You’re Going to Connect to the Wrong Domaın Name

@erbbysam

DEFCON 25 PACKET HACKING VILLAGE

whoami

@erbbysam

Software Engineer

DC23, DC24 black badge (Badge Challenge, Co9)

The opinions expressed here are my own &

no one was phished in the creation of this presentation

Typosquatting

Humans are not perfect, we mistype domain names. A malicious person can register these mistyped domain names.

Only 2 of the 61 1-keyboard letter off variants of americanexpress.com are unregistered.

Example:
qmericanexpress.com
Expires:2018-01-06T00:00:00 Created:2008-01-06T00:00:00 Updated:2017-01-06T00:00:00
Registrar:ABOVE.COMTPTYTLTD.

americanexpress
snweuxsbwzoewaa
wjrtovwmrcltrdd
qksdjdqhss dsee
z dfkfzjdd fdww
xx
zz

Bitsquatting

A form of typosquating, but one where the computer gets the domain name wrong by flipping a bit.

eoogle-analytics

01100101 01101111 01101111 01100111 01101100 01100101 00101101 01100001 01101110 01100001 01101100 01111001 01110100 01101001 01100011 01110011

01100011 01101111 01101111 01100111 01101100 01100101 00101101 01100001 01101110 01100001 01101100 01111001 01110100 01101001 01100011 01110011

google-analytics

Bitsquatting - Searching for Domains

foogle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.

eoogle-analytics.com no record

coogle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
ooogle-analytics.com Expires:2017-12-20T00:00:00 Created:2014-12-20T00:00:00 Updated:2017-03-08T00:00:00 Registrar:ENOM,TINC.
woogle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
gnogle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
gmogle-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
gkogle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
ggogle-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
gongle-analytics.com Expires:2017-09-13T00:00:00 Created:2011-09-13T00:00:00 Updated:2016-08-12T00:00:00 Registrar:MARKMONITORTINC.
gomgle-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
gokgle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
goggle-analytics.com Expires:2017-06-19T00:00:00 Created:2008-06-19T00:00:00 Updated:2016-06-20T00:00:00 Registrar:NAUGUSTLIMITED,TLLC.
goofle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
gooele-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
goocle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
gooole-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
goowle-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
googme-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
googne-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
googhe-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
googde-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
googld-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
googlg-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
googla-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
googlm-analytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
googlu-analytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
googlemanalytics.com Expires:2017-08-05T00:00:00 Created:2013-08-05T00:00:00 Updated:2016-08-09T00:00:00 Registrar:GODADDY.COM,TLLC
google-cnalytics.com Expires:2017-11-17T00:00:00 Created:2014-11-17T00:00:00 Updated:2016-11-20T00:00:00 Registrar:DYNADOT,TLLC
google-enalytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-inalytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
google-qnalytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-aoalytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-alalytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
google-ajalytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-afalytics.com Expires:2018-03-22T00:00:00 Created:2016-03-22T00:00:00 Updated:2017-04-15T00:00:00 Registrar:ENOM,TINC.
google-anclytics.com Expires:2017-11-17T00:00:00 Created:2014-11-17T00:00:00 Updated:2016-11-20T00:00:00 Registrar:DYNADOT,TLLC
google-anelytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-anilytics.com Expires:2017-11-17T00:00:00 Created:2014-11-17T00:00:00 Updated:2016-11-20T00:00:00 Registrar:DYNADOT,TLLC
google-anqlytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-anamytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-ananytics.com Expires:2017-11-17T00:00:00 Created:2014-11-17T00:00:00 Updated:2016-11-20T00:00:00 Registrar:DYNADOT,TLLC
google-anahytics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-anadytics.com Expires:2017-11-17T00:00:00 Created:2014-11-17T00:00:00 Updated:2016-11-20T00:00:00 Registrar:DYNADOT,TLLC
google-analxtics.com Expires:2017-09-14T00:00:00 Created:2011-09-14T00:00:00 Updated:2016-08-13T00:00:00 Registrar:MARKMONITORTINC.
google-analqtics.com Expires:2017-11-17T00:00:00 Created:2014-11-17T00:00:00 Updated:2016-11-20T00:00:00 Registrar:DYNADOT,TLLC
google-analitics.com Expires:2018-01-03T00:00:00 Created:2009-01-03T00:00:00 Updated:2016-12-02T00:00:00 Registrar:MARKMONITORTINC.

Bitsquatting - Example

Registered eoogle-analytics.com

Used Let’s Encrypt to get a TLS certificate

Found a misconfigured server, but within 24 hours saw 2 “hits”

HTTPServerRequest(protocol='http', host='www.eoogle-analytics.com', method='GET', uri='/r/]_utm.gif?[removed]', version='HTTP/1.1', remote_ip='[removed]', headers={'Accept-Language': 'ja-JP, en-US;q=0.8', 'Accept-Encoding': 'gzip, deflate', 'X-Wap-Profile': 'http://[removed].com/[removed].xml', 'X-Getzip': 'supported', 'Host': 'www.eoogle-analytics.com', 'User-Agent': '[removed]', 'Accept-Charset': 'utf-8, iso-8859-1, utf-16, *;q=0.7', 'Connection': 'keep-alive', 'X-Requested-With': 'com.android.browser', **'Referer': 'http://[removed].net/823.html'**, 'Cache-Control': 'no-cache', 'Cookie': 'VisitorID=[removed]&Exp=11/12/2018 9:13:02 AM'})

HTTPServerRequest(protocol='https', host='www.eoogle-analytics.com', method='GET', uri='/analytics.js', version='HTTP/1.1', remote_ip='[removed]', headers={'Save-Data': 'on', 'Accept-Language': 'en-US,en;q=0.8', 'Accept-Encoding': 'gzip, deflate, sdch, br', 'Host': 'www.eoogle-analytics.com', 'Accept': '*/*', 'User-Agent': 'Mozilla/5.0 (Linux; Android 5.0.2; P01V Build/LRX22G) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/58.0.3029.83 Safari/537.36', 'Connection': 'keep-alive', **'Referer': 'http://www.[removed].lk/channel/'**})

```
174 <script type="text/javascript">
175 var gaJsHost = (("https:" == document.location.protocol) ? "https://ssl." : "http://www.");
176 document.write(unescape("%3Cscript src='" + gaJsHost + "eoogle-analytics.com/ga.js' type='text/javascript'%3E%3C/script%3E"));
177 </script>
178 <script type="text/javascript">
179 try {
180 var pageTracker = _gat._getTracker("            ");
181 pageTracker._trackPageview();
182 } catch(err) {}</script>
183
```

Bitsquatting - gTLD

.got

01100111 01101111 01110100

01100111 01101111 01110110

.gov

.bom

01100010 01101111 01101101

01100011 01101111 01101101

.com

IDN Homoglyphs

IDN = “Internationalized domain name”, stored as punycode (xn--*)

Homoglyphs are 2 characters that look the same

Example:

xn--ggle-55da.com = g**oo**gle.com

xn--e1anr4f.com = **тіме**.com

Depending on the IDN and your browser, you may see:

xn--ggle-55da.com

Or

g**oo**gle.com

IDN Homoglyphs - Identification

I wanted to conduct a survey of existing homoglyphs in IDN domain names against popular .com domains...

3 options to gather domain names:

1) zone files (hard/impossible to acquire)
2) Certificate Transparency
3) Third party lists ($$$)

Google “pilot” CT log contains ~100 million certificates

- 400GB (compressed)
- ~96.5 million domain names
- searchable (crt.sh)
- A great source of utilized domain names

IDN Homoglyphs - Identification Continued

Another reason for using Certificate Transparency - if a certificate was registered, the domain was more likely to be used

Let's build a pipeline:

[Google CT Pilot log] → [parse CN, SAN domains] → [filter punycode .com domains (xn--*.com)]

Cross Reference:

1) Pipeline list, rendered as unicode, passed through the python unidecode package (ex. Ꮲ → P)
2) Alexa top 1 million domains

End result:
1,938 CT certificates containing impersonating domains, modified Chromium unit test for punycode display status
https://github.com/erbbysam/IDN_impersonators

IDN Homoglyphs - Cross Referenced Results

ĸ, 22, 0x138, "LATIN SMALL LETTER KRA"
96074858, 1509667199, xn--faceboo-jhb.com, facebooĸ.com , ĸ, facebook.com, 3, 1
86142753, 1507679999, xn--autodes-jhb.com, autodesĸ.com , ĸ, autodesk.com, 697, 1

ł, 5, 0x142, "LATIN SMALL LETTER L WITH STROKE"
94011919, 1524055021, xn--ppe-8ka60c.com, àppłe.com , àł, apple.com, 69, 1
94724468, 1500291180, xn--sack-01a.com, słack.com , ł, slack.com, 205, 1

ı, 100, 0x131, "LATIN SMALL LETTER DOTLESS I"
18331655, 1488327078, xn--reddt-q4a.com, reddıt.com , ı, reddit.com, 7, 1
95900673, 1500493680, xn--t-fka.com, tı.com , ı, ti.com, 3235, 1
84518766, 1497998760, xn--gml-kua34j.com, gmàıl.com , àı, gmail.com, 22463, 1
95900424, 1500493860, xn--fat-jua.com, fıat.com , ı, fiat.com, 54102, 1
94504694, 1509148799, xn--curacao-egamng-hgc.com, curacao-egamıng.com , ı, curacao-egaming.com, 524456, 1
94724500, 1500493920, xn--suzu-kza.com, ısuzu.com , ı, isuzu.com, 866480, 1

ì, 25, 0xec, "LATIN SMALL LETTER I WITH GRAVE"
95900680, 1500670920, xn--twttr-7raz.com, twìttèr.com , ìè, twitter.com, 11, 1
85019386, 1507161599, xn--polonex-3ya.com, polonìex.com , ì, poloniex.com, 1595, 1
83724035, 1497798600, xn--gma-pma40b.com, gmaìÍ.com , ìÍ, gmail.com, 22463, 1

IDN Homoglyphs - More Cross Referenced Results

2 interesting domains observed bypasses Chromium checks by using only cyrillic characters:
07022746, 1443571199, xn--80aac5cct.com, таобао.com , таобао, taobao.com, 10, 1
10303999, 1461542399, xn--e1anr4f.com, тіме.com , тіме, time.com, 817, 1

IDN Homoglyphs - Results Contd

A breakdown of the unicode blocks observed:
89 LATIN
25 CYRILLIC
16 HEBREW
14 GREEK
8 KATAKANA
4 ARABIC
3 HANGUL
2 HIRAGANA
1 RUNIC
1 MALAYALAM
1 CANADIAN SYLLABICS

IDN Homoglyphs - Canadian Aboriginal Syllabics

Firefox & Chromium IDN checks were bypassed(punycode value was not displayed) for the following sample domains. Firefox & Chromium security bugs were reported.

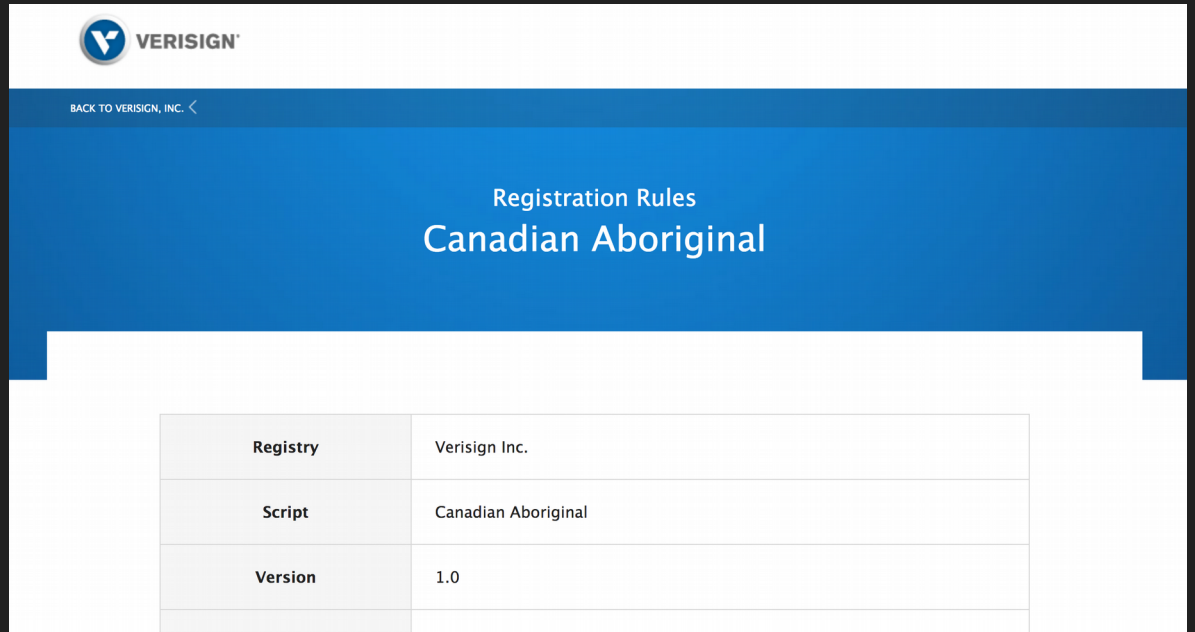
http://xn--youtue-084a.com/ -- youtuᑲe.com -- example domain
http://xn--youtbe-z72a.com/ -- youtUbe.com -- example domain
http://xn--uny-8wq.com/ -- ᑭuny.com -- example domain
http://xn--oor-hxq.com -- ᑯoor.com -- example domain
http://xn--ego-73q.com/ -- Lego.com -- example domain
http://xn--fc-lym.com/ -- fc2.com -- example domain
http://xn--ulu-7sr.com/ -- Hulu.com -- example domain
http://xn--acebook-yp9a.com/ -- Facebook.com -- example domain

```
Chromium - CVE-2017-5076
Firefox  - CVE-2017-7764
```

IDN Homoglyphs - Policy to the Rescue

While a domain name may render in a browser, you may not be able to register it!

https://www.verisign.com/assets/idn/idn-canadian-aboriginal.html



Personal Mitigations

Don’t click links

Use a password manager

Don’t click links

Use a password manager

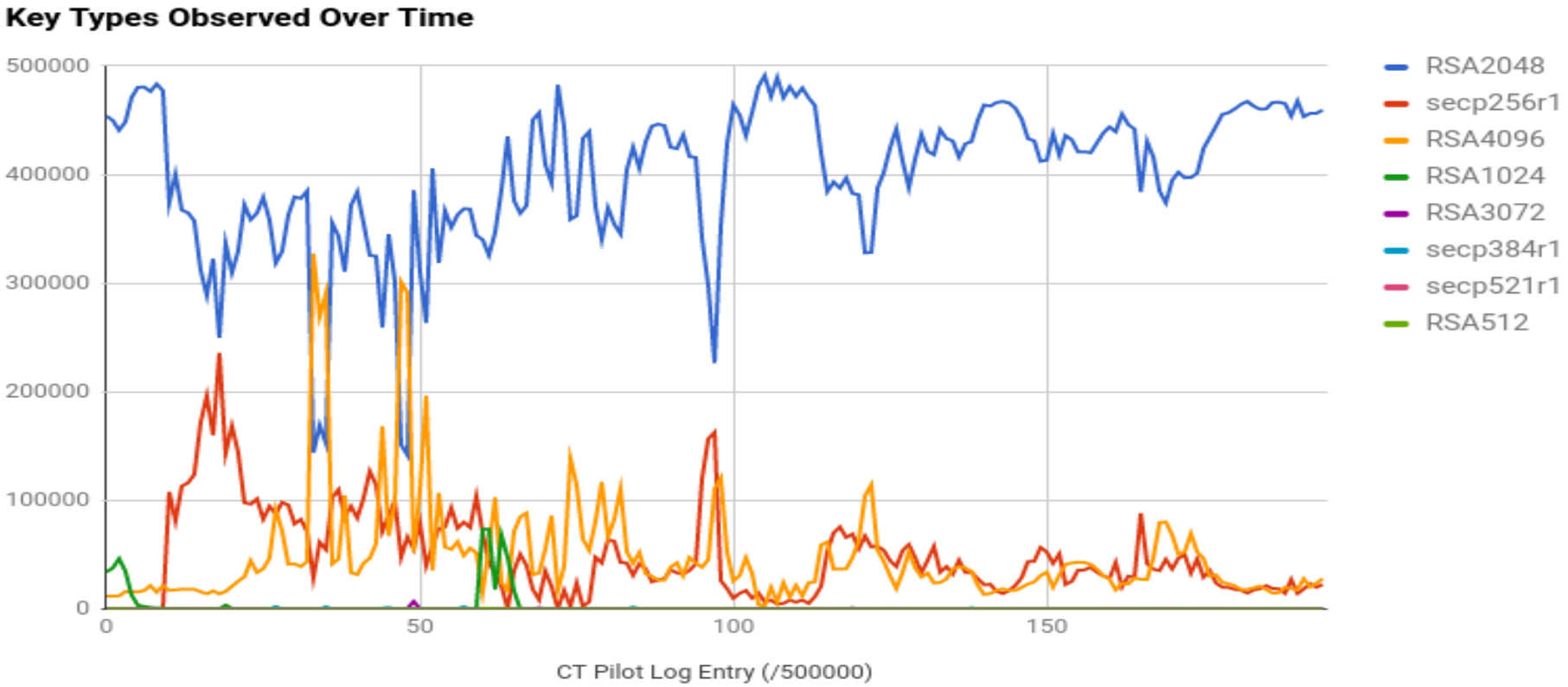
Don’t click links

Use a password manager

Don’t click links

Use a password manager

Certificate Transparency Fun - Graph of Key Types



Certificate Transparency Fun - Most Common Key Types

RSA2048	78019787
secp256r1	9556582
RSA4096	9447685
RSA1024	484262
RSA3072	45921
secp384r1	39336
RSA512	3026

```
78019787 RSA2048
9556582 secp256r1
9447685 RSA4096
 484262 RSA1024
  45921 RSA3072
  39336 secp384r1
   3026 RSA512
   2429 RSA8192
   1847 RSA2432
    418 DSA2048
    314 RSA4056
    229 RSA1023
    226 RSA3248
    217 RSA2560
    213 RSA2084
    195 RSA2047
    184 RSA2056
    166 RSA2049
    153 secp521r1
    153 RSA4092
    146 RSA3096
    131 RSA4048
    129 RSA4098
    127 RSA16384
    124 RSA4086
    118 RSA4069
    110 RSA1536
     72 RSA1048
     68 RSA768
     65 RSA2058
     64 RSA2408
     63 RSA2096
     52 RSA3024
     41 RSA4095
     37 RSA3076
     30 RSA4046
     27 RSA4196
     24 RSA8096
     23 RSA2064
     22 RSA2046
     21 RSA5120
     21 DSA1024
     20 RSA2345
     20 RSA2024
     19 RSA8196
     19 RSA4094
     19 RSA3768
     19 RSA2736
     17 RSA2080
     16 RSA1025
     15 RSA4088
     14 RSA6144
     14 RSA4097
     14 RSA15360
     13 RSA3048
     12 RSA4028
     12 RSA15424
     11 RSA2948
     11 RSA1212
     10 RSA2848
     10 RSA2050
     10 RSA2028
      9 RSA511
      9 RSA3120
      9 RSA3000
      9 RSA2078
      8 RSA4906
      8 RSA3087
      8 RSA2304
      7 RSA4192
      7 RSA2043
      7 RSA1280
      6 RSA8000
      6 RSA4100
      6 RSA3073
      6 RSA2612
      6 RSA2040
      5 RSA3584
      5 RSA3456
      5 RSA3333
      5 RSA3192
      5 RSA2176
      5 RSA1234
      4 RSA8092
      4 RSA4089
      4 RSA4068
      4 RSA4024
      4 RSA3600
      4 RSA3128
      4 RSA3071
      4 RSA3027
      4 RSA2066
      4 RSA2052
      4 RSA2051
      4 RSA2045
      4 RSA1369
      4 RSA1042
      4 RSA1034
      4 RSA1028
      3 RSA4090
      3 RSA3702
      3 RSA3172
      3 RSA3080
      3 RSA30720
      3 RSA3050
      3 RSA2536
      3 RSA2480
      3 RSA2054
      2 RSA9192
      2 RSA8392
      2 RSA8191
      2 RSA7680
      2 RSA6095
      2 RSA5012
      2 RSA4611
      2 RSA4444
      2 RSA4114
      2 RSA4084
      2 RSA4082
      2 RSA4042
      2 RSA4000
      2 RSA3957
      2 RSA3925
      2 RSA3892
      2 RSA3210
      2 RSA3092
      2 RSA2890
      2 RSA2481
      2 RSA2400
      2 RSA2222
      2 RSA2182
      2 RSA2148
      2 RSA2142
      2 RSA2136
      2 RSA2128
      2 RSA2098
      2 RSA2087
      2 RSA2086
      2 RSA2060
      2 RSA2042
      2 RSA2038
      2 RSA2014
      2 RSA1924
      2 RSA1825
      2 RSA16348
      2 RSA1204
      2 RSA1026
      1 RSA9216
      1 RSA8888
      1 RSA8184
      1 RSA8182
      1 RSA8172
      1 RSA7168
      1 RSA7094
      1 RSA7024
      1 RSA5487
      1 RSA5192
      1 RSA5096
      1 RSA5048
      1 RSA5001
      1 RSA5000
      1 RSA500
      1 RSA4608
      1 RSA4321
      1 RSA4198
      1 RSA4099
      1 RSA4080
      1 RSA4076
      1 RSA4072
      1 RSA4065
      1 RSA4013
      1 RSA4007
      1 RSA4006
      1 RSA3983
      1 RSA3972
      1 RSA3971
      1 RSA3931
      1 RSA3904
      1 RSA3889
      1 RSA3875
      1 RSA3819
      1 RSA3817
      1 RSA3779
      1 RSA3629
      1 RSA3400
      1 RSA3336
      1 RSA3328
      1 RSA3224
      1 RSA3200
      1 RSA3163
      1 RSA3132
      1 RSA3124
      1 RSA3103
      1 RSA3102
      1 RSA3100
      1 RSA3098
      1 RSA3070
      1 RSA3052
      1 RSA3049
      1 RSA3047
      1 RSA3028
      1 RSA2999
      1 RSA2942
      1 RSA2857
      1 RSA2685
      1 RSA2642
      1 RSA2600
      1 RSA2580
      1 RSA2549
      1 RSA2344
      1 RSA2342
      1 RSA2319
      1 RSA2291
      1 RSA2240
      1 RSA2220
      1 RSA2190
      1 RSA2175
      1 RSA2160
      1 RSA2146
      1 RSA2111
      1 RSA2094
      1 RSA2088
      1 RSA2068
      1 RSA2059
      1 RSA2057
      1 RSA2053
      1 RSA2044
      1 RSA2039
      1 RSA2018
      1 RSA2010
      1 RSA16383
      1 RSA16318
      1 RSA1548
      1 RSA1506
      1 RSA13999
      1 RSA1027
      1 RSA10240
      1 RSA1000
      1 DSA512
```

Questions?

Contact:

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