Part 1: Registration

Created: 06/03/2018 • Last updated: 06/04/2018

Please complete this form to register as an official nominee of the 2018 Broadcom MASTERS competition. The content in Part 1 is not used in evaluation. Please note that this section contains a second page.

Student/Parent Information

STUDENT INFORMATION

* Required Field

Student First Name*	Nathaniel
Student Middle Name	Matthew Fish
Student Last Name*	Waterman
Student Preferred Name/Nickname	Nathaniel
Student Email Address*	nmfwaterman@gmail.com
Student Phone Number (xxx-xxx-xxxx)	(No response)
Date of Birth (mm/dd/yyyy)*	07/19/2004
Sex	Male
Ethnicity	(No response)
Race	(No response)
T-shirt Size (adult sizes)*	Large
If you are selected as one of the Top 300 MASTERS or 30 finalists, do we have permission to share your contact information with your members of Congress?*	Yes

Mailing Address

Street Address 1*	40 Tolman St.
Street Address 2	(No response)
City*	Sharon
State*	MA
Zip Code*	02067

PARENT/GUARDIAN INFORMATION

This information will be used after the application has closed. You may enter the same adult listed in the Designated Adult section, or you may choose a different parent or guardian.

Parent/Guardian First Name*	Jennifer
Parent/Guardian Last Name*	Waterman
Parent/Guardian Relationship to Entrant	Mother
Parent/Guardian cell phone number (xxx-xxx-xxxx)*	339-364-9932
Parent/Guardian home phone number (xxx-xxx-xxxx)	(No response)
Parent/Guardian Email Address*	jenniferwaterman1@comcast.net
*If you are applying from one of our DOD fairs, please enter a US phone number above and your international phone number here	(No response)

Teacher/Science Fair Information

SCHOOL INFORMATION

Name of Current School (2017/2018 academic year)*

*If your school is not listed, please email **masters@societyforscience.org** with the name and address of your school and we will add it to the list. You can search for your school by typing in the name or the zip code. Home schooled students should select "Home School."

Sharon Middle School, Sharon, MA, 02067

Type of School* Public

School Address

Street Address 1*	75 Mountain Street
Street Address 2	(No response)
City*	Sharon
State*	MA
Zip Code*	02067

Identify the teacher who has most supported your science or engineering project. This teacher MUST be a middle school teacher, a middle school informal science program educator, or a middle school homeschooling instructor. Your teacher receives application reminders and notifications from The Society, and receives notification if you are selected as one of the 30 finalists or Top 300 MASTERS. This teacher will receive awards if you advance to the Top 300 MASTERS or finalist level. You will not be permitted to change the teacher listed here after the application deadline.

Teacher Information

Teacher Prefix	(No response)
Teacher First Name*	Gregory
Teacher Last Name*	Warren
Teacher Email Address*	g_warren@sharon.k12.ma.us

Principal Information

Title	Principal
Principal First Name*	Kevin
Principal Last Name*	O'Rourke
Principal Email Address*	k_orourke@sharon.k12.ma.us

SCIENCE FAIR INFORMATION

You were nominated for the Broadcom MASTERS by USMA01. Did you receive a second nomination from another science fair?*

No

Is this a team project?*

No

Just a friendly reminder: each member of a team project needs to submit his/her own independent application in his/her own words.

If you worked on a team, please list the name(s) of your team member(s). If you did not work on a team, please leave this question blank.

	First Name	Last Name
Team Member #1		

	First Name	Last Name
Team Member #2		

Are you an alumnus of the Broadcom MASTERS program?*

This is my first year receiving a nomination! (Awesome!)

Part 2: Project Information

Last updated: 06/03/2018

This is your chance to tell us about your awesome science or engineering project in your own words. If you are feeling stumped, take a look at your science fair board for inspiration. This section is designed to feel like a judging interview at your science fair.

Project Title/Team info

Select a category that best describes your project*:

These categories might differ from the categories at your local science fair. Here's a helpful hint to help you choose: think about what type of scientist or educator would best understand your project.

Computer Science & Software Engineering

Project Title*

This is how your project title will appear in our materials if you are select to the top 300 or top 30.

HFetch: A User-Friendly API Client for the Schoology LMS

What is your current grade (2017/2018 academic year)*?

8th

Remind us, is this a team project*?

Just a reminder that each member of a team must submit his/her own application in his/her own words.

No

What was the inspiration for your science or engineering project? Please describe if there was a personal experience, challenge or individual(s) that inspired your choice of this project.* (max. 100 words)

The challenge to remember homework was my inspiration.

Project Reflections

TELL US ABOUT YOUR SCIENCE FAIR PROJECT

What was your research question? For engineering projects: what was the human need or problem you wanted to solve?* (max. 50 words)

Problem: Students forget to check for homework posted on Schoology.

What was your scientific hypothesis or engineering design criteria?* (max. 125 words)

Design Criteria: The design must
1) Retrieve homework assignments from Schoology
2) Be able to be integrated into other programs easily
3) Be able to run on MacOS

Explain your methodology and procedures for carrying out your project in detail, addressing the questions below. *
For engineering projects, explain your methods and procedures for building your design, addressing the questions below (max. 400 words).

1) How did you collect your data? For engineering projects, how did you build your design?
2) What were your testing procedures? For engineering projects, how did you test your design?
3) Discuss your control group and variables tested. For engineering projects, discuss the controls and variables tested in your design.

I wrote HFetch over the course of several weeks, testing the basic functionality by frequently running it and the integrability by integrating it into my pre-existing reminder systems. I tested the program on varying operating systems, amounts of assignments, and assignment titles.

How did you analyze and interpret your data?* (max. 300 words)

Use this section to write about the process of analyzing and interpreting your data. You will have an opportunity to share charts, tables, graphs, photos, etc. containing your data in a ONE (1) page PDF document later in this application. For engineering projects, this question still applies. Tell us HOW you formed your conclusions through observation and any special analysis used.

As this is a computer program, there wasn't much useful quantitative data to collect, but the qualitative data of user friendliness most certainly increased as the program went from unreliable and unusably ugly when the first working iteration was completed to idiot-proof after weeks of improvement.

What conclusions did you reach? Why? How does your data support this conclusion?* (max. 250 words)

The frequency of uncaught exceptions has decreased to zero, showing that the end result definitely works, but more importantly, it is easy to use and integrate into other programs, as demonstrated in its successful and integration into programs and use by its users.

TELL US WHAT YOU LEARNED FROM YOUR PROJECT

Did questions or problems arise that you were not expecting? How would you adjust your experimental design or your engineering design process to address these problems?* (max. 150 words)

A few lessons were learned while designing HFetch:
When testing the shell script, it was discovered that requests to the server
must be sent with increments of at least 1 second, as the PHP time() function returns the time in seconds, not milliseconds. The program was adjusted such that it retries a request if it fails and waits one second between requests.

Also, when the API credentials on disk became corrupted (somehow), jq failed to parse the server's responses due to them being error messages instead of JSON. It took much troubleshooting to find that the root of the problem was not jq, but a credential issue. The program was adapted to easily handle such issues.

The shell script uses jq to parse the JSON from the API, but since jq is not installed by default on MacOS, it had to be installed during setup. However, as MacOS does not have a package manager, the package manager Homebrew had to be installed in order to install jq! The program was modified and the GUI application now attempts to install Homebrew.

Where did you conduct your experimentation?*

Please select all that apply.

- Home
- School

A science or engineering project is never a solitary activity. Tell us who contributed to your research and what resources did they bring to your project:* (max. 250 words)

- Where and how did you conduct your research? What special equipment did you use?
- Who supervised and/or collaborated with you on your research (i.e. parents, teachers, mentors, peers?) What were their contributions?
- Were there others who helped you perform your research who you wish to tell the evaluators about?

My parents helped me brainstorm an idea, but nobody I know knows bash, so no-one else particularly contributed to the development except my friend who tested the GUI.

What did you learn from conducting and presenting your science fair project?* (200 word maximum)

Please consider addressing the following points in your answer:
· What lessons did you learn from doing your project?
· What lessons did you learn from presenting your project?
· What question would you ask next or engineering project would you pursue if you chose to continue exploring this topic?

A few lessons were learned while designing HFetch:
When testing the shell script, it was discovered that requests to the server
must be sent with increments of at least 1 second, as the PHP time() function returns the time in seconds, not milliseconds.

Also, OAuth was found to be uncompromising in security - when the API credentials on disk became corrupted (somehow), jq failed to parse the server's responses due to them being error messages instead of JSON. It took much troubleshooting to find that the root of the problem was not jq at all, but a credential issue.

The shell script uses jq to parse the JSON from the API, but since jq is not installed by default on MacOS, it had to be installed during setup. However, as MacOS does not have a package manager, the package manager Homebrew had to be installed in order to install jq!

I also learned about what a RESTful API is, and how HTTPS works in general.

In the future, a user interface should be created for Linux as the current one is written in AppleScript, new versions of this program should be created for Windows and iOS, and a similar client for the Powerschool API (used to store and manage grades) should be created or added as a part of HFetch.

If you were a member of a team project, please explain your role in researching, developing and presenting your project. Describe how work was divided among your team. (max. 150 words)

(No response)

Part 3: Essay Questions

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This section provides you with an opportunity to tell us more about you and your thoughts about science, technology, engineering and math (STEM) as they relate to your project and in general.

Select one (1) question in each of the three sections: About My Project, About Me, and Solve a Problem, then compose your answers in the resulting text boxes.

About My Project (please select ONE question, then answer in the text box below):

Submit an abstract for your project (250 words or less).

About My Project:

Schoology is popular and powerful, but it takes time to check for homework posted there. This was the reason for designing HFetch, which uses a RESTful API to fetch, display, and provide details about assignments from Schoology in 2 clicks, or 1 if it is launched automatically.

The introduction to Schoology’s API documentation mentions that there were no Schoology API clients at the time it was written, but an implemen- tation in Java was found on GitHub (rvanasa/schoology-api). I intend to inform you about HFetch, seemingly the second such API client.

About Me (please select ONE question, then answer in the text box below):

What things do you do everyday that you wish were automated? Tell us about a device you might invent to tackle one of these issues and why it would be helpful. (max. 250 words)

About Me:

Each day, I try to remember to check for homework that my teachers have posted on Schoology. Occasionally, I forget. When this happens, and my grades suffer needlessly. It would be really nice if I had some sort of computer program that would automatically check it for me...

Solve a Problem (please select ONE question, then answer in the text box below):

In a 2012 report, the National Oceanic and Atmospheric Administration (NOAA) predicated that by 2100 sea levels will have risen somewhere between 8 inches and 6.6 feet. What are some challenges you can foresee being created if sea levels rise by 3 feet? What would you suggest to combat these issues? (max. 300 words)

Solve a Problem:

If sea levels rise by even 3 feet, there will be terrible consequences. Not only will most beaches be reduced to thin strips of seaside sand, other coastal areas will flood, destroying habitats for animals and humans. The humans will be able to move, but relocation is expensive, especially when entire coastal cities are doing so. The permeation of land with rising saltwater will also cause increased erosion, contaminate aquifers and soil, making farming in coastal areas impossible. To stop this from occurring, we must switch completely from fossil fuels to green energy and plant more plants in order to convert the carbon dioxide in the atmosphere back to oxygen.

Part 4: Personal Interests

Last updated: 06/04/2018

Tell us a about yourself as an individual, apart from your science fair project and your thoughts on science or engineering. Share information that will help us get to know you better.

Check activities in which you are currently or have been involved:

Check all that apply

- Computer Club
- Music (instrument or choir)
- Robotics
- Science/Math Olympiad
- Science or Engineering Summer Camp (list name of camp): College Academy
- Student Council
- Foreign Language studies (list language): French

Which instrument? (select all that apply)

- Piano
- Guitar

What hobbies or extra-curricular activities do you most enjoy and why? (max. 100 words)

I particularly enjoy automating various annoying tasks on my MacBook using bash. It's satisfying to create something that's functional and useful.

Tell us about a time you worked in a team. In your opinion, what is the most important trait of a successful team? (max. 150 words)

Once, I wrote a miniature movie plot with a team, completely sans bickering. It was wonderful and productive, as the best thing about a team is a separation of argument and work – the team should never be arguing while working, only one or the other.

Is there additional information that you wish to share with the judges to help them better know you as an individual and what is personally important to you? Future goals, favorite topics, accomplishment of which you are most proud, etc.-- this is your chance to share anything (max. 100 words)

I'm quite proud of all the bash I've learned and the things that I've made with it.

Which one of the following STEM careers are you most interested in pursuing?

Please note-- careers will display below in random order. To find a specific career, click inside the box and type the name. If it's included in the list, the career will appear in blue.

Computer Scientist

Why does this career interest you? (max. 100 words)

I enjoy programming.

Science Fair Paperwork Wizard

Last updated: 06/04/2018

Where did you conduct your lab work? (check all that apply)	Home School
Check all aspects among the following that were used in your research (must select at least one):	None of the above

If you have checked any of the aspects above, EXCEPT the last option "None of the above," your project may have required pre-approval by a Scientific Review Committee (SRC) or Institutional Review Board (IRB). Please upload copies of any forms your science fair or school required to approve your research, and answer the questions below.

Many fairs use the Intel ISEF approval forms (Form 1A, 1B and other supplemental forms); however some fairs have their own local equivalent. Please see the Intel ISEF Rules for clarification: https://student.societyforscience.org/international-rules-pre-college-science-research

If you checked "None of the above," you do not need to submit any forms.

Please do not upload supplemental essays, abstracts, links, or documents about your project, as only the written information in your application will be reviewed

Thank you! You do not need to submit any paperwork to Broadcom MASTERS for additional review. We recommend that you save copies of any paperwork you may have completed for your personal records.