GR 8

Secure Instant Messaging

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Context

- Motive
- Our Work
- Implementation Details
- References

Motive

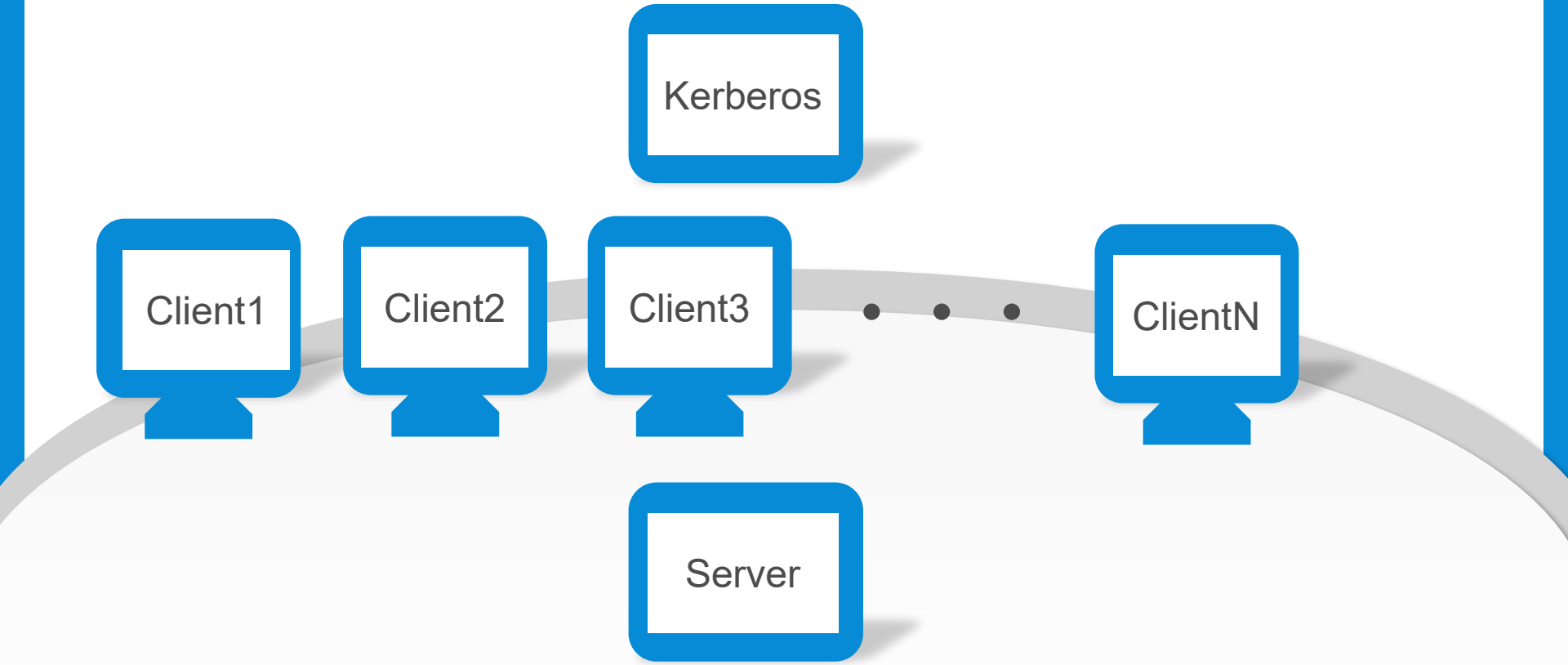
Security Challenges

- Replay
- Eavesdropping
- Replay
- …

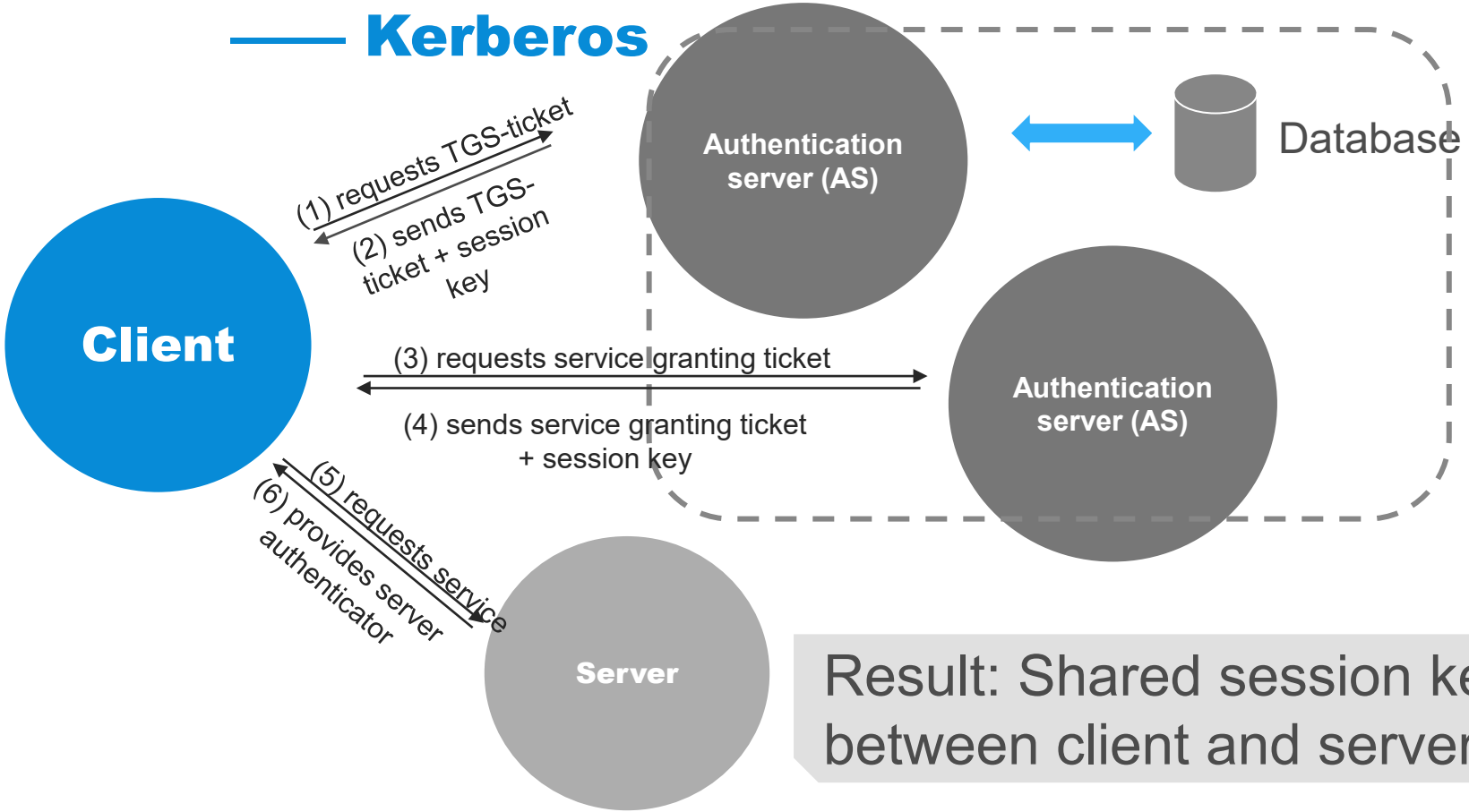
Our work

1. A secure instant messaging system
2. Functionality: logging in, online list, secure text messaging, etc.
3. Security Services: confidentiality, peer-entity and message authentication, integrity, nonrepudiation

Client-Server Architecture with Kerberos Authentication



Phase I : Authentication —— Kerberos

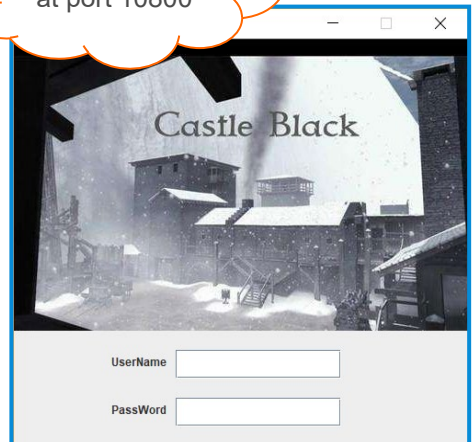


Result: Shared session key between client and server

Phase I


```
public AS() {
    sessiongeneration aeskey = new sessiongeneration();
    sessionkeytgsclient = aeskey.aeskey();
    begintime = a.begintime();
    endtime = a.endtime();
    try {
        ASsocket = new ServerSocket(10800);
    } catch (IOException e) {
        e.printStackTrace();
    }
}
```

AS listening at port 10800




```
String transmit = clientid + "@" + tgsid + "@" + begintime;
```

04fc711301f3c784d66955d98d399afb@11111111@20171212200526


```
if (tgsidfromsocket.equals(tgsid) && clientIdflag) {
    String tickettgsunprocess = sessionkeytgsclient + "@" + clientidfromsocket + "@" + tgsid;
    String tickettgs = AES.Encrypt(tickettgsunprocess, tgskey);
    String resultunprocess = sessionkeytgsclient + "@" + tgsid + "@" + tickettgs;
    result = AES.Encrypt(resultunprocess, clientkey);
    System.out.println("the TGS ticket in AS is " + tickettgs);
} else {
    result = "unauthorized client";
}
```

suTguRN2FjschXw=@11111111@
4f15e903add2d7b557613ea42588
53b0255e3fe4442166b59d692cd8c
969ca58fffaf45e56109b649a4cb2d
b78f13c9e35cd8b565ba938435203
67282e30cbf4

Request TGS

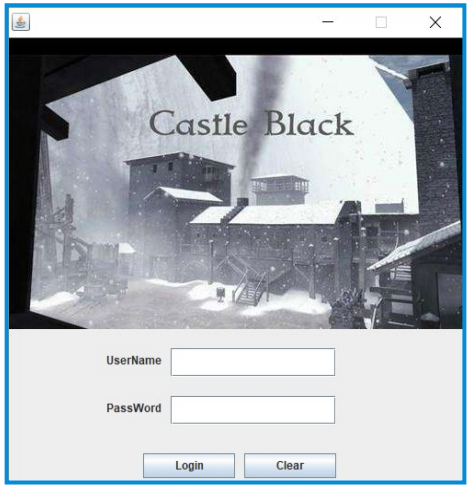
Client → TGS

```
public TGS() {
    sessiongeneration aeskey = new sessiongeneration();
    sessionkeyclientserver = aeskey.aeskey();
    try {
        TGSsocket = new ServerSocket(10801);
    } catch (Exception e) {
        e.printStackTrace();
    }
```

TGS listening at port 10801

```
String auth = AES.Encrypt(clientid, sessionkeytgsclient);
String transmit = serverid + "@" + tickettgs + "@" + auth;
```

222222222@4f15e903add2d7b557613ea4258853b0255e3fe4442166b59d692cd8c969ca58fffaf45e56109b649a4cb2db78f13c9e35cd8b565ba93843520367282e30cbf4@2d6a80c862c1039de8bc9d21a2251b25

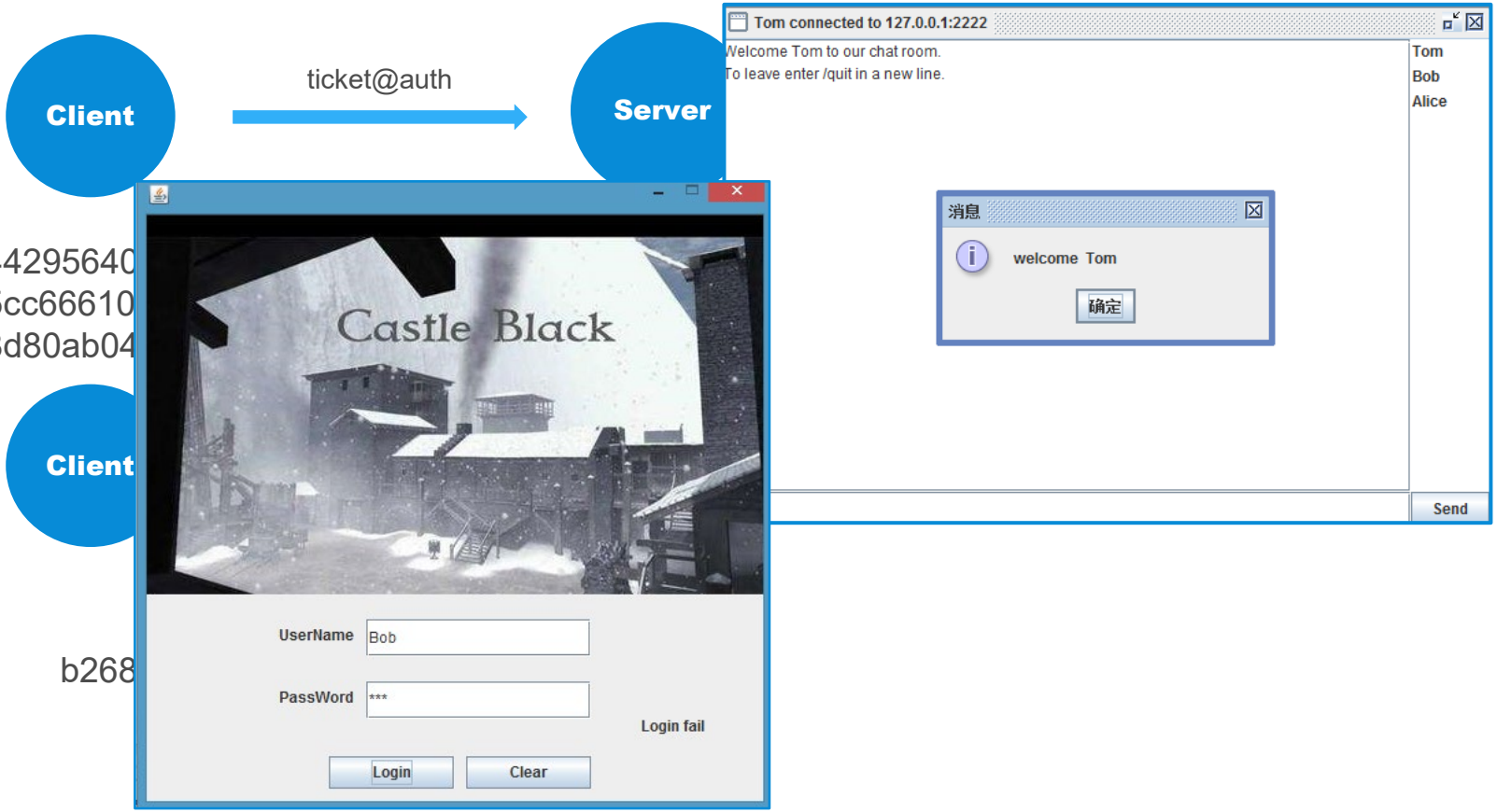


Client ← TGS

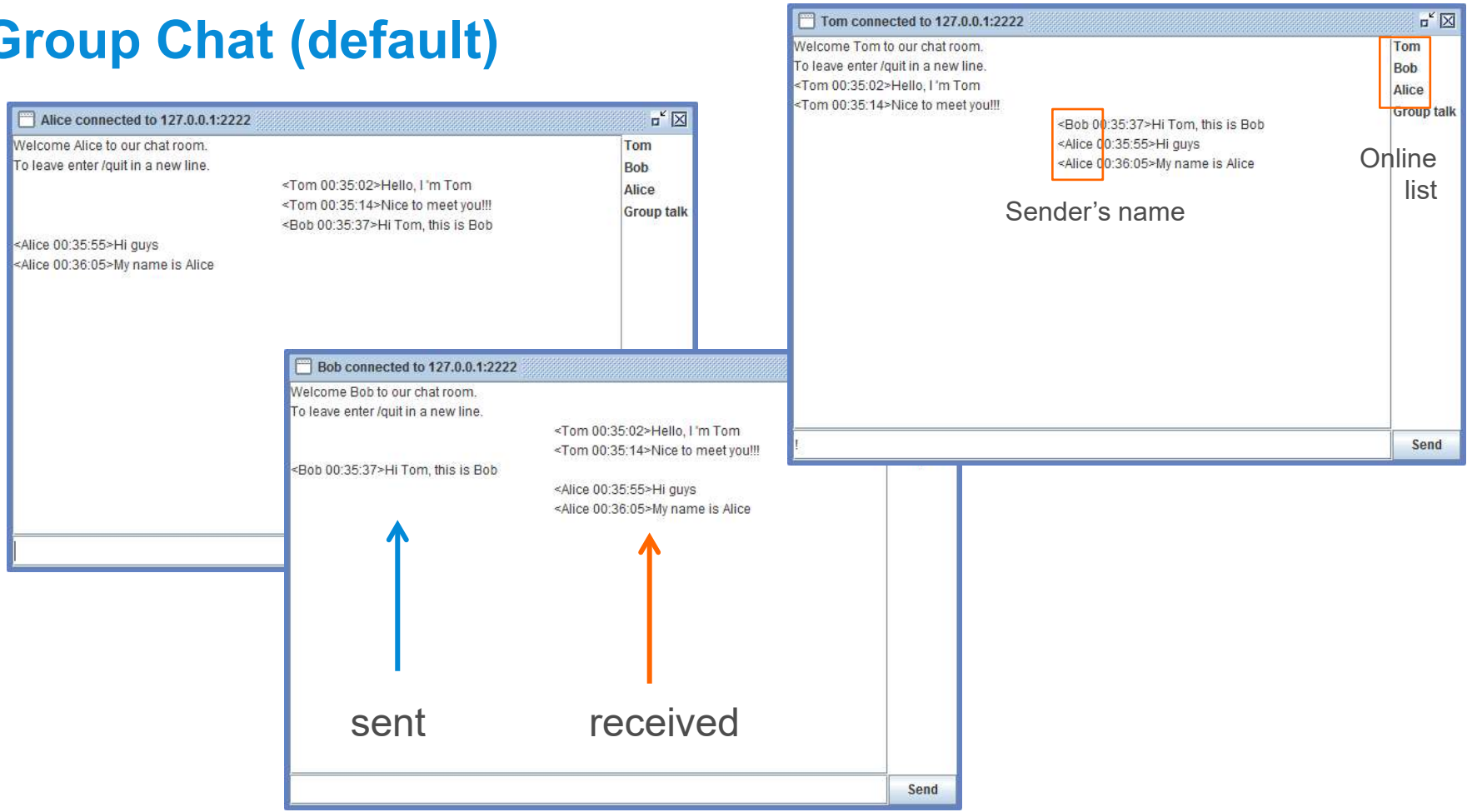
ofBtvBWdGZ3LDio=@222222222@442956401baf0a28359cd224f54ccfbf395df880e32f65cc66610139d98b3ba4ed76e6e2f9c1003d26117d6d8d80ab04

```
if(clientidfromAS.equals(clientidfromclient)&&TGSidfromAS.equals(tgsid)&&serveridfromclient.equals(serverid)){
    String ticketserverunprocess = sessionkeyclientserver + "@" + clientidfromclient + "@" + serverid;
    String ticketserver = AES.Encrypt(ticketserverunprocess, serverkey);
    String transmitunprocess = sessionkeyclientserver + "@" + serverid + "@" + ticketserver;
    result = AES.Encrypt(transmitunprocess, sessionkeytgsclient);
}else{
    result = "unauthorized client";
}
```

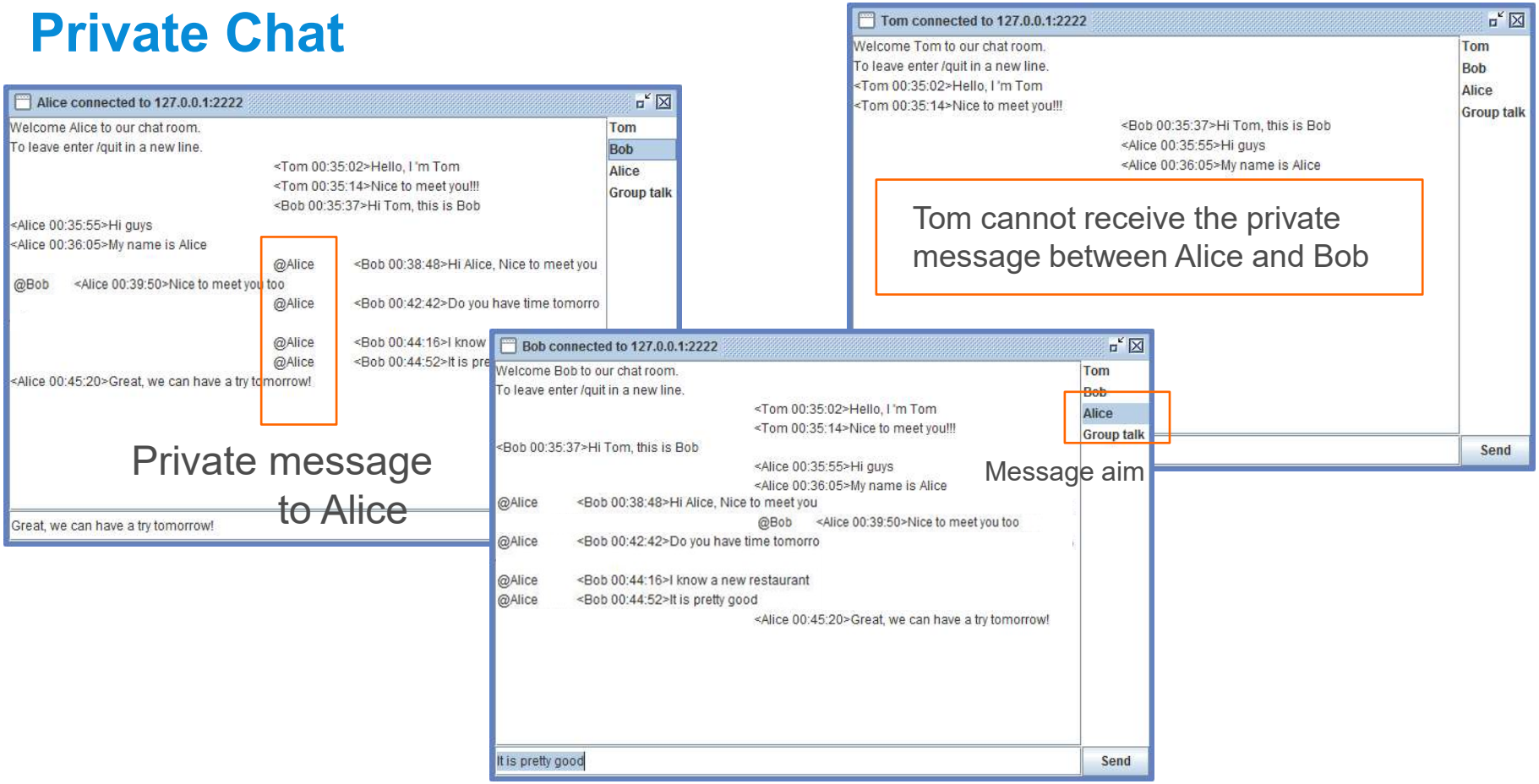
Connect to server



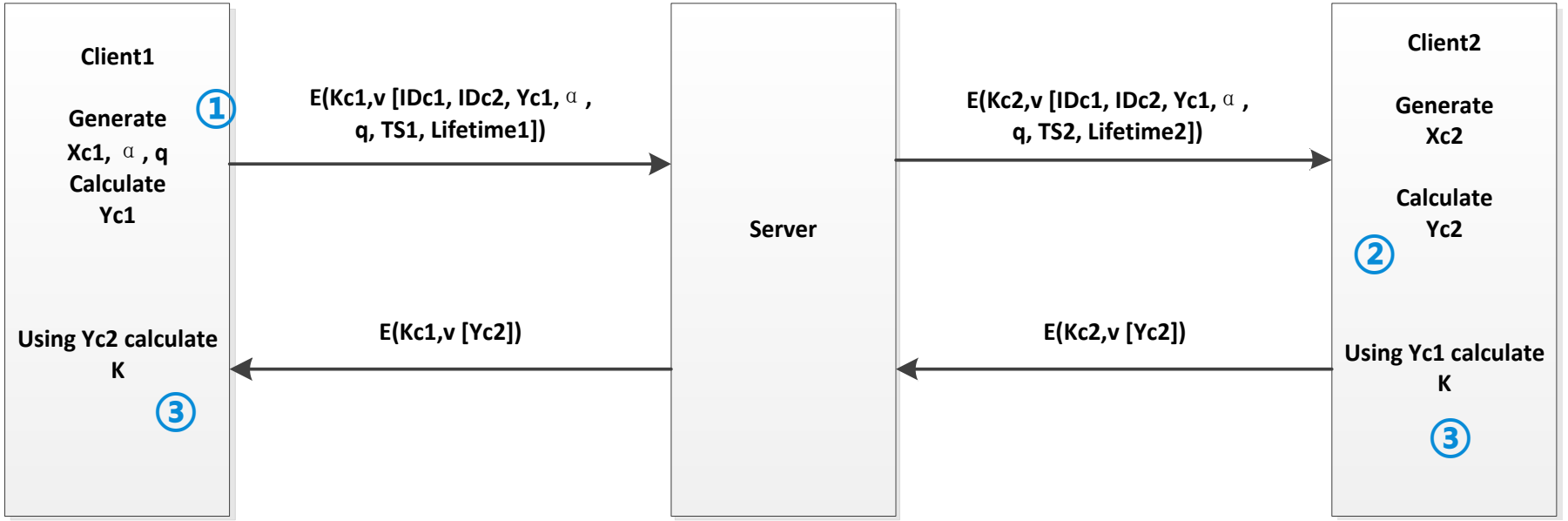
Group Chat (default)



Private Chat



Phase II : Client Key Exchange
—— Diffie-Hellman Algorithm



Result: Exchange secret key K between Client1 and Client2

Phase II : Client Key Exchange
—— Diffie-Hellman Algorithm

①

```
public HQKeyPair initPartyAKey(int keySize) throws NoSuchAlgorithmException
{
    KeyPairGenerator keyPairGen = KeyPairGener
    keyPairGen.initialize(1024);
    KeyPair keyPair = keyPairGen.generateKeyPa
    return new HQKeyPair(keyPair);
}
```

②

```
public HQKeyPair initPartyBKey(byte[] partyAPublicKey) throws Exception
{
    X509EncodedKeySpec x509KeySpec = new X509EncodedKeySpec(partyAPublicKey);
    KeyFactory keyFactory = KeyFactory.getInstance(ALGORITHM);
    PublicKey pubKey = keyFactory.generatePublic(x509KeySpec);

    DHParameterSpec dhParamSpec = ((DHPublicKey) pubKey).getParams();

    KeyPairGenerator keyPairGenerator = KeyPairGenerator.getInstance(keyFactory.getAlgorithm());
```

③

```
private SecretKey getSecretKey(byte[] publicKey, byte[] privateKey, String algorithm) throws Exception
{
    KeyFactory keyFactory = KeyFactory.getInstance(ALGORITHM);
    X509EncodedKeySpec x509KeySpec = new X509EncodedKeySpec(publicKey);
    PublicKey pubKey = keyFactory.generatePublic(x509KeySpec);

    PKCS8EncodedKeySpec pkcs
    Key priKey = keyFactory.

    KeyAgreement keyAgree =
    keyAgree.init(priKey);
    keyAgree.doPhase(pubKey,

    SecretKey secretKey = ke

    return secretKey;
}
```

Problems | Javadoc | Declaration | Console | LogCat

```
login (1) [Java Application] D:\softwear\JDK\bin\javaw.exe (2017-12-14 上午4:16:25)
B_PublicKey: MIIBpjCCARsGCSqGSIb3DQEDATCCAQwCgYEA/X9TgR11EilS30qcLuzk5/YRt1I870QAwx4/gLZRJmlFXUAiUftZPY1Y+r/F9bow9subVWzXgTuAHTRv8mZgt2uZUKWk
A_PrivateKey: MIIBZwIBADCCARsGCSqGSIb3DQEDATCCAQwCgYEA/X9TgR11EilS30qcLuzk5/YRt1I870QAwx4/gLZRJmlFXUAiUftZPY1Y+r/F9bow9subVWzXgTuAHTRv8mZgt2u
secretKey: EDxcpK7f6hy5JvQ=
========================================
before encrypte: <Bob 04:16:55>Hello everyone
after encrypte: a5d047b7a246c2033084630ed8a581fa8d04ac0dedfe0cca00669eac7f220cdd
========================================
before_decrypte: a5d047b7a246c2033084630ed8a581fa8d04ac0dedfe0cca00669eac7f220cdd
after_decrypte: <Bob 04:16:55>Hello everyone
========================================
```

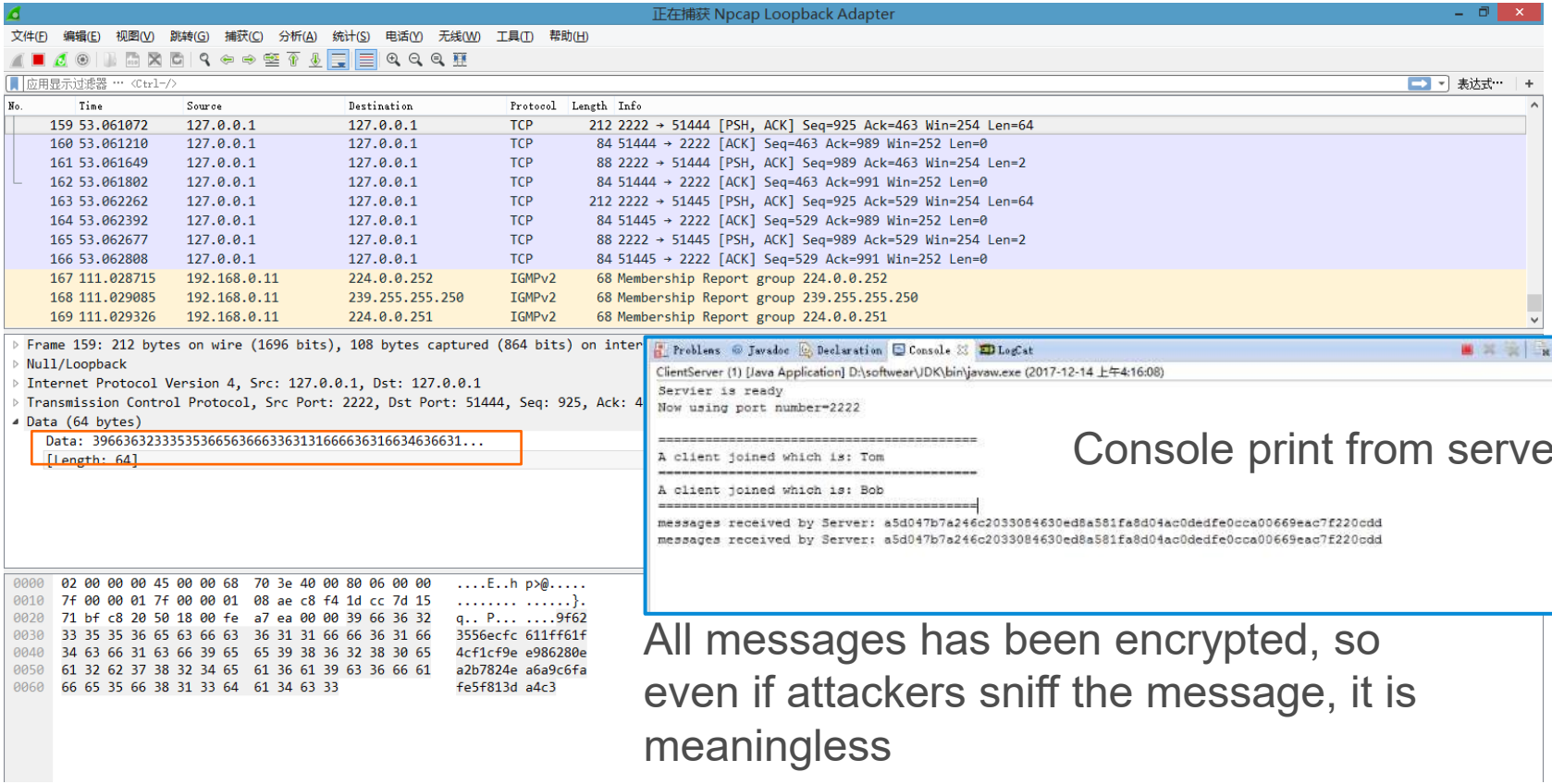
Console print from client

Phase III : Encrypted Communication —— AES

```java
// encryption
public static String Encrypt(String plaintext, String sKey) throws Exception {
    if (sKey == null) {
        System.out.println("Key cannot be null");
        return null;
    }

    if (sKey.length() != 16) {
        System.out.println("Key's length must be 16");
        return null;
    }

    byte[] raw = sKey.getBytes();
    SecretKeySpec skeySpec = new SecretKeySpec(raw, "AES");
    Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5Padding");
    IvParameterSpec iv = new IvParameterSpec("0102030405060708".getBytes());
    cipher.init(Cipher.ENCRYPT_MODE, skeySpec, iv);
    byte[] encrypted = cipher.doFinal(plaintext.getBytes());

    return byte2hex(encrypted).toLowerCase();
}
```

```java
public static String Decrypt(String myCipher, String sKey) throws Exception {
    try {

        if (sKey == null) {
            System.out.println("Key cannot be null");
            return null;
        }

        if (sKey.length() != 16) {
            System.out.println("Key's length must be 16");
            return null;
        }

        byte[] raw = sKey.getBytes("ASCII");
        SecretKeySpec skeySpec = new SecretKeySpec(raw, "AES");
        Cipher cipher = Cipher.getInstance("AES/CBC/PKCS5Padding");
        IvParameterSpec iv = new IvParameterSpec("0102030405060708".getBytes());
        cipher.init(Cipher.DECRYPT_MODE, skeySpec, iv);
        byte[] encrypted1 = hex2byte(myCipher);

        try {
            byte[] original = cipher.doFinal(encrypted1);
            String originalString = new String(original);
            return originalString;
        } catch (Exception e) {
            System.out.println(e.toString());
            return null;
        }

            } catch (Exception ex) {
                System.out.println(ex.toString());
                return null;
            }
        }
```

Bad Test --Sniffing



Reference

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6. Anita Narwal, Sunita Tomar. (2015) Kerberos Protocol: A Review
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Thank you

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