

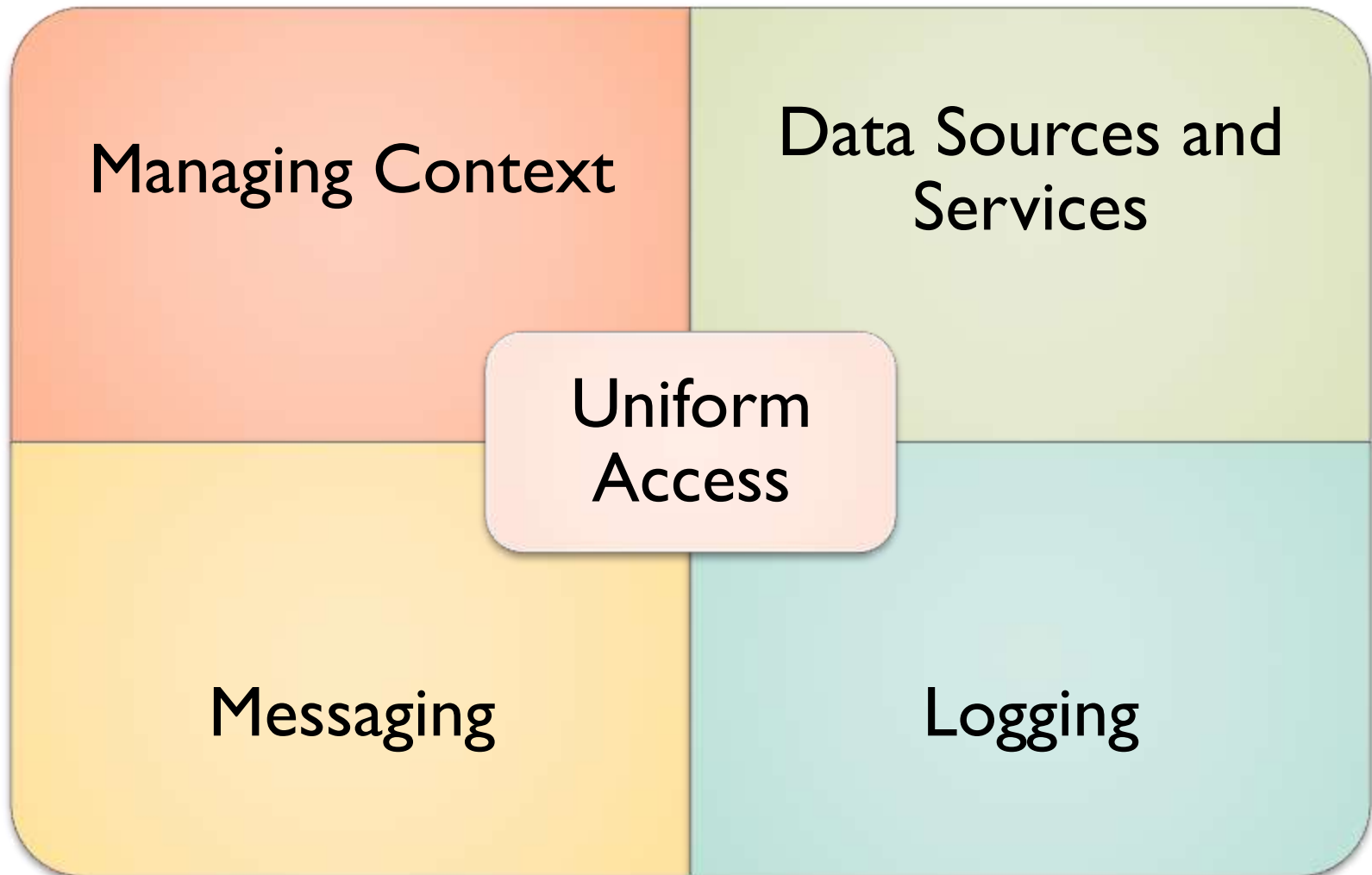
# **ROVER: A FRAMEWORK FOR CONTEXT-AWARE APPLICATIONS**

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Christian Almazan  
The MIND Lab  
University of Maryland  
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agrawala@cs.umd.edu

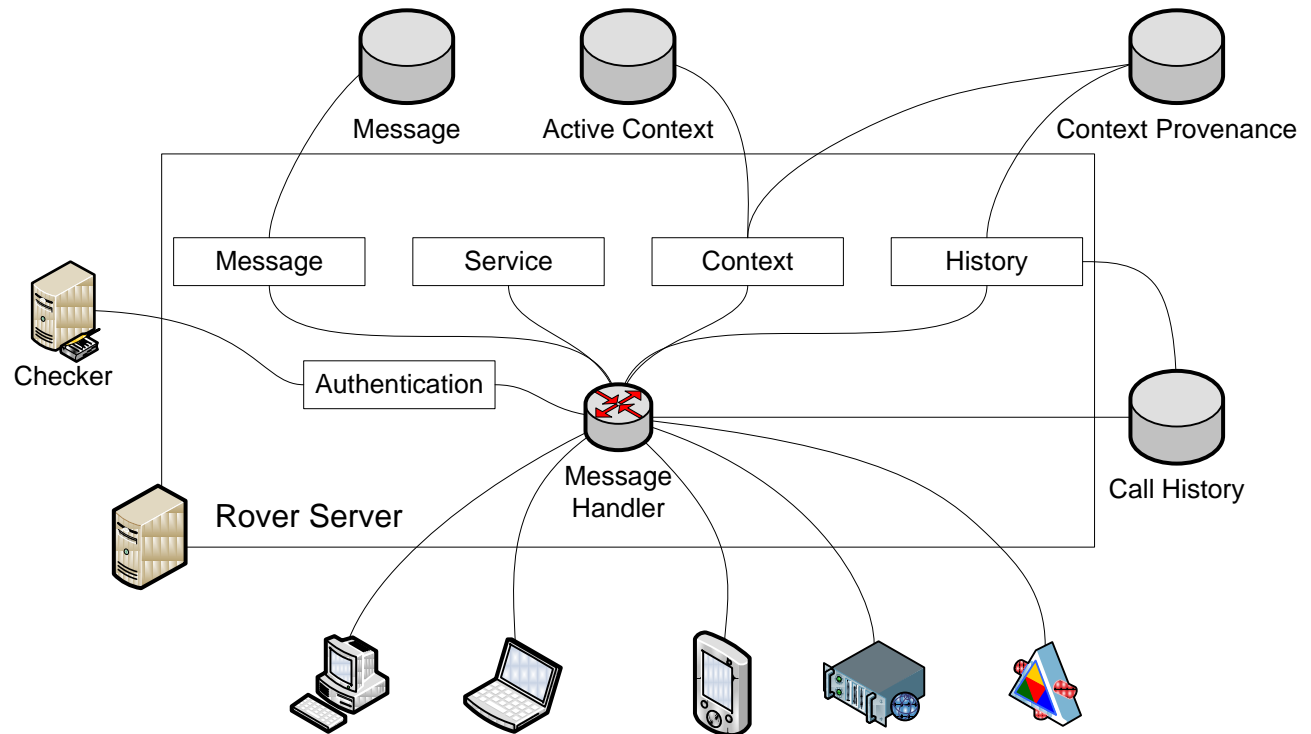
# Overview of Rover

- Context-Aware Application Integration Platform
- Independent of
  - Client devices
    - Smart phones, PDA, Laptop,...
  - Communication Technology
    - WiFi, WiMAX, 2G, 3G, 4G

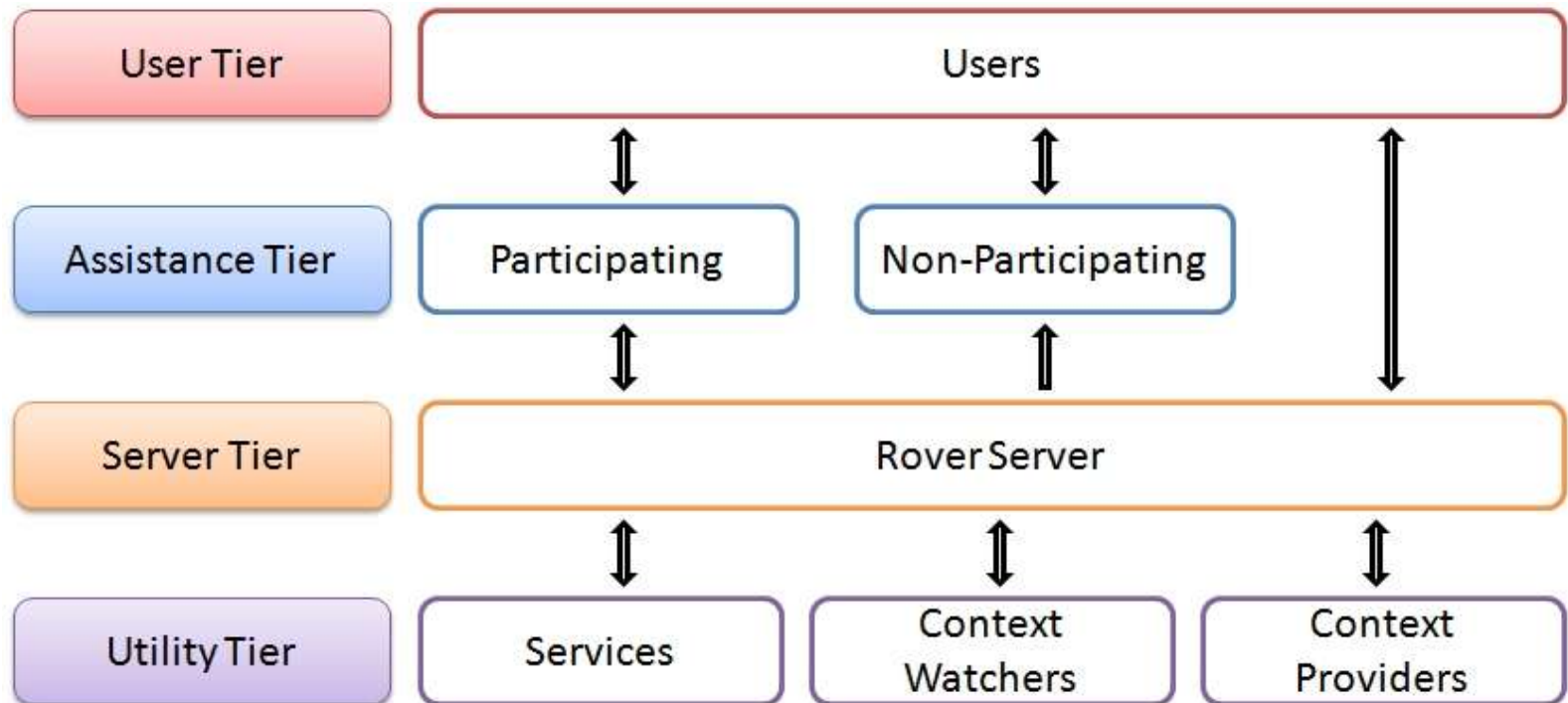
# Overall Goals of Rover



# Rover Server



# Rover Ecosystem and Entities



# What Rover Does Not Address

- Usability / Human-Computer Interaction
- Authorization
- Privacy Issues
- Dissonant Information
- Misinformation
- Methods of Reasoning
- Schema and Ontology Development



# MyeVyu

Improving the Quality of Life on Campus

# Team

## Faculty

- Ashok Agrawala
- Amitabh Varshney
- Neil Spring
- Bobby Bhattacharjee
- Atif Memon
- Evan Golub

## Students

- Christian Almazan
- Thomas Krug
- Ankur Oberoi
- Rachana Gandhi
- Saurabh Kulkarni
- Vinay Gangadhar
- Paulo Shakarian
- Geoff Stoker
- Larry Michele
- ...

## Campus Organizations

- UMIACS
- OIT
- Facilities
- Department of Public Safety
- ...



# MyeVyu Goals – High Level

- Quality of Life
  - Education
  - Social/community
  - Safety
  - Transportation
  - ...
- Quality of Life Support for
  - Students
  - Faculty
  - Staff
  - Visitors
- Integrate university services and enhance them with *context* (time, location, security, ...)

# Enabling Technologies

## Communications

- WiFi
- WiMAX
- Cellular
- ...

## Location

- Horus
- PinPoint
- GPS
- Cell-based location
- ...

## Time

- Clock Synchronization

## Information Integration

- Rover

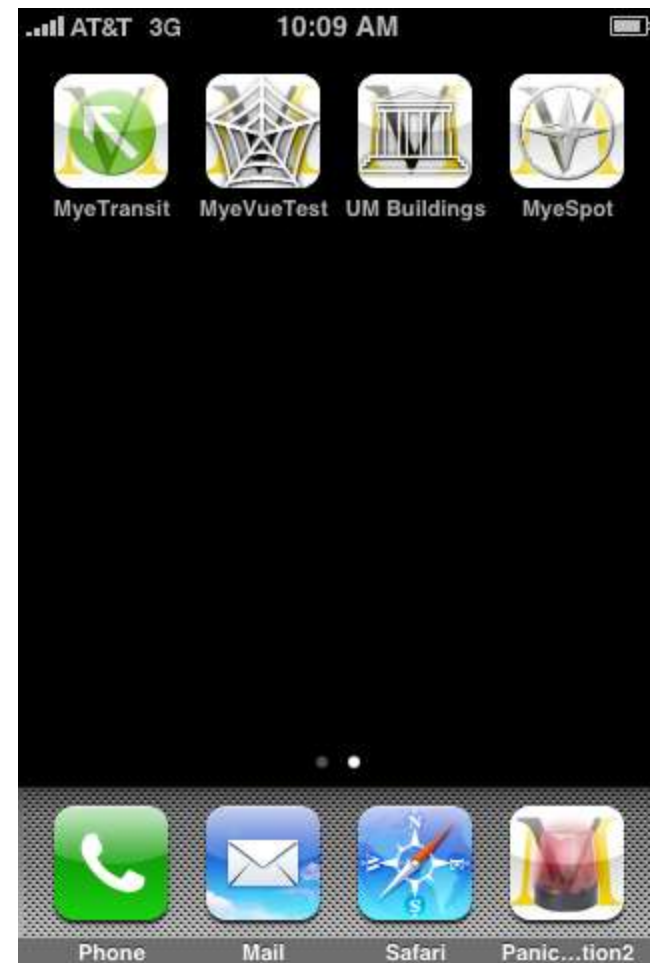
# Location Technologies

- Indoors and Outdoors
- Accuracy
  - Depends on Application
    - Few feet
- Rapid Deployability
- Robust
- ..
- Horus
  - Based on Signal Strength
- PinPoint
  - Based on Time of Flight measurement

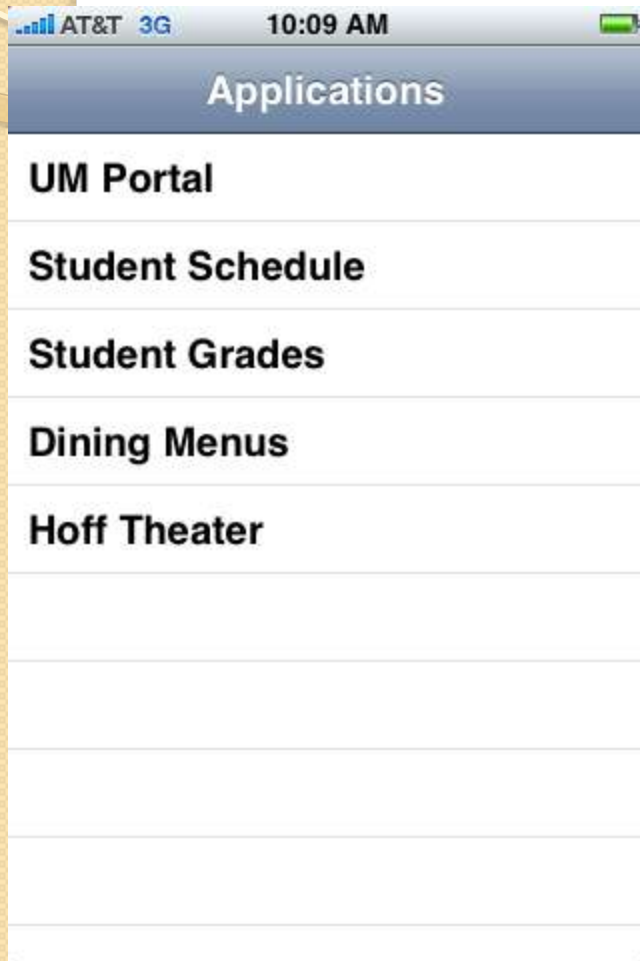
# MyeVyu on Campus

- Mobility Initiative
  - 200 undergrads are part of the initial test
  - Devices used
    - iPhone
    - iPod Touch
    - Palm Pre
    - Android
    - Windows Mobile - Samsung

# MyeVyu Applications on iPhone



# Logging to UM Portal



# Testudo Access

iPod 4:50 PM

Applications

**TESTUDO**  
Interactive Web Services for Current Students, Prospective Students, & Alumni

**Student Schedule**

UID: 109870801  
Remember to verify that there is enough time to walk between classes

Course meeting locations are subject to change. Please check your course locations on the first day of classes for the most up to date information.

**Term: Fall 2008**

	Mon	Tue	Wed	Thu	Fri
10am	UNSC1016 9:55-10:45 2100-2100		UNSC1016 9:55-10:45 2100-2100		
11am					
12pm					
1pm					
2pm	UNSC1016 1:55-2:45 2100-2100		UNSC1016 1:55-2:45 2100-2100		
3pm					

**Classes with Class Times To Be Announced**  
CONSC1016 1000-1000

[Click here to process Check-in.](#)

UNIVERSITY OF MARYLAND  
The MIND Lab

Copyright © 2008 University of Maryland  
Please send questions or comments to:  
[webmaster@testudo.umd.edu](mailto:webmaster@testudo.umd.edu)

iPod 4:56 PM

Applications

**TESTUDO**  
Interactive Web Services for Current Students, Prospective Students, & Alumni

**Grade Inquiry**

You Have No Grades To Be Inquired About.

UNIVERSITY OF MARYLAND

Copyright © 1999 University of Maryland  
Please send questions or comments to:  
[webmaster@testudo.umd.edu](mailto:webmaster@testudo.umd.edu)

# UM Portal Access

The screenshot shows the UM Portal Access interface on an iPod screen. At the top, the status bar displays "iPod", signal strength, and the time "4:57 PM". Below this is a blue bar with the word "Applications" in white. A black bar below that shows the date and time "Nov 19, 2008 4:56:36 PM" and a "Contact Us" link. The main content area features the "MyUM" logo, the "UNIVERSITY OF MARYLAND" logo, and a welcome message for "Rachana Anil Gandhi". Below this are links for "Email", "Phone", and "Text". A navigation bar contains links for "MyUM", "Student Services", "Academic & Advising", "My Calendar", and "New Page". The main content area is divided into several sections: "E-MAIL" (showing a list of messages), "MY UNIVERSITY MESSAGES" (a placeholder for important information), "NEWS READER RSS" (a link to the University of Maryland News RSS feed), "COLLEGE PARK" (a weather widget showing 39°F), and "FEEDBACK" (a form for user feedback). At the bottom, a black bar contains the copyright notice "Copyright © 2008 University of Maryland" and a "Feedback" link.

iPod 4:57 PM

Applications

Nov 19, 2008 4:56:36 PM Contact Us

**MyUM** UNIVERSITY OF MARYLAND

Welcome, Rachana Anil Gandhi

View Contact Info  
Email: [rgandhi@umd.edu](mailto:rgandhi@umd.edu) into Mobile Phone: [View cell phone](#)  
To change visit us on our mobile phone

Customize This Page Log Off

**MyUM** Student Services Academic & Advising My Calendar New Page

**E-MAIL**

(Click to view)

Last updated on 11/19/08 10:58 PM

**Waka - gandhi@umd.edu**

1558 messages (22 unread)

From: [ingrid@umd.edu](mailto:ingrid@umd.edu)  
Received: Thu 10 11:34 PM  
SUBJ:   
From: "Michelle L. Corley"  
Received: Thu 10 11:31 PM

[[alt\\_gp\\_mdu@umd.edu](#)] FW: Water Cool Drive  
From: "Michelle L. Corley"  
Received: Thu 10 11:31 PM

[[alt\\_gp\\_mdu@umd.edu](#)] Water Cool Drive - Drop  
Off in 11:32:10 AM  
From: "Your President/Student Representative"  
Received: Thu 10 11:32:10 AM

**Maryland Day 2008**

From: "PIT's automatic digital system"  
Received: Thu 10 11:32:10 AM

PIT's digital - 18 Nov 2008 to 19 Nov 2008  
(2008-278)

Note: Message status not reflected when  
reading messages with the iPod.

**MY UNIVERSITY MESSAGES**

This area will be used to  
show important information  
meant exclusively for you.  
Please take a moment to  
glance here when you sign  
on.

You currently have no  
messages.

**NEWS READER RSS**

Unsub Add Unsub Manage Feeds  
Help

University of Maryland News  
RSS (via Your Information)  
The Standard Web

**COLLEGE PARK**

View 5 day forecast

39°F

Partly Sunny

See expected at College Park, MD, on  
11/19/2008 at 4:59 PM Local time

Local Time Report  
(Click to view)  
Local and National Weather  
(Click to view)

**FEEDBACK**

If you are having problems with any of the  
applications, please call the Help Desk at  
301.405.1400.

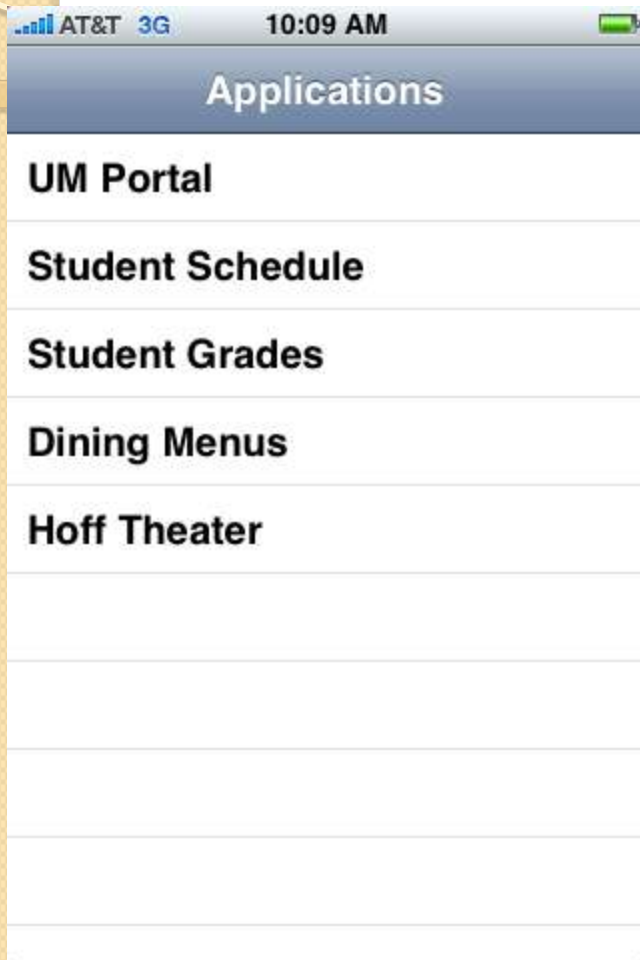
Did any feedback? Tell us in the box below. It  
doesn't matter if it's a compliment, a complaint,  
or a request for something missing - we want to  
hear from you. It's your portal, help us build it.  
Feedback

Send Anonymous Submit

Copyright © 2008 University of Maryland Feedback



# Dining Hall Menus



# Dining Hall Menus



## Entrees

Selections vary daily

Monday-Friday, 11:00 a.m.-2:15 p.m. and 4:15 p.m.-7:15 p.m.

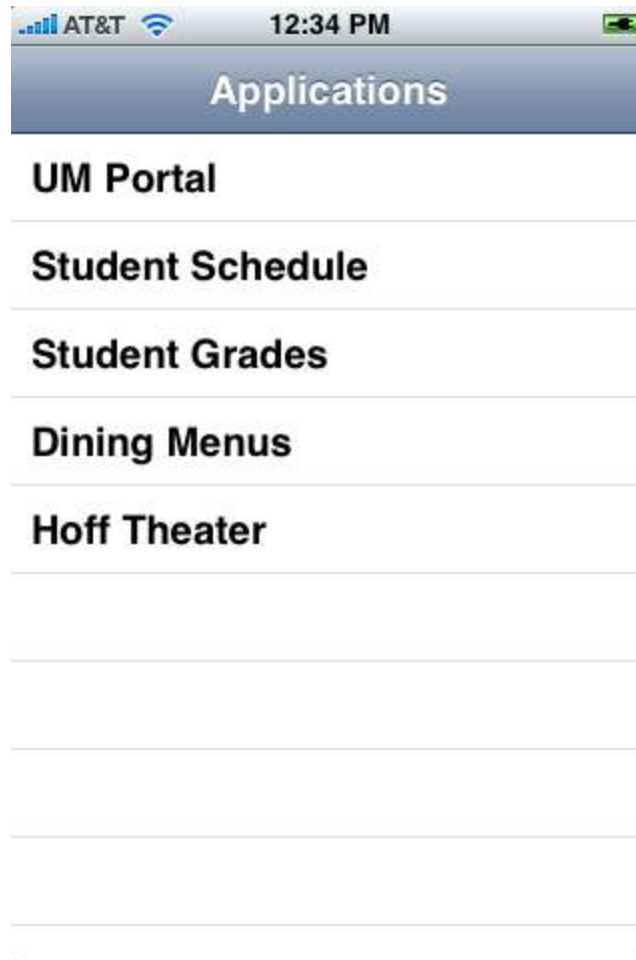
- \* Shrimp Scampi
- \* Cajun Chicken
- \* Pizza Rolls and Stromboli
- \* Spaghetti with Marinara
- \* Spaghetti and Meatballs



## Entrees

- \* Spaghetti and Meatballs
- \* Meat Lasagna
- \* Fettuccini with Alfredo Sauce
- \* Pasta Primavera
- \* Spiral Pasta with Marinara
- \* Spiral Pasta with Meatballs
- \* Ravioli
- \* Stuffed Shells

# Hoff Theater Schedule



# Hoff Theater Schedule



A screenshot of a mobile application interface for the Hoff Theater. The status bar at the top shows 'AT&T', signal strength, Wi-Fi, and the time '12:34 PM'. Below the status bar is a header with a blue button labeled 'Applications' and the text 'Hoff Theater'. The main content area lists five theater events, each with a title, date, and time. The events are: 'The Dark Knight' on November 19 at Noon, 'Barefoot Gen/Welcome...' on November 19 at 7:00p (Free!), 'The Dark Knight' on November 20 at Noon, 'Unhappy Meal' on November 20 at 7:00p (Free!), and 'Indiana Jones and The...' on November 21 at 5:00p (Free!).

Event	Date	Time
<b>The Dark Knight</b>	November 19	Noon
<b>Barefoot Gen/Welcome...</b>	November 19	7:00p (Free!)
<b>The Dark Knight</b>	November 20	Noon
<b>Unhappy Meal</b>	November 20	7:00p (Free!)
<b>Indiana Jones and The...</b>	November 21	5:00p (Free!)



A continuation of the mobile application interface for the Hoff Theater. The status bar at the top shows 'AT&T', signal strength, Wi-Fi, and the time '12:34 PM'. Below the status bar is a header with a blue button labeled 'Applications' and the text 'Hoff Theater'. The main content area lists five theater events, each with a title, date, and time. The events are: 'The Dark Knight' on November 20 at Noon, 'Unhappy Meal' on November 20 at 7:00p (Free!), 'Indiana Jones and The...' on November 21 at 5:00p (Free!), 'Chronicles of Narnia: Pri...' on November 22 at Noon, and 'Baby Mama' on November 23 at 7:00p (Free!).

Event	Date	Time
<b>The Dark Knight</b>	November 20	Noon
<b>Unhappy Meal</b>	November 20	7:00p (Free!)
<b>Indiana Jones and The...</b>	November 21	5:00p (Free!)
<b>Chronicles of Narnia: Pri...</b>	November 22	Noon
<b>Baby Mama</b>	November 23	7:00p (Free!)

# MyeTransit

AT&T 10:16 AM

**Stations and Stops** [Edit](#)

**Metrorail Favorites**

**Columbia Heights #2**

- Branch Avenue 1 10:16:52 AM
- Huntington 3 10:18:52 AM
- Branch Avenue 6 10:21:52 AM

**College Park-U of MD #1**

- Greenbelt 5 10:20:52 AM
- Greenbelt 11 10:26:52 AM

**Shuttle-UM Favorites**

**30585: Paint Branch Pkwy & Rhode...**

- 104 College Park Metro 9 10:25:34 AM
- 104 College Park Metro 23 10:39:34 AM
- 104 College Park Metro 34 10:50:34 AM

**Metrorail Nearby**

[Locate Me](#) [i](#)

AT&T 10:16 AM

**Stations and Stops** [Edit](#)

**Shuttle-UM Favorites**

**Metrorail Nearby**

- **College Park-U of MD**

---

- **Prince George's Plaza**

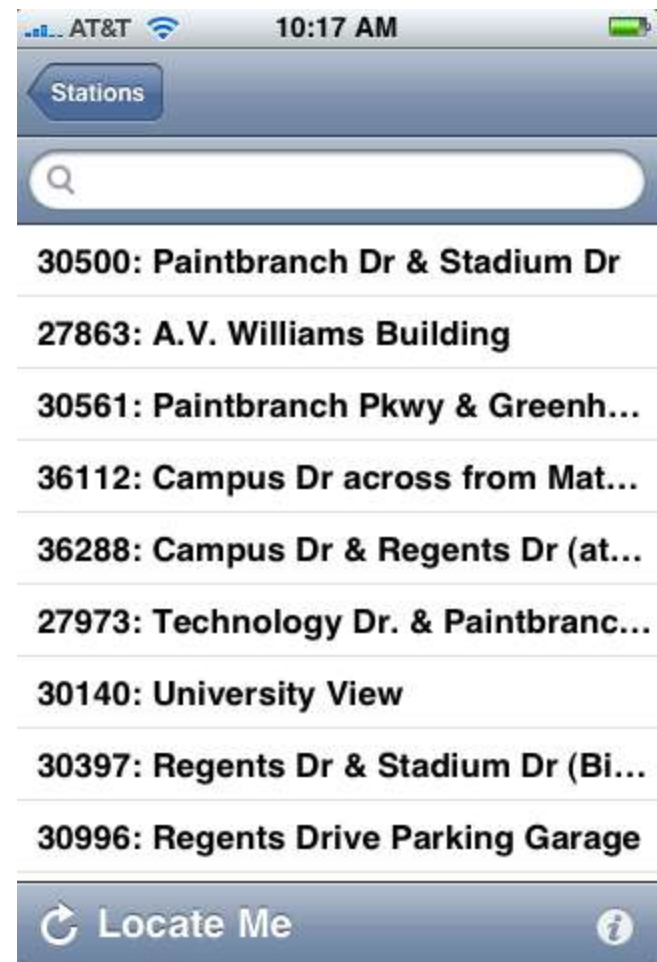
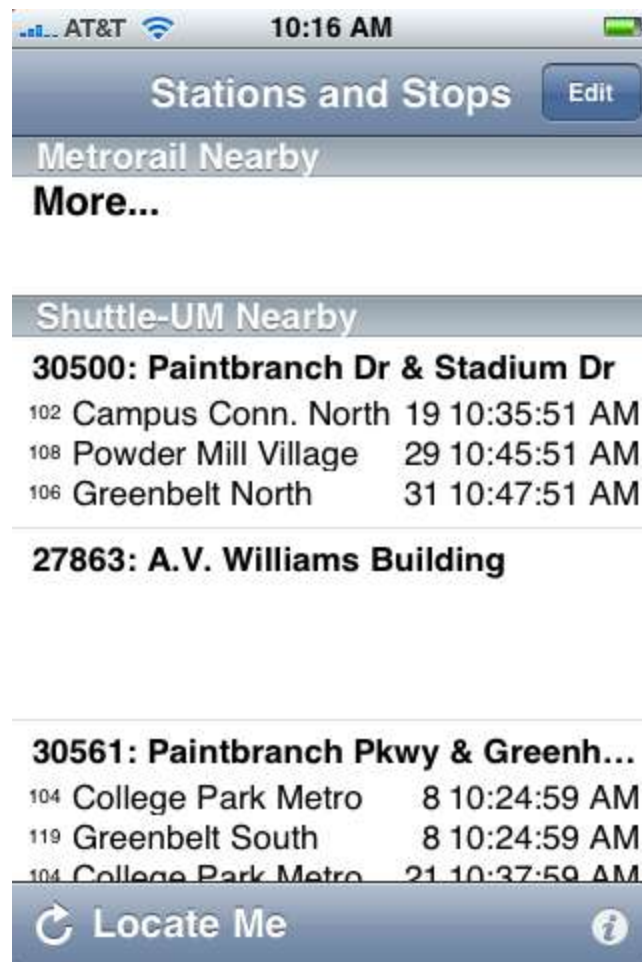
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- **Greenbelt**

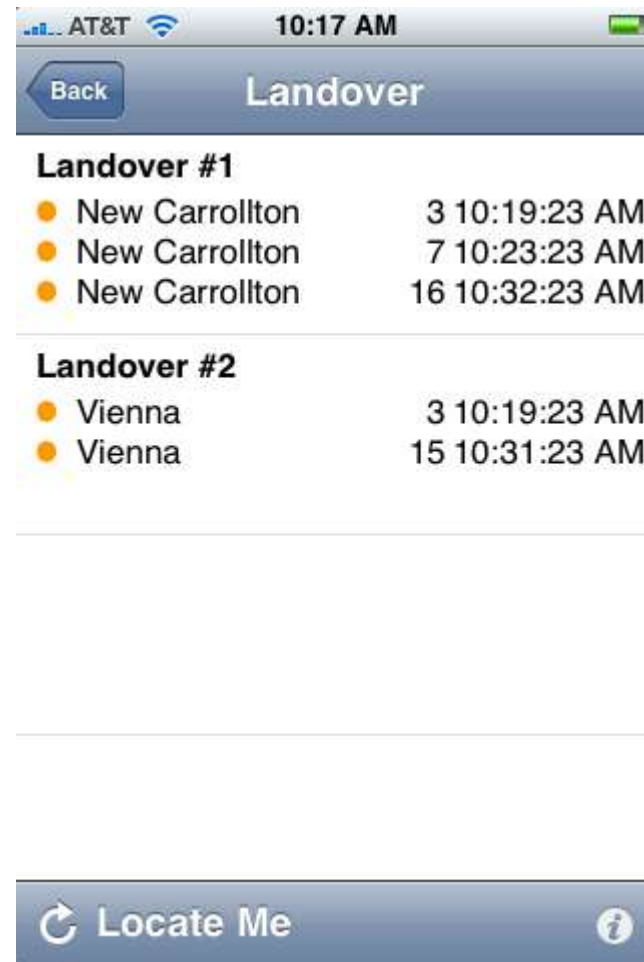
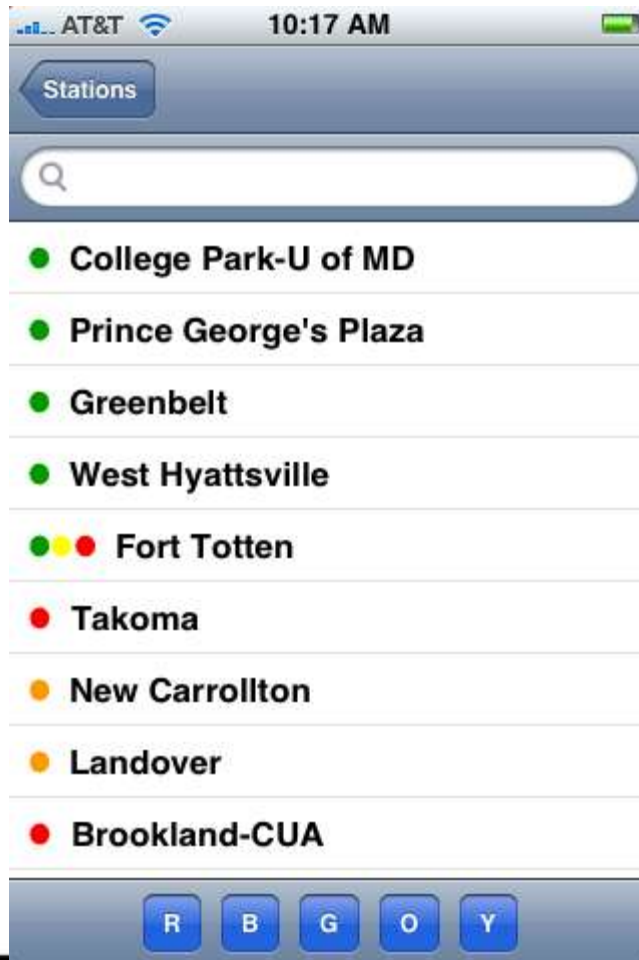
---

[Locate Me](#) [i](#)

# MyeTransit

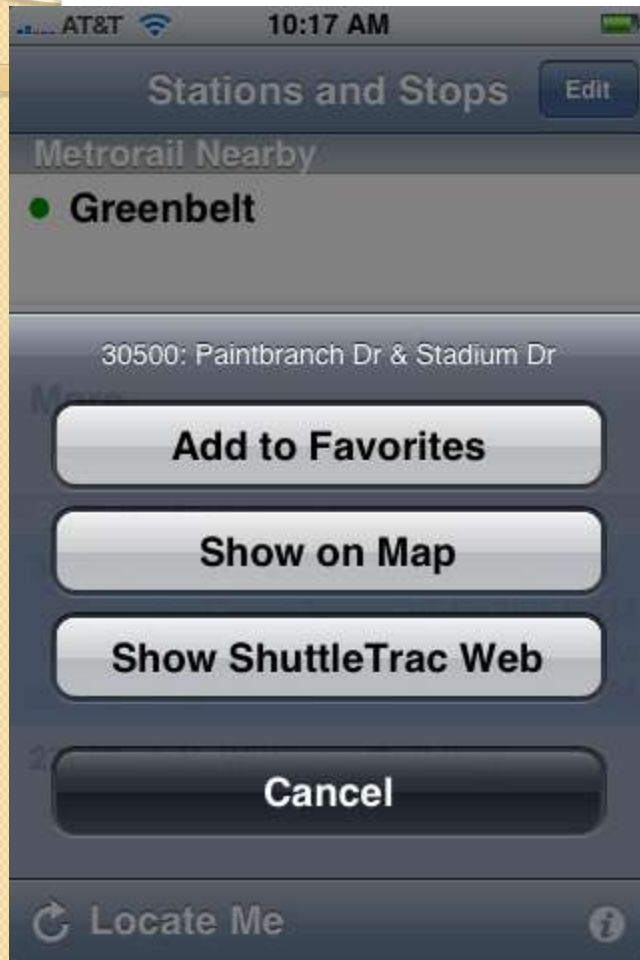


# MyeTransit





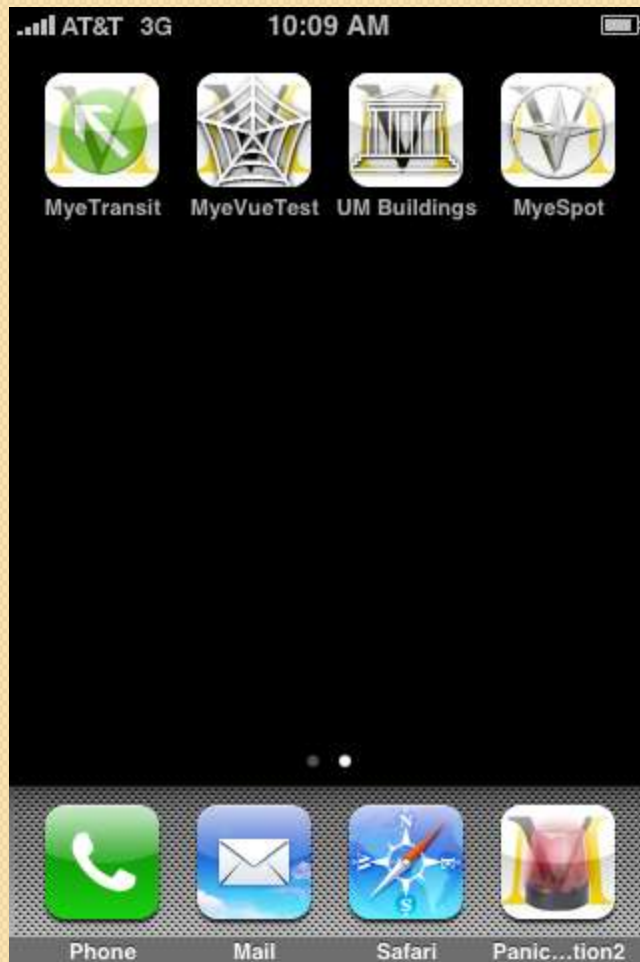
# MyeTransit





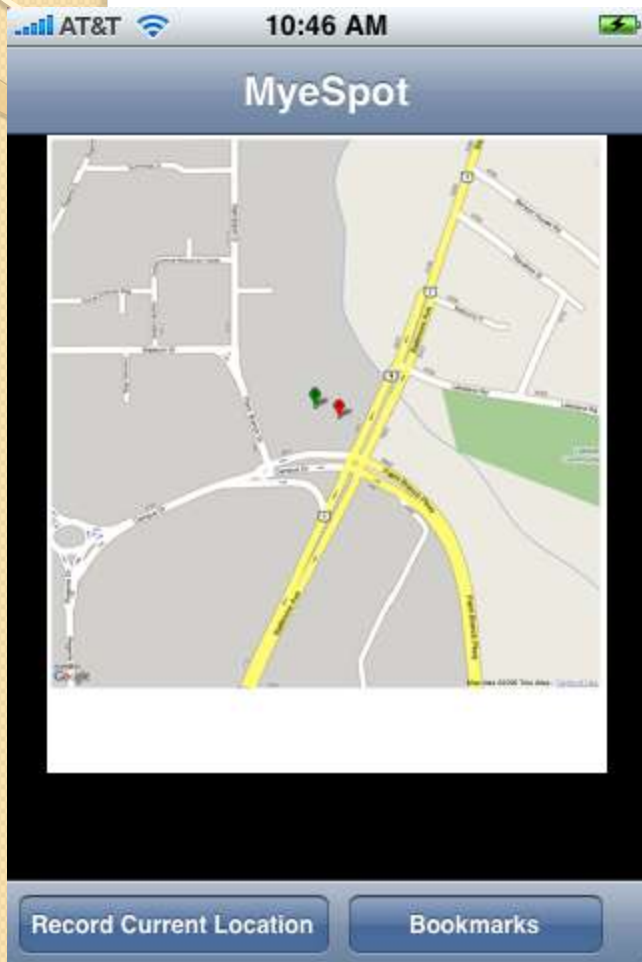
## Remember a Spot of Interest

- Parking Location
- See how to get there from anywhere

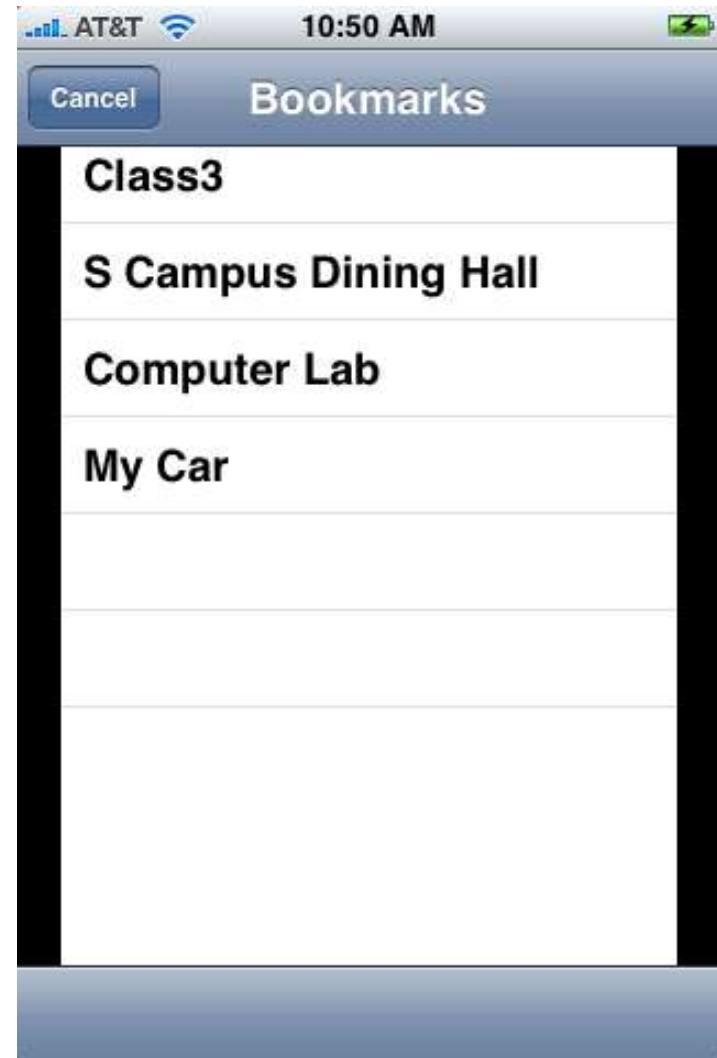


eSpot

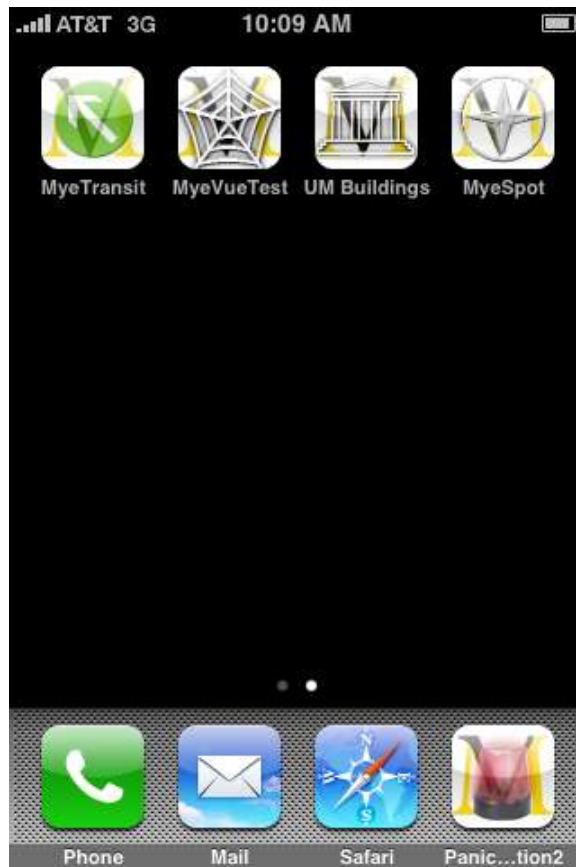
# MyeSpot



# MyeSpot



# MyeBuildings



- Information about all buildings on campus
- Location on the map
- More to come

# Mye Buildings



**A.V. Williams Building**

**Adele H. Stamp Student Union...**

**Agriculture/Life Sciences Sur...**

**Allegany Hall (Dorm)**

**Animal Science/Agricultural...**

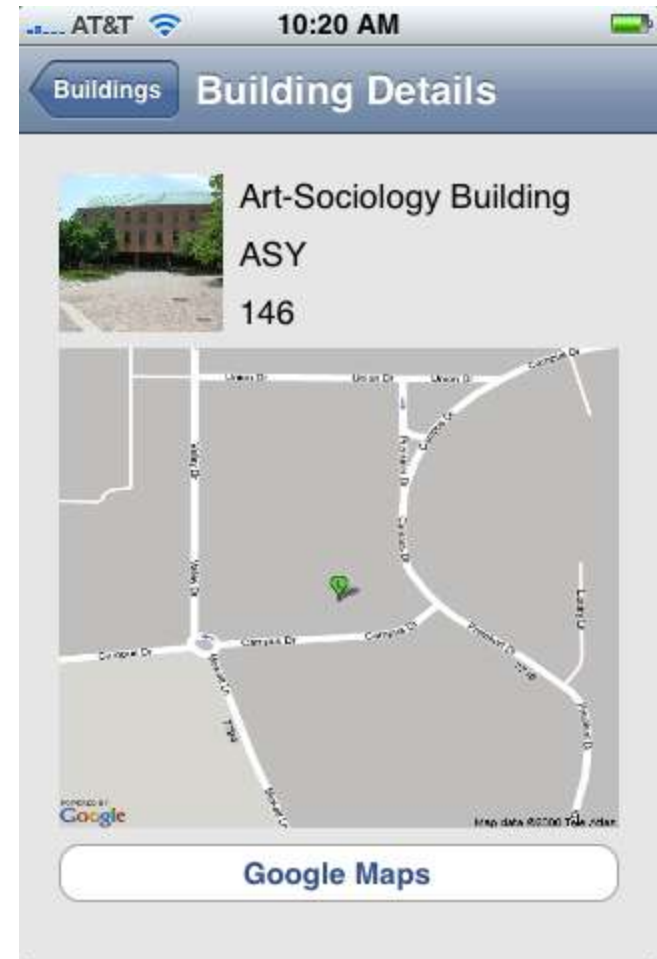
**Annapolis Hall**

**Anne Arundel Hall (Dorm)**

**Architecture Building**

**Art-Sociology Building**

**Augustus C. ...**



# Usage of MyeVyu

- Log from 7 month period
  - 1,052,124 log entries
  - 1029 distinct IP addresses
- Session of a mobile application-
  - If the inter-click time between two application access is less than 15 minutes, it is considered one session
  - Some outliers (>200,000 clicks in a session) removed
  - 1365 sessions
  - Average Number of Clicks/session = 28.61

## Most Frequent Sessions

Session Type	Count
['metro', 'shuttle']	845
['metro']	227
['hoff', 'meal']	80
['meal', 'misc']	44
['hoff', 'metro', 'shuttle']	34
['hoff']	32

## Session vs Number of Clicks

Session	Number of Clicks
['hoff', 'metro', 'shuttle']	36
['metro', 'shuttle']	35
['metro', 'misc', 'shuttle']	29
['metro']	25
['meal', 'metro', 'shuttle']	22
['hoff', 'metro', 'misc', 'shuttle']	22
['hoff', 'meal', 'metro', 'shuttle']	14
['metro', 'misc']	13
['meal', 'metro', 'misc']	11
['hoff', 'metro', 'misc']	10
['shuttle']	8
['hoff', 'meal']	6
['hoff']	5
['hoff', 'meal', 'misc']	5
['meal']	4
['hoff', 'metro']	4
['misc']	3
['meal', 'misc']	3
['hoff', 'misc']	3
['hoff', 'meal', 'metro']	3



# V911 - Public Safety

- Sources of information

- Video
  - Static Cameras –CCTV
  - Mobile – Squad Cars
  - Alerts
- Sensors
- Databases
- Web

- Resources

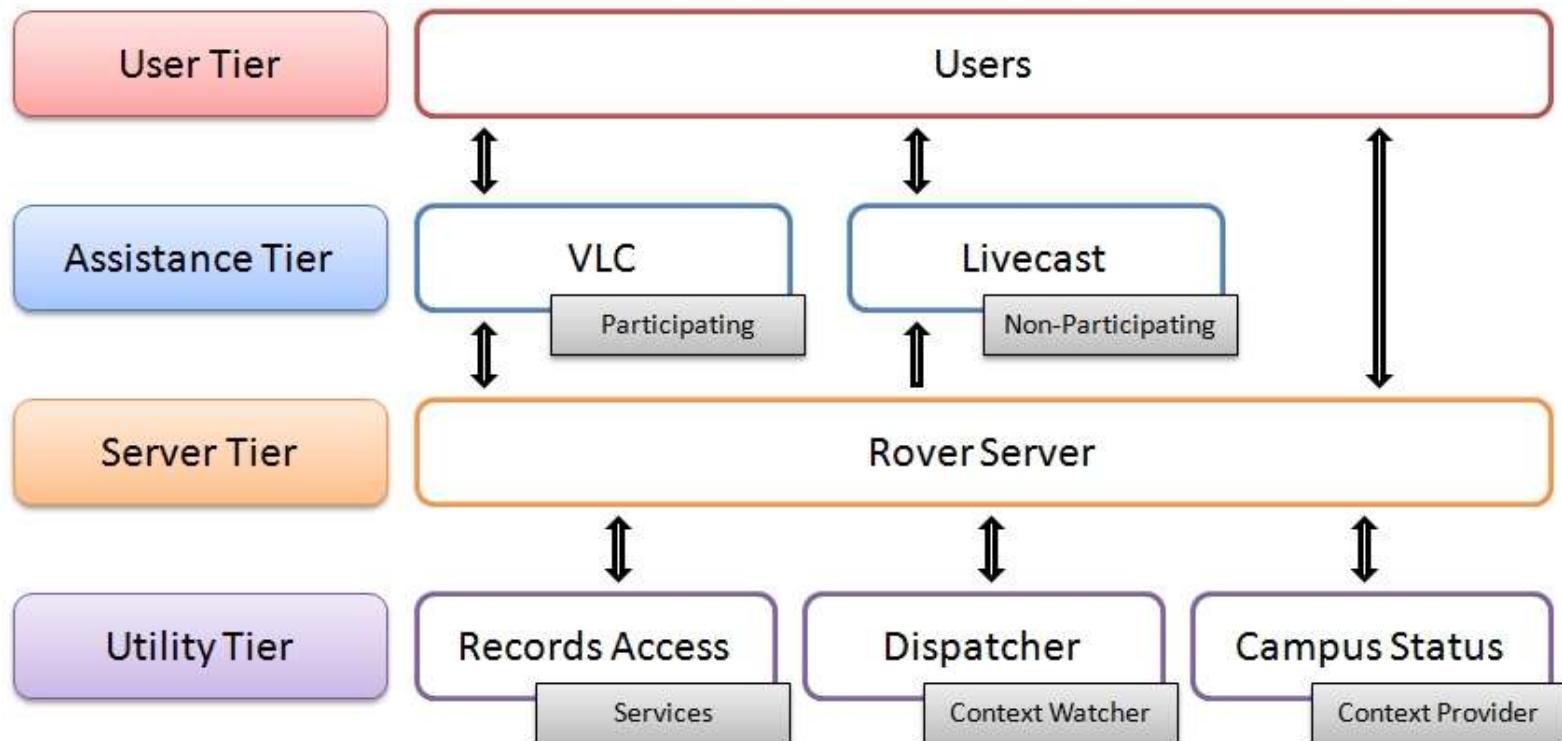
- People
  - Roles
  - Capabilities
- Equipment
- Specialized

Common Situational Awareness

# V 911



# V911 Example



# Commander's Console


- Information from multiple sources
- Available resources
- Issuing commands/tasks
- Real-time monitoring
- Distributed implementation
- Dynamic reporting
- Delegation

# MyeVyu Commander's Console

MyeVyu Commander's Console

Log View Connectivity Help

Map




Resources

Squadcar 001 on MD-193E 39 00 3.43 N 76 56 4.84 W	Ambulance 010 College Park Volunteer Lakeland Road	Fire Truck A College Park Volunteer Lakeland Road
Call Mute	Call Mute	Call Mute

Live Videos


Static Cameras Squad Cars Panic Calls

Camera: South Campus



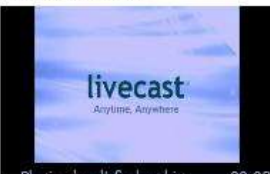
LCM Livecast Media Inc. 00:05

Camera: M-Circle




LCM Livecast Media Inc. 00:08

Camera: A.V. Williams




Camera: Stamp Student Union



In-Focus

Camera: Panic User "abc"



no title 00:48

Streaming from: Nokia N810 Using Wimax  
Status: In Call with Operator 'X'  
Streaming Since: 2:26 PM 12/8/2008  
Information Log: Call238.mcc

Location:  
38 59 20.2 N  
76 56 14.88 W

# MyeVyu Status

- IP – Patent application has been filed
  - Two patents for location technologies have been issued.
- Public Safety
- Next Steps
  - Devices –
  - Location
  - GIS
  - Public safety
  - Handicap Support
  - Visitors





## TagMeAR:

### Context Aware Augmented Reality Information Browser

Class Project in CMSC818G: Information-Centric Design of Systems



- Goal: TagMeAR is a mobile system which aims to be a personal information browser utilizing augmented reality to deliver relevant information/services to users at the right time and place.

#### CONCEPT. Ideas

#### Augmented Reality User Interface

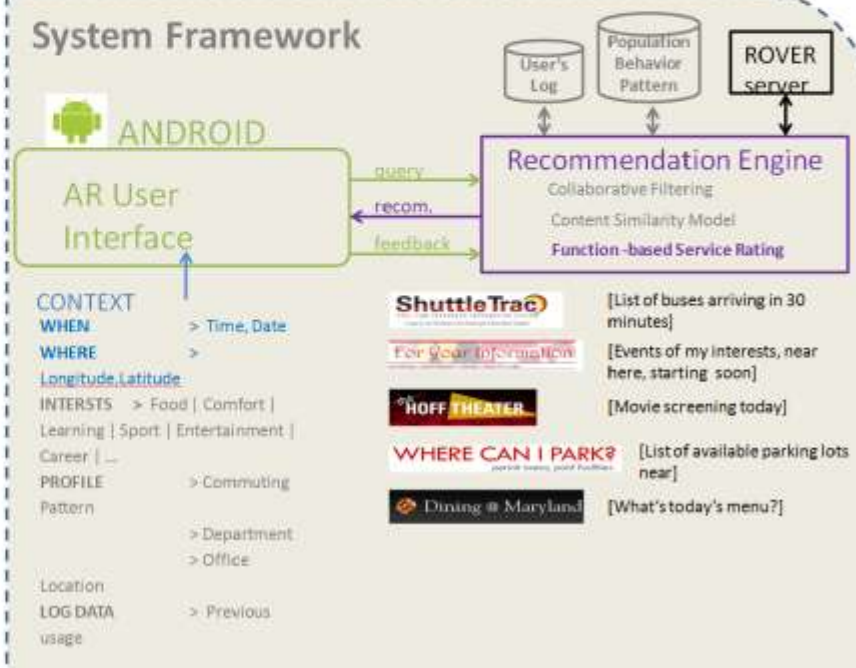
- Query without keyword → useful for "What is THAT building?",
- Mitigating information overloads by using device orientation
  - It might be faster if user knows where to point the device
- Recommendation Setting
  - Toggling dynamic filters (context entity, service, thresholds, amount of information and so on)
- Getting feedback from user → Updating MLN



... : services



#### System Framework



## Concept

### The Problem:

- Faculty and students come across many small problems on campus
- They do not know where to go for help
- Problems may happen when they do not have access to a computer

### The Solution

- Create a unified issue tracking system
- Mobile app that faculty/students can use to report problems
- The underlying system will figure out where to direct the problem based on the information provided by the user



## Mobile app

Users can do the following:

- Submit new issues
- Track submitted issues

Users can describe their problem using:

- Free text
- Categorizing the issue
- Picture/Video of the problem

Users can specify the location of the problem (can augment this with information from Rover)

Users will be identified by a username in our system

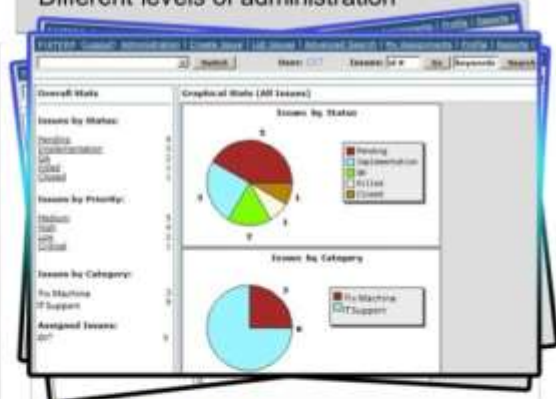
## Web interface

### System:

Track incoming issues  
Users see, edit, and delete tickets  
Use mobile app to submit issues to our Issue Tracking System

### Possible enhancements:

Interactive map of campus issues  
Admins manage mobile app categories  
Different levels of administration



## System Users

- **Faculty/Staff/Student:** Will use the mobile app to submit issues
- **FixTerp admins:** will use web-interface
  - Will manage issues in the issue tracker
  - Update status of the issue



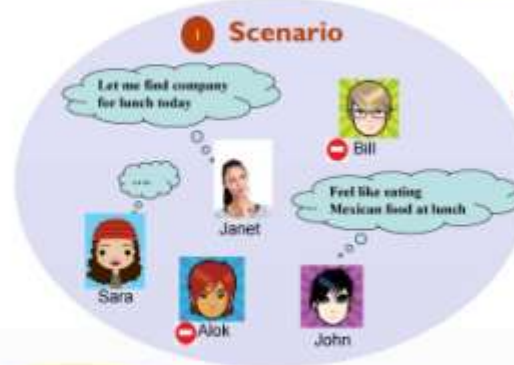


# StarNET – Transient Social Networks

K.Ashwin Kumar, Arijit Biswas, Udayan Khurana, Ashok Agrawala  
University of Maryland, College Park



## 1 Scenario



## 2 Communication



## 3 Summary

- Transient social groups formation
- Need and Time based groups
- Use – Lunch, Soccer Practice, Party, Group Study, Carpool, Movie .....
- Reduces – Effort, Spam, Overload
- Helps – Connect, Decide, Schedule



## 4 Results

USER PREFERENCE CUISINE and TIME

User	Cuisine preference	Time preference
Jack	Chinese, Thai	1-2 pm
Sara	Lasagne, French	12:30-1:30 pm
Arijit	Indian, Thai, Chinese	1:30-2:30 pm
Ashwin	Rice cuisines, Spanish	12-12:30 pm
Janet	Dose, Italian, Chinese	1-2pm

Group1: Jack, Arijit, Janet



Group2: Arijit, Janet

Group3: Sara, Janet

This work is a part of course  
CMSC818G.  
Acknowledgements:  
Christian Almazan

## 5 Interface

