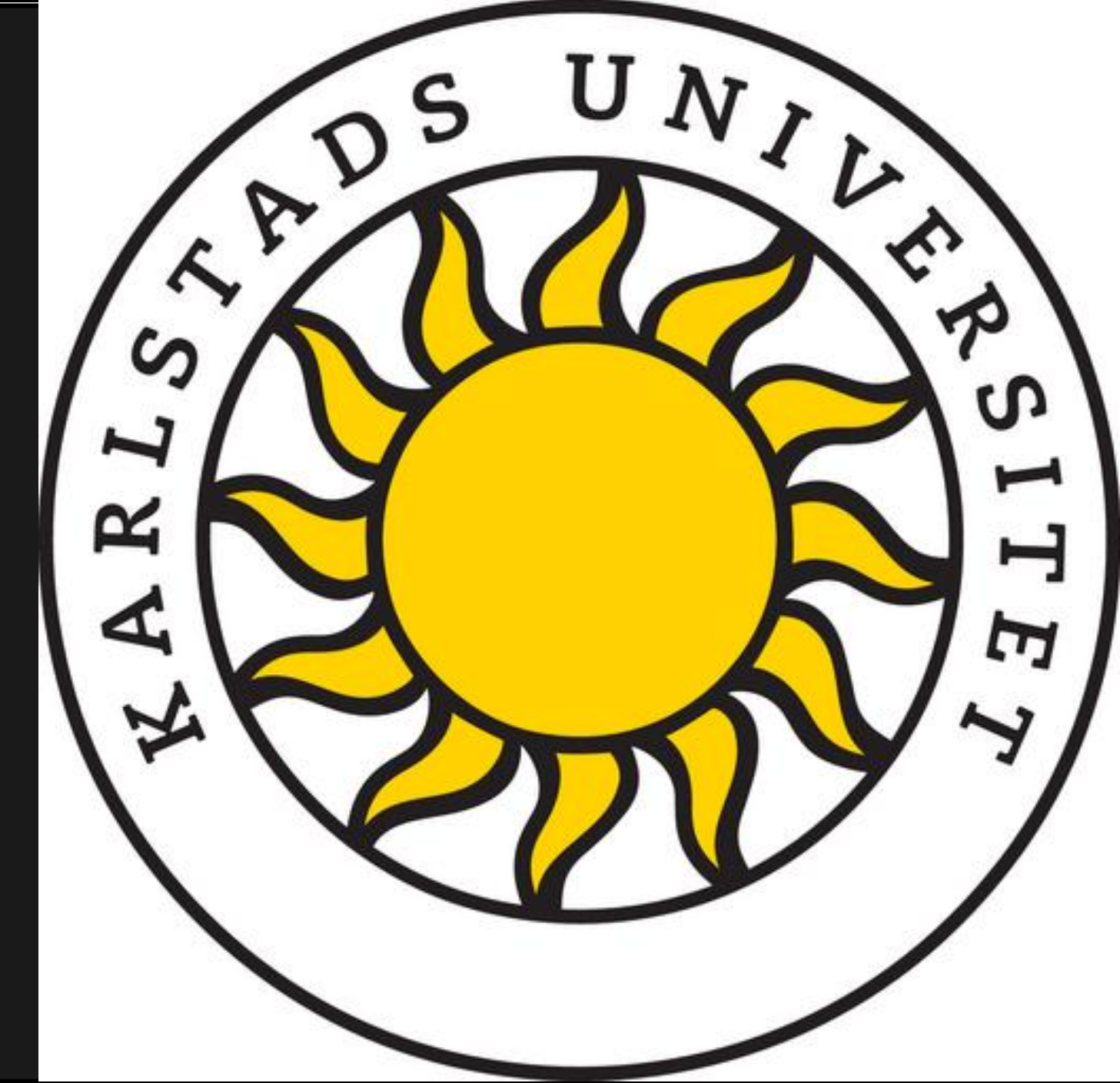


The Cyber Range Lite



Leonardo Martucci, Jonathan Magnusson, Tobias Vehkajärvi, and Jonas Karlsson



CRL at a Glance

- Lightweight container-based cyber range
- Individual labs — no student sharing
- Runs on-premise or cloud, open-source
- First deployed: 42 students, Jan–Mar 2025

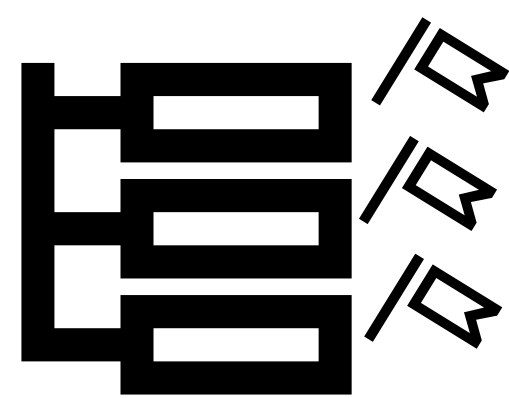
Why did we need CRL?

- Legacy VM range on GCP
€150 / world / month 
\$\$\$\$
- Shared worlds
flag sharing, littering, lags, crashes
 - Mitigation
12–24 h restores, flag rotations
- High admin load 

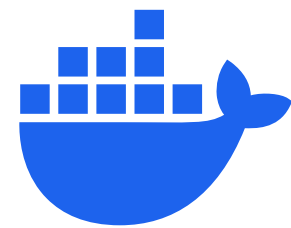
- Goals: 
 - ➡ individual worlds
 - ➡ self-service
 - ➡ lower cost

What's already available?

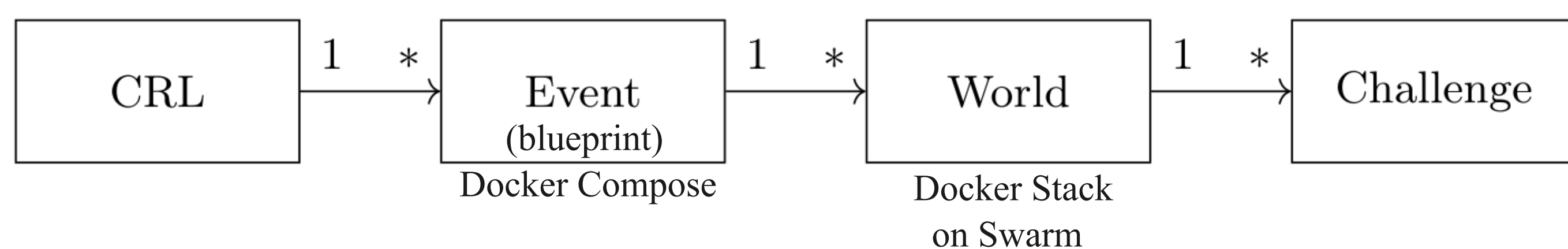
- Container-based CTF
Avatao, InCTF, CyExec, GIT-CTF
- Good start, but often:
 - 1 challenge = 1 container
 - Shared flags (manual grading overhead)
 - No per-student overlay network (range)





What makes CRL different?


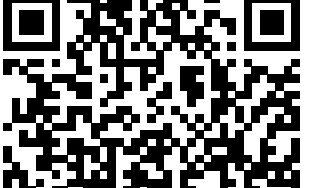
- Multi-challenge services
 - richer labs, fewer images
- Unique flag per student
 - no sharing of flags
- Docker Compose + Swarm 
 - 100 + hosts / world
- CTFd plugins:
 - OAuth login
 - create/reset worlds
 - hint economy

CRL architecture




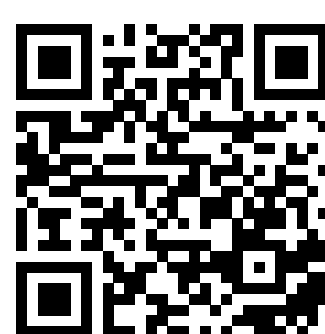
- CRL ➡ builds / resets
- Event ➡ a course or a CTF event
- World ➡ an individual cyber range
- Challenge ➡ exercises
- WireGuard config file: at world creation/reset 
- Admin effort ≈ zero 

Deployment and Feedback

- 42 students (+ 8 guests)
 - Worker capacity:
40-core server, 755GB
 - avg CPU: 20-50%
 - avg mem: 100 GB
 - Reset: Avg 30 sec
- World
 - 13 challenges on 5 services
 - 15 red herring services
 - 1 VPN service
- Feedback 
"I love this course" 

What's next?

- Planned improvements
 - richer logging
 - security hardening
 - Windows scenarios
 - Proxmox support
- Open source code and documentation 



Takeaways

- Cyber Range Lite (CRL)
 - scalable, cost-effective, low maintenance
 - container-based
 - runs on-prem; cloud optional



Acknowledgements

- CyberCampus



- Interreg EU CBCC



leonardo.martucci@kau.se

