

**Corso di Laurea in Ingegneria Informatica**



**Corso di Reti di Calcolatori  
(a.a. 2011/12)**

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**ICMP: ping e traceroute**

28 ottobre 2011

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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**

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## ICMP



	<u>Type</u>	<u>Code</u>	<u>description</u>
• I messaggi sono individuati da un tipo e da un codice	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	

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## ICMP



- 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

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## Esempio di traceroute (1/9)



```
C:\Documents and Settings\sromano>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.
```

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## Esempio di traceroute (2/9)



The screenshot shows a Wireshark capture of an ICMP Echo (ping) request. The packet list pane shows packet 1 at time 0.000000, source java.comics.unina.it, destination grid.grid.unina.it, protocol ICMP, and info Echo (ping) request. The packet details pane is expanded to show 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)

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## Esempio di traceroute (3/9)



The screenshot shows a Wireshark capture of an ICMP Time-to-live exceeded message. The packet list pane shows packet 2 at time 0.002111, source 192.168.2.1, destination java.comics.unina.it, protocol ICMP, and info Time-to-live exceeded. The packet details pane is expanded to show the following structure:

- Frame 2 (134 on wire, 134 captured)
- Ethernet II
  - Destination: 00:02:2d:09:17:be (java.comics.unina.it)
  - Source: 00:02:2d:09:17:be (java.comics.unina.it)
  - Type: IP (0x0800)
- 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)

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## Esempio di traceroute (4/9)



The screenshot shows a packet capture window titled "<capture> - Ethereal". The packet list pane shows three ICMP Echo (ping) requests. The selected packet (No. 7) is an Echo (ping) request from java.comics.unina.it (192.168.2.6) to grid.grid.unina.it (143.225.229.3). The packet details pane shows the following structure:

- 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)

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## Esempio di traceroute (5/9)



The screenshot shows a packet capture window titled "<capture> - Ethereal". The packet list pane shows four ICMP Echo (ping) requests. The selected packet (No. 8) is a Time-to-live exceeded message from 217.9.64.193 to java.comics.unina.it (192.168.2.6). The packet details pane shows the following structure:

- 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: 3 (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

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## 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)

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## 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: 0xb1c5 (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

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## Esempio di traceroute (8/9)



The screenshot shows a packet capture window titled "<capture> - Ethereal". The packet list pane shows five entries, with the fifth entry (No. 19) selected. The details pane for this entry shows the following information:

- 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)

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## Esempio di traceroute (9/9)



The screenshot shows a packet capture window titled "<capture> - Ethereal". The packet list pane shows five entries, with the fifth entry (No. 20) selected. The details pane for this entry shows the following information:

- 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)

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