```
% cat routes.run1/adv/ucl.816386489.1
traceroute to 128.16.6.13 (128.16.6.13), 30 hops max, 40 byte packets

  1   199.222.103.254   2.449 ms   2.254 ms   2.343 ms
  2   199.222.77.65   6.051 ms   5.53 ms   5.104 ms
  3   140.222.32.222   5.2 ms   4.999 ms   4.882 ms
  4   140.222.56.2   10.506 ms   10.333 ms   10.273 ms
  5   140.222.147.1   30.327 ms   29.679 ms   *
  6   192.41.177.240   232.248 ms   35.538 ms   223.272 ms
  7   198.67.131.10   251.487 ms   182.376 ms   236.444 ms
  8   192.157.65.114   328.088 ms   204.046 ms   174.569 ms
  9   128.86.1.2   272.086 ms   *   231.948 ms
 10   193.63.94.12   218.437 ms   *   187.305 ms
 11   * 193.63.203.34   238.758 ms   241.42 ms
 12   128.40.20.252   289.954 ms   *   *
 13   128.40.14.1   253.005 ms   241.997 ms   237.639 ms
 14   * 128.16.64.13   256.976 ms   *
%
```

```
% cat routes.run3/ncar/connix.817499508.2
traceroute to 198.69.10.4 (198.69.10.4), 30 hops max, 40 byte packets
   1  * * *
   2  * * *
   3  * * *
   4  * * *
   5  * * *
   6  * * *
   7  * * *
   8  * * *
   9  * * *
  10  * * *
  11  * * *
  12  * * *
  13  * * *
  14  * * *
  15  * * *
  16  * * *
  17  * * *
  18  * * *
  19  * * *
  20  * * *
  21  * * *
  22  * * *
  23  * * *
  24  * * *
  25  * * *
  26  * * *
  27  * * *
  28  * * *
  29  * * *
  30  * * *
%
```

```
% cat routes.run1/sintef2/sintef1.815572479.2
traceroute to hp7ux10.runit.sintef.no (129.241.100.249), 30 hops max, 40 byte packets

  1  129.241.1.1  2 ms  2 ms  2 ms
  2  129.241.100.249  2 ms  2 ms  2 ms
%
```

```
% cat routes.run1/mit/near.815568606.1
traceroute to all-purpose-gunk.near.net (198.114.157.114), 30 hops max, 40 byte packets

  1  18.26.0.1  1 ms  1 ms  1 ms
  2  18.23.0.5  3 ms  1 ms  2 ms
  3  18.168.0.4  3 ms  2 ms  2 ms
  4  192.233.33.10  2 ms  2 ms  2 ms
  5  192.233.149.201  3 ms  3 ms  4 ms
  6  192.52.71.12  3 ms  3 ms  4 ms
  7  198.114.157.114  4 ms  3 ms  4 ms
%
```

```
% cat routes.run6/oce/wustl.819445704.2
traceroute to tango.cs.wustl.edu (128.252.166.57), 30 hops max, 40 byte packets
 1   134.188.1.1   0 ms   10 ms   0 ms
 2   193.79.245.1   4240 ms   3210 ms   3600 ms
 3   193.79.251.1   4700 ms   4590 ms   4880 ms
 4   * * *
 5   * * *
 6   194.178.244.129   5760 ms * *
 7   * 194.178.244.36   6250 ms *
 8   193.78.240.33   6540 ms *   6940 ms
 9   * * *
10   * * *
11   * * *
12   * * 204.70.45.5   5080 ms
13   * * *
14   * * *
15   * * *
16   * * *
17   * * *
18   * * 204.70.27.6   7070 ms
19   * 128.252.5.123   3350 ms   3500 ms
20   128.252.123.249   3670 ms   3490 ms   4370 ms
21   128.252.166.57   4930 ms   4920 ms *
%
```

```
% cat routes.run1/lbl/inria.815657132.1
traceroute to tom.inria.fr (138.96.24.81), 30 hops max, 40 byte packets

 1   128.3.112.1   1.974 ms   1.813 ms   1.72 ms
 2   131.243.128.11   1.95 ms   1.943 ms   1.887 ms
 3   198.128.16.11   2.307 ms   2.133 ms   2.142 ms
 4   134.55.12.65   4.105 ms   3.274 ms   3.197 ms
 5   134.55.12.231   4.367 ms   4.499 ms   4.327 ms
 6   134.55.22.2   76.288 ms   76.728 ms   76.673 ms
 7   134.55.6.33   88.135 ms   209.991 ms   118.532 ms
 8   192.203.229.245   766.092 ms   905.301 ms   887.126 ms
 9   * * 192.157.65.130   4918.87 ms
10   192.121.156.201   374.685 ms   253.787 ms   390.073 ms
11   192.121.156.73   260.539 ms   225.824 ms   200.427 ms
12   192.93.43.169   276.068 ms   269.433 ms *
13   192.93.43.18   335.441 ms   280.589 ms *
14   192.93.43.89   313.956 ms   329.628 ms   262.983 ms
15   192.93.43.73   203.297 ms   235.92 ms   195.808 ms
16   192.93.43.49   224.48 ms   247.333 ms *
17   * 193.48.50.33   319.344 ms   278.943 ms
18   193.48.50.50   296.165 ms   303.097 ms   250.985 ms
19   193.48.50.170   241.874 ms   278.812 ms   262.95 ms
20   193.51.208.1   321.388 ms   291.483 ms   290.652 ms
21   138.96.64.250   246.033 ms   308.371 ms   251.972 ms
22   138.96.24.81   252.288 ms *   352.023 ms
%
```

```
% cat routes.run5/harv/mit.818507063.1
traceroute to mercury.lcs.mit.edu (18.26.0.122), 30 hops max, 40 byte packets

 1   140.247.60.1   2 ms   1 ms   2 ms
 2   140.247.5.1   2 ms   1 ms   2 ms
 3   140.247.20.1   2 ms   2 ms   2 ms
 4   192.54.223.21   2 ms   3 ms   3 ms
 5   131.192.5.2   2 ms   4 ms   4 ms
 6   199.94.205.1   4 ms   4 ms   3 ms
 7   * 192.233.149.202   1265 ms   1229 ms
 8   192.233.33.1   4 ms   4 ms   5 ms
 9   18.168.0.6   14 ms   6 ms   4 ms
10   18.52.0.1   5 ms   5 ms   3 ms
11   18.26.0.122   4 ms   5 ms   4 ms
% 
```

```
% cat routes.run1/ustutt/ucl.816207344.2
traceroute to 128.16.64.13 (128.16.64.13), 30 hops max, 40 byte packets

 1   129.69.210.254   4 ms   2 ms   2 ms
 2   129.69.205.10   2 ms   2 ms   2 ms
 3   129.69.18.110   3 ms   2 ms   2 ms
 4   129.143.70.1   3 ms   3 ms   3 ms
 5   129.143.203.2   3 ms   3 ms   3 ms
 6   129.143.203.1   4 ms   3 ms   3 ms
 7   129.143.203.2   3 ms   3 ms   4 ms
 8   129.143.203.1   4 ms   4 ms   4 ms
 9   129.143.203.2   4 ms   4 ms   4 ms
10   129.143.203.1   4 ms   5 ms   5 ms
11   129.143.203.2   6 ms   4 ms   5 ms
12   129.143.203.1   6 ms   5 ms   5 ms
13   129.143.203.2   6 ms   6 ms   5 ms
14   129.143.203.1   6 ms   5 ms   6 ms
15   129.143.203.2   6 ms   6 ms   8 ms
16   129.143.203.1   6 ms   7 ms   6 ms
17   129.143.203.2   6 ms   6 ms   6 ms
18   129.143.203.1   7 ms   8 ms   8 ms
19   129.143.203.2   8 ms   6 ms   7 ms
20   129.143.203.1   7 ms   9 ms   8 ms
21   129.143.203.2   8 ms   8 ms   7 ms
22   129.143.203.1   8 ms   8 ms   10 ms
23   129.143.203.2   8 ms   9 ms   8 ms
24   129.143.203.1   9 ms   10 ms   12 ms
25   129.143.203.2   9 ms   9 ms   9 ms
26   129.143.203.1   10 ms   10 ms   10 ms
27   129.143.203.2   9 ms   11 ms   12 ms
28   129.143.203.1   10 ms   11 ms   10 ms
29   129.143.203.2   11 ms   10 ms   10 ms
30   129.143.203.1   11 ms   12 ms   10 ms
%
```

```
% cat routes.run5/austr/mid.818212111.1
traceroute to shocker.mid.net (198.247.231.16), 30 hops max, 40 byte packets

 1   128.250.1.1   3 ms   2 ms   3 ms
 2   128.250.29.1   3 ms   3 ms   2 ms
 3   128.250.3.2   3 ms   3 ms   3 ms
 4   192.43.209.1   5 ms   5 ms   4 ms
 5   139.130.240.2   4 ms   4 ms   6 ms
 6   204.70.35.5   186 ms   195 ms   194 ms
 7   * 204.70.3.161   203 ms   191 ms
 8   204.70.1.37   415 ms   243 ms   422 ms
 9   204.70.1.58   215 ms * *
10   204.70.1.158   234 ms   232 ms   226 ms
11   204.70.2.66   257 ms * *
12   204.70.2.65   227 ms   228 ms   234 ms
13   * 204.70.2.66   237 ms   236 ms
14   * 204.70.2.65   234 ms   235 ms
15   204.70.2.66   228 ms   231 ms *
16   204.70.2.65   256 ms   241 ms   231 ms
17   204.70.2.66   226 ms   236 ms   231 ms
18   204.70.2.65   225 ms   231 ms   234 ms
19   204.70.2.66   236 ms   238 ms   236 ms
20   204.70.2.65   233 ms   232 ms   234 ms
21   204.70.2.66   236 ms   234 ms   238 ms
22   204.70.2.65   236 ms   231 ms *
23   204.70.2.66   235 ms   230 ms *
24   204.70.2.65   233 ms   230 ms *
25   204.70.2.66   229 ms   227 ms   227 ms
26   204.70.2.65   234 ms *   229 ms
27   * 198.247.231.16   620 ms   601 ms
%
```

```
 1   199.2.96.33    3.212 ms    2.903 ms    2.348 ms
 2   204.70.52.29   8.119 ms    7.509 ms    8.303 ms
 3   204.70.2.145   10.255 ms   11.472 ms   9.087 ms
 4   204.70.1.89    42.005 ms   45.637 ms   41.765 ms
 5   204.70.1.57    180.353 ms  210.453 ms  222.771 ms
 6   204.70.1.110   192.796 ms  224.263 ms  257.99 ms
 7   204.70.1.106   96.183 ms   90.611 ms   90.897 ms
 8   204.70.74.68   88.917 ms   98.286 ms   99.512 ms
 9   204.70.74.118   95.96 ms   111.302 ms  121.937 ms
10   192.41.177.240  91.077 ms  102.348 ms  95.265 ms
11   * * *
12   * * *
13   * * 204.70.74.68   269.431 ms
14   204.70.74.118   440.782 ms  293.266 ms  166.355 ms
15   192.41.177.181  89.681 ms   94.609 ms   90.987 ms
16   204.70.74.101   91.661 ms   89.673 ms   96.562 ms
17   204.70.74.49   137.351 ms  174.362 ms  204.639 ms
18   204.70.74.68   95.169 ms   90.19 ms    94.371 ms
19   204.70.74.118   97.839 ms   91.079 ms   97.236 ms
20   192.41.177.181  92.483 ms   91.213 ms   91.38 ms
21   204.70.74.101   92.318 ms   92.662 ms   95.358 ms
22   * * *
23   199.2.96.33    3.343 ms !H * *
24   * 138.96.64.250   779.58 ms  *
25   138.96.24.81   657.659 ms  * *
```

This trace output captures several extraordinary phenomena:

- First, it confirms the existence of a routing loop that consists of 5 nodes (hops 13-21):
204.70.74.68 → 204.70.74.118 → 192.41.177.181 → 204.70.74.101 → 204.70.74.49.

```
traceroute to geige.informatik.uni-stuttgart.de (129.69.210.20), 30 hops max,
40 byte packets

 1   128.138.241.1   1 ms   2 ms   1 ms
 2   128.138.138.1   3 ms   9 ms   4 ms
 3   204.131.58.10   8 ms   101 ms   38 ms
 4   192.52.106.250   15 ms   6 ms   102 ms
 5   204.70.29.5   37 ms   8 ms   34 ms
 6   204.70.3.113   8 ms   12 ms   12 ms
 7   204.70.1.110   50 ms   48 ms   55 ms
 8   204.70.1.106   61 ms   63 ms   52 ms
 9   204.70.74.68   64 ms   53 ms   66 ms
10   204.70.74.118   61 ms   60 ms   71 ms
11   192.41.177.241   66 ms   59 ms   75 ms
12   144.228.10.41   61 ms   58 ms   59 ms
13   144.228.20.6   68 ms   66 ms   60 ms
14   144.228.10.34   91 ms   64 ms   76 ms
15   144.228.10.33   63 ms   74 ms   66 ms
16   144.228.10.34   72 ms   81 ms   72 ms
17   144.228.10.33   77 ms   81 ms   69 ms
18   144.228.10.34   66 ms   82 ms   97 ms
19   144.228.10.33   67 ms   80 ms   69 ms
20   144.228.10.34   78 ms   71 ms   73 ms
21   *  *  *
22   *  *  192.203.230.16   41 ms !H
23   *  *  204.70.158.106   41 ms
24   204.70.158.105   118 ms   222 ms   38 ms
25   204.70.158.106   38 ms   46 ms   57 ms
26   204.70.158.105   106 ms   247 ms   224 ms
27   204.70.158.106   65 ms   48 ms   45 ms
28   204.70.158.105   132 ms   243 ms   245 ms
29   204.70.158.106   48 ms   40 ms   38 ms
30   204.70.158.105   145 ms   245 ms   238 ms
```

```
% cat routes.run1/mit/austr2.816326409.1
traceroute to 134.148.96.116 (134.148.96.116), 30 hops max, 40 byte packets

 1   18.26.0.1   2 ms   2 ms   1 ms
 2   18.23.0.5   2 ms   2 ms   3 ms
 3   18.168.0.4   4 ms   3 ms   2 ms
 4   192.233.33.11   11 ms   5 ms   3 ms
 5   204.70.20.5   4 ms   4 ms   4 ms
 6   204.70.2.33   4 ms   4 ms   4 ms
 7   204.70.1.1   7 ms   7 ms   8 ms
 8   204.70.1.5   13 ms   14 ms   14 ms
 9   204.70.1.177   80 ms   80 ms   80 ms
10   204.70.170.18   80 ms   81 ms   80 ms
11   204.70.171.62   344 ms   371 ms   351 ms
12   139.130.249.193   379 ms   365 ms   328 ms
13   139.130.192.2   760 ms   620 ms 139.130.249.194   553 ms
14   139.130.249.194   562 ms 139.130.249.193   401 ms *
15   139.130.249.194   403 ms * 139.130.80.2   554 ms
16   * * 134.148.24.250   1367 ms
17   * 139.130.249.194   357 ms   318 ms
18   139.130.249.193   305 ms   327 ms   306 ms
19   139.130.249.194   376 ms   364 ms   376 ms
20   139.130.249.193   307 ms   301 ms   309 ms
21   139.130.249.194   481 ms   354 ms   344 ms
22   139.130.249.193   417 ms 134.148.96.116   734 ms   647 ms
% 
```

```
% cat routes.run1/oce/sintef1.816130535.2
traceroute to 129.241.100.249 (129.241.100.249), 30 hops max, 40 byte packets

 1   134.188.1.1   0 ms   0 ms   0 ms
 2   193.79.245.1   980 ms   1000 ms   1070 ms
 3   193.79.251.1   650 ms   450 ms   570 ms
 4   193.79.62.1   520 ms   790 ms   560 ms
 5   193.79.242.33   610 ms   510 ms   580 ms
 6   193.79.236.1   530 ms   580 ms   520 ms
 7   193.78.240.36   700 ms   510 ms   610 ms
 8   193.78.240.33   580 ms   590 ms   570 ms
 9   134.222.18.1   440 ms   700 ms   580 ms
10   134.222.85.6   520 ms   150 ms   240 ms
11   134.222.27.2   160 ms   670 ms   1030 ms
12   193.166.255.9   590 ms   590 ms 192.36.148.53   820 ms (ttl=243!)
13   192.36.148.53   590 ms   730 ms   680 ms
14   192.36.148.58   1150 ms   1440 ms   930 ms
15   128.39.0.89   930 ms   930 ms   1000 ms
16   128.39.9.7   1010 ms   1000 ms   720 ms
17   129.241.100.249   800 ms   1230 ms   1210 ms
%
```

```
Hops with at least one missing reply: 59% (!)
          402209 TIME TIME TIME
           17137 TIME * TIME
           13626 * * *
           12683 * TIME TIME
           11873 TIME TIME *
            5229 TIME * *
            5208 * TIME *
            4732 * * TIME
```
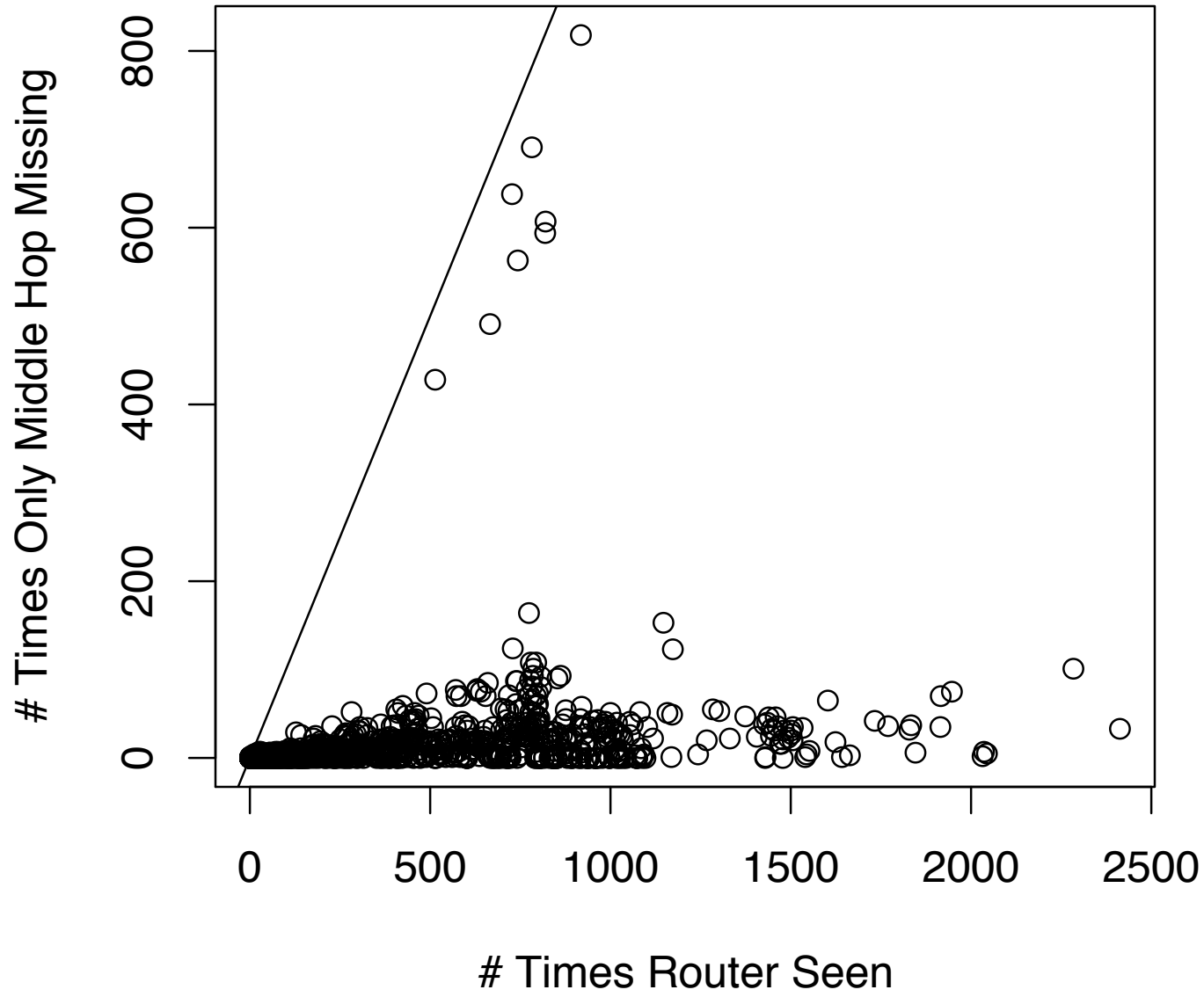
```
% cat routes.run2/umann/ucla.816950187.1
traceroute to barbican.cs.ucla.edu (131.179.96.125), 30 hops max, 40 byte packets

 1   134.155.50.200   2 ms   1 ms   2 ms
 2   129.143.61.1   3 ms   1 ms   2 ms
 3   153.17.200.25   454 ms   507 ms   495 ms
 4   153.17.200.68   579 ms   605 ms   612 ms
 5   193.174.74.200   633 ms   567 ms   601 ms
 6   * 193.174.74.110   542 ms   439 ms
 7   194.41.0.73   606 ms *   639 ms
 8   194.41.0.42   947 ms   1020 ms *
 9   * 204.149.4.5   789 ms *
10   * 140.222.48.1   983 ms *
11   * * *
12   * * *
13   140.222.96.2   529 ms * *
14   * * *
15   * * *
16   * * 198.32.128.65   1048 ms
17   * 198.32.128.226   906 ms *
18   198.32.128.197   772 ms   793 ms *
19   * 204.70.158.105   986 ms *
20   * * *
21   * * *
22   * * 204.70.2.130   491 ms
23   * 204.70.48.6   677 ms *
24   204.102.78.1   816 ms   823 ms *
25   128.9.16.1   518 ms   506 ms *
26   130.152.64.2   479 ms *   531 ms
27   131.179.240.1   490 ms * *
28   * 131.179.96.125   475 ms *
%
```

```
% cat routes.run1/austr2/inria.815870067.1

traceroute to tom.inria.fr (138.96.24.81) 30 hops max, 40 byte packets
 1   134.148.96.250   3 ms   2 ms   1 ms
 2   134.148.2.1   3 ms   2 ms   2 ms
 3   134.148.24.251   3 ms   2 ms   2 ms
 4   139.130.80.1   468 ms   584 ms   457 ms
 5   139.130.192.1   740 ms   699 ms   655 ms
 6   139.130.249.194   538 ms   754 ms   657 ms
 7   204.70.171.61   1039 ms *   747 ms
 8   204.70.170.17   811 ms   877 ms   812 ms
 9   204.70.1.153   1069 ms (ttl=248!)   932 ms (ttl=248!)   1041 ms (ttl=248!)
10   204.70.3.164   1321 ms (ttl=248!) *   1047 ms (ttl=248!)
11   204.70.158.118   971 ms (ttl=247!) *   937 ms (ttl=247!)
12   192.203.230.16   1215 ms (ttl=246!) *   1093 ms (ttl=246!)
13   * 144.228.10.21   1022 ms (ttl=245!)   1277 ms (ttl=245!)
14   144.228.10.1   944 ms *   927 ms
15   144.228.20.103   877 ms (ttl=242!) *   855 ms (ttl=242!)
16   * 192.157.65.130   882 ms (ttl=241!)   1004 ms (ttl=241!)
17   * 192.121.156.73   800 ms (ttl=240!) *
18   * 192.93.43.169   959 ms (ttl=239!)   886 ms (ttl=239!)
19   192.93.43.18   968 ms (ttl=238!) * *
20   192.93.43.89   825 ms (ttl=237!)   674 ms (ttl=237!) *
21   192.93.43.73   831 ms (ttl=236!)   754 ms (ttl=236!) *
22   192.93.43.49   945 ms (ttl=235!) *   1005 ms (ttl=235!)
23   193.48.50.33   1195 ms (ttl=234!) * *
24   * 193.48.50.50   793 ms (ttl=233!)   812 ms (ttl=233!)
25   193.48.50.170   701 ms (ttl=232!)   782 ms (ttl=232!)   663 ms (ttl=232!)
26   * 193.51.208.1   858 ms (ttl=231!) *
27   * 138.96.64.250   1049 ms (ttl=230!)   744 ms (ttl=230!)
28   138.96.24.81   950 ms (ttl=229!) * *
%
```

```
% cat routes.run1/near/inria.816078831.2
traceroute to 138.96.24.81 (138.96.24.81), 30 hops max, 40 byte packets
  1   198.114.157.1   3.074 ms   1.941 ms   1.82 ms
  2   192.52.71.11   143.766 ms   3.162 ms   2.97 ms
  3   192.233.149.202   7.571 ms   3.5 ms   3.034 ms
  4   192.233.33.11   6.942 ms   3.326 ms   3.546 ms
  5   204.70.20.5   7.042 ms   4.79 ms   5.964 ms
  6   204.70.2.33   8.187 ms   5.156 ms   4.984 ms
  7   204.70.1.1   10.788 ms   9.224 ms   8.307 ms
  8   204.70.1.5   18.916 ms   13.899 ms   14.369 ms
  9   204.70.3.4   13.899 ms   14.004 ms   17.65 ms
 10   204.70.74.118   17.869 ms   13.898 ms   14.878 ms
 11   192.41.177.240   19.646 ms   19.456 ms   22.741 ms
 12   * * *
 13   * * *
 14   * * *
 15   * * *
 16   * * *
 17   * * *
 18   * * *
 19   * * *
 20   * * *
 21   * * *
 22   * * *
 23   * * *
 24   * * *
 25   * * *
 26   * * *
 27   * * *
 28   * * *
 29   * 138.96.24.81   3700.99 ms   140.936 ms
% 
```