OTTAWA
PC NEWS

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MERRY CHRISTMAS

ARTICLE

Exploring Android's File System – Part 2

by Alan German

In the earlier article in this series, we saw that the internal storage on an Android device normally uses a GPT partitioning scheme and may contain dozens of disk partitions. In particular, I noted that the 8 GB eMMC flash drive in my Motorola Moto G3 smartphone contains 42 partitions.

End users do not normally see the full structure of the Android storage system as most of the details are hidden by the operating system. However, users with root access to the device can list the available partitions (see Figure 1).

/dev/block/mmcblk0p1	modem
/dev/block/mmcblk0p2	sbl1
/dev/block/mmcblk0p3	DDR
...	
/dev/block/mmcblk0p30	kpan
/dev/block/mmcblk0p31	boot
/dev/block/mmcblk0p32	recovery
/dev/block/mmcblk0p33	ssd
...	
/dev/block/mmcblk0p39	customize
/dev/block/mmcblk0p40	cache
/dev/block/mmcblk0p41	system
/dev/block/mmcblk0p42	userdata

Figure 1. Android partitions

Many of the partitions, e.g. sb11, DDR, likely have unfamiliar names and purposes. However, the nature of several other partitions, such as boot and recovery, is relatively clear. The boot partition contains files, such as the kernel image, that are used to boot Android normally. The recovery partition is used as an alternate boot location when conducting various operations, such as a factory reset, and for (automatically) installing system updates.

From the end user's standpoint, the last two partitions are the most important, namely: system and userdata. The system partition holds portions of the operating system such as libraries, files related to the user interface, and applications that have been pre-installed by the phone's manufacturer. The contents of the userdata partition includes user-installed apps and the files and folders that are available to the end user.

In Windows, accessing and/or using some of the system files and folders may require elevated privileges through User Account Control (UAC). Linux uses the sudo (Super User) command for the same purpose. However, in both of these operating systems the files and folders across the entire file system are visible to the end user. But, this level of file system transparency is not usually the case with Android even though this OS essentially uses both the Linux kernel and the basic Linux file system. In Android, a regular (non-root) user can't see any of the folders in the system partition, and can only see a portion of the userdata partition.

The Android boot process itself is not exactly simple. A very good description is given by Dave Smith from New Circle, Inc. in a one-hour YouTube video entitled "Digging Into Android Startup". The good news is that, if you are only interested

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Inside this issue:

Next Meeting: WEDNESDAY, December 8th, 2021

Next Meeting

Wednesday, December 8th, 2021

Topic: SECURITY LAYERS
Speaker: Tom Trottier, OPCUG

There is no magic security bullet, no single protection against others trying to scam you, ransomware you, or steal your identity. What you can do is what people do in the winter: put on layers.

Tom will go through the threats, vulnerabilities, and the methods and programs he uses to protect his personal computer and devices against infiltration – and exfiltration. He will point to other ways to increase/improve your layers. Tom will also have recommendations on security podcasts you can listen to in order to stay current on the latest security threats.

Tom has been using computers professionally or personally since 1968 and the time of BBSs (Bulletin Board Systems) pre-internet, when monitors had green text and a great improvement was amber text.

Due to COVID-19 restrictions, this meeting will be via Zoom video conference.

Join us at https://tinyurl.com/opcug-meeting. The Zoom link will be live at 7:15 pm. The meeting will begin at 7:30 pm.

The above link includes the meeting ID and password. However, if you are prompted for the information, use:

Meeting ID: **924 9556 0898**
Password: **opcug**

Instructions for using Zoom are provided here:
https://opcug.ca/wp-content/uploads/Zoom-instructionsv3.pdf

Until further notice, Q&A sessions are no longer held after regular monthly meetings. Hence, monthly meetings now end 1 hour earlier at 9 pm. Everyone is welcome to join us on all other Wednesdays for weekly Q&A sessions.

Coming Up in 2022

January 12

Topic: Encryption 101
Speaker: Stephane Richard, OPCUG

If you are using a computer and the internet, you are using cryptography. This presentation provides a basic introduction to cryptography. It covers the definitions of the terms used in cryptography and basic cryptographic processes. [more…]

February 9

Topic: Getting Started in Genealogical Research
Speakers: Heather Oakley and Mike More, Ottawa branch of the Ontario Genealogical Society

Mike Moore says, "I don't know how many times I have heard somebody say 'I wish I'd known that when I started my genealogy'". There is no RIGHT way to do genealogy but there are better ways. [more…]

March 9

Topic: Microsoft Teams
Speaker: Lawrence Patterson, OPCUG

(details to follow)

April 13

Topic: Office Smackdown
Speakers: Alan German and Chris Taylor, OPCUG

Are there any significant limitations in using LibreOffice instead of Microsoft Office? In this presentation, we will review the features of the major modules of both packages. [more…]

All scheduled regular monthly meetings, weekly Q&A sessions, and a link to OPCUG presentations at the OPL are posted on our website at https://opcug.ca/#upcoming. All events are via video conference until further notice.

2021 CALENDAR

Meetings	Date	Time and Venue
Regular Monthly Meeting	Wednesday, December 8th	7:30 pm via Zoom video conference: **https://tinyurl.com/opcug-meeting** To see all scheduled events, visit https://opcug.ca/#upcoming
Q&A Session	N/A	Until further notice, Q&A sessions are no longer held after regular monthly meetings. Join us on all other Wednesdays for weekly Q&A.
Beer BOF (Wing SIG East)	Wednesday, December 8th	Enjoy a cold brew or other beverage in the comfort of your home during the video conference.

ARTICLE

Introduction to WinGet

by Tristan Wrubleski

What is WinGet

WinGet is an official package manager for Windows, which was released by Microsoft on May 26, 2021. A package manager provides software install automation; allowing users to quickly and easily find, install and update software using simple commands. This is especially useful when setting up a new PC as one can simply execute a PowerShell script with a series of WinGet install commands for any available software.

WinGet is supported for Windows 10 1809 and later. At the moment it must be installed manually, though is likely to be included as part of Windows in the future.

How to install WinGet

The simplest method to install WinGet is through the Microsoft Store, using these steps:

- From the Start menu open Microsoft Store.
- In the Microsoft Store click on the Search button. Enter the search term **App Installer**. Be sure to confirm it is the one released by Microsoft.

- Click on the Get button, which will then present an Install button to click.

Once installed, the application will be automatically updated as new versions are released.

How to use WinGet

WinGet commands can be executed from either Windows Command Prompt or PowerShell. In either case I suggest you select Run as Administrator. Doing so will ensure you don't get prompts to approve every software install.

As an example I will demonstrate the installation of Notepad++.

To search for the Notepad++ application, the first command we will execute is **winget search notepad++** .

On your first execution, you will likely receive a prompt asking if you agree to the source agreements terms. Please, select Yes. This prompt only occurs on the first execution or if the terms are changed.

```
PS C:\> winget search notepad++
The `msstore` source requires that you view the following agreements before using.
Terms of Transaction: https://aka.ms/microsoft-store-terms-of-transaction
The source requires current machine's geographic region to be sent to function properly.

Do you agree to all the source agreements terms?
[Y] Yes  [N] No:
```

(Continued on next page)

WinGet *(Continued from page 3)*

Once the terms are accepted our WinGet command will proceed, giving us the following results.

```
Name                    Id                  Version Source
-----------------------------------------------------------
(unofficial) NotePad++ 9PLHC123MQWT        Unknown msstore
Notepad++ (Unofficial) 9PHSCTZMKC27        Unknown msstore
Notepad++              Notepad++.Notepad++ 8.1.9   winget
```

I highly recommend for any software that only the official and stable releases be used. In the case of NotePad++, we can see the release we want has the Id of **Notepad++.Notepad++** .

We will now use this Id to install the application silently with all default settings. This is done by executing the command **winget install --id Notepad++.Notepad++ --silent** .

```
PS C:\> winget install --id Notepad++.Notepad++ --silent
Found Notepad++ [Notepad++.Notepad++] Version 8.1.9
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licences to, third-party packages.
Downloading [redacted]
  4.14 MB / 4.14 MB
Successfully verified installer hash
Starting package install...
Successfully installed
```

That's it! NotePad++ is now installed and ready to be used.

Additional Information

If you would like to explore more of the commands available for WinGet, the full documentation can be found here: https://docs.microsoft.com/en-us/windows/package-manager/winget/.

I would also encourage you as a PC enthusiast to contribute by suggesting features or submitting bug reports, to the WinGet team on their official GitHub repository at https://github.com/microsoft/winget-cli.

♦♦♦

Quick Tip 37: Hotkeys

by Chris Taylor

Hotkeys are keystrokes for performing functions that otherwise require you to take your hands off the keyboard, grab the mouse, and dig into menus or click on-screen controls. Some are (usually) well-known, such as Ctrl+c to *copy*, Ctrl+z to *undo*, and Ctrl-b for *bold*. Here are a few less-common hotkeys that I find useful enough to remember:

- Win+i – open the *Settings* app
- Win+up/down arrow keys – maximize/minimize/restore current window
- F2 – rename a file in File Explorer
- Win+v – open clipboard history
- Win+m – minimize all windows
- Shift+Alt+up/down arrow keys – in Microsoft Word, move paragraph up/down
- Win+Ctrl+c – toggle colour filters on and off (enable shortcut in *Settings|Ease of Access|Colour filters*). Especially useful to photographers to quickly view a photo in B&W.

The last one is *very* useful to me, but not likely worth remembering for most people. Don't waste brain cells remembering hotkeys for functions you rarely use. Peruse lists of shortcut keys on the Internet or review the shortcut keys available in the programs you use to find some that are worth remembering—for you.

THROUGH THE LENS

A guide to digital photography for computer enthusiasts. After the click of your camera, you're only half done!

Intentional Camera Movement

by Lynda Buske

No, really, I did this on purpose!

Intentional Camera Movement (ICM) is when you purposely move the camera while the shutter is activated. You may wish to create an ethereal image where the viewer can still probably identify the items in the image (e.g., leaves in Figure 1) or you may wish to have the effect result in a purely abstract depiction. Figure 2 is a photo of wall graffiti but is now completely abstract.

Figure 1

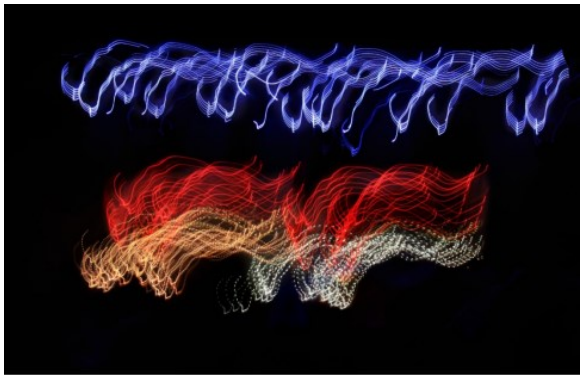
Figure 2

In terms of camera settings, there is a lot of trial and error so don't be surprised if you keep only one image out of 10 or 20. The idea is to give yourself enough time to move the camera up and down, side to side, or even in a wavy motion to create an interesting effect.

If you shoot mostly in Auto, your camera will never give you a shutter speed of 1-2 seconds as it assumes you want the image to be sharp so it will either open the aperture wider to let in more light or it will bump the ISO (sensitivity). The easiest way to set up your camera for ICM photos is to set the dial to shutter priority (S or Tv). Select a speed of at least one second, then see if the aperture can close tightly enough to ensure your shot is not over-exposed. If it is a bright day, this may not be possible depending on how small an opening your camera can create since you may need an aperture of f/20 or more.

If your camera's smallest aperture is f/8 or f/10, it is still possible to create an ICM image during the day. You may have to move your camera very quickly to get the image during the half second or less exposure time. Or you can attach a neutral density filter that will block some light and allow for a longer exposure time.

I often use the ICM technique in December when I am shooting festive lights around the neighbourhood (see images below). I have no trouble creating long exposures because there is so little ambient light at that time of day. Typically, I am looking for between 1 and 3 seconds to provide enough time to execute the motion. This means you will need a smaller aperture than usual so the lighter sections will not be over-exposed. Even if your camera has an aperture of f/10 or less, there should be no difficulty at night getting an exposure time of one second or more. If needed, you can eliminate any distracting background by darkening the image with free photo editing software such as Windows Photos or Photoscape X.



♦♦♦

Lynda regularly gives presentations for the OPCUG at the ***Ottawa Public Library*** *(https://opcug.ca/opl-presentations/).*
This article is also in PDF format on the OPCUG website (https://opcug.ca/digital-photography/).

Android-Part 2 *(Continued from page 1)*

in how the file system is established, you really only need to view the first 20 minutes or so of the video. The following paragraph provides a simplified view of the boot process in terms of the file system management activities that occur.

When an Android device is powered on, a bootloader program, that is hard-coded in the device hardware, is executed. This program sets up the available hardware then locates and loads the kernel image. Once the Linux kernel is running, a program named init, is executed. For our present purposes, one of the main tasks undertaken by init is management of the file system. The program creates various empty directories, and uses a file system table (fstab) to define which partitions are mounted, the mount points to be used, the file system types, and any associated flags (e.g. read-only or read-write).

While we don't see precisely what is happening during the boot process, with root access, we can identify some of the end results for the file system. For example, two of the mount points used on my Moto G3 smartphone are / (root) which is used for the system partition, and /data which is used to mount the userdata partition (see Figure 2).

```
/dev/block/mmcblk0p41 on / type ext4
(ro,seclabel,nodev,relatime,discard)

/dev/block/mmcblk0p42 on /data type f2fs
(rw,seclabel,nosuid,nodev,noatime,nodiratime,
background_gc=on,user_xattr,inline_xattr,acl,
inline_data,active_logs=6)
```

Figure 2. Mount points / and /data

Note that the system partition (/dev/block mmcblk0p41) is mounted as ro = read-only whereas the userdata partition (/dev/block mmcblk0p42) is mounted as rw = read-write.

The Android kernel protects the system partition and, in particular, does not allow access to the partition by regular users. This is why pre-installed apps, which are stored on the system partition, cannot be uninstalled. Only on devices for which the bootloader has been unlocked, and root access established, can the full contents of the root folder be viewed.

We saw that the userdata partition was mounted as /data. With root access we can also see the folders contained at this mount point. The file system is complex and many folders and sub-folders are present (see Figure 3). However, with a little digging, we can identify the purpose for some of these folders. For example, we know that user-installed apps are stored somewhere in this partition and, sure enough, the folder /data/app contains sub-folders such as ca.opcug.sitefinder-1 (SiteFinder) and com.easy4u.writer-1 (Writer Plus) which are programs that I installed on my phone.

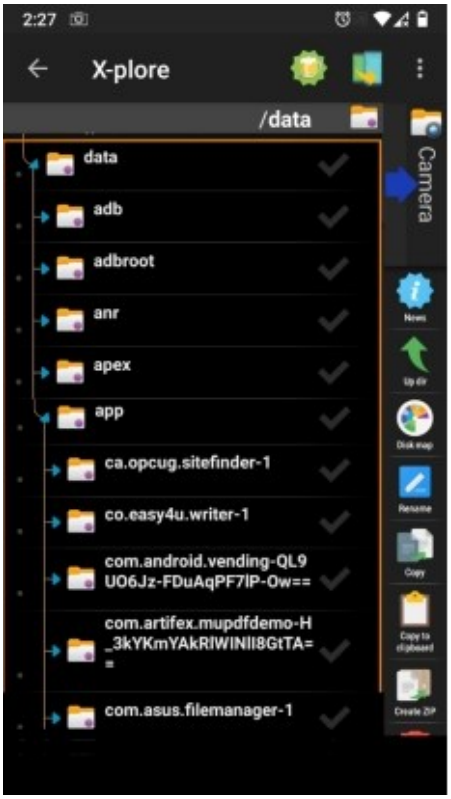


Figure 3. Folders at the /data mount point

Another portion of the userdata partition is used to store the user's data, i.e. the files and folders that are shown to a regular (non-root) user in a file manager. Figure 4 shows the list of these folders as shown in Google's *Files* app. The mount point location for this group of folders is found to be /data/media/0 as shown in Figure 5.

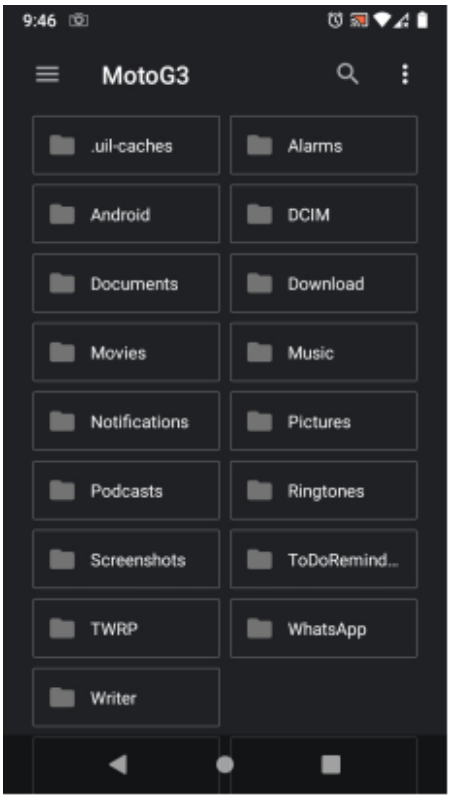


Figure 4. Moto G3 Internal Storage

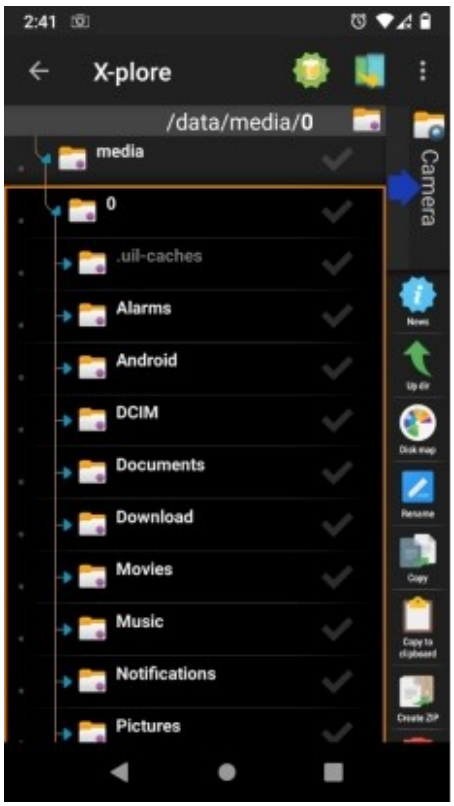


Figure 5. /data/media/0 mount point

(Continued on page 8)

REVIEW

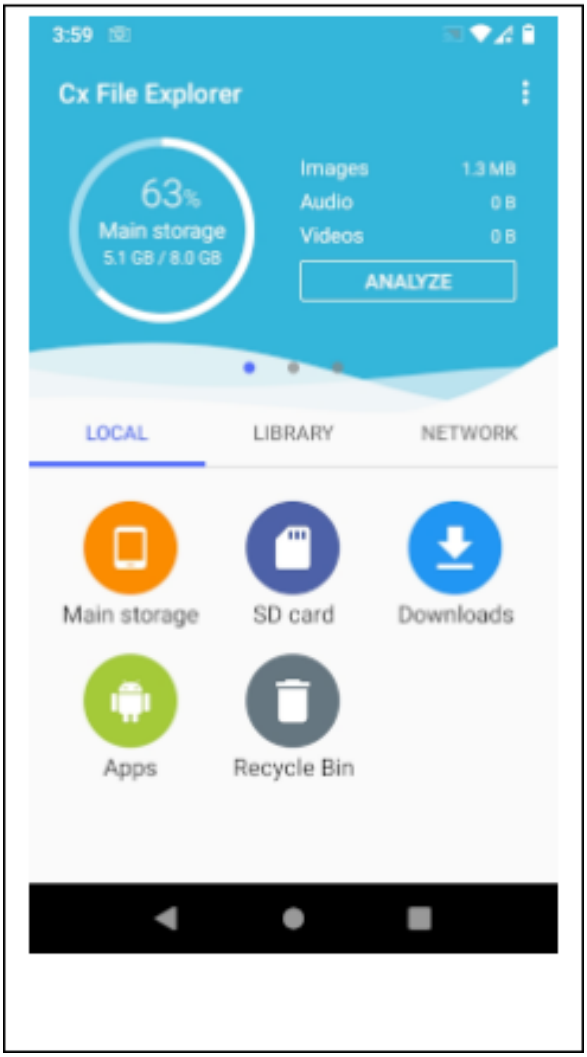
Another File Explorer for Android

by Alan German

For some time my preferred file management app for Android was Asus File Manager; however, for some reason this app has been dropped from Google's Play Store and, in addition, seems to be no longer listed by ASUS Computer Inc, the app's developer. While an APK (installation) file for this program can be downloaded from a number of third-party web sites, I'm not sure that I have complete trust in such sources.

The X-Plore File Manager functioned well for exploring and managing files on my rooted phone but I missed the simple interface of the Asus utility. Looking through various on-line reviews and the file managers currently available in the Play Store led me to Cx File Explorer.

The good news is that this is a free app and does not display advertisements. It gets good reviews from a number of on-line sources, including Android Authority and Lifewire, and has a high rating (4.8/5 based on more than 140,000 reviews) in the Play Store. The (somewhat) bad news is that the developer chooses to remain anonymous, with no web site, and just a Gmail address for support.



The likely upsides were enough for me to give the app a try and I have to say that I am very impressed by the quality and functionality of the software. In particular, the user interface is very reminiscent of Asus File Manager.

The screenshot shows the program's main window which. by default, displays information on the usage of the phone's internal storage (in the blue panel at the top of the screen), and a set of icons (in the lower portion of the screen) that can be used to navigate to show the contents of the main storage, external micro-SD card, Downloads folder, etc.

Note the three-horizontal dots in the centre of the display window. These indicate that additional pages are available for the top portion of the display such that, for example, swiping to the left on top of the screen brings up the information for the micro-SD card.

The LIBRARY tab features a set of icons to access documents, images, audio files, videos, and new files stored on the system. The NETWORK tab provides access to web-based services such as Dropbox and Google Drive, a local network, or FTP connections.

Clicking on the ANALYZE button for one of the storage devices produces a breakdown of the disk usage in categories such as images and documents; a list of apps that are using the greatest amounts of storage, and the space taken by cache files. A control button can be used to clear the cache.

The program has a number of settings that include specifying when a notification should indicate that the storage is nearly full, and the option to use the Recycle Bin when deleting files. A *Built-in apps* section shows that image, music and video players, and a text editor, are included in the app and all of these are enabled by default. I was pleased to discover that the built-in Image Viewer has very similar features to the Simple Gallery app that I normally use, which suggests that the latter may actually be redundant.

I need to make further use of Cx File Explorer before I commit to making this my daily-driver file manager but first impressions are very positive. So, if you could use a simple yet powerful file manager for your Android device, it may well be worth giving this app a try. You won't beat the price!

Bottom Line

Cx File Explorer (Freeware)
Version 1.5.8

https://play.google.com/store/apps/details?id=com.cxinventor.file.explorer

Android-Part 2 *(Continued from page 6)*

These folders are primarily storage locations for data files, such as DCIM and Pictures which are typically used for digital photographs and screenshots, and Writer where documents produced in Writer Plus are stored.

The complex, some would say confusing, nature of Android's file system can be seen by the fact that, although the mount point for these folders from the root directory is /data/media/0, different file managers show this same group of folders with different mount points. For example, we saw in the previous article in this series that Asus File Manager reports my phone's internal storage as being mounted at /sdcard ("> root > sdcard") while the X-plore File Manager indicates this same storage to be /storage/emulated/0. If we dig further into the file system as root, we discover that the same folders are to be found at both /sdcard and /storage/self/primary!

The reasons for these multiple mount points are not clear (to me); however, this is only the start of our problems. The situation gets even more complex (confusing!) when we consider both the internal and external storage locations in more detail. Stay tuned!

♦♦♦

Quick Tip 38: Light across the world

by Chris Taylor

Did you ever wonder if the sun is up somewhere else in the world? Windows 10 can let you know.

Run *Alarms & Clock* and select *World Clock* (1) in the left-hand panel. A map of the world is displayed, highlighting where the sun is currently shining.

World Clock has a few other tricks up its sleeve.

Click *Add new city* (2) to put extra locations on the map. They will show with the current date and time at those locations.

Want to know what the local time will be when one of your pinned locations is at a specific time and don't want to do the mental arithmetic? Click the *Compare* button (3) and all your pinned locations will be displayed. Choose a time for any one of them and the time and date for the other locations will be shown.

If you right-click on any added location, you can choose *Pin to Start*. An icon on the Start menu will show the current date and time for that location. If you click the Start menu icon, it will load *Alarms & Clock* on the *World Clock* tab.

I submitted a suggestion through *Feedback Hub* that they allow the user to choose an arbitrary date and time to see where the sun will be showing at that time. That could be useful for things like planning vacations.

Nominations for OPCUG Board for 2022

Once a year, the OPCUG holds elections for the 9-member Board of Directors. We are once again coming up to this annual event.

We encourage all members to consider running for a board position or getting involved in some other manner in the operations of the OPCUG.

If you want more information about what is involved, please talk to me or any current or past Board member. Names are listed on the back page of this newsletter and on the web site at https://opcug.ca/executives/ .

Nominations can be submitted by sending an email to nominations@opcug.ca .

Nominations must be received by midnight, December 31, 2021.

Please get involved. Please help the OPCUG continue in its role of Users Helping Users!

Bob Herres
Election Chair, 2022

OTTAWA PC NEWS

Ottawa PC News is the newsletter of the Ottawa PC Users' Group (OPCUG), and is published monthly except in July and August. The opinions expressed in this newsletter may not necessarily represent the views of the club or its members.

Member participation is encouraged. If you would like to contribute an article to Ottawa PC News, please submit it to the newsletter editor (contact info below). Deadline for submissions is three Sundays before the next General Meeting.

To receive the monthly newsletter by email, send an email to:
opcug-newsletter+subscribe@googlegroups.com (leave subject and body fields blank)
You do **not** need to create a Gmail or Google Groups account.

To subscribe to other OPCUG Google Groups member services, go to:
https://opcug.ca/google-groups-how-to/

Group Meetings

OPCUG meets on the second Wednesday in the month, except July and August, at the Riverside United Church, 3191 Riverside Drive, Ottawa. Parking is free at the church. OCTranspo bus #90 stops nearby. Details at https://opcug.ca/venue/.
(NOTE: Due to COVID-19 safety guidelines, all our events are via video conference until further notice. Details at https://opcug.ca/venue/)

Meetings are 7:30–9:00 p.m. followed by a Q&A Session until 10 p.m.

OPCUG Membership Fees:	$20 per year
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Q&A HAS GONE ON-LINE! WEEKLY!

Because of the pandemic, the OPCUG is holding weekly Q&A sessions in Zoom video-conferences.

Join us every Wednesday (except on regular monthly meeting nights) at 7:30 pm to discuss computer issues. Questions (and answers) on any computer-related issue are welcome. Or, do you have a favourite computer program or topic that you would like to share with the group? Send your questions, answers, or the details of what you would like to share to: SuggestionBox@opcug.ca

Everyone is welcome to attend Q&A sessions and to ask questions about their specific computer-related problems. Join us at: https://tinyurl.com/opcug-meeting (if you use the Zoom client, the meeting ID is **924 9556 0898** and the password is **opcug**).