Let's Encrypt! Free certificates for everyone!

Nicola Corti

Gruppo Utenti Linux Pisa



03 February 2016

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Let's Encrypt is a **Certification Authority (CA)** that issue **free** SSL/TLS certificates

- From 5 December 2015 L.E. is available in Public Beta
- L.E. has released more than **480 k** certificate
- It's major focus is automation of processes.
- https://letsencrypt.org/

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12-2015 Public beta

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10 0015	B. I.P. Later	
12-2015	Public beta!	

- ► Free
- Automated
- Open
- ► Secure
- ▶ Transparent

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Architecture

The Let's Encrypt system is based on **3 components**: a **server**, a **client** and the **protocol** that defines the communication rules between server and client

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Server

Architecture

The Let's Encrypt system is based on **3 components**: a **server**, a **client** and the **protocol** that defines the communication rules between server and client

The server is called **Boulder** and it's completely written in **Go**. It's responsible of handling all the procedures for **issuing**, **renewal** and **revocation** of certificates.

y an HTTPS server that exposes a **RESTful** interface.

https://github.com/letsencrypt/boulder

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The client is called (obviously) **letsencrypt** and it's completely written in **Python**. It's responsible for interaction with the remote server and it **handles your certificates**.

Download through .deb package letsencrypt (only on debian sid/stretch).

the git repository.

https://github.com/letsencrypt/letsencrypt

letsencrypt

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https://github.com/letsencrypt/letsencrypt

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The client's main purpose is to **simplify and automate** the whole process of authentication and creation of the certificate.

For this reason the client comes with several plugins, useful to automatically setup the new certificates on popular web servers: apache and nginx

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The procol use by Let's Encrypt is called **Automated Certificate Management Environment (ACME)**.

ACME is based on exchanges of signed JSON files (a.k.a. JWS, Json Web Signature). These documents contains all the requests and the responses between the client and the server.

These documents **must** be exchanged over **HTTPS**.

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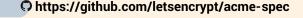
Nicola Corti

Network Working Group R. Barnes
Internet-Draft Mozilla
Intended status: Standards Track J. Hoffman-Andrews
Expires: January 22, 2016 EFF
J. Kasten
University of Michigan

Automatic Certificate Management Environment (ACME)

Abstract

Certificates in the Web's X.509 PKI (PKIX) are used for a number of purposes, the most significant of which is the authentication of domain names. Thus, certificate authorities in the Web PKI are trusted to verify that an applicant for a certificate legitimately represents the domain name(s) in the certificate. Today, this verification is done through a collection of ad hoc mechanisms. This document describes a protocol that a certificate authority (CA) and an applicant can use to automate the process of verification and certificate issuance. The protocol also provides facilities for other certificate management functions, such as certificate revocation.



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The ACME protocol is aimed to:

- **Prove** that we are the owners of a specific domain, say example.com
- 2. Obtain a new certificate for the domain example.com
- 3. Revoke or Renew a certificate for the domain example.com

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The ACME protocol is aimed to:

- Prove that we are the owners of a specific domain, say example.com
- 2. Obtain a new certificate for the domain example.com
- 3. **Revoke** or **Renew** a certificate for the domain *example.com*

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Security

All the interactions between client and servers are encrypted with a **public/private key pair** generated during the first execution of the client.

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All the interactions between client and servers are encrypted with a **public/private key pair** generated during the first execution of the client.

In order to **prove** that we are the owners of the domain, the server sends us a set of challenges that we must solve.

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Security

Security

All the interactions between client and servers are encrypted with a **public/private key pair** generated during the first execution of the client.

In order to **prove** that we are the owners of the domain, the server sends us a set of **challenges** that we must solve.

Every interaction with the server is marked with a **nonce** number that allows to avoid **Replay** attacks.

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Challenges

The server can decide to send one or more challenge from the followings:

Туре	Description
	You must provide a token inside a TXT
	record of your DNS server
	You must sign a document using a keypair that the

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awbacks sources The server can decide to send one or more challenge from the followings:

Туре	Description
Simple HTTP	You must place a token file inside your web-
	server root folder. Both HTTP and HTTPS
	are accepted
DNS	You must provide a token inside a TXT
	record of your DNS server
Proof of possession	You must sign a document using a keypair that the
	server already consider yours
Domain Validation with	You must configure a TLS server on a specific IP ad-
Server Name Indication	dress (through an A record inside the DNS).

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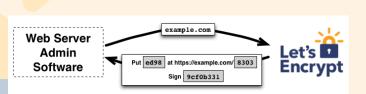
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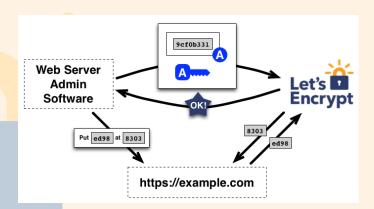
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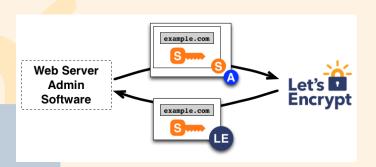
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Certificate Issuance



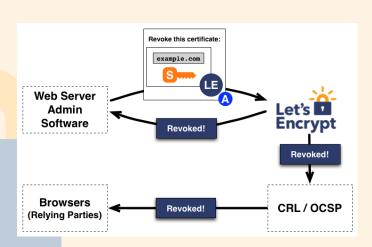
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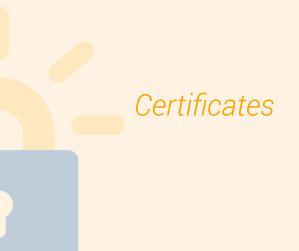
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DV Certificates

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All the certificates issue from L.E. are **Domain Validated** certificates. They basically prove that you are the owner of a specific domain, nothing more.

Organization Validation and Extended Validation certificates requires to explicit verify the identity of the subject that is requesting a certificate.

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Cross Signing

All the issued certificates are *Cross-signed* by **IdenTrust**. In this way, all the L.E. certificates are trusted by major browsers.

We can avoid browser errors such as:

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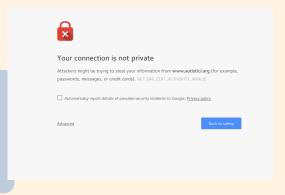
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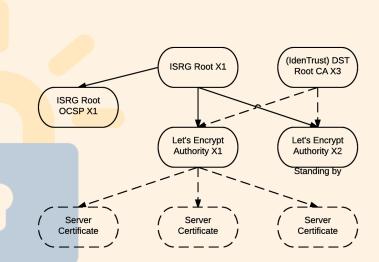
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Validity

All the certificates have a **90 days** validity. After the expiry, the certificates are not valid anymore and the browsers will raise security errors.

90-days validity

This is nothing new on the web. Having certificates with a reduced validity could help to limit damage from key compromise and mis-issuance.

You will receive *remind emails* whenever a certificate is near to expire. Gertificate renewal can be automated with a **cron** task.

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Validity

All the certificates have a **90 days** validity. After the expiry, the certificates are not valid anymore and the browsers will raise security errors.

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The client minimal requirements are:

- Unix like system.
- Python 2.6 or 2.7.
- root rights on the system.

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The **apache** setup plugins works only on Debian based system: **Ubuntu 12.04+** and **Debian 7+**

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First, let's download the **letsencrypt** client.

On Debian sid/stretch:

```
$ sudo apt-get install letsencrypt
$ letsencrypt --help
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First, let's download the **letsencrypt** client.

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First, let's download the **letsencrypt** client.

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$ sudo apt-get install letsencrypt
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On other OS:

```
$ git clone https://github.com/letsencrypt/letsencrypt
$ cd letsencrypt
$ ./letsencrypt-auto --help
```

From now on we will use **letsencrypt-auto** for all the commands, assuming to proceed with clone of the repository.

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```

From now on we will use **letsencrypt-auto** for all the commands, assuming to proceed with clone of the repository.

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To execute the client you simply have to invoke:

\$./letsencrypt-auto

We will be guided through the issuing process

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Apache

If you want to automatically configure **Apache** with the generated certificates you can invoke:

```
\$\ ./letsencrypt-auto\ --apache\ -d\ example.com\ -d\ www.example.com
```

With **--apache** we are enabling the apache plugin, and with **-d** we are giving the list of involved domains.

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Contacts

During the first run, the client will ask for our **mail address** and it will request to accept the **Terms of service**.

You can skip these steps using these flags:

\$./letsencrypt-auto --email admin@example.com --agree-tos

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Α	ı	Descrizione
Υ	Υ	Obtain and setup automatically the certs. on
		Apache 2.4 (Debian based)
Υ	Ν	Obtain the cert with a standalone web server
		on ports 80/443
Υ	Ν	Obtain a certificate touching a token inside the
		root folder of an already existing webserver
Υ	Ν	Prints the commands to manually obtain the
		certs from a different client
Υ	Υ	Obtain and setup automatically the certs. on
		nginx (experimental)
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You can use the plugins with authentication support (A column) just to obtain the certificates without installation.

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certonly

You can use the plugins with **authentication** support (A column) just to obtain the certificates without installation.

Simply add the option **certonly** to the command line.

Standalone example

```
$ ./letsencrypt-auto --standalone-supported-challenges \
http-01 certonly -d example.com
```

This command will start a standalone webserver on port 80 and it will obtain the certificate for example.com

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Plugins

All the certificates and the auth keys will be saved into /etc/letsencrypt.

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All the certificates and the auth keys will be saved into /etc/letsencrypt.

Inside this folder you will find all the **certificates** and all the public/private keys. It's extremely recommended to make a **backup** of this folder to a secure place.

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All the certificates and the auth keys will be saved into /etc/letsencrypt.

Inside this folder you will find all the **certificates** and all the **public/private keys**. It's **extremely** recommended to make a **backup** of this folder to a secure place.

Inside /etc/letsencrypt/live/example.com/ you will find symlinks that will be updated after every renewal.

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You will find the following files:

privkey.pem Private key of the certificate. DO NOT SHARE IT!

cert.pem Webserver certificate (sent to the browser).

chain.pem List of all the intermediate certificates connected to this certificate.

fullchain.pem cert.pem + chain.pem

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Revoke

To revoke a certificate you can simply use the option **revoke**.

\$ /.letsencrypt-auto revoke --cert-path example-cert.pem

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Renewal

The renewal process it's extremely easy, you can simply invoke **letsencrypt** without parameters.

You can also use the **--renew-by-default** to perform the automatic renewal of the certificate without user interaction.

In this way, it's possible to schedule a **cron** task to automatically renew the certificates before the expiry.

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Since Let's Encrypt it's a public beta, it's fundamental to keep the client up to date.

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Update

Since Let's Encrypt it's a public beta, it's fundamental to keep the client up to date.

On Debian sid/stretch:

\$ apt-get update && apt-get upgrade

On other O<mark>S</mark>

\$ cd letsencryp†
\$ git pull

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Since Let's Encrypt it's a public beta, it's fundamental to keep the client up to date.

On Debian sid/stretch:

```
$ apt-get update && apt-get upgrade
```

On other OS:

```
$ cd letsencrypt
```

```
$ git pull
```

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General usage

During everyday usage, you can simply invoke letsencrypt without parameters. The terminal UI will guide you through the desidered process.

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General usage

During everyday usage, you can simply invoke letsencrypt without parameters. The *terminal UI* will guide you through the desidered process.

You simply have to answer to the client questions.

Having only **too much parameters** could be hard to remember.

The UI will help on this, but the parameter still give the flexibility to embed the client inside **scripts**.

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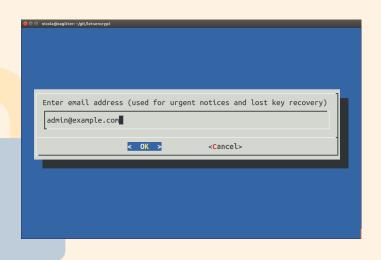
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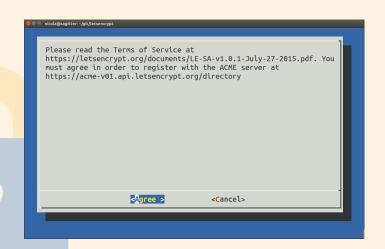
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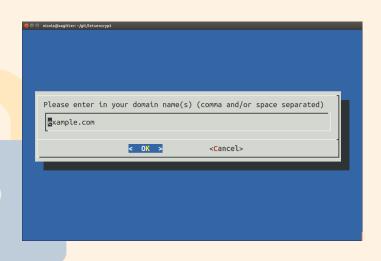
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```
nicola@sagitter: ~/git/letsencrypt
Make sure your web server displays the following content at
http:// /.well-known/acme-challenge/S-phkbW1bo ZS2MDmtZzvPKvOgsDpuGN0DH
9YdSshi0 before continuing:
S-phkbW1bo ZS2MDmtZzyPKvOqsDpuGN0DH9YdSshi0.8K2NX9Rba6j230BnmRz0OsNfrWrBM1Ur8cGV
6aY2IFc
If you don't have HTTP server configured, you can run the following
command on the target server (as root):
mkdir -p /tmp/letsencrypt/public html/.well-known/acme-challenge
cd /tmp/letsencrypt/public html
printf "%s" S-phkbW1bo ZS2MDmtZzvPKvOqsDpuGN0DH9YdSshi0.8K2NX9Rba6i230BnmRz0OsNf
rWrBM1Ur8cGV6aY2IFc > .well-known/acme-challenge/S-phkbW1bo ZS2MDmtZzvPKvOgsDpuG
N0DH9YdSshi0
# run onlv once per server:
$(command -v python2 || command -v python2.7 || command -v python2.6) -c \
'import BaseHTTPServer, SimpleHTTPServer: \
s = BaseHTTPServer.HTTPServer(('', 80), SimpleHTTPServer.SimpleHTTPRequestHandle
r); \
s.serve forever()"
Press ENTER to continue
```

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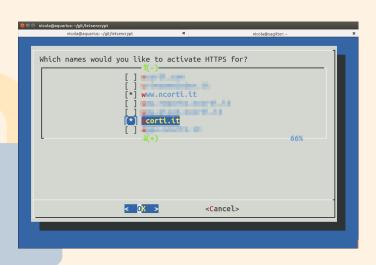
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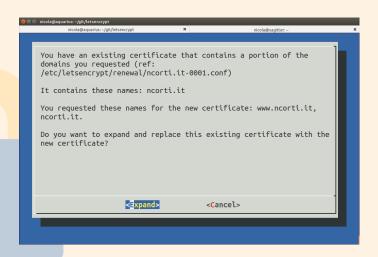
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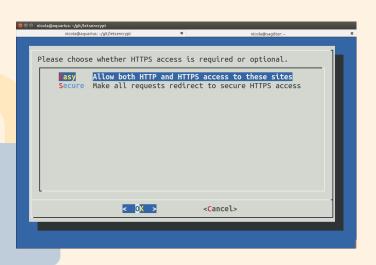
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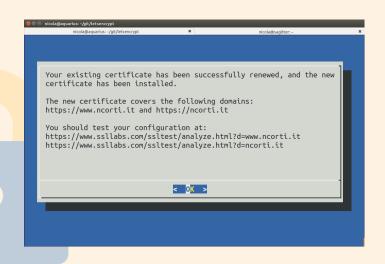


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Drawbacks

No support for Organization Validation or Extended
 Validation, to hard to automate.

No support for wildcards (*.example.com), maybe in the future.

Only HTTP challenge is supported (public beta), DNS challenge support is not already available.

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► How it works https://letsencrypt.org/howitworks/

Tech details https://letsencrypt.org/howitworks/technology/

Read the docs https://letsencrypt.readthedocs.org/

Community board https://community.letsencrypt.org/

Code https://github.com/letsencrypt/

Mailing lists

Client https://groups.google.com/a/letsencrypt.org/ forum/#!forum/client-dev

Server https://groups.google.com/a/letsencrypt.org/ forum/#!forum/ca-dev

ACME (IETF) https://www.ietf.org/mailman/listinfo/acme

Questions...?

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Sources at https://github.com/cortinico/gulp-letsencrypt

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