Kerberos in Your JVM

An Introduction to Apache Kerby

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Kiran Ayyagari

- Apache Member
- Chairman of Apache Directory Project
- Involved with ApacheDS since 2008
- Independent Consultant

What is Kerberos?

- An authentication protocol
- Designed to work over untrusted networks
- Passwords are NOT sent over wire

continued…

What is Kerberos?

- A classical Single SignOn solution
- Authorization at OS host level

How Does it Work?

KEYDAP

Participants

Alice

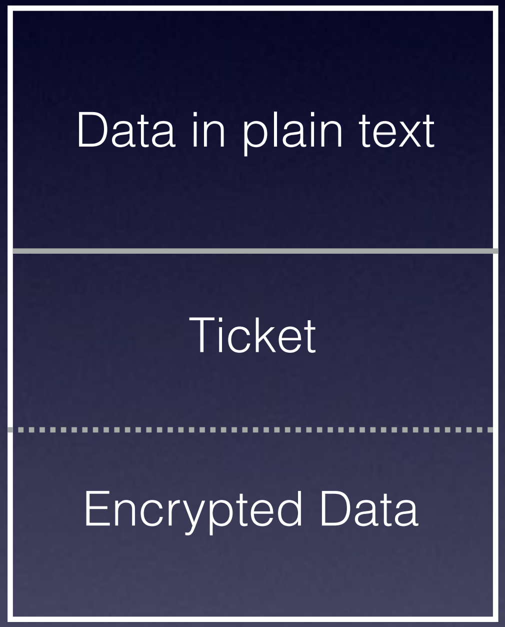
Authentication Server + Ticket Granting Server

Kerberos Server

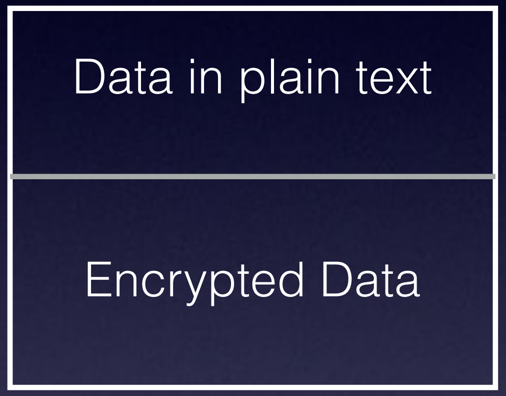
Bob

General Payload Structure

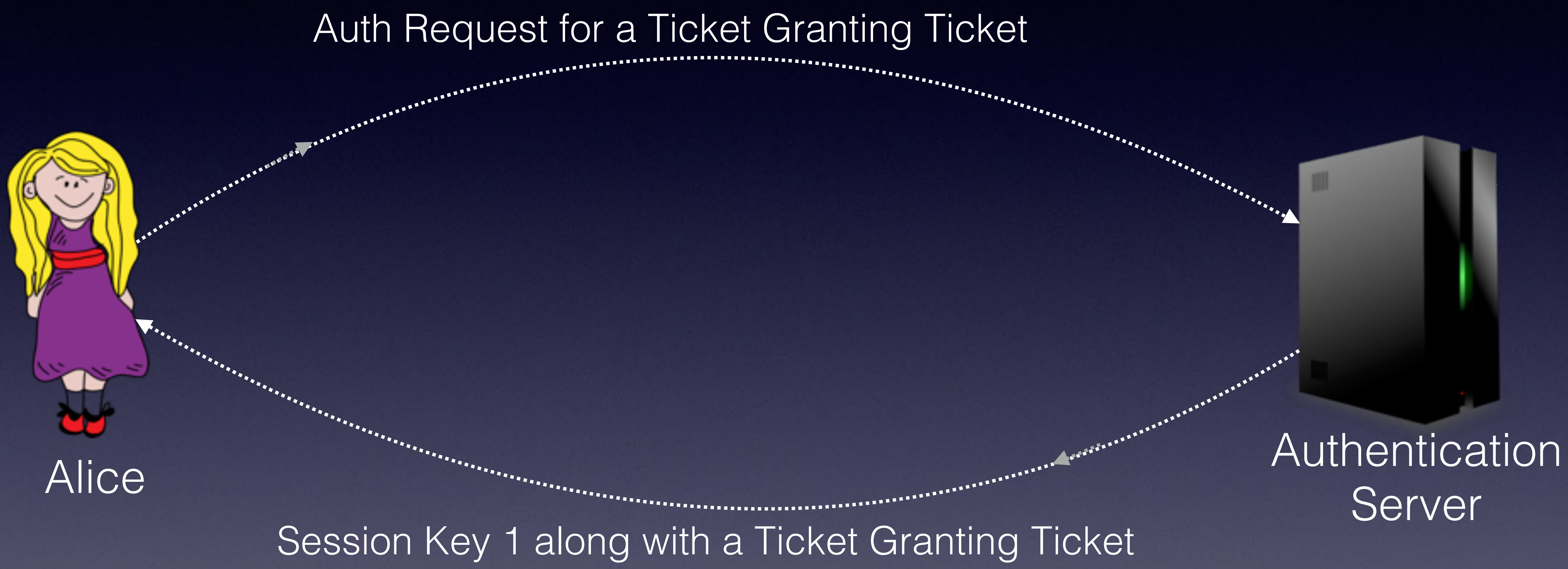
General Request/Response Payload



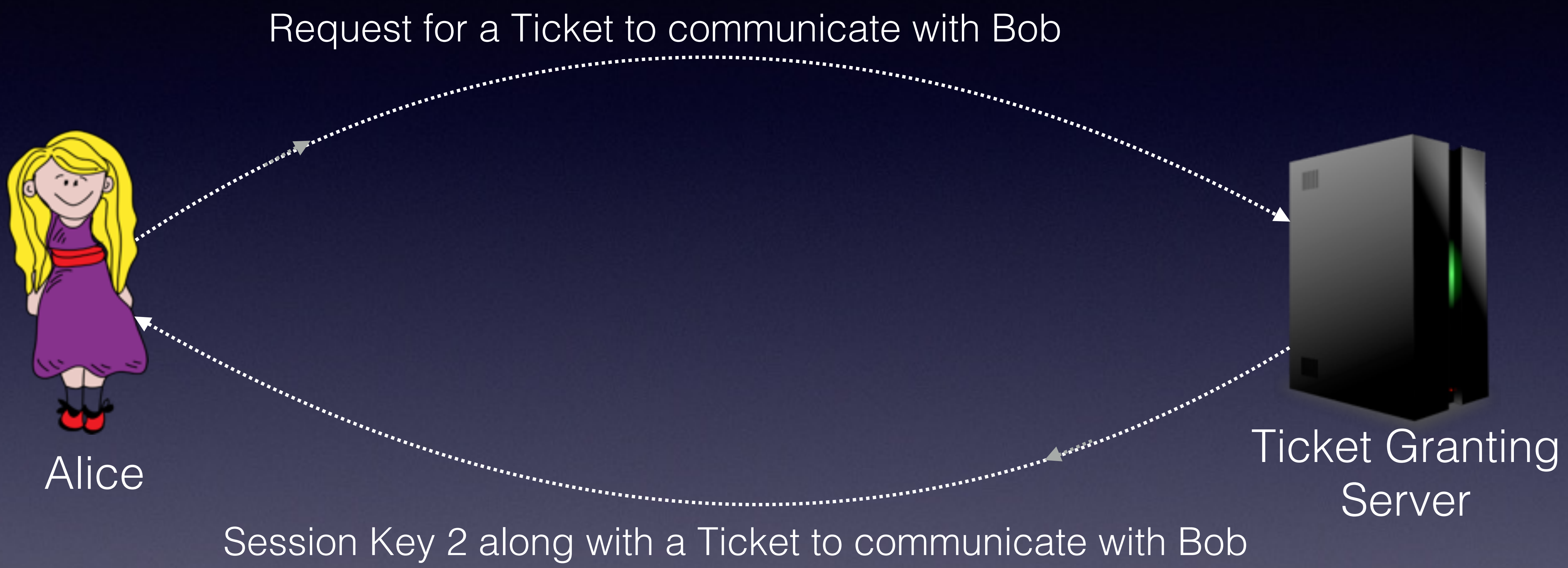
Ticket



Part - I


Auth Request for a Ticket Granting Ticket
Alice
Authentication Server
Session Key 1 along with a Ticket Granting Ticket

Part - II



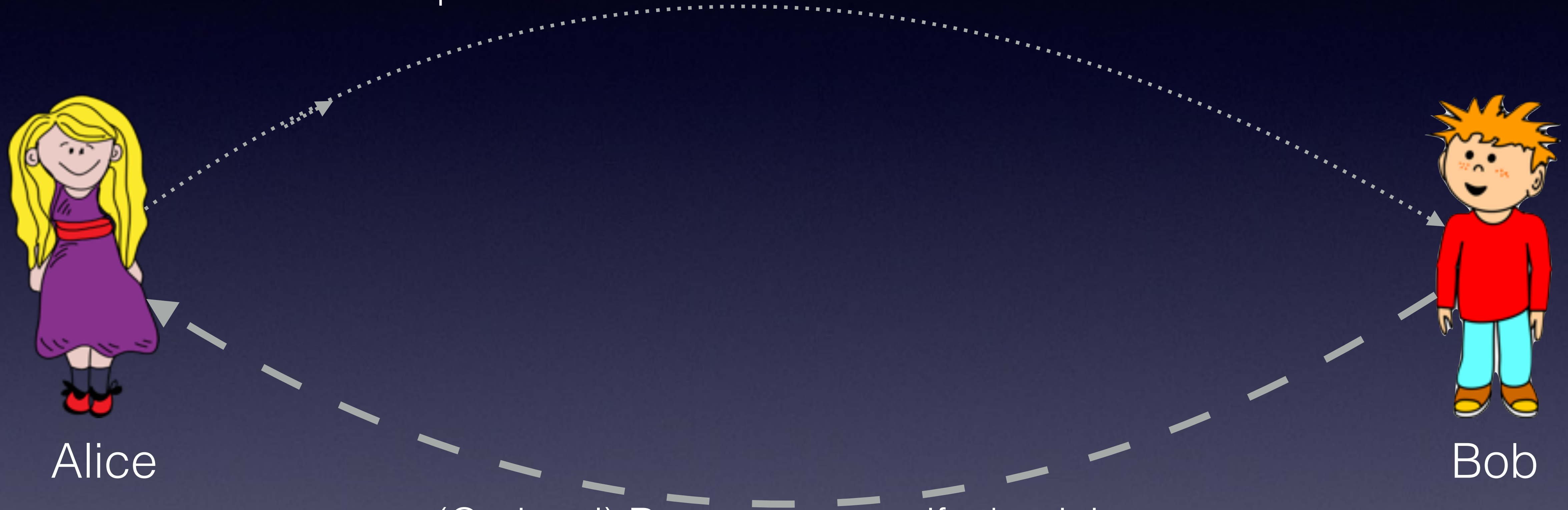
Request for a Ticket to communicate with Bob

Alice

Ticket Granting Server

Session Key 2 along with a Ticket to communicate with Bob

Part - III



Request with the session Ticket to Bob

Alice

Bob

(Optional) Response to verify that it is Bob indeed (mutual verification)

Where it is Used?

In authenticating users

- on workstations
- in network services like SSH, FTP

and in Apache Hadoop

Kerberos at Apache?

- Part of ApacheDS since 2004
- Written by one person, Enrique Rodriguez
- Tightly coupled with LDAP backend
- Totally reviewed in 2010
- Client implementation was added in 2011

ApacheDS Kerberos Status?

- Functional
- Tightly coupled with Directory Server
- Lacks many features (cross-realm, pkinit, FAST etc..)
- Complex codebase
- Not enough maintainers

What’s Next?

- Zheng Kai from Intel started working on a simplified codec
- Proposed to bring his effort to Apache Directory Project
- Jiajia Li, Lin Chen and Xu Yanning, all from Intel joined the effort
- Development was apace and resulted in release of a fully functional server and client with several features

Apache Kerby

- http://directory.apache.org/kerby
- A Kerberos v5 server written in java
- Can run standalone or in-process
- supports transient and numerous persistent storage options
- Bundled with a client, kadmin and other utilities
- An excellent choice for unit testing kerberized clients and servers

Embedding Kerby

```
 KdcServer kdc = new KdcServer();
 NettyKdcServerImpl network = new NettyKdcServerImpl(kdc.getKdcSetting());

 kdc.setXXX(); // set the basic settings, host, port, protocol and realm
 kdc.init();
 kdc.start();

 kadmin = new Kadmin( kdc.getKdcSetting(), kdc.getIdentityService() );
 kadmin.createBuiltinPrincipals();
 kadmin.addPrincipal( "elecharny", "sha1024" );

// THAT IS ALL ;)
```

Kerby in Unit Tests

```
@BeforeClass
 public static void setup() throws Exception {
     // start KDC
    // initialize client
}

 @AfterClass
 public static void stop() throws Exception {
    // stop KDC
 }

 @Test
 public void testGetTGTicket() throws Exception {
     TgtTicket tgt = client.requestTgtWithPassword("el@EXAMPLE.COM", "secret");
     assertNotNull(tgt);
 }
```

Using Kerberos over HTTP?

- SPNEGO works but won’t work out of box everywhere
- JWT seems promising

JSON Web Token

- A compact URL-safe means of representing claims to be transferred between two parties
- Contains a Header, Claims and Signature <header>.<claims>.<signature>
- All parts are Base64 encoded individually
- Header: {"typ":"JWT", “alg”:”HS256"}
- Claims: {“iss”:"elecharny", "exp":1300819380}

Example App

https://github.com/kayyagari/krb2jwt

Kerberos Ticket to JWT

JWT Header :

```
    {
      "srvtkt": <base64-encoded-Ticket>,
      "keytype": “aes128-cts-hmac-sha1-96",
      "alg": “HS512”
    }
```

JWT Claims :

```
   {
      "aud": "webapp1@EXAMPLE.COM",
      "exp": "1443706562444",
      "iat": "1443706262444",
      "iss": "krb2jwt",
      "sub": "elecharny@EXAMPLE.COM"
  }
```

Usecases of Krb2JWT

- HTTP clients communicating via backchannel
- Hadoop nodes

Roadmap

- PKINIT
- Cross-Realm
- OTP based ticket granting

Questions?

http://directory.apache.org/kerby

Thank You!

Zheng Kai and his band at Intel

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