ABX Ninja
Backend Design Document

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Vision Statement

Our goal is to create a web application that can be used by clinicians at Johns Hopkins Bayview Medical Center in order to provide antibiotic recommendations for patients affected by common infections. Centers for Disease Control and Prevention estimates that up to 50% of all the antibiotics prescribed for people are not needed or are not optimally effective as prescribed. This overuse of antibiotics is a dangerous issue facing healthcare in the United States and other countries around the world. To improve the accuracy of antibiotic prescription, Antibiotic Ninja will assist healthcare providers by making an appropriate antibiotic recommendation for patients based on their history, vital signs, and lab results.

Use Cases

Healthcare provider successfully launches using Epic

1. User clicks on icon in Epic to visit login page
2. Home page displays a login selection with username and password fields
3. User clicks on “Register through Epic”
4. User providers username and password
5. User is brought to Clinical Pathway screen

Healthcare provider unsuccessfully signs in using Epic

1. User clicks on icon in Epic to visit login page
2. Home page displays a login selection with Epic username and password fields
3. User provides invalid username and password
4. User is brought back to login home page with invalid login error message

Healthcare provider successfully launches from web browser

1. User enters “www.abxninja.com” to visit login page
2. Home page displays a login selection with username and password fields
3. User clicks on “Register through Epic”
4. User providers username and password
5. User is brought to Clinical Pathway screen

Healthcare provider unsuccessfully signs in from web browser

1. User enters “www.abxninja.com” to visit login page
2. Home page displays a login selection with Epic username and password fields
3. User provides invalid username and password
4. User is brought back to login home page with invalid login error message

Healthcare provider receives recommendation for [UTI, SSTI, or Respiratory Infection]

1. User successfully signs in
2. User is brought to Clinical Pathway screen
3. User clicks on [“Urinary Tract Infection,” “Soft Skin and Tissue Infection,” or “Respiratory Infection”] to follow [UTI, SSTI, or Respiratory Infection] pathway
4. User enters patient’s clinical features and past history by selecting items from a list
5. User enters patient’s symptoms by selecting items from a list
6. User enters patient’s general information by typing in fields
7. User enters patient’s image findings by moving sliders to “yes” position

8. User receives assessment for [UTI, SSTI, or Respiratory Infection]
9. User receives recommendation for [UTI, SSTI, or Respiratory Infection]

Administrator successfully launches using Epic

1. User clicks on icon in Epic to visit login page
2. Home page displays a login selection with Epic username and password fields
3. User clicks on “Register through Epic”
4. User providers username and password
5. User is brought to Administrator Dashboard

Administrator unsuccessfully signs in using Epic

1. User clicks on icon in Epic to visit login page
2. Home page displays a login selection with Epic username and password fields
3. User provides invalid username and password
4. User is brought back to login home page with invalid login error message

Administrator successfully launches using web browser

1. User enters “www.abxninja.com” to visit login page
2. Home page displays a login selection with Epic username and password fields
3. User clicks on “Register through Epic”
4. User providers username and password
5. User is brought to Administrator Dashboard

Administrator unsuccessfully signs in using web browser

5. User enters “www.abxninja.com” to visit login page
6. Home page displays a login selection with Epic username and password fields
7. User provides invalid username and password
8. User is brought back to login home page with invalid login error message

Administrator edits [UTI, SSTI, or Respiratory Infection] decision tree details

1. User successfully signs in
2. User is brought to Administrator Dashboard
3. User clicks “Edit Pathway”
4. User is brought to Clinical Pathways screen
5. User selects “Urinary Tract Infection”
6. User is brought to a list of antibiotic recommendations
7. User clicks on a particular antibiotic and views alternate choices

8. User selects alternate choice
9. User clicks “Save”
10. User returns to Dashboard

Administrator views hospital stats

1. User successfully sign in
2. User is brought to Administrator Dashboard
3. User clicks “View Stats”
4. User is brought to Hospital Statistics screen
5. User returns to Dashboard

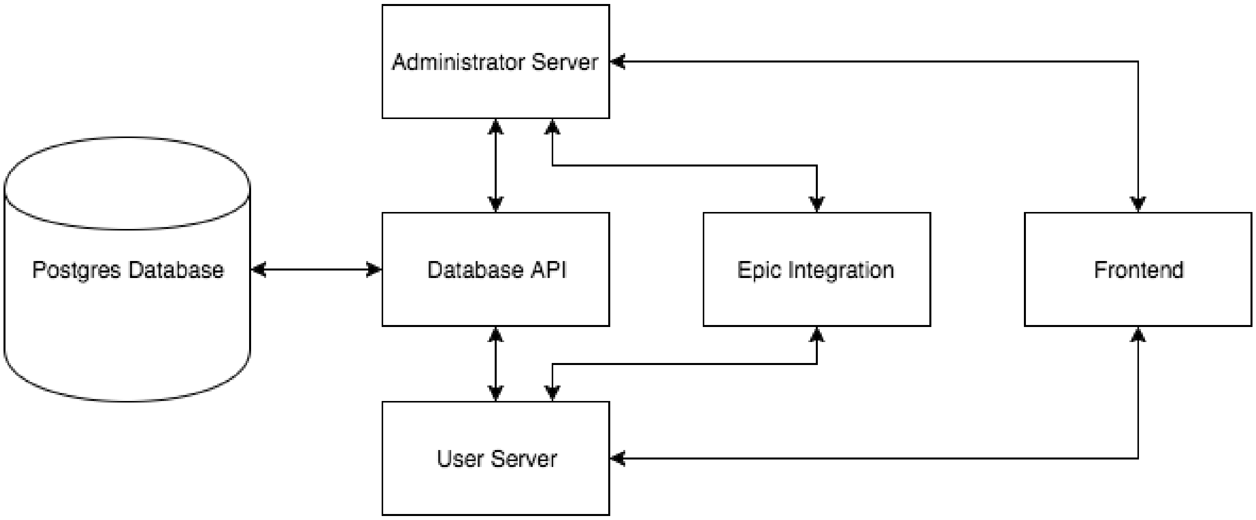
Architecture

Overview

The ABX Ninja web application will give decision support to doctors when prescribing antibiotics. Our advisor, Dr. Jenny Townsend, has developed decision trees that healthcare providers follow when diagnosing a suspected infection patient. These decision trees will inform the underlying database structure and flow of our application. The web application will have an administrator portal, which will allow administrators to customize these decision trees and view institution statistics, and a user portal, which will allow healthcare providers to enter patient health data as prompted and receive an antibiotic recommendation. We will use a PostgreSQL database to store the data for the decision trees. For the rest of the stack, we will use Node.js, Express.js, Angular.js, and Bootstrap.

Component Diagram

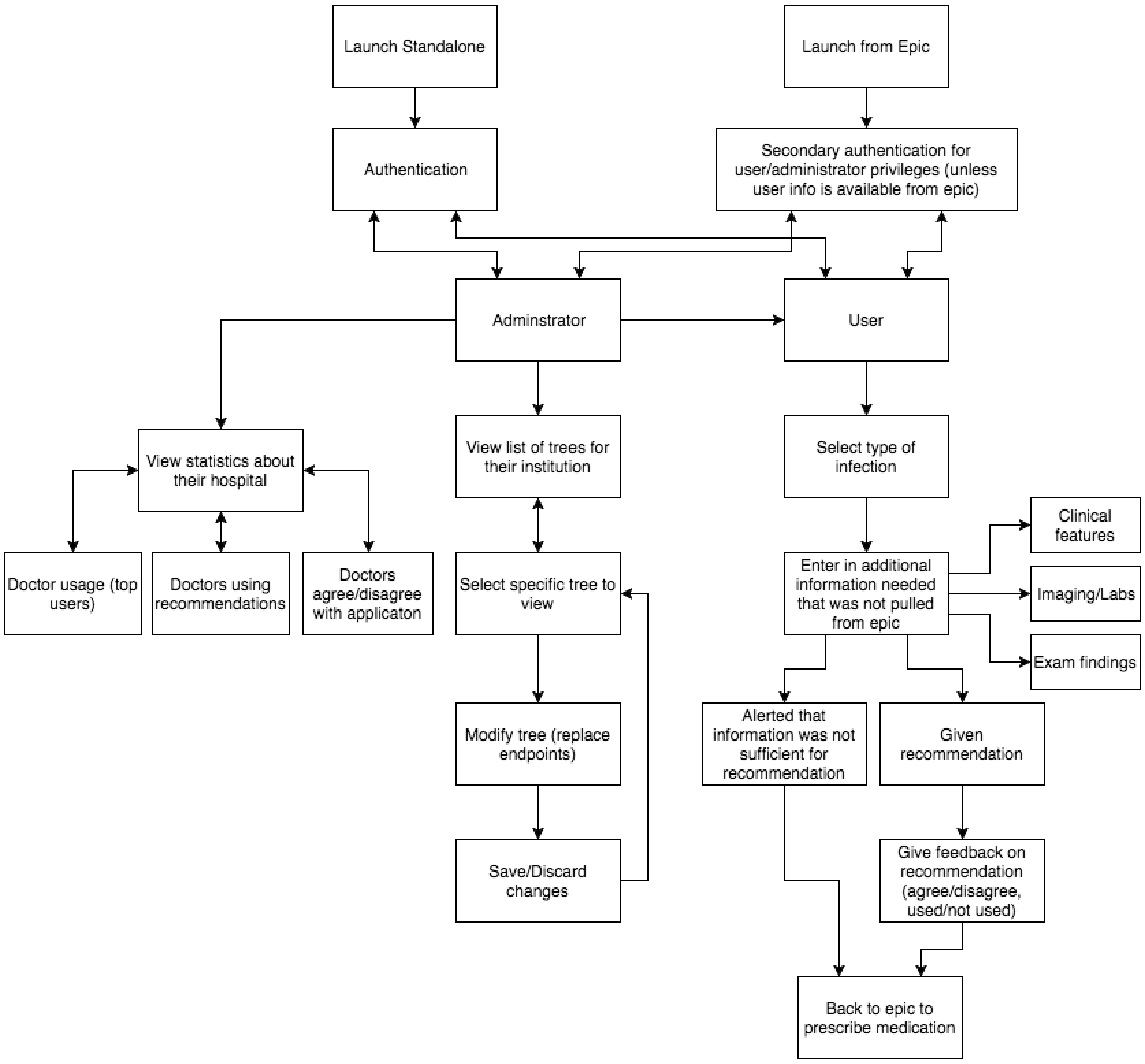
The following diagram shows the general components of the design and their interaction. A PostgreSQL database will store all of the application's information. An API will be used to query and access the database as well as perform object-relational mapping. This API will be used by the administrator server and the user server. Once Epic integration is supported, both the administrator server and user server will have access to an API that will be responsible for interactions with Epic. The frontend will be built out to support functionality for all users, however, certain features will only be available to users with administrative access.



Architecture

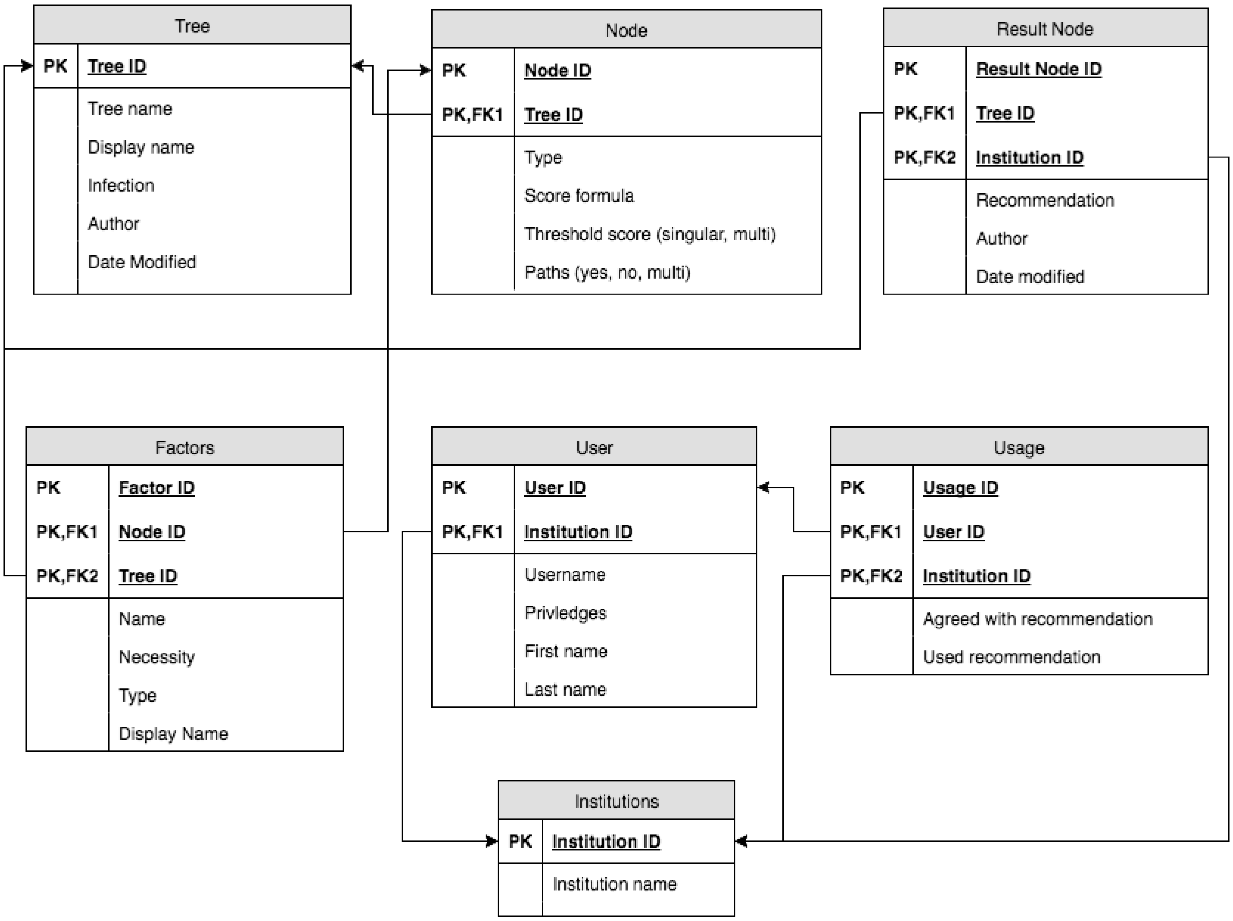
State Diagram

The following diagram shows the flow of the application. There will be two launch types and two types of users. General users will have the ability to select an infection type, enter patient information, and receive an antibiotic recommendation. If the user has administrative privileges, they will be able to access the administrator tasks which include modifying the decision trees as well as viewing statistics about the application's usage within their institution.


Launch Standalone
Launch from Epic
Authentication
Secondary authentication for user/administrator privileges (unless user info is available from epic)
Adminstrator
User
View statistics about their hospital
View list of trees for their institution
Select type of infection
Clinical features
Doctor usage (top users)
Doctors using recommendations
Doctors agree/disagree with applicaton
Select specific tree to view
Enter in additional information needed that was not pulled from epic
Imaging/Labs
Exam findings
Modify tree (replace endpoints)
Alerted that information was not sufficient for recommendation
Given recommendation
Save/Discard changes
Give feedback on recommendation (agree/disagree, used/not used)
Back to epic to prescribe medication

Architecture

Database Design



Tree	
PK	Tree ID
	Tree name Display name Infection Author Date Modified

Node	
PK	Node ID
PK,FK1	Tree ID
	Type Score formula Threshold score (singular, multi) Paths (yes, no, multi)

Result Node	
PK	Result Node ID
PK,FK1	Tree ID
PK,FK2	Institution ID
	Recommendation Author Date modified

Factors	
PK	Factor ID
PK,FK1	Node ID
PK,FK2	Tree ID
	Name Necessity Type Display Name

User	
PK	User ID
PK,FK1	Institution ID
	Username Privledges First name Last name

Usage	
PK	Usage ID
PK,FK1	User ID
PK,FK2	Institution ID
	Agreed with recommendation Used recommendation

Institutions	
PK	Institution ID
	Institution name

The database will also be responsible for storing current patient data to be used to obtain outcome data 30 days post discharge. However, due to the time constraints on integration with Epic to obtain that data, we have left out the schemas for those tables. If we are able to integrate with Epic prior to the deadline of our project, we will update this document. Otherwise, we feel it would be best to allow the developers who take over this project to determine the best schema for that data when they actually are able to pull from Epic.

References

CDC. Antibiotic Resistance Threats in the United States, 2013. Vol CS239559-B. Atlanta, GA2013:114.