## Analytics

The SDW has the ability to do analysis of model elements and depict the results on diagrams using image depictions or fill colors. An Analytic Collection contains a number of Analytics. Adding an analytic collection to a diagram analyzes the diagram and adds the depictions according to the analytics in the collection

An Analytic has an Analytic Report and a color and/or icon. Anything returned by the report will be colored by the color, and have the icon displayed nearby.

An Analytic Report is a simple report that returns items matching a query that should be depicted a certain way.

* Each analytic corresponds to a query/report with a set of definitions having a property that matches some value - and a depiction for that value.
* These can be used individually to color or annotate a diagram for any purpose - say for example, services that don’t contribute any outcomes.
* Or if the analytic involves a range of values (say High, Medium and Low), then an analytic collection can be used to group together the three reports and use images that display gauges depicting each value.
* Or analytic collections could be used to organize related analytics, even though they don't reference different values of the same property

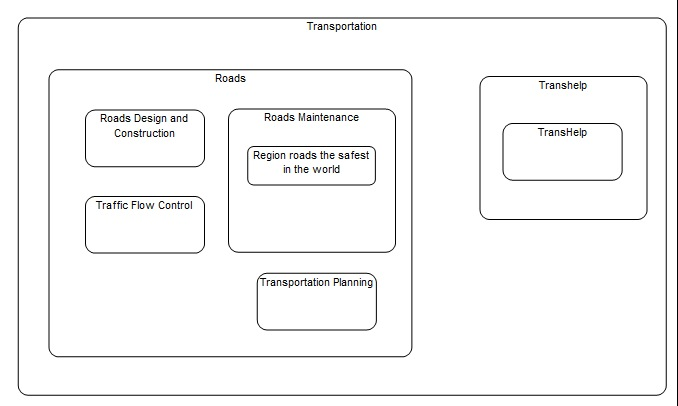
You can apply analytics to a diagram by dragging and dropping the analytic onto the diagram. That will annotate any symbols depicting definitions that match the analytic report with the associated analytic depiction (color or icon).

## Heatmap manager

You can also use the Heat Map Manager to select analytics from a collection defined for the diagram, and apply them to the diagram - including adding a legend for the collection that includes the selected analytics.

* This view is used to apply analytics - and optionally, to add explorer reports to diagrams.
* The analytic collections configured for the currently selected diagram are displayed at the top.
* Select the analytics in the collection you wish to display, a legend is automatically added to the diagram
* In the middle are the available explorer relationship reports that can be used to populate the diagram if needed
* Click on these reports to add the related items - they will be automatically depicted with their analytics
* Save the diagram and then click on the "Click to apply the selected analytics" button at the top of the view to run the analytics
* You can also drag and drop any Analytic onto any diagram to depict elements by that analytic if any

For example, consider the PSAM diagram for the Transportation department:



There are a number of applicable Performance Indicators:

* Miles of motorways per square mile
* Percentage of poor quality roads - applies to road maintenance and design and construction, and transportation planning services - and Roads program
* Availability of Underground (metro) / Light Rail System
* Percentage of employed people in the city taking public transport to work
* Service consumption
* Existence of transport strategic plan
* Existence of traffic management system
* Existence of Smarter solutions or capabilities for congestion management
* Congested road system
* Average delay per peak traveler
* Congestion cost per peak traveler
* Number of rush hours
* Average travel time to work
* Transport energy consumption per capita
* Transport energy consumption
* Percentage Petroleum energy consumption as a Percentage of total energy consumption
* Use of alternative fuels in public transport
* Highest second maximum non-overlapping 8 hour concentration of CO
* Highest arithmetic mean concentration of NO2
* Highest second maximum 24 hour concentration of PM10
* Highest weighted annual mean concentration of PM2.5
* Number of Days with Air Quality Index values greater than 100
* Air Quality Rating for Particulate Matter
* Availability of Alternative Fuel Stations pre capita
* Use of alternative fuels in public transport
* Number fatal car crashes and road traffic accidents per capita
* Number fatalities in car crashes and road traffic accidents per capita
* Pedestrians involved in fatal accidents per capita

## Approaches to using heat maps to depict performance assessments

There are various approaches that could be used to depict performance assessments on diagrams. The MRM elements that can be assessed are Assessable Elements: Programs, Services, Processes and Resources. Each Assessable Element can be assessed by any number of Performance Indicators, each having an Algorithm, Units, Value and Criteria. The Criteria are BMM Objectives that specify the performance target. There should generally only be one Criteria. A performance indicator can also assess many Assessable Elements. That is, it is a mediator object between an Assessable Element and the Objective that specifies the desired result.

### Analytic Collection for each Performance Indicator

This is the simplest approach and requires no further customization in the meta-model. Users can create specific assessments as needed. Assessments would likely be specific to the planning activity and particular concerns, not something that could be anticipated and applied for a large set of "standard" performance indicators. There could also be a lot of variability around performance indicators, depending on municipal concerns, or the processes actually used to implement the services.

1. Create an Analytic Collection for each Performance Indicator
2. Create an Analytic for each assessment point with the associated icon and/or fill color depiction
3. Create the corresponding Analytic Report to select the items that should be depicted with the assessment.

For example, here are some Performance Indicator/Analytic Collections we could create for assessing road quality:

* Road Quality
* Road Congestion
* Rush Hours
* Traffic Accidents
* Traffic Fatalities
* Pedestrian Fatalities

1. Look at Performance Indicators and set the algorithm
2. Create an analytic collection for each Performance Indicator
   1. Analytic Collection and Performance Indicator should have the same name.
3. For each analytic collection, add an analytic for each range of actual against target creating the report to generate the values and the depiction
   1. Analytic and Analytic Report should have the same name.
4. Add the analytic collections to particular Diagram Type so they show up in the Heat Map Manager

Some performance indicators will be binary so that the analytic report displays a depiction for which the value is true. These don't require an analytic collection unless they need to appear on the Heat Map Manager.

This is going to result in a lot of analytic collections and a lot of analytics, analytic reports and icons. It may not scale to hundreds of performance indicators.

### One Performance Assessment Analytic Collection for all Performance Indicators

We need to reduce the number of analytic collections, analytics and analytic reports that need to be created, and the number of depictions that would show up on diagrams. This approach looks at having a single Performance Assessment Analytic collection with three Analytics for Low, Medium and High assessments.

* Add a "Deviation Assessment" property to Performance indicator with values {High, Medium, Low}
* Add properties "High Deviation", "Medium Deviation" and "Low Deviation" to describe how the assessments should be estimated
* Users look at the performance indicator actual and planned value, and make an assessment right there in the performance indicator
* Create one Analytic Collection "Performance Assessment" with three Analytics "Low Deviation", "Medium Deviation" and "High Deviation"
* Each analytic returns all the model elements that are assessed by a high, medium, or low deviation respectively - use a different icon for each one - a gauge would be fine
* Add that "Performance Assessment" to the Heat Map Manager to all diagrams
* When the assessment is applied to a diagram, all the elements that have high, medium, or low performance indicator deviations (depending on what analytics were selected in the heat map manager) will be depicted with an appropriate icon - one for each matching performance indicator that assesses that model element.

This doesn’t work. The Analytic report returns all the model elements that have low, medium or high assessment. It does not distinguish between different performance indicators. And only the last assessment would be depicted.

### Put the assessment depiction on the Performance Indicator, not the assessed model elements

It is really the performance indicator that is doing the assessment, not the assessed model elements, or the objective targets. So the icon and/or fill color depiction could be displayed on the performance indicator on a diagram, not on the assessed elements. This allows the indicator to simply depict the results of the assessment for each performance indicator, as it applies to each assessed model element.

This also means if the objective changes, or the performance indicator value changes, the assessment would change, even though there was no change to the assessable element.

This will require the ability to include performance indicators on any diagram that should show a heat map for performance assessment.

Still need to create an Analytic Collection for each Performance Indicator.

It is still desirable to have a Deviation Assessment property with values Low, Medium and High to assess the difference between the performance indicator Value and Criteria:

* For each Performance Indicator, create an Analytic Collection with the same name
* For each Analytic Collection, create three Analytics choosing the assessment icon and/or fill color depiction for each assessment range (e.g., Low, Medium, High)
* For each Analytic, create an Analytic Report that gets the Performance Indicators that are assessed with a particular assessment range.

Approaches for reducing the work to support this, and automate it a bit so the addition of a new performance indicator does not require the creation of an Analytic Collection and one or more Analytics and corresponding Analytic Reports (which would not scale well at all for hundreds of performance indicators).

* Have Performance Indicator subtype Analytic Collection. That combines the assessment technique with the KPI.
* Use three Analytics that use a Macro to select the containing performance indicator and provide low, medium and high depictions based on the value of the Deviation Assessment property. These three Analytics would be included in every Performance Indicator.

In summary:

1. MRM Performance Indicator specializes Analytic Collection

2. Performance indicator has an additional property "Deviation Assessment" with values {Low, Medium, High} to allow users to make an assessment based on the Algorithm, Units, Value and Criteria (Objectives). This is a compromise since the algorithm isn't machine processable at this time.

3. Each Performance Indicator (as an Analytic Collection) automatically gets three Analytics added: Low Performance, Medium Performance, High Performance with appropriate icon and fill colors to depict the results (a gauge and red, yellow, green fill colors)

4. These Analytics use a macro to find the Performance Indicators that have the corresponding Deviation Assessment value

5. Diagrams will show the Assessable Element (Program, Service, Process and/or Resource) with the assessing Performance Indicators and Objective Criteria.

6. The heat map will depict (using the gauge and fill color) the deviation assessment of the performance indicator (not the assessed elements since they could be assessed by many performance indicators).

I haven't implemented the macro yet, so I can't demo this. But the big change is putting the assessment depictions on the performance indicator, not the assessable element. I had to do this to avoid having to create multiple Analytics and Analytic Reports plus an Analytic Collection for every performance indicator, resulting in a lot of work, something that wouldn't scale for hundreds of performance indicators, and something that would make it difficult to deal with assessments of multiple performance indicators on the same assessable element.

I believe this will work nicely, and should provide what we need to support high-level performance assessment. Then the Performance Indicators can be imported into Focal Point as Criteria to support performance management activities.