Easy Application Security with Apache Shiro

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- Identity Management and Access Control API
- Security for ***your*** applications
- User security workflows
- Security best practices
- Developer tools, SDKs, libraries

What is Apache Shiro?

- Application security framework
- ASF TLP http://shiro.apache.org
- Quick and Easy
- Simplifies Security

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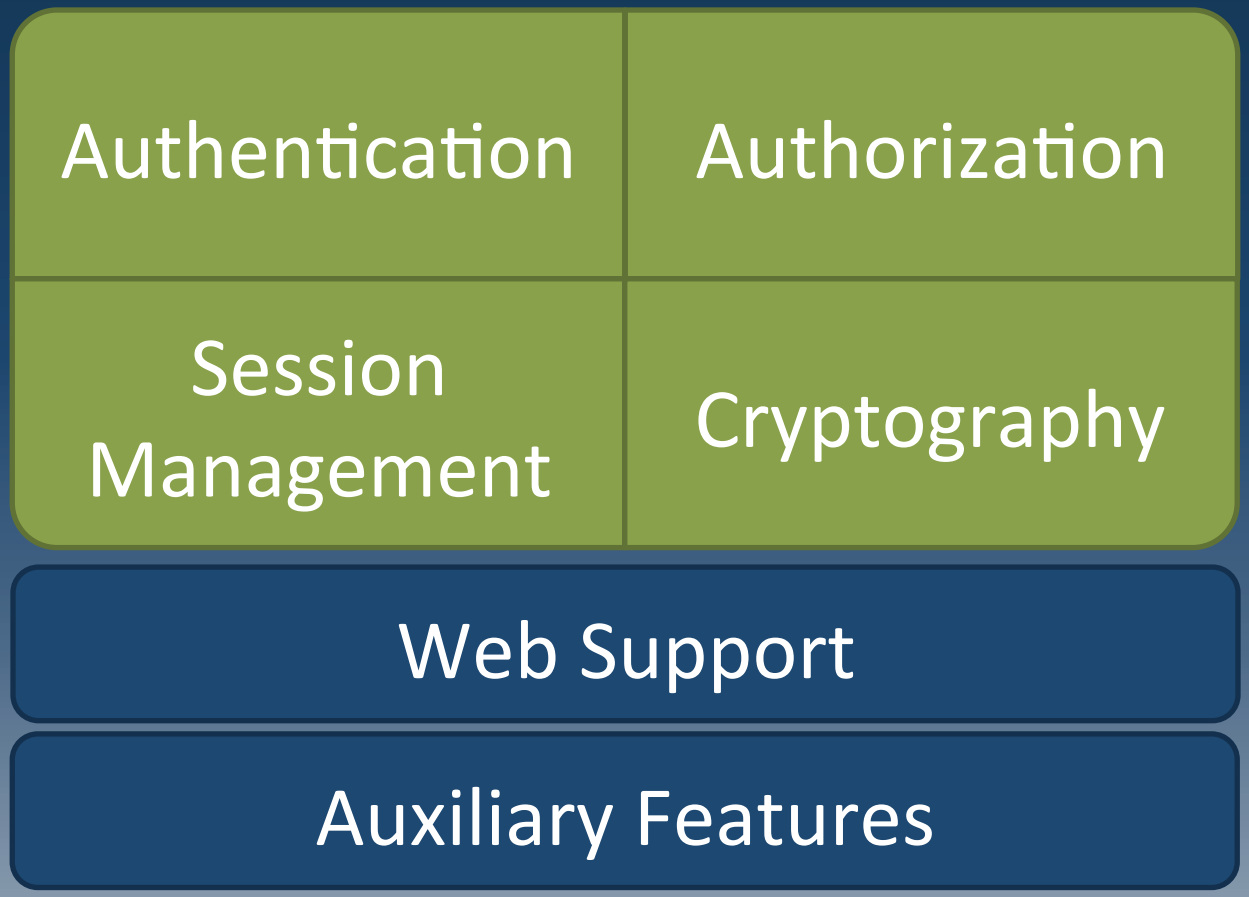
Agenda



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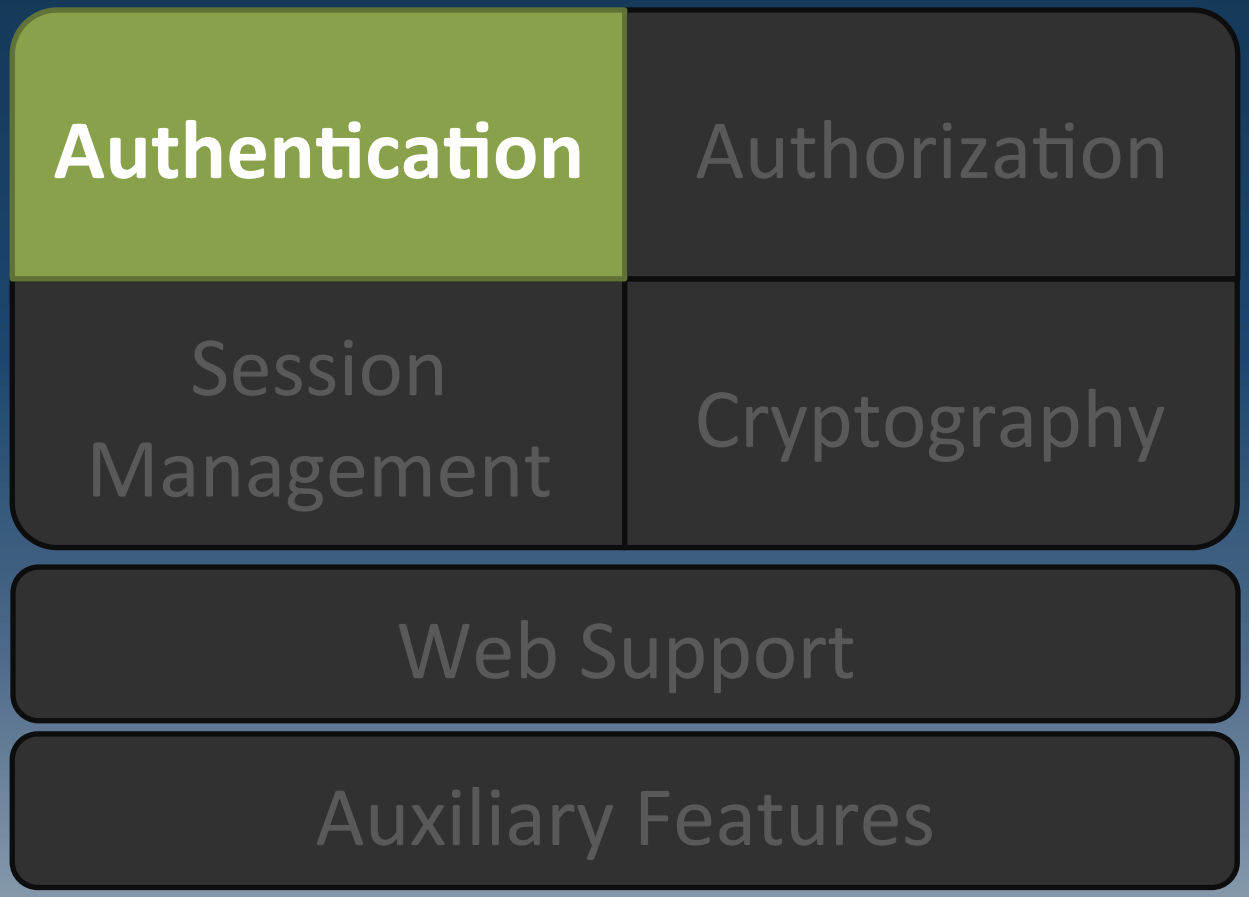
Quick Terminology

- **Subject** – Security-specific user 'view'
- **Principals** – Subject's identifying attributes
- **Credentials** – Secret values that verify identity
- **Realm** – Security-specific DAO

Authentication



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Authentication Defined

Identity verification:

Proving a user is who he says he is

Shiro Authentication Features

- Subject-based (current user)
- Single method call
- Rich Exception Hierarchy
- ‘Remember Me’ built in
- Event listeners

How to Authenticate with Shiro

Steps

1. Collect principals & credentials
2. Submit to Authentication System
3. Allow, retry, or block access

Step 1: Collecting Principals & Credentials

```
UsernamePasswordToken token = new
  UsernamePasswordToken(username, password);

//"Remember Me" built-in:
token.setRememberMe(true);
```

Step 2: Submission

```
Subject currentUser =
   SecurityUtils.getSubject();

currentUser.login(token);
```

Step 3: Grant Access or Handle Failure

```
try {
    currentUser.login(token);
} catch (UnknownAccountException uae ){ ...
} catch (IncorrectCredentialsException ice { ...
} catch ( LockedAccountException lae ) { ...
} catch ( ExcessiveAttemptsException eae ) { ...
} ... catch your own ...
} catch ( AuthenticationException ae ) {
    //unexpected error?
}
//No problems, show authenticated view…
```

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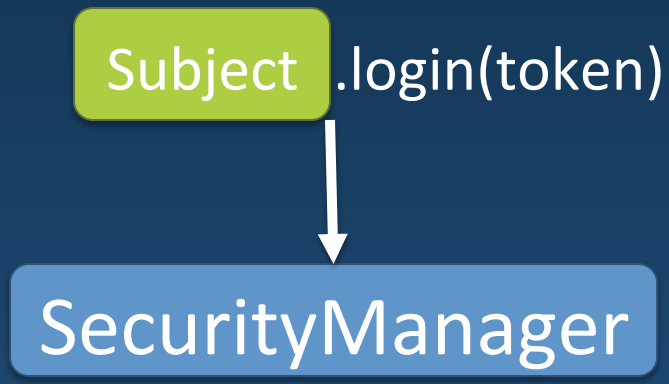
How does it work?

Subject .login(token)

How does it work?



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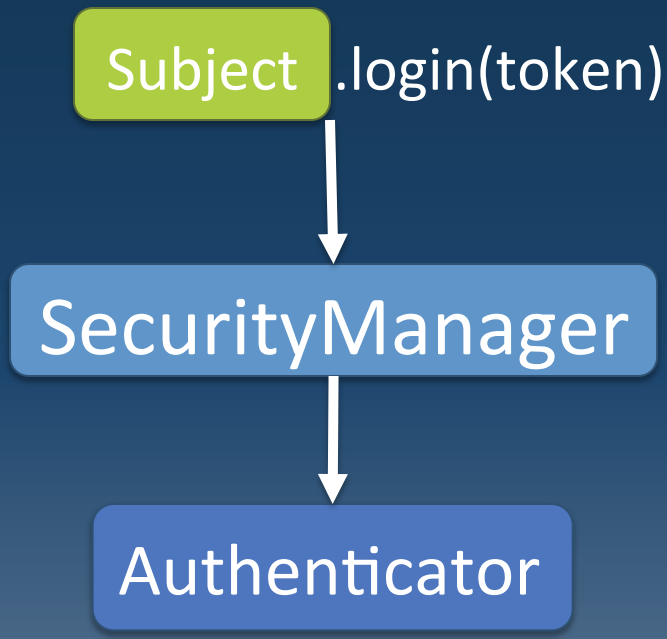

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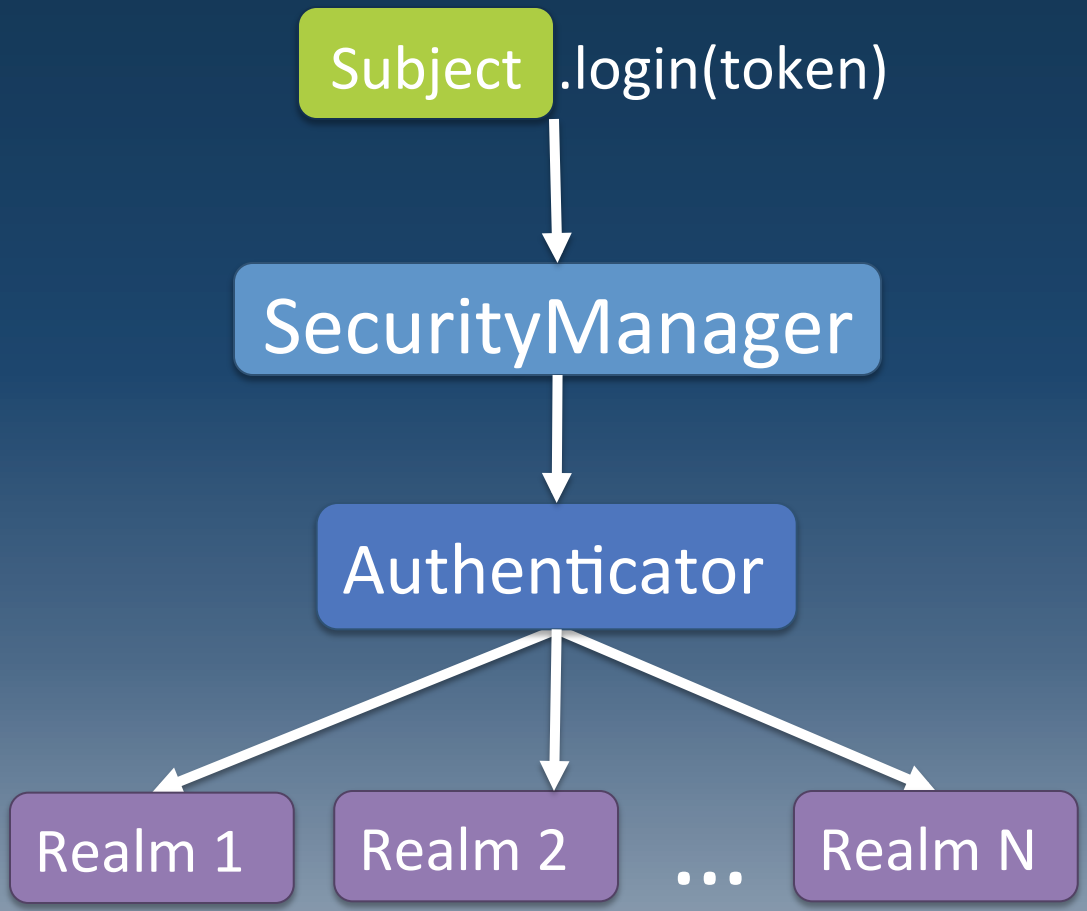

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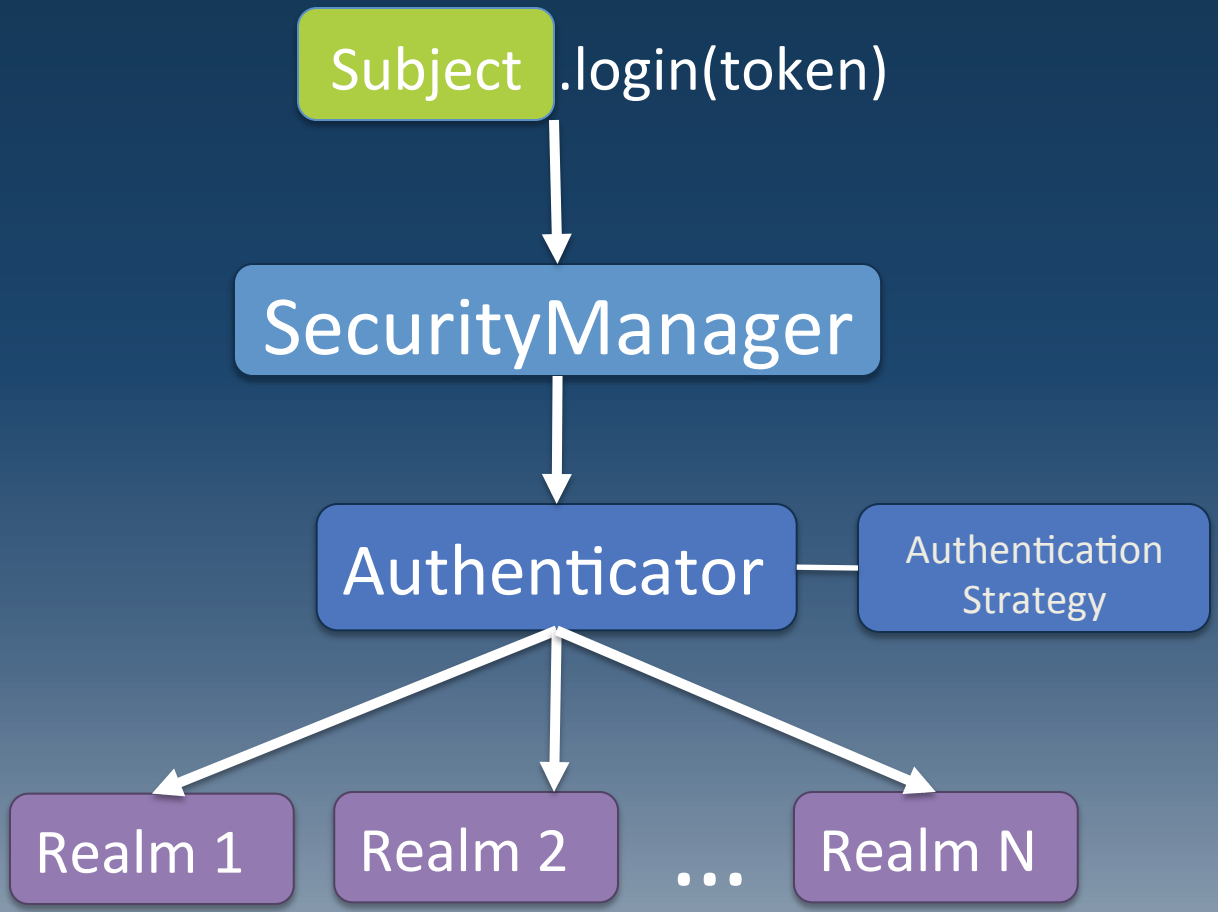

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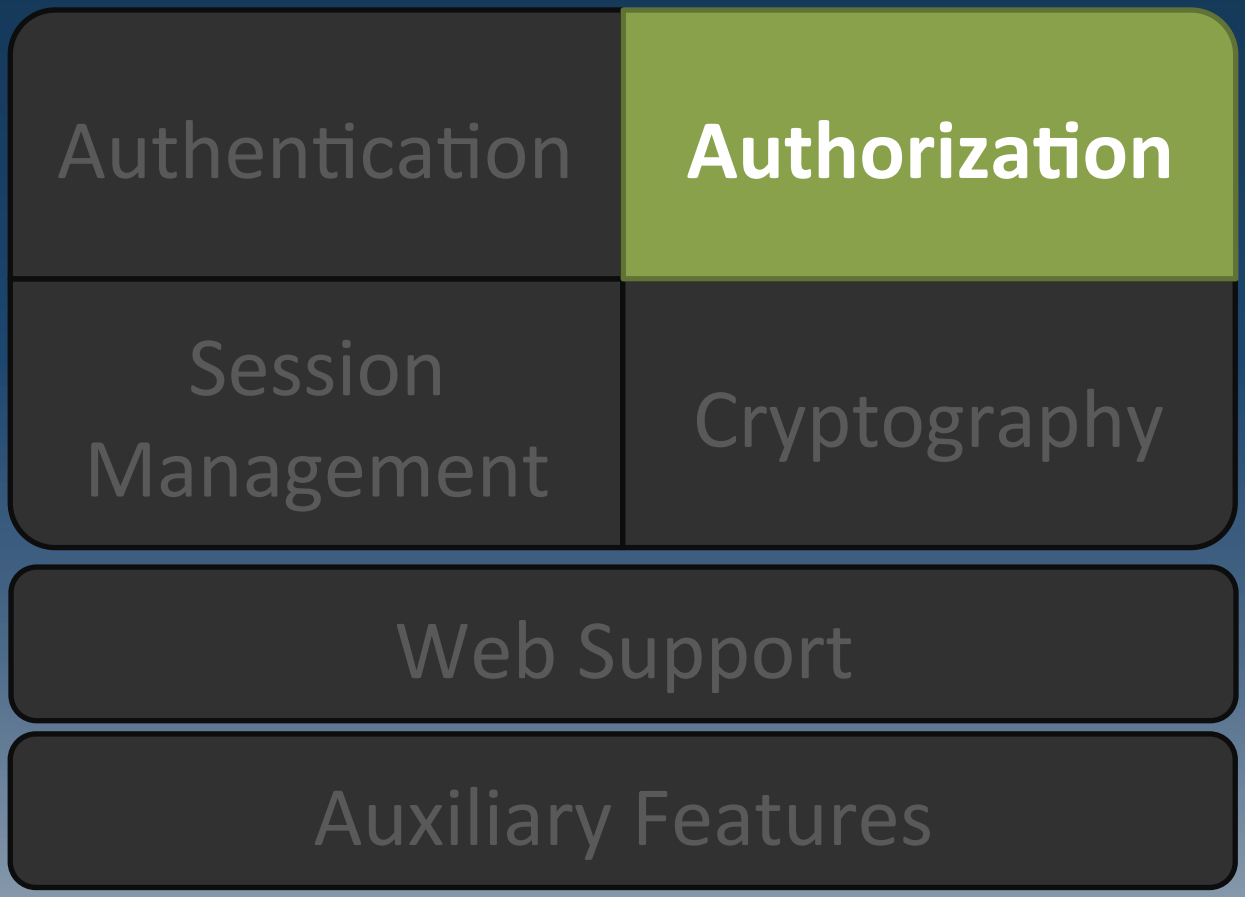
Authorization



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Authorization Defined

Process of determining “who can do what”
AKA Access Control

Elements of Authorization

- Permissions
- Roles
- Users

Permissions Defined

- Most atomic security element
- Describes resource *types* and their behavior
- The “what” of an application
- Does not define “who”
- AKA “rights”

Roles Defined

- Implicit or Explicit construct
- Implicit: Name only
- Explicit: A named collection of Permissions

  Allows behavior aggregation

  Enables dynamic (runtime) alteration of user abilities.

Users Defined

- The “who” of the application

- What each user can do is defined by their association with Roles or Permissions

Example: User’s roles imply PrinterPermission

Authorization Features

- Subject-centric (current user)
- Checks based on roles or permissions
- Powerful out-of-the-box WildcardPermission
- Any data model – Realms decide

How to Authorize with Shiro

Multiple means of checking access control:

- Programmatically
- JDK 1.5 annotations & AOP
- JSP/GSP/JSF* TagLibs (web support)

Programmatic Authorization

Role Check

```
//get the current Subject
Subject currentUser =
    SecurityUtils.getSubject();

if (currentUser.hasRole("administrator")) {
    //show the 'delete user' button
} else {
    //don't show the button?)
}
```

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Programmatic Authorization

Permission Check

```
Subject currentUser =
    SecurityUtils.getSubject();

Permission deleteUser =
new UserPermission("jsmith","delete");

If (currentUser.isPermitted(deleteUser)) {
    //show the 'delete user' button
} else {
    //don't show the button?
}
```

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Programmatic Authorization

Permission Check (String-based)

```
String perm = "user:delete:jsmith";

if(currentUser.isPermitted(perm)){
    //show the 'delete user' button
} else {
    //don't show the button?
}
```

Annotation Authorization

Role Check

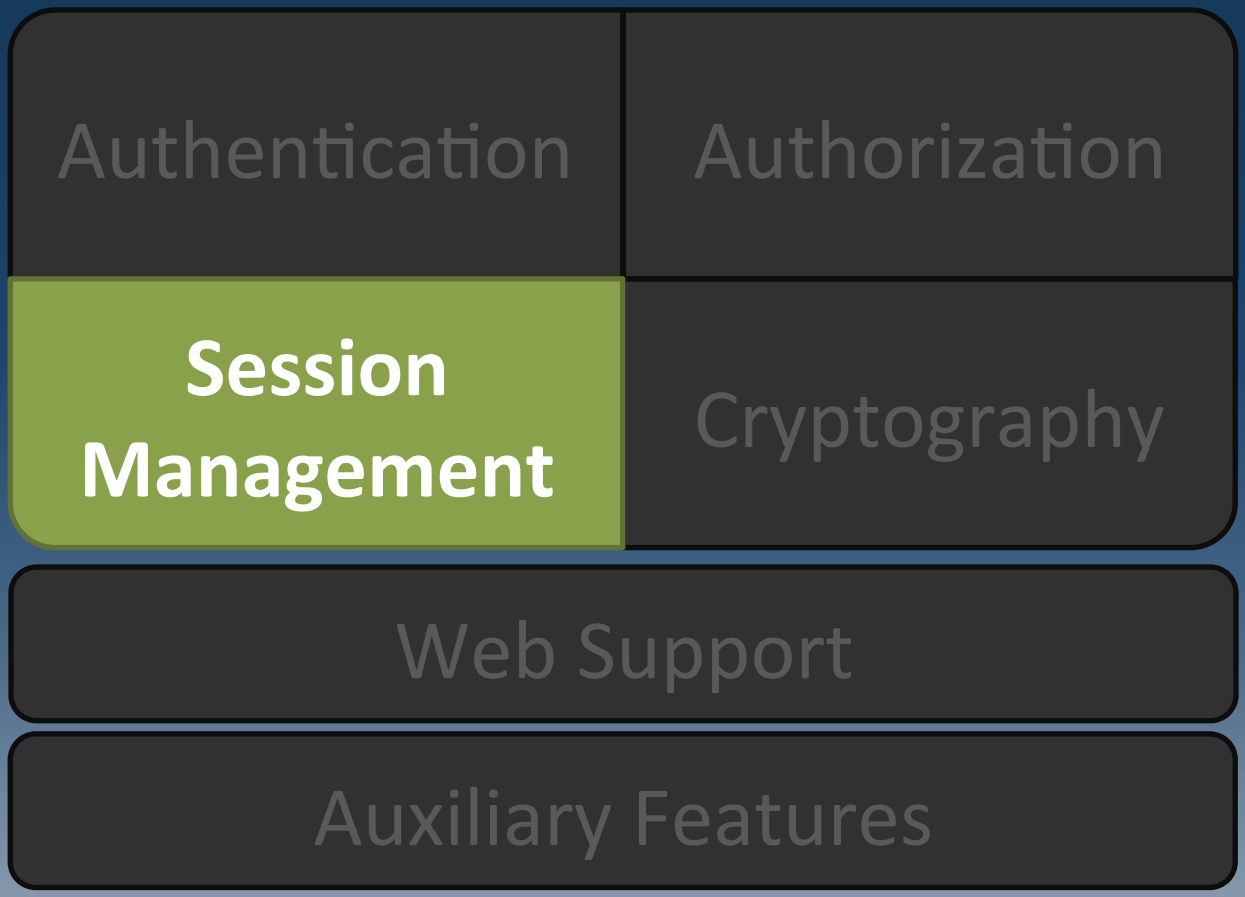
```
@RequiresRoles( “teller” )
public void openAccount(Account a) {
    //do something in here that
    //only a ‘teller’ should do
}
```

Annotation Authorization

Permission Check

```
@RequiresPermissions("account:create")
public void openAccount(Account a) {
    //create the account
}
```

Enterprise Session Management



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Session Management Defined

Managing the lifecycle of Subject-specific temporal data context

Session Management Features

- Heterogeneous client access
- POJO/J2SE based (IoC friendly)
- Event listeners
- Host address retention
- Inactivity/expiration support (touch())
- Transparent web use - HttpSession
- Container-Independent Clustering!

Acquiring and Creating Sessions

```
Subject currentUser =
    SecurityUtils.getSubject()

//guarantee a session
Session session = subject.getSession();


//get a session if it exists
subject.getSession(false);
```

Session API

```
getStartTimestamp()

getLastAccessTime()

getAttribute(key)

setAttribute(key, value)

get/setTimeout(long)

touch()

...
```

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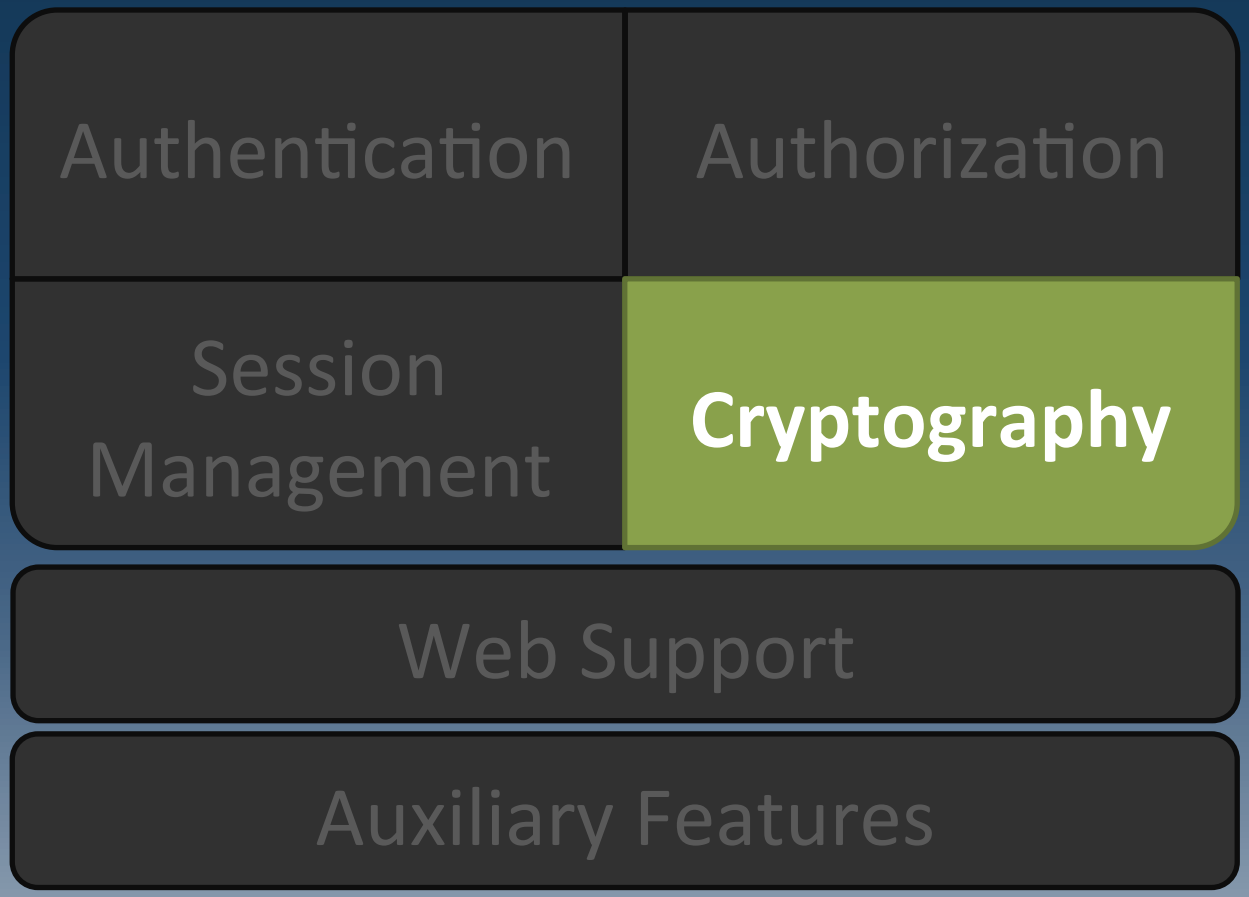
Cryptography



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Cryptography Defined

Protecting information from undesired access by hiding it or converting it into nonsense.

Elements of Cryptography

- Ciphers
- Hashes

Ciphers Defined

Encryption and decryption data based on shared or public/private keys.

- **Symmetric Cipher –** same key
  - Block Cipher – chunks of bits
  - Stream Cipher – stream of bits
- **Asymmetric Cipher -** different keys

Hashes Defined

A one-way, irreversible conversion of an input source (a.k.a. Message Digest)

Used for:

- Credentials transformation, Checksum
- Data with underlying byte array

  Files, Streams, etc

Cryptography Features

Simplicity

- Interface-driven, POJO based
- Simplified wrapper over JCE infrastructure.
- “Object Orientifies” cryptography concepts
- Easier to understand API

Cipher Features

- OO Hierarchy

  JcaCipherService, AbstractSymmetricCipherService, DefaultBlockCipherService, etc

- Just instantiate a class

  No “Transformation String”/Factory methods

- More secure default settings than JDK!

  Cipher Modes, Initialization Vectors, et. al.

Example: Plaintext

(image courtesy WikiPedia)

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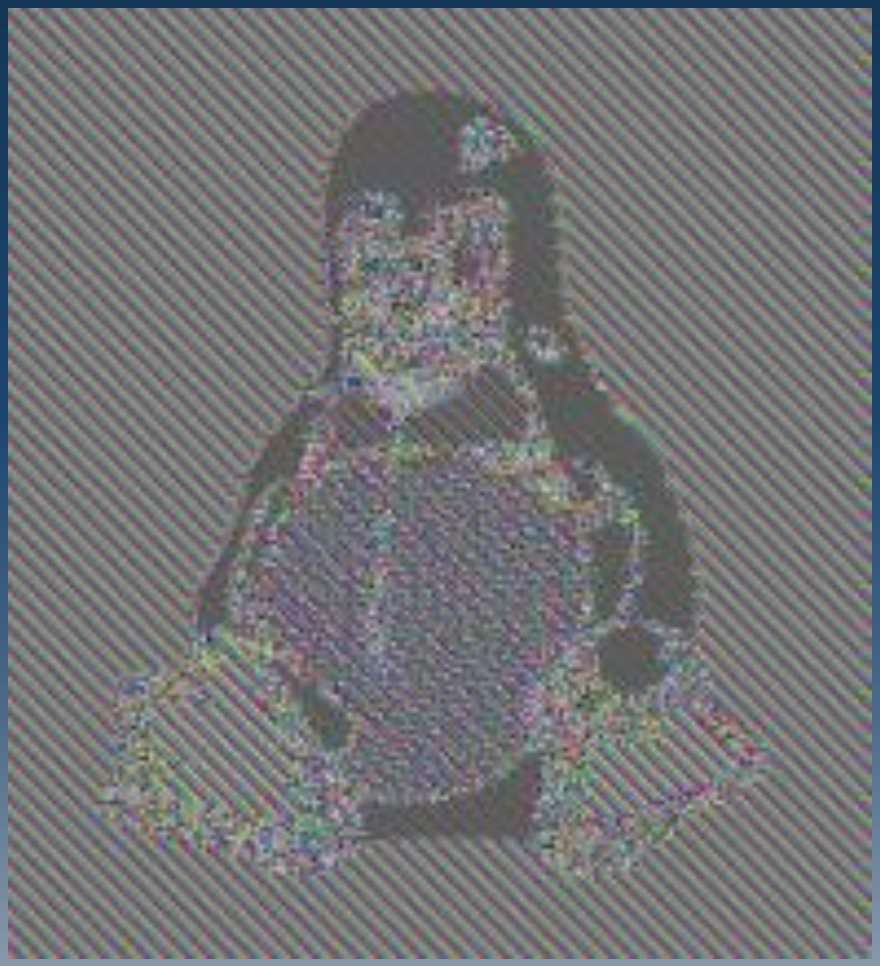
Example: ECB Mode (JDK Default!)



(image courtesy WikiPedia)

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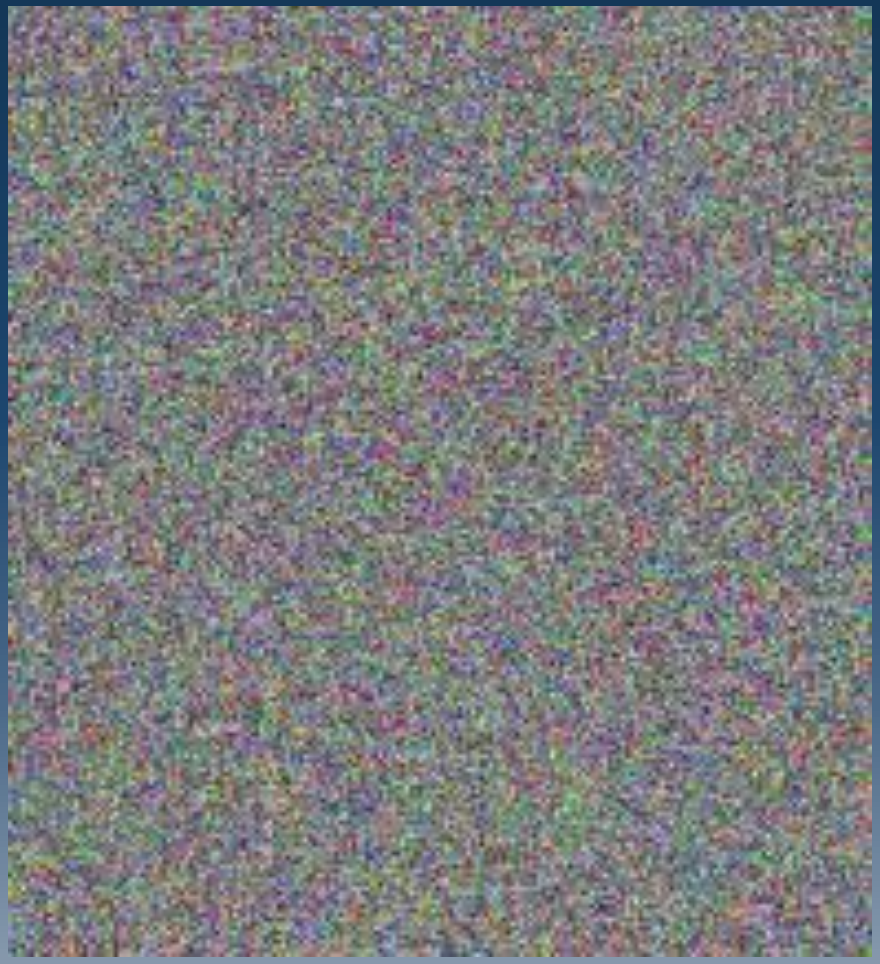
Example: Shiro Defaults



(image courtesy WikiPedia)

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Shiro's CipherService Interface

```
public interface CipherService {

    ByteSource encrypt(byte[] raw,
        byte[] key);

    void encrypt(InputStream in,
         OutputStream out, byte[] key);

    ByteSource decrypt( byte[] cipherText,
         byte[] key);

    void decrypt(InputStream in,
         OutputStream out, byte[] key);
}
```

Hash Features

- Default interface implementations
  MD5, SHA1, SHA-256, et. al.
- Built in Hex & Base64 conversion
- Built-in support for Salts and repeated hashing

Shiro's Hash Interface

```
public interface Hash {

    byte[] getBytes();

    String toHex();

    String toBase64();

}
```

Intuitive OO Hash API

```
//some examples:
new Md5Hash("foo").toHex();

//File MD5 Hash value for checksum:
new Md5Hash( aFile ).toHex();

//store password, but not plaintext:
new Sha512(aPassword, salt,
           1024).toBase64();
```

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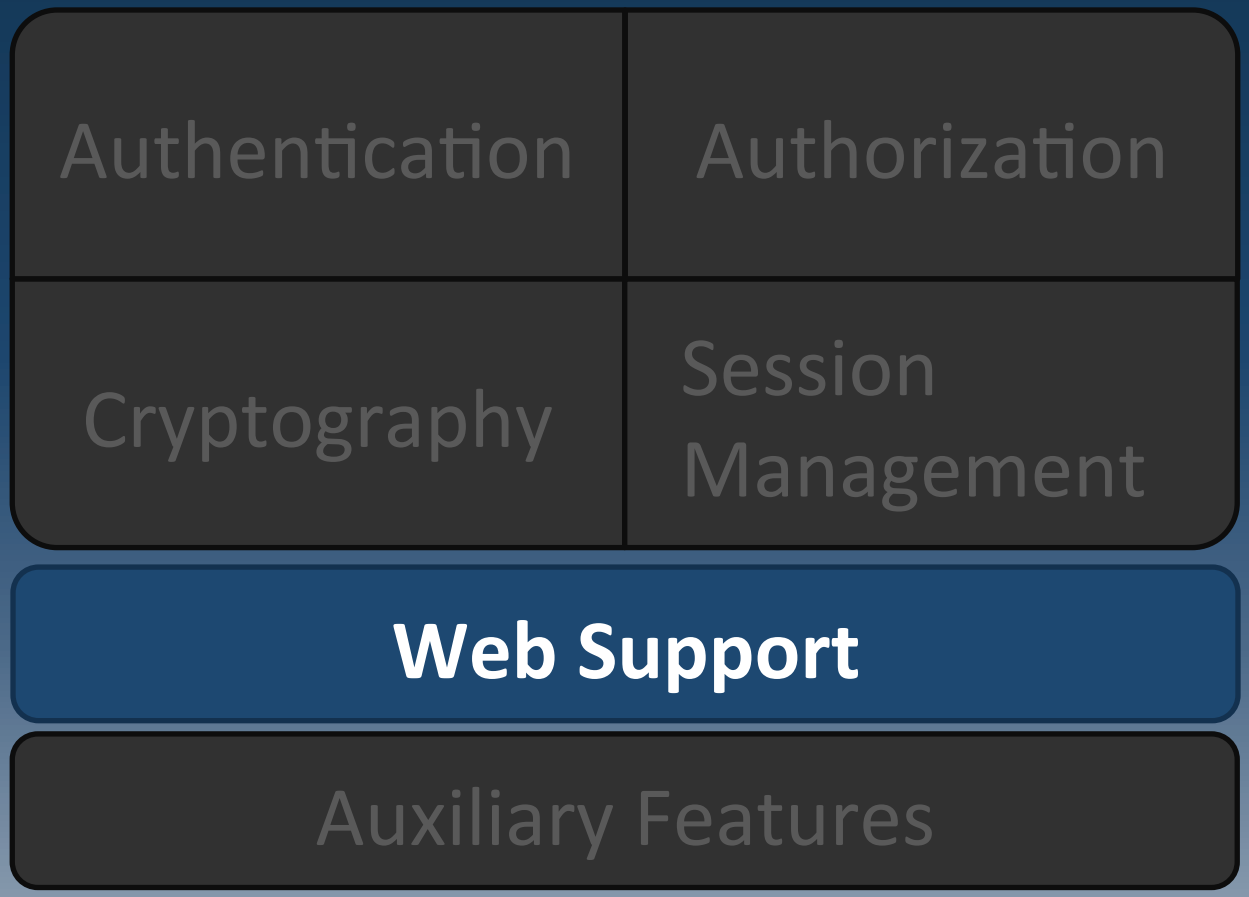
Web Support



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Web Support Features

- Simple ShiroFilter web.xml definition
- Protects all URLs
- Innovative Filtering (URL-specific chains)
- JSP Tag support
- Transparent HttpSession support

web.xml

```
<filter>
  <filter-name>ShiroFilter</filter-name>
  <filter-class>
 org.apache.shiro.web.servlet.IniShiroFilter
  </filter-class>
</filter>

<filter-mapping>
  <filter-name>ShiroFilter</filter-name>
  <url-pattern>/*</url-pattern>
</filter-mapping>
```

shiro.ini

```
[main]
ldapRealm = org.apache.shiro.realm.ldap.JndiLdapRealm
ldapRealm.userDnTemplate = uid={0},ou=users,dc=mycompany,dc=com
ldapRealm.contextFactory.url = ldap://ldapHost:389

securityManager.realm = $realm

[urls]
/images/**  = anon
/account/** = authc
/rest/** = authcBasic
/remoting/** = authc, roles[b2bClient], …
```

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JSP TagLib Authorization

```
<%@ taglib prefix="shiro"
           uri="http://shiro.apache.org/tags" %>
<html>
<body>
    <shiro:hasRole name="administrator">
        <a href="manageUsers.jsp">
            Click here to manage users
        </a>
    </shiro:hasRole>
    <shiro:lacksRole name="administrator">
        No user admin for you!
    </shiro:hasRole>
</body>
</html>
```

JSP TagLibs

```
<%@ taglib prefix="shiro" uri=
http://shiro.apache.org/tags %>

<!-- Other tags: -->
<shiro:guest/>
<shiro:user/>
<shiro:principal/>
<shiro:hasRole/>
<shiro:lacksRole/>
<shiro:hasAnyRoles/>
<shiro:hasPermission/>
<shiro:lacksPermission/>
<shiro:authenticated/>
<shiro:notAuthenticated/>
```

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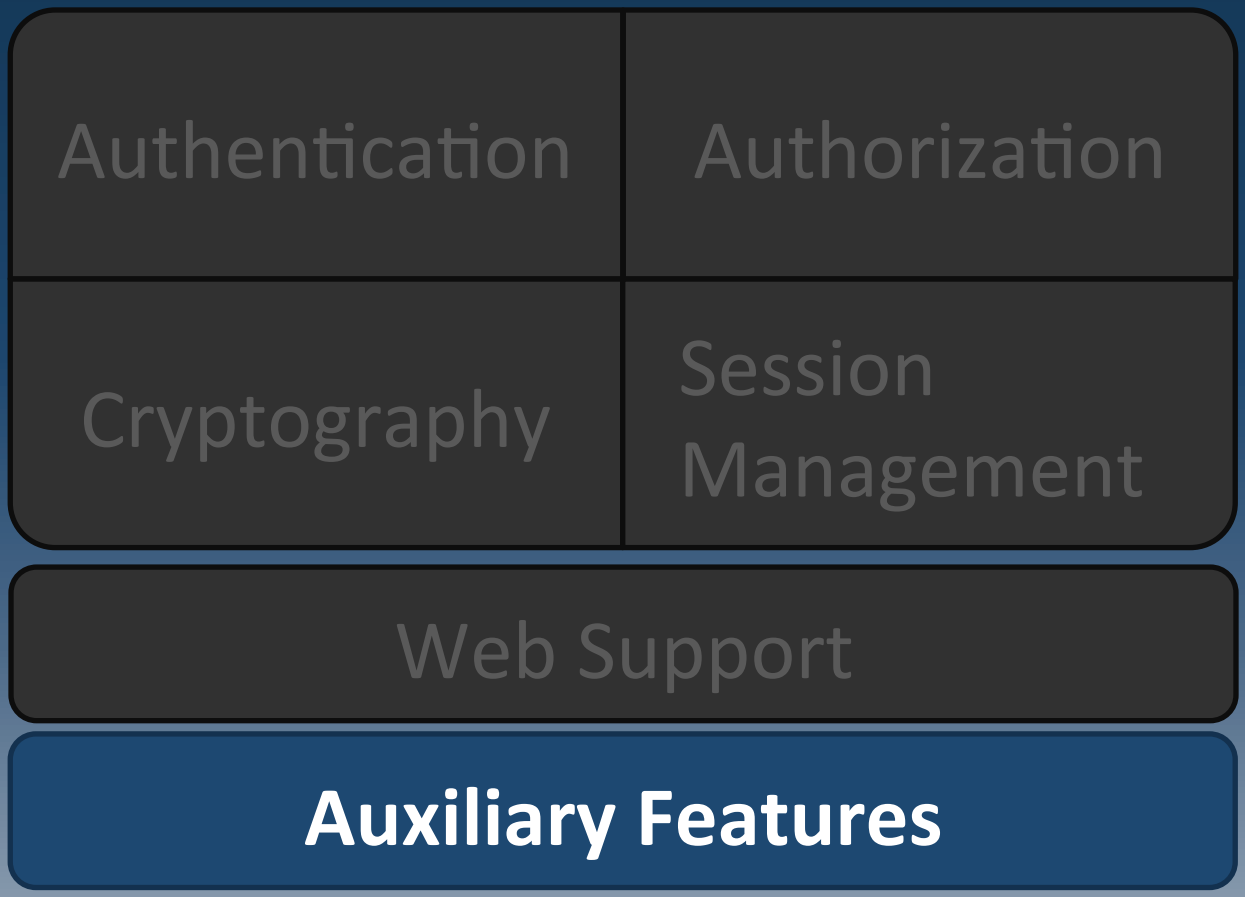
Auxiliary Features



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Auxiliary Features

- Threading & Concurrency

  Callable/Runnable & Executor/ExecutorService

- “Run As” support
- Ad-hoc Subject instance creation
- Unit Testing
- Remembered vs Authenticated

Logging Out

```
//Logs the user out, relinquishes account
//data, and invalidates any Session
SecurityUtils.getSubject().logout();
```

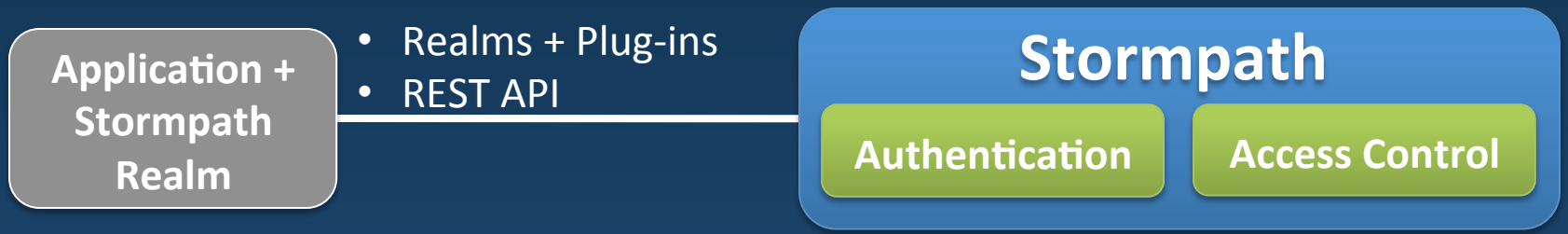
App-specific log-out logic:

- Before/After the call
- Listen for Authentication or StoppedSession events.

Coming in 1.3, 2.0

- Typesafe EventBus
- OOTB Hazelcast Session clustering
- Lower coupling in components
  Composition over Inheritance
- Stronger JEE (CDI, JSF) support
- Default Realm
  Pluggable authc lookup, authz lookup
- Default Authentication Filter
  (multiple HTTP schemes + UI fallback)

Stormpath: User Management API Service



Out-of-the-box Features

- Managed security data model
- Secure credential storage
- Password self-service
- Management GUI

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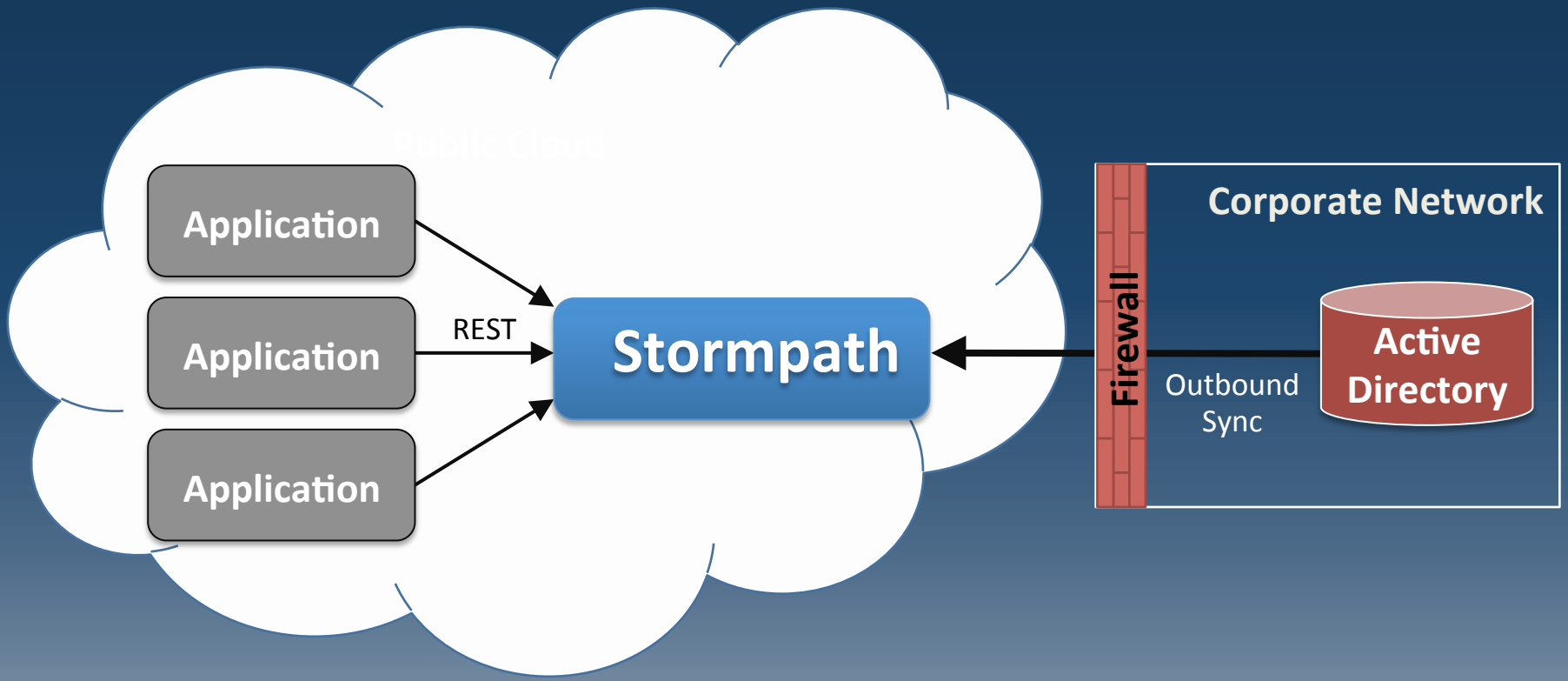
Stormpath: Cloud Deployment



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Thank You!

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