

# **Corso di Laurea in Ingegneria Informatica**



## **Corso di Reti di Calcolatori**

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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

Type	Code	description
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 azzera 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)

<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

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: 0xaeaff (correct)
- Identifier: 0x0300
- Sequence number: 46:00
- Data (64 bytes)



# Esempio di traceroute (3/9)

<capture> - Ethereal

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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)

Screenshot of the Ethereal network traffic analyzer showing a ping request and its reply.

The capture window shows the following table:

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 details for Frame 7:

- 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)

Screenshot of the Ethereal network traffic analyzer showing a traceroute session.

The capture window displays the following table:

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

Details for the selected ICMP Type 11 (Time-to-live exceeded) packet:

- Type: 11 (Time-to-live exceeded)
- Code: 0 (TTL equals 0 during transit)
- Checksum: 0x4fff (correct)
- 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: 8 (Echo (ping) request)
  - Code: 0
  - Checksum: 0xabff (correct)
  - Identifier: 0x0300
  - Sequence number: 49:00



# Esempio di traceroute (6/9)

<capture> - Ethereal

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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: 0xfc5 (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)