



Il protocollo ICMP

A.A. 2005/2006

Walter Cerroni

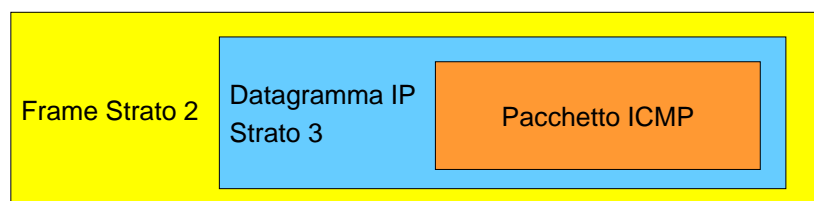
Il protocollo IP...

- offre un servizio di tipo **best effort**
 - non garantisce la corretta consegna dei datagrammi
 - se necessario si affida a protocolli affidabili di livello superiore (TCP)
 - è comunque necessario un protocollo di controllo
 - gestione di situazioni anomale
 - notifica di errori o di irraggiungibilità della destinazione
 - scambio di informazioni sulla rete
- **ICMP (Internet Control Message Protocol)**
- ICMP segnala solamente errori e malfunzionamenti, ma non esegue alcuna correzione
 - ICMP **non rende affidabile IP**

Internet Control Message Protocol (ICMP)

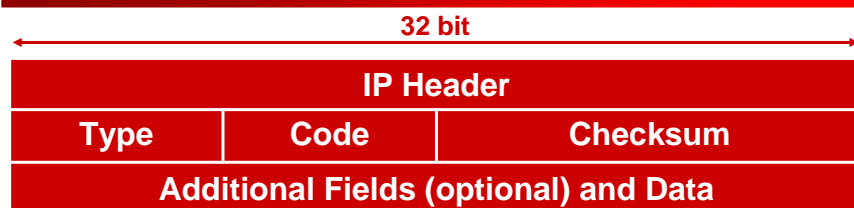
ICMP (RFC 792) svolge funzioni di controllo per IP

- IP usa ICMP per la gestione di situazioni anomale, per cui ICMP offre un servizio ad IP
- i pacchetti ICMP sono incapsulati in datagrammi IP, per cui IP fornisce il trasporto a ICMP



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Formato del pacchetto ICMP



- **Type** definisce il tipo di messaggio ICMP
 - messaggi di errore
 - messaggi di richiesta di informazioni
- **Code** descrive ulteriormente il messaggio ICMP
- **Checksum** controlla i bit errati nel messaggio ICMP
- **Additional Fields and Data** dipendono dal tipo di messaggio ICMP (in genere intestazione e parte dei dati del datagramma che ha generato l'errore)

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Messaggi di errore (1)

- **Destination Unreachable** (Type = 3)
generato da un gateway quando la sottorete o l'host non sono raggiungibili, oppure da un host quando si presenta un errore sull'indirizzo dell'entità di livello superiore a cui trasferire il datagramma
- Codici errore (Code) di Destination Unreachable
 - 0 = sottorete non raggiungibile
 - 1 = host non raggiungibile
 - 2 = protocollo non disponibile
 - 3 = porta non disponibile
 - 4 = frammentazione necessaria ma bit *don't fragment* settato

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Messaggi di errore (2)

- **Time Exceeded** (Type = 11)
 - generato da un router quando il Time-to-Live di un datagramma si azzerà ed il datagramma viene distrutto (Code = 0)
 - generato da un host quando un timer si azzerà in attesa dei frammenti per riassemblare un datagramma ricevuto in parte (Code = 1)
- **Source Quench** (Type = 4)
i datagrammi arrivano troppo velocemente rispetto alla capacità di essere processati: l'host sorgente deve ridurre la velocità di trasmissione (obsoleto)
- **Redirect** (Type = 5)
generato da un router per indicare all'host sorgente un'altra strada più conveniente per raggiungere l'host destinazione

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Messaggi di richiesta di informazioni (1)

- **Echo** (Type = 8)
- **Echo Reply** (Type = 0)
 - l'host sorgente invia la richiesta ad un altro host o ad un gateway
 - la destinazione deve rispondere immediatamente
 - metodo usato per determinare lo stato di una rete e dei suoi host, la loro raggiungibilità e il tempo di transito nella rete
 - Additional Fields:
 - **Identifier**: identifica l'insieme degli *echo* appartenenti allo stesso test
 - **Sequence Number**: identifica ciascun *echo* nell'insieme
 - **Optional Data**: usato per inserire eventuali dati di verifica

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Messaggi di richiesta di informazioni (2)

- **Timestamp Request** (Type = 13)
- **Timestamp Reply** (Type = 14)
 - l'host sorgente invia all'host destinazione un *Originate Timestamp* che indica l'istante in cui la richiesta è partita
 - l'host destinazione risponde inviando un
 - *Receive Timestamp* che indica l'istante in cui la richiesta è stata ricevuta
 - *Transmit Timestamp* che indica l'istante in cui la risposta è stata inviata
 - serve per valutare il tempo di transito nella rete, al netto del tempo di processamento = $T_{\text{Transmit}} - T_{\text{Receive}}$

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Messaggi di richiesta di informazioni (3)

- **Address Mask Request** (Type = 17)
- **Address Mask Reply** (Type = 18)
inviato dall'host sorgente all'indirizzo di broadcast (255.255.255.255) per ottenere la *subnet mask* da usare dopo aver ottenuto il proprio indirizzo IP tramite RARP o BOOTP
- **Router Solicitation** (Type = 10)
- **Router Advertisement** (Type = 9)
utilizzato per localizzare i router connessi alla rete

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Applicazioni di ICMP

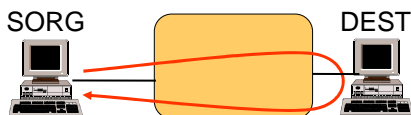
A.A. 2005/2006

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Comando PING

ping DEST

Permette di controllare se l'host DEST è raggiungibile o meno da SORG



- SORG invia a DEST un pacchetto ICMP di tipo “**echo**”
- Se l'host DEST è raggiungibile da SORG, DEST risponde inviando indietro un pacchetto ICMP di tipo “**echo reply**”

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Comando PING – Opzioni

- n **N** permette di specificare quanti pacchetti inviare (un pacchetto al secondo)
- l **M** specifica la dimensione in byte di ciascun pacchetto
- t esegue **ping** finché interrotto con **Ctrl-C**
- a traduce l'indirizzo IP in nome DNS
- f setta il bit *don't fragment* a 1
- i **T** setta *time-to-live* = **T**
- w **T_{out}** specifica un timeout in millisecondi

Per maggiori informazioni consultare l'help: **ping /?**

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Comando PING – Output

L'output mostra

- la dimensione del pacchetto “echo reply”
- l'indirizzo IP di DEST
- il numero di sequenza della risposta (solo UNIX-LINUX)
- il “time-to-live” (TTL)
- il “round-trip time” (RTT)
- alcuni risultati statistici: N° pacchetti persi, MIN, MAX e media del RTT

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Comando PING – Esempio 1

```
ping -n 10 www-tlc.deis.unibo.it
```

```
PING deis238a.deis.unibo.it (137.204.59.238) from 137.204.59.237 : 56(84) bytes of data.  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=0 ttl=128 time=1.0 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=1 ttl=128 time=0.5 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=2 ttl=128 time=0.5 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=3 ttl=128 time=0.5 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=4 ttl=128 time=0.5 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=5 ttl=128 time=0.5 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=6 ttl=128 time=0.5 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=7 ttl=128 time=0.6 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=8 ttl=128 time=0.5 ms  
64 bytes from deis238a.deis.unibo.it (137.204.59.238): icmp_seq=9 ttl=128 time=0.5 ms  
  
--- deis238a.deis.unibo.it ping statistics ---  
10 packets transmitted, 10 packets received, 0% packet loss  
round-trip min/avg/max = 0.5/0.5/1.0 ms
```

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Comando PING – Esempio 2

```
ping -n 10 www.unica.it
```

```
PING vaxcal.unica.it (192.146.242.3) from 137.204.59.237 : 56(84) bytes of data.  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=0 ttl=55 time=99.1 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=1 ttl=55 time=102.4 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=2 ttl=55 time=58.6 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=3 ttl=55 time=77.9 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=4 ttl=55 time=38.6 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=5 ttl=55 time=44.6 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=6 ttl=55 time=58.8 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=7 ttl=55 time=39.8 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=8 ttl=55 time=64.0 ms  
64 bytes from vaxcal.unica.it (192.146.242.3): icmp_seq=9 ttl=55 time=72.6 ms  
  
--- vaxcal.unica.it ping statistics ---  
10 packets transmitted, 10 packets received, 0% packet loss  
round-trip min/avg/max = 38.6/65.6/102.4 ms
```

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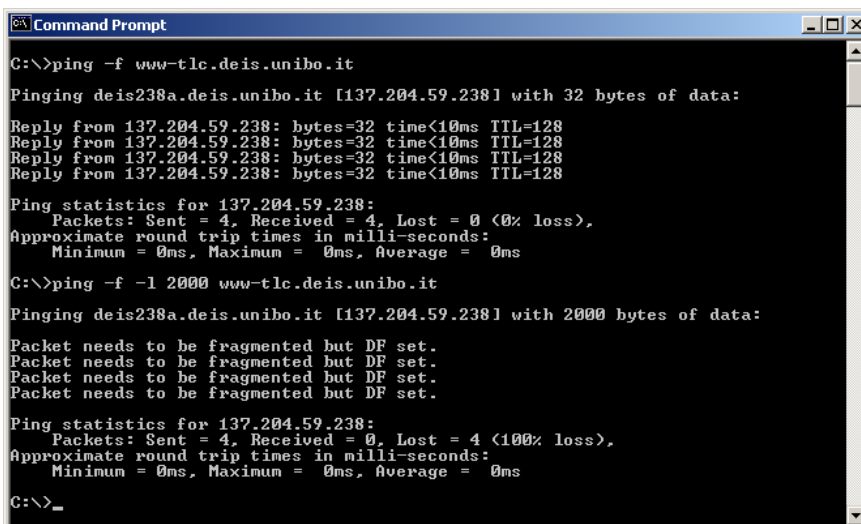
Comando PING – Esempio 3

```
ping -n 10 www.berkeley.edu
```

```
PING amber.berkeley.edu (128.32.25.12) from 137.204.59.237 : 56(84) bytes of data.  
64 bytes from amber.Berkeley.EDU (128.32.25.12): icmp_seq=4 ttl=45 time=173.2 ms  
64 bytes from amber.Berkeley.EDU (128.32.25.12): icmp_seq=5 ttl=45 time=179.0 ms  
64 bytes from amber.Berkeley.EDU (128.32.25.12): icmp_seq=6 ttl=45 time=175.7 ms  
64 bytes from amber.Berkeley.EDU (128.32.25.12): icmp_seq=7 ttl=45 time=185.9 ms  
64 bytes from amber.Berkeley.EDU (128.32.25.12): icmp_seq=8 ttl=45 time=197.7 ms  
64 bytes from amber.Berkeley.EDU (128.32.25.12): icmp_seq=9 ttl=45 time=251.9 ms  
  
--- amber.berkeley.edu ping statistics ---  
10 packets transmitted, 6 packets received, 40% packet loss  
round-trip min/avg/max = 173.2/193.9/251.9 ms
```

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Comando PING – Esempio 4



```
C:\>ping -f www-tlc.deis.unibo.it
Pinging deis238a.deis.unibo.it [137.204.59.238] with 32 bytes of data:
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128

Ping statistics for 137.204.59.238:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

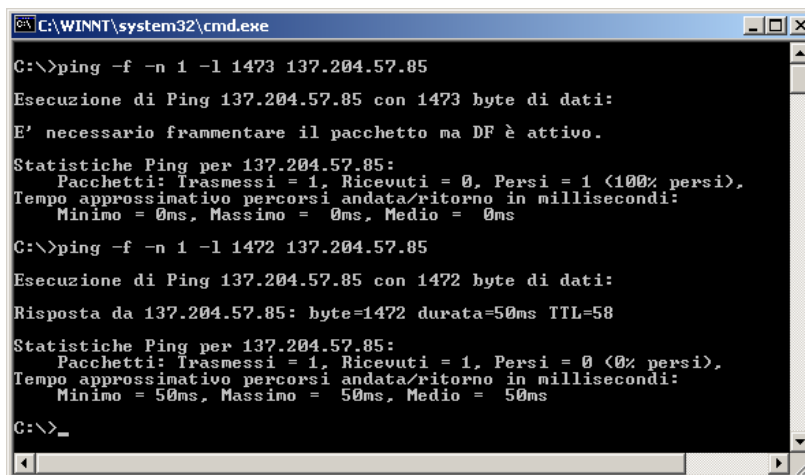
C:\>ping -f -l 2000 www-tlc.deis.unibo.it
Pinging deis238a.deis.unibo.it [137.204.59.238] with 2000 bytes of data:
Packet needs to be fragmented but DF set.
Packet needs to be fragmented but DF set.
Packet needs to be fragmented but DF set.
Packet needs to be fragmented but DF set.

Ping statistics for 137.204.59.238:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>_
```

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Ethernet MTU = 1500



```
C:\WINNT\system32\cmd.exe
C:\>ping -f -n 1 -l 1473 137.204.57.85
Esecuzione di Ping 137.204.57.85 con 1473 byte di dati:
E' necessario frammentare il pacchetto ma DF è attivo.

Statistiche Ping per 137.204.57.85:
    Pacchetti: Trasmessi = 1, Ricevuti = 0, Persi = 1 (100% persi),
    Tempo approssimativo percorsi andata/ritorno in millisecondi:
        Minimo = 0ms, Massimo = 0ms, Medio = 0ms

C:\>ping -f -n 1 -l 1472 137.204.57.85
Esecuzione di Ping 137.204.57.85 con 1472 byte di dati:
Risposta da 137.204.57.85: byte=1472 durata=50ms TTL=58

Statistiche Ping per 137.204.57.85:
    Pacchetti: Trasmessi = 1, Ricevuti = 1, Persi = 0 (0% persi),
    Tempo approssimativo percorsi andata/ritorno in millisecondi:
        Minimo = 50ms, Massimo = 50ms, Medio = 50ms

C:\>_
```

1472 (dati) + 8 (ICMP Echo header) + 20 (IP header) = 1500

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Comando PING – Esempio 5

```
Command Prompt
C:\>ping www.unica.it
Pinging vaxca1.unica.it [192.146.242.3] with 32 bytes of data:
Reply from 192.146.242.3: bytes=32 time=170ms TTL=55
Reply from 192.146.242.3: bytes=32 time=90ms TTL=55
Reply from 192.146.242.3: bytes=32 time=150ms TTL=55
Reply from 192.146.242.3: bytes=32 time=190ms TTL=55

Ping statistics for 192.146.242.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 90ms, Maximum = 190ms, Average = 150ms

C:\>ping -i 1 www.unica.it
Pinging vaxca1.unica.it [192.146.242.3] with 32 bytes of data:
Reply from 137.204.58.254: TTL expired in transit.
Reply from 137.204.58.254: TTL expired in transit.
Reply from 137.204.58.254: TTL expired in transit.
Reply from 137.204.58.254: TTL expired in transit.

Ping statistics for 192.146.242.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

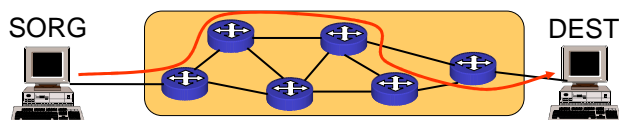
C:\>_
```

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Comando TRACEROUTE

tracert DEST

Permette di conoscere il percorso seguito dai pacchetti inviati da SORG e diretti verso DEST



- SORG invia a DEST una serie di pacchetti ICMP di tipo **ECHO** con un **TIME-TO-LIVE (TTL)** progressivo da 1 a 30 (per default)
- Ciascun nodo intermedio decrementa TTL
- Il nodo che decrementa TTL a 0 invia a SORG un pacchetto ICMP di tipo **TIME EXCEEDED**
- SORG costruisce una lista dei nodi attraversati fino a DEST
- L'output mostra il TTL, il nome DNS e l'indirizzo IP dei nodi intermedi ed il **ROUND-TRIP TIME (RTT)**

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Comando TRACEROUTE – Esempio 1

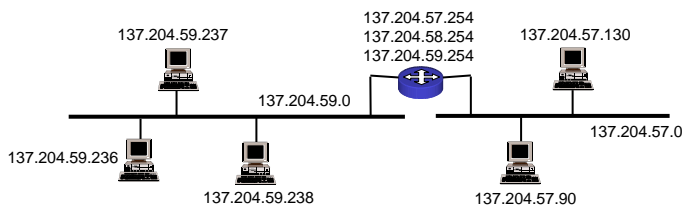
```
tracert www-tlc.deis.unibo.it
```

```
From deis237a.deis.unibo.it (137.204.59.237):  
traceroute to deis238a.deis.unibo.it (137.204.59.238), 30 hops max, 38 byte packets
```

```
1 deis238a.deis.unibo.it (137.204.59.238) 1.130 ms 0.458 ms 0.437 ms
```

```
From deis130.deis.unibo.it (137.204.57.130):  
traceroute to deis238a.deis.unibo.it (137.204.59.238), 30 hops max, 38 byte packets
```

```
1 almr06_ing.ing.unibo.it (137.204.58.254) 3.065 ms 0.743 ms 0.715 ms  
2 deis238a.deis.unibo.it (137.204.59.238) 1.081 ms 1.278 ms 0.991 ms
```



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Comando TRACEROUTE – Esempio 2

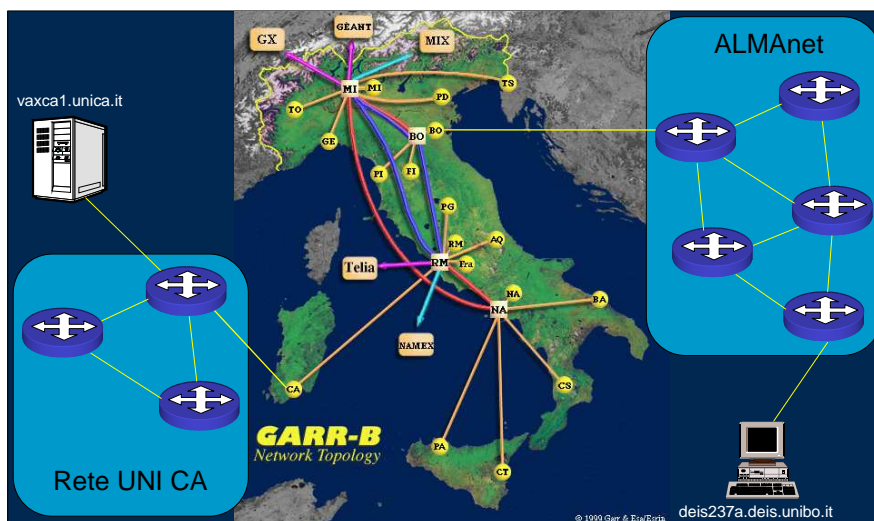
```
tracert www.unica.it
```

```
traceroute to vaxcal.unica.it (192.146.242.3), 30 hops max, 38 byte packets
```

```
1 almr06_ing.ing.unibo.it (137.204.58.254) 74.142 ms 54.147 ms 58.419 ms  
2 192.12.77.73 (192.12.77.73) 151.930 ms 18.047 ms 78.195 ms  
3 almr55.unibo.it (137.204.1.20) 139.140 ms 75.712 ms 22.821 ms  
4 rc-unibo.bo.garr.net (193.206.128.97) 108.183 ms 236.839 ms 116.541 ms  
5 rt-rc-1.bo.garr.net (193.206.134.153) 162.645 ms 84.050 ms 152.948 ms  
6 rm-bo-2.garr.net (193.206.134.38) 125.898 ms 143.387 ms 122.385 ms  
7 ca-rm-1.garr.net (193.206.134.114) 135.245 ms 50.876 ms 81.444 ms  
8 unica2-rc.ca.garr.net (193.206.137.26) 118.439 ms 74.400 ms 78.163 ms  
9 vaxcal.unica.it (192.146.242.3) 85.004 ms 74.715 ms 78.879 ms
```

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Comando TRACEROUTE – Esempio 2



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Comando TRACEROUTE – Esempio 3

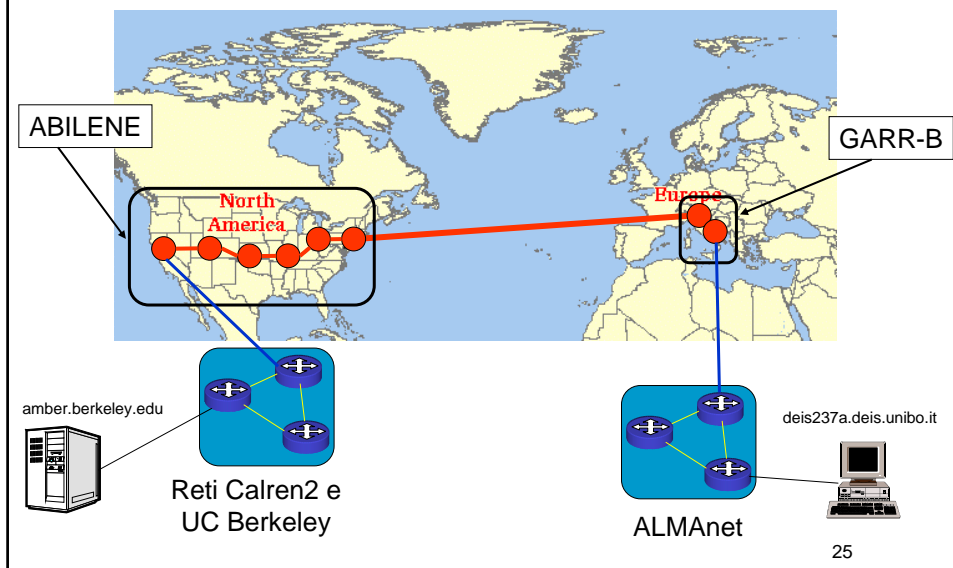
tracert www.berkeley.edu

tracert to amber.berkeley.edu (128.32.25.12), 30 hops max, 38 byte packets

```
1 almr06_ing.ing.unibo.it (137.204.58.254) 104.116 ms 68.939 ms 30.182 ms
2 192.12.77.73 (192.12.77.73) 112.297 ms 169.932 ms 125.108 ms
3 almr55.unibo.it (137.204.1.20) 17.416 ms 74.859 ms 83.061 ms
4 rc-unibo.bo.garr.net (193.206.128.97) 181.461 ms 75.791 ms 68.349 ms
5 rt-rc-2.bo.garr.net (193.206.134.157) 227.687 ms 175.577 ms 66.948 ms
6 mi-bo-1.garr.net (193.206.134.1) 223.206 ms 136.979 ms 203.290 ms
7 ny4-milan.dante.net (212.1.200.25) 114.813 ms 166.677 ms 287.161 ms
8 abilene-dante-ny.abilene.ucaid.edu (212.1.200.154) 199.562 ms 173.607 ms 261.802 ms
9 cleve-nycm.abilene.ucaid.edu (198.32.8.29) 226.195 ms 128.963 ms 173.126 ms
10 ipls-clev.abilene.ucaid.edu (198.32.8.25) 141.899 ms 156.029 ms 215.304 ms
11 kscy-ipls.abilene.ucaid.edu (198.32.8.5) 205.389 ms 190.448 ms 194.304 ms
12 dnvr-kscy.abilene.ucaid.edu (198.32.8.13) 240.823 ms 253.574 ms 278.428 ms
13 scrm-dnvr.abilene.ucaid.edu (198.32.8.1) 256.334 ms 294.050 ms 190.924 ms
14 QSV--abilene.POS.calren2.net (198.32.249.61) 361.691 ms 269.880 ms 282.785 ms
15 BERK--SUNV.POS.calren2.net (198.32.249.13) 307.270 ms 297.676 ms 309.840 ms
16 posl-0.inr-000-eva.Berkeley.EDU (128.32.0.89) 308.682 ms 289.019 ms 254.860 ms
17 vlan199.inr-202-doecev.Berkeley.EDU (128.32.0.203) 300.646 ms 264.492 ms 235.889 ms
18 fast4-0-0.inr-107-eva.Berkeley.EDU (128.32.0.39) 382.771 ms 350.700 ms 229.652 ms
19 f8-0.inr-100-eva.Berkeley.EDU (128.32.235.100) 262.469 ms 284.734 ms 380.641 ms
20 amber.Berkeley.EDU (128.32.25.12) 289.826 ms 250.696 ms 304.285 ms
```

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Comando TRACEROUTE – Esempio 3



Comando TRACEROUTE – Esempio 4

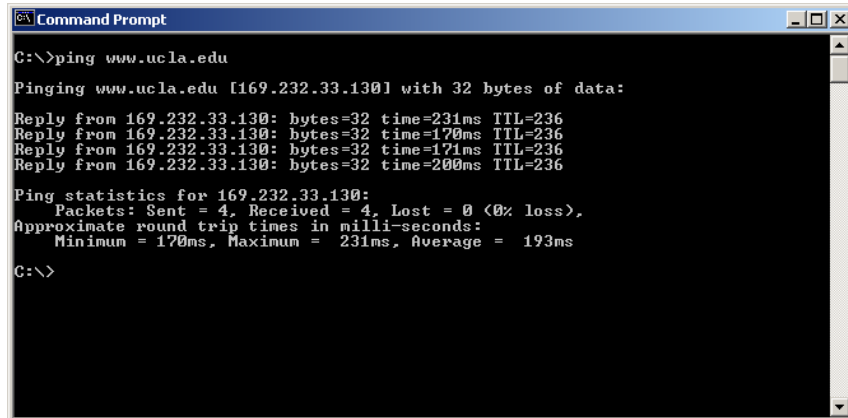
```

C:\>tracert www.microsoft.com
Rilevazione instradamento verso www.microsoft.akadns.net [207.46.249.27]
su un massimo di 30 punti di passaggio:

 1  <10 ms  <10 ms  <10 ms  DEIS76 [192.168.10.76]
 2  <10 ms  <10 ms  <10 ms  almr06-ing-83-ing.unibo.it [137.204.83.254]
 3  <10 ms  <10 ms  <10 ms  almr55.unibo.it [137.204.2.14]
 4   30 ms   30 ms   30 ms   rc-unibo.bo.garr.net [193.206.128.97]
 5   30 ms   40 ms   40 ms   ni-bo-g.garr.net [193.206.134.21]
 6   30 ms   40 ms   30 ms   so-6-0-ar2.LIN1.gblx.net [64.214.196.241]
 7   30 ms   40 ms   50 ms   pos4-0-622M.cr1.LIN1.gblx.net [208.51.236.57]
 8  200 ms  220 ms  211 ms  pos0-0-2480M.cr2.SER1.gblx.net [64.215.195.2]
 9  210 ms  211 ms  220 ms  so1-0-0-2480M.br2.SER1.gblx.net [64.213.83.182]
10  220 ms  221 ms  230 ms  208.51.243.22
11  *      *      *      pos1-0-core2-sea1.us.msn.net [207.46.33.25]
12  221 ms  230 ms  230 ms  207.46.36.78
13  *      *      *      207.46.155.13
14  *      *      *      Richiesta scaduta.
15  *      *      *      Richiesta scaduta.
16  *      *      *      Richiesta scaduta.
17  *      *      *      Richiesta scaduta.
18  *      *      *      Richiesta scaduta.
19  *      *      *      Richiesta scaduta.
20  *      *      *      Richiesta scaduta.
21  *      *      *      Richiesta scaduta.
22  *      *      *      Richiesta scaduta.
23  *      *      *      Richiesta scaduta.
24  *      *      *      Richiesta scaduta.
25  *      *      *      Richiesta scaduta.
26  *      *      *      Richiesta scaduta.
27  *      *      *      Richiesta scaduta.
28  *      *      *      Richiesta scaduta.
29  *      *      *      Richiesta scaduta.
30  *      *      *      Richiesta scaduta.
    
```

Analisi di Ping – 1

Sorgente: 137.204.57.174/24



```
C:\>ping www.ucla.edu

Pinging www.ucla.edu [169.232.33.130] with 32 bytes of data:

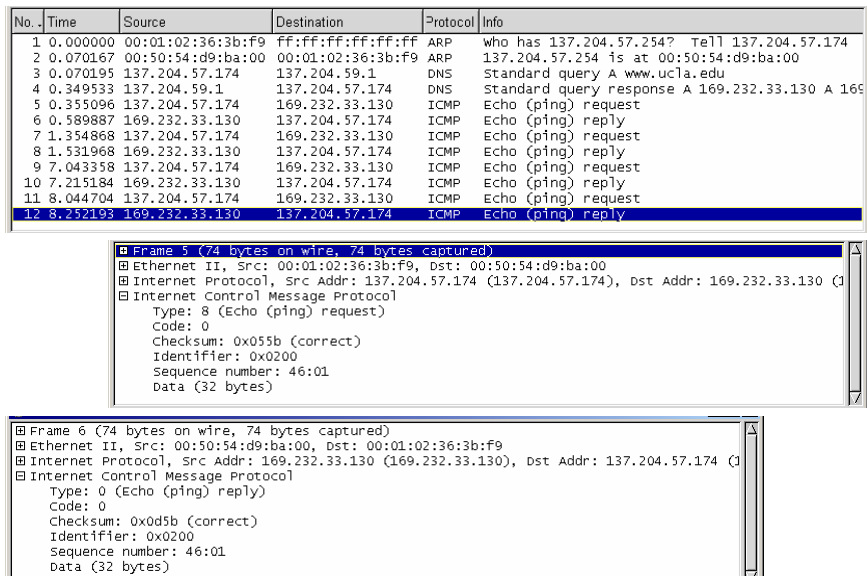
Reply from 169.232.33.130: bytes=32 time=231ms TTL=236
Reply from 169.232.33.130: bytes=32 time=170ms TTL=236
Reply from 169.232.33.130: bytes=32 time=171ms TTL=236
Reply from 169.232.33.130: bytes=32 time=200ms TTL=236

Ping statistics for 169.232.33.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 170ms, Maximum = 231ms, Average = 193ms

C:\>
```

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Analisi di Ping – 1



No.	Time	Source	Destination	Protocol	Info
1	0.000000	00:01:02:36:3b:f9	ff:ff:ff:ff:ff:ff	ARP	who has 137.204.57.254? Tell 137.204.57.174
2	0.070167	00:50:54:d9:ba:00	00:01:02:36:3b:f9	ARP	137.204.57.254 is at 00:50:54:d9:ba:00
3	0.070195	137.204.57.174	137.204.59.1	DNS	standard query A www.ucla.edu
4	0.349533	137.204.59.1	137.204.57.174	DNS	standard query response A 169.232.33.130 A 169
5	0.355096	137.204.57.174	169.232.33.130	ICMP	Echo (ping) request
6	0.589887	169.232.33.130	137.204.57.174	ICMP	Echo (ping) reply
7	1.354868	137.204.57.174	169.232.33.130	ICMP	Echo (ping) request
8	1.531968	169.232.33.130	137.204.57.174	ICMP	Echo (ping) reply
9	7.043358	137.204.57.174	169.232.33.130	ICMP	Echo (ping) request
10	7.215184	169.232.33.130	137.204.57.174	ICMP	Echo (ping) reply
11	8.044704	137.204.57.174	169.232.33.130	ICMP	Echo (ping) request
12	8.252193	169.232.33.130	137.204.57.174	ICMP	Echo (ping) reply

Frame 5 (74 bytes on wire, 74 bytes captured)	
Ethernet II, Src: 00:01:02:36:3b:f9, Dst: 00:50:54:d9:ba:00	
Internet Protocol, Src Addr: 137.204.57.174 (137.204.57.174), Dst Addr: 169.232.33.130	
Internet Control Message Protocol	
Type: 8 (Echo (ping) request)	
Code: 0	
Checksum: 0x055b (correct)	
Identifier: 0x0200	
Sequence number: 46:01	
Data (32 bytes)	

Frame 6 (74 bytes on wire, 74 bytes captured)	
Ethernet II, Src: 00:50:54:d9:ba:00, Dst: 00:01:02:36:3b:f9	
Internet Protocol, Src Addr: 169.232.33.130 (169.232.33.130), Dst Addr: 137.204.57.174	
Internet Control Message Protocol	
Type: 0 (Echo (ping) reply)	
Code: 0	
Checksum: 0x0d5b (correct)	
Identifier: 0x0200	
Sequence number: 46:01	
Data (32 bytes)	

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Analisi di Ping – 2

```
Command Prompt
C:\>ping -f www-rlc.deis.unibo.it
Pinging deis238a.deis.unibo.it [137.204.59.238] with 32 bytes of data:
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128
Reply from 137.204.59.238: bytes=32 time<10ms TTL=128
Ping statistics for 137.204.59.238:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping -f -l 2000 www-rlc.deis.unibo.it
Pinging deis238a.deis.unibo.it [137.204.59.238] with 2000 bytes of data:
Packet needs to be fragmented but DF set.
Packet needs to be fragmented but DF set.
Packet needs to be fragmented but DF set.
Packet needs to be fragmented but DF set.
Ping statistics for 137.204.59.238:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
```

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Analisi di Ping – 2

No.	Time	Source	Destination	Protocol	Info
1	0.000000	137.204.57.174	137.204.59.238	ICMP	Echo (ping) request
2	0.000548	137.204.59.238	137.204.57.174	ICMP	Echo (ping) reply
3	0.999843	137.204.57.174	137.204.59.238	ICMP	Echo (ping) request
4	1.000094	137.204.59.238	137.204.57.174	ICMP	Echo (ping) reply
5	6.888331	137.204.57.174	137.204.59.238	ICMP	Echo (ping) request
6	6.888583	137.204.59.238	137.204.57.174	ICMP	Echo (ping) reply
7	7.889684	137.204.57.174	137.204.59.238	ICMP	Echo (ping) request
8	7.889918	137.204.59.238	137.204.57.174	ICMP	Echo (ping) reply

```
Frame 1 (74 bytes on wire, 74 bytes captured)
Ethernet II, Src: 00:01:02:36:3b:f9, Dst: 00:50:da:13:28:0b
Internet Protocol, Src Addr: 137.204.57.174 (137.204.57.174), Dst Addr: 137.204.59.238 (137.204.59.238)
  Version: 4
  Header length: 20 bytes
  Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
  Total Length: 60
  Identification: 0x9b3e
  Flags: 0x04
    .1.. = Don't fragment: Set
    ..0. = More fragments: Not set
  Fragment offset: 0
  Time to live: 128
  Protocol: ICMP (0x01)
  Header checksum: 0xd64d (correct)
  Source: 137.204.57.174 (137.204.57.174)
  Destination: 137.204.59.238 (137.204.59.238)
Internet Control Message Protocol
```

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Analisi di Ping – 3

```

C:\>ping -n 1 -i 1 www.ucla.edu
Pinging www.ucla.edu [169.232.33.129] with 32 bytes of data:
Reply from 137.204.58.254: TTL expired in transit.
Ping statistics for 169.232.33.129:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping -n 1 -i 3 www.ucla.edu
Pinging www.ucla.edu [169.232.33.129] with 32 bytes of data:
Reply from 137.204.2.14: TTL expired in transit.
Ping statistics for 169.232.33.129:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping -n 1 -i 10 www.ucla.edu
Pinging www.ucla.edu [169.232.33.129] with 32 bytes of data:
Reply from 198.32.8.29: TTL expired in transit.
Ping statistics for 169.232.33.129:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
    
```

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Analisi di Ping – 3

No.	Time	Source	Destination	Protocol	Info
1	0.000000	137.204.57.174	169.232.33.129	ICMP	Echo (ping) request
2	4.938007	137.204.58.254	137.204.57.174	ICMP	Time-to-live exceeded
3	13.399787	137.204.57.174	169.232.33.129	ICMP	Echo (ping) request
4	13.591212	137.204.2.14	137.204.57.174	ICMP	Time-to-live exceeded
5	26.919606	137.204.57.174	169.232.33.129	ICMP	Echo (ping) request
6	27.117564	198.32.8.29	137.204.57.174	ICMP	Time-to-live exceeded

```

Frame 3 (74 bytes on wire, 74 bytes captured)
Ethernet II, Src: 00:01:02:36:3b:f9, Dst: 00:50:54:d9:ba:00
Internet Protocol, Src Addr: 137.204.57.174 (137.204.57.174)
Version: 4
Header Length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00)
Total Length: 60
Identification: 0x015b
Flags: 0x00
    .0.. = Don't fragment: Not set
    ..0. = More fragments: Not set
Fragment offset: 0
Time to live: 3
Protocol: ICMP (0x01)
Header checksum: 0x2783 (correct)
Source: 137.204.57.174 (137.204.57.174)
Destination: 169.232.33.129 (169.232.33.129)
Internet Control Message Protocol
    
```

```

Frame 4 (70 bytes on wire, 70 bytes captured)
Ethernet II, Src: 00:50:54:d9:ba:00, Dst: 00:01:02:36:3b:f9
Internet Protocol, Src Addr: 137.204.2.14 (137.204.2.14)
Version: 4
Header Length: 20 bytes
Differentiated Services Field: 0xc0 (DSCP 0x30)
Total Length: 56
Identification: 0xf14b
Flags: 0x00
    .0.. = Don't fragment: Not set
    ..0. = More fragments: Not set
Fragment offset: 0
Time to live: 253
Protocol: ICMP (0x01)
Header checksum: 0x7c64 (correct)
Source: 137.204.2.14 (137.204.2.14)
Destination: 137.204.57.174 (137.204.57.174)
Internet Control Message Protocol
Type: 11 (Time-to-live exceeded)
Code: 0 (TTL equals 0 during transit)
Checksum: 0x0fa3 (correct)
Internet Protocol, Src Addr: 137.204.57.174 (137.204.57.174)
Internet Control Message Protocol
    
```

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Analisi di Ping – 4

```
Command Prompt
C:\>ipconfig
Windows 2000 IP Configuration
Ethernet adapter Local Area Connection:
    Connection-specific DNS Suffix . :
    IP Address. . . . . : 137.204.57.174
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 137.204.57.254
C:\>ping 137.204.24.226
Pinging 137.204.24.226 with 32 bytes of data:
Reply from 137.204.24.226: bytes=32 time=20ms TTL=125
Reply from 137.204.24.226: bytes=32 time<10ms TTL=125
Reply from 137.204.24.226: bytes=32 time<10ms TTL=125
Reply from 137.204.24.226: bytes=32 time=10ms TTL=125
Ping statistics for 137.204.24.226:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 20ms, Average = 7ms
C:\>
```

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Analisi di Ping – 4

```
Command Prompt
C:\>ipconfig
Windows 2000 IP Configuration
Ethernet adapter Local Area Connection:
    Connection-specific DNS Suffix . :
    IP Address. . . . . : 137.204.57.174
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . : 137.204.57.254
C:\>ping 137.204.24.226
Pinging 137.204.24.226 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Ping statistics for 137.204.24.226:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>_
```

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Analisi di Ping – 4

Netmask = 255.255.255.0

No.	Time	Source	Destination	Protocol	Info
1	0.000000	00:01:02:36:3b:f9	ff:ff:ff:ff:ff:ff	ARP	who has 137.204.57.254? Tell 137.204.57.174
2	0.016670	00:50:54:d9:ba:00	00:01:02:36:3b:f9	ARP	137.204.57.254 is at 00:50:54:d9:ba:00
3	0.016697	137.204.57.174	137.204.24.226	ICMP	Echo (ping) request
4	0.019274	137.204.24.226	137.204.57.174	ICMP	Echo (ping) reply
5	0.992686	137.204.57.174	137.204.24.226	ICMP	Echo (ping) request
6	0.994227	137.204.24.226	137.204.57.174	ICMP	Echo (ping) reply
7	6.681041	137.204.57.174	137.204.24.226	ICMP	Echo (ping) request
8	6.682570	137.204.24.226	137.204.57.174	ICMP	Echo (ping) reply
9	7.682487	137.204.57.174	137.204.24.226	ICMP	Echo (ping) request
10	7.697670	137.204.24.226	137.204.57.174	ICMP	Echo (ping) reply

Netmask = 255.255.0.0

No.	Time	Source	Destination	Protocol	Info
1	0.000000	00:01:02:36:3b:f9	ff:ff:ff:ff:ff:ff	ARP	who has 137.204.24.226? Tell 137.204.57.174
2	1.283402	00:01:02:36:3b:f9	ff:ff:ff:ff:ff:ff	ARP	who has 137.204.24.226? Tell 137.204.57.174
3	2.284825	00:01:02:36:3b:f9	ff:ff:ff:ff:ff:ff	ARP	who has 137.204.24.226? Tell 137.204.57.174
4	3.286265	00:01:02:36:3b:f9	ff:ff:ff:ff:ff:ff	ARP	who has 137.204.24.226? Tell 137.204.57.174

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Analisi di Traceroute

```

C:\>tracert www.berkeley.edu

Tracing route to arachne.Berkeley.EDU [169.229.131.109]
over a maximum of 30 hops:

 1  <10 ms  10 ms  <10 ms  alnr06.ing.ing.unibo.it [137.204.58.254]
 2  <10 ms  <10 ms  20 ms  192.12.77.73
 3  <10 ms  <10 ms  <10 ms  alnr55.unibo.it [137.204.2.14]
 4  10 ms  30 ms  20 ms  rc-unibo.bo.garr.net [193.206.128.97]
 5  20 ms  <10 ms  50 ms  rt-rc-2.bo.garr.net [193.206.134.157]
 6  10 ms  30 ms  20 ms  ni-bo.garr.net [193.206.134.1]
 7  40 ms  50 ms  20 ms  garr.it1.it.geant.net [62.40.103.89]
 8  60 ms  60 ms  80 ms  it-de2.de.geant.net [62.40.96.61]
 9  110 ms  130 ms  100 ms  62.40.103.254
10  110 ms  150 ms  111 ms  cleve-nycm.abilene.ucaid.edu [198.32.8.29]
11  170 ms  150 ms  120 ms  ipls-clev.abilene.ucaid.edu [198.32.8.25]
12  130 ms  130 ms  140 ms  kscy-ipls.abilene.ucaid.edu [198.32.8.5]
13  150 ms  180 ms  170 ms  dnvr-kscy.abilene.ucaid.edu [198.32.8.13]
14  171 ms  170 ms  200 ms  snva-dnvr.abilene.ucaid.edu [198.32.8.11]
15  161 ms  190 ms  190 ms  198.32.249.161
16  160 ms  161 ms  160 ms  BERK--SUNU-POS.calren2.net [198.32.249.13]
17  170 ms  161 ms  170 ms  pos1-0.inr-000-eva.Berkeley.EDU [128.32.0.89]
18  170 ms  200 ms  180 ms  vlan199.inr-202-doecev.Berkeley.EDU [128.32.0.20]
31
19  200 ms  180 ms  201 ms  vlan210.inr-203-eva.Berkeley.EDU [128.32.255.10]
20  160 ms  200 ms  201 ms  arachne.Berkeley.EDU [169.229.131.109]

Trace complete.
C:\>
    
```

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Analisi di Traceroute

No. v	Time	Source	Destination	Protocol	Info
3	0.215024	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
4	0.222874	137.204.58.254	137.204.57.174	ICMP	Time-to-live exceeded
5	0.223176	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
6	0.224732	137.204.58.254	137.204.57.174	ICMP	Time-to-live exceeded
7	0.224989	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
8	0.225431	137.204.58.254	137.204.57.174	ICMP	Time-to-live exceeded
9	5.911991	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
10	5.915870	192.12.77.73	137.204.57.174	ICMP	Time-to-live exceeded
11	5.916149	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
12	5.918405	192.12.77.73	137.204.57.174	ICMP	Time-to-live exceeded
13	5.918654	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
14	5.939798	192.12.77.73	137.204.57.174	ICMP	Time-to-live exceeded
15	20.803865	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
16	20.805677	137.204.2.14	137.204.57.174	ICMP	Time-to-live exceeded
17	20.805961	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
18	20.807703	137.204.2.14	137.204.57.174	ICMP	Time-to-live exceeded
19	20.807959	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
20	20.809601	137.204.2.14	137.204.57.174	ICMP	Time-to-live exceeded
21	26.492259	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
22	26.510951	193.206.128.97	137.204.57.174	ICMP	Time-to-live exceeded
23	26.511241	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
24	26.538949	193.206.128.97	137.204.57.174	ICMP	Time-to-live exceeded
25	26.539245	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
26	26.561176	193.206.128.97	137.204.57.174	ICMP	Time-to-live exceeded
27	27.543772	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
28	27.566161	193.206.134.157	137.204.57.174	ICMP	Time-to-live exceeded
29	27.566448	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
30	27.572922	193.206.134.157	137.204.57.174	ICMP	Time-to-live exceeded
31	27.573319	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
32	32.301557	193.206.134.157	137.204.57.174	ICMP	Time-to-live exceeded
33	33.252212	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request
34	33.267713	193.206.134.1	137.204.57.174	ICMP	Time-to-live exceeded
35	33.268004	137.204.57.174	169.229.131.109	ICMP	Echo (ping) request