HPC Ranking Based on Real Applications

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National Science Foundation WHERE DISCOVERIES BEGIN

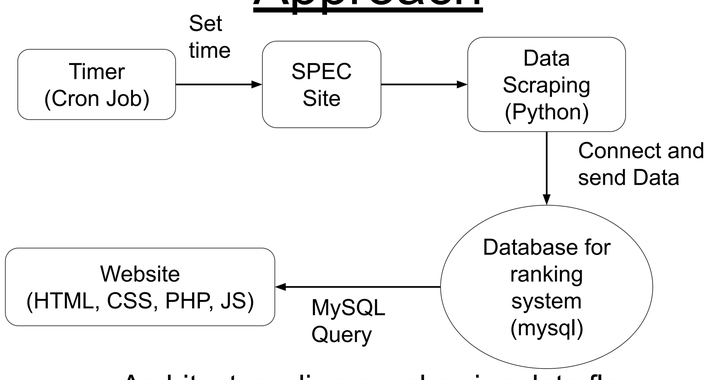
Introduction

Performance benchmarks are used to stress test hardware and software of large scale computing systems. A corporation known as SPEC has developed a benchmark suite, SPEC ACCEL, consisting of test codes representative of kernels in large applications. This project ranks the published results from ACCEL based on different criteria. The goal is to prepare a ranking website for the work-in-progress real-world SPEC HPG benchmark suite, HPC2021 that will soon be released (time frame 2020-2021).

Project Goals

- Organize and display HPC systems based on SPEC ACCEL benchmarks suite
- Compare HPC systems more holistically
- Enable visualization of the differences between each HPC system
  - **Base & Peak score**: Denotes the default benchmark output and optimized benchmark output.
  - **Hardware speed and size**: Shows their impact on benchmark performance.
  - **Developers**: Vendors such as Intel, NVIDIA, AMD, etc., which allows the end-user to see who they may choose to buy parts from.
  - **Location**: Where are the HPC systems hosted

Approach



Architecture diagram showing data flow

Cron Job:

- Runs web-scraper periodically

Web-Scraper:

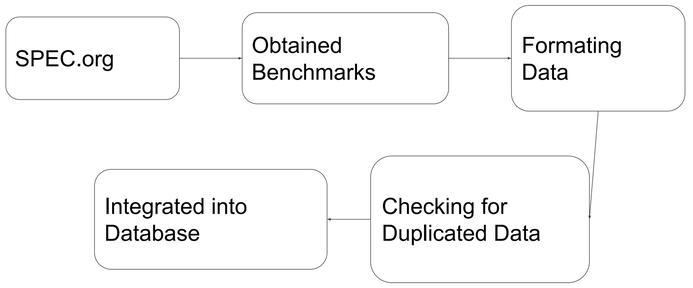
- Takes data from SPEC.org website
- Organizes and formats data
- Inputs benchmark data into database

MySQL Database:

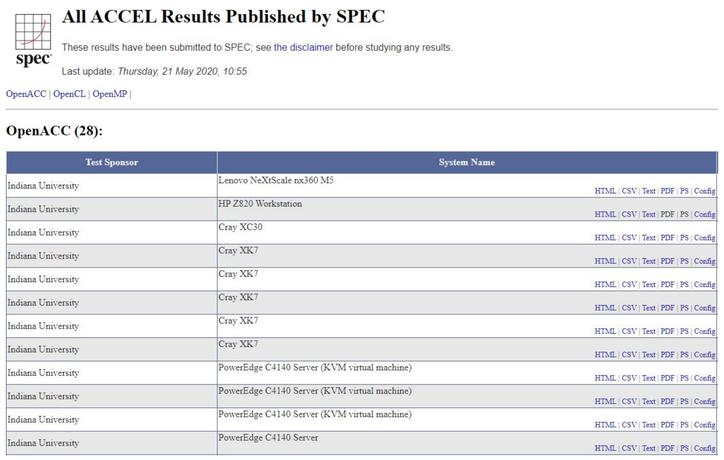
- Easy-to-use
- Large documentation for use with websites

Data is taken from the SPEC.org website, condensed and formatted, and transferred into the database.

Data Flow



- Visualization of the data movement within the web-scraper.
- Cron job triggers the web-scraper to move necessary data from SPEC.org to the database.



All ACCEL Results Published by SPEC

These results have been submitted to SPEC, see the disclaimer before studying any results.

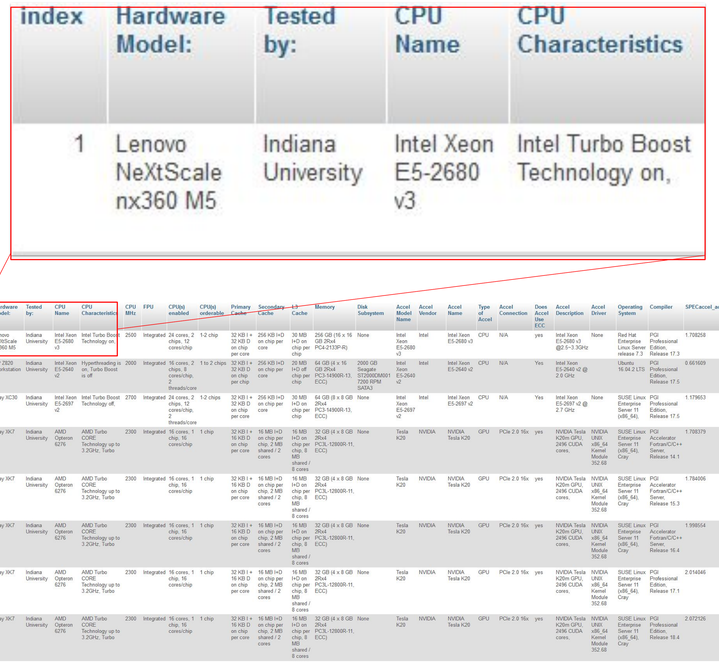
Last update: *Thursday, 21 May 2020, 10:55*

OpenACC | OpenCL | OpenMP |

OpenACC (28):

Test Sponsor	System Name
Indiana University	Lenovo NeXtScale nx360 M5 HTML | CSV | Text | PDF | PS | Config
Indiana University	HP Z820 Workstation HTML | CSV | Text | PDF | PS | Config
Indiana University	Cray XC30 HTML | CSV | Text | PDF | PS | Config
Indiana University	Cray XK7 HTML | CSV | Text | PDF | PS | Config
Indiana University	Cray XK7 HTML | CSV | Text | PDF | PS | Config
Indiana University	Cray XK7 HTML | CSV | Text | PDF | PS | Config
Indiana University	Cray XK7 HTML | CSV | Text | PDF | PS | Config
Indiana University	Cray XK7 HTML | CSV | Text | PDF | PS | Config
Indiana University	PowerEdge C4140 Server (KVM virtual machine) HTML | CSV | Text | PDF | PS | Config
Indiana University	PowerEdge C4140 Server (KVM virtual machine) HTML | CSV | Text | PDF | PS | Config
Indiana University	PowerEdge C4140 Server (KVM virtual machine) HTML | CSV | Text | PDF | PS | Config
Indiana University	PowerEdge C4140 Server HTML | CSV | Text | PDF | PS | Config

- The snapshot partial image of the original benchmarks organized on **SPEC.org**.
- All the results are located within different locations CSV, text, and other files.
- The scraper looks into each CSV file and takes the appropriate benchmark to copy into a table.

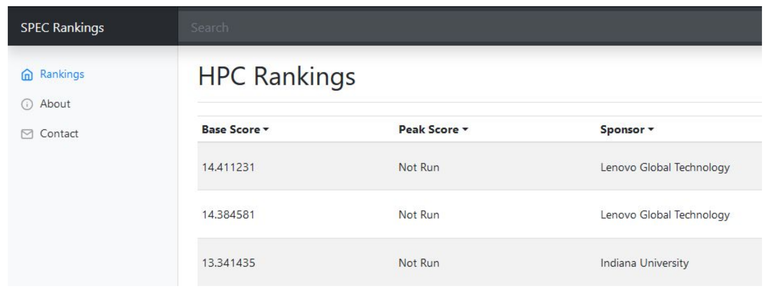


index	Hardware Model:	Tested by:	CPU Name	CPU Characteristics
1	Lenovo NeXtScale nx360 M5	Indiana University	Intel Xeon E5-2680 v3	Intel Turbo Boost Technology on,

- After being scraped the benchmarks are organized and inserted into a MySQL database which is shown above.
- This visual is from **PHPMyAdmin**, which allows for the data to be easily accessed to display on the website.

Results

The following design demos a simplistic view:



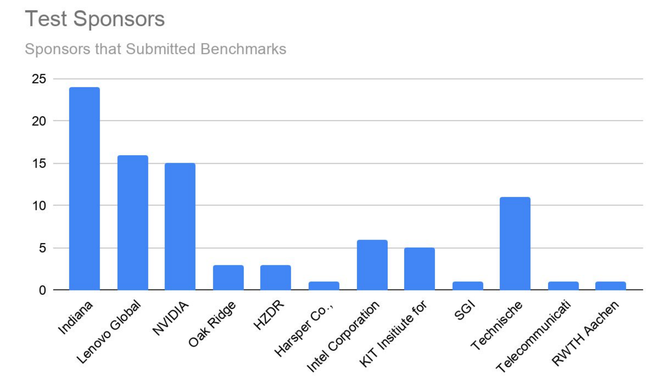
Key features of the website are as follows:

- A **filter** button, which allows for the changing of which default columns are shown.
- A **search** function, which allows for computers, locations, etc. to be searched for and displayed.
- **More information** for each HPC, which is shown by clicking on the sponsor & name. This shows every computer specification.
- A **contact** page, which allows for the user to provide feedback about features or errors on the website.
- An **about** page, which shows background information about the website.

The website shows the **key specifications** of each HPC system while giving the user tools to delve deeper into each one.

Future Work

- The methods and approaches will be applied to the upcoming new benchmark suite from SPEC, i.e. SPEC HPC2021
- When needed, the data can easily be tweaked through PHPMyAdmin, as the data output from SPEC is not always standardized.
- **Other benchmarks** besides SPEC can also be implemented into the website. For example, the **SPEC CPU 2017** benchmark, which specifically focuses on a system's CPU performance, could be added.



- Finally, **informative graphs** could be added to the website. These graphs would provide another means to visualizing data, allowing for data to be simply compared. For example, the image above shows a graph comparing test sponsors.

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