

**Corso di Laurea in Ingegneria Informatica**



**Corso di Reti di Calcolatori I**

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**ICMP: ping e traceroute**

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# ICMP (Internet Control Message Protocol)



- Funzionalità:
  - Verificare lo stato della rete
    - echo request, echo reply
  - Riportare anomalie
    - destination unreachable
    - time exceeded
    - parameter problem
  - Scoprire la netmask
    - mask request
    - address mask reply
  - Migliorare il routing
    - Redirect
- **Messaggi ICMP trasportati in datagrammi IP con Protocol Type = 0x01**

# ICMP



- I messaggi sono individuati da un tipo e da un codice

<u>Type</u>	<u>Code</u>	<u>description</u>
0	0	echo reply (ping)
3	0	dest. network unreachable
3	1	dest host unreachable
3	2	dest protocol unreachable
3	3	dest port unreachable
3	6	dest network unknown
3	7	dest host unknown
4	0	source quench (congestion control - not used)
8	0	echo request (ping)
9	0	route advertisement
10	0	router discovery
11	0	TTL expired
12	0	bad IP header



- Applicazioni:
  - Ping
    - Utilizzato per verificare la connettività a livello rete tra due host, A e B
      - l'host A invia un pacchetto "echo request"
      - alla ricezione di tale messaggio, l'host B risponde con un pacchetto "echo reply"
  - Traceroute
    - Utilizzato per scoprire il percorso seguito per raggiungere una certa destinazione
    - Viene inviata una serie di pacchetti con TTL via via crescente, a partire da 1:
      - il router che, decrementando il TTL, lo azzererà invierà indietro un messaggio "time exceeded"
        - » in questo modo si riesce a determinare il percorso fino alla destinazione



# Esempio di traceroute (1/9)

```
C:\Documents and Settings\spromano>tracert 143.225.229.3  
Rilevazione instradamento verso grid.grid.unina.it [143.225.229.3]  
su un massimo di 30 punti di passaggio:  
  
 1      2 ms      2 ms      2 ms  192.168.2.1  
 2      4 ms      8 ms      9 ms  217.9.64.193  
 3     11 ms     19 ms     19 ms  192.55.101.129  
 4      3 ms      3 ms      3 ms  grid.grid.unina.it [143.225.229.3]  
  
Rilevazione completata.
```



# Esempio di traceroute (2/9)

The screenshot shows the Ethereal interface with a single captured packet. The packet list table is as follows:

No.	Time	Source	Destination	Protocol	Info
1	0.000000	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request

The packet details pane shows the following structure:

- Frame 1 (106 on wire, 106 captured)
- Ethernet II
  - Destination: 00:30:bd:96:28:fa (BELKIN\_96:28:fa)
  - Source: 00:02:2d:09:17:be (java.comics.unina.it)
  - Type: IP (0x0800)
- Internet Protocol, Src Addr: java.comics.unina.it (192.168.2.6), Dst Addr: grid.grid.unina.it (143.225.229.3)
  - Version: 4
  - Header length: 20 bytes
  - Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
  - Total Length: 92
  - Identification: 0x2042
  - Flags: 0x00
  - Fragment offset: 0
  - Time to live: 1**
  - Protocol: ICMP (0x01)
  - Header checksum: 0x61cc (correct)
  - Source: java.comics.unina.it (192.168.2.6)
  - Destination: grid.grid.unina.it (143.225.229.3)
- Internet Control Message Protocol
  - Type: 8 (Echo (ping) request)
  - Code: 0
  - Checksum: 0xaeff (correct)
  - Identifier: 0x0300
  - Sequence number: 46:00
  - Data (64 bytes)



# Esempio di traceroute (3/9)

<capture> - Ethereal

File Edit Capture Display Tools Help

No.	Time	Source	Destination	Protocol	Info
1	0.000000	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
2	0.002111	192.168.2.1	java.comics.unina.it	ICMP	Time-to-live exceeded

Frame 2 (134 on wire, 134 captured)

- Ethernet II
- Internet Protocol, Src Addr: 192.168.2.1 (192.168.2.1), Dst Addr: java.comics.unina.it (192.168.2.6)
- Internet Control Message Protocol
  - Type: 11 (Time-to-live exceeded)
  - Code: 0 (TTL equals 0 during transit)
  - Checksum: 0xf4ff (correct)
  - Internet Protocol, Src Addr: java.comics.unina.it (192.168.2.6), Dst Addr: grid.grid.unina.it (143.225.229.3)
    - Version: 4
    - Header length: 20 bytes
    - Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
    - Total Length: 92
    - Identification: 0x2042
    - Flags: 0x00
      - Fragment offset: 0
      - Time to live: 1
      - Protocol: ICMP (0x01)
      - Header checksum: 0x61cc (correct)
      - Source: java.comics.unina.it (192.168.2.6)
      - Destination: grid.grid.unina.it (143.225.229.3)
    - Internet Control Message Protocol
      - Type: 8 (Echo (ping) request)
      - Code: 0
      - Checksum: 0xaeff (correct)
      - Identifier: 0x0300
      - Sequence number: 46:00
      - Data (64 bytes)





# Esempio di traceroute (4/9)

<capture> - Ethereal

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No. .	Time	Source	Destination	Protocol	Info
5	0.004468	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
6	0.006490	192.168.2.1	java.comics.unina.it	ICMP	Time-to-live exceeded
7	1.006318	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request

Frame 7 (106 on wire, 106 captured)

- Ethernet II
- Internet Protocol, Src Addr: java.comics.unina.it (192.168.2.6), Dst Addr: grid.grid.unina.it (143.225.229.3)
  - Version: 4
  - Header length: 20 bytes
  - Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
  - Total Length: 92
  - Identification: 0x2045
  - Flags: 0x00
  - Fragment offset: 0
  - Time to live: 2
  - Protocol: ICMP (0x01)
  - Header checksum: 0x60c9 (correct)
  - Source: java.comics.unina.it (192.168.2.6)
  - Destination: grid.grid.unina.it (143.225.229.3)
- Internet Control Message Protocol
  - Type: 8 (Echo (ping) request)
  - Code: 0
  - Checksum: 0xabff (correct)
  - Identifier: 0x0300
  - Sequence number: 49:00
  - Data (64 bytes)



# Esempio di traceroute (5/9)

<capture> - Ethereal

File Edit Capture Display Tools Help

No. .	Time	Source	Destination	Protocol	Info
5	0.004468	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
6	0.006490	192.168.2.1	java.comics.unina.it	ICMP	Time-to-live exceeded
7	1.006318	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
8	1.011137	217.9.64.193	java.comics.unina.it	ICMP	Time-to-live exceeded

▣ Frame 8 (70 on wire, 70 captured)

- ▣ Ethernet II
- ▣ Internet Protocol, Src Addr: 217.9.64.193 (217.9.64.193), Dst Addr: java.comics.unina.it (192.168.2.6)
- ▣ Internet Control Message Protocol
  - Type: 11 (Time-to-live exceeded)
    - Code: 0 (TTL equals 0 during transit)
    - Checksum: 0xf4ff (correct)
  - ▣ Internet Protocol, Src Addr: java.comics.unina.it (192.168.2.6), Dst Addr: grid.grid.unina.it (143.225.229.3)
    - Version: 4
    - Header length: 20 bytes
    - ▣ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
    - Total Length: 92
    - Identification: 0x2045
    - ▣ Flags: 0x00
      - Fragment offset: 0
      - Time to live: 1
      - Protocol: ICMP (0x01)
      - Header checksum: 0x61c9 (correct)
      - Source: java.comics.unina.it (192.168.2.6)
      - Destination: grid.grid.unina.it (143.225.229.3)
  - ▣ Internet Control Message Protocol
    - Type: 8 (Echo (ping) request)
    - Code: 0
    - Checksum: 0xabff (correct)
    - Identifier: 0x0300
    - Sequence number: 49:00



# Esempio di traceroute (6/9)

**<capture> - Ethereal**

File Edit Capture Display Tools Help

No.	Time	Source	Destination	Protocol	Info
13	2.023553	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request

▣ Frame 13 (106 on wire, 106 captured)

- ▣ Ethernet II
- ▣ Internet Protocol, Src Addr: java.comics.unina.it (192.168.2.6), Dst Addr: grid.grid.unina.it (143.225.229.3)
  - Version: 4
  - Header length: 20 bytes
  - ▣ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
    - Total Length: 92
    - Identification: 0x2049
    - ▣ Flags: 0x00
      - Fragment offset: 0
      - Time to live: 3**
    - Protocol: ICMP (0x01)
    - Header checksum: 0x5fc5 (correct)
    - Source: java.comics.unina.it (192.168.2.6)
    - Destination: grid.grid.unina.it (143.225.229.3)
  - ▣ Internet Control Message Protocol
    - Type: 8 (Echo (ping) request)
    - Code: 0
    - Checksum: 0xa8ff (correct)
    - Identifier: 0x0300
    - Sequence number: 4c:00
    - Data (64 bytes)



# Esempio di traceroute (7/9)

<capture> - Ethereal

File Edit Capture Display Tools Help

No.	Time	Source	Destination	Protocol	Info
13	2.023553	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
14	2.034492	192.55.101.129	java.comics.unina.it	ICMP	Time-to-live exceeded

.....

Frame 14 (70 on wire, 70 captured)

- Ethernet II
- Internet Protocol, Src Addr: 192.55.101.129 (192.55.101.129), Dst Addr: java.comics.unina.it (192.168.2.6)
- Internet Control Message Protocol
  - Type: 11 (Time-to-live exceeded)
    - Code: 0 (TTL equals 0 during transit)
    - Checksum: 0xf4ff (correct)
  - Internet Protocol, Src Addr: java.comics.unina.it (192.168.2.6), Dst Addr: grid.grid.unina.it (143.225.229.3)
    - Version: 4
    - Header length: 20 bytes
    - Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
    - Total Length: 92
    - Identification: 0x2049
    - Flags: 0x00
      - Fragment offset: 0
      - Time to live: 1
    - Protocol: ICMP (0x01)
    - Header checksum: 0x61c5 (correct)
    - Source: java.comics.unina.it (192.168.2.6)
    - Destination: grid.grid.unina.it (143.225.229.3)
  - Internet Control Message Protocol
    - Type: 8 (Echo (ping) request)
    - Code: 0
    - Checksum: 0xa8ff (correct)
    - Identifier: 0x0300
    - Sequence number: 4c:00



# Esempio di traceroute (8/9)

<capture> - Ethereal

File Edit Capture Display Tools Help

No. .	Time	Source	Destination	Protocol	Info
15	2.034848	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
16	2.054220	192.55.101.129	java.comics.unina.it	ICMP	Time-to-live exceeded
17	2.054538	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
18	2.074440	192.55.101.129	java.comics.unina.it	ICMP	Time-to-live exceeded
19	16.070350	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request

▣ Frame 19 (106 on wire, 106 captured)

▣ Ethernet II

▣ Internet Protocol, Src Addr: java.comics.unina.it (192.168.2.6), Dst Addr: grid.grid.unina.it (143.225.229.3)  
Version: 4  
Header length: 20 bytes

▣ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)  
Total Length: 92  
Identification: 0x2053

▣ Flags: 0x00  
Fragment offset: 0  
**Time to live: 4**

Protocol: ICMP (0x01)  
Header checksum: 0x5ebb (correct)  
Source: java.comics.unina.it (192.168.2.6)  
Destination: grid.grid.unina.it (143.225.229.3)

▣ Internet Control Message Protocol  
Type: 8 (Echo (ping) request)  
Code: 0  
Checksum: 0xa5ff (correct)  
Identifier: 0x0300  
Sequence number: 4f:00  
Data (64 bytes)



# Esempio di traceroute (9/9)

<capture> - Ethereal

File Edit Capture Display Tools Help

No.	Time	Source	Destination	Protocol	Info
16	2.054220	192.55.101.129	java.comics.unina.it	ICMP	Time-to-live exceeded
17	2.054538	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
18	2.074440	192.55.101.129	java.comics.unina.it	ICMP	Time-to-live exceeded
19	16.070350	java.comics.unina.it	grid.grid.unina.it	ICMP	Echo (ping) request
20	16.074284	grid.grid.unina.it	java.comics.unina.it	ICMP	Echo (ping) reply

Frame 20 (106 on wire, 106 captured)

- Ethernet II
- Internet Protocol, Src Addr: grid.grid.unina.it (143.225.229.3), Dst Addr: java.comics.unina.it (192.168.2.6)
  - Version: 4
  - Header length: 20 bytes
  - Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00)
  - Total Length: 92
  - Identification: 0xa0b4
  - Flags: 0x00
    - Fragment offset: 0
    - Time to live: 252
    - Protocol: ICMP (0x01)
    - Header checksum: 0xe658 (correct)
    - Source: grid.grid.unina.it (143.225.229.3)
    - Destination: java.comics.unina.it (192.168.2.6)
  - Internet Control Message Protocol
    - Type: 0 (Echo (ping) reply)
    - Code: 0
    - Checksum: 0xadff (correct)
    - Identifier: 0x0300
    - Sequence number: 4f:00
    - Data (64 bytes)