**Product:** Waterford Early Learning

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# Architecture

## Overview

The purpose of this paper is to define the individual elements of the *Waterford Early Learning*™ *5* architecture, how they are set up, and how they interact with each other.

The new architecture of *Waterford Early Learning5* provides benefits for teachers, students, and technical directors. Users will experience improved data security, a smaller media footprint, easier technical install, and better scalability.

New features of the *Waterford Early Learning 5*architecture include the following:

* *Waterford Manager* has been completely rewritten and is now a Web application that runs within a Web browser. Both the manager and the Student App now communicate through HTTP to help educators and students more easily access media.
* *Waterford Early Learning* now uses PostgreSQL as the database. This move reduces the total cost of ownership for customers who are implementing the program in more than one classroom.
* The Web-enabled manager is built on a Service Oriented Architecture to allow for a Web-friendly install of the software. This new architecture follows standard conventions that will allow future releases of *Waterford Early Learning* to include API interfaces and LDAP integration.

## Definition of Elements

The architecture of *Waterford Early Learning 5* is composed of four elements: the Browser, the Student App, the Application Server, and the Database.

The following is an overview of each element:

* The Browser runs *Waterford Manager.*
* The Student App is a Java Webstart application that runs the *Waterford Early Learning* Client.
* The Application Server uses Oracle Glassfish v3.1, which is an open source application server. This element of the *Waterford Early Learning* architecture contains all services, reports, and media used by *Waterford Manager* and the *Waterford Early Learning* Client.
* The Database uses the PostgreSQL database, which reduces the total cost of ownership for customers implementing *Waterford Early Learning*.

## Components of Each Element

The elements within the architecture of *Waterford Early Learning 5* are comprised of components that run the program and communicate between the elements in order to provide needed information.

### Browser

The Browser includes the following:

* *Waterford Manager*
* Google Web Toolkit—a development toolkit that provides the language framework, written in Java
* HTTP—the networking protocol that provides communication between the Browser and the Application Server

### Student App

The Student App includes the following:

* *Waterford Early Learning* Client—the application students run when using the program; it is installed using Java Webstart technology
* HTTP—the networking protocol used for communication; the Student App communicates with the server using HTTP REST services provided by the Application Server

### Application Server

The Application Server includes the following services:

* *Waterford Manager* Service—the Web application that sends the *Waterford Manager* to the Browser
* Binary Service—the service that contains audio and images uploaded by *Waterford Manager* or the Student App
* Student Service—the service that contains student profiles; a unique ID is assigned to each student
* Session Service—the service that tracks students’ sessions that students are currently playing as well as history of session times for reporting purposes
* Sequencer Service—the service that communicates which activity to play
* Scoring Service—the service used to process and store student performance data
* Licensing Service—the service that is used by the Student App to make sure licensing exists in order to begin the program
* ApacheDS—a locally deployed LDAP server where users and their roles are stored
* *Waterford Early Learning* Media Filter—the service that Clients connect to in order to retrieve media
* Webstart Service—the service used for Webstart installation of Clients and handling their updates
* Reports Service—the service that uses the BIRT Reports engine to generate reports

### Database

The database uses the PostgreSQL database.

## Communication between Components

The Browser and the Student App both use HTTP to communicate with the Application Server. Because *Waterford Manager* is built in Google Web Toolkit, the Application Server also includes Google Web Toolkit and JAXB in order for the Browser to communicate and retrieve services from the Application Server.

Reports use port 8081 for communications; all other communications with the server are done through port 8080.

The Application Server communicates to the database using Hibernate to retrieve the needed data from the PostgreSQL database. The server communicates with the PostgreSQL database using the port 5432.