S-72.333 Postgraduate Course in Radio Communications.

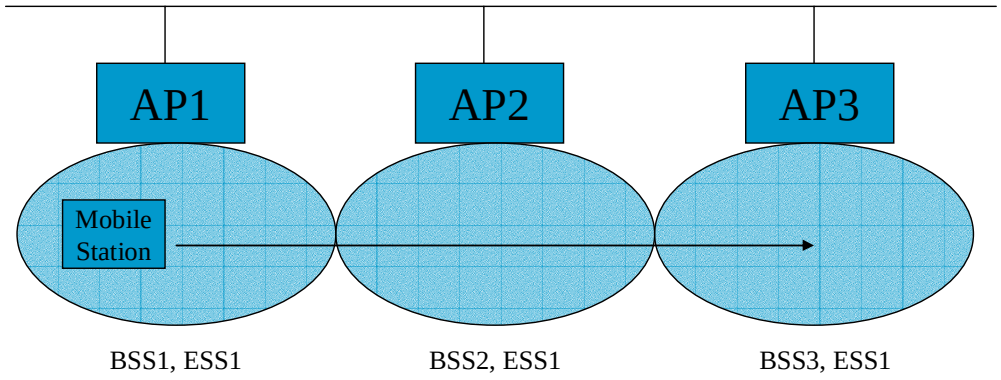
Application Layer Mobility in WLAN

Antti Keurulainen, 13.5.2004
antti.keurulainen@bitville.fi

The Mobility Concepts is WLAN

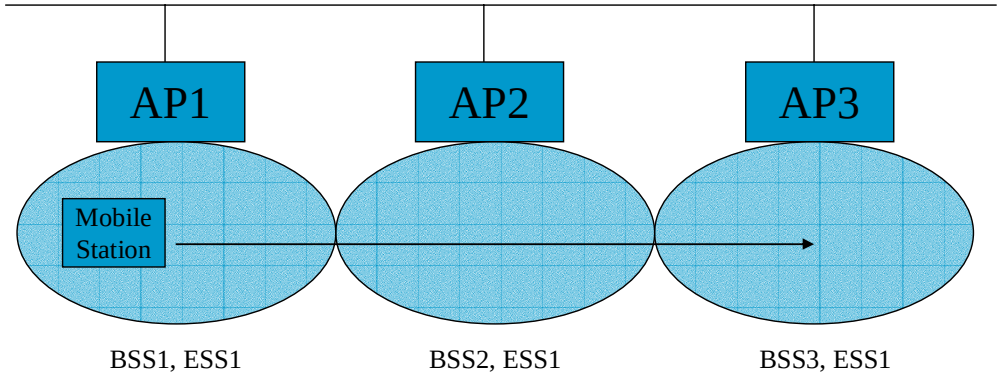
- Link layer Mobility
- Network layer Mobility
- Application layer Mobility

Link Layer Mobility (BSS Transition, MAC Layer Mobility)



- 802.11 provides MAC layer mobility within an Extended Service Set
- Stations continuously monitor the signal strength and quality from all access points.
- Link layer mobility provides a seamless transition from one AP to another
- Station in the distribution system can send out frames addressed to the MAC address of the other mobile station, Access Points take care of the final hop to the Mobile Stations.
- Link layer mobility requires cooperation of the Access Points
- A Standardised Inter-Access Point Protocol (IAPP) is likely to provide standardised method for the link layer mobility

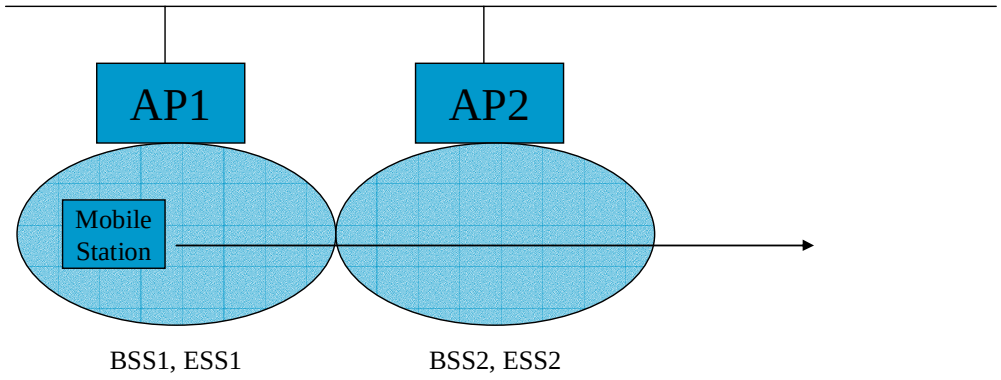
Link Layer Mobility (BSS Transition, MAC Layer Mobility)



- Latest activity in standardisation:
  - Task Group r (802.11r) investigates so called fast-roaming concept, Intra-ESS roaming, authentication and key exchange.

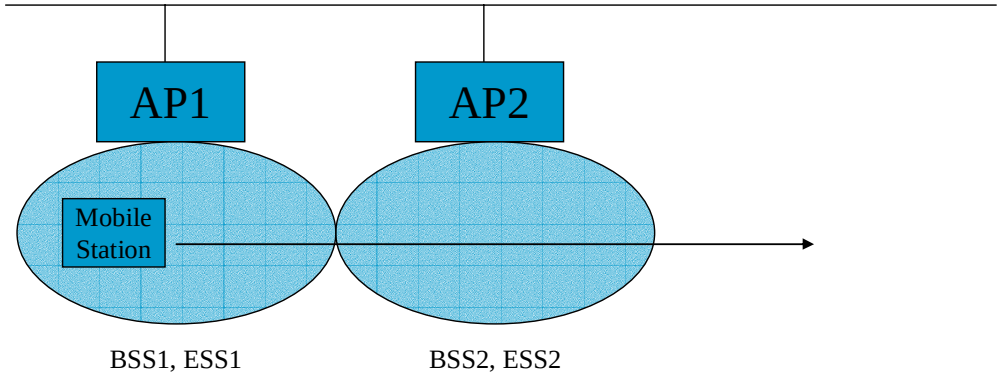
    802.11i will provide enhanced security and 802.11e will provide enhanced QoS.

Network Layer Mobility (ESS Transition)



- When Mobile Station moves from one ESS to another, the seamless transition is not supported without suitable protocol support.
- Mobile IP is considered to provide network layer mobility in WLAN networks
- Software client in the terminals are needed for mobility, which slows down the wide deployment
- The implementation differs between vendors

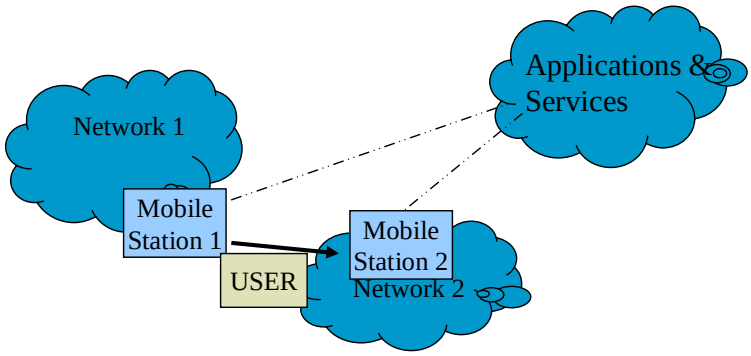
Network Layer Mobility (ESS Transition) : Mobile IP



Mobile IP

- Two IP addresses are allocated for the Mobile Station: ”Home Address” and so called ”care of Address”
- Mobile IP is based on the idea that the visited network informs the home network the ”care of” IP address where the visiting mobile station can be found.
- IP Mobility support is described in RFC 2002, edited by C. Perkins 1996
- Additional support and system components are needed: a Home Agent and a Foreigner Agent

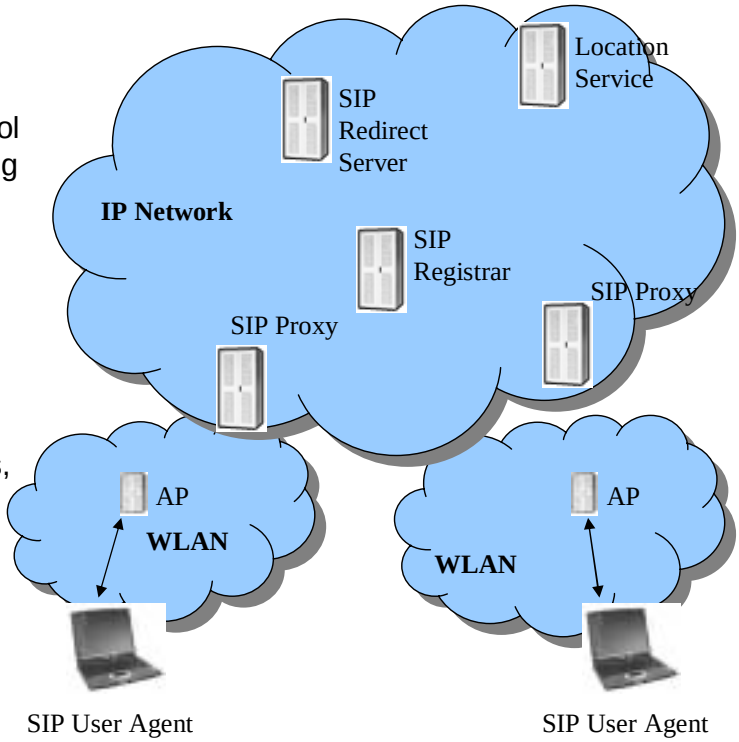
Application Layer Mobility (User Mobility, Personal Mobility, Session Mobility)



- Application Layer Mobility provides mobility of users instead of mobility of terminals or IP addresses.
- Users can use different terminals
- Application Layer Mobility is based on SIP (Session Initiation Protocol)
- SIP is designed by IETF and defined in RFC3261 (June 2002) (http://www.ietf.org/rfc/rfc3261.txt)
- SIP resembles HTTP
- 3GPP has adopted SIP for 3GPP Release 5 specifications

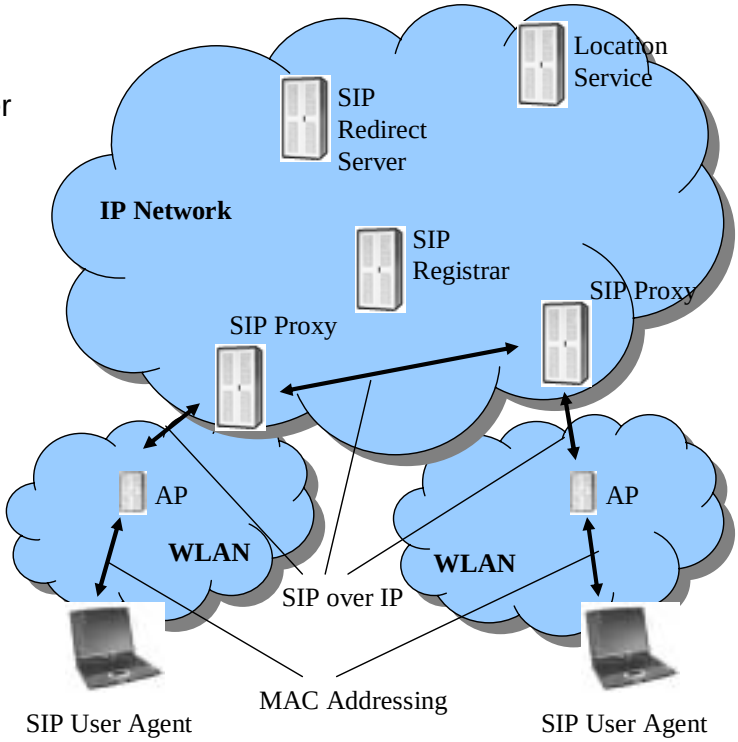
SIP (Session Initiation Protocol)

- The Session Initiation Protocol (SIP) is a protocol for establishing, controlling and releasing anything from VoIP calls to multiparty multimedia sessions over the packet networks
- The SIP architecture includes SIP User Agents, SIP Proxy servers, SIP Registrar, SIP Redirect Servers and Location Service.



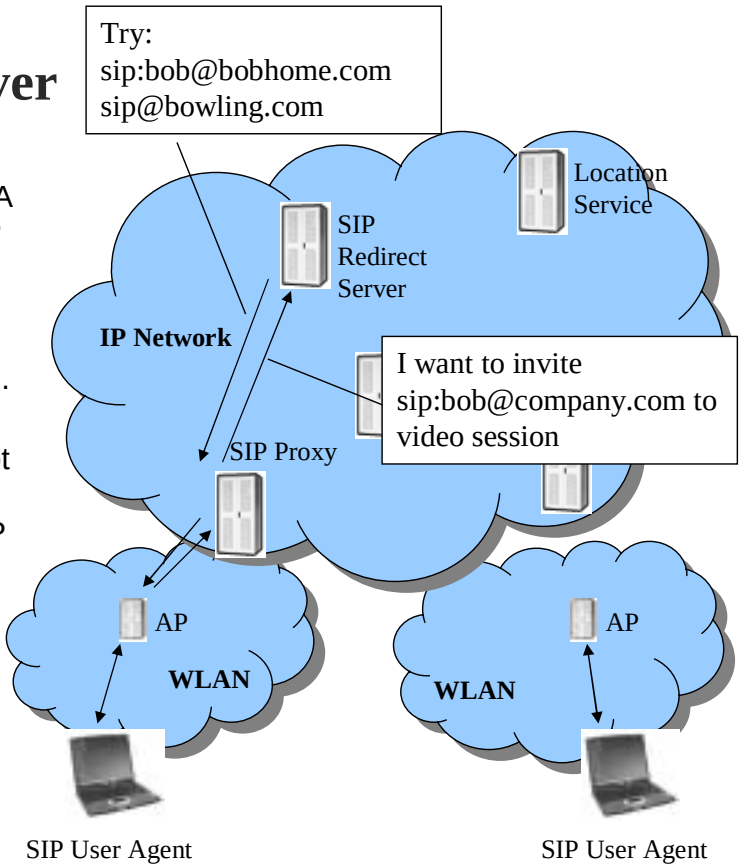
SIP – User Agents

- User Agents (UA) communicate with each other via intermediate servers during the call setup and directly with each other after the call setup.
- Typically the user agent is a software including user interface and SIP support.



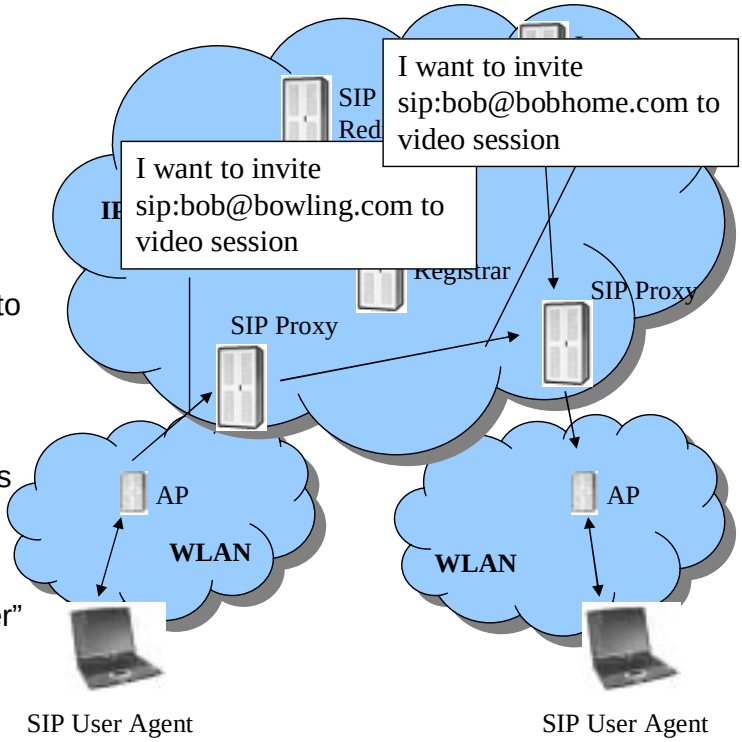
SIP Redirect Server

- When requested by a SIP UA or SIP Proxy Server, the SIP Redirect Server tries to help locating the user by offering possible SIP addresse(s) where the user can be found.
- SIP Redirect Server does not initiate any actions, but instead suggests a list of SIP addresses where the user can possibly be found.



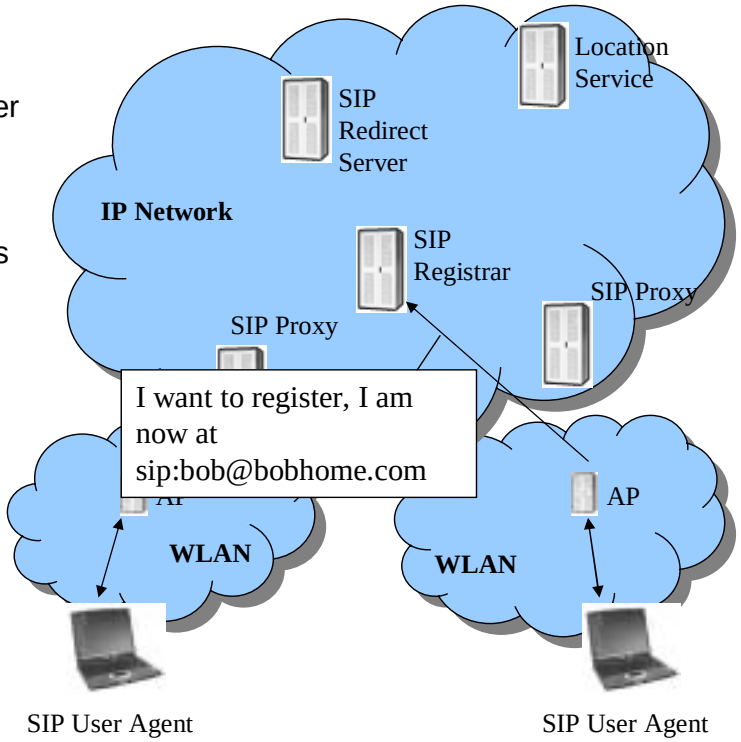
SIP Proxy

- SIP Proxy Servers forward the SIP messages to propriate next SIP Proxy or SIP UA.
- Unlike SIP Redirect Servers, it does not return the alternative SIP Address(es) to the UA but forwards the messages on behalf of the calling UA.
- There can be several Proxies on the signalling path between the SI Uas
- The generic term ”SIP Server” refers both to SIP Redirect and SIP Proxy Servers



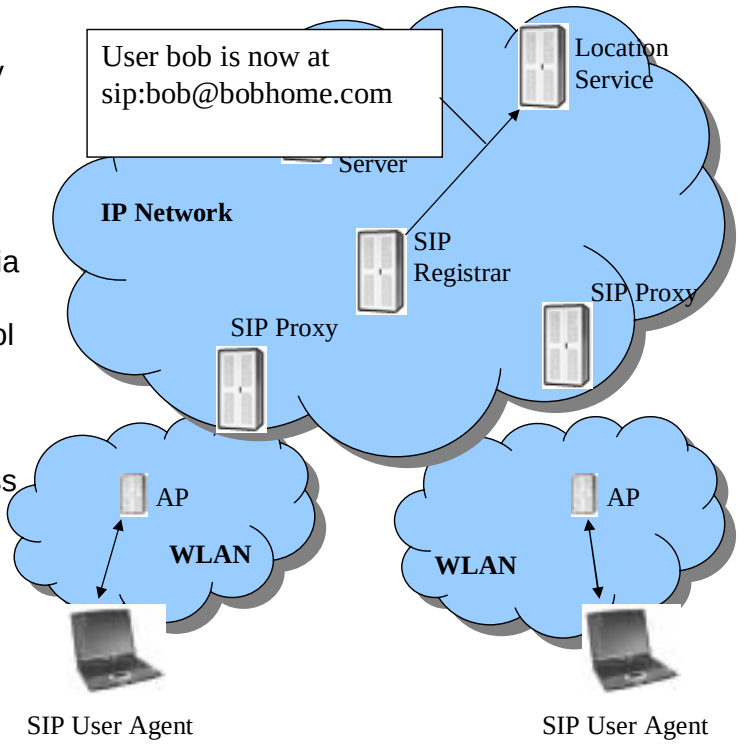
SIP Registrar

- Before a user can be reached, he/she must register in the network. This is done by sending a registration message to the ”SIP registrar” which then updates the relevant location database.
- The SIP Registrar is usually co-located with a redirect servers or a proxy server



Location Service

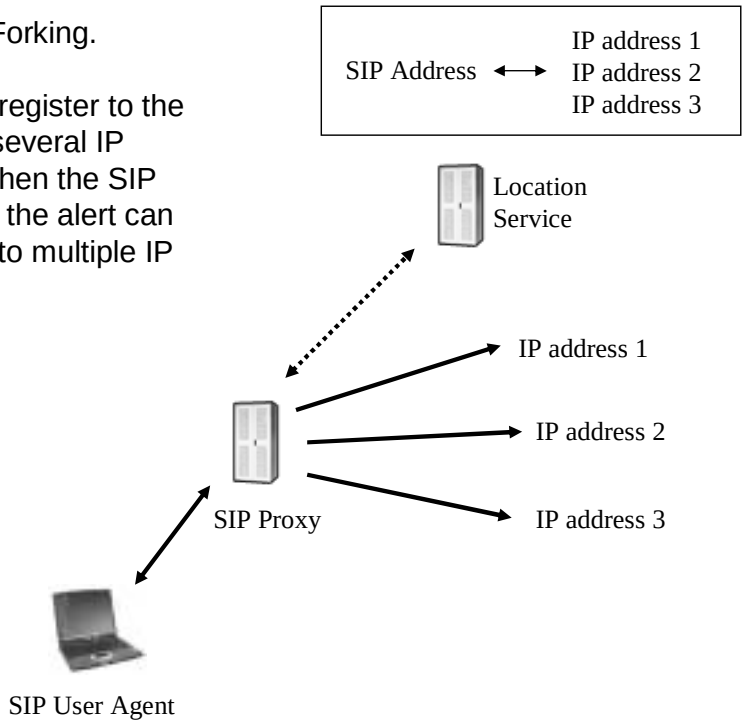
- Location servers are actually not SIP entities, but they are an important part of any architecture using SIP
- As an example, IP Multimedia Subsystem (specified by 3GPP) use Diameter protocol between SIP registrar and Location Service. Some systems use LDAP (Lightweight Directory Access Protocol)



SIP forking

- SIP Enables Forking.

  The user can register to the network with several IP addresses. When the SIP user is called, the alert can be forwarded to multiple IP addresses.

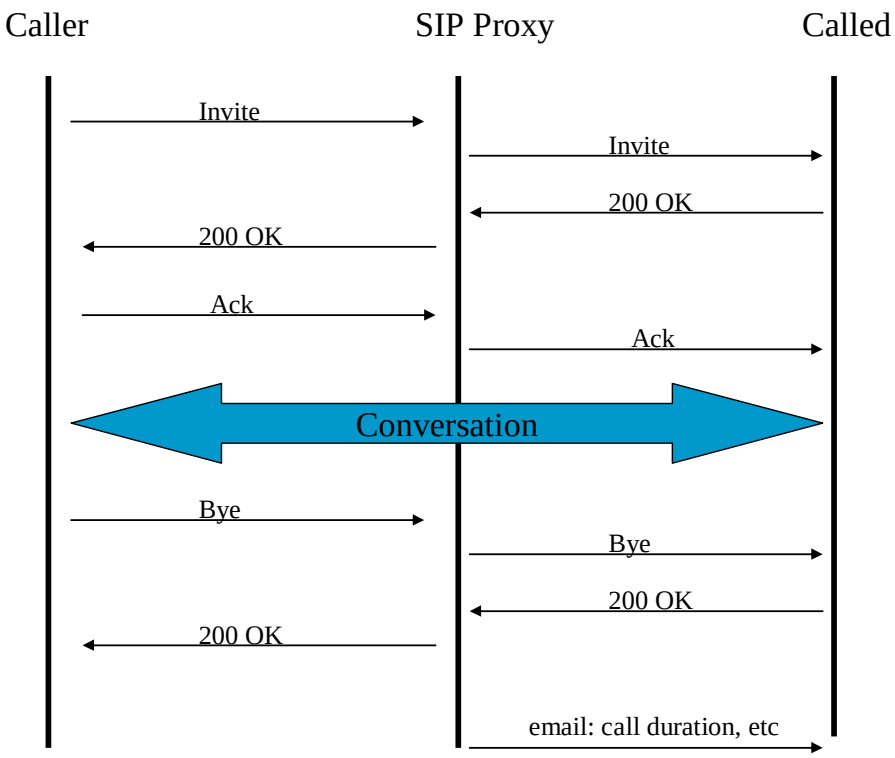


Structure of the SIP Message

- SIP message is a text based message
- A SIP Message containsof a start line, header fields, an empty line indicating the end of header and an optional message body.
- The message body is the SIP payload, it usually includes the session description. The session can be described, for example, with the Session Description Protocol (SDP)

```
INVITE sip:bob@biloxi.com SIP/2.0
Via: SIP/2.0/UDP pc33.atlanta.com;branch=z9hG4bK776asdhds
Max-Forwards: 70
To: Bob <sip:bob@biloxi.com>
From: Alice <sip:alice@atlanta.com>;tag=1928301774
Call-ID: a84b4c76e66710@pc33.atlanta.com
CSeq: 314159 INVITE
Contact: <sip:alice@pc33.atlanta.com>
Content Type: application/sdp
Content-Length: 142
```

SIP Protocol Operation



Acronyms

- 3GPP – 3G Partnership Project
- AP – Access Point
- BSS – Basic Service Set
- ESS – Extended Service Set
- HTTP – Hypertext Transfer Protocol
- IAPP – Inter Access Point Protocol
- IETF – Internet Engineering Task Force
- IP – Internet Protocol
- LDAP – Lightweight Directory Access Protocol
- MAC – Medium Access Protocol
- SDP – Session Description Protocol
- SIP – Session Initiation Protocol
- UA – User Agent
- VOIP – Voice Over IP

References

- http://www.ietf.org/rfc/rfc3261.txt
- SIP Demystified, G. Camarillo, McGraw-Hill 2002,
- 802.11 Wireless Networks, Matthew S.Gast, O'Reilly 2002
- http://groupee.ieee.org/groups/802/11

Homework

- Try to explain briefly why to use SIP instead of Mobile IP for application layer mobility? Explain briefly the benefits that SIP can offer.