CS1120 Guest Lecture: Web applications

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Last lecture

• Lazy evaluation
  – Don’t need to evaluate arguments until they’re needed

This lecture

• Introduction to web applications
  – Why they are interesting
  – History
  – Developing a web application
    • Challenges
    • Testing
  – Errors in web applications

Why I care about web applications

• Built them professionally in 2004
• Topic of my dissertation research
  – How to make testing easier
  – How does consumer perception involve error severity
• Ubiquitous

Why you care about web applications

• Upcoming project
• You may want to build them in the future
  – A way to reach billions of people
• They combine many interesting components and functionality
  – Databases
  – Session state
  – Graphical user interfaces
  – Security
  – E-commerce

What is a web application?

• Web applications started as static pages
• Client-server model delivers static and/or dynamic pages
  – Client side versus server side
  – What is Web 2.0?
Web applications are everywhere

- 73% of the people in the US used the Internet in 2008
- Internet-based transaction orders total several trillions of dollars annually
- Information sent in HTML; accessible by any browser

Growth of web applications

- Increasing exponentially
- Dynamic environment:
  - have short delivery times, high developer turnover rates, and rapidly-evolving user needs that translate into an enormous pressure to change
  - Developed informally

What happens during informal development?

- User-visible failures are endemic to top-performing web applications:
  - about 70% of such sites are subject to user-visible failures
  - one hour of downtime at Amazon.com has been estimated to cost the company $1.5 million dollars
  - Customer loyalty is low

How can we make web applications more reliable?

- Design with care
- Testing!
Problems with testing web applications

- Perceived return on investment is low
- Testing can be resource intensive
  - Example: one of my benchmarks took 50 hours to complete
  - Runtime = (# user sessions) * [database clean + (#urls)*curl]
    - Average 30 urls per session
    - curl takes 5 seconds on average per url
    - Database clean takes 1 minute
    - Run entire test rig more than once a day

Errors in Web applications

- Inheritance: String is not a subclass of DateTime
  ```python
  datetime1 = datetime.utcnow()
datetime2 = "I am not a valid date"
if (datetime2 > datetime1)
    print "I am in the future"
  ```

- Objects: an object packages state and procedures
  ```python
  $spot = Dog()
  spot = Cat()
  spot.bark("Hello")
  ```
• Encapsulation: why do we want to hide some things from view?

```python
class Thing(object):
    _next_id = 0

thing1 = Thing('one')
if (thing1._next_id > 0)
    print "I'm not zero"
```

• Functional programming: can pass a function as an argument

```python
# statement-based loop
for e in lst:
    func(e)

# passing func as an argument
map(func, lst)
```

• Typing: why might we want to use a strongly-typed language?

• Security: want to avoid passing string arguments that may be interpreted as code and run on the host machine
  – Example: a line of code that deletes a table in the database

Summary

• Web applications
  – Are growing exponentially and used widely
  – Combine interesting technologies
  – Need to be tested like all software

Information

• The Django tutorial is posted on the course site now
  – Go through this by Sunday
• Professor Evans won't have normally scheduled office hours today
  – normal office hours Tuesday morning (10:30-11:30am)