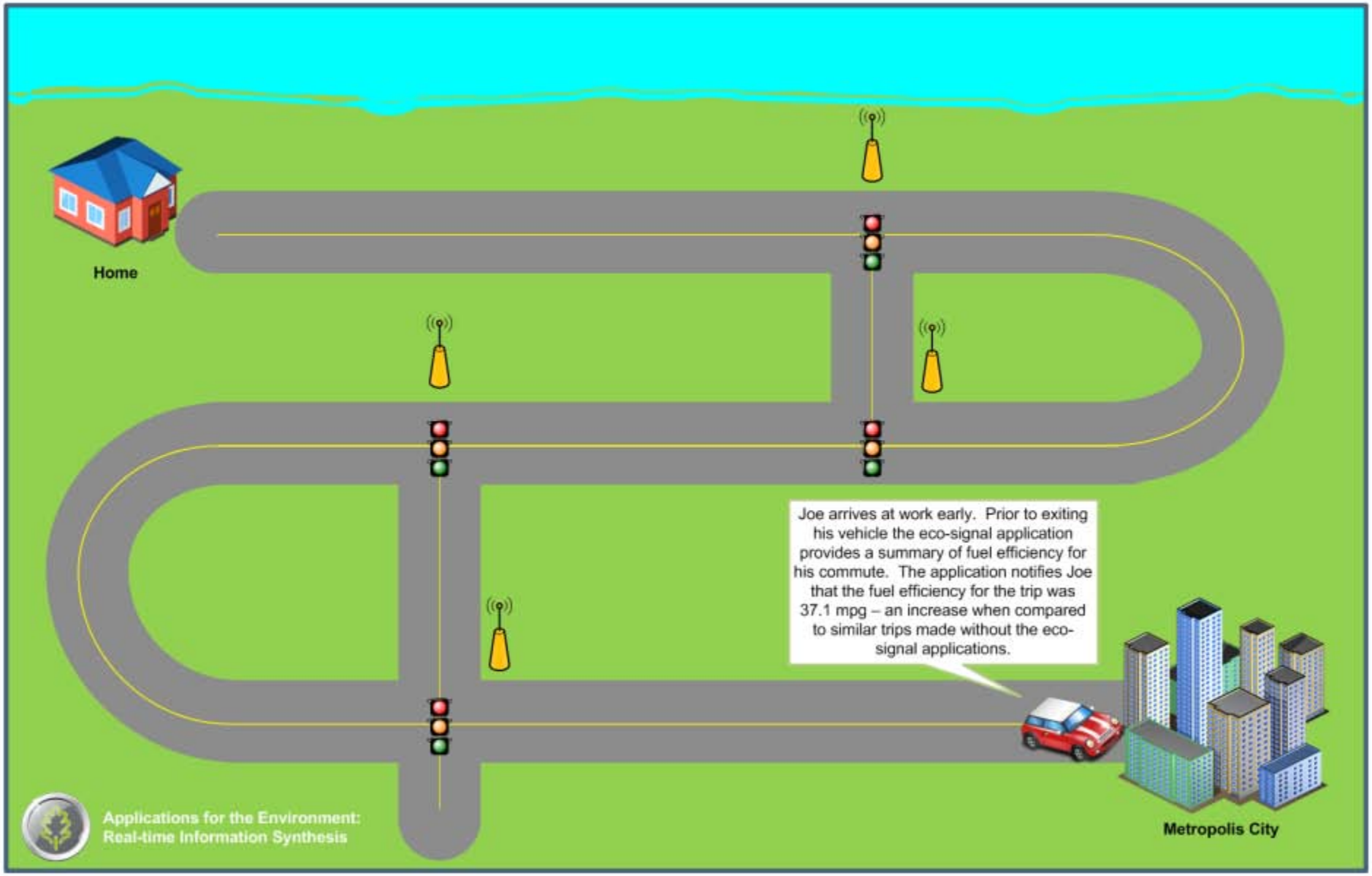

Home
As Joe's vehicle approaches the next signalized intersection, the OBE sends an alert to Joe that the traffic signal will be turning yellow in 8 seconds. In order to transverse the intersection, Joe must increase the vehicle's speed to 37 mph.
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
After accelerating to 37 mph, Joe's vehicle passes through the signalized intersection without stopping. If Joe had not increased his speed, he would have had to stop at the intersection which would have resulted in idling that consumed fuel and increased emissions.
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
Joe continues his trip and is able to transverse three signalized intersections without stopping. As he approaches the next signalized intersection, he receives an alert from the vehicle's OBE that the traffic signal will be turning red in 5 seconds.
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
The OBE alerts Joe that he cannot safely transverse the signalized intersection. In order to reduce fuel consumption, the OBE alerts Joe that he should slowly begin to decelerate. A recommended deceleration rate is issued by the OBE.
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

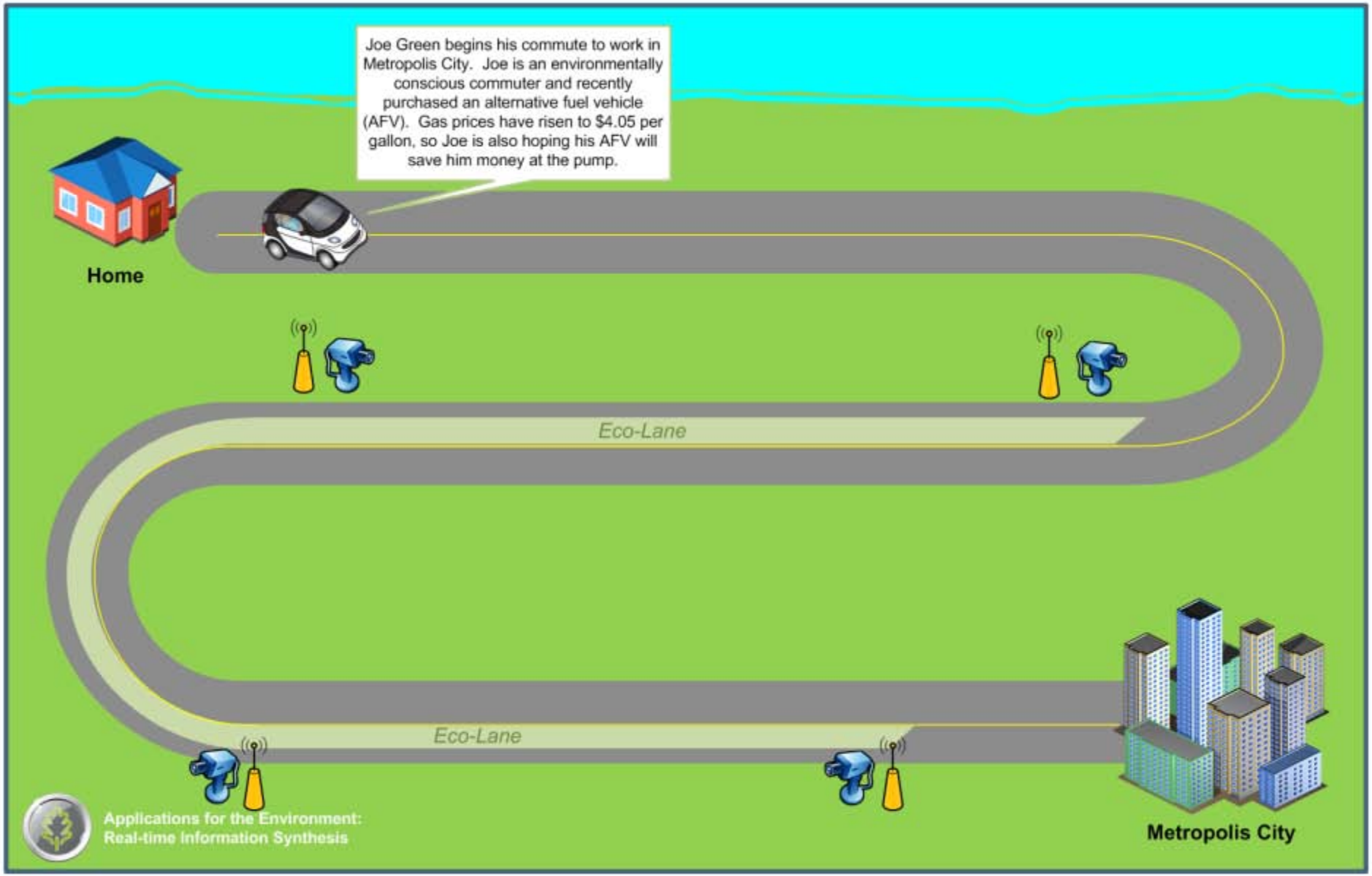

Home
Following the deceleration recommendations provided by the OBE, Joe slowly stops his vehicle at the signalized intersection.
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

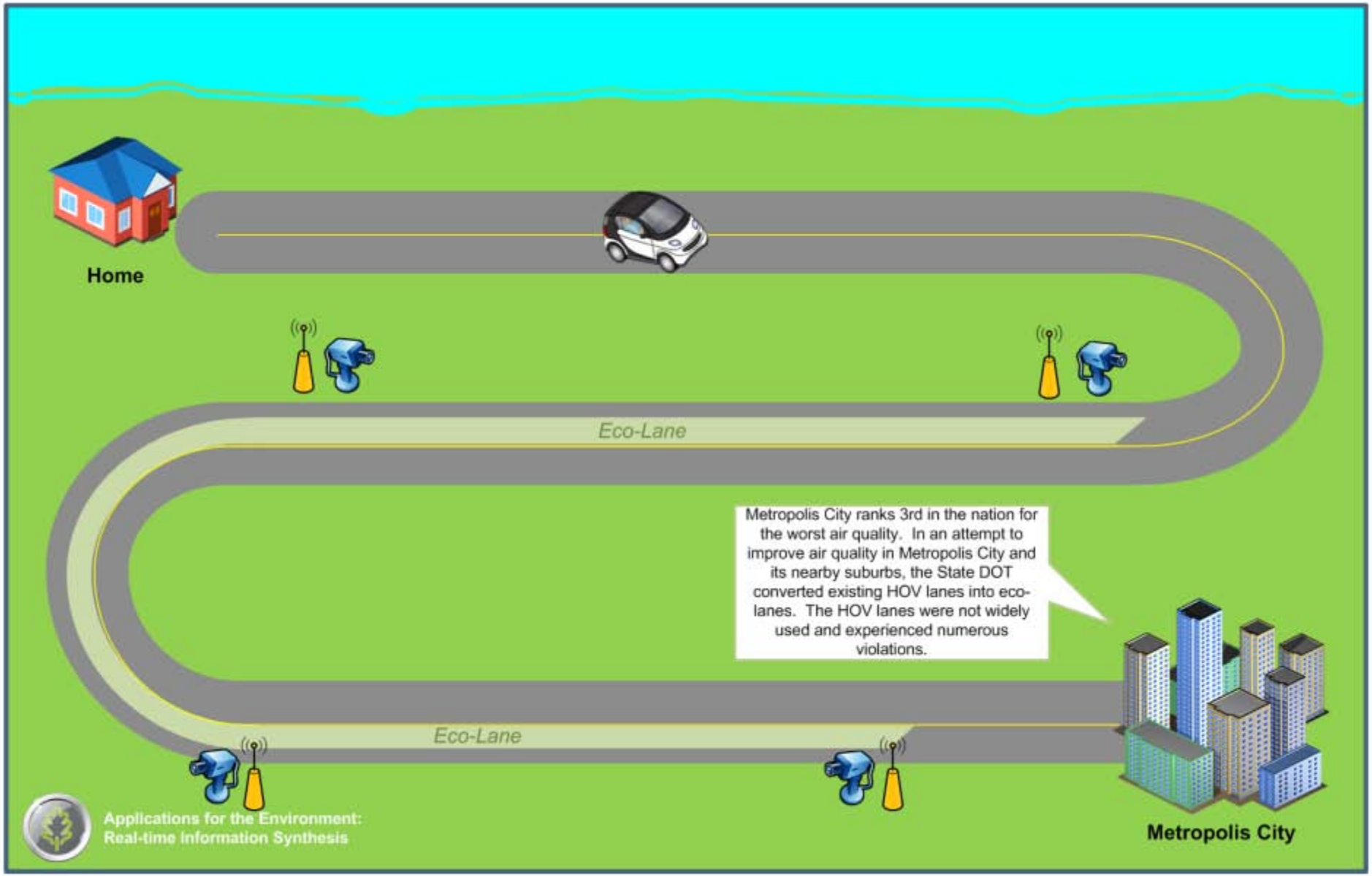

Home
Joe arrives at work early. Prior to exiting his vehicle the eco-signal application provides a summary of fuel efficiency for his commute. The application notifies Joe that the fuel efficiency for the trip was 37.1 mpg – an increase when compared to similar trips made without the eco-signal applications.
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

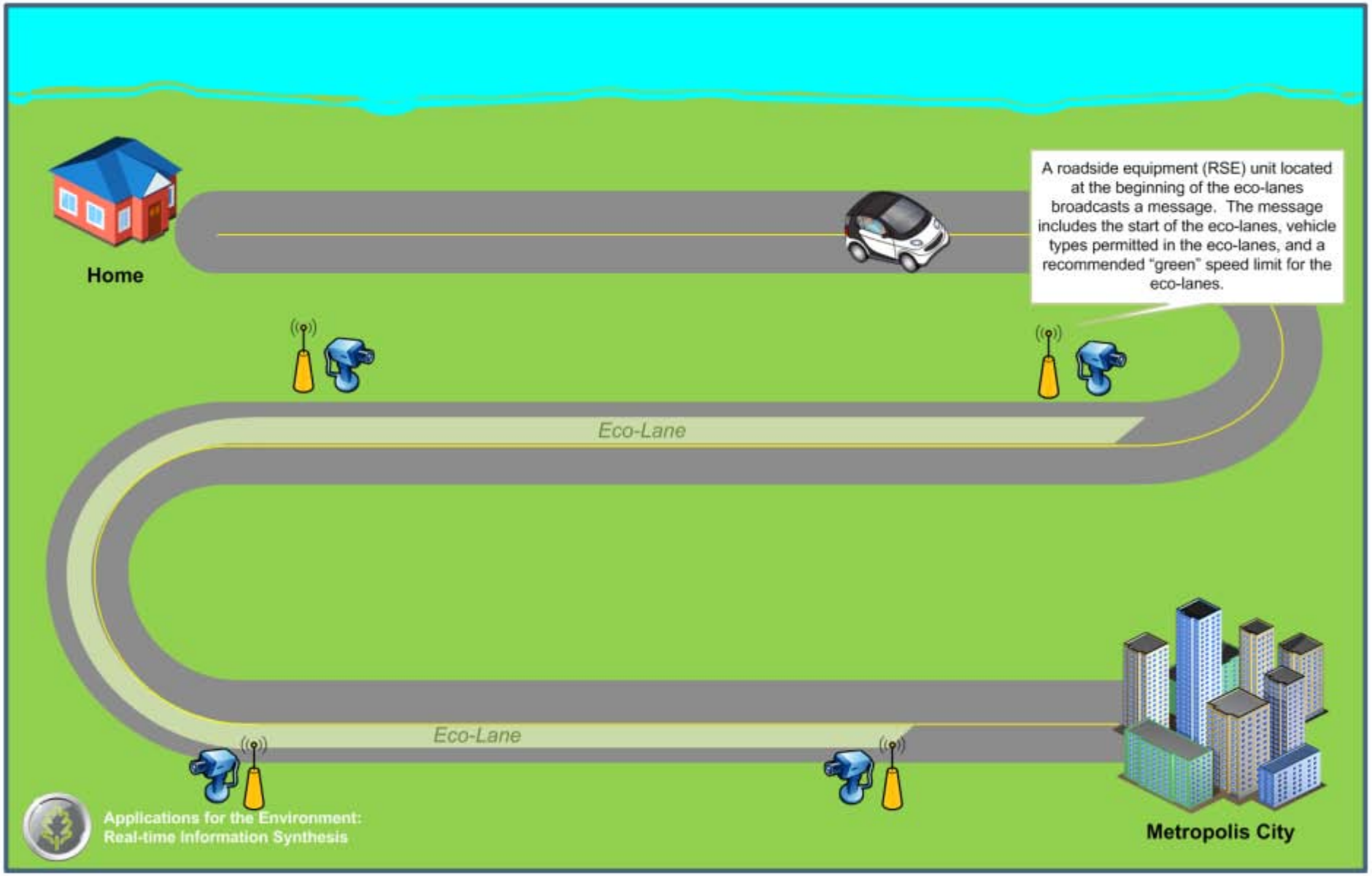
ECO-LANES

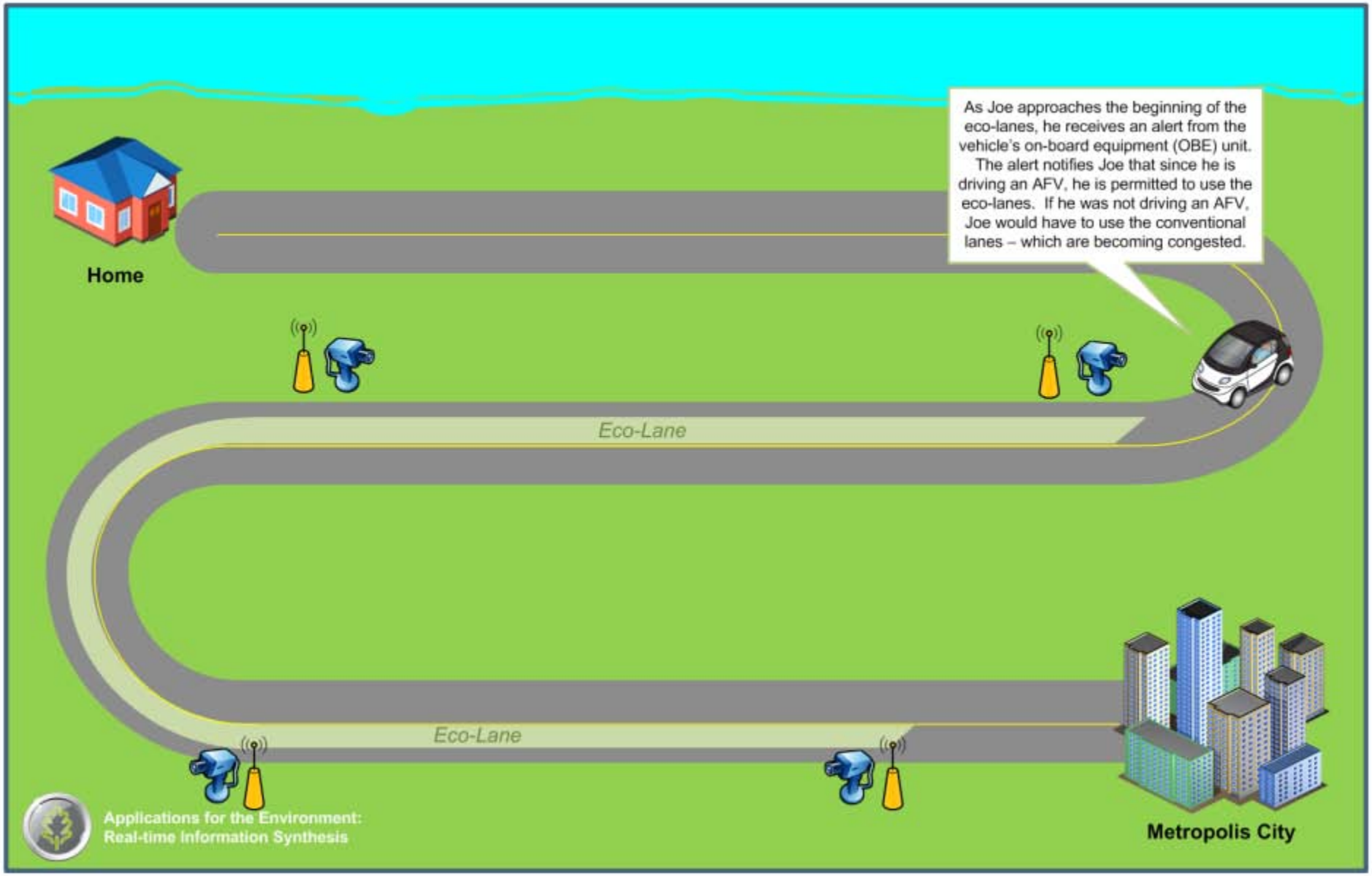
Transformative Concept | Eco-Lanes

- This Transformative Concept includes dedicated eco-lanes on freeways that are optimized for the environment. Drivers would be able to **opt-in to these dedicated lanes to take advantage of eco-friendly applications**.
- Low emission, high-occupancy, freight, transit, and alternative fuel vehicles would be encouraged to use these lanes.
- Once in the eco-lanes, drivers would be provided with **recommended or variable speeds optimized for the environment**. Vehicles would be encouraged to drive at these speeds to improve throughput and reduce transportation-related emissions.
- This Transformative Concept also considers **eco-adaptive cruise control** applications. These applications would consider topography, roadway geometry, and vehicle interactions **to determine a driving speed** for a given vehicle that uses the momentum of the vehicle, when suitable, **to avoid unnecessary accelerations and reduce emissions.**

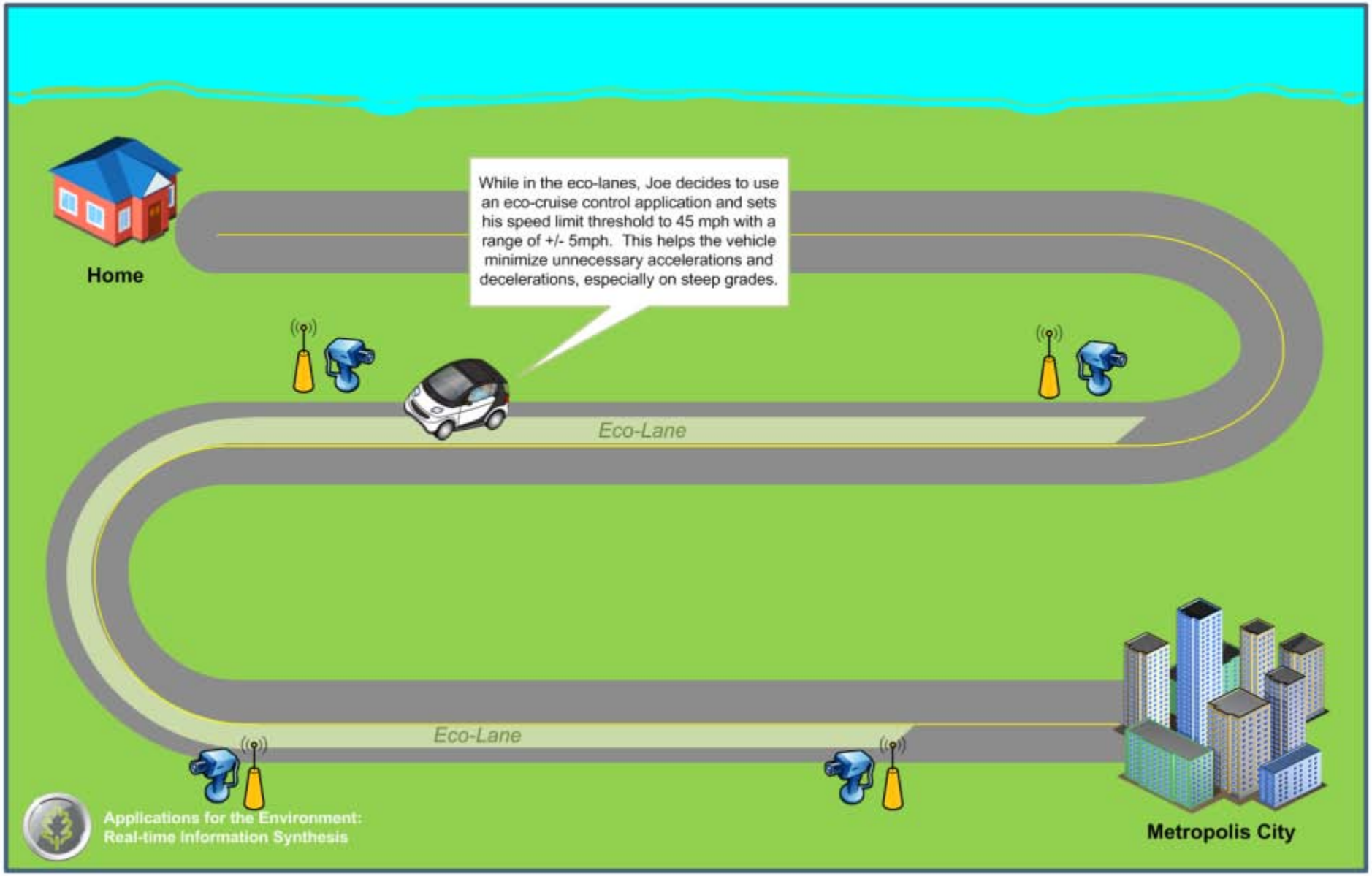

Joe Green begins his commute to work in Metropolis City. Joe is an environmentally conscious commuter and recently purchased an alternative fuel vehicle (AFV). Gas prices have risen to $4.05 per gallon, so Joe is also hoping his AFV will save him money at the pump.
Home
Eco-Lane
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

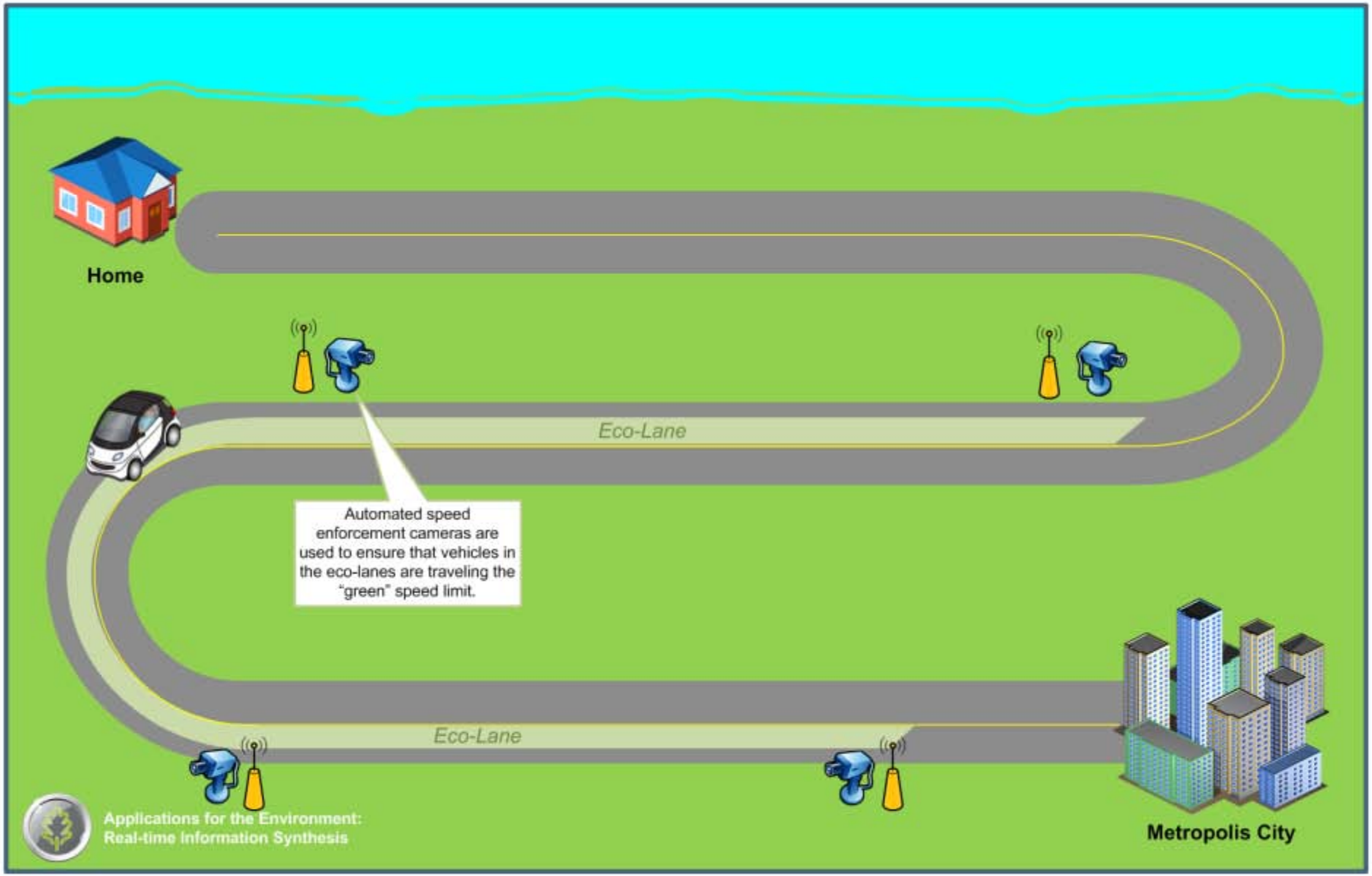

Home
Eco-Lane
Metropolis City ranks 3rd in the nation for the worst air quality. In an attempt to improve air quality in Metropolis City and its nearby suburbs, the State DOT converted existing HOV lanes into eco-lanes. The HOV lanes were not widely used and experienced numerous violations.
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

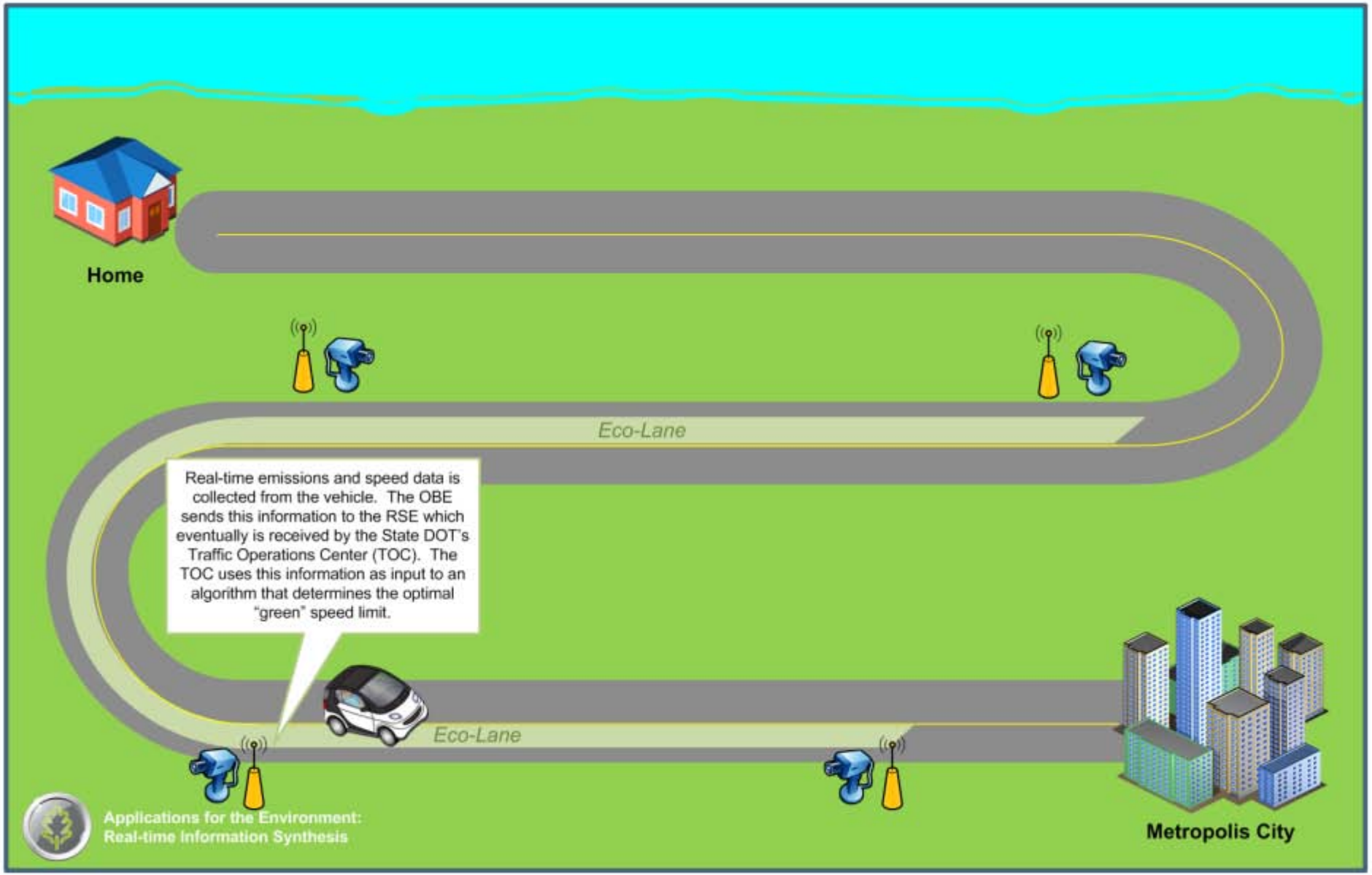

Home
A roadside equipment (RSE) unit located at the beginning of the eco-lanes broadcasts a message. The message includes the start of the eco-lanes, vehicle types permitted in the eco-lanes, and a recommended "green" speed limit for the eco-lanes.
Eco-Lane
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

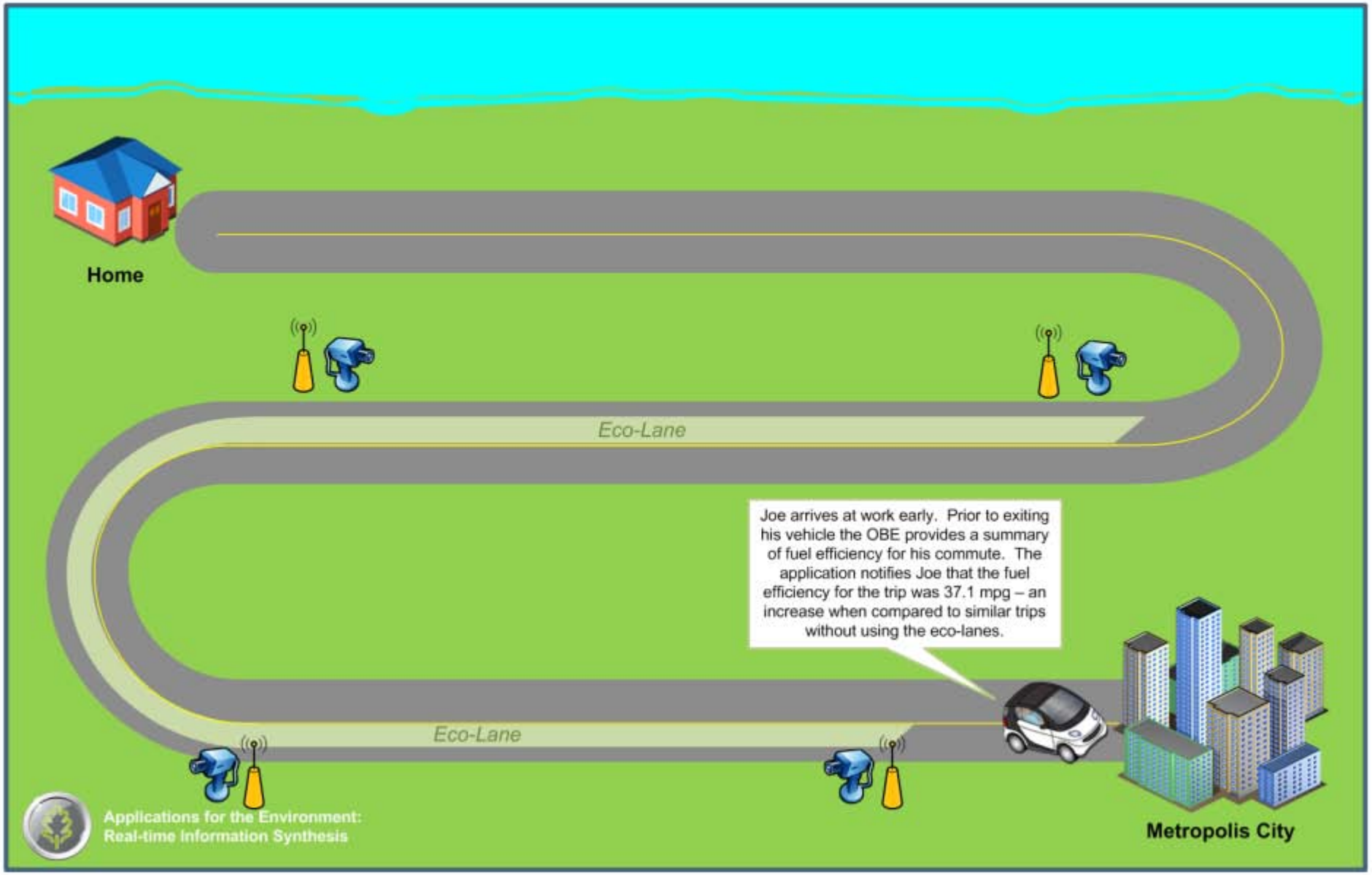

As Joe approaches the beginning of the eco-lanes, he receives an alert from the vehicle's on-board equipment (OBE) unit. The alert notifies Joe that since he is driving an AFV, he is permitted to use the eco-lanes. If he was not driving an AFV, Joe would have to use the conventional lanes – which are becoming congested.
Home
Eco-Lane
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
Once in the eco-lanes, Joe is alerted by his vehicle's OBE that the "green" speed limit is 45 mph – an optimal speed limit determined to reduce fuel consumption and emissions. The speed limit in the conventional lanes is 55 mph.
Eco-Lane
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
While in the eco-lanes, Joe decides to use an eco-cruise control application and sets his speed limit threshold to 45 mph with a range of +/- 5mph. This helps the vehicle minimize unnecessary accelerations and decelerations, especially on steep grades.
Eco-Lane
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
Eco-Lane
Automated speed enforcement cameras are used to ensure that vehicles in the eco-lanes are traveling the "green" speed limit.
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

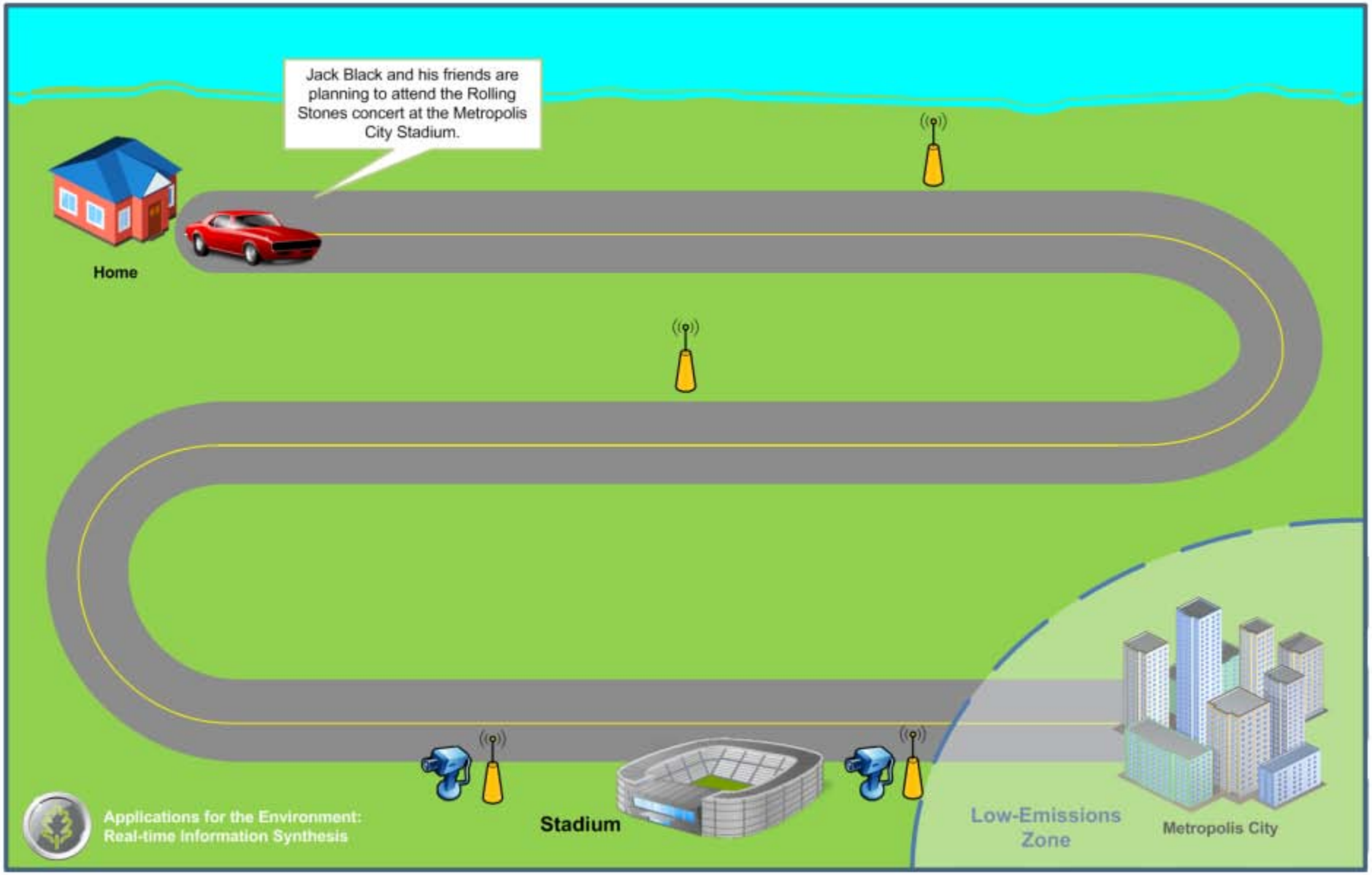

Home
Eco-Lane
Real-time emissions and speed data is collected from the vehicle. The OBE sends this information to the RSE which eventually is received by the State DOT's Traffic Operations Center (TOC). The TOC uses this information as input to an algorithm that determines the optimal "green" speed limit.
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

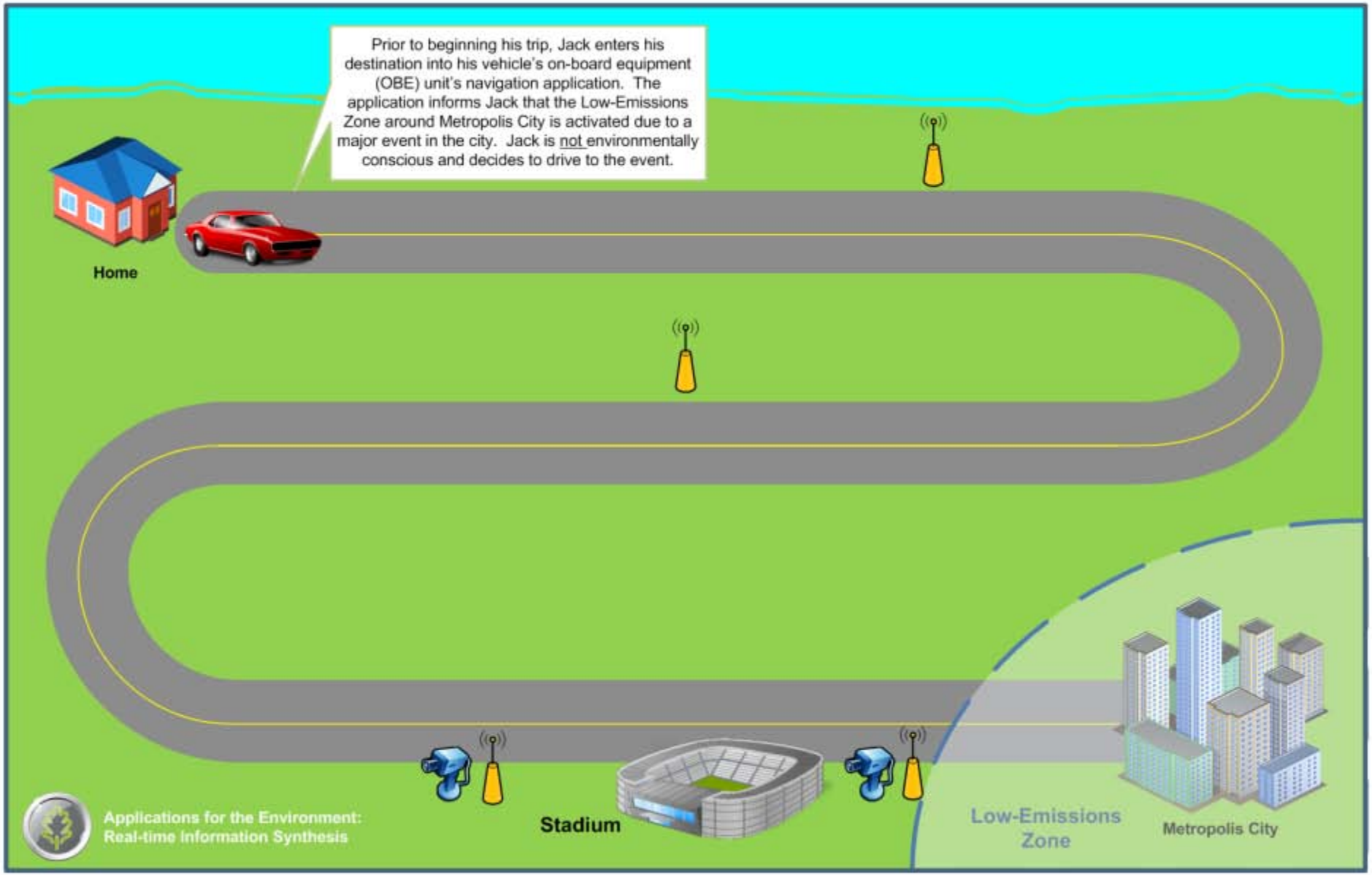

Home
Eco-Lane
Joe arrives at work early. Prior to exiting his vehicle the OBE provides a summary of fuel efficiency for his commute. The application notifies Joe that the fuel efficiency for the trip was 37.1 mpg – an increase when compared to similar trips without using the eco-lanes.
Eco-Lane
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

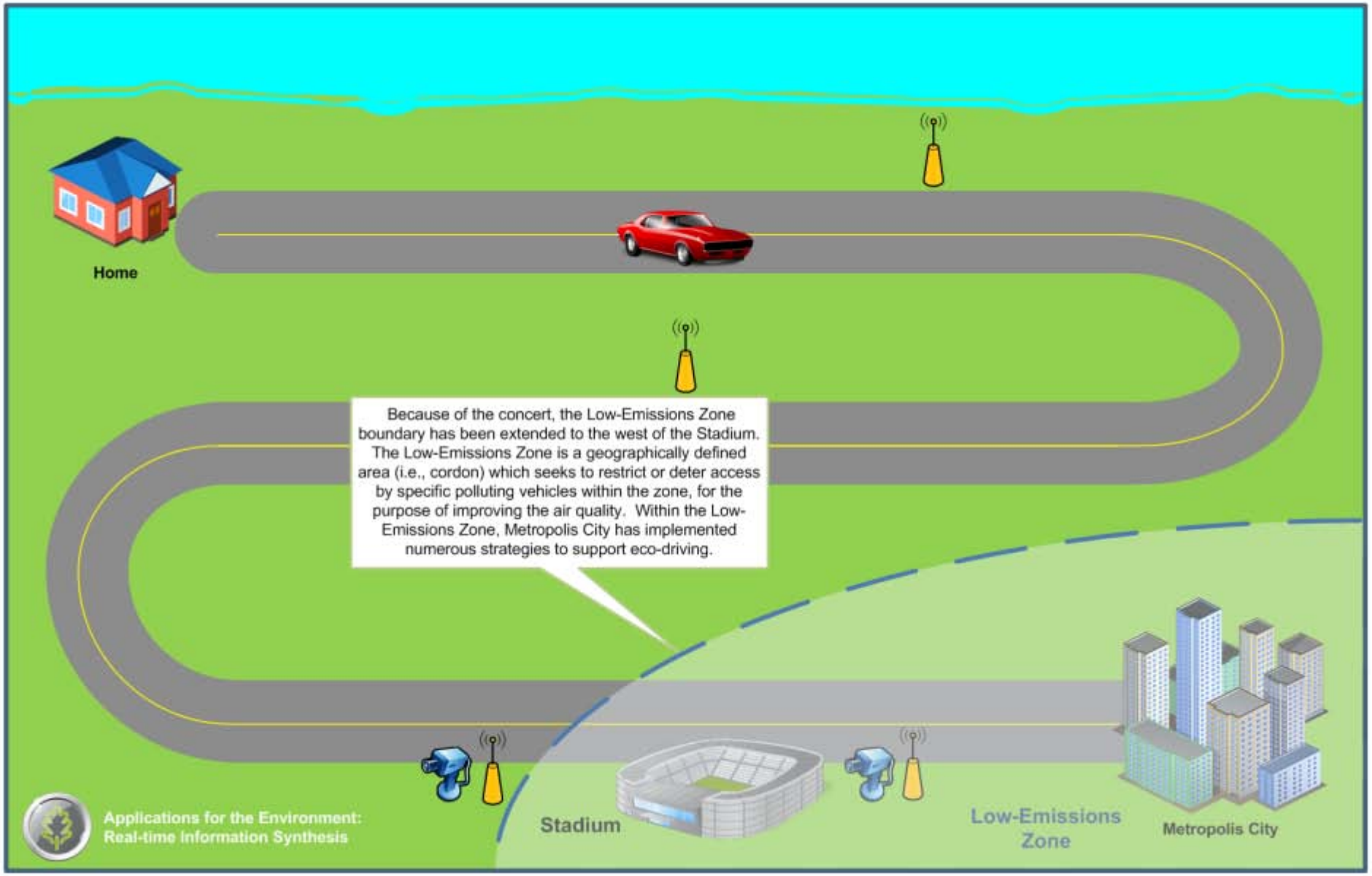
Low-Emissions Zone

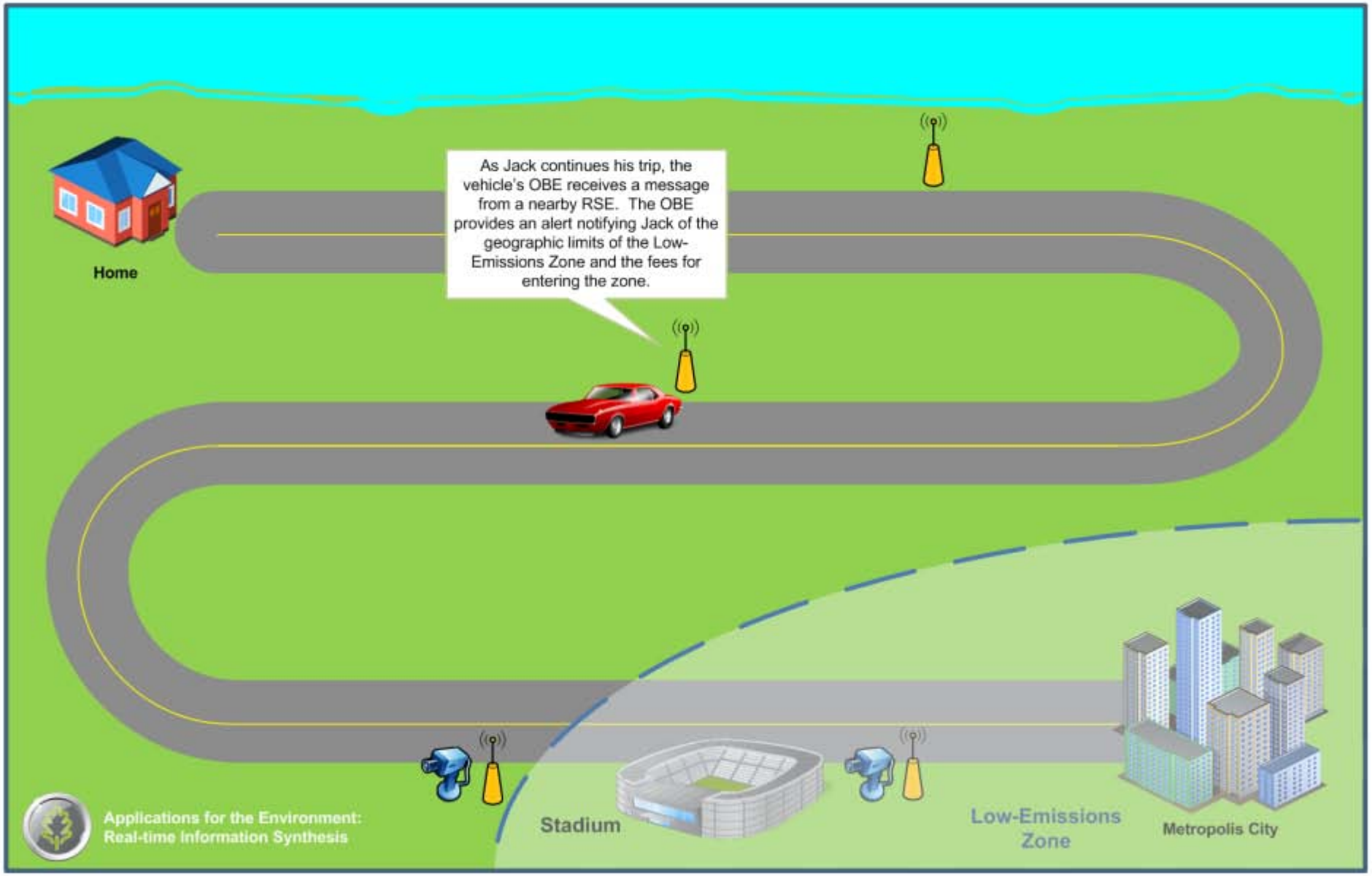
Transformative Concept | Low-Emissions Zone

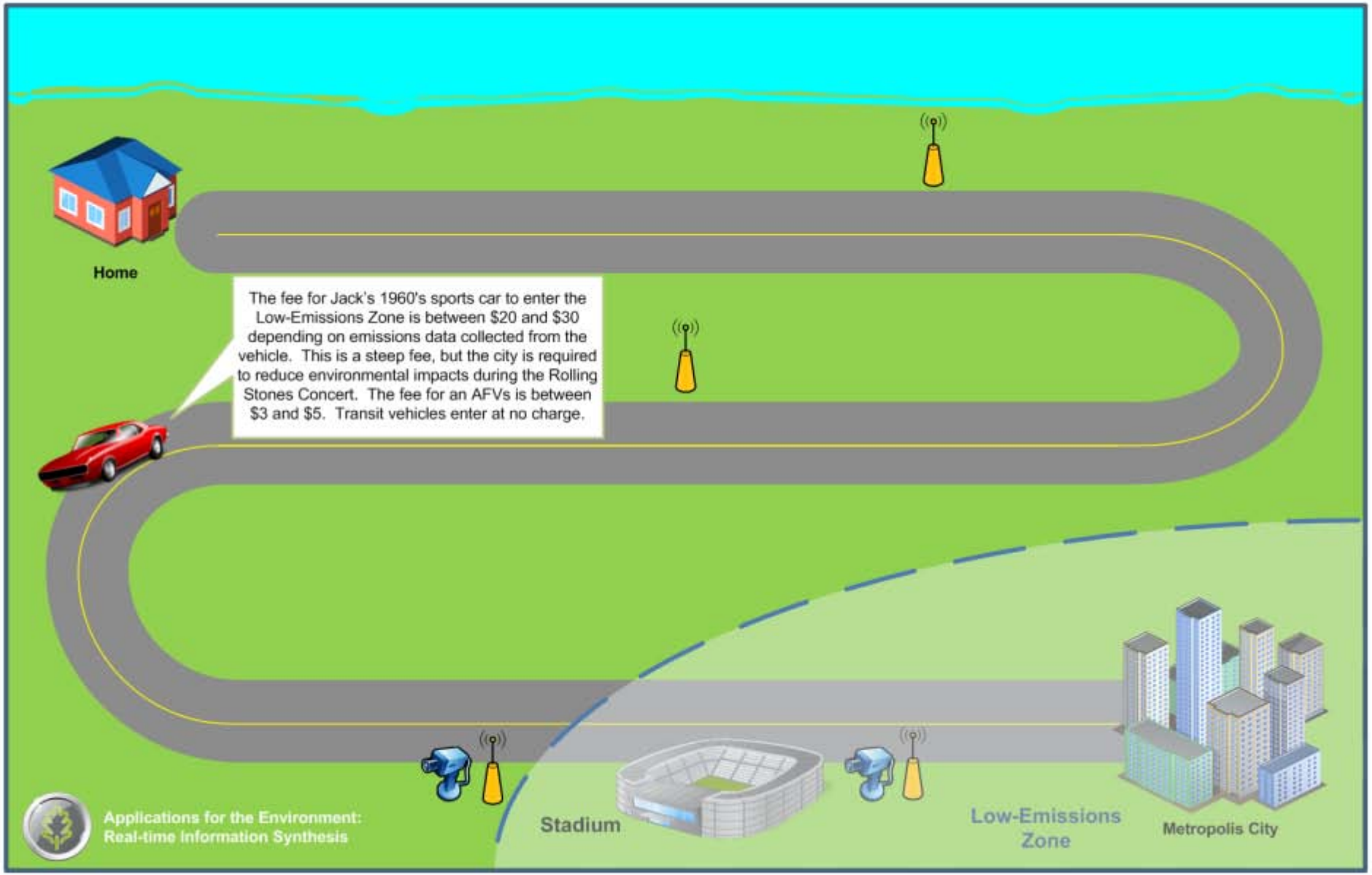
- This Transformative Concept includes a **geographically defined area** (i.e., cordon) which seeks to **restrict or deter access by specific polluting vehicles** within the zone, **for the purpose of improving the air quality** within the geographic area.
- The **size and location of the Low-Emissions Zone may also be dynamic**.
- The **fee for entering the low-emissions zone would be based on the vehicle's engine emissions standard or historical emissions data** collected directly from the vehicle using V2I communications.
- This Transformative Concept would also:
  - Encourage eco-driving inside the low-emissions zone.
  - Include **Connected Eco-driving** (from the previous Transformative Concept)
  - Encourage commuters to use **public transportation**.

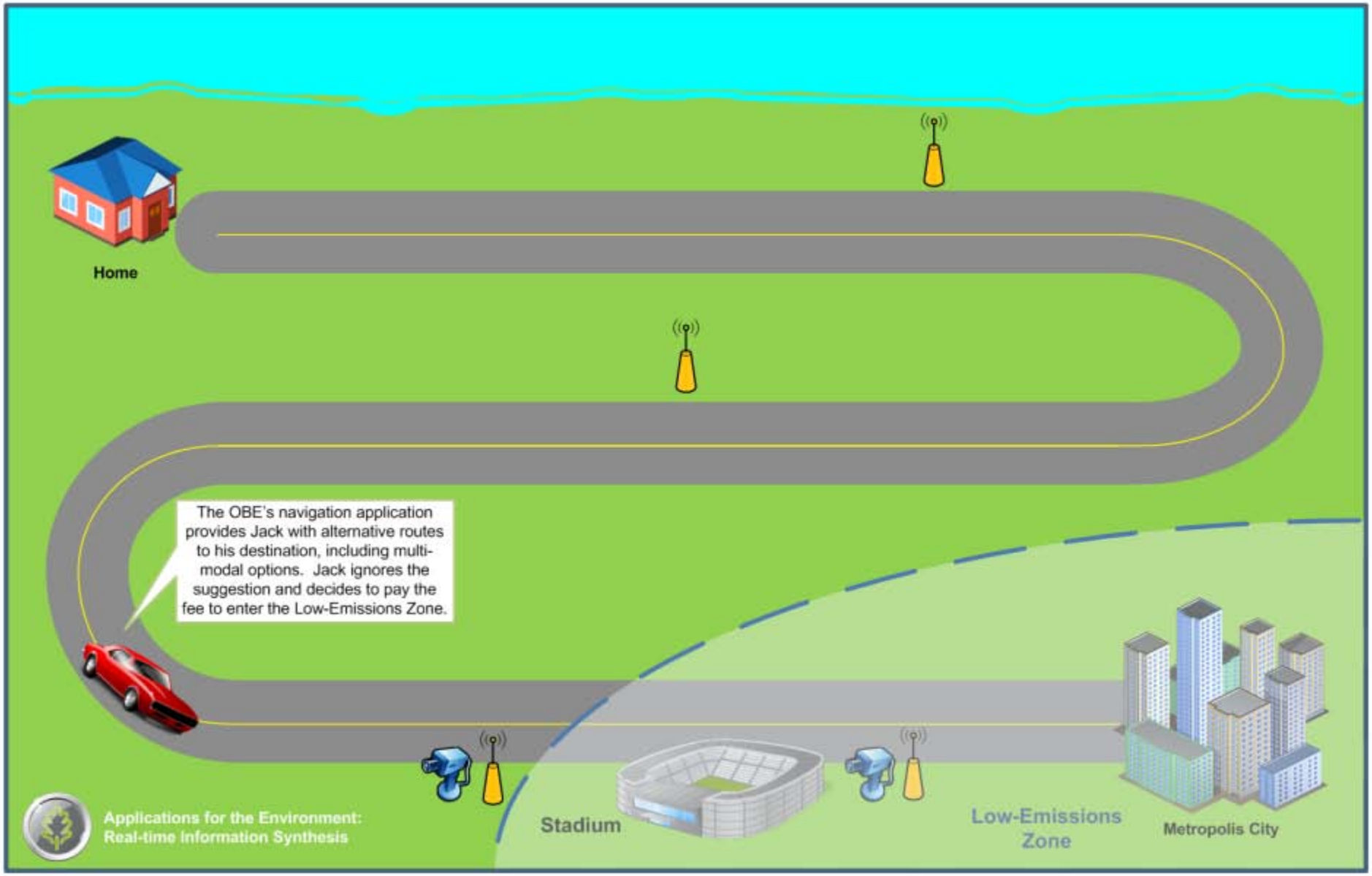

Jack Black and his friends are planning to attend the Rolling Stones concert at the Metropolis City Stadium.
Home
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

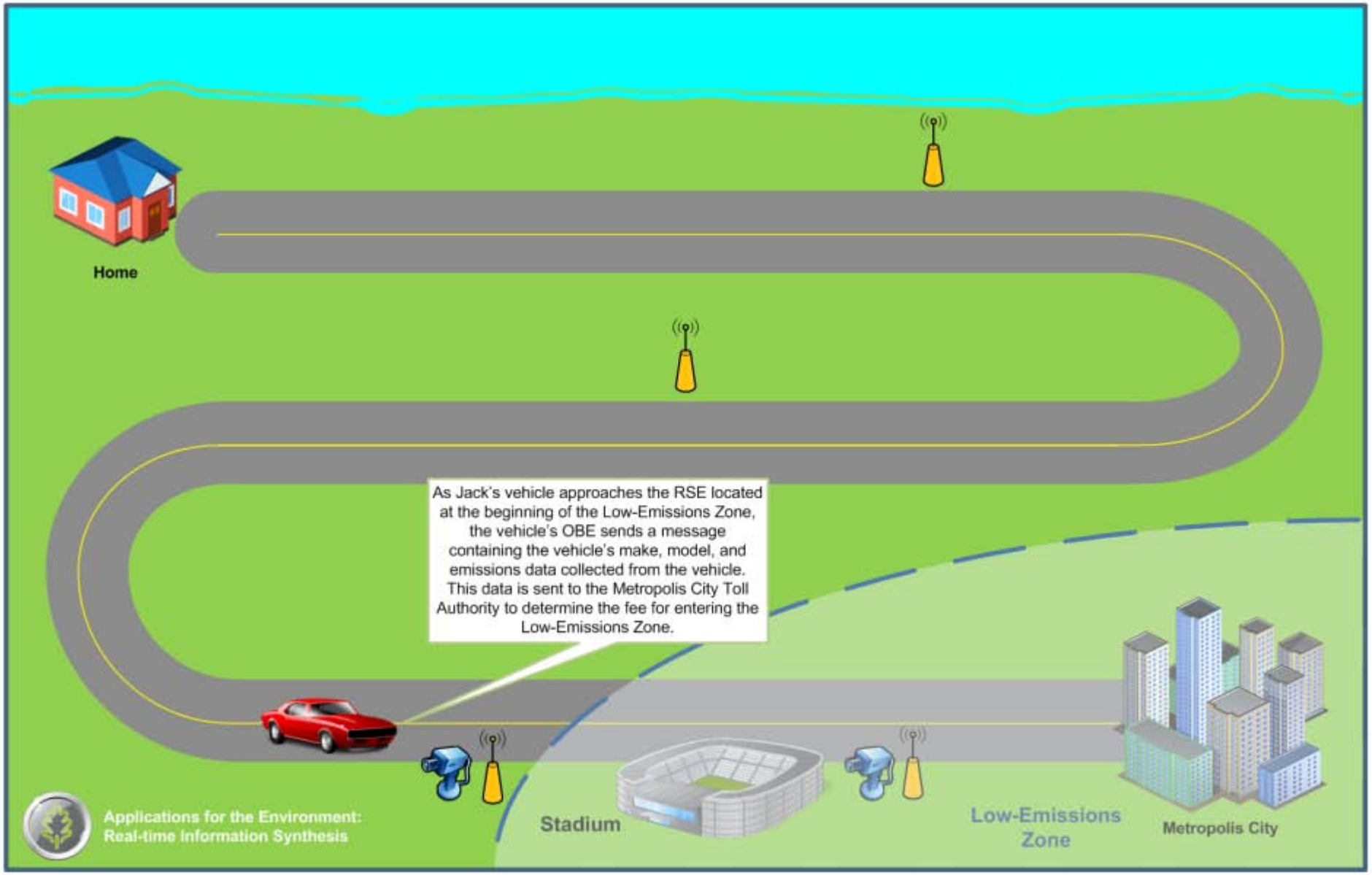

Prior to beginning his trip, Jack enters his destination into his vehicle's on-board equipment (OBE) unit's navigation application. The application informs Jack that the Low-Emissions Zone around Metropolis City is activated due to a major event in the city. Jack is not environmentally conscious and decides to drive to the event.
Home
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

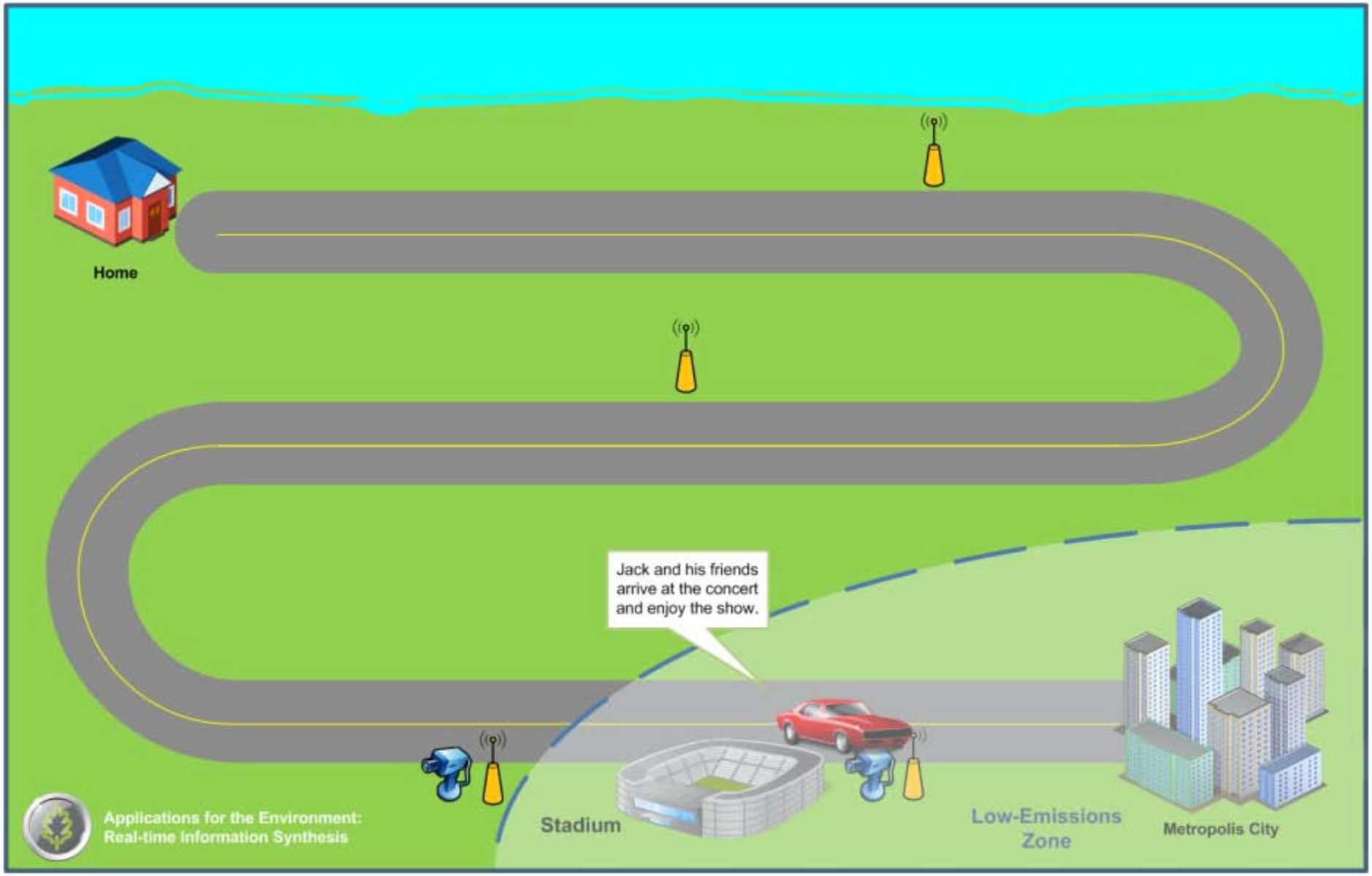

Home
Because of the concert, the Low-Emissions Zone boundary has been extended to the west of the Stadium. The Low-Emissions Zone is a geographically defined area (i.e., cordon) which seeks to restrict or deter access by specific polluting vehicles within the zone, for the purpose of improving the air quality. Within the Low-Emissions Zone, Metropolis City has implemented numerous strategies to support eco-driving.
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

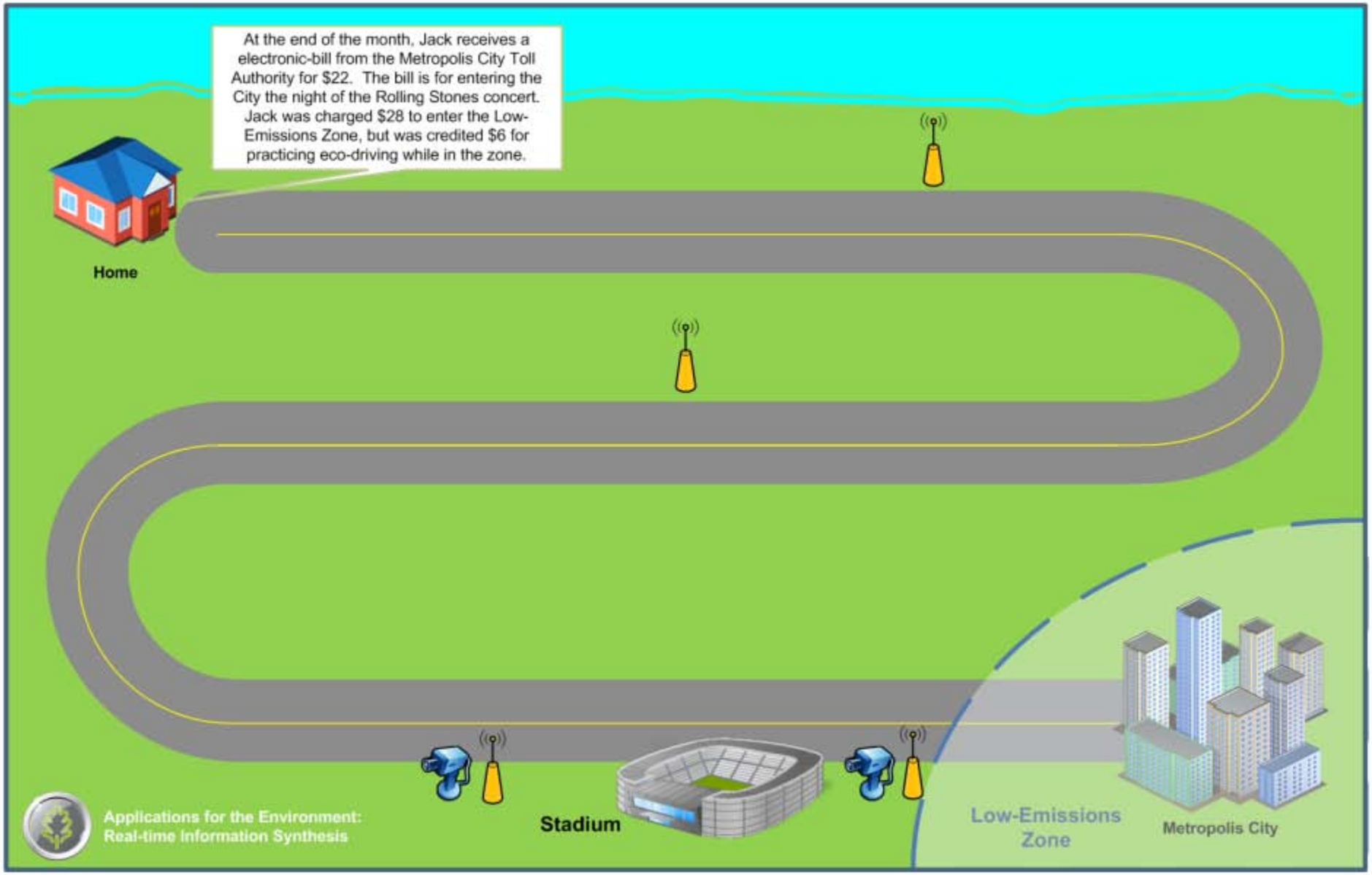

Home
As Jack continues his trip, the vehicle's OBE receives a message from a nearby RSE. The OBE provides an alert notifying Jack of the geographic limits of the Low-Emissions Zone and the fees for entering the zone.
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
The fee for Jack's 1960's sports car to enter the Low-Emissions Zone is between $20 and $30 depending on emissions data collected from the vehicle. This is a steep fee, but the city is required to reduce environmental impacts during the Rolling Stones Concert. The fee for an AFVs is between $3 and $5. Transit vehicles enter at no charge.
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
The OBE's navigation application provides Jack with alternative routes to his destination, including multi-modal options. Jack ignores the suggestion and decides to pay the fee to enter the Low-Emissions Zone.
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis


Home
As Jack's vehicle approaches the RSE located at the beginning of the Low-Emissions Zone, the vehicle's OBE sends a message containing the vehicle's make, model, and emissions data collected from the vehicle. This data is sent to the Metropolis City Toll Authority to determine the fee for entering the Low-Emissions Zone.
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

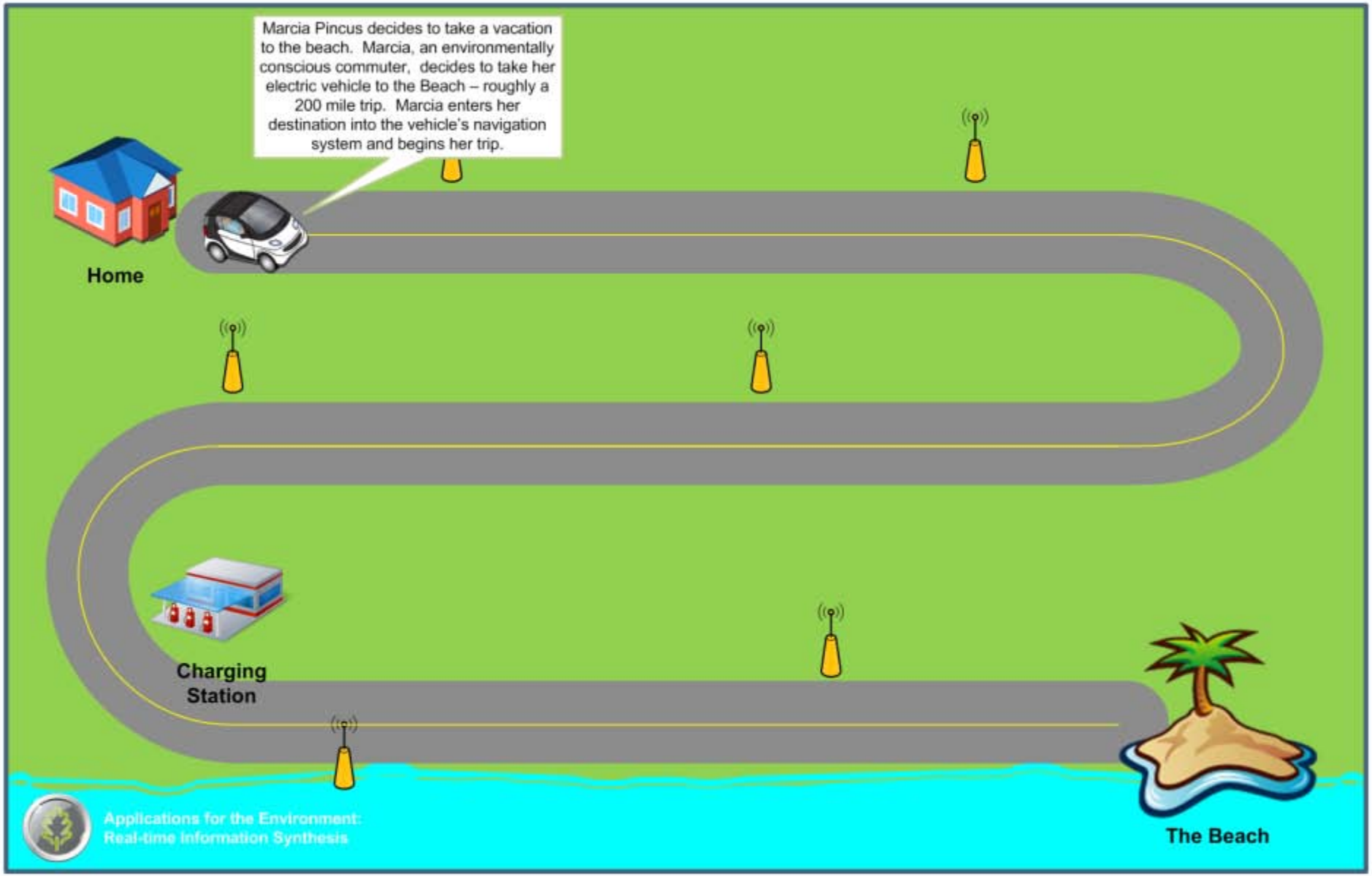

Home
Jack and his friends arrive at the concert and enjoy the show.
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

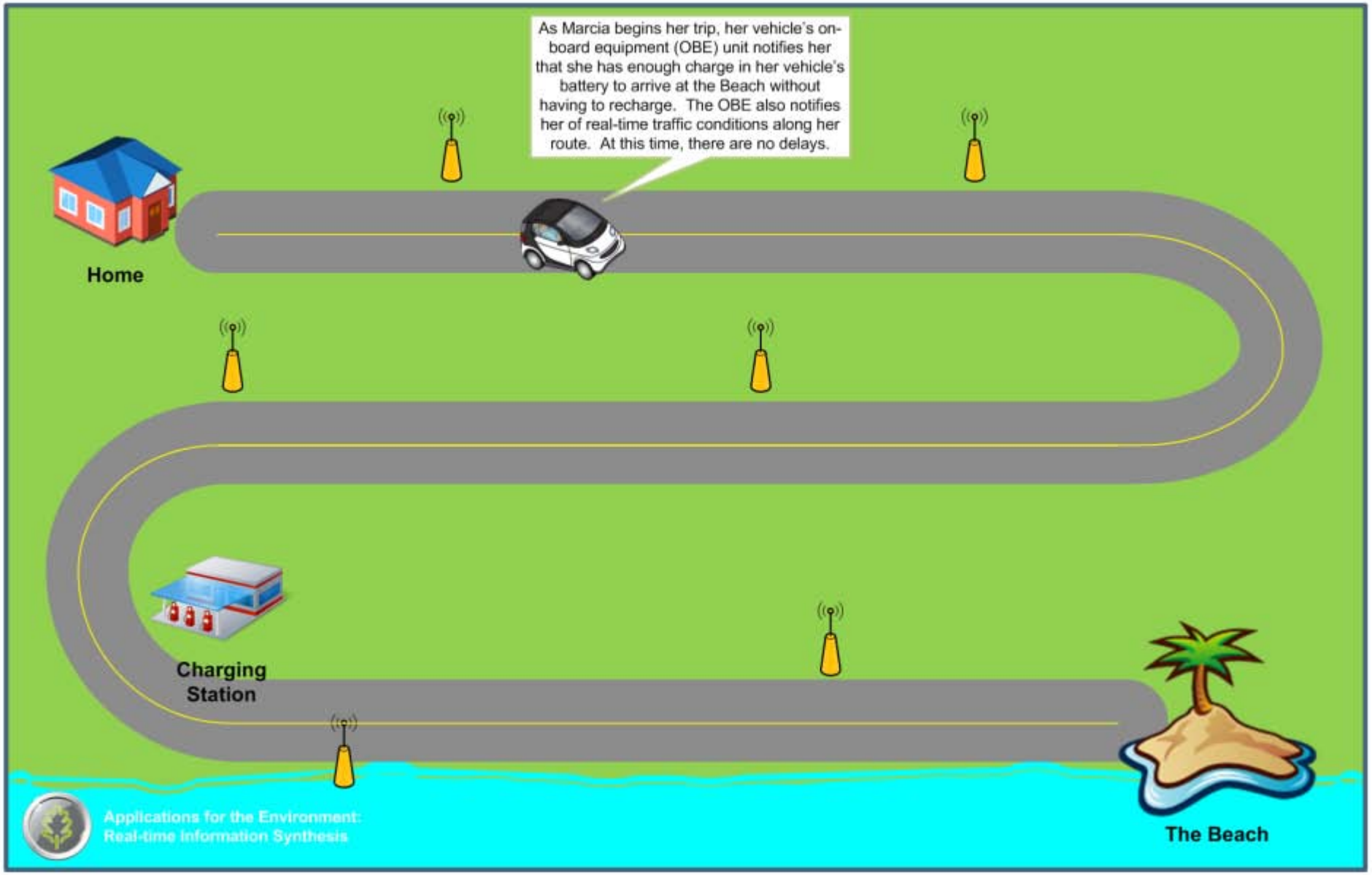

At the end of the month, Jack receives a electronic-bill from the Metropolis City Toll Authority for $22. The bill is for entering the City the night of the Rolling Stones concert. Jack was charged $28 to enter the Low-Emissions Zone, but was credited $6 for practicing eco-driving while in the zone.
Home
Stadium
Low-Emissions Zone
Metropolis City
Applications for the Environment:
Real-time Information Synthesis

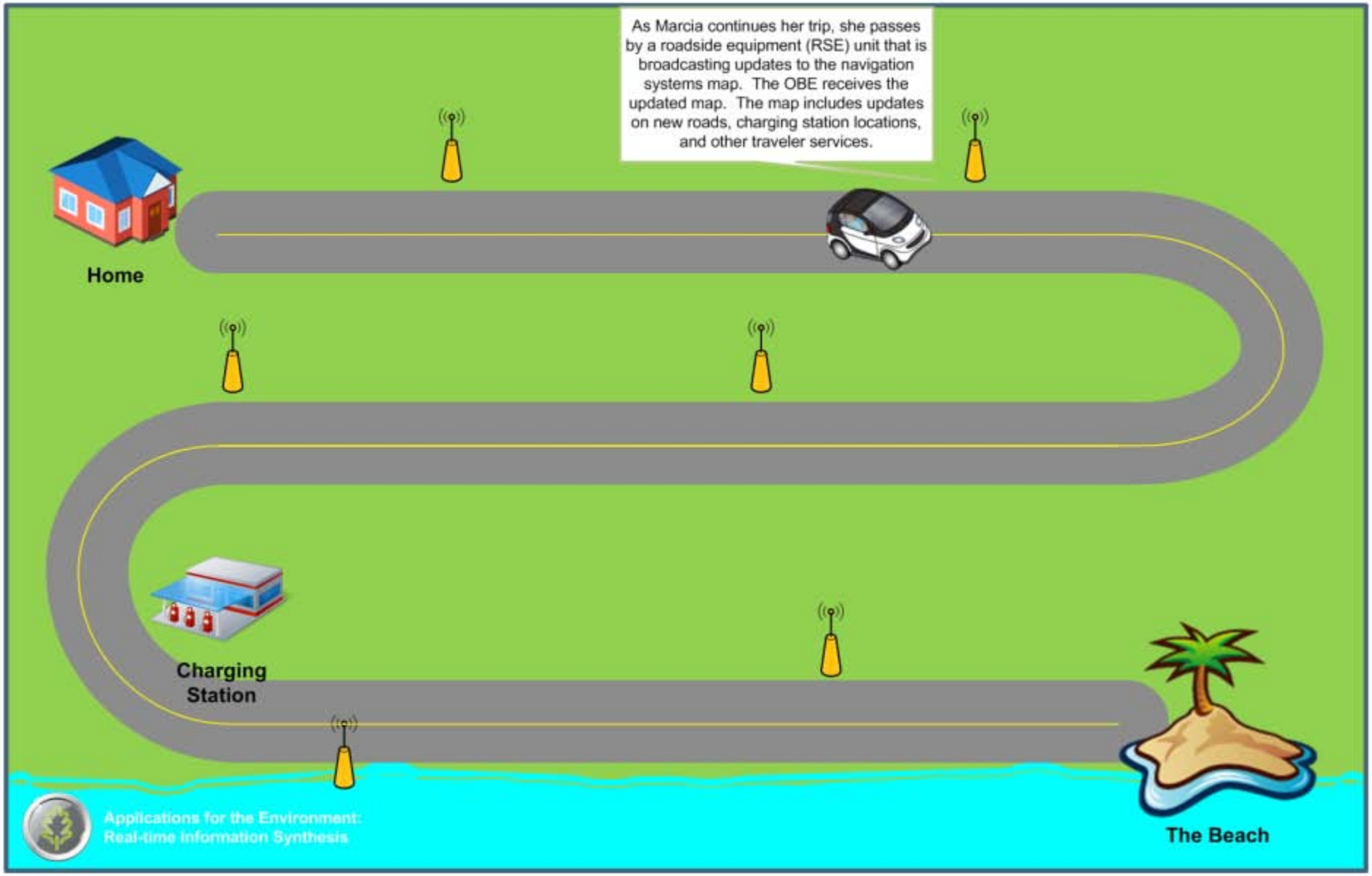
Support Alternative Fuel Vehicle Operations

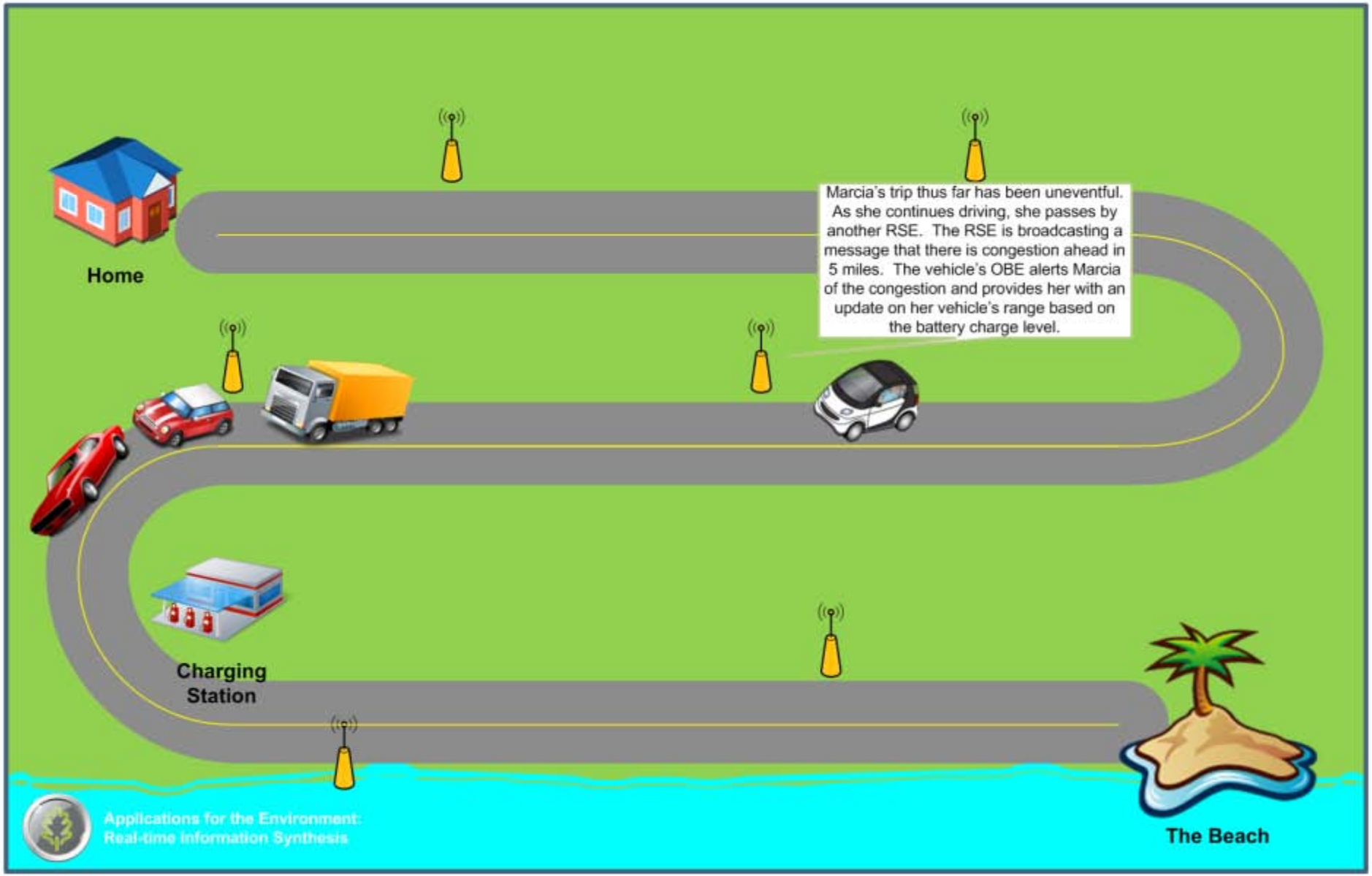
Transformative Concept | Support Alternative Fuel Vehicle Operations

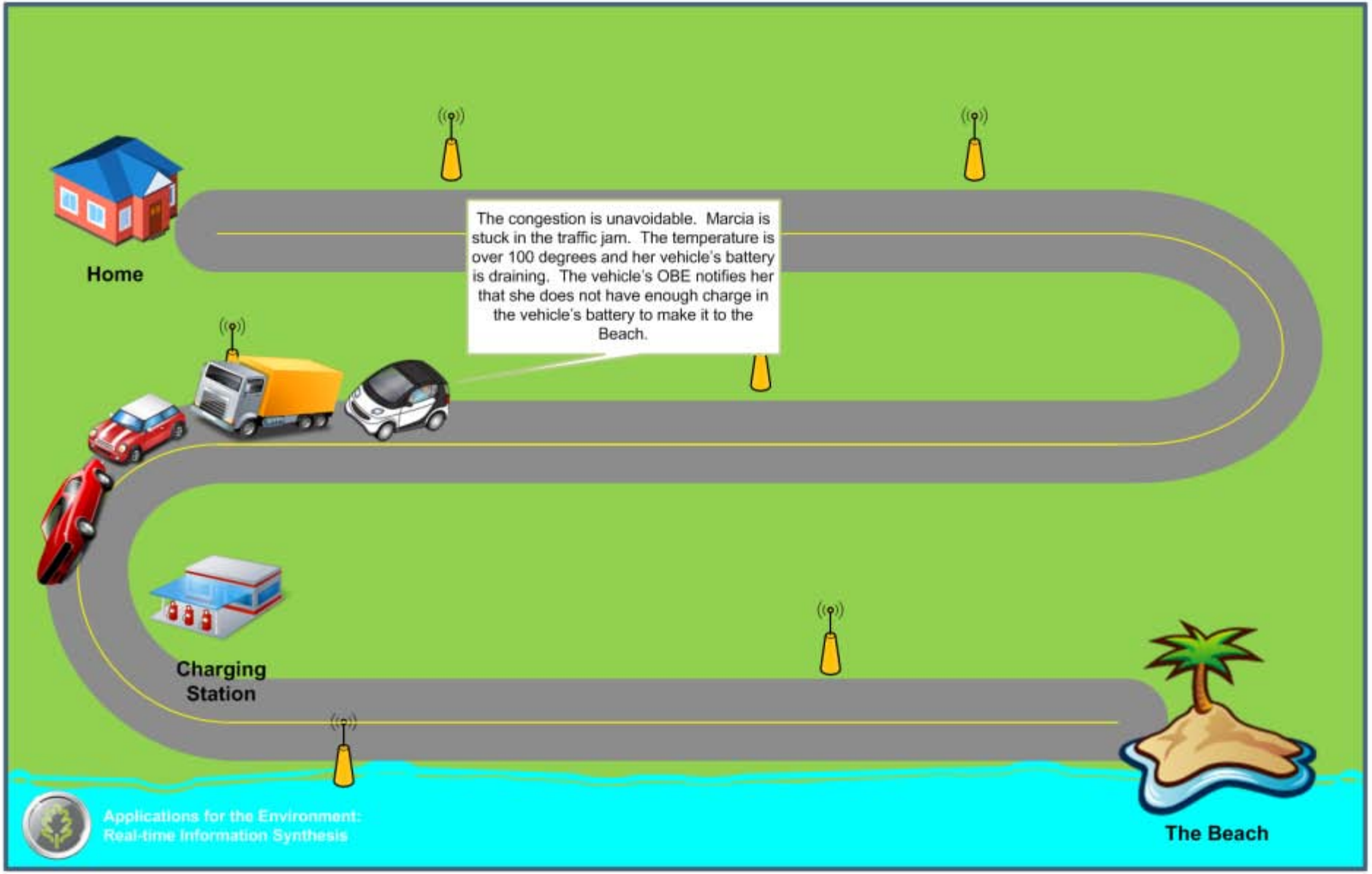
- This Transformative Concept **supports operations of alternative fuel vehicles (AFVs)** — vehicles that run on a fuel other than "traditional" petroleum fuels, including vehicles whose engines do not solely use petroleum (e.g. electric cars and hybrid electric vehicles).
- Potential strategies include:
  - Disseminating information on the **locations and availability of charging/refueling stations**,
  - Applications targeted at using V2V and V2I information for **engine performance optimization**,
  - Provide travelers with AFV options to support the “last mile” of their multi-modal trip,
  - **Smart parking systems** whereby AFVs would have prioritized parking.

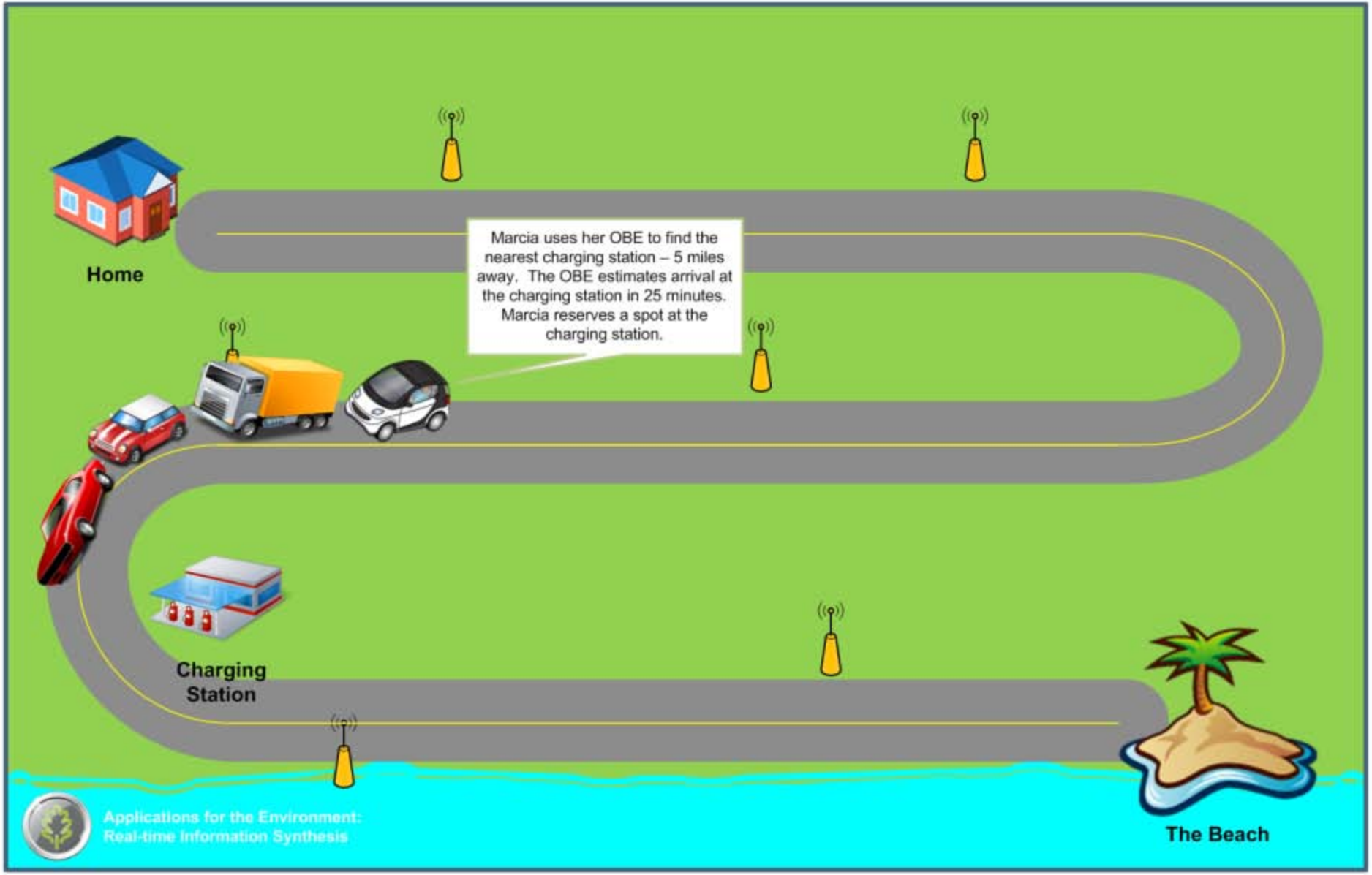

Marcia Pincus decides to take a vacation to the beach. Marcia, an environmentally conscious commuter, decides to take her electric vehicle to the Beach – roughly a 200 mile trip. Marcia enters her destination into the vehicle's navigation system and begins her trip.
Home
Charging Station
The Beach
Applications for the Environment:
Real-time Information Synthesis

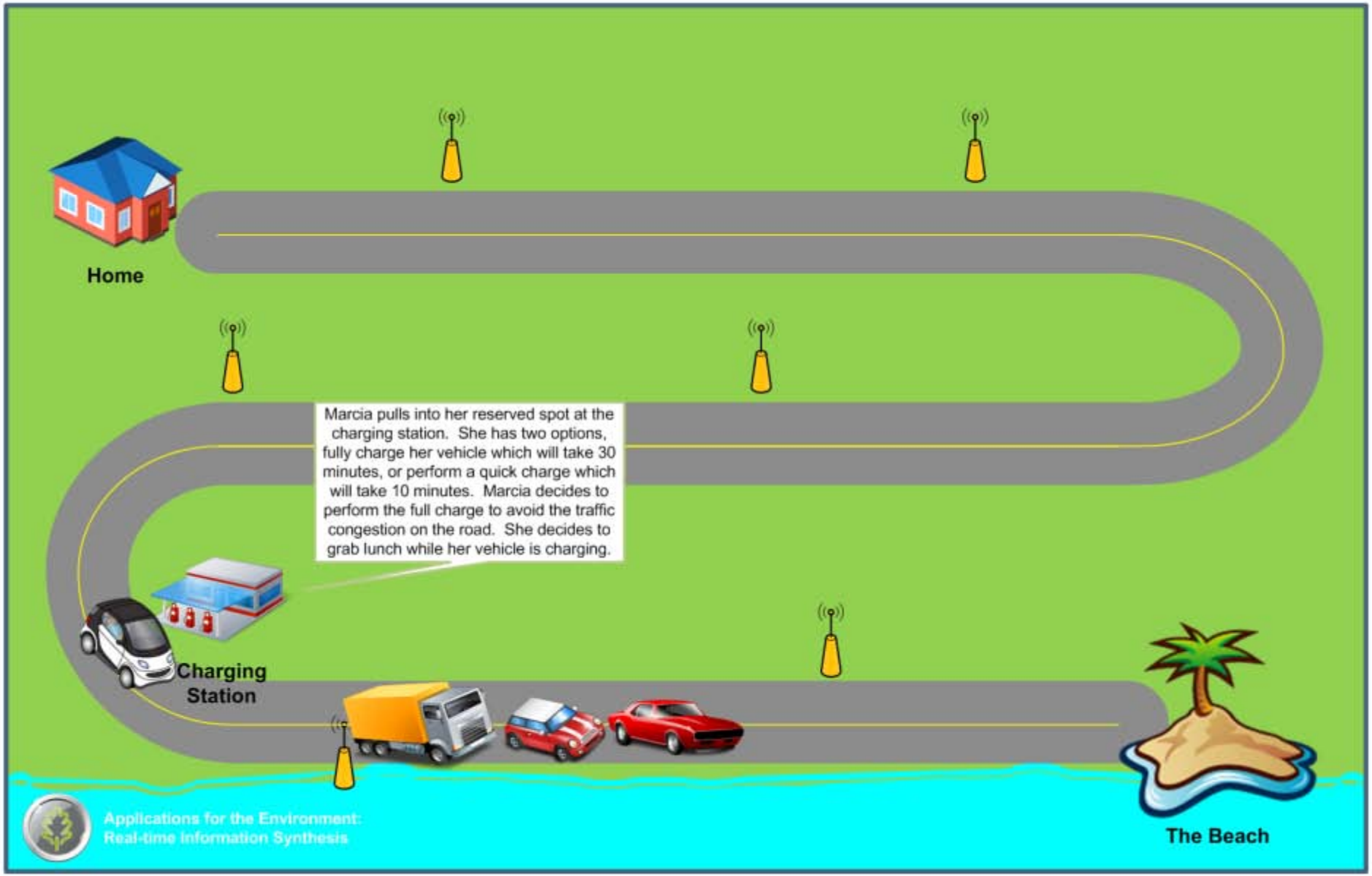

As Marcia begins her trip, her vehicle's on-board equipment (OBE) unit notifies her that she has enough charge in her vehicle's battery to arrive at the Beach without having to recharge. The OBE also notifies her of real-time traffic conditions along her route. At this time, there are no delays.
Home
Charging Station
The Beach
Applications for the Environment:
Real-time Information Synthesis

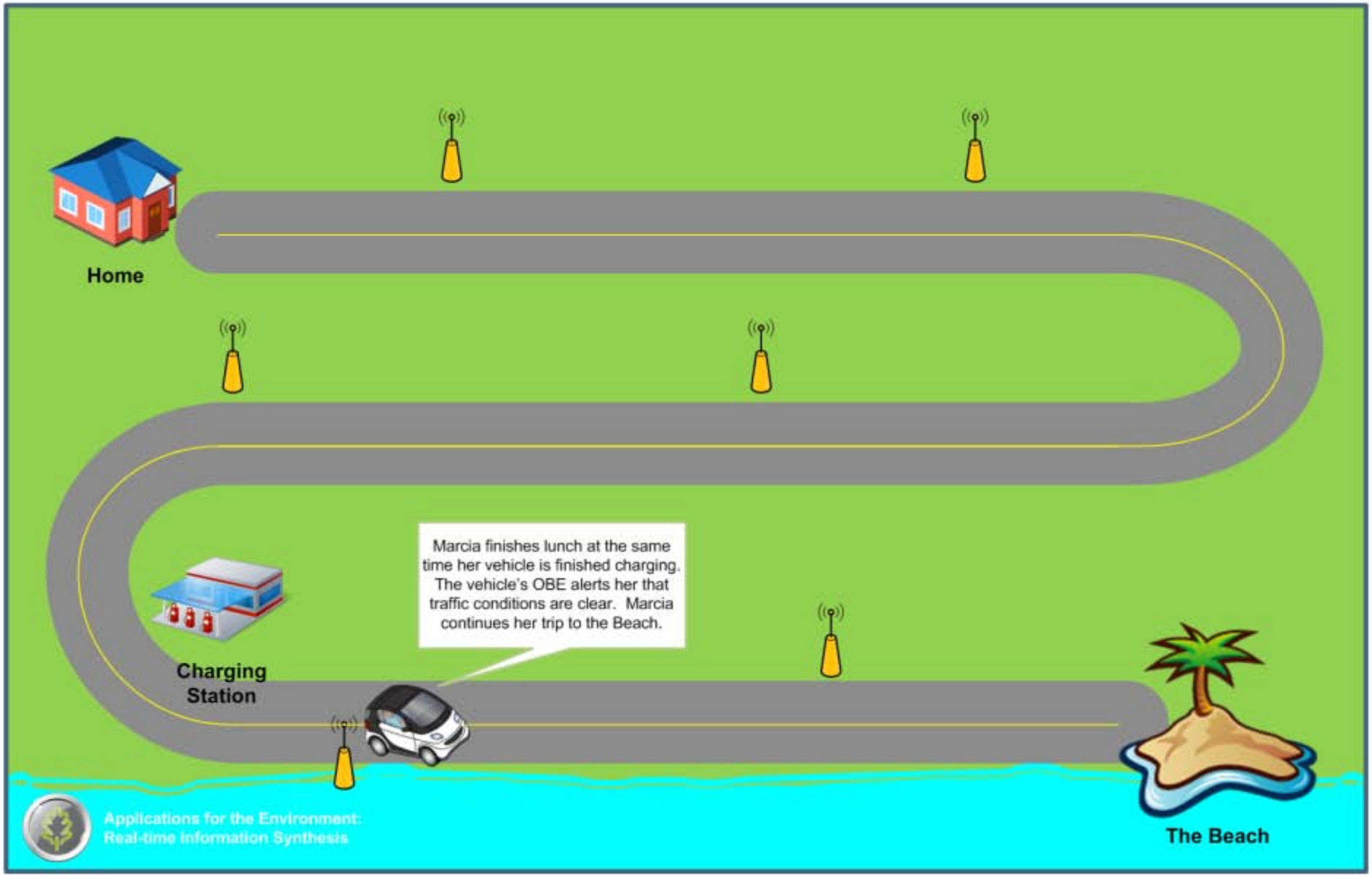

As Marcia continues her trip, she passes by a roadside equipment (RSE) unit that is broadcasting updates to the navigation systems map. The OBE receives the updated map. The map includes updates on new roads, charging station locations, and other traveler services.
Home
Charging Station
The Beach
Applications for the Environment:
Real-time Information Synthesis

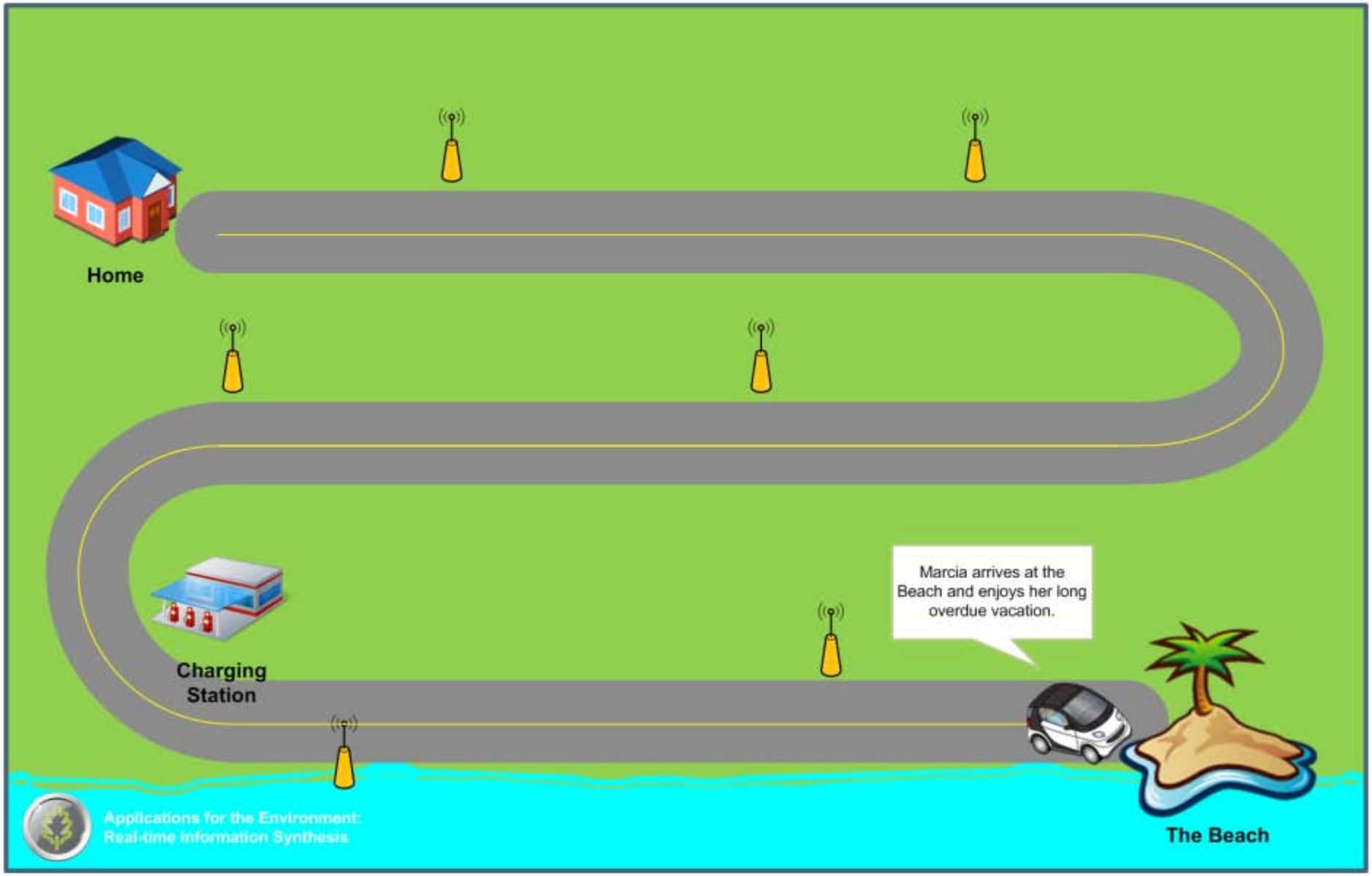

Home
Marcia's trip thus far has been uneventful. As she continues driving, she passes by another RSE. The RSE is broadcasting a message that there is congestion ahead in 5 miles. The vehicle's OBE alerts Marcia of the congestion and provides her with an update on her vehicle's range based on the battery charge level.
Charging Station
The Beach
Applications for the Environment:
Real-time Information Synthesis


Home
The congestion is unavoidable. Marcia is stuck in the traffic jam. The temperature is over 100 degrees and her vehicle's battery is draining. The vehicle's OBE notifies her that she does not have enough charge in the vehicle's battery to make it to the Beach.
Charging Station
The Beach
Applications for the Environment:
Real-time Information Synthesis


Home
Marcia uses her OBE to find the nearest charging station – 5 miles away. The OBE estimates arrival at the charging station in 25 minutes. Marcia reserves a spot at the charging station.
Charging Station
The Beach
Applications for the Environment:
Real-time Information Synthesis


Home
Marcia pulls into her reserved spot at the charging station. She has two options, fully charge her vehicle which will take 30 minutes, or perform a quick charge which will take 10 minutes. Marcia decides to perform the full charge to avoid the traffic congestion on the road. She decides to grab lunch while her vehicle is charging.
Charging Station
The Beach
Applications for the Environment:
Real-time Information Synthesis


Home
Charging Station
Marcia finishes lunch at the same time her vehicle is finished charging. The vehicle's OBE alerts her that traffic conditions are clear. Marcia continues her trip to the Beach.
The Beach
Applications for the Environment:
Real-time Information Synthesis


Home
Charging Station
Marcia arrives at the Beach and enjoys her long overdue vacation.
The Beach
Applications for the Environment:
Real-time Information Synthesis

ECO-TRAVELER INFORMATION

Transformative Concept | Eco-Traveler Information

- The AERIS Program seeks to enable the development of new, advanced traveler information applications through the provision of **integrated, multi-source, multi-modal data**.
- Although specific traveler information applications may not be directly developed by the AERIS Program, an **open data / open source approach is intended to engage researchers and the private sector to spur innovation**.
- Applications considered under this Transformative Concept include:
  - **Dynamic Eco-Routing** – applications targeted at providing drivers with a recommended travel **route** that would be determined based on **reducing emissions instead of reducing travel time**.
  - **Multi-modal Real-time Traveler Information** – applications that convey real-time pre-trip and en-route information to **encourage greener transportation choices**.
  - **Smart Parking** – applications targeted at providing real-time parking information to **reduce time searching for a parking space**.

ECO-INTEGRATED CORRIDOR MANAGEMENT

Transformative Concept | Eco-Integrated Corridor Management

This Transformative Concept :

- Includes the **integrated operation** of a major travel corridor **to reduce transportation-related emissions on arterials and freeways**.
- Includes the partnering of various surface transportation modes—such as highway agencies, transit agencies, commuter rail agencies—to treat a major travel corridor as an integrated asset coordinating their operations simultaneously, with a focus on reducing transportation related emissions.
- Utilizes a **real-time data fusion and decision support system**. It involves using multi-source, real-time V2I data on arterials, freeways, and transit systems to determine the best **operational decisions** that are **environmentally beneficial to the corridor**.
- Combines multi-modal applications defined in the other five Transformative Concepts.

Freight's Role in the Transformative Concepts

Freight's Impact on Air Quality

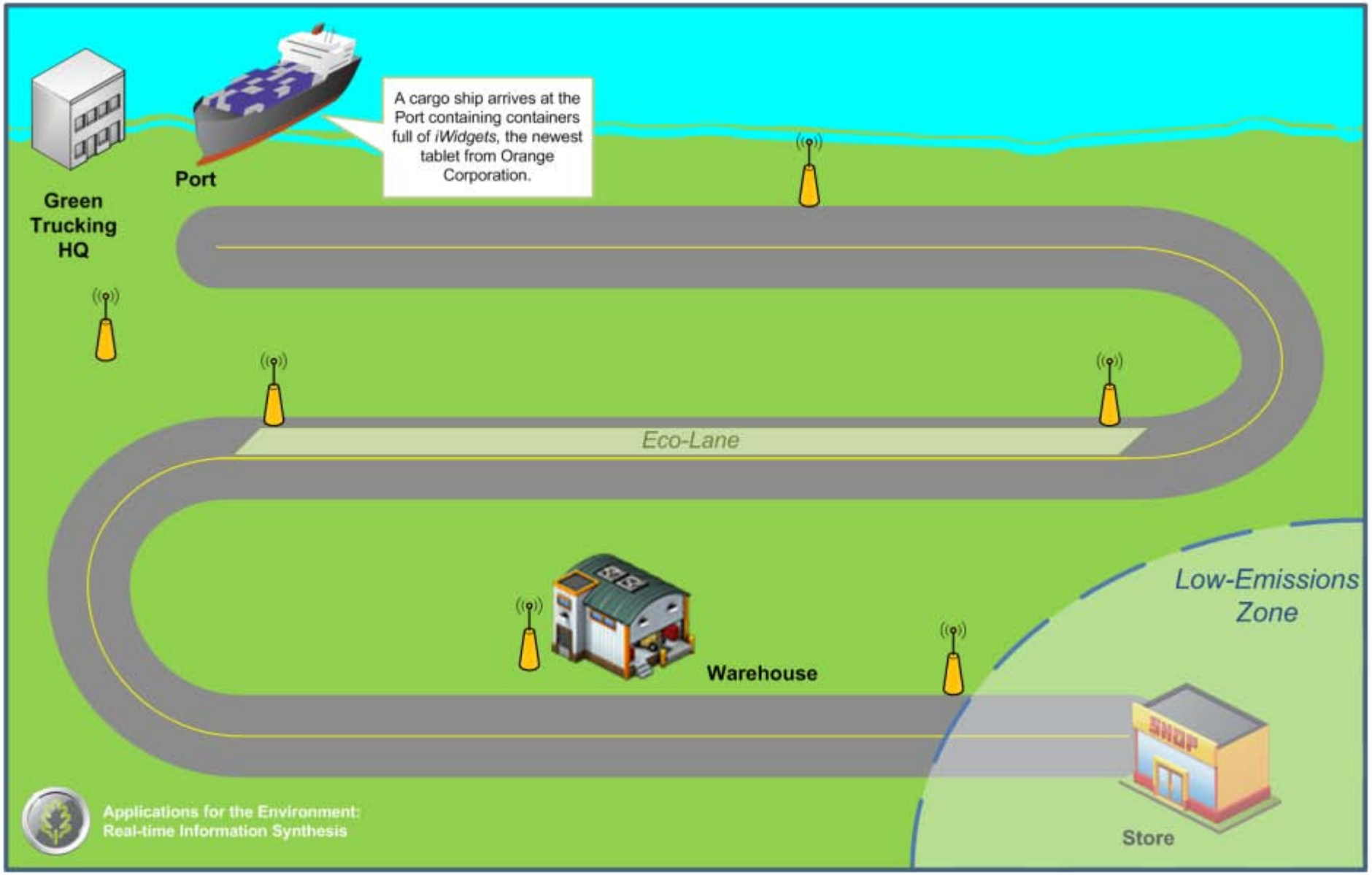
- Freight movement has a significant impact on air quality
  - Robust growth in global economy
  - Reliance on diesel engines for propulsion

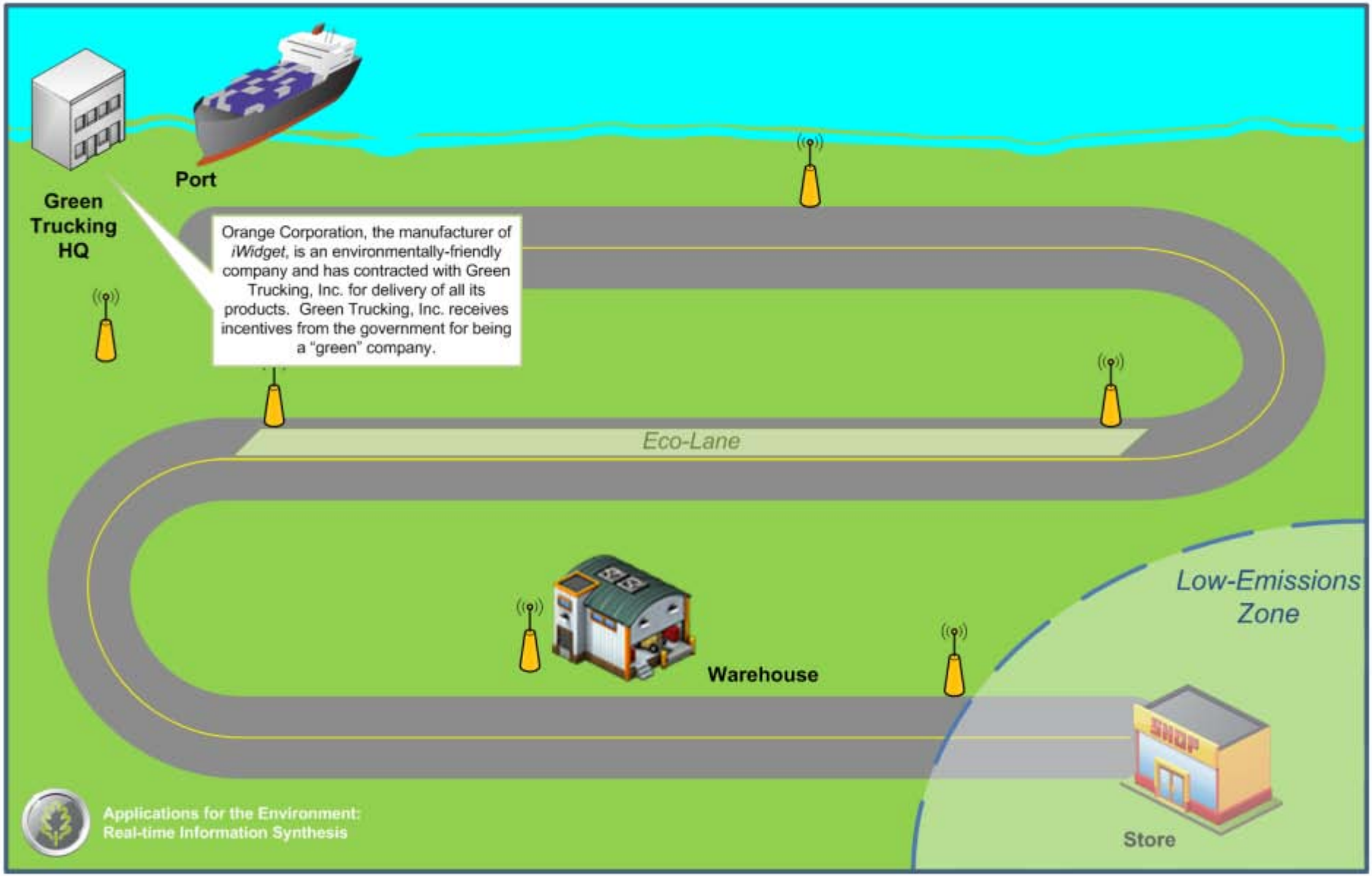
- Freight movement is a major source of emissions, generating:
  - 50% of all mobile NO_x
  - 36% of all mobile PM_{10}
  - 25% of all mobile GHG (mostly CO_2)

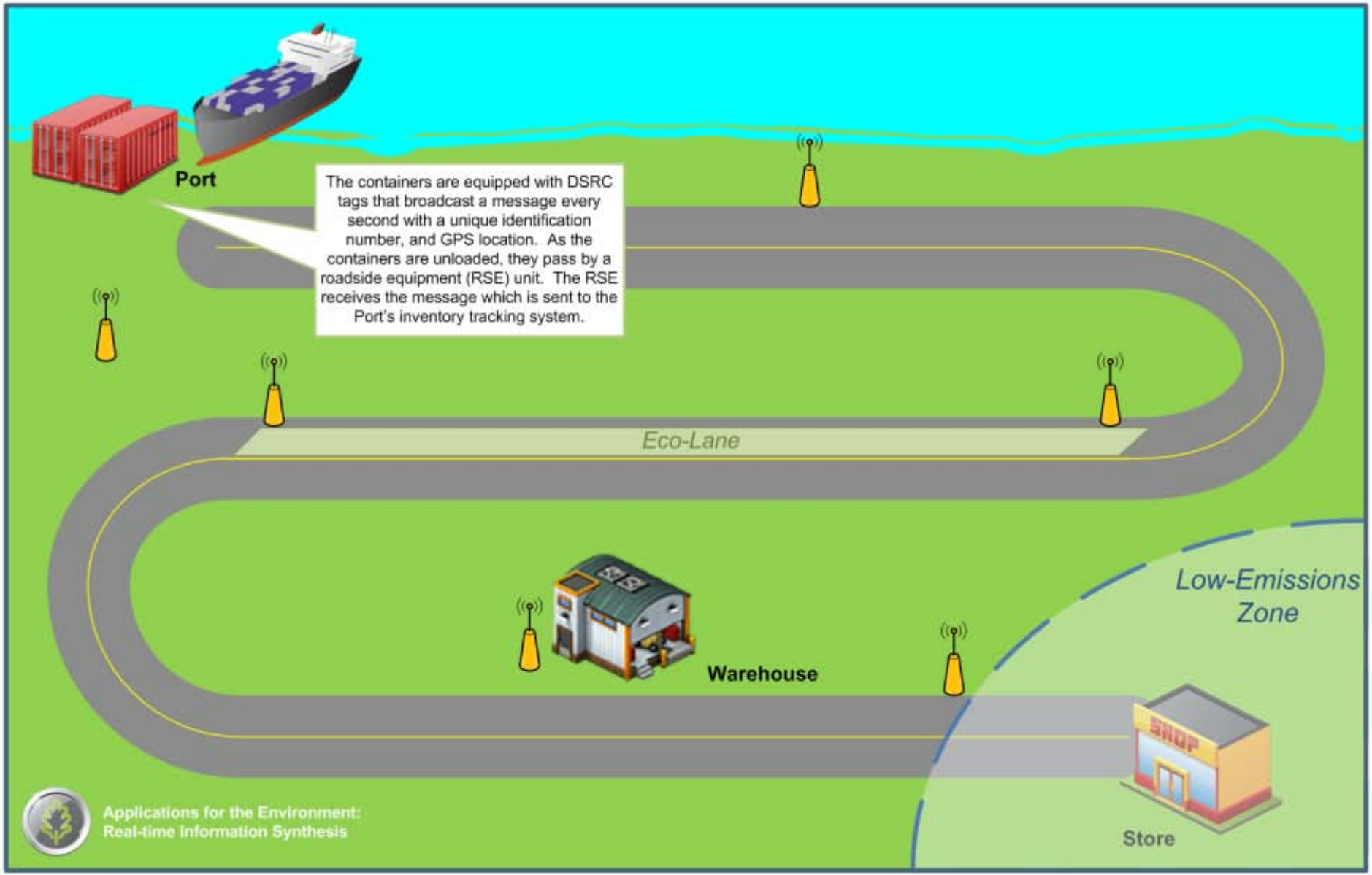
Freight's Impact on Air Quality

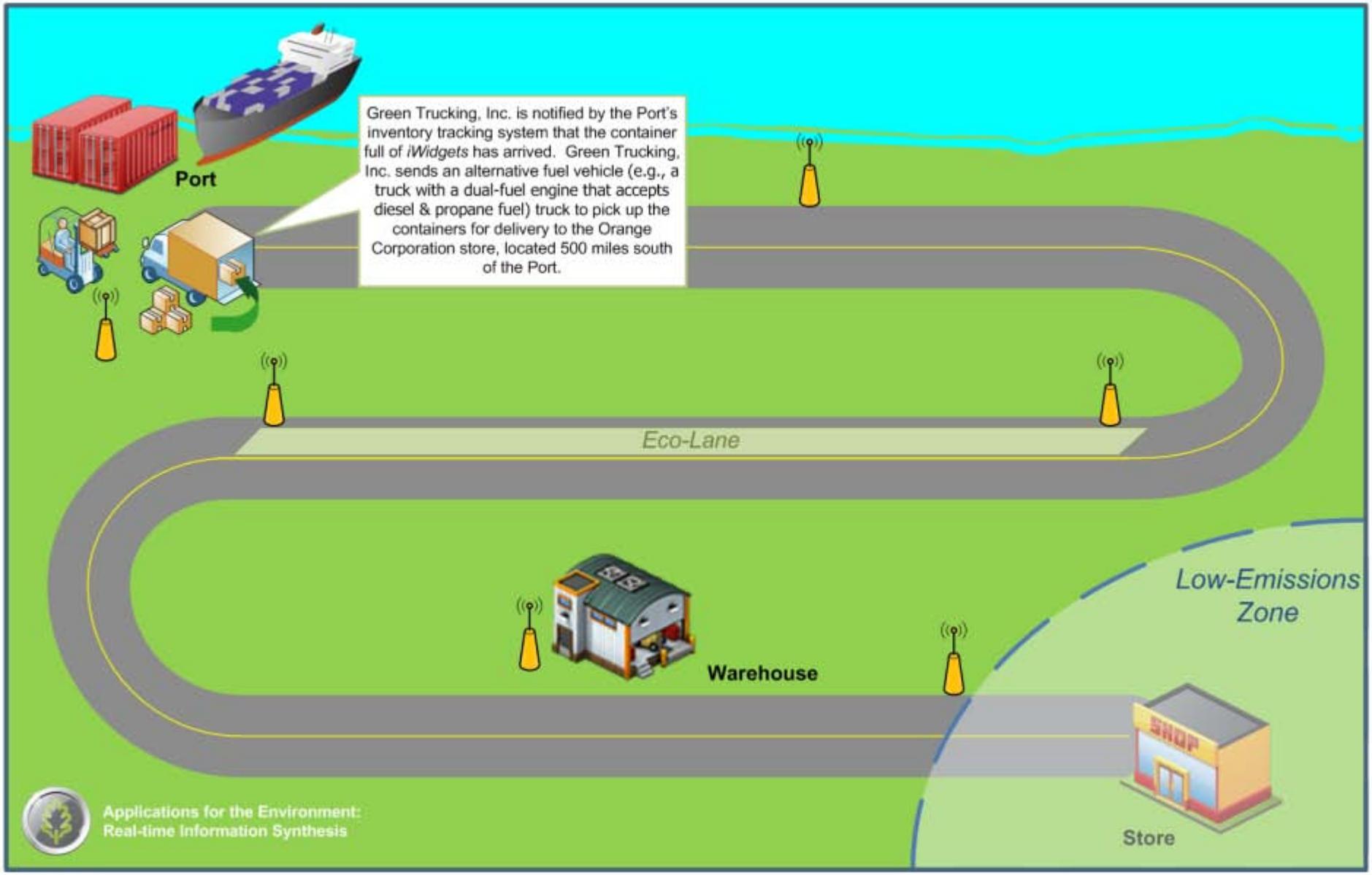
- Impact of heavy vehicles on air quality can be mitigated by:
  - Reducing idling
  - Improving fuel efficiency
  - Switching to alternative fuels
  - Improving operational efficiency

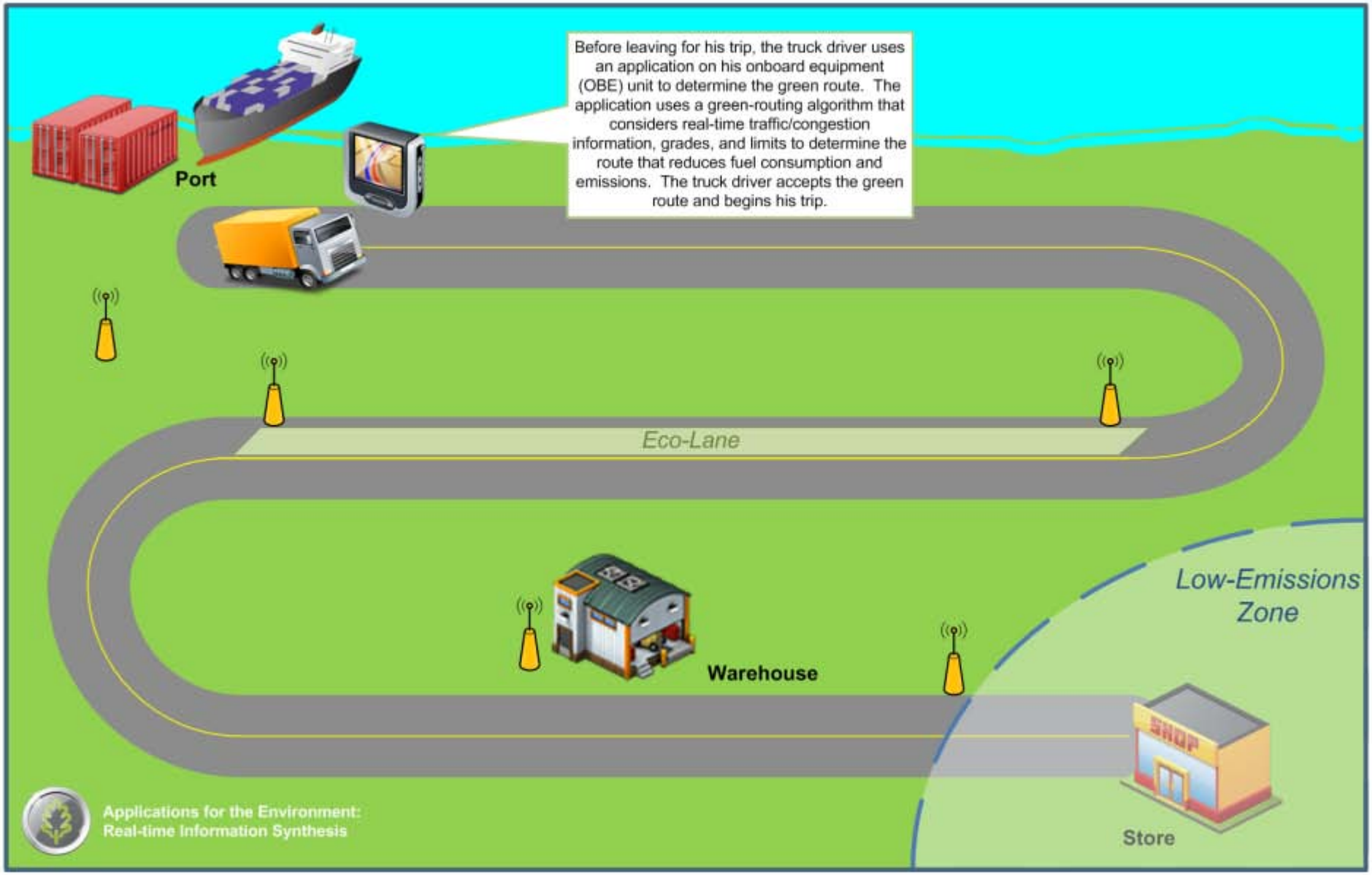
GREEN FREIGHT SCENARIO – 'IMAGINE'

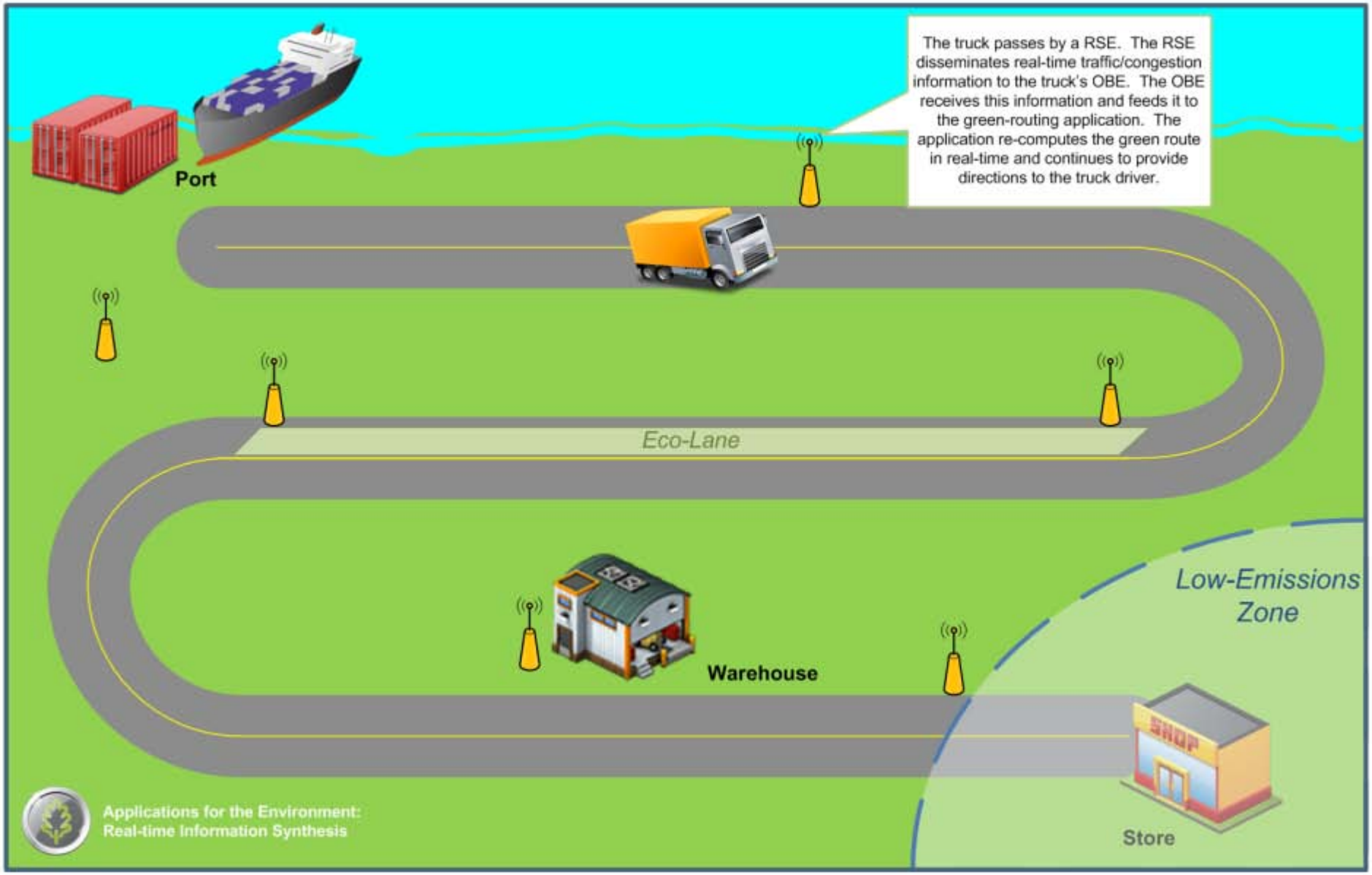

A cargo ship arrives at the Port containing containers full of *iWidgets*, the newest tablet from Orange Corporation.
Port
Green Trucking HQ
Eco-Lane
Warehouse
Low-Emissions Zone
Store
Applications for the Environment:
Real-time Information Synthesis

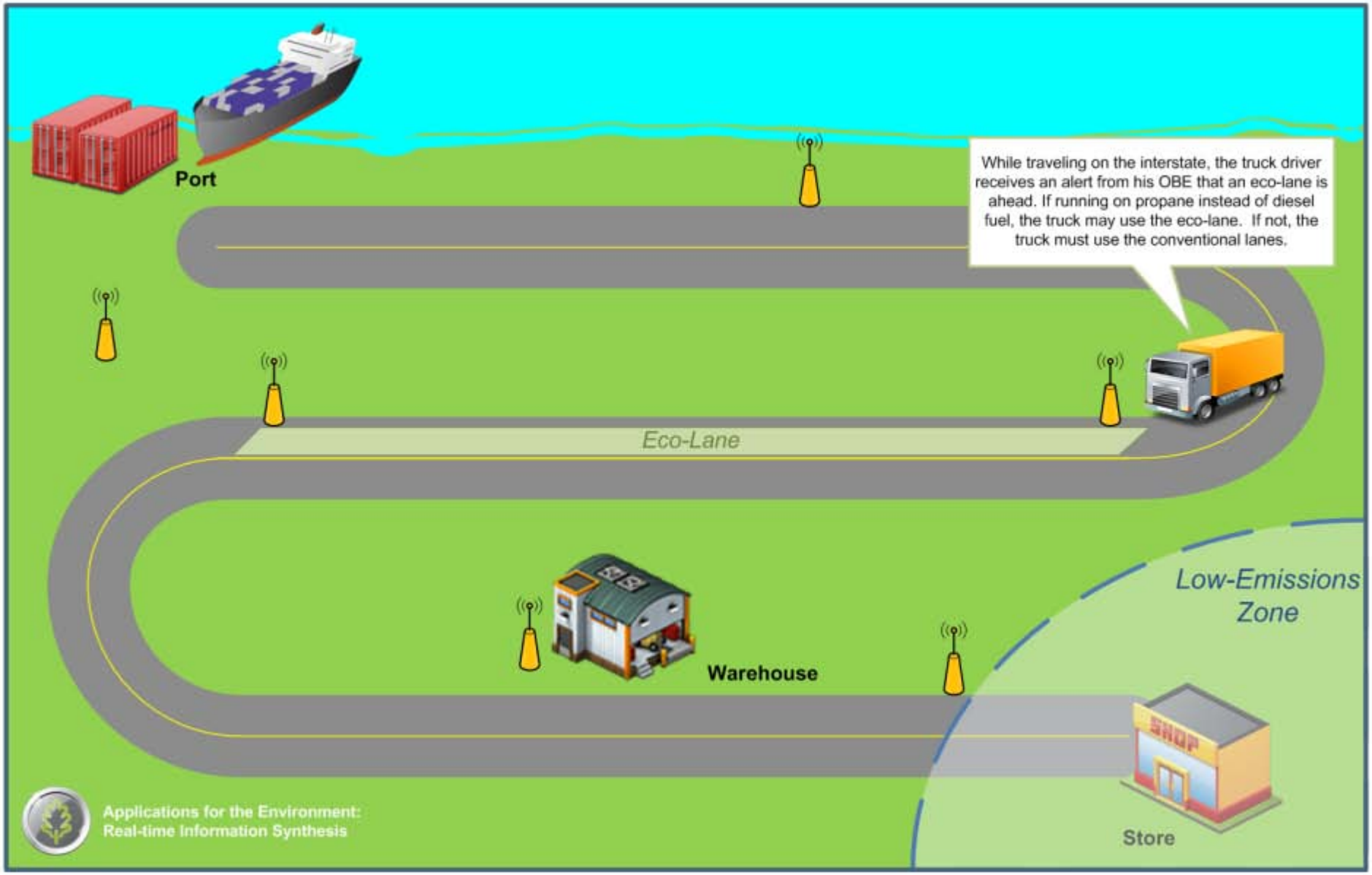

Green Trucking HQ
Port
Orange Corporation, the manufacturer of *iWidget*, is an environmentally-friendly company and has contracted with Green Trucking, Inc. for delivery of all its products. Green Trucking, Inc. receives incentives from the government for being a "green" company.
Eco-Lane
Warehouse
Low-Emissions Zone
Store
Applications for the Environment:
Real-time Information Synthesis

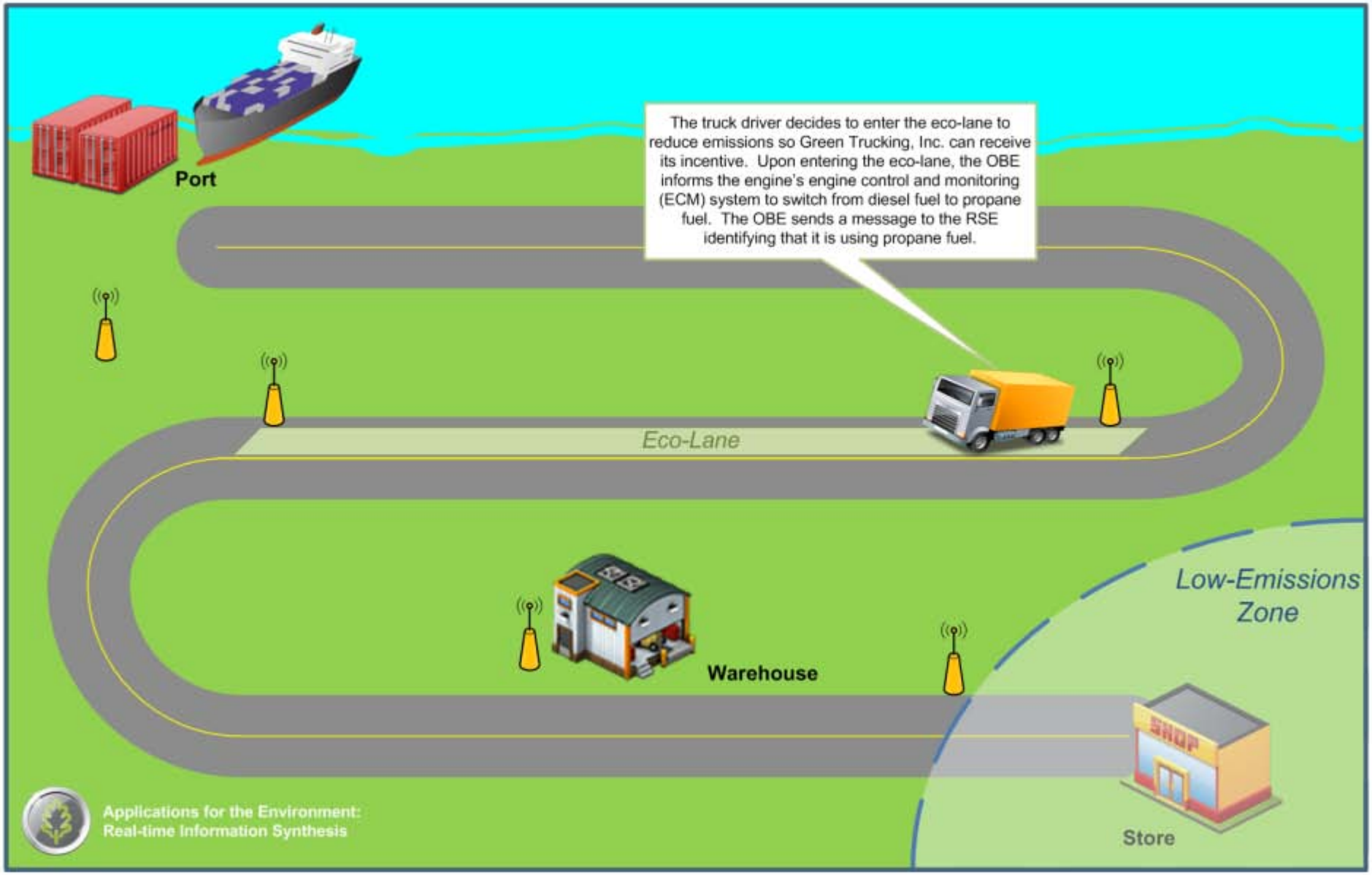

Port
The containers are equipped with DSRC tags that broadcast a message every second with a unique identification number, and GPS location. As the containers are unloaded, they pass by a roadside equipment (RSE) unit. The RSE receives the message which is sent to the Port's inventory tracking system.
Eco-Lane
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis

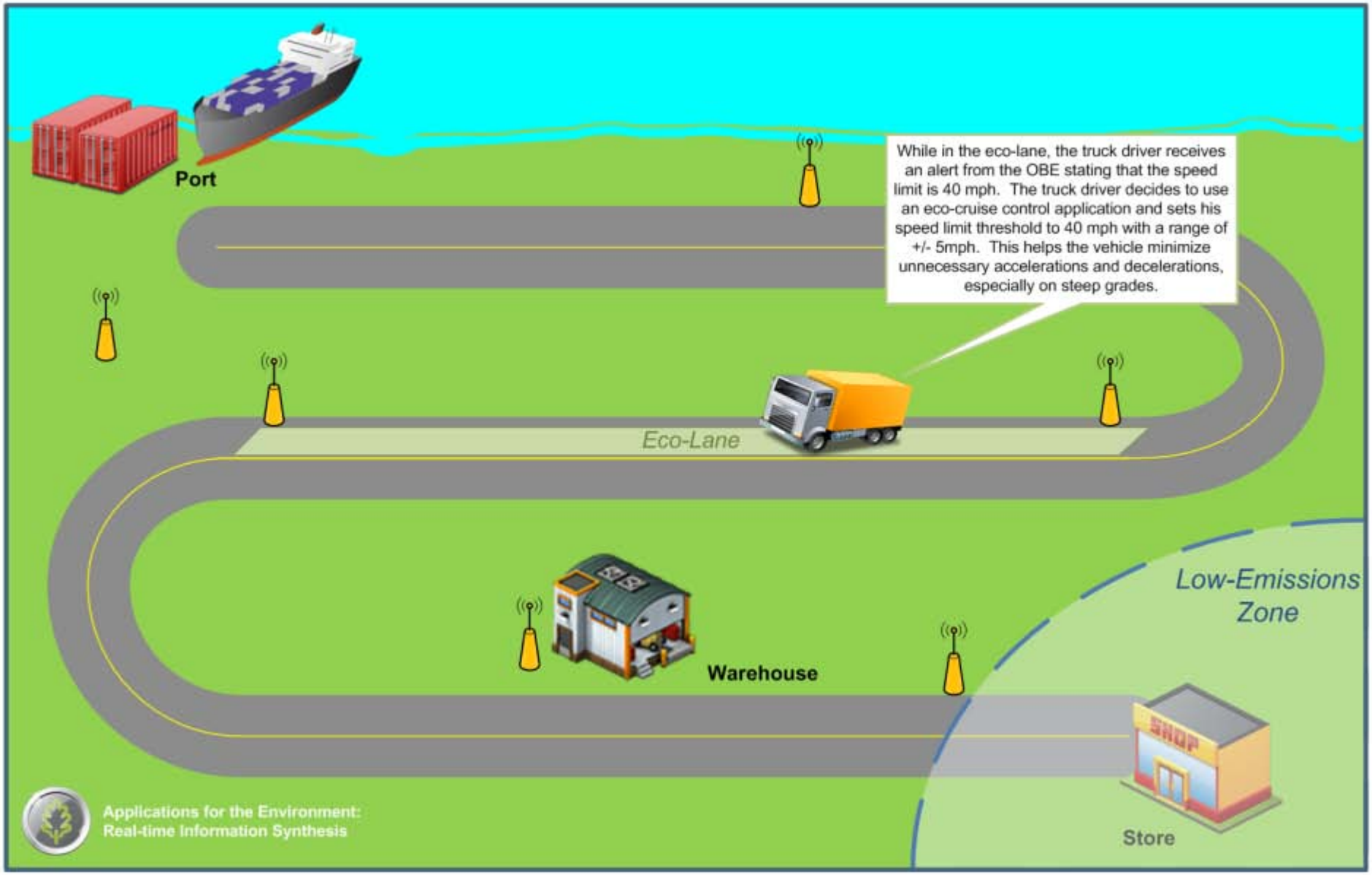

Port
Green Trucking, Inc. is notified by the Port's inventory tracking system that the container full of *iWidgets* has arrived. Green Trucking, Inc. sends an alternative fuel vehicle (e.g., a truck with a dual-fuel engine that accepts diesel & propane fuel) truck to pick up the containers for delivery to the Orange Corporation store, located 500 miles south of the Port.
Eco-Lane
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis

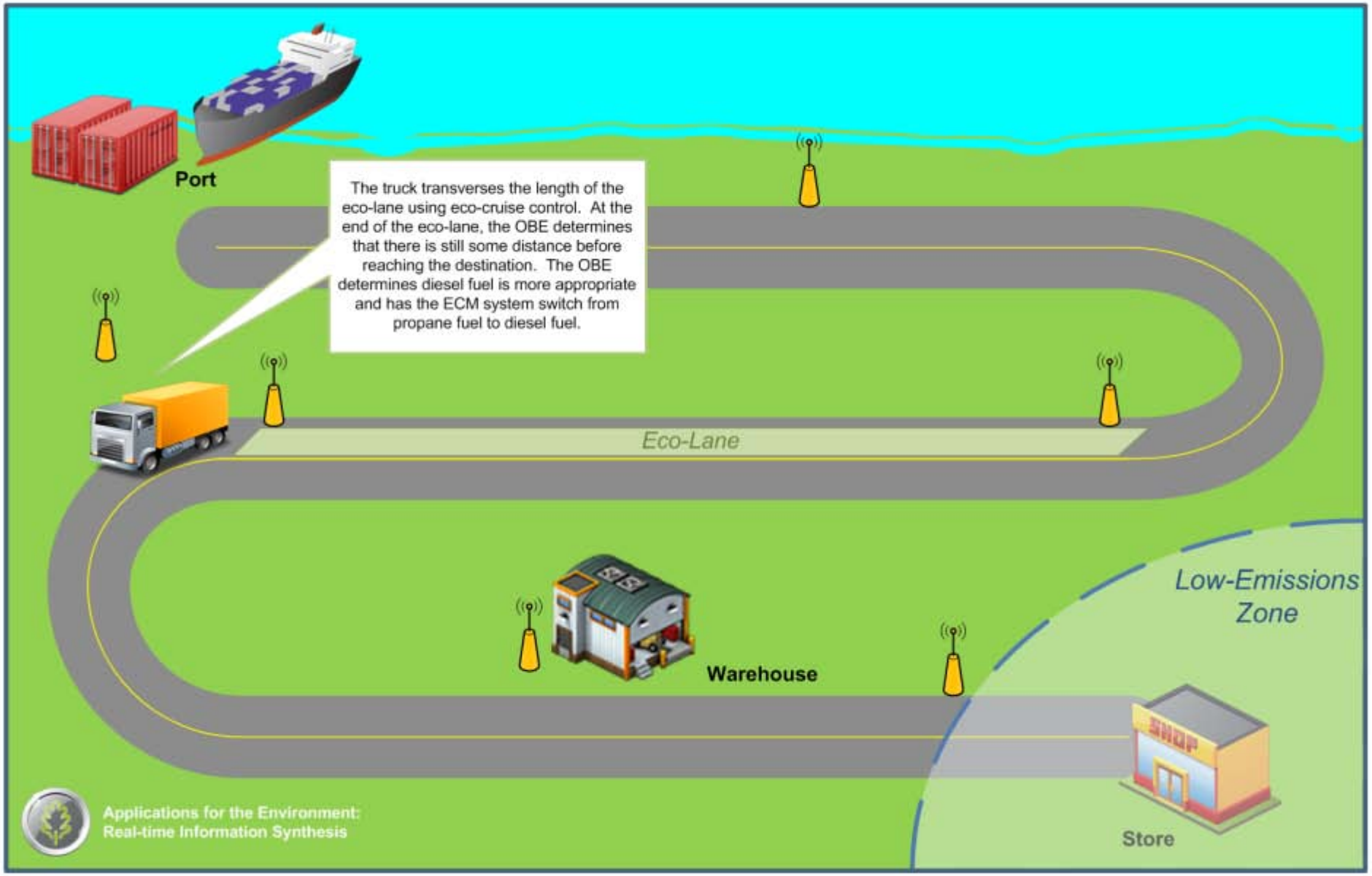

Before leaving for his trip, the truck driver uses an application on his onboard equipment (OBE) unit to determine the green route. The application uses a green-routing algorithm that considers real-time traffic/congestion information, grades, and limits to determine the route that reduces fuel consumption and emissions. The truck driver accepts the green route and begins his trip.
Port
Eco-Lane
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis

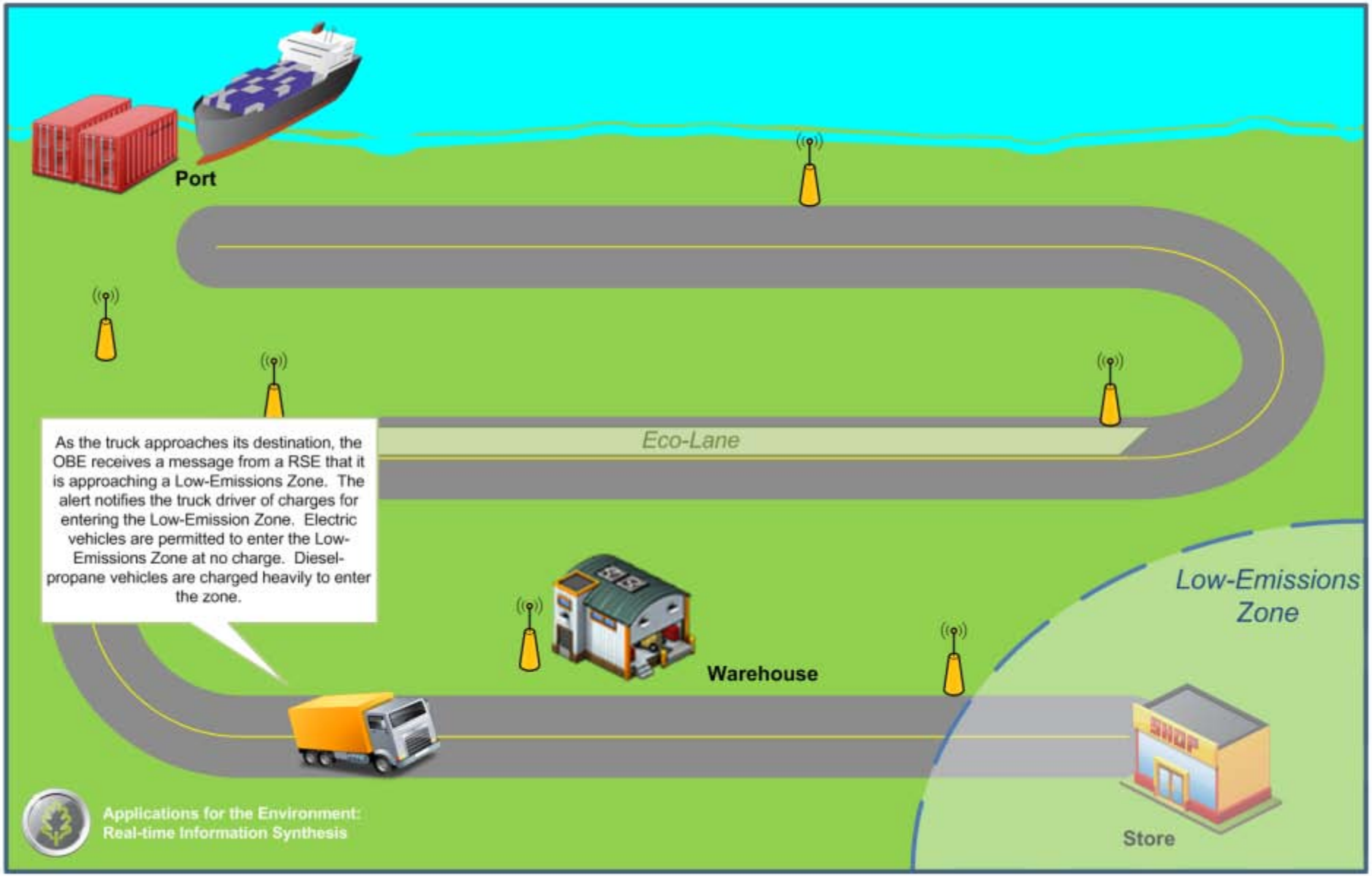

The truck passes by a RSE. The RSE disseminates real-time traffic/congestion information to the truck's OBE. The OBE receives this information and feeds it to the green-routing application. The application re-computes the green route in real-time and continues to provide directions to the truck driver.
Port
Eco-Lane
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis

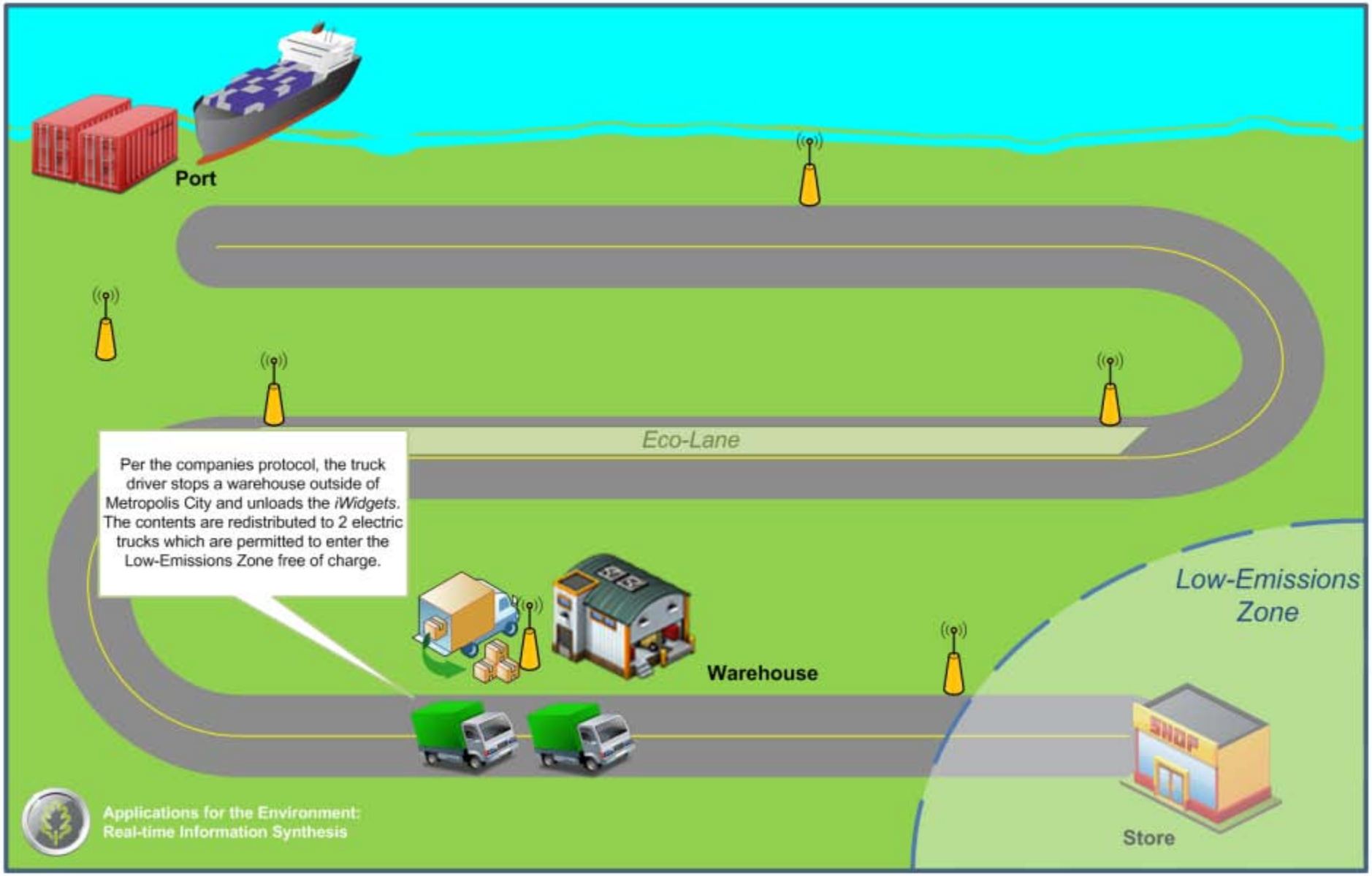

Port
While traveling on the interstate, the truck driver receives an alert from his OBE that an eco-lane is ahead. If running on propane instead of diesel fuel, the truck may use the eco-lane. If not, the truck must use the conventional lanes.
Eco-Lane
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis

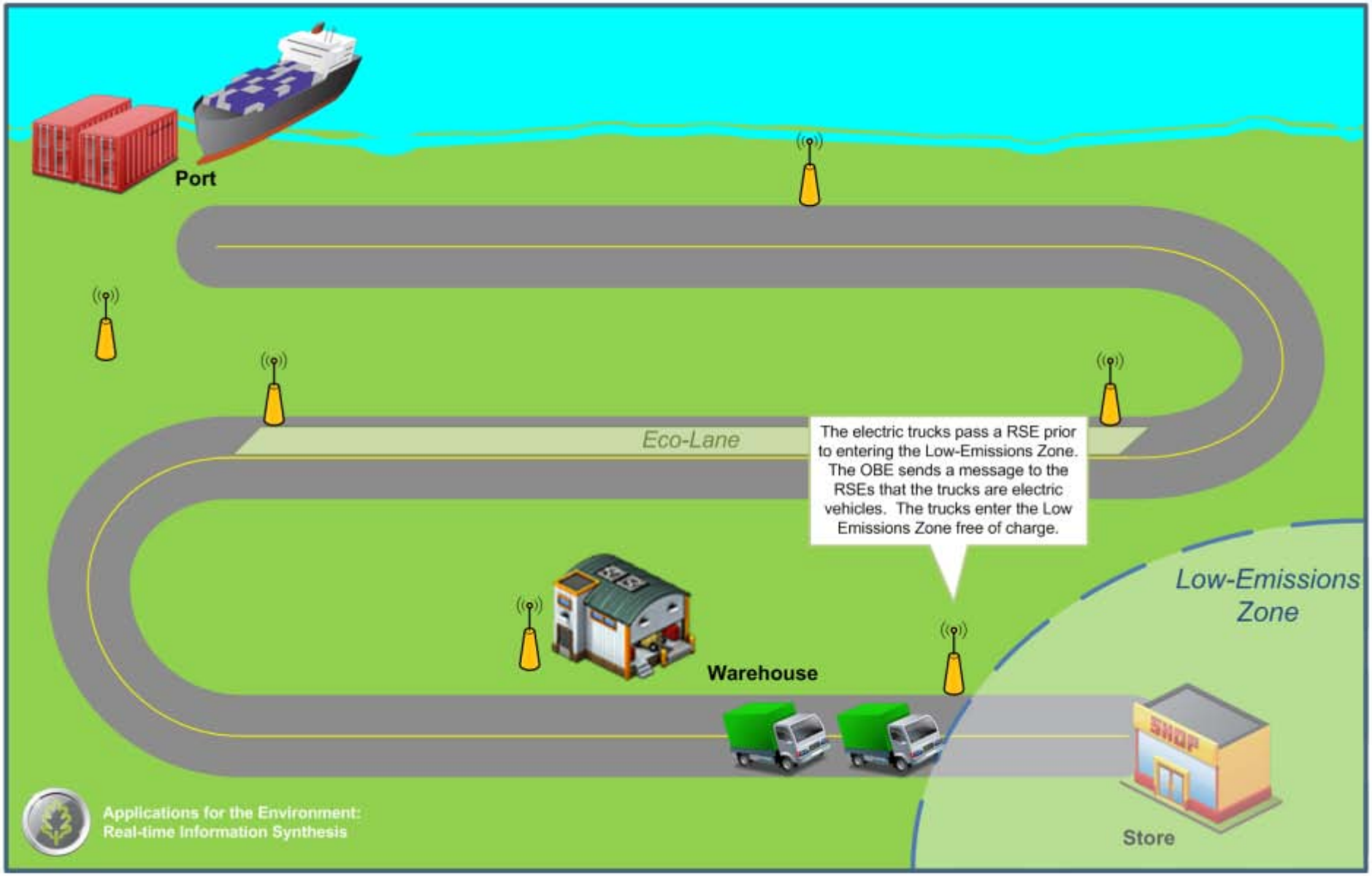

Port
The truck driver decides to enter the eco-lane to reduce emissions so Green Trucking, Inc. can receive its incentive. Upon entering the eco-lane, the OBE informs the engine's engine control and monitoring (ECM) system to switch from diesel fuel to propane fuel. The OBE sends a message to the RSE identifying that it is using propane fuel.
Eco-Lane
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis

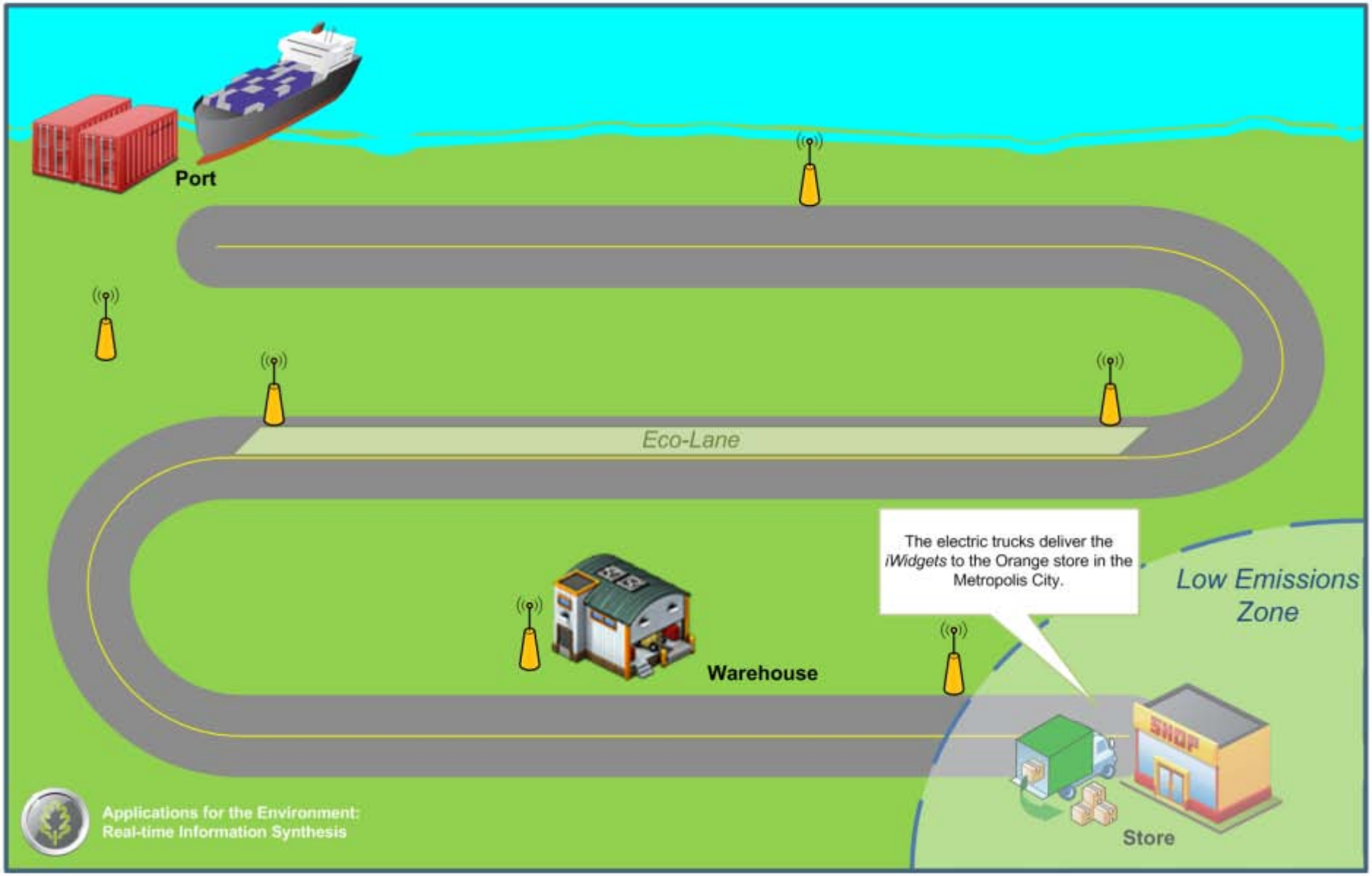

Port
While in the eco-lane, the truck driver receives an alert from the OBE stating that the speed limit is 40 mph. The truck driver decides to use an eco-cruise control application and sets his speed limit threshold to 40 mph with a range of +/- 5mph. This helps the vehicle minimize unnecessary accelerations and decelerations, especially on steep grades.
Eco-Lane
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis


Port
The truck transverses the length of the eco-lane using eco-cruise control. At the end of the eco-lane, the OBE determines that there is still some distance before reaching the destination. The OBE determines diesel fuel is more appropriate and has the ECM system switch from propane fuel to diesel fuel.
Eco-Lane
Warehouse
Low-Emissions Zone
Store
Applications for the Environment:
Real-time Information Synthesis


Port
Eco-Lane
As the truck approaches its destination, the OBE receives a message from a RSE that it is approaching a Low-Emissions Zone. The alert notifies the truck driver of charges for entering the Low-Emission Zone. Electric vehicles are permitted to enter the Low-Emissions Zone at no charge. Diesel-propane vehicles are charged heavily to enter the zone.
Warehouse
Low-Emissions Zone
Store
Applications for the Environment:
Real-time Information Synthesis


Port
Eco-Lane
Per the companies protocol, the truck driver stops a warehouse outside of Metropolis City and unloads the *iWidgets*. The contents are redistributed to 2 electric trucks which are permitted to enter the Low-Emissions Zone free of charge.
Warehouse
Low-Emissions Zone
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis


Port
Eco-Lane
The electric trucks pass a RSE prior to entering the Low-Emissions Zone. The OBE sends a message to the RSEs that the trucks are electric vehicles. The trucks enter the Low Emissions Zone free of charge.
Low-Emissions Zone
Warehouse
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis


Port
Eco-Lane
The electric trucks deliver the *iWidgets* to the Orange store in the Metropolis City.
Low Emissions Zone
Warehouse
SHOP
Store
Applications for the Environment:
Real-time Information Synthesis

Summary

- This story exemplified four AERIS Transformative Concepts in freight movement:
  - Eco-lanes
  - Low-Emissions Zone
  - Eco-Traveler Information
  - Support Alternative Fuel Vehicle (AFV) Operations

- The other two Transformative Concepts could also have been applied:
  - Eco-Signal Operations
  - Eco-Integrated Corridor Management (E-ICM)

Potential Benefits

- Reduced fuel consumption and emissions
  - Potential fuel savings for trucking companies
  - Incentive for green trucking decisions
  - Reduced emissions in the Low-Emission Zone
- Support for alternate fuel vehicles
- Real-time information for ‘Green Decisions’
  - Green routing, real-time traffic information, truck parking, and locations of alternate fuel stations
- Just in time delivery (Reliability = Money)
- Improved freight operations and coordination of deliveries

Transit's Role in the Transformative Concepts

Potential Benefits

- Eco-signal Operations
  - Helps expedite transit service
  - Minimizes idling
  - Avoid transit bunching phenomenon
  - Maximizes engine performance
  - Improves fuel economy
  - Extends transit vehicle service life
- Low-Emissions Zone
  - Transit becomes a supporting entity to assist in offering alternative travel options and increase mode shift
  - Potential ridership increase

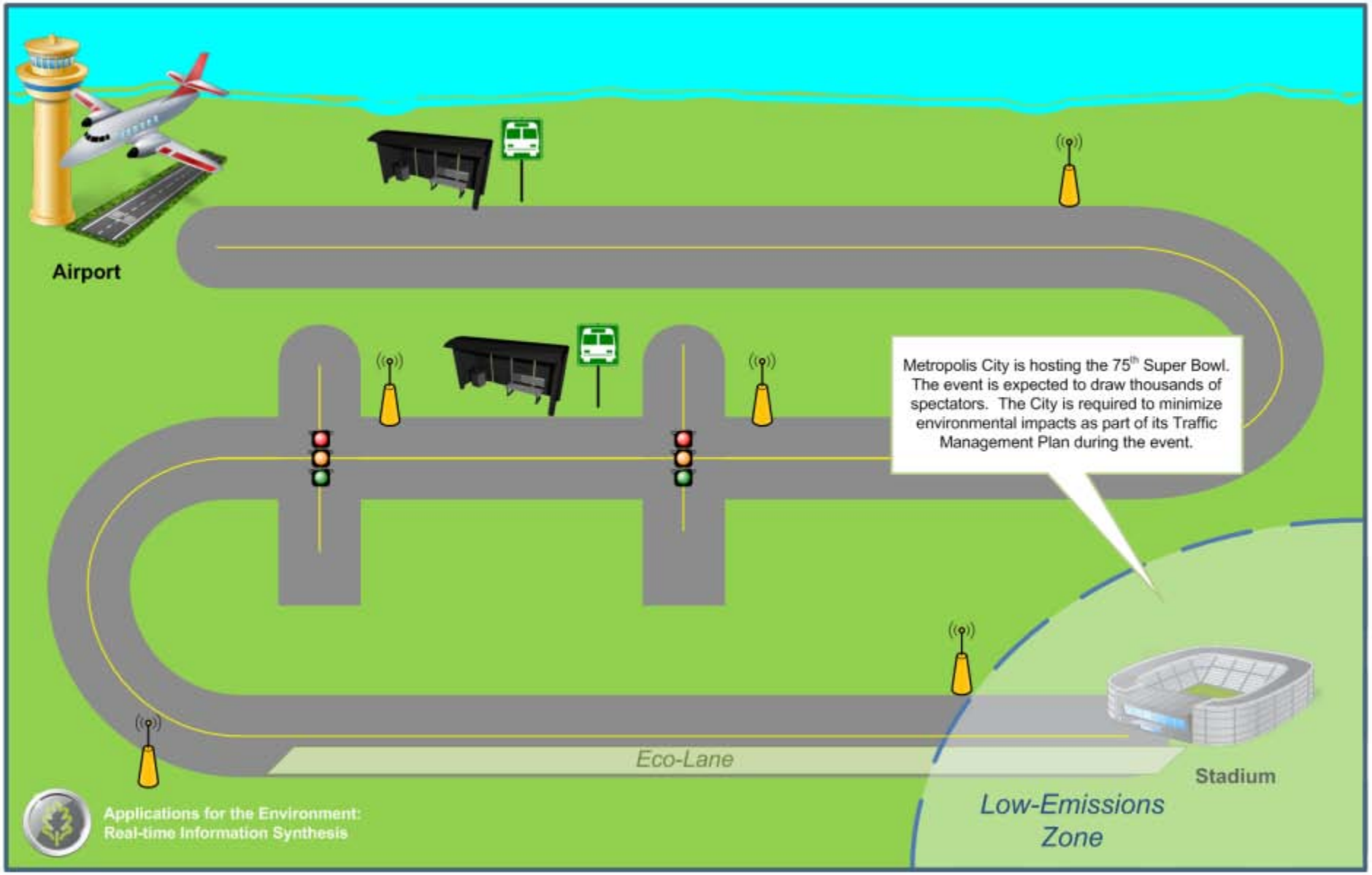
Potential Benefits

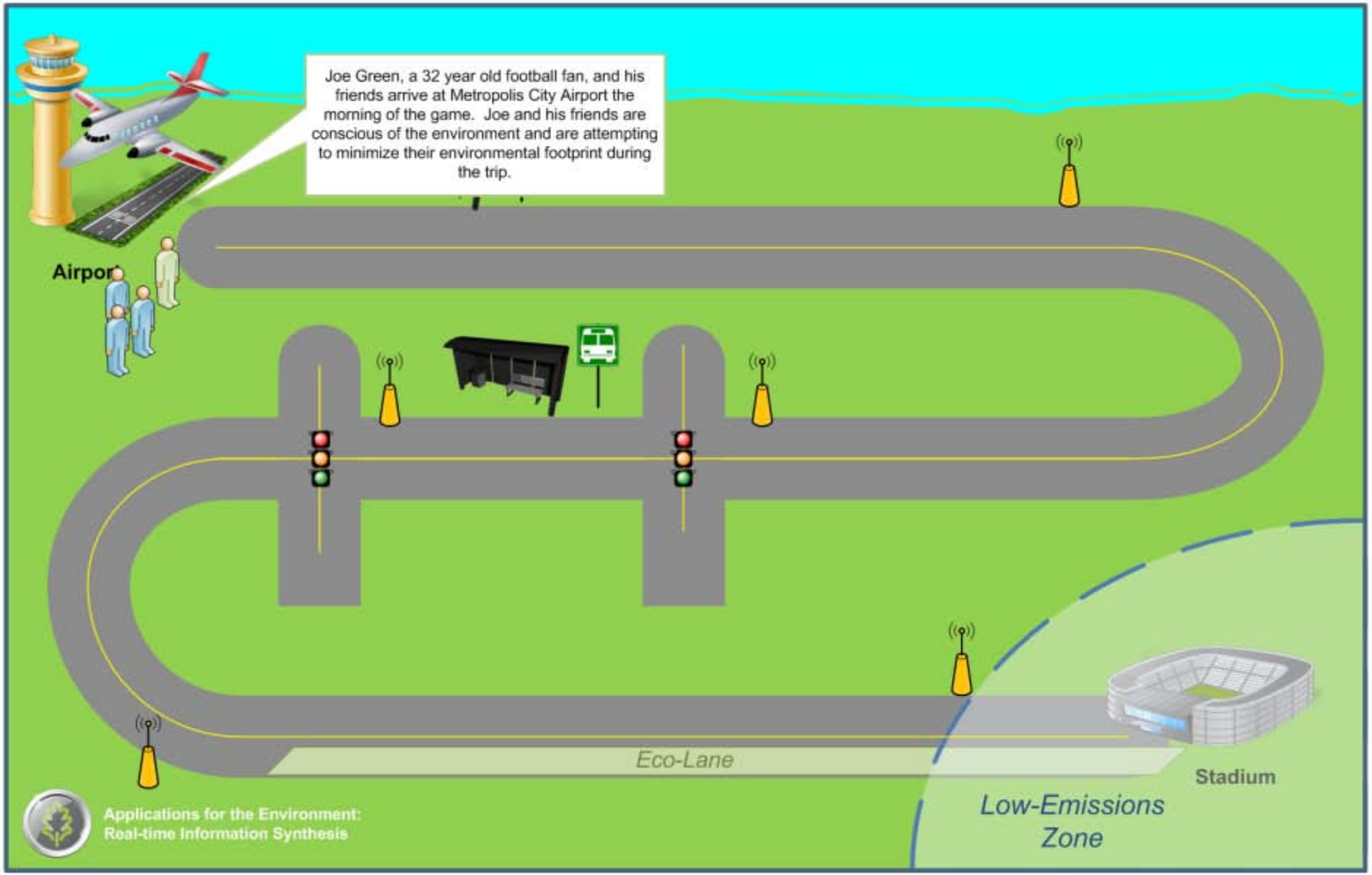
- Eco-Lanes
  - Potential to expedite transit service
  - Maximizes engine performance
  - Improves fuel economy
  - Extends transit vehicle service life

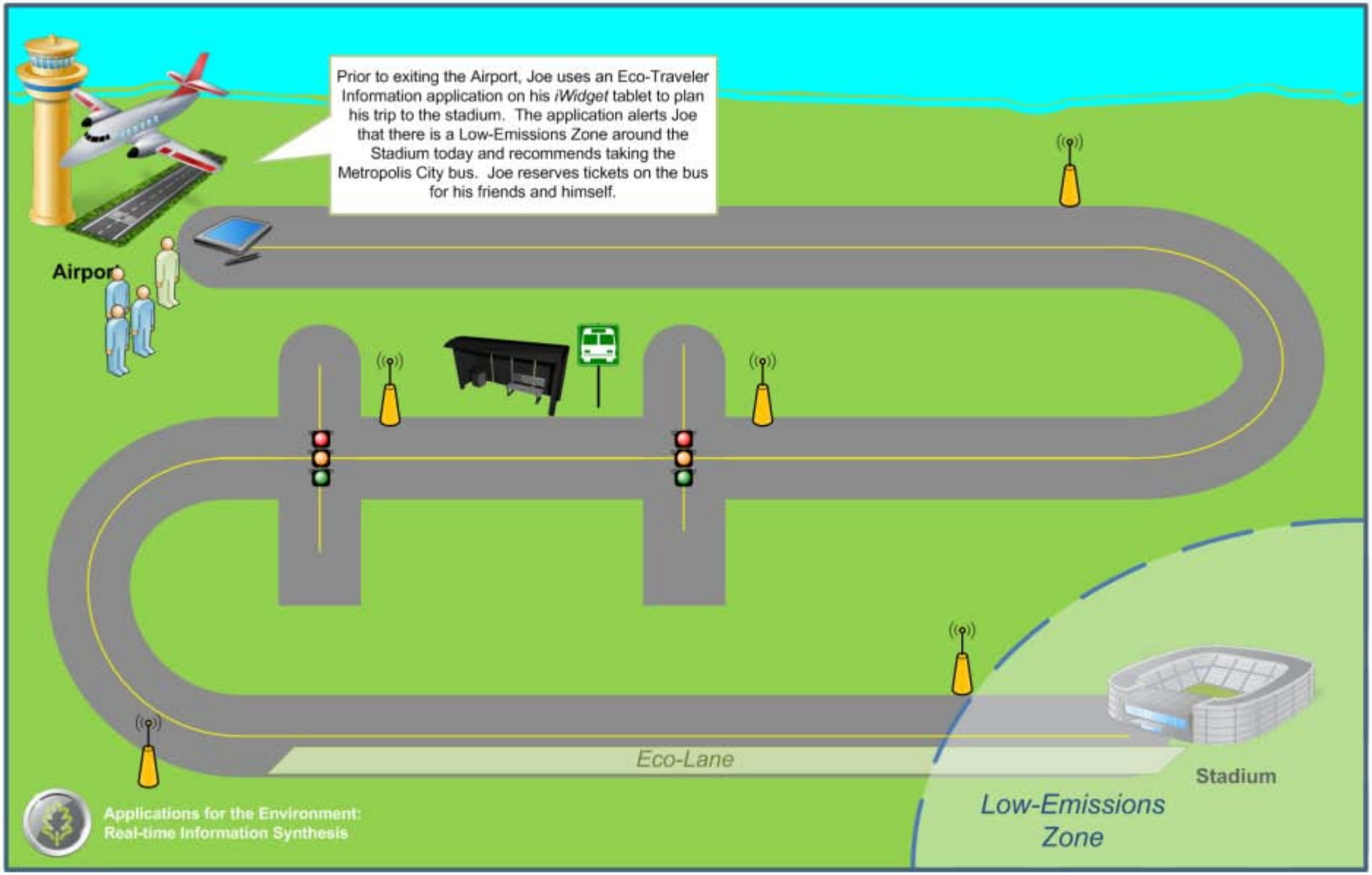
- Support Alternative Fuel Vehicle Operations
  - Transit becomes a supporting entity in offering a more environmentally-friendly travel mode.
  - Hybrid-diesel vehicle purchase (reaching 30% of national fleet)
  - Compressed Natural Gas nearly 25% of new orders (10K transit vehicles)
  - Ultimately, an all-electric vehicle (All Battery or Fuel Cell)

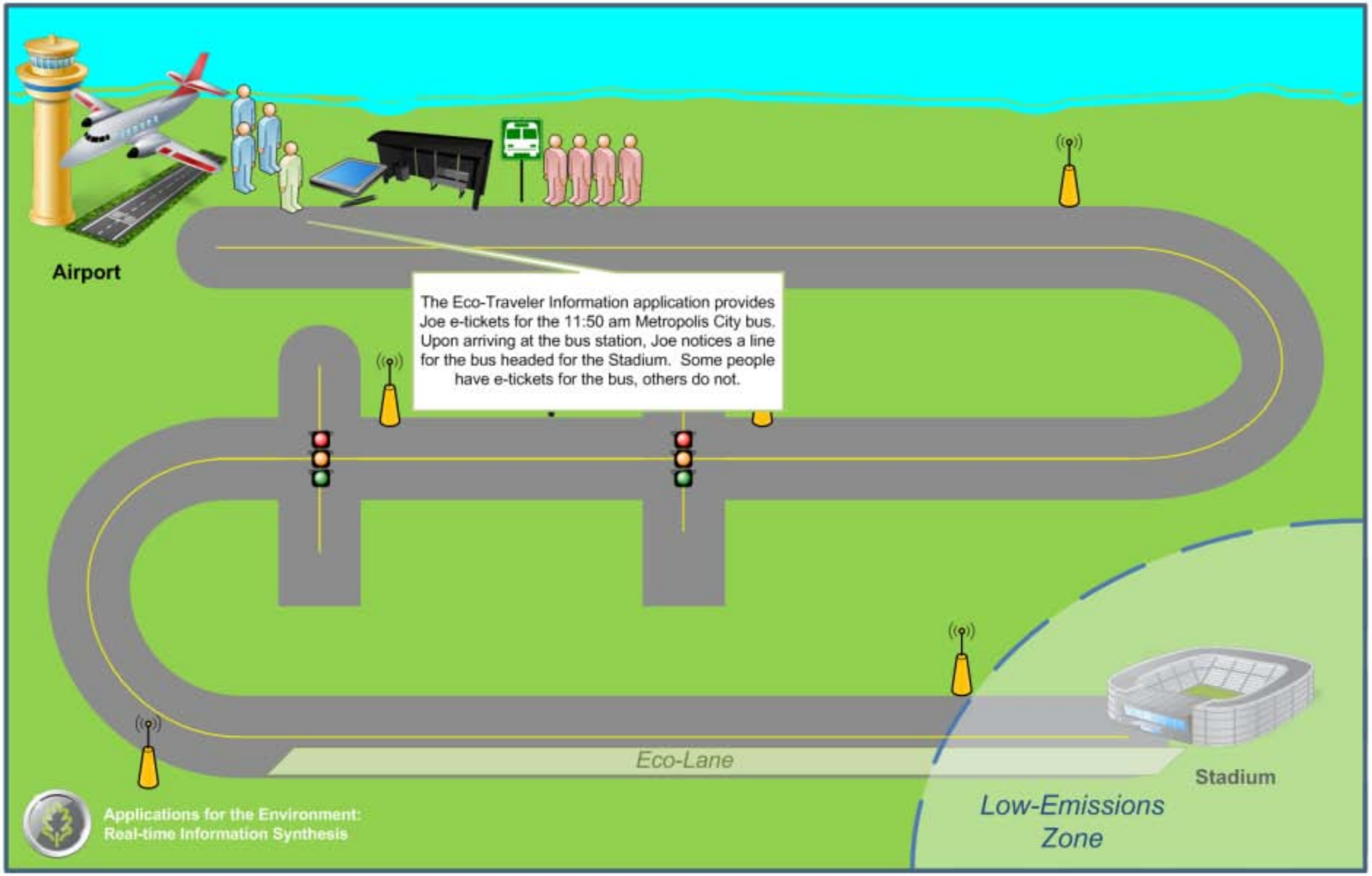
GREEN TRANSIT SCENARIO – 'IMAGINE'

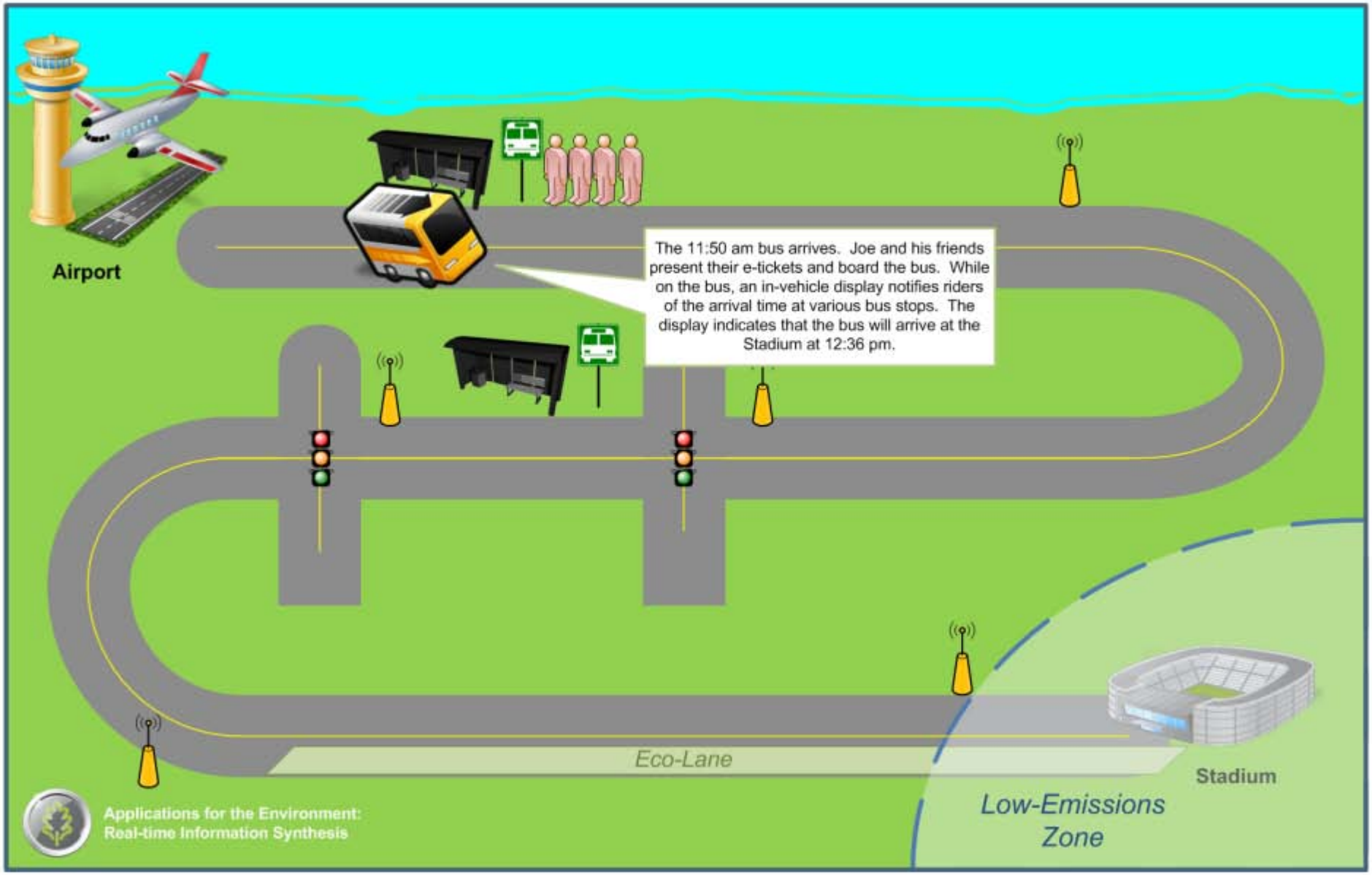
Source: http://fastlane.dot.gov/2011/02/last-friday-we-ended-our-official-work-week-at-the-department-of-transportation-with-five-very-special-visitors-an-fc-ev-a.html

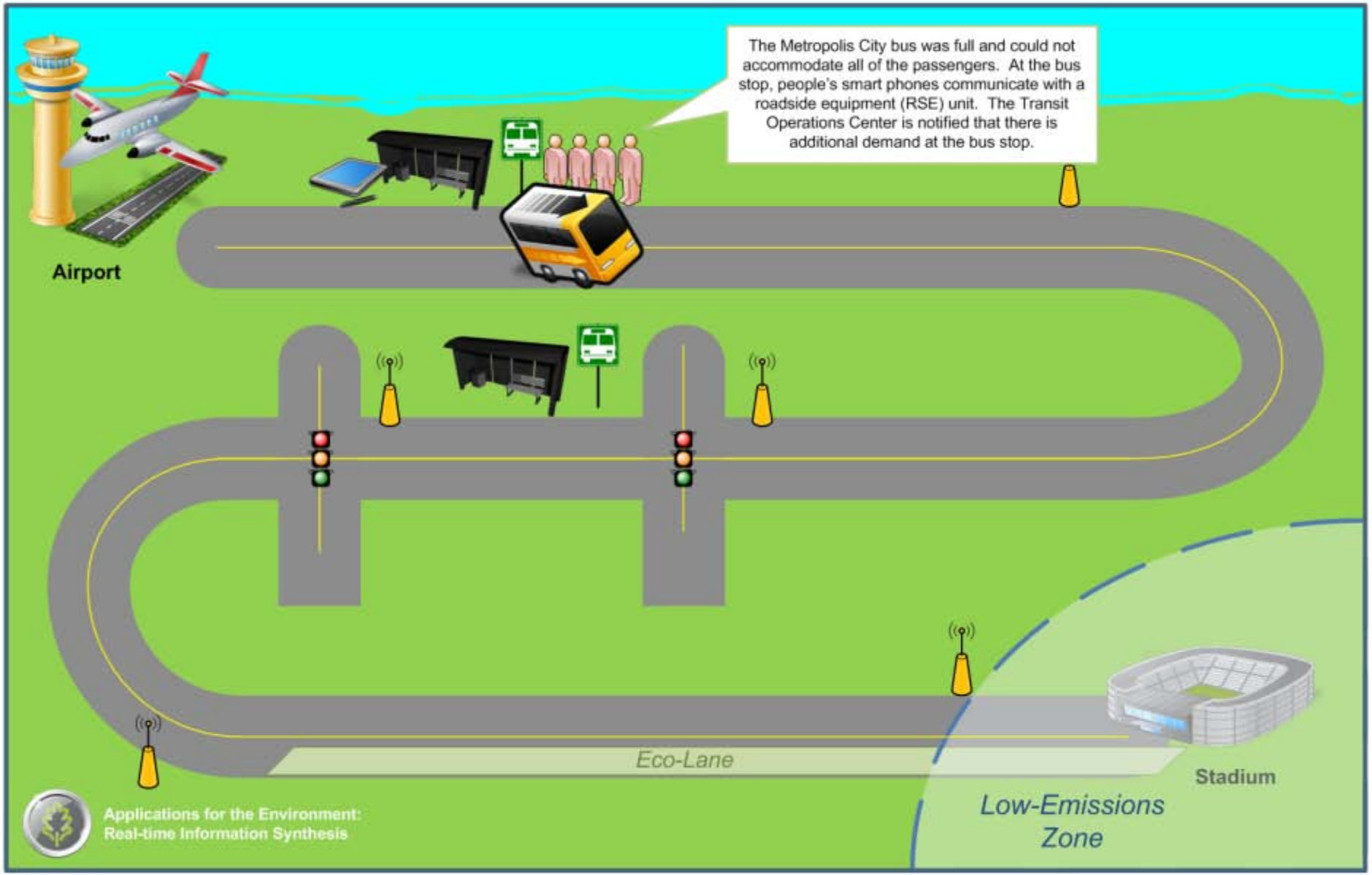

Airport
Metropolis City is hosting the 75th Super Bowl. The event is expected to draw thousands of spectators. The City is required to minimize environmental impacts as part of its Traffic Management Plan during the event.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

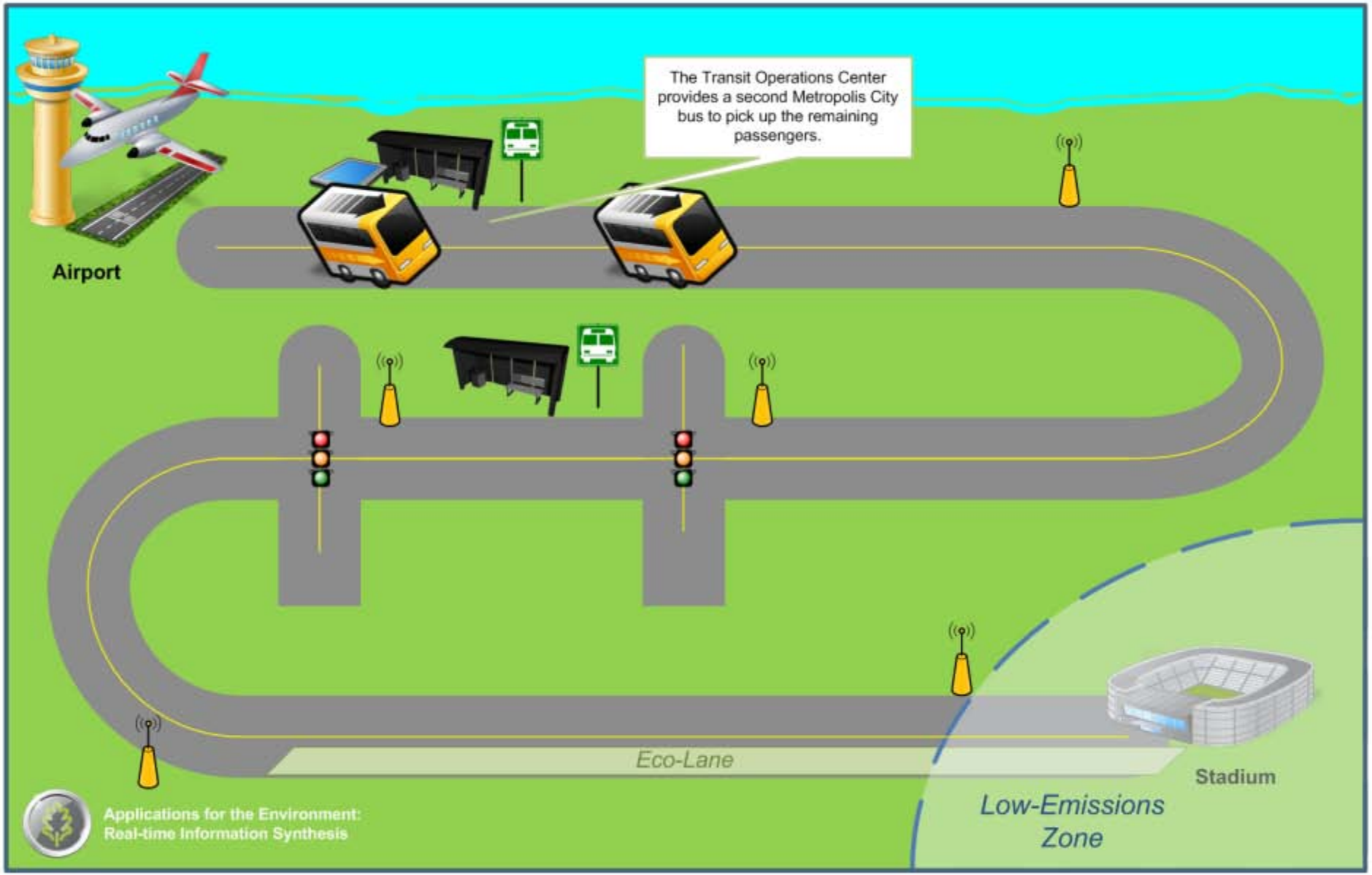

Joe Green, a 32 year old football fan, and his friends arrive at Metropolis City Airport the morning of the game. Joe and his friends are conscious of the environment and are attempting to minimize their environmental footprint during the trip.
Airport
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

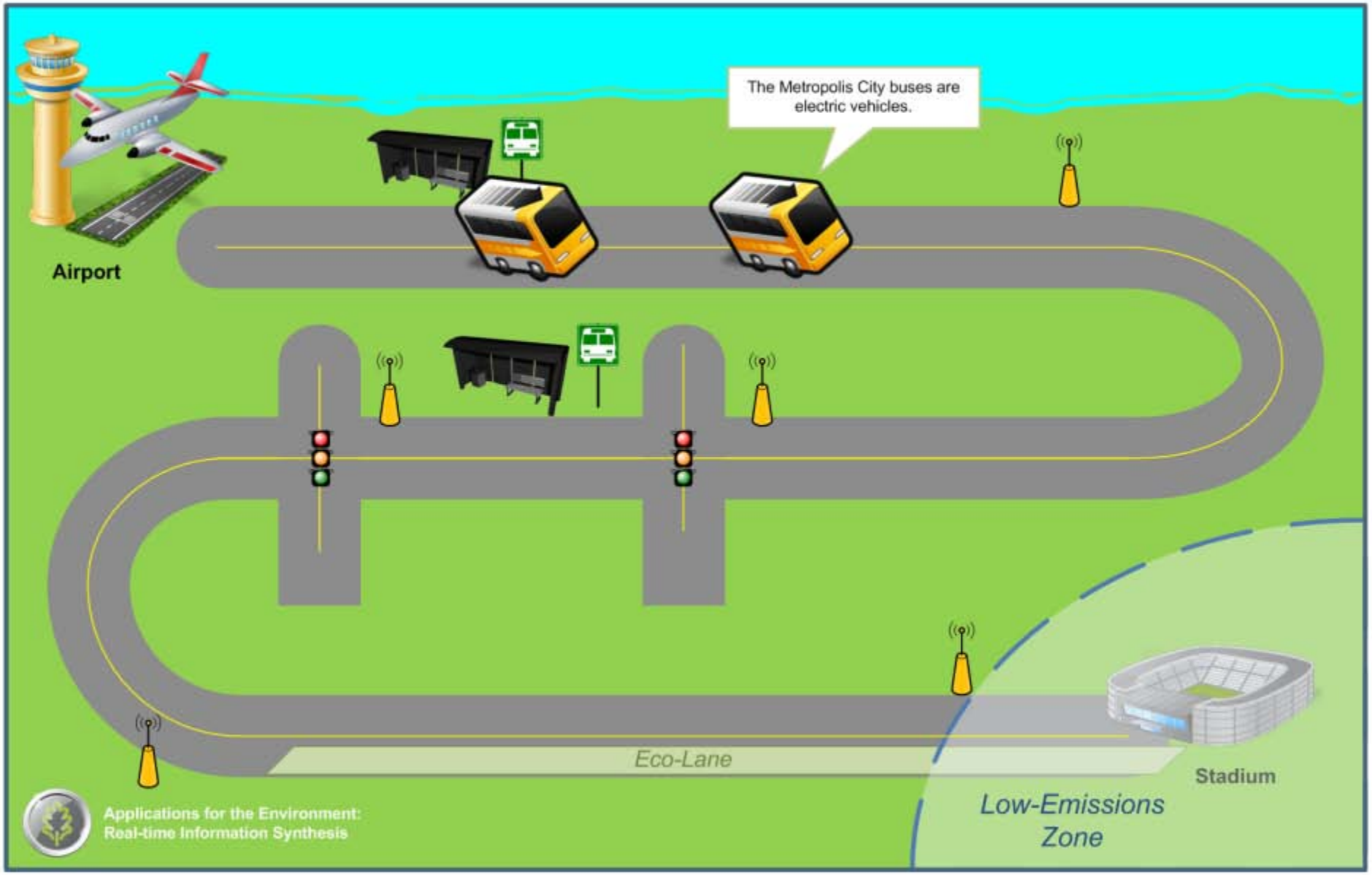

Prior to exiting the Airport, Joe uses an Eco-Traveler Information application on his *iWidget* tablet to plan his trip to the stadium. The application alerts Joe that there is a Low-Emissions Zone around the Stadium today and recommends taking the Metropolis City bus. Joe reserves tickets on the bus for his friends and himself.
Airport
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

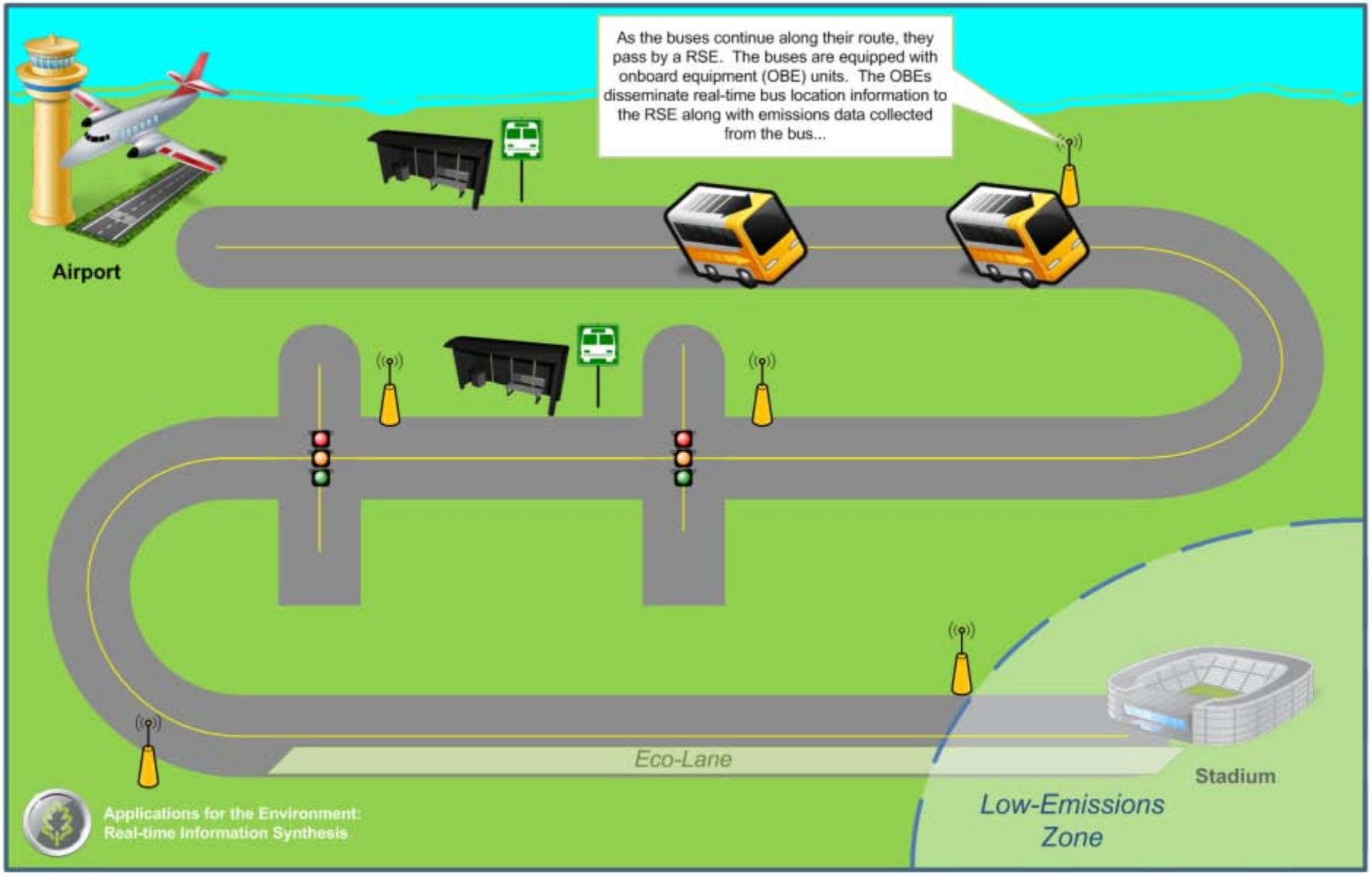

Airport
The Eco-Traveler Information application provides Joe e-tickets for the 11:50 am Metropolis City bus. Upon arriving at the bus station, Joe notices a line for the bus headed for the Stadium. Some people have e-tickets for the bus, others do not.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

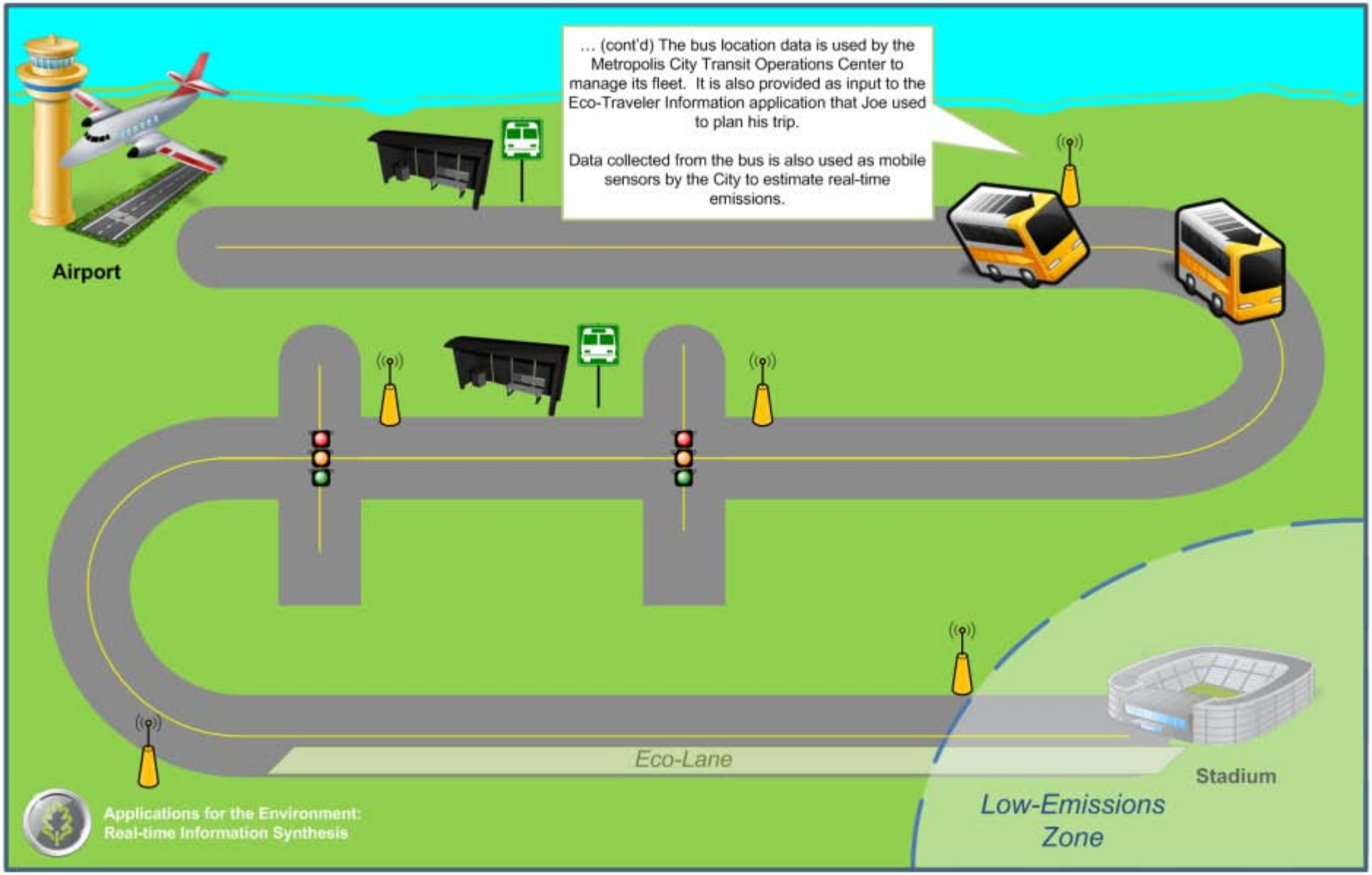

Airport
The 11:50 am bus arrives. Joe and his friends present their e-tickets and board the bus. While on the bus, an in-vehicle display notifies riders of the arrival time at various bus stops. The display indicates that the bus will arrive at the Stadium at 12:36 pm.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

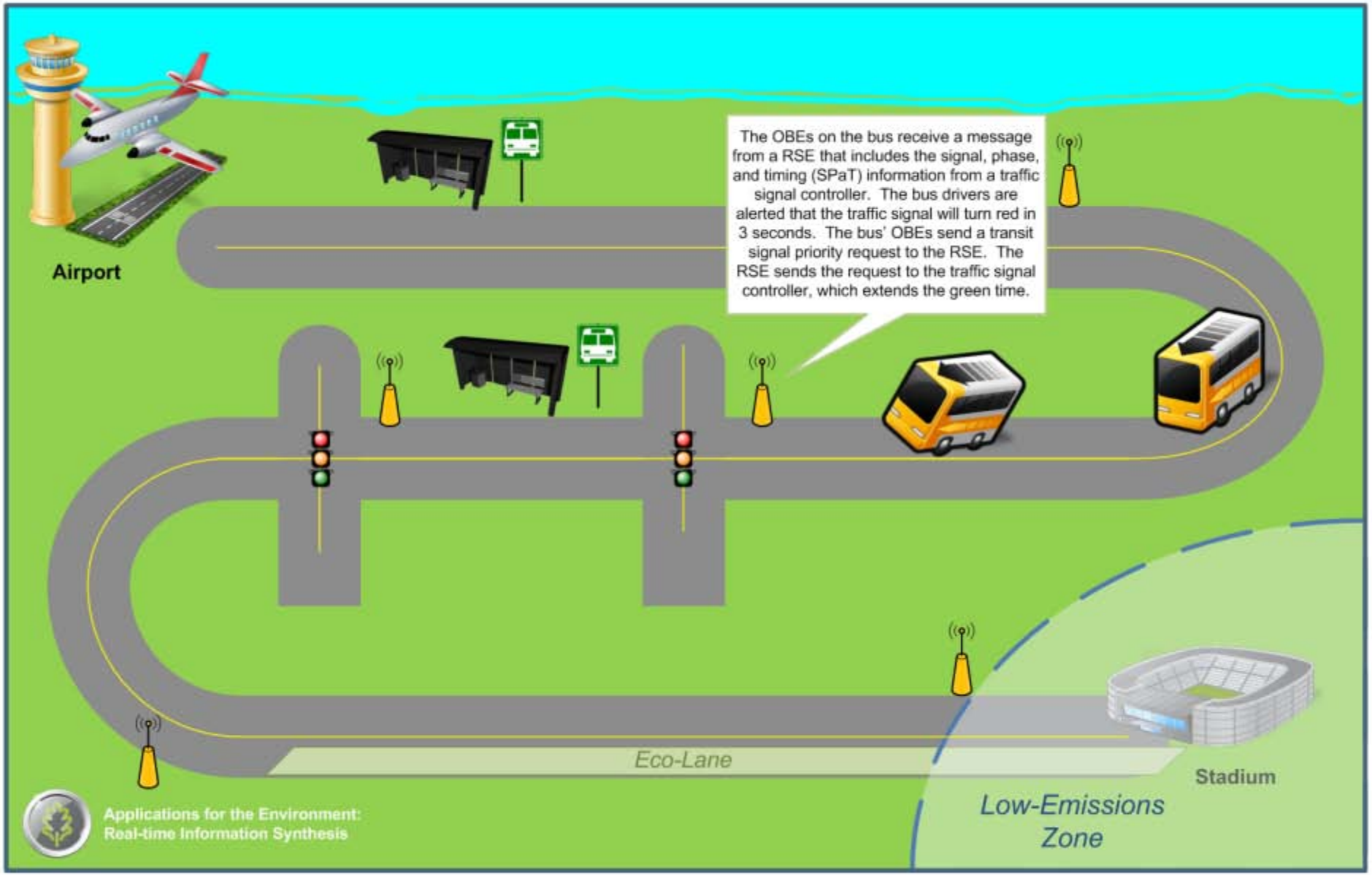

The Metropolis City bus was full and could not accommodate all of the passengers. At the bus stop, people's smart phones communicate with a roadside equipment (RSE) unit. The Transit Operations Center is notified that there is additional demand at the bus stop.
Airport
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

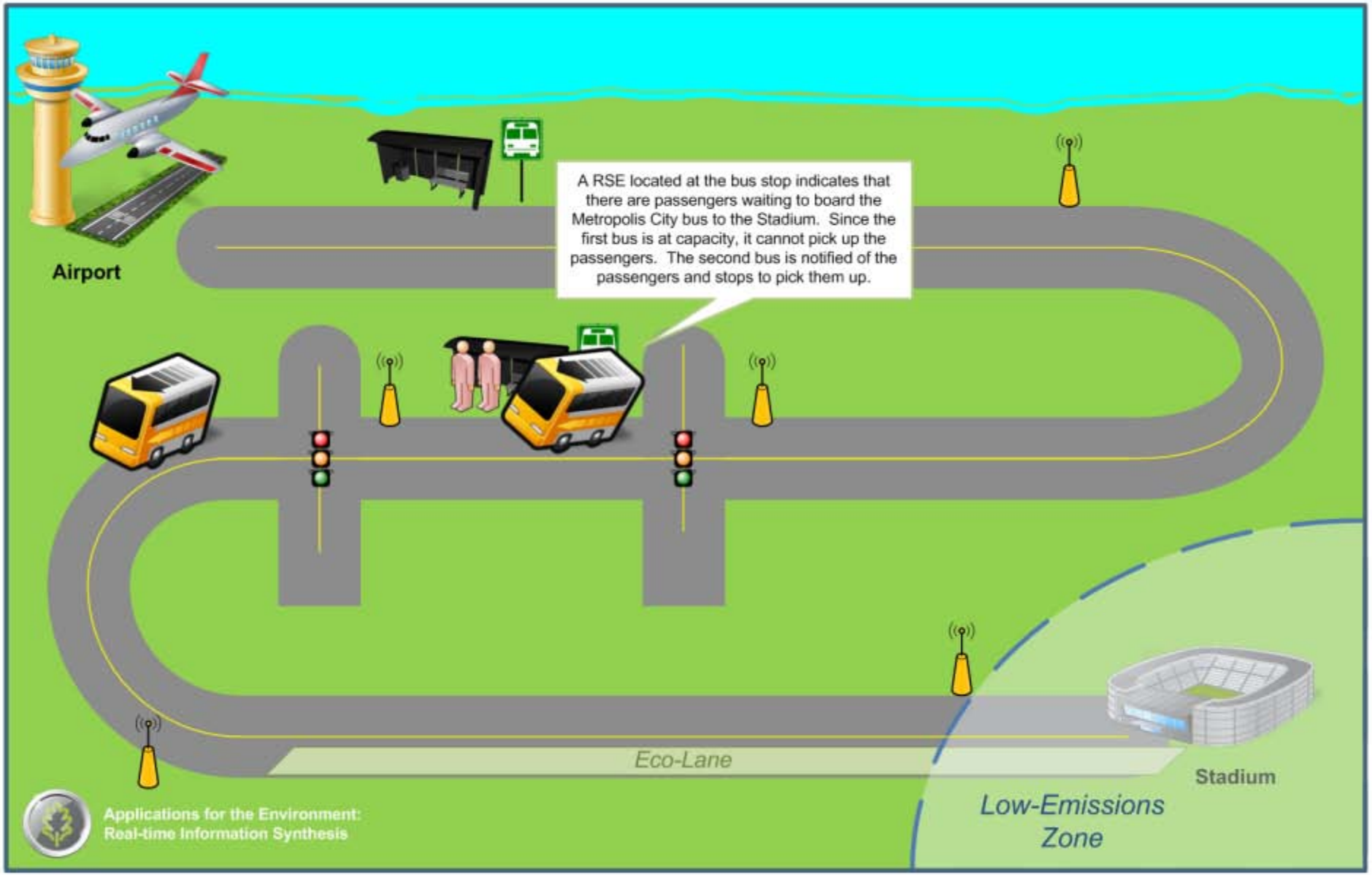

The Transit Operations Center provides a second Metropolis City bus to pick up the remaining passengers.
Airport
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

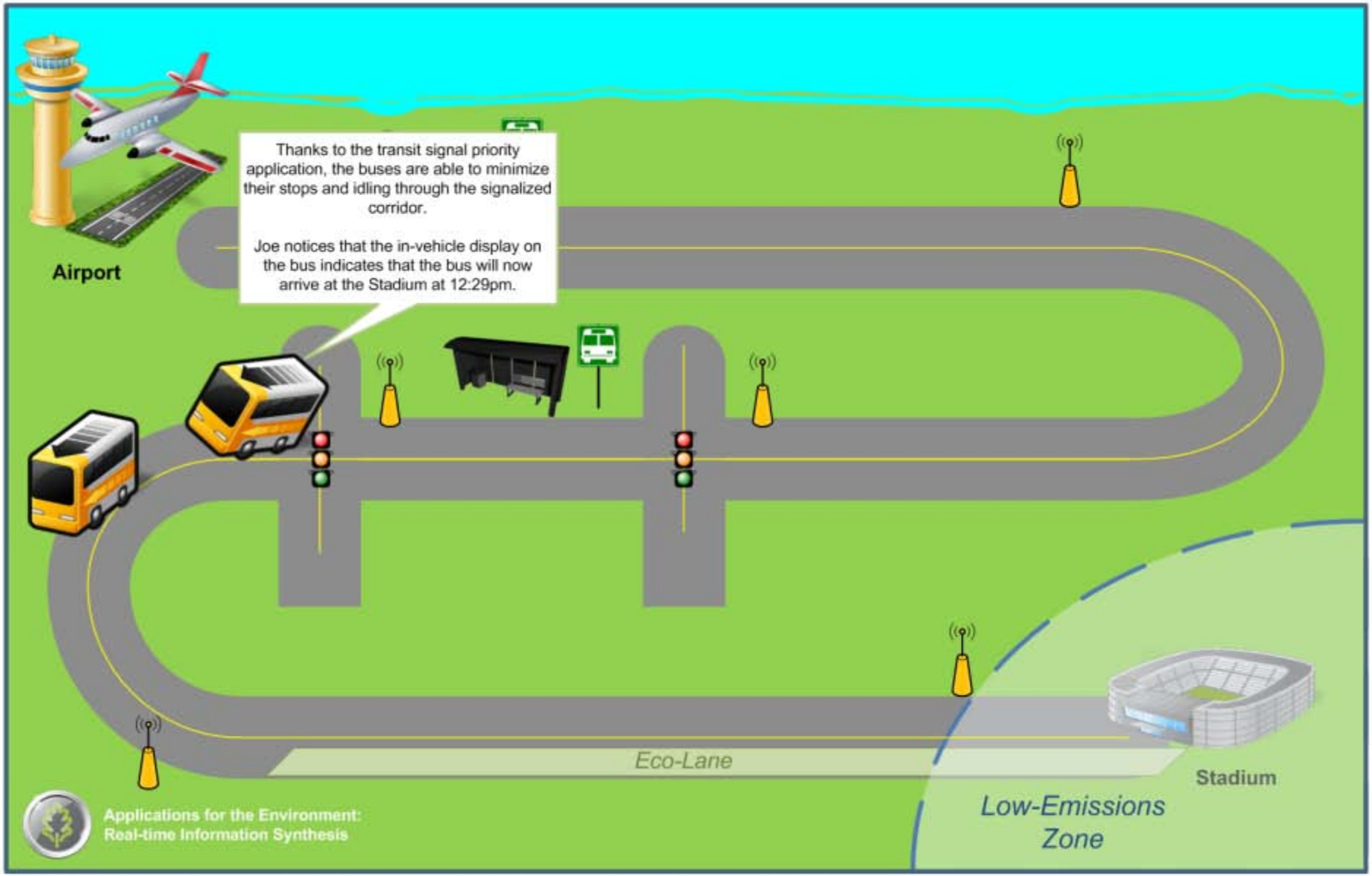

The Metropolis City buses are electric vehicles.
Airport
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

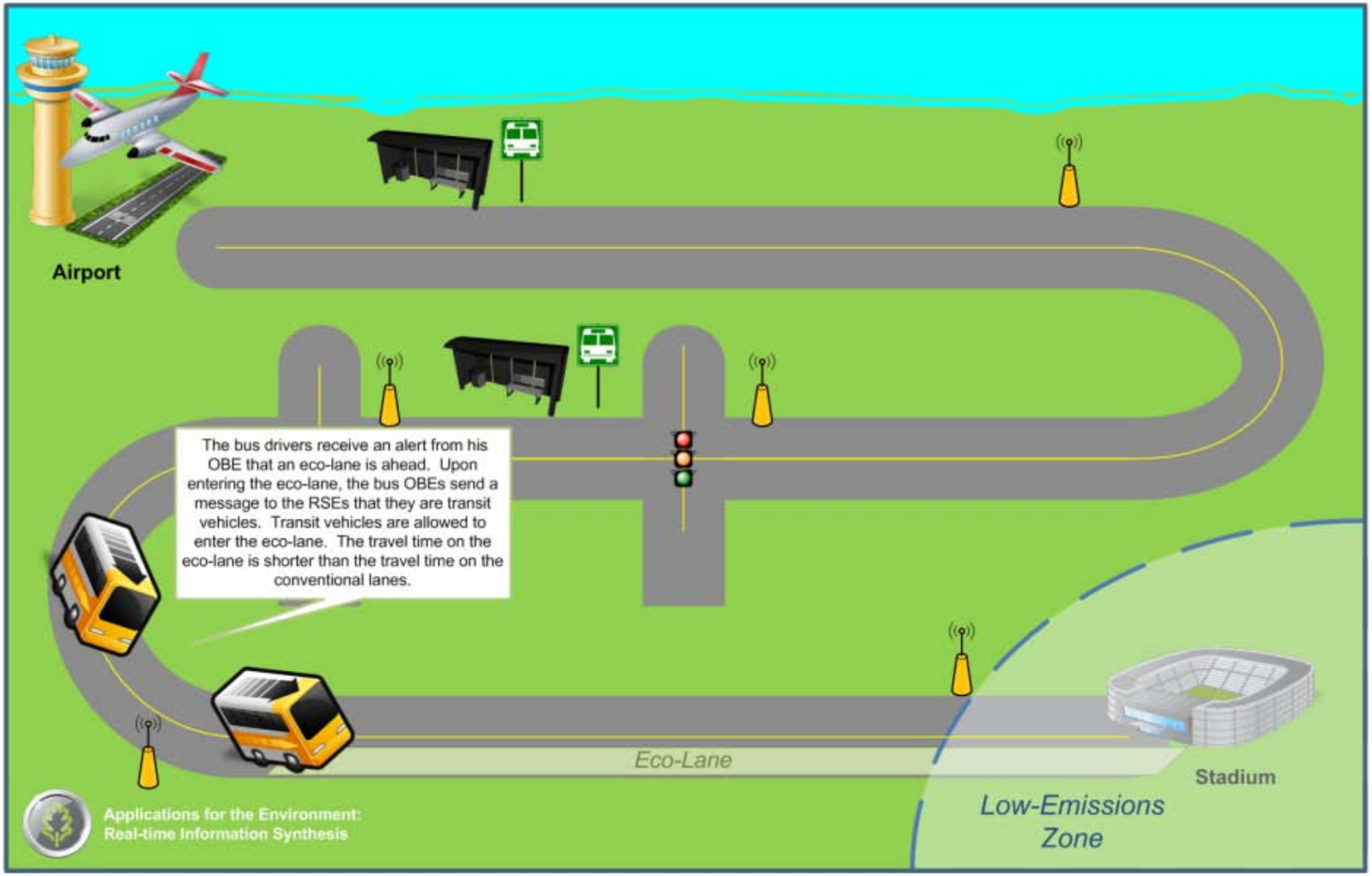

As the buses continue along their route, they pass by a RSE. The buses are equipped with onboard equipment (OBE) units. The OBEs disseminate real-time bus location information to the RSE along with emissions data collected from the bus...
Airport
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

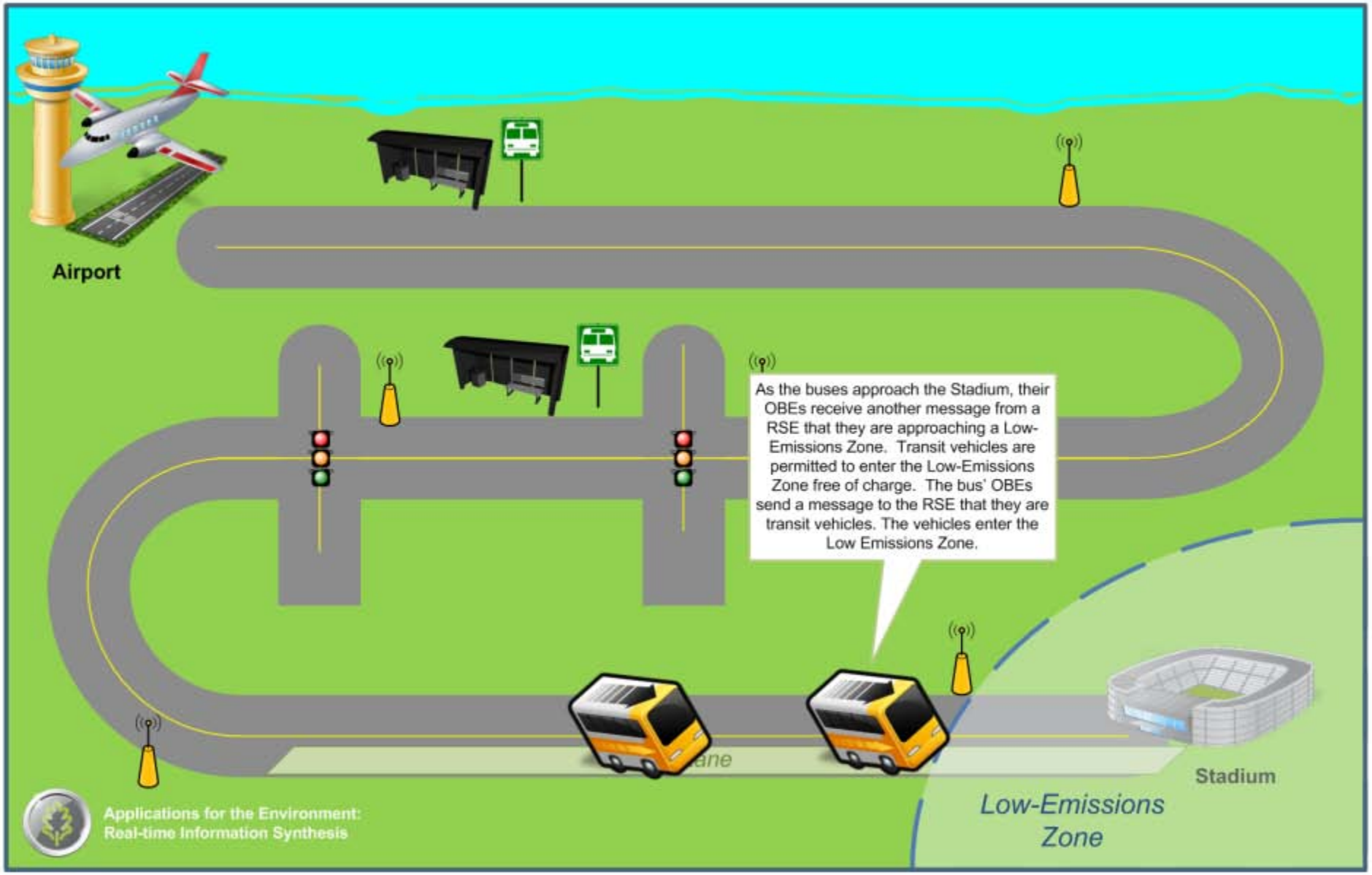

… (cont'd) The bus location data is used by the Metropolis City Transit Operations Center to manage its fleet. It is also provided as input to the Eco-Traveler Information application that Joe used to plan his trip.
Data collected from the bus is also used as mobile sensors by the City to estimate real-time emissions.
Airport
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

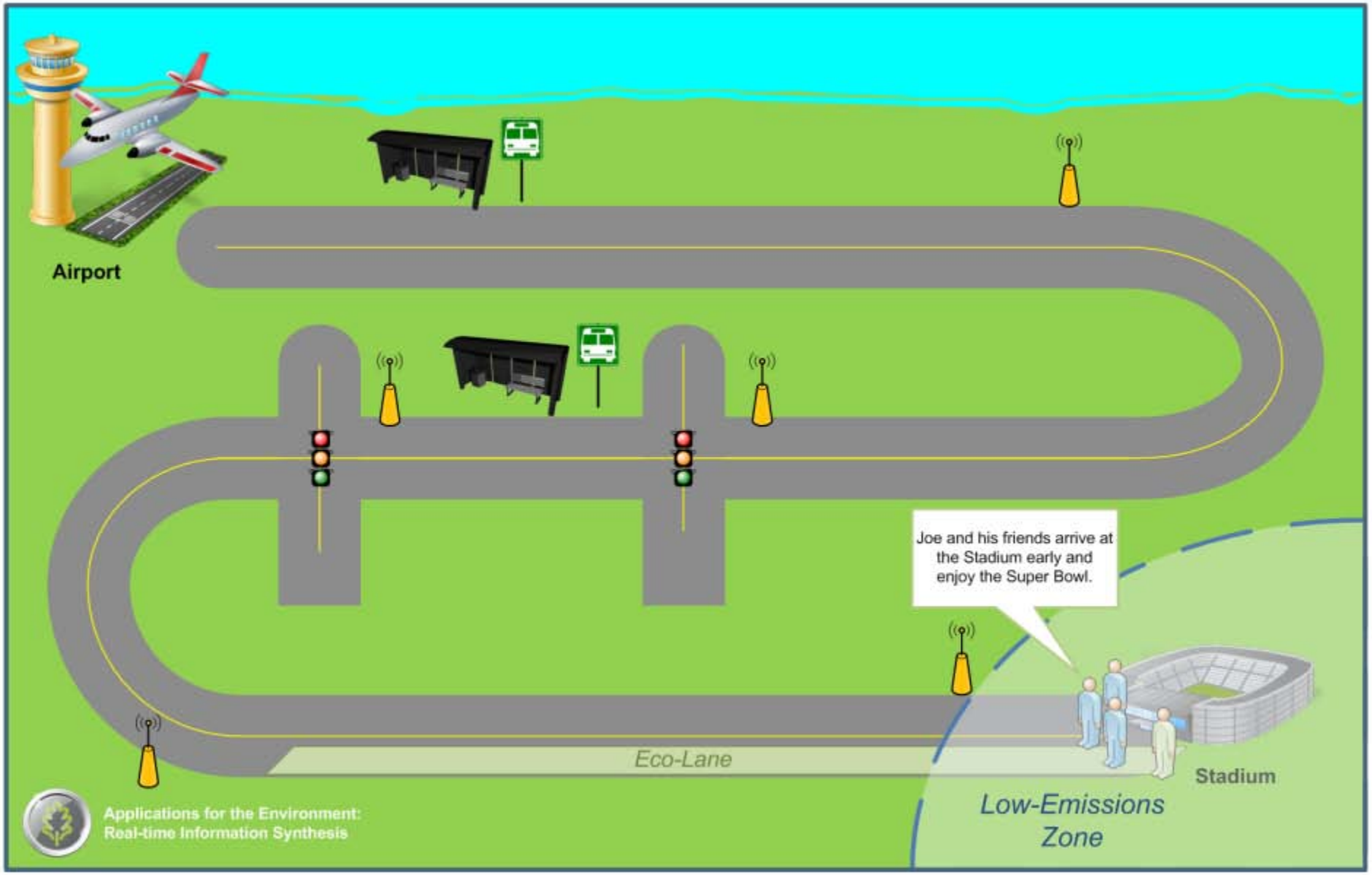

Airport
The OBEs on the bus receive a message from a RSE that includes the signal, phase, and timing (SPaT) information from a traffic signal controller. The bus drivers are alerted that the traffic signal will turn red in 3 seconds. The bus' OBEs send a transit signal priority request to the RSE. The RSE sends the request to the traffic signal controller, which extends the green time.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis


Airport
A RSE located at the bus stop indicates that there are passengers waiting to board the Metropolis City bus to the Stadium. Since the first bus is at capacity, it cannot pick up the passengers. The second bus is notified of the passengers and stops to pick them up.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis


Airport
Thanks to the transit signal priority application, the buses are able to minimize their stops and idling through the signalized corridor.
Joe notices that the in-vehicle display on the bus indicates that the bus will now arrive at the Stadium at 12:29pm.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis


Airport
The bus drivers receive an alert from his OBE that an eco-lane is ahead. Upon entering the eco-lane, the bus OBEs send a message to the RSEs that they are transit vehicles. Transit vehicles are allowed to enter the eco-lane. The travel time on the eco-lane is shorter than the travel time on the conventional lanes.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis


Airport
As the buses approach the Stadium, their OBEs receive another message from a RSE that they are approaching a Low-Emissions Zone. Transit vehicles are permitted to enter the Low-Emissions Zone free of charge. The bus' OBEs send a message to the RSE that they are transit vehicles. The vehicles enter the Low Emissions Zone.
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis


Airport
Joe and his friends arrive at the Stadium early and enjoy the Super Bowl.
Eco-Lane
Stadium
Low-Emissions Zone
Applications for the Environment:
Real-time Information Synthesis

Summary

- This story exemplified five AERIS Transformative Concepts:
  - Eco-lanes
  - Low-Emissions Zone
  - Eco-Traveler Information
  - Support Alternative Fuel Vehicle (AFV) Operations
  - Eco-Signal Operations

- The other Transformative Concept could also have been applied:
  - Eco-Integrated Corridor Management (E-ICM)

Break-out Session Overview

Transformative Concept Break-out Sessions

- Workshop participants will be divided among 4 rooms to ensure that everyone has the opportunity to think creatively and constructively
- Facilitation Teams will facilitate discussion around every one of the following Transformative Concepts:
  - Eco-Signal Operations
  - Eco-Lanes
  - Low-Emissions Zone
  - Support Alternative Fuel Vehicle Operations
- At the end of the break-out sessions, each facilitator will report to the larger group on their discussions

Break-out Session Schedule

Each Transformative Concept will be discussed for 45 minutes.

▪ Opening and Ground Rules	5 minutes
▪ Discussion	30 minutes
▪ Other Transformative Concept Ideas	5 minutes
▪ Prepare Group Report	5 minutes

Break-out Session Ground Rules

- The AERIS Team wants to promote an open, honest exchange of ideas among workshop participants
- Break-out Session Ground Rules:
  - Speak openly and honestly
  - Listen carefully to what others have to say
  - Treat everyone, and their ideas, with respect
  - All input provided by stakeholders will be treated as anonymous
  - Input will be aggregated and synthesized
  - Where appropriate, input will be selectively excerpted *without attribution*
  - ‘Imagine’

Transformative Concept Break-out Sessions

- Lunch is from 11:30 am to 12:30 pm sharp
- Please review the AERIS Transformative Concept read-ahead materials over lunch if you have not done so already
- When you return at 12:30 pm, report to your break-out session room:
  - **Red:** South American A
  - **Yellow:** California
  - **Blue:** Massachusetts
  - **Green:** Pan American

Transformative Concept Break-out Sessions

- The webinar will end now
- Webinar participants can access a survey/evaluation form at http://www.its.dot.gov/meetings/aeris__workshop.htm to provide input/feedback on the Transformative Concepts
- Please complete the survey and return it to Adam Hopps:
  - Email: ahopps@itsa.org
  - Fax: 1 202 484 3483, Attention: Adam Hopps (Meetings)

LUNCH

Reports from Break-out Sessions

Closing Remarks

Did We Accomplish What We Wanted?

Workshop Participants	
Participants should have a greater understanding of the AERIS Program and the AERIS Transformative Concepts	✓
Participants should feel that they have contributed to the refinement of the AERIS Transformative Concepts	✓
Participants should understand how they can be involved in the AERIS Program	✓

Did We Accomplish What We Wanted?

The AERIS Team	
The AERIS Team should gather information/feedback that will allow them to refine the AERIS Transformative Concepts	✓
The AERIS Team may identify other Transformative Concepts that should be considered	✓
The AERIS Team will have input on the following issues: • Subjective reaction to the Transformative Concepts • Objective reaction to the Transformative Concepts • Next steps with respect to the Transformative Concepts	✓

Next Steps

- Refine and further define the AERIS Transformative Concepts
- Develop detailed Concepts of Operations for the AERIS Transformative Concepts
- Model the AERIS Transformative Concepts to determine potential environmental benefits and mobility trade-offs

Upcoming AERIS Events and Activities

- **ITS World Congress** | October 16 - 20, 2011; Orlando, FL
  - AERIS Booth in Sustainability Village
    - Interact with AERIS Team and BAA Researchers
  - Demonstrations of Environmental Applications
    - Imperial College | Mobile Environmental Sensing
    - Southwest Research Institute (SwRI) | Environmental Management
    - Ricardo | EcoGreen
    - Telvent | TRACE Air Quality Modeling
  - For more information, visit: www.itsworldcongress.org
- **International Summit on Connected Vehicles and the Environment** | Thursday October 20, 2011 in Orlando, FL
- **Future AERIS Webinars** | Fall and Winter 2011
  - BAA Research Projects
  - Transformative Concepts Update

THANK YOU!

Contact

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