The Dashboard View:
An intuitive “at-a-glance” health check of your entire z/OS storage environment with expert analysis built-in

Summary:
This report describes the objectives and implementation of the RMF Magic Dashboard functionality.
RMF Magic analyzes RMF data and provides estimates for workload parameters based on this information. However, IntelliMagic does not guarantee the correctness of these numbers, and therefore any sizing based on the RMF Magic results remains the responsibility of the RMF Magic user.

Support

Please direct requests for information to rmfmagic@intellimagic.net

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The RMF Magic Dashboard: Our Expertise Applied to your Environment

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Preface

RMF Magic includes a dashboard function that provides an automated health check of your entire disk subsystem configuration. The dashboard makes it possible to review a very large configuration in minutes, even down to the data set level. You can customize the thresholds for your environment.

In this document explains how to use and interpret the current dashboard results.

May 2007
Leiden, Netherlands
Dr. Gilbert Houtekamer
Why the Dashboard?
In spite of continued advances in Disk Subsystem technology including built-in processing power and advanced algorithms, I/O performance problems still occur. The skill to quickly diagnose and resolve performance problems is therefore mission critical, and even better is the ability to see and avoid issues before they become problems.

The advances in storage capabilities however, have at the same time introduced significant layers of complexity in the storage infrastructure that makes effective I/O performance analysis more complex than it used to be. And virtualized storage resources are even more difficult to tune than conventional resources!

Visibility Gap
Over the last decade the pace of change in disk subsystem architectures and workloads has exceeded the pace of change in I/O performance analysis tools and processes. The old ways of viewing and balancing I/O no longer provide a sufficient understanding of performance and all of its components. This discrepancy between architecture and tools has created a “Visibility Gap” that limits your ability to recognize, understand, diagnose, and avoid I/O related performance issues.

RMF Magic’s Insight
RMF Magic addresses the visibility gap by linking information from many different data sources in RMF, thus creating new, value-added views that reflect our long-standing experience in analyzing disk subsystem performance. RMF Magic is not simply another reporter for RMF data; it is designed to make it easier for you to interpret the data and to gain an in-depth understanding of your I/O workload. It allows you to review the health of your disk subsystems operation quickly, starting at a high level and allowing you to explore more details when needed.

IntelliMagic’s Expertise
With the new dashboard function we take the analysis one step further: RMF Magic not only presents you with detailed insight in disk subsystem performance and behavior, but the dashboard will also tell you whether your I/O subsystems are performing as you might expect them to.

RMF Magic accomplishes this by comparing your actual performance results with reference values that IntelliMagic experts have established for different types of equipment. So when you have a modern disk subsystem, you will expect a better performance than when you have a very old subsystem.

The Dashboard provides a value-added, compact view on the actual performance of your entire disk subsystem configuration. Performance numbers are pre-evaluated and qualified as “OK”, “needs attention”, or “out of spec”, allowing you to immediately see all relevant performance information by means of a color coded ‘bubble’ chart: large red bubbles indicate problem areas; small green bubbles indicate that performance is just fine.

When I/O performance problems exist, RMF Magic will even provide recommendations on what can be done to address the performance issues.
Window in Disk Subsystem Performance

The dashboard also provides a starting point to explore Disk Subsystem performance. By clicking on the charts associated with a particular Disk Subsystem, you can explore the busiest array groups (ranks), devices and data sets residing on that Subsystem. This allows you to quickly understand which workloads are most important for each Subsystem, and it allows you to correlate the performance levels that your hardware delivers to your applications and workload.

Once you identified particular areas of interest, you can use the other functions and charts in RMF Magic to further explore and document the issues.
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The Dashboard View

The RMF Magic dashboard is presented in an Excel worksheet. It can also be saved as an HTML file with the Publish HTML function in RMF Magic. The top part of the worksheet shows the bubble chart with a health summary, and below the bubble chart are the details about key performance metrics for each of the Disk Subsystems. Each detail mini-chart is a clickable item that provides access to a ‘detail viewer’, showing which array groups, LSS, devices or data sets are most active.

In following sections we will describe how to create a dashboard with RMF Magic, how to interpret it and how to use the detail viewers.

Requesting a Dashboard View

To request a dashboard view, you need to select the Dashboard Page in the ‘Reporter Control Center’ as shown below. We recommend that you select one day at a time for the dashboard presentation, although you can pick any time period (first interval / last interval range). If you want to keep multiple dashboards in project file, for example one per day, select one of options under “Suffix for Dashboard sheet name in Excel”. By default, a new dashboard will overwrite an existing one.

![Requesting the Dashboard view.](image)

It will take some time to create the dashboard view, since RMF Magic will perform an in-depth analysis of the performance for each Disk Subsystem. The main RMF Magic window will show the progress. For a large configuration it may take several minutes to create the dashboard.

Once completed, the index page will show the Dashboard simply as one of the worksheets. Click on the link to see the dashboard page.
**Figure 2: The dashboard is a sheet in the Excel workbook.**

**Dashboard Summary View**

Figure 3 shows the top part of the dashboard view, for a sample configuration with 5 disk subsystems.

**Figure 3: The Dashboard Summary View.**
Each line (row) represents one Disk Subsystem, so in this sample we have ‘DSS-FIVE’, ‘DSS-FOUR’, ‘DSS-ONE’, ‘DSS-THREE’ and ‘DSS-TWO’. If you did not define your own names for these subsystems, the serial numbers like HTC-23556 or IBM-12847 would be shown on the left.

Each column represents one major performance variable: I/O rate, Throughput (MB/s), Response time, IOSQ time, Pending time, Disconnect time and Connect time.

The blue bubbles at each row/column intersection in the I/O rate column show how active the Disk Subsystem is in terms of I/O rate; a large bubble is very active controller, and a small one is a less active controller. When the I/O rate is very high (large bubble) the other observations will be of more significance to your overall performance.

The green, orange or red bubbles for the other variables show whether or nor the disk subsystem is operating well from a performance perspective:

- A large (red or yellow) throughput bubble means that the channels and/or host adapters are near their maximum capacity for a significant number of time periods.
- A large (red or yellow) response time bubble means that one of four response time components is higher than it should be; the next columns will show which component(s) is/are too high.

Note that in this example, overloaded channel interfaces cause connect time elongation (high connect time).

It should be noted that RMF Magic determines its ratings not just based on the actual pending, disconnect or connect time, but also taking into consideration the performance characteristics of the hardware being analyzed, the workload properties and the use of copy services. Therefore the dashboard provides a truly relevant assessment of how your disk subsystems perform; more so than a threshold based system making its judgments on RMF data only.

Of course, you may want to know more than what is shown in this summary section, so you can scroll down on the page to see details for each individual Disk Subsystem. You can also click on a DSS name label to start exploring that DSS.

**DSS Dashboard View**

Figure 4 shows the Dashboard for one individual Disk Subsystem. On the far left is the subsystem identification, and next to it the same performance variables as in the summary view. (Note that the ‘Read+Write’ refers to the ‘Throughput’). You will recognize the same color scheme as in the summary view: red for high values, and green for OK values.

The second row displays the more detailed performance properties of the Disk Subsystems; it is these detailed values that are (primarily) used to determine whether performance is ‘good’ or ‘bad’.
Some of the small charts show horizontal red and yellow reference lines; when the red line is exceeded the corresponding parameter is well in the danger zone; when the yellow line is exceeded but the red line is not, then performance does start to suffer, but it is usually still acceptable. As an example, let’s look at the Read+Write (Throughput) mini chart in Figure 5 below.

The vertical axis shows the Read+Write MB/s as indicated with the label at the bottom of the graph. The horizontal axis spans the selected time period (we recommend one day for these types of reports).

The red line shows the maximum throughput to plan for, considering this particular type of Disk Subsystem and the number of FICON channels available.

The yellow line shows the throughput at which you may start to see this first performance impact, but more importantly it shows when you start to run out of spare capacity on the channels.

The **R 0.41** at the bottom shows what fraction of the observations cross the yellow or red line. **R=1** means that all measurements in the data sample are above the yellow line, or 50% are above the red line.

**Details** provides a link to a spreadsheet with all the numeric details.

The mini-charts on the bottom line each focus on one particular aspect of performance.

If performance is not good for one of these charts, for example the effective channel data is too low, then this will result in high connect time and thus a red frame on the chart for connect time.

**DSS Dashboard Coloration**

The dashboard uses ‘yellow’ and ‘red’ thresholds to indicate high response times or throughputs. RMF Magic uses thresholds that depend on the particular subsystem that you are analyzing.

Each data point that exceeds the ‘red’ level is given a value 2, each data point that exceeds the yellow level is given a value 1, and other points count as zero. The average of all interval values is called the **Rating**, shown as “R: 0.xx” in the dashboard under each mini-chart.
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So when all values exceed the yellow threshold, but are less than the red threshold R will be equal to 1. Or when all values exceed the red threshold, R will be 2.

The mini charts are colored red when $R \geq 0.40$, that is when at least 40% of the observations is yellow or 20% is red. Note that this means that mini chart can be red, even when the red level is never reached!

The mini charts are colored yellow when $R \geq 0.15$, that is when 15% of the observations is yellow, or 7.5% is red (or a mix).

There is no way to change these thresholds for Yellow and Red.

You can change the level for Yellow and Red, to make them stricter or more relaxed, with the Customize button on the Dashboard tab. This dialog is described below in the section “DSS Thresholds dialog” on page 12.

**DSS Dashboard Advice**

For each of the charts, an explanation is available as to why the mini chart is colored the way it is. In the example below, the assessment is that connect time becomes very high because of FICON channel constraints. Figure 6 shows one example for high connect time, but each chart has its own specific explanation on what is causing the problem, and what could be done to address it.

*Figure 6: Hints are shown when you hover over the R field.*
**DSS Dashboard Drill-Down Capabilities**

The dashboard provides a summary of each performance variable, with a color-coded assessment on the health. If you want to explore the information in a chart in more detail, you can click (single click) a mini chart, and a dialog will be show, the **Dashboard Detail Viewer**. shows an example of this dialog, as it will be shown initially. The lower portion of the dialog shows a large version of the mini-chart.

![Dashboard detail viewer](image)

As soon you click one of the three buttons (Array Group Detail, LSS Detail, Device Detail), the chart will be replaced with two scrollable text windows, as shown in the example below.
There are three list windows in the dialog:

- The top list shows the information from the table in chart, along with the I/O rate and average number of Active I/Os.

- The middle list can show Array Group (Rank), LSS (SSID) or Device details for the interval selected in the top window. You populate the list by clicking on any of the buttons.
  - The Array Group view will show all array groups (ranks) in the disk subsystem with the activity and the selected performance variable. Use this to assess whether the activity is balanced across the ranks.
  - The LSS (SSID) view shows information per LSS. This is most useful with pending time problems to make sure all LSSs show similar performance. If not, you may have a problem with the channel configuration.
The device view shows individual devices. By default, RMF Magic will only keep information on devices that are busy at least 3% of the time (30 ms per second), so you will not see all devices in this list.

You can change this setting with the command ‘analyze activedevicethreshold=xxx”, with xxx the ms per second that the device is busy. For example, analyze activedevicethreshold=100 would mean that with a response time of 2 ms at least 50 I/Os per second are required.

When you identify a busy array group, LSS or device, you can select “All intervals”; this will show information for the selected line for all intervals.

- The bottom list shows devices in a particular rank or LSS, with the storage groups, rank IDs and other identification information. You can view All Volumes, or only the Active volumes in the LSS or Rank. When data set information has been collected and is available, an ‘Active Data Sets’ button is also shown. The figure below shows an example with data set details.

**Figure 9: Dashboard detail viewer (bottom half shown) with data set details.**

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**DSS Dashboard Detail sheets**

If you want to see the exact numbers behind the mini-charts, you can click on the Details link to go to the data sheet that was used to create these charts. This data sheet not only shows the detailed data points, but also the rules applied to each data point. So while the overall chart might be green because the
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threshold of the number of exceptions required to trigger the warning and error levels for the whole chart was not exceeded, there might exist some red values and this Details link provides visibility into those.

Figure 10 shows a sample worksheet.

Figure 10: The Dashboard Detail Tables (one DSS shown).
The dialog shows the thresholds as they are applied. You can use this dialog to:

- Review what thresholds RMF Magic recommends for each Disk Subsystem type.
- Change the settings for individual disk subsystems, or for multiple disk subsystems. Select the DSS(s) for which you want to modify thresholds, make the changes, and apply them. Note that this will only change the thresholds in the rule database; you need to re-create the dashboard to see the results.
- Export and import settings, such that you can save a scheme and re-use it with other projects once you are happy about it.
- Copy from another interestgroup, such that you can use a scheme in the same database and modify it slightly, for example to create separate profiles for day and night.
- Restore the IntelliMagic recommended default values.
Summary

With the Dashboard function, RMF Magic provides another big step in automating the performance analysis of your Disk Subsystem configuration. It helps you direct your tuning efforts, and it provides you with an early insight in capacity constraints before such constraints becoming a limiting factor for your application performance.