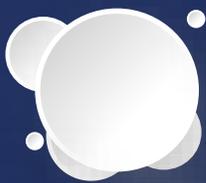




计算机网络

ICMP

苏铅坤



PING, 测试主机连通性

```
C:\Documents and Settings\XXR>ping mail.sina.com.cn

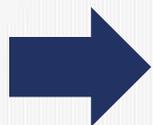
Pinging mail.sina.com.cn [202.108.43.230] with 32 bytes of data:

Reply from 202.108.43.230: bytes=32 time=368ms TTL=242
Reply from 202.108.43.230: bytes=32 time=374ms TTL=242
Request timed out.
Reply from 202.108.43.230: bytes=32 time=374ms TTL=242

Ping statistics for 202.108.43.230:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 368ms, Maximum = 374ms, Average = 372ms
```

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ICMP 报文的种类

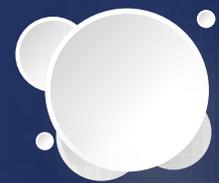
2

ICMP应用举例

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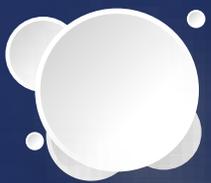
5



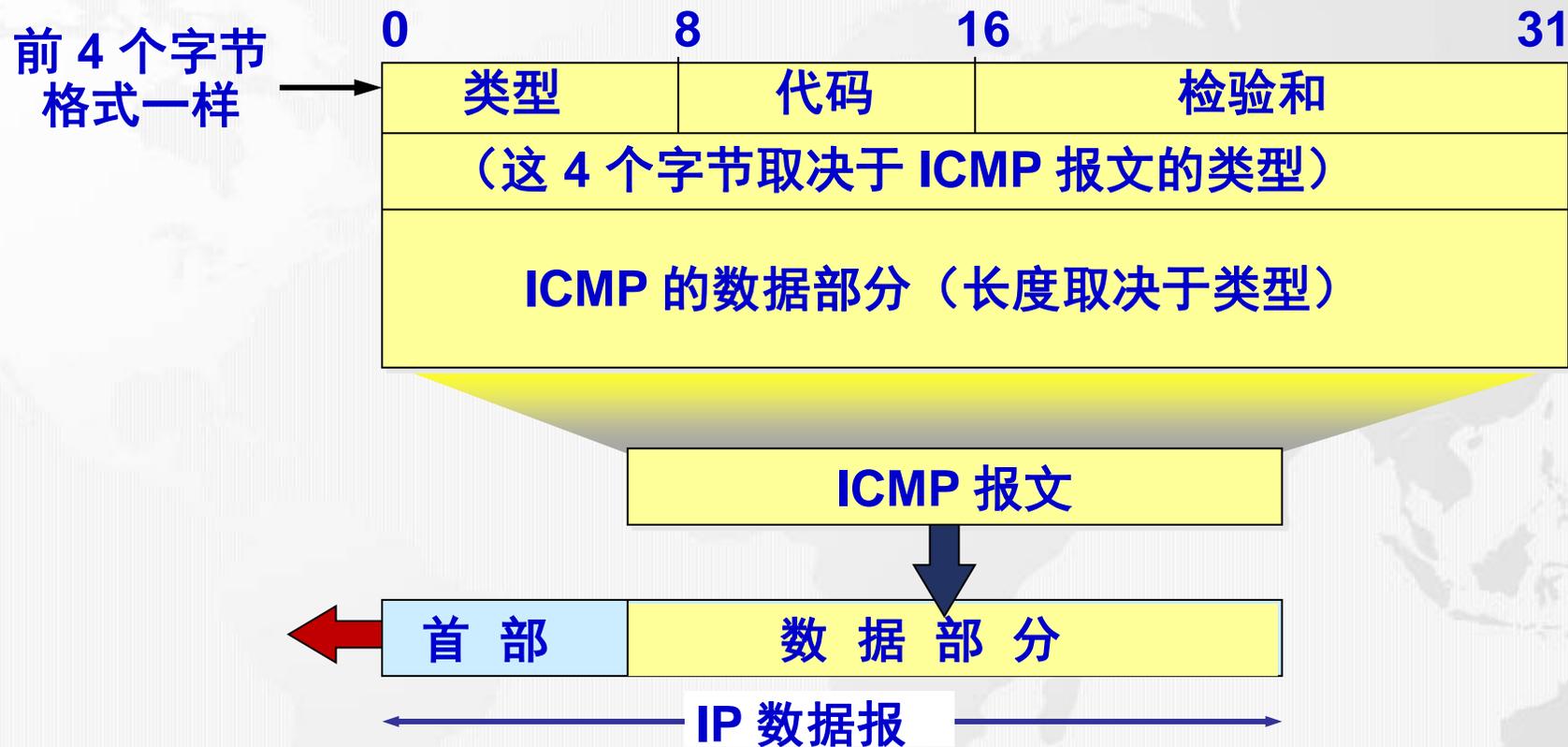
网际控制报文协议 ICMP

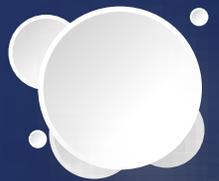
- ☺ 网际控制报文协议 ICMP (Internet Control Message Protocol)
 - 为了更有效地转发 IP 数据报和提高交付成功的机会
 - ICMP 允许主机或路由器**报告差错情况**和**提供有关异常情况的报告**。

- ☺ 但ICMP不是高层协议，而是IP层的协议。



ICMP报文的格式





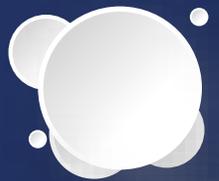
ICMP报文的种类

- ☺ ICMP 报文的前 4 个字节是统一的格式
 - 共有三个字段：即类型、代码和检验和
- ☺ ICMP 报文的种类有两种
 - ICMP 差错报告报文、ICMP 询问报文
- ☺ 接着的 4 个字节的内容与 ICMP 的类型有关

A faint, light gray world map is visible in the background of the slide. Two overlapping arrow-shaped boxes are positioned horizontally across the middle of the slide. The left box is dark blue and contains the text '1.1'. The right box is black and contains the text '差错报告报文'.

1.1

差错报告报文



ICMP差错报告报文共有4种

☺ 终点不可达

- 当主机或者路由器不能交付数据报时就向源点发送终点不可达报文

☺ 时间超过

- TTL=0, 丢弃, 向源点发送时间超时报文

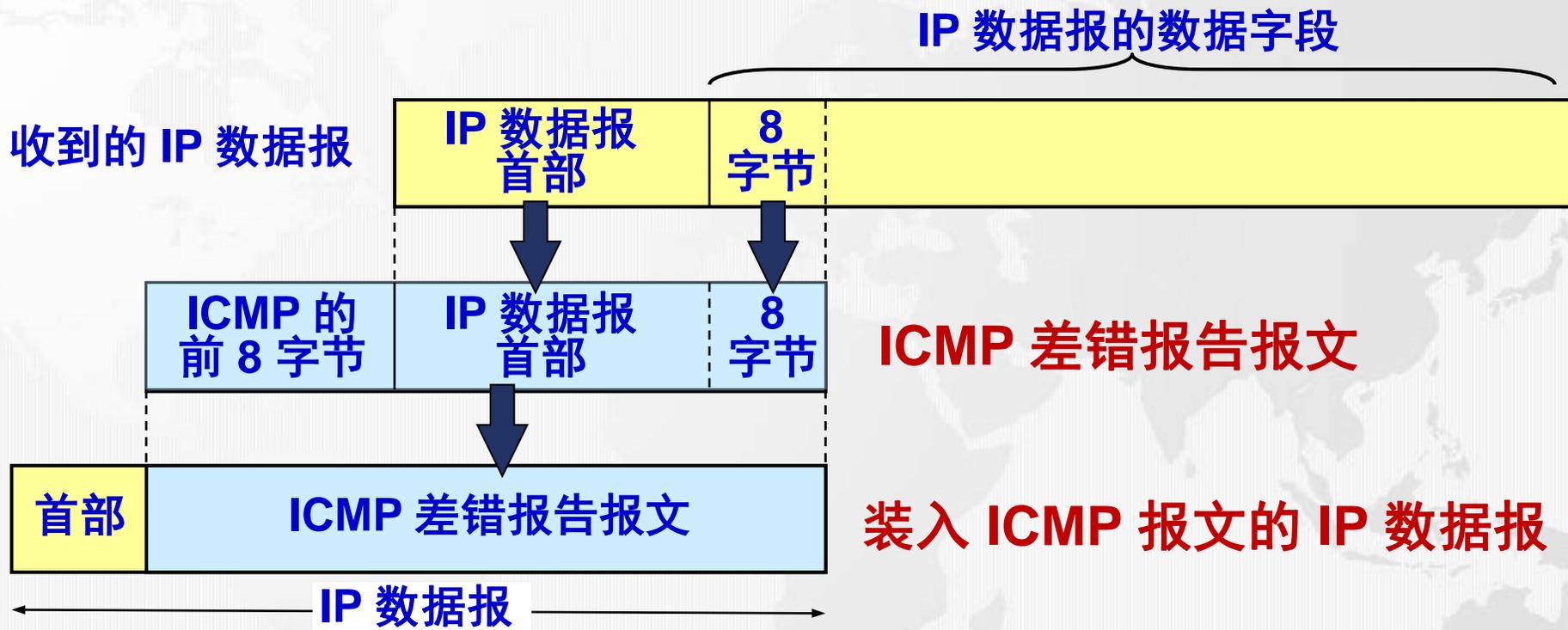
☺ 参数问题

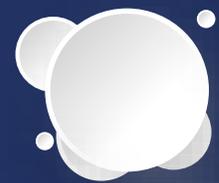
- 收到数据报的首部中的字段不正确, 丢弃, 发送参数问题报文

☺ 改变路由 (重定向) (Redirect)



ICMP差错报告报文的数据字段的内容





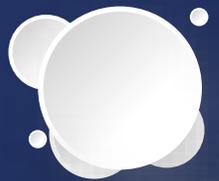
不应发送ICMP差错报告报文的几种情况

- ☺ 对 ICMP差错报告报文不再发送 ICMP 差错报告报文。
- ☺ 对第一个分片的数据报片的所有后续数据报片都不发送ICMP差错报告报文。
- ☺ 对具有多播地址的数据报都不发送ICMP差错报告报文。
- ☺ 对具有特殊地址（如127.0.0.0 或 0.0.0.0的数据报不发送ICMP差错报告报文。

A faint, light gray world map is visible in the background of the slide. The map shows the continents and oceans, with a slightly darker shade of gray for the landmasses.

1.2

询问报文



ICMP询问报文有两种

☺ 时间戳请求和回答报文

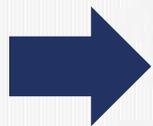
- 请某台主机或者路由器回答当前日期和时间

☺ 回送请求和回答报文

- 主机或路由器向一个特定的目的主机发出的询问，测试目的站是否可达及了解其状态

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1

ICMP 报文的种类

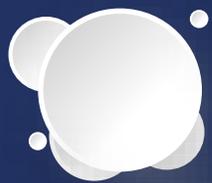
2

ICMP应用举例

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PING: Packet InterNet Groper

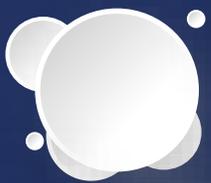
- ☺ PING用来测试两个主机之间的连通性。
- ☺ PING使用了ICMP回送请求与回送回答报文
- ☺ PING是应用层直接使用网络层ICMP的例子，它没有通过运输层的TCP或UDP

```
C:\Documents and Settings\XXR>ping mail.sina.com.cn

Pinging mail.sina.com.cn [202.108.43.230] with 32 bytes of data:

Reply from 202.108.43.230: bytes=32 time=368ms TTL=242
Reply from 202.108.43.230: bytes=32 time=374ms TTL=242
Request timed out.
Reply from 202.108.43.230: bytes=32 time=374ms TTL=242

Ping statistics for 202.108.43.230:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 368ms, Maximum = 374ms, Average = 372ms
```



Traceroute

☺ Windows命令是tracert

☺ 用来跟踪一个分组从源点到终点的路径。

- 利用IP数据报中的TTL字段和ICMP时间超过差错报告报文，实现对从源点到终点的路径的跟踪。

```
C:\Documents and Settings\XXR>tracert mail.sina.com.cn

Tracing route to mail.sina.com.cn [202.108.43.230]
over a maximum of 30 hops:

  0  0 ms    0 ms    0 ms   10.0.2.15
  1  24 ms   24 ms   23 ms  222.95.172.1
  2  23 ms   24 ms   22 ms  221.231.204.129
  3  23 ms   22 ms   23 ms  221.231.206.9
  4  24 ms   23 ms   24 ms  202.97.27.37
  5  22 ms   23 ms   24 ms  202.97.41.226
  6  28 ms   28 ms   28 ms  202.97.35.25
  7  50 ms   50 ms   51 ms  202.97.36.86
  8  308 ms  311 ms  310 ms  219.158.32.1
  9  307 ms  305 ms  305 ms  219.158.13.17
 10 164 ms  164 ms  165 ms  202.96.12.154
 11 322 ms  320 ms  2988 ms 61.135.148.50
 12 321 ms  322 ms  320 ms  freemail43-230.sina.com [202.108.43.230]

Trace complete.
```



Q & A

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苏铅坤