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# Storage Performance Management with IntelliMagic products

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GSE Meeting Brussels  
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## Topics

- IntelliMagic Introduction
- The Challenges
- IntelliMagic Products Overview
- RMF Magic
- Disk Magic
- Magic Advisor 
- Wrap-up



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## IntelliMagic Introduction

The IntelliMagic product suite and services as an answer to the challenge of getting more performance out of your storage environment in less time and for less money.



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## Questions, Questions, Questions

Would large disk drives be suitable for us? And what about SSDs?

We expect DB2 transactions to increase by 50% over the next year; can our present disk subsystem handle that?

Could a single DMX4 replace our current configuration of 4 x DMX2000?

Which logical volumes do we combine on our 3390-54s and EAVs?

Our channel reports do not suggest that we can improve performance by adding more front-end directors. Right?

We suffer from degrading performance. Time to upgrade the hardware, or are there cheaper options?



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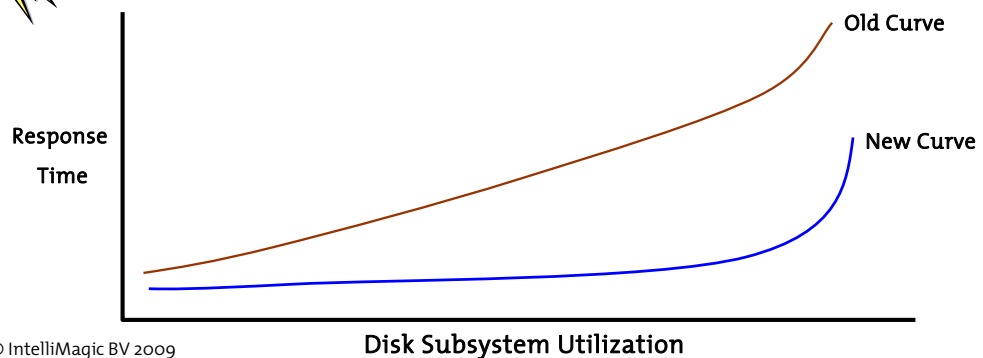


## The Effect of Modern Disk Architectures on I/O Visibility

- On older architectures, response times would grow gradually and visibly as the Disk Subsystem became more utilized
- In modern architectures, parallelism keeps response times flat until near maximum capacity; then it goes up quickly



*It is therefore more important than ever to carefully understand and monitor I/O performance to avoid painful SLA issues*



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## Mainframe I/O Performance: A “Visibility Gap”

The visibility gap is not from a lack of data. It is due to the difficulty of obtaining meaningful visibility into all of the data.

*Full visibility is essential to avoiding painful impacts!*

Issues affecting visibility:

- Front-end throughputs are reported, while back-end loads are often essential to the performance
- Some very important performance metrics are **not** available in existing measurement data; they must be computed
- Default views are from an LPAR perspective, not from the disk perspective showing the consolidated activity
- Default views are for short intervals that can mislead
- Commonly used reporting tools do not have built in-intelligence about the architecture and data (reporting vs. analysis tools)

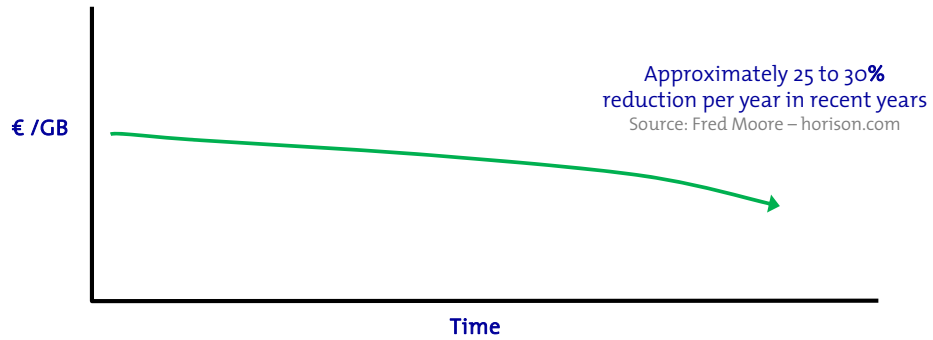
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# Enterprise Storage Expenditures



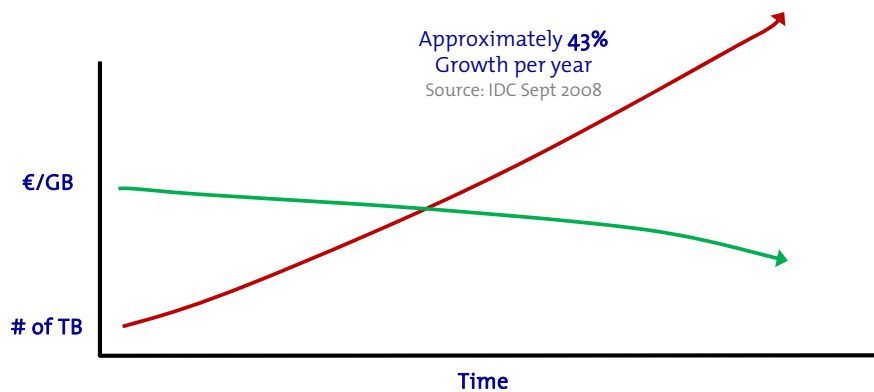
The good news is that the cost of storage in terms of price per GB continues to decrease with technological advances, but...



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# Enterprise Storage Expenditures



...the bad news is that the rate of growth in storage significantly exceeds the decline in per GB storage prices...



# Storage throughput costs

- Throughput cost can be expressed as €€€ per MB/sec
- The lower this number for any configuration that provides the throughput **your** workloads really need, the better

• Two ways to lower the quotient:

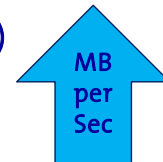


1. **Decrease the top side (price)**

- Configuring for lower acquisition cost
- Configuring for lower operating cost

2. **Increase the bottom side (throughput)**

- Utilizing current hardware in a way that increases actual throughput



# The Challenges

How can I save money on expensive disk hardware acquisition and get better performance out of my current hardware

*(How do I get more value for my money)*

How can I Manage my Disk Performance more Efficiently and prevent problems in time

*(How do I get a grip on storage performance for lower management and operational cost)*



## The Challenges

How do I get more value for my money (1)

- Don't buy what doesn't help your workloads
- Avoid expensive over-configuring and dangerous under-configuring by having insight in your workloads
- Get higher storage throughputs by balancing workloads
- Keep current disk hardware configurations performing well as long as possible
- Optimize price-performance with Storage Tiers



## The Challenges

How do I get more value for my money (2)

- Select cost effective solutions by modeling the impact of various options
- Possible Savings in CPU upgrades through I/O Performance Tuning not previously feasible
- Reduce dependency on hardware vendor
- Decreasing costs while increasing throughput



# The Challenges




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How do I get a grip on storage performance

- Pro-active Storage Performance Management: Avoid application performance surprises with early I/O bottleneck warnings through a daily health check
- Quicker problem solving: visibility to see inside the Disk Subsystem through dashboard and drill-down capabilities
- Trend and Management Reporting
- Obtain reliable replication planning through sizing and monitoring
- Show performance per storage user group and manage SLAs
- Plan Storage Migration with figures instead of feelings



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## Use your storage to the max

- ▶ Get higher storage utilization by balancing workloads
- ▶ Delay CPU upgrades by streamlining I/O throughput
- ▶ Avoid over-configuration by insight in workload distribution
- ▶ Select cost-effective solutions by modeling the impact of options

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← **More value for money**

Is there an opportunity to get more for your money from your enterprise storage infrastructure, and have a better grip on its performance?

**More control** →



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## Get a grip on storage performance

- ▶ Check storage health daily to avoid sudden surprises
- ▶ Discover problem areas quickly by using drill down possibilities
- ▶ Receive early warnings before performance degrades
- ▶ Obtain reliable replication through sizing and monitoring

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# IntelliMagic Products Overview

## More value for money

Is there an opportunity to get more for your money from your enterprise storage infrastructure, and have a better grip on its performance?

## More control

# Yes!



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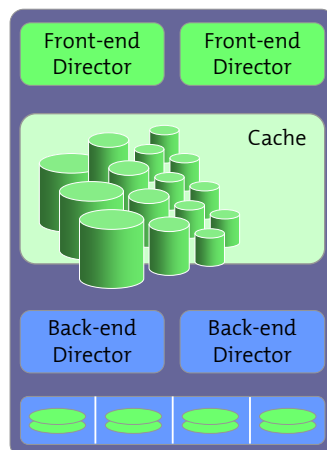
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# IntelliMagic Product Scope

Our products are used for:

- **Performance analysis:** from the high-level Disk Subsystem perspective to the volume level
- **Capacity Planning:** charting and trending to assess overall performance and workload growth
- **Modeling:** predicting how much more work could be handled by the Disk Subsystems, and what upgrades would work best
- **Migration Planning:** Create logical volume mapping based on actual workload



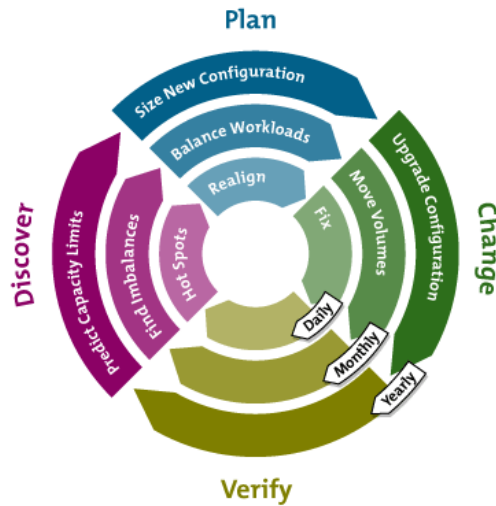




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# Storage Performance Management Cycles



## Daily

Detect service delivery exceptions  
 Preventive health check  
 Make sure you will not be hit by a foreseeable problem in the upcoming week

## Weekly

Service delivery verification  
 Monitor balanced use of disk subsystem resources  
 Evaluate disk subsystem level performance  
 Identify problems in-the-making

## Monthly

Monitor balanced use of disk subsystem resources  
 Workload profiling  
 Management reporting



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# IntelliMagic Products & Services

## IntelliMagic Product Portfolio:

- **RMF Magic:**  
Enabling z/OS Disk Performance Best Practices
- **Disk Magic:**  
Disk subsystem Performance Modeling for zSeries, iSeries, Open
- **Batch Magic:**  
z/OS Tape/Virtual Tape Analysis and sizing

## IntelliMagic Services:

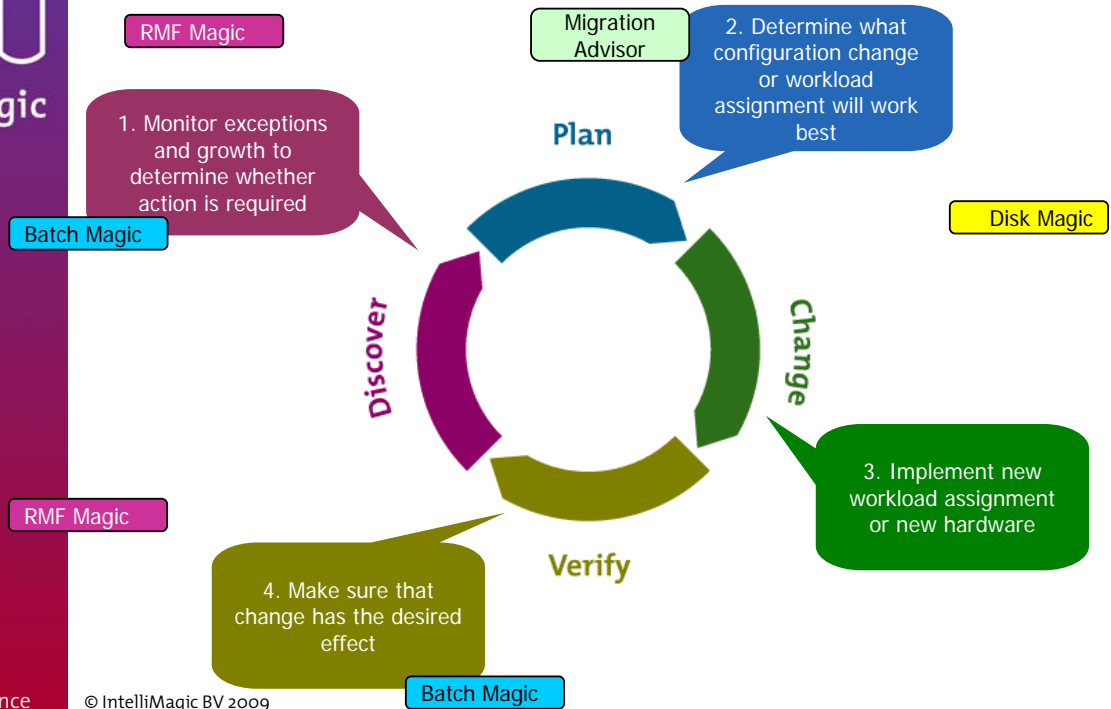
- **Migration Advisor (new)**  
z/OS Logical Volume Migration
- **Educational services** such as the 4-day class: “z/OS I/O Architecture & Performance Analysis”



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## I/O Performance Management cycle



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## Product Strengths

- A **complete and focused solution**, without additional measurement overheads on the hosts
- **Pro-active** monitoring and analysis of your storage environment
- **Daily graphical health check** of the previous day: potential bottlenecks will be spotted long before they turn into performance problems
- The need for real-time monitoring will decrease significantly



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## Product Strengths (2)

- Ease of use, vendor-independence and pro-activeness are focus points of our solutions
- Products are under continuous development and innovation
- We listen to our customers when making development choices



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## Benefits over ...

### Generic Reporting tools:

- IntelliMagic expertise to analyze storage performance using newly deduced performance metrics
- User-configurable Dashboard
- Drill-down capability on hot-spots without any coding
- Unique Performance Modeling capabilities

### Vendor management products or Vendor services:

- IntelliMagic provides integrated view of z/OS and disk subsystem performance
- Support for all vendors hardware, not just one vendor

### Traditional mainframe monitoring products:

- Disk centric reporting, Dashboard
- No need/overhead for real-time monitor for detailed data



## Customer Experience from one of the largest US Banks:

*“Using Disk Magic we planned a migration to a new technology level. Disk Magic gained us insight, and allowed us to discuss the possible configurations with our vendor, which we could not do previously. The process resulted in a consolidation of 49 Generation 2’s to 20 Generation 3 and 4’s across our development, production and disaster recovery sites. This equated to a **34% reduction in hardware in addition** to what we initially planned for consolidation.”*

(Don't buy what you don't need, get vendor-independent)



## Customer experience from one of the largest U.K. banks:

*“While our vendor was willing to provide an 8th DSS to ease performance issues in our configuration, we preferred to understand what was causing our performance issues such that we could address them. The IntelliMagic products allows us to do just that, greatly improving performance without additional hardware”*

(Don't buy what you don't need, get vendor-independent and don't over-configure)



## One of the largest US auto insurers experience:

*“The primary cost justification for the IntelliMagic suite was simply the ability to **safely increase the number of TB configured per box** which is cheaper to acquire and run (electrical costs and floor space) than adding more frames to handle the same number of TB which was the historical practice for trying to handle performance concerns.”*

(Don't over-configure and don't buy what you don't need)

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## FICON elongation experience of a major US Insurance Co:

*“Through hardware upgrades, connectivity improvements, and balancing (decisions supported by RMF Magic) we have reduced our average response time from 4.2 to 1.4 milliseconds over the past 3 years. That works out to an elapsed time savings of about 1,500 hours a day, mostly during our batch window. Since we have CPU available during the early morning hours, shifting our batch processing let us **reduce our overall CPU capacity by 1 engine (\$600,000 yearly savings).**”*

(Get a good insight of what is happening in your storage and balance well)

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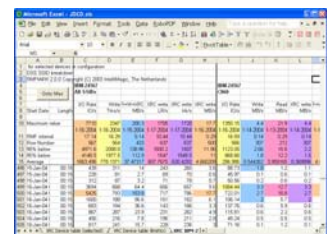
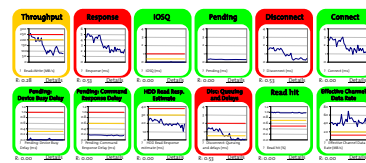
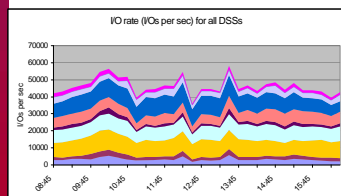
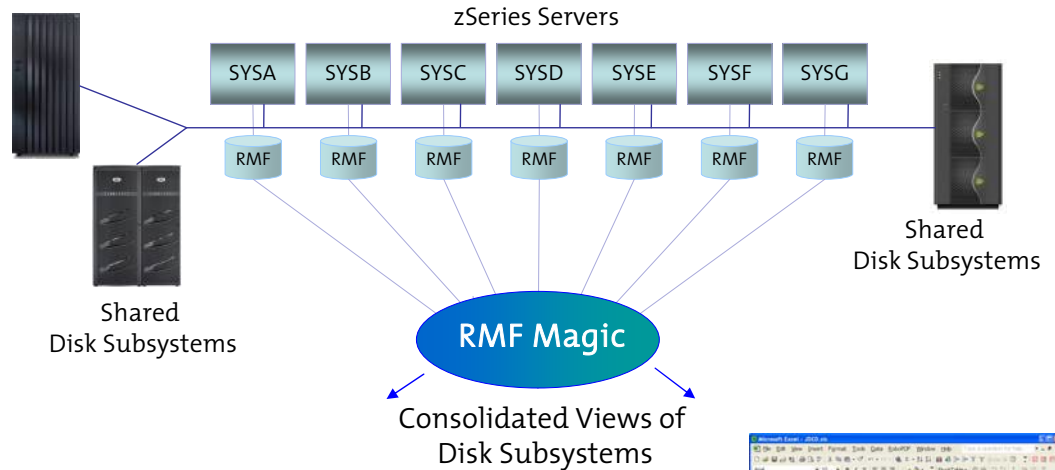
# RMF Magic




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# RMF Magic

Sysplex wide analysis of zSeries shared storage systems for days, weeks, months and years of RMF data



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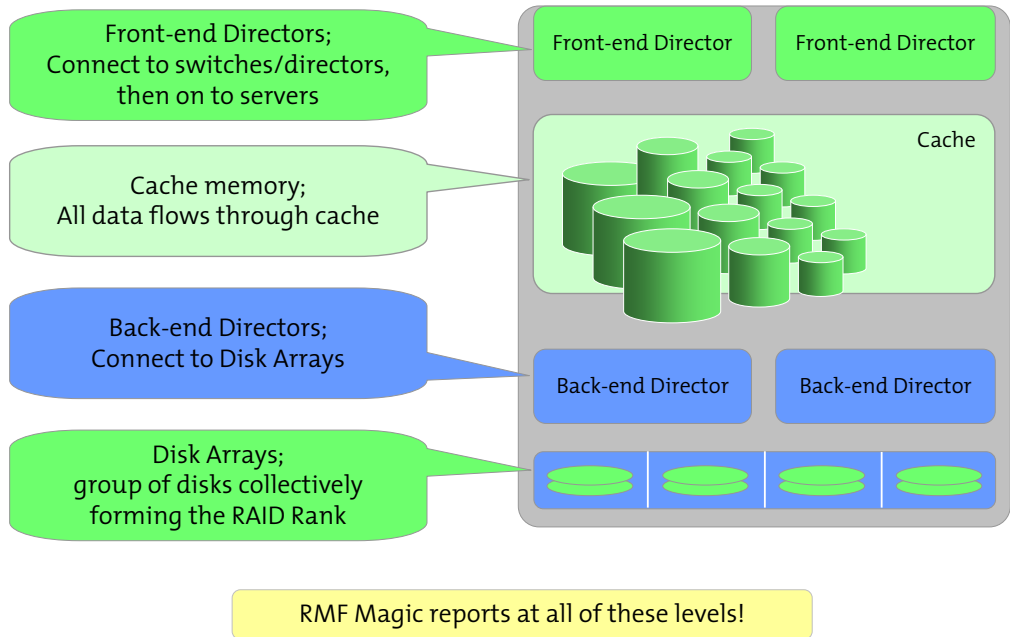
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Check balance


Drill down

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# More Insight by Looking Inside the Disk Subsystem



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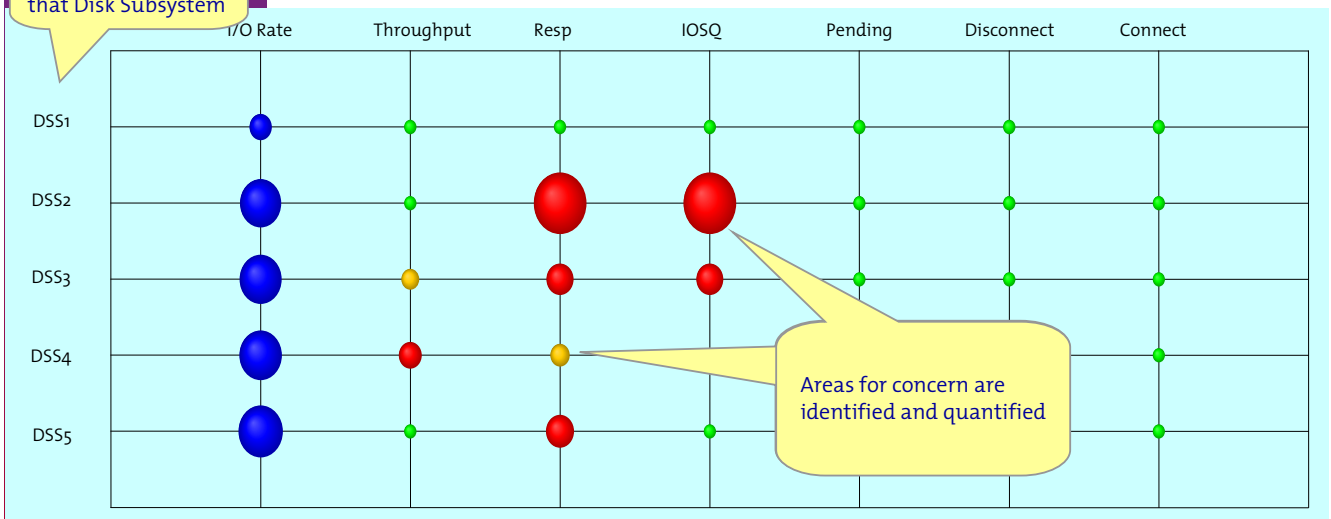
Click on any name to see more detail for that Disk Subsystem

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# Examples – RMF Magic

## I/O Analysis & Optimization

Daily dashboard assesses health of entire disk farm at a glance



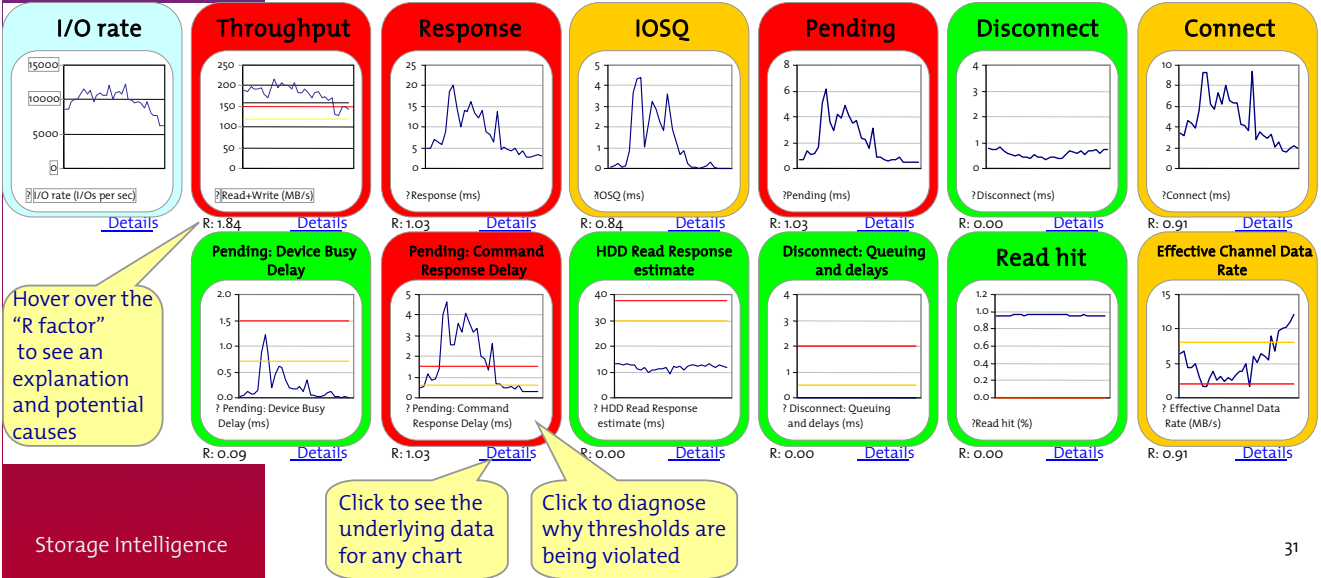


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# Examples – RMF Magic

## I/O Analysis & Optimization

Disk subsystem view with details and hardware-sensitive thresholds



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Dashboard detail viewer for DSS IBM-

R=1.38 means that there are serious performance concerns for effective channel data rate because of FICON channel overload, with many intervals exceeding exception levels.

The table below shows one line per interval, with highest or worst value shown on top, initially. Click the column headers to change the sort order of the data.

Interval	I/O Rate	Active I/Os	Effective Data Rate (MB/s)
2007-02-16 09:45:00	3,285.10	8.18	15.99
2007-02-16 11:30:00	2,673.00	4.73	14.57
2007-02-16 10:00:00	3,284.90	7.52	13.12
2007-02-16 10:30:00	3,205.60	6.67	12.83
2007-02-16 10:45:00	3,110.50	7.43	12.05
2007-02-16 11:00:00	3,044.00	6.76	11.98
2007-02-16 10:15:00	3,448.90	7.66	11.74
2007-02-16 11:15:00	2,824.00	5.85	11.54

View information about all intervals for selected line, or view all items for one interval.

SSID	Interval	I/O Rate	Effective D...	IOSQ (ms)	Pending (ms)	Disconnect ...	Connect (ms)
120C	2007-02-16...	120.53	25.29	0.00	0.30	1.96	1.87
120D	2007-02-16...	233.40	20.40	0.00	0.29	0.78	1.26
1209	2007-02-16...	176.85	19.03	0.00	0.32	0.88	1.01
120A	2007-02-16...	320.79	18.44	0.00	0.32	0.40	0.93
120F	2007-02-16...	75.33	17.51	0.00	0.32	1.43	0.91
1206	2007-02-16...	180.36	16.32	0.00	0.43	1.82	2.31
120E	2007-02-16...	179.86	16.12	0.00	0.30	0.74	1.00
1205	2007-02-16...	85.77	15.55	0.00	0.31	1.79	1.35
1201	2007-02-16...	405.71	14.65	0.00	0.29	0.76	1.06

Active Data Sets

Volser	Data Set Name	Data S...	I/O Rate	Resp (ms)	IOSQ (ms)	Pendin...	Conne...	Discon...	Read (...)
LOGW22	IMSVS.IMSD.OLDSP05	Phys seq	6.30	1.30	0.40	0.30	0.60	0.00	0.00
MVSWJ1	SYSS.JOBTRAC.CHKPT	Phys seq	2.00	1.20	0.30	0.10	0.80	0.00	0.02

Data shown for interestgroup IGT from 2007/02/16 09:45:00 to 2007/02/16 11:30:00.

Drill down to dataset level to determine sources of activity and victims

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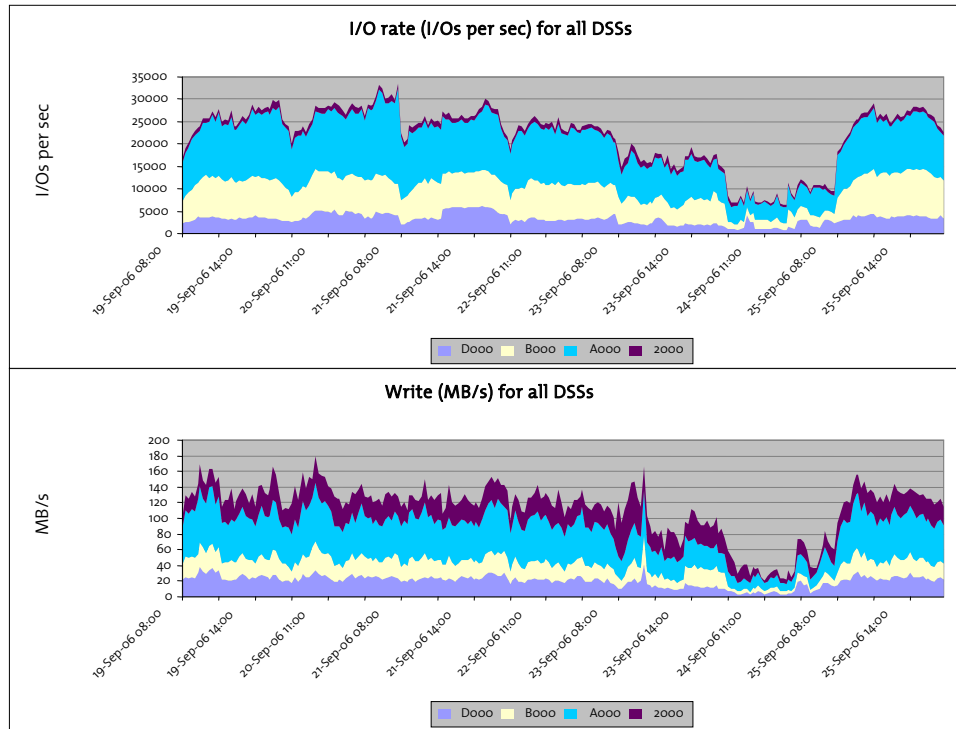




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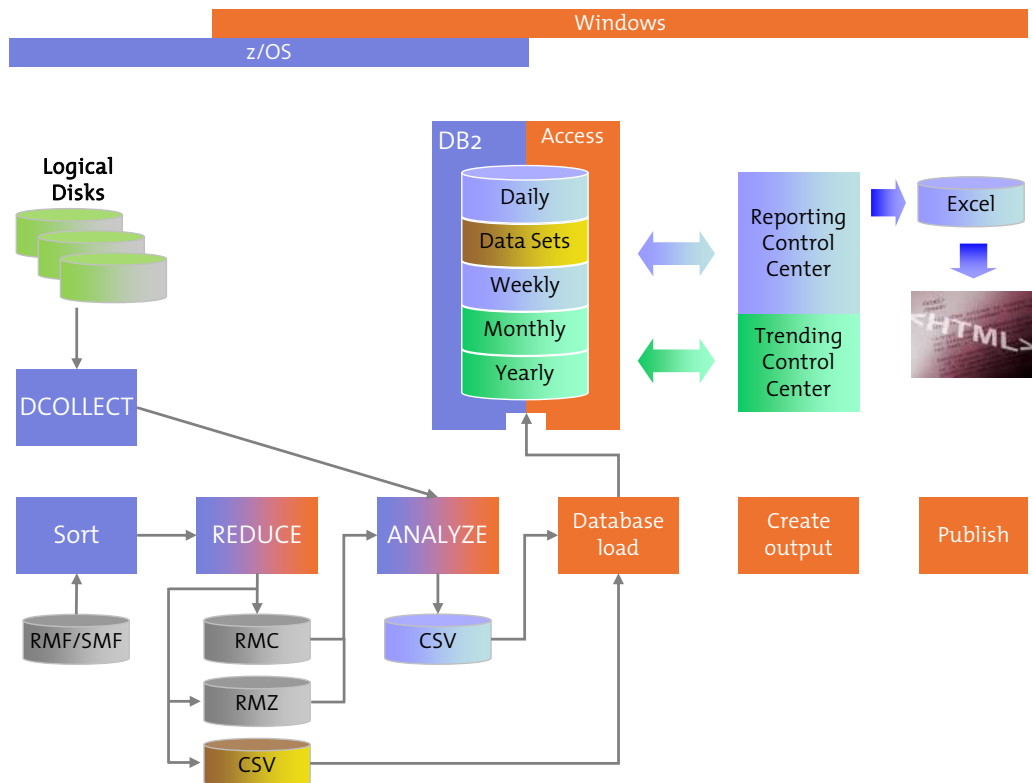
# More Insight Through Graphical Views



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# RMF Magic runs on Mainframe or PC



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## Unique Features RMF Magic

### ✓ Save money and prevent wrong investments

- Does real analysis, not just plain reporting
- Has a full view of both the front-end and back-end performance
- Disk subsystem is the center of attention (instead of reporting per LPAR)
- Shows which workloads would benefit from new technologies (Tiering: large capacity Fibre disks or fast SSDs)
- Extensive support for all types of Copy Services for planning and monitoring
- Provides input for Disk Magic for scenario modeling

### ✓ Solve problems before they affect performance

- Unique Dashboard for daily disk subsystem health check
- Thorough insight in complete Disk Subsystem performance
- Drill down from Dashboard to dataset level
- Forward-looking, so no need for real-time monitoring

### ✓ Proven, easy-to-use, vendor-independent product

- Built by experts who are familiar with all disk subsystems and performance
- Computes new information that is not provided by RMF/CMF
- Trending through historical databases (weekly, monthly, yearly)



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## Summary

### RMF Magic gives you “More with Less”

<b>More</b> performance out of your I/O infrastructure	<b>Less</b> (fewer) hardware upgrades, <b>Less</b> imbalances and configuration problems <b>Less</b> money spent on new hardware
<b>More</b> early, automatic identification of I/O trouble	<b>Less</b> real-time, urgent I/O performance diagnosis
<b>More</b> intelligence built-in to the tool & knowledge for you	<b>Less</b> digging; manual investigation, guesswork
<b>More</b> flexibility, ad-hoc reporting	<b>Less</b> specialized own programming
<b>More</b> knowledge and power in hardware configuration decisions	<b>Less</b> dependence on vendor claims and finger pointing
<b>More</b> immediate results in I/O diagnosis (minutes not days)	<b>Less</b> time solving problems, <b>Less</b> time of performance degradation
<b>More</b> reliable remote copy operations, accurate bandwidth	<b>Less</b> wasted bandwidth or delayed RPO due to insufficient bandwidth



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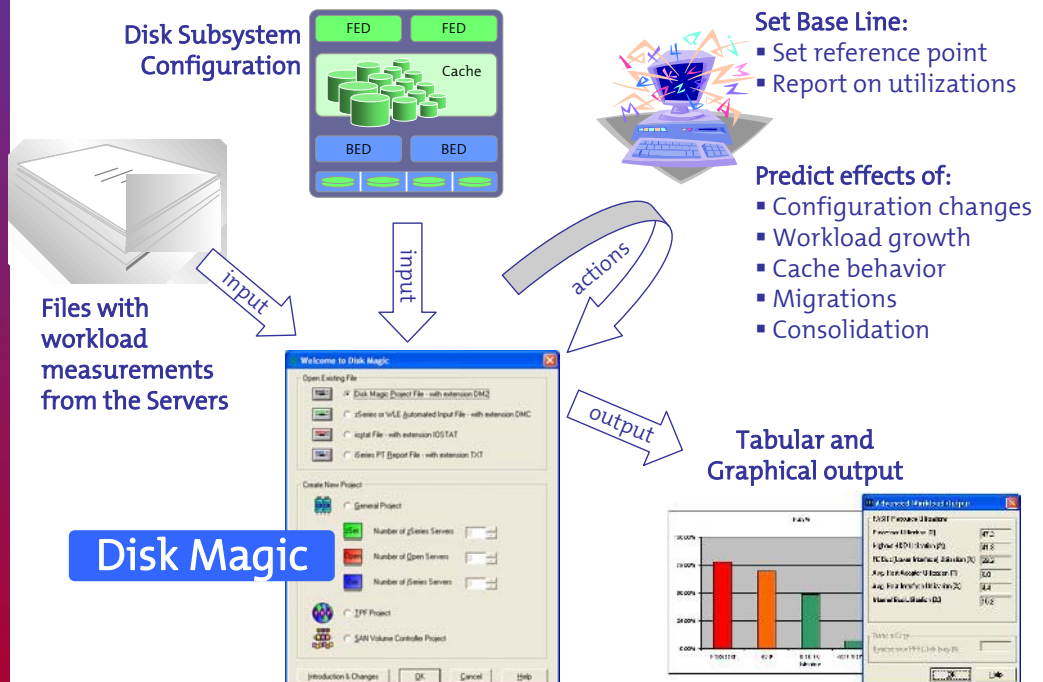


# Disk Magic



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# Disk Magic Overview



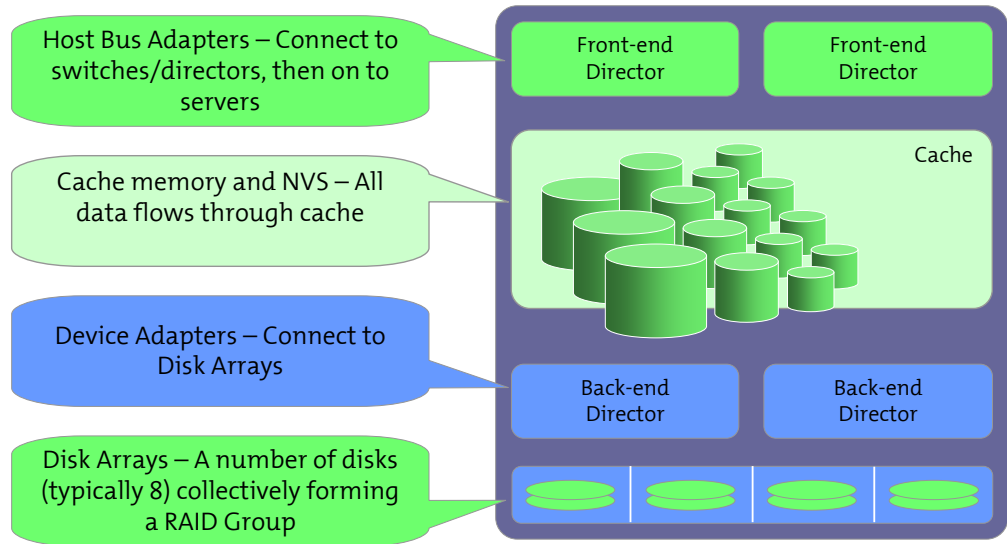
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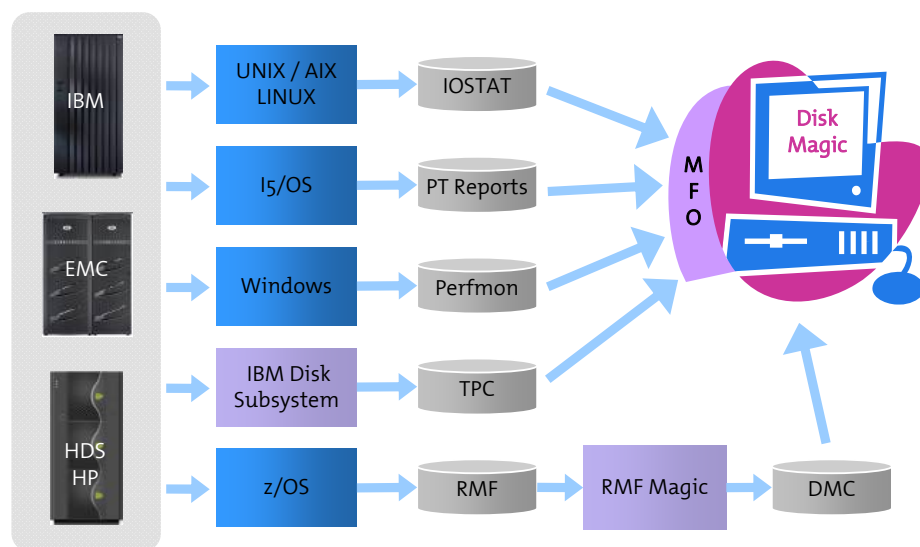
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## Disk Magic Provides a View Inside the Disk Subsystem



## Supports All Mainline Hardware and Software Platforms



PT = Performance Tool  
TPC = TotalStorage Productivity Center

MFO = Multi-File Open  
DMC = Disk Magic Control



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# Examples – Disk Magic

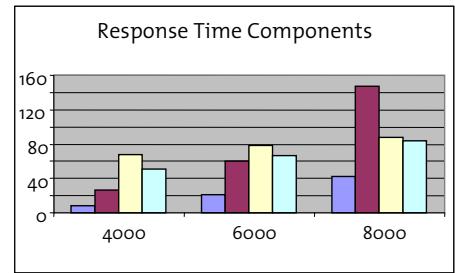
## Performance Modeling

1. Disk Subsystem Configuration Details (automatic from RMF Magic)

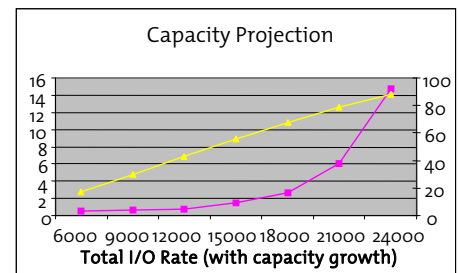


2. Input Measured Data from:

- RMF Magic (z/OS)
- Iostat (UNIX)
- Perfmon (Windows)
- TPC



	8000	10000	12000	14000	16000	18000	20000
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4.6%	5.8%	6.9%	8.1%	9.2%	10.4%	11.5%	
48.0%	48.1%	48.7%	48.7%	48.5%	48.7%	48.9%	
29.9%	37.4%	44.9%	52.5%	60.0%	67.5%	75.1%	
32.2%	40.2%	48.2%	56.2%	64.2%	72.2%	80.2%	
29.0%	36.3%	43.5%	50.8%	58.0%	65.3%	72.6%	



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# Disk Magic Applications

To achieve hardware cost savings:

- **Develop tuned plans for new disk configuration**
  - Storage consolidation / technology upgrades
  - Based on own installation's I/O load and growth expectation
  - Optimize Front-end Directors, cache, physical disk, ...
- **Explore growth options existing disk configurations**
  - More I/O, same disk capacity (higher Access Density)
  - More I/O, more disk capacity (same Access Density)
  - Study impact on utilization of external/internal data buses, disks, Front-end Directors, ...
- **Validate Copy Services implementation plans**
  - Synchronous: Metro Mirror, SRDF/S, TrueCopy/S
  - Asynchronous: Global Mirror, SRDF/A, TrueCopy/A, Universal Replicator, Global Mirror for z/OS



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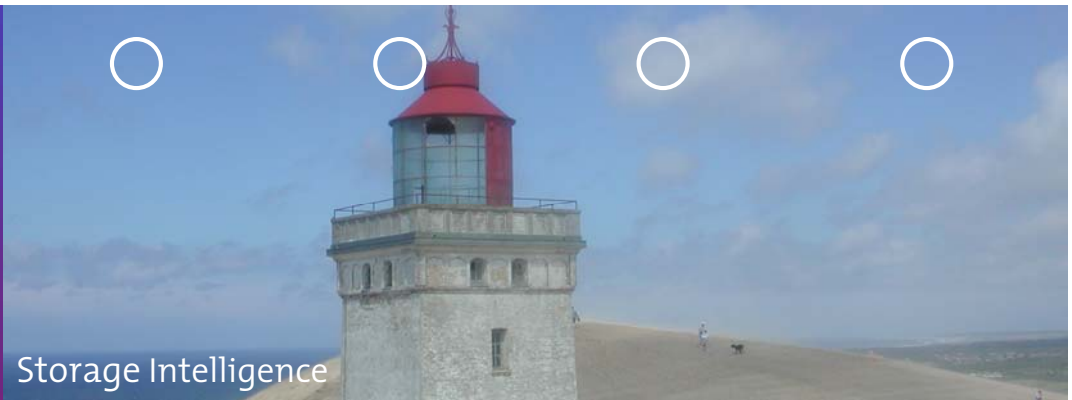
## Unique Features Disk Magic

- Disk Subsystem performance modeling tool
  - Supports products of multiple vendors, including IBM SVC
- Shows current utilization levels of all major Disk Subsystems that may be attached to multiple host platforms: z/OS, i/OS, Unix/Linux, Windows, TPF
- Modeling at DSS, LSS, Extent Pool or device level (z/OS)
- Supports 'What-if' analysis for storage acquisitions:
  - Other HW, more cache, faster interfaces, ...
  - I/O load growth, redistribution, merge
  - Synchronous or asynchronous Copy Services
  - Allows to design a configuration that will do the job for the least amount of €€€
- Automated input for z/OS, i/OS, Unix, Linux, Windows
- Interfaces to Microsoft® Excel for Graphical output
- Avoids expensive over-configuration and dangerous under-configuration
  - "we don't really know, so let's play it safe"
  - "we don't really know, so let's go for the cheapest"



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## Migration Advisor

Service offering in 2009  
Available as product in 2010



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## Migration Advisor

- Migration Advisor provides recommendations on how to combine logical volumes during a migration ..
  - to a new hardware environment with array groups
  - to a multi-tier environment (SSD/FC/SATA)
  - to large logical volumes (EAV or Model 54's)
- Advice is based on days – weeks of RMF Magic data



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## Migration Advisor Outputs

- A list of specific volumes for each target (array group, EAV, ..) showing which volumes can best be combined
- A set of charts, showing how active each of the proposed new targets is
  - Eg I/O rate, back-end I/O rate over time
- A set of charts showing the busiest volumes, to help explain peaks



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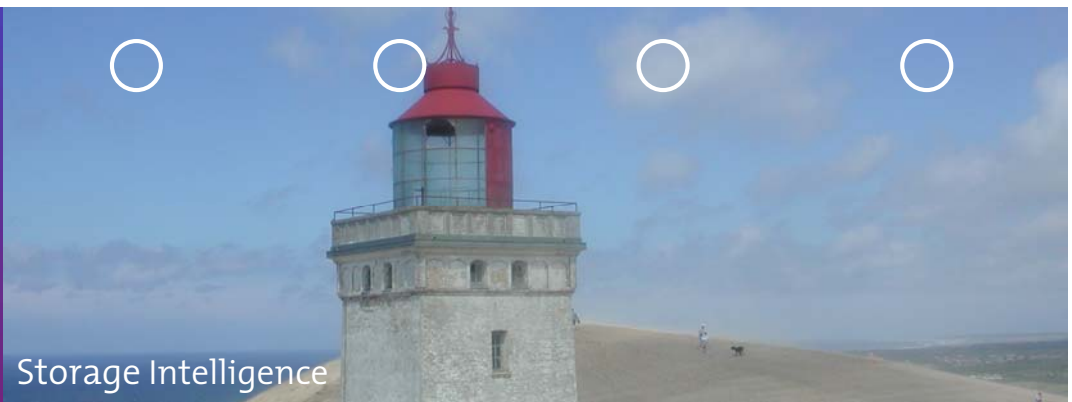
## Migration Advisor Unique Features

- Migration Advisor will take the guesswork out of logical volume placement in migration
  - For Model 54's and EAVs
  - For large single-tier environment (all 300 GB, all 450 GB)
- Migration Advisor allows you to 'dry run' tiered storage implementation without installing hardware
  - Supplements Disk Magic study
  - Provide implementation plan once hardware is acquired
- More functions coming:
  - pick best SSD candidate volumes
  - 'best X moves' to tune existing configuration.



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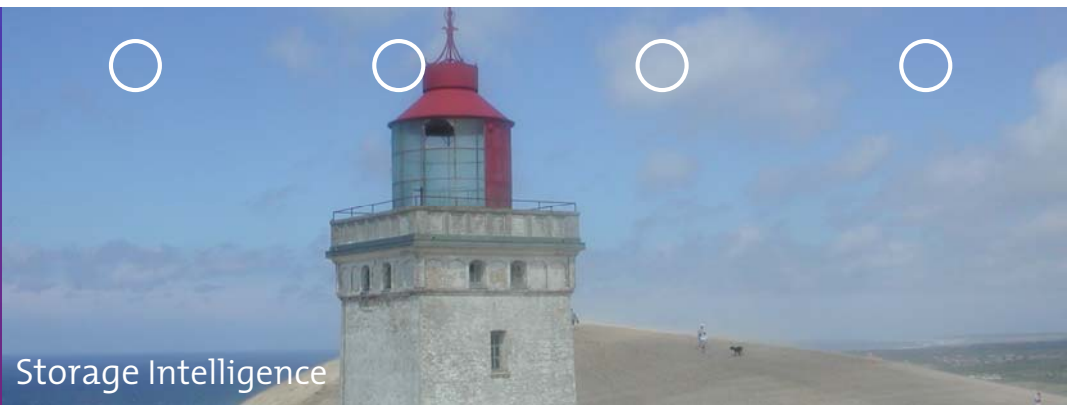
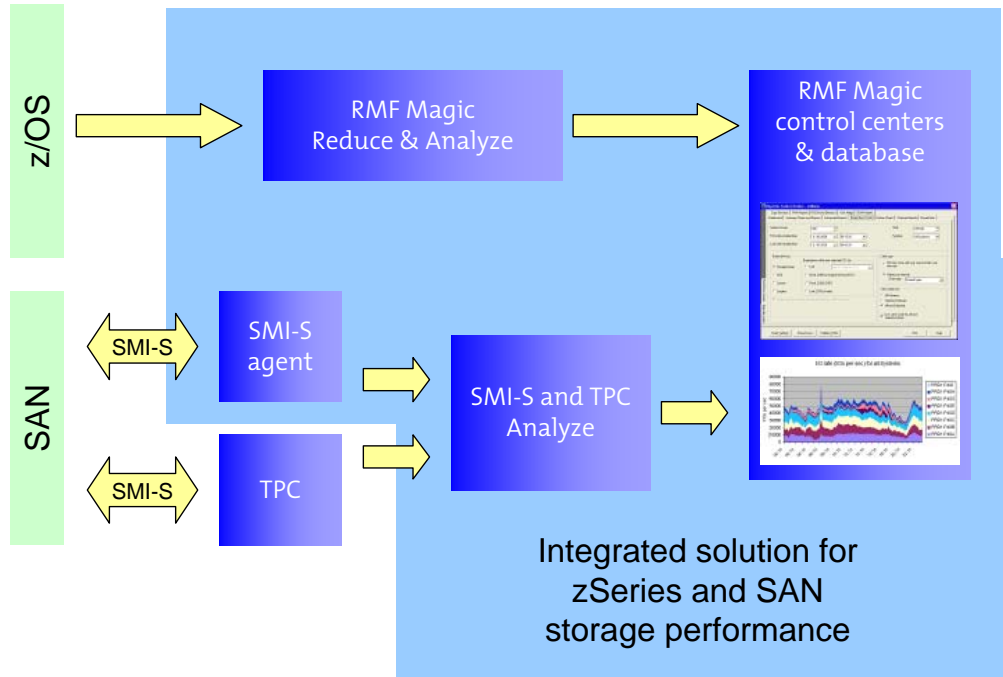


2010





# Statement of Direction



# Summary



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## Product Strengths

- A **complete and focused solution**, without additional measurement overheads on the hosts
- **Pro-active** monitoring and analysis of your storage environment
- **Daily graphical health check** of the previous day: potential bottlenecks will be spotted long before they turn into performance problems
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## Product Strengths (2)

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Thank You!

Questions?