# ACME

## Not just for rockets anymore!

SCaLE 15x

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Image: Kenneth Lu (flickr)

# ACME

## New ways of blowing things up

Image: wikipedia

# Magnus Hagander

- Redpill Linpro
  - Infrastructure services
  - Principal database consultant
- PostgreSQL
  - Core Team member
  - Committer
  - PostgreSQL Europe

# A small case study

# The environment

- The postgresql.org infrastructure
- Around 65 VMs
  - 5 datacenters (4 countries)
  - 1 cloud (aws)
- Around 0 staff
  - (4-5 with 0 dedicated time, at best)

# The environment

- Debian jessie
  - Has been lenny>squeeze>wheezy>
- Custom config management
  - Not puppet/chef/etc
  - Because they sucked at the time
  - And considering problem scope
- (Almost) fully automated

# The challenge

- Encrypt everything
  - (well...)
  - https everywhere the obvious
  - Also smtp, imap, pgsql, etc, etc
  - Both public and restricted
- *Certificate management*

# The dark ages

- Individual service certificates
    - Manual issuing
    - Manual renewal
- Domain level wildcard certificate
    - For *.postgresql.org
        - Nothing for other domains
    - Shared private keys
    - Still manual

# Enter ACME

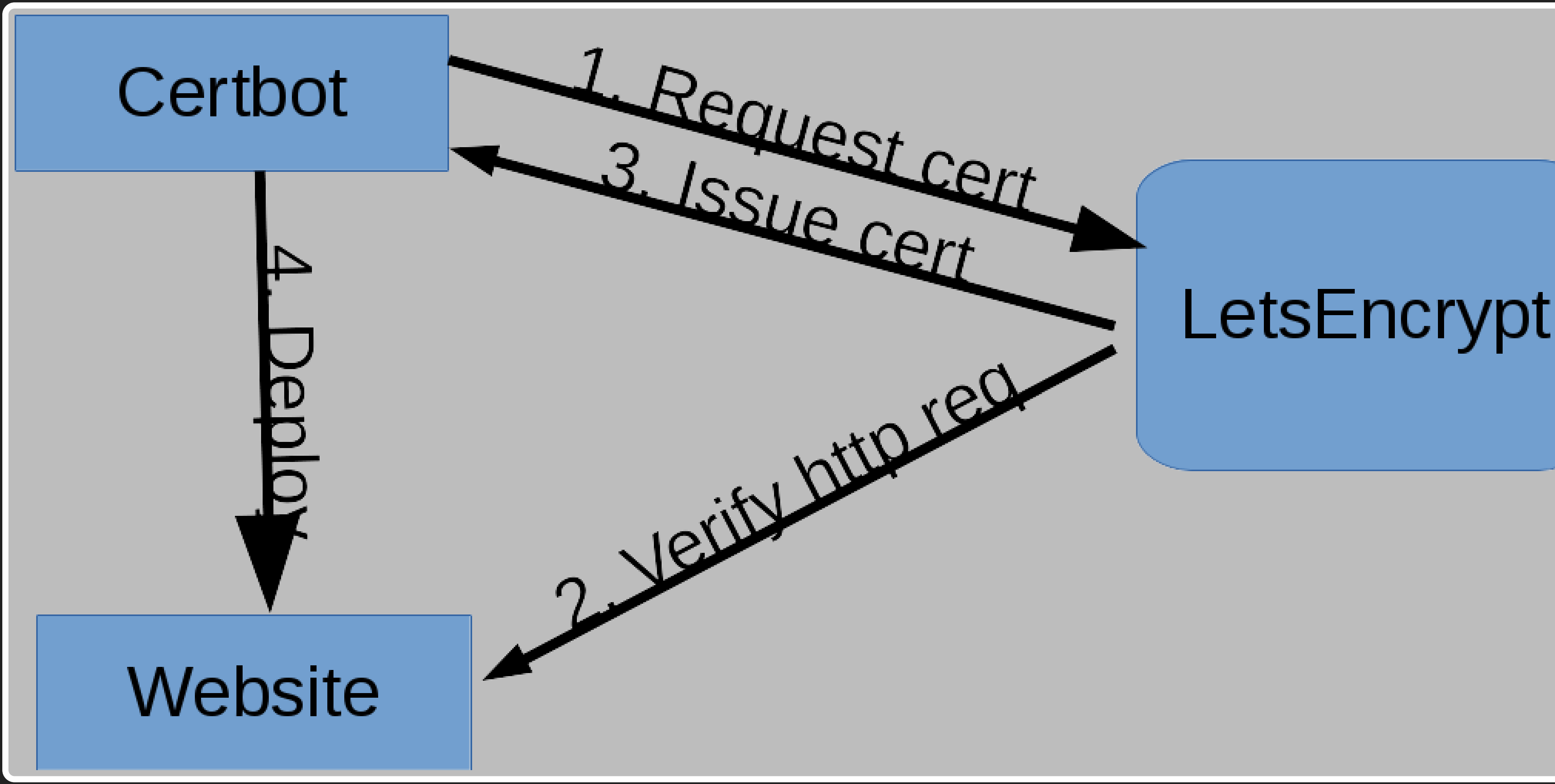
- Automatic Certificate Management Environment
- Best known implementation: LetsEncrypt

# LetsEncrypt

- Issues *domain validated* certificates
  - Same as we had before
- Fully automated validation
- Short lifetime (90 days)
  - *Requires* automation

# certbot

- Default client for LetsEncrypt



# certbot

- Requires exposed http services
- Tries to auto-config webserver
  - SCARY

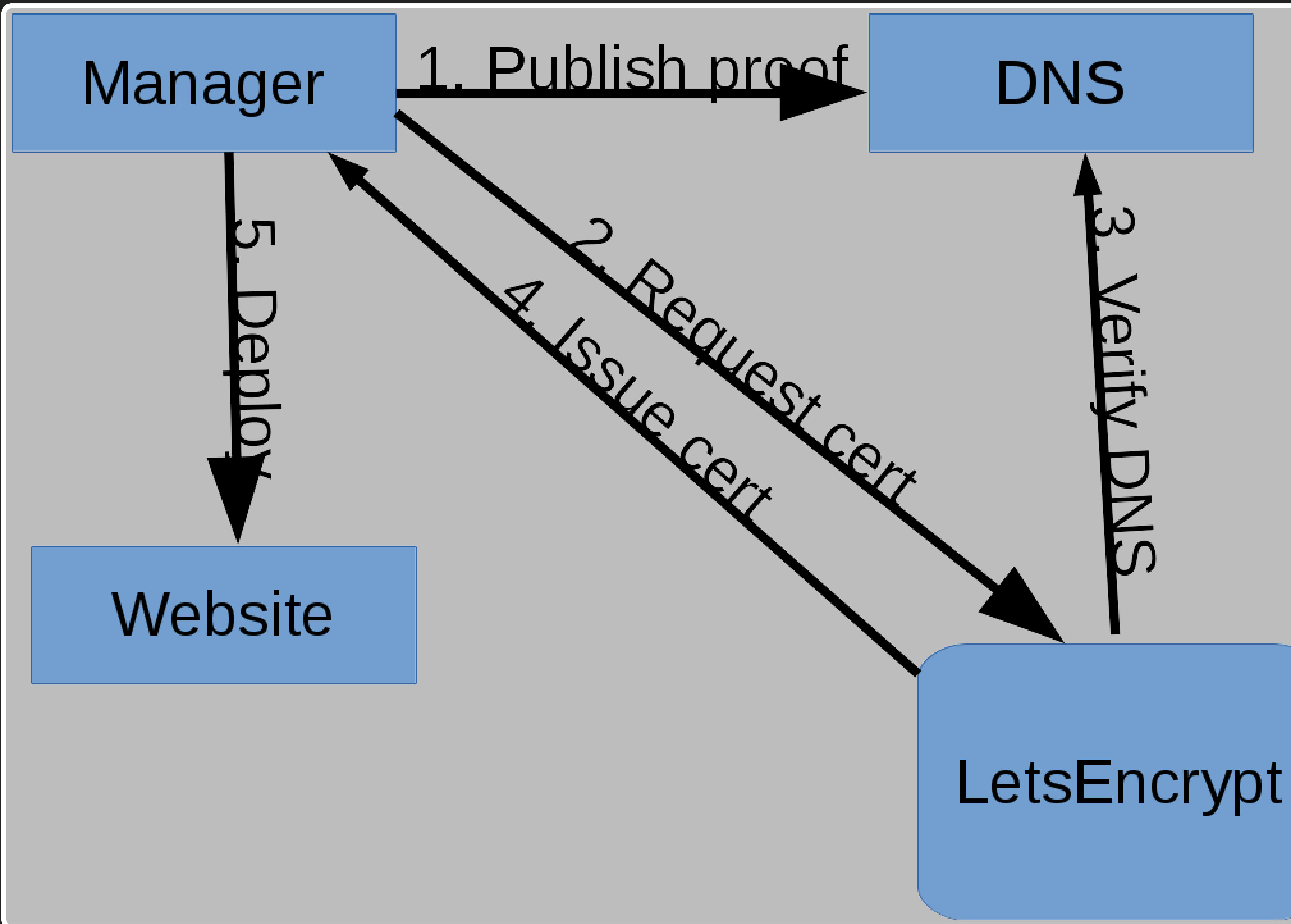
# ACME

- Is a protocol
- Not a client
- Multiple ways to verify exists
  - Just not in default client

# ACME dns-01

- Issue TXT records in DNS
- Better suited for central management
  - DNS probably already is

# ACME dns-01


Manager
DNS
1. Publish proof
2. Request cert
3. Verify DNS
4. Issue cert
5. Deploy
Website
LetsEncrypt

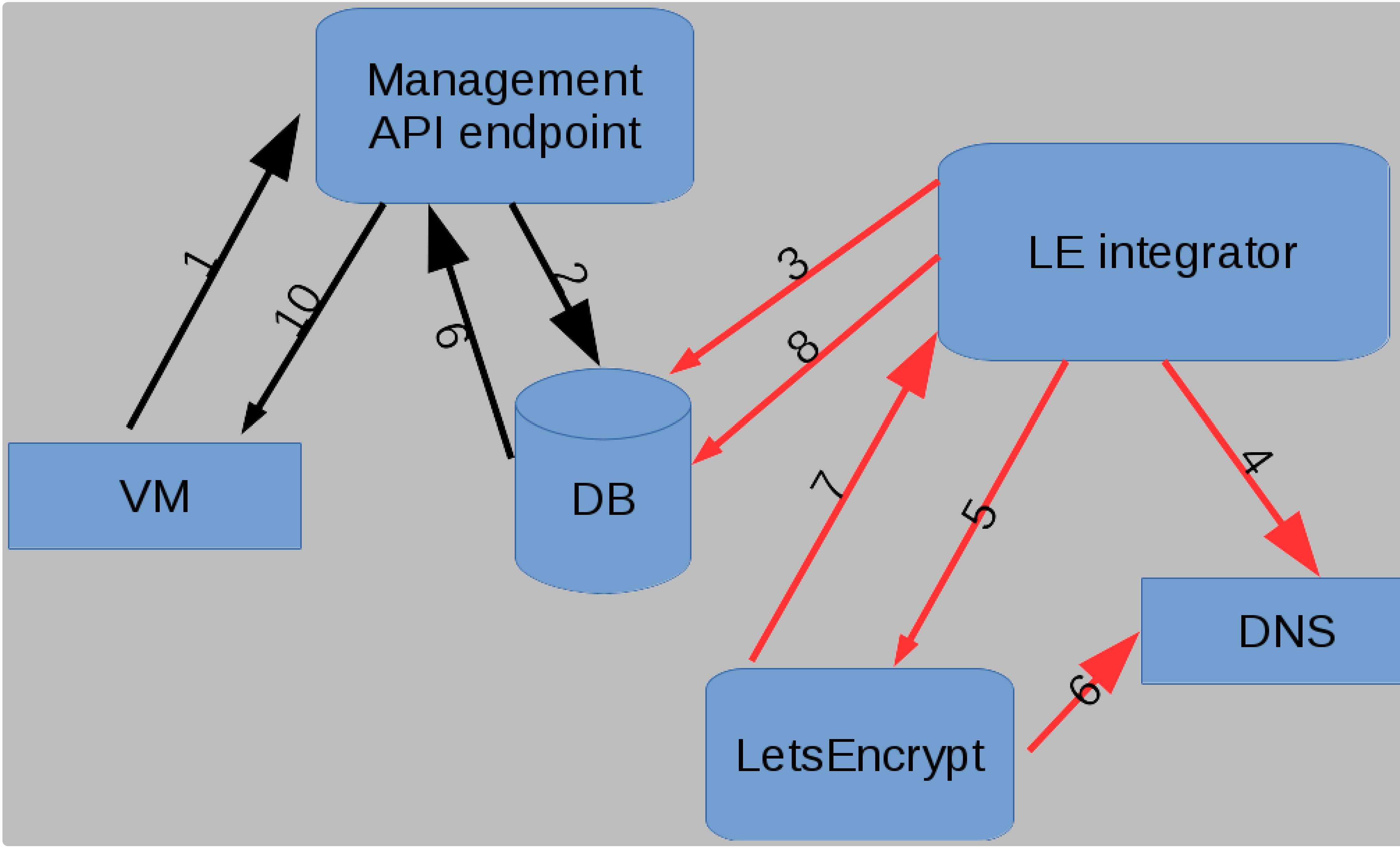
# New set of problems

- Centralized key distribution
  - Private keys in one place
  - Not good for security!
- Or distributed access to DNS
  - Doable with dynamic DNS
  - As long as it's controlled

# Back to postgresql.org

- Existing simple config management
- Central API
- Client certificate authenticated
- Can be leveraged

# ACME in pginfra



Management API endpoint

LE integrator

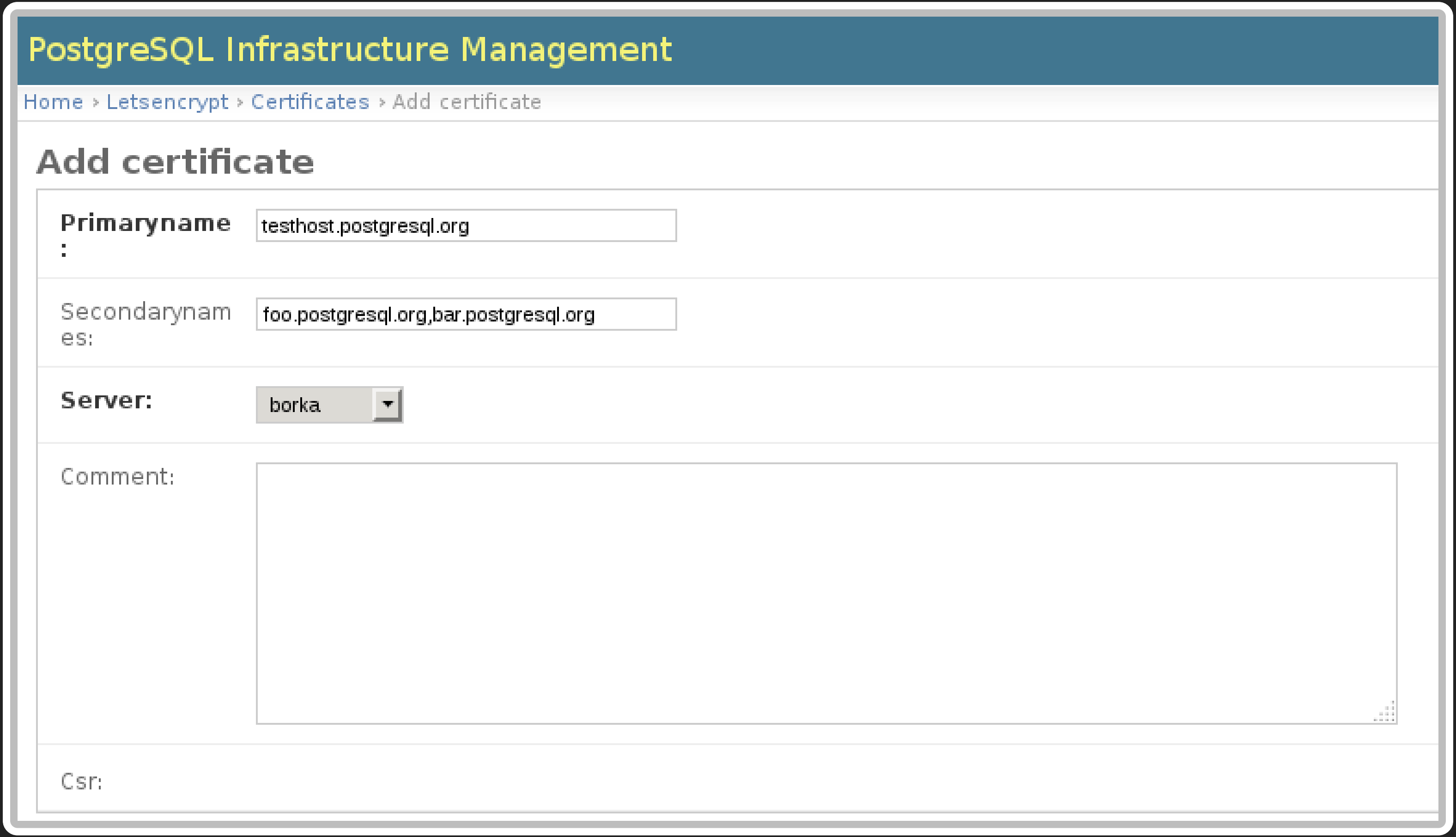
VM

DB

DNS

LetsEncrypt

# ACME in pginfra



PostgreSQL Infrastructure Management

Home › Letsencrypt › Certificates › Add certificate

## Add certificate

| | |
|---|---|
| **Primaryname:** | testhost.postgresql.org |
| Secondarynames: | foo.postgresql.org,bar.postgresql.org |
| **Server:** | borka |
| Comment: | |
| Csr: | |

# ACME in pginfra

## On the VM

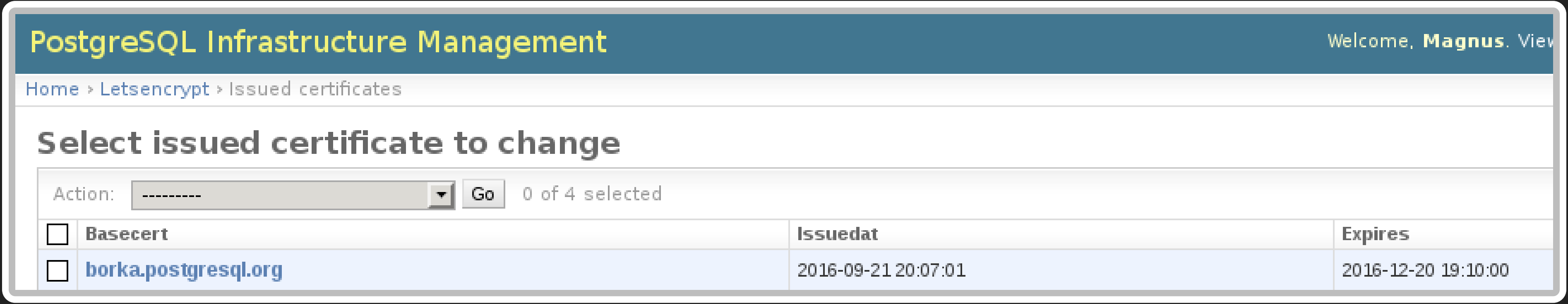
```
... borka pginfra: Completed user and package checks.
... borka pginfra: Creating certificate request for 5-borka.postgr
```

# ACME in pginfra

## On central server

```
~$ ./letsencrypt_cron.py
Getting challenges for 1 identifiers
Setting up for 1 remaining challenges
Waiting for 8 more records to show up in DNS
Waiting for 8 more records to show up in DNS
Waiting for 4 more records to show up in DNS
Waiting for 2 more records to show up in DNS
Waiting for 1 more records to show up in DNS
All records present in DNS
Waiting for 1 challenges...
Issued certificate for borka.postgresql.org
```

# ACME in pginfra



PostgreSQL Infrastructure Management

Welcome, **Magnus**. View

Home › Letsencrypt › Issued certificates

**Select issued certificate to change**

| □ | Basecert | Issuedat | Expires |
|---|---|---|---|
| □ | borka.postgresql.org | 2016-09-21 20:07:01 | 2016-12-20 19:10:00 |

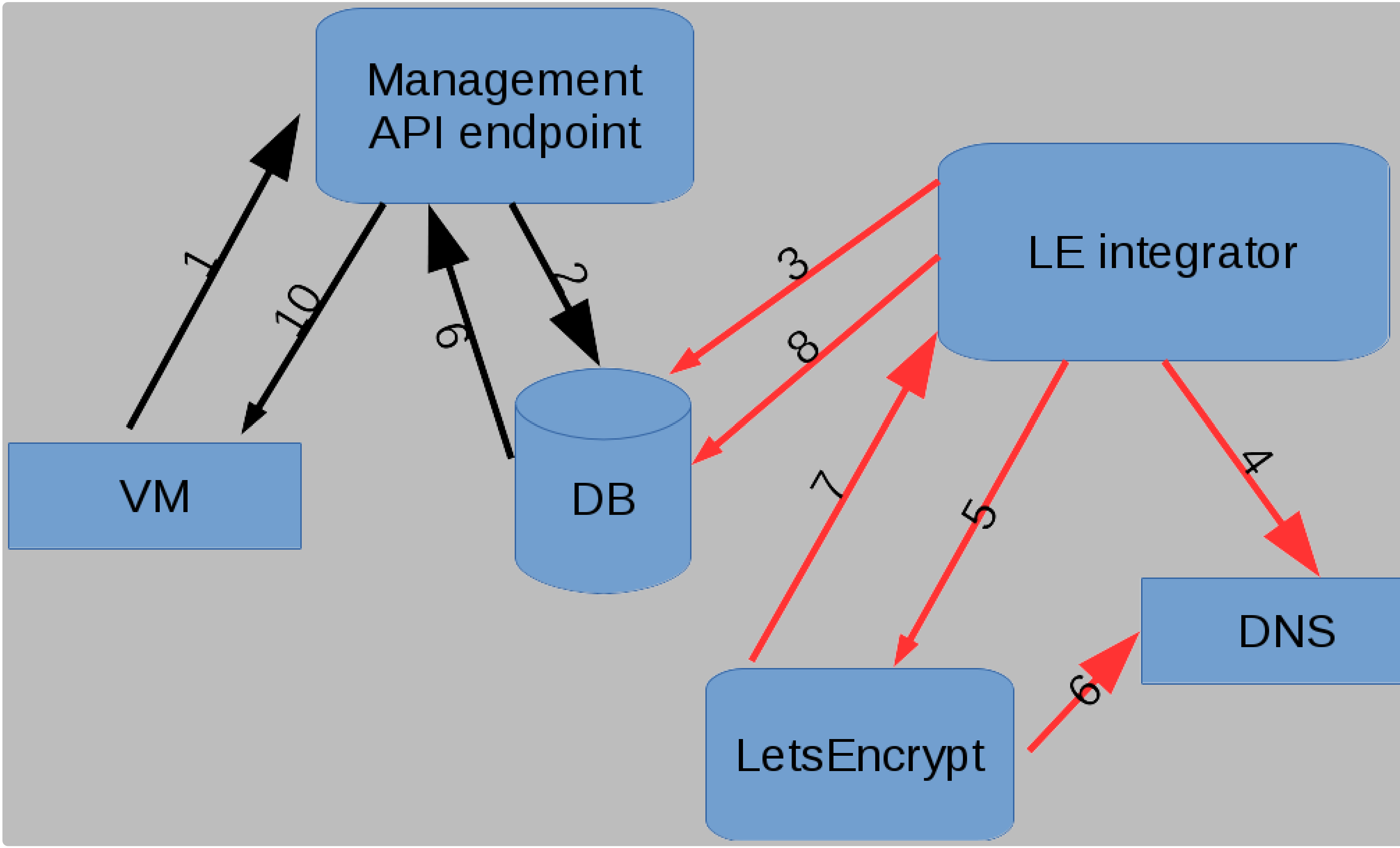
# ACME in pginfra

## Back on the VM

```
borka pginfra: Downloading certificate 5-borka.postgresql.org
borka pginfra: Replaced file /etc/lighttpd/certfiles/5-borka.postg
borka pginfra: Replaced file /etc/lighttpd/certfiles/5-borka.postg
borka pginfra: Replaced file /etc/lighttpd/conf-available/_pginfra
borka pginfra: Completed user and package checks.
borka pginfra: Restarting service lighttpd
```

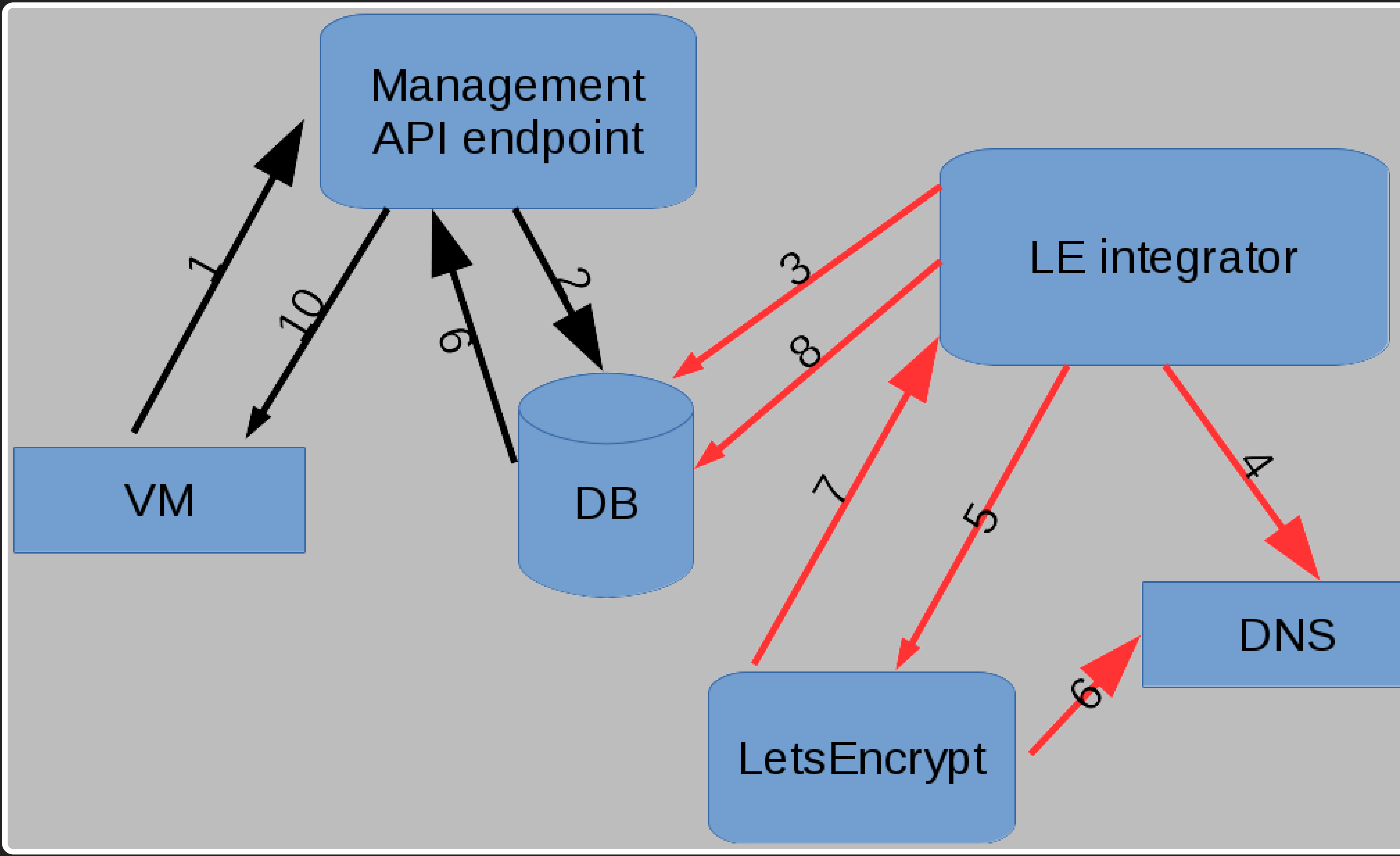
# ACME in pginfra

## Keys stay on VM


Management
API endpoint
LE integrator
1
10
9
2
3
8
VM
DB
7
5
4
DNS
6
LetsEncrypt

# ACME in pginfra

## Services never exposed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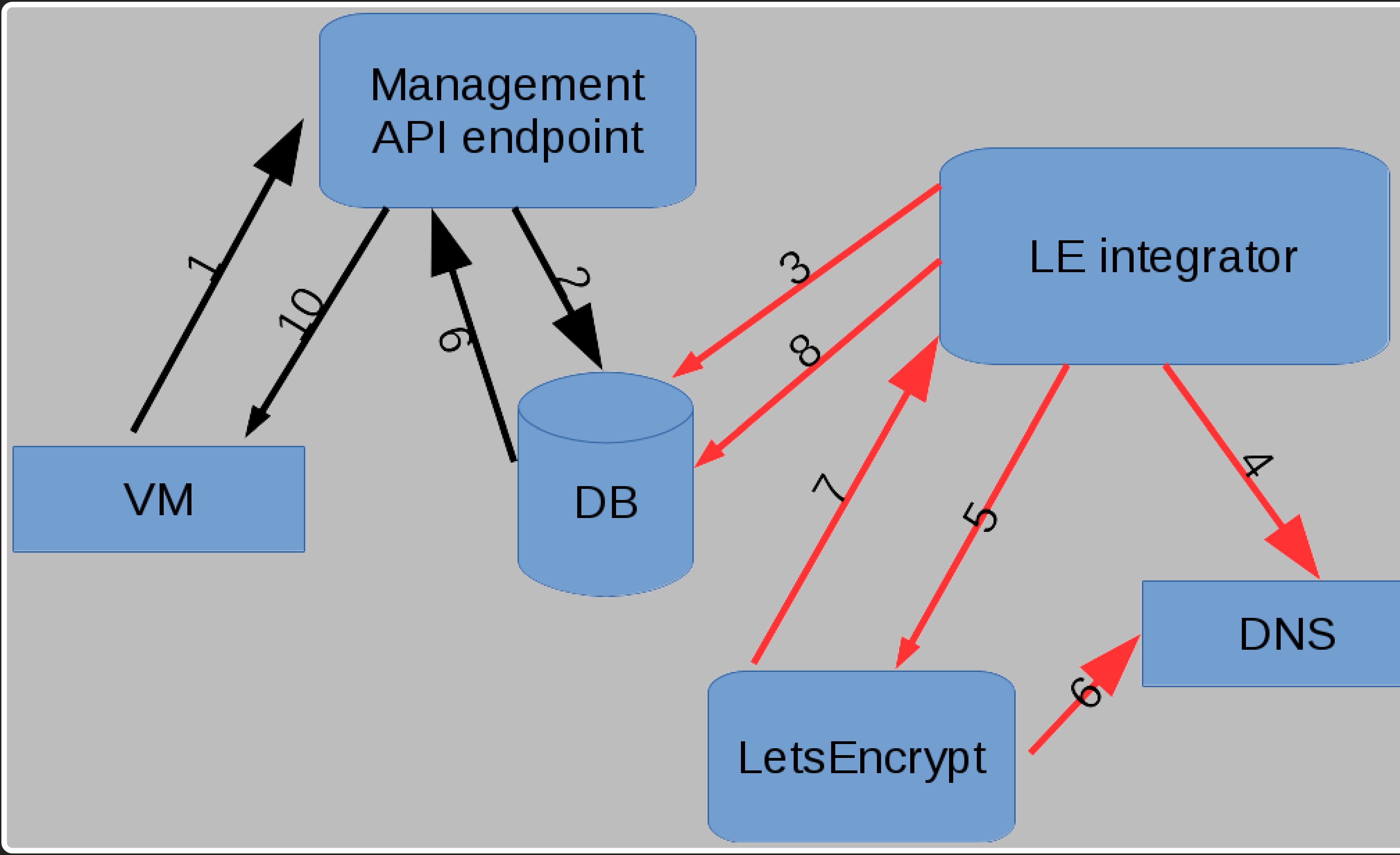
# ACME in pginfra

## Audit trail and certificates archived



Management API endpoint

LE integrator

VM

DB

LetsEncrypt

DNS

# What does it look like?

- Simple code
- acme python module
    - DNS support not released yet
    - Using git head version
    - Same as certbot…
- OpenSSL
    - …

# Generating CSR

```
def sync_public_certificates():
   ...
   for c in certdata:
      if c['csrneeded']:
         key = crypto.PKey()
         key.generate_key(crypto.TYPE_RSA, 4096)
         req = crypto.X509Req()
         req.get_subject().CN = hostname
         if c['secondary']:
            req.add_extensions([crypto.X509Extension(
                  b'subjectAltName',critical=False,
                  value=", ".join("DNS:%s" % d for d in c['seconda
         req.set_version(2)
         req.set_pubkey(key)
         req.sign(key, "sha256")
         csrdata[c['name']] = crypto.dump_certificate_request(
```

# Central integration

```
def main():
   dns = LetsencryptDnsManager()
   curs.execute("""SELECT c.id, primaryname, secondarynames, csr
FROM letsencrypt_certificate c
LEFT JOIN letsencrypt_issuedcertificate ic
ON ic.basecert_id=c.id WHERE csr != ''
GROUP BY c.id HAVING max(issuedat) < now()-'60 days'::interval
OR max(issuedat) IS NULL""")
   leissuers = [LetsencryptIssuer(*r) for r in curs.fetchall()]

   if len(leissuers) == 0: sys.exit(0)

   leclient = LetsencryptClient()
```

# Central integration

```
# Get all possible identifiers (the same one might be used more th
identifiers = set(chain.from_iterable([i.get_all_identifiers() for

leclient.get_challenges(identifiers)
remaining = leclient.remaining_challenges()
if remaining:
  for challenge in remaining:
    dns.add_challenge_record(challenge.get_dns_name(), challenge.g

  # Update zone serials and commit
  dns.flush_challenges()

  while True:
    n = dns.check_records()
    if n == 0: break
    time.sleep(30)
```

# Central integration

```
# Trigger letsencrypt to check
for challenge in remaining:
  challenge.answer_challenge()

# Wait for all challenges to be confirmed
while True:
  remaining = leclient.remaining_challenges(True)
  if not remaining: break
  time.sleep(30)

for i in leissuers:
  (pemcert, pemchain, expires) = i.issue(leclient)
  curs.execute("INSERT INTO letsencrypt_issuedcertificate ....")

dns.cleanup()
```

# Certificate deployment

- Depends on webserver
- Already have plugin setups
- Note order of certs, keys and chains!
- Don't forget to restart!

# Certificate renewal

- Same as reissue
- No special handling
- Separate rate limit

# Rate limits

- Letsencrypt has rate limits
  - 20 new certs / domain / week
  - 100 names / cert
  - 5 duplicate certs / week
  - 500 registrations / ip / 3 hours
  - 300 pending authorization
- We're nowhere near these limits

# Conclusions

- Much easier than before
  - Close to 0 work deployment
  - 0 work maintenance and renewal
- Better security
  - No shared keys

# Conclusions

- Direct work with ACME is easy!
- Don't forget to monitor expiry!!

# Thank you!

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