# Simple Application Security

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Apache Shiro Project Chair

## About Me

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## What is Apache Shiro?

- Application security library
- Quick and easy
- Simplifies security concepts

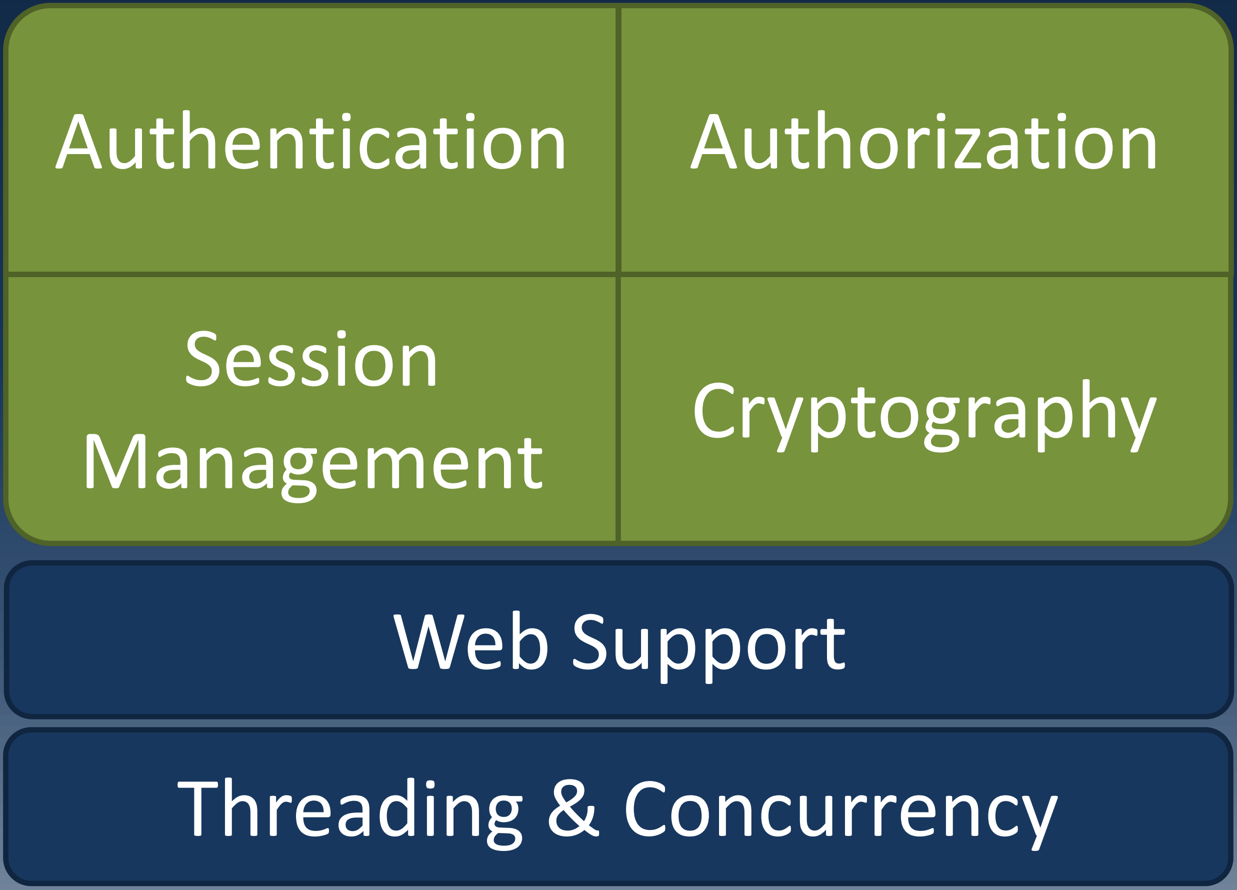
## About Shiro

- Started in 2003, JSecurity in 2004
- Simplify or replace JAAS
- Dynamic changes at runtime
- Sessions - Heterogeneous Clients
- Reduce Design Flaws
- ‘One stop shop’
- Apache Top Level, September

## Reduce Design Flaws

## No Silver Bullets

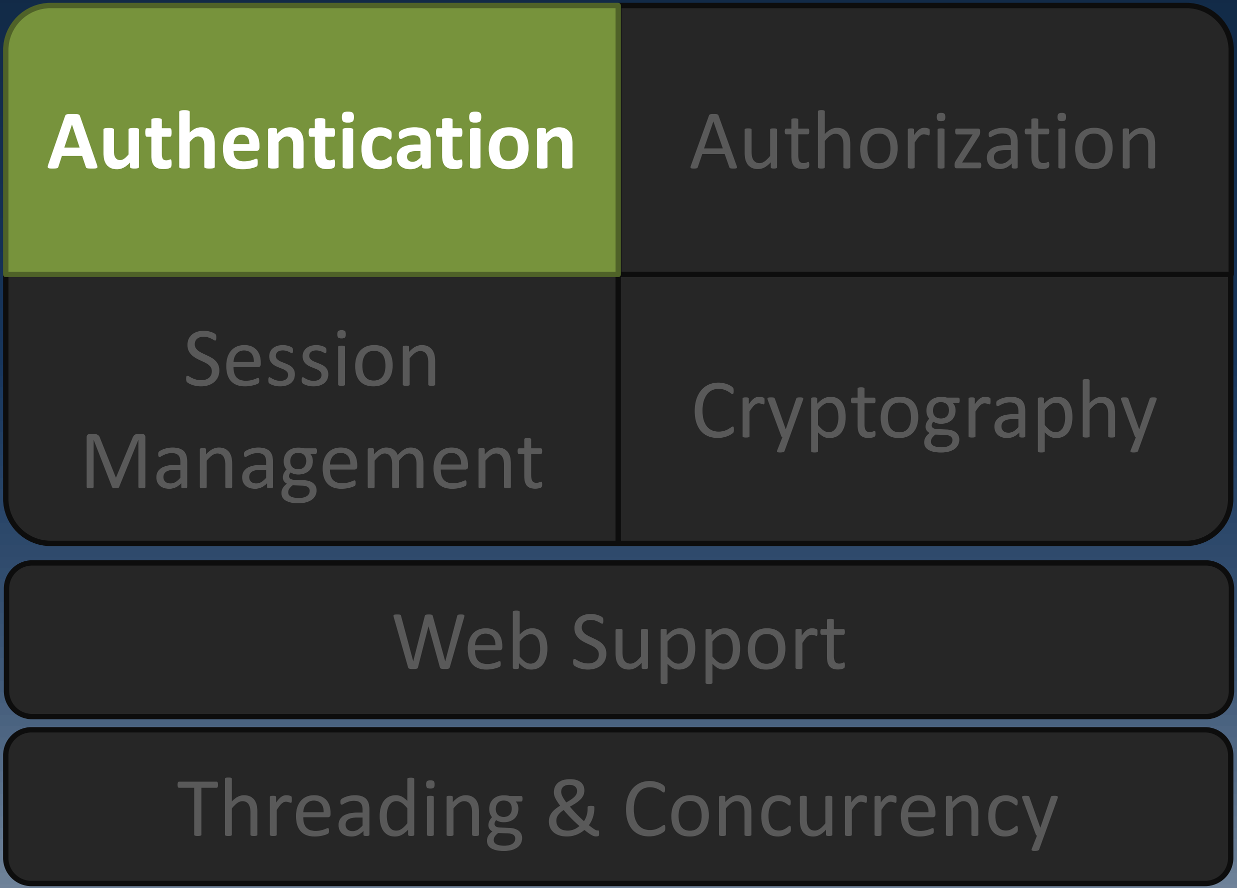
## Agenda


Authentication
Authorization
Session Management
Cryptography
Web Support
Threading & Concurrency

## Quick Terminology

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

# Authentication



## 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

## 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

```
//Example using most common scenario:
//String username and password.  Acquire in
//system-specific manner (HTTP request, GUI, etc)

UsernamePasswordToken token =
 new UsernamePasswordToken( username, password );

//"Remember Me" built-in, just do this:
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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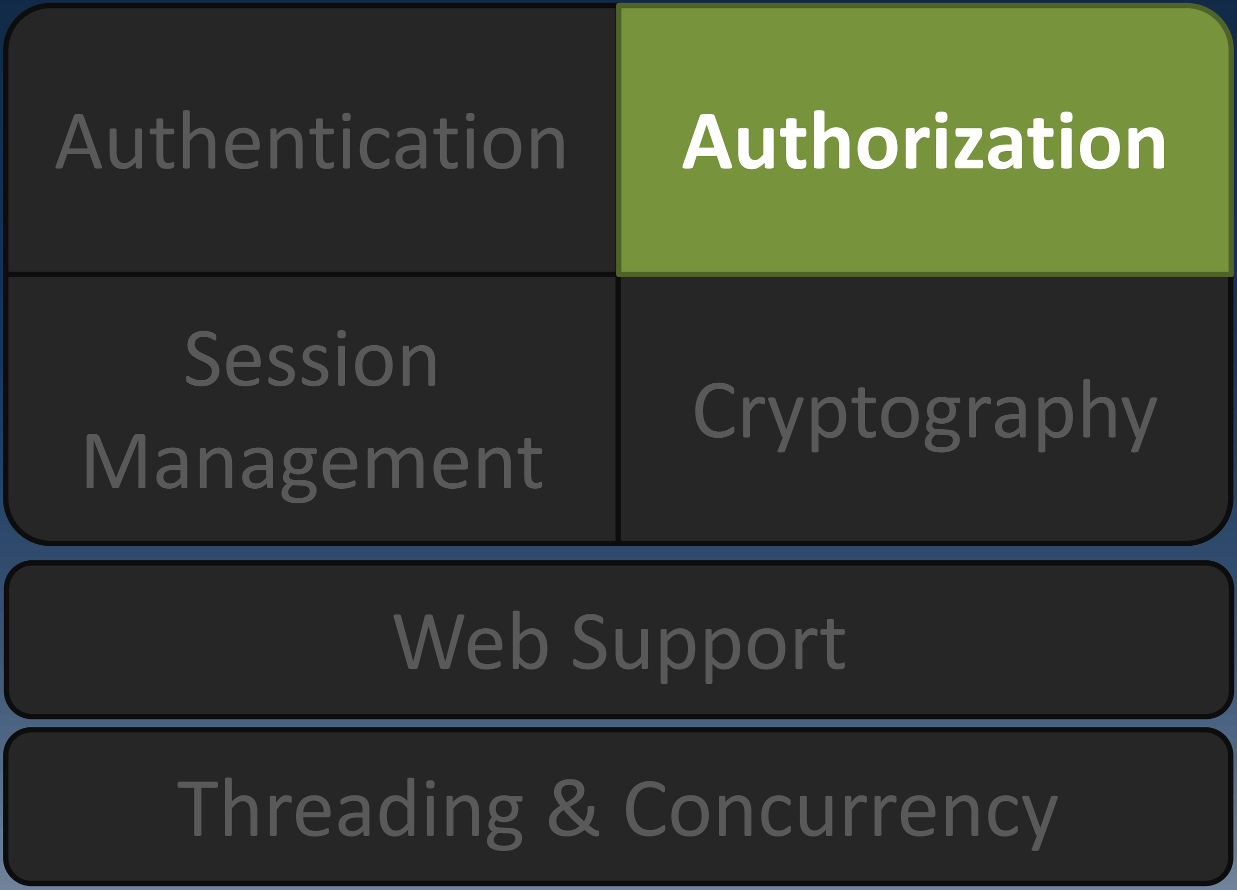
## “Remember Me” support

- `subject.isRemembered()`
- `subject.isAuthenticated()`
- remembered != authenticated

# Authorization



## Authorization Defined

Process of determining Access Control

“who can do what”

**Elements of Authorization**

- Permissions
- Roles
- Users

## Permissions Defined

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

## 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

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## 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
- JSP/GSP TagLibs (web support)

## Programmatic Authorization

### Role Check

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

if (currentUser.hasRole(“administrator”)) {
    //do one thing (show a special button?)
} else {
    //don’t show the button?)
}
```

# Programmatic Authorization

## Permission Check

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

Permission printPermission =
new PrinterPermission(“laserjet3000n”,“print”);

If (currentUser.isPermitted(printPermission)) {
    //do one thing (show the print button?)
} else {
    //don’t show the button?
}
```

# Programmatic Authorization

## Permission Check (String-based)

```
String perm = “printer:print:laserjet4400n”;

if(currentUser.isPermitted(perm)){
    //show the print button?
} else {
    //don’t show the button?
}
```

## Annotation Authorization

### Role Check

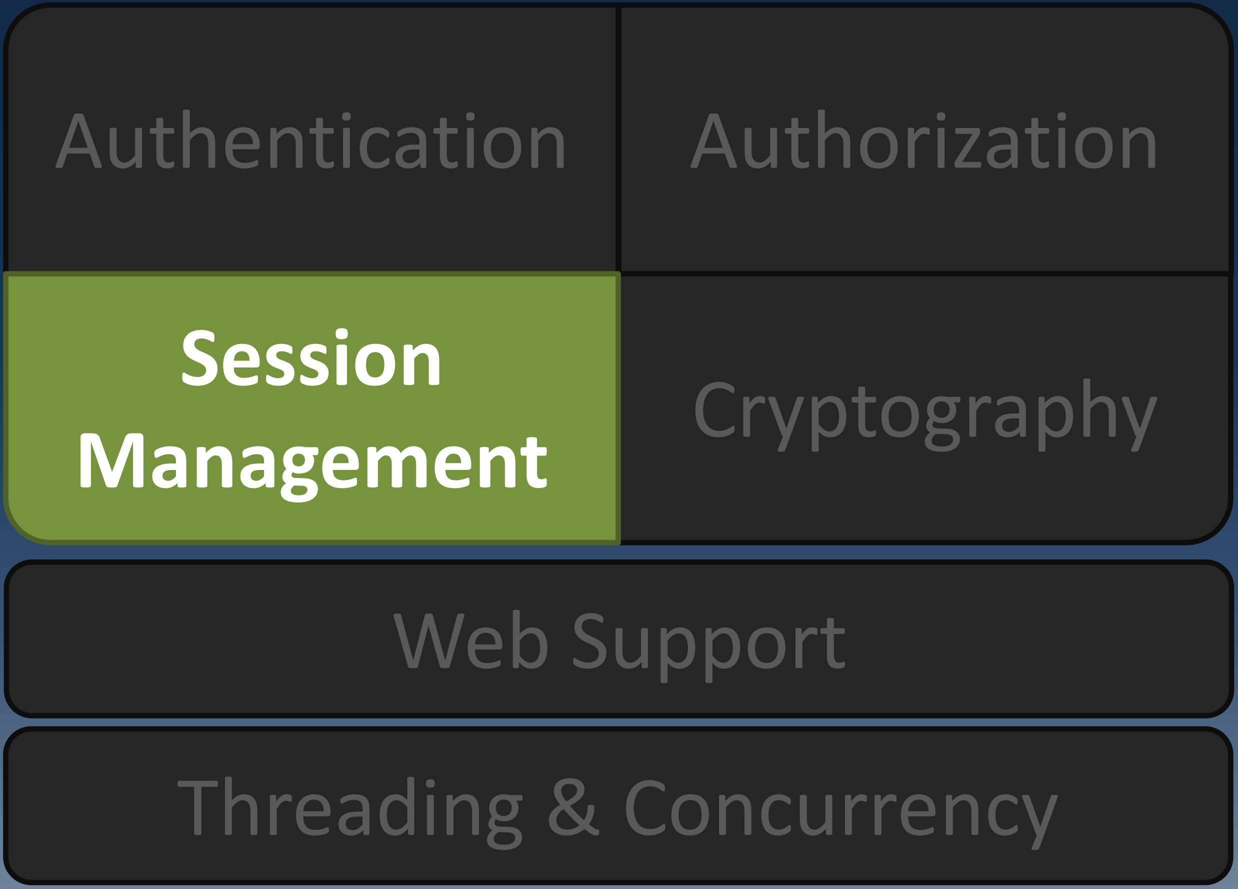
```
//Throws an AuthorizationException if the caller
//doesn’t have the ‘teller’ role:

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

## Annotation Authorization

### Permission Check

```
//Will throw an AuthorizationException if none
//of the caller’s roles imply the Account
//'create' permission

@RequiresPermissions(“account:create”)
public void openAccount( Account acct ) {
    //create the account
}
```

## Enterprise Session Management



## 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
- Can be used for SSO

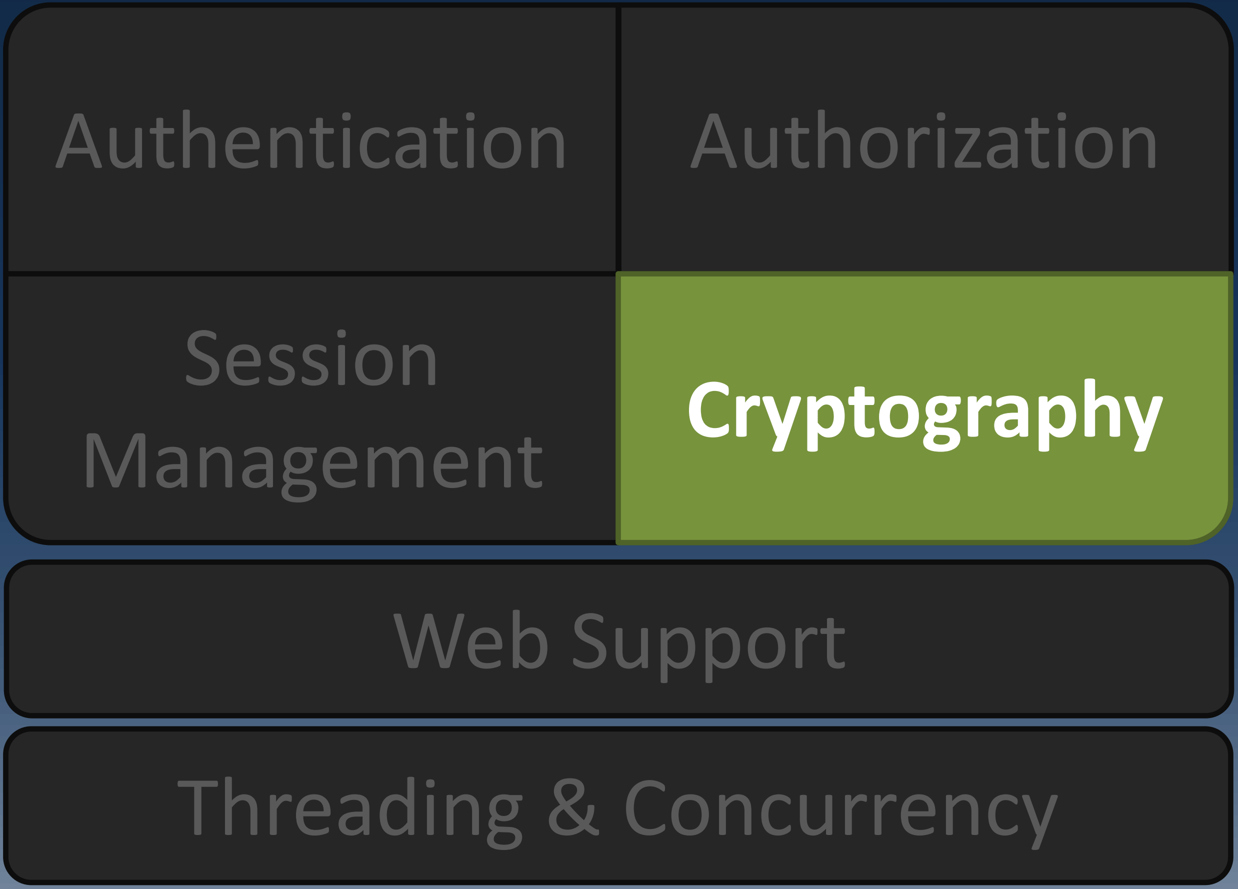
## Acquiring and Creating Sessions

```
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()

...
```

## Cryptography



## 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 public/private keys.

- **Symmetric Cipher -** same key for encryption and decryption.
- **Asymmetric Cipher -** different keys for encryption and decryption

## Hashes Defined

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

**Used for:**

- Credentials transformation
- Data with underlying byte array

  Files, Streams, etc

## Cryptography Features

### Simplicity

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

## Cipher Features

- OO Hierarchy

  JcaCipherService, AbstractSymmetricCipherService, DefaultBlockCipherService, etc

- Just instantiate a class

  No “Transformation String”/Factory methods

- More secure default settings

  Initialization Vectors, et. al.

## 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

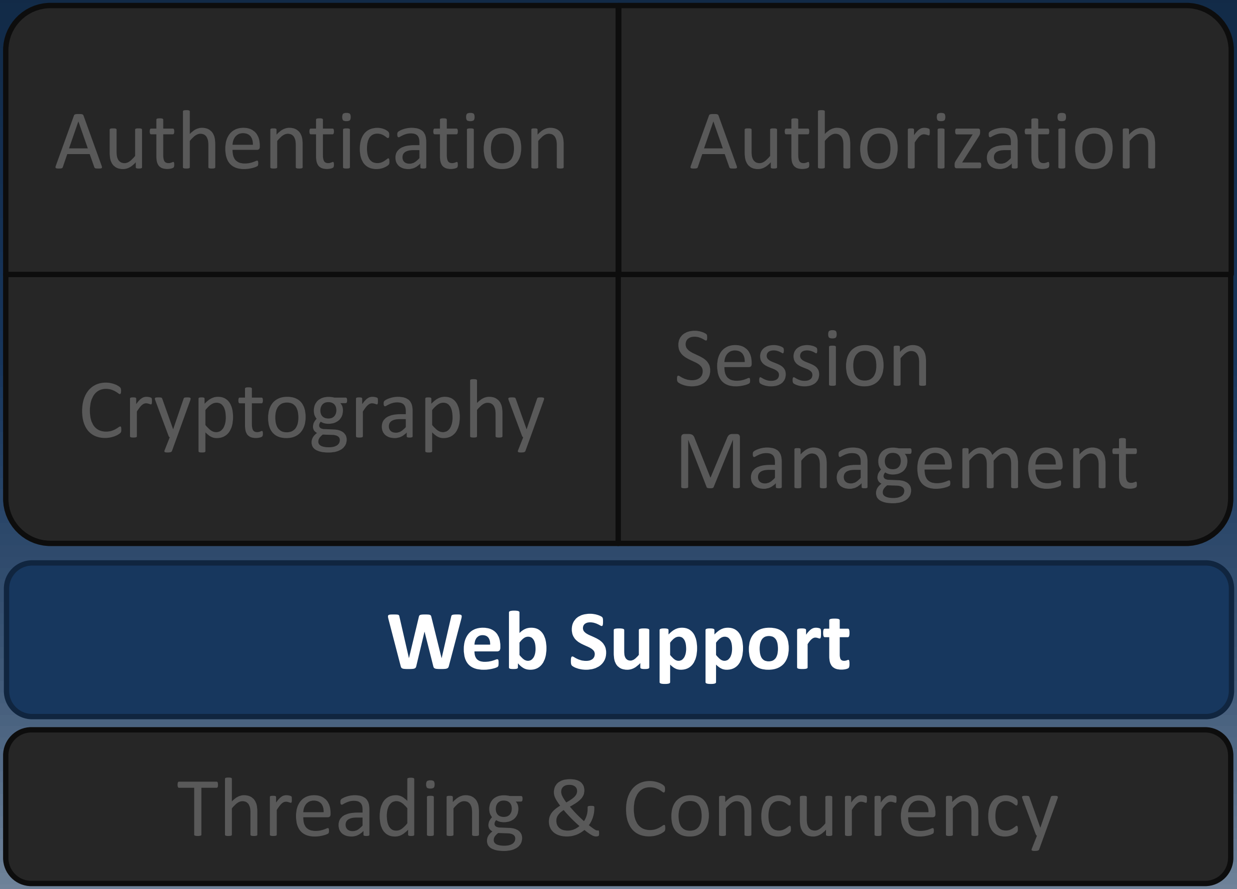
## Shiro’s Hash Interface

```
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 a password, but not raw:
new Sha256(aPassword, salt,
           1024).toBase64();
```

# 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>
  <init-param><param-name>config</param-name><param-value>
   [main]
     realm = com.my.custom.realm.Implementation
     securityManager.realm = $realm
   [urls]
     /account/** = authc
     /remoting/** = authc, roles[b2bClient], ...
  </param-value></init-param>
</filter>

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

# JSP TagLib Authorization

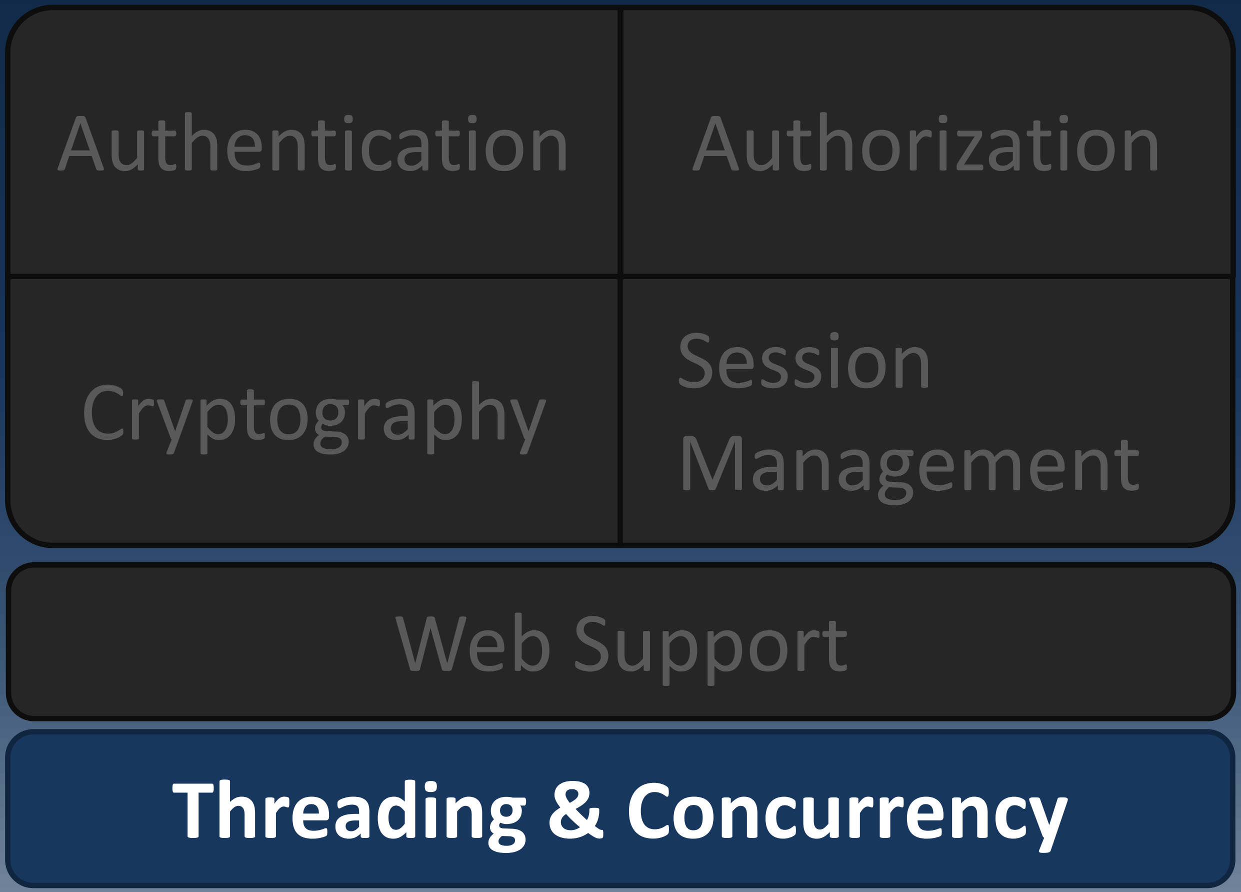
```
<%@ taglib prefix=“shiro”
uri=http://shiro.apache.org/tags %>
<html>
<body>
    <shiro:hasRole name=“administrator”>
        <a href=“manageUsers.jsp”>
            Click here to manage users
        </a>
    </shiro:hasRole>
    <shiro:lacksRole name=“administrator”>
        No user admin for you!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

# Threading & Concurrency



## Threading & Concurrency Features

- Subject retained on multiple threads
- Automatic thread cleanup
- Transparent Executor/ExecutorService support

## ThreadLocal

- Currently-executing Subject is thread-bound via a ThreadContext
- Executing logic in the current thread is fine. What about other threads?
- Runnable & Callable support
- ExecutorService support

## Subject Thread Association

Can associate a Subject with a Callable or Runnable intended to run on another thread:

```
Callable myCallable = //create or acquire
Subject currentUser = SecurityUtils.getSubject();

Callable associated =
currentUser.associateWith(myCallable);

associated.call(); //current thread
//or another thread:
anExecutorService.execute(associated);
```

## Transparent Association

Subject ‘Aware’ Executor implementations transparently retain Subject:

`SubjectAwareExecutor`, `SubjectAwareExecutorService`, `SubjectAwareScheduledExecutorService`

```
//Look mom! No Shiro API imports!

Callable myCallable = //create or acquire
anExecutorService.execute(myCallable);
```

## MISCELLANEOUS

## “Run As” Support

- “Run As” allows a Subject to assume the identity of another
- Useful for administrative interfaces
- Identity retained until relinquished

## “Run As” Support

```
//assume current user is the ‘admin’ user:
Subject currentUser = SecurityUtils.getSubject();

PrincipalCollection newIdentity = new
SimplePrincipalCollection(“jsmith”, “jdbcRealm”);

currentUser.runAs(newIdentity);
//behave as the ‘jsmith’ user here

currentuser.isRunAs(); //true = assumed identity
currentUser.getPreviousPrincipals();//prev. identity

//return back to the admin user:
currentUser.releaseRunAs();
```

## Unit Testing

- Subject.Builder creates ad-hoc Subjects
- Use with subject.execute for easy testing:

```
Subject testSubject =
  Subject.Builder(securityManager)
  .principals(“jsmith”).buildSubject()
testSubject.execute( new Runnable() {
  public void run() {
      callTestMethod();
  }
});
```

## 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.

## APACHE SHIRO DEMO

## Thank You!

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- Seeking engineering talent

- Seeking product feedback