A Survey on Business Intelligence tools for University Dashboard development

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Abstract— **This paper presents a detailed survey on existing Business Intelligence (BI) tools for developing a dashboard in a typical academic setup. As a survey, few most popular BI tools like SpagoBI, Tableau, Pentaho, Qliksense, Jaspersoft and Jedox are considered based on the ease of use, support in terms of training and minimal initial cost. At the end, a sample dashboard has been developed using one of the tools Tableau to demonstrate the feasibility of the same for the university data visualization.**

Keywords: Dashboard, Business Intelligence, Data Reports, Visualization, Data Analytics

Introduction

Business Analytics or Business Intelligence (BI) are becoming more needed by the top management of any organization to visualize, analyze and prepare the strategic planning for the future. However, the availability of business intelligence tools, the support on the existing infrastructure (including hardware and software), scalability, usability, financial commitment and other parameters make it challenging for the IT team to decide the right BI tool for the organization. This work attempts in easing the decision making process on the BI tools, particularly useful for a typical academic setup by surveying the top BI tools in the market in terms of cost, support, scalability and other necessary parameters.

This paper discusses about the Business Intelligence tools that are available either open source or running on open source with less cost in implementing for a university. This is prepared with an intention of identifying a suitable tool for the data visualization/ dashboard/business intelligence in a typical university for academic and management purpose.

1. JasperReports

JasperReports is an open source reporting engine and BI tool developed in Java by Jaspersoft [1]. The main fucntions include dashboards, tables, crosstabs, charts and gauges.

Data sources can be a relational database, flat files or XML and reports can be generated in HTML, PDF, or office suite formats. And there can be multiple data sources of multiple kinds in one report.

JasperReports is part of a wider suite of tools that make up Jasersoft's business intelligence suite "community edition". There are tools available for OLAP, ETL and SOA Web services.

It has various versions under community and commercial licenses in which the later gets more in terms of professional support and add-ons.

1.1 Additional Features

Training support: The JasperReports has a strong learning sources which includes learning materials, training (self-paced and instructor lead), scheduled events and webinars, on-demand webinars and resource centers [2].

*Cloud Support:*The JasperReports suite is available on the cloud to host the services on a license basis. However, for a trial, it provides a cloud based live trial environment with sample data, reports, analysis views and dashboards [3].

Academic Partners: The JasperReports has a presence among reasonable number of universities in North America. As per the report from their

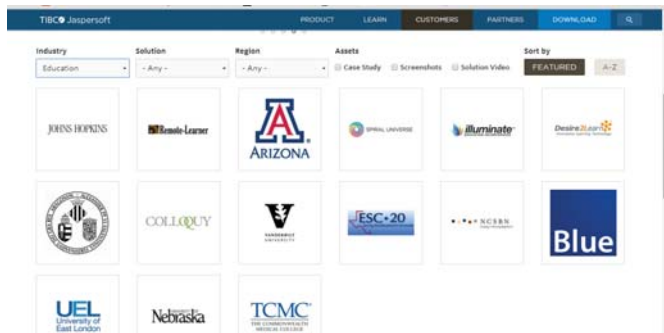website, the Fig 1 shows the academic partners of JasperReports.

Fig 1. University Customers using JasperSoft
(source: http://www.jaspersoft.com/customers)

2. Pentaho

Pentaho is a suite of BI tools including apps for data integration, reporting, analysis, dashboards and data mining [4].

Like the other enterprise-class BI tools, Pentaho's reporting module supports multiple data sources and can report to the Web, PDF and office document formats.

Pentaho release builds are available from the SourceForge.net open source site or the source code is available direct from the Subversion repository.

The enterprise edition of Pentaho has additional functionality and support. Pentaho now integrates with the Hadoop open source cloud platform.

2.1 Additional Features

Features of Business Analytics: It provides interactive visual analysis, graphical and responsive dashboards, comprehensive solutions for reporting, streamlined management and administration, complete data integration and predictive analysis [5].

Learning Support: The Pentaho provides very good support for learning. It has sources in terms of getting started, knowledge base which has best practices and blogs, training includes video materials (paid and free), online or public class room training and documentation.

Cloud/Mobile Support: Pentaho provides a flexible platform for cloud based visualization of data from any source [6].

The list of academic customers are reasonable in numbers and it has good presence among countable number of other industries like Finance, Healthcare and Retail.

3. SpagoBI

SpagoBI is part of the SpagoWorld open source initiative founded by Italian IT services company Engineering Group [7].

Its developers proclaim SpagoBI to be the only "entirely open source" business intelligence suite. The BI suite consists of some 15 components – from reporting, OLAP and data mining to charting, dashboards and ETL. The SpagoBI server includes an interactive dashboard and integration with other reporting tools.

SpagoBI is composed of the following main modules [8]:

- *SpagoBI Server*, the core of the suite including the analytical tools and features

- *SpagoBI Studio*, the integrated development environment

- *SpagoBI Meta*, the metadata environment

- *SpagoBI SDK*, the integration layer allowing to use SpagoBI with external tools

- *SpagoBI Applications*, a collection of vertical analytical models that are developed using SpagoBI.

Data can be accessed from the Oracle, MySQL, Ingres or PostgreSQL databases.

In addition to the BI product, SpagoWorld includes apps for enterprise Java and SOA development, quality measurement and middleware.

3.1 Additional Features

Fully Opensource: Spago has a strong community and forum to support the users. It also has a tracker which is used to report the bugs and fix it. It's the 10th year for SpagoBI and hence one can expect a sound user base.

Learning Support: SpagoBI has scheduled webinars, video tutorials (available through youtube) [9] and presentations through Slideshare [10]

Mobile Support: SpagoBI supports mobile interface by allowing access through interactive reports, dashboards and cockpits. SpagoBI mobile [11] enables

- user authentication

- role-based document and data access

- data update

- scheduled analysis

- periodical and automatic access to identify possible alarms and notifications.

University Customers: SpagoBI has a very strong collaboration with universities by taking part in workshops, presentations and training and support and master's thesis [12]. It has a huge line up of universities majorly from Italy and other European countries.

4. Palo/Jedox

Palo is a business intelligence suite designed for performance management functions, including planning, analytics, reporting and ETL.

The suite, develped by German software company Jedox, includes an in-memory OLAP Server, an Ajax-enabled online spreadsheet and a web-based ETL tool [13].

Add-ons are available for Excel and OpenOffice to make better use of data housed in spreadsheets.

Integration with SAP is also a feature of Palo and Jedox. It is working with researchers from the

University of Freiburg and the University of Western Australia on Palo GPU, a technology that uses Nvidia GPU hardware to speed up large data processing jobs.

4.1 Additional Features

Flexible Cost: As per the pricing stated, the base version is free and the cost of other models vary depending on the requirement of the customers

Learning Support: Jedox provides learning support in terms of Academy which includes specialized traning for various levels of users like developers, experts, professionals and administrators; consulting which is used to plan, build and deploy step by step; Knowledge base which has articles, tutorials and community forum

Cloud/Mobile Support: Jedox Cloud provides quick development of reporting and planning. It is robust, secure, scalable and cost effective [14]. The mobile apps support Android and iOS as shown in Fig 2.

Fig 2. Jedox Mobile App suppport (source: http://jedox-mobile.com/en/)

University Customers: Jedox has a strong user base in the education industry as listed below [15];

- Disney English
- Fachhochschule für öffentliche Verwaltung Nordrhein-Westfalen (Federal University of Applied Administrative Sciences North Rhine-Westphalia)
- IMC Fachhochschule Krems

- Klett Lernen und Information GmbH
- Leuphana Universität Lüneburg
- Macquarie University
- Monash College
- Studygroup
- University Medical Center Göttingen (Vorstand der Universitätsmedizin Göttingen Georg-August-Universität)
- University of Wollongong, New South Wales

5. Tableau

Tableau has been very aggressive in marketing by the most attractive feature of drag and drop products [16]. Anyone can analyze data with Tableau's intuitive drag & drop products. No programming, just insight. Connecting and visualizing your data in minutes, Tableau is 10 to 100x faster than existing solutions are some of the significant features for the business analysts to choose this tool.

Sharing of the data is made easy through web and mobile. It connects to a wide range of data sources. The dashboards are rich in terms of data visualization and very interactive. Fig 4 shows the versions of Tableau product available for various purposes.
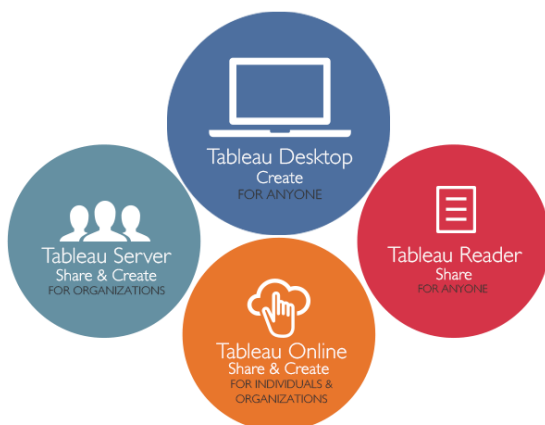

Fig 4. Tableau products (source: http://www.tableau.com/products)

5.1 Tableau Desktop

This version of Tableau is available in two editions as Professional Edition which supports all data sources and connects to Tableau server for web-based analytics and Personal Edition which supports only Excel, Access and CSV formats of data sources and doesn't provide any server support. Both of them are priced for commercial purpose and available for academic purpose for one year.

5.2 Tableau Server

Tableau Server is an online & mobile business intelligence solution. This is used to publish dashboards with Tableau Desktop and share them throughout your organization. IT supports all the same data sources as Tableau Desktop. Also it extends support to all browsers across platforms and devices.

5.3 Tableau online

Tableau Online is a hosted version of Tableau Server. It is used to publish dashboards with Tableau Desktop and share them with colleagues, partners or customers. With this version, it is easy to find answers in minutes—whenever, wherever you are. It provides a storage of 100 Gigabytes for the commercial license.

5.4 Tableau Public

Tableau Public is for anyone who wants to tell interactive data stories on the web. You'll be able to connect to data, create interactive data visualizations and publish them directly to your website. This is useful for some who share lots of data online.

5.5 Tableau Reader

Tableau Reader is a free desktop application that can be used to open and view visualizations built in Tableau Desktop. With Tableau Reader it is possible to open and interact with visualizations built with Tableau Desktop, data included.

However, it won't allow to edit or perform any interactions if the author hasn't built it.

5.6 Learning Support

Tableau provides very robust support for learning through online tutorials, webinars, on demand videos, video tutorials, and scheduled seminars. The forums and other community based help is also available for learning the tool.

6. Qlik Sense

Qlick Sense is an interactive self-service visualization and discovery tool to analyze, interpret and visualize huge data sources [17]. The drag and drop features of the interface is good for rapid building of dashboards, data visualization and reports (Fig 3). It is available as desktop and server or in cloud versions.

Fig 3. Drag and Drop Features of Qlik Sense (Source: http://www.qlik.com/products/qlik-sense)

Following are the three versions for different types of users:

6.1 Qlik Sense Desktop

This is targeting the individual users for importing own data and visualizing on a personal computer. The good news about this version is that it's free to download for personal use. Anyone wants to try before going on a large scale, this would be best choice.

6.2 Qlik Sense Enterprise

This is for enterprises having large data sources with custom visualizations.

6.3 Qlik Sense Cloud

Competing with other tools, this version supports the cloud hosting of the data analysis and visualization.

In additional to the features stated above, Qlik sense provides wide support through webinars, forums, training materials and video tutorials.

7. Comparison and Inference

The above BI tools are surveyed for the purpose of developing a dashboard for a University. Hence all the tools are viewed and analyzed from the perspective of an academic research and possible deployment of the tool for the analytics of university data. Table 1 shows the comparison of three of the BI tools that the authors have installed and tried from the academic research perspective which includes resource constraints like computing platforms, licensing and data sources.

Table 1. Comparison of BI tools

BI Tool	License	Trial	Easy of use	Training / Forums	Platform	Data Integration	Remarks
Tableu	Commercial	Yes	Easy to Install, Importing data is easier	Lots of video tutorials/ Demos/ Webinars	Windows	All	Though its commercial, academic purpose may try with one year free license.
SpagoBI	Fully Opensource	Full version	Bit tricky	Forums, Training documents	Windows, Linux	All	It runs Tomcat server, it needs openoffice.
Qlik	Commercial	Yes	Easy to install and importing data	Tutorials/Video and online forums available	Windows 8 and later (not on earlier versions)	All	It runs on Windows 8 or later. Doesn't support Windows 7.

Fig 4. KPIs shown with interactive data

8. Dashboard development

In this section, a sample dashboard development has been demonstrated. It shows only a module of the whole dashboard. We have considered showing the visual interpretation of quality process data which are categorized under Key Performance Indicators (KPI). The data source is Oracle. We used Tableau Desktop for experimentation. Also availed the feature of Tableau public to demonstrate the availability of Dashboard online.

Fig 4 shows one of the screenshots of data visualization produced from various KPIs of Al Yamamah University, Kingdom of Saudi Arabia. The data source include oracle and few from Excel sheets. The front end is built interactive to filter the data interpretation.
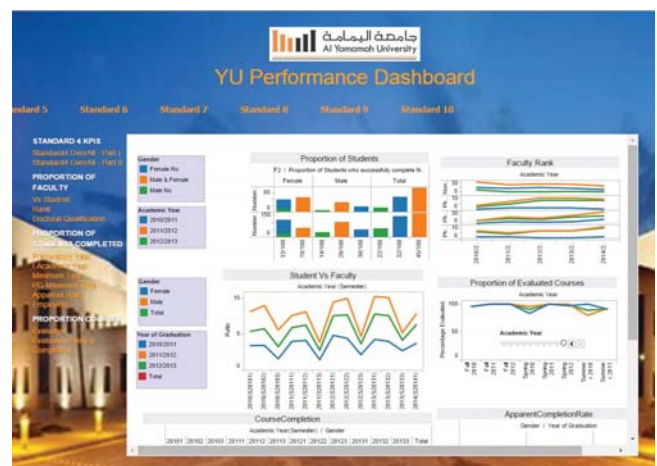
9. Conclusion

At the time of writing this paper, there are plenty of BI tools available in the market. In this paper, we have considered few potential BI tools that could be used for the purpose of academic and commercial purpose whereas the preference of this paper was on research on Business Intelligence. With the limited resources and the cost of investment, the authors have explored the tools presented in this paper. However, considering the size of university and

initial cost of investment, it is recommended to go with fully open source or partial open source where the training, deployment and continuous support are provided by the service provider.

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