

北京邮电大学  
BEIJING UNIVERSITY OF  
POSTS AND  
TELECOMMUNICATIONS

STATE KEY LABORATORY OF SWITCHING TECHNOLOGY AND  
TELECOMMUNICATION NETWORK

## SIP协议分析

### — SIP协议基础架构 (续)

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## 理解协议处理的基本原理与实现模型

- SIP协议消息处理规则及基本概念
  - Transaction
  - Dialog
  - Session
- SIP协议的实现模型
  - 协议栈结构
  - 协议处理模型
- 用户管理
- 组网与路由
- 会话建立与媒体协商

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## 用户管理

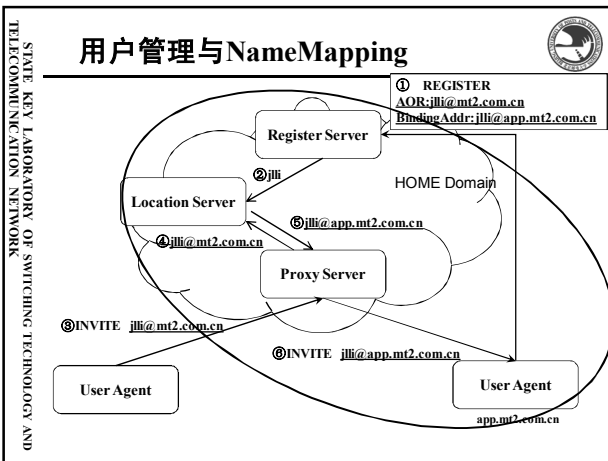
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### SIP的用户组织 SIP注册请求与响应

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## 用户管理的基本概念

- 回想AOR
  - Address-of-Record (AOR) 概念
    - address-of-record (AOR) 必须是 SIP 或 SIPS URI
    - AOR 一般被认为是一个用户的公共 / 公开地址 (public address)
    - AOR 必须指向一个提供 location service 能力的 domain, 在这个 domain 中可以将提供的 SIP URI 映射为能够联系到用户的实际 URI
  - 在 Name Mapping 特性里面, 用户的声明地址 (用于用于注册的地址) 一定是 AOR
- Home Domain (归属控制域)
  - 为 SIP 用户提供服务的网络域 (The domain providing service to a SIP user)
  - Home Domain 最重要的特征
    - Home Domain 为用户提供 Name Mapping 服务
    - This is the domain present in the URI in the address-of-record (AOR) of a registration
- AOR - HOME Domain 的关系
  - AOR 是用户的唯一号码
  - HOME Domain 维护用户唯一号码与实际号码的映射关系
- Home Domain 的用户管理方式
  - 用户使用 AOR 注册到 Register Server



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## 注册请求与响应

注册到的 Register Server

```
REGISTER sip:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;bran
Max-Forwards: 70
To: Bob <sips:bob@biloxi.example.com>
From: Bob <sips:bob@biloxi.example.com>;tag=12345
Call-ID: 1j9FpLxk3uxt8tn@biloxi.example.com
CSeq: 2 REGISTER
Contact: <sips:bob@client.biloxi.example.com>
Content-Length: 0
```

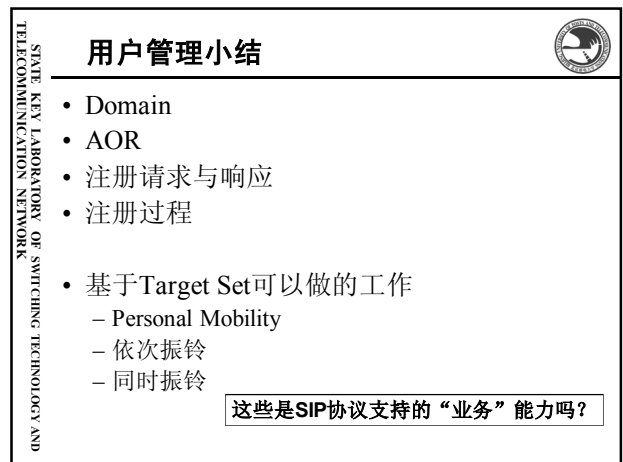
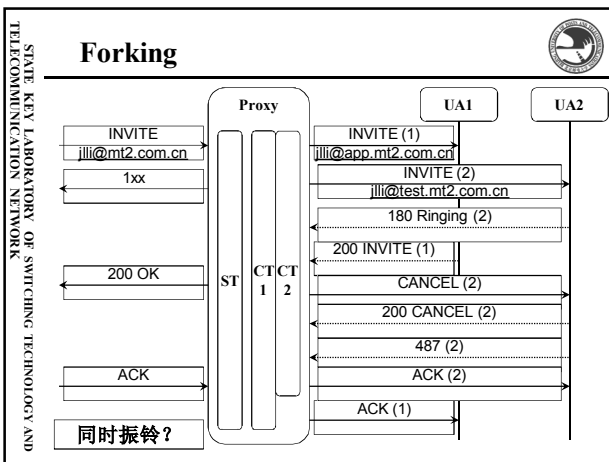
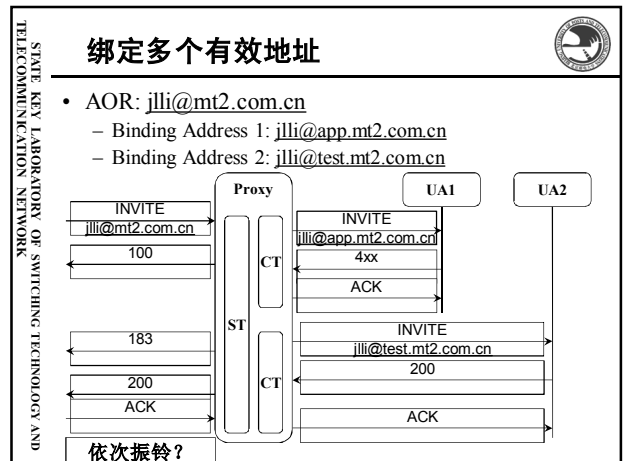
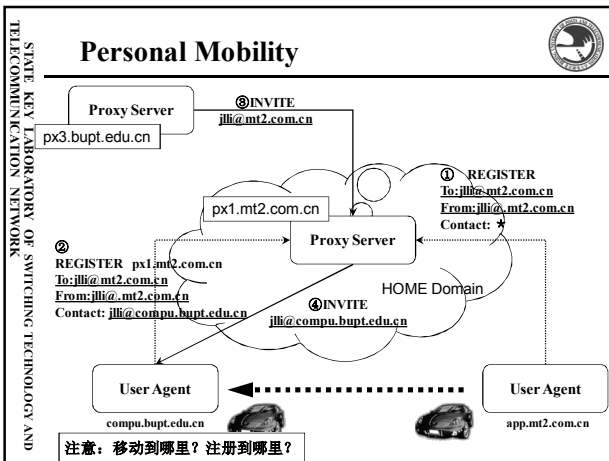
要注册的 AOR 必须是 SIP / SIPS 地址

发起注册请求的 AOR 缺省 From=To 特殊: 第三方注册

注册 AOR 所绑定的实际联系地址可以携带 0~n 个合法的 URL 地址  
Contact: \* = 取消注册  
不携带 Contact = 查询

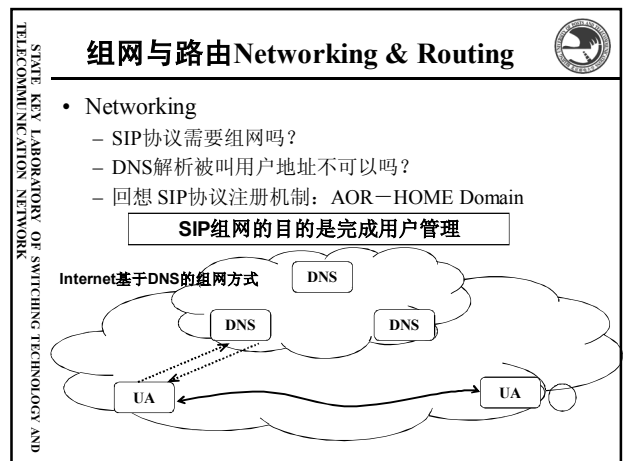
```
SIP/2.0 200 OK
Via: SIP/2.0/TLS client.biloxi.example.com:5061
received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=ja743k76-8811
To: Bob <sips:bob@biloxi.example.com>;tag=37GkEh
Call-ID: 1j9FpLxk3uxt8tn@biloxi.example.com
CSeq: 2 REGISTER
Contact: <sips:bob@client.biloxi.example.com>;expires=3600
Contact: <mailto:bob@biloxi.example.com>;expires=4294967295
Content-Length: 0
```

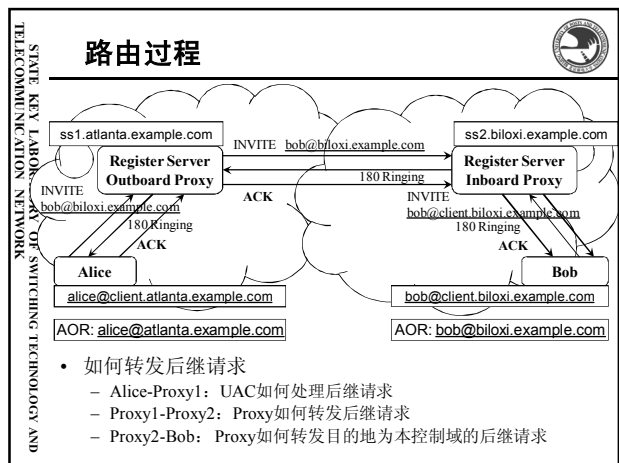
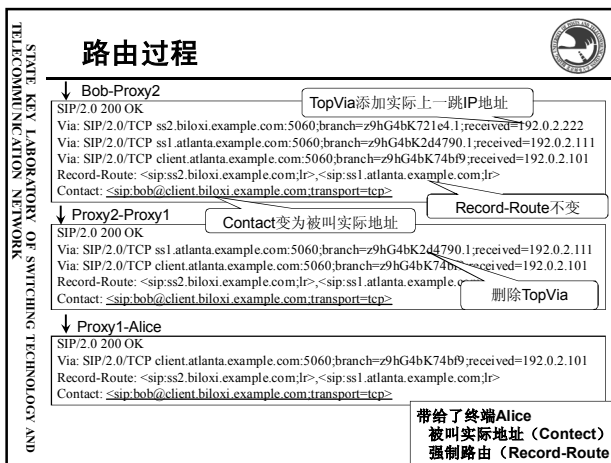
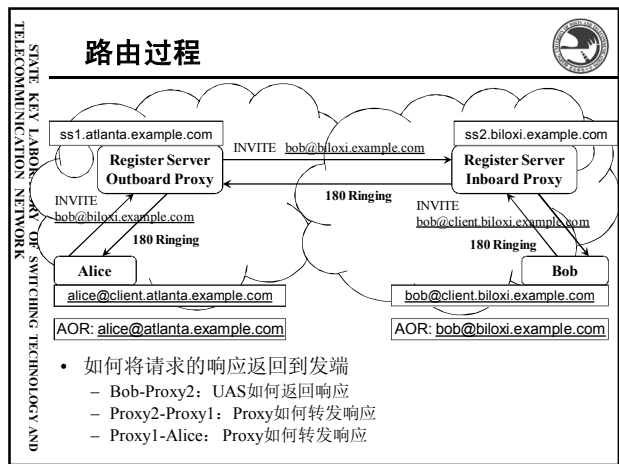
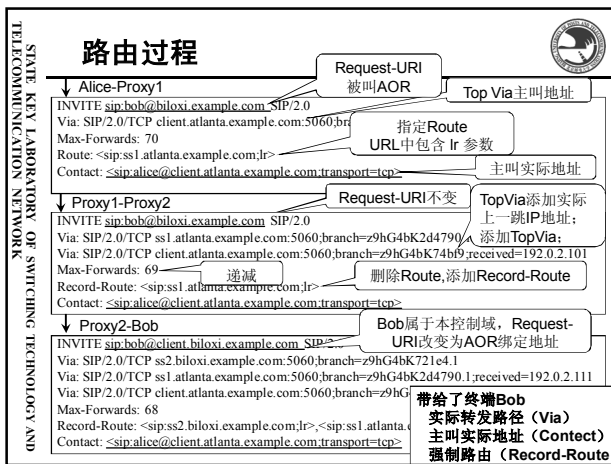
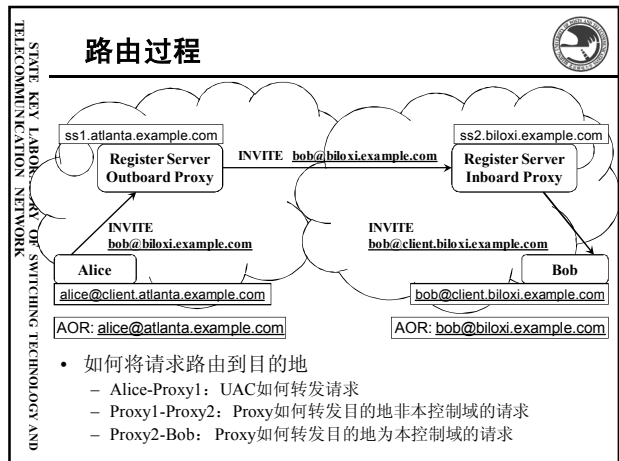
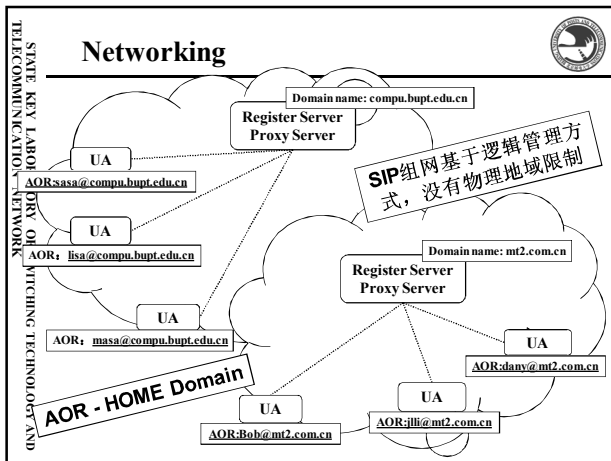
当前已绑定的联系地址及相应的生存周期  
取消注册: 返回空

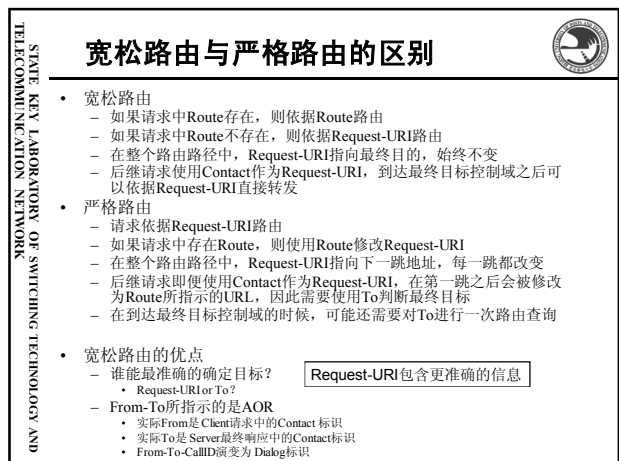
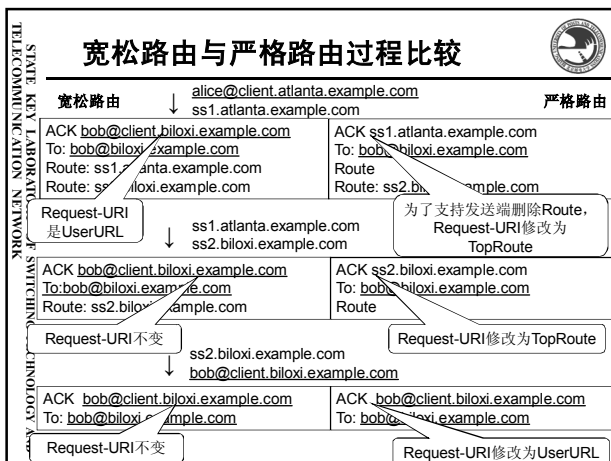
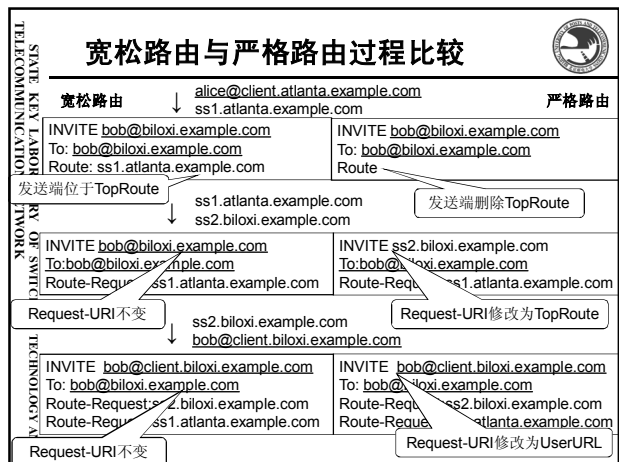
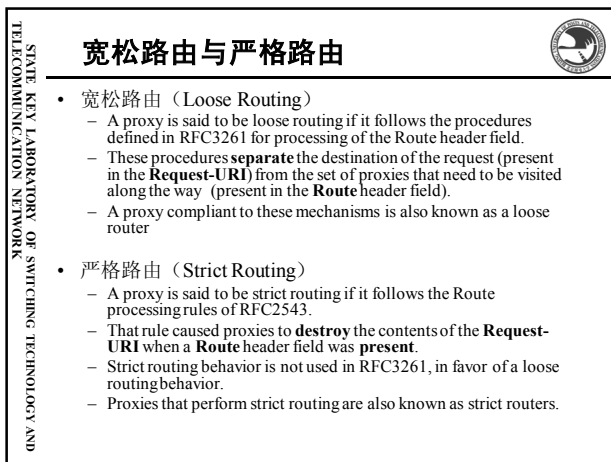
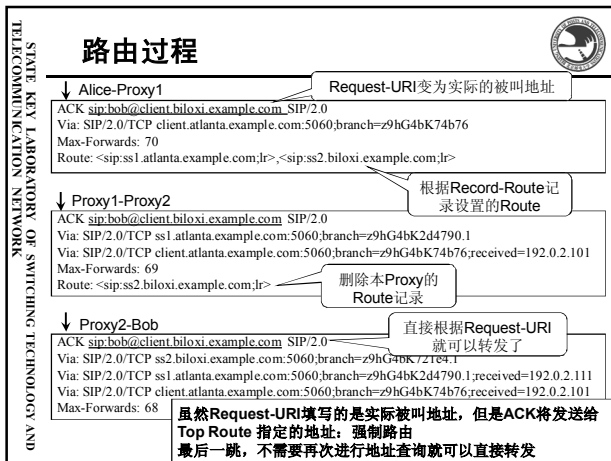


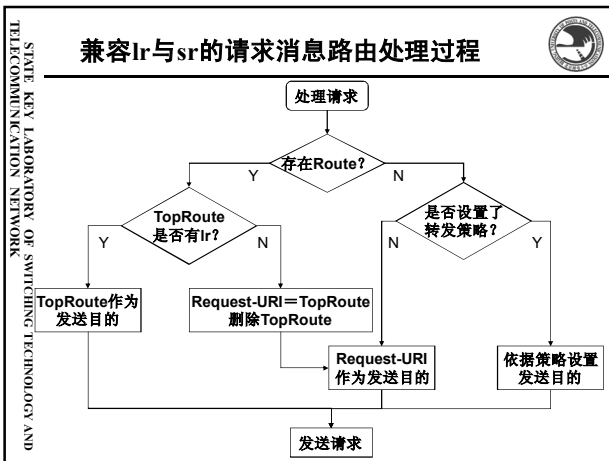
### SIP组网与路由

SIP的组网结构  
SIP的路由过程









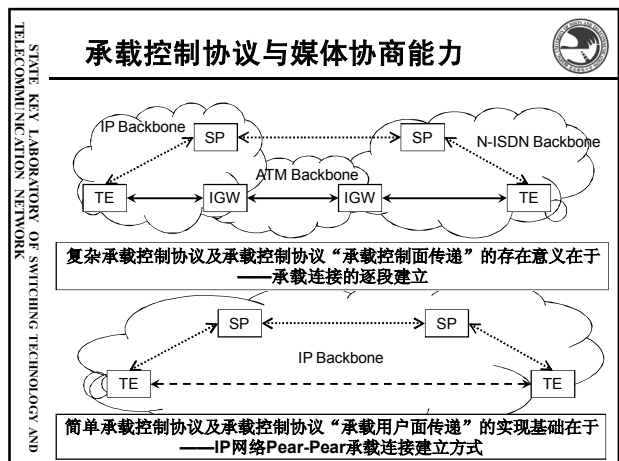
- ### 组网与路由小结
- 组网
  - 路由过程
  - 宽松路由
  - 严格路由
  - 兼容宽松路由与严格路由
- 严格路由 - B2BUA ?

### 会话建立与媒体协商

SIP会话  
SIP注册请求与响应

- ### H.323协议的承载控制与媒体协商
- H.245 — 承载控制协议
  - H.245 session:
    - The part of the call that begins with the establishment of an H.245 Control Channel and ends with the receipt of the H.245 EndSessionCommand or termination due to failure.
    - Not to be confused with a call, which is delineated by the H.225.0 Setup and Release Complete messages.
  - H.245的主要目的是
    - Master/slave determination 主从确定 承载控制
    - Logical Channel Signalling 逻辑通道信令
    - Bidirectional Logical Channel Signalling
    - Close Logical Channel Signalling
    - Mode Request
    - Round Trip Delay Determination
    - Maintenance Loop Signalling
  - Capability Exchange 能力交换 媒体协商

- ### IP网络上需要承载控制协议吗
- IP网络上需要承载控制与媒体协商协议吗
    - IP网络连接并进行数据传输的基本要求
      - 交换传输类型 (TCP/UDP) 与地址 (IP地址+端口号)
        - 主从决定
      - 交换媒体描述 (媒体类型与参数)
        - 能力交换
    - IP网络连接并进行实时数据传输的扩展要求
      - 实时媒体传输与控制—RTP/RTCP
  - H.323基于IP网络，为什么还有复杂的承载控制协议
    - 在ITU-T的场景下，要适应广义的网络
    - H.3xx系列协议并不仅仅针对IP网络
    - H.245也不仅仅针对IP网络的媒体连接控制



## 会话建立与媒体协商



- 会话建立的三层含义
  - 实体之间逻辑连接关系的建立
  - 实体之间承载连接的建立
  - 实体之间媒体流的建立
- SIP协议完成的是“会话”建立吗
  - SIP协议完成的是：维持Peer-Peer之间的逻辑连接关系
  - SIP协议本身不关心承载连接和媒体流的建立
- SIP协议“族”中有媒体建立与协商协议吗？
  - SDP: Session Description Protocol
    - SDP is intended for describing multimedia sessions for the purposes of session announcement, session invitation, and other forms of multimedia session initiation.
    - SDP完成的仅仅是如何描述Multimedia Sessions

SIP协议是一个满足会话控制与媒体控制分离的协议吗？

## SDP的内容



- Session name and purpose
- Time(s) the session is active
  - An arbitrary list of start and stop times bounding the session
  - For each bound, repeat times such as "every Wednesday at 10am for one hour"
- The media comprising the session
  - The type of media (video, audio, etc)
  - The transport protocol (RTP/UDP/IP, H.320, etc)
  - The format of the media (H.261 video, MPEG video, etc)
  - Multicast
    - Multicast address for media
    - Transport Port for media
  - Unicast
    - Remote address for media
    - Transport port for contact address
- Information to receive those media (addresses, ports, formats and so on)
- Information about the bandwidth to be used by the conference
- Contact information for the person responsible for the session

媒体协商

承载控制

## SDP描述



- **Session description**
  - v= (protocol version)
  - o= (owner/creator and session identifier)
    - o=<username> <session id> <version> <network type> <address type> <address>
  - s= (session name)
  - c= (connection information - not required if included in all media)
    - c=<network type> <address type> <connection address>
- **Time description**
  - t= (time the session is active)
    - t=<start time> <stop time>
- **Media description**
  - m= (media name and transport address)
    - m=<media> <port> <transport> <fmt list>
    - m=<media> <port> <number of ports> <transport> <fmt list>
  - a=\* (zero or more media attribute lines)
    - a=recvonly / sendrecv / sendonly / inactive
    - a=fmtp:<format> <format specific parameters>

SDP是否可以认为是一种承载控制协议？

## SDP的传递——SIP如何携带SDP



```

INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bF9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxcdd76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9yxSti55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 1234 4321 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
a=sendonly
  
```

消息体的类型  
Application/sdp

消息体的长度

Username, session id, version, network type, address type, address

media, port, transport, fmt list

SDP消息体

fmtp: format, format specific Parameters

SDP是作为净荷承载的，SIP并不关心SDP所要表达的内容

## SDP如何完成承载控制

### ——Offer-Answer模型

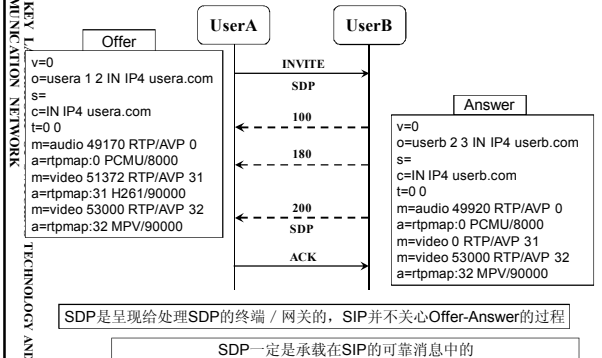


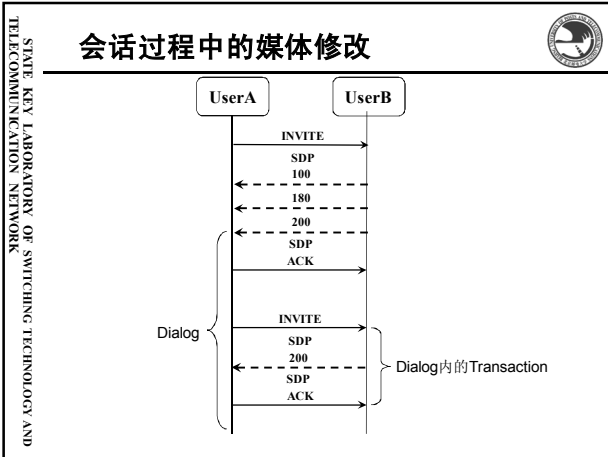
```

Offer
v=0
o=alice 1234 1234 IN IP4 ua1.com.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 62986 RTP/AVP 0 4 18
a=rtpmap:0 PCMU/8000
a=rtpmap:4 G723/8000
a=rtpmap:18 G729/8000
a=sendrecv

Answer
v=0
o=bob 5678 5678 IN IP4 ua2.com.cn
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 49920 RTP/AVP 0 4
a=rtpmap:0 PCMU/8000
a=rtpmap:4 G723/8000
a=sendonly
m=video 0 RTP/AVP 31
m=video 53000 RTP/AVP 32
a=rtpmap:32 MPV/90000
  
```

## SIP协议与Offer-Answer模型





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- ### 会话建立与媒体协商相关协议
- RFC2327—SDP: Session Description Protocol
  - RFC3264—An Offer/Answer Model with the Session Description Protocol (SDP)

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- ### 会话建立与媒体协商小结
- SIP不是媒体建立 / 协商协议
  - SDP的定义
  - SDP如何描述会话
  - Offer-Answer过程
  - SDP与SIP的关系