A Software Crisis
Denver International Airport

- Approved for construction in 1989
- First major airport to be built in the United States in over 20 years.
- Three terminals + several runways
- Built on 53 square miles of land (Twice the size of Manhattan Island!)
BAE Contract

- Original assumption: Every company builds its own baggage transport system
- United (70% Denver traffic) was the only to begin planning; contract with BAE
- First fully automated baggage system
- Later, Denver airport extended contract to entire airport – three times original size
The Scope

- 20 miles of track
- 6 miles of conveyor belts
- 56 laser arrays that read bar coded tags
- 400 frequency readers
- 3,100 standard size baggage ‘Telecars’
- 450 6.5 ft by 4 ft oversize cars
- 55 separate computers
The System
The Timeframe

- BAE started work 17 months before scheduled opening October 31, 2003
- In Munich (similar system), engineers had spent two years just testing the system (with 24/7 operation six months before the airport opened)
More Risks

• Most of buildings were already done, so BAE had to accommodate system (sharp turns, narrow corridors…)

• BAE paid little attention to German sister project and devised system from scratch

• Little communication within BAE
Final Blunder

• The decision to broadcast the preliminary test of the “revolutionary” new baggage system on national television
A Disaster

- Carts jammed together
- Damaged luggage everywhere, some bags literally split in half
- Tattered remains of clothing strewn about caused subsequent carts to derail
- Half the luggage that survived the ordeal ended up at the wrong terminal
More Issues

- Carts got stuck in narrow corridors
- Wind blew light baggage from carts
- 5% of the labels were read correctly
- Normal network load was 95%
Complexity: Empty Carts

• Empty carts need to go where they are needed

• Cart has to be at its “cannon” at the right moment

• Lanes have limited length → traffic jam

• All controlled by single central system
Consequences

- Airport opening delayed four times – overall, sixteen months late
- New engineering firm
  - split system in three (one per terminal)
  - implemented manual backup system
- BAE got bankrupt
- Overall damage: 1.3 bln USD
Glass’ Law

Requirement deficiencies are the prime source of project failures.
Project Success

- Successful: 52%
- Challenged: 29%
- Failed: 19%

Source: Standish Group CHAOS Report, 2015
Based on 50,000 software projects around the world
## Project Success by Size

<table>
<thead>
<tr>
<th></th>
<th>Successful</th>
<th>Challenged</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grand</td>
<td>2%</td>
<td>7%</td>
<td>17%</td>
</tr>
<tr>
<td>Large</td>
<td>6%</td>
<td>17%</td>
<td>24%</td>
</tr>
<tr>
<td>Medium</td>
<td>9%</td>
<td>26%</td>
<td>31%</td>
</tr>
<tr>
<td>Moderate</td>
<td>21%</td>
<td>32%</td>
<td>17%</td>
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<tr>
<td>Small</td>
<td>62%</td>
<td>16%</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: Standish Group CHAOS Report, 2015, based on 50,000 software projects around the world
More Examples

- Mariner 1 (1962)
  Missing overbar crashes Venus probe
- Eole 1 (1971)
  72 weather balloons get wrong cmd
- Nimbus 7 (1978)
  Satellite misses ozone hole for 6 yrs
- HMS Sheffield (1982)
  Exocet rocket id’ed as “friend”
- Stanislaw Petrow (1983)
  Russia detects global nuclear attack
- Therac 25 (1985)
  Radiation overdose kills six
- Stock crash (1987)
  Dow Jones loses 22% in one day
- Vincennes (1988)
  Passenger jet mistaken to be F-14
- Patriot (1991)
  Misses to shoot down Iraqi Scud
- Climate Orbiter (1999)
  Confuses metrics and imperial
  50 mln affected for 5 days
- Apple SSL bug (2012)
  18 months w/o SSL authentication
- Heartbleed bug (2014)
  Silent data leak in major SSL code
- Stagefright MMS (2015)
  All Android <5.1 vulnerable
How the customer explained it

How the Project Leader understood it

How the Analyst designed it

How the Programmer wrote it

How the Business Consultant described it

How the project was documented

What operations installed

How the customer was billed

How it was supported

What the customer really needed
Challenges

- Why does it take so long to get software finished?
- Why are the development costs so high?
- Why can’t we find all errors?
- Why do we spend so much time and effort maintaining existing programs?
- Why is it difficult to measure progress?
Topics

• Requirements Engineering
• Software Specification
• Software Design and Architecture
• Software Quality Assurance and Testing
• Software Maintenance and Evolution
• Software Project Management
Your Lecturers

- Andreas Zeller
- Dr. Alessio Gambi
- Dr. María Gómez Lacruz
- Lecture every Tue+Thu 8:30 here in E2.2
- Start with 2x/week, later 0x/week
Your Tutors

- Ezekiel Soremekun Olamide
  (course manager)
- Abbas Rezaey
- Adekunle Onaopepo
- Aditya Gulati
- Ahmad Taie
- Alyona Morozova
- Chirag Shah
- Firuza Sharifullaeva
- Jyoti Prakash
- Muhammad Muaz
- Petr Tikhonov
- Timo Gühring
- Tri Huynh
Books

1. SOFTWARE ENGINEERING: A Practitioner's Approach, Sixth Edition
   - Roger S. Pressman

2. FUNDAMENTALS OF Software Engineering, Second Edition
   - Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli
Exam

( + extra exam beginning of September)
Projects

- SW Engineering is best learned by *doing* (There is no “theory of software engineering”)
- Therefore, *projects* make up 2/3 of course
Projects
Tutor
Supervision
Honor
Client
Project Details

- Non-trivial piece of software
- Suggested by *client* (mostly CS members)
- Client is *busy* (spends max 15 hrs total)
- Client is *vague* (on purpose)
Deliverables

• Full set of requirements
• User interface design
• Architecture design
• Project plan
• Prototype
Grading

- Need to pass exam \textit{and} project to pass

- Project grades based on group performance (with bonus for individuals)
Software Engineering
Core Course - Summer 2017

Software Engineering Chair (Prof. Zeller)
Saarland University - Computer Science
Campus E9 1 (CISPA)
66123 Saarbrücken, Germany
E-mail: se2017-contacts@lists.st.cs.uni-saarland.de

Select a page:  SE 2017  Lectures  Projects  F.A.Q.  Exams

News

<table>
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<tr>
<th>Date</th>
<th>News Update</th>
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<tbody>
<tr>
<td>20 Apr. 2017</td>
<td>First Lecture.</td>
</tr>
<tr>
<td>13 Apr. 2017</td>
<td>Registration Starts. Register here</td>
</tr>
<tr>
<td>14 Feb. 2017</td>
<td>Course page went live.</td>
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Dates and Events

SE2017

<table>
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<tr>
<th>Mon</th>
<th>Tue</th>
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Web Site
Sign up!

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Summary

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