

Lowering the Barriers to Capture The Flag Administration and Participation

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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

Challenges

Cryptography

RSA Encryption
200

RSA Decryption
200

Forensics

Too Many Puppies
100

Programming

Squares
100

Multiple

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

Challenge

19 Solves

×

Phase 1 (x86)

100

The CMU bomb lab is a famous reverse engineering challenge from CMU.

This category's challenges will track your progress through the 32-bit x86 CMU bomb lab.

Welcome to my fiendish little bomb. You have 6 phases with which to blow yourself up. Have a nice day!

```
phase_1:
push    ebp
mov     ebp, esp {var_4}
sub     esp, 0x8
mov     eax, dword [ebp+0x8 {arg_4}]
add     esp, 0xffffffff8
push    0x80497c0 {"Public speaking is very easy."}
push    eax
call    strings_not_equal
add     esp, 0x10
test    eax, eax
je      0x8048b43

mov     esp, ebp
pop     ebp
retn

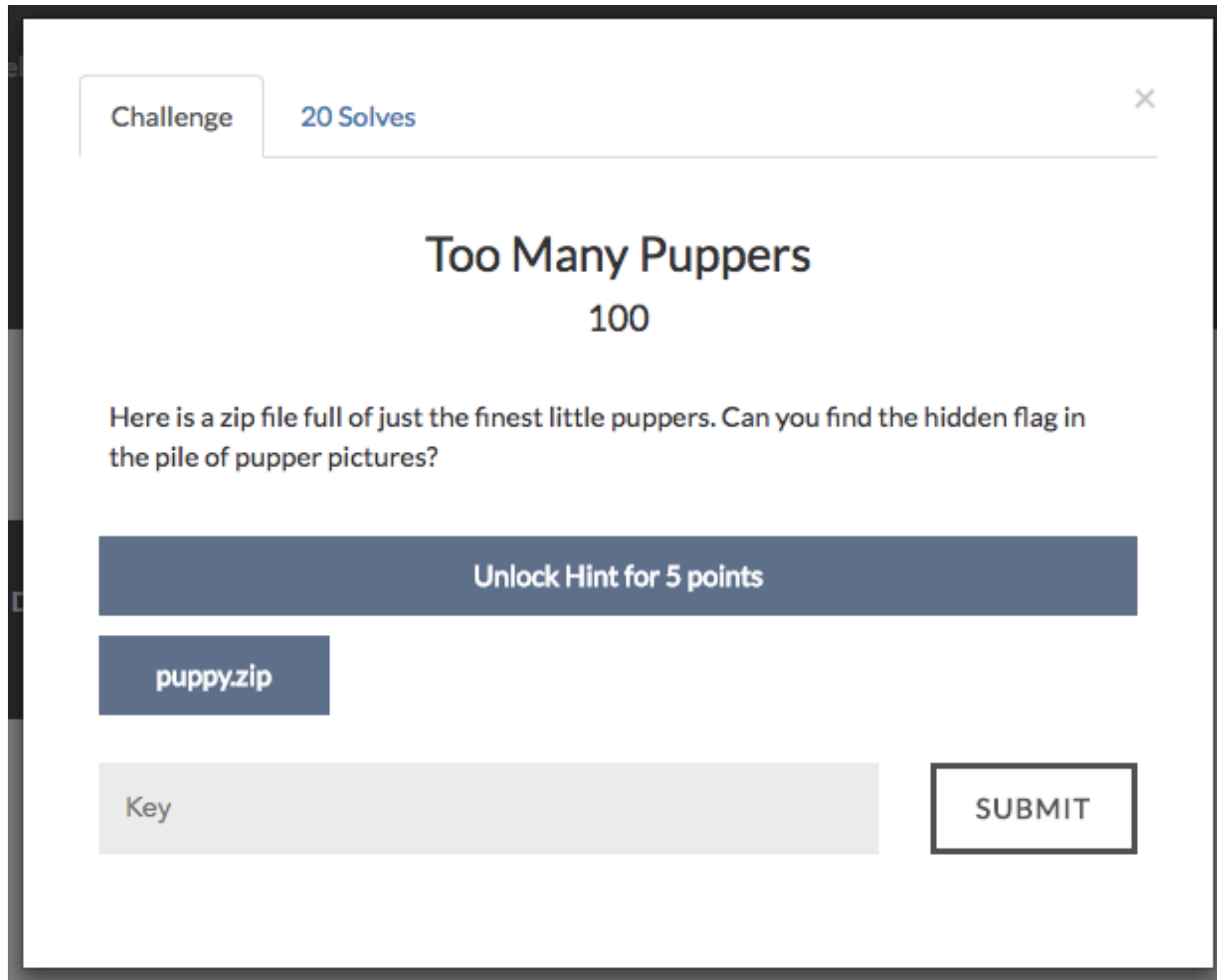
call    explode_bomb
{ Does not return }
```

bombphase_1.html

Key

SUBMIT

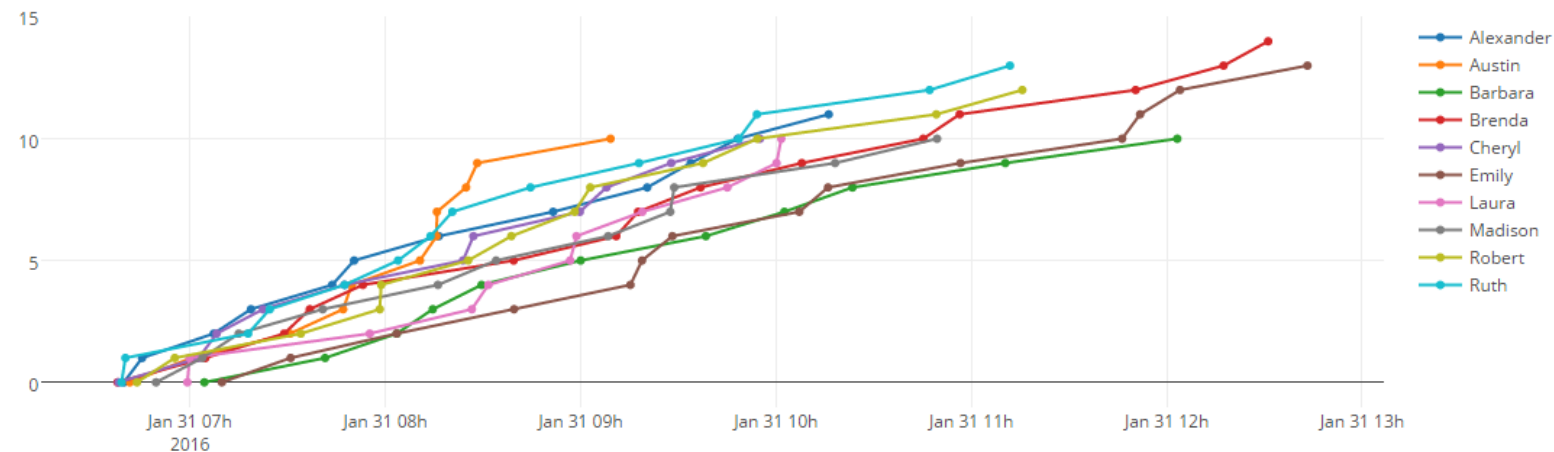
Correct



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

Scoreboard

Top 10 Teams



Place	Team	Score
1	Brenda	3700
2	Emily	3700
3	Robert	3550

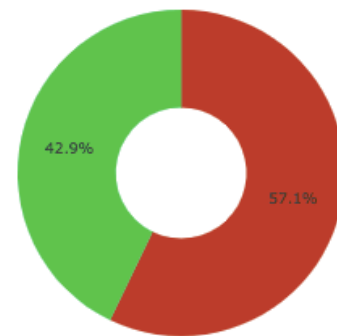
**CTFd keeps track of
who solves what and when**
This is all rendered on a large score graph

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

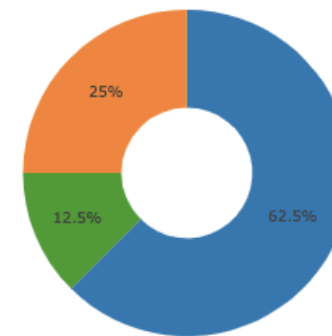
1st place
515 points

Key Percentages



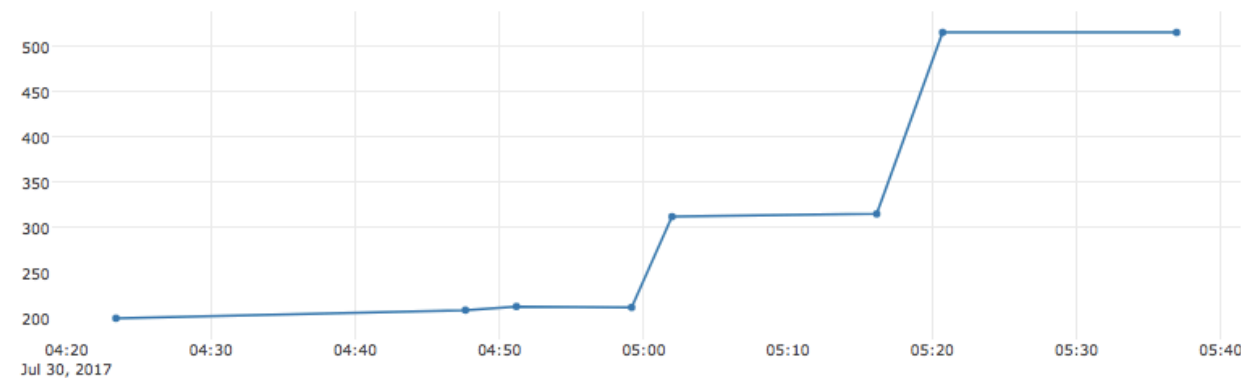
Fails
Solves

Category Breakdown

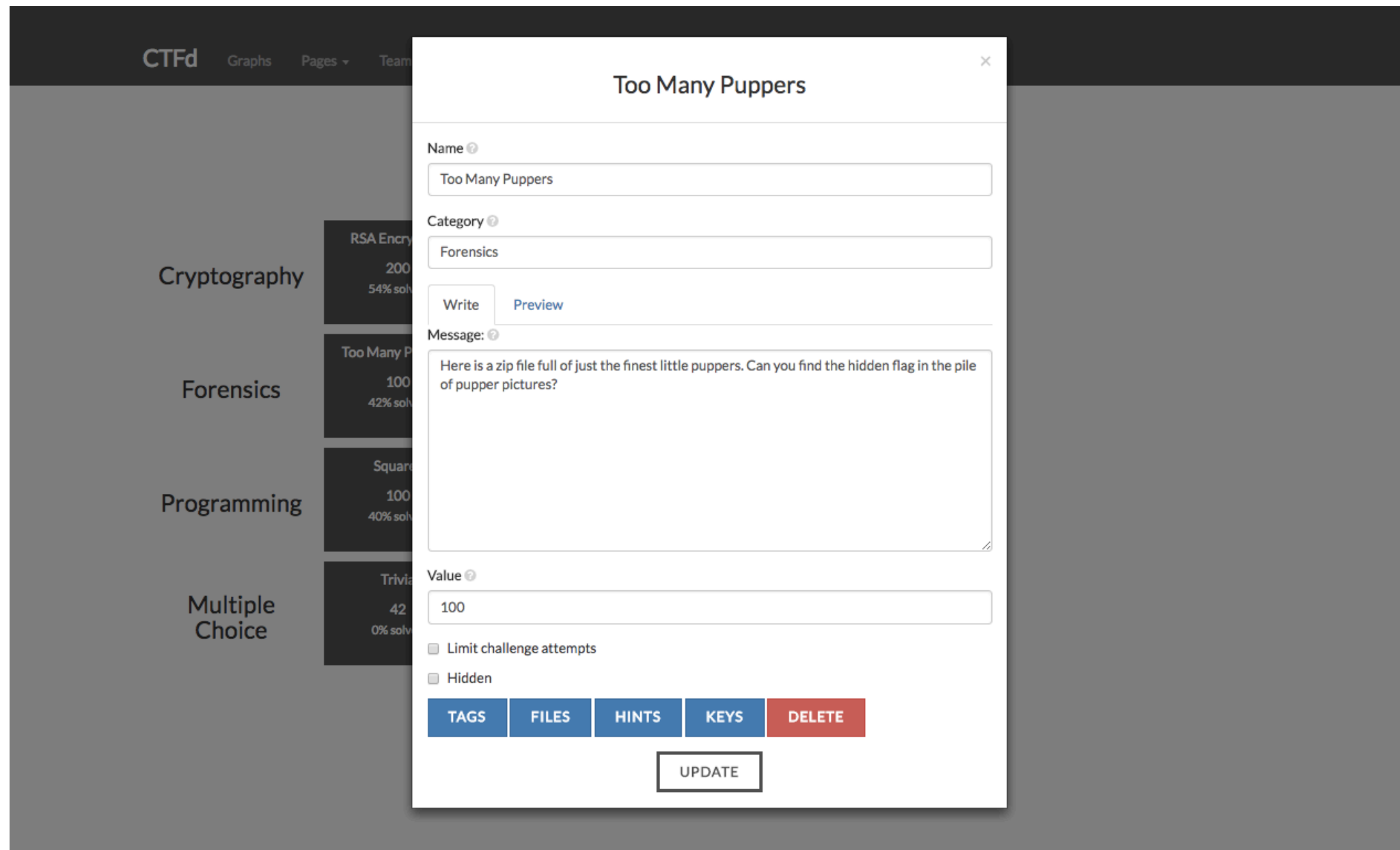


Award
Cryptography
Programming

Score over Time



**CTFd also generates statistics graphs
for individual teams**
All graphs are downloadable

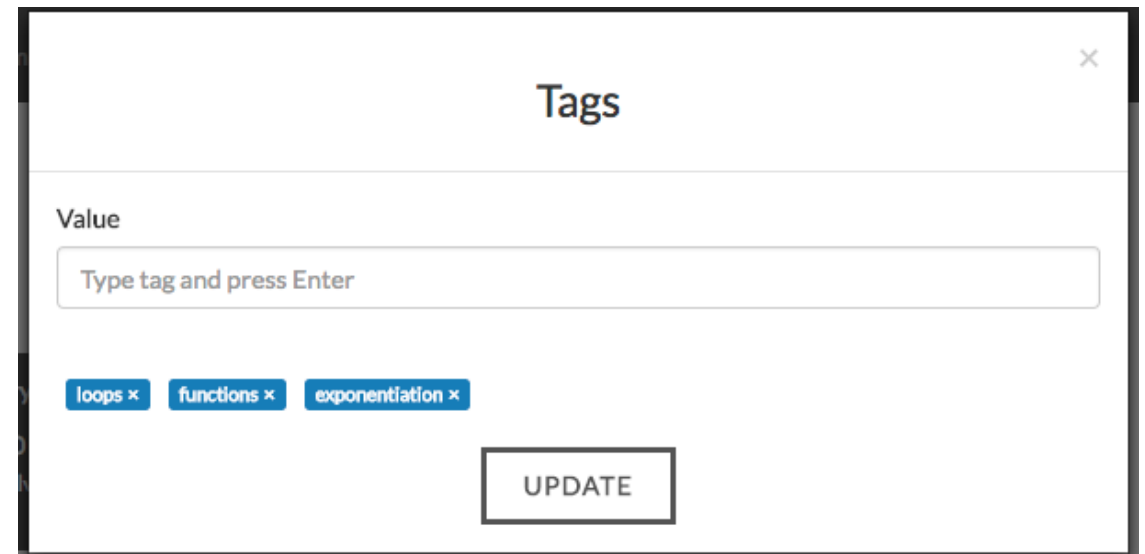


CTFd's admin interface lets us change data without leaving the browser

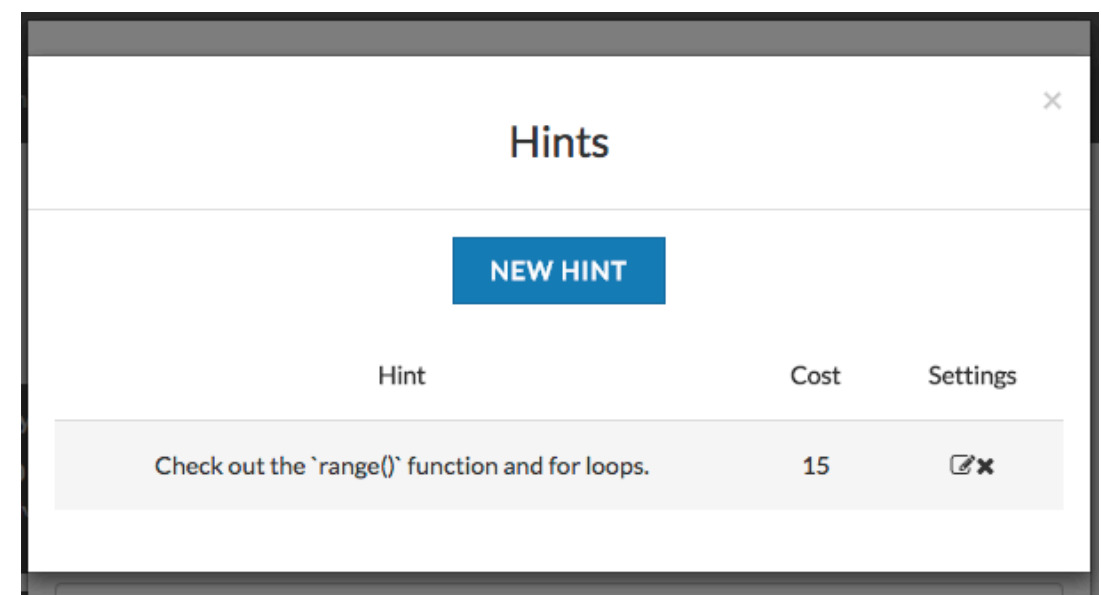
We can do the same for
team information and website pages

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



The 'Tags' modal window has a title bar with a close button (X). Below the title is a section labeled 'Value' containing a text input field with the placeholder text 'Type tag and press Enter'. Below the input field are three blue buttons with white text: 'loops x', 'functions x', and 'exponentiation x'. At the bottom right of the modal is a rectangular 'UPDATE' button.



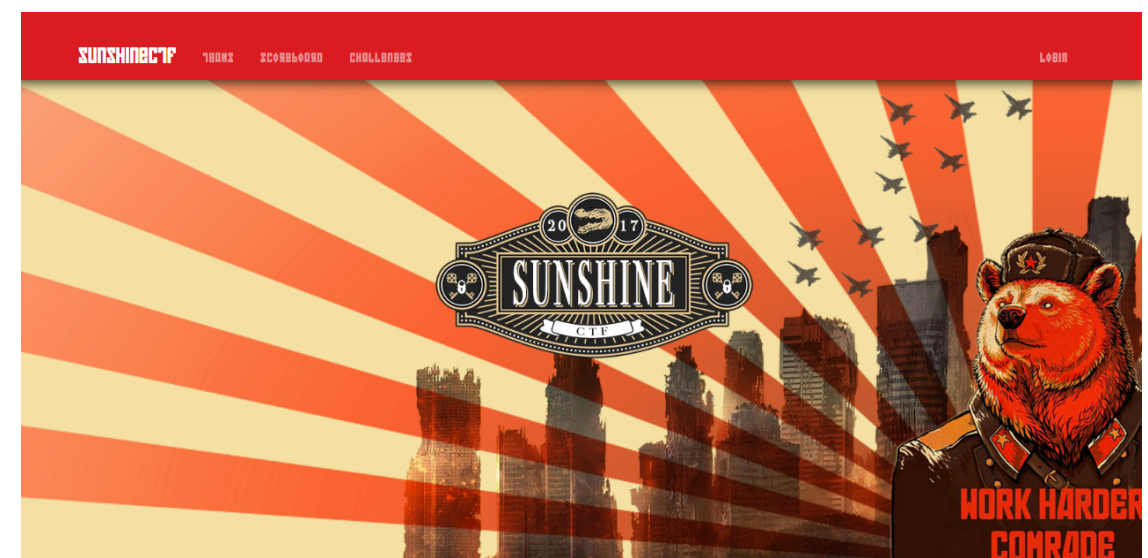
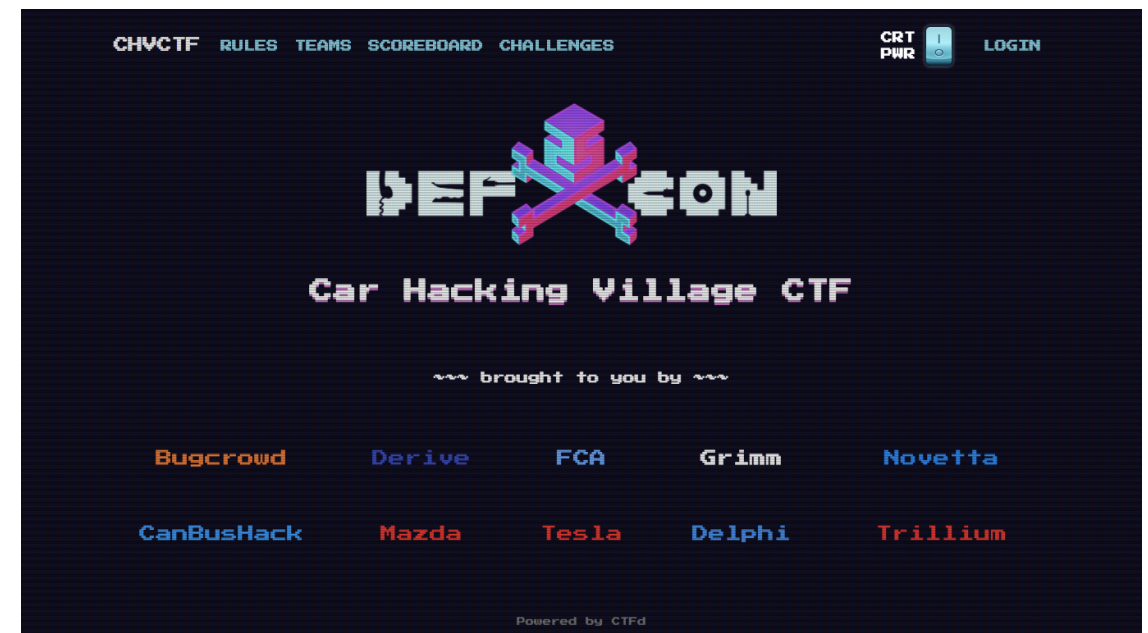
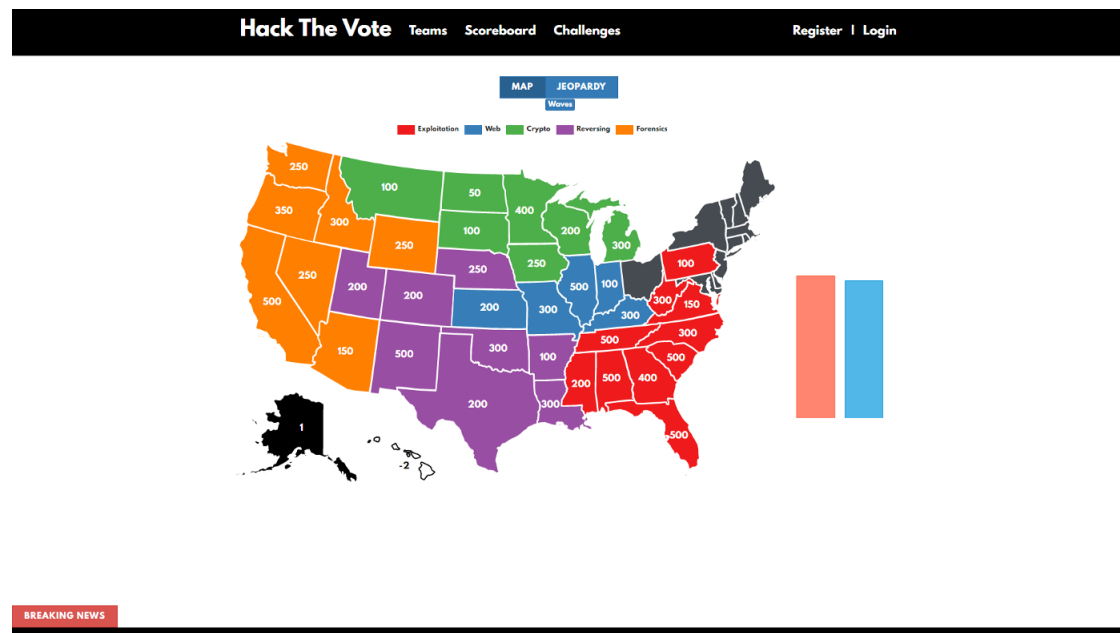
The 'Hints' modal window has a title bar with a close button (X). Below the title is a blue button with white text labeled 'NEW HINT'. Below this button is a table with three columns: 'Hint', 'Cost', and 'Settings'.

Hint	Cost	Settings
Check out the <code>range()</code> function and for loops.	15	 

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

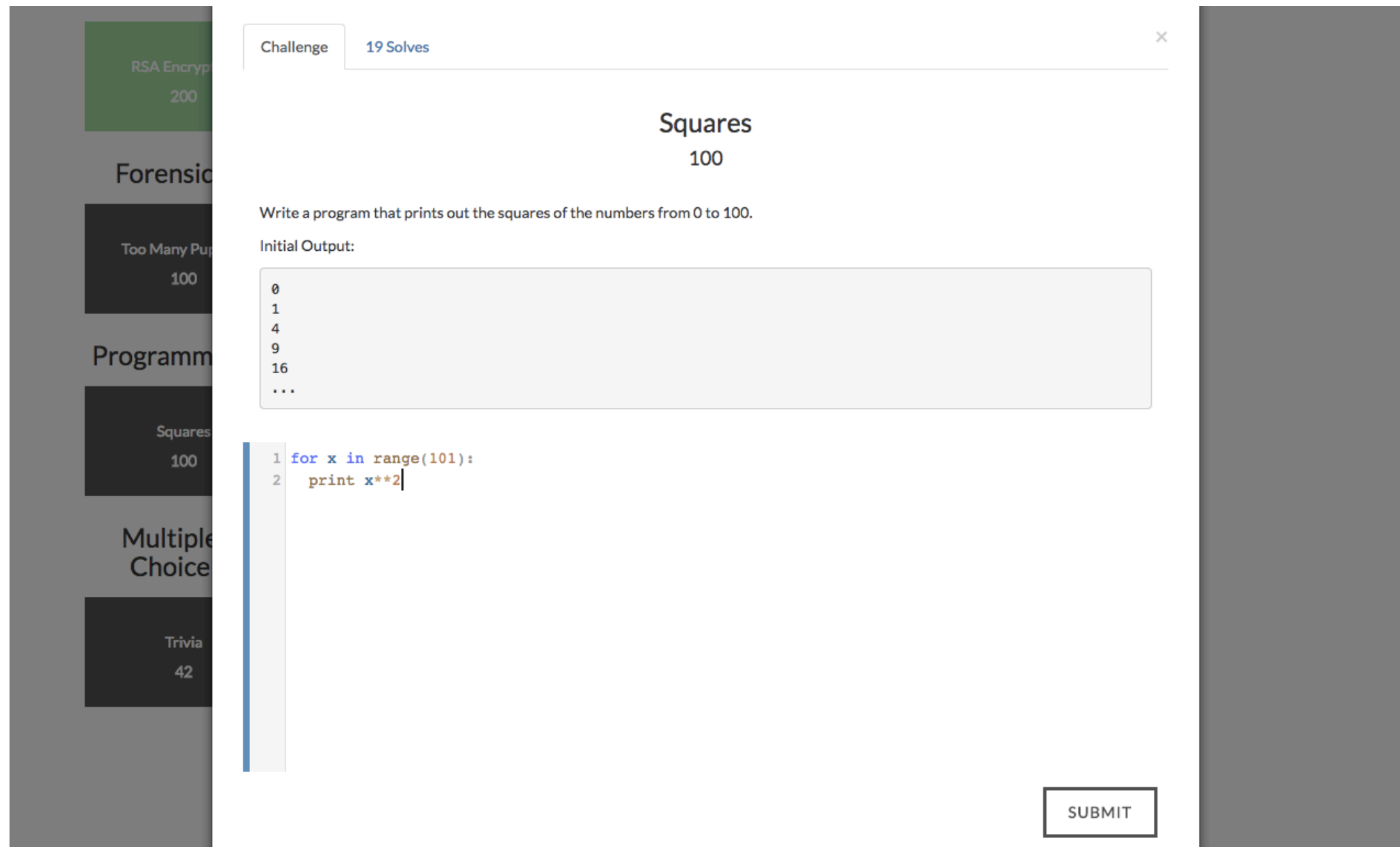


Plugins

- 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

- Programming Challenges

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

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

...

1

2

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



**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 Unique ctfd.io subdomain Secure TLS/SSL connection	Unlimited users Unique ctfd.io subdomain Secure TLS/SSL connection Unlockable Challenges ? Programming Challenges ? Multiple Choice Questions ?	Unlimited users Unique ctfd.io subdomain or your own domain Secure TLS/SSL connection Custom Feature Development Custom Plugin Development 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

