
ANALYTICS DASHBOARD
HUAWEI
EUROPEAN
UNIVERSITY
CHALLENGE 2020
HIGH-PERFORMANCE COMPUTING
UNITED
KINGDOM
OCTOBER 19 - NOVEMBER 30
REGISTRATION OPENS OCTOBER 5

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Introdcution

Introduction

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As the leading global provider of information and communications technology (ICT) infrastructure and smart devices, Huawei takes great pride in hosting this annual programming competition in order to encourage students to solve real world industrial problems and learn advanced technologies, raise students' research interests, and provide them opportunities to interact with industrial experts.

The European University Challenge 2020 in the UK is organized by Huawei UKRD club. This six week digital event is an opportunity for our team to collaborate with the innovators and developer of tomorrow and we can't wait to see what you have in store!

Overview

About the challenge

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The theme of this year's challenge is High Performance Computing (HPC). HPC makes it possible to solve problems at high speeds and is the foundation of many scientific, technical, and industrial advances.

Data science development, including artificial intelligence, data analysis, network analysis, social media analysis, knowledge graphs, etc., needs the ability to analyse and reason about large scale data represented in graphs. The challenge is implementing fast graph algorithms that perform well on large sparse graphs, running parallel on multiple machines. How could we accelerate graph computation by exploiting high performance computing?

This challenge encourages participants to solve this problem in the setting of network analysis. Large scale undirected graphs are randomly generated to simulate networks. Participants will be given two tasks related to graph calculation and are invited to design parallel algorithms to traverse the graphs and to identify the most important vertices. The winning algorithms are supposed to achieve the best performance.

Judging Criteria

The jury will select the winning Teams based on the following criteria:

- Judging will be based on running time, the time required for the system to evaluate the algorithm submitted by the participant, however, each task is weighted differently.
- The first task will account for 35% of the total score, and the second task for the remaining 65%.

Prizes

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1st prize: £5,000.00

2nd prize: £3,000.00

3rd prize: £2,000.00

(Cash prizes will be divided equally between the team members)

Task details

Task details:

We describe in detail the problems for participants to solve. We will define the problem, give an example algorithm in pseudocode, demo example inputs and outputs, and specify the evaluation criteria. The participants (teams) have three weeks to implement an algorithm to solve each task if they've registered before 19 October 2020. The only input for these tasks is a testing large graph specified as a list of pairs of natural numbers. All submitted algorithms will be evaluated on huge graph. The participants are encouraged to generate large graphs by themselves to test proposed algorithms.

Task 1 (Traversal): Parallel Breadth First Search

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Given an undirected graph the participants are invited to implement a parallel breadth first search algorithm to output all nodes in the graph reachable from some node. For example, for the following graph specified as a list of edges (pairs of nodes in natural numbers):

[(0,1), (0,2), (1,2), (1,3), (1,4), (2,3), (3,5), (4,5)]

the proposed algorithm should output the sequence:
[0, 1, 2, 3, 4, 5]

A serial breadth first search algorithm is given below in pseudocode.

```
qs := [0]
while qs is not empty
  q := dequeue qs
  if q is not visited
    add all neighbours of q from graph into qs
    mark q as visited
```

A naïve parallel breadth first search algorithm uses a small pool of threads. At each step, each of the threads is provided with a single entry $\mathbf{q_n}$ (where **n** is the thread id) drawn from **qs.** The threads then find new elements connected to their $\mathbf{q_n}$, check if they are in **qs** and if not add them.

[[[(0,1),(0,2)],[],[]],
[[(1,2),(1,3),(1,4)],[(2,3)],[]],
[[(3,5)],[(4,5)],[]]]

In the first step, threads 1 and 2 are idle as only one element was available in **qs** ($\mathbf{q_0=0}$). In the second step, thread 0 ($\mathbf{q_0=1}$) deals with three edges, thread 1 ($\mathbf{q_1=2}$) deals with one edge, and thread 2 is idle; in the last step, the load balance is better than previous steps. A good algorithm is should

produce the correct node sequence;
take as little exploration time as possible;
use as few threads as possible.

The participants are encouraged to implement their own parallel breadth first search algorithm using popular programming languages, e.g., C, Python, etc. We also encourage the participants to use linear algebra libraries, e.g., OpenBLAS, etc.

Task 2 will be released on 9 November 2020

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Stay Tuned!

More details coming soon...

FAQs

FAQs

WHEN WILL THE SUBMISSION START?

☞ The 1st Task will be released on Monday, 19th October, 12 p.m. (UK Time)

WHERE TO CONSULT THE RESULT?

☞ The results will be updated in the leaderboard, accessible from the platform (link available from Monday, 19th October, 12 p.m. (UK Time)

WHAT IS THE 1ST TASK DEADLINE SUBMISSION DATE?

☞ The 1st Task can be submitted until 9th November, 10.59 p.m. (UK Time)

I'VE REGISTERED, WHAT'S THE NEXT STEP?

☞ After registration, you should receive a confirmation email from us. In order to receive the tasks and submit your work, you are expected to form a team with others. Each team is expected to have up to 3 participants. Please beware, it is necessary to form a team even it is a one man team. The follow up information will be sent out to teams, not individuals.

WHAT KEY INFORMATION AM I EXPECTING FROM THE CHALLENGE SYSTEM?

☞ After forming the team, you and your teammates should receive an email from Huawei with following information

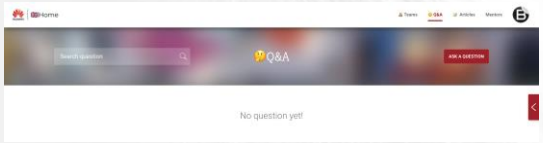
- Your unique team ID and password
- The web portal for task submission
- Information on how to access the development server
- How to submit your work

The team ID and password will be required to access the dev server and task submission

HOW CAN ASK QUESTIONS ABOUT THE TASK?

☞ Post a question in the Q&A section

Besides, a live Q&A session will be held on Wednesday, 28th October, end of the day (time to be defined)



FAQs

WHAT IS THE SPECIFICATION OF THE DEVELOPMENT SERVER?

☞ The development server you have access to has two HiSilicon Kunpeng 920 4826 processors, with 256GB memory. Each processors has 48 cores, so in total, you have 96 cores to play with. For more details regarding Kunpeng 920 4826 processor, please see Annex.

Please be aware that this development server will be shared among all teams. So you should keep following rules in mind to be a good citizen:

- Don’t assume you own the machine, so keep your information secure
- Don’t use the machine for other purposes other than testing your implementation for UK challenge tasks
- Don’t keep unnecessary data on the server to keep it clean
- Don’t try to install random software unless it is really required by your task implementation
- Keep everything in your home directory

If we discovered violations on the rules above, you might lose the access to the development server, and be removed from participant list if it is serious.

There is another server with exactly same specification dedicated for benchmarking your work submitted. So use the development server for development and testing, use benchmark server, via web portal, for real benchmark score.

FAQs

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WHAT IS THE RECOMMENDED DEVELOPMENT ENVIRONMENT?

☞ You are recommended to work in Linux. The recommended languages are C/C++, Python3 and Bash.

The OS installed on the servers is CentOS Linux release 7.7.1908 (AltArch). The system compiler is GCC 4.8.5, with alternative GCC 10.2.0 installed as well. Both python 2.7.5 and 3.6.8 have been installed, but we recommend Python3. In order to fully utilizing the computing resources available on the servers, it is expected you will invoke other libraries, e.g. OpenMP, for parallelization, and more efficient matrix operation, e.g. OpenBLAS

WHAT SHOULD I BEWARE OF WHEN SUBMITTING JOB?

☞ In order to automate the benchmarking process, you are required to structure your submission and output following certain rules. These will be communicated with you via emails. Once the code is submitted, a sanity check will be done first. If the test passes, your work will be put on the job queue for benchmarking. The run result will be sent back to you via email. A time limit will be set for each run to avoid job queue congestion.

In order to get accurate benchmark score, each submission will be run three times to get average score. This will take a while. Also, submission is limited to 24 times per day. So don’t wait until the last minute to submit your work as you may miss the deadline. There is no limit on the total number of submissions you can upload during the challenge period.

Annex: Details about Kunpeng 920 4826 – HiSilicon

Kunpeng 920 4826 is a octatetraconta core 64 bit ARM server microprocessor introduced by HiSilicon in early 2019. Fabricated by TSMC on a 7nm HPC process based on the TaiSHan v110 microarchitecture, this chip incorporates 48 cores operating at 2.6 GHz with a TDP of 150 W. This chip supports up to 1 TiB of octa channel DDR4 2933 memory.

Cache:

Cache Organization

L1$	6 MiB	L1I$	3 MiB	48x64 KiB
		L1D$	3 MiB	48x64 KiB
L2$	24 MiB			48x512 KiB
L3$	48 MiB			48x1 MiB

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Annex: Details about Kunpeng 920 4826 – HiSilicon

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Memory controller:

Integrated Memory Controller	
Max Type	DDR4 2933
Supports ECC	Yes
Max Mem	1 TiB
Controllers	1
Channels	8
Width	64 bit
Max Bandwidth	190.7 GiB/s
Bandwidth	**Single** 23.84 GiB/s **Double** 47.68 GiB/s **Quad** 95.37 GiB/s **Octa** 190.7 GiB/s

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Annex: Details about Kunpeng 920 4826 – HiSilicon

Features:

Supported ARM Extensions & Processor Features

NEON	Advanced SIMD extension
CRC32	CRC 32 checksum Extension
Crypto	Cryptographic Extension
FP16	ARMv8.2 A half precision floating point extension
RAS	Reliability, Availability, and Serviceability extension

Expansion options:

Revision: 4.0

PCIe Max Lanes: 40

Configuration: x16, x8, x4

USB **Revision:** 3.0 **Max Ports:** 4

SATA **Revision:** 3.0 **Max Ports:** 2

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Annex: Details about Kunpeng 920 4826 – HiSilicon

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Facts about "Kunpeng 920 4826 HiSilicon"

Has subobject	Kunpeng 920 4826 HiSilicon#pcie
base frequency	2,600 MHz (2.6 GHz, 2,600,000 kHz)
core count	48
core name	TaiShan v110
designer	HiSilicon and ARM Holdings
die count	3
family	Hi16xx
first announced	April 26, 2019
first launched	April 26, 2019
full page name	hisilicon/kunpeng/920 4826
has ecc memory support	true
instance of	microprocessor
is multi chip package	true
isa	ARMv8.2
isa family	ARM
l1$ size	6 MiB (6,144 KiB, 6,291,456 B, 0.00586 GiB)
l1d$ size	3 MiB (3,072 KiB, 3,145,728 B, 0.00293 GiB)
l1i$ size	3 MiB (3,072 KiB, 3,145,728 B, 0.00293 GiB)
l2$ size	24 MiB (24,576 KiB, 25,165,824 B, 0.0234 GiB)
l3$ size	48 MiB (49,152 KiB, 50,331,648 B, 0.0469 GiB)
ldate	April 26, 2019

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Annex: Details about Kunpeng 920 4826 – HiSilicon

Facts about "Kunpeng 920 4826 HiSilicon"

manufacturer	TSMC
market segment	Server
max CPU count	4
max memory	1,048,576 MiB (1,073,741,824 KiB, 1,099,511,627,776 B, 1,024 GiB, 1 TiB)
max memory bandwidth	190.7 GiB/s (331.818 GB/s, 195,276.8 MiB/s, 0.186 TiB/s, 0.205 TB/s)
max memory channels	8
max sata ports	2
max usb ports	4
microarchitecture	TaiShan v110
model number	920 4826
name	Kunpeng 920 4826
series	920
smp max ways	4
supported memory type	DDR4 2933
tdp	158 W (158,000 mW, 0.212 hp, 0.158 kW)
technology	CMOS
thread count	48
transistor count	20,000,000,000
used by	HiSilicon D06, TaiShan 5280, TaiShan 5290 and TaiShan X6000
word size	64 bit (8 octets, 16 nibbles)

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Good Luck!