You Build It You Break It

We Do Research On It And Publish It

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Obligatory: We Care About Security

```
41      if(!strncmp("rootmydevice",(char*)buf,12)){
42              cred = (struct cred *)__task_cred(current);
43              cred->uid = 0;
44              cred->gid = 0;
45              cred->suid = 0;
46              cred->euid = 0;
47              cred->euid = 0;
48              cred->egid = 0;
49              cred->fsuid = 0;
50              cred->fsgid = 0;
51              printk("now you are root\n");
52      }
```

Where we come in: contests

- Well designed contests can capture a lot of the security space
- Lots of contests for operational aspects of security
  - DEFCON CTF
  - NCCDC / CDX
- Contests for research purposes
  - CGC

A “new” contest

- Security focused
  - Unlike TopCoder
- Development focused
  - Unlike CTF
- Programming language / tool independent
  - Best tools should win

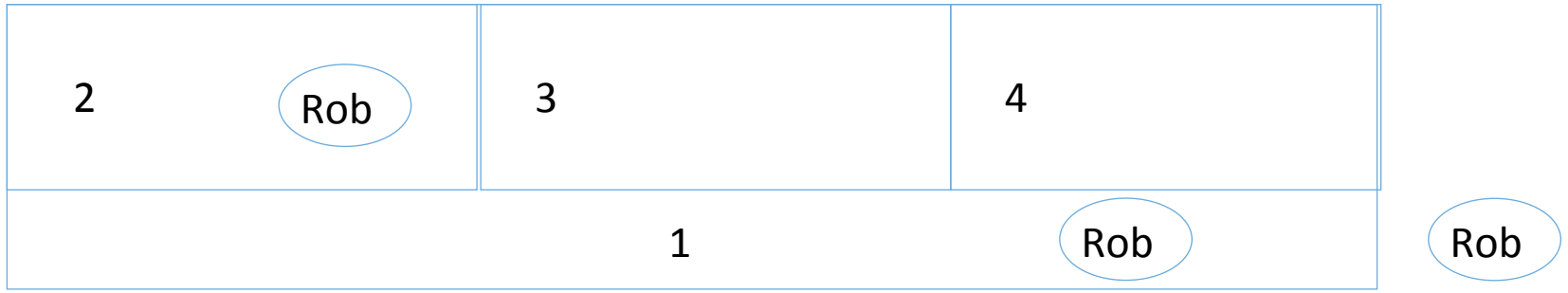
What's our idea?

- A contest where contestants
  - **Build** some secure software according to a specification
  - **Break** the software written by other contestants
  - **Fix** the bugs found in their software by other
- Organizers provide the specification
- Spread the contest over three weekends
- Each phase takes one weekend
- Announce two winners, one for best software, one for most bugs found

Challenge specifications

- Needs to be at least a little fun
- Have high and low level security properties
  - Writing in Java or Python should not win by default
- Judge implementations on both correctness and performance
- Capable of unambiguously testing features
- Should be somewhat complicated, but doable in 72 hours

Secure Log



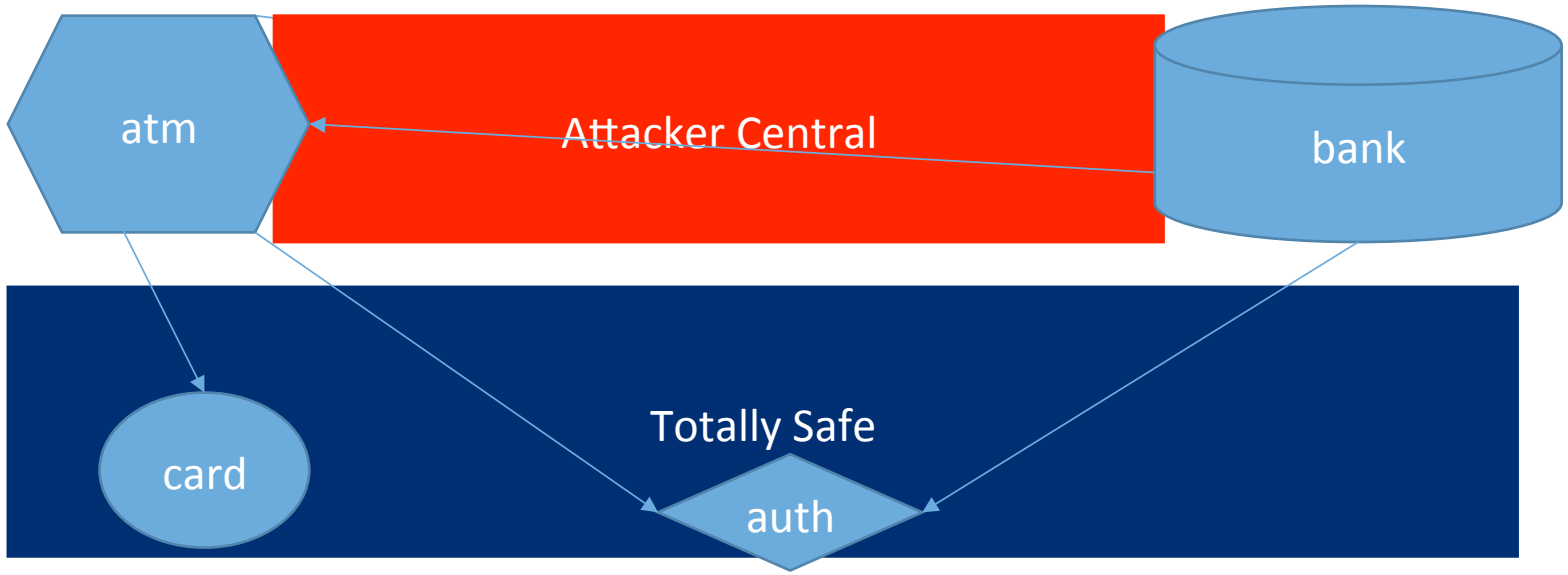
logappend –T 1 –A –E Rob logfile

logappend –T 2 –A –E Rob –R 1 logfile

logappend –T 3 –L –E Rob –R 1 logfile

logappend –T 4 –A –E Rob –R 2 logfile

ATM / Bank



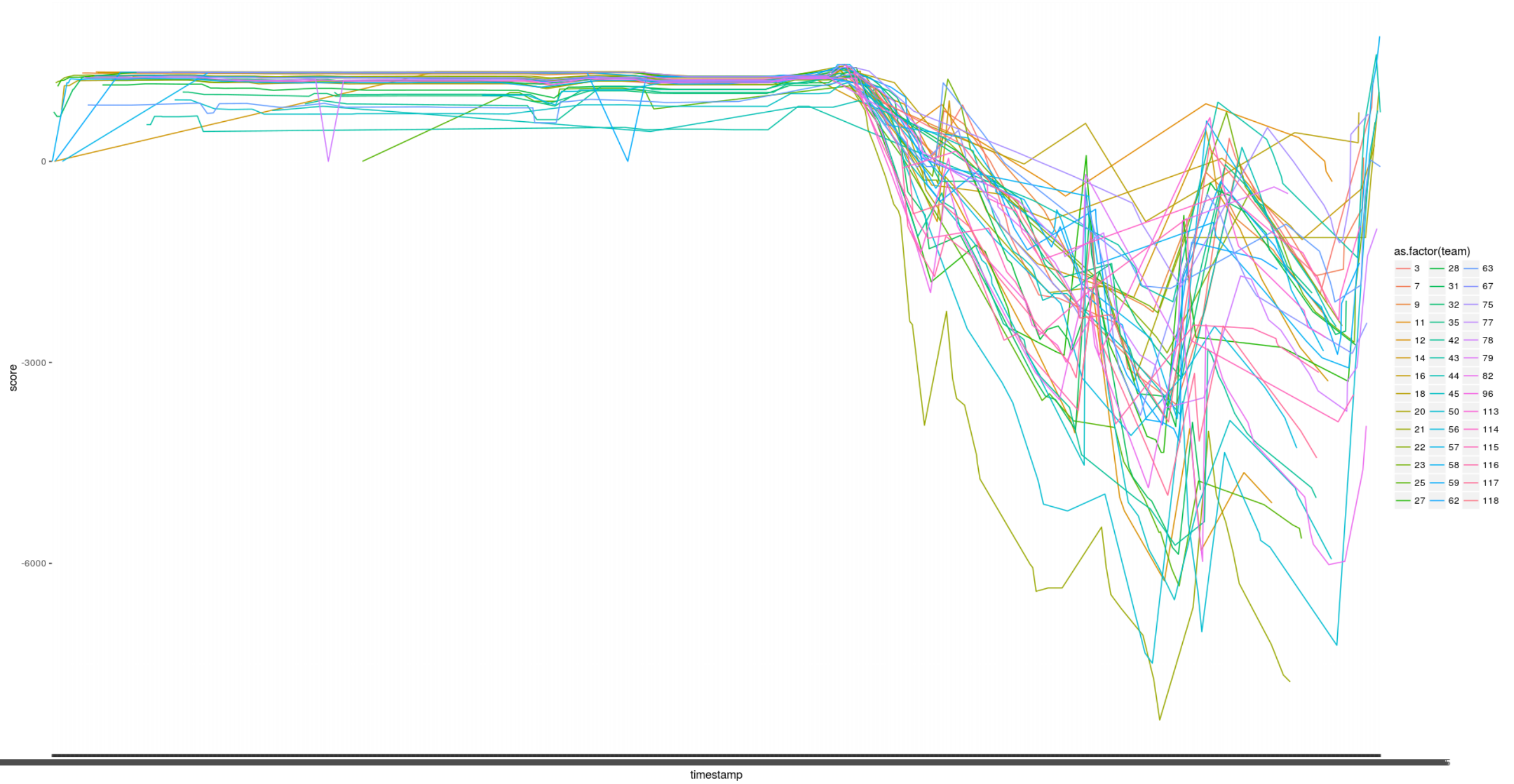
Types of failures

- **Correctness** – The program didn't meet some part of the specification, or crashes
- **Integrity** – The log can be modified to attest to a false fact
- **Confidentiality** – The log can be analyzed to determine a protected fact
- We can automatically judge correctness and integrity bugs
- Integrity, confidentiality, and a correctness bug that produces a crash are counted as **exploits**

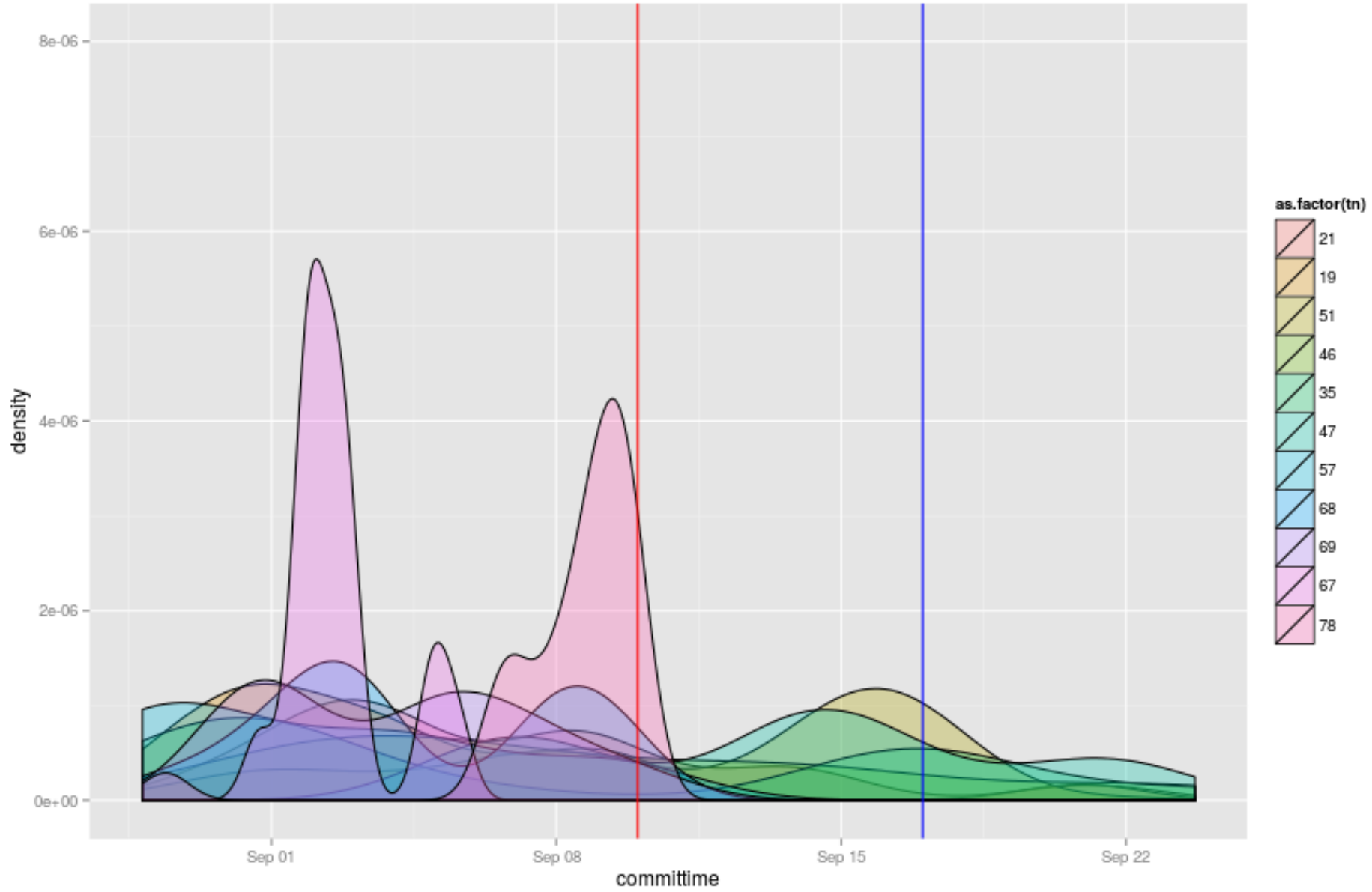
Data

- Run 3 contests over 2 years
  - ~70 implementations of problems
  - ~160 participants
- Commit history by author
- Program artifacts over time
  - C, C++, Ocaml, Python, Java, PHP, go, rust…
- Bugs found over time

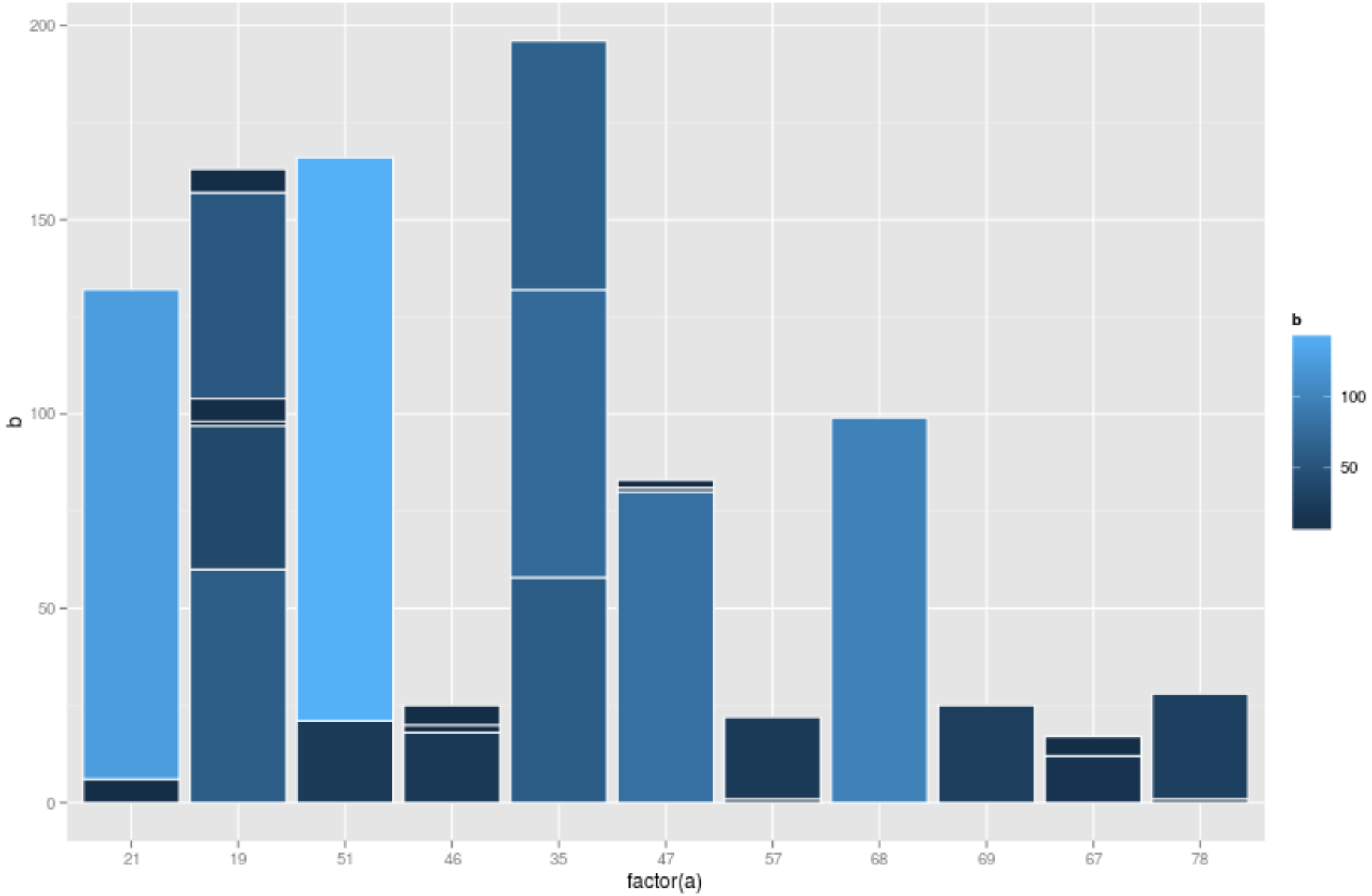
Scores over tim



Commit Activity



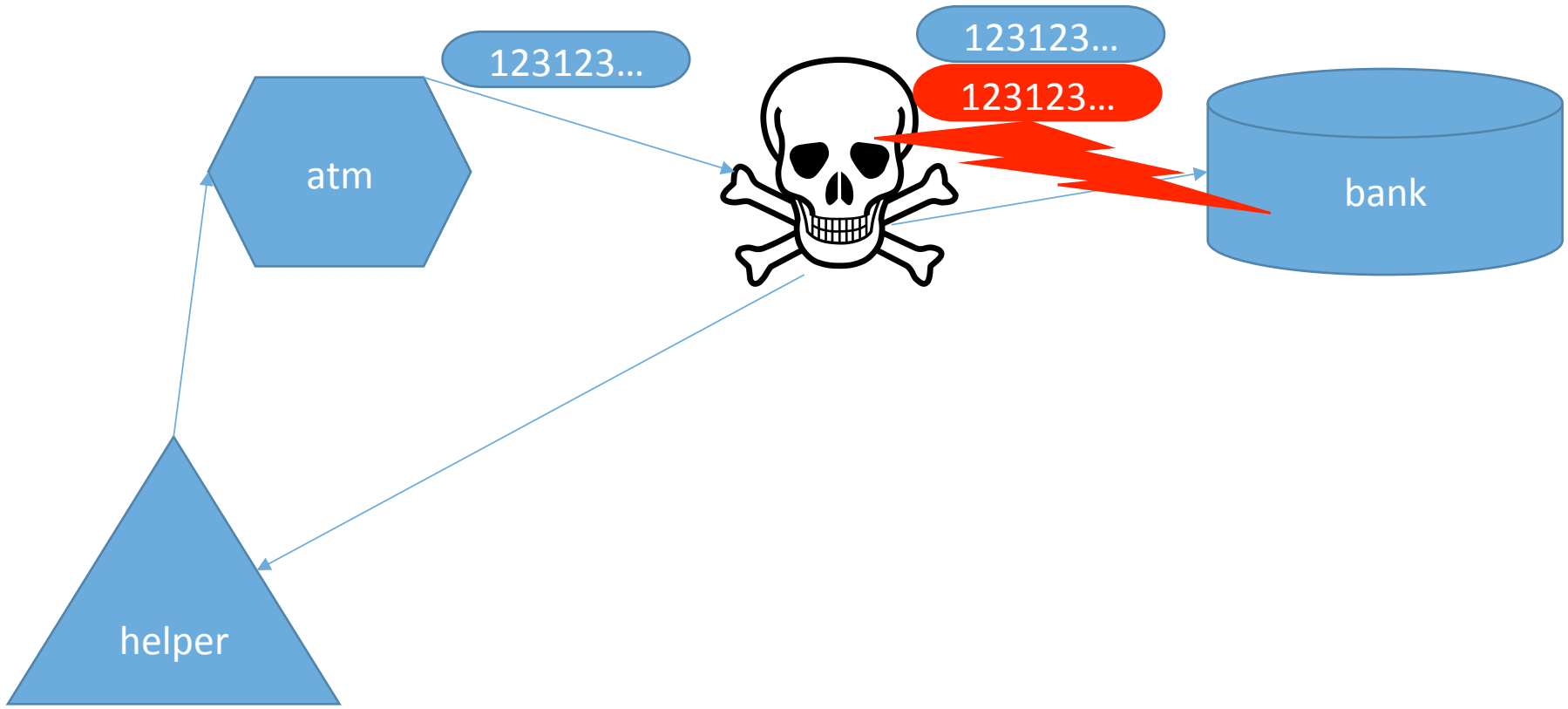
Commits by contributor, per team



ATM break scenario

- No access to bank/ATM auth file or account card file
- Confidential break – reveal secret data (account name or balance)
- Integrity break – modify an account holders balance
- Can request a few things
  - Creation of an account with an unknown name
  - An unknown user performs some action

ATM break scenario



Good stories

- Use SSL and PKI
  - Bank / ATM auth files are SSL private keys
  - Certificate level auth
- Use NaCl
  - Messages are NaCl secret boxes with a nonce (starting at 1337 of course)

Bad stories

- Predictable generated auth tokens
  - Accounts can be forged
- Custom encrypted transport protocol with no nonces
  - Messages can be replayed

Ugly stories

- No encryption / no authentication
- Bad command line parameter sanitization
  - While writing C code
- Home rolled crypto algorithms

Data analysis ongoing

- Participant factors that lead to secure code
  - Experience
  - Past history with security
- Model developed, analysis under submission

- In the future, quantitative properties of programs?
  - Cyclomatic complexity
  - State “depth”

Future problems?

- Online poker
- Remote vehicle control
- Image processing

Thanks!