

# La délivrabilité e-mail

SPF, DKIM, DMARC, ??

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LES EMPLOIS DE L'INCLUSION  
GIP INCLUSION

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**1** E-mail

2 Spam

3 Sender Policy Framework

4 DomainKey Identified Mail

5 DMARC

6 Réputation

# ANATOMIE D'UN E-MAIL - RFC 5322

```
Date: Tue, 3 Sep 2024 11:11:11 +0200
From: The Sender <sender@email.test>
To: me@beta.gouv.fr
Message-ID: <430617367.736715.1725348550243@uniq>
Subject: Mon message pour vous
Content-Type: text/plain; charset=UTF-8
Content-Transfer-Encoding: 8bit
Return-Path: <me@beta.gouv.fr>
```

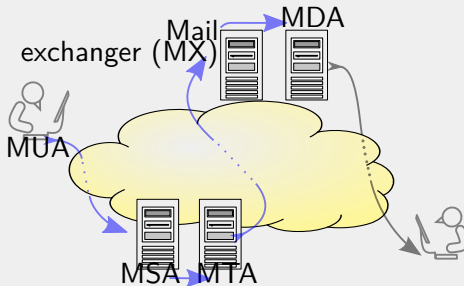
Salutations de rigueur,

Le corps de l'email.

--

Moi

# LA CIRCULATION DES EMAILS



**Figure** – source :

<https://commons.wikimedia.org/wiki/File:SMTP-transfer-model.svg>

**MUA** Mail User Agent

**MSA** Mail Submission Agent

**MTA** Mail Transfer Agent (Mail Relay)

**MDA** Mail Delivery Agent

# MX : MAIL EXCHANGER

Ensemble d'entrées DNS pour un domaine indiquant quels serveurs e-mail contacter, avec un ordre de priorité :

example.org.	MX	10	principal.example.org.
	MX	50	secondaire.example.org.

# SIMPLE MAIL TRANSFER PROTOCOL

```
> telnet smtp.----.---- 25
< Connected to smtp.----.----.
< 220 smtp.----.---- SMTP Ready
> HELO yyyy.yyyy
< 250-smtp.----.----
< 250-PIPELINING
< 250 8BITMIME
> MAIL FROM: <auteur@yyyy.yyyy>
< 250 Sender ok
> RCPT TO: <destinataire@----.---->
< 250 Recipient ok.
> DATA
< 354 Enter mail, end with "." on a line by itself
> Subject: Test
>
> Corps du texte
> .
< 250 Ok
> QUIT
< 221 Closing connection
Connection closed by foreign host.
```

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- 1978** : Email de publicité de Digital Equipment Corporation sur ARPANET par un membre du marketing
- 1993** : Accidentellement posté 200 messages sur Usenet, première utilisation du terme spam
- 1994** : Deux avocats (Canter & Siegel) embauchent un dev pour "spammer" (5 500 messages) Usenet avec une pub pour la lotterie pour l'obtention d'une green card.  
⇒\$100-200K



# PREMIER SPAM À SUCCÈS

Path: gmd.de!urmel.informatik.rwth-aachen.de!newsserver.rrzn.uni-hannover.de!hrz-wsl1.hrz.uni-kassel.de!news.th-darmstadt.de!fauern!zib  
From: ni...@indirect.com (Laurence Canter)  
Newsgroups: alt.bonehead.paul-hendry,alt.online-service.america-online  
Subject: Green Card Lottery- Final One?  
Date: 12 Apr 1994 07:40:23 GMT  
Organization: Canter & Siegel  
Lines: 34  
Message-ID: <2odj97\$25f@herald.indirect.com>  
NNTP-Posting-Host: id1.indirect.com

Green Card Lottery 1994 May Be The Last One!  
THE DEADLINE HAS BEEN ANNOUNCED.

The Green Card Lottery is a completely legal program giving away a certain annual allotment of Green Cards to persons born in certain countries. The lottery program was scheduled to continue on a permanent basis. However, recently, Senator Alan J Simpson introduced a bill into the U. S. Congress which could end any future lotteries. THE 1994 LOTTERY IS SCHEDULED TO TAKE PLACE SOON, BUT IT MAY BE THE VERY LAST ONE.

PERSONS BORN IN MOST COUNTRIES QUALIFY, MANY FOR FIRST TIME.

The only countries NOT qualifying are: Mexico; India; P.R. China; Taiwan, Philippines, North Korea, Canada, United Kingdom (except Northern Ireland), Jamaica, Dominican Republic, El Salvador and Vietnam.

Lottery registration will take place soon. 55,000 Green Cards will be given to those who register correctly. NO JOB IS REQUIRED.

THERE IS A STRICT JUNE DEADLINE. THE TIME TO START IS NOW!!

For FREE information via Email, send request to  
cs...@indirect.com

--  
\*\*\*\*\*  
Canter & Siegel, Immigration Attorneys  
3333 E Camelback Road, Ste 250, Phoenix AZ 85018 USA  
cs...@indirect.com telephone (602)661-3911 Fax (602) 451-7617

# LE NOM SPAM

Un sketch des Monty Python



Impossible d'authentifier l'expéditeur :

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- Standards d'authentification non implémentés
- Les MTA font des erreurs très diverses
- Les MTA ne sont pas mis à jour

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⇒ **On abandonne ?**

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⇒ **On abandonne ?**

⇒ ⇒ Mécanismes **optionnels** pour authentifier l'expéditeur.

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« An SPF record is a DNS record that declares which hosts are, and are not, authorized to use a domain name for the "HELO" and "MAIL FROM" identities. »



# ENREGISTREMENT SPF

```
$ dig +short TXT inclusion.beta.gouv.fr  
"v=spf1 include:spf.mailjet.com "  
  "include:spf.sendinblue.com "  
  "include:_spf.alwaysdata.com "  
  "include:_spf.google.com "  
  "include:mail.zendesk.com "  
  "?all"
```

"+" **pass** (default, can be omitted), authorized

"-" **fail** not authorized

"~" **softfail** probably not authorized

"?" **neutral** not asserting whether the IP address is authorized

## EXAMPLES D'INCLUDE

```
$ dig +short TXT spf.mailjet.com
"v=spf1 ip4:87.253.232.0/21 ip4:185.189.236.0/22 "
    "ip4:185.211.120.0/22 ip4:185.250.236.0/22 "
    "~all"
```

```
dig +short TXT _spf.alwaysdata.com
"v=spf1 ip4:185.31.40.0/22 ip4:188.72.70.0/24 "
    "ip4:78.142.219.0/24 "
    "ip6:2a00:b6e0::/32 ip6:2001:41d0:8:4734:1::1/64 "
    "ip4:176.31.58.20 ip4:176.31.58.21 "
    "ip4:176.31.58.22"
```

« If none of the mechanisms match [...] then [...] "neutral", just as if "?all" were specified as the last directive. »

# VALIDATION SPF (SIMPLIFIÉE)

1. Lire l'adresse IP de l'expéditeur
2. Lire <DOMAIN> depuis MAIL FROM:
3. `dig TXT <DOMAIN> | grep spf`
4. Vérifier la correspondance entre l'IP de l'étape 1. et la politique SPF

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- 4 DomainKey Identified Mail**
- 5 DMARC
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« DomainKeys Identified Mail (DKIM) permits a person, role, or organization that owns the signing domain to claim some responsibility for a message by associating the domain with the message. »

[...]

« Assertion of responsibility is validated through a cryptographic signature and by querying the Signer's domain directly to retrieve the appropriate public key. »

# ENREGISTREMENT DKIM

Selector : name.\_domainkey.example.org

```
$ dig +short TXT ovhex1077009-selector1._domainkey.beta.gouv.fr  
"v=DKIM1; k=rsa; t=s; "  
"p=MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEA3[...]wIDAQAB;"
```

v Version

k Key type

p Public key

t Flags

# HEADER EMAIL DKIM

```
DKIM-Signature: v=1; a=rsa-sha256; d=beta.gouv.fr; s=ovhex1077009-selector1;  
c=relaxed/relaxed; t=1725378012; h=from:to:subject:date;  
bh=8MRBsVcw7gmBo1jQwq9N6SM30uPOFrywUxo3X3oBDW0=;  
b=G3S65gh+sW52q/ryL/iHWl0jwp2MBxtA6LHier[...]Ug==
```

- v Version
- a Algorithm to compute the digital signature
- d Sender domain
- s Selector to lookup the public key
- c Canonicalization (header/body)
- t Signature timestamp
- h Signed header fields
- bh Hash of the canonicalized body
- b Signature data (generated from h and bh, signed with private key)

## RELAXED HEADER CANONICALIZATION (SIMPLIFIÉE)

1. Convertir le nom des headers en minuscules
2. Joindre les lignes de continuation des headers
3. Remplacer les espaces consécutifs par un seul espace
4. Supprimer les espaces de fin de ligne
5. Supprimer les espaces autour du séparateur de header ( : )



# VALIDATION DKIM (SIMPLIFIÉE)

1. Verifier que From: correspond au domain (d=)
2. dig TXT <selector (s=)>.<domain (d=)>
3. Canonicaliser, tronquer (l=, mailing lists) et hasher le body
- 3bis.** body-hash = hash-alg (canon-body, l-param)
4. Collecter et canonicaliser les headers du mail (h=)
5. Vider le contenu du champ signature de DKIM-Signature b=
- 5bis.** data-hash = hash-alg (h-headers, D-SIG, body-hash)
6. signature = sig-alg (d-domain, selector, data-hash)

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« Domain-based Message Authentication, Reporting, and Conformance (DMARC) is a scalable mechanism by which a mail-originating organization can express domain-level policies and preferences for message validation, disposition, and reporting, that a mail-receiving organization can use to improve mail handling. »

# ENREGISTREMENT DNS

```
$ dig +short TXT _dmarc.inclusion.beta.gouv.fr
"v=DMARC1;p=none;"
"rua=mailto:dmarc@inclusion.beta.gouv.fr,"
    "mailto:dmarc@mailinblue.com!10m;"
"ruf=mailto:dmarc+forensics@inclusion.beta.gouv.fr,"
    "mailto:dmarc@mailinblue.com!10m"
```

v Version

p Requested policy {none, quarantine, reject}

pct Apply policy to pct (%) messages

rua Send aggregated reports to these addresses

ruf Send failure reports to these addresses

adkim DKIM alignment {strict,relaxed}

aspf SPF alignment {strict,relaxed}

fo failure option (dans quel cas rapporter les erreurs?)

- La politique DMARC est héritée du domaine parent
- Alignement SPF (From: et Return-Path)
  - strict** uniquement le domaine expéditeur
  - relaxed** autorise également les sous domaines
- Alignement DKIM (From: et DKIM-signature: d=)
  - strict** le FQDN
  - relaxed** l'organizational domain

# SPF ALIGNMENT ?

MAIL FROM: <sender@example.com>

From: sender@example.com

Date: Fri, Feb 15 2002 16:54:30 -0800

To: receiver@example.org

Subject: here's a sample

# SPF ALIGNMENT ?

```
MAIL FROM: <sender@example.com>
```

```
From: sender@example.com
```

```
Date: Fri, Feb 15 2002 16:54:30 -0800
```

```
To: receiver@example.org
```

```
Subject: here's a sample
```

**OK**

# SPF ALIGNMENT ?

MAIL FROM: <sender@example.com>

From: sender@sample.net

Date: Fri, Feb 15 2002 16:54:30 -0800

To: receiver@example.org

Subject: here's a sample



# SPF ALIGNMENT ?

```
MAIL FROM: <sender@example.com>
```

```
From: sender@sample.net
```

```
Date: Fri, Feb 15 2002 16:54:30 -0800
```

```
To: receiver@example.org
```

```
Subject: here's a sample
```

## KO

⇒ C'est ce qui a été changé en juin sur Mailjet, pour aligner le Return-Path: avec le From:.

# MAIL FROM VS RETURN-PATH:

Date: Tue, 3 Sep 2024 11:11:11 +0200  
From: The Sender <sender@email.test>  
To: me@beta.gouv.fr  
Subject: Mon message pour vous  
Return-Path: <me@beta.gouv.fr>

BODY

# MAIL FROM VS RETURN-PATH:

```
Date: Tue, 3 Sep 2024 11:11:11 +0200
From: The Sender <sender@email.test>
To: me@beta.gouv.fr
Subject: Mon message pour vous
Return-Path: <me@beta.gouv.fr>
```

BODY

« When the delivery SMTP server makes the "final delivery" of a message, it inserts a return-path line at the beginning of the mail data. This use of return-path is required; mail systems **MUST** support it. The return-path line preserves the information in the <reverse-path> from the MAIL command. »

# DKIM ALIGNMENT ?

```
DKIM-Signature: v=1; ...; d=sample.net; ...  
From: sender@child.example.com  
Date: Fri, Feb 15 2002 16:54:30 -0800  
To: receiver@example.org  
Subject: here's a sample
```

# DKIM ALIGNMENT ?

```
DKIM-Signature: v=1; ...; d=sample.net; ...  
From: sender@child.example.com  
Date: Fri, Feb 15 2002 16:54:30 -0800  
To: receiver@example.org  
Subject: here's a sample
```

**KO**

# DKIM ALIGNMENT ?

```
DKIM-Signature: v=1; ...; d=example.com; ...  
From: sender@example.com  
Date: Fri, Feb 15 2002 16:54:30 -0800  
To: receiver@example.org  
Subject: here's a sample
```

# DKIM ALIGNMENT ?

```
DKIM-Signature: v=1; ...; d=example.com; ...  
From: sender@example.com  
Date: Fri, Feb 15 2002 16:54:30 -0800  
To: receiver@example.org  
Subject: here's a sample
```

OK

# RAPPORT DMARC RUA - HEADER

```
<?xml version="1.0"?>
<feedback xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <version>1.0</version>
  <report_metadata>
    <org_name>Enterprise Outlook</org_name>
    <email>dmarcreport@microsoft.com</email>
    <report_id>6e504d1d4cf846868ff04235dc7e4799</report_id>
    <date_range>
      <begin>1721692800</begin>
      <end>1721779200</end>
    </date_range>
  </report_metadata>
```



```
<policy_published>  
  <domain>inclusion.beta.gouv.fr</domain>  
  <adkim>r</adkim>  
  <aspf>r</aspf>  
  <p>none</p>  
  <sp>none</sp>  
  <pct>100</pct>  
  <fo>1</fo>  
</policy_published>
```

**fo=0** report if all fail (Default)

**fo=1** report if any fail (Recommended)

**fo=d** only DKIM failures (regardless of alignment)

**fo=s** only SPF failures (regardless of alignment)

# RAPPORT DMARC RUA - OK

```
<!-- dig TXT spf.mailjet.com
      "v=spf1 ip4:87.253.232.0/21 ip4:185.189.236.0/22 "
      "ip4:185.211.120.0/22 ip4:185.250.236.0/22 -all" -->
<row>
  <source_ip>87.253.239.91</source_ip>
  <count>10</count>
  <policy_evaluated>
    <disposition>none</disposition>
    <dkim>pass</dkim>
    <spf>pass</spf>
  </policy_evaluated>
</row>
<identifiers>
  <envelope_to>are33.com</envelope_to>
  <envelope_from>bnc3.inclusion.beta.gouv.fr</envelope_from>
  <header_from>inclusion.beta.gouv.fr</header_from>
</identifiers>
<auth_results>
  <dkim>
    <domain>inclusion.beta.gouv.fr</domain>
    <selector>mailjet</selector>
    <result>pass</result>
  </dkim>
  <spf>
    <domain>bnc3.inclusion.beta.gouv.fr</domain>
    <scope>mfrom</scope>
    <result>pass</result>
  </spf>
</auth_results>
```

# RAPPORT DMARC RUA - SPF FAIL

```
<!-- dig TXT spf.mailjet.com
      "v=spf1 ip4:87.253.232.0/21 ip4:185.189.236.0/22 "
      "ip4:185.211.120.0/22 ip4:185.250.236.0/22 -all" -->
<row>
  <source_ip>40.93.69.3</source_ip>
  <count>1</count>
  <policy_evaluated>
    <disposition>none</disposition>
    <dkim>pass</dkim>
    <spf>fail</spf>
  </policy_evaluated>
</row>
<identifiers>
  <envelope_to>adef-emploi.fr</envelope_to>
  <envelope_from>bnc3.inclusion.beta.gouv.fr</envelope_from>
  <header_from>inclusion.beta.gouv.fr</header_from>
</identifiers>
<auth_results>
  <dkim>
    <domain>inclusion.beta.gouv.fr</domain>
    <selector>mailjet</selector>
    <result>pass</result>
  </dkim>
  <spf>
    <domain>bnc3.inclusion.beta.gouv.fr</domain>
    <scope>mfrom</scope>
    <result>fail</result>
  </spf>
</auth_results>
```

**Résultats de l'authentification** résultats SPF et DKIM

**En-têtes de message**

**Contenu du message** permet d'identifier l'origine du message

**Détails de cryptage** *optionnel*

**Résultats de l'authentification** résultats SPF et DKIM

**En-têtes de message**

**Contenu du message** permet d'identifier l'origine du message

**Détails de cryptage** *optionnel*

Mais presque pas utilisé :

- **Confidentialité** l'administrateur du domaine suit les messages
- **Sécurité** un acteur malveillant peut inonder la boîte RUF  
(1 rapport/erreur)

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# RÉPUTATION

Chacun pour soi... souvent basé sur les adresses IP émettrices.

Un exemple de service : <https://emailrep.io>

- Data breach
- First seen
- Last seen
- Domain exists
- Domain reputation
- Days since domain creation
- Suspicious TLD
- Free provider
- Malicious activity
- SPF record
- DKIM record
- DMARC record

```
{  
  "email": "tech@inclusion.beta.gouv.fr",  
  "reputation": "low",  
  "suspicious": true,  
  "references": 0,  
  "details": {  
    "blacklisted": false,  
    "malicious_activity": false,  
    "malicious_activity_recent": false,  
    "credentials_leaked": false,  
    "credentials_leaked_recent": false,  
    "data_breach": false,  
    "first_seen": "never",  
    "last_seen": "never",  
    "domain_exists": true,  
    "domain_reputation": "low",  
    "new_domain": false,  
    "days_since_domain_creation": 3115,  
    "suspicious_tld": false,  
    "spam": false,  
    "free_provider": false,  
    "disposable": false,  
    "deliverable": true,  
    "accept_all": false,  
    "valid_mx": true,  
    "primary_mx": "mx1.alwaysdata.com",  
    "spoofable": true,  
    "spf_strict": false,  
    "dmarc_enforced": false,  
    "profiles": []  
  }  
}
```



# AMÉLIORATION EFFECTUÉES

- 04 juillet 2024** Envoi des rapports DMARC à `tech@inclusion.beta.gouv.fr` (source)
- 04 juillet 2024** Demande à Mailjet d'envoyer avec `bnc3.inclusion.beta.gouv.fr` (source)
- 05 juillet 2024** Envoi depuis `bnc3.inclusion.beta.gouv.fr` (source)
- 24 juillet 2024** Envoi des rapports DMARC à une boîte mail dédiée (source)
- 25 juillet 2024** Ajout de `include:spf.mailinblue.com` au SPF (source)
- 30 juillet 2024** Ajout des ruf à la politique DMARC (source)
- 02 octobre 2024** Ajout de `include:bnc3.inclusion.beta.gouv.fr` au SPF (source)
- 08 octobre 2024** Remplacement de `include:spf.sendinblue.com` dans le SPF par `include:spf.brevo.com` (source)
- 09 octobre 2024** Retrait des ruf de la politique DMARC (source)

AMÉLIORER CETTE RÉPUTATION ?

# AMÉLIORER CETTE RÉPUTATION ?

## 1. SPF :

```
$ dig +short TXT inclusion.beta.gouv.fr  
"v=spf1 include:spf.mailjet.com [...] ?all"
```

# AMÉLIORER CETTE RÉPUTATION ?

## 1. SPF :

```
$ dig +short TXT inclusion.beta.gouv.fr  
"v=spf1 include:spf.mailjet.com [...] ?all"
```

## 2. DMARC :

```
$ dig +short TXT _dmarc.inclusion.beta.gouv.fr  
"v=DMARC1;p=none;rua=[...]"
```

MERCI DE VOTRE ATTENTION

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AVEZ-VOUS DES QUESTIONS ?