

Gathering Insights from Teenagers' Hacking Experience with Authentic Cybersecurity Tools

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Level 1: Introduction



We create **hacking games** for **professional security training**.



We have **rich experience** from a university **cybersecurity team**.



We let **28 teenagers** play such game at a public **science event**.



We aim to **raise awareness** of security and **engage** new students.

Level 2: New hacking workshop

Schedule:

- Intro **lecture** and **Q&A** (20 min)
- Kahoot practice **quiz** (10 min)
- Capture the flag **game** (90 min)
- Conclusion, **survey** (15 min)



Level 3: Capture the flag

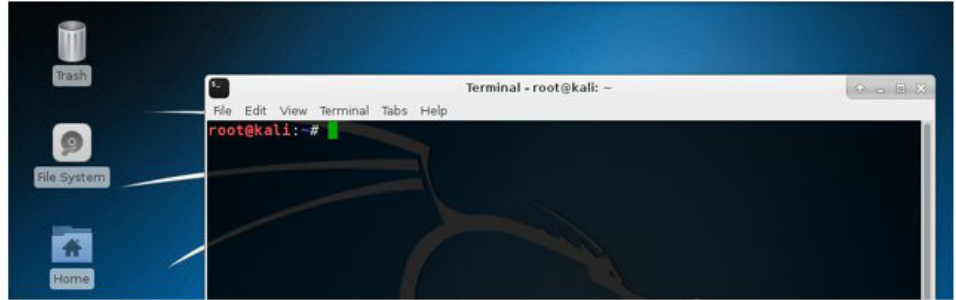
Kali-attacker / 10.10.20.2



connect →



HTTP-server / 10.10.10.2



Level 1

Task: Scan the HTTP server.

Flag format: The number of the highest open port.

Points available: 6/8

Need help?

Hint 1: What tool to use

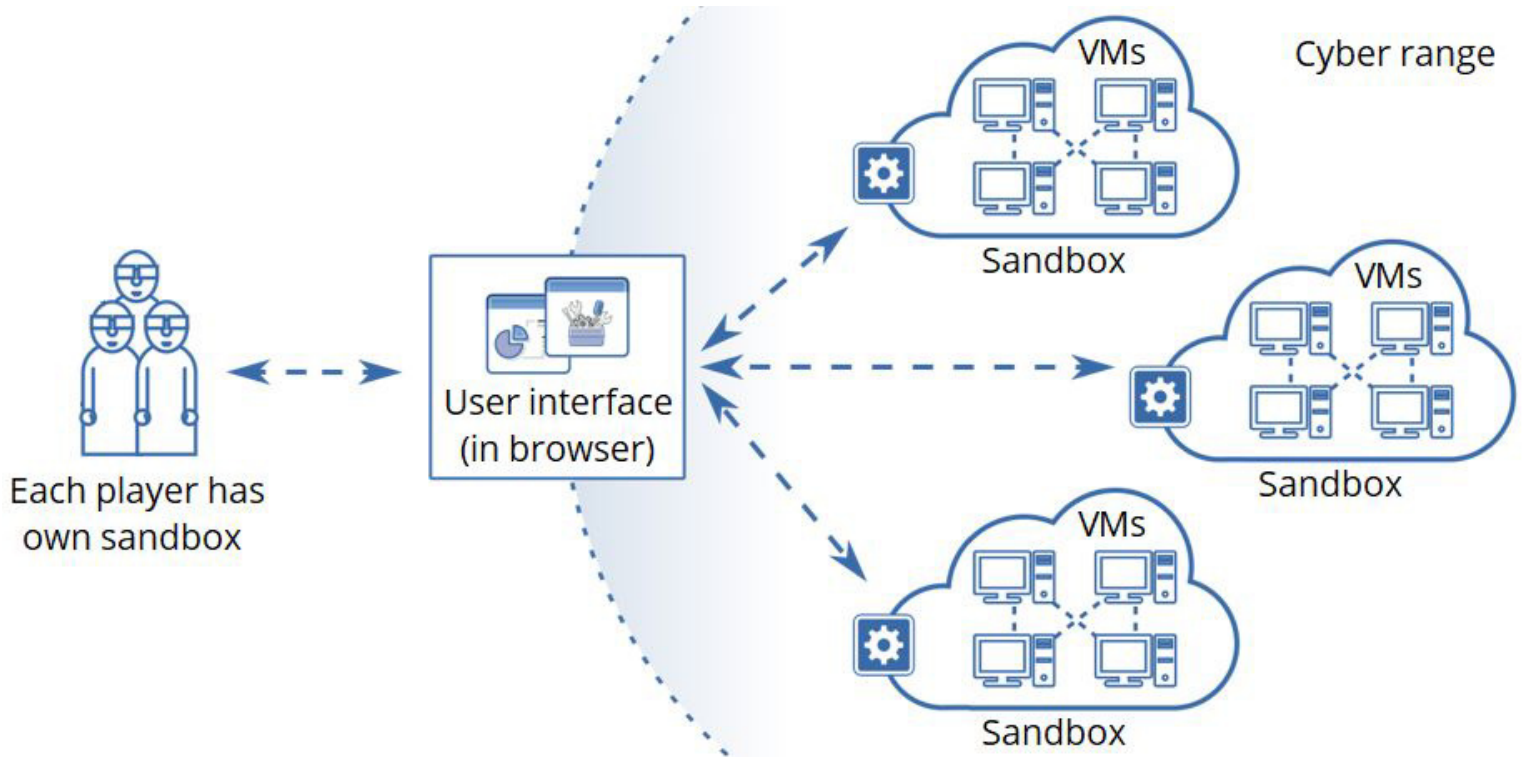
Hint 2: How to use the tool

Show Hint 1 (-2 points)

Use nmap.

- Background story
- Tools from professional practice
- Realistic infrastructure
- Isolated virtual network

Bonus level: KYPO platform



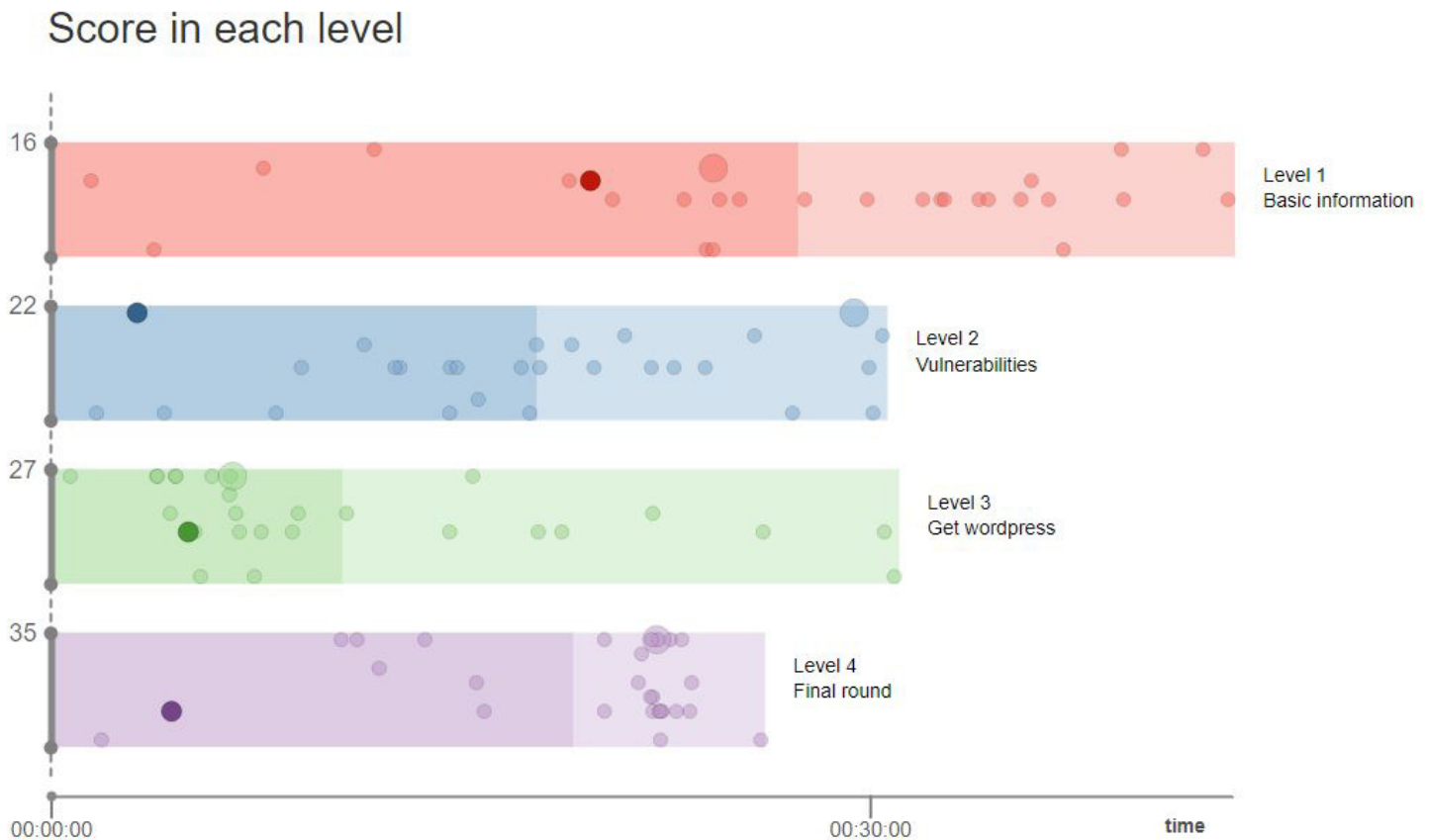
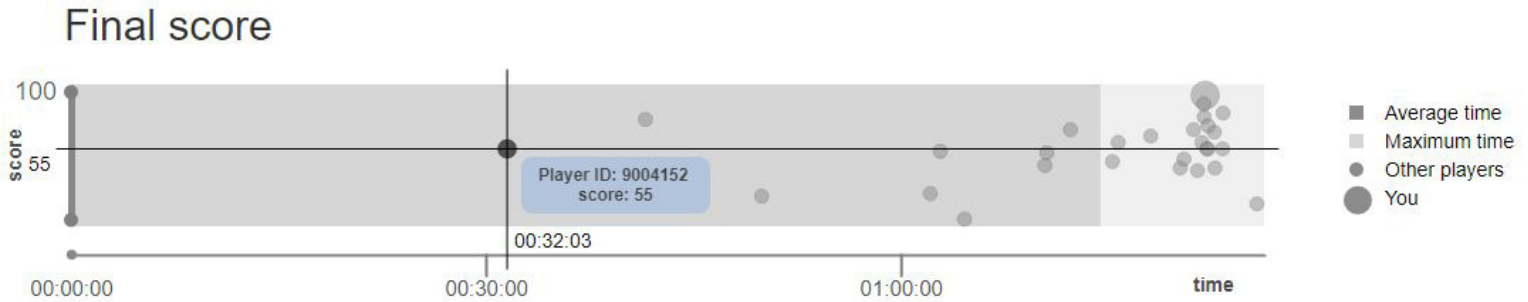
Level 4: Game event logging

- **Starting** a level
- **Skipping** a level
- Submitting a **correct flag**
- Submitting an **incorrect flag**
- Taking a **hint**
- Displaying a **solution**

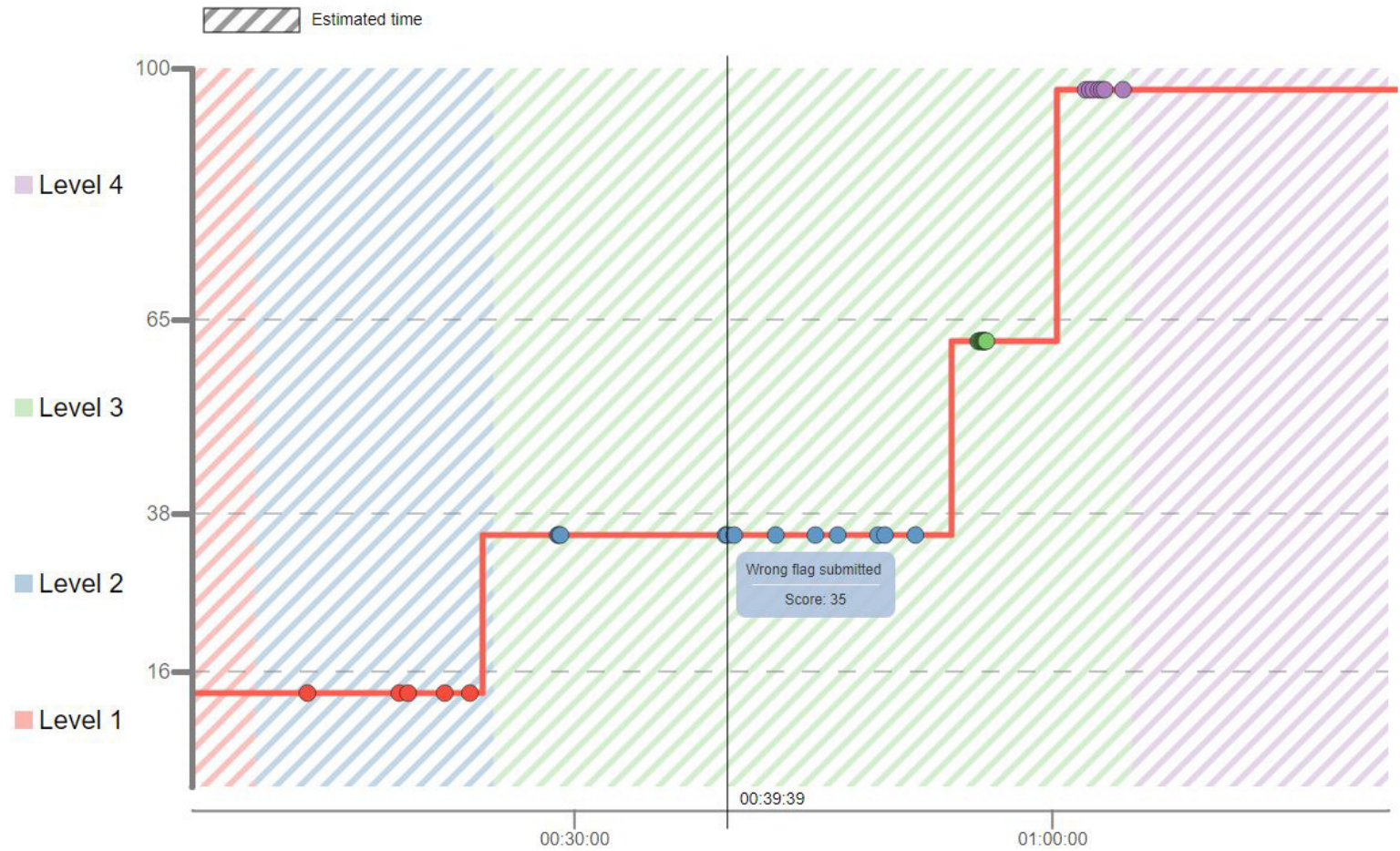
player_ID, timestamp, level, action

81, 2018-08-24 16:57:54, 4, Hint 3 taken

Level 5: Score visualization



Level 6: Event visualization



Level 7: Research topics

- **How do the players interact with CTF games?**
 - Which tasks are easy?
 - Which are problematic?
 - Where are the difficulties?
 - How do they use the tools?
- **How to provide automated feedback for both learners and instructors?**

Level 8: Survey

- N = **27** (age 13–15)
- Overall satisfaction:
 - Extremely **3** x
 - Very **16** x
 - Moderately 4 x
 - Slightly 4 x
 - Not at all 0 x
- **61%** wants to learn more
- Comments:
 - “If I'm nice and report security holes, I can earn money.”
 - “I can search garbage cans to find sensitive documents.”

Level 9: Preliminary results

- Difficulties with **Linux terminal**
- Not reading the instructions and **misunderstanding** a flag format
- **Guessing** (bursts of wrong flags)
- **Competition** for points
- Those with **previous interest** in cybersecurity performed better

Level 10: Conclusion, next steps

- The participants learned about **tools, exploits, and defense**
- In progress:
 - New games
 - Other demographic groups
 - Bash history analysis

Young learners should be allowed more hands-on experience with cybersecurity topics.