IBM® Watson IoT
Maximo Asset Management

Maximo 7.6

Analytic Options and Comparisons

Revision 2

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CONTENTS

REVISION HISTORY

Date	Version	Revised By	Comments
March 2017	2	PDenny	Update to include Watson Analytics
January 2015	1	PDenny	Update to Meta data comparison section
January 2015		PDenny	Initial Release

1   Overview

IBM Maximo Asset Management® collects vast amounts of data through its various applications, and enables you to transform, visualize and act on the data through its Analytic and Business Intelligence (BI) suite of tools.

With increasing industry emphasis on big data and analysis, it is imperative that analytic tools are readily available to answer the myriad of questions that are continually presented to you. Questions and answers which enable you to realize the full power and benefits of applying Maximo in your organization.

Maximo provides an extensive portfolio of Analytic tools to do this. These tools meet the evolving and varying skill sets of your users, their use cases and preferences, along with the business needs and regulatory requirements of your organization.

To fully understand the analytic options available to you, this paper will review the entire suite of the Maximo Analytic products. It will do this by

> A. Detailing each of the tools thru a review of each of these analytic categories
> (1) Application Analysis (2) Enterprise Reporting and (3) User Analytics.
>
> B. Comparing the Enterprise Reporting and User Analytics tools of BIRT Reporting, Cognos BI and Watson Analytics.

This provides flexibility in gaining a better understanding of the analytic features and tools, or directly accessing the comparison section for users very familiar with the capabilities.
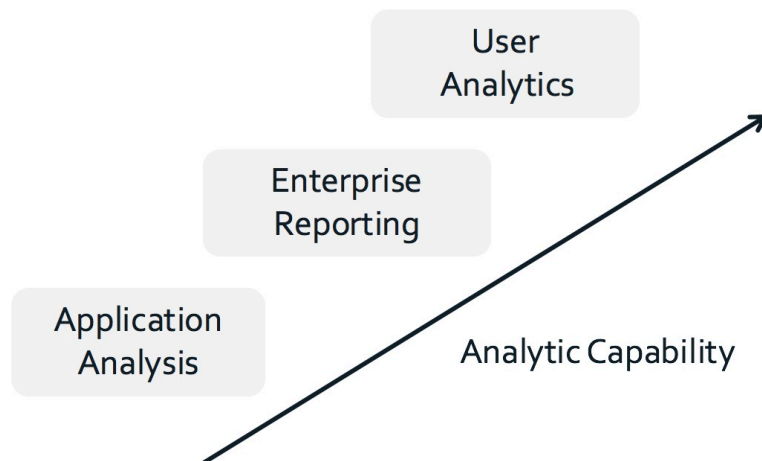
2   **Application Analysis**

Application analysis tools are tightly embedded within the Maximo applications.   They are frequently accessed by users multiple times a day to provide listing of records and statuses.   Their format is fixed to either a record listing, or a small range of chart options.   Each are powered within Maximo's System Framework, and no additional third party tools are used.

These tools frequently use the application queries, like Reactive work to complete today, Overdue Purchase Orders, or My kits to issue.   Applying the application query capitalizes on the existing functionality – and provides a range of format options to see the results.   The results can be an exported csv or xls file, a chart or listing of records on the start center, or a performance metric.

They are categorized as analytic tools as they enable users to analyze a set of records or performance. However, they are not configurable and their range of analytic features is limited.

Application Analysis tools include Query by Example (QBE), Application Export, Results Sets and Key Performance Indicators or KPIs and are detailed below.

2.1 QBE: Query by Example or Application List Download

Available from all Application List pages, this functionality enables the user to immediately download the results to Microsoft ® Excel for additional analysis. This is a quick and simple way for all users to analyze key application data quickly and seamlessly.
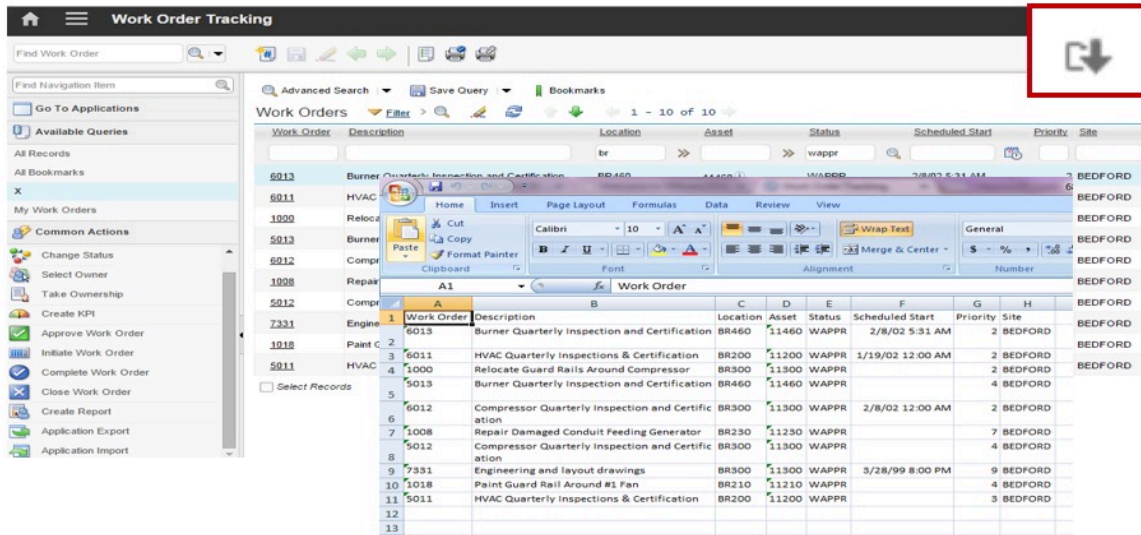
Figure 1: QBR example from Work Order Tracking

2.2 Application Export

This feature extends the QBE functionality by enabling multiple attributes from multiple objects to be downloaded to Microsoft ® Excel for additional analysis.   Application exporting is enabled by Integration Object Structures, which pre-join the database objects and define which attributes are available for exporting.   This is an excellent feature for using the application query in combination with a greater number of fields that QBE offers – in a spreadsheet format.
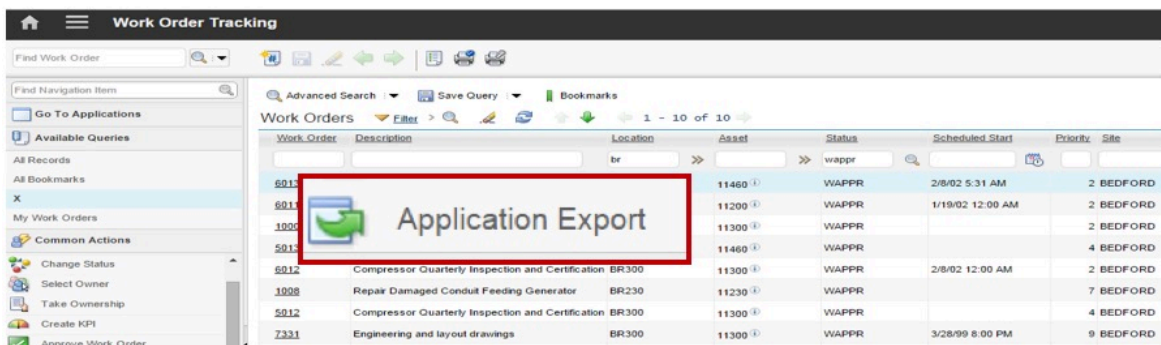
Figure 2: Application Exporting example from Work Order Tracking

2.3   Result Sets

Result Sets display selected fields or charts on the user's Start Center.   Results sets utilize predefined application queries, and starting with Maximo 7.6.0.4, attributes from multiple related objects can be displayed in result sets.

Results sets are focused on user specific activities. Users can review the listings of the results, and click on a record to be taken to the application where it can be acted on.
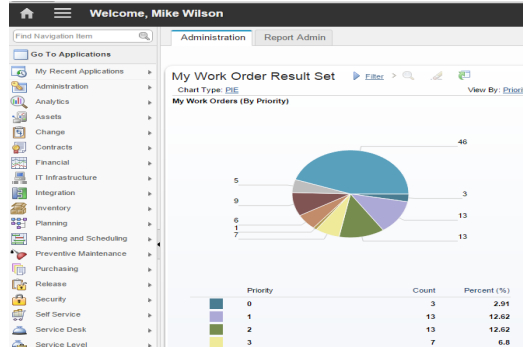
Figure 3: Result Set example on Start Center

2.4   KPI: Key Performance Indicators

KPIs are metrics highlighting performance against a set goal. KPIs are available in list and graphic format. They are used to quickly highlight status in red/yellow/green colors. Additionally, KPIs are able to link to other KPIs or related reports for additional data analysis.

KPIs can be created within the KPI Template or Manager application. They can capitalize on existing application queries, or the administration can create the KPI with a new sql statement. This sql is combined with the Target, Caution and Alert Values to generate KPI results.

KPIs can then be viewed by end users either on the Maximo Start Center, or the KPI Viewer application, introduced in Maximo 7.6.   Using the KPI viewer application, a user can see the current KPI data, view its history and how it was calculated, along with interacting with others via its communication log.

Examples of KPIs include: Average Emergency Work Response Time, Percent of SLA Compliance, Number of Purchase Orders with 1 Line Item, Number of Inventory Turns, Percentage of Reactive Work Orders.
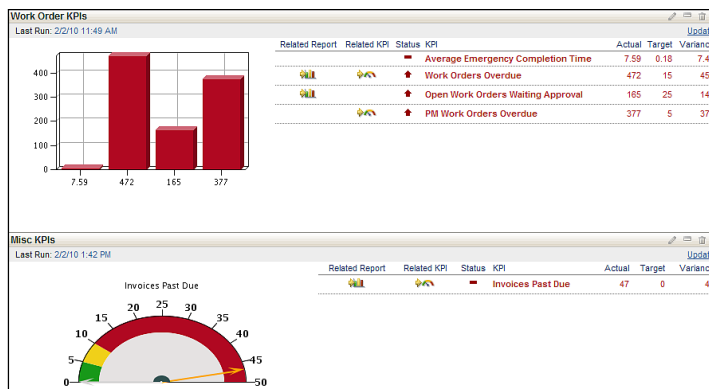
Figure 4: KPI examples on Start Center

3   Enterprise Reporting

Reporting is the traditional Business Intelligence or analytics tool. Whether day to day, month or quarter end, ad hoc or analytic reports, Maximo provides you a depth of reporting tools and solutions to choose from.

Enabling your report choices is Maximo's Enterprise Reporting Architecture. It has been designed to enable you to utilize the reporting tool or tools that is best for your unique business, regulatory, user and project needs.

Four report options are available to you including: four key options: BIRT, Cognos Reporting, External Report Integration and the Open Database Platform.

Enterprise Reporting

BIRT Reporting | Cognos BI Server | External Report Integration | Open Database Platform
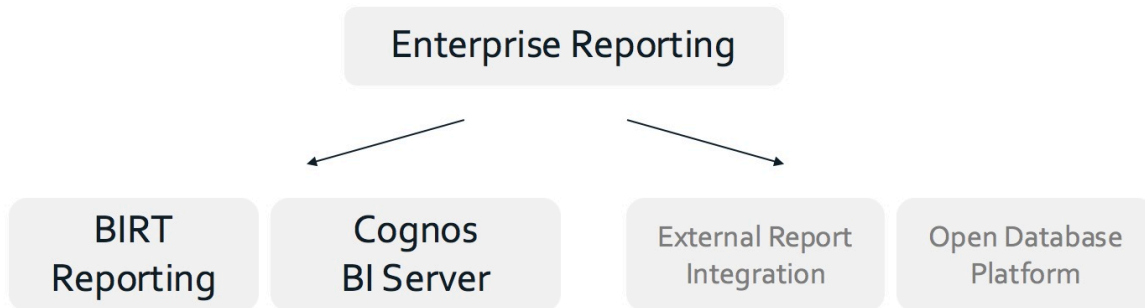
The BIRT reporting and Cognos BI Server options are included and supported with the Maximo 76 releases, and therefore will be detailed in the next section.

An overview of External Report Integration and the Open Database Platform, will be presented, but not reviewed in detail as they are not licensed or supported with Maximo.   These two options are enabled thru Maximo APIs and its Open database platform.

3.1   BIRT Reporting

Overview

BIRT, Business Intelligence and Reporting, is the embedded reporting tool in Maximo 7.6. It is installed when Maximo is installed, and is seamlessly included throughout the various Maximo applications.

Licensing

Within Maximo 76, Open Source Eclipse BIRT Version 4.3.1 is utilized.   As an open source product, no licensing entitlements are required.

Installation

The embedded BIRT report server is silently installed during the Maximo installation process. No separate install or integration process is required to activate the embedded report engine. This significantly reduces setup time, and enables a quick deployment for development environments.

Report developers, who are a very small subset of users, may be required to install the BIRT report design tool on their local machines.   This tool enables report developers to create, customize or upgrade individual BIRT reports.   Utilizing the BIRT report designer requires advanced development skill sets and is only recommended for users skilled in Eclipse development.

*Note: BIRT reporting is available as a cloud based solution for Maximo SAAS

Delivered Reports

Depending on the specific products you are licensed for, over 110 reports are delivered with Maximo 76. These reports span the variety of applications, and include Analysis, Detail, Hierarchical, and Drill down Reports. Reports can update the database, hyperlink to one another to enable more detailed analysis, and refresh data dynamically.   These reports are designed to quickly and clearly convey information to the end user, and approximately 20% include graphs, including pie, bar and line charts along with daily and monthly calendar views and control limits.

The out of the box reports provide you a starting point for your custom report needs.   You can quickly customize these reports to meet your individual business needs, and also utilize the delivered business logic to create any new reports you need.

Figure 5: Maximo BIRT report examples

Developing Reports

Developers use the Eclipse Based BIRT Designer Tool to create or customize the delivered Maximo reports. Utilizing the popular Eclipse Platform reduces learning curves and minimizes unique development platforms for developers.

A large number of Maximo report templates are available enabling report developers to quickly create reports. Library and Style sheets are used to simply development, and insure a consistent look and feel among all reports. Report designs are saved as XML Files, which are imported into the Database, and accessed at run time to display the user's requested information.

*Note: As stated in the Installation section, this tool should only be used by advanced developers familiar with Eclipse, report and database development skill sets.
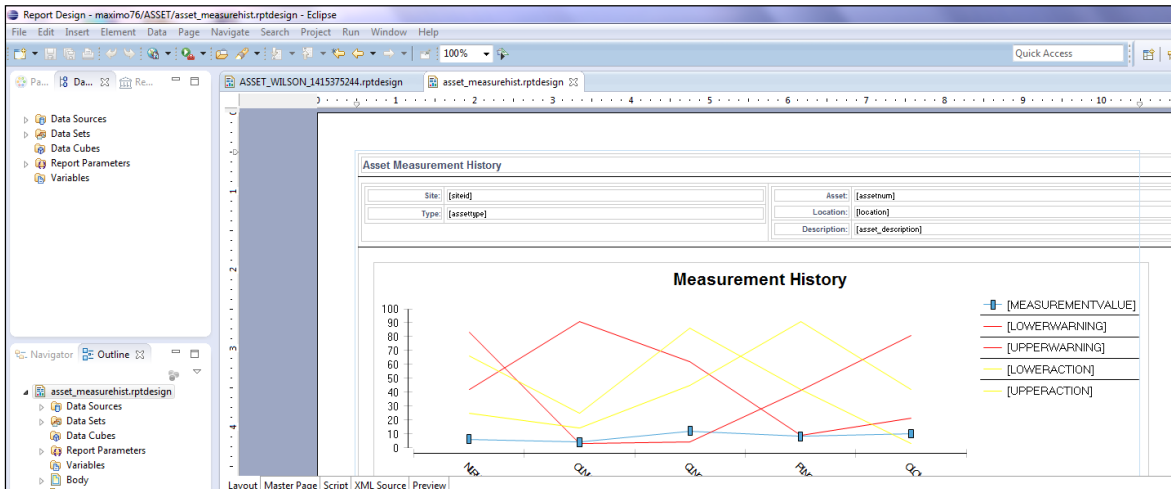
Figure 6: BIRT Report Designer displaying the delivered Asset Measurement History report

Running BIRT Reports

From within the various applications, users can run reports immediately for display in the report browser. From the report browser, reports can be searched through for particular data sets, converted to PDF for printed, or downloaded to other file formats including xls, xlsx and other configurable file formats for additional analysis.

To enable users to quickly retrieve their filtered data in a report, Maximo reports can be configured to run against either the application's current query, or against user inputted parameters. User inputted parameter options include single or multi values, required or non-required and report lookups.

Application Toolbar Access

Frequently used reports are often required to be accessed within the applications via a minimum number of mouse clicks. In certain scenarios, they are also required to be directly printed to the user's default printer. This functionality can be enabled through the use of report toolbar access. Three different variations of this functionality are available including Browser View ⊟, Toolbar Print 🖨 or Toolbar Print with Attachments 🖨.

Figure 7: Application toolbar access displayed in Work Order Tracking

Browser View 📄 automatically displays a report in the separate report browser. Once the report opens, the user can choose any actions from the reporting toolbar, including printing, searching and downloading.

Toolbar Print 🖨️ prints the configured report to the user's default printer, or a printer that he selects. A temporary window displays during the printing process which closes when the print operation is complete, and the separate report browser session does not open.

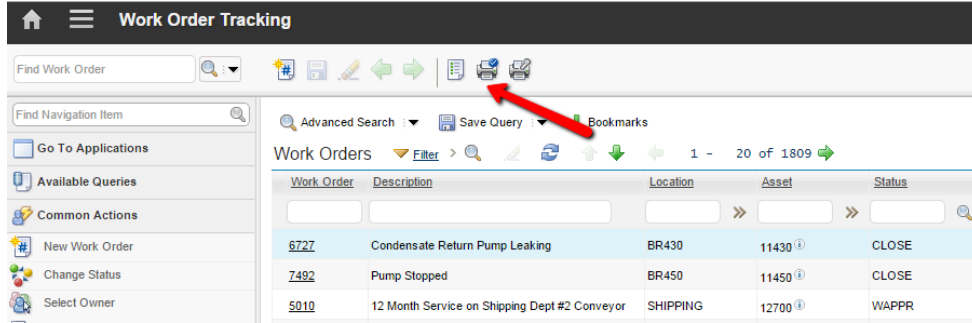Toolbar Print with Attachments 🖨️ prints the configure report to the user's default printer, , or a printer that he selects, along with any printable attachments it may have. A window asking the user to confirm if he wants to print the attached documents displays, followed by a temporary window which closes when the print operation is complete. The report browser does not open.

Note: These three features are only available for BIRT application reports. Application reports are frequently referred to as 'launch in context' and silently pass the user's application query and/or filter to the report engine at run time.   Application reports do not utilize parameter values which require user input.

Ad Hoc Reports

Query Based Reports (QBR) or ad hoc reports provide one-off reporting needs for your users.   QBR's enable users to create their own unique reports by selecting columns, specifying sorting and grouping, and the query the report will run against.   Once the user saves the report, this information is fed through an API to create an xml report design file, which is then executed thru the report engine.

This functionality enables business users to create their own custom reports. This is critical for many reasons, including
- Enables users to quickly create their own reports for their unique business needs
- Does not require technical, development skills, like Java, to create the report
- Does not consume development hours in creating and maintaining large numbers of unique reports, which may only be used by a very small number of users

Within the various Maximo applications, users can access the ad hoc reporting familiar in a familiar environment. They can then select what type of report they want to create, which fields they want to display, and whether to group and sort the results. Additionally, they can define unique report parameters, and also determine if they want the report to execute against the application's record set.

Users can then choose to save and share the reports with others, or determine that it is needed for single usage only.   If a user saves his report, it can be scheduled and emailed to him or a number of users similar to other BIRT reports.

Additionally, in Maximo 76, numerous new ad hoc features have been added including

Calculations

Power Users can create simple to complex calculations as columns in their reports using standard mathematical operators, or advanced sql syntax enabled thru an expression library.

Summaries

Business and Power users can add summaries on selected attributes to the report. Summaries are very powerful in quickly providing the user immediate information on totals, counts, and averages of various attributes.

Performance

Improved performance limits have been introduced for individual security groups. These limits restrict the number of records the user accesses when developing his report during the preview stage.
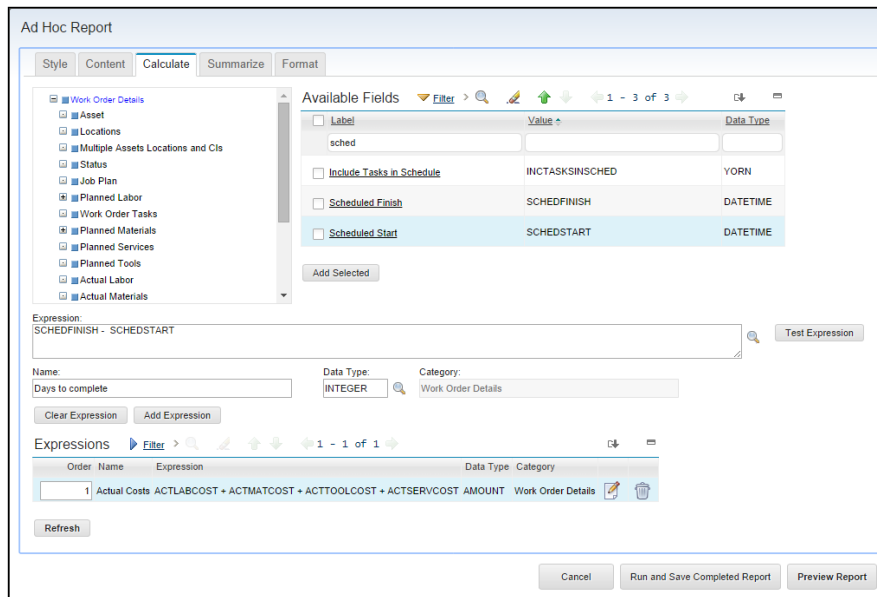
Figure 8: Ad Hoc Reporting creation dialog displaying calculation features

Report Administration

This application enables administrators to configure and manage reports. Based on Maximo's system framework and user interface, the report administration features include importing and exporting of report designs to the database repository. Individual reports can also be configured for features including application tool bar access, priorities, record limits and parameters.

Security

Report Security – which users can have access to which reports – is enabled in the Report Administration application. Security can be granted at the individual report level, the application level or can be granted access to all reports. Multiple views are available so you can quickly see which reports each security group has access to. Additionally, with BIRT, no synchronization of security groups with external reporting systems is required.

Report Performance

A variety of mechanisms are available to optimize report performance.   These features are categorized into five separate components, including Configuration, Designing, Developing, Administering and Running. Each of these five functional areas is described in detail in the Report Performance Guide referenced at the end of this guide.   The most frequently requested information on Configuration and Administration is described below.

Configuration

BIRT can be configured to be a separate, dedicated server called BROS (BIRT Report Only Server.) This is a very popular configuration as re-locating the report processing from the UI server to its own server can improve overall system performance.

Administering

Administration of reports is extremely critical to their performance success. This includes features like record limits - which can be set at the individual report level or at the security group level. These limits prevent users from inadvertently running records against very large record sets.

Additionally, the administrator can specify the maximum number of scheduled reports a user can have. This can force users to manage their scheduled reports, and delete recurring scheduled reports which are no longer required – thereby minimizing unnecessary report processing.

Administrators can use tools like the Performance Tab and Viewing Report Processing to monitor report performance.   Or they can automatically receive notification of long running reports thru new report escalations added in Maximo 76.

Report Logging

Report logging is available to monitor the usage and execution of the BIRT reports. This can be used to answer the questions "Which Report takes the longest to execute?" "Are users scheduling reports" and "Which reports are executed most frequently?"

Administrators can view this for individual reports in an application or for all BIRT reports.

3.2   Cognos BI Server

Overview
With Maximo 7.6, you are directly entitled to use the Cognos 10.2.1.1 Business Intelligence Server. This extends the suite of Maximo BI tools into a deeper level of Enterprise Reporting. With Cognos, users can perform detailed drilldown analysis, and dynamically filter and re-display information to best meet their unique needs.

Maximo Cognos Licensing
The Cognos BI Suite of enterprise tools provide an extensive suite of tools targeting your Business User, Administrator and Developer. These tools include

      Cognos BI Server Products
            Cognos Connection
            Cognos Administration
            Report Studio
            Query Studio
            Workspace
            Workspace Advanced

      Framework Manager
      Cognos Insight
      Cognos Lifecycle Manager
      Cognos Dynamic Query Analyzer

The Maximo 76 Cognos Product Entitlement and License guide available from the resource links at the end of the guide details each of these tools in detail, including their intended user.
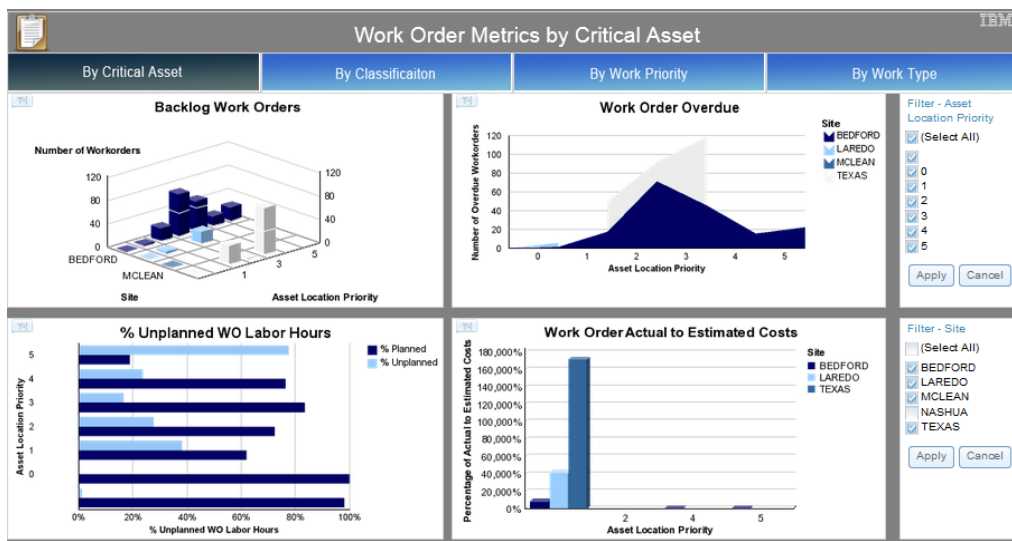

Figure 9: Maximo Application Workspaces displayed in Cognos Workspace

Maximo Cognos Installation

Utilizing Cognos with Maximo, requires a separate installation after Maximo is deployed, in an on-premise Maximo environment. Once Cognos is installed, a number of integration steps to enable Maximo and Cognos to interact are required.   These steps may vary depending on your configuration, but include creating data sources and defining Maximo property settings and end point values.   After completing the integration steps, an architecture, similar to what is shown below, is available.
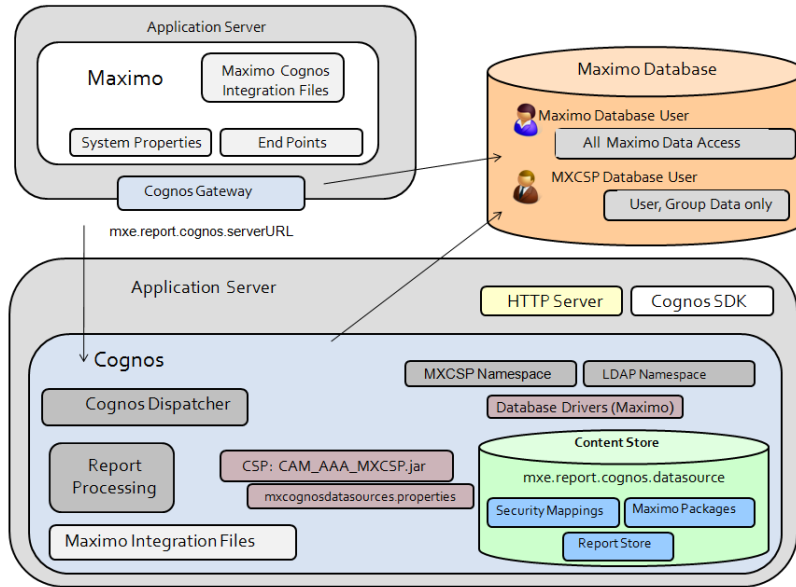
Figure 10: Top level Maximo Cognos Architecture

After installation, the Cognos products required for administering, maintaining, developing and running Cognos reports are all web-based and accessed via urls. The only exception is the Cognos Framework Manager (FM) tool which is a separate, windows based installation. FM is used by a very small set of users to validate, create or customize the Cognos metadata models.

Access Points

There are multiple ways your users can access the Maximo Cognos reports depending on the business needs of the user. These access points include

1. From Maximo's Analytics Module, users can directly launch to the Cognos home page

2. From within configured Maximo applications, users can see and access Cognos reports.
    - In this case, the Cognos reports are displayed in a separate browser session within the Cognos Portal. This is enabled through a silent log-in from Maximo to Cognos.

3. Business users can directly sign into the Cognos portal - without accessing Maximo. This feature can be very powerful for users whose main job responsibilities are developing or consuming large numbers of reports.

Maximo Cognos Metadata

A key attribute of this integration is the ability to create the Cognos metadata, or packages, within Maximo.   The meta data consists of pre-joined Maximo tables, which is used by developers and business users to create Enterprise or Ad Hoc Reports. The pre-joined meta data enables developers to quickly and consistently develop reports.

Traditionally, the metadata is created in Cognos Framework Manager (FM).   However, using FM requires a very specialized, technical skill set and Maximo's relational database is not optimized for use in FM. (Maximo's database does not use foreign keys which Cognos uses to form table relationships)

To bypass this hurdle, the Cognos metadata packages can be created using Maximo's Integration Framework. Report Object Structures (ROS) are created for a variety of Maximo applications, including Assets, Work Orders and Inventory. These ROS are collections of related tables, joined together via maxrelationships, with defined cardinality and join properties. Once created, the ROS are published from Maximo to the Cognos Content Store thru Maximo's Integration Framework and Cognos API's.

By capitalizing on the features of Maximo's Integration Framework, development time for Cognos packages is significantly reduced. Manual efforts to create individual Cognos Packages within the FM and researching the correct object relationships is no longer required.
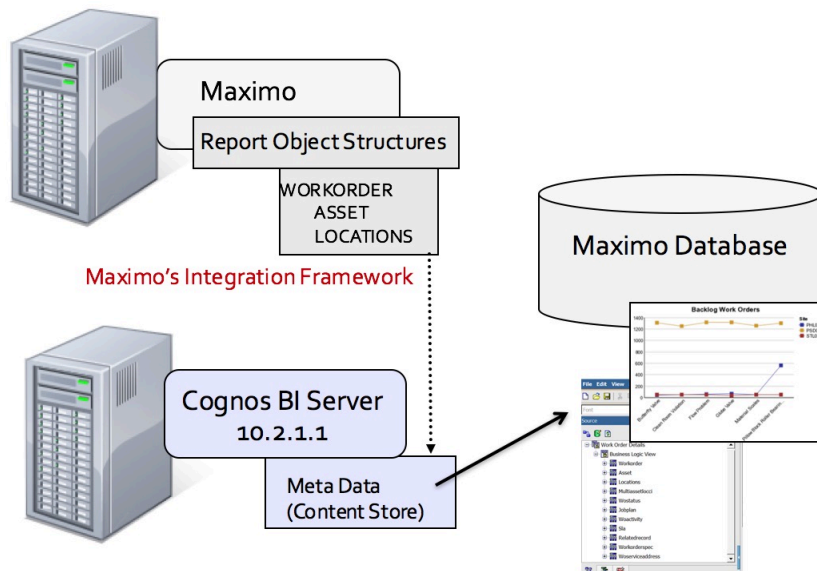
Figure 11: Maximo Cognos metadata publishing process

Many Maximo clients extend the Maximo applications and database. To minimize the impact of this on model creation, any, custom attributes added to the various Maximo objects are seamlessly included in the Cognos package when they are published using the Integration Framework.   Custom objects or views must be added to the individual report object structures before publishing to Cognos.

Additionally, with Maximo 76, Site, Organization and Site restrictions are applied at publishing time to the metadata packages. This feature insures that your users only see the site or organizational data that they have security privileges to when creating or running a report within Cognos.
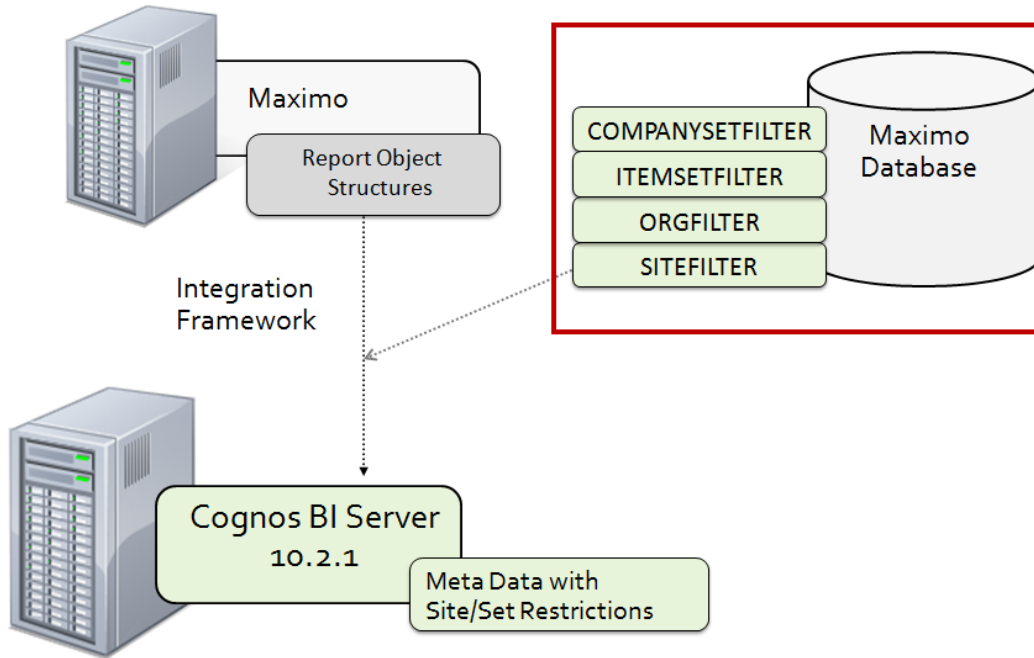
Figure 12: Dynamic application of org, site, item and company set restrictions to Cognos metadata

A five-part series of You Tube videos on using Maximo's Integration Framework to publish the Cognos meta data packages can be found <ins>here</ins>

<u>Developing Reports</u>
The powerful Cognos Reporting Products provide two different report development tools:

> *Report Studio:* Report Developer's tool for creating detailed enterprise reports. This tool an extensive array of capabilities, which in turn, make it the most complex tool to learn.

> *Workspace Advanced:* This tool contains a subset of features of Report Studio. Because of this, it can be quickly learned – and used by either report developers or technical power users.

Each of these two tools is very powerful and fit the needs of multiple user cases. Additionally, each tool is browser based, and utilizes the metadata packages. This reduces report development time because developers no longer have to create sql statements joining objects together, and additionally insures consistency of sql for all created reports.

Ad Hoc Reports

Using Query Studio, power users can create simple to complex Ad Hoc reports. These reports utilize the meta data, so no sql skills are required to form advanced ad hoc reports. These reports can utilize attributes from multiple objects, can include filters and hidden columns, along with advanced calculations, styles and graphs.
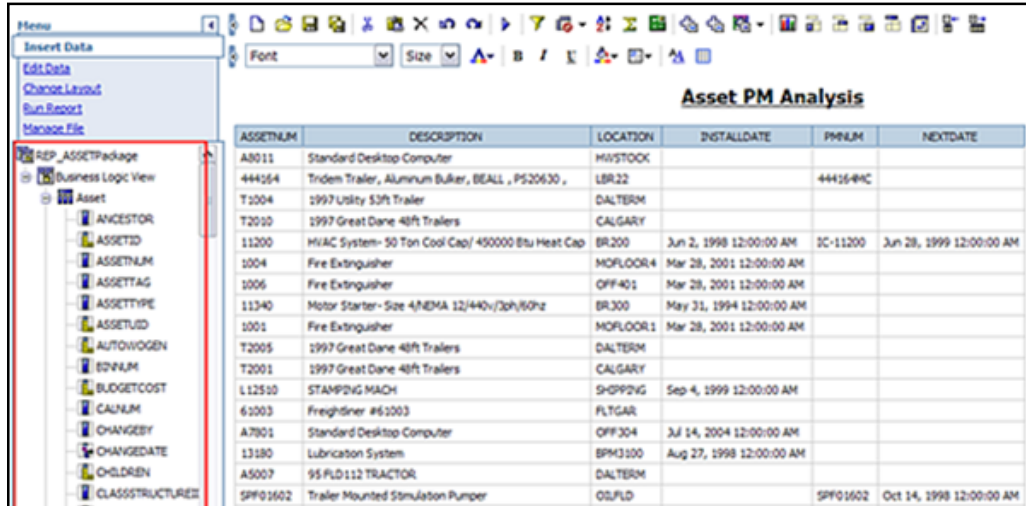
Figure 13: Cognos Query Studio

Delivered Cognos Content

Focusing on Asset, Asset Failure, Work Order and Inventory, a suite of Cognos reports and workspaces are included in Maximo. These include metric reports, application workspaces and trending workspaces. Metric reports provide you with detailed information and are accessible within the Cognos portal.

Application workspaces highlight non-performing areas within your business. Utilizing a range of filterable values, they provide visual, intuitive, and configurable metrics which your users can easily interact with.
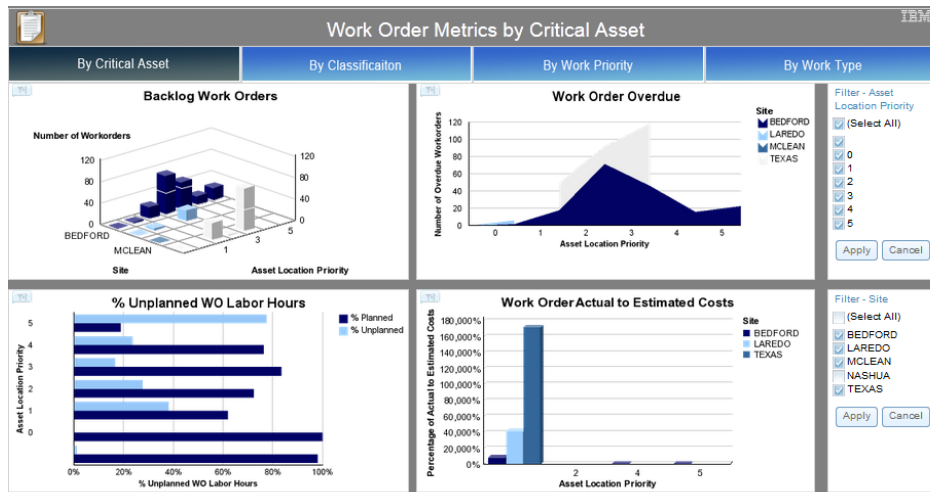
Figure 14: Maximo Application Workspaces displayed in Cognos Workspace

Trending workspaces provide a view of metrics using the time dimensions of week, month, quarter and year. By capitalizing on the new Maximo KPI Template application combined with KPI Scheduling features, these workspaces provide historical data views for trending analysis.

Figure 15: Maximo Trending Workspaces displayed in Cognos Workspace

*NOTE: Trending workspaces are available on IBM's ISM Library for download. Details on accessing them can be found [here](#).

3.3   External Report Integration

Overview

The External Report Integration, or ERI, is available to integrate the Maximo Framework with external Reporting Systems. These external reporting systems could include a variety of reporting tools, including Hyperion, Information Builders, SAS, Oracle BI, or many others.

With the ERI, users can access these reports directly from the Maximo applications. For example, a listing of Crystal reports can appear within the Work Order application. After selecting one, they are seamlessly launched and authenticated to the Crystal Server, where the Crystal report would display in a separate browser session.

This functionality is very flexible in that it is report system and report version independent.   You determine what reporting tool and version best meets your unique reporting needs.
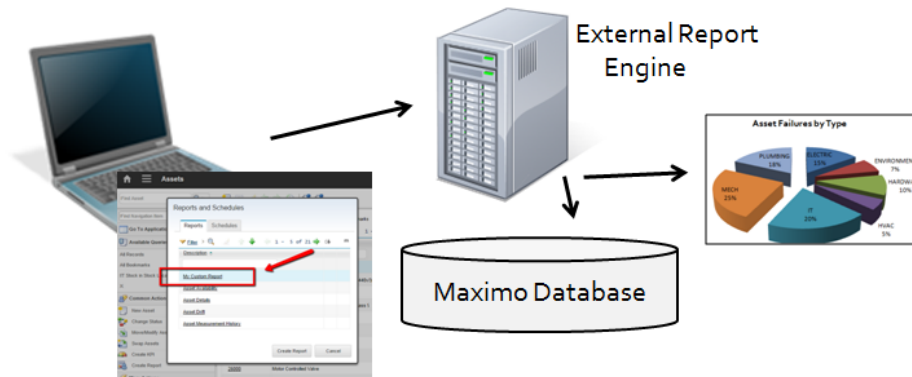
Figure 16: Maximo External Report Integration

ERI Considerations

IBM does not provide any report licenses or support in working with external reporting tools. You must purchase and maintain licenses for any of these tools.

ERI does not enable the full suite of embedded reporting functionality. Examples of embedded functionality not included are report toolbar access, delivered reports, and emailing and scheduling from within the Maximo applications.

For more details on the ERI, including how to enable it and its corresponding integration functionality, access the reference materials section at the end of the guide.

3.4   Open Database Platform

Overview
This last reporting option enables you to create and view powerful reports based on the Maximo data - outside of the Maximo applications and framework.   In this configuration, you configure your reporting tool or tools to connect to the Maximo database.   Your users then view reports created off of the database in a separate report portal or viewer.

This option again enables you to utilize any reporting tool or version – as you simply configure your reporting tool directly to the database.
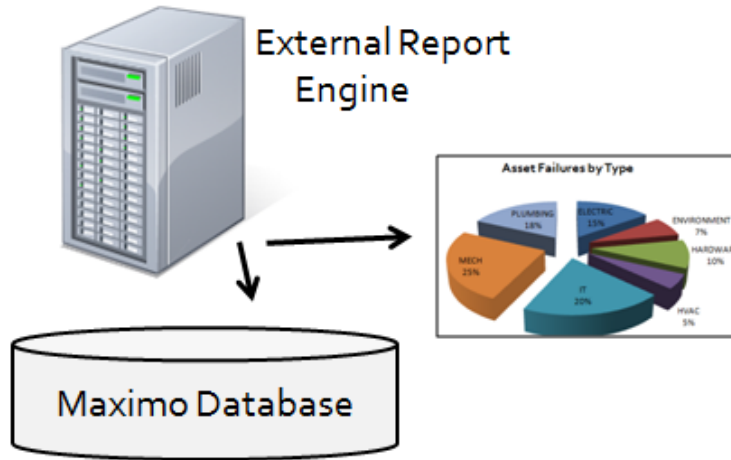
Figure 17:   Maximo Open Database Platform

Open Database Platform (ODP) Considerations
With the Open Database Platform (ODP), the Maximo Framework is not used to execute reports. Users navigate to a separate reporting portal or viewer where they run reports.

With this approach, users do not see these reports from the Maximo applications. Embedded reporting features –including emailing, scheduling, security and report toolbar access – are not available because reports are accessed external to the Maximo framework.   Additionally, Maximo security privileges and database access are not available from an ODP environment

Finally, because this report integration is not enabled within the framework, IBM does not provide licenses or support for the variety of integrations that you could utilize with ODP.

4   User Analytics

Maximo's newest category of analytic tools is User Analytics.   User analytics empower business and power users to explore data themselves – without IT involvement.

User analytics have become increasingly critical in today's volatile business world.   Skilled business users need to be able to analyze and explore data immediately.   They can no longer wait days, weeks or months for IT to create reports or dashboards – that once delivered – are outdated.

Additionally, user analytics open the world of exploration.   Unlike reports, where predefined fields are selected for analysis and content is monitored and managed by IT organizations, user analytics exposes fields or relationships that the user may otherwise not have thought to explore.

Watson Analytics is Maximo's solution to User Analytics.
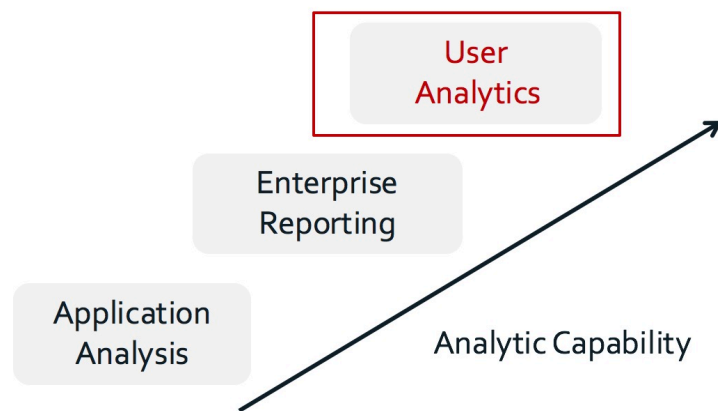
4.1   Watson Analytics

Overview

Watson Analytics is Maximo's User Analytic Solution.   Watson Analytics is a cloud-based system which enables business and power users to refine, explore, discover and create displays of Maximo data.
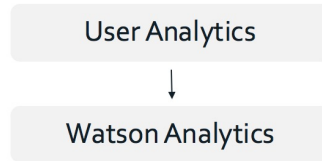
Watson Analytics contains three components or applications: Data, Discover and Display
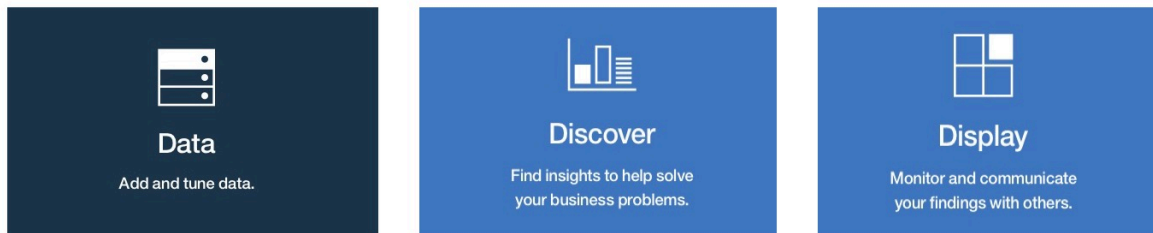
Figure 18: Watson Analytics applications

These components enable you to

    Import data via csv files or direct connections to your data sources

    Receive Data Quality Scores

    Refine your imported data sets

    Explore your data by using Watson's Natural Language Processing

    Review predictive insights on influencers of individual or multiple data components

    Discover related attributes or features thru data investigations

    Create visual, dynamic dashboards of your Maximo data

    Display data in organized components or chapters in storybook format

    Share your insights with users via downloads, links, or email

Licensing
Watson Analytics is a cloud based service, which is licensed at a monthly rate per user. This licensing and costs are external to the Maximo licensing.

As of this paper's publishing date, there are three pricing models based on the quantity of data to be analyzed. A free, thirty-day trial version of Watson Analytics is available, along with a Plus and Professional Version.   The Professional Version enables data sets of 10 million rows to be analyzed, along with direct connections to databases for data export and multi-tenant user accounts.

IBM Watson Analytics Product pricing		
Free	**Plus**	**Professional**
Upload spreadsheets, get visualizations, discover insights and build dashboards-all on your own.	Get all the features of Free plus more storage and data sources, including databases and Twitter.	Get all the features of Plus plus a multi-user tenant to collaborate, more storage and more data.
$0 00 USD	Starting at $30 00 USD per user per month	Starting at $80 00 USD per user per month
Try free edition	Purchase now	Purchase now
1 user	1 user	1 or more users
1 MB of storage included	2 GB of storage included	100 GB of storage included
Professional single user trial for first 30 days	Add storage in 10GB increments for a minimal fee	Add storage in 50GB increments for a minimal fee
	Access relational databases, on prem and on cloud	Access relational databases, on prem and on cloud
	Access 18 data connectors	Access 19 data connectors including IBM Cognos reports
	Access Twitter data	Access Twitter data
Limited access to IBM Analytics Exchange offerings	Full access to IBM Analytics Exchange data & offerings	Full access to IBM Analytics Exchange data & offerings

Figure 19: Watson Analytics Pricing (Check website for latest information)

To sign up for a Watson account, including a Trial Version, access this url
http://bit.ly/2cVwbvM

For the latest pricing details, access this link

Watson Analytics: Data

The three areas of Watson Analytics Data include (1) Data Import (2) Data Quality and (3) Data Refinement

1.   Data Import

After signing up for a Watson Analytics account, Maximo data is imported to Watson for analysis. Depending on your Maximo Version and type of Watson account, this import can occur multiple ways including:
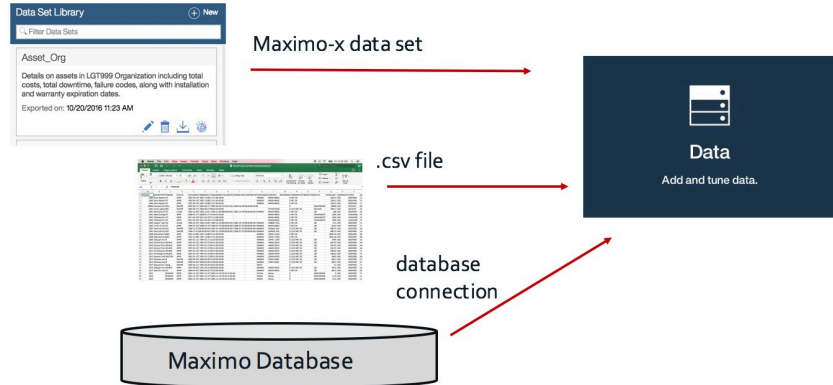

Figure 20: Maximo Watson Analytics Data Import

A.   Maximo-x Data Set
  - Starting with Maximo 7.6.0.5, you can use the new Business Analyst Work Center to directly export Maximo data to Watson.   This streamlines the process of creating and manually importing csv files to Watson.

B.   CSV File
  - Using Maximo's Enterprise Reporting and Application Analysis tools, you can quickly create csv files to import into Watson.   These tools include
        QBE (Query By Example)
        Application Exporting
        Results Sets
        QBR (Ad Hoc Reporting)
        BIRT
        Cognos

  - Additionally, you can import Maximo or other csv content you have via exports thru spreadsheet or database sql querying tools

    Note: When importing data to Watson via external systems, carefully review the data types to validate the transfer.

C.   Maximo Database
  - If you have a Watson Professional account, you can configure Watson Analytics to import data directly from your Maximo database

2. Data Quality

With Watson Analytics, the concept of detailing and tangibly measuring 'data quality' is introduced. Watson measures how ready the Maximo data is for analysis.

Data quality is a very critical component to your business. It determines how 'completely' your users are inputting data – and can also identify fields were users input data for convenience versus accuracy. Without accurate, deep data – you may be making inaccurate business decisions and will be unable to utilize advanced predictive analytic tools.

Data quality measurements are not available in any other Maximo analytic tool.

Watson Analytics measures data quality on a scale of 0 to 100, where 100 is the best score. Each data set imported into Watson is given an overall data quality score. The score is based on an average of the individual field scores within the data set.

As shown below, the scores are shown in red, yellow, green colors to quickly indicate their scoring value, along with a visual representation of the value distribution.
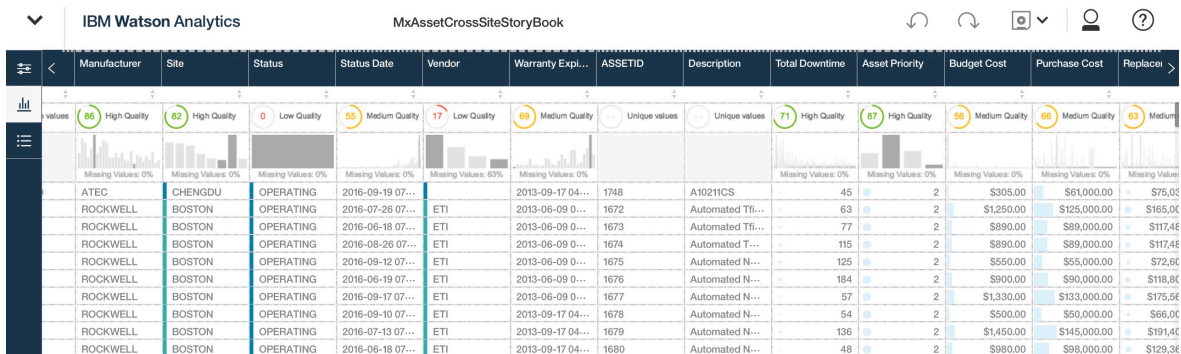

Figure 21: Watson Analytics Data Quality

A variety of factors determine the score for each individual field. These factors include the field type, missing values, missing values, constant values, imbalance, outliers and skewness.

Note: Watson Analytics analyzes structured data. Structured data includes numbers, categories of text and date/time fields. Unstructured data – like the data found in Description or Long Description fields – is not handled by Watson Analytics. Consequently, it will not be scored or available for analysis.

3. Data Refinement

After importing and reviewing the data set in Watson Analytics, the user can modify the data set to perform actions including

   Exclude Fields
   Change Field Type
   Create new fields via calculations
   Group data
   Develop data hierarchies

Watson Analytics: Discoveries

Once a data set is imported into Watson, business and power users can explore the data.   No models, design files, or unique skill sets are required to do this.   By simply importing the csv file, Watson performs the work to guide the user through an exploration of their data.

The user can explore the data by using Watson's Natural Language processing which presents a variety of starting points to analyze within their data set. Selecting any one of the individual visualizations or cards generates a chart or predictive element for the user to analyze.
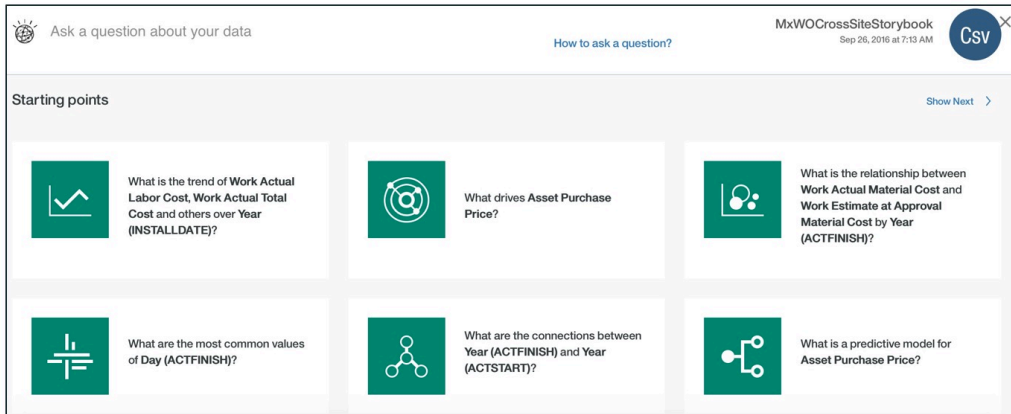

Figure 22: Watson Analytics Natural Language Exploration

Users can ask Watson a question about their data using the wizard features, which presents the individual field and question variations.
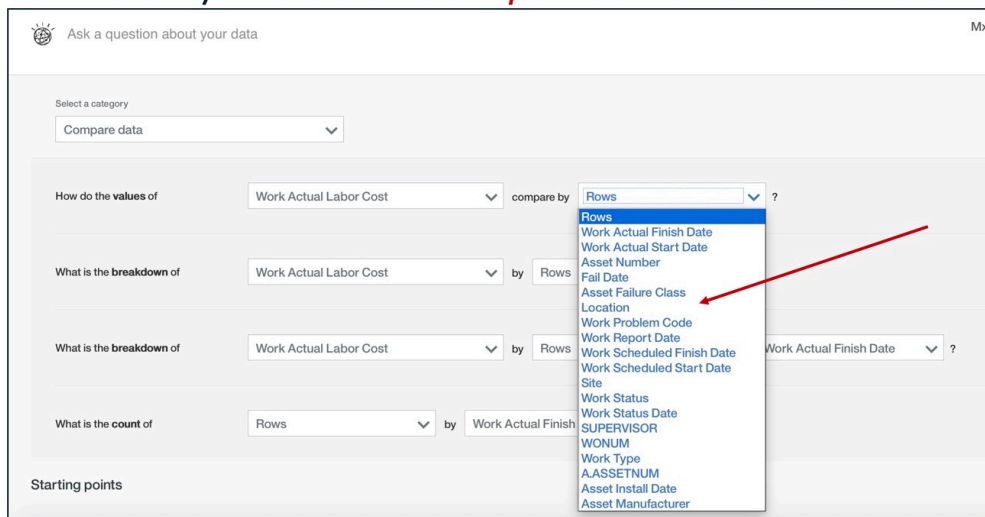

Figure 23: Watson Analytics Data Exploration Wizard

Or the user can create their own visualization in Watson if they have predefined areas which they want to immediately focus on.
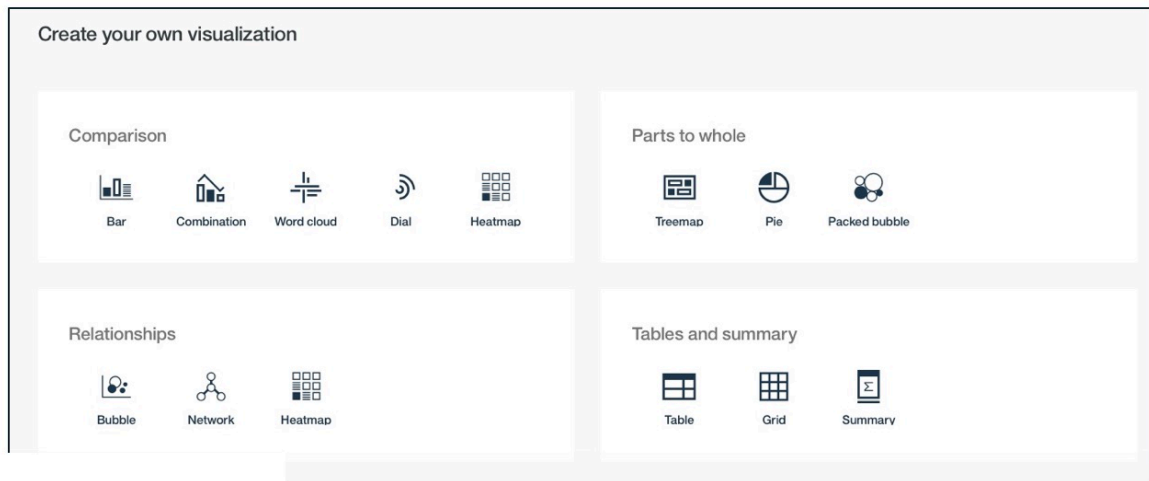
Figure 24: Watson Analytics Visualization Creation

After selecting or creating any of the visualizations, Watson presents the user with additional *Discoveries* as shown below. In this example, the user is exploring work order costs by the asset age (Year (INSTALLDATE)). Watson learns from the user's selections, and presents additional information they may want to explore. For example – Work Order Labor Hours by Asset Age.

This guides the user through an exploration of their data.   Instead of looking at a fixed chart or listing of fields – the user is exposed to other areas of data that they may want to analyze.

Figure 25: Watson Analytics Visualization example

<u>Predictive Analysis</u>
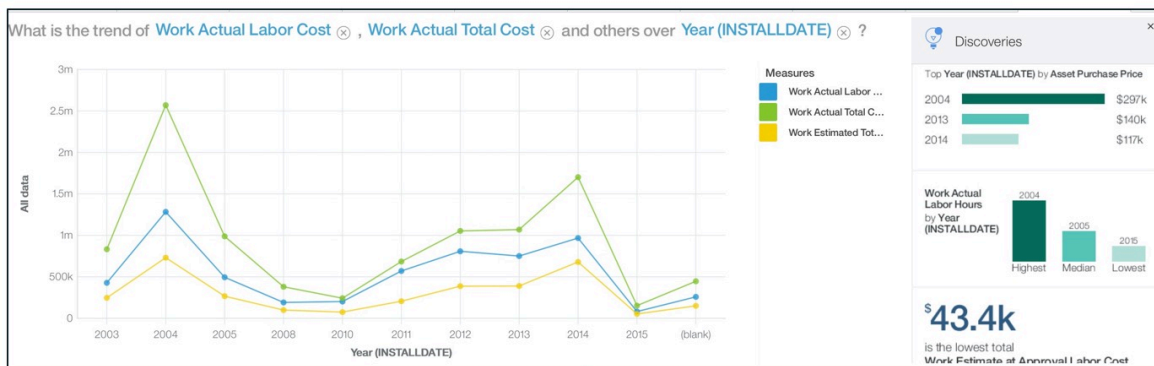Watson's Predictive analysis component highlights what is most influencing an attribute or set of attributes.

The predictive analysis is visualized through a spiral chart. At the center of the spiral chart is the target field(s) that are being analyzed. Then, each of the influencers or drivers of the target field are shown spiraling out from the center – with the fields with the greatest influence displayed closest to the center.

An example of a predictive analysis is shown below with a Maximo Work Order data set. This data set contains a variety of work order information, including costs, assets, location, site and more. The user wants to gain a greater understanding of what is influencing the Work Order Actual Labor Hours (ACTLABHRS) which is at the center of the spiral.

The attributes or fields most influencing Actual Labor Hours are shown in the Drivers section. These fields may include some items that are expected – like Estimated Labor Hours, or Actual Labor Costs. But there may be some items that are not expected – including why does the location of the Asset have a significant influence on the Actual Labor Hours of the work?

Figure 26: Predictive Analysis of Work Order Actual Labor Hours

Watson Analytics: Displays

Watson provides three options to display the discoveries and predictive analysis including (1) Dashboards (2) Infographics and (3) Storybooks

1. Displays: Dashboards

Dashboards display the variety of discoveries and predictive elements uncovered in a tabular format. Once created, dashboards can be shared via links, emailing or exporting.   Additionally, for multi-tenant accounts – any data set, discovery or display can be placed in a shared folder for multiple individuals to access.
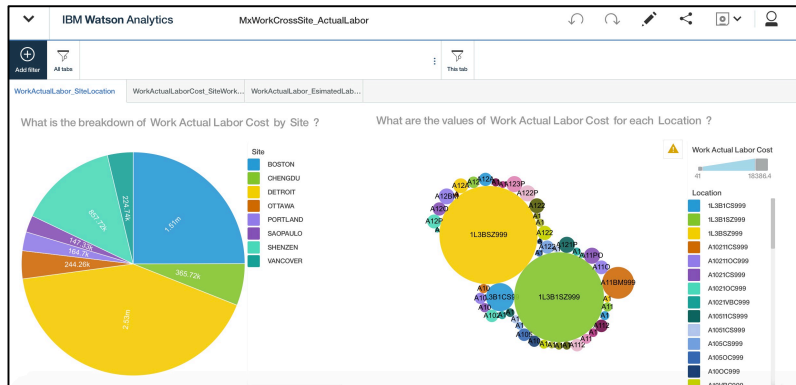

Figure 27:   Watson Analytics Dashboard Display

2. Displays: Infographics

Infographics display discoveries in a banner-type display. Focusing on consolidated data in structured format, infographics lead consumers of content through data insights.

3. Displays: Storybooks

A storybook is a guided exploration of a topic, which includes chapters or categories of detailed information.   Storybooks can be published and used as templates best practice data analysis.

As of November 2016, Maximo provides two storybooks: (1) IBM Maximo: Asset Management and (2) IBM Maximo: Work Management. These storybooks are available on Watson's Community Site and can be imported into your Watson Account with no additional licensing fees.   Once imported, the storybook can be quickly updated with your unique Maximo data.
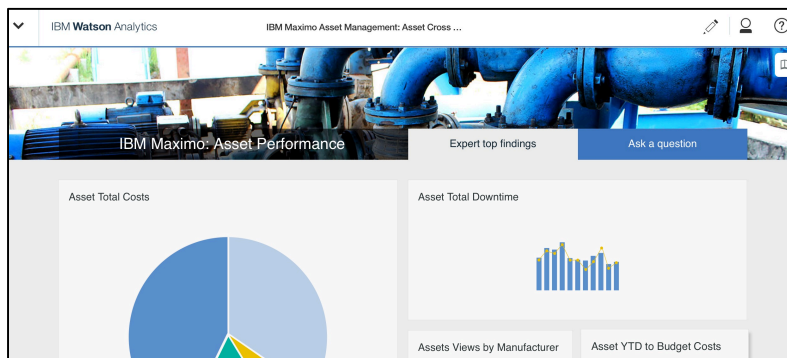

Figure 28: Watson Analytics Storybook Display

5   Comparisons

5.1   Overview

Maximo provides an extensive collection of analytic tools within its portfolio as noted in the previous sections. From downloading application list tab fields to spreadsheet files via QBE, to printing a BIRT Work Order details report to exploring data with Watson's Natural Language processing – you may start to wonder what tool or tools should I use? And who should use these tools and when should they use them?

Deciding which tool or tools to use within your Maximo environment is a critical decision.   Analytic tools enable your users to perform their daily tasks, report on the health of your business, provide visualization of trends and issues and much, much more.   Therefore, selecting the right tool or tools, can have a major impact on your user's experience with Maximo, and the value you derive from it.

To help you with your reporting evaluation, this section will present features you may want to take into consideration.
NOTE: This evaluation is done on the specific versions of BIRT 4.3.1 and Cognos 10.2.1.1 supported with Maximo 7.6, along with cloud-based Watson Analytics.

1.   First, an overview of Maximo users and their skill sets will be presented.

It is critical that a user's skill sets and business needs are carefully evaluated before granting access to any analytic tool. This insures the user is qualified, trained and successful in using the tool – and most importantly –that the user is acting on accurate analytic information. For example, if a user does not have strong sql and development skills, along with an understanding of the Maximo relational database - giving them access to create reports in the BIRT Designer can lead to inaccurate report content.

2.   Then, an evaluation of BIRT, Cognos BI Server and Watson Analytics only will be detailed.
Please note that BIRT and Cognos are reporting tools focused on rendering and displaying operational and enterprise reports.   Watson analytics is a self-service, cloud based tool focused on enabling a business user the ability to import, discover, explore and analyze data.

The different features of each of these will be highlighted by comparing key components of the analytic process including

> Deployment Options
> IT Administration of Content
> Software and Version Dependencies
>
> Content Types
> Content Authors
> Data Quality
> Delivered Content
> Content Access
> Miscellaneous

Please note that this evaluation is not an inclusive list. There are numerous features in the analytics processes of preparing, extracting, transforming and consuming data.   And within each of these processes, there are numerous features which may impact your selection decision.   For example, if you have multiple developers familiar with developing Cognos models and reports, and it is your corporate reporting standard, these factors may over-ride any comparisons listed here.

5.2   Maximo Users

A user's skill sets and business needs are one of the most important factors in determining which analytic tool is best for them.   This can be a difficult challenge as in many Maximo implementations, there are a wide range of users with a wide range of skills sets.

Examples of these users are shown in the diagram below. In a typical Maximo environment, the greatest number of users are Enterprise, Hourly users. Their skills sets are in other areas outside of Maximo, so their use is limited to one or two applications in Maximo and they depend on a guided user experience.

As you move up the pyramid of users, the number of users decrease, while their application usage, skill set and database knowledge in Maximo increase.   In the center of the pyramid – users including maintenance leads, buyers, supervisors and storeroom managers – access a variety of Maximo applications – and hence their Maximo skill sets are strong.

At the top of the pyramid is the business analyst who works in all Maximo applications, has a very strong understanding of the Maximo database, and often analyzes data for managers, project requirements or other Maximo users.
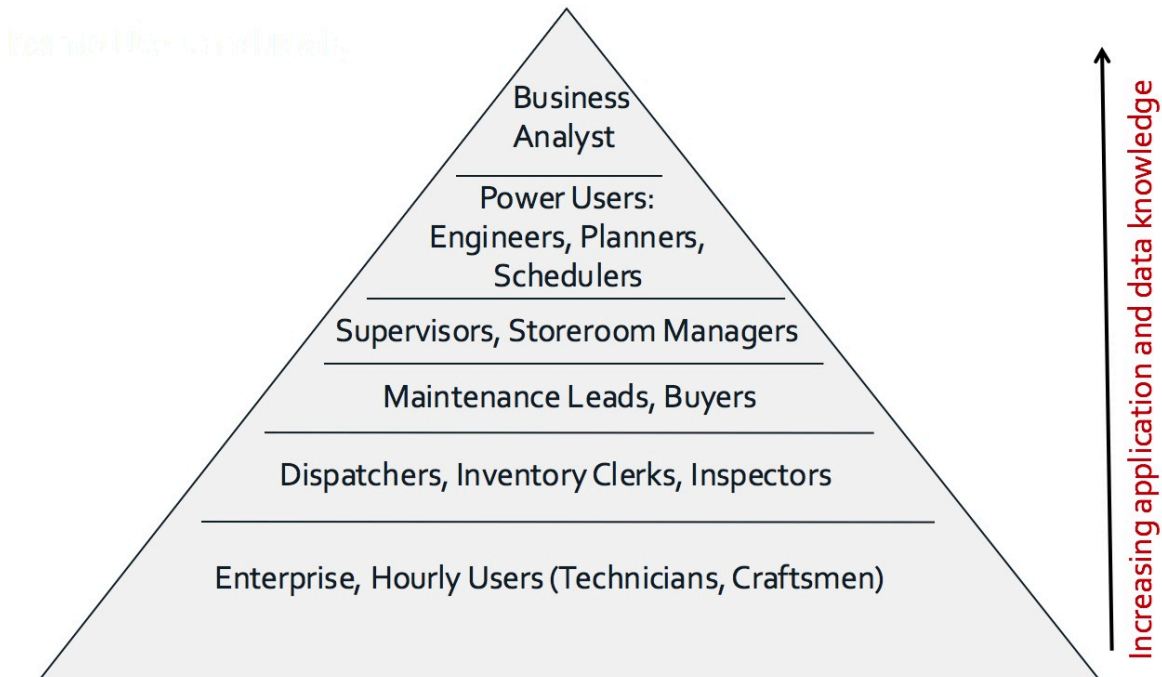

Figure 29: Pyramid of Maximo Users with Increasing Application and Data Knowledge

To simplify this, the broad range of Maximo users can be categorized in three levels:

Level 1: This largest percentage of users have limited Maximo knowledge and skills, and rely heavily on a guided user experience.

Level 2: This next category utilizes Maximo frequently throughout the day, and accesses a variety of applications. They are frequent consumers of – and rare heavily dependent on – regular report content for their daily tasks.

Level 3: This top category includes the most skilled and knowledgeable of Maximo users in Business Analysts and Power Users. They access the largest number of applications, are the most knowledgeable, and are often referred to as the 'Go To' Maximo person. These individuals consume report content – but they need more. They need to dynamically analyze Maximo data for themselves and others by creating their own ad hoc reports, queries , data exports and data analysis.
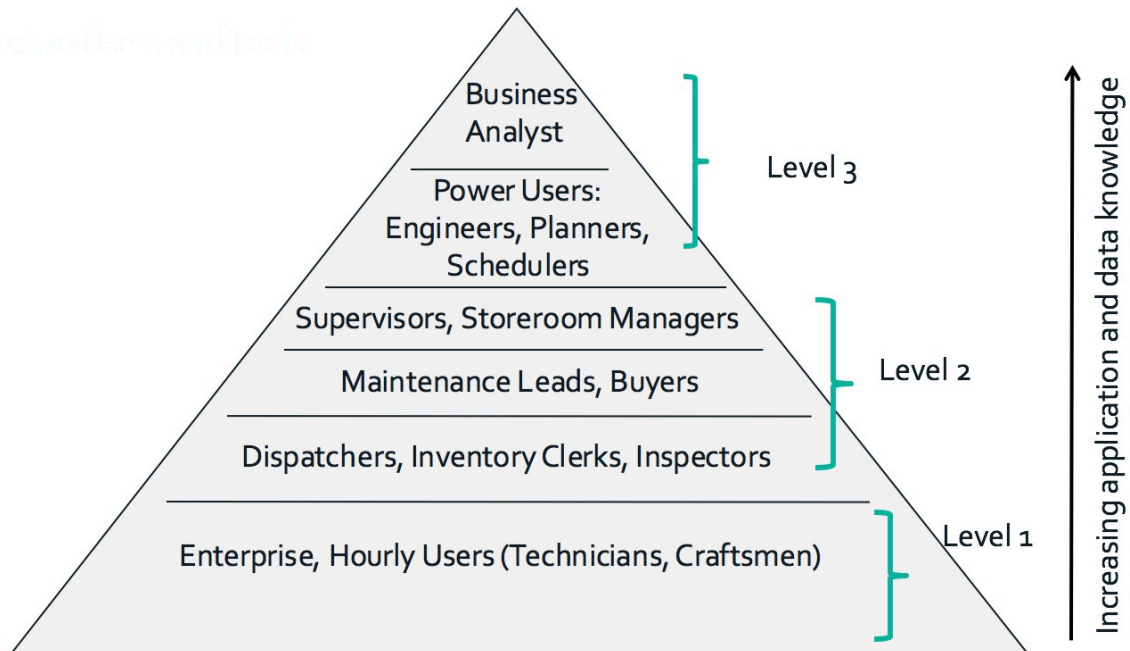

Figure 30: Level 1, 2 and 3 Maximo Users

5.2.1   Maximo Users and Analytic Tools

With the categories and skill sets of Maximo users defined, the types of analytic tools required for their daily business tasks can be highlighted.

Level 1 Users: Their Maximo tasks involve a very limited number of actions and tasks. Therefore, they depend heavily on application analysis tools - which supply guided actions and immediate visual display – along with one or two reports that they can access via a minimum number of mouse clicks.

This user is often identified as the primary user of the BIRT Work Order Details report, accessible via a single icon within the application's toolbar.

Level 2 Users: This category of users builds on the application analysis tools of the Level 1 users with their increasing skill sets.   They often want to interact with report or query results – by drilling down into data, changing filters or chart types, or exporting results to Microsoft Excel for additional analysis.

This user can seamlessly navigate a variety of applications, actions and interfaces and is comfortable running reports in both the embedded BIRT reporting tool, as well as the very different Cognos interface.

Level 3 Users: The most knowledgeable and curious of the users are the Business Analysts and Power users in Level 3. They require the greatest depth of data access and analysis.

By nature, they are curious and want to explore and ask questions. These users gravitate to tools like application exporting where they can export mass amounts of data, and Ad Hoc reports where they can build their own report content.

Additionally, they are the target users for Watson Analytics.   These users need to rapidly explore evolving data sets – and not be limited to a fixed set of operational reports, to meet the dynamic demands of their business environments.

Application Analysis	Level 1 User	Level 2 User	Level 3 User
QBE, Query By Example	X	X	X
Application Exporting			X
Results Sets	X	X	X
KPIs, Key Performance Indicators	X	X	X

Enterprise Reporting	Level 1 User	Level 2 User	Level 3 User
BIRT Reports	X	X	X
Author Ad Hoc Reports			X
Cognos Reports		X	X

User Analytics	Level 1 User	Level 2 User	Level 3 User
Watson Analytics			X

This section provides a comparison of BIRT Reporting Cognos BI Server and Watson Analytics.

5.3   Deployment Options

Depending on your unique environment, you may want to maintain your analytic solutions within your own on-premise environment or have it administered and maintained as a cloud based solution.   This paper will not compare the benefits or constraints with these two different solutions, and instead will share the options that are available.

BIRT Reporting and Cognos BI Server are available as on-premise solutions.   Watson Analytics is only available as a cloud-based solution.

	BIRT Reporting	Cognos BI Server	Watson Analytics
On-Premise Solution			
Cloud Solution			

5.3.1   On-Premise Solutions Installations

BIRT Reporting

BIRT is silently installed during the Maximo installation process. No separate installation process is required, which can significantly reduce your setup time.

Additionally, you can capitalize on extensive configuration options to maximize performance and user experience including
> Separate Report Server (BROS)
> Clustered Report Servers (Configurable for Immediate, Scheduled or All Report Processing)
> Configurable Database Connection (Production or Replicated)

Note: The BIRT Designer, required for report developers to create, customize and maintain individual report design files, is a separate client installation.

Cognos BI Server

Cognos BI is not installed during the Maximo installation process. It requires a separate installation, and once installed, integration steps must be performed to connect it with Maximo.

With Cognos reporting, you can also utilize extended architectural configurations to separate and cluster the Cognos Server, along with specifying the database connection to either a production or replicated Maximo database.

Note: The Cognos report development, end user and administration tools are all web-based tools, and are available once Cognos is installed.   However, the Frame Work Manager tool, required for model verification, customization and creation, is a Windows Only installation.

5.3.2   Cloud Solutions

BIRT reporting and Watson Analytics are available as cloud-based solutions.   Although Cognos can be deployed as a cloud solution, as of the writing of this paper, the cloud solution is not currently supported with Maximo 7.6.

With the Cloud solutions, architectural reviews, hardware procurements, installations and product and software upgrades are not required.

5.4   IT Administration of Content

Analytic environments may require IT management of the hardware, software versions, upgrades along with the design, development, testing, management and administration of individual report content. Depending on the number of users and the types and numbers of reports, this IT management can range from a few individuals to a team of individuals – either internally, or thru services arrangements.

There is a vast amount of individual IT administration tasks required to support enterprise reports – and this section will explore only a subset of those features.

Note: A staff of IT individuals is not required for Watson Analytics. Watson analytics enables business users to create, manage and share their own content without IT involvement.

Administering Content	BIRT Reporting	Cognos BI Server	Watson Analytics
Synchronization of Maximo Security Groups			
Enterprise Report Administration Features			
Report Performance Enablers			

5.4.1   Synchronization of Security Groups

If you utilize BIRT, you do not have to synchronize your Maximo security groups between multiple systems. The security groups are maintained in one location – either the Maximo database or an LDAP directory. This simplifies the initial setup configuration, as well as the long term maintenance of the system when adding or deleting new users or security groups.

Your security groups can also be synchronized with Cognos when using either the LDAP or MXCSP namespaces.

5.4.2   Enterprise Report Administration features

Many clients may be limited on personnel to administer and maintain the system. In these cases, utilizing a single tool to manage the security privileges and report access may be critical.

With BIRT, you will utilize the Security Group and Report Administration applications to manage privileges and access to your reports.   Additionally, using these tools, the administrator can import new reports into the report repository, configure unique features like report display, priorities and while also viewing and managing report performance.

Similar features are available within Cognos. However, the administrator will utilize the separate Cognos Administration tool to manage report content, as well as security and report privileges.

5.4.3   Report Performance Enablers

Capitalizing on the Maximo framework, a number of report performance enablers are available for BIRT. These include the ability to define execution times of complex, batch reports, visual and KPI displays of report execution times, and defining the maximum number of records a report can execute against. Additionally, escalations can be enabled to notify an administrator of long running reports. These specific features are only available for the BIRT reporting tool.

5.5   Software and Version Dependencies

Managing software, middleware and third party version support can be a consuming and challenging task. Browser versions frequently change, along with evolving corporate requirements for items including application server and database type and versions.

Individuals are often tasked to manage these software versions and dependencies in increasingly complex environments.

	BIRT Reporting	Cognos BI Server	Watson Analytics
Version Agnostic			
Management of Sub-Software Versions not required			

5.5.1   Version Agnostic

With Maximo 7.6, only BIRT 4.3.1 and Cognos 10.2.1.1 BI Server are used and supported.   These are the specific versions that reports have been designed, developed and tested on with the Maximo 7.6 release.

There are later versions of both tools available, but they are not embedded, incorporated or available via license entitlements – and therefore, not supported with Maximo 7.6.

These version dependencies can create issues when later versions of the tools are used in other areas of the business, and the IT department would like to standardize within the corporation.   Again – this can consume the time of multiple individuals to plan, coordinate, and maintain.

Watson Analytics is the only tool that is version agnostic. As a cloud-based service, there are no dependencies on which Maximo version it is used with – and likewise, there is no Watson Analytics version it is dependent on.

5.5.2   Management of Sub-Software versions not required

Each reporting tool has a list of software types versions it supports – from application servers, databases, browsers, adobe reader versions and more. Managing the top level reporting version and each of these child software and hardware versions can again be time consuming.

An example is BIRT 4.3.1 used in Maximo 7.6 supports up to Adobe Reader 10. However, there are later versions of Adobe Reader now available.   Do you utilize the supported BIRT version – or is your corporation forcing you to upgrade to a later version of Adobe Reader which may not be supported?

With Watson Analytics, management of the child software and hardware versions are not required.   With its cloud based service, you no longer have to manage and coordinate the type of browser, or database type and version that is used

5.6   Content Types

Content type often dictates which tool or tools should be used.   This paper for example, contains a large amount of text. The tool that was chosen to write this paper was Microsoft Word as it contains key formatting, spelling, inserting and other textual based features critical for the paper's creation.   The paper was not written in Microsoft Excel or Power Point, as their features target separate numerical and graphical content – not large amounts of text.

Likewise, the types of analytic content your business requires impacts which analytic tool best fits its requirements.   From traditional enterprise reports, containing complex database queries, calculations and fixed formatting to ad hoc reports required for one-off business or project needs to user data explorations - the variety of analytic content is immense.

Understanding the types of analytic content your business requires is critical to selecting the applicable analytic tool.

As there are an infinite number of variables associated with report content, a subset of content types will be explored in this section.

Output Formats	BIRT Reporting	Cognos BI Server	Watson Analytics
List reports with columns and rows of individual data			
Variety of chart types: column, bar, pie, heat…			
Predefined, heavily formatted enterprise reports			
Display of complex calculations, which may require user parameter input			
Interactive Dashboards			
Storybooks – Content Organization			

5.6.1 List reports with columns and rows of individual data

List reports contain rows and columns for individual records. These records may be sorted (ascending or descending order) – or grouped into categories (for example – site, location, priority and type).

List reports are frequently used to perform daily business tasks like kitting, expediting, scheduling or monitoring. They are also used to investigate anomalies – such as why a set of work orders may be costing or taking longer to complete than other similar work orders.

Both BIRT and Cognos reporting produce a variety of list reports thru QBR Ad hoc reporting, BIRT reporting, Query Studio, Workspace Advanced and report studio.

Watson Analytics enables a user to view a preview of individual record data in the Data and Discover sections, but does not produce output listing individual records.

Figure 31: Maximo BIRT Grouped List report

5.6.2   Variety of chart types: column, bar, pie, heat

Charts are collections of data which enable a user to quickly consume output.   They are often designed around the '3 Second rule' – which states that a user must be able to understand the content displayed within the chart in 3 seconds or less.

Charts come in a wide variety of formats – including column, bar, line, pie, heat, bubble and many, many more.   Users often have a preference for one type of chart type over another – so the ability for a user to change the chart type after rendering is a requirement for some clients.

All three tools – BIRT, Cognos and Watson Analytics – are able to produce a wide range of chart types.   Within Cognos workspace and Watson Analytics, users can change the chart type and colors to meet their individual preferences.

Figure 32: Watson Analytics Heat Map Discovery Display

5.6.3   Predefined, heavily formatted enterprise reports

Clients may have the need to submit or retain weekly, monthly, quarterly or year-end reports to meet regulatory or corporate requirements.   Additionally, users may require specifically formatted reports to perform daily business tasks, send to external suppliers or contractors at regularly scheduled intervals.

BIRT and Cognos reporting best fit these types of use cases.   Format of reports can be specifically defined and controlled, scheduled and emailed regularly to both internal and external Maximo users.

Figure 33: Maximo BIRT Work Order Details report

5.6.4   Display of complex calculations, which may require user parameter input

Report output frequently reflects specific database attributes, like Work Type, Purchase Order Required Delivery Date or Asset Description.   Additionally, report output may also require information not readily contained within a single database field.   The additional fields may be a simple combination of subtracting or adding two or more database fields together – but in some cases, more complex calculations are required. Often these complex calculations rely on user parameter input to determine the results.

Examples of more complex calculations include industry standard metrics like MTTR (Mean Time to Repair), MTBF (Mean Time between Failure), Vendor Schedule Compliance, or Asset year-to-date costs. Asset year-to-date costs is a calculation of all work order costs for the asset, and any child or grandchild assets that may be in its hierarchy.

All three tools have the ability to add new columns or fields which are calculations of various database attributes.

However, BIRT and Cognos reporting only have the capability to add very complex calculation types for fields like asset year-to-date costs, and also to utilize user inputted parameter values in their output.
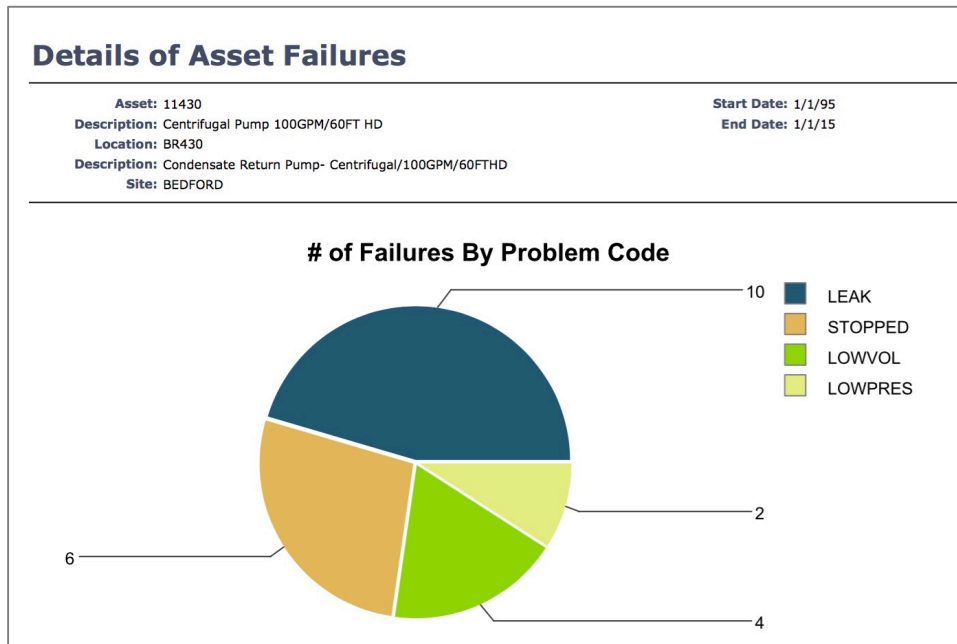

Figure 34: Maximo BIRT report containing complex calculations

5.6.5 Interactive Dashboards

Dashboards enable a user to view multiple data components at once.   Instead of a traditional report which may present a single chart or set of records, dashboards provide an overview of a particular feature or organization.   Dashboards frequently contain a variety of chart types, filters, and drill down features.

Dashboards are meant for quick consumption of data, and to highlight to the individual consumer what areas may be degrading. The user can then take action or investigate the low performing areas. Interactive dashboards are available within Cognos Workspace Advanced and Watson Analytics Dashboards or Infographics.
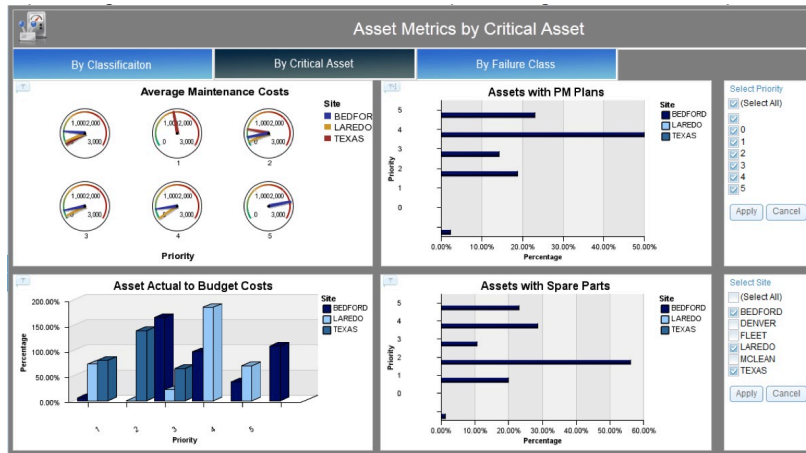
Figure 35: Cognos Workspace Display

5.6.6   Storybooks

Storybooks provide an organized method of displaying content.   The content can be organized in categories or chapters, providing a walk-thru of data for the consumer. Each chapter enables a text overview section, followed by any number of charts accessible via tasks.   As the consumer of the content navigates thru the various chapters and their individual pages, they can additionally ask Watson follow-up questions.

Storybooks are templates.   The data contained within them can easily be updated after they are downloaded from the Analytics Community, or by the individual user who may create them.

Storybooks are only available with Watson Analytics, and provide a unique data analysis and interaction experience.
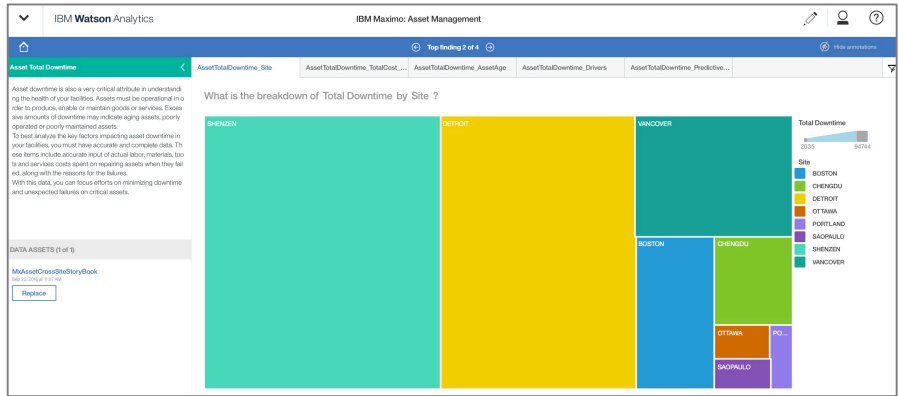

Figure 36: Maximo Watson Analytics Storybook

5.7   Content Authors

The numbers and skill levels of users requiring and asking to create their own content has escalated over the last few years due to increasing skill sets of users and an increasing need for immediate data analysis. Users can no longer wait for their highly formatted, enterprise reports to arrive each week for analysis. Today's dynamic business requirements require users to access evolving data sets at any time.   They cannot wait for IT to specify, develop, test and maintain individual unique reports.

Because of these evolving needs, a variety of tools must be available to meet the user's analytic needs and business requirements, which are detailed below.

Authoring Content	BIRT Reporting	Cognos BI Server	Watson Analytics
Enterprise Reports: Skilled IT Developers			
Ad Hoc Reports: Level 3 Business and Power users			
Natural Language Data Exploration: Level 3 Business and Power users			

5.7.1   Enterprise Reports: Skilled IT Developers

Developing report content can require highly skilled developers depending on the type and content of reports.   Simple list reports can be quickly developed, whereas reports rendering content from multiple database objects, requiring conditional displays, advanced charting, calculations or formatting require significantly more development time and skills.

BIRT reporting provides the use of a single report development tool - the Eclipse BIRT Designer. This tool requires a very technical reporting skill set, and a solid understanding of sql queries. Developers new to the BIRT Designer tool frequently have a learning curve and may require on-line or on-site training.

Cognos provides two very different report development tools in Cognos 10.2.1, which require a range of technical skill sets.

> ***Report Studio***: This is the legacy Cognos report development tool, and provides developers a wide depth of features and functionality enabling the creation of very simple to complex reports. This tool requires developers to have detailed knowledge of sql, programming logic, HTML, and java scripting.

> ***Workspace Advanced***: This is a newer Cognos report development tool, which exposes a subset of the features available from Report Studio. It is therefore, easier to learn, but consequently, enables a smaller range of reports that can be created from it.
> *Note: Starting with Cognos Version 11, Workspace Advanced has been discontinued.*

5.7.2   Ad Hoc Reports: Level 3 Business and Power Users

Ad Hoc reporting enables Level 3 Business and Power users to create their own reports for their unique business and project needs. This can greatly reduce the number of reports that need to be designed, created, tested, administered and maintained, leading to large time and cost savings.

Ad Hoc reporting features include the ability to create content using fields from multiple objects (tables), along with defining sorting, grouping, parameters (filters), summaries and calculations. After the ad hoc report content is created, it can be edited and shared with other users.

QBR, Query Based Reporting, is Maximo's Ad Hoc reporting feature. QBR enables the ad hoc reporting features described above within the individual Maximo applications. Because QBR is only available within the Maximo applications, users can capitalize on applying application queries to their ad hoc reports to minimize report creation time.

Like enterprise reports, QBR reports can utilize the Maximo features of emailing, scheduling, security privileges and more – to be used. They are also frequently used be report developers as a starting point to custom enterprise reports.
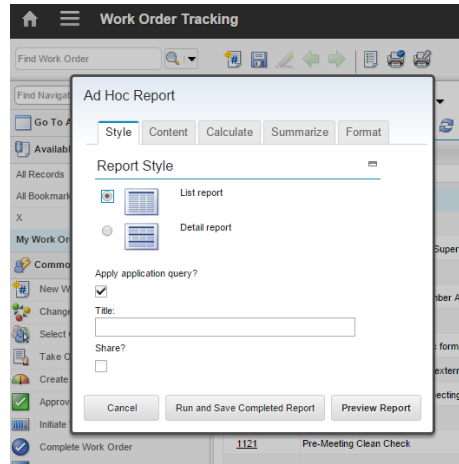
Figure 37: Maximo QBR Creation dialog

Query Studio, is the ad hoc reporting tool for Cognos. Query Studio provides advanced analytic features including a variety of report styles to choose from, advanced filtering capabilities, and the ability to add from a wide range of graph styles to include in their reports. Query Studio is only accessible from the Cognos Portal, and the ability to use Maximo's application queries is not available.

5.7.3   Natural Language Data Exploration: Level 3 Business and Power Users

With the increasing need of users – with a range of skill sets and business needs – to analyze data immediately – it becomes subsequently critical that analytic tools do not require highly technical or specialized skill sets. The traditional analytic skill sets of technical developers or statisticians severely limit the numbers and types of users who can utilize them.

Watson Analytics offers a very different, business or self-service user analytic experience. It targets users without statistician, development or database sql skill sets. Business and power users can explore imported data without models or complex design files.

And instead of being overwhelmed by large amounts of data – Watson immediately offers starting points of data discoveries for the user. These discoveries are enabled with Watson's Natural Language processing which presents a variety of starting points to analyze within their data set. Selecting any one of the individual visualizations or cards generates a chart or predictive element for the user to analyze.

5.8 Data Quality

The quality and completeness of data is critical to any type of analysis. This criticality is frequently demonstrated when reports are run and no data displays. Or when significant investments are made in complex analytic models – only to find out missing, incomplete or inaccurate data yields to no conclusive results.

With Watson Analytics, the ability to tangibly measure data quality is now available! Fabulous! Individual data sets and attributes are consistently measured for quality. This provides a determination of how ready the data is for analysis.

Data Quality	BIRT Reporting	Cognos BI Server	Watson Analytics
Data Quality scoring available			
Data Refinement and Cleansing features available			

5.8.1 Data Quality scoring available

As Watson Analytics imports each data set, it calculates and assigns a data quality score. The score is based on a range of 0 – 100, with 100 being the best and 0 the poorest values. Each individual attribute is scored based on a variety of factors, including completeness, constant values, imbalance and a variety of other factors determined by the individual attribute type.

Once a data set score is available, a tangible measure of its quality is available and can be progressively tracked.

As noted earlier, data quality is critical as the statement we are all familiar with holds true "the better the data.... the better the analysis".

While a higher data quality score is always desired, Watson Analytics will still provide discoveries on your data set – no matter how low its score may be.

5.8.2 Data Refinement features available

Once a data quality score is calculated, the data set may need to be refined or cleansed to remove non-value attributes or to evaluate and change data types which may not have been transformed properly during the import.

Watson Analytics provides a variety of ways to perform these actions either in the 'Refine' section of a data set in the Data Application. Additionally, a data cleanse is available before the data set is imported when a direct database connection is used.

5.9 Access to content

Content is only useful to users if it can be accessed.   Many users demand BI content be accessible by clicking on an icon from a Maximo application, other users want all their content accessible in one single location whereas others only want to view content that is emailed to them.

The variety of ways that content can be accessed may have an impact on your analytic tool selection.

Access to content	BIRT Reporting	Cognos BI Server	Watson Analytics
Report toolbar access: application icons			
Launch to content within Maximo			
Single, central location of all content			
Emailing and Exporting			
Scheduling			

5.9.1 Report Toolbar Access: Application Icon

Level 1 Maximo users access a small number of applications in Maximo. They rely on a very guided user interface, and perform the same actions in Maximo on a regular basis.   One of these actions may be to access or print the same report with a minimum number of mouse clicks via configured icons.   This functionality is called application or report toolbar access and includes

Browser View:
Opens configured report directly in report browser.

Toolbar Print:
Prints configured report to user's default printer via a one click action.

Toolbar Print with Attachments:
Prints configured report and any print-able attachments directly to the user's default   printer.

This feature set is only available with BIRT reporting.
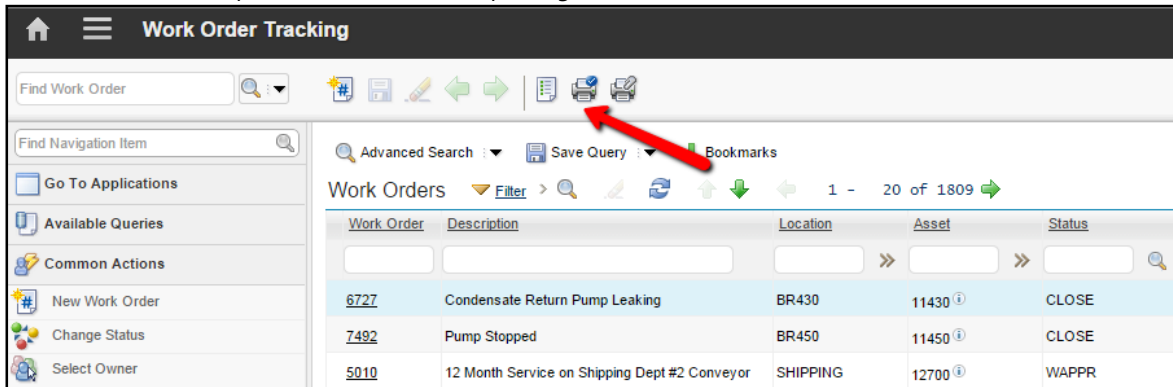
Figure 38:   Maximo Report Toolbar access from Work Order Tracking

5.9.2 Launch to Content within Maximo

As a user performs his business tasks within the Maximo applications, they may need to run a report, or review analytic content for additional information. Enabling seamless access to that information from an action or a launch point – may be very important for Maximo Level 1 and Level 2 users.

All tools offer this feature – with a varying degree of access.

With BIRT, users can access reports from the 'Run Report' action in configured applications. They can also access report content thru Report List portlets, KPI linkage and in some scenarios, from within specific application dialogs (ex. Change Status dialog in Work Order Tracking)

Cognos has similar access points, although the delivered functionality does not include access from specific application dialogs.

Launching from Maximo to Watson Analytics is available – but currently – in very limited scenarios. Starting with Maximo 7.6.0.5, a user can launch directly to Watson Analytics from the Maximo-x Business Analyst work center only.

5.9.3 Single, central location of content

Portals enables a user to access a variety of reports or metrics from a single location. This may be especially important to a Level 3 business or power user whose main focus is to interpret and analyze data.

With BIRT, a single report is executed from Maximo and displayed in the separate report viewer or browser. From this location, the user can view, print or export the report's contents. However, the user cannot navigate to other reports from this session (with the exception of hyperlinks) or to other reporting tools.
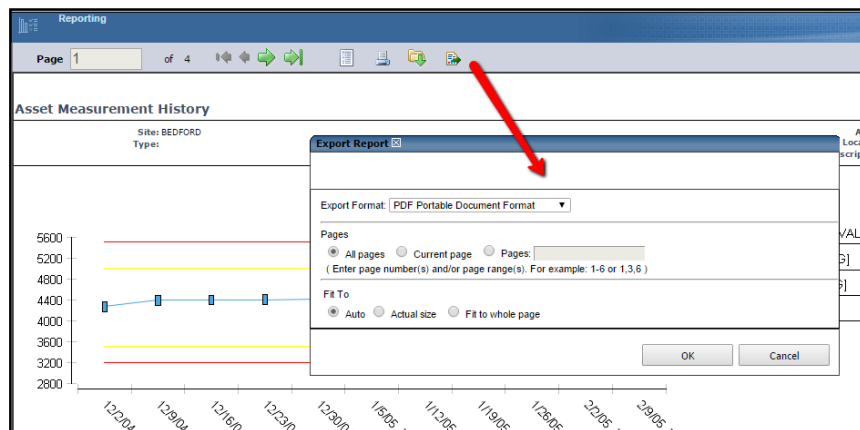
Figure 39: Maximo BIRT report displayed in separate browser

Cognos provides a connection location or portal which can be used to run a number of different reports or workspaces. Additionally, depending on a user's security access, the portal can be used to quickly navigate between different Cognos tools, including administration, development and viewing tools.
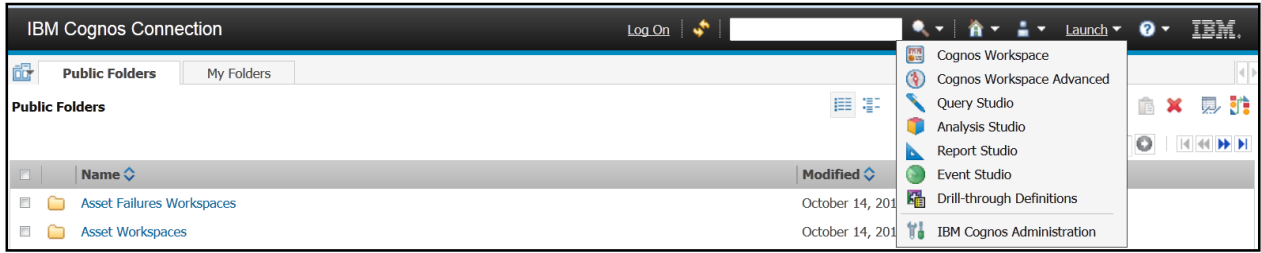

Figure 40: Cognos Connection or Portal displaying menu navigation to various Cognos tools

Watson Analytics also provides one location where all content – data sets, discoveries and displays – are available to the user.
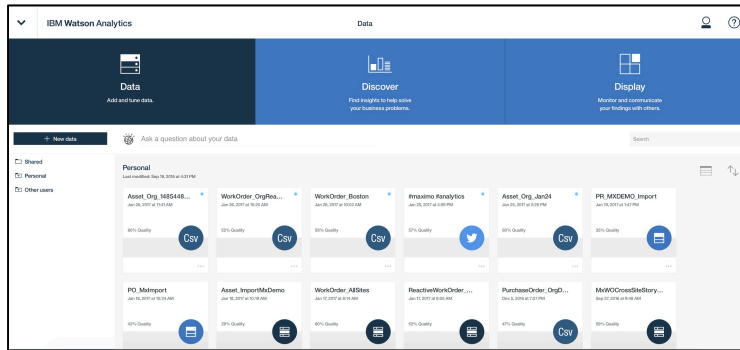
Figure 41: Watson Analytics Home Location

5.9.4   Distributing content thru emailing and exporting

Content is often required to be shared with other users, or exported to be used for additional analysis or displays.

All three tools enable you to email and export content with unique functionality and configurability options. For example, BIRT capitalizes on the Maximo framework for its emailing features, and enables exporting to a wide variety of options in the Report Viewer.

Cognos also has a wide variety of exporting and emailing features, and those for Watson Analytics are shown below.
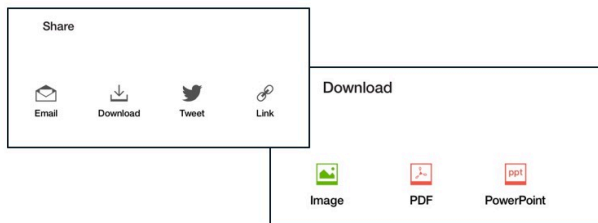
Figure 42: Watson Analytics Email and Export Options

5.9.5 Automated scheduling of content

Scheduling automates the delivery process of report content that users regularly consume or are required to run for regulatory or business requirements.

BIRT and Cognos reporting offer a variety of schedule options including scheduling a report to run a single time or on a recurring basis (For example – every Monday at 6am, every 1st day of the month, or every Friday at 4pm.)

Scheduling - for example to publish updated data sets – within Watson Analytics is not currently available.

5.10   Delivered Content

Delivered content highlights the features and functionality of both the Maximo applications and the BI tools.   This content is often used as a starting point by clients in understanding how content can be created – and as a launching point to custom report creation.

Maximo delivers a variety of analytic content within all three tools.   While the volume of content will vary by tool, the content of each reflects its unique attributes. Additionally, the source files are made available for ease of customization, application and learning.

Delivered content	BIRT Reporting	Cognos BI Server	Watson Analytics
Delivered analytic content			

5.10.1   BIRT: Delivered Reports and templates

Depending on the specific products you are licensed for, a variety of delivered BIRT reports are available for you.

These reports span the variety of applications, and include Analysis, Detail, Hierarchical, and Drill down Reports. Reports can update the database, hyperlink to one another to enable more detailed analysis, and refresh data dynamically.   These reports are designed to quickly and clearly convey information to the end user, and approximately 20% include graphs, including pie, bar and line charts along with daily and monthly calendar views and control limits.

The out of the box reports provide you a starting point for your custom report needs.   You can quickly customize these reports to meet your individual business needs, and also utilize the delivered business logic to create any new reports you need.

Additionally, a suite of Maximo templates are delivered containing critical integration features, including security and the maximo 'where clause'. Enabling these templates are system libraries, which contain universal formatting features for all reports - including font types, sizes and layouts.   Using these templates and libraries streamlines your report development time.
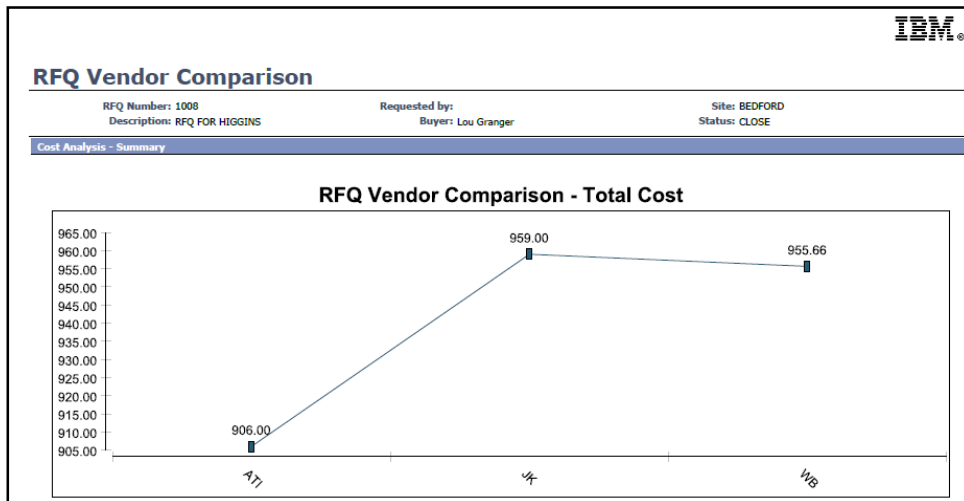
Figure 43: Maximo BIRT delivered report example

5.10.2 Cognos: Delivered Reports and Work Spaces

With Cognos, the delivered reports focus on four key areas of Work Order, Asset, Asset Failure and Inventory Management. The reports include required and optional parameters, graphs and detailed listings of records. These reports can be emailed, scheduled and exported to various file formats for additional analysis and review.
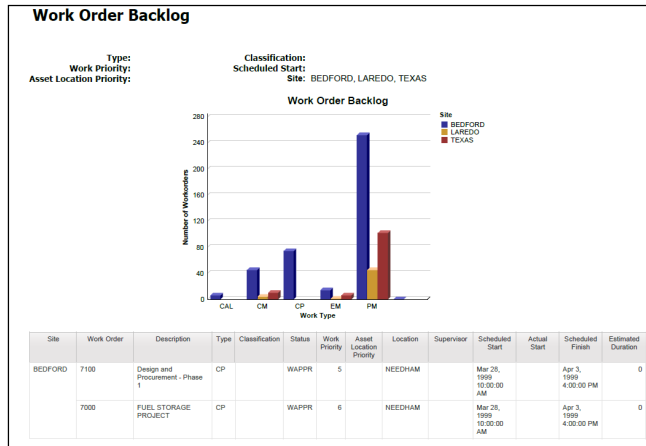

Figure 44: Maximo Cognos delivered report example

Additionally, with Cognos, a set of workspaces are delivered. Cognos workspaces are collections of metric reports displayed in a single page, and enable user interaction with the content by changing views, filters, graph types, report content and more. Two types of workspaces are available. Application workspaces show current metric values and Trending workspaces shown metric values over time.
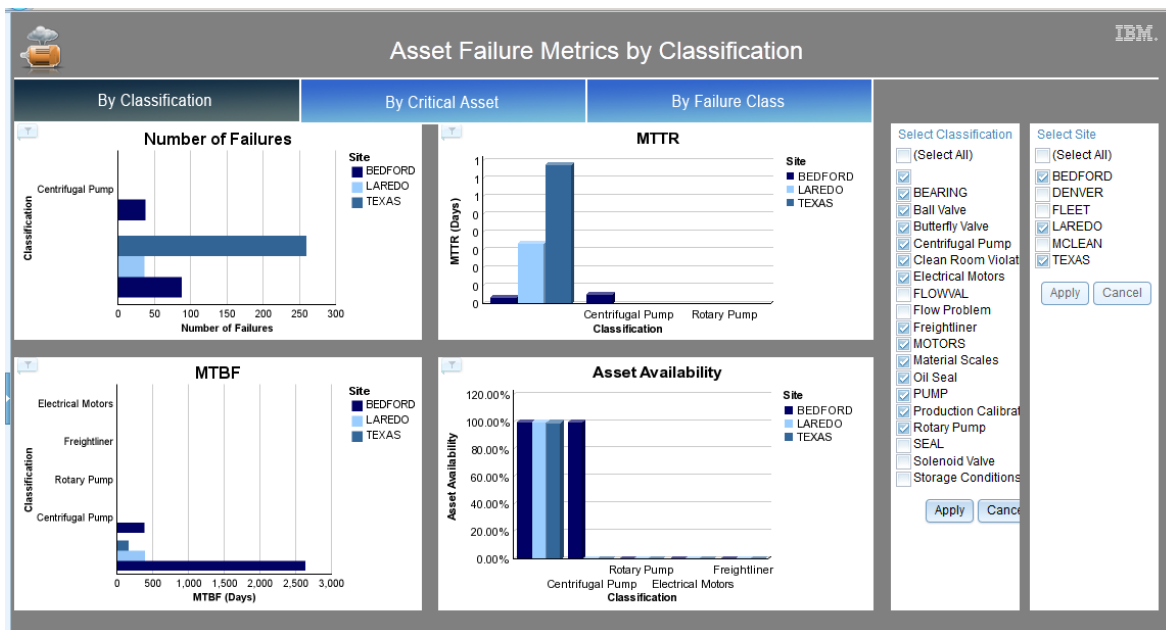
Figure 45: Maximo Application Workspaces displayed in Cognos Workspace

Figure 46: Maximo Trending Workspaces displayed in Cognos Workspace

5.10.3   Watson Analytics: Storybook Content

A storybook is a guided exploration of a topic, which includes chapters or categories of detailed information.   Storybooks can be published and used as templates best practice data analysis.

As of November 2016, Maximo provides two storybooks: (1) IBM Maximo: Asset Management and (2) IBM Maximo: Work Management. These storybooks are available on Watson's Community Site and can be imported into your Watson Account with no additional licensing fees.   Once imported, the storybook can be quickly updated with your unique Maximo data.
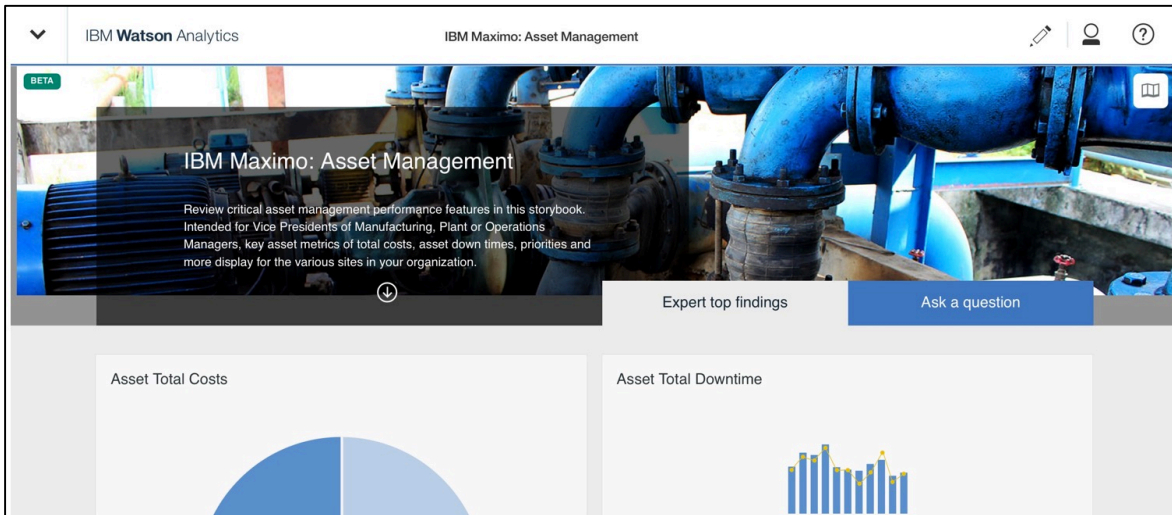
Figure 47: Maximo Watson Analytics Asset Management Storybook
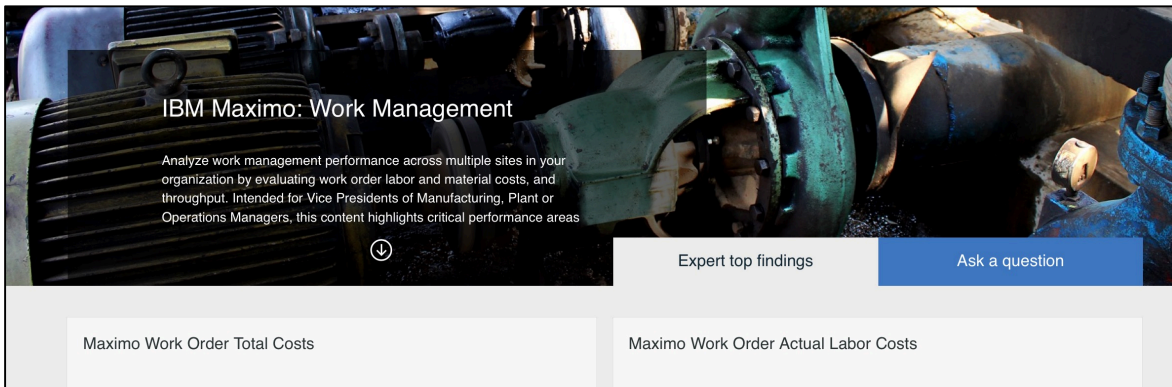
Figure 48: Maximo Watson Analytics Work Management Storybook

5.11   Miscellaneous

This section covers a variety of comparisons on various aspects of the analytics tools.

Miscellaneous	BIRT Reporting	Cognos BI Server	Watson Analytics
Multi-Language Support			
Pre-joined database objects			
Maximo query capitalization			
Content usage			
Data restrictions			

5.11.1   Multi-Language support

You may require multi-language support in your analytic requirements. BIRT Reporting and Cognos BI Server provide multi-language support, and enable the contents of a single report (Titles, labels and localized data) to display in the language defined for the user.

Watson Analytics can be used in multiple languages.   However, imported data content and displays will not dynamically change for the language of the user consuming the information.

5.11.2   Pre-joined database objects or metadata

Metadata consists of pre-joined tables or objects. The metadata layer is used by developers to create enterprise reports, and for power users to create ad hoc reports. Utilizing a meta data provides many benefits including enabling developers to quickly and consistently develop reports versus the traditional method of creating complex sql statements for each individual report.

Cognos utilizes a meta data in its products. To reduce the time to create the meta data, Maximo provides tools capitalizing on its Integration Framework. Report object structures can be dynamically published to Cognos as the meta data, and are then available for use in Report Studio, Query Studio, Workspace Advanced or in Framework Manager

Neither BIRT or Watson Analytics require models or meta data.   Both can consume content created from pre-joined Report Object Structures – but it is not a requirement for either tool.

5.11.3   Maximo Query Capitalization

Within the Maximo applications, simple to advanced queries enable users to see, analyze and act on record sets. These queries can be created from searches, filters or advanced where clauses containing sql syntax, that can then be saved, shared and edited.

The application of these predefined queries to reports can be very powerful and critical as it can minimize time and errors required to reproduce these in a separate tool or session.   BIRT capitalizes on these queries, throughout the use of both operational and ad hoc reports.

Maximo application queries can be used for Cognos reports only developed in Cognos Report Studio, and require manipulation of those reports to include the maximo where parameter.

With Watson Analytics, Maximo application queries can be used to create data sets, result sets or other data which is imported into Watson.   However, once the data is imported, Watson Analytics has no visibility into the query.

5.11.4 Content Usage

Understanding which reports are being executed on a consistent basis, and how long those reports take to display may be critical data points for your IT staff.   They enable you to make important decisions when determining which reports to migrate from release to release, and which reports need to be further analyzed for potential performance improvements.

Within Maximo's report administration application, this data is available for the BIRT reports.   By using either the performance tab, or running reports against the database object reportuasagelog, information can quickly be obtained on who is executing reports, how those reports are executing, and if they render properly.

5.11.5 Data Restrictions

Maximo provides a variety of data restrictions that can be enabled within its applications including qualified object restrictions, row level and field level data restrictions.

A user's qualified data restrictions are passed to the BIRT report when it is run from Maximo. This insures that the user only sees the data that he has access to. This feature is enabled by passing the restrictions in the Maximo where clause.

Due to the large variety of ways users can access and create reports in Cognos, data restrictions must be handled differently.   With Maximo 76, site, organization and set views are applied when the report object structures are published as meta data packages in Cognos. This processes defines the data restrictions within the model – and insures that the user only sees the site, organization or set data that they have access to when running or developing reports from a variety of ways in Cognos.

With Watson Analytics, if a user imports a Maximo data set, result set, QBE or csv file from application exporting – this data will inherently contain the user's data restrictions.   And the user will only see the data the user has access to.   However, if data is imported into Watson Analytics via a Maximo database connection, only the database security access will be utilized.

6   Reference Materials

A variety of materials are available for additional information on the Analytic tools referenced in this guide including:

1. Video Recordings
Video recordings are available for QBR Ad Hoc reporting, BIRT reporting, Cognos, and Watson Analytics on the IBM IoT Support You Tube Channel.

https://www.youtube.com/channel/UCkcm7pKdtuWbQ9mugvMmpZg

To quickly find and view the analytic videos you may be most interested in, access these Playlists

IBM Maximo Watson Analytics
IBM Maximo with Watson Analytics Storybooks
IBM Maximo 76 BI Development
IBM Maximo 76 Cognos

2. Maximo 76 Report Reference Materials
Listing of report reference materials, including description, revision levels and hyperlinks to the documentation.
http://ibm.co/2k7VvFW

3.   Maximo BI Wiki Home Page
Variety of information on all aspects of designing, developing, administering, and configuring report content with BIRT, QBR ad hoc reporting and Cognos.

http://ibm.co/2k0EmVI

4. Maximo Watson Analytics Wiki page
Includes details on configuring Watson Analytics integration with Maximo-x, getting started with Watson Analytics and multiple reference links and videos.

http://ibm.co/2k0AzYd

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