UNIVERSITY of VIRGINIA

CS6501
CLOUD SYSTEM RELIABILITY

Course Introduction

Prof. Chang Lou, UVA CS, Spring 2026

AGENDA

- **What this course is about**
  - why study on cloud system reliability?
- **What you can expect from this course**
  - and what we expect from you

- **But first, tell us more about yourself!**
  - your name/CS-background/hobby, and why you took this course

WHY YOU TOOK THIS COURSE

- **Likely answers**
  - **No exam**
  - Interested in cloud computing
  - Get experience for related jobs in industry
  - Try a small research project
  - Write more reliable codes

WHY CLOUD SYSTEM RELIABILITY MATTERS

WHY CLOUD SYSTEM RELIABILITY MATTERS

— Modern world depends on cloud systems

WHY CLOUD SYSTEM RELIABILITY MATTERS

— In 2025, 96% of enterprises use cloud services

https://map.datacente.rs/ https://www.zippia.com/advice/cloud-adoption-statistics/

WHAT IS RELIABILITY

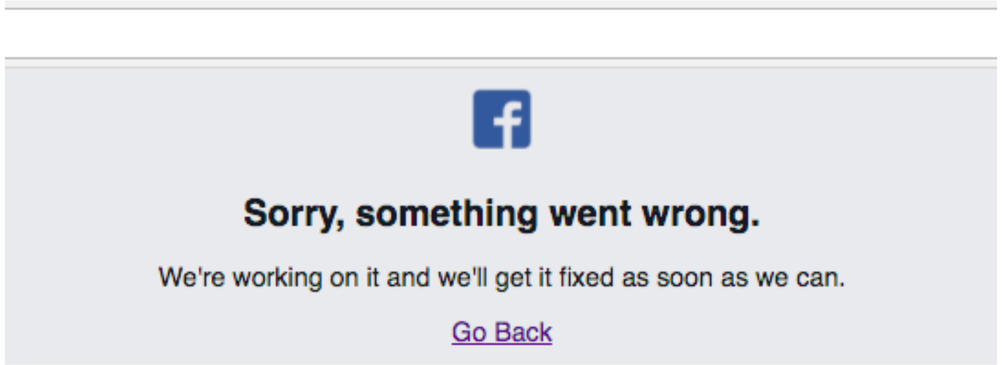
— What are some common qualities we measure on systems?

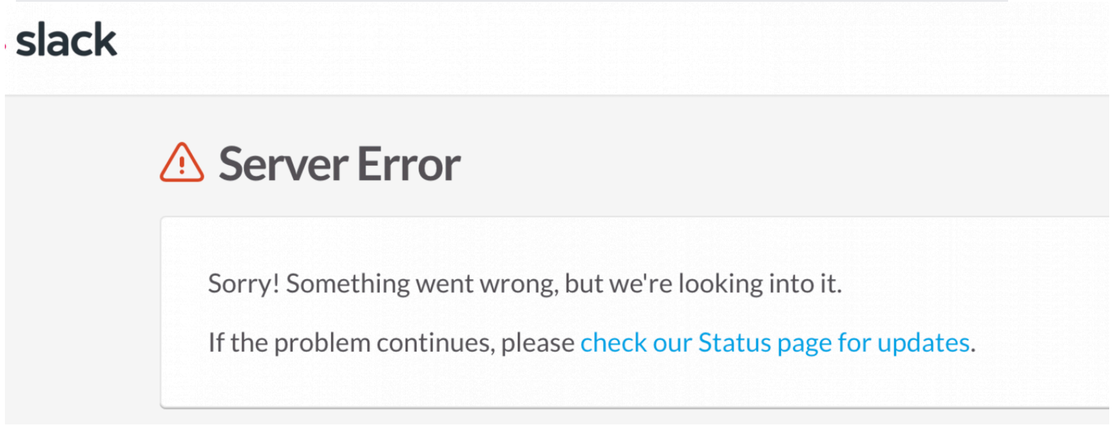
WHAT IS RELIABILITY

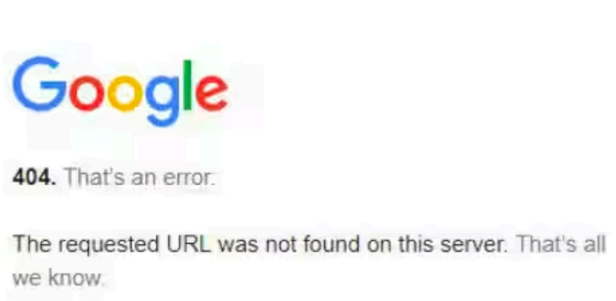
- **Reliability is not**
  - Performance: make systems faster
  - Usability: make systems more user-friendly
  - Security: make systems safer against intrusions
  - Cost-effectiveness: make systems more affordable
- **Reliability is**
  - the system's ability to consistently perform its intended function without **failure** over a given period.

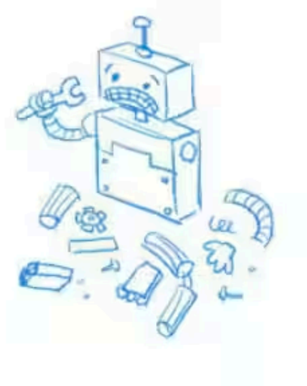
CLOUD FAILURES

— Cloud failures are prevalent









CLOUD FAILURES

— Cloud failures can be really annoying

CLOUD FAILURES

— .. or much worse, huge economic loss and service unavailability

Microsoft's MFA is so strong, it locked out users for 8 hours

23 May 2013

3 difficult days for Rackspace Cloud Load Balancers

Posted by **iwgcr**

After almost 24 hours of technical difficulties, Facebook is back

Facebook blamed the issue on a "server configuration change."

Amazon 'missed out on $34m in sales during internet outage'

The e-commerce giant generates $9,615 in sales per second – but not when it's website is down

Ben Chapman • Tuesday 08 June 2021 16:54 • 1 Comments

Millions online hit by Microsoft 365 outages

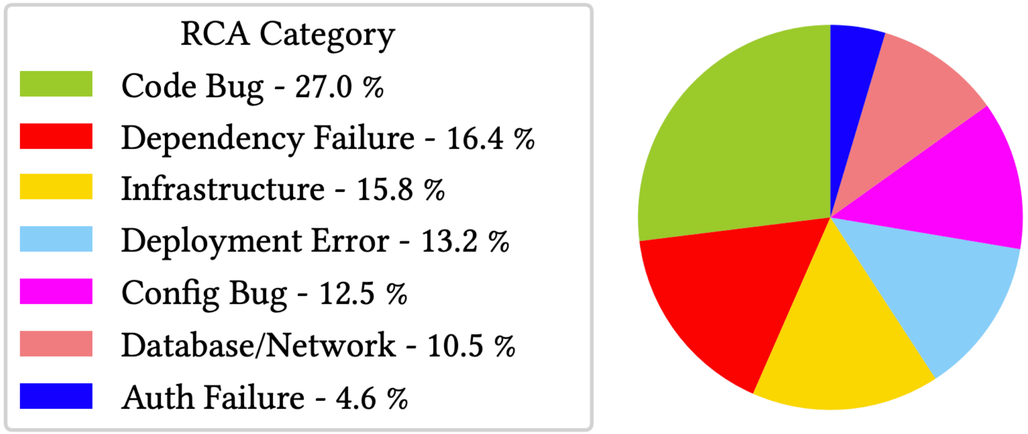
911 emergency services go down across the US after CenturyLink outage

Zack Whittaker @zackwhittaker / 4 months ago

Comment

CLOUD FAILURES

— Cloud systems fail due to different root causes



• S. Ghosh et al., How to Fight Production Incidents? An Empirical Study on a Large-scale Cloud Service, In Proceedings of the 13th Symposium on Cloud Computing (SoCC '22), November 2022.

CLOUD FAILURES

— .. sometimes very surprising root causes

TECH TECHNOLOGY GOOGLE FIBER

Google Fiber Shot Down By 'Bored' Hunters

'Bored' Hunters Shoot Down Google Fiber

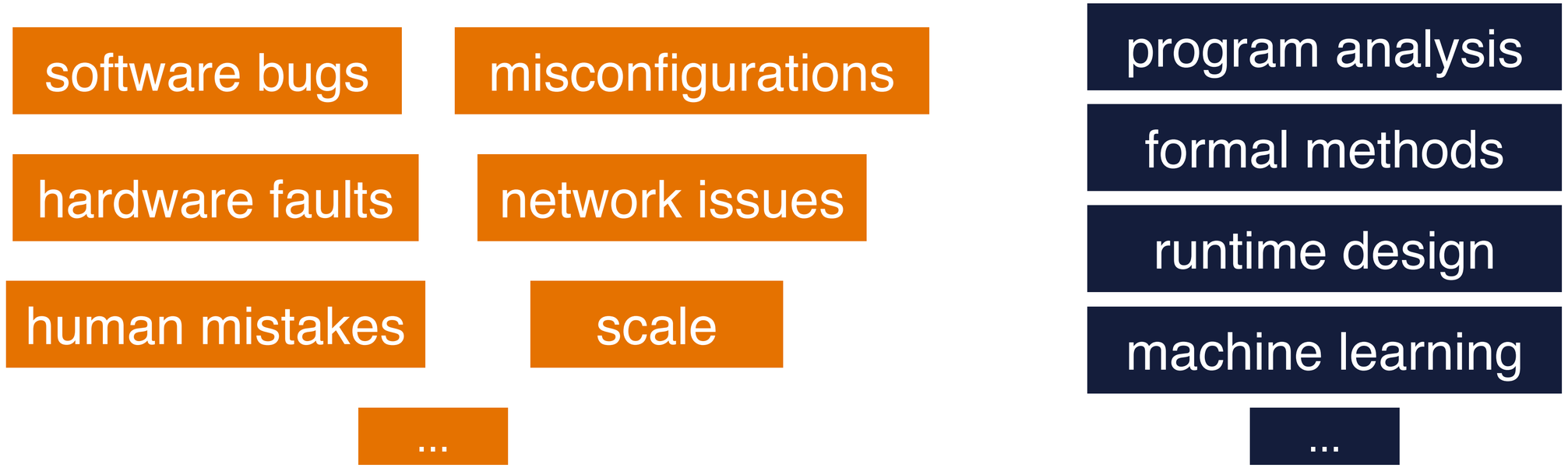
By Bianca Bosker

Nov 22, 2010, 05:12 AM EST | **Updated** May 25, 2011, 05:50 PM EDT

Google reinforces undersea cables after shark bites

Sharks have been biting down on fibre optic cables under the Pacific, possibly confused by electrical signals that resemble fish

IN THIS COURSE



GOAL OF THIS COURSE

- Introduce foundational concepts of cloud computing and system reliability.
- Provide hands-on opportunities to engage in cutting-edge CSR research.

IN THIS COURSE

- **Review literatures about cloud reliability**
  - classic work + state-of-art
  - from top system conferences: SOSP/OSDI, NSDI, ASPLOS..
- **Learn how to present a research work**
  - ..and defend it like you were the author!
- **Explore a research topic you feel excited ★**
  - a try-out if you are considering to apply Ph.D. programs in the future

Course Info

COURSE INFO

- **Time/Location**
  - MoWe 02:00 PM–03:15 PM, Olsson Hall 011
- **Office Hours**
  - MoWe 3:15pm - 4:15pm, Rice Hall 304
- **Discussion Forum**
  - UVA Canvas (where you submit reviews)
- **Questions**
  - Send emails to chlou@virginia.edu or stop by at my office (open-door policy)

LECTURER INFO

- **Chang Lou**
  - Ph.D. from Johns Hopkins
- **Research Areas**
  - Distributed Systems, Operating Systems, Software Reliability
- **Research Goal**
  - Enhance cloud systems to be more resilient against arising reliability challenges

TA INFO

- **$ whoami**
  - Zhenyu Li
  - third year Ph.D. student at UVA CS
- **$ echo $OFFICE**
  - Rice Hall
- **$ head research_interests**
  - Distributed Systems and Reliability
- **$ cat ta.email**
  - vnr3ne@virginia.edu

GRADING

- Reviews: 15%
- Class Participation: 15%
- Presentation: 20%
- Project: 50%

REVIEWS

- **Each class we will discuss two papers**
  - choose **only one** reading to write reviews
  - light reading on the other one
- **Submit to Canvas before 11:59 am on class day**
  - maximum **five** reviews are allowed to miss without penalties
  - you **don't** need to submit reviews if you are the presenter for that paper (they will not be counted as missing reviews)

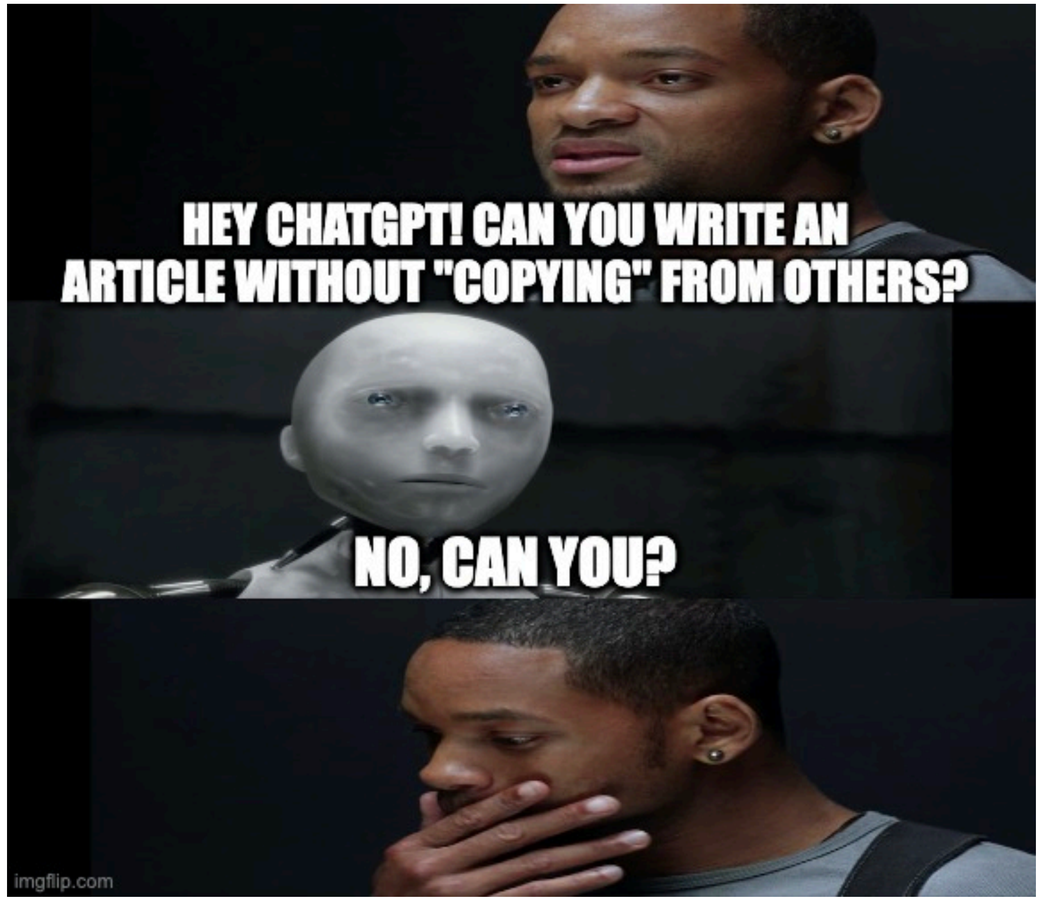
LATE POLICY

- **Everyone has 96 hour late tokens (for reviews, report ...)**
- **To use, just send an email to staff email list**
  - cs6501csrstaff@virginia.edu
  - late submissions using late tokens receive no penalty
- **What if I run out of tokens?**
  - 1 day late, 15% deduction
  - 2 days late, 30% deduction
  - 3 days late, 60% deduction
  - after 4 days, no credit.

CHATGPT POLICY

- **How to best use AI writing assistant**
  - brainstorm initial ideas
  - check grammar errors
- **You should not use AI to**
  - directly generate reviews for you

A few genuine questions from you are far more valuable than lengthy AI-generated passages.



But.. what if I have never read a paper before?

HOW TO READ A PAPER (3-PASS APPROACH)

by S. Keshav, University of Waterloo

- **The first pass: general idea (5-10 mins)**
  - title, abstract, and introduction
  - headings
  - conclusion
- **The second pass: content (< 1 hour)**
  - figures, diagrams and other illustrations in the paper
  - references
- **The third pass: details (may take hours)**
  - "re-implement" the paper

https://web.stanford.edu/class/ee384m/Handouts/HowtoReadPaper.pdf

HOW TO READ AN ENGINEERING RESEARCH PAPER

by William G. Griswold, CSE, UC San Diego

- What are the **motivations** for this work?
- What is the proposed **solution**?
- What is the work's **evaluation** of the proposed solution?
- What is your **analysis** of the identified problem, idea and evaluation?
- What are the **contributions**?
- What are **future directions** for this research?
- What **questions** are you left with?
- What is your **take-away message** from this paper?

CLASS PARTICIPATION

- **Attend classes**
  - discuss reviewed papers with peers
  - there might be a few random (but simple!) quizzes ☺
- **Exceptions: illness and other absences**
  - If you feel uncomfortable, it is better for you to get some rest at home
  - sometimes you need to pursue career opportunities - interviews, conferences, ..
  - **three** absences allowed with no questions

PRESENTATION

- **Each student present two papers through the semester**
  - Register at Google Sheet **TODAY**! (Link also in Canvas Announcement)
    - https://docs.google.com/spreadsheets/d/1fW1jrnkRDZEmrOQ-gp_9H3dDc722d7zc9Gvpthx95CY/edit?gid=0#gid=0
  - Presenters in First Eight Slots get **bonus credits**
- **For each presentation**
  - Main body: 25-30 min
  - Q&A: 5 min
- **Lead the discussion and defend the work**
  - (people call thesis "defense" for a reason)

QUICK TIPS FOR PRESENTATION

- **One common pitfall: too many details**
  - the presenter tries to cover everything in the paper
  - however, it is impossible for anyone to learn all details in 40 min!
- **Simple tip: focus on three takeaways**
  - most people can only remember three things after the talk
  - build your slides around them to make points clear
  - key concepts + logic >> technical details

PROJECT

PROJECT

- **Week 1: Form a team (2-3 students)**
  - brainstorm on your project topic (related to cloud system reliability)
- **Week 2-3: Schedule a meeting with me to discuss**
- **Week 4-5: Write and submit proposal (1-2 pages)**
- **Week 6-14: Do research**
  - Week 11: Checkpoint report due (~3 pages)
- **Week 15-16: Presentation**
- **Week 17: Final report (including codes)**

IMPORTANT TIMELINE

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Q & A

- **ToDo 1) Team up**
  - find your teammates and elect a team leader
  - team leader emails me name list and schedules a meeting with me **(ddl: 1/21)**
- **ToDo 2) login Canvas**
  - sign up in the presentation schedule
  - read Wednesday class papers and submit review **(ddl: 1/14)**
- **Next class**
  - paper reading: Reliability Overview
  - discuss: how to find a project idea

chlou@virginia.edu

ACKNOWLEDGEMENT

PROF. RYAN HUANG (UMICH) AND PROF. TIANYIN XU (UIUC) FOR SHARING THEIR COURSE MATERIALS AND TEACHING INSIGHTS