CS 410 – Blue Team

Traffic Wizard
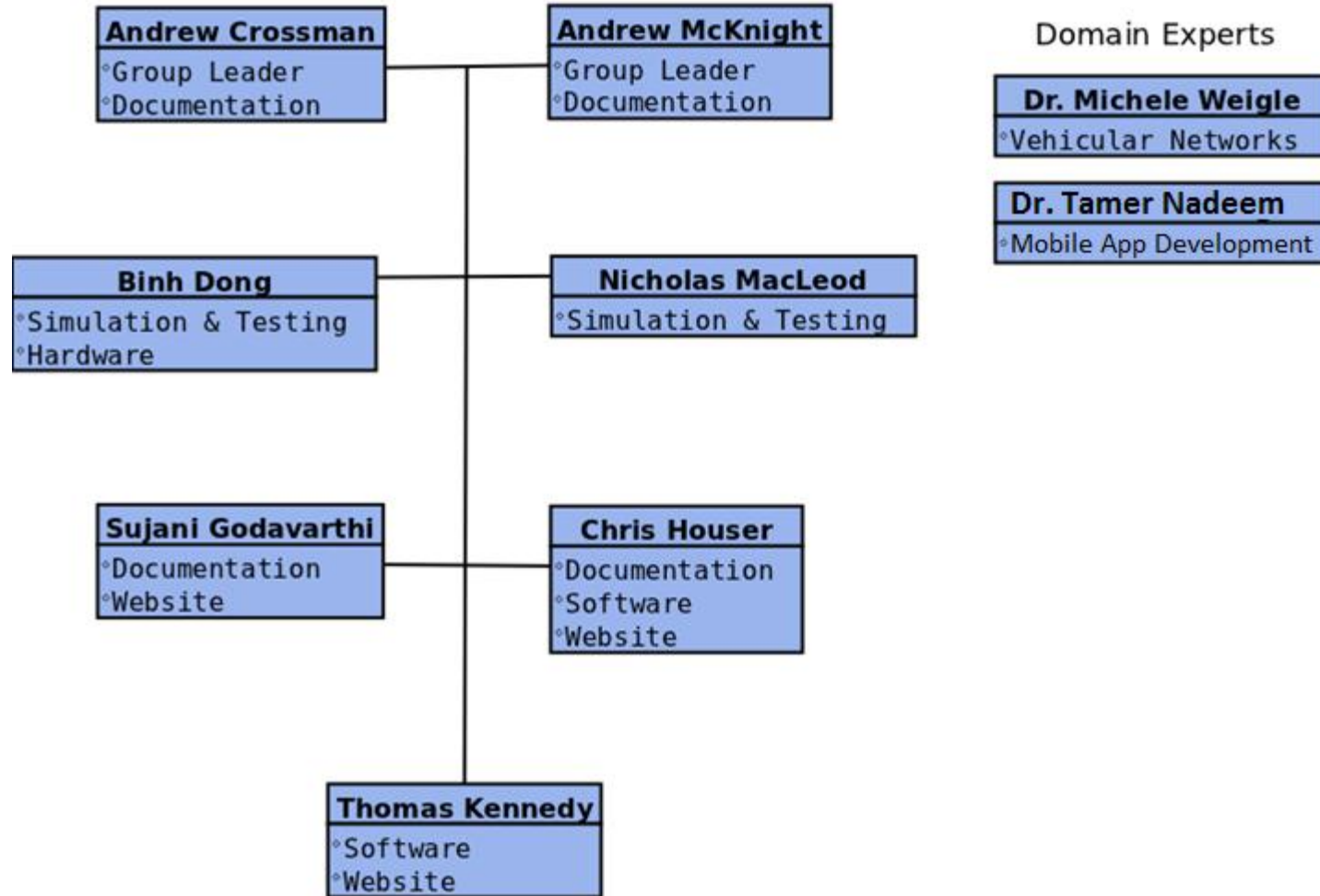
Personalized traffic-monitoring smartphone app

Outline

- Team Blue Staff Chart
- Societal Problem
- Heavy Traffic Factors
- Traffic Wizard Solution
- U.S. Traffic Data
- U.S. Population Trends
- Without Traffic Wizard
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- Customer Identification
- Market Analysis
- Competition
- Major Functional Components
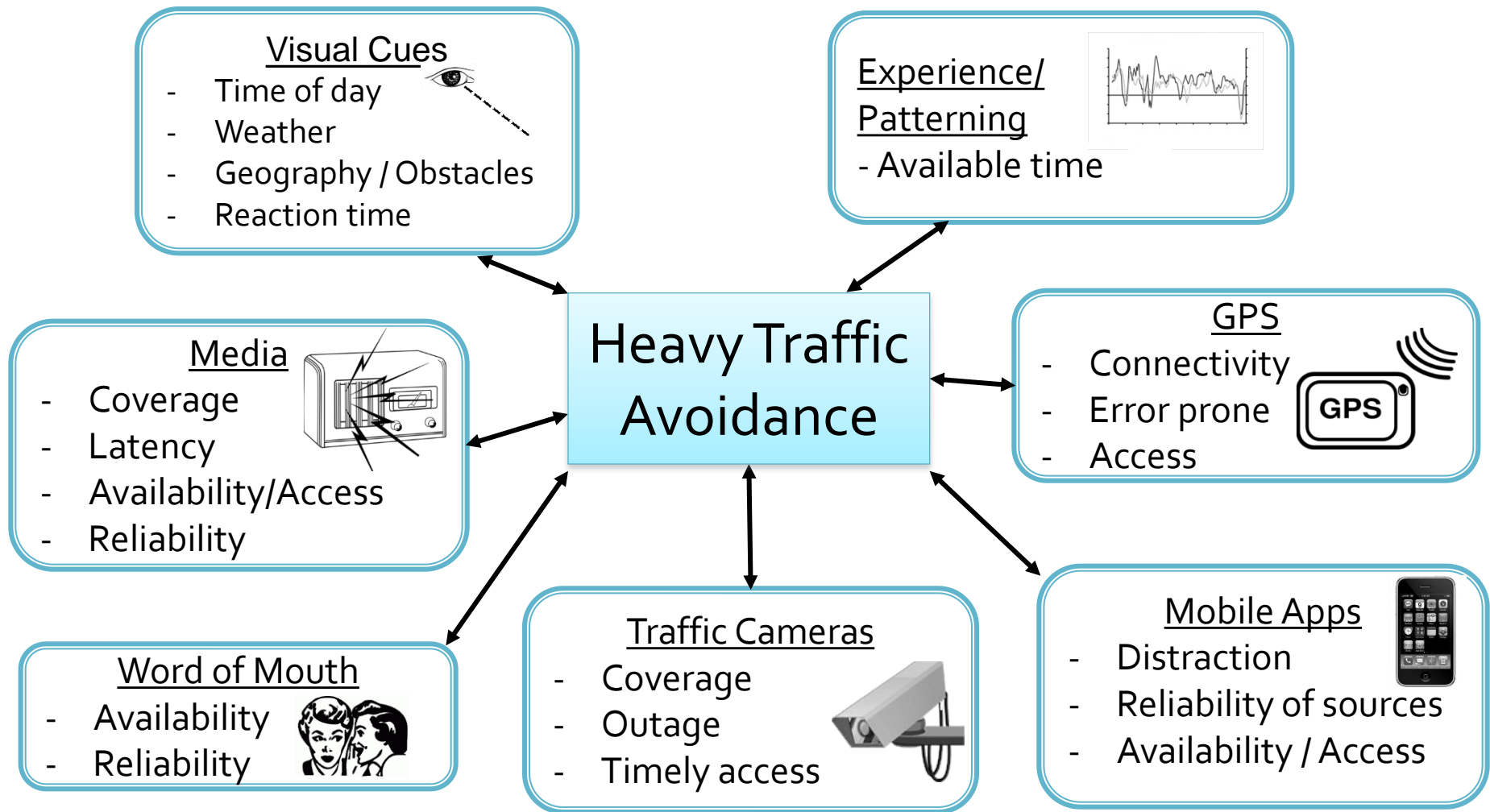- Risk Assessment
- Conclusion

Team Blue Staff Chart

Andrew Crossman
- Group Leader
- Documentation

Andrew McKnight
- Group Leader
- Documentation

Domain Experts

Dr. Michele Weigle
- Vehicular Networks

Dr. Tamer Nadeem
- Mobile App Development

Binh Dong
- Simulation & Testing
- Hardware

Nicholas MacLeod
- Simulation & Testing

Sujani Godavarthi
- Documentation
- Website

Chris Houser
- Documentation
- Software
- Website

Thomas Kennedy
- Software
- Website

Societal Problem

A driver's limited awareness of adverse road conditions increases their potential to get caught in heavy traffic congestion.

Heavy Traffic Factors

Visual Cues
- Time of day
- Weather
- Geography / Obstacles
- Reaction time

Experience/ Patterning
- Available time

Heavy Traffic Avoidance

GPS
- Connectivity
- Error prone
- Access

Media
- Coverage
- Latency
- Availability/Access
- Reliability

Word of Mouth
- Availability
- Reliability

Traffic Cameras
- Coverage
- Outage
- Timely access

Mobile Apps
- Distraction
- Reliability of sources
- Availability / Access
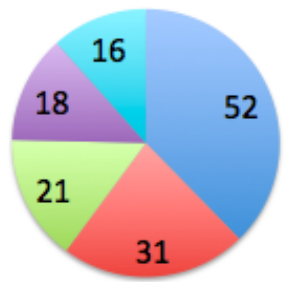
Traffic Wizard Solution

<u>Goals</u>
Traffic Wizard is a traffic analysis smartphone app, personalized for each driver, to inform them of route-specific traffic conditions before they get caught in heavy traffic. The app will feature:

- Accurate traffic information distribution based on custom routes
- Profile system to store frequent routes for pre-analysis before travel time
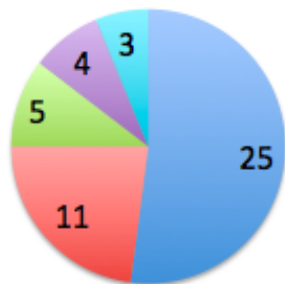- Virtual checkpoint system for efficient data transfer during traffic updates.

U.S. Traffic Data
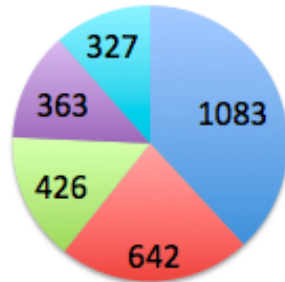
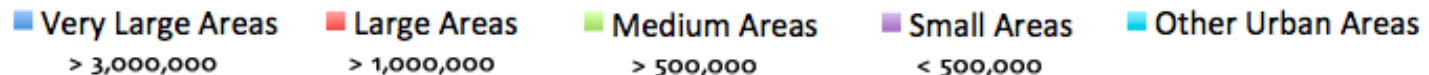**Aggregate Cost, as calculated from fuel and delay excesses** (dollars)

1083, 642, 426, 363, 327
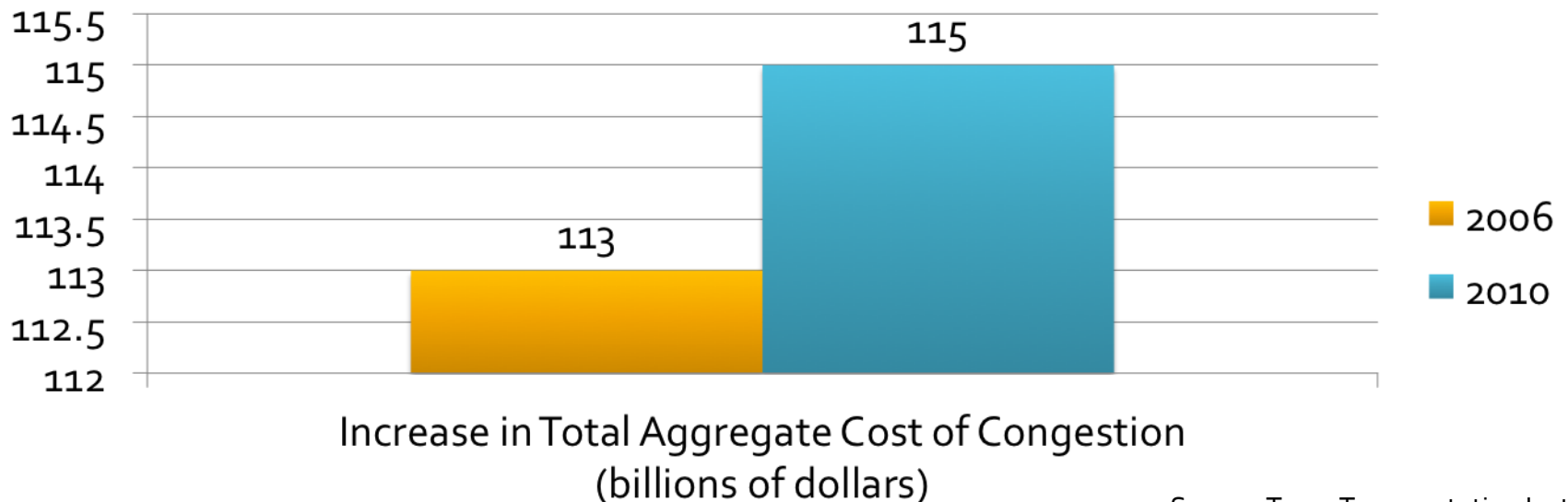
Average Hours Delayed

52, 31, 21, 18, 16

Average Fuel Excess, due to longer commute times

25, 11, 5, 4, 3

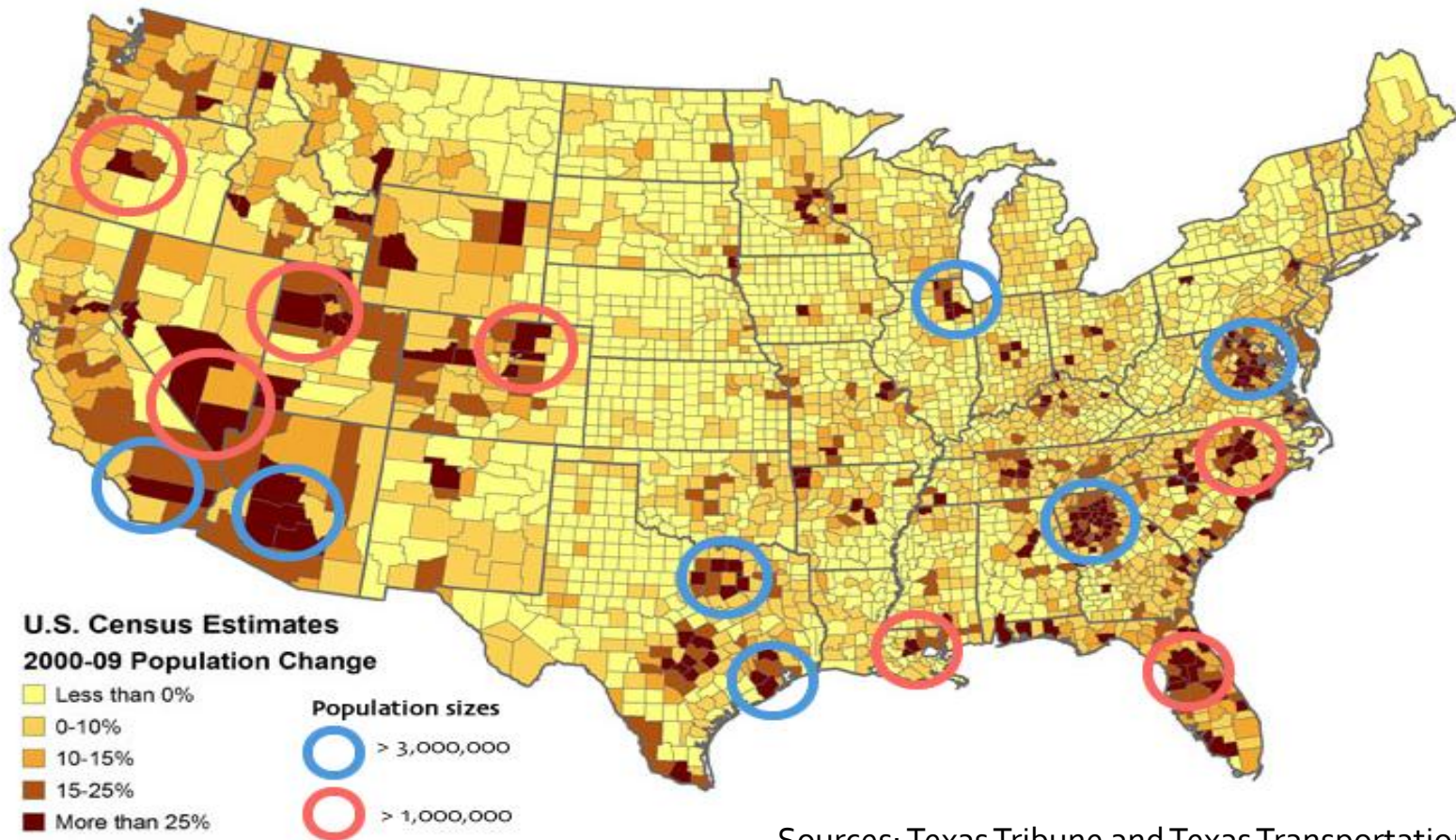| Legend of population sizes				
■ Very Large Areas	■ Large Areas	■ Medium Areas	■ Small Areas	■ Other Urban Areas
> 3,000,000	> 1,000,000	> 500,000	< 500,000	

U.S. Traffic Data

- 4.8 billion hours of excess commute time
- 1.9 billion gallons of excess fuel consumed
- $100.9 billion aggregate from fuel and time lost (from salary and other opportunity cost)

Increase in Total Aggregate Cost of Congestion
(billions of dollars)

Source: Texas Transportation Institute

U.S. Population Trends

- The highest congestion cost is incurred in areas with large populations.
- Populations are increasing the fastest in these high population areas.

U.S. Census Estimates
2000-09 Population Change

- Less than 0%
- 0-10%
- 10-15%
- 15-25%
- More than 25%

Population sizes
- > 3,000,000
- > 1,000,000

Sources: Texas Tribune and Texas Transportation Institute
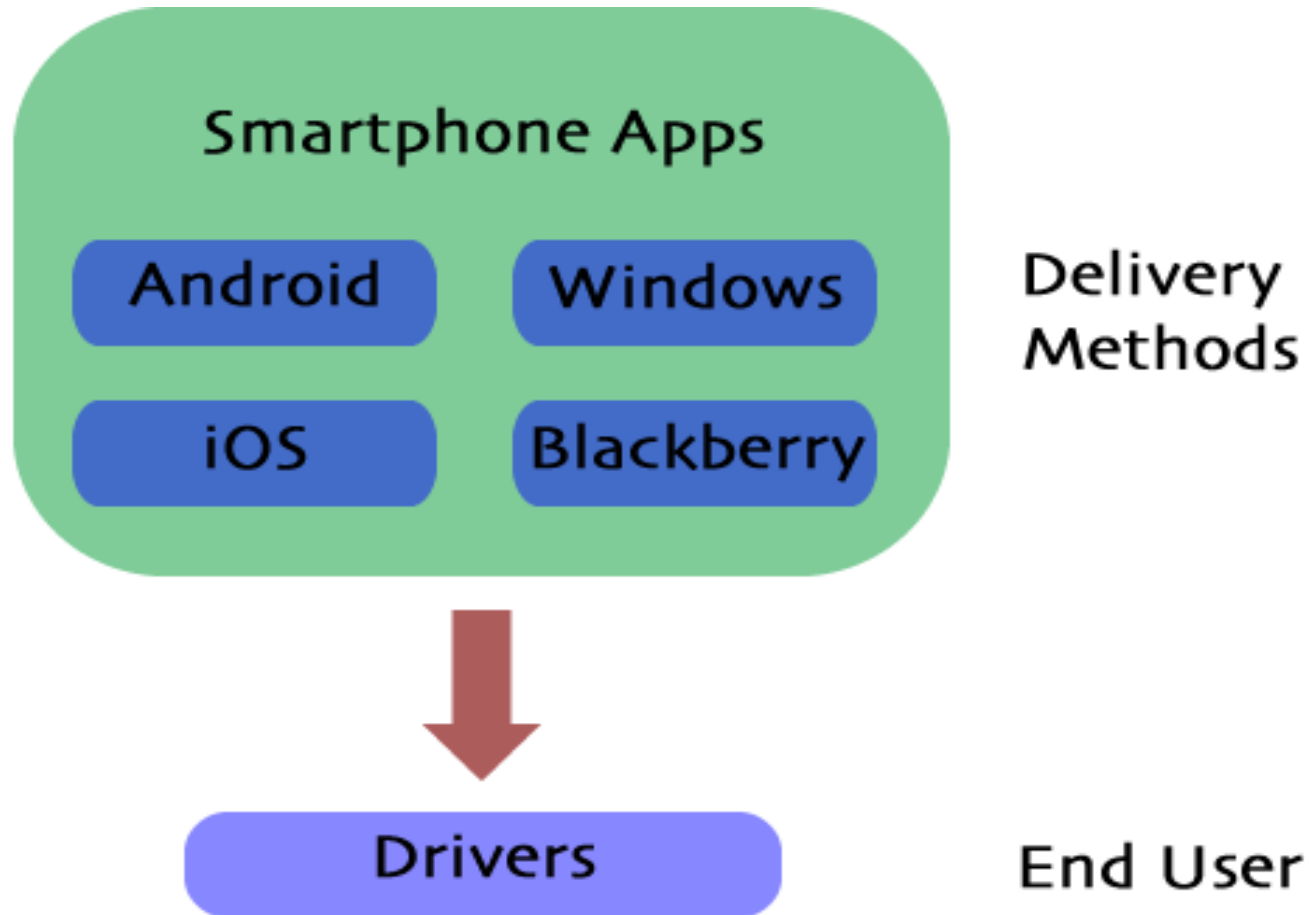
Without Traffic Wizard

Drivers travel, some with navigation devices, yet get stuck in unpredicted congestion.

With Traffic Wizard

1. Vehicles report slower velocities, indicating congestion.

2. Vehicles indicate ideal velocities at these checkpoints. Along with analyzing time lapse between checkpoints, network determines that a bottleneck exists between checkpoints.

3. Vehicles at the checkpoints on this route are near ideal velocity. **TrafficWizard** determines this route would be faster than the current route.

4. Vehicle passes checkpoint and sends data to network, but also receives notification of congestion ahead and a suggestion for the alternate route.
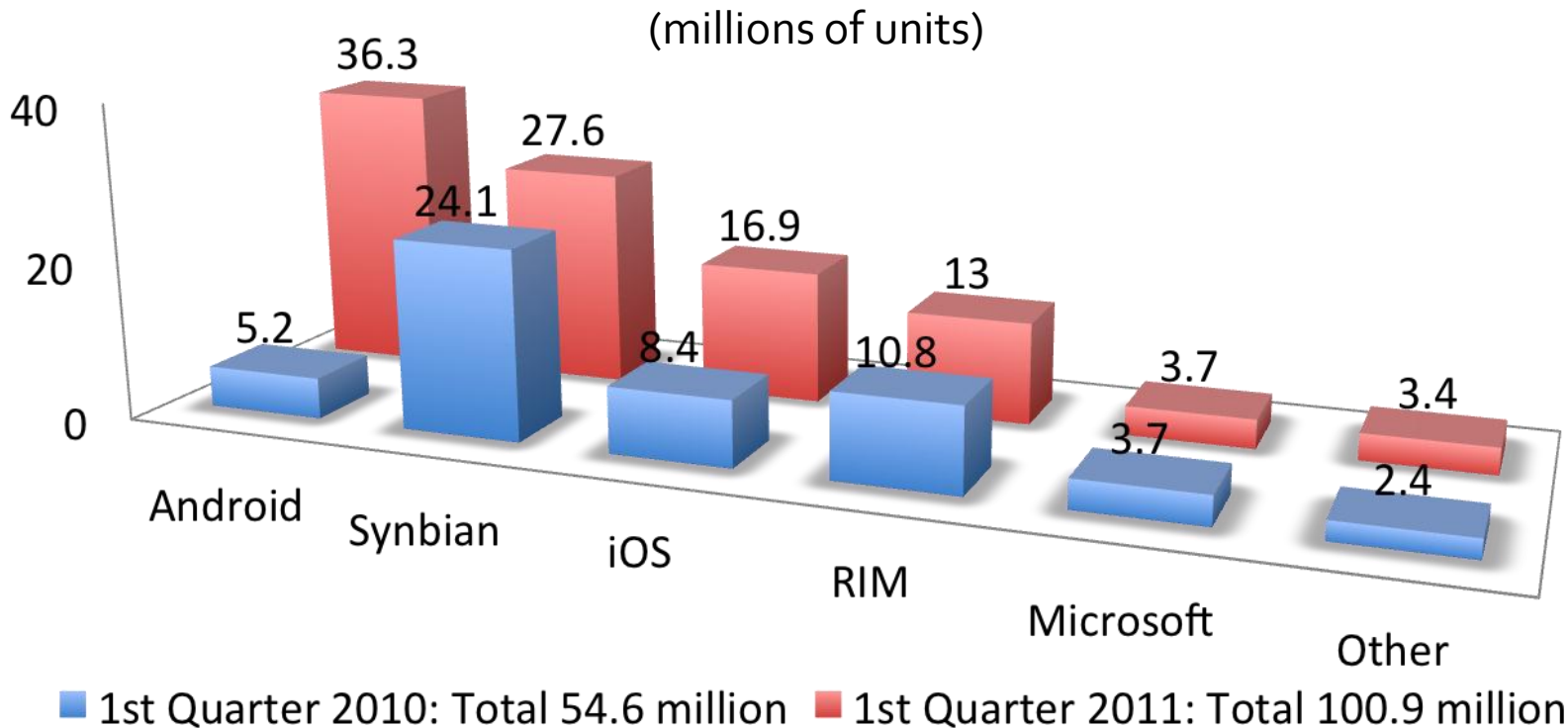
Customer Identification

Smartphone Apps

Android Windows

iOS Blackberry

Delivery Methods

Drivers

End User

Market Analysis

Worldwide Smartphone Sales Increases by OS
(millions of units)

Data labels: Android 5.2, 36.3; Synbian 24.1, 27.6; iOS 8.4, 16.9; RIM 10.8, 13; Microsoft 3.7, 3.7; Other 2.4, 3.4

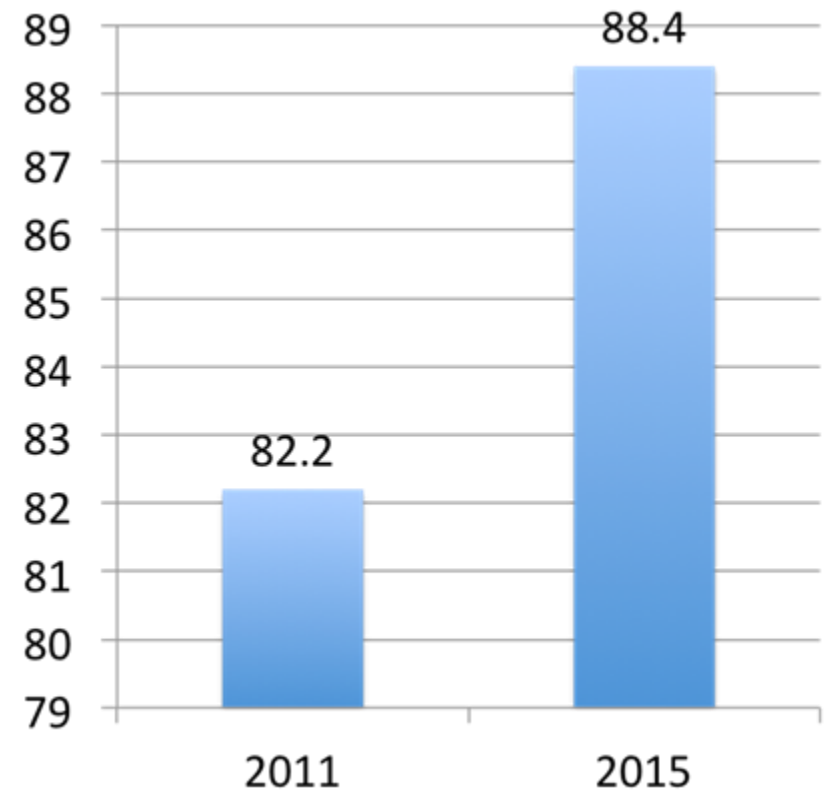■ 1st Quarter 2010: Total 54.6 million   ■ 1st Quarter 2011: Total 100.9 million

[5]Source: Mashable Tech

Market Analysis

Projected Worldwide Smartphone Sales
(Millions of units)
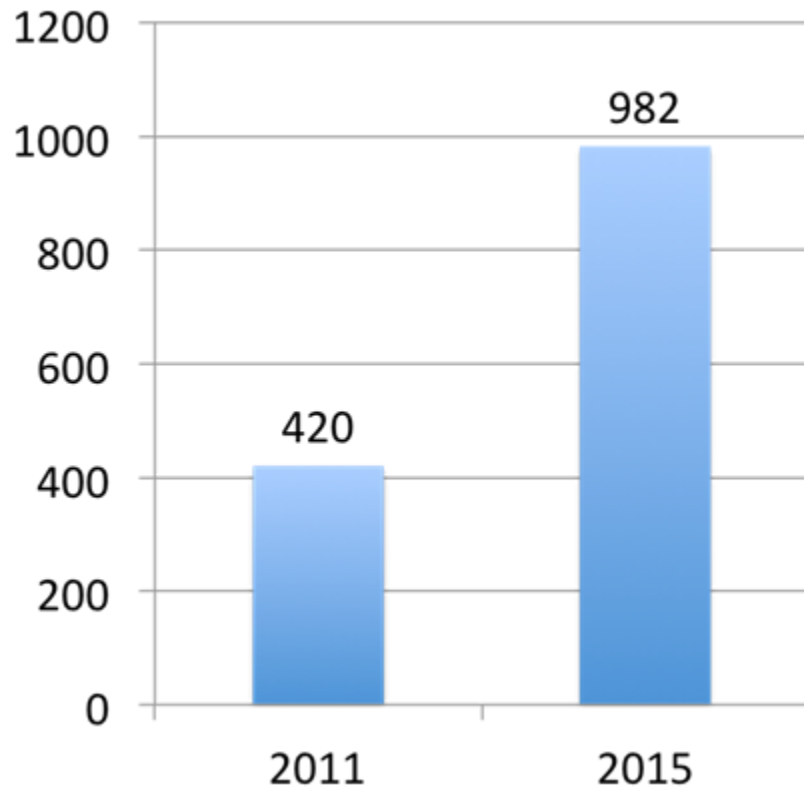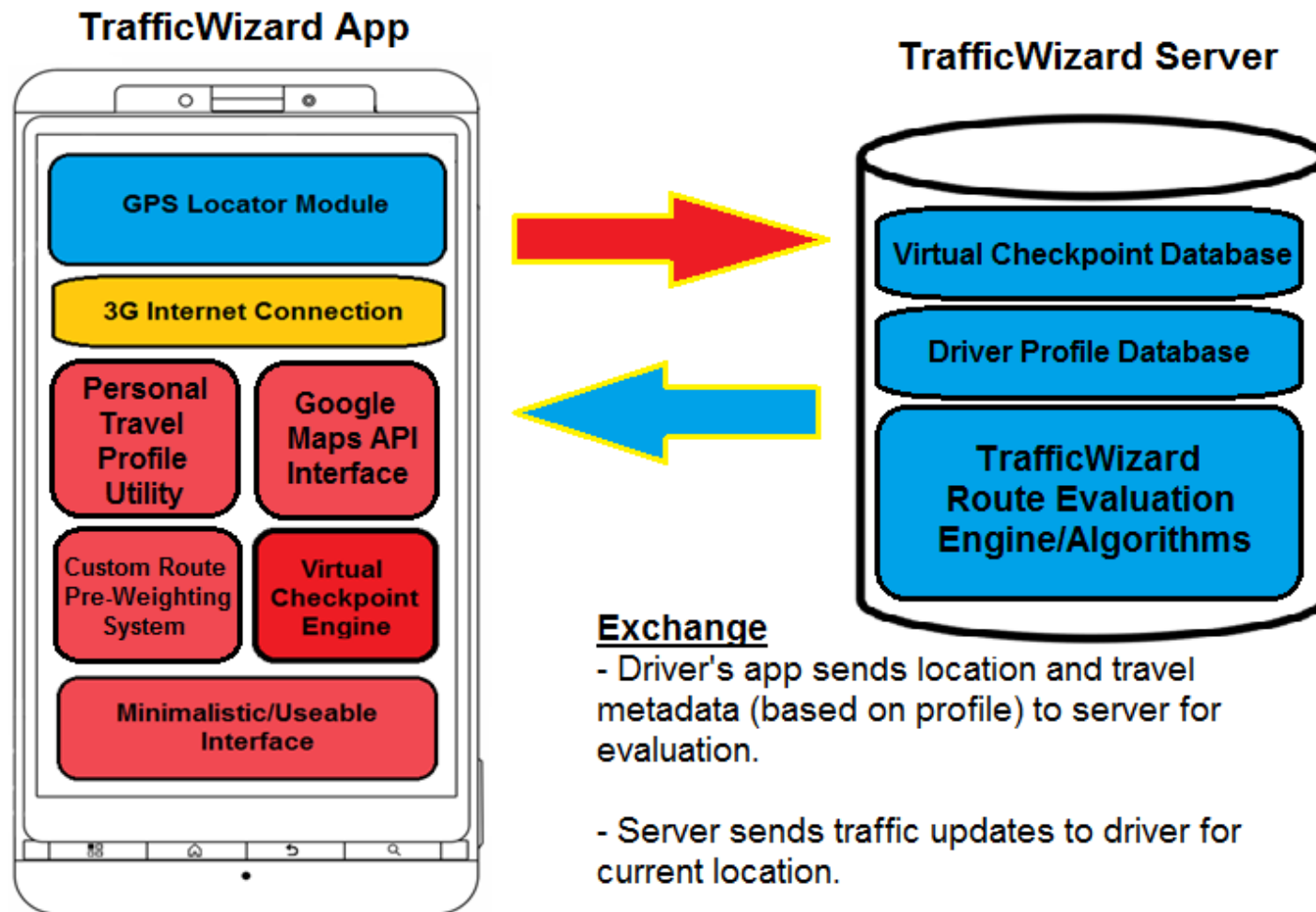
Projected US Smartphone Sales
(Millions of units)

[1]Source: Email Marketing Reports

Competition

	Traffic Wizard	INRIX	TomTom	Sygic	RAC Traffic Plus (UK)	Traffic.com	Beat The Traffic
Android Support	x	x		x	x		x
iPhone Support	x	x	x	x	x	x	x
Real-time Traffic Updates	x	x	x	x	x	x	x
Virtual Checkpoint System	x						
Accident Notification	x	x			x	x	x
Time Predictions	x	x	x	x			x
GPS Navigation Routing			x	x			
Traffic Camera Viewer							x
Personalized Travel Patterning	x						

Major Functional Components

TrafficWizard App

- GPS Locator Module
- 3G Internet Connection
- Personal Travel Profile Utility
- Google Maps API Interface
- Custom Route Pre-Weighting System
- Virtual Checkpoint Engine
- Minimalistic/Useable Interface

TrafficWizard Server

- Virtual Checkpoint Database
- Driver Profile Database
- TrafficWizard Route Evaluation Engine/Algorithms

Exchange
- Driver's app sends location and travel metadata (based on profile) to server for evaluation.

- Server sends traffic updates to driver for current location.

Risk Assessment

Probability

Impact	1	2	3	4	5
5	T1, S1		F2, C4		F1
4		S2	C1	C3	
3					S3
2		T2, T3			
1		C2			

Financial Risks
F1. Customer Investment – Vital to initial growth and sales
F2. Hardware/Software Network Maintenance - Fixing broken equipment, maintaining network

Customer Risks
C1. Product Interest – Market competition
C2. Ease-of-use to Customer – Simple and easy to use interface / installation
C3. Driver Distraction – Interaction becomes a potential distraction
C4. Product Accessibility – Requires smartphone / data plan to provide updates

Technical Risks
T1. Hardware Selection – Feature limitations
T2. Communication Protocols – Usefulness and latency of technology
T3. Server Infrastructure – Configuration for distribution (scalability)

Schedule Risks
S1. Hardware Selection – Platform switching
S2. Product Design – Oversights in implementation, setting up virtual checkpoints
S3. Prototype / Test Phase – Dependent on quality, resolving issues

Financial Risks:

F1. Customer Investment

Probability 5   Impact 5

The RoadNet app cannot succeed if customers do not buy into it. This is highly dependent on marketing and can be counter-acted with effective advertising and marketing.

F2. Hardware/Software Network Maintenance

Probability 3   Impact 5

Server infrastructure is subject to needing repairs and the network connecting drivers must be maintained. Since the foundation of the app lies in drivers' smartphones (as opposed to additional hardware), the probability of this decreases.

Customer Risks:

C1. Product Interest

Probability 3   Impact 4

With so many products and competition in the market, customers will need to prefer this solution over others. This can be mitigated with effective marketing.

C2. Ease-of-use to Customer

Probability 2   Impact 1

Low cost, efficient, and easy installation of the product onto drivers' smartphones.

C3. Driver Distraction

Probability 4   Impact 4

Interaction with an app while driving is a high distraction risk. This will be counteracted with a minimalistic interface that assists the driver with little to no physical interaction with the device.

C4. Product Accessibility

Probability 3   Impact 5

Not every driver has a smartphone to access and download the app. The smartphone market has been well analyzed and is expected to grow immensely.

Technical Risks:

T1. Hardware Selection

Probability 1   Impact 5

The selected hardware will heavily influence the product's features – limiting the uses of RoadNet. Smartphones apps are an effective platform to be accessible to drivers and provide lots of functionality.

T2. Communication Protocols

Probability 2   Impact 2

Communication between a device and the cloud must occur within small time frames. Latency will negate the usefulness of traffic data. RoadNet's virtual checkpoint system will assist with efficient information exchange.

T3. Server Infrastructure

Probability 2   Impact 2

The configuration and design of the server infrastructure must be able to compile and distribute data to connected drivers. The server will have to be designed to be efficiently scalable. RoadNet will hold the potential to connect with manufacturer telematics to assist with scalability in the future.

<u>Schedule Risks:</u>

S1. Hardware Selection

Probability 1   Impact 5

The initial platform selection influences later decisions for product features. RoadNet, as a smartphone app, has access to many features that assist in the functionality of this program.

S2. Product Design

Probability 2   Impact 4

Oversights in implementation and development can significantly delay progress of the app. The virtual checkpoint system will have to be practiced and polished before being considered useable.

S3. Prototype/Testing Phase

Probability 5   Impact 3

This phase is directly dependent on the quality of execution of the product. Design issues must be resolved in this stage and the program must be proven to work.

Conclusion

Traffic Wizard will assist drivers by providing effective real-time updates on upcoming traffic conditions beforehand and helping them avoid unfavorable traffic congestion.

With Traffic Wizard's virtual checkpoint system, custom route profile utility, and pre-travel route analysis engine, this will be accomplished in a new way that makes these benefits accessible and more effective than ever.

References

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4. Lomax, Time, David Schrank and Shawn Turner. Texas Transportation Institute. (2011). Annual Urban Mobility Report. College Station, TX. Retrieved from http://mobility.tamu.edu/ums/
5. Schroeder, Stan. "Smartphone Sales Up 85% Year-Over-Year." May 19, 2011. Mashable Tech. Retrieved from http://mashable.com/2011/05/19/smartphone-sales-q1-2011-gartner/
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7. U.S. National Highway Traffic Safety Administation, Traffic Safety Facts. Retrieved from http://www.census.gov/compendia/statab/2012/tables/12s1108.pdf

Competition App Reference Links:

Beat The Traffic:
http://itunes.apple.com/us/app/beat-the-traffic/id339660839?mt=8

Sygic:
http://www.sygic.com/en

INRIX:
http://www.inrix.com/mobile.asp

TomTom:
http://www.tomtom.com/en_gb/products/mobile-navigation/tomtom-app-for-iphone/

RAC:
http://itunes.apple.com/gb/app/rac-traffic-plus/id389339076?mt=8

Traffic.com:
http://itunes.apple.com/us/app/traffic.com/id327245871?mt=8