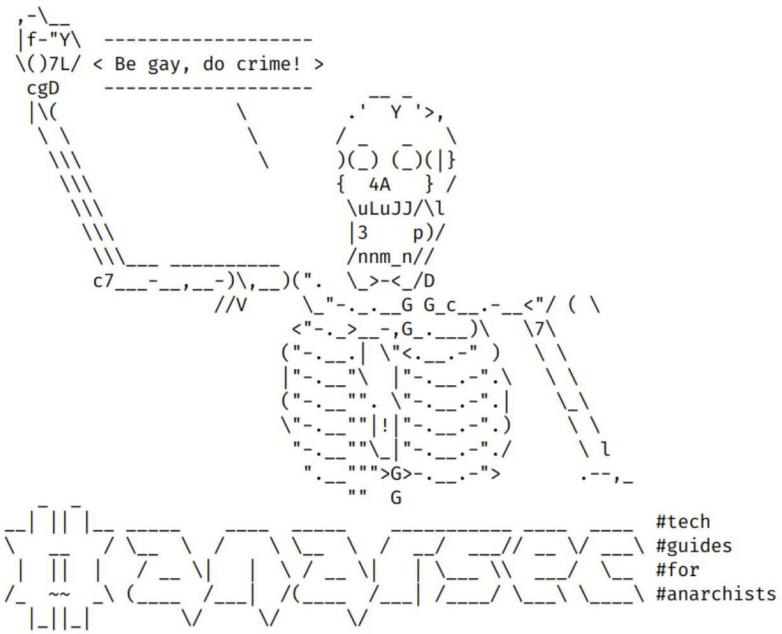
Qubes OS is a security-oriented operating system (OS), which means it is an operating system designed from the ground up to be more difficult to hack. This is achieved through compartmentalization, where the base system is divided into compartments called “qubes”. All other Linux systems like Tails are monolithic, which means that they are not compartmentalized, so if a hack succeeds anywhere on the system, it can more easily take over. In Qubes OS, if one qube is compromised, the others remain safe. You can think of using Qubes OS as having many different computers on your desk, each for a different activity, but with the convenience of a single physical machine and a set of tools for securely using them all together as a unified system.



Qubes OS for Anarchists

QUBES OS
A REASONABLY SECURE OPERATING SYSTEM

Series: Defensive

This version of the zine was last edited on 2024-04-24. Visit anarsec.guide to see whether it has been updated since.

The dagger symbol † on a word means that there is a glossary entry for it. Ai ferri corti.

AnarSec is a resource designed to help anarchists navigate the hostile terrain of technology — defensive guides for digital security and anonymity, as well as offensive guides for hacking. All guides are available in booklet format for printing and will be kept up to date.

Defensive

Tails

- Tails for Anarchists
- Tails Best Practices

Qubes OS

- Qubes OS for Anarchists

Phones

- Kill the Cop in Your Pocket
- GrapheneOS for Anarchists

General

- Linux Essentials
- Remove Identifying Metadata From Files
- Encrypted Messaging for Anarchists
- Make Your Electronics Tamper-Evident

Offensive

Coming soon

Contents

For more information, see Privacy Guides[146], and for an excellent comparison of a VPN and Tor†, see Defend Dissent: Anonymous Routing[147].

[146] privacyguides.org/en/basics/vpn-overview/

[147] open.oregonstate.education/defenddissent/chapter/anonymous-routing/

Virtual Machine (VM)

A virtual machine is a virtualization†/emulation of a computer system. Virtual machines are based on computer architectures and provide the functionality of a physical computer. This can provide the security benefit of sandboxing[133]. Qubes OS† consists of VMs that run directly on the hardware[144] (referred to as "bare metal"). According to the Qubes project, "virtualization is currently the only practically viable approach to implementing strong isolation while simultaneously providing compatibility with existing applications and drivers."

VPN (Virtual Private Network)

A VPN extends a private network (like your home network) over a public network (like the Internet). Devices connected to the VPN are part of the private network, even if they are physically located elsewhere. Applications that use a VPN are subject to the functionality, security, and management of the private network.

In other words, it is a technology that essentially makes it appear that you are connecting to the Internet from the network of the company providing the service, rather than from your home network. Your connection to the company is through an encrypted "tunnel". A VPN is not the best tool for anonymity (defined as knowing who you are — Tor is far better), but it can partially enhance your privacy (defined as knowing what you are doing).

It is important to emphasize this to cut through the widespread marketing hype; a VPN is not enough to keep you anonymous[145]. Using a VPN can be thought of as simply shifting your trust from a local Internet Service Provider which is guaranteed to be a snitch to a remote company that claims to limit its ability to effectively snitch on you.

[144]qubes-os.org/faq/#how-does-qubes-os-compare-to-running-vms-in-a-conventional-os

[145]ivpn.net/privacy-guides/will-a-vpn-protect-me/

Qubes OS is a security-oriented operating system† (OS), which means it is an operating system designed from the ground up to be more difficult to hack. This is achieved through compartmentalization[1], where the base system is divided into compartments called "qubes". All other Linux systems like Tails[2] are *monolithic*, which means that they are not compartmentalized, so if a hack succeeds anywhere on the system, it can more easily take over. In Qubes OS, if one qube is compromised, the others remain safe. You can think of using Qubes OS as having many different computers on your desk, each for a different activity, but with the convenience of a single physical machine and a set of tools for securely using them all together as a unified system.

Qubes OS can be configured to force all Internet connections through the Tor network† (like Tails) by using Whonix[3], which is included by default. Devices (USBs, network devices, microphone and camera) are all strongly isolated and only allowed access when explicitly granted. "Disposables" are one-off qubes that self-destruct when shut down.

Who is Qubes OS For?

Given that anarchists are regularly targeted[4] with malware in repressive investigations, Qubes OS is an excellent choice for us. We recommend Qubes OS for everyday use, and below[5] we compare when it is appropriate to use Tails vs. Qubes OS in more detail — both have unique strengths. While Tails is so easy to use that you don't even need to know anything about Linux, Qubes OS is a bit more involved, but still designed to be accessible to users with limited technical know-how, like journalists. This guide is labelled as "intermediate", though if

[1]qubes-os.org/faq/#how-does-qubes-os-provide-security

[2]anarsec.guide/tags/tails/

[3]whonix.org/

[4]notrace.how/threat-library/techniques/targeted-digital-surveillance/malware.html

[5]anarsec.guide/posts/qubes/#when-to-use-tails-vs-qubes-os

you need to extensively customize your set up or troubleshoot something, it is more likely to be "advanced".

Even if you don't do anything directly incriminating on the computer you use every day, if it were compromised, this would still give investigators a field day for network mapping[6] — knowing who you talk to and what you talk to them about, what projects you are involved in, what websites you read, etc. Most anarchists use everyday computers for some anarchist projects and to communicate with other comrades, so making our personal computers difficult to hack is an important baseline for all anarchists. That said, the time investment to learn Qubes OS isn't for everyone. For those with limited energy to put towards increased anonymity and security, Tails is much more straightforward.

How Does Qubes OS Work?

Qubes OS is not quite another version of Linux. Rather, it is based on many "virtual machines†" running Linux. All of these "virtual machines" are configured to work together to form a cohesive operating system.

What is a virtual machine? Virtualization† is the process of running a virtual computer *inside* your computer. The virtual machine thinks it's a computer running on real hardware, but it's actually running on abstracted hardware (software that mimics hardware). Qubes OS uses a special program called a hypervisor to manage and run many of these virtual machines simultaneously, on the same physical computer. To simplify things, virtual machines are referred to as qubes. Different operating systems such as Debian, Whonix, Fedora, Windows, etc. can all run together at the same time in their own qubes. The hypervisor strongly isolates each of the qubes from one another.

[6] notrace.how/threat-library/techniques/network-mapping.html

Tor network

Tor[140] (short for The Onion Router) is an open and distributed network that helps defend against traffic analysis. Tor protects you by routing your communications through a network of relays run by volunteers around the world: it prevents someone monitoring your Internet connection from learning what sites you visit, and it prevents the operators of the sites you visit from learning your physical location.

Every website visited through the Tor network passes through 3 relays. Relays are servers hosted by different people and organizations around the world. No single relay ever knows both where the encrypted connection is coming from and where it is going. An excerpt from a leaked top-secret NSA assessment calls Tor "the King of high secure, low latency Internet anonymity" with "no contenders for the throne in waiting". The Tor network can be accessed through the Tor Browser on any operating system. The Tails† operating system forces every program to use the Tor network when accessing the Internet.

For more information, see Tails for Anarchists[141] and Privacy Guides[142]. To understand the limitations of Tor, see the Whonix documentation[143].

Virtualization

Virtualization is a technology that creates a virtual version of something, including virtual computer hardware. A Virtual Machine† takes advantage of this technology.

[140] torproject.org/
[141] anarsec.guide/posts/tails/#tor
[142] privacyguides.org/en/advanced/tor-overview/
[143] whonix.org/wiki/Warning

Malware

Malware (malicious software) is a generic term for software that contains unwanted or malicious functionality. Malware includes ransomware, Trojan horses, computer viruses, worms, spyware, scareware, adware, etc. Today, malware is more difficult to categorize because sophisticated malware often combines characteristics of different categories. For example, WannaCry[138] spread like a worm, but encrypted files and held them for ransom (ransomware).

Open-source

The only software we can trust because the "source code" that it is written in is "open" for anyone to examine.

Operating system (OS)

The system software that runs your device before any other software. Some common examples include Windows, macOS, Linux, Android, and iOS. Linux and some versions of Android are the only open-source options on this list.

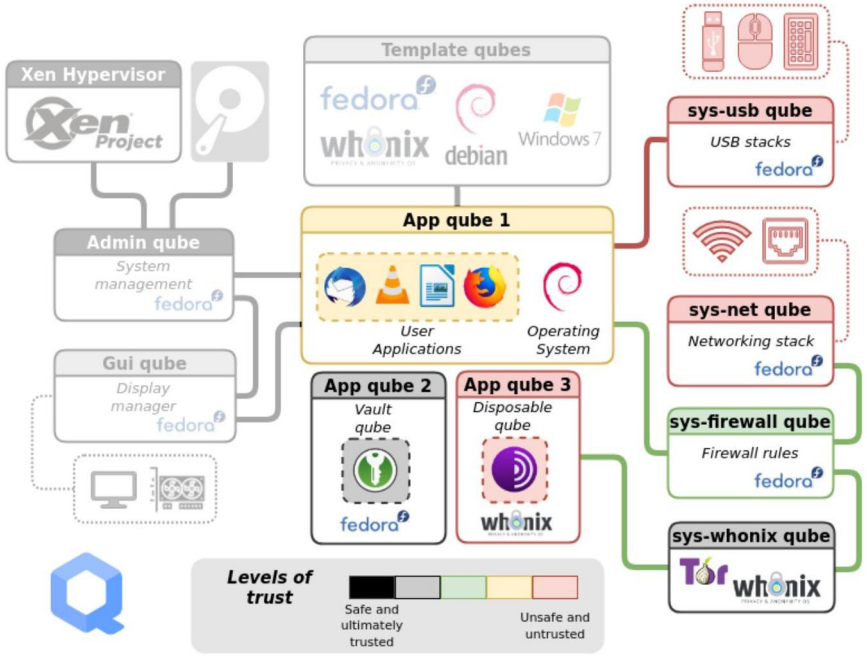
Phishing

Phishing is a technique of social engineering[133]. Attackers send SMS messages, emails, chat messages, etc. to their targets to get their personal information. The attackers can then try to impersonate their victims. It can also be used to get the victim to download malware† onto a system, which can be used as a starting point for hacking. Spear phishing[133] is a more sophisticated form of phishing. For more information, see the Kicksecure documentation[139].

[138] en.wikipedia.org/wiki/WannaCry_ransomware_attack
[139] kicksecure.com/wiki/Social_Engineering

At the risk of overwhelming you, here is an overview of how Qubes OS is structured. You don't need to memorize any of this to actually use Qubes OS, but it may be helpful to understand the outline of the system before you get started. Each rectangle represents a qube (i.e. a virtual machine). Let's break it down.

General Usage



Ignore the greyed-out parts of the diagram for now. Daily use of Qubes OS primarily involves interaction with two components:

- **App qubes**. In this example, there are three. #1 is running the Debian operating system, #2 is running Fedora, and #3 is running Whonix. App qubes are where you run applications, store files, and do your work. You can have many isolated App qubes for different activities or purposes. Each App qube is like a complete, self-contained operating system.
- **Service qubes**. Sys qubes (as in *system*) connect to the Internet and to devices. **sys-usb** manages connected USB devices so that they are only able to attach to a qube if you give them permission. **sys-net** is similar to sys-usb, but for network devices. **sys-firewall** is firewall control for all Internet-connected qubes, and is in a separate qube so that if sys-net is compromised, the firewall isn't. Note that qubes

can verify the checksum[133] of a file using either a GUI (the GtkHash program) or a CLI command (`sha256sum`).

For more information, see Linux Essentials[134]. The Tech Learning Collective's "Foundations: Linux Journey" course on the command line[135] is our recommended introduction to using the CLI/terminal.

Full Disk Encryption (FDE)

FDE means that the entire disk is encrypted† until a password is entered when the device is powered on. Not all FDE is created equal. For example, the quality of how FDE is implemented on a phone depends not only on your operating system, but also on your hardware (the model of your phone). FDE uses symmetric cryptography[133], and on Linux it typically uses the LUKS specification†.

Hardening

Hardening is a general term for the process of securing systems against attacks.

LUKS

The Linux Unified Key Setup (LUKS)[136] is a platform-independent specification for disk encryption. It is the standard used in Tails†, Qubes OS†, Ubuntu, etc. LUKS encryption is only effective when the device is powered off. LUKS should use Argon2id[137] to make it less vulnerable to brute-force attacks.

[133] anarsec.guide/glossary
[134] anarsec.guide/posts/linux/#the-command-line-interface
[135] techlearningcollective.com/foundations/linux-journey/the-shell
[136] gitlab.com/cryptsetup/cryptsetup
[137] anarsec.guide/posts/tails-best/#passwords

> anti-forensic features. However, it is accessible enough for journalists and other non-technical users. Basic knowledge of using Linux is required — see Linux Essentials[128]. Qubes OS can even run Windows programs such as Adobe InDesign, but much more securely than a standard Windows computer. See Qubes OS for Anarchists[129].

See When to Use Tails vs. Qubes OS[130]. We do not offer "harm reduction" advice for Windows or macOS computers, as this is already widespread and gives a false sense of privacy and security.

Encrypted Messaging

See Encrypted Messaging for Anarchists[131]

Storing Electronic Devices

See Make Your Electronics Tamper-Evident[132].

Appendix: Glossary

Command Line Interface (CLI)

The "command line" is an all-text alternative to the graphical "point and click" tool that most of us are more familiar with; the Command Line Interface (CLI) allows us to do some things that a Graphical User Interface (GUI) does not. Often, either a GUI or a CLI would work, and which you use is a matter of preference. For example, in Tails†, you

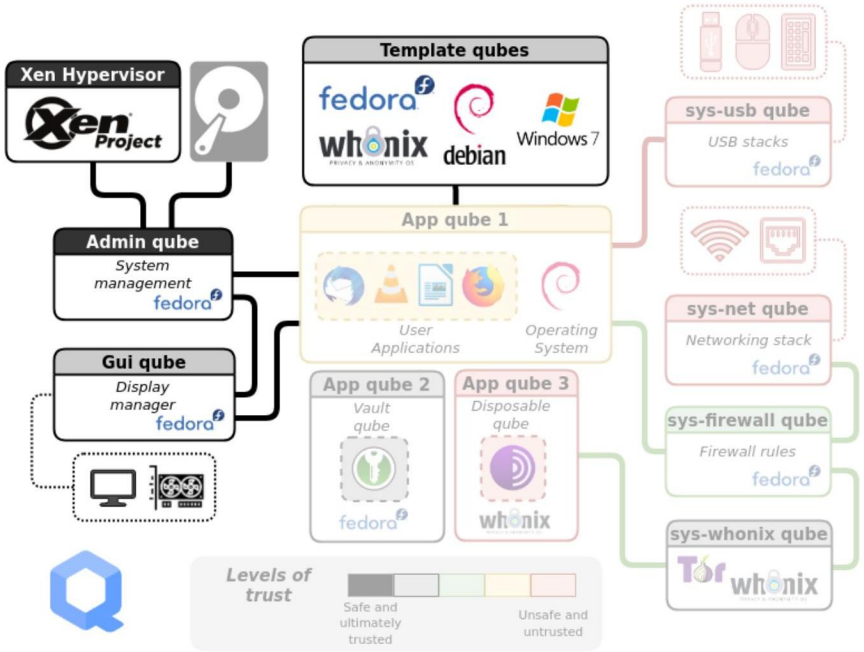
[128] anarsec.guide/posts/linux
[129] anarsec.guide/posts/qubes/
[130] anarsec.guide/posts/qubes/#when-to-use-tails-vs-qubes-os
[131] anarsec.guide/posts/e2ee/
[132] anarsec.guide/posts/tamper/

never connect directly to sys-net, they always connect via sys-firewall. **sys-whonix** forces all network traffic through Tor, and connects to the firewall itself.

You'll notice that App qube #1 is connected to the Internet, App qube #2 is offline, while App qube #3 is connected to the Internet via Tor and is Disposable. Note that Whonix is actually split between two qubes: the workstation (App qube #3) and the gateway (sys-whonix). This has the security property that if the workstation qube is compromised, the gateway qube (where Tor runs) is not.

A Disposable qube is a type of App qube that self-destructs when its originating window closes. Note that while Tails uses only memory (when the Persistent Storage feature is not enabled), Qubes OS uses the hard drive, so a Disposable qube will leave forensic traces on your computer. A Disposable isn't intended to be anti-forensic, it's intended to reset a qube in case it is compromised by malware.

Management Qubes



Two more components are needed to complete the Qubes OS system:

- **Admin qube**. This is the small, isolated and trusted qube that manages the other qubes. It's very protected because if it's compromised, it's game over. It uses a technology called Xen as the hypervisor. It is also called dom0, which is a Xen naming convention. The Admin qube has no network connectivity and is only used to run the desktop environment[7] and window manager[8].
- **Template qubes**. These are where applications and operating system files live and where you install and update software. Each App qube is based on a Template qube, and the App qube can only read from the Template, not write to it. This means that the more sensi-

[7] en.wikipedia.org/wiki/Desktop_environment
[8] en.wikipedia.org/wiki/Window_manager

worked watch, etc.) close to a conversation in which "private or confidential words are spoken" and must remain so, even if it's switched off, we become a potential state informer..."

You may also be interested in the Threat Library's "Digital Best Practices"[123].

Your Phone

Operating system†: **GrapheneOS** is the only reasonably secure choice for cell phones. See GrapheneOS for Anarchists[124]. If you decide to have a phone, treat it like an "encrypted landline" and leave it at home when you are out of the house. See Kill the Cop in Your Pocket[125].

Your Computer

Operating system†: **Tails** is unparalleled for sensitive computer use (writing and sending communiques, moderating a sketchy website, researching for actions, reading articles that may be criminalized, etc.). Tails runs from a USB drive and is designed with the anti-forensic property of leaving no trace of your activity on your computer, as well as forcing all Internet connections through the Tor network†. See Tails for Anarchists[126] and Tails Best Practices[127].

Operating system†: **Qubes OS** has better security than Tails for many use cases, but has a steeper learning curve and no

[123] notrace.how/threat-library/mitigations/digital-best-practices.html
[124] anarsec.guide/posts/grapheneos/
[125] anarsec.guide/posts/nophones/
[126] anarsec.guide/posts/tails/
[127] anarsec.guide/posts/tails-best/

If you need to save a file to the vault

You may also need to copy a file to the vault, so that it can be saved after the disposable is closed. Using the untrusted disposable qube `whonix-workstation-17-dvm`:

- Start `debian-12-offline-dvm` (let's say it opens `disp1312`).
- Copy the file to `disp1312` from the untrusted qube.
- When you are done using the untrusted qube, shut it down.
- Start `vault`. Copy the file from `disp1312` to the `vault`. Sanitize it[118] before opening.

Alternatively, you can create a vault qube for file storage that is compartmentalized to the activity (`vault-webmoderation`). Such a vault can run simultaneously to untrusted qubes used for that activity. Keep your KeePassXC database in `vault`.

Appendix: Recommendations

As anarchists, we must defend ourselves against police and intelligence agencies that conduct targeted digital surveillance[119] for the purposes of incrimination[120] and network mapping[121]. Our goal is to obscure the State's visibility into our lives and projects. Our recommendations are intended for all anarchists, and they are accompanied by guides to put the advice into practice.

We agree with the conclusion of an overview of targeted surveillance measures in France[122]: "So let's be clear about our responsibilities: if we knowingly bring a networked device equipped with a microphone and/or a camera (cell phone, baby monitor, computer, car GPS, net-

[118] anarsec.guide/posts/qubes/#sanitizing-files

[119] notrace.how/threat-library/techniques/targeted-digital-surveillance.html

[120] notrace.how/threat-library/tactics/incrimination.html

[121] notrace.how/threat-library/techniques/network-mapping.html

[122] actforfree.noblogs.org/post/2023/07/24/number-of-the-day-89502-preventive-surveillance-measures-france/

tive system files are protected from whatever happens in an App qube — they are not retained between App qube restarts. Multiple App qubes can be based on a single Template, which has the convenient feature that updating one Template will update all App qubes based on that Template.

Another security feature of the Qubes OS structure is that the App qubes don't have direct access to the hardware — only the Admin qube can directly access the hard drive and only the Service qubes can directly access the networking, USB, microphone and camera hardware. This means that it's more difficult to compromise the hardware from a compromised App qube.

When to Use Tails vs. Qubes OS

Put simply, Tails is easier to use and better protects against *forensics*, while Qubes OS better protects against malware.

Qubes OS includes Whonix by default, which forces all connections through Tor. As compared by Privacy Guides[9] (emphasis added):

> Whonix is meant to run as two virtual machines: a "Workstation" and a Tor "Gateway." All communications from the Workstation must go through the Tor gateway. **This means that even if the Workstation is compromised by malware† of some kind, the true IP address remains hidden.**
>
> Tails is great for counter forensics due to amnesia (meaning nothing is written to the disk); however, it is not a hardened† distribution like Whonix. It lacks many anonymity and security features that Whonix has and gets updated much less often (only once every six weeks). **A Tails system that is compromised by malware may potentially bypass the**

[9] privacyguides.org/desktop/#anonymity-focused-distributions

transparent proxy allowing for the user to be deanonymized.

Whonix virtual machines may be more leak-proof, however they are not amnesic, meaning data may be recovered from your storage device. By design, Tails is meant to completely reset itself after each reboot. Encrypted persistent storage can be configured to store some data between reboots.

For more information on how Whonix compares to Tails in regards to different types of deanonymization attacks, see the Whonix documentation[10].

In order to recover data from a Qubes OS system when it is turned off, an adversary would still need to successfully bypass[11] the Full Disk Encryption† (e.g. by cracking a weak password). In order to recover data from a Tails system when it is turned off, **the situation is the same if any data is saved to Persistent Storage or an encrypted USB** — this saved data is no longer protected by anti-forensic features but by Full Disk Encryption.

Keep in mind that with Tails it is easy to destroy an encrypted USB you no longer need in order to revert to a blank slate of "no trace", but the equivalent with Qubes OS requires destroying the hard drive.

Our recommendation is to use Tails:

- For writing and submitting communiques
- For action research
- For provisioning and connecting to hacking infrastructure
- For anything else where traces will land you in prison
- If the learning curve for Qubes OS is too steep

And to use Qubes OS:

[10] whonix.org/wiki/Comparison_with_Others#Circumventing_Proxy_Obedience_Design

[11] notrace.how/threat-library/techniques/targeted-digital-surveillance/authentication-bypass.html

If you need a password from KeePassXC

While using an untrusted qube, you may need to have access to a password. We'll use the "Emergency pause" feature to neutralize the untrusted qube while opening the vault for the password. For instance, using the untrusted disposable qube `whonix-workstation-17-dvm`:

- Using the Domains widget[117], "Emergency pause" all untrusted qubes that are running.
- Start `vault`. Open KeePassXC and copy the required password to the global clipboard.
- Shutdown `vault`
- Unpause the untrusted qube(s). You can now paste the password from the global clipboard.

If you need a file from the vault

While using an untrusted qube, you may need to copy a file from the vault. To avoid having the vault and untrusted qube running simultaneously, we'll use an intermediary offline disposable. For instance, using the untrusted disposable qube `whonix-workstation-17-dvm`:

- Using the Domains widget, "Emergency pause" all untrusted qubes that are running.
- Start `vault` and your offline disposable, `debian-12-offline-dvm` (let's say it opens `disp1312`). Copy the file from the `vault` to `disp1312`.
- Shutdown `vault`
- Unpause the untrusted qube(s). You can now copy the file to it from `disp1312`.

Alternatively, you can create a vault qube for file storage that is compartmentalized to the activity (`vault-webmoderation`). Such a vault can run simultaneously to untrusted qubes used for that activity. Keep your KeePassXC database in `vault`.

[117] anarsec.guide/posts/qubes/#how-to-shutdown-qubes

Principles

Make sure to always be aware of which qubes are running simultaneously.

- Perform sensitive operations in trusted qubes (without networking if not required), while no untrusted qubes are running. Shut down trusted qubes when they are not in use. The `vault` is considered a trusted qube.
- While untrusted qubes are running there should be no qubes running simultaneously that put sensitive data into memory, because you are assuming that all memory could be leaked. Qubes containing sensitive data include:
  - Any qubes containing data that isn't compartmentalized to your current activity. For example, if you are moderating a website, images files you are going to upload to the website aren't sensitive, but files associated with an unrelated project are.
  - The `vault` qube containing your KeePassXC database.
  - If your untrusted qube requires access to SSH or PGP private keys, set up split-GPG[115] or split-SSH[116]. Use split-GPG or split-SSH from untrusted qubes that you have freshly started (and that are therefore less likely to have been compromised) rather than from untrusted qubes that you've already been using for hours.

Sys qubes

- sys-usb: Set as disposable during the post-installation. Run only when needed, and shut down when finished. Restart after using an untrusted USB device.
- sys-net: Set as disposable during the post-installation. Run only when needed, and shut down when finished. Shut down when performing sensitive operations in other qubes, if possible. Restart before compartmentalized activities that require high security.

[115] qubes-os.org/doc/split-gpg/

[116] forum.qubes-os.org/t/split-ssh/19060

- As an everyday computer
- For sanitizing untrusted files
- For tasks or workflows where Tails is too restrictive
- For increased security against malware in a project, *if* you will be storing sensitive project data long-term on an encrypted volume anyways, because this long-term storage negates the anti-forensic property of Tails. For example, a project's private PGP key needs to be stored long-term, so the benefit of using Tails is negated but the benefit of using Qubes OS remains (increased security against malware).

Getting Started

Qubes OS works best on a laptop with a solid state drive (SSD, which is faster than a hard disk drive, or HDD) and 16GB of RAM. Check this hardware compatibility list[12] to see if a specific laptop model will work. If you want to install HEADS open-source firmware[13] it has limited compatibility[14], so keep that in mind when buying your laptop. We recommend the ThinkPad X230 because it's the only developer-tested laptop model and it is easily found in refurbished computer stores for around $200 USD. See the list of community-recommended computers[15] for some other options, and the appendix[16] for further discussion of hardware security.

The installation guide[17] will get you started. The verification step[18] requires using the command line[†]. If this is over your head, ask a friend to walk you through it. Alternatively, learn the basics of the command

[12] qubes-os.org/hcl/

[13] anarsec.guide/posts/tails-best/#to-mitigate-against-remote-attacks

[14] osresearch.net/Prerequisites#supported-devices

[15] forum.qubes-os.org/t/5560

[16] anarsec.guide/posts/qubes/#appendix-hardware-security

[17] qubes-os.org/doc/installation-guide/

[18] qubes-os.org/security/verifying-signatures/

line with Linux Essentials[19] and see the explanation of a similar verification for Tails[20].

Do not set up "dual boot"[21] — another operating system could be used to compromise Qubes OS.

After you first boot Qubes OS, there is a post-installation:

- Check the boxes for Whonix qubes, and for updates to happen over Tor.
- The post-installation gives the you option to install only Debian or only Fedora Templates (instead of both), and to use the Debian Template for all sys qubes (the default is Fedora). Whether you choose to use Debian or Fedora for qubes that don't require Tor is up to you, but this guide assumes you choose Debian. The Privacy Guides project argues[22] that the Fedora software model (semi-rolling release) is more secure than the Debian software model (frozen), but also recommends Kicksecure[23] (which is based on Debian). See the appendix[24] for further discussion of this configuration choice.
- Make sys-net disposable. If you are using Wi-Fi instead of Ethernet, you will need to re-enter the Wi-Fi password after every boot (you can simply paste it from your password manager).

The Getting Started[25] document is a good overview of most of what you need to know to begin — stop here to read it! The Qubes documentation[26] is very thorough, but can be difficult for a new user to navigate. We'll go over some basics here that aren't already covered on the Getting Started page.

[19] anarsec.guide/posts/linux/

[20] anarsec.guide/posts/tails-best/#appendix-gpg-explanation

[21] qubes-os.org/faq/#can-i-install-qubes-os-together-with-other-operating-system-dual-bootmulti-boot

[22] privacyguides.org/os/linux-overview/#choosing-your-distribution

[23] privacyguides.org/en/os/linux-overview/#kicksecure

[24] anarsec.guide/posts/qubes/#appendix-post-installation-decisions

[25] qubes-os.org/doc/getting-started/

[26] qubes-os.org/doc/

- **Microcode updates**: Spectre and Meltdown are mitigated by microcode updates for this generation of CPUs[111] which are installed by default on Qubes OS[112]. Some attacks target only newer CPUs (new CPU extensions mean new attack surface), and the Ivy generation CPUs won't be vulnerable to these attacks.

Qubes OS also applies appropriate software mitigation to this class of attacks at the hypervisor level, including disabling HyperThreading[113].

Appendix: OPSEC for Memory Use

Each running qube uses memory, and a compromised qube could use CPU vulnerabilities to read and exfiltrate memory used by other qubes. To address "future not-yet-identified vulnerabilities of this kind", the operational security (OPSEC) suggestion is to limit the presence of things in memory that a compromised qube could read.

Disposables are recycled[114] after they are shut down, so we can assume that their compromise would likely be temporary (for it to not be temporary, an adversary would need to escape from the virtual machine with a Xen exploit, before the disposable is shut down). Memory OPSEC protects against an adversary who can exploit a CPU vulnerability, but cannot escape from a Xen virtual machine.

We call a qube "untrusted" when it is networked and thus is at a higher risk of compromise. While it can be useful to distinguish levels of trust for networked qubes based on likely attack vectors (red borders for fully untrusted, purple borders for semi-trusted, etc.), any networked qube should be considered untrusted on some level. Whenever possible, untrusted qubes should be disposable.

[111] forum.qubes-os.org/t/secure-hardware-for-qubes/19238/52

[112] whonix.org/wiki/Spectre_Meltdown#Qubes_2

[113] qubes-os.org/news/2018/09/02/qsb-43/

[114] qubes-os.org/doc/how-to-use-disposables/

- **Microcode updates**: Newer hardware gets microcode[105] updates to the CPU that (ideally) fix vulnerabilities as they are discovered, while older hardware doesn't after it's considered end-of-life. The Heads threat model page[106] explains why CPU vulnerabilities are important:

> "With the disclosure of the Spectre and Meltdown vulnerabilities in January 2018, it became apparent that most processors manufactured since the late 1990s can potentially be compromised by attacks made possible because of transient execution CPU vulnerabilities[107]. [...] Future not-yet-identified vulnerabilities of this kind is likely. For users of Qubes OS, this class of vulnerabilities can additionally compromise the enforced isolation of virtual machines, and it is prudent to take the risks associated with these vulnerabilities into account when deciding on a platform on which to run Heads and Qubes OS."

Of the community-recommended computers[108], the **ThinkPad X230** and **ThinkPad T430** strike a relatively unique balance because they both use the Ivy generation[109] of CPUs and are both compatible with Heads:

- **Root of trust**: Heads uses the Trusted Platform Module (TPM)[110] to store secrets during the boot process — the Thinkpad X230 and T430 have TPM v1.1.
- **Blobs**: There are no binary blobs on these models after Heads is installed, except for the Intel Management Engine (which can be neutered) and the Ethernet blob (which can be generated).

[106] osresearch.net/Heads-threat-model/#binary-blobs-microcode-updates-and-transient-execution-vulnerabilities
[107] en.wikipedia.org/wiki/Transient_execution_CPU_vulnerability
[108] forum.qubes-os.org/t/5560
[109] en.wikipedia.org/wiki/Ivy_Bridge_(microarchitecture)
[110] tech.michaelaltfield.net/2023/02/16/evil-maid-heads-pureboot/#tpm

How to Update

On Qubes OS, you should **not** use the `apt update` or `apt upgrade` commands, which you may be used to from other Linux experiences. As the documentation[27] states, "these bypass built-in Qubes OS update security measures. Instead, we strongly recommend using the Qubes Update tool or its command-line equivalents." The first thing you'll want to do after connecting to the Internet in a new Qubes installation is to run Qubes Update. From the docs:

> you can [...] start the tool manually by selecting it in the Applications Menu under "Qubes Tools." Even if no updates have been detected, you can use this tool to check for updates manually at any time by selecting "Enable updates for qubes without known available updates," then selecting all desired items from the list and clicking "Next."

Make sure to have the computer plugged into power whenever you run Qubes Update. Updates take a moment to be detected on a new system, so select "Enable updates...", check the boxes for all qubes, and press **Next**. A Whonix window may pop up asking you to do a command line update, but ignore this since the update will resolve it. Once Qubes Update is complete, reboot.

How to Copy and Paste Text

Qubes has a special global clipboard that allows you to copy and paste text between qubes.

1. Press **Ctrl+C** to copy text as normal to the internal clipboard of the source App qube.
2. Press **Ctrl+Shift+C** to copy the contents of the internal clipboard of the source App qube to the global clipboard.

[27] qubes-os.org/doc/how-to-update/

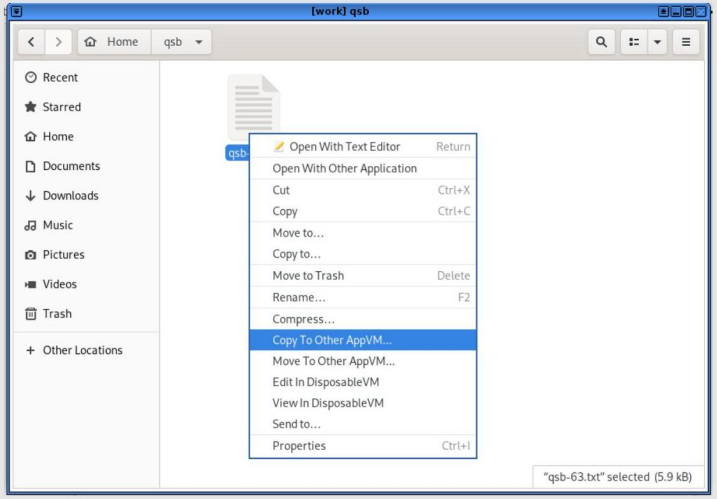
3. Press **Ctrl+Shift+V** in the destination App qube to copy the contents of the global clipboard to the internal clipboard of the destination App qube.
4. Press **Ctrl+V** to paste text as usual from the internal clipboard of the destination App qube.

It's a bit tricky at first, but you'll get the hang of it in no time!

How to Copy and Move Files

There is a special tool for moving files and directories (folders) between qubes that requires explicit user permission.

From the docs[28]:

> 1. Open a file manager in the qube containing the file you wish to copy (the source qube), right-click on the file you wish to copy or move, and select **Copy to Other AppVM**... or **Move to Other AppVM**....
>
> 
>

[28] qubes-os.org/doc/how-to-copy-and-move-files/

To create a Kicksecure disposable, go to **Applications menu → Qubes Tools → Create Qubes VM**:

- **Name**: kicksecure-17-dvm
- **Color**: purple
- **Type**: AppVM
- **Template**: kicksecure-17
- **Networking**: default (sys-firewall)
- In the new qubes' **Settings → Advanced** tab, under "Other", check "Disposable Template", then press **OK**. You will now see the disposable in the Apps tab of the Applications Menu. Make sure you are not working in the disposable Template (the same name in the Templates tab of the Applications menu).

Kicksecure is not officially supported[103] for sys qubes. If you set all sys qubes to use the Debian Template during the Qubes OS installation, and set sys qubes to be disposable, the Template for `sys-net`, `sys-firewall`, and `sys-usb` will be `debian-12-dvm`. If you want to use disposable Kicksecure for sys qubes, set `sys-net`, `sys-firewall`, and `sys-usb` to use the `kicksecure-17-dvm` Template.

Appendix: Hardware Security

Hardware security is a nuanced subject, with three prominent factors at play for a Qubes OS computer:

- **Root of trust**: A secure element for storing secrets that can be used as a root of trust during the boot process.
- **Blobs:** Newer hardware comes with binary blobs[104] that require trusting corporations to do the right thing, while some older hardware is available without binary blobs.

[103] forums.kicksecure.com/t/kicksecure-for-sys-qubes-and-sys-vpn/442/2
[104] en.wikipedia.org/wiki/Binary_blob
[105] en.wikipedia.org/wiki/Microcode

GPG keys are stored in an offline qube and access to them is strictly controlled.

Wrapping Up

The documentation has several troubleshooting entries[97], and the forum[98] is generally very helpful. We recommend that you start using Qubes OS gradually, as trying to learn everything at once can be overwhelming. But we promise, it's not as complicated as it seems at first!

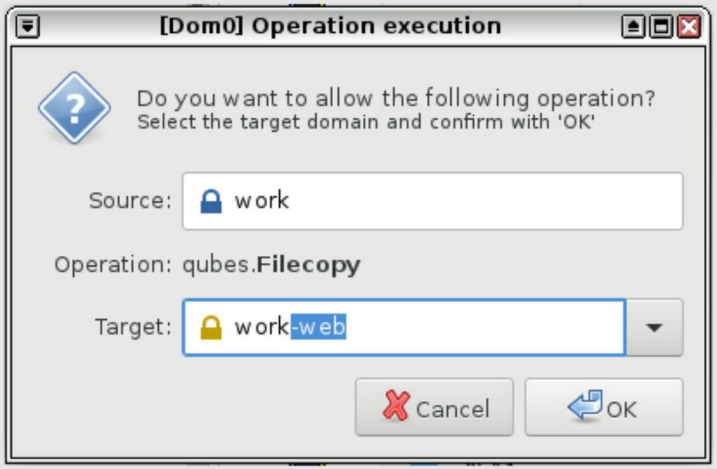
Appendix: Post-installation Decisions

During the post-installation of Qubes OS[99], you have the option to install only Debian or only Fedora Templates (instead of both). You also have the option to use the Debian Template for all sys qubes (the default is Fedora). Our recommendation is to install only Debian Templates and convert them to Kicksecure[100]. This way, every App qube on your system will be either Whonix or Kicksecure — Kicksecure is significantly more hardened[†] than either Debian or Fedora.

Kicksecure is not currently available as a Template[101]. To get the Kicksecure Template, clone the Debian Template — follow the Kicksecure documentation for "distribution morphing" on Qubes OS[102]. App qubes that require Internet access without Tor can now use the Kicksecure template instead of the Debian Template. We recommend using disposable qubes whenever possible when connecting to the Internet.

[96] qubes-os.org/doc/split-gpg/
[97] qubes-os.org/doc/#troubleshooting
[98] forum.qubes-os.org/
[99] anarsec.guide/posts/qubes/#getting-started
[100] privacyguides.org/en/os/linux-overview/#kicksecure
[101] kicksecure.com/wiki/Qubes#Template
[102] kicksecure.com/wiki/Qubes#Distribution_Morphing

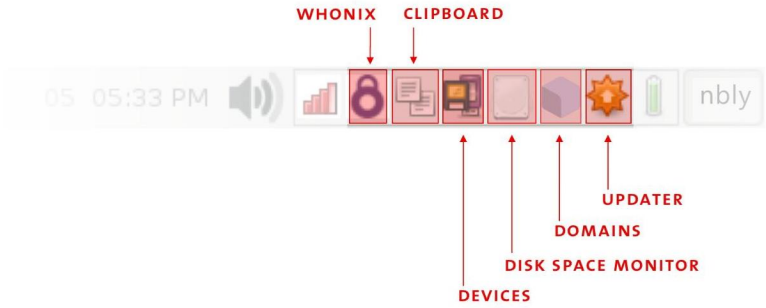
2. A dialog box will appear in dom0 asking for the name of the target qube (qube B). Enter or select the desired destination qube name.



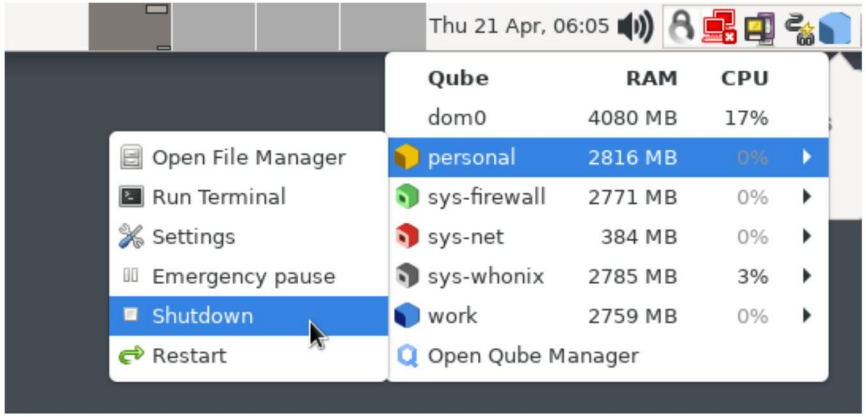
3. If the target qube is not already running, it will be started automatically, and the file will be copied there. It will show up in this directory (which will automatically be created if it does not already exist): `/home/user/QubesIncoming/<source_qube>/`. If you selected Move rather than Copy, the original file in the source qube will be deleted. (Moving a file is equivalent to copying the file, then deleting the original.)

4. If you wish, you may now move the file in the target qube to a different directory and delete the `/home/user/QubesIncoming/` directory when no longer needed.

How to Shutdown Qubes



Click on the Domains widget to see which Qubes are currently running and how much memory (RAM) and processing power (CPU) they are using. Each qube uses memory, so when you are done with a qube, you should shut it down to free up the memory it is using. Closing windows isn't enough — you need to shut down the qube when you're done with it.



- Only attach USBs and external drives to a qube that is disposable and offline.
- To mitigate physical attacks on the computer, buy a dedicated laptop from a refurbished store, make the laptop screws tamper-evident, and use tamper-evident storage[91].
- To mitigate remote attacks on the computer, you can use anonymous Wi-Fi. You can also replace the BIOS with HEADS[92], though this is advanced. Unlike for Tails, it's not possible to remove the hard drive because it is used by the operating system. Qubes OS already isolates the Bluetooth interface, camera, and microphone. USBs with secure firmware are less important thanks to the isolation provided by sys-usb, and a USB with a physical write-protect switch is unnecessary because the operating system files are stored on the hard drive.

Phishing awareness

- This is where Qubes OS really shines. Awareness is no longer your only defense — Qubes OS is designed to protect against phishing† attacks.
- Open attachments in a disposable and offline qube.
- Open links in a disposable Whonix-Workstation qube.

Encryption

- Passwords: See above[93]
- Encrypted containers: SiriKali works the same way, and is useful for a second layer of defense.
- Encrypted communication: Use Cwtch[94]. See Encrypted Messaging for Anarchists[95]. The Qubes OS documentation can be used to configure Split-GPG[96] — this is an advanced configuration where private

[90] tails.net/install/expert/index.en.html
[91] anarsec.guide/posts/tamper/
[92] anarsec.guide/posts/tails-best/#to-mitigate-against-remote-attacks
[93] anarsec.guide/posts/qubes/#password-management
[94] cwtch.im/
[95] anarsec.guide/posts/e2ee/

Best Practices

Configuring Qubes OS is much more flexible than configuring Tails, but most of the Tails best practices[84] still apply. To summarize, in the order of the Tails article:

Protecting your identity

- Clean metadata[85] from files before you share them.
- Compartmentalization is baked into Qubes OS; instead of restarting Tails, use a dedicated qube.

Limitations of the Tor network

- For sensitive activities, don't use Internet connections that could deanonymize you, and prioritize .onion links when available. BusKill is also available for Qubes OS[86] (and we recommend not obtaining it through the mail).
- If you might be a target for physical surveillance, consider doing surveillance detection[87] and anti-surveillance[88] before going to a cafe to use the Internet. Alternatively, use a Wi-Fi antenna from indoors. See the Tails article for further advice on deciding what Internet connection to use.

Reducing risks when using untrusted computers

- The verification stage[89] of the Qubes OS installation is equivalent to the GnuPG verification of Tails[90].

[84] anarsec.guide/posts/tails-best/
[85] anarsec.guide/posts/metadata/
[86] buskill.in/qubes-os/
[87] notrace.how/threat-library/mitigations/surveillance-detection.html
[88] notrace.how/threat-library/mitigations/anti-surveillance.html
[89] qubes-os.org/security/verifying-signatures/

How to Install Software

While Tails can install additional software through a Graphical User Interface[29] (GUI, the "point and click" alternative to the Command Line Interface[†]), Qubes OS cannot at this time, so new software must be installed from the command line. If you are unfamiliar with the command line or how software works in Linux, see Linux Essentials[30] to get acquainted. When choosing what additional software to install, keep in mind that being open-source[†] is an essential criteria, but not sufficient to be considered secure. The list of included software for Tails[31] will cover many of your needs with reputable choices.

Software is installed into Templates, which have network access only for their package manager (apt or dnf). Installing a package requires knowing its name, which can be found using a web browser for both Debian[32] and Fedora[33], or using the command line.

It is best not to install additional software into the default Template, but rather to install the software into a cloned Template, to avoid unnecessarily increasing the attack surface of all App qubes based on the default Template. The basic formula is:

1) Clone Template
2) Install additional packages in the cloned Template
3) Create an App qube based on the cloned Template
4) Optional: Make this App qube a disposable

For example, to install packages for working with documents, which are not included by default in `debian-12`, clone it first. Go to **Applications menu → Qubes Tools → Qube Manager**. Right click on `debian-12` and select "Clone qube". Name the new Template `debian-12-documents`.

[29] tails.net/doc/persistent_storage/additional_software/index.en.html
[30] anarsec.guide/posts/linux/
[31] tails.net/doc/about/features/index.en.html#index1h1
[32] packages.debian.org/
[33] packages.fedoraproject.org/

To install new software, as described in the docs[34]:

1. Start the template.
2. Start a terminal.
3. Install software as normally instructed inside that operating system, e.g.:

- Fedora: `sudo dnf install <PACKAGE_NAME>`
- Debian: `sudo apt install <PACKAGE_NAME>`

4. Shut down the template.
5. Restart all qubes based on the template.
6. (Recommended) In the relevant qubes' **Settings → Applications** tab, move the new application(s) to the "Selected" list, and press **OK**. These new shortcuts will appear in the Applications Menu. (If you encounter problems, see here[35] for troubleshooting.)

[34] qubes-os.org/doc/how-to-install-software/#installing-software-from-default-repositories

[35] qubes-os.org/doc/app-menu-shortcut-troubleshooting/

verify that a backup is not silently corrupted[78] by actually restoring it — first rename the App qube you will restore to avoid confusion.

Password Management

Manage passwords by using KeePassXC from the `vault` App qube. If you are not familiar with KeePassXC, you can learn about it in Tails for Anarchists[79]. This approach requires you to memorize three passwords:

1. LUKS† password (first boot password)
2. User password (second boot password, which is much less important than the LUKS password[80])
3. KeePassXC password

Shutdown Qubes OS whenever you are away from the computer for more than a few minutes. For advice on password quality, see Tails Best Practices[81].

Windows Qubes

It is possible to have Windows qubes[82], although the installation is a bit involved. This allows programs not available for Linux, such as the Adobe Creative Suite programs, to be used from Qubes OS (ideally offline). Installing "cracked" software downloaded from a torrent is not recommended, as these files are often malicious. The Adobe Creative Suite can be downloaded from Adobe and then cracked using GenP[83].

[78] github.com/QubesOS/qubes-issues/issues/6386

[79] anarsec.guide/posts/tails/#password-manager-keepassxc

[80] forum.qubes-os.org/t/recommended-length-of-linux-user-account-password/19337/3

[81] anarsec.guide/posts/tails-best/#passwords

[82] qubes-os.org/doc/windows/

[83] reddit.com/r/GenP/wiki/redditgenpguides/

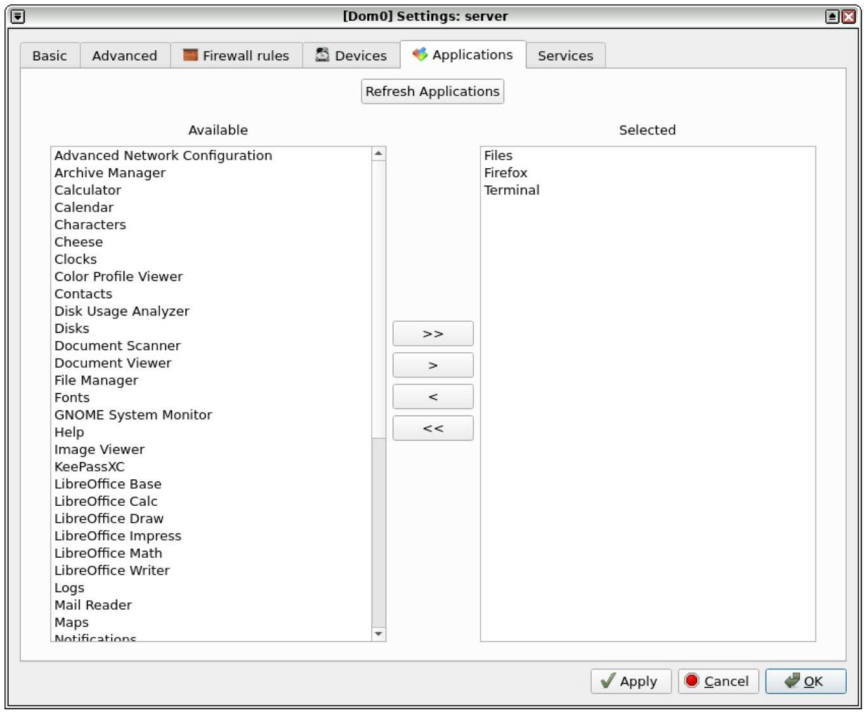
you have configured your Templates, Service qubes and dom0 so that you don't need to back them up. Once you have selected all desired VMs, click Next.

3. Go to **Applications menu: Apps tab → debian-12-offline-dvm → Files** to start a file manager in an offline disposable. Plug in the LUKS USB or external drive you will be saving your backup to and attach it to the qube (see above for instructions on creating and attaching this drive[77]). The drive should now be displayed at **Other Locations** in the file manager. Mount the LUKS partition by entering your password. Create a new directory in the LUKS partition called `backups`.
4. In Backup Qubes, select the destination for the backup:

- **Target qube**: select the disposable, named something like disp1217.
- **Backup directory**: click **...** to select the newly created folder `backups`.

5. Enter an encryption passphrase, which can be the same as your Qubes OS user passphrase, because you will need to memorize it to restore from backup, and it will contain the same data. This is dom0, so you won't be able to paste it from a password manager.
6. Untick "Save settings as default backup profile", and press **Next**.
7. Once the backup is complete, test restore your backup. Go to **Applications menu → Qubes Tools → Restore Backup**. Do not forget to select **Test restore to verify backup integrity (no data actually restored)**. A test restore is optional but strongly recommended. A backup is useless if you can't restore your data from it. You can also

[77] anarsec.guide/posts/qubes/#how-to-use-devices-like-usbs



Remember that you should not run `apt update` or `dnf update`.

Returning to the example above, I start a terminal in the `debian-12-documents` Template I just cloned, and then run `sudo apt install libreoffice-writer mat2 bookletimposer gimp gocryptfs gnome-disk-utility`. Once the installation was complete, I shut down the Template. I could then create or assign an App qube to use this Template, and it would now have LibreOffice, etc. Installing software should be the only time most users *need* to use the command line with Qubes OS.

You may want to use software that is not in the Debian/Fedora repositories, which makes things a bit more complicated and also poses a security risk — you must independently assess whether the source is trustworthy, rather than relying on Debian or Fedora. Linux software can be packaged in several ways: deb files (Debian), rpm files (Fedora),

AppImages, Snaps and Flatpaks. A forum post[36] outlines your options, and several examples are available in Encrypted Messaging for Anarchists[37]. Basically, deb and rpm files are installed into Templates as you would expect, while AppImages, Snaps and Flatpaks are installed into App qubes.

If the software is available as a Flatpak on Flathub[38] but not in the Debian/Fedora repositories, you can use Qube Apps[39] — if the Flathub software is community maintained, this is a security consideration[40].

How to Organize Your Qubes

The next step is to decide how to organize your system — the options are much more flexible in Qubes OS than in a monolithic system like Tails (and more prone to user error). In general, you should try to use disposables to connect to the Internet whenever possible. Here is our recommended setup for the typical user, which can be tweaked as needed.

After installation, a number of qubes will already exist by default. Click on the Applications Menu to see them all. We are going to delete the following default App qubes because they connect to the Internet without being disposable: `anon-whonix`, `work`, `personal`, and `untrusted`. Go to **Applications menu → Qubes Tools → Qube Manager**. Right-click and select "Delete qube" for each.

This is how the App qubes will be organized, without displaying service qubes or Templates:

[36] forum.qubes-os.org/t/installing-software-in-qubes-all-methods/9991
[37] anarsec.guide/posts/e2ee/
[38] flathub.org/home
[39] micahflee.com/2021/11/introducing-qube-apps/
[40] kicksecure.com/wiki/Install_Software#Flathub_Package_Sources_Security

cated USB controller[73].

You don't always need to attach a USB drive to another qube with the Qubes Devices widget — external devices are also accessible directly from sys-usb, through the File Manager. You can copy specific files[74] between the USB and another App qube without having to attach the USB controller to the App qube.

How to Backup

Once your qubes are organized the way you want them, you should back up your system. Depending on your needs, we recommend a weekly backup. We also recommend making a redundant backup that you store off-site and synchronize monthly (to protect against data loss in a house raid[75]). You can simply have two backup USBs that you switch out at the off-site location (rather than bringing a backup USB home to update it monthly, which leaves you vulnerable to having no off-site backups during this time window).

Adapted from the docs[76]:

1. Go to **Applications menu → Qubes Tools → Backup Qubes**.
2. Move the VMs that you want to back up to the right-hand Selected column. VMs in the left-hand Available column will not be backed up. You may choose whether to compress backups by checking or unchecking the Compress the backup box. Compressed backups will be smaller but take more time to create. We recommend selecting any App qubes with irreplaceable data, and documenting how

[73] qubes-os.org/doc/usb-qubes/#qubes-41-how-to-enable-a-usb-keyboard-on-a-separate-usb-controller
[74] anarsec.guide/posts/qubes/#how-to-copy-and-move-files
[75] notrace.how/threat-library/techniques/house-raid.html
[76] qubes-os.org/doc/how-to-back-up-restore-and-migrate/#creating-a-backup

such as disp4653. If Disks is not displayed in the menu, make the change in the **Settings → Applications** tab.

2. The Qubes Devices widget is used to attach a USB drive (or just its partitions) to any qube. Just click on the widget and plug in your USB drive (see the screenshot above[68]). The new entry will be under "Data (Block) Devices", typically `sys-usb:sda` is the one you want (`sda1` is a partition and would need to be mounted manually). Hover over the entry and attach it to the disposable you just started (in the case of the example above, disp4653).

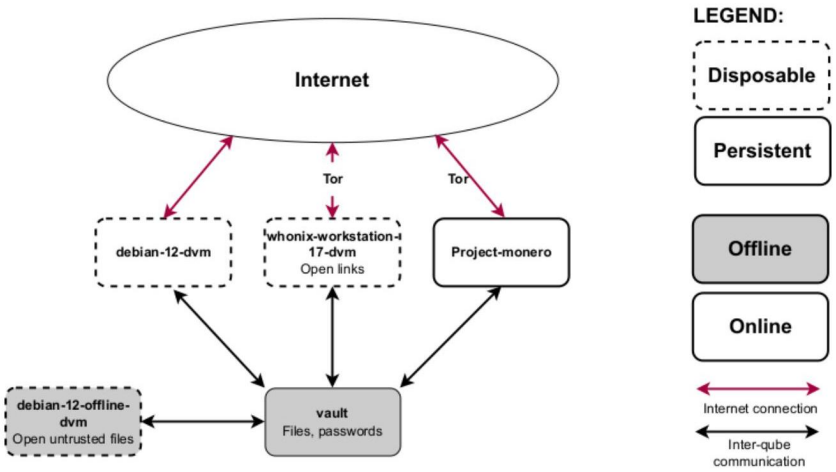
3. The empty USB or hard drive should now appear in the Disks application. Format the empty device, and then create a new encrypted partition as you would in Tails[69]. You can use the same LUKS password that you use for your Qubes OS LUKS because it will need to be reliably memorized to restore a backup (i.e. you may lose access to your KeePassXC file in a scenario where you need your backups) and the USB will contain the same data as your Qubes OS drive.

4. Before removing the USB drive, first eject it using the Qubes Devices widget, which will eject it from the qube. Then go to **Applications menu → sys-usb → Files** and select "Safely Remove Drive" to eject it from the computer. After the USB is ejected, restart sys-usb to take advantage of it being disposable.

Cameras and microphones are considered devices and must be attached to an App qube to be used.

There are command line instructions for setting up an external keyboard[70] or mouse[71] — if you decide to use these, we recommend configuring a confirmation prompt, and storing both in a tamper-evident manner[72]. We also recommend enabling a USB keyboard on a dedi-

[68] anarsec.guide/posts/qubes/#how-to-shutdown-qubes
[69] anarsec.guide/posts/tails/#how-to-create-an-encrypted-usb
[70] qubes-os.org/doc/usb-qubes/#manual-setup-for-usb-keyboards
[71] qubes-os.org/doc/usb-qubes/#usb-mice
[72] anarsec.guide/posts/tamper



- **A vault qube**. This is used for all data storage because you don't need internet to store files. This qube can be reassigned to the `debian-12-documents` Template so that trusted files can be opened there.

- **A disposable Whonix-Workstation qube (`whonix-workstation-17-dvm`)**.
  - Remember[41] that Whonix works by using the Whonix-Workstation Template (`whonix-workstation-17`) for the App qube, and the Whonix-Gateway Template (`whonix-gateway-17`) for a separate Service qube called `sys-whonix` (not shown in this diagram). Unless you are an advanced user, you should never touch the Whonix-Gateway — all your activity takes place in an App qube using the Whonix-Workstation Template. When an App qube is disposable, the naming convention is to append `-dvm` for *disposable virtual machine.*
  - Disposables appear in the Applications Menu in a way that can be confusing. You will see two entries for this qube: the **whonix-workstation-17-dvm** entry in the Apps menu, which is where

[41] anarsec.guide/posts/qubes/#general-usage

you launch applications from, and the **whonix-workstation-17-dvm** entry in the Templates menu, which is the Template for the disposable (do not use applications from here).
  - You can think of a disposable Whonix-Workstation qube as similar to Tails: system-wide Tor, and deletion after shutdown (without the anti-forensics property, as noted above).
  - Do not customize the disposable Template at all to resist fingerprinting.
- **A disposable Debian or Fedora qube**. The default `debian/fedora-dvm` qube (depending on your post-installation decision) is disposable, and it is great for web browsing that blocks Tor, such as logging into online banking.

Creating Qubes

If you wanted, you could use the system as is, but let's create an App qube and a disposable so that you have more options.

An App qube for Monero

Say you want to use the Monero wallet for an anarchist project. We'll create a new qube to compartmentalize this activity.

Go to **Applications menu → Qubes Tools → Create Qubes VM**:

- **Name**: Project-monero
- **Color**: Yellow
- **Type**: AppVM
- **Template**: whonix-workstation-17
- **Networking**: sys-whonix
- Now that the qube exists, install the Monero wallet into the App qube, following the instructions for "Kicksecure-Qubes App qube"[42].

[42] kicksecure.com/wiki/Monero#c-kicksecure-for-qubes-app-qube

To understand this configuration, it may help to visualize the qubes involved in networking for whonix-workstation-17-dvm:

Qube name	Qube description	Net qube
sys-net	*Your default network qube (pre-installed)*	*n/a*
sys-firewall	*Your default firewall qube (pre-installed)*	sys-net
`sys-vpn`	The VPN qube you created	sys-firewall
sys-whonix	The Whonix-Gateway qube	`sys-vpn`
whonix-workstation-17-dvm	A disposable Whonix-Workstation qube	sys-whonix

Connecting to a VPN ties you to any other computer activity you've used it for (via your subscription). You can think of it as equivalent to connecting to a trustworthy Internet Service Provider. If you are intentionally using an Internet connection not tied to your identity[66], such as Wi-Fi at a random cafe, leave sys-whonix's net qube set to `sys-firewall` (connect to Tor directly).

How to Use Devices (like USBs)

To learn how to attach devices, let's format the empty USB or hard drive that will be used for backups. Attaching the USB to an offline disposable mitigates against BadUSB attacks[67].

1. Go to **Applications menu: Apps tab → debian-12-offline-dvm → Disks**. The disposable will have a name with a random number

[66] anarsec.guide/posts/tails-best/#an-internet-connection-not-tied-to-your-identity

[67] en.wikipedia.org/wiki/BadUSB

- To not forget to revert the change, do so before shutting down the laptop.

To understand this configuration, it may help to visualize the qubes involved in networking for debian-12-dvm:

Qube name	Qube description	Net qube
sys-net	*Your default network qube (pre-installed)*	*n/a*
sys-firewall	*Your default firewall qube (pre-installed)*	sys-net
`sys-vpn`	The VPN qube you created	sys-firewall
debian-12-dvm	Your disposable Debian qube	`sys-vpn`

If you will use Whonix-Workstation, then configure sys-whonix

We recommend connecting to a VPN *before* connecting to Tor (i.e. You → VPN → Tor → Internet[63]) when you are using an Internet connection tied to your identity.

- To configure connecting to a VPN before connecting to Tor, go to sys-whonix's **Settings → Basic** tab and change the net qube from `sys-firewall` to `sys-vpn`.
- To not forget to revert the change, do so before shutting down the laptop.

For more information on the rationale of this configuration, see Privacy Guides[64]. Note that you should not connect to a VPN *after* Tor because this breaks Stream Isolation[65].

[63] gitlab.torproject.org/legacy/trac/-/wikis/doc/TorPlusVPN#you-vpnssh-tor
[64] privacyguides.org/en/advanced/tor-overview/#safely-connecting-to-tor
[65] gitlab.torproject.org/legacy/trac/-/wikis/doc/TorPlusVPN#you-tor-x

- In the **Settings → Applications** tab, move Monero Wallet to the Selected column and press **OK**. The shortcut will now appear in the Applications Menu.

This App qube is not disposable. We prefer all networked qubes to be disposable, but this qube requires data persistence for the wallet to work, so it cannot be disposable with a simple setup.

Note that we don't need to clone the Template because the Monero wallet is a Flatpak, so it is installed into the App qube, not into the Template.

A disposable that is offline

At the moment, both disposables are networked (with and without Tor). To finish, we will demonstrate how to create a disposable without networking for opening untrusted files (like PDFs and LibreOffice documents).

The cloned Template we will need is already configured: `debian-12-documents`. Go to **Applications menu → Qubes Tools → Create Qubes VM**:

- **Name**: debian-12-offline-dvm
- **Color**: Black
- **Type**: AppVM
- **Template**: debian-12-documents
- **Networking**: none
- In the new qubes' **Settings → Advanced** tab, under "Other", check "Disposable Template", then press **OK**. You will now see the offline disposable in the Apps tab of the Applications Menu. Make sure you are not working in the disposable Template (the same name in the Templates tab of the Applications menu).
- Go to **Applications menu → Qubes Tools → Qubes Global Settings**. Set the default disposable Template to `debian-12-offline-dvm`

Now, if a malicious document achieves code execution[43] after being opened, it will be in an empty Qube that has no network and will be destroyed upon shutdown.

Additional Settings

By default, App qubes only have 2 GB of private storage. This small amount will fill up quickly — when an App qube is about to run out of space, the Disk Space Monitor widget will alert you. To increase the amount of private storage for any qube, go to the qubes' **Settings → Basic** tab and change the "Private storage max size". This storage won't be used immediately, it's just the maximum that can be used by that qube.

If a Disposable keeps crashing, try to increase the amount of RAM allocated to it: go to the disposable Template's **Settings → Advanced** tab and increase the "Initial memory" and "Max memory".

How to Use Disposables

Disposables can be launched from the Apps tab of the Applications menu. For example, to use a disposable Tor Browser, go to **Application Menu: Apps tab → whonix-workstation-17-dvm → Tor Browser**. This is how you do all your Tor browsing. Once you close all the windows of a disposable, the whole disposable is shut down and reset to the state of its Template — any malware that may have been installed is now gone.

In contrast, an App qube must be shut down manually (using the Qubes Domains widget), and will persist data in the `/home`, `/usr/local`, and `/rw/config` directory. The next time an App qube boots, all locations in its file system other than these three directories will reflect

[43] en.wikipedia.org/wiki/Arbitrary_code_execution
[44] qubes-os.org/doc/templates/#inheritance-and-persistence

before connecting to an access point (whether Wi-Fi or ethernet) configured with a "VPN Kill Switch".

However, it's still valuable to know how to configure Qubes OS to force all network traffic through a VPN, for when you are using the laptop away from home. This involves creating a VPN qube. If you never use Qubes OS away from home, you can skip ahead to the next topic[55]. Keep in mind that you'll want to revert these changes before connecting to your home's "VPN Kill Switch" access point.

Creating a VPN qube

For your VPN provider, we recommend either Mullvad[56] or IVPN[57]. A VPN subscription should be purchased anonymously — vouchers are available from Mullvad[58] and IVPN[59] to purchase the subscription anonymously without Monero[60].

To create a VPN qube, follow the guide for the Mullvad app[61] or the the IVPN app[62]. We'll assume that you named the new VPN qube `sys-vpn`. It will force all network traffic through the VPN before it reaches `sys-firewall`.

Configure non-Tor qubes that you will use

- For any disposables or App qubes you will be using while away from your home Wi-Fi, go to their **Settings → Basic** tab and change the net qube from `sys-firewall` to `sys-vpn`. For example, make this change for debian-12-dvm.

[55] anarsec.guide/posts/qubes/#how-to-use-devices-like-usbs
[56] privacyguides.org/en/vpn/#mullvad
[57] privacyguides.org/en/vpn/#ivpn
[58] mullvad.net/en/blog/2022/9/16/mullvads-physical-voucher-cards-are-now-available-in-11-countries-on-amazon/
[59] ivpn.net/knowledgebase/billing/voucher-cards-faq/
[60] privacyguides.org/en/cryptocurrency/#monero
[61] privsec.dev/posts/qubes/using-mullvad-vpn-on-qubes-os/
[62] forum.qubes-os.org/t/ivpn-app-4-2-setup-guide/23804

Occasionally, Tor Browser will notify you that a new version is available before it can be updated by using the Qubes Update tool. When this happens, you can run **Tor Browser Downloader**[52] from the Whonix-Workstation Template (`whonix-workstation-17`). As noted in the docs[53], do **not** run this tool from a disposable Template — the disposable Template will be updated automatically.

Force All Network Traffic Through a VPN

When using the Internet from home, it is best to use a VPN† for all network traffic — this puts your trust in your VPN instead of an inherently untrustworthy Internet Service Provider. As the Security Lab[54] notes:

> Using a reputable VPN provider can provide more privacy against surveillance from your ISP or government and prevent network injection attacks from those entities. A VPN will also make traffic correlation attacks — especially those targeting messaging apps — more difficult to perform and less effective.

There are two ways you can run a VPN: from your laptop or from your networking device (either a router or a hardware firewall). When using your laptop from home, we recommend the latter.

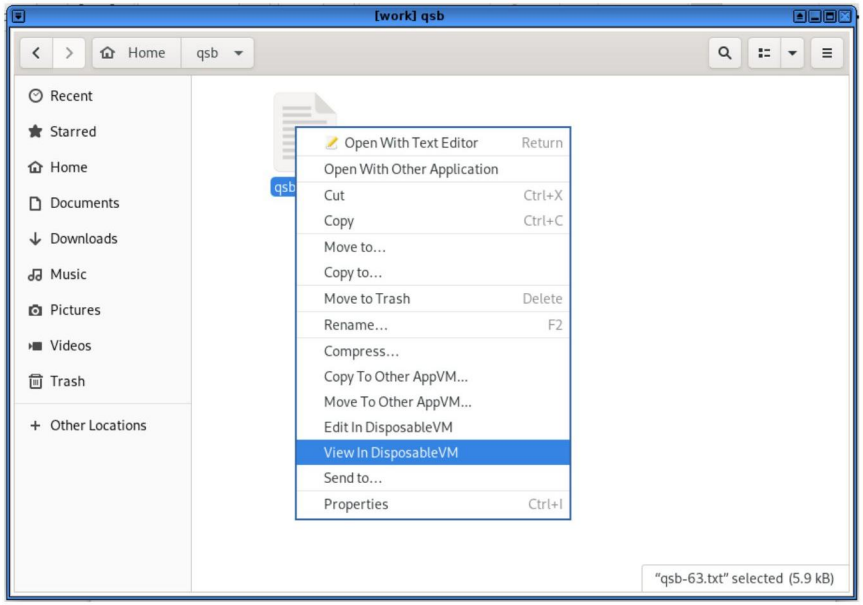
It's unnecessary to "double up" a VPN — if its running on your networking device, it doesn't need to be running on your laptop, and vice-versa. This means that a laptop running a VPN should disable it

[52] whonix.org/wiki/Tor_Browser#Installation_Process

[53] whonix.org/wiki/Tor_Browser#Summary

[54] securitylab.amnesty.org/latest/2023/10/technical-deep-dive-into-intellexa-alliance-surveillance-products/

the state of its Template. See how inheritance and persistence[44] works for Templates, App qubes, and disposables for more information.



In the file manager of an App qube, right-clicking on certain file types gives you the **Edit In DisposableVM** and **View In DisposableVM** options. This is how we want to open any untrusted files. It will use the default disposable that we set earlier, which is offline. If you *edit* the file and save the changes, the changed file will be saved back to the original app qube, overwriting the original. In contrast, if you *view* the file, it opens in a disposable that is read-only — this way, if the file does something malicious it can't write to the App qube you launched it from. This is why it is preferable to only view files that you don't need to edit.

If your file opens in an application other than the one you want, you'll need to change the default for the disposable Template:

1. Send a file of this type to your disposable Template (in our case, `debian-12-offline-dvm`).
2. Open the file manager for the disposable Template.

3. Select the file, right click and select **Properties**.
4. In the **Open With** tab, select your preferred application for this file type.
5. Press **Set as default**.
6. Delete the file from the disposable Template (remember to empty the trash).
7. Shut down the disposable Template for the change to take effect.

Sanitizing files

You can also use disposables to "sanitize" an untrusted file, which means making it trusted. It does this by converting it to images in a disposable and wiping the metadata. For PDF files, right-click and select **Convert To Trusted PDF**, and for image files, right-click and select **Convert To Trusted Img**. See the guide[45] to open all file types in a disposable by default.

Whonix and Tor

The Whonix project has its own extensive documentation[46]. So does Kicksecure[47], on which Whonix is based. When Whonix is used in Qubes OS, it is referred to as Qubes-Whonix. Whonix can be used on other operating systems, but it's preferable to use it on Qubes OS because of the superior isolation it provides.

Multiple default applications on a Whonix-Workstation App qube are configured to use unique circuits[48] of the Tor network[†] so that their activity cannot be correlated — this is called stream isolation[49].

To take advantage of compartmentalization, create separate Whonix-Workstation App qubes for distinct activities/identities, as we did

[45] forum.qubes-os.org/t/opening-all-files-in-disposable-qube/4674
[46] whonix.org/wiki/Documentation
[47] kicksecure.com/wiki/Documentation
[48] whonix.org/wiki/Stream_Isolation#List
[49] whonix.org/wiki/Stream_Isolation

above[50] for the Project-monero qube. Distinct Whonix-Workstation App qubes are automatically stream isolated. Note that it is considered best practice not to use multiple Whonix-Workstation App qubes[51] at the same time:

> While multiple Whonix-Workstation are recommended, this is not an endorsement for using them simultaneously! It is safest to only use one Whonix-Workstation at a time and for a single activity. New risks are introduced by running multiple Whonix-Workstation at the same time. For instance, if a single Whonix-Workstation was compromised, it could potentially perform various side channel attacks to learn about running processes in other VMs, and not all of these can be defeated. Depending on user activities, a skilled adversary might be able to correlate multiple Whonix-Workstations to the same pseudonym.

Tor Browser won't be able to upload files from `/home/user/QubesIncoming/` due to how permissions are set, so you'll need to move files to another location in `/home/user/` to upload them, such as the Downloads directory.

Like any software, the Tor Browser has vulnerabilities that can be exploited — various police agencies have Tor Browser exploits for serious cases. To mitigate this, it's important to keep Whonix up to date, and you should increase the Tor Browser's security settings: click the shield icon, and then click **Settings...**. By default, it's set to Standard, which maintains a browsing experience comparable to a regular browser. **We strongly recommend that you set it to the most restrictive setting before you start browsing: Safest.** The vast majority of exploits against Tor Browser will not work with the Safest setting.

[50] anarsec.guide/posts/qubes/#creating-qubes
[51] whonix.org/wiki/Multiple_Whonix-Workstation#Safety_Precautions