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Hackathons 101

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Hackathons have been around for decades. This article is a primer on what constitutes a hackathon, how hackathons have evolved, and why it can be advantageous to participate in and sponsor hackathons.

The majority of hackathons are low-key events. Hackathons draw participation from developers and nondevelopers with varying levels of subject-matter expertise. Hackathons come in many flavors, but what they have in common is that they provide participants with an opportunity to learn, contribute, and have fun.

The word "hackathon" uses the word "hack" in its original spirit in the tech world—to come up with clever solutions—and not in the sense of breaking into things, even though hackathons are popular in the computer security industry, and breaking things can be on the agenda. Also, while the word implies a marathon, hackathons aren't always the 48-h, no-sleep events people seem to expect them to be, as many corporations now host hackathons where the expectation is a more leisurely 9-to-5 schedule.

One thing is clear: Hackathons are popular! A simple web search returns information about lots of upcoming hackathon events across many continents. In this article, we provide a brief history of hackathons and what you can expect if you participate in one. We also describe how these events can be used to advance cybertrust.

WHAT ARE HACKATHONS?

While there have undoubtedly been similar hacking sessions for as long as people have been programming, the word appears to have been coined by well-known security expert Niels Provos, who used the word *hackathon* in early 1999 to describe an event held in Calgary, Canada. Ten developers on the OpenBSD project assembled to avoid export regulations while working on their implementation of Internet Protocol security.[1] Hackathons became a regular part of the OpenBSD culture, and they certainly helped to

popularize the concept in the open source community.

Although, fewer than two weeks after the OpenBSD hackathon, the JavaOne conference apparently used the same term to encourage attendees to build a program for the Palm V personal digital assistant.[2] It's unclear whether the terms were coined independently, or if the JavaOne hosts were keeping tabs on the OpenBSD community. However, it was an important event because hackathons quickly became popular at conferences as a way to drive innovation and foster community.

map of future products. For example, HackerOne, a cybersecurity firm, held a hackathon in which 27% of the projects were put into production.[5] Meilleurs Agents Engineering held internal hackathons that resulted in products used in its platform as well as its signature data-visualization project for the real estate market.[6] Over the course of DARPA's three-year Cyber Grand Challenge project, DARPA developers held several, three-day hackathons for all of the reasons mentioned here as well as to bring the geographically distributed development team together for an intensive face-to-face exchange of ideas,

on Eventbrite while others can be found on Hackathon.com.[10]

External and virtual hackathons are commonplace and were even so before the arrival of COVID-19. Organizations frequently sponsor external hackathons to engage the public. External hackathons are becoming more popular than internal ones.[10] Organizers often use external hackathons to crowdsource ideas from external entities or simply to increase the use of their own products and services, which provides the organizers with revenue. Some external hackathons are in the form of a convention that offers a wide variety of participation opportunities, ranging from never touching a computer to listening to speakers on related topics or participating in specific challenges. For example, DEF CON,[11] the largest U.S. hacking conference, offers 2-h contests to design something, such as hacking a way to cool a beverage or a car hacking challenge. The theme is "learn, hack, and play." The organizers provide the contestants with guidelines (for example, no appliances used in the design or only three people to a team). One of the more interesting challenges was to test the security of voting equipment. Over the past two years, DARPA has been a sponsor of DEF CON and offered a challenge for participants to break into decommissioned election equipment.[7]

Even companies may sponsor external hackathons. It can be a great way to promote employment opportunities and recruit new talent.[8] Participants benefit from the social interaction, and the fruits of the effort are typically expected to be open source, not intellectual property owned by the sponsoring organizations.

Universities also organize hackathons. University-sponsored hackathons are typically open to students from any institution but also to corporate sponsors. Penn State University holds a virtual hackathon[12] that is open to anyone enrolled in a higher education program. All aspects of this event are

> Organizations holding internal hackathons may use the forum to spur the company's next innovation or even to create a road map of future products.

From these beginnings, the concept widely and quickly spread. Today there are more than 1,000 hackathons each year,[3] attended by professionals, students, and hobbyists. For instance, annual or semiannual corporate hackathons are an ingrained part of the culture of many tech companies. Such events provide creative time to solve business problems, fix critical bugs, develop new ideas, and foster collaboration and effective teamwork among employees. It is not just the big tech companies offering these events to their employees. For example, auto manufacturer Ford Motor Company uses a hackathon format to stimulate innovation. In fact, the Ford voice-controlled digital assistant in cars came from a hackathon winner.[4] A hackathon may offer you an opportunity to build prototypes and pitch ideas to your organization.

Typically, an internal hackathon is a one-to-two-day event dedicated to new ideas, with the stipulation that the project being worked on must be related to company business. Organizations holding internal hackathons may use the forum to spur the company's next innovation or even to create a road

trouble shooting, and development. These hackathons were held away from the team members' home locations to minimize normal day-to-day distractions and promote team building within the development group, with work days lasting as long as 12–14 h in some cases.

Another important point regarding an internal hackathon is that the organization may stipulate that it owns the intellectual property of anything developed at the event. These events are also a means for the leadership of an organization to improve the retention of employees, motivating the workforce to grow professionally and contribute to intellectually stimulating challenges/problems. It is also highly motivating to employees to have some autonomy with time to cultivate new ideas and have a chance to collaborate with other departments. Additionally, internal hackathons are a great way for an organization to promote intrapreneurship and build technical leaders within it.

Beyond the world of internal hackathons, there are many hackathon opportunities open to the general public. Some hackathon organizers advertise

online, including judging. Virtual hackathons are similar to an external hackathon but have the additional benefit of attracting participants from many geographic locations. The downside is that networking can be limited. Individuals attending an external or virtual hackathon need to understand the conditions or agreements with their own organization to avoid any conflict of interest, such as for intellectual property rights. Hackathon participation is an excellent learning and networking opportunity for students.

Invitation-only hackathons are a category of cross-organization hackathons organized to introduce and connect similar organizations to create solutions to benefit all of them. For example, the retail industry holds an annual event for retailers and e-commerce businesses called Hack-Retail to engage in problem solving for modern retail issues. The rules are that the participants must be highly skilled and that they must complete the given technical challenges within 48 h. Some of the challenges have involved mobile applications that are able to locate an item (that is taken from the customer's camera) for purchase; QR codes for clothing that would provide the user with sizes and available colors, which would be sent directly to a dressing room; and a line-queue application to hold your place in a physical line without you being present.[9]

HOW DO THEY WORK?

The concept of a hackathon is pretty loose, but it's common for hackathons to be fairly well organized. There's typically at least a theme, if not specific objectives. Ideas are often tracked and discussed in advance of a more formal event kickoff meeting, where existing ideas are reviewed, and new ideas are often pitched.

Participants can work solo, but work often happens on small teams. They also do not typically need to show up with a team of collaborators. Team creation may be assisted by the host, who provides the means to have skill profiles as well as team profiles shared by participants so they can source and complement skill sets. Once teams are assembled, ideas and participants look for other developers who can offer relevant skills to the project goal.

Hackathon organizers may also supply each team with one or more mentor(s); the mentors provide guidance to the teams. Mentors can even be vendors, who, in addition to providing guidance, makes their products, services, and technical experts available to the team during the hackathon event.

Hackathons can last as short as a couple of hours but typically are at least a day, often two, and occasionally longer. They can be caffeine-fueled 24/7 sessions, where sleeping is frowned upon, or they can be 9 to 5 affairs.

Often, organizers ensure social opportunities beyond collaboration, such as lunches. Networking is often nearly as important to participants as the hacking itself.

Hackathons are usually fairly loose on projects and team sizes, allowing them to organize by interest. Still, it's not uncommon for organizers to give a particular problem to solve that fits within the theme of the hackathon (for example, selecting and analyzing a security protocol for vulnerabilities).

At the end of a hackathon, there's generally a demo session for people to showcase their work. In many instances, the results will be available for other participants or, if appropriate, for the general public to peruse, often in a code repository hosted on a site like GitHub. Sometimes, the hackathon organizers supply judges to provide feedback on each team's performance and, in some cases, to select winners if the event is arranged as a competition.

Hackathon projects are not always polished, nor are they expected to be, but they can be quite elegant. Sometimes they are quickly cobbled together like a makeshift contraption from an episode of the television series *MacGyver*. Some hackathon projects may get further attention after the hackathon. Many others, however, are never heard of again. That can even happen with spectacular projects. For instance, we once saw a hackathon produce an amazing game intended for a company's 404 error page. In other words, when the company's server returns an HTTP status code 404, indicating to the person trying to reach a website that that site cannot be found, the user is also presented with a game to play. We're still waiting to play the game in production.

Often, for people participating in a hackathon, the event is stressful, not because the work is intense but because it can be embarrassing to not deliver on a project. Some hackathons make the mistake of calling on everyone to demo, even if some people might not be ready, forcing them to admit they made less progress than expected in front of their peers. However, even in more enlightened hackathons, there's a lot of value in discussing projects up front, and people notice when things don't get finished. Even though everyone's had the experience of underestimating tasks, especially ones with purposefully aggressive timelines, it's still a downside for many people and definitely does keep some people from participating.

IMPROVING KNOWLEDGE AND SKILL SETS

For many participants of hackathons, the primary motivation isn't getting the work done or the adulation of their peers—it's the opportunity to learn. People often select projects in areas outside of their expertise. We've seen systems engineers develop their first user interfaces with React (a JavaScript library available at https://reactjs.org/) and React developers write their first lines of system code.

In fact, while the word "hack" does imply coding, it's often not expected! Projects benefit from the expertise of project managers, architects, testers,

business development professionals, and others. For instance, at one of our corporate hackathons, the human resources and sales teams both contributed to the hackathon, producing documentation and tools that had long been wanted but deprioritized.

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Hackathons aren't the only events of their kind that are good for building hands-on experience in new areas. Specifically, every year, the computer security community sponsors hundreds of Capture the Flag (CTF) events, which are hacking competitions in the more nefarious sense of the word. A commonly used source of scheduling information for these events is https:// ctftime.org.

The first CTF event was at the DEF CON security conference in 1996. While there are now hundreds of CTF events every year, the DEF CON CTF event still takes place and is essentially the world championships of computer security.

Participants in a CTF typically focus on breaking things—breaking into systems or finding vulnerabilities in software. Some CTFs may include defensive elements, requiring participants to simultaneously attack and defend. Yet other events, such as the National Collegiate Cyber Defense Competition, are almost exclusively oriented around defense. As with hackathons, many CTF events are culturally geared to help people grow their skills, whether they're beginners or experts.

Take, for example, the HACKtheMACHINE (www.hackthemachine .ai) hackathon, which originated from a Naval Postgraduate School research project and is sponsored by the U.S. Navy. The event has a CTF challenge for participants to solve Navy computer

security problems, such as testing the security of 3D printers, hacking into a ship's control system, or generally finding flaws in one of a ship's systems. Concurrently, the event will offer challenges in another track for participants to work on data science. For example, the participants are challenged to innovate ways to analyze the mounds of data collected from Naval missions to help them make better operational decisions or find more effective ways to maintain the systems on a ship. There are plenty of opportunities for people to grow their skills without needing to know how to reverse engineer x86 or ARM assembly code.
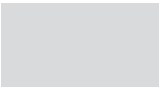
For the typical participant, hackathons provide excellent opportunities to learn and network. For the organizer of a hackathon, it is a way to get important work

done that's been taking a back seat and to create a sense of community that inspires the attendees to collaborate, learn, and innovate. No matter which type of hackathon you attend, the experience and network of collaborators are priceless. ▣

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