Predicting the Future of Diverse CTFs

Zion (@mahaloz)
(@m3me_l0rd on a good day)
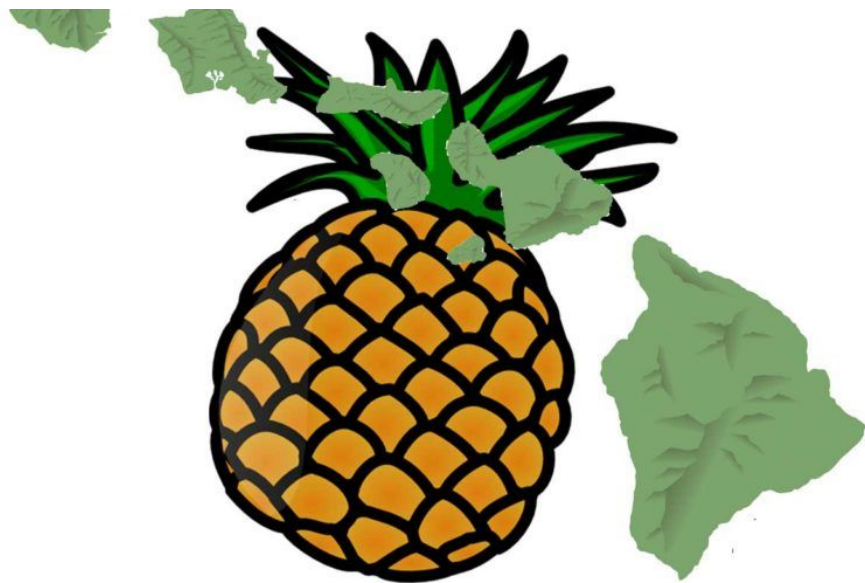
$ whoami

Zion (mahaloz):

- Captain of pwndevils
    - Run most AZ Shellphish things.
- Undergraduate working at SEFCOM
    - ML & Fuzzing
- Native Hawaiian whom hates pineapples
    - Very important fact

Story Time

$ VolgaCTF Quals 2018

Scoreboard

411 teams total

Place	Team	CTF points	Rating points
♚ 1	Bushwhackers	3320.000	51.060
2	SUSlo.PAS	3060.000	36.296
3	Corrupted Reflection	3060.000	32.041
4	Lights Out	2820.000	28.068
5	RPISEC	2710.000	25.945
6	Balsn	2610.000	24.325
7	STT	2610.000	23.717
8	Made In MIM	2460.000	22.108
9	0x90r00t	2410.000	21.369
10	SiBears	2310.000	20.316
11	hxp	2310.000	20.084
12	pwndevils	2260.000	19.506
13	Destructive Voice	2260.000	19.343
14	SFT0	2060.000	17.664
15	void_hack	1970.000	16.851

$ VolgaCTF Quals 2018 - 53%

Scoreboard

411 teams total

Place	Team		CTF points	Rating points
♛ 1	Bushwhackers		3320.000	51.060
2	SUSlo.PAS		3060.000	36.296
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Collusion or Coincidence?

(@InfoWars)

$ *CTF 2019

Scoreboard

333 teams total

Place	Team	CTF points	Rating points*
♛ 1	r3kapig	12127.000	50.000
2	Nu1L	12127.000	37.500
3	Balsn	11258.000	31.542
4	0ops	10518.000	27.933
5	iSec	7079.000	19.593
6	Whitzard	5882.000	16.293
7	De1ta	5684.000	15.289
8	Kap0K	5566.000	14.599
9	bi0s	5556.000	14.232
10	Gr3yW0lf	5496.000	13.830
11	ROIS	5372.000	13.347
12	Rah	5205.000	12.814
13	Lancet	4641.000	11.491
14	方班DigApis	4538.000	11.141
15	L	4518.000	10.981

$ *CTF 2019 🇨🇳 - 66%

Scoreboard

333 teams total

Place	Team		CTF points	Rating points*
♛ 1	r3kapig	🇨🇳	12127.000	50.000
2	Nu1L	🇨🇳	12127.000	37.500
3	Balsn		11258.000	31.542
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14	方班DigApis	🇨🇳	4538.000	11.141
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So what? Most CTFs are like that.

(#NationalismWinsAlways)

No. They really aren't.

(#NationalismWinsOnlySometimes?)

ASU

SHELLPRISH

REDACTED ENDGAME MEME
(@carolina)

$ HackIT 2019

Scoreboard

333 teams total

Place	Team	CTF points	Rating points*
♔ 1	r3kapig	12127.000	50.000
2	Nu1L	12127.000	37.500
3	Balsn	11258.000	31.542
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$ HackIT 2019 🇺🇦 - 0%

Scoreboard

333 teams total

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♔ 1	r3kapig	12127.000	50.000
2	Nu1L	12127.000	37.500
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$ HackIT 2019 🇺🇦 - 0% : 93% Difference

Scoreboard

333 teams total

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$ scoring

Two Methods:
- Locality Score
  - Countries in scoreboard are different from organizer country
- Diversity Score
  - Countries in scoreboard are different from each other

$ scoring

Two Methods:

- Locality Score

$$Score = \frac{Length(Scoreboard - OrganizerCountry)}{Length(Scoreboard)}$$

- Diversity Score:

$$Score(Scoreboard) = 1 - \frac{Length(Scoreboard) - Cardinality(Scoreboard))}{Length(Scoreboard)}$$

Applying It to Big Data

(#SizeStillMatters)

$ ctftime

Public CTF Data:

- Analyzed all CTF's from 2014-Present
  - Discarded CTF's with scoreboard less than 30 people
  - Discarded CTF's with no organizer
- Total: 1848 different CTFs
- Big thanks: @mipu and @Markkkkkk

$ locality-by-host-score

Top Countries: (higher is better)

1. Hungary 96
2. Iran 96
3. Brazil 96
4. Sweden 95
5. Germany 94
6. India 90
7. Italy 90
8. Tunisia 88
9. Korea 83
10. USA 83
11. Japan 81
12. Canada 81
13. Vietnam 73
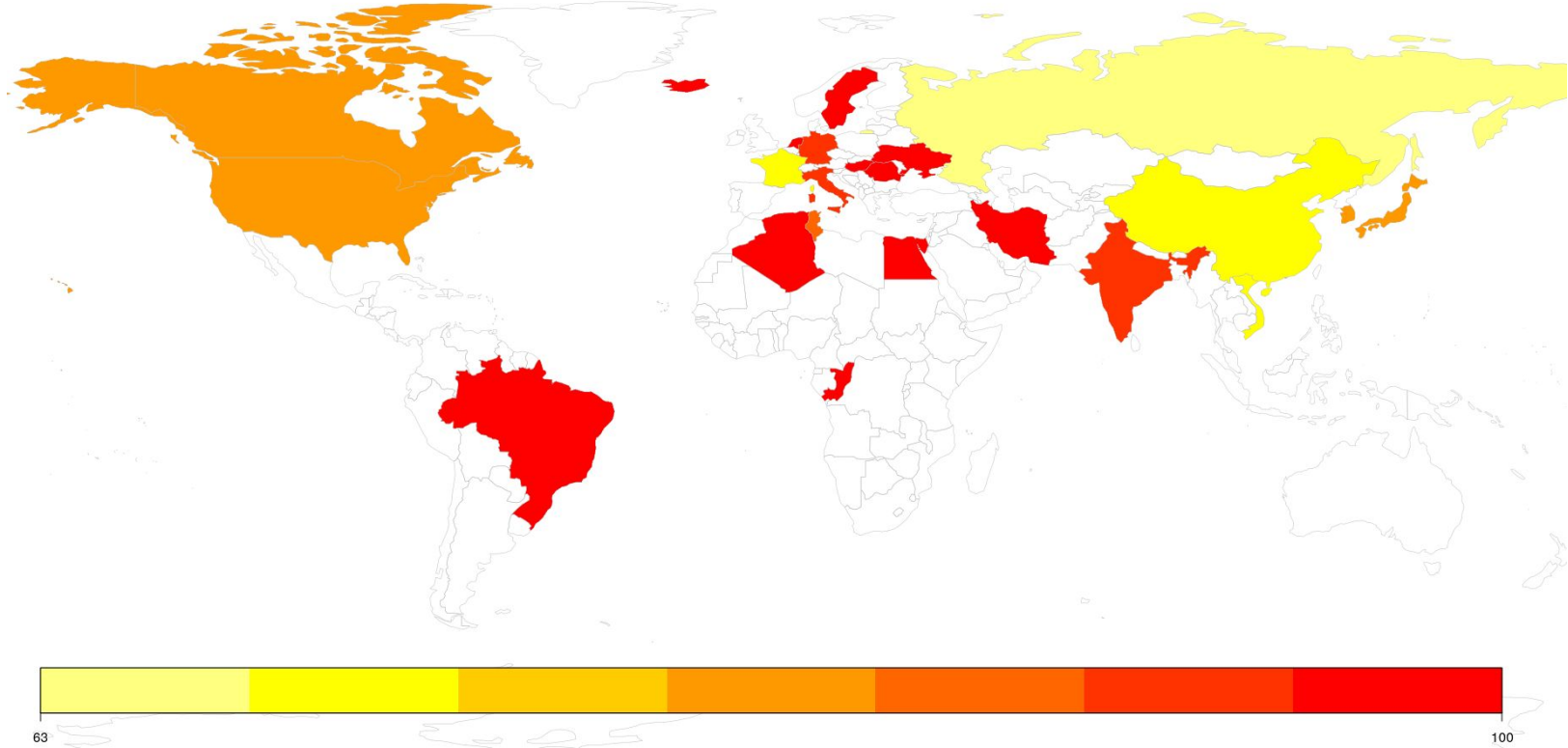14. France 71
15. China 71
16. Russia 63

$ locality-by-host-score

Top Countries: (higher is better)

1. Hungary 96
2. Iran 96
3. Brazil 96
4. Sweden 95
5. Germany 94
6. India 90
7. Italy 90
8. Tunisia 88
9. Korea 83
10. USA 83
11. Japan 81
12. Canada 81
13. Vietnam 73
14. France 71
15. China 71
16. Russia 63
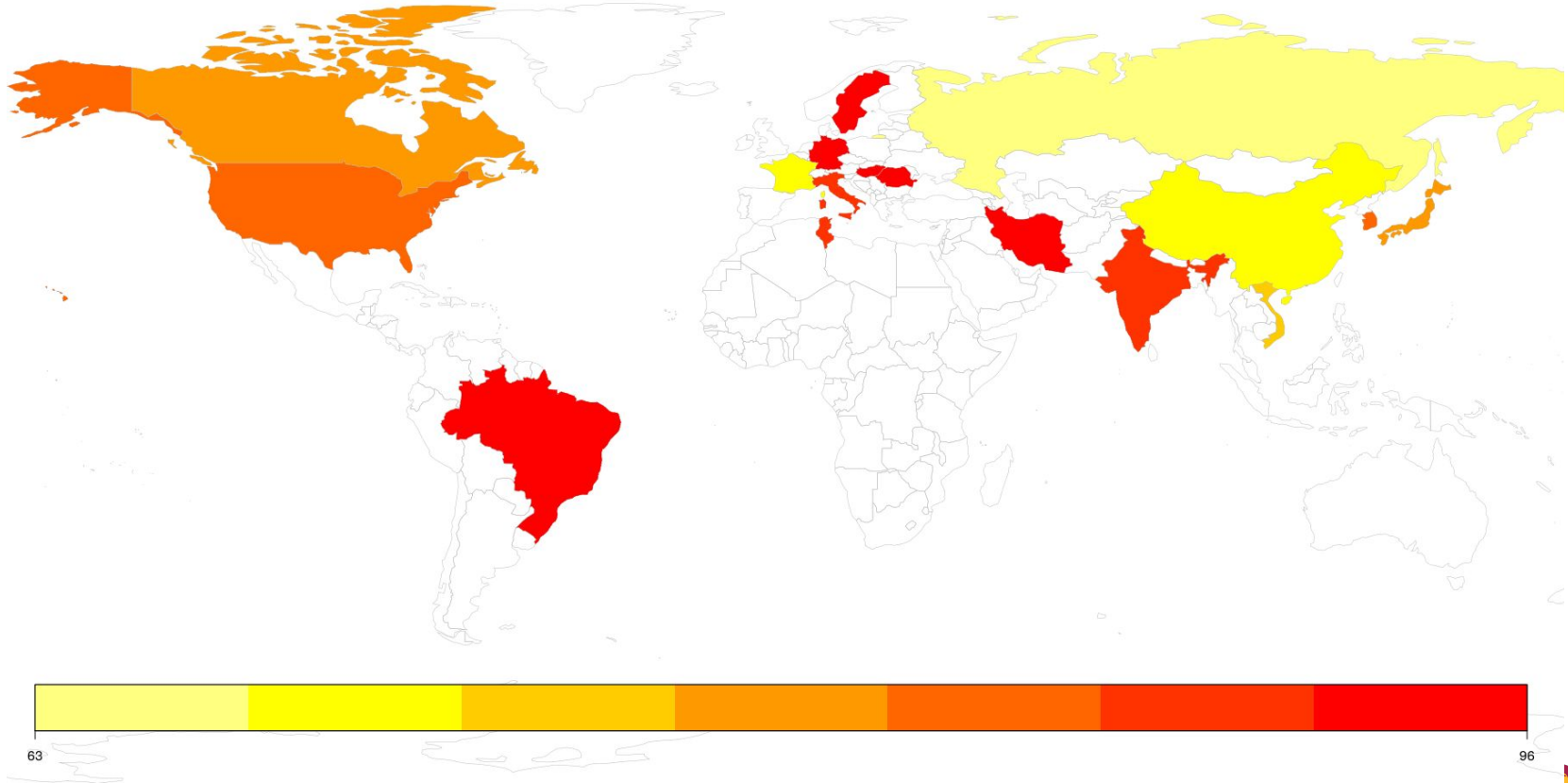17. United 63

ASU

SHELLPHISH

Locality-Score-By-Host

$ diversity-by-host-score

Top Countries:

1. Romania 96
2. Hungary 96
3. Brazil 96
4. Iran 96
5. Sweden 95
6. Germany 94
7. India 90
8. Italy 90
9. Tunisia 88
10. Korea, Republic of 83
11. United States 83
12. Japan 81
13. Canada 81
14. Viet Nam 73
15. France 71
16. China 71
17. Russian Federation 63

Diversity-Score-By-Host

So why is USA not the best?

(#WaitUSAIsNotTheBest?)

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Gotta remove countries that are too small.

(#SizeStillMattersAgain)
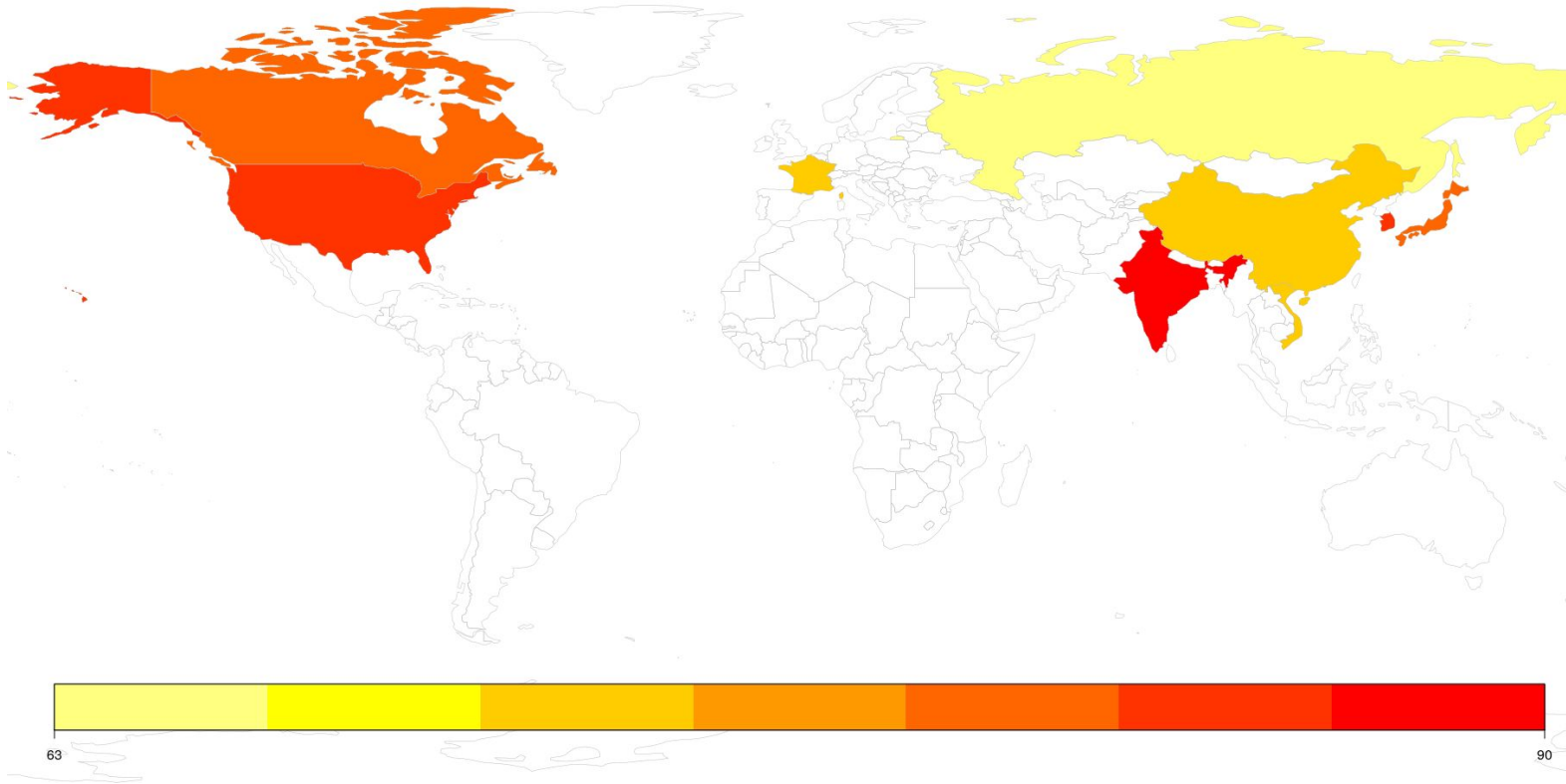
$ evan-moar-ctftime-facts

Top 10 countries by team count

- 🇺🇸 US — 1908
- 🇮🇳 IN — 1110
- 🇷🇺 RU — 699
- 🇨🇳 CN — 654
- 🇮🇩 ID — 499
- 🇫🇷 FR — 469
- 🇯🇵 JP — 390
- 🇻🇳 VN — 388
- 🇰🇷 KR — 381
- 🇪🇬 EG — 330

9817 teams total

Locality-Score-By-Host (Top Countries Only)

$ data-interpretation

East-V-West:

- Western countries allow more countries to succeeded other than itself
- Less good worldwide teams compete in Western CTFs.

So why don't people like to play US?

(#MakeAmericaGreatAgain)

So why don't people like to play US?

(#MakeAmericaGreatAgain)

$ machine-learning-trends

Really just linear regression:

- Event Weight
- UTC Time
- Event Length
- CTF Type

$ machine-learning-trends

Really just linear regression:

- Event Weight: More weight, more Diversity
- UTC Time
- Event Length
- CTF Type

$ machine-learning-trends

Really just linear regression:

- Event Weight: More weight, more Diversity
- UTC Time: UTC Start at 20:00:00 was the best
- Event Length
- CTF Type

$ machine-learning-trends

Really just linear regression:

- Event Weight: More weight, more Diversity
- UTC Time: UTC Start at 20:00:00 was the best
- Event Length: Diversity caped out at 2 day lengths
- CTF Type

$ machine-learning-trends

Really just linear regression:

- Event Weight: More weight, more Diversity
- UTC Time: UTC Start at 20:00:00 was the best
- Event Length: Diversity caped out at 2 day lengths
- CTF Type: Attack Defense (lowest rate)

$ summary-trends

Really just linear regression:

- Event Weight: **More weight**, more Diversity
- UTC Time: UTC Start at **20:00:00** was the best
- Event Length: Diversity caped out at **2 day** lengths
- CTF Type: **Attack Defense** (lowest rate)

$ todo-analysis

I've Got a lot of data:

- Better Feature Tracking
- More than 30 people in scoreboard
- Auto Erase countries of less than 30 teams
- Arbitrary Parameter Searching
- Better Machine Learning?

$ take-away

- Western countries allow more countries to succeeded other than itself
- Less good worldwide teams compete in Western CTFs.
- Start your CTFs later maybe.
- Create standards for international CTFs

$ take-away-part-2

- Need more analysis in CTF competitions
- Education standards are good
- Keep making good ctfs

$ take-away-part-3

- Together I think we can solve lacking diversity in CTFs.
- Make a super US Group, call it:
- U-SUC
- (United-States University Collegiate)

questions?

(#ItsAlmostOver)

Thanks for listening!

Zion (@mahaloz)