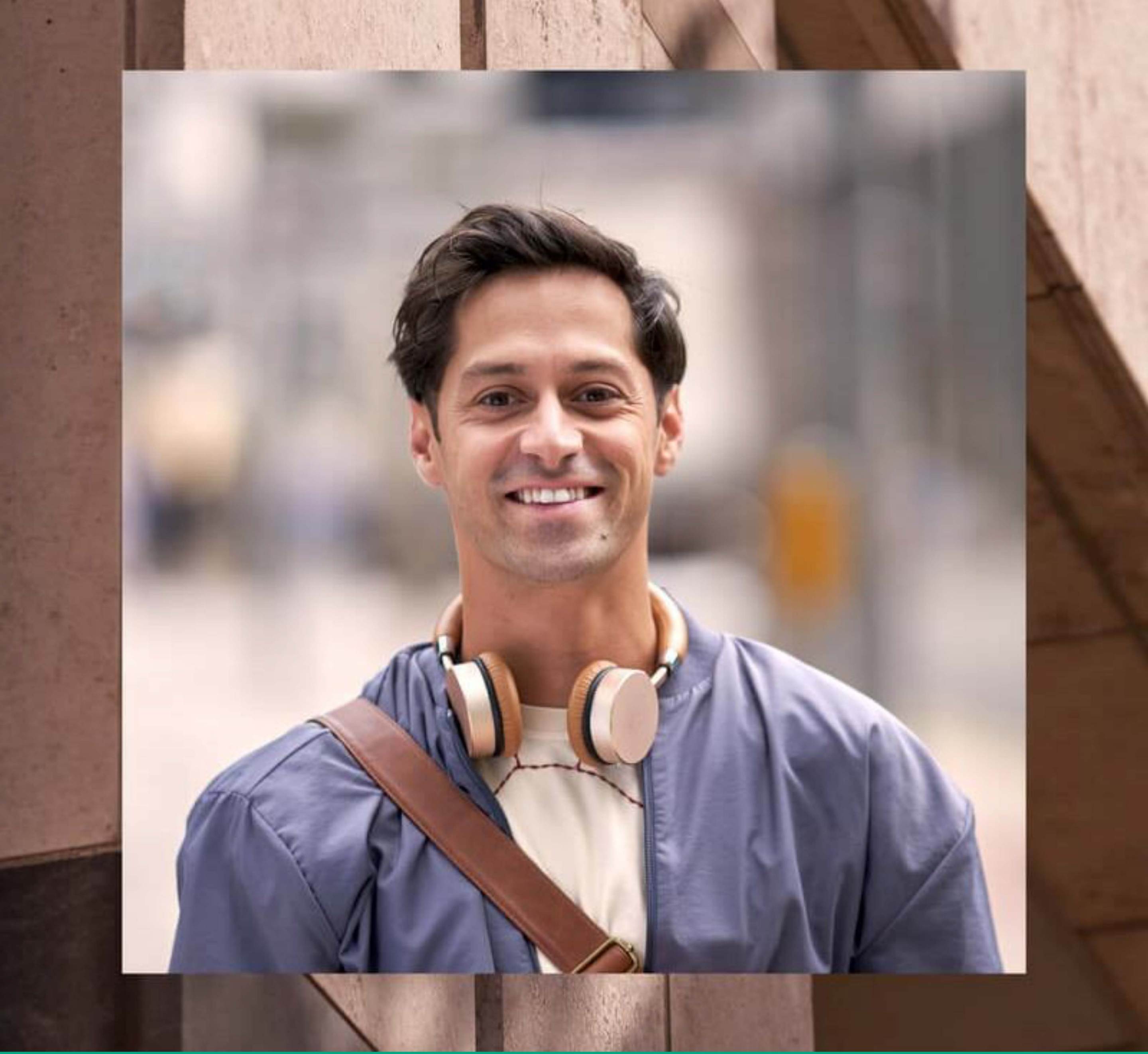

# High performance computing: Facilitator guide

## This lesson is designed for students ages 16+ (grades 10 to 12 or adults)

In this lesson, students will discover what high performance computing is, why it is used, and how it works. Students will learn about different case studies and research how different industries use supercomputing and HPC to solve problems.

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# Lesson plan




## Lesson purpose

- Students will be introduced to the concept of high performance computing (HPC) and understand how different industries use HPC and supercomputing to compute complex problems and store massive amounts of data.

## Lesson objectives

Students will be able to …

- Describe what high performance computing is and how it works
- Share why high performance computing is necessary to complete complex processes
- Research examples of how high performance computing is used in different industries

## Agenda

- Introduction (5 minutes)
- Warmup & discussion (15 minutes)
- Activity – Supercomputing & society (20 minutes)
- Share out (15 minutes)
- Wrap up (5 minutes)

## Materials

**(Print one of each material per student)**

- Activity handout
- Pre- and post-session surveys (share pre-survey with teacher ahead of session)
- Video: What is a supercomputer?
- Video: ARCHER2 - the UK's new supercomputer

## Vocabulary

- **High Performance Computing (HPC):** encompasses solutions that are able to process data and execute calculations at a rate that far exceeds other computers. This aggregate computing power enables different science, business, and engineering organizations to solve large problems that would otherwise be unapproachable.
- **Supercomputing:** efficiently solves extremely complex or data-intensive problems by concentrating the processing power of multiple, parallel computers.

## Pre-visit prep

Preparation will take 30 minutes.

- Familiarize yourself with the basics of high performance computing. Read What is high performance computing? on HPE's website.
- Learn about the setting of your visit, how many students you will be working with, and ask the teacher if there is anything helpful to know in advance.
- Share the pre-session survey with the teacher and ask to have students complete it ahead of the session.
- Work with the teacher ahead of time to figure out a room arrangement where students can gather into groups of 3-4. These groups will carry out the small-group activity. Knowing their students, the teacher may also want to pre-compose the groups in order to get the most out of the activity and minimize disruptions.
- Gather a few interesting stories about high performance computing from the news or your personal experience that you can share with the students as quick real-world anecdotes (during warm-up activity discussion).
- Learn what technology will be available and use that to determine how the activity will be facilitated.
- Print necessary handouts and materials.

### Teaching tip

Read the general characteristics of students in various grade/age groupings and be sure to ask the teacher what additional characteristics may be helpful for you to know about their students.

**Students ages 16 and older (grades 9 to 12)**

- Mature learners, especially by 12th grade
- Have more experience to help formulate questions and can visualize cause and effect presentations
- Beginning to plan for career choices and training beyond high school
- Higher degree of self-confidence
- Enjoy engaging in discussion

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## Step 1: Introduction (5 minutes)

Share your …

- Name
- What you do
- Why you enjoy working in tech
- Fun fact to help you connect to the students (hobbies, favorite subject, your connection to the school or city you are in)

**Teaching tip**

**Build excitement and trust early on:** Be friendly and enthusiastic! Feel free to build some rapport with students, such as asking them to raise their hands if they're interested in working in tech or sharing a story from school when you first learned about tech careers.

## Step 2: Warm-up activity (15 minutes)

### Video (5 minutes)

Ask students if they have heard of high performance computing to gauge their knowledge of the topic. Then tell students that supercomputers are an example of high performance computing, and they are going to watch two videos to learn more.

Share this video: What is a supercomputer?

Next, share this video: ARCHER2 - the UK's new supercomputer

### Discussion about high performance computing (5 minutes)

**Ask:** Computers are very smart but have limitations. What are some limitations?
[**Ideal responses:** storage, speed, power]

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# Lesson plan



**Say:** High performance computing is the practice of combining computing power to deliver more performance than a typical computer. For example, an average desktop computer can perform billions of calculations per second. High performance computing is capable of performing quadrillions of calculation in one second.

**Ask:** How do you think high performance computing works?
[**Ideal responses:** an HPC cluster consists of hundreds or thousands of servers (nodes) that are networked together. The nodes in each cluster work with each other to boost processing speed to deliver high performance]

**Ask:** Why is high performance computing important?
[**Ideal responses:** store a lot of data, calculate things quickly, approach problems humans otherwise wouldn't be able to address]

**Ask:** One example of how high performance computing is used is for weather prediction and forecasting. Why do you think high performance computing is needed in order to predict weather?
[**Ideal responses:** massive amounts of data collected by satellites, complex equations to understand the physics of weather, collecting information about weather around the world, needs to be reliable and always working]

**Ask:** Another example of high performance computing is to manage medical records and information for doctors and nurses. Why do you think they need high performance computing?
[**Ideal responses:** keep patient data safe, information to make better diagnoses and treatment plans, cut down on time medical staff spend inputting and organizing data]

## Teaching tips

- **When asking a question:** "Count to seven" to wait for answers (students need time to think!) or pair students up.
- **Think-Pair-Share:** Give time for students to brainstorm their ideas independently, then ask them to share their ideas with the person next to them, then share to the larger group.

### Understanding why high performance computing is important (5 minutes)

- **Explain:** Companies like HPE build high performance computing systems so research facilities and organizations can solve large problems in science, business, and engineering that would otherwise be unapproachable.

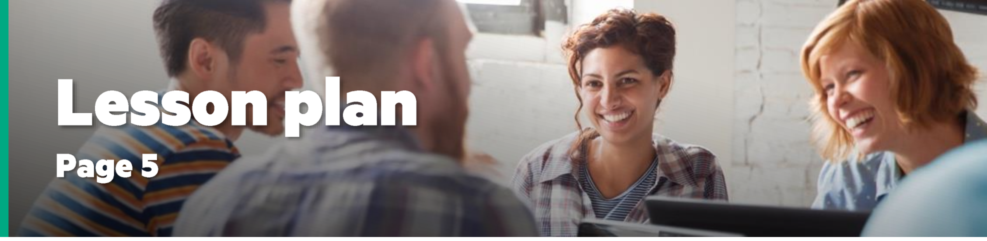
- **Ask:** What are some other examples of high performance computing use cases?
  [**Ideal responses:** in research labs to understand the world around us, in media and entertainment to edit feature films, in artificial intelligence and machine learning, financial services to detect fraud or track stock trends]

- **Dig in:**
  - What are some future problems that high performance computing could help solve?
  - What are some potential risks or consequences that we might need to think about in the future regarding high performance computing?

- **Say:** In this next activity, you will work in groups to research examples of how high performance computing is used.

## Step 3: Activity (Supercomputing & society) – Small group activity (20 minutes)

**Overview:** Students will research examples of how high performance computing is used by different industries. Students will share their findings with each other.



## Step 4: Share out (15 minutes)

**Share out:** Give each team two minutes to present their findings to the rest of the class.

## Step 5: Wrap up (5 minutes)

**Say:** Now that we've learned more about high performance computing, why does it matter? [**HPE facilitator note:** Have students share answers. Examples could include "high performance computing can solve complex computational problems and store massive amounts of data."]

**Say:** I'm going to have you fill out a short Exit Ticket survey. **[Pass it out or share link]** While you work on this, I'm going to tell you a little more about what happens at HPE around high performance computing. We offer HPC solutions across industries, from energy and manufacturing, to health and life sciences, in order to power innovation.

**Say:** Thank you for contributing and working with me! I'm impressed by your knowledge and ideas, your creative problem solving, and your teamwork. If you are interested in learning more about HPE, you can visit hpe.com/about. We offer HPC solutions to our customers to handle today's massive amounts of computing and data.

## Step 6: Post visit follow-up checklist

- Thank the teacher/school/youth organization and the students.
- Share any resources HPE offers that may be helpful to the students.
- Ask for feedback.
- Offer to visit again with another topic in the series if the school is interested and can make time.

# Activity:

## Supercomputing & society

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**Directions:** In a small group, choose one of the following topics and research how supercomputing or high performance computing is used in that area.

**Topics (select one)**

- **Scientific research** (HPC is used to help scientists find sources for renewable energy, understand the evolution of our universe, predict and track storms, and create new materials)
- **Medical research** (HPC is used to help develop cures for diseases like diabetes and cancer and to enable faster, more accurate patient diagnosis)
- **Media and entertainment** (HPC is used to edit feature films, render special effects, and stream live events around the world)
- **Financial services** (HPC is used to detect credit card fraud, track real-time stock trends, and automate trading)
- **Artificial intelligence and machine learning** (HPC is used to provide self-guided technical support, teach self-driving vehicles, and enable the Metaverse)

**Researching your topic:** With your chosen topic as guidance, go online to research how supercomputing is impacting your topic area. Try to find an example that you think is both innovative (it's trying to solve a new problem or an old problem in a new way) and is personally interesting.

Use the space below to record notes about interesting products you find, patterns that you're seeing, or problems within your chosen topic that people are trying to address.

# Activity:

## Supercomputing & society

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Based on the research you did on the last page, select one example of supercomputing you found to focus on. You may need to head back online to gather more details about your example.

| | |
|---|---|
| **What organization or company is using high performance computing?** | |
| **What problem are they solving using high performance computing?** | |
| **What are they computing that requires more power than a regular computer?** | |
| **What data are they using and storing?** | |

Be prepared to share your findings.

# Surveys

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## Pre-survey

A team member from Hewlett Packard Enterprise (HPE) will be joining your class today to talk about technology! Could you please answer a few quick questions before the session?

On a scale of 1 (not interested) to 5 (very interested), how interested are you in technology?

| | | | | |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** |

On a scale of 1 (not a lot) to 5 (a lot), how much do you know about high performance computing?

| | | | | |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** |

Do you have any questions for the HPE team member about technology related to high performance computing?

# Surveys

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## Exit survey

Thank you for participating in the session! Could you please answer a few quick questions to let us know how we did?

What did you enjoy most about today's session?

On a scale of 1 (not interesting) to 5 (very interesting), how interested are you in technology?

| | | | | |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** |

On a scale of 1 (not a lot) to 5 (a lot), how much do you know about high performance computing after today's session?

| | | | | |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** |

Do you have any questions for the HPE team member about anything from today's session?

a00135538enw, November 2023