Lowering the Barriers to Capture The Flag Administration and Participation

Kevin Chung, CTFd LLC

What is a Capture The Flag

- Teams of users participate in a online/LAN competition
  - Receive cyber security “challenges”
  - By exploiting, patching, or reverse engineering each challenge, a team receives points
  - Whoever has the most points at the end wins

What are CTFs used for?

- Games of skill
  - CTFs began as a way of testing and teaching cyber security techniques
- Education & Internal Training
  - Educational institutions and companies use CTFs to teach their students and employees
- Recruitment
  - Some companies leverage CTFs as a means of filtering and identifying candidates

The Future of CTF

- De-facto security training interface?
- Expand into more than just cyber security?
- Can a security CTF become an e-sport?

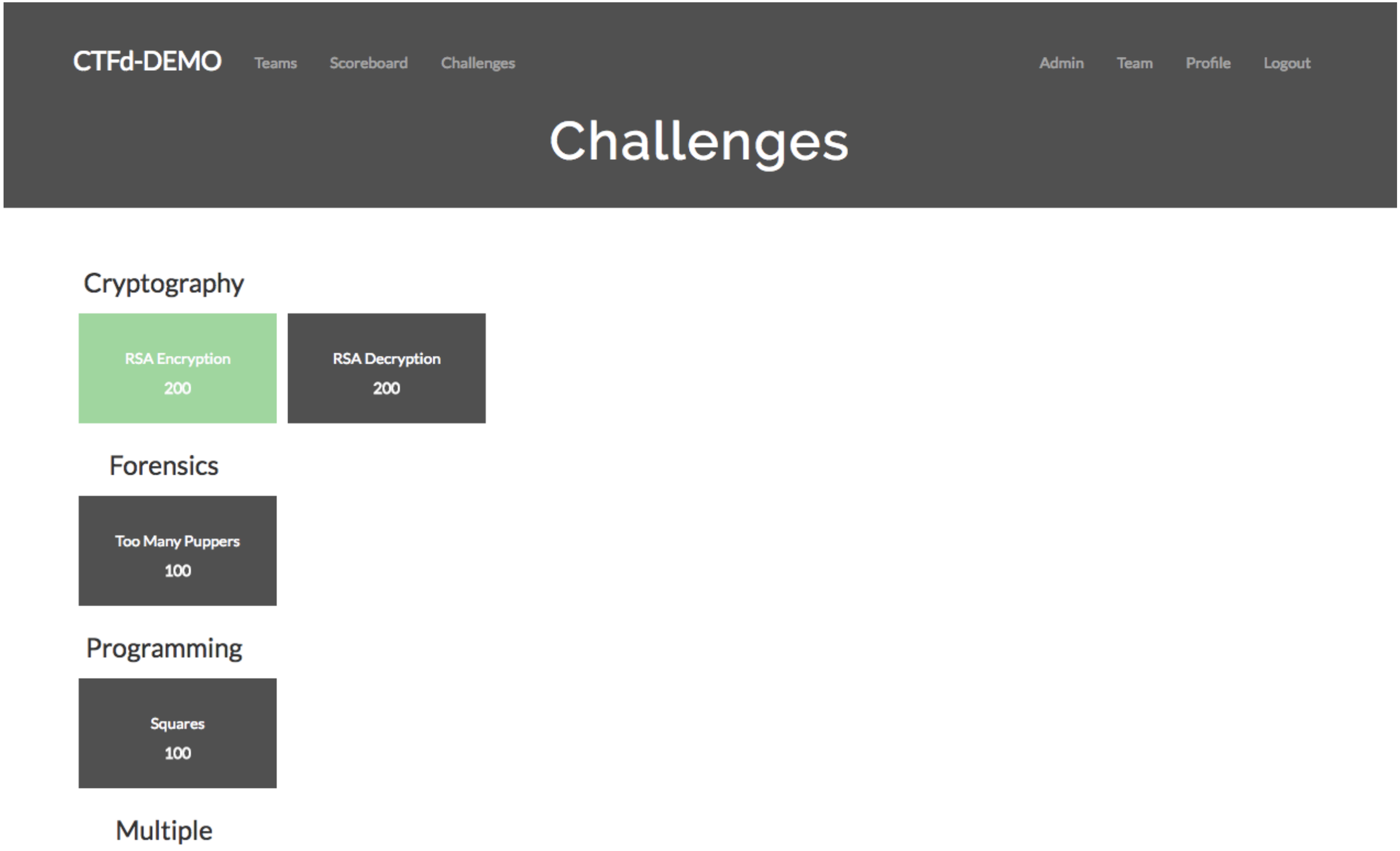
CTF as an e-sport

- What drives a decision?
- How do you add meta game to CTF?
  - e.g. Types of units/utilities, map layouts, item economy
- Would someone watch a CTF for 30 mins to an hour?

- Started life at CSAW CTF in 2014 and was open sourced in 2015
- Focuses on ease of use and extensibility
  - Written in Python, Flask, and JavaScript
- CTFd comes with everything needed code-wise to run a CTF
  - Anything additional can be implemented with a theme or plugin

Features

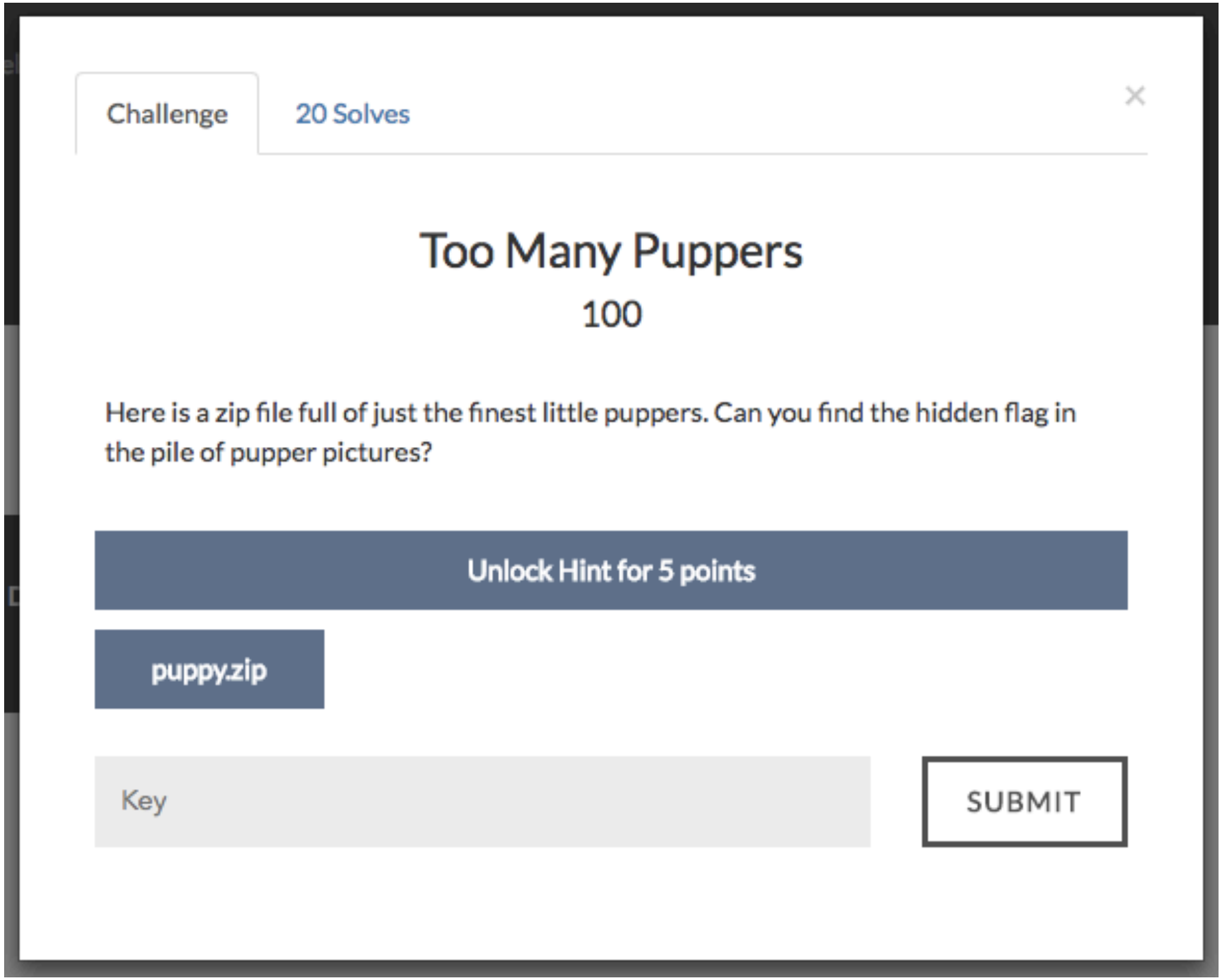
- Team Scoring algorithm
- User profiles
- Graph visualizations
- Challenge board interface
- Content Management System
- Hints and Awards
- Plugins
- Themes
- CTF backup and restoration
- Automatic CTF starting and ending
- Mail server configuration



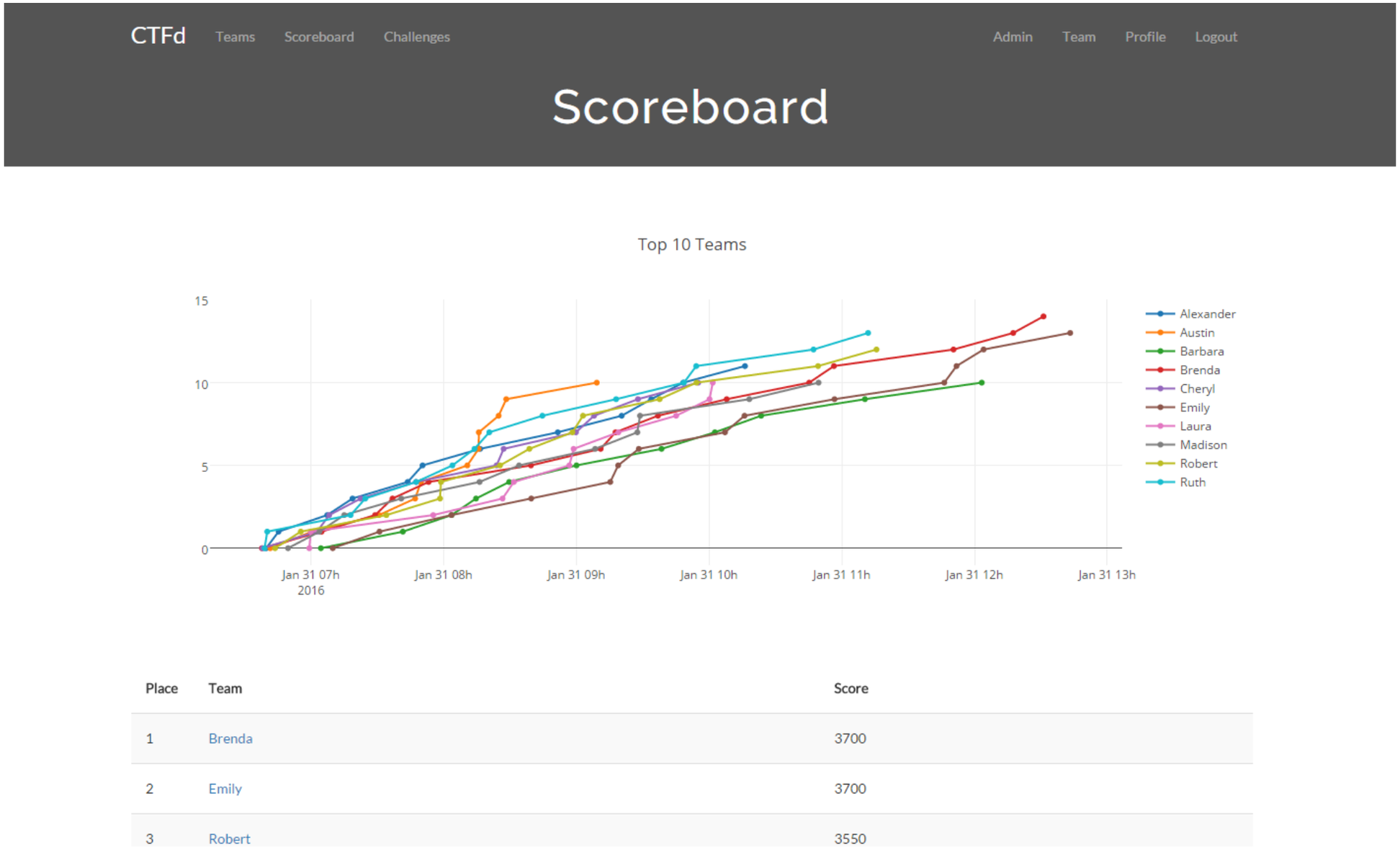
CTFd gives users a clean and simple interface to access challenges

Challenges

- Information appears when you click the associated button
- Descriptions are written in Markdown/ HTML
- When a user has found the flag they can submit it for validation



CTFd provides hints, files, solves, and associated other information

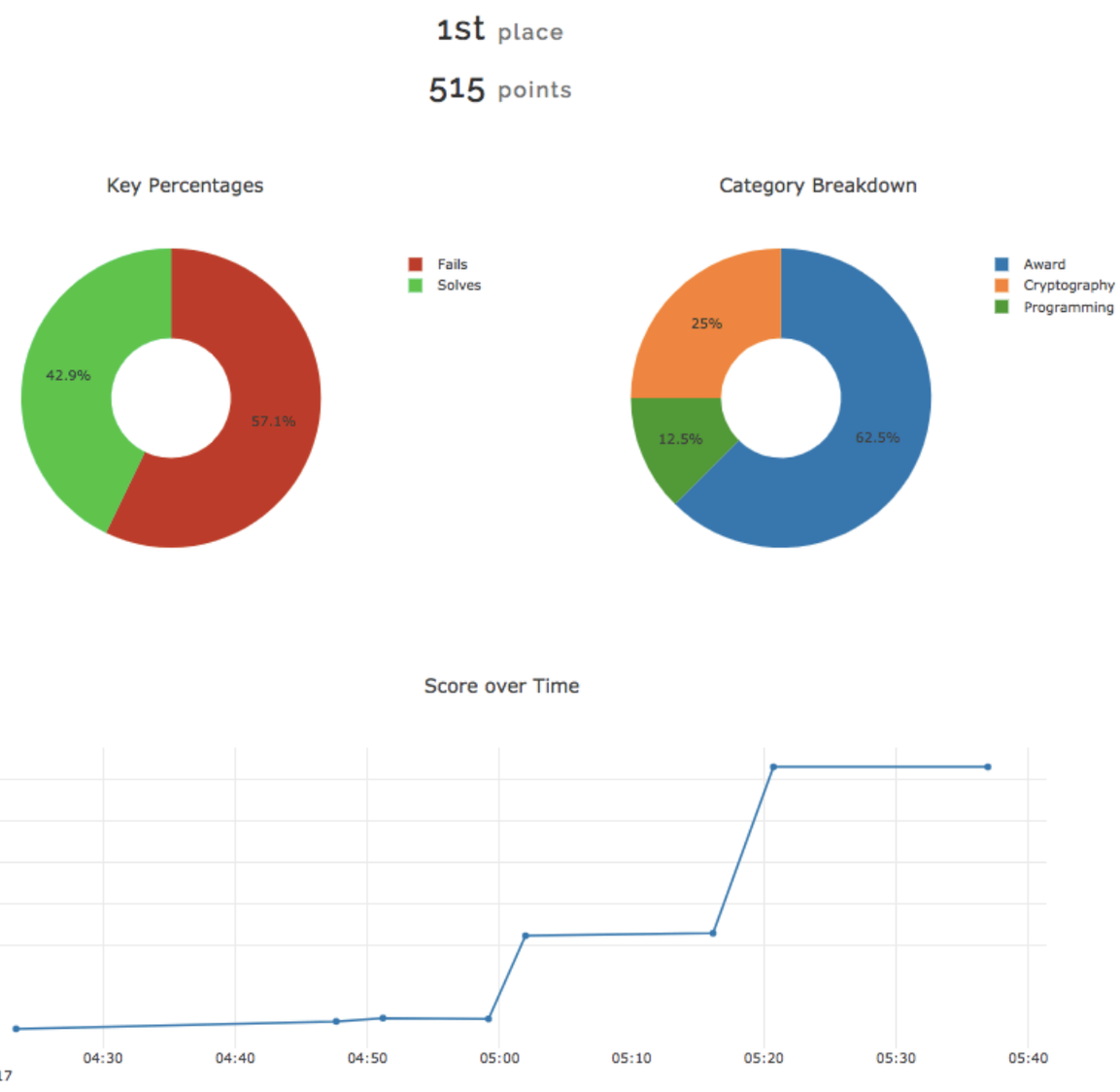


CTFd keeps track of who solves what and when

This is all rendered on a large score graph

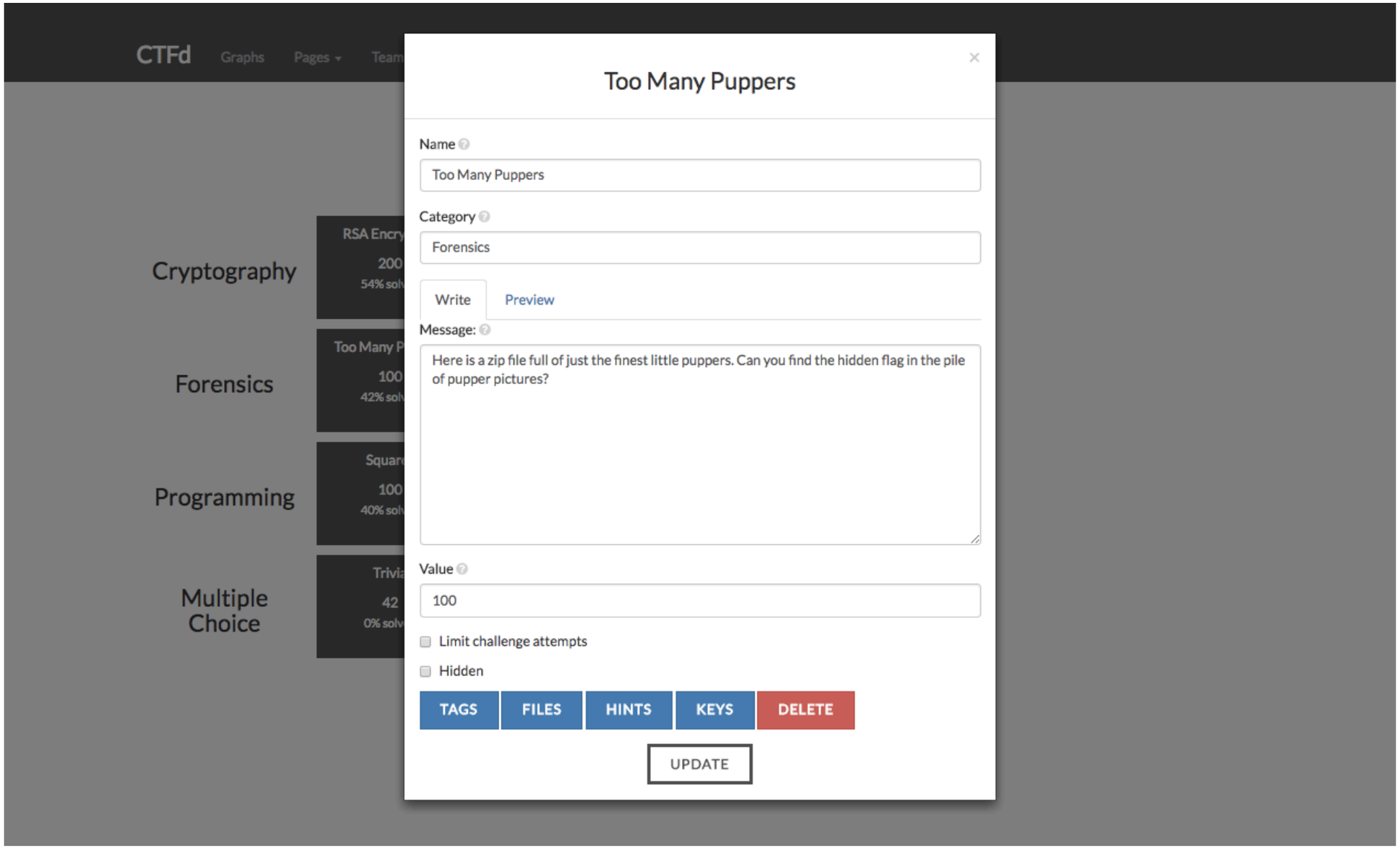
Scoring Algorithm

1. Who has the most points
    - Sum the value of all the challenges the team has solved
2. Apply any extra awarded points
    - Admins can award points for good behavior
3. In the case of a tie, who was quicker to achieve the score
    - Sort by the recorded time of the team’s last solve



CTFd also generates statistics graphs for individual teams

All graphs are downloadable

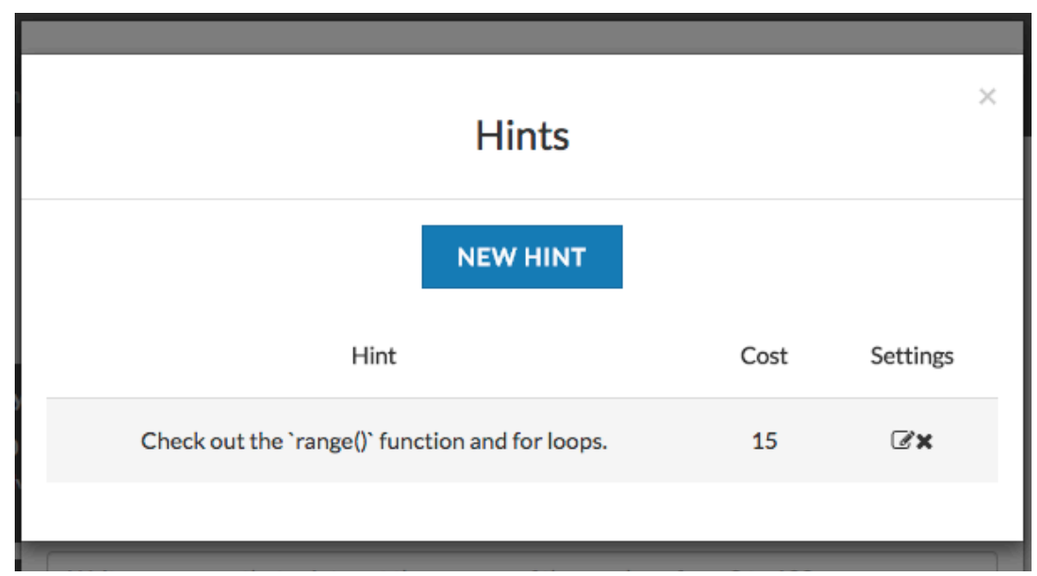


CTFd's admin interface lets us change data without leaving the browser

We can do the same for
team information and website pages

Tags, Hints, Keys

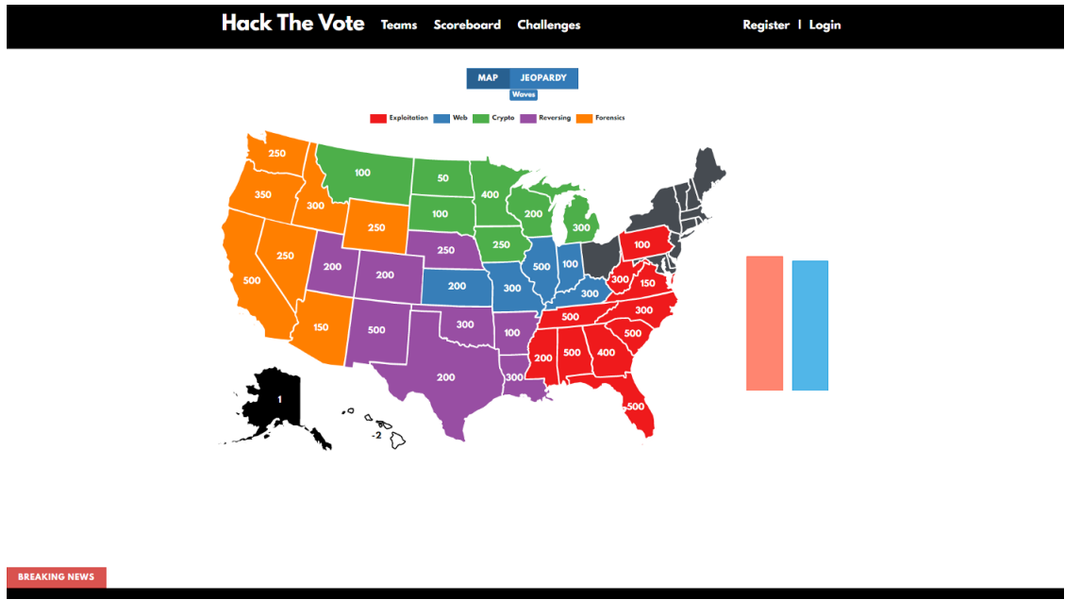
- Tags - An additional way to mark challenges to be customized by themes/plugins for the end user
- Hints - Reveal hints to the user and optionally charge points for the hint
- Keys - Add and delete keys/ flags that are accepted by the challenge

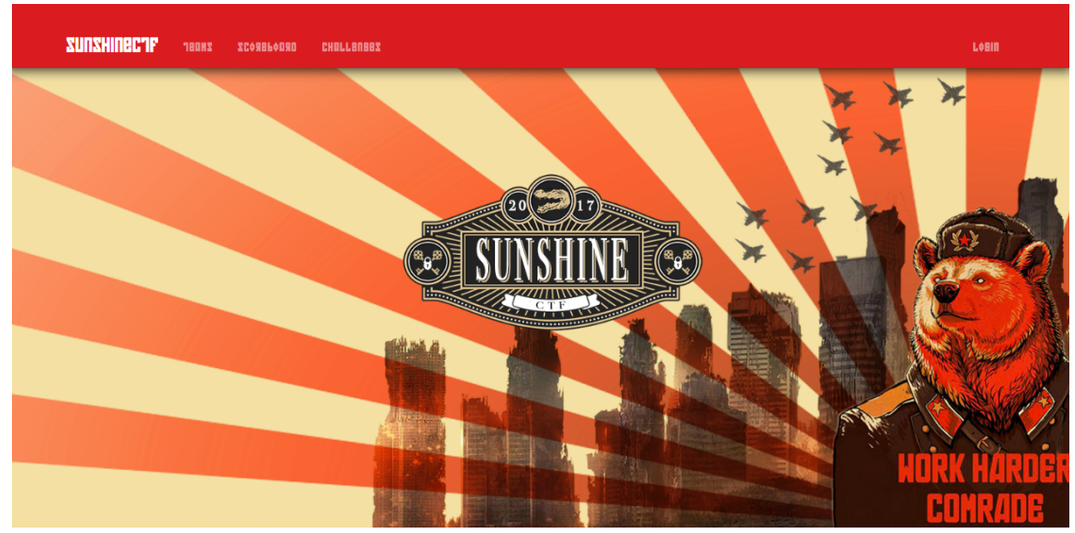


Customizability

- CTFd exposes plugins and themes to heavily customize a CTF
- Themes are written in Jinja2, HTML, CSS, and Javascript
- Plugins and CTFd itself are written in Python and Flask

Example CTFd Themes



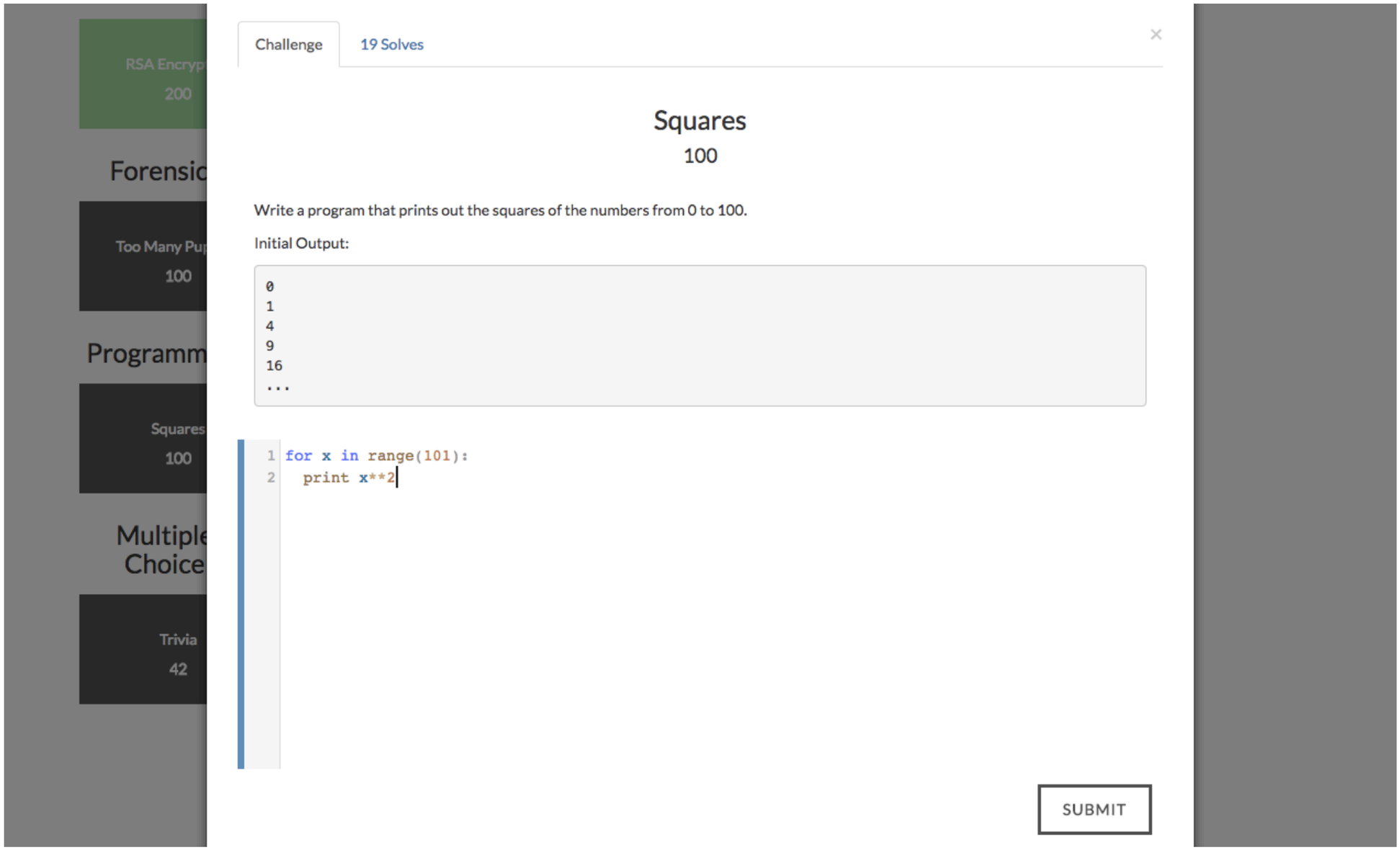


Plugins

- CTFd will load specially written Python modules as plugins
- These plugins override default behavior and add additional behavior

Plugin Examples

- Private Registration - Only accept users with unique tokens
  - https://github.com/farisv/CTFd-Private-Registration
- Instancing Plugin - Unique Challenges per team
  - https://github.com/tamuctf/ctfd-instancing-plugin
- Competitor Shells - Web terminals for teams
  - https://github.com/tamuctf/ctfd-shell-plugin



CTFd supports custom challenges

CTFd allows you customize
how challenges are seen and solved

Custom Challenges

- Based on the observation that CTFs are primarily about solving challenges, not the challenge format
- Challenges can define how they look to competitors and how they are edited by CTF administrators
- Answer acceptance can be defined with Python
- End result is that CTF challenges gain format diversity

- Multiple Choice Questions

Challenge | 0 Solves

Trivia

42

What is the answer to life, the universe, and everything?

- The Cake
- 42
- The Red Umbrella
- All of the above

SUBMIT

- Programming Challenges

Challenge | 19 Solves

Squares

100

Write a program that prints out the squares of the numbers from 0 to 100.

Initial Output:

```
0
1
4
9
16
...
```

```
for x in range(101):
  print x**2
```

CTF Backups

- CTFd supports the export and import of backups
- Meant to support CTFd itself, offline analysis, & archival sites
- The backup format is a zip file containing
  - JSON files representing the serialized database
  - A copy of all files uploaded to CTFd

Installation

- Setup scripts provided for native installation
- Docker build files provided for Docker installation

```
1. git clone https://github.com/CTFd/CTFd.git
2. pip install -r CTFd/requirements.txt
3. python CTFd/serve.py
```

Planned Improvements

- More documentation around CTFd's feature set
- Fully RESTful API
- Attack and Defense format support

bugcrowd

CSAW'15

VECTOR 35

VIRGINIA CYBER RANGE

FireEye

HACK UCF

MC MONTGOMERY COLLEGE

A small sample of companies and schools using CTFd

Hosting Services

We offer managed hosting for CTFd because
you have better things to do
than worry about infrastructure.

Check out a CTFd demo here

Basic	Professional	Enterprise
$50/mo	$100/mo	Contact Us
Unlimited users	Unlimited users	Unlimited users
Unique ctfd.io subdomain	Unique ctfd.io subdomain	Unique ctfd.io subdomain or your own domain
Secure TLS/SSL connection	Secure TLS/SSL connection	Secure TLS/SSL connection
	Unlockable Challenges	Custom Feature Development
	Programming Challenges	Custom Plugin Development
	Multiple Choice Questions	Custom Challenge Development
		Dedicated Support

Managed Hosting

We offer managed CTFd instances for those not interested in hosting on their own

Questions?

github.com/CTFd/CTFd

ctfd.io

@ctfdio

/ctfdio