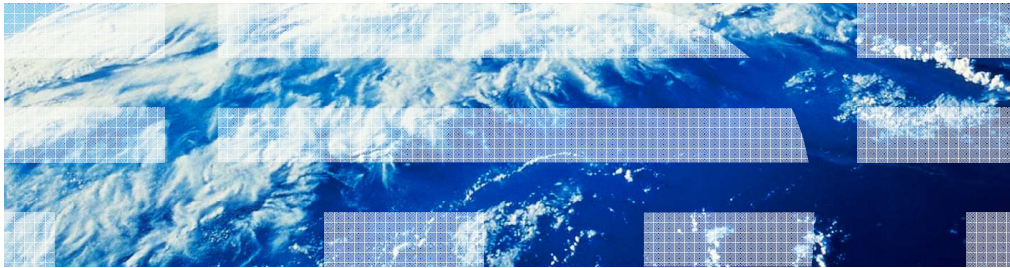


# IBM Business Monitor

## KPI history and prediction



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This presentation should provide an overview of KPI history and prediction in IBM Business Monitor.

## Goals

- Introduce Key Performance Indicator (KPI) history and prediction in IBM Business Monitor

This presentation will give you an overview of KPI history and prediction in IBM Business Monitor.

## Agenda

- Overview
- Dashboard widget
- Configuration
- Usage

This is the agenda for this presentation. You will see an overview of the capability of the KPI history and prediction feature. You will learn about the KPI history and prediction widget in the dashboard, and you will review its configuration and usage.

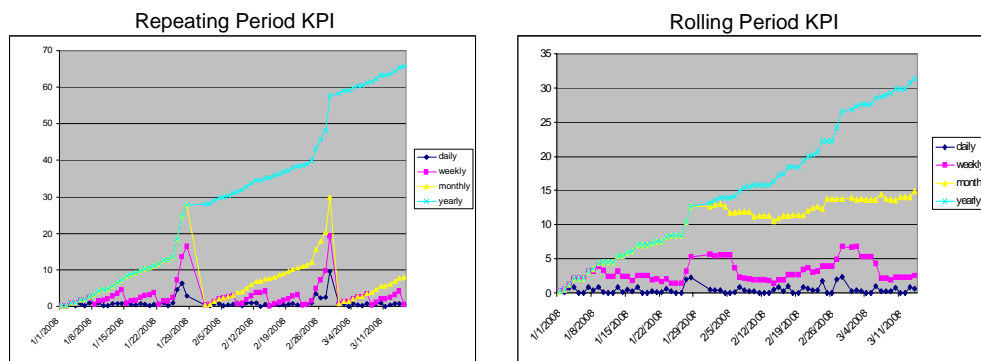
## Overview

- Track and analyze Key Performance Indicator (KPI) changes over time
- Snapshots of KPI values are persisted so that you can view and analyze the historical values
- KPI widget
  - Fully interactive experience supports altering displayed time range and granularity of data points

The Key Performance Indicator (KPI) values are stored in the Monitor database so that you can view and analyze historical values. This is an optional feature which you can selectively apply for each KPI in the model. To see the KPI history, you will use the KPI history and prediction widget in the dashboard. This widget is a fully interactive graph of the KPI values over time where you can update the time range and granularity to suit your preferences.

## Time period impact

- The KPI chart is highly dependent on the time period of the KPI
- Repeating period KPIs
  - Within a KPI period, the KPI can be thought of as a running total. KPI resets at end of period, yielding a 'saw tooth' graph for KPIs that aggregate with count or sum
- Rolling period KPIs
  - Rolling period KPIs will typically display a more stable graph, after an initialization period equal to rolling period duration
- Fixed period KPIs - Behaves as a single period running total
- KPIs with no time period - Behaves as an unbounded running total



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KPI history and prediction

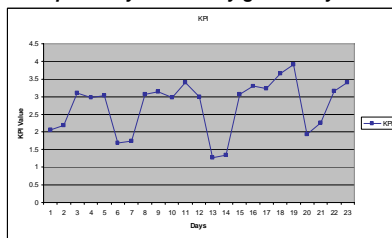
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When you are reviewing the KPI historical values in the KPI widget, you should be aware of the impact of the time period on the chart. For repeating period KPIs, you will typically see a saw tooth graph for KPIs that aggregate with the count or sum functions. The chart in the lower left shows repeating period KPIs for various periods. You will notice that the line representing any KPI resets to zero at the end of the period for that KPI. For rolling period KPIs, the graph shows more stability since the functions operate on a continuously rolling time period. For fixed period KPIs the chart shows a bounded running total. For KPIs without a time period, the chart shows an unbounded running total.

## Dashboard granularities by KPI type

yp ▼   iy ▶	y	y y	y	y	yQ	y
Minutely KPI (rolling)	Sampled hourly					
Hourly KPI (rolling)	✓					
Daily KPI (repeating/rolling)	I	✓				
Weekly KPI (repeating/rolling)	I	I	✓			
Monthly KPI (repeating/rolling)	I	I	I	✓		
Quarterly KPI (repeating)	I	I	I	I	✓	
Yearly KPI (repeating/rolling)	I	I	I	I	I	✓
Fixed or No time period KPI	I	I	I	I	I	I

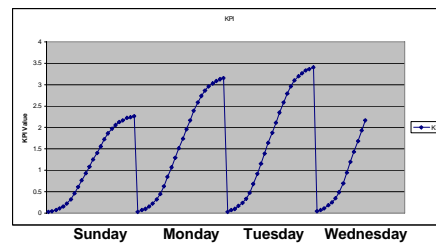
✓ = KPI Period matches chart granularity  
Compare period-end values across time  
*Example: Daily KPI at daily granularity*



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KPI history and prediction

I = Intra-period chart granularity  
Visibility into trend within past and current periods  
*Example: Daily KPI at hourly granularity*



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The table in this slide shows the supported granularities by KPI type. For example, a daily repeating or rolling KPI can be viewed with hourly or daily granularity. You don't want to view a daily KPI on a monthly basis, since the KPI resets to zero every day and the data points at the end of each month are not comparable. In the lower left corner of this slide, you see a daily KPI with daily granularity, so it is easy to see how the aggregated KPI varies from day to day on the chart. In the lower right corner of this slide, you see a daily KPI with hourly granularity, so you can see how the aggregated KPI varies hourly within each day.

## KPI history

- KPI history is persisted in table KPI\_HISTORY\_T
- KPI history is optional per KPI, enabled in monitor model editor (MME) or KPI manager
- KPI services run every 60 minutes – not configurable
- Import and export scripts in <serverPath>\scripts.wbm\kpi
  - Export KPI history to CSV
    - Choice of KPIs, granularity, and time range
  - Import KPI history from CSV, for several reasons
    - Server was down and KPIs are calculated using external user defined functions
    - Backlog of events or failed events skewed KPI values at the time
    - Load a history of KPI values, from before the model was deployed

Because of the intensive data demands, it is not feasible to calculate historical KPI data points on-demand based on instance data. Instead, the KPI values are stored hourly into the KPI history table in the monitor database. When you define the KPI, either in the monitor model editor (MME) or KPI manager, you can optionally choose to track KPI history. To enable this feature, the KPI service runs every hour to store the KPI values. There are scripts which allow you to import and export the KPI data. You can export the KPI history to a comma delimited file, with a choice of KPI, granularity and time range. You can also import a comma delimited file into the monitor database. This is useful if the server was down, or there were failed events, or you want to load values before model deployment.

## Retroactive calculation

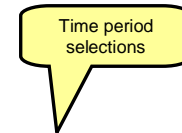
- Retroactively create KPI history (automatically for up to one week) if previous measurements did not occur
  - When the server is down for several hours. Scheduler will retroactively create KPI history from the time of the last collected value and forwards.
- Retroactively create KPI history on demand
  - Available in KPI manager widget, action 'History and Prediction'
  - Reasons to retroactively calculate
    - Monitor was up but not receiving events
    - KPI history is newly enabled on an existing KPI
    - When KPI is updated then the previous KPI history is deleted
    - A new KPI is created in the dashboard

Calculate KPI history data retroactively

Choose a time period for which you want to calculate history information about this KPI:

One day

Replace existing history data with this information.



One day

One day

One week

One month

Three months

Six months

Nine months

One year

Retroactive calculation is a feature that you can use to retroactively create KPI history. This will happen automatically if the server is down for up to one week, then the KPI service will automatically calculate KPI history data from the time of the last collected value.

You can also retroactively create KPI history on demand, using the KPI manager widget where you can specify calculation for up to a year of history. There are many reasons to use retroactive calculation. Monitor server was running, but inbound events were not being received. Or you have an existing KPI and are newly enabling KPI history. Or you are making a change to the KPI, in which case the KPI history is deleted. Or you are creating a new KPI against a model which has a history of instance data.



**Configuration of KPI history**

- Checkbox in the monitor model editor in KPI details page
- KPI history configuration in dashboard widget
- Time range type – current period, fixed interval, last completed period, sliding interval

**KPI History and Prediction Edit**

KPI History

Select the time-range options.

Time-range basis:  Latest version  All versions

Display options

KPI ranges  KPI target

Select the KPI to display.

GlobalProcessMonitor 2009-11-10 20:00:00

Order Handling 2008-06-27 14:14:44

Average Process Duration KPI

Percentage of Orders Shipped KPI

Shipped Orders

Total Orders

ClipsAndTasks 2007-09-11 12:07:30

The \* symbol indicates that historical data collection is

Specify a height in pixels to adjust the display area of the chart.

Chart height:  pixels

**Widget configuration pages**

**KPI Details**

Edit the details of the KPI, which is a performance measu

ID:

Name:

Description:

Type:

Keep track of historical values for this KPI

**KPI Details**

Monitoring context:

Metric:

Aggregation function:

Use values from:  All model versions  Only this version of the model

**Be aware of version selections in the model and the widget configuration**

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To enable KPI history, there is a check box in the monitor model editor on the KPI details page. You can select this when you first create the KPI or at any time thereafter.

When you configure the widget to display the KPI history, you can select any version of a model. But you need to be aware of the KPI definition since the KPI can be marked to use values from all model versions or for just a specific model version.

In the widget configuration, you can select the time range type, which determines the period of time that you see displayed on the graph.

**Current period** displays the current KPI time period and the past periods for the duration that you specify.

**Fixed interval** displays history for the date range that you select.

**Last completed period** displays the previous KPI time period.

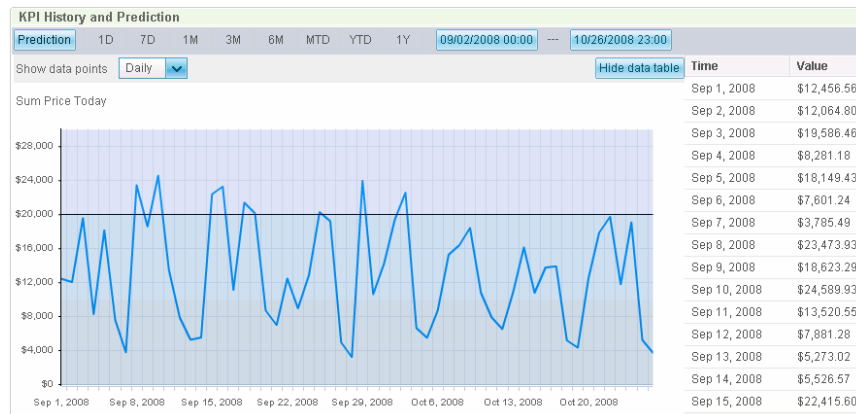
**Sliding interval** displays the duration of time that you specify, up to today. For example, when you choose a **Number of past periods** of one month, the graph displays the past month of history up to today.

In the widget configuration you can also specify the number of periods, time zone, location, granularity and chart height.



## KPI history and prediction widget

- Graph and data table, target, ranges
- Granularity
  - Hour, day, week, month, quarter, year
  - For example, if you configure the KPI widget to see weekly KPI values, then only the week-end data points are displayed
- Time range




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KPI history and prediction

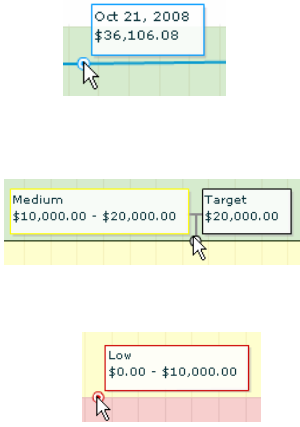
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This slide shows you a screen capture of the KPI history and prediction widget. The widget shows the KPI history graph and table along with KPI target and ranges. The target is the horizontal black line on the graph and the ranges are the color coded bands in the graph. You can set the granularity to show the end of period data values for hour, day, week, month, quarter or year. You can also select a time range at the top of the widget using built-in ranges or you can enter specific time ranges by starting date and ending date. And there is a button to hide or show the data table.



## Widget usage

- Pop-ups to show the current value, target and ranges
- Click the graph line to highlight the row in the table
- Click the table row to highlight the point in the graph



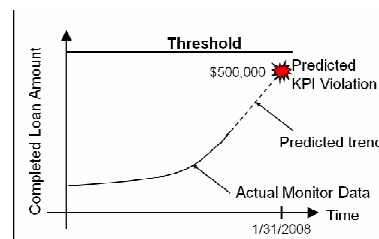
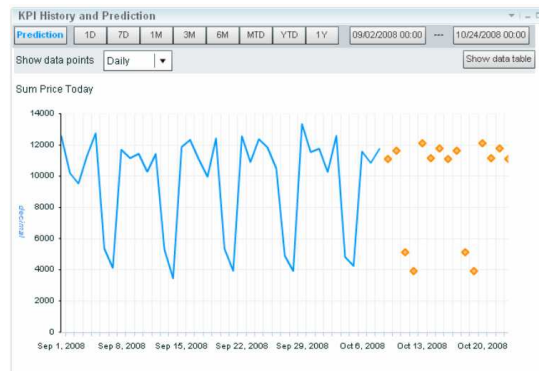
11 KPI history and prediction © 2011 IBM Corporation

In the KPI history and prediction widget, there are pop-ups to show the current value, target value and range values. When you hover the mouse over the graph line, the pop-up shows the date and value for that point in the graph. When you hover the mouse over the target line, the pop-up shows the value of the target. When you hover the mouse over the line separating two ranges, the pop-up shows the lower range name and range boundary values.

Also, you can click the graph line and the associated value is highlighted in the data table. Or you can click a row in the data table and it will highlight the point in the graph by opening the pop-up at the associated data point.

## KPI prediction

- Use KPI history to predict future KPI values based on current conditions and historical seasonal and cyclical patterns
- Create alerts if KPI predictions are over or under predetermined values
- Exponential smoothing algorithm is used which gives more weight to recent values



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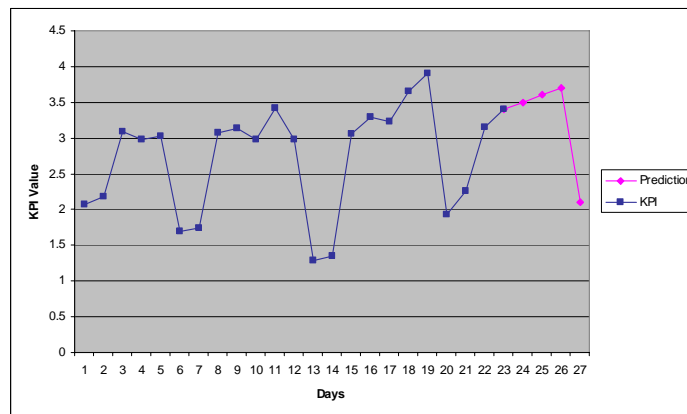
KPI history and prediction

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KPI prediction also uses the KPI history data. By using an exponential smoothing algorithm which gives more weight to recent values, you can view a set of predicted values that represent the future values for the KPI. The algorithm will also take into account any seasonal or cyclic patterns in the historical data. In the screen capture, you can see the predicted values which are displayed as orange diamonds. Using these predicted values you can define alerts which are triggered whenever a KPI predicted value exceeds a given threshold.

## Scenario one: End-of-period predictions

- Use period-end KPI values to predict values for future periods
  - Example: use daily time series to predict daily KPI
    - Weekday values are typically higher than weekend values – seven day seasonal cycle



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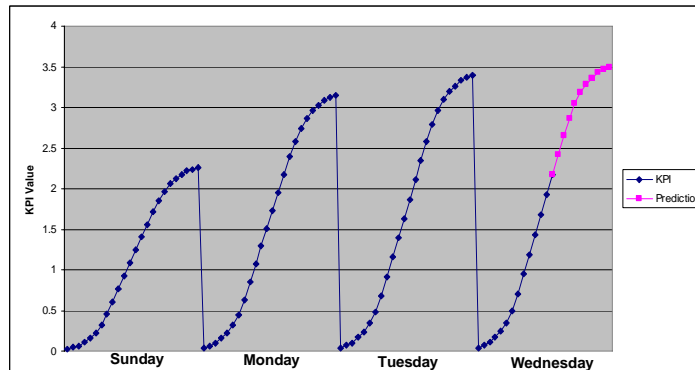
KPI history and prediction

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This slide shows one usage of KPI prediction, where you use end of period values to predict values for future time periods. In the example graph, a daily repeating KPI is shown with daily granularity, then these values are used to predict daily values for four days into the future. Notice that there is a natural seven day seasonal cycle in the graph, so that the values drop dramatically every sixth and seventh day. The prediction algorithm takes this into consideration and produces a drop in predicted value which relates to the cycle.

## Scenario two : Current period prediction

- Use intra-period KPI values to predict value at end of period
  - Configuration
    - Choose interval of intra-period time series – must be smaller granularity than KPI period
  - Example: use hourly time series to predict end of day value for a daily KPI
    - KPI depends on time of day and day of week – 168 hour seasonal cycle



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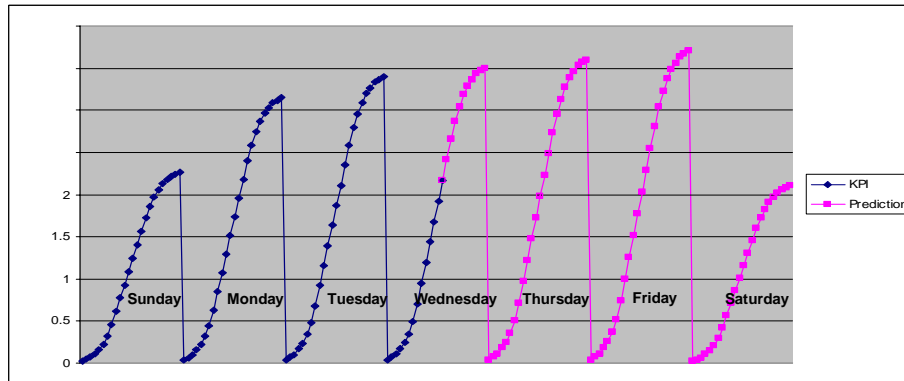
KPI history and prediction

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Here is a prediction scenario that uses intra-period values to predict values at the end of the current period. So in this example you see a daily repeating KPI which is shown with hourly granularity and the prediction values are used to predict the final value at the end of the current day. To use this capability the granularity on the chart must be smaller than the interval on the repeating KPI time period.

### Scenario three: Prediction within next periods

- Use intra-period values to predict KPI values into future periods
  - Configuration
    - Choose interval of intra-period time series – must be smaller granularity than KPI period
    - Choose number of future periods
  - Example: use hourly time series to predict values over the week



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KPI history and prediction

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You can also use KPI prediction to use inter-period values to predict KPI values for future periods. This example is similar to the previous example except you see both the current period prediction and the future period predictions. You can choose any number of future periods, but in this example it is a daily repeating KPI and it shows predictions for the current day and for three days into the future. This will also use the seasonal cycles to reflect repeating patterns, and in this example it shows lower values for weekend activity on a seven day repeating cycle.

## KPI prediction runtime initialization

- If there is no seasonal cycle configured, KPI predictions can begin after two non-zero, non-null KPI data points.
  - For daily KPI prediction there must be at least two days of KPI data before predictions can be made
- If there is a seasonal cycle configured, KPI predictions can begin after one full season of data
  - For daily KPI prediction utilizing weekly seasonal cycle, there must be at least one full week of KPI data before predictions can be made

A certain amount of data must be collected before KPI prediction can be used. If you don't configure a seasonal cycle, then KPI predictions can begin after two non-zero, non-null data points. So for example a daily KPI prediction requires at least two days of KPI data. If you do configure a seasonal cycle, then KPI predictions can begin after one full season of data has been collected. So for example a daily KPI prediction with a weekly seasonal cycle requires one full week of KPI data.



**Prediction models**

**KPI Manager**

- Actions
  - New Aggregate KPI
  - New Expression KPI
  - Copy
  - Delete
  - Properties
  - Alert Manager
  - History and Prediction**
  - AveragePriceThisQuarterGMT

**Prediction Model Definition**

Model name: PredictionFor90Days

Prediction data points: Once a day

Prediction period: 90 Days

To the end of the KPI time period

Include a repeating business pattern

**KPI History and Prediction**

Sum price

KPI History

Track historical data for this KPI (updated hourly)

Calculate KPI history data retroactively

Choose a time period for which you want to calculate history information for this KPI:

One day

Replace existing history data with this information.

Calculate

KPI Prediction

Enable KPI Prediction based on the historical data for this KPI

New Model

Model Name	Interval	Period	Cyclical Pattern
PredictionFor30Days	Once a day	30	-
PredictionFor60Days	Once a day	60	-

OK Apply Cancel

- Prediction service is run immediately after saving the models
- Use repeating business pattern for accuracy

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A prediction model must be created to enable KPI prediction. To create the model, select menu option 'History and Prediction' in the KPI manager widget. You should select the check box to enable KPI prediction. After selecting this option, click Apply. If you forget this step, then the predictions are not displayed immediately in the KPI history and prediction widget and you will have to wait up to an hour for the KPI prediction service to run.

Click 'New Model' to create a prediction model. In the prediction model you will provide a model name, interval, period, and seasonal cycle. If your data has a seasonal cycle but you don't configure it in the prediction model then the prediction data is created but the results are not as accurate. A user with privileges to administer the KPI can create prediction models in KPI Manager. KPI history tracking must be enabled before prediction models can be created. When you save the model, the KPI prediction service runs immediately so you can open the KPI prediction widget to see the results.

When creating a prediction model, there are several configuration options.

Prediction data points specify the prediction interval such as hourly or daily.

Prediction period is the number of intervals that are predicted by the service. This is set to a fixed number of periods or it is set to the end of the KPI period. The latter is available when the KPI has a repeating time filter or a fixed time filter.

Repeating business pattern is the duration of a KPI's cyclical pattern, which must be a multiple of the prediction interval.

## KPI history and prediction widget - Configuration for prediction

**KPI History and Prediction**

**KPI** History and Prediction

Select the models for which you want to retrieve the KPIs.

Latest version  All versions

Display options

KPI ranges  KPI target

Select the KPI to display. You can choose only one at a time.

OrderItem 2006-08-03 00:00:00

Avg Order Price

Sum Price Today

\* Historical data collection is not currently active for this KPI.

---

**KPI History and Prediction**

KPI History and Prediction

avgOrderPrice

KPI Prediction

Show predictions based on the following prediction model

PredictionFor30Days

Show prediction data on graph by default

KPI History

Select the default KPI History values to display

Time range type

Current period

Number of past periods

2 Month

Time zone

GMT-06:00

Location (for daylight saving)

America/Chicago

Show data points

Daily

Specify a height in pixels to adjust the display area of the chart.

Chart height

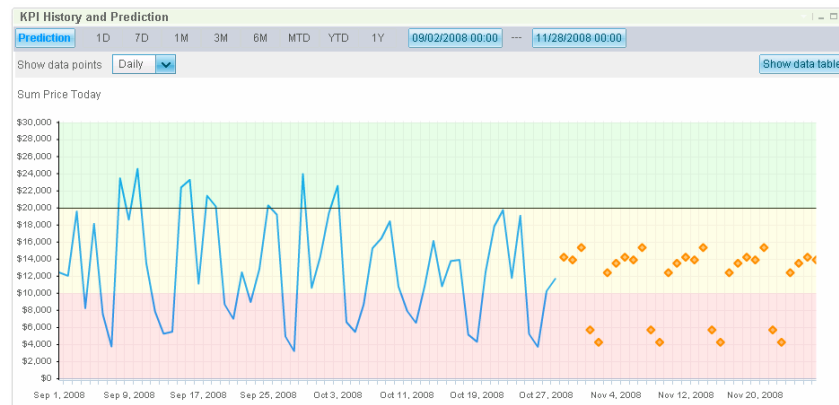
425 pixels

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When you add the KPI history and prediction widget to the dashboard, you will configure it to show the prediction data. On the history and prediction tab, you select the check box to show predictions and you also select the specific prediction model to display. You can optionally choose to show the prediction data by default, but if you don't then you can still click a button in the widget to display the prediction data.

## Prediction sample

- KPI
  - Daily repeating
- History
  - Daily; current period for two months
- Prediction Model
  - Daily
- Prediction Cycle
  - Seven days



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KPI history and prediction

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This is a sample of the KPI history and prediction widget which is configured to display history for a daily repeating KPI using daily granularity showing a two month time range. The prediction model is configured as a daily model with a seven day repeating cycle. On the chart the prediction points are shown as orange diamonds and they reflect the weekly seasonal cycle.

## Summary

- Covered KPI history and prediction in IBM Business Monitor

In summary, this presentation covered an overview of KPI history and prediction in IBM Business Monitor.



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