CTF — GNU Guix storefile mistake

May 27, 2024

Functional package management in a pill

- Dolstra, Eelco (2006). “The Purely Functional Software Deployment Model” (Ph.D.). Utrecht University
- pioneered by Nix
- also employed by GNU Guix
- no Filesystem Hierarchy Standard (no /usr/bin, /usr/share, etc.)
- packages live in a **store** directory, e.g.
  - /gnu/store/y0d8ab1mi6lh0a3vpx5lyd4ksq9wbn4x-orc-0.4.32
  - /gnu/store/9pypr3c3y379shbwm9ilb4pik9mkfd83-mesa-22.2.4
  - /gnu/store/rv91v4s30kcjh7xq6k4l2njklk79frxk-freeglut-3.4.0
  - /gnu/store/30zfbjasrsk2wg8nhsd1xgi3q3n9796z-less-608
- a daemon builds packages from definitions and puts them in the store

2024-05-27

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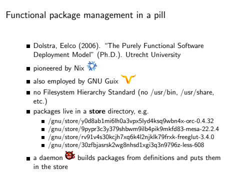

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- we’re using GNU Guix here (no, not the trademarked GUIX. . .)
- store filename determine by hash of package inputs + definition
- multiple versions of a package can coexist
- per-project development environments
- easy rollbacks
- emphasis on reproducible builds

Functional package management in a pill (sample package)

```
$ cd /gnu/store/30zfbjasrsk2wg8nhsd1xgi3q3n9796z-less-608/
$ find . -type f
./bin/less
./bin/lessecho
./bin/lesskey
./etc/ld.so.cache
./share/doc/less-608/LICENSE
./share/doc/less-608/COPYING
./share/man/man1/lessecho.1.gz
./share/man/man1/lesskey.1.gz
./share/man/man1/less.1.gz
$ ls -lh bin/less
-r-xr-xr-x 2 root root 192K Jan  1  1970 bin/less
```

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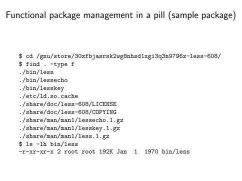

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```

- store is read-only (only Nix/Guix daemon can write)
- store files are root-owned and world-readable =¿ secrets must be managed differently
- dates set to Epoch (but ls -lch shows real creation time)
- the same package won't be built twice, even if requested by multiple users
- a package will built again (or grafted) when one of its dependencies gets updated
- a package not in use can be garbage-collected
- no support for quotas yet as of 2024

Functional package management in a pill (declarative OS)

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- service **configurations** are defined declaratively *as well*...

```
(service httpd-service-type
         (httpd-configuration
           (config
             (httpd-config-file
               (server-name "www.example.com")
               (document-root "/var/public_html")))))
```

  - ...and result in store files like /gnu/store/54ywa5x1b75simbvzhxqkfxsjk040ail-httpd.conf
- Yay, we can replace Ansible! But what about secrets?
  - option 1: keep private keys and passwords outside the store
  - option 2: put them encrypted in the store

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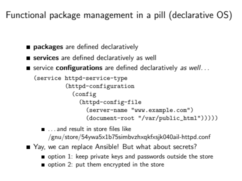

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- GNU Guix and Nix have their DSLs (the first one is actually Scheme Lisp + some APIs)
- on Guix/Nix server packages and configurations are immutable (we can switch to different ones but not alter the existing ones) — convenient
- an application may require database credentials, some API token, a private key for TLS certificate, etc.
- encrypted secrets in store — one master key kept outside the store

Sensitive information exposure scenario

challenge — password hunt in /gnu/store

"You're an employee of a secret government agency. Analysis of wiretap recordings have lead the agency to believe that an individual known as Abdul Al-Inh-Ohn-Ih has come into possession of highly classified government documents. If this turn out true and Abdul blows the whistle on information from those materials, years of intelligence efforts shall be ruined.

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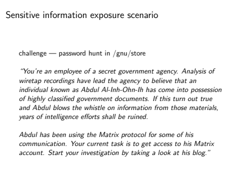

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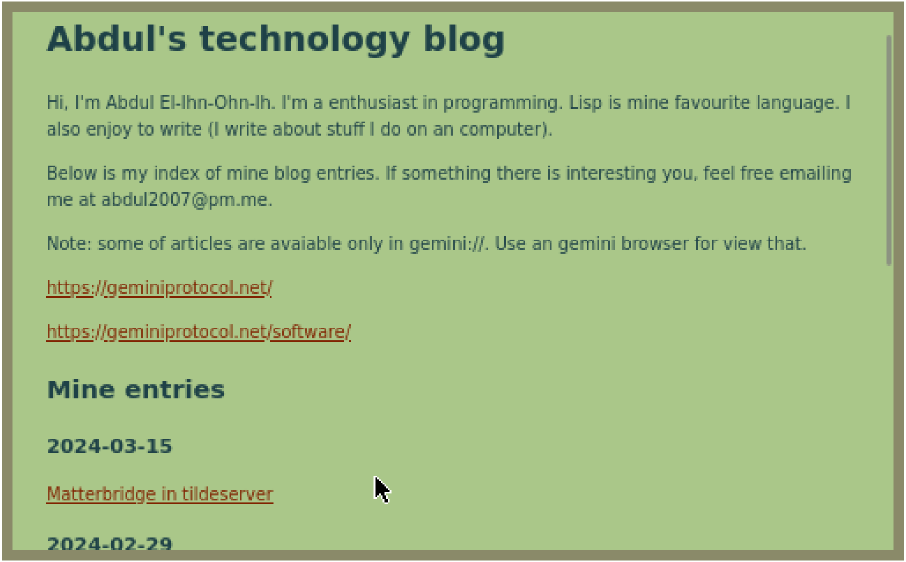
A user of certain shared GNU Guix system has put a secret (a password) in /gnu/store by mistake. The CTF competitioneer has to SSH into another account on said system and find the password.

- we have some lore
- real-world references might be intended or not...
- no direct info about the exposures (one needs to figure this out)

Investigation (Abdul's blog)



Abdul's technology blog

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Mine entries

2024-03-15

Matterbridge in tildeserver

2024-02-29

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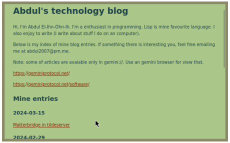

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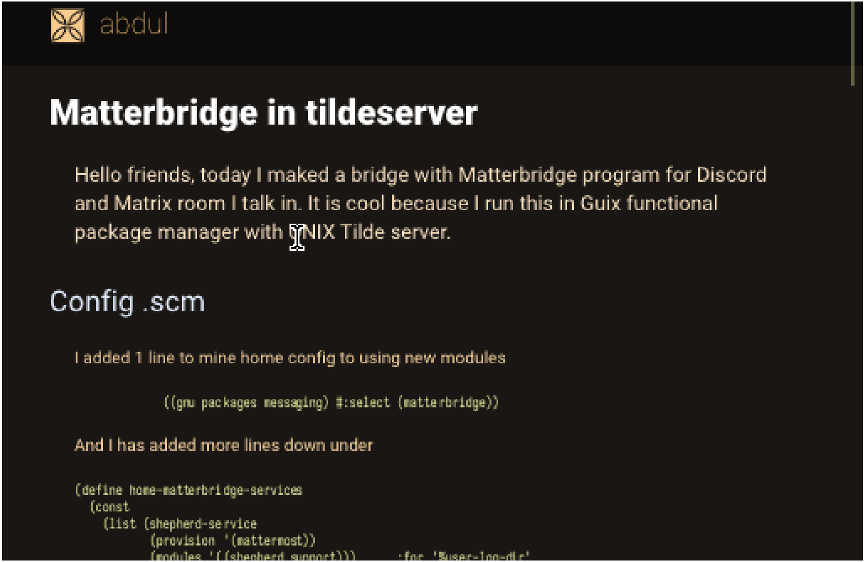
- language — itself a hint Abdul is likely to make mistakes
- only the few relevant blog entries (no misleading of competitioneers)
- mechanics of Guix relevant to the challenge are touched in the posts
- some extra effort required — obtaining a Gemini browser

Investigation (peeking through Gemini)



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Hello friends, today I maked a bridge with Matterbridge program for Discord and Matrix room I talk in. It is cool because I run this in Guix functional package manager with UNIX Tilde server.

Config .scm

I added 1 line to mine home config to using new modules

```
((gnu packages messaging) #:select (matterbridge))
```

And I has added more lines down under

```
(define home-matterbridge-services
  (const
    (list (shepherd-service
            (provision '(mattermost))
            (modules '((shepherd support)))      ;for '%user-log-dir'
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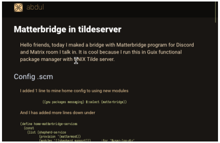

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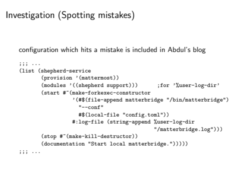
- most relevant parts of blog only accessible through Gemini (a lightweight alternative to HTTP)
- a Gemini browser “Lagrage” recommended in HTTP part of Abdul’s blog

Investigation (Spotting mistakes)

configuration which hits a mistake is included in Abdul's blog

```
;;; ...
(list (shepherd-service
       (provision '(mattermost))
       (modules '((shepherd support)))      ;for '%user-log-dir'
       (start #~(make-forkexec-constructor
                 '(#$(file-append matterbridge "/bin/matterbridge")
                   "--conf"
                   #$(local-file "config.toml"))
                 #:log-file (string-append %user-log-dir
                                           "/matterbridge.log")))
       (stop #~(make-kill-destructor))
       (documentation "Start local matterbridge.")))))
;;; ...
```



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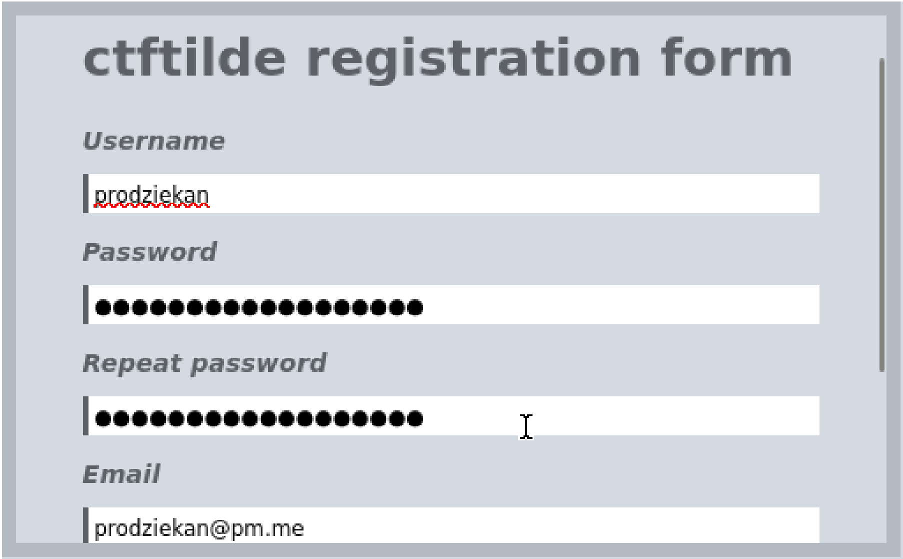
```

- the config suggests Matrix password is in config.toml in /gnu/store

Investigation (Account creation)



ctftilde registration form

Username

prodziekan

Password

●●●●●●●●●●●●●●●●●●

Repeat password

●●●●●●●●●●●●●●●●●●

Email

prodziekan@pm.me

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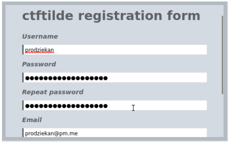

ctftilde registration form

Username	prodziekan
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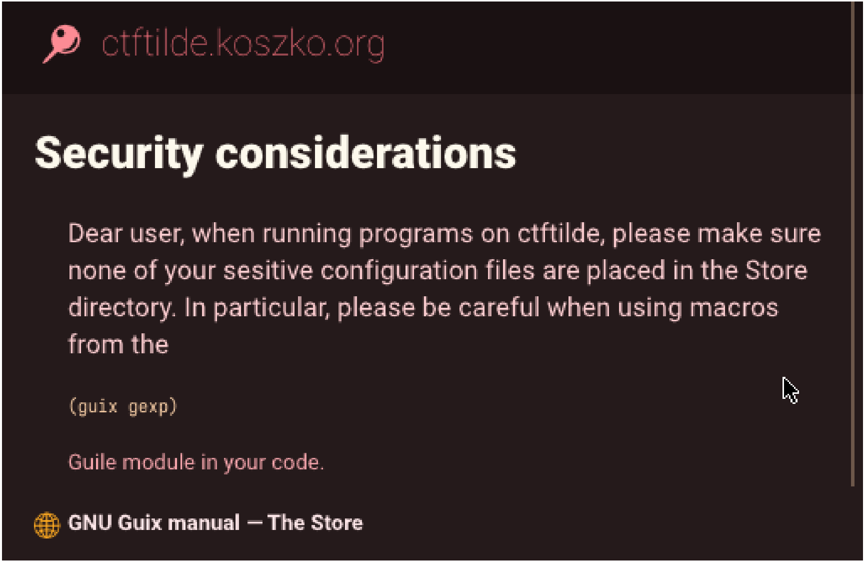
Repeat password	●●●●●●●●●●●●●●●●●●
Email	prodziekan@pm.me

- both Abdul’s blog and the server’s main website urge one to make an account and log in to the tilde server with SSH
- emails entered not actually used

Hint 1



ctftilde.koszko.org

Security considerations

> Dear user, when running programs on ctftilde, please make sure none of your sesitive configuration files are placed in the Store directory. In particular, please be careful when using macros from the
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> `(guix gexp)`
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> Guile module in your code.

GNU Guix manual — The Store

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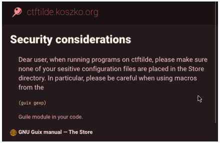

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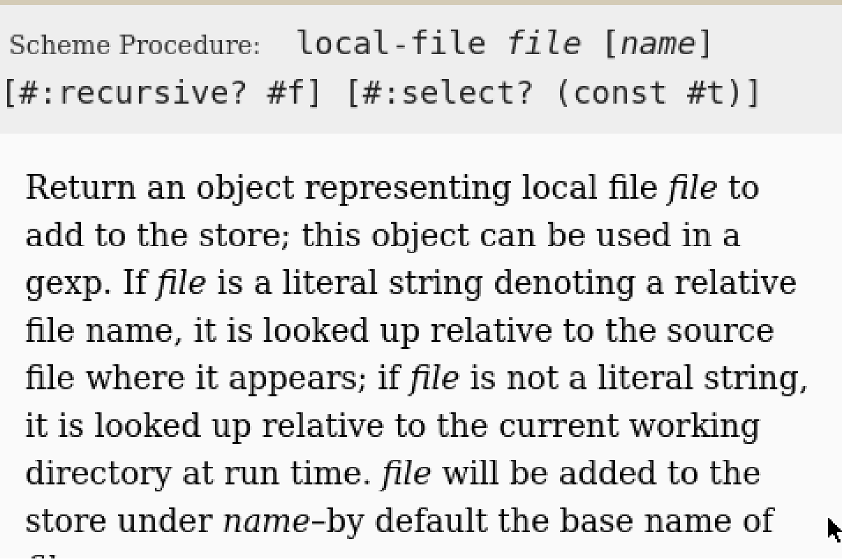
GNU Guix manual — The Store

- page with the hint accessible through Gemini only

Hint 2



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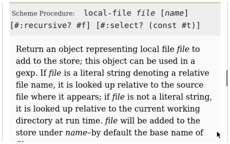

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- link to GNU Guix HTML documentation
- suggestion that it has sth to do with the local-file macro (used in Abdul's code)

Finding the flag

```
~$ (cd /gnu/store && ls -cht *config.toml*)
qmdh299prllp4fygw893w00lv9ypi5z2-config.toml
~$
```

rather expected contents of
qmdh299prllp4fygw893w00lv9ypi5z2-config.toml

```
# ...
[matrix.noevil-pl]
Server="https://matrix.noevil.pl"
Login="abdul"
Password="fla\u0067{full_source-bootstrap}"
RemoteNickFormat="[{PROTOCOL}] <{NICK}> "
NoHomeServerSuffix=false
# ...
```

└─Finding the flag

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- “g” in flag replaced with unicode escape to make bypassing with recursive grepping harder

Credits

- GNU Guix logo — Luis Felipe López Acevedo (CC BY-SA 4.0 International)
- red flag — by Wikipedia user Wereon, uploaded 2007 (released into public domain)
- Nix logo — Tim Cuthbertson (CC BY-SA 4.0 International)
- Awesome Demon — by Openclipart user qubodup, uploaded 2014 (released into public domain with CC Zero v1.0)