



TOOLBX

Developing on and
troubleshooting emerging OSes

DEBARSHI RAY

Principal Software Engineer,
Red Hat

✉ rishi@fedoraproject.org

🌐 debarshiray.wordpress.com

[m] @rishi:gnome.org

I am ...

- rishi
- Red Hat Desktop Team

✉ rishi@fedoraproject.org



I work on ...

- Fedora
 - Silverblue
 - Workstation

- GNOME
- Flatpak

✉ rishi@fedoraproject.org



Emerging OSES

- What is an emerging operating system?



Emerging OSES

- Linux OS as an OSTree image
- <https://ostree.readthedocs.io/>
- Robust upgrades
- Easy to roll back faulty upgrades
- Easy to test



Emerging OSES

- Operating system is separate from applications
- Apps are in containers
 - Flatpak
 - OCI



Emerging OSes

- <https://os.gnome.org/>
 - Nightly reference builds of GNOME
- <https://endlessos.com/>
 - Debian and GNOME derivative
 - Emerging markets



Emerging OSes

- <https://silverblue.fedoraproject.org/>
- <https://kinoite.fedoraproject.org/>
 - Next-generation Fedora Workstation and KDE
- <https://coreos.fedoraproject.org/>
 - CoreOS Inc's Container Linux
 - Project Atomic's Atomic Host
 - Cloud and server workloads



Emerging OSES

- No package managers like DNF
- Read-only /usr
- OSTree image is hard to modify





```
rishi@svoboda:~  
[rishi@svoboda ~]$ cat /etc/fedora-release  
Fedora release 35 (Thirty Five)  
[rishi@svoboda ~]$  
[rishi@svoboda ~]$ which dnf  
/usr/bin/which: no dnf in (/var/home/rishi/opt/bin:/opt/bin:/var/home/rishi/.local/bin:/var/home/rishi/bin:/usr/local/bin:/usr/local/sbin:/usr/bin:/usr/sbin)  
[rishi@svoboda ~]$  
[rishi@svoboda ~]$ rpm-ostree status --version  
rpm-ostree:  
Version: '2022.2'  
Git: 1e62f2bb60bc39b443dac0c00d40124ef002bb73  
Features:  
- rust  
- compose  
- fedora-integration  
[rishi@svoboda ~]$
```

Developing on emerging OSes

- How to set up a development environment?
- How to install compilers, debuggers, editors, SDKs, and so on?



Developing on emerging OSes

- GNOME Builder as a Flatpak
- GNOME Builder is a container-native IDE
 - It can be installed in a container
 - Development environment in a container
 - Build a Flatpak of the application as an artifact



Developing on emerging OSes

- What about working on plumbing, not applications?
- Lots of development tools not available as Flatpak runtime extensions



Developing on emerging OSes

- What about other IDEs?
 - Visual Studio as Flatpak, but ...
- What about good old Emacs, Vim and the usual command-line?



Troubleshooting emerging OSes

- How to troubleshoot the operating system
 - `sos report`
 - <https://sos.readthedocs.io/>
- How to troubleshoot the network?
 - Nmap, tcpdump, etc.



Fedora Silverblue

- Package layering with rpm-ostree
 - Locally built OSTree images with custom content
 - `rpm-ostree install strace`
- Need to reboot can be annoying
- Too much use negates the benefits of OSTree





Toolbx

- <https://containertoolbx.org/>
- Trivial to get a mutable package-based environment
- Decoupled from the operating system

- Formerly Toolbox or Fedora Toolbox.





```
rishi@toolbox:~ — toolbox enter
[rishi@svoboda ~]$ toolbox enter
[rishi@toolbox ~]$
[rishi@toolbox ~]$ cat /etc/fedora-release
Fedora release 35 (Thirty Five)
[rishi@toolbox ~]$
[rishi@toolbox ~]$ which dnf
/usr/bin/dnf
[rishi@toolbox ~]$
[rishi@toolbox ~]$ sudo dnf install strace
Last metadata expiration check: 0:04:31 ago on Fri Apr 29 00:20:28 2022.
Dependencies resolved.
=====
Package                Architecture  Version      Repository    Size
=====
Installing:
strace                  x86_64       5.16-1.fc35  updates      1.4 M
Transaction Summary
=====
Install 1 Package

Total download size: 1.4 M
Installed size: 2.8 M
Is this ok [y/N]:
```

Toolbx

- Based on the Open Containers Initiative (or OCI)
- <https://podman.io/>
- No cognitive overhead of containers
 - No need to figure out why the SSH agent or the display server or Kerberos isn't working



Toolbx — primary goal

- Bring back the usual command-line on emerging OSes
 - Development
 - Troubleshooting
- Crucial for adoption of these OSes



Toolbx — primary goal

- `toolbox` ...
 - Equivalent to `$USER` on the host

- `sudo toolbox` ...
 - Equivalent to `root` on the host



Toolbx

- <https://github.com/containers/toolbox>
- 31st August, 2018 — first commit
- Two months after rootless Podman
 - <https://github.com/containers/podman/pull/871>
- Written in Go



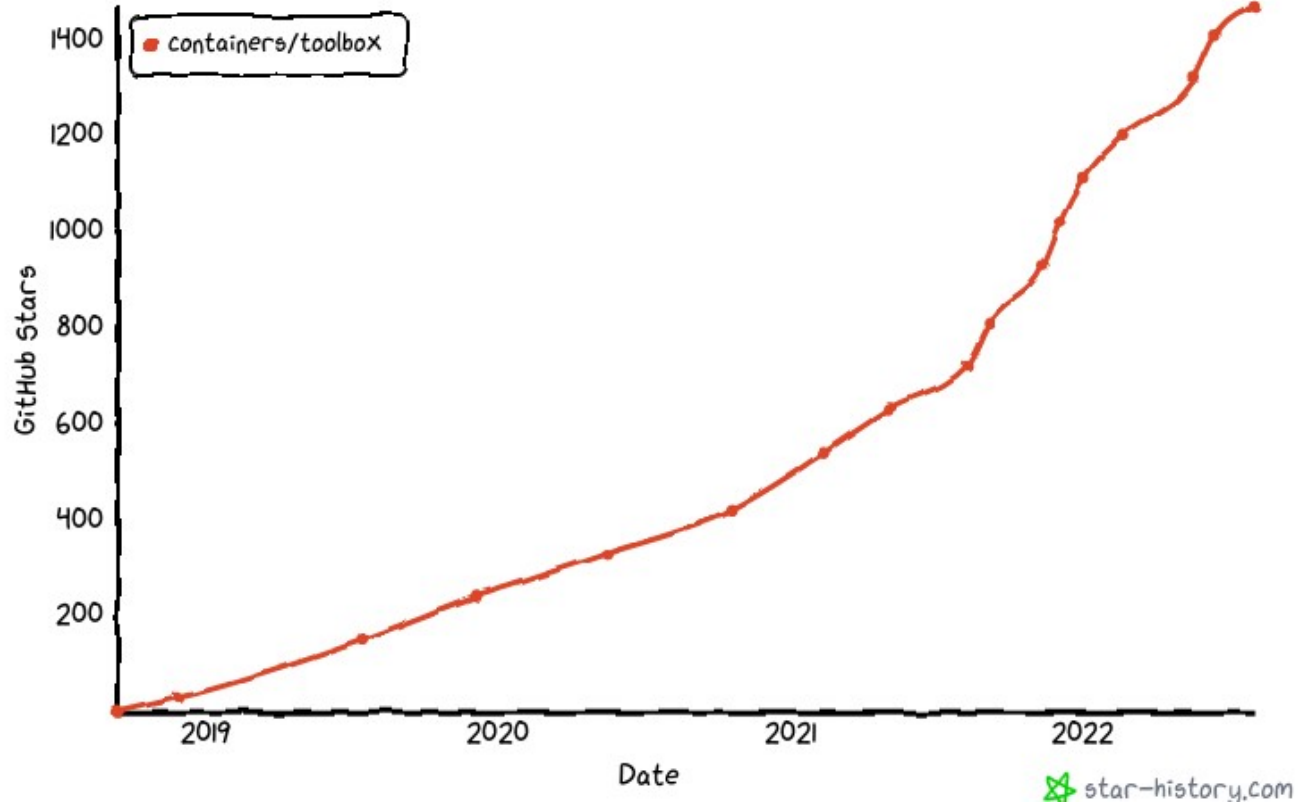
Toolbx

- Inspired by <https://github.com/coreos/toolbox>
- Completely different code base, without
 - <https://github.com/rkt/rkt>
 - systemd-nspawn(1)



Star History

Align timeline



Toolbx — what works ...

- Wayland and X applications
- SSH agent
- User D-Bus clients and daemons



Toolbx — what works ...

- Avahi, DNS, VPN, etc.
- ping(8)



Toolbx — what works ...

- Nmap
 - OS detection
 - TCP SYN scan
- tcpdump(8)



Toolbx — what works ...

- Timezones
 - /etc/localtime and /etc/timezone
- Removable devices



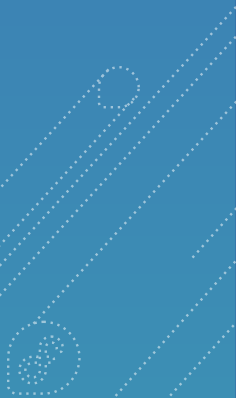
Toolbx — what works ...

- Kerberos
- PC/SC smart card daemon
- locate(1),
- ulimits



Toolbx — what works ...

- libvirt, including the system instance
- <https://minikube.sigs.k8s.io/>



Toolbx — what doesn't work yet

- NVIDIA proprietary driver
 - <https://github.com/containers/toolbox/issues/116>
- Running a full Wayland session with logind, etc.
 - <https://github.com/containers/podman/issues/6140>
 - <https://github.com/containers/toolbox/issues/992>



Toolbx — what doesn't work yet

- Some rough edges with locales
- CA certificates
 - <https://github.com/containers/toolbox/issues/626>



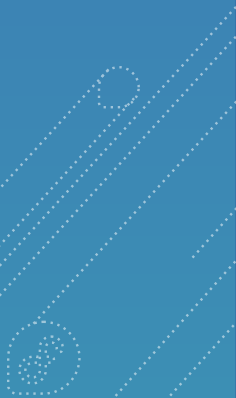
Toolbx — environments

- Fedora
- Red Hat Enterprise Linux



Toolbx — environments

- Arch
 - <https://github.com/containers/toolbox/pull/861>
- Ubuntu
 - <https://github.com/containers/toolbox/pull/483>



Toolbx on conventional OSes

- Doesn't require an OSTree based operating system
- Works just fine on package based OSes
 - Arch Linux
 - Fedora Workstation
 - Red Hat Enterprise Linux ≥ 8.5
 - ... and others



Toolbx on conventional OSes

- Value in keeping the OS pristine
- Easy access to different toolchain and library versions
- Reduces the need for a virtual machine



<https://containertoolbx.org/>

