Damage Tracker
A Cloud and Mobile System for Collecting Damage Information
after Natural Disasters

Chris Hodapp*, Matthew Robbins*,
Jeff Gray*, and Andrew Graettinger†

Departments of Computer Science* and Civil Engineering†
University of Alabama,
Tuscaloosa, Alabama 35487

5 April 2013
Acknowledgement

This project was supported in part by NSF grant #1047780
Outline

Motivation and Background

Implementation

Deploying in the Cloud

Demo

Future Work
Motivation and Background
Motivation

- Tornado outbreaks in April-May 2011
  - Tornadoes hit cities across the states of Alabama and Mississippi
  - Tuscaloosa County devastated (43 lives lost, 12% of city damaged\(^1\))
- Other geographically-distributed disasters (e.g. Gulf oil spill)

---

\(^1\) Tuscaloosa county death toll from tornado increases to 43. Tuscaloosa News, 1 June 2011.
Researchers collect data after tornadoes
- Researchers take photos, sync GPS data later
- Hand-written notes

Enhanced Fujita Scale
- Ratings between 1 and 5
- 28 Damage indicators, each with several degrees
- Indicator & Degree → Wind Speed Range → EF Rating
Design Requirements

- Allow users to report damage indicators & degrees
  - Estimate wind speed / EF rating automatically
  - Take textual notes (Speech-to-text a plus)
- Provide the ability to upload data from the web and from mobile phones in the field
- Support many concurrent users
- Allow users to collaborate and see each other’s data on the web
Implementation
MVC web framework for Java/Scala

- Templating system
- Routes
- Database Evolutions
- ORM alternative library for queries
- Deploys as zip archive of jars with a launch script
- Encourages stateless server applications
- Code hot-swapping and in-browser errors
Scala

Statically-typed, Functional, Object-oriented language on JVM

- Pragmatic: enables multiple programming styles
- Type inference
- Great collections
- Great concurrency features
  - Monadic Futures (we used them heavily)
  - Actors (Play uses them internally)
- Simple Build Tool (SBT) offers Maven-like dependency management
Additional Technologies

H2  In memory database of domain-specific data
T2V Auth  Authentication module for Play
Twitter Bootstrap  Site theme
Metadata-Extractor  GPS data extraction
  Imgscalr  Server-side image manipulation
  JBCrypt  Password hashing
Android SDK  Mobile application
Deploying in the Cloud
Elastic Compute Cloud

- Provides virtual machines, in which the user has root access (Virtual Private Server)
- Standard Linux machines
- Pay by hour
Amazon EBS

Elastic Block Storage

- Provides raw (mass) storage volumes for EC2 instances
- Allowed us to start running our application in Amazon’s cloud with no modifications
- Severely limited scalability: can only be connected to a single EC2 instance at a time
Amazon RDS

Relational Database (as a) Service

- MySQL database in the cloud
- Completely drop-in replacement for a self-managed database (just update configuration file)
Amazon S3

- Simple Storage Service
- Scalable storage in ‘buckets’
- Web API for reading and writing files
- Allowed us to overcome the limitations of EBS
- Use Rhinofly library to interface with S3 from Scala code
Demo
Android Application

Damage Tracker

- Camera
- View Images
- Upload

Add Information

Fri 11/30/2012 13:05:05
Latitude: 33.214432
Longitude: -87.544704
Address:
  123 Alabama Way
Damage Indicator:
  20 - Institutional bldg. (hospital, govt...
1. The University of Alabama, Tuscaloosa, AL 35487, USA
Upload Screen

Upload New Photos

+ Add files...  🔄 Upload  🗑️ Remove  ✔ select all

tuscaloosa1.jpg  42.15 KB

Upload  Remove
Image Information

- **Capture Time**: 11/19/12 12:08 PM
- **Upload Time**: 12/10/12 6:27 PM
- **Latitude**: 33.21473611111115
- **Longitude**: -87.54272222222223
- **Uploader**: john.smith@gmail.com
- **Notes**: sherry hall
- **Damage Indicator**: 19 - High-rise (over 20 stories)
- **Degree of Damage**: 9 - Uplift or collapse of roof of 1
- **EF Rating**: 3
- **On Map**: true

**Edit Screen**
Future Work

- Deployment
  - Host a canonical instance?
  - Release source code?
- Evaluate after a tornado
  - How much does the app help researchers?
  - How does the app deal with load?
Questions