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Some Past Presentations:

Open Source and Free Software
Protecting Your Identity
Keeping Mobile Devices Secure
3D Printing, ENABLE project
Flash Drives-Not Just for Storage
Features, Mac OS X & Windows
Tablets, the Programs and Uses
Personal Finance Software
Amazing Browser Tips
Linux is Like Cars
Close up Photography



The Rochester Computer Society, Inc.
a computer/tech club open to everyone

MONITOR

Vol. 36, No. 07

July 2018

Tues, July 10

Presentation on Drones

by Brian Pitre, co-founder of SkyOp

Tues, August 14

Our Annual Club Picnic, Henrietta Town Park

Tues, October 9, Cyber Awareness Month

presentation by Norbert (Bob) Gosticha, via Zoom

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IBM, Department of Energy Unveil World's Fastest Supercomputer

By Ryan Whitman on June 8, 2018

The US pioneered work in supercomputers decades ago, but the most powerful systems have resided in China for several years. That's changing today with the unveiling of Summit, a new supercomputer from IBM and the US Department of Energy's Oak Ridge National Laboratory (ORNL). It's an order of magnitude more powerful than current US supercomputers



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Special Interest Group

Linux Sig

The workshop is the **third Saturday of each month**, at Interlock Rochester, 1115 East Main St.



www.interlockroc.org

Enter through door #7 on the end of building, near *Comics Etc* and Goodman St. Find 'Interlock' on the intercom directory to get buzzed in and go upstairs to suite #200. We have experts on hand to fix problems and answer questions about Linux and FOSS (free and open source software). Bring your system in so we can help you get the most out of it. Hope to see you there.

Free, Virtual Technology Conferences, ONLINE

presented by APCUG

Saturdays: 8/18, 11/3

For Conference Description & Registration Links, go to apcug2.org/category/virtual-tech-conference

train and operate neural networks and process massive data sets. IBM and Oak Ridge National Laboratory expect scientists to clamor for time on the new supercomputer. ORNL says Summit already has a full schedule including work on cancer research, fusion energy, and addiction treatment.

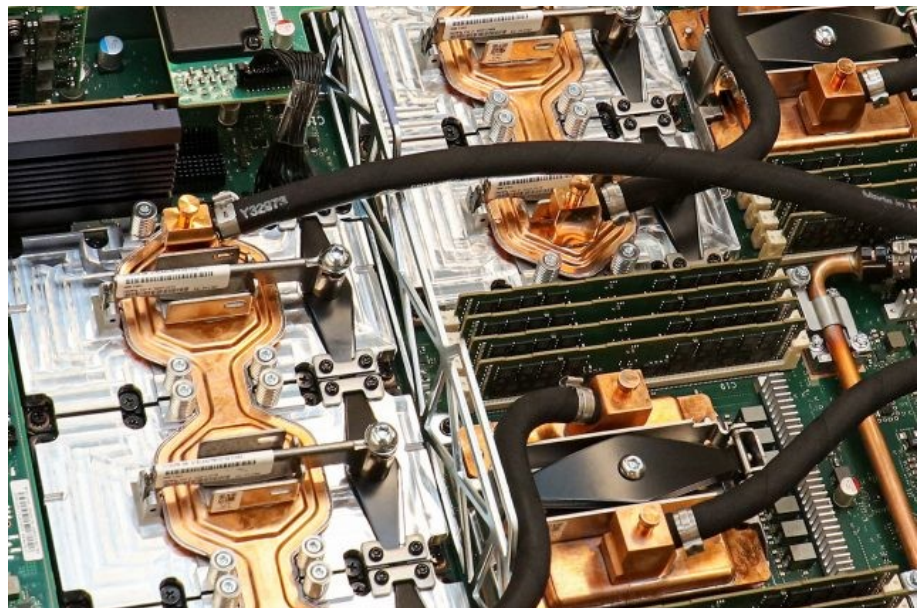
and fast enough to beat every other system in the world with a theoretical peak performance of 200 petaflops per second. More than that, it has the hardware to support machine learning and artificial intelligence processing on a previously unheard of scale.



ORNL has spent the last couple years building Summit because of how ludicrously complex and powerful it is. Summit consists of 4,608 compute servers, each of which packs some serious processing power. A single server in the Summit array has two IBM Power9 CPUs with 22 processing cores. That's over 200,000 CPU cores across all of Summit, and they're paired with more than 10 petabytes of RAM.

Each server in Summit also contains six Nvidia Tesla V100 GPUs, which are data center chips based on the Volta architecture (i.e. you can't pop one in your PC). That works out to 27,648 individual GPUs powering Summit. These GPUs include dedicated Tensor Core hardware for machine learning as well. According to Nvidia, the GPUs in Summit account for 95 percent of its processing capacity.

The raw processing power isn't the only thing that makes Summit impressive. The AI-enabled hardware of Summit will allow researchers to



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Planning Meeting

Held on 1st Tuesday of each month
at 7 pm, at St. John's Meadows,
Briarwood building.

Newsletter Printing

The newsletter was printed at St
John's/Chestnut Court by the
printing group, with the help of
Don Wilder (computer and printer
operator). *We will try and print on
the 1st or 2nd Thursday morning,
following the monthly meeting.*

The previous top supercomputer in the US, known as Titan, is also an ORNL project. This machine features an Nvidia GPU in every node, which was unusual at the time. It has a peak performance of about 27 petaflops per second. The top supercomputer on Earth before Summit was the Chinese Sunway TaihuLight system. It has a max capacity of 125 petaflops per second. At 200 petaflops, Summit beats it by a comfortable margin.

The Department of Energy is also working on a smaller version of Summit called Sierra. This supercomputer will have "only" four V100 GPUs per node for a maximum processing capacity of around 125 petaflops. Sierra should be online at Lawrence Livermore National Laboratory later this year.

Reported on www.extremetech.com and many other websites.

Be Prepared

By Ken Goodman
Central Kentucky Computer Society

It's happened to many of us. We've made a mistake, hardware crashes or an update causes our PC to go south. You never know when it will happen, but it does. I've developed a plan for just those occasions that helps make the recovery easier.

The first step is an image backup. This allows you to recover the entire system if your hard drive crashes or it is corrupted. Most external hard drives have a program that will do this, or you can use a program such as Acronis Backup. Make sure that you have the backup recovery program saved some place safe so that you can recover the system.

The next step is a second backup, this time of all my personal files. I prefer this to be stored in the cloud. This can get a few, or all my documents, pictures, music, etc. back when I recover. If you own Microsoft Office 365 you have a large cloud repository on One Drive. If not, there is Google Drive, Dropbox, etc. You can also use the windows built-in backup File History available in the Setting app.

Once I have all my backups in place, I create two additional resources. These are a copy of all my currently installed or saved software I have downloaded. I set up a library in file manager called Software and move my downloaded software to it. I categorize the library into folders. They include Applications, Internet or Online, Games, Graphics or Pictures, Multimedia or Music & Video, and Tools or Utilities. I also make sure that this library is backed up with my personal files.

The second of these resources is a catalog of all my software keys. Have you ever tried to install a program on your new computer and lost the key? If so, you understand that this will save you from repurchasing the program. I keep this information in two places. The first is a loose-leaf binder labeled 'Software

Bible' with A- Z indexes. When I receive a key for a piece of software, I print the email and the file sheet(s) in my binder under the programs name. The second place I store this information is in a saved folder on my e-mail account. My primary email is setup as 'imap' so that it retains the emails I do not delete in the cloud as well as bringing it into my commuter through my e-mail program. I can then use my e-mail to search for the program and retrieve the key. If that doesn't work I have the 'Software Bible' as a backup.

I hope this will help you to be prepared for an emergency or a new computer.

From the February 2018 issue, CKCS newsletter, www.ckcs.org, newsletter@ckcs.org.

Activity Simulator Could Eventually Teach Robots Tasks Like Making Coffee or Setting the Table

Source:

Massachusetts Institute of Technology, Computer Science and Artificial Intelligence Laboratory (CSAIL)

Summary:

Recently, computer scientists have been working on teaching machines to do a wider range of tasks around the house. Researchers demonstrate 'VirtualHome,' a system that can simulate detailed household tasks and then have artificial 'agents' execute them, opening up the possibility of one day teaching robots to do such tasks.

A system developed at MIT aims to teach artificial agents a range of chores, including setting the table and making coffee.



Recently, computer scientists have been working on teaching machines to do a wider range of tasks around the house. In a new paper spearheaded by MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) and the University of Toronto, researchers demonstrate "VirtualHome," a system that can simulate detailed household tasks and then have artificial "agents" execute them, opening up the possibility of one day teaching robots to do such tasks.

The team trained the system using nearly 3,000 programs of various activities, which are further broken down into subtasks for the computer to understand. A simple task like "making coffee," for example, would also include the step "grabbing a cup." The researchers demonstrated VirtualHome in a 3-D world inspired by the Sims video game.

The team's AI agent can execute 1,000 of these interactions in the Sims-style world, with eight different scenes including a living room, kitchen, dining room, bedroom, and home office.

"Describing actions as computer programs has the advantage of providing clear and unambiguous descriptions of all the steps needed to complete a task," says PhD student Xavier Puig, who was lead author on the paper. "These

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Computer Recycling

Some Residential Drop off Locations: **Call first**, to find out what is accepted, especially for 'tube type' tvs or monitors.

Deeley IT

---(Pittsford), 585-381-3100

Tech Source

---(Rochester), (585) 789-1785

Stereo Shop

----(Webster), 585-787-7467

Certified Document

Destruction & Recycling, accepts electronic waste, but charges 40 cents/pound for crt type monitors. Located in Rochester at 1133 Emerson St, 482-9400, www.cdd-r.com

TSC Computer & Electronics Repair, accepts most electronic waste, including printers. Does not accept crt type monitors or tvs. They are located at 765 Elmgrove Road, Gates. 429-6880, www.tscelectronics.com

programs can instruct a robot or a virtual character, and can also be used as a representation for complex tasks with simpler actions."

The project was co-developed by CSAIL and the University of Toronto alongside researchers from McGill University and the University of Ljubljana. It will be presented at the Computer Vision and Pattern Recognition (CVPR) conference, which takes place this month in Salt Lake City.

How it works

Unlike humans, robots need more explicit instructions to complete easy tasks -- they can't just infer and reason with ease.

For example, one might tell a human to "switch on the TV and watch it from the sofa." Here, actions like "grab the remote control" and "sit/lie on sofa" have been omitted, since they're part of the commonsense knowledge that humans have.

To better demonstrate these kinds of tasks to robots, the descriptions for actions needed to be much more detailed. To do so, the team first collected verbal descriptions of household activities, and then translated them into simple code. A program like this might include steps like: walk to the television, switch on the television, walk to the sofa, sit on the sofa, and watch television.

Once the programs were created, the team fed them to the VirtualHome 3-D simulator to be turned into videos. Then, a virtual agent would execute the tasks defined by the programs, whether it was watching television, placing a pot on the stove, or turning a toaster on and off.

The end result is not just a system for training robots to do chores, but also a large database of household tasks described using natural language. Companies like Amazon that are working to develop Alexa-like robotic systems at home could eventually use data like this to train their models to do more complex tasks.

The team's model successfully demonstrated that, their agents could learn to reconstruct a program, and therefore perform a task, given either a description: "pour milk into glass," or a video demonstration of the activity.

"This line of work could facilitate true robotic personal assistants in the future," says Qiao Wang, a research assistant in arts, media, and engineering at Arizona State University. "Instead of each task programmed by the manufacturer, the robot can learn tasks just by listening to or watching the specific person it accompanies. This allows the robot to do tasks in a personalized way, or even some day invoke an emotional connection as a result of this personalized learning process."

In the future, the team hopes to train the robots using actual videos instead of Sims-style simulation videos, which would enable a robot to learn simply by watching a YouTube video. The team is also working on implementing a reward-learning system in which the agent gets positive feedback when it does tasks correctly.

"You can imagine a setting where robots are assisting with chores at home and can eventually anticipate personalized wants and needs, or impending action," says Puig. "This could be especially helpful as an assistive technology for the elderly, or those who may have limited mobility."

Reported by www.sciencedaily.com, May 30 2018. Material provided by MIT CSAIL.

Tidbits of probably useless information

Forest fires move faster uphill than downhill.

Almost half the newspapers in the world are published in the United States and Canada.

The two-foot long bird called a Kea that lives in New Zealand likes to eat the strips of rubber around car windows.

Most lipsticks contain fish scales.

Skepticisms is the longest word that alternates hands when typing.

One ragweed plant can release as many as one billion grains of pollen.

What's the Difference between a Hub, a Switch, and a Router?

Hubs, switches, and routers are all computer networking devices with varying capabilities. Unfortunately, the terms are also often misused.

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What's the difference between a hub, a switch, and a router?

In a word, intelligence.

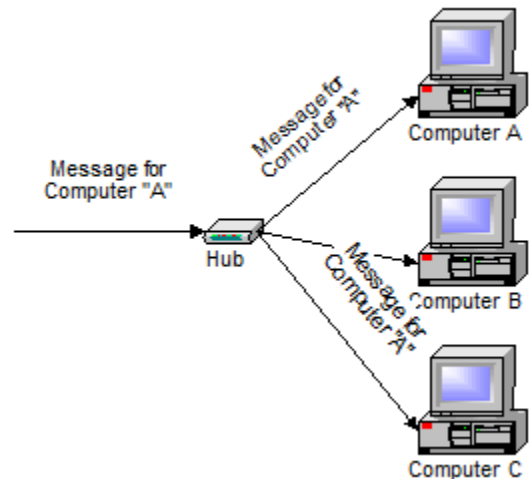
Hubs, switches, and routers are all devices that let you connect one or more computers to other computers, networked devices, or even other networks. Each has two or more connectors called ports into which you plug in the cables to make the connection. Varying degrees of magic happen inside the device and therein lies the difference. I often see the terms misused, so let's clarify what each one really means.

Hubs

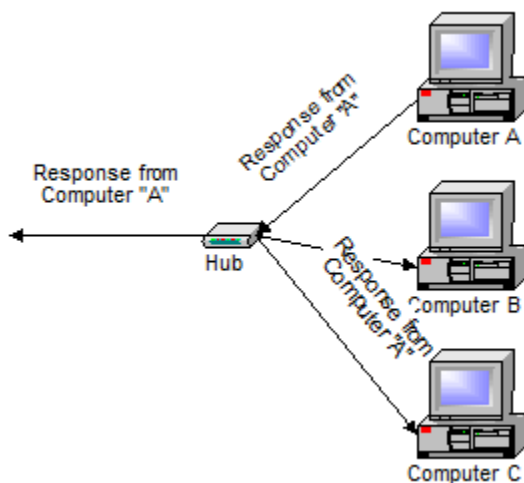
A **hub** is typically the least expensive, least intelligent, and least complicated of the three. Its job is very simple – anything that comes in one port, is sent out to the others.

That's it.

If a message comes in for computer "A", that message is sent out all the other ports, regardless of which one computer "A" is on:



And when computer "A" responds, its response also goes out to every other port on the hub:



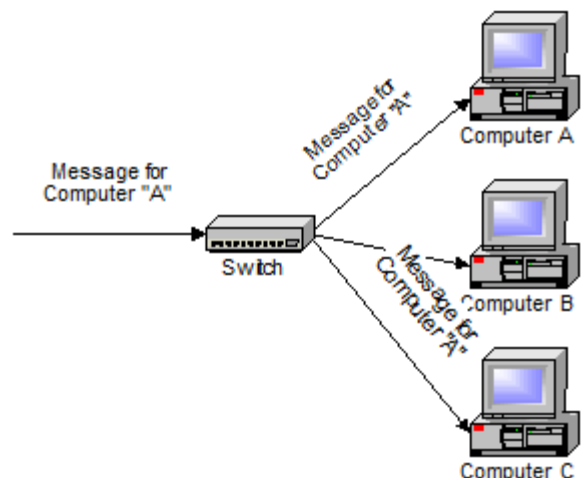
Every computer connected to the hub "sees" everything that every other computer on the hub sees. The computers themselves decide if they are the targeted recipient of the message and when a message should be paid attention to or not.

The hub itself is blissfully ignorant of the data being transmitted. For years, simple hubs have been quick and easy ways to connect computers in small networks.

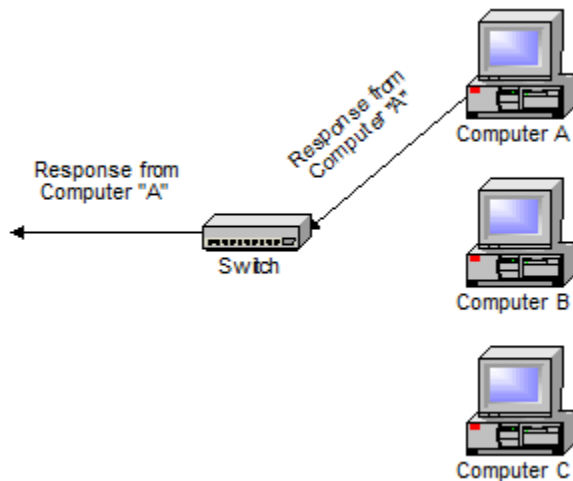
Switches

A **switch** does essentially what a hub does, but more efficiently. By paying attention to the traffic that comes across it, it can "learn" where particular addresses are.

Initially, a switch knows nothing and simply sends on incoming messages to all ports:

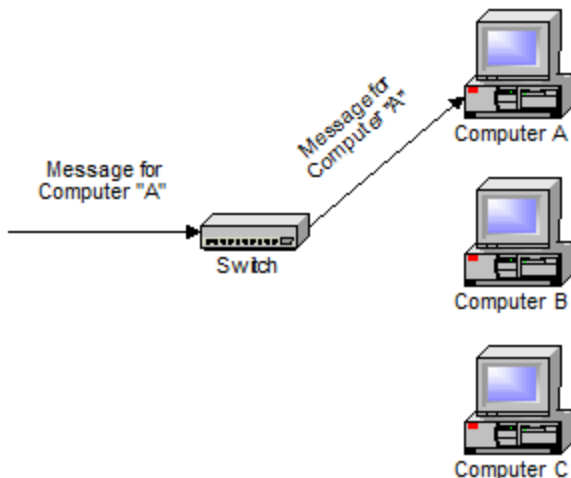


Even accepting that first message, however, the switch has learned something – it knows on which connection the sender of the message is located. Thus, when machine “A” responds to the message, the switches only need to send that message out to the one connection:



In addition to sending the response through to the originator, the switch has now learned something else – it now knows on which connection machine “A” is located.

That means that subsequent messages destined for machine “A” need only be sent to that one port:



Switches learn the location of the devices that they are connected to almost instantaneously. The net result is that most network traffic only goes where it needs to rather than to every port. On busy networks, this can make the network *significantly* faster.

Routers

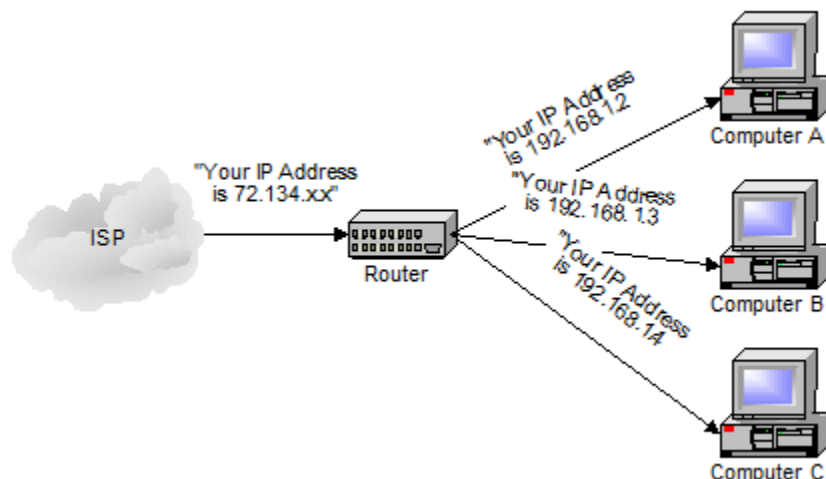
A **router** is the smartest and most complicated of the bunch. Routers come in all shapes and sizes – from the small, four-port broadband routers that are very popular right now to the large industrial strength devices that drive the Internet itself.

A simple way to think of a router is as a computer that can be programmed to understand, possibly manipulate, and route the data that it's being asked to handle. Many routers today are, in fact, little computers dedicated to the task of routing network traffic.

As far as simple traffic routing is concerned, a router operates exactly as a switch, learning the location of the computers on its connections and routing traffic only to those computers.

Consumer grade routers perform at minimum two additional and important tasks: DHCP and NAT.

DHCP – Dynamic Host Configuration Protocol – is the way dynamic IP addresses are assigned. A device asks for an IP address to be assigned to it from “upstream” and a DHCP server responds with an IP address assignment. A router connected to your ISP-provided Internet connection will typically ask your ISP’s server for an IP address; this will be your IP address on the Internet. Your local computers, on the other hand, will ask the router for an IP address and these addresses are local to your network.



NAT – Network Address Translation – is the way that the router *translates* the IP addresses of packets that cross the Internet/local network boundary. When computer “A” sends a packet out, the IP address that it’s “from” is that of computer “A” – 192.168.1.2 in the example above. When the router passes that on to the Internet, it replaces the local IP address with the Internet IP address assigned by the ISP. It also keeps track, so that if a response comes back from somewhere on the internet, the router knows to do the translation in reverse – replace the Internet IP address with the local IP address for machine “A” and then send that response packet on to machine “A”.

A side effect of NAT is that machines on the Internet cannot initiate communications to local machines – they can only respond to communications initiated by those local machines.

The net effect is that the router then also acts as a firewall:

What that means is that malware that might spread by trying to independently connect to your computer over the network cannot.

All routers include some kind of user interface for configuring how the router will treat traffic. The really large routers include the equivalent of a full-blown programming language to describe how they should operate as well as the ability to communicate with other routers to describe or determine the best way to get network traffic from point A to point B.

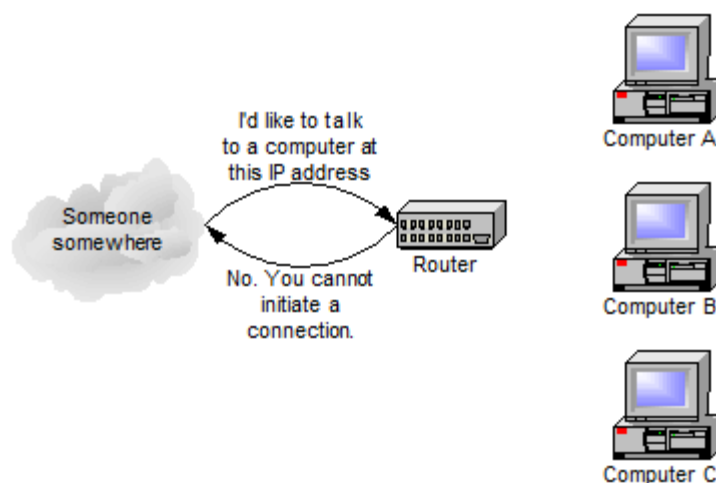
A note about speed

A quick note on one other thing that you’ll often see mentioned with these devices and that’s network speed. Most devices now are capable of both 10mbps (10 mega-bits, or million bits, per second) as well as 100mbps and will automatically detect the speed.

More and more devices are now capable of handling 1000 mbps or a billion bits per second (1gpbs).

Similarly, many devices are now also wireless transmitters that simply act like additional ports on the device.

*** End of Article ***



This year's Rochester Maker Faire will be taking place on Friday, November 16th & Saturday, November 17th, 2018 at the Rochester Riverside Convention Center, so save the date!

Educational, Fun, and Interesting Web Sites

by Howard Lewis
Midland Computer Club, MI

<https://forvo.com/>

Forvo is the largest pronunciation guide in the world, the place where you'll find millions of words pronounced in their original languages. If you have a word you would like to know how to pronounce – whether it be English or one of the hundreds of languages around the world – you might be able to find help at this site. If there is a word you would like to know how to pronounce, you can request someone to pronounce it for you.

<http://www.techrepublic.com/article/what-kinds-of-people-fall-prey-to-identity-theft-phishing-and-hacks-itsnot-who-you-think/?ftag=TRE684d531&bhid=51477600>

Who's most likely to be the victim of hacks and identity theft? Surprisingly, it is not who we normally think that fall prey to the various scams running around. This article looks into some of the data and draws mixed conclusions. Interesting reading!

<https://betanews.com/2017/03/08/disable-ads-file-explorer-windows-10/>

If you are getting ads in Windows 10's File Explorer, here is how to disable them (at least temporarily).

<https://support.office.com/en-us/article/office-training-roadmaps-62a4b0dc-beba-4d8e-b79c-0ad200e705a1>

Microsoft offers free basic training on the use of several of the Microsoft Office products (Word, Excel, Outlook, PowerPoint and Access). They are in pdf format and can be downloaded to view at your leisure.

<http://deep-web.org/how-to-research/deep-web-search-engines/>

We all search the web at various times and we sometimes hear about the “dark web” (you don't want to go there unless you know the ramifications!). But did you know there is also the “deep web”? The web as we know it is really just a small portion of the Internet that the major search engines (Google, Bing, Yahoo, etc.) view. But there is much more out there that can be searched with the appropriate search engine. This site lists some of the specialized search engines to find that really hard to find information.

From the <http://mcc.apcug.org/capmidmi@yahoo.com>.

Use Speech to Control Your PC and Compose Text

By Nancy DeMarte, 2nd Vice President
Sarasota Technology Users Group, FL

Speak:

Many modern devices have digital voice personalities that can help you find things or complete tasks. Some of these even have names, like Siri for Apple devices, Alexa for Amazon Echo, and Cortana for Windows. Microsoft Office and Windows 10 recently have added or upgraded speech features that provide both text to speech and speech to text. Speak is a new feature that helps you proofread what you have typed by listening to the computer read it aloud.

For example, if I'm typing a Word document and want to see if my wording is smooth and accurate, I can use “Speak” to hear how it sounds. The Speak feature is also found in other Microsoft apps - Outlook, PowerPoint, and OneNote.



Speak
icon

To use ‘Speak,’ click anywhere in a document. Then click the Review tab on the ribbon. In the Speech group, click ‘Read Aloud,’ which opens an audio control bar. Click the right-pointing single arrow, then sit back and listen. You can choose a male or female



Audio Control bar

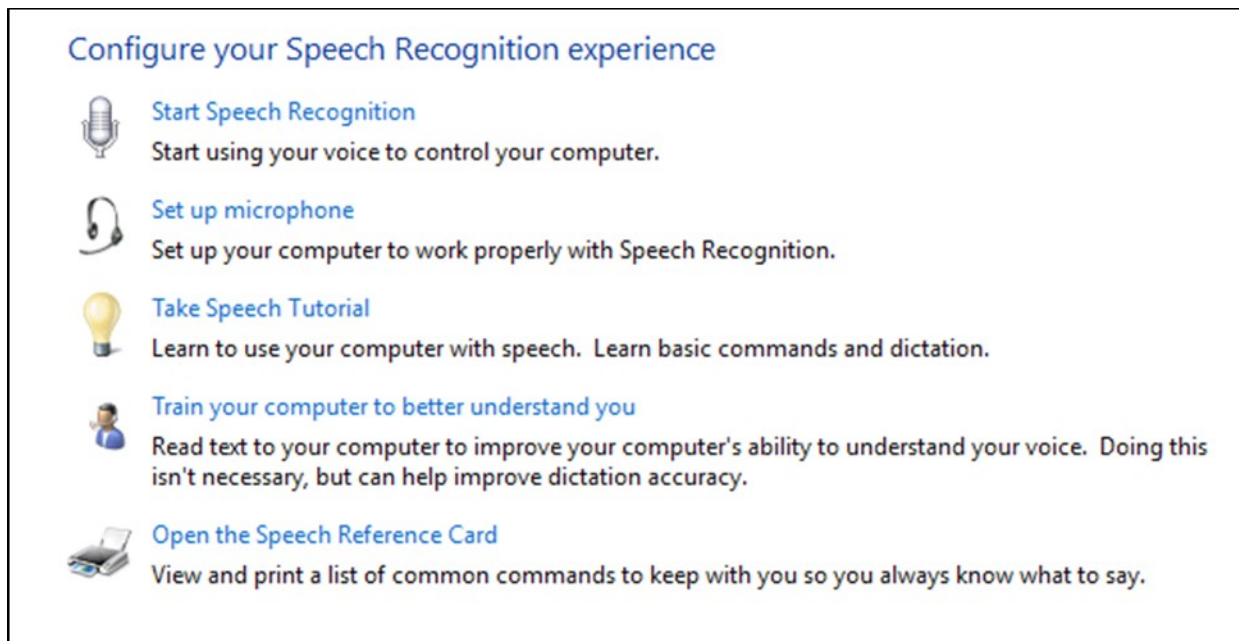
voice by clicking the setting icon which resembles a person on the audio bar.

Windows Speech Recognition (WSR):

Windows has had a speech recognition feature for several years. This tool lets a user dictate into a microphone without the use of a keyboard or mouse and have his or her speech translated into text. It can be used to compose articles, write letters or emails, fill out forms, or complete other writing tasks. You can also use WSR to perform the basic functions of a computer, like opening an app, selecting a word, showing a list of commands, and adding punctuation. Originally, it was difficult to set up, but the current version is much , o configure and use. Learning to use WSR is especially worthwhile if your typing skills are weak.

You must have a microphone before setting up Speech Recognition. I found that a set of headphones with a microphone attached works very well. While it is also possible to find a Windows microphone in the MS store, a headset or free-standing mic is recommended.

Once you have a microphone plugged into your computer and turned on, it's time to locate and set up Speech Recognition. In Windows 7, click Start > All Programs > Accessories > Ease of Access > Speech Recognition. In Win 10, type 'Speech' in the Search box and choose the best match, Speech Recognition, which opens the Speech Configuration window, pictured below:



Speech Configuration Window

1. There is a wizard (set of steps) to help you with setup. Click "Start Speech Recognition" to start the wizard. It will take you through all the steps in the order in which they are listed.
2. First, you will set up the microphone for correct placement and volume setting.
3. The speech tutorial consists of two short video tutorials that demonstrate the two main uses for speech recognition: "How to use WSR to get around your computer" and "How to use dictation with WSR". These are worth watching more than once.
4. In "Train your computer," you practice reading text aloud so that WSR can learn your vocal inflections, accent, and tone. This makes the transition from speech to text more accurate.
5. The last step is to print a few pages of valuable commands that WSR recognizes, a handy list.

While no speech recognition tool is perfect, the Windows version does a pretty good job, and setup is an easy, non-threatening process.

From the October 2017 issue, STUG Monitor, www.spcug.org, ndemarte@Verizon.net.

Web Surfing for Music

By Len Nasman, Webmaster
Bristol Village Computer Club, OH

I had a little time to kill the other day, things I investigated was ***strange***

Auto Playing Music Machines

During my surfing, I found some museum in Holland that Diana and I

The Museum Speelklok has a large musical instruments. One of these was (which is yet another story) was provided amazing machine. Clicking on the photo

The Paganini uses paper rolls to cause This is like a player piano on steroids. building, however, some similar machines picture is of a giant fairground organ.



so I went web surfing. One category of ***musical instruments***.

YouTube videos of music boxes in a visited during our Tulip Time Trip. collection of music boxes and auto playing the Paganini. A fellow from Wintergatan_ with a special demonstration of this links to a video tour of the Paganini. multiple musical instruments to play. The Paganini was built to be inside a were for outdoor use. For example, the

If you watch the Paganini video, you will see the operator loading the program into the machine. This machine uses large linked punched cards that look like a giant version of player piano rolls that are flat cards linked together. This technology was borrowed by earlier automated weaving machines.

The Jacquard machine was a device fitted to a power loom that simplifies the process of manufacturing textiles with such complex patterns as brocade, damask and matelassé. It was invented by Joseph Marie Jacquard in 1804. The loom was controlled by a "chain of cards", a number of punched cards, laced together into a continuous sequence.

Strange Musical Instruments

If you want to be amused, try Googling strange musical instruments. There is a whole world of creative folks who invent or play very unusual instruments. Some are fairly well known... such as Benjamin Franklin's harmonium.

It seems that Franklin likes the sound of rubbed wine glasses, but got tired of having to set up a table full of glasses, add the right amount of water to tune each glass and then play... kind of like Robert Tiso in this example.

So, Franklin cut the stems off the glasses and mounted them on a shaft that could simultaneously spin all the glasses while applying wet fingers to make the sound. Some well-known composers wrote music for Franklin's instrument, but it never took off. Maybe it did not travel very well.

The next time you finish your soft drink, you might take the can duplicate this soda straw recorder. Here is a video that [straw recorder](#).

The picture here shows a woman old barbecue grill cover, but it's [Drum](#). Although the name hints that actually comes from Switzerland. It interesting sounds.



The Hang Drum is constructed from glued together at the rim leaving the The top ("Ding") side has a center fields' hammered around the center.

hole in the center with a tuned note that can be created when the rim is struck. – Wikipedia

Here is a cute but weird thing. This guy has arranged a collection of [kitten squeeze toys](#) and uses them to play Somewhere Over the Rainbow.

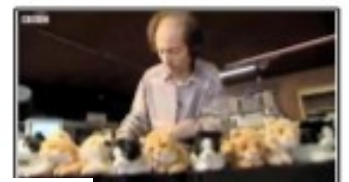
Now we get back to Wintergatan. One of their productions that has gotten a bit of attention is the [Rube Goldberg](#) looking [marble machine](#).



soda straw and see if you shows [how to make a](#)

playing what looks like an actually called a [Hang](#) it might be Chinese, it makes some very

two half-shells of deep drawn, nitride steel sheet inside hollow and creating a distinct 'UFO shape'. 'note' hammered into it and seven or eight 'tone The bottom is a plain surface that has a rolled



The machine is powered by hand, and works by raising 2,000 steel marbles through the machine into multiple feeder tubes, where they are then released from height via programmable release gates, falling and striking an instrument below. All the instruments are played by striking them and include a vibraphone, bass guitar, cymbal, and emulated kick drum, high hat and snare drum sounds using contact microphones. The music score is stored on two programmable wheels that utilize Lego Technic beams and stud connectors to trigger armatures to release the marbles.



If you find the marble machine interesting you may also like this entry from

[Wintergatan](#).



From the September/October issue,
Webmaster@bvres.org.

BVCC Newsletter, <http://bvres.org/bvcchome.html>,

GNU Octave

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Engineers, scientists, and educators use computer math tools extensively, and students would also find these helpful, but their costs are often a barrier. Fortunately, free programs such as GNU Octave (<http://www.gnu.org/software/octave/>) and Scilab (<http://www.scilab.org/>) provide similar power to their commercial kin and both are available for Windows, OS X, and Linux. They are modeled after the popular commercial program Matlab (<https://www.mathworks.com/>), which sells for \$50 for the student version and up to \$2150 for the standard one. If you are a parent, you may be concerned that if your student uses such a tool, he or she may use it to avoid learning math, but in my experience, this doesn't happen. While teaching engineering, I found that many in my class had not mastered basic math, and I introduced computer tools to provide them with alternate approaches. However, the only students who made use of these were those already skilled in math. Apparently, people who had the initiative and talent to master computer math had already used these same assets to learn what was being taught in the math classroom, and they used the computer tools to gain additional advantages over their slower friends. Life isn't fair.

I'll discuss GNU Octave in this article, mostly because it is closer to the widely-used Matlab than is Scilab; indeed, many Matlab programs will run without change on Octave. Becoming proficient with any math tool takes considerable time, and if possible you should choose one that gives you skills you can transfer later. Octave is basically a programmable scientific calculator; that is, you enter a math relation and it computes a numerical result. Figure 1 shows the program in operation.

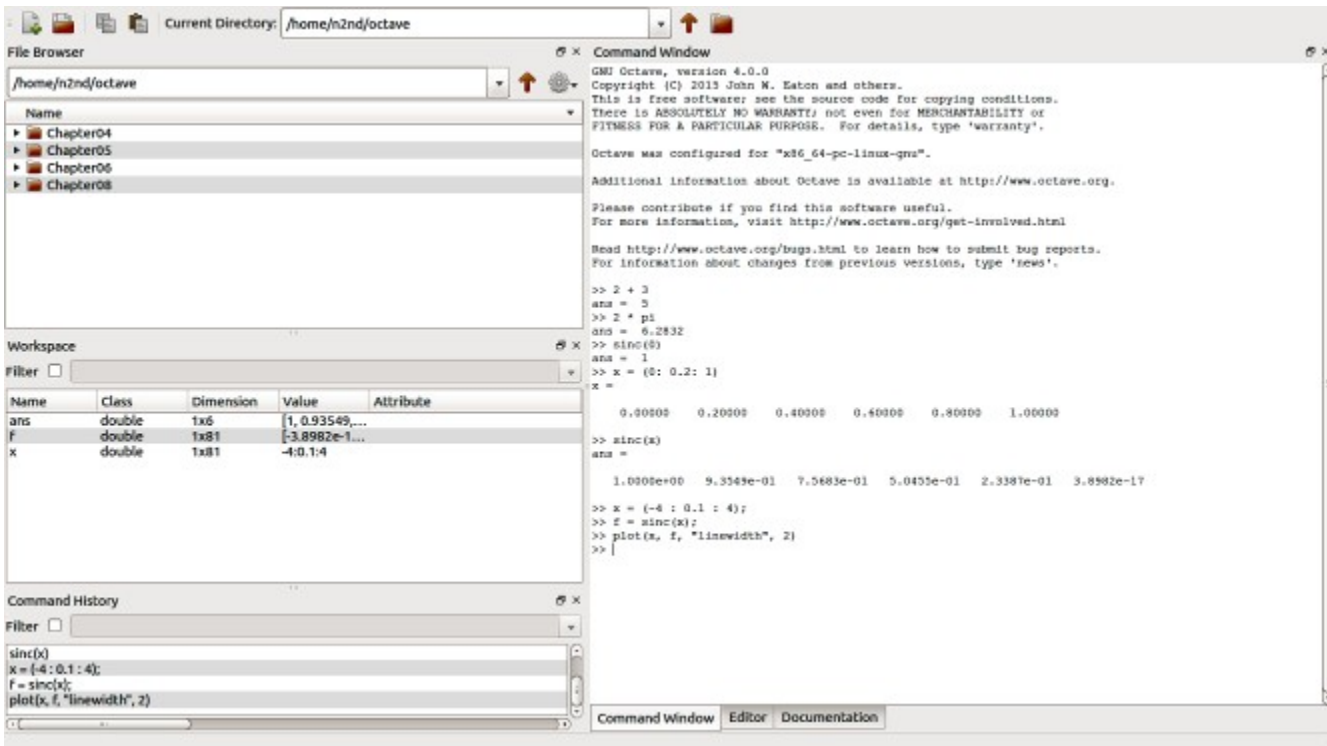


Figure 1. Gnu Octave Window.

Its window has four panes

6. upper-left – file browser,
7. center-left – workspace, showing the active variables,
8. lower-left – command history, and
9. right – commands and results.

The command pane is where you work and is essentially a view into a command-line terminal. You can do only primitive editing here, usually with the arrow keys, backspace, and delete, but you can also copy and paste. The “>>” character pair is the command prompt. Note the tabs below the command pane, which give you access to a real editor and extensive help.

Let’s look at the simple examples shown in Figure 1.

- You do simple arithmetic just by entering an expression followed by a tap of the Enter key. Here, we see that $2 + 3 = 5$.
- There are built-in constants such as π (“pi” in Octave-speak), which you can use in your expressions, and we see that $2\pi = 6.2832$. Note that multiplication must be declared explicitly using the “*” character.
- Higher-level functions are available, such as `sinc(x)`, which is defined as $\sin(\pi x)/(\pi x)$, except that `sinc(0)` is defined as 1.0. (This exception is needed because $0/0$ isn’t defined.) Figure 1 shows this verified.
- When using Octave, you will often be working with vectors, arrays, and matrices, and there are shortcuts to help in defining these. The example shows one, where `x = (0 : 0.2 : 1)` defines `x` as an array with values starting at 0, increasing by 0.2, and ending at 1.
- We can use this array as an argument for `sinc`, to find `sinc(x)` for $x = 0, 0.2, 0.4, 0.6, 0.8$, and 1.0.
- Finally, we can redefine `x` to be an array with values from -4 to +4 and separated by 0.1 and plot the `sinc` function. (The arguments “linewidth” and 2 make the trace thicker than its default, which I felt was too thin.) The result appears in Figure 2.

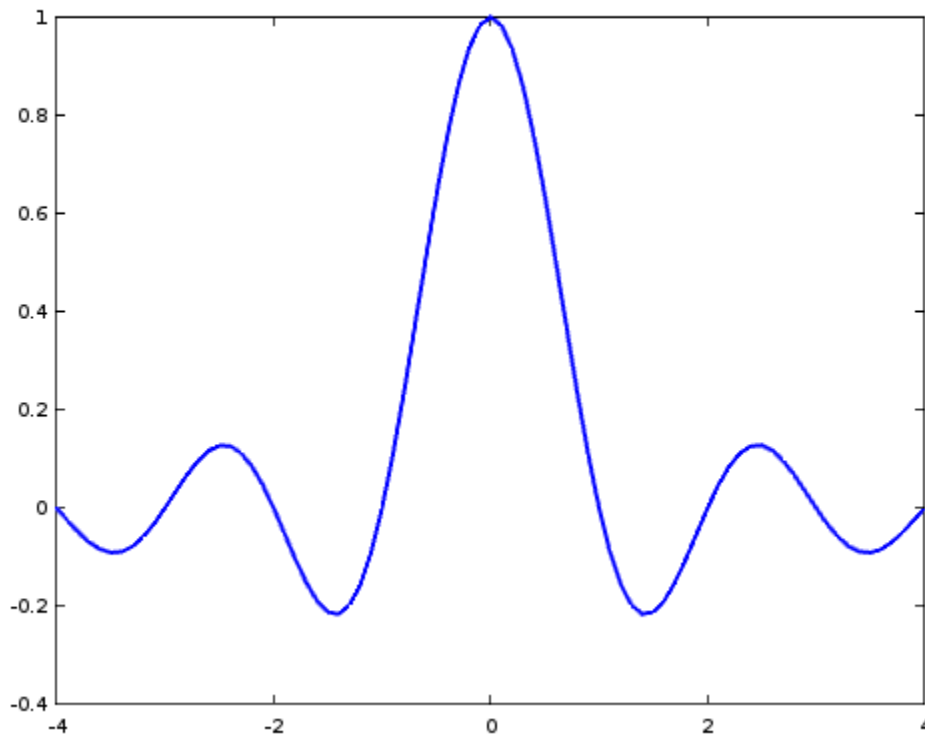
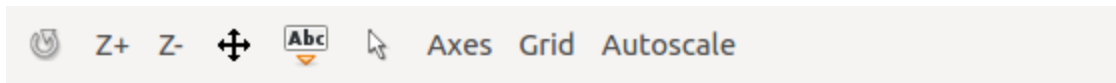


Figure 2. Plot of the sinc function.

You can often gain more insight from a simple plot than from an expression or a table of values.

Let's show a more complex example using the sinc function, as shown in Figure 3.

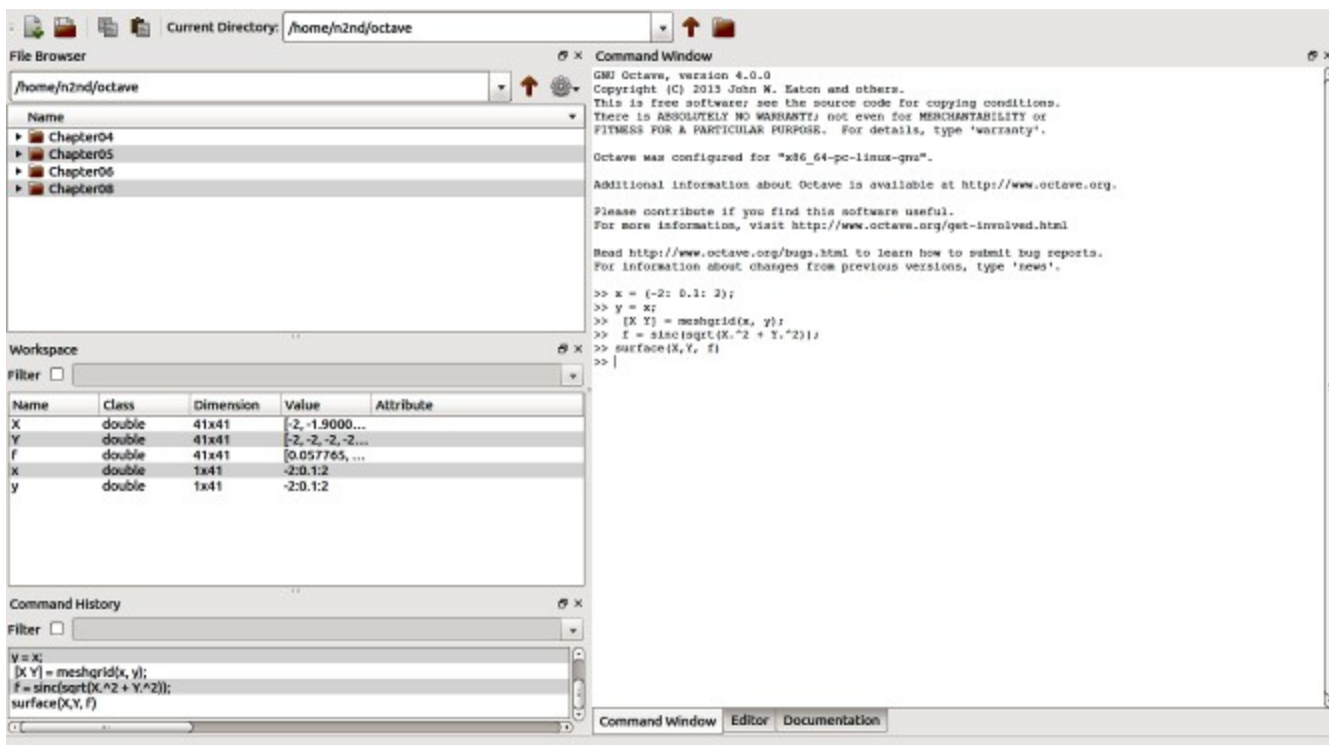


Figure 3. Three-dimensional Plotting Commands.

Figure 3 shows the following steps. (If your math is rusty, the details may be gibberish, but that's unimportant. The point here is that defining a plotting complex functions is easy and provides insight that is difficult to achieve by just looking at the expressions.)

- Define an array `x` with values from -2 to +2 in steps of 0.1. (The semicolon at the end of the line prevents printing the 41 values.
- Define a second array `y` with the same values as `x`.
- Define a two-dimensional array `[X Y]` with each element being a pair of numbers from `x` and `y`. Its top row is (-2, 2), (-1.9, 2), ... (2, 2); its second row is (-2, 1.9), (-1.9, 1.9), ... (2, 1.9); and so on.
- Evaluate `sync` for every element of `[X Y]`. Note that the expression `X.^2` causes the elements of the array to be squared individually. If instead we had used `X^2` (without the `."`), we would have multiplied the entire array of `X` values by the same array. With the operation shown, `f` is a 41 by 41 array whose elements are the sum of the squares of the elements of `[X Y]`. This is shown in the Workspace pane.
- Finally, we make a surface plot of the result, shown in Figure 4. (The button at the upper-left corner of the screen enables rotating the plot by dragging its corners.)

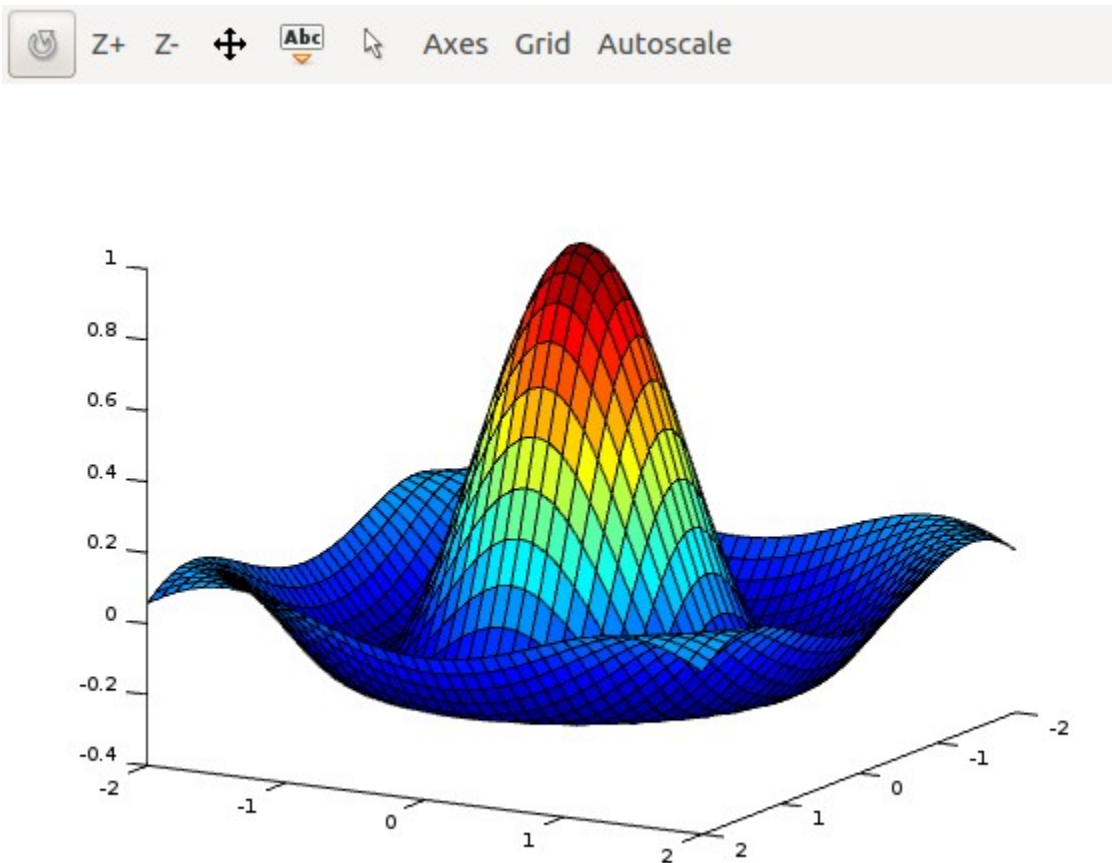


Figure 4. Surface Plot of the Sinc Function.

Octave can also solve simultaneous linear equations (beloved by algebra teachers and feared by their students). Figure 5 shows an example.

$$\begin{aligned} 2x_1 + x_2 - 3x_3 &= 1 \\ 4x_1 - 2x_2 - 2x_3 &= 3 \\ -x_1 + 0.5x_2 - 0.5x_3 &= 1.5 \end{aligned}$$

Figure 5. Simultaneous Equations.

We can restate this, using matrix notation, as $Ax = b$, where the matrices are defined as shown in Figure 6. Compare Figures 5 and 6 and you'll see that A contains the coefficients of the equations. Its top row holds those of

the top algebraic equation and so on. Matrix b is similarly defined by the constants on the right.

$$A = \begin{bmatrix} 2 & 1 & -3 \\ 4 & -2 & -2 \\ -1 & 0.5 & -0.5 \end{bmatrix} \quad b = \begin{bmatrix} 1 \\ 3 \\ 1.5 \end{bmatrix} \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Figure 6. Simultaneous Equation Matrix Definitions.

Again, using matrix notation, the solution is $x = A^{-1}b$, where the -1 exponent indicates that the matrix A is inverted. (Using Octave commands, this becomes `x = inv(A)*b`.) Finding the inverse of a matrix, even only a 3 by 3 one, using paper and pencil is time-consuming and error-prone. As a result, those of us who were educated BC (before computers) relied on algebra instead. All this changed when personal computers and mathematics programs became available. Figure 7 shows this problem solved using Octave.

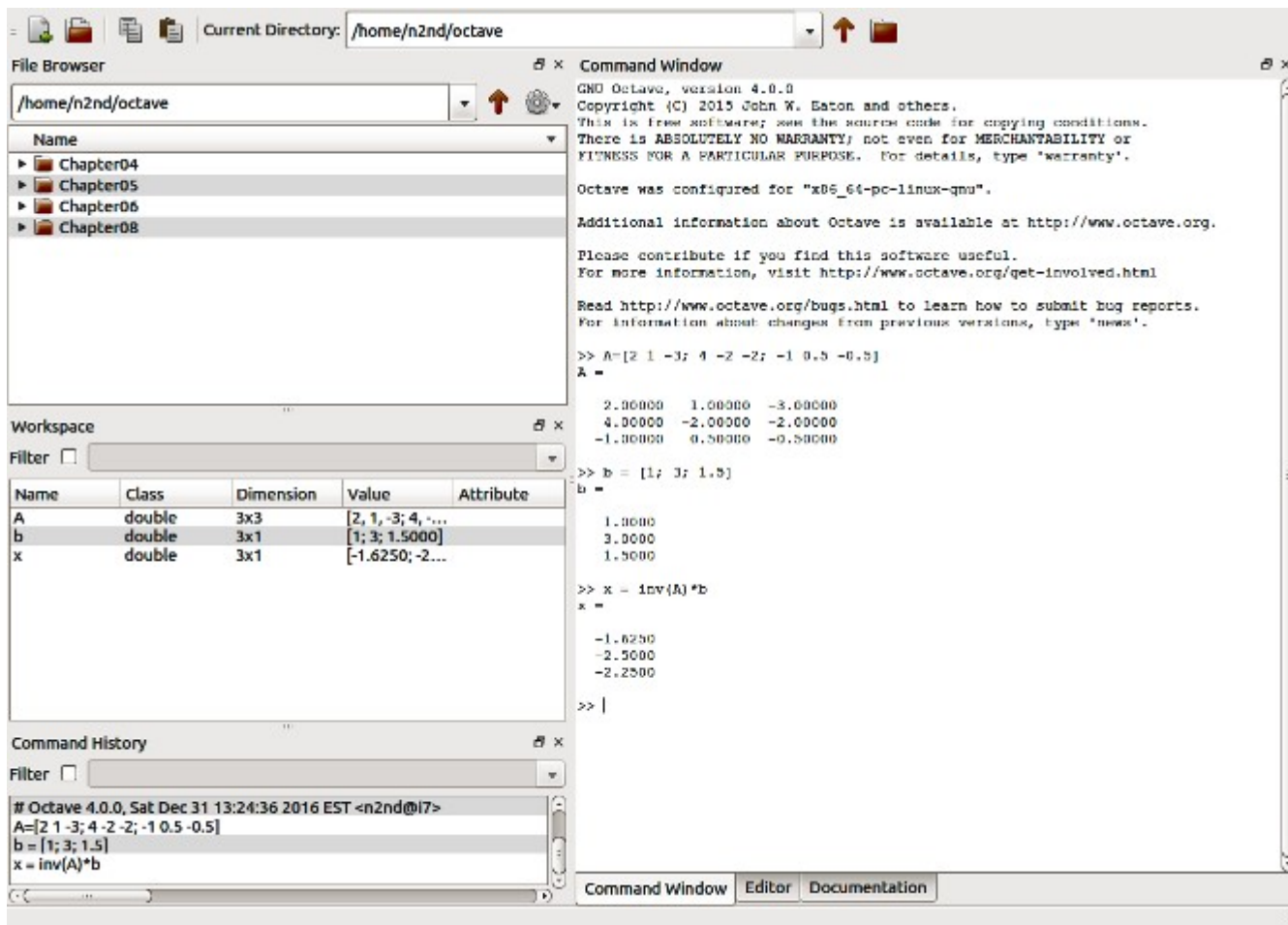


Figure 7. Simultaneous Equation Solution Using Octave.

As you can see, it required entering only three lines, one to define A , one to define b , and one to request the solution, which is $x_1 = -1.6250$, $x_2 = -2.5$, $x_3 = -2.25$.

This has been a brief introduction to Octave with the goal of letting you know what it is and the sorts of things it can do, and I've covered only a very few of its capabilities. In particular, I haven't discussed Octave programs, which you can write to solve complex problems. Although it can't compensate for a lack of math skills, it can be invaluable for those that have them. There are many applications packages that add additional capabilities. These are listed on the Octave Website, and some are discussed in the references below.

A good starting tutorial for learning more is the 280-page *GNU Octave Beginner's Guide* (<http://jordi.platinum.linux.pl/octave/Jesper%20Schmidt%20Hansen%20-%20GNU%20Octave%20for>

[%20Beginners.pdf](#)), which you will also see available in print. The user interface has evolved since this was written, but the commands are unchanged and its examples work. Also, see the 300-page and more up-to-date *Octave at BFH-TI Biel* (<http://web.ti.bfh.ch/~sha1/Labs/PWF/Documentation/OctaveAtBFH.pdf>). It shows the current user interface, but has a more academic approach than the Beginner's Guide. Unfortunately, both documents don't always use standard ASCII characters. For example “*” is not always the asterisk that Octave uses for multiplication. As a result, pasting the examples into the program often produces errors, but you will quickly find what to look for. The official manual is the 1000-page *GNU Octave* (<https://www.gnu.org/software/octave/>). This too is up-to-date, but its heavy reading and is a command reference rather than a tutorial. Finally, an Internet search will turn up several getting-started guides.

A math program like Octave won't compensate for deficient math skills, but it will add insight and speed up finding solutions for those who already have them.

From the June 2017 issue, BUG Bytes, www.bcug.com, n2nd@att.net.