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OLAP TOOLS REPORT

IBM COGNOS & SISENSE

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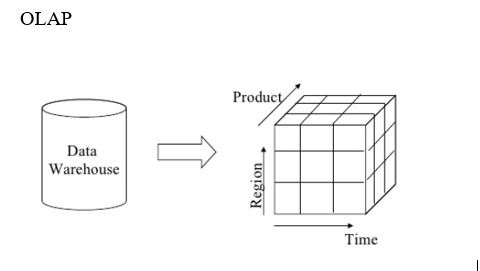
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# CHAPTER 1 - INTRODUCTION TO OLAP

As brief introduction, Online Analytical Processing (OLAP) is used to analyze multidimensional data interactively from multiple perspectives. In other words, an Online Analytical Processing database, transforms table-based datasets into multi-dimensional arrays known as Cubes in order to optimize querying and data retrieval. Users or stakeholders can then access specific dimensions of the data for analysis purposes. For instance, in an e-commerce platform or a company, a stakeholder may want to know a given product sales revenues at a given point in time, and in some specific regions for decision making purpose. So, OLAP helps to run multi-dimensional analytical queries, analyze, and present data with different dimensions such as location, time, product just to cite a few. In addition, to efficiently answer queries, OLAP process is divided into three categories that will be further developed in the analysis below. These categories include: Consolidation or Roll-up (these are roll-up cells that contain aggregate data, based on some parameters such as items by sales by location.), Drill-down, and slicing and dicing.



Furthermore, there are several OLAP products including:

Multidimensional Online Analytical Processing (MOLAP): This is an OLAP that indexes directly into a multidimensional database. This particularity of this tool is that it processes data that is already stored in a dimensional array in which all possible combinations of data are reflected, each in a cell that can be accessed directly. Below is an example of MOLAP

A screenshot of a cell phone

Description automatically generated

Relational Online Analytical Processing (ROLAP) is known as a form of OLAP that performs dynamic multidimensional analysis of data stored in a relational database rather than in a multidimensional database. Also, in ROLAP data processing may take place within a database system, a client, or mid-tier server. Another particularity of ROLAP is the fact that it requires more processing time and disk space to execute some of the tasks that multidimensional databases are designed for because ROLAP uses a relational database. Furthermore, as benefits, ROLAP can support larger group of users and greater amounts of data.

HOLAP (Hybrid Online Analytical Processing) is a combination of both ROLAP and MOLAP. User of HOLAP made it clear that one of the particularities of this tool is that “it was developed to combine greater data capacity of ROLAP with the superior processing capacity from MOLAP”. For this reason, HOLAP remains the preferred choice in the market for most users. Also, it is important to mention that HOLAP can store data in both relational and multidimensional database. Then, it uses which database is best suited for processing depending the processing type (speculative or data heavy processing).

In addition, even though OLAP technology provided a great basis for business intelligence over two decades, it suffers from some limitations which make it less favorable for most modern BI projects. These limitations or constraints includes: Resource-intensive data storage and management, time-consuming to produce each build when new data is added, and the need to pre-defined queries just to cite a few.

# CHAPTER 2- OVERVIEW OF SELECTED OLAP TOOLS

## IBM Cognos

As brief history, Cognos was a Canadian company based in Ontario and making business intelligence and performance management software. Founded by Peter Glenister and Alan Rushforth in 1969, it was acquired by IBM in 2007 and formally changed its name to IBM Cognos.

According to IBM Knowledge Center, IBM Cognos Intelligence is an integrated business intelligence suite that provides a wide range of functionality to help understand an organization’s data. It helps to create business reports, analyze data, and monitor events and metrics in order to make effective business decisions. IBM Cognos BI integrates several business intelligences tools into one web-based solution. Its components include IBM Cognos Connection, Insight, Workspace, Report Studio, Event Studio, Metric Studio, Query Studio and IBM Cognos Analysis Studio. Every organization, depending on its licensing permissions, can tailor its IBM Cognos Business Intelligence based on the components of the suite listed

## Sisense

Sisense is an analytical reporting cloud technology that has helped business industries by creating easy and fast data processes through technological innovation. Sisense started 10 years ago and it has been a leader in the industry and widely accepted by the data and business analytic market. It is a powerful tool that can tackle big and disparate datasets. Google defines it as a business intelligence platform that lets you join, analyze, and picture out information they require to make better and more intelligent business decisions and craft out workable plans and strategies.

LinkedIn defines it as the easiest way to get real business insights from complex data with radically innovative business analytics. Sisense software has a lot of benefits to designers. It can be used to gather important information from data sources and recreate them into a single repository. Apart from that, designers can share their insights with their team members and clients on Sisense.

Sisense has the following top features that distinguishes it from other business analytic tools. It has an attractive visualization that is very interactive. There are embedded dashboards with drag and drop interfaces, data mashups, data unification and finally data can be exported to pdf, excel csv and etcetera. These features make it easy to use for designers all over the world.

Sisense allows designers connect to any data source e.g. excel, csv, MySQL, etc. It centralizes and model your data; it can predict insights with advanced analytics and generating insightful answers automatically. The Sisense tools allows you harness data, extend them with actionable applications, mashup and analyze data from anywhere in the world. Other things Sisense provides designers are; customization of brand experience, and exploration of unearth insights with machine language.

# CHAPTER 3- EVALUATIONS' CRITERIA

### HOW DOES THE TOOL DEAL WITH MULTIDIMENSIONAL DATASET "CUBE" OR DATA IN GENERAL?

In Online Analytic Processing, Cubes are used to generate or collect data from users, to store it, and to perform calculations as needed. Furthermore, one can refers to Cube as a multi-dimensional spreadsheet. So, this criterion will help to fully understand how both IBM Cognos and Sisense Cube store and handle data in relation to one aspect of business such as revenue or a business. Furthermore, the criterion would help to shed light on how the tool performs aggregate query. Also, we will be looking at the type of OLAP products each tool uses that is (MOLAP, ROLAP, HOLAP). finally, we will look how each OLAP stored data and the ETL process. This would enable a reasonable comparison both software of at a granular level.

### PERFORMANCE: QUERY AND STORAGE PERFORMANCE

This criterion will point out the query performance and storage performance. Does the query run consistently? How long does it take to run? At what point will it crash? Can it run alone without supervision? Also, we are going to be discussing how well the storages of both tools perform in the hardware aspect. What is the CPU storage of each tool? The hard disk drive storage space? All these metrics will be discussed.

### SECURITY: POLICY AND SECURITY ARCHITECTURE

Here, we will point out the policy and architecture of security and draw a meaningful comparison at a granular level.

### COSTS OF OWNERSHIP

We will look at the Licensing, Software, Hardware, & installations costs of each software

### USABILITY

We will look at the User interface, ease of use, and platforms supported

# CHAPTER 4- EVALUATION OF IBM COGNOS BASED ON CRITERIA

## How does the tool deal with multi-dimensional dataset (Cube) and data in general?

When it comes to dealing with multidimensional dataset or data in general, IBM Cognos provides various data solutions. Some of these solutions include Cognos TM1 (which is a MOLAP Technology that can handle medium data volumes. Also, aggregation takes place on the fly, which degrades the performance with very large volumes of data and users); IBM Cognos PowerCubes (which is also a MOLAP technology that uses pre-aggregation of data. Here, Cube doesn’t have any active connection to the data source, which makes it static.

Furthermore, it does cause latency during the movement of data. It is mostly used for interactive analysis of transactional or operational data); and Dynamic Cubes (which are commonly used for the analysis of large volumes of data. All dimensions in Dynamic Cubes are preloaded. Furthermore, PowerCubes has several advantages: It minimizes the data movement between relational sources and dynamic cube engines and supports in-memory caching through DQM) just to cite a few. Finally, key features to keep in mind include:

* Cognos TM1 is a MOLAP Technology that can handle medium data volumes.
* IBM Cognos PowerCubes is a MOLAP technology that uses pre-aggregation of data
* Dynamic Cubes:  are commonly used for the analysis of large volumes of data. It provides ROLAP capabilities within dynamic query support for both in-database and in-memory aggregates.
* Dimensional Modeled Relational (DMR) is an OOT (object-oriented technology) which is used when we need a dimensional advantage in relational data. Also, it can be used for the analysis of the low volume of data.
* HOLAP Cognos Solution: Tailored solution based on PowerCubes & Dynamic Cubes: Data is stored in both multidimensional and relational database.
* HOLAP Speedy data retrieval makes it the best for "slicing and dicing”. The setup allows more flexibility for handling data. For heavy Processing, data is stored in relational database

## Performance: Query and Storage performance

IBM Cognos Business Intelligence has a variety of tools that helps to deal with performance issues. First, it is important to mention that IBM Cognos’ data solutions vary depending on performance need. For instance, A company that deals with very large volume of data (terabytes of data) would be advised to use Dynamic Cubes, which are meant for high-performance and low latency interactive analysis. Whereas, an organization, or person that deals with small or medium size of data would be advised to choose dimensional modeled Relational (DMR) which are meant for low to medium volume of data. In addition, IBM Cognos Metric Studio and IBM Cognos Event Studio help to tailor the web-based solution for an optimum performance. For instance, one could use System Metrics, in System Performance Metrics setup to monitor activities by creating internal queue (job queue, task queue and STMP queue) and then, assign some priorities to different services as needed.

Furthermore, to improve scalability, one can enable or disable content Manager and the dispatcher services on individual application servers to balance the load for each computer by request type. One example given by IBM Cognos is that “if you have three application servers’ computers, you might dedicate one to running interactive report requests, another to Content Manager, and the third to the other IBM Cognos services”.

## Security: Policy and Security Architecture

IBM Cognos has a robust system when it comes to security. It’s based on the expected user access, group access model where one can maintain such groups by only allowing specific access to different parts of Cognos or users for that matter. Furthermore, ease of use is quickly adapted when one uses the Cognos Namespace which allows an organization to develop and implement security processes across the enterprise. This is much like an active directory that allows for single sign on use to increase efficiency throughout the enterprise. Furthermore, in today's market we see that Cognos has set itself apart from its competitors in granular terms by having Authentication provider, authorization, previously mentioned Cognos namespace and, IBM Cognos Application Firewall.

The authentication providers are an optional part of Cognos like all the rest of the add-ons. It utilizes usernames, IDs, passwords, regional settings, and personal preferences. This is your basic boiled down version of name space that lacks the active directory part. Essentially this is one of the bare minimum things you can do to secure your Cognos instance, however you don’t have to if your use case or organization does not have a need.

The Authorization process that can be added on to Cognos basically grants users access to specific data and allows for a specific set of actions upon the data based on what user, or what group is using Cognos to create, update, import, or extract. Not much going here.

Back to the Cognos Namespace. One special note it contains the IBM Cognos objects such as groups, roles, data sources, distribution lists and contacts, so basically an active directory.

Lastly, we have the IBM Cognos Application firewall. This is not something that should be skipped. It is known as CAF and is a security tool used to supplement the existing base Cognos security infrastructure at the application level. The idea behind CAF is that it “analyzes, modifies, and validates HTTP and XML requests before the gateways or dispatches process them, but before they’re sent to the requesting client/service.” It acts as a proxy for Cognos gateways and dispatchers. Thus, it prevents Cognos components from getting taken advantage or via malware. However, for the most part it blows buffer overflows, and cross site scripting attacks through either script injection or redirection to other websites.

## Costs: Licensing, Software, Hardware, & installations

The overall costs of having an optimum custom IBM Cognos BI will highly varies depending on the components chosen for the tailored solution. However, for a standard solution with somewhat limited functionalities, the subscription costs include:

User pricing:

* A workgroup license is $75 per user, per month, with a minimum subscription of 50 users and a minimum six-month term. It is renewed semi-annually with monthly billing.
* A standard license is $95 per user, per month, with a minimum subscription of 100 users and a minimum one-year term. It is billed monthly and renewed annually.
* An enterprise license is $125 per user, per month, with a minimum subscription of 150 users and a minimum one-year term. It is billed monthly and renewed annually.

Administrator pricing:

* Analytics Administrator (authorized user [AU]): List price is $15,100 per AU; typical discount is 30% and annual support percentage is 20%.
* Analytics Explorer (authorized user and processor [PVU]):$2,500 per AU; typical discount is 30% and annual support percentage is 20%.
* Analytics User Authorized (user and processor [PVU]): $1,350 per AU; typical discount is 30% and annual support percentage 20%.
* Information Distribution (processor [PVU]): $500 per PVU; typical discount is 30% and annual support percentage is 20%.

Furthermore, there is a free trial available and a student subscription accessible through universities that have the agreement with IBM. Also, additional costs of installation (servers for instance), maintenance will be applied depending on your custom solution.

## Usability: Implementation, ease of use, platforms supported

IBM Cognos has an intuitive and user-friendly interface which is accessible through several types of supports like mobile and desktop. However, there is need for expert level skillsets to set up the enterprise web-based solution. There is also availability of free and on demand paid training materials that can help users familiarize and understand the application. It is also supported by UNIX, WINDOWS, MAC and LINUX Operating Systems.

# CHAPTER 5- EVALUATION OF SISENSE BASED ON CRITERIA

## How does the tool deal with multi-dimensional dataset (Cube) and data in general?

As earlier defined above; Cubes are used to generate data from users, afterwards stored to perform calculations as needed. Sisense uses two data models to store and manage data. Designers utilize Sisense to create data and live models in representing data that can be used to support dashboards. There are two types of data models used in Sisense; Elastic Cube models and live models. The former is high performance database designed to resist broad and deep queries for any business intelligence application while the latter is not a database but used to run queries directly against the data source.

Elastic cube models assist a designer to import data from various data sources which will become the database that supports the designer’s dashboard. Either of the data models can be used when working on your dashboard. However, the elastic cubes models are known to be faster to use especially when working with extensive dashboards with large data sets. When a designer is working with real-time updates, it’s advisable to use the live model.

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Elastic cubes connect a designer to its data source where it can import data. After data is imported, the designer can go on to build the elastic cube. Live models are built on live connections to a data source. Data can be derived from connection and credential information to data sources. After live model is published, it is added to the list of data models where the designer can select from when working with dashboards.

## Performance: Query and Storage performance

All the tasks done on Sisense is being carried out on a dashboard. A dashboard is a collection of widgets that displays the data selected to design. Widgets are dynamic visualizations of data. So, the performance of the dashboard is very important to the designer. Sisense provides a good dashboard performance for its users. A good dashboard performance is important for designers when loading data and running queries and Sisense has designed its software to return queries very quickly. They do this by optimizing load time relative to the data the dashboard is processing. The performance on Sisense is great because the RAM consumption on its ElastiCube is at 100gb even though it has a memory size of 500gb in its disk. Also, the CPU usage during any load test has been approximated to be 10-20%. For these reasons, the query return time on Sisense is quick with a minimum return time of 0.1s and maximum return time of 3.1s.

## Security: Policy and Security Architecture

Sisense platform provides a well-arranged flexible security design which is very thorough and perspective in nature. The security process has helped enterprises secure dashboards, data, and introduce custom security requirements as they deem fit for their organizations. Also, security processes are automatically added during enterprise deployments. The security features can be broken down into three levels; system, data and object level.

### System level security

The system level security comprises of security features for role-based and integration options. They include user and server management, connection to an active directory, single sign-on (SSO) implementation and the use of REST API security.

User and server management- As a user, this feature assigns Sisense user to be administrators, data administrators, data designers, designers, or viewer roles. Also, as a server, a user can be assigned rights to ElastiCubes server as an individual or as a group.

Active directory- This feature enables existing and new users reduce deployment time as they can be connected from their organizations active directory to define security and sharing characteristics. This way, passwords are unnecessary because users can depend on existing credentials.

Single Sign-On (SSO) - The SSO feature improves user effectiveness by avoiding password fatigue and reducing support overhead. SSO provides a coherent integration between Sisense and systems in users organizations by offering standardization of authentication policies across it.

REST API - The Security REST API provide access to parameters to integrate and automate restrictions and access control based on existing settings and standards. Specify access rights and security to dashboards, data models and data. Manage users via the API to create, edit and assign new users or groups. Click here to visit the API documentation site.

### Object security level

The object security designates access rights for different users and groups to dashboards and data models within Sisense. A user can share dashboards individually or as a group level. This sharing option include the configuration of access rights for all users as well as whether users defined as designers may edit the dashboard. The sharing options also include subscription settings that define which users and groups will receive email reports.

For the data model option, a user has access rights to different Data Models on a user or group level. This permits flexibility to create models for specific user or group needs while offering strict access control.

### Data security level

The data security level allows users access to data only needed to complete their jobs. data security level ensures that access and visibility to data is limited to users. For instance, a single dashboard can be shared with many users, but each viewer sees only data relevant to their needs. This reduces both development time and provides for security.

Security on row level is a feature of this level. This feature allows user access to specific rows in a data so for each data model, users can utilize rules to administer access control. Another feature is the row level default permits users have access to data that do not have explicit rules. An example, a new employee will have restrictions to some data sets until they are added to relevant groups.

## Costs: Licensing, Software, Hardware, & installations

According to Sisense documentation, the table below provides an overview of the cost of licensing, installation and maintenance for Sisense.

|  |  |
| --- | --- |
| License/Subscription Cost | Annual license cost is based on tiers depending on the number of users. The first tier allows up to 10 users (Basic). The second tier (Business) supports up to 50 users, and the third tier (Business+) supports an unlimited number of users |
| Maintenance Cost | There are no additional costs for training or to maintain the software  For each pricing plan, there are free levels of support |
| Installation/Implementation Cost | The solution can be implemented in a short span of time as there are no additional hardware or servers to set up |
| Customization Cost | Dependent on functional requirements and specific needs of the organization |
| Data Migration Cost/Change Management/Upfront Switching Cost | Dependent on your current software, amount of data to be migrated, availability of migration tools, complexity of data and gaps between the existing system and the new system |
| Recurring/Renewal Costs | Renewal cost is equivalent to the fees paid annually |

## Usability: Implementation, ease of use, platforms supported

Sisense is the closest one will get to self-service business intelligence. It's built with non-technical users in mind, because the majority of what to do is achieved via a simple drag-and-drop interface. Sisense can be easily accessed via its web application which runs on most web browsers and all operating systems e.g. MacOS, and Linux. It can also be accessed via the mobile devices.

The Sisense web application enables designers interact, view design, share and explore dashboards. However, there is a limit to what one can do using the mobile interface option because the user interface is not very much friendly.

## limitations

* Does not support predictive modeling and analysis
* Dashboards do not support advanced visualizations such as 3-D graphics
* UI of the mobile app is not user friendly
* Does not work well with complex and huge data sets
* Does not offer scheduled reports that can be sent via email so that users can consume
* Does not offer scheduled reports that can be sent via email so that users can consume reports outside of the online dashboard

# CHAPTER 6- COMPARATIVE ANALYSIS IN TERMS OF THE RELEVANT CRITERIA

As a brief comparative analysis in term of relevant criteria, we have ascertained that both tools share similarities and differences to some extents as shown in the comparative summary table below.

## Comparative summary Table

|  |  |  |
| --- | --- | --- |
|  | IBM COGNOS | SISENSE |
| How the tool deals with multidimensional dataset "Cube" or data in General. | Can support MOLAP, ROLAP and HOLAP ✅  Data is stored in both multidimensional and relational database (RDMS), columns, rows, tables and data cubes.  It has ETL tool called decisionStream.  Examples of RDMS supported by COGNOS are IBM DB2, Microsoft SQL Server, and Oracle. | Act as Dynamic cubes so it supports ROLAP. It uses in-chip technology called ELASTICUBES.  It stores data in Columnar Database Management System (CDBMS) which is also a function ROLAP. ROLAP stores data in columns, rows and tables.  It has an integrated database, extract/transform/load (ETL) modality, analytics and visualization tool functions.  Supports DBMS like MYSQL, SQL Server, Oracle and Access. All store tabular data row-by-row |
| Query performance | Users can fine tune tuning performances however this will vary depending on the operating system such as UNIX and Windows.  Query response time is slow | ElastiCubes do not require pre-aggregations and/or creation of indexes. It has been designed to use both as efficiently and speedily as possible by default. ✅  For a standard query, query return time on Sisense is quick with a minimum return time of 0.1s and maximum return time of 3.1s. ✅ |
| Storage performance | High CPU utilization  Slow data storage  There is a need to create optimized data mart when dealing with large dataset or millions of rows. | Low CPU utilization ✅  Super-fast data storage ✅  The creation of dedicated OLAP cubes and/or optimized data marts are completely unnecessary when dealing with hundreds of millions of rows of raw data. ✅ |
| Security /Architecture | Application Tier/Firewall/Router/Encryption  Data Tier/Firewall/Router/Encryption/Row based security  REST API | System level – User Management/Single sign on  Object level - Dashboard access/Elastic Cube access  Data level- Row based security and Row level defaults  REST API |
| Cost of ownership | License cost is expensive and depends on number of users. Cognos has minimum of 50 users and 6 months contract.  Software and hardware are very expensive  Cost of implementation is high and takes long  Trial version online is not a custom fully integrated solution | It is cheaper than COGNOS and has a minimum user as 10. ✅  There are no additional costs for training or to maintain the software. ✅  The solution can be implemented in a short span of time as there are no additional hardware or servers to set up. ✅ |
| Usability | User friendly, available documentation, Accessible via Desktop and Mobile. Supported in UNIX, WINDOWS, MAC and LINUX Operating System | User friendly, accessible on web and mobile devices.  Available on LINUX OS  Access to technical support |

# CONCLUSION

After a meticulous evaluation of both IBM Cognos HOLAP tailored solution and Sisense, based on the selected criteria shown in the comparative summary analysis, we firmly believe that Sisense would be an optimum solution for small to medium size companies. Whereas, Cognos Hybrid Online Analytical custom solution would be an optimum solution for medium to large size organizations. This conclusion is partly derived from the fact that IBM Cognos licensing requires a minimum of 50 users. Whereas, Sisense offers individual licensing plan. Furthermore, IBM Cognos would be cost efficient for medium to large organizations that deal with large volumes. Finally, detailed comparison of both tools shown in the summary table backup our assertion.

# WHAT WE LEARNED

Lade Biyi- Adejayan: After this project, I have been able to understand deeply business intelligence and online dimensioning analytics. During the comparison of both tools discussed, I realized there are no best tools for a business and that every tool is different depending on what the user is looking for. Whether a self-service tool as in the case of Sisense which allows a user to see both marketing and product data in one place or IBM Cognos which is not designed as self -service but has a different service which requires a user to customize service. IBM COGNOS is made for larger enterprise companies unlike Sisense and a user needs to subscribe to its service to have access to it. Finally, I learnt deeply the types of online analytical processing applications. I understood that in order to provide analytics, pre-aggregation, indexing, hashing and optimize queries, business tools depend on the OLAP cubes service. And it comes in different dimensions; multidimensional, relational and hybrid providing users with different options.

Jordan Tyler: For the OLAP team project I learned a great amount. I learned not only more about OLAP in terms of Cognos or Sisense, but I learned how to better work with individuals who are different from me in culture, expectations, and communication. While the main points with OLAP were synthesized, understanding the differences between HOLAP, ROLAP, and MOLAP, it was the understanding of how to conduct myself with a diverse team that truly stood out as the gem I was able to take away from the project. Yes, Cognos would work better for larger organizations doing more data at volume, and smaller businesses would get more out of Sisense by leveraging the cloud instead of bulky infrastructure and management fees.

Moving forward my main contributions to the team were communication based such as delivering information to the class, tightening up the presentation and conducting reviews of my teammates and I in terms of our parts for the presentation. I also provided some of the foundation in the paper around Cognos, the cube and the ways that OLAP is expressed in the IBM Cognos system.

I am extremely grateful to be able to work on such a high performing team consisting of Sango and Lade. They pushed me to contribute on a higher level and motivated me to deliver a solid presentation as well as dig into HOLAP, MOLAP, and ROLAP on a deeper level. Because of them I have a better understanding of the OLAP eco-system and will use this understanding to further my career and skillset.

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