Honda Research Institute EU

Innovate through Science, Life-long Learning in Company Research

Dr. Michael Gienger

European Computer Science Summit

2023-10-25

THE HONDA RESEARCH INSTITUTES

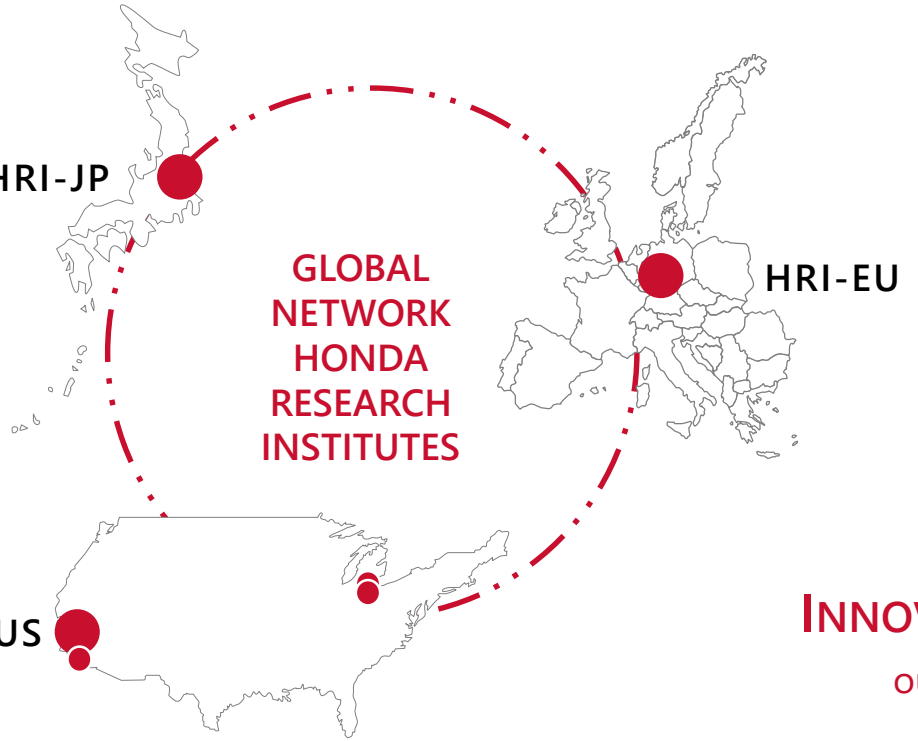
Honda Motor Co., Ltd.
Honda R&D Co., Ltd.
HRI-EU GmbH

2003
Founded as Centre of Excellence for Intelligent Systems[1]

2008
Impact on existing Honda Business Fields

2016
Balancing fundamental research and applied technology

2021
Reorganisation and introduction of Global Honda Research Institutes



INNOVATE THROUGH SCIENCE

our philosophy - our DNA

[1]focus on fundamental research in domains that are non-automotive (computer science, neuroscience, bioinformatics, computational intelligence, optimization, robotics). founded as 100% owned subsidiary of Honda R&D Co. Ltd. which is 100% owned by Honda Motor Co. Ltd.

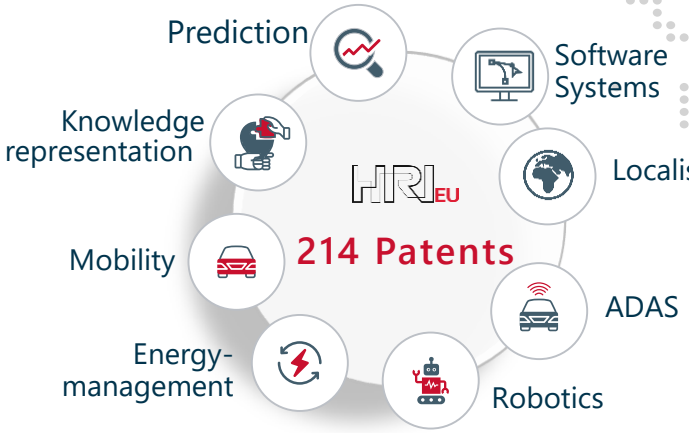
THE HRI UNIVERSE – EU AND OUR EXPERT CONNECTIONS

Global HRI acting as virtual institute to foster global synergies

HRI-US

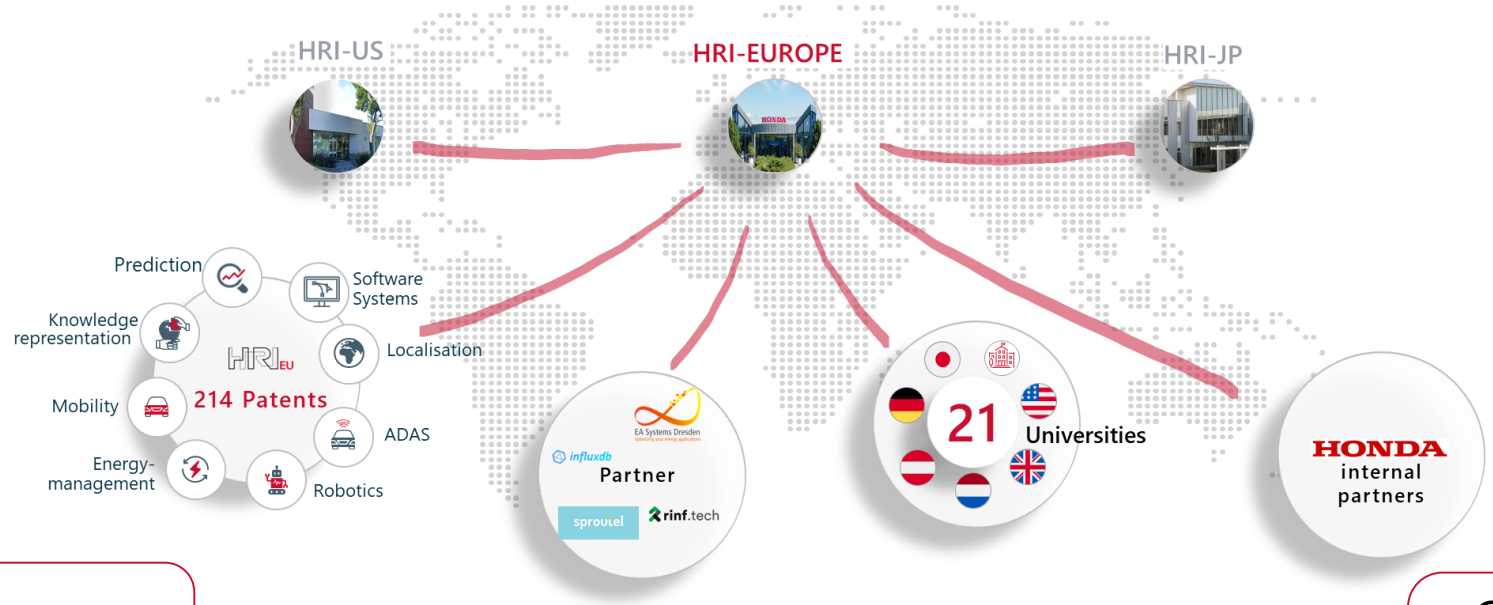
HRI-EUROPE

HRI-JP



and a vast Outside Network with universities to enlarge technology scanning capability and absorb new methods for potential application

THE HRI UNIVERSE – CHALLENGES FOR THE WORKFORCE



Interdisciplinary research

Collaborations with companies

Collaborations with Academia

Collaborations and contributions to Honda

UPSKILLING AND RESKILLING IN THE COMPUTER SCIENCE ECOSYSTEM – OUR COMPANY PERSPECTIVE

- Empower researchers and scientists to use SoA
- Manage diversities in educational backgrounds
- Support software & know-how transfer into partner's departments
- SW quality and life-cycle management
- Strengthen intrinsic motivation to learn

MEANS FOR LIFE-LONG LEARNING IN COMPANY RESEARCH

SECURITY TRAININGS

KNOWLEDGE MANAGEMENT

ACTIVITIES

SPECIAL INTEREST GROUPS

KNOWLEDGE-HUBS

PROJECT COMPOSITION

SOFTWARE CONTRACTING

COURSES AND TRAININGS

CHALLENGES

OPEN-SOURCING

CODE SCRUBBING

TECH- & IT SUPPORT

AGILE WORKFLOWS

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KNOWLEDGE MANAGEMENT - HRI-EU TOOL LANDSCAPE

A DIVERSE TOOL LANDSCAPE

TOOLS WITH OVERLAPPING FUNCTIONALITIES

OVERARCHING CATEGORY	TOOL
COMMUNICATION	MS Teams, Cisco Jabber, Jitsi, Outlook
DOCUMENT MANAGEMENT	Tikiwiki, Confluence, Yaws, hri-eu/ storage fileserver, MS Sharepoint,
PROJECT MANAGEMENT	Twproject, MS Project/ MS Planner, (Jira)
SOFTWARE DEVELOPMENT	Jira, Gitlab, Github, Toolbos, Pycharm, Matlab, CLion, Embold, ...
COLLABORATION/ SHARING	MS Teams, Sharepoint, Jira, Confluence, Git*, Twproject

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SOFTWARE SYSTEMS ENGINEERING (SSE)

SOFTWARE ENGINEERING ENCOMPASSES NOT JUST THE ACT OF WRITING CODE, BUT ALL OF THE TOOLS AND PROCESSES AN ORGANIZATION USES TO BUILD AND MAINTAIN THAT CODE OVER TIME. [1]

SOFTWARE SYSTEMS ENGINEERING [...] ADDRESSES THE DEVELOPMENT OF COMPLEX SOFTWARE-INTENSIVE SYSTEMS. IT INVOLVES ANALYZING, DESIGNING, DEVELOPING, TESTING, AND MAINTAINING A BROAD RANGE OF SOFTWARE BASED ON SPECIFIC USER NEEDS WHILE PUTTING INTO CONSIDERATION THE QUALITY, TIME, AND BUDGET. [2]

[1]: T. Winters et al, "Software Engineering at Google", 2020
[2]: https://www.ecpi.edu/blog/what-is-software-systems-engineering

SSE OBJECTIVE

IDENTIFY THE SOFTWARE ENGINEERING PROCESS PROVIDING OPTIMAL QUALITY & SPEED FROM RESEARCH LEVEL TO OPERATION.

FROM RESEARCH

fast exploration,

good enough to evaluate concept

TO DEVELOPMENT

maturity and flexibility,

good enough to build large scale systems

TO PRODUCT

high quality,

designed for maintainability

TARGETS

Enable HRI researchers to maintain high quality, easily reusable, and quickly transferable software

Support professionalization of software development

HRI should become a synonym for high-quality software engineering and spread the knowledge and support within Honda

CHALLENGES

Traditionally, HRI and Honda in general are not software companies (and thus, lack experience in modern software development)

Research projects have different requirements and workflows than software development projects

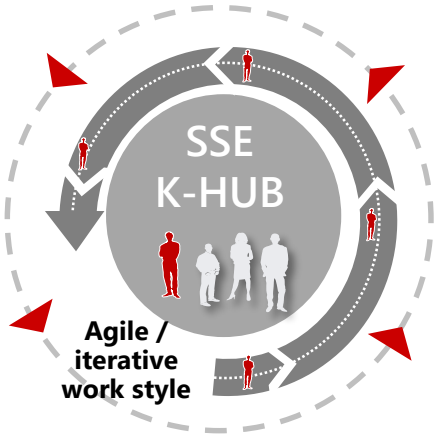
WHAT WE DO

Hands-on software (quality) improvement

Software restructuring for stability, maintainability and testability

Unit testing, integration testing, Continuous Integration

Support for implementing new features or porting software



Evaluation of modern software development tools and practices and adaptation to research world

Education, knowledge transfer, consulting (inhouse and for other Honda units)

Deduce practical requirements from research projects and to improve institute infrastructure

Software and knowledge transfer to HRI partners

WORKFLOW

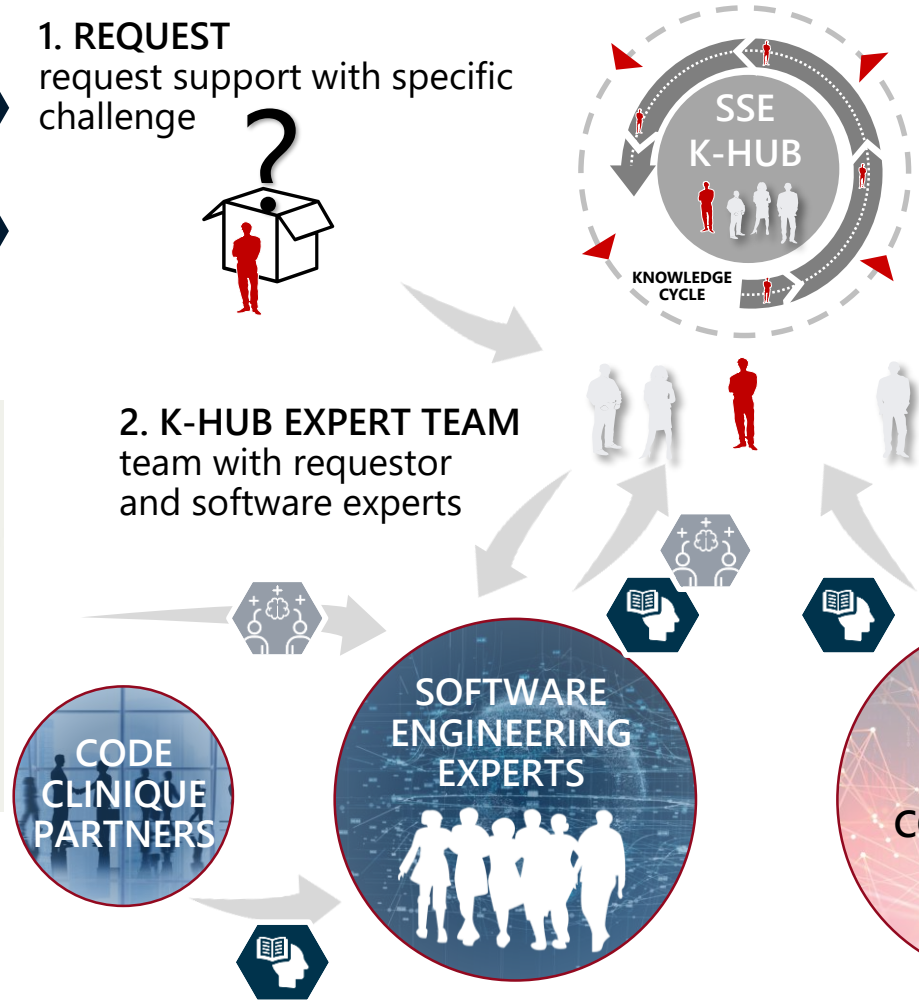
1. REQUEST
request support with specific challenge

2. K-HUB EXPERT TEAM
team with requestor and software experts

3. ITERATE & INNOVATE
in agile setting the team creates high quality software innovations

4. INNOVATION TRANSFER
ready-to-use software innovations + know-how + mindset

5. AUGMENT BY RESEARCH
integration of cutting-edge research and seed for new research topics



(CODE) KATA

is an exercise (in programming) which helps (a programmer) hone their skills through practice and repetition.

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SOFTWARE WORKSHOPS

Empower researchers to write high quality, sustainable software

Increase speed and output by state-of-the-art software engineering processes

CATEGORIES

CLEAN CODE

Training how to write efficient yet maintainable code in various programming languages.

How to optimally structure and design applications with modern methodologies and workflows.

FILE VERSIONING

Bring every developer to same level of tool usage skills, explain typical workflows and their pro/contra.

How to efficiently use the tool in HRI's contexts with worldwide students and collaborators.

ADVANCED VERSIONING

Learn the very internals of Git, master complex situations and get to know most configuration details.

Show possible pitfalls and how to avoid or resolve them. Enable support staff to rescue broken or misconfigured systems.

DATA SCIENCE

Processing and visualization of data with popular Machine Learning and AI toolkits.

Acquaint newcomers with standard tools and libraries of the scientific community. Enrich presentation of results in papers and reports with eye-catching graphics.

EXAMPLE: DATA-SCIENCE WITH PYTHON

Targets:

- Acquaint newcomers with standard tools, methodologies and libraries of the scientific community.
- Familiarize researchers with best-practices and workflows.
- Enable researchers to write better and work more efficient code by re-using state-of-the-art toolkits.

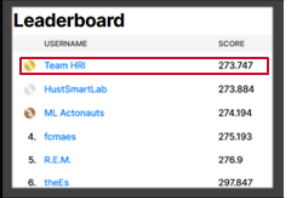
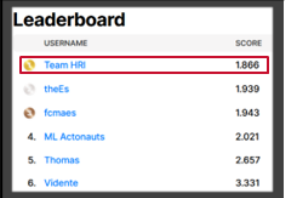
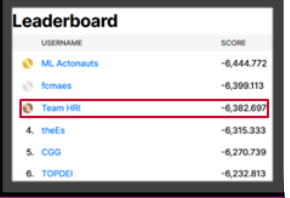
Settings:

- December 2021 – February 2022
- 46 attendees in 5 groups
- 2x 4 hours intensive training per group

Empower researchers to write high quality, reliable research software

Increase speed, output, and interoperability by using state-of-the-art tools and libraries

PARTICIPATION IN CHALLENGES

Scenario		Problem	Approach	Result
	Wormhole Transportation Network Optimize tours of a fleet of spaceships through a system of wormholes	Path planning in a large directed graph 6000 decision variables	Graph reduction + MILP + compute time	
	Morphing Rovers Optimize a controller for a Mars rover	Neuroevolution 19133 decision variables	Rule-based controller + imitation learning + fine-tuning via EA + compute time	
	Quantum Communications Constellations Optimize a network of communication satellites	Bi-objective mixed integer problem 20 decision variables	Trick to reduce problem + multi-objective EA + compute time	

TOTAL RANK: 1ST

2014 — Outstanding Organization Award

2018 — 2nd Rank Top German Industry Labs

2019 — 1st Rank Collision Avoidance Challenge Space Debris Office

2020 — 2nd Rank for IEEE-CIS Challenge on Energy Prediction

2021 — 3rd Rank for IEEE-CIS Challenge on Predict+Optimize

2022 — 2nd Rank Space Optimization Competition

2022 — 3rd Rank for Learning to Run a Power Network

2023 — 1st Rank Space Optimization Competition

CODE SCRUBBING WEEK

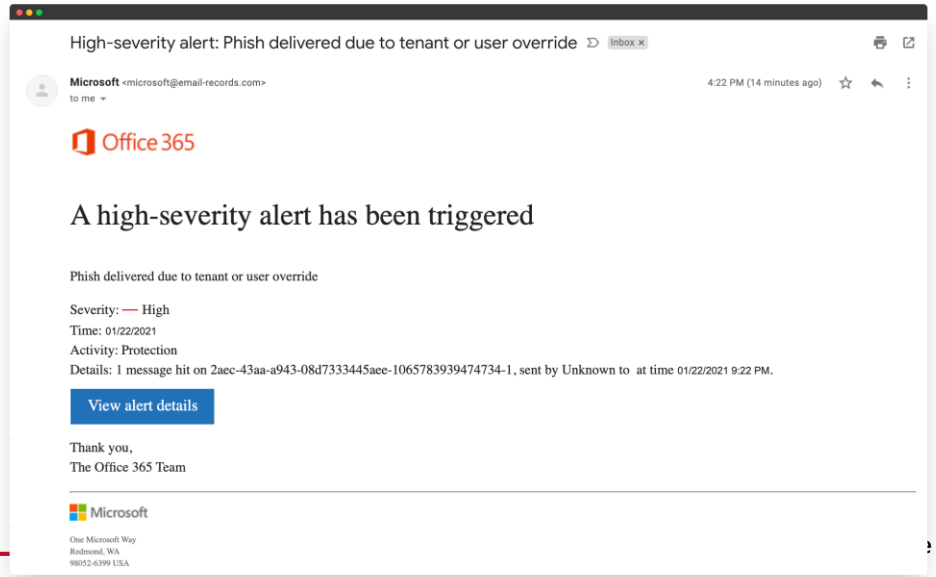
- A week of software improvement
- Goal: Improve SW quality by testing and peer reviewing
- Often aligned with migration task (OS upgrade…)
- No meetings, no paper writing
- Invited talk on selected software
- Socializing with the “Craizest Bug” list etc.

SUPPORTED BY FRESH FRUITS

USER SECURITY AWARENESS CAMPAIGN

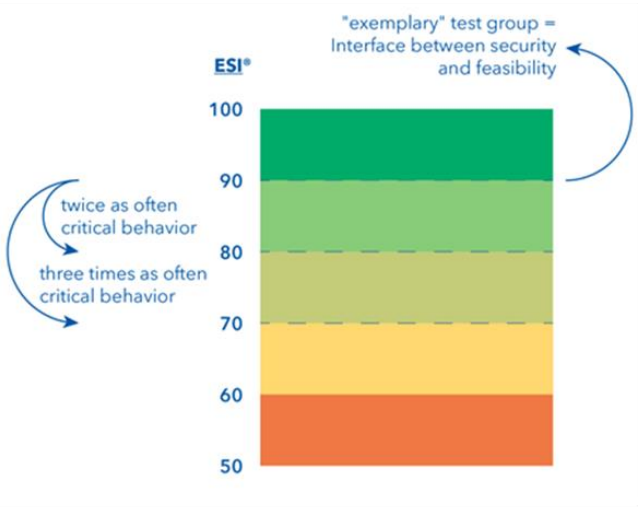
TRAINING BY VIDEOS

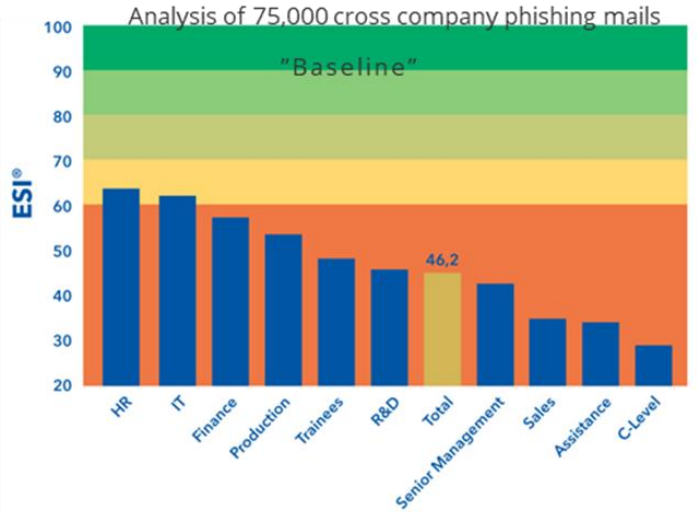
TRAINING BY SIMULATED ATTACKS



EFFECTIVENESS CAN BE MEASURED

From www.it-seal.de

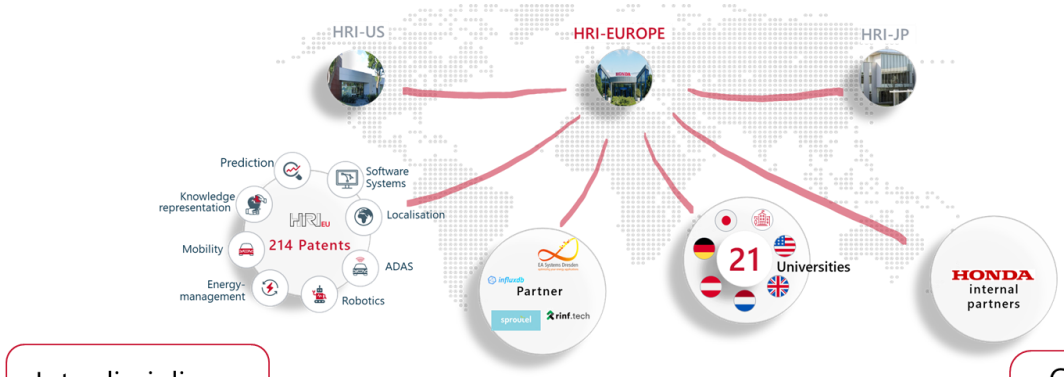




SUMMARY

- Up- and re-skilling in CS is a key challenge in our research environment
- Nothing is static
- We are curious to hear your perspectives!

Thanks very much for your attention!



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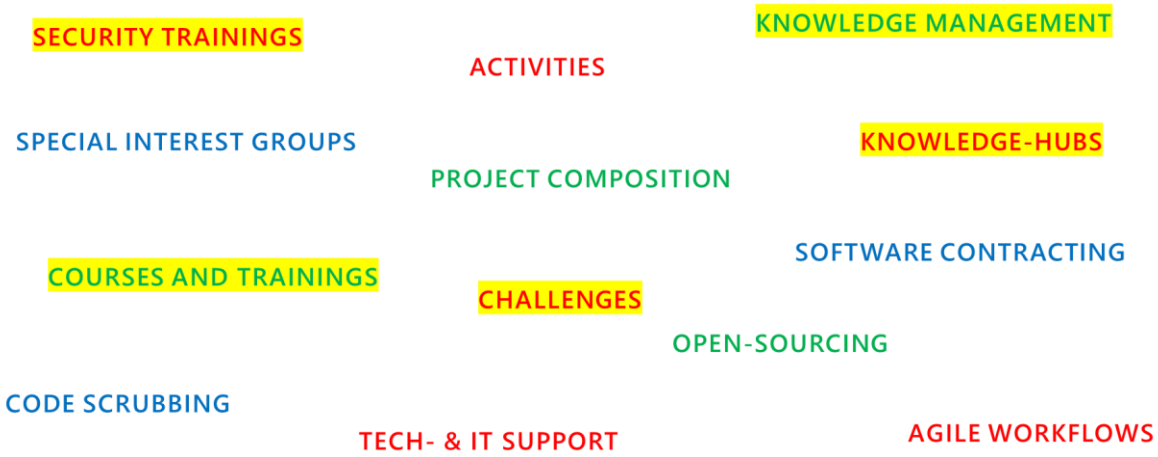
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