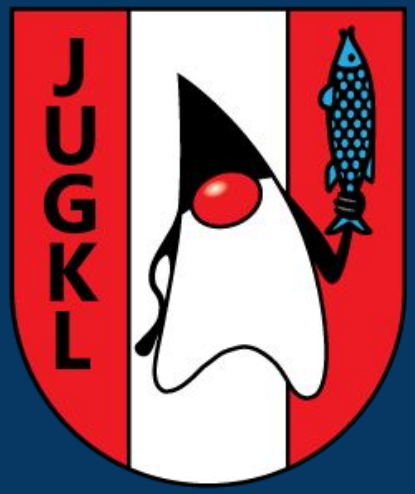
Single Sign-on with KEYCLOAK



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eurodata AG

15.02.2018

Thomas Darimont

@thomasdarimont
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- Software Architect @ >eurodata
- Spring Team Alumni
- Open Source Enthusiast
- Java User Group Saarland Organizer
- Keycloak Contributor for over 2 years

The Journey

Keycloak

Single Sign-on

Securing Applications

Keycloak Extensions

Keycloak

KEYCLOAK

ABOUT DOCS DOWNLOADS COMMUNITY SECURITY SUPPORT SEARCH BLOG

Open Source Identity and Access Management

For Modern Applications and Services

Add authentication to applications and secure services with minimum fuss. No need to deal with storing users or authenticating users. It's all available out of the box.

You'll even get advanced features such as User Federation, Identity Brokering and Social Login.

For more details go to about and documentation, and don't forget to try Keycloak. It's easy by design!

NEWS

12 Sep

Keycloak 3.3.0.CR2 released

28 Aug

Keycloak 3.3.0.CR1 released

21 Jul

Keycloak 3.2.1.Final released

Single-Sign On
Login once to multiple applications

Standard Protocols
OpenID Connect, OAuth 2.0 and SAML 2.0

Centralized Management
For admins and users

Adapters
Secure applications and services easily

LDAP and Active Directory
Connect to existing user directories

Social Login
Easily enable social login

Identity Brokering
OpenID Connect or SAML 2.0 IdPs

High Performance
Lightweight, fast and scalable

Clustering
For scalability and availability

Themes
Customize look and feel

Extensible
Customize through code

Password Policies
Customize password policies

keycloak.org

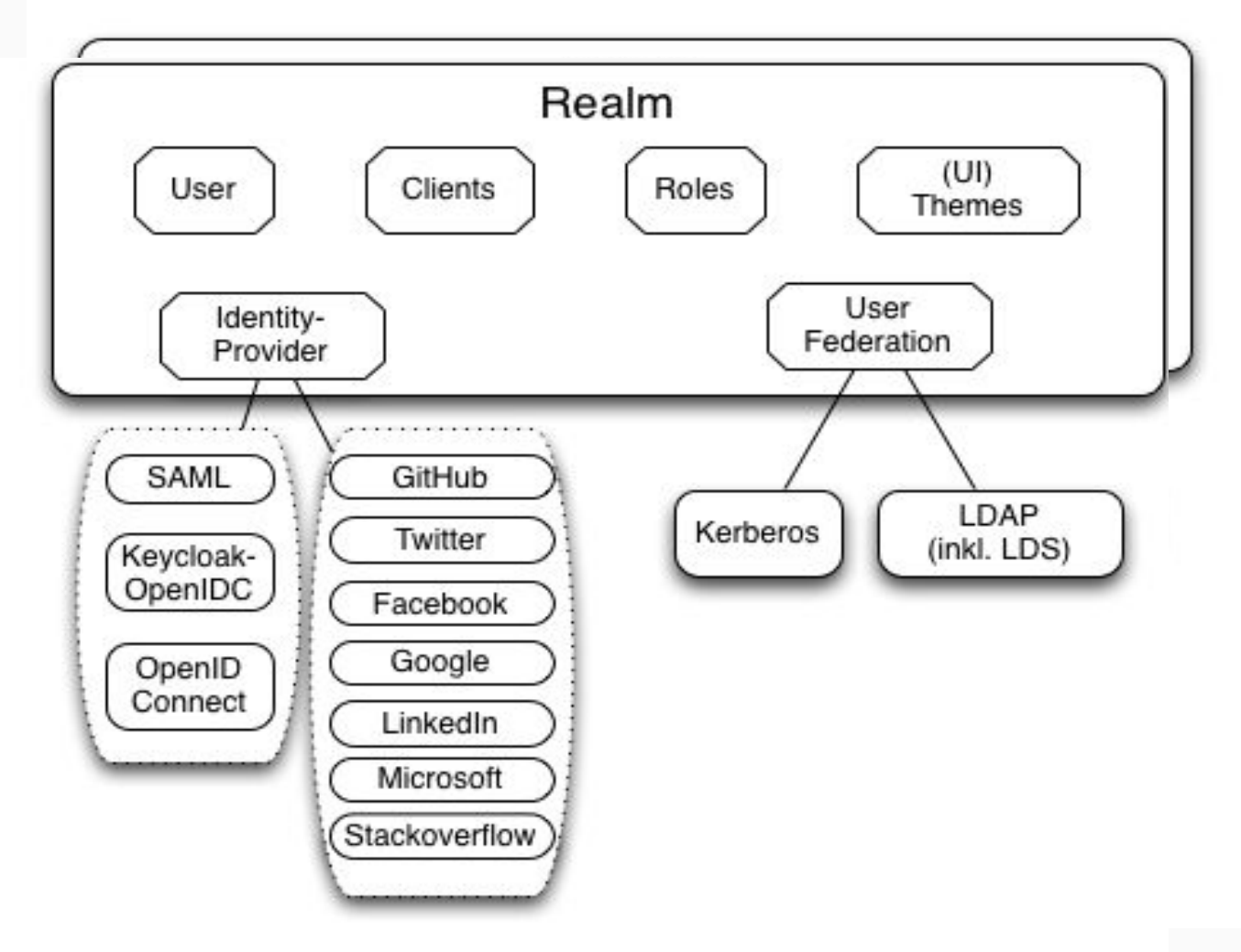
Keycloak Project

- **Open Source** Identity and Access Management Solution
- JBoss Developers (Red Hat)
- Since 2013, Release ~ every 6 Weeks
- Current Version 3.4.3.Final
- Good documentation, many Examples
- Hosted on Github 228+ Contributors, 1144+ Forks
- **Vital Community**
- **Commercial Offering** available

Keycloak Features

- **Single Sign-on** and Single Sign-out
- Flexible **Authentication** and **Authorization**
- **Multi-Factor Authentication** One-time Password
- **Standard Protocols** OAuth 2.0, OIDC 1.0, SAML 2.0, Docker Auth
- **Social Login** Google, Facebook, Twitter,...
- Provides centralized **User Management**
- Supports **Directory Services**
- **Customizable** and **Extensible**
- **Easy** Setup and Integration

Main Concepts



Admin Console

KEYCLOAK

Admin

Acme

Configure

- Realm Settings
- Clients
- Client Templates
- Roles
- Identity Providers
- User Federation
- Authentication

Manage

- Groups
- Users
- Sessions
- Events
- Import
- Export

Acme

General | Login | Keys | Email | Themes | Cache | Tokens | Client Registration | Security Defenses

* Name	acme
Display name	Acme Inc.
HTML Display name	Acme Inc.
Enabled	ON
Endpoints	OpenID Endpoint Configuration

Save Cancel

DEMO

Admin Console Login

Technology Stack - Keycloak 3.4.x

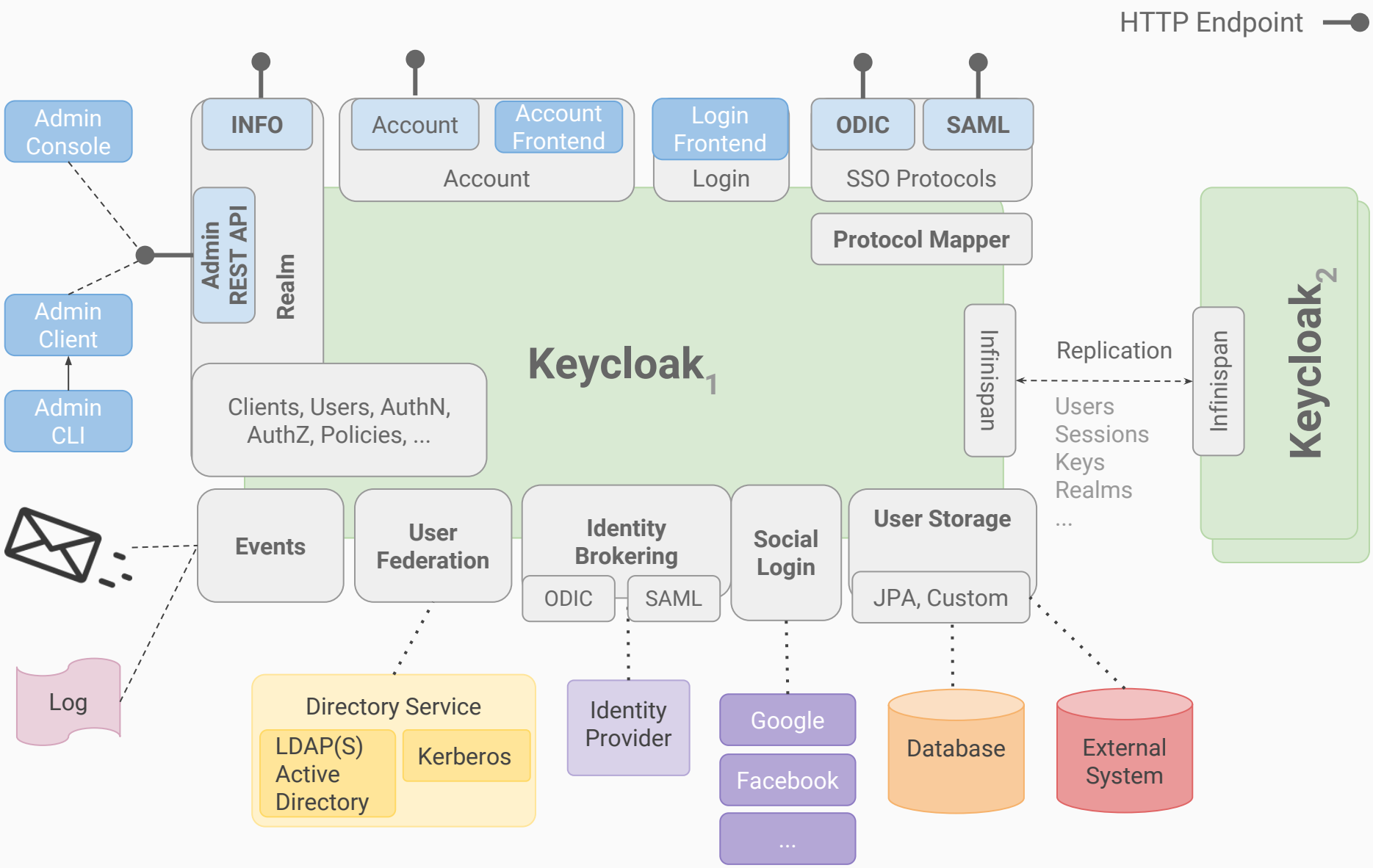
Admin Console

- Angular JS (1.6.4)
- PatternFly
- Bootstrap

Server

- Wildfly 11.0.0.x
- JAX-RS (Resteasy)
- JPA (Hibernate)
- Infinispan (JGroups)
- Freemarker
- Jackson 2.0
- JBoss Logging
- Apache Directory API
- Commons HTTP Client

Server Architecture



Authentication & Authorization in Keycloak

- **Authentication (AuthN)**
  - Determines ***who*** *the user* ***is***
  - via *OIDC, SAML, Docker Auth, Kerberos*
  - Internal & Federated User Storage (Kerberos, LDAP, Custom)
- **Authorization (AuthZ)**
  - Determines ***what*** *the user* ***is allowed*** *to do*
  - Role based Access Control (RBAC)
  - *Authorization Services*
    - Flexible Access Control Management
    - More Variants like ABAC, UBAC, CBAC supported

Single Sign-on

in Keycloak

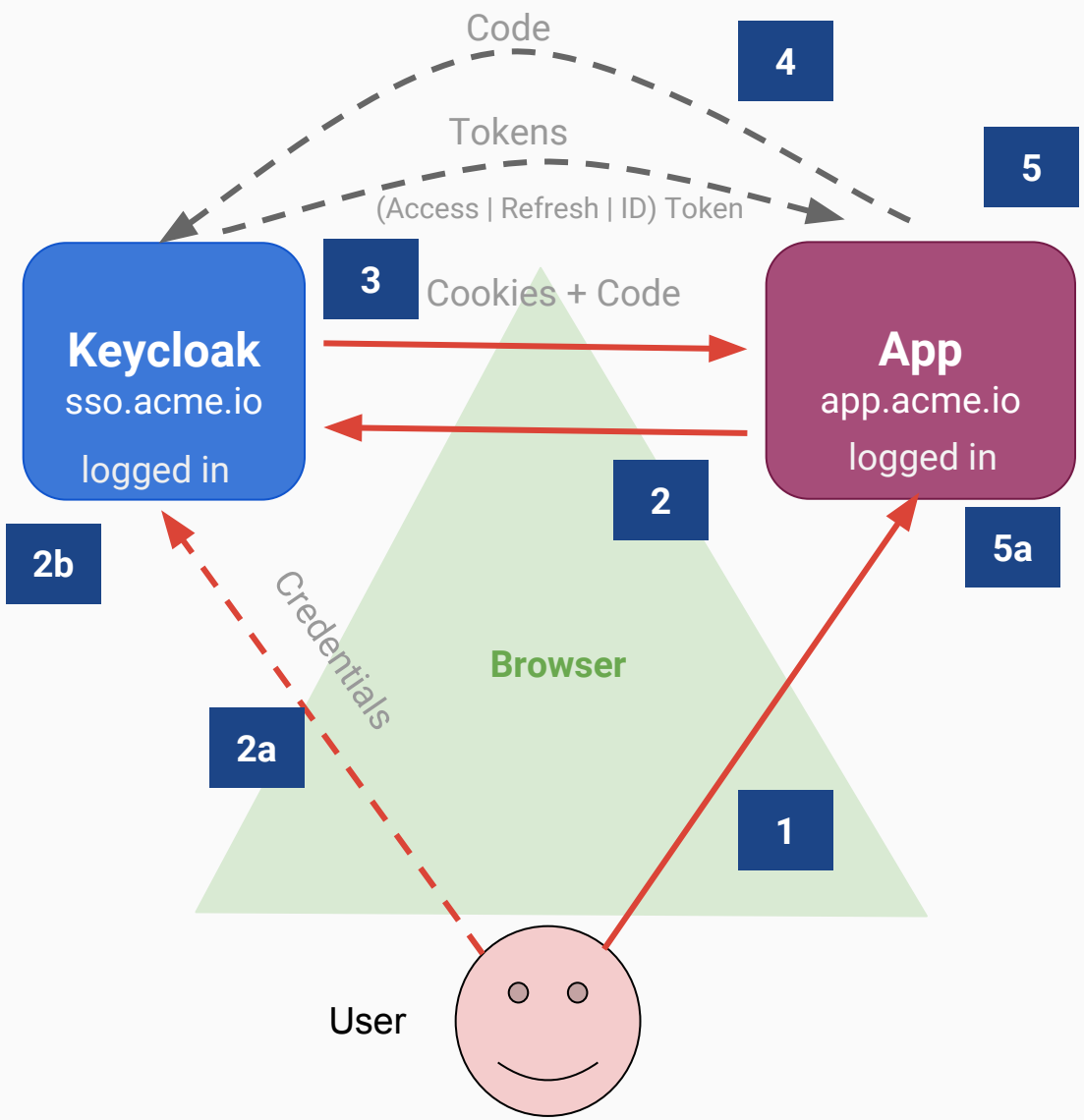
Single Sign-on & Single Sign-out

- **SSO** ⇒ Login **once** to access all applications
- **Standardized Protocols**
  - Open ID Connect 1.0 (OIDC)
  - Security Assertion Markup Language 2.0 (SAML)
- **Browser based “Web SSO”**
- works for Web, Mobile and Desktop Apps
- Support for **Single Sign-out**
  - Logouts can be propagated to clients
  - Clients can opt-in

Supported Single Sign-on Protocols

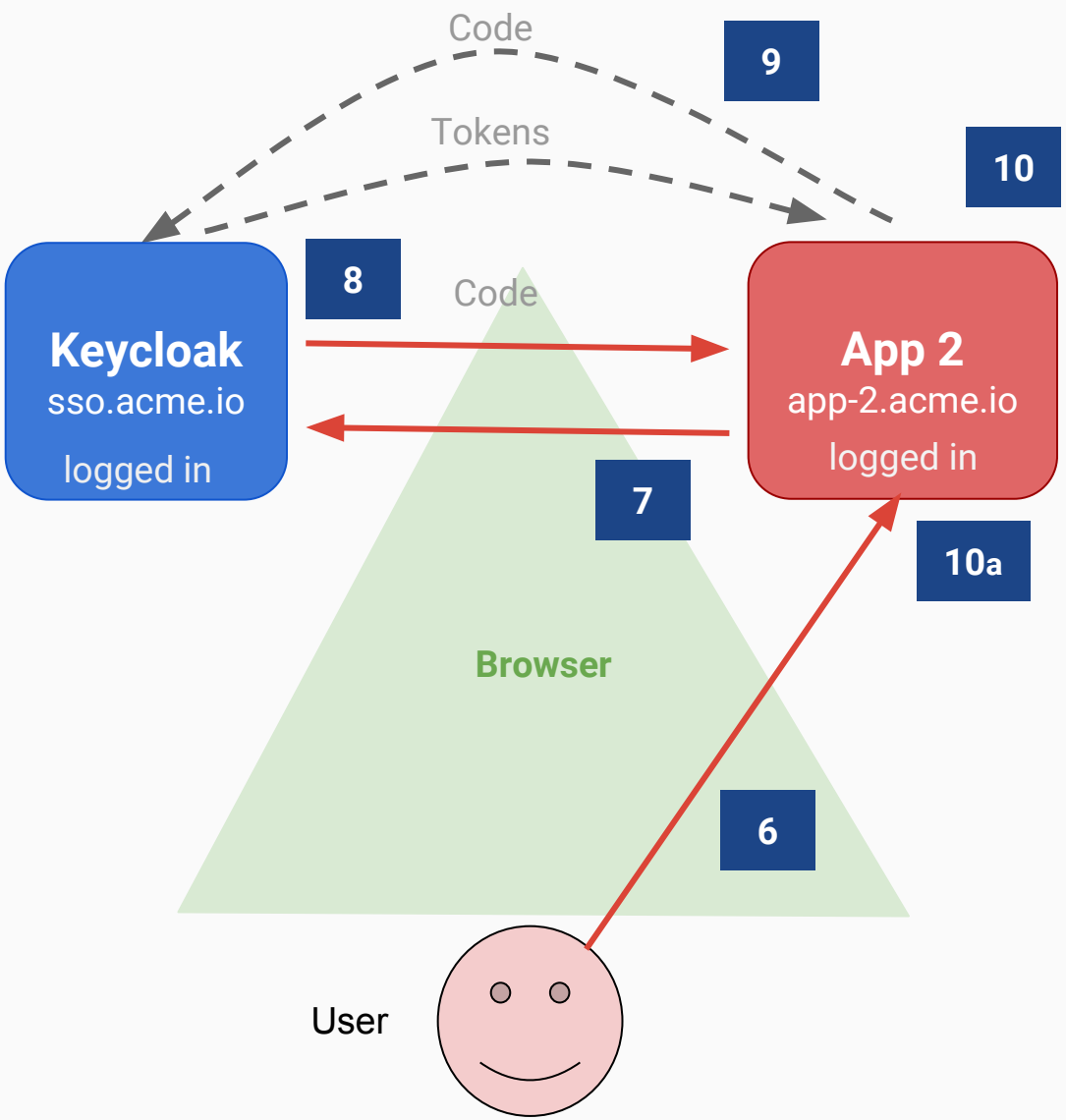
- **OpenID Connect 1.0**
  - Authentication protocol based on OAuth 2.0
  - Provides OAuth 2.0 tokens + IDToken to encode Identity
  - Tokens are encoded as JSON Web Tokens (JWT)
  - Requires communication over secure channel (HTTPS/TLS)
  - Recommended for Mobile- and Web-Applications
- **SAML 2.0** (Security Assertion Markup Language)
  - XML based authentication protocol
  - Uses XML signature and encryption → no secure channel required
  - Very mature standard & common in enterprise environments
  - Verbose and known to be not mobile friendly
- **Docker Registry v2 Authentication (new)**

Keycloak Web SSO with OIDC - Unauthenticated User



1	Unauthenticated User accesses App
2	App redirects to Keycloak for Login
2a	User submits Credentials to Keycloak
2b	Keycloak validates User Credentials
3	Keycloak creates SSO Session + Cookies and redirects User to App
4	App exchanges Code to Tokens with Keycloak via separate Channel
5	App verifies received Tokens and associates it with a session
5a	User is now “logged-in” to App

Keycloak Web SSO with OIDC - Authenticated User



...	
6	Authenticated User accesses App 2
7	App 2 redirects User to Keycloak for Login
8	Keycloak detects SSO Session creates code & redirects to App 2
9	App 2 exchanges Code to Tokens with Keycloak via separate Channel
10	App 2 verifies received Tokens and associates it with a session
10a	User is now “logged-in” to App 2

Keycloak Tokens

- Token contains User information + Metadata
  - Signed self-contained **JSON Web Token** (JWT)
  - Issued by Keycloak, Signed with Realm Private Key
  - Limited lifespan; can be revoked
- Tokens can be verified by Clients
  - … by checking the Signature with Realm Public Key
  - … or via a HTTP POST to Keycloaks /token_introspection_endpoint
- Multiple Token Types
  - **`AccessToken`** short-lived (Minutes), used for accessing a Resource
  - **`RefreshToken`** long-lived (Days), used for requesting new Tokens
  - **`OfflineToken`** special RefreshToken that “never” expires
  - **`IDToken`** contains information about User (OpenID Connect)

JSON Web Token

`<header-base64>.<payload-base64>.<signature-base64>`

Encoded

PASTE A TOKEN HERE


```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJz
dWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gR
G9lIiwiYWRtaW4iOnRydWV9.TJVA95OrM7E2cBab3
0RMHrHDcEfxjoYZgeFONFh7HgQ
```


Note

Base64 means **Encoding**

Encoding != **Encryption**

Decoded

EDIT THE PAYLOAD AND SECRET (ONLY HS256 SUPPORTED)

HEADER: ALGORITHM & TOKEN TYPE

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

PAYLOAD: DATA

```
{
  "sub": "1234567890",
  "name": "John Doe",
  "admin": true
}
```

VERIFY SIGNATURE

```
HMACSHA256(
  base64UrlEncode(header) + "." +
  base64UrlEncode(payload),
  secret
) secret base64 encoded
```

https://jwt.io

Keycloak JWT Example

Encoded PASTE A TOKEN HERE


```
eyJhbGciOiJSUzI1NiIsInR5cCIgOiAiSldUIiwia2
lkIiA6ICJMT0Rxc1Q3NFRwMFJRcjlHSmVpSXJRVnNV
blZZQzk3eF9fZ0ttc0k1TE93In0.eyJqdGkiOiJiMG
IyMGRjYy0wNmRkLTRiMzgtYTUyOS00ZDhiODg2Njdh
YjIiLCJleHAiOjE0OTA2NTM3NDIsIm5iZiI6MCwiaW
F0IjoxNDkwNjUzNDQyLCJpc3MiOiJodHRwOi8vc3Nv
LnRkbGFicy5sb2NhbDo4ODk5L3UvYXV0aC9yZWFsbX
MvamF2YWxhbmQiLCJhdWQiOiJpZG0tY2xpZW50Iiwi
c3ViIjoiMjI0Yjg3YWQtY2RkMi00NjY3LWFlODUtZW
EzZDhmZDNhNmFjIiwidHlwIjoiQmVhcmVyIiwiYXpw
IjoiaWRtLWNsaWVudCIsImF1dGhfdGltZSI6MCwic2
Vzc2lvbl9zdGF0ZSI6IjZmZDQ3MjNkLTQwYjItNGM4
Ny1iMzliLTk4YTA3N2ZmM2FkNCIsImFjciI6IjEiLC
JjbGllbnRfc2Vzc2lvbiI6IjM4Nzk5ZjgyLTBkNmMt
NDAyYy1hYmEwLTY3ZDI3NGVjZWIzMCIsImFsbG93ZW
Qtb3JpZ2lucyI6W10sInJlYWxtX2FjY2VzcyI6eyJy
b2xlcyI6WyJ1bWFfYXV0aG9yaXphdGlvbiIsInVzZX
IiXX0sInJlc291cmNlX2FjY2VzcyI6eyJhcHAtZ3Jl
ZXRpbmctc2VydmljZSI6eyJyb2xlcyI6WyJ1c2VyIl
19LCJkZW1vLXNlcnZpY2UiOnsicm9sZXMiOlsidXNl
ciJdfSwiYXBwLWphdmFlZS1wZXRjbGluaWMiOnsicm
9sZXMiOlsidXNlciJdfSwiYWNjb3VudCI6eyJyb2xl
cyI6WyJtYW5hZ2UtYWNjb3VudCIsInZpZXctcHJvZm
lsZSJdfSwiYXBwLWRlc2t0b3AiOnsicm9sZXMiOlsi
dXNlciJdfX0sIm5hbWUiOiJUaGVvIFRlc3RlciIsIn
ByZWZlcnJlZF91c2VybmFtZSI6InRlc3RlciIsImdp
```


Decoded EDIT THE PAYLOAD AND SECRET (ONLY HS256 SUPPORTED)

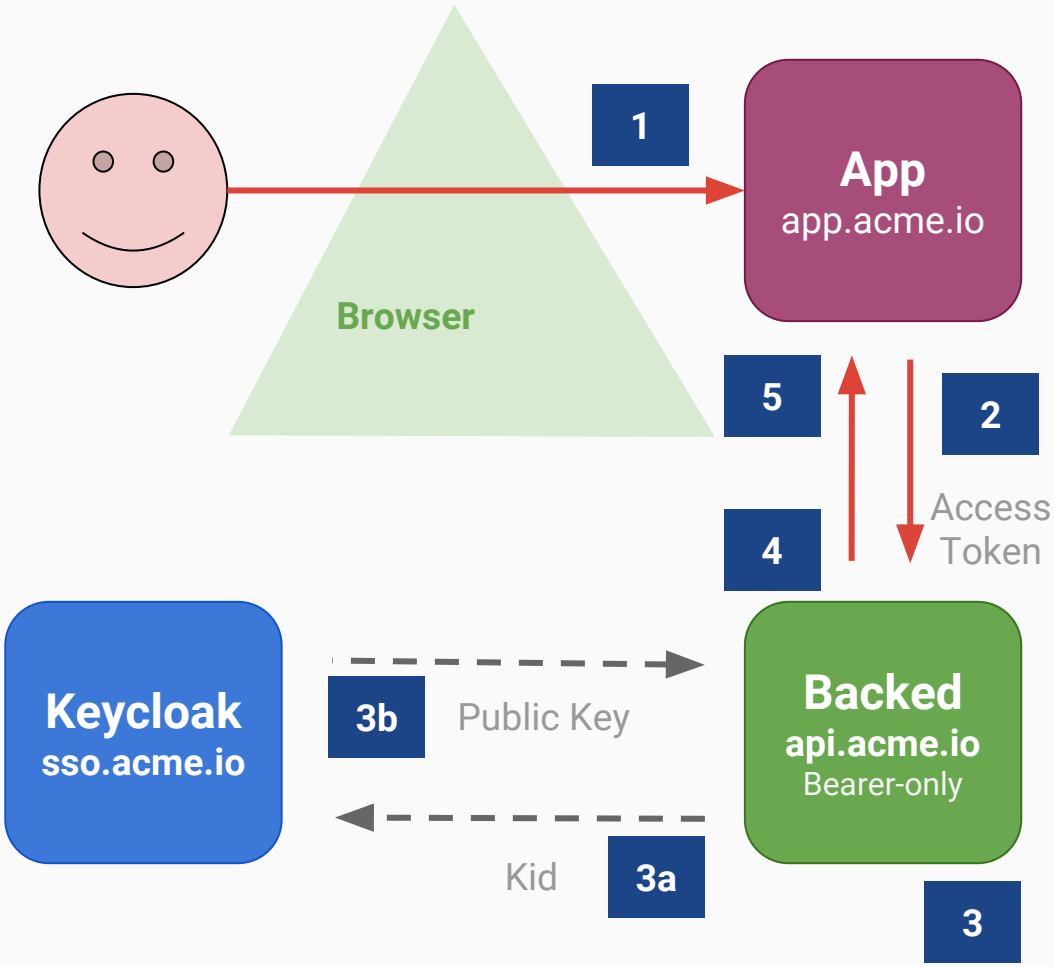
HEADER: ALGORITHM & TOKEN TYPE


```
{
  "alg": "RS256",
  "typ": "JWT",
  "kid": "LODqsT74Tp0RQr9GJeiIrQVsUnVYC97x__gKmsI5LOw"
}
```


PAYLOAD: DATA


```
{
  "jti": "b0b20dcc-06dd-4b38-a529-4d8b88667ab2",
  "exp": 1490653742,
  "nbf": 0,
  "iat": 1490653442,
  "iss":
"http://sso.tdlabs.local:8899/u/auth/realms/javaland",
  "aud": "idm-client",
  "sub": "224b87ad-cdd2-4667-ae85-ea3d8fd3a6ac",
  "typ": "Bearer",
  "azp": "idm-client",
  "auth_time": 0,
  "session_state": "6fd4723d-40b2-4c87-b39b-98a077ff3ad4",
  "acr": "1",
  "client_session": "38799f82-0d6c-402c-aba0-67d274eceb30",
  "allowed-origins": [],
  "realm_access": {
    "roles": [
      "uma_authorization",
      "user"
    ]
  },
  "resource_access": {
    "app-greeting-service": {
      "roles": [
        "user"
      ]
```

Calling Backend Services with AccessToken



1 Authenticated User accesses App

2 App uses `AccessToken` in HTTP Header to access backend

3 Backend looks-up Realm Public Key in cache with in `Kid` from JWT

3a If not found, fetch Public Key with `Kid` from Keycloak

3b Keycloak returns Realm Public Key

4 Backend verifies `AccessToken` Signature with Realm Public Key

5 Backend Service grants access and returns user data

Keycloak

Client Integration

Keycloak Integration Options

Keycloak Integrations

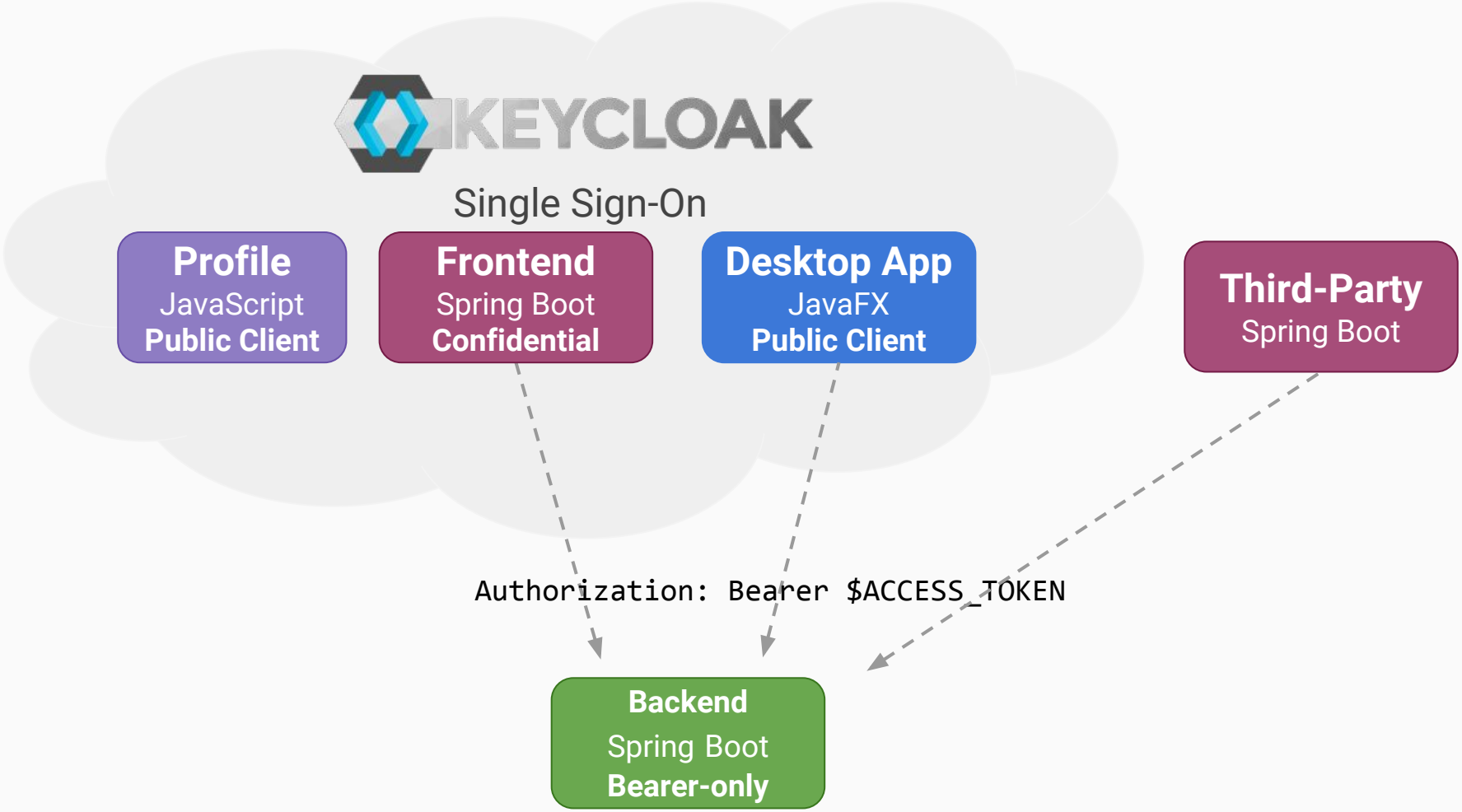
- OpenID Connect Adapters
  Spring Security, Spring Boot, ServletFilter, Tomcat, Jetty, Undertow, Wildfly, JBoss EAP, JAAS, …
  NodeJS, JavaScript, Angular, AngularJS, Aurelia, CLI & Desktop Apps...
- SAML Adapters
  ServletFilter, Tomcat, Jetty, Wildfly

Generic Integrations

- Apache Modules
  - `mod_auth_oidc` for OpenID Connect - maintained by Ping Identity
  - `mod_auth_mellon` for SAML - maintained by Red Hat
- Reverse Proxies
  - Official Keycloak Proxy injects auth info into HTTP headers
  - keycloak-proxy on github… same written in Go
- other Languages and Frameworks
  - Certified OpenID Connect Implementations
  - SAML Interoperable Implementations, Tools, Libraries and Services

Keycloak Demo
Securing Apps

Demo Environment



Desktop Applications?

- **Two ways to integrate Desktop Applications**
  - Direct Access Grants - ***no*** SSO
  - KeycloakInstalled Adapter - SSO
- **Direct Access Grants**
  - Client sends HTTP POST request to Keycloaks /token Endpoint `client_id, username, password, grant_type=password`
  - Keycloak returns Tokens (Access, ID, Refresh)
  - Client needs to parse & validate tokens
  - Client sees password → Password Anti-Pattern
- **KeycloakInstalled Adapter**
  - Enables authorization code flow for Desktop / CLI apps
  - Code to token exchange via short lived `ServerSocket@localhost`
  - Uses Keycloak Login via Browser
  - Can reuse existing SSO session

Using the KeycloakInstalled Adapter

1 Add Maven Dependency

```
<dependency>
    <groupId>org.keycloak</groupId>
    <artifactId>keycloak-installed-adapter</artifactId>
    <version>${keycloak.version}</version>
</dependency>
```

2 Export keycloak.json for Client

```
{ "realm": "acme",
 "auth-server-url": "http://sso.tdlabs.local:8899/u/auth",
 "ssl-required": "external",
 "resource": "app-frontend-javafx",
 "public-client": true,
 "use-resource-role-mappings": true }
```

3 Create KeycloakInstalled

```
KeycloakInstalled keycloak = new KeycloakInstalled();
```

4 Trigger Browser login

```
keycloak.loginDesktop();
```

5 Read current username

```
keycloak.getIdToken().getPreferredUsername()
```

6 Read & use AccessToken string

```
String token = keycloak.getTokenString(10, TimeUnit.SECONDS);
httpClient.header("Authorization", "Bearer " + token);
```

7 Trigger Browser Logout

```
keycloak.logout()
```

Keycloak

Extensions

Keycloak Extension Points

- Extensions via Service Provider Interfaces
- Custom Authentication Mechanisms
- Custom “Required Actions”
- Custom User Storage (JDBC, REST, etc.)
- Event Listener (Provisioning, JMS)
- Credentials Hashing Mechanisms
- Custom REST Endpoints
- Custom Persistent Entities
- Custom Themes
- … many more

Spi *(org.keycloak.provider)*
- ImportSpi *(org.keycloak.exportimport)*
- FormAuthenticatorSpi *(org.keycloak.authentication)*
- IdentityProviderSpi *(org.keycloak.broker.provider)*
- UserSessionSpi *(org.keycloak.models)*
- IdentityProviderMapperSpi *(org.keycloak.broker.provider)*
- PasswordHashSpi *(org.keycloak.hash)*
- MongoConnectionSpi *(org.keycloak.connections.mongo)*
- EventStoreSpi *(org.keycloak.events)*
- SocialProviderSpi *(org.keycloak.broker.social)*
- EmailTemplateSpi *(org.keycloak.email)*
- HttpClientSpi *(org.keycloak.connections.httpclient)*
- MongoUpdaterSpi *(org.keycloak.connections.mongo.updater)*
- RequiredActionSpi *(org.keycloak.authentication)*
- MessagesSpi *(org.keycloak.messages)*
- TruststoreSpi *(org.keycloak.truststore)*
- BruteForceProtectorSpi *(org.keycloak.services.managers)*
- ClusterSpi *(org.keycloak.cluster)*
- UserSpi *(org.keycloak.models)*
- ClientDescriptionConverterSpi *(org.keycloak.exportimport)*
- TimerSpi *(org.keycloak.timer)*
- InfinispanConnectionSpi *(org.keycloak.connections.infinispan)*
- EmailSenderSpi *(org.keycloak.email)*
- LoginFormsSpi *(org.keycloak.forms.login)*
- WellKnownSpi *(org.keycloak.wellknown)*
- UserFederationMapperSpi *(org.keycloak.mappers)*
- UserFederationSpi *(org.keycloak.models)*
- ThemeSpi *(org.keycloak.theme)*
- AuthenticatorSpi *(org.keycloak.authentication)*
- JpaUpdaterSpi *(org.keycloak.connections.jpa.updater)*
- ProtocolMapperSpi *(org.keycloak.protocol)*
- FormActionSpi *(org.keycloak.authentication)*
- AccountSpi *(org.keycloak.forms.account)*
- LoginProtocolSpi *(org.keycloak.protocol)*
- ClientAuthenticatorSpi *(org.keycloak.authentication)*
- ClientRegistrationSpi *(org.keycloak.services.clientregistration)*
- MigrationSpi *(org.keycloak.migration)*
- UserSessionPersisterSpi *(org.keycloak.models.session)*
- JpaConnectionSpi *(org.keycloak.connections.jpa)*
- CacheRealmProviderSpi *(org.keycloak.models.cache)*
- ExportSpi *(org.keycloak.exportimport)*
- ClientInstallationSpi *(org.keycloak.protocol)*
- EventListenerSpi *(org.keycloak.events)*
- CacheUserProviderSpi *(org.keycloak.models.cache)*
- RealmSpi *(org.keycloak.models)*

Keycloak Extensions: BeerCloak

dteleguin / beercloak https://github.com/dteleguin/beercloak

Watch 2 | Unstar 4 | Fork 1

Code | Issues 0 | Pull requests 0 | Projects 0 | Wiki | Pulse | Graphs

BeerCloak: a comprehensive KeyCloak extension example

1 commit | 1 branch | 0 releases | 1 contributor

Branch: master | New pull request | Create new file | Upload files | Find file | Clone or download

dteleguin Initial import — Latest commit 570036d on Oct 31, 2016

src/main	Initial import	5 months ago
.gitignore	Initial import	5 months ago
README.md	Initial import	5 months ago
pom.xml	Initial import	5 months ago

README.md

BeerCloak: a comprehensive KeyCloak extension example

BeerCloak is a collection of different techniques for building custom admin resources in KeyCloak.

Custom Dashboard Extension

KEYCLOAK

Master

Configure

- Realm Settings
- Clients
- Client Templates
- Roles
- Identity Providers
- User Federation
- Authentication

Manage

- Dashboard
- Groups
- Users
- Sessions
- Events
- Import

Dashboard

10 Total Users

7 Active Users

181 Logins

4 | 1

3 Registrations

1

Logins along the year

April May June July August September October November December January February March

Latest Logins

Username	login at	last visit
user777	6:43:00 PM	never
admin	6:42:08 PM	6:41:57 PM
admin	6:41:57 PM	6:41:43 PM
admin	6:41:43 PM	6:35:33 PM
admin	6:35:33 PM	6:35:31 PM

New Registrations

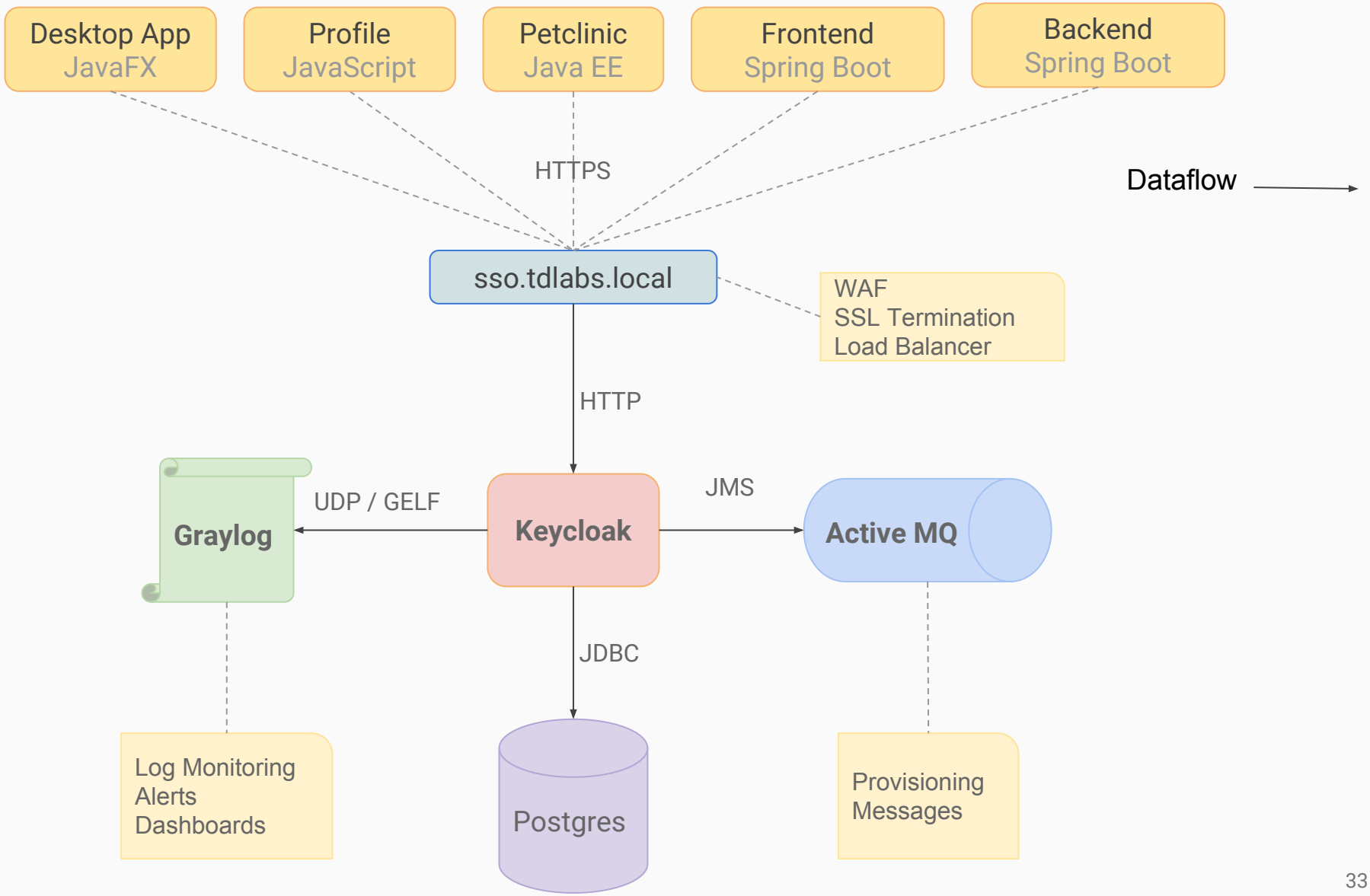
Username	Registered at
user5	11:29:39 PM
user777	6:43:00 PM
user6	9:54:52 PM

Please vote :) https://issues.jboss.org/browse/KEYCLOAK-1840

Keycloak

In the Field

Demo Environment (Docker)



https://github.com/thomasdarimont/jcon2017-keycloak

Example Docker Environment Demo

Messages

graylog

Previous 1 Next

Timestamp	source	clientId	realmId	SystemComponent	SystemGroup	type	username
2017-10-23 21:35:36.280	c9b07a369186	app	acme	idm-sso	idm	CODE_TO_TOKEN	
type=CODE_TO_TOKEN, realmId=acme, clientId=app-frontend-plainjs, userId=af86fe6e-6558-4872-88ee-0e9448e5ae91, i n_code, refresh_token_type=Refresh, refresh_tok							
2017-10-23 21:35:36.071	c9b07a369186	app	acme	idm-sso			
type=LOGIN, realmId=acme, clientId=app-frontend-plainjs, userId=af86fe6e-6558-4872-88ee-0e9448e5ae91, ipAddress= ttp://apps.tdlabs.local:20002/webapp/, consent=							
2017-10-23 21:35:34.468	c9b07a369186	app	acme	idm-sso			
type=CODE_TO_TOKEN, realmId=acme, clientId=app-javaee-petclinic, userId=af86fe6e-6558-4872-88ee-0e9448e5ae91, i a9, grant_type=authorization_code, refresh_toke							
2017-10-23 21:35:34.412	c9b07a369186	app	acme	idm-sso			
type=LOGIN, realmId=acme, clientId=app-javaee-petclinic, userId=af86fe6e-6558-4872-88ee-0e9448e5ae91, ipAddress= ttp://apps.tdlabs.local:28080/hello.jsf, consen							


```
{
  "eventId" : "f3f2fb8f-6594-499d-9590-287d9c5645bf",
  "instanceName" : "192@c9b07a369186:172.20.0.7",
  "realmId" : "acme",
  "userId" : "af86fe6e-6558-4872-88ee-0e9448e5ae91",
  "type" : "USER",
  "timestamp" : 1508793043073,
  "contextId" : "USER",
  "contextAction" : "UPDATE_PROFILE",
  "contextData" : { },
  "auditInfo" : {
    "realmId" : "acme",
    "clientId" : "account",
    "ipAddress" : "172.20.0.1",
    "userId" : "af86fe6e-6558-4872-88ee-0e9448e5ae91",
    "username" : "tester"
  },
  "userInfo" : {
    "userId" : "af86fe6e-6558-4872-88ee-0e9448e5ae91",
    "realmId" : "acme",
    "emailVerified" : false,
    "enabled" : true,
    "username" : "tester",
    "email" : "tom+tester@localhost",
    "firstname" : "Theo",
    "lastname" : "Tester",
    "creationDateTime" : 1488399721096,
    "attributes" : {
      "dev" : [ "true" ],
      "origin" : [ "legacy-system1" ]
    }
  }
}
```


ActiveMQ™

Home | Queues | Topics | Subscribers | Connections | Network | Scheduled | Send

Browse idm.queue.keycloak.r...

Message ID ↑	Correlation ID	Persistence	Priorit
ID:68752835ce14-33643-1490700806614-11:1:1:1:1		Persistent	4
ID:68752835ce14-33643-1490700806614-13:1:1:1:1		Persistent	4
ID:68752835ce14-33643-1490700806614-9:1:1:1:1		Persistent	4

Tips for working with Keycloak

- **Keep your Tokens small**
  - HTTP Header limits!
  - Only put in the token what you really need (*Full Scope Allowed = off*)
- **Keycloak provides a Realm-scoped Admin Console**
  - http://kc-host:8080/auth/admin/my-realm/console
  - Admin users needs permissions for `realm-management` in `my-realm`
- **Keycloak Admin CLI**
  - See **Blog Post**
  - `$KEYCLOAK_HOME/bin/kcadm.sh create users -r acme -s username=bubu`
- **Secure your Keycloak Installation!**
  - Keycloak exposes some undocumented Endpoints by default on server AND client!
  - Lock down `/admin`
  - Tip: Inspect other Keycloak instances to learn what to hide
    - Google Search for Keycloak Endpoints
    - Shodan search for Keycloak

Summary KEYCLOAK

- Easy to get started
  - unzip & run, Keycloak Docker Images
- Provides many features out of the Box
  - SSO, Social Login, Federation, User Management,...
- Builds on proven and robust standards
  - OAuth 2.0, OpenID Connect 1.0, SAML 2.0
- Very extensible and easy to integrate
  - Many extension points & customization options
- a Pivotal part of an Identity Management infrastructure

Links

Keycloak Website

Keycloak Docs

Keycloak Blog

Keycloak User Mailing List

Keycloak Developer Mailing List

OpenID Connect

SAML

JSON Web Tokens

Awesome Keycloak

Keycloak Dockerized Examples

Keycloak Quickstarts Example Projects

Some Missing Features

Keycloak already provides a lot out of the box, but…

- Analyzing events in Admin Console is tedious and very limited
- Events don't contain enough information
- No hooks to notify other applications about User Profile changes

Needed to extend Keycloak with...

- Custom `EventListener` that enriches and forwards events via JMS
- Integrated `GELF` Logging Appender to ship logs to Graylog Log Server
- See https://github.com/jugsaar/visit-yajug-20161023-keycloak

Accessing the API Backend with CURL

1 Request new Tokens via Password Credentials Grant (Direct Access Grants in Keycloak)

```
KC_RESPONSE=$(curl -X POST \
  http://sso.tdlabs.local:8899/u/auth/realms/acme/protocol/openid-connect/token \
  -d 'grant_type=password' \
  -d 'username=tester&password=test' \
  -d 'client_id=app-frontend-springboot' \
  -d 'client_secret=4822a740-20b9-4ff7-bbed-e664f4a70eb6' \
)
```

2 Extract AccessToken

```
KC_ACCESS_TOKEN=$(echo $KC_RESPONSE | jq -r .access_token)
# eyJhbGciOiJSUzI1NiIsInR5cCIgOiAiSldUIiwia2lkIiA6ICJGY3RMVHJqeWRxYkpISGZ0d29U ...
```

3 Use AccessToken in Authorization Header

```
curl \
  -H "Authorization: Bearer $KC_ACCESS_TOKEN" \
  http://apps.tdlabs.local:20000/todos/search/my-todos

Response
{
  "_embedded" : { "todos" : [ { "name" : "Buy milk",  "description" : "...",...
```