Improve z/OS Storage Operations with Better Operational Intelligence Generated by IntelliMagic Vision

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Agenda

1. Modernizing the Processing & Interpretation of IO Metrics
   - Brent Phillips, Managing Director

2. z/OS Disk & Replication Examples
   - Lee LaFrese, Senior Storage Performance Consultant

3. z/OS Tape & Virtual Tape Examples
   - David Heggen, Storage Performance Consultant
Better Intelligence to Improve IT Operations

Why were lighthouses built?
A signal to know where you really are so you could avoid hidden danger

Why are they outdated?
Modernization provided better intelligence for human decision making

Relevance to z/OS analytics?
IntelliMagic is inspired by creating better intelligence from the RMF/SMF data using an AI-driven approach.
Improving Human Decision Making in IT Ops

Human Decision Making is a 3 Stage Process
(based on model from H.A. Simon, an ACM Turing Award Winner in 1947):

1. **Intelligence:**
The identification of a problem (or opportunity) and the collection of relevant information

2. **Design:**
Create alternative solutions based on the intelligence

3. **Choice:**
Evaluate the alternatives and commit to a course of action
# Impact on Decision Making of Better Intelligence

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<thead>
<tr>
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<th>Status Quo SMF Reporting</th>
<th>With Modernized Intelligence</th>
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<tbody>
<tr>
<td><strong>Problem Identification</strong></td>
<td>Slow &amp; incomplete – static, disparate reports that only provide partial views (logical not physical)</td>
<td>Fast &amp; deep – dynamic, interconnected views with rated metrics based on the specific workload type, hardware capabilities, and best practices</td>
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<td><strong>Collection of information</strong></td>
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<td><strong>Create Solution</strong></td>
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<td><strong>Decisions</strong></td>
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How to Get Better Intelligence?

\[ \text{AI}^{(3)} = \text{Availability Intelligence} \]

for your \text{Application Infrastructure},
leverages \text{applied Artificial Intelligence} techniques.

Dynamic intelligence automatically created
allows customers to improve availability
using the superior and early insight
into performance and configuration issues.
Sample Questions $\text{AI}^{(3)}$ Intelligence Answers

• What is good or bad across our entire, complex environment?  
  (exception charts, rated metrics)

• What related metrics are relevant to the context of this issue?  
  (side-by-side mini-charts that are clickable)

• Where do I want to go next to discover the root causes?  
  (intelligent drill downs)

• What help is there to create solutions for the problem?  
  (built-in recommendations)
Utilize applied artificial intelligence/cognitive techniques that include embedded, z/OS specific expert knowledge that, for example:

– Derives new, meaningful metrics out of the raw RMF/SMF data

– Normalizes the data to properly correlate related metrics

– Automatically applies knowledge to rate metrics as good or bad:
  • Internal component capacity limits (e.g., port throughput)
  • z/OS best practices for configuration and performance management
  • Workload balance and redundancy loss identification
  • Relationship and interaction of logical and physical resources
Better Intelligence Monitors Root Causes not just Symptoms of Problems

Root causes are hard to monitor; requires deep expert knowledge, e.g.,:
1. Know how to get or calculate the metric, e.g., port utilization
2. Know hardware characteristics – what utilization levels are dangerous?
Metrics: Predictive Value vs. Difficulty

Status Quo Metric Analysis

1 = IO Response Time
2 = Throughput
3 = Utilization %
4 = Danger Rating
Metrics: Predictive Value vs. Difficulty

Modernization makes it easy to get high value intelligence for better decisions.

“Any sufficiently advanced technology is indistinguishable from magic”

1 = IO Response Time
2 = Throughput
3 = Utilization %
4 = Danger Rating
IntelliMagic Vision **Disk & Virtual Tape**
Scope of RMF/SMF record types currently supported

**Disk**
- Devices (74)
- Channels (73, 78)
- Storage Systems (74, 78)
- Links & Replication (78)
- FICON Dir. (74)
- Page Datasets (75)
- Data sets (42)
- Address Space (30)

**Replication**
- XRC (42) & GDPS (105)
- EMC SRDF/A

**Tape**
- SMF (14/15, 21, 30)
- BVIR for IBM TS7700
- SMF for Oracle STK
- Tape Catalogs
IntelliMagic Vision **Systems**

Scope of RMF/SMF record types currently supported

**Legacy**
- CEC, LPAR, 4HRA (70)
- Real Storage, Paging (71)
- WLM (72)
- Channels (73)
- CF, XCF, FICON Dir. (74)
- Page Datasets (75)
- Virtual Storage (78)
- Address Space (30)

**Emerging**
- PCIe/zEDC (74)
- LPAR Topology (99)
- Processor Cache (113)
- zIIP SMT* (70)
- Transaction* (72)
- SCM (Flash)* (74)
- SCRT/Usage* (89, 30)

* = March 2017
Future: Expanding the Data Coverage

• Current, comprehensive support for:
  – Disk & System: Storage, Processors, WLM, CF and XCF
  – Tape: Real and Virtual Tape: IBM & Oracle (DLm coming)

• March 2017 deliverable
  – RMF Transaction reporting (mobile), MT zIIP – Q1, SCRT (89s)
  – Network: TCP/IP (119 subtypes 5-7, OSA channels)

• Roadmap
  – System: Logger, Locks & Enqueues, customer driven
  – Network: MQ, WebSphere
  – Work with customers on CICS, IMS and DB/2 reporting reqs.
IntelliMagic Vision as a Service (or on premise)

- Good problem to solve with Software as a Service
- Easy Access to intelligence relevant to different roles
- Access to IntelliMagic experts for knowledge transfer, analysis
- Solution infrastructure is managed for you, creating more focus
Dashboards and Ratings

*Embedded Expertise*
z/OS Disk: High CONN Time
Embedded Expertise, Patterns, Drill Down
On January 31st, CONN time changed to “yellow” (early warning).

The next day, February 1st, CONN Time was “red” (performance exception).
The overall response time for the DSS had become poor many times throughout the day.

CONN time was driving the response times. Investigate root cause of high CONN time.
Drill down shows that three volumes have the bulk of the CONN time issue.

Expand the date/time window to see onset of the problem.
An inefficient SQL Query had been introduced and run against datasets on the affected volumes. The SQL query was fixed on Feb. 14th and CONN time was reduced.
Operational Benefits

- **Expertise**: The software knew there was an issue before staff did.
- **Expertise**: Thresholds built in to flag good versus bad metrics.
- **Find Pattern**: Easy to see problem onset and that fix really worked.
- **Drill Down**: Identified affected volumes and helped find root cause.

After the SQL query was fixed, dashboard returned to “green”.
z/OS Replication: Global Mirror RPO Spikes

Visibility, Patterns, Drill Down
Visibility

Average RPO over interval (sec) [rating: 0.17] for all Global Mirror Sessions by Session name

Periodic spikes in Recovery Point Objective (RPO) seen for one Global Mirror session
We see this happening on Sundays in the morning.
Out of Sync Tracks (#)
For Session name 'ISCEPR31'

Volumes in Suspended status (#)
For Session name 'ISCEPR31' by Serial

There are a high number of out-of-sync tracks when the RPO spikes. Could the storage be overloaded?

Global Mirror is briefly suspended when the RPO spikes and the suspended volumes are on one DSS. This DSS is a MM target in an MGM configuration.
The Metro-Mirror activity writing to this DSS spikes to around 900 – 1100 MB/sec during the suspends.

The GM send peaks at over 400 MB/sec. The network was not adequately provisioned for this.
Operational Benefits

- **Visibility**: The issue was found and flagged quickly
- **Find Pattern**: Easy to see when problem occurred and what caused it
- **Drill Down**: Identified affected DSS and helped determine root cause
z/OS Tape
z/OS and Hardware Tape Data Sources

- SMF data from each LPAR, includes VSM events also
- RMF data about tape devices
- Collect data on a per sysplex basis

**Required:**
- SMF Type 14: DSN Read
- SMF Type 15: DSN Write
- SMF Type 30: Jobs/Programs

**Optional:**
- RMF Type 74.1: Device Data
- TMS
- SMF Type 21: Tape Demounts
- HSC events (VSM)
- Real and/or Virtual Tape
- Optional: TMS

**Optional:**
- TS7700 BVIR data is per Library (Grid/Cluster)
- Oracle HSC writes special SMF records for VSM events (Default Type 235)

**BVIR (TS7700)**
Roadmap

- Dashboards and Ratings
- z/OS Disk: High CONN Time Problem
- z/OS Replication: Global Mirror RPO Spikes
- z/OS Tape: Physical to Logical Mapping
- z/OS Tape: Tape Management Catalog Analysis

Status:
- Done
- Done
- Done
- Next
Bridge from Physical to Logical Activity

*Expertise, Visibility, Drilldown*
Operational Benefits

• Expertise: The software knows there was an issue
• Visibility: Easy to assess how busy the CPU is
• Drill Down: Identified zOS workload active around the time of event

This information can allow you to smooth out the peaks to avoid CPU/Hardware upgrade.
New TMC trend Analysis

Who’s using up all my tapes?

*Patterns, Drilldown, Visibility*
New Tape Management Catalog Analysis

IntelliMagic Vision supports 5 Tape Catalog Systems
- CA1
- RMM
- Zara
- TLMS
- Control T

IBM Tape Tools Utility FORMCATS transforms TMC extracts to common format
New TMC Analysis (cont)

IntelliMagic for zOS Tape Volume Groups supported
• Initial use was for SMF reporting of Application activity
• Applied to TMC data
  – Allows for assignment of Virtual Volume to a Workload
• Example: VOLGROUP BACKUP PGM(ADRDSSU,FDR);
  – Categorization by Job/PGM/DSN/DDNAME/Device/Media
    • PGM and DSN are most useful for TMC analysis
• TMC data is a Point-in-Time capture of the library
• Keep summary data by Volume Group for Yearly Trending
• Trend Volume Counts and MB by Volume Group
Operational Benefits

• Patterns: Look for Volume/MB growth in application areas
• Drill Down: Identify specific tape assignments, bridge from trend to current TMC info.

This information can allow you to decide if buying more tapes is your best option.
Questions?
More information

• Also available: White Papers, Customized Demo
  – See: www.intellimagic.com

• Additional pages / capabilities:
  – Storage Performance Modeling: IntelliMagic Direction
  – Other focus areas such as:
    • www.intellimagic.com/zEDC
    • www.intellimagic.com/MLC

• Easy, fast Proof of Concept available with Software as a Service
SAVE THE DATE!

CMG imPACt 2017

November 6 – 9, 2017
Loews New Orleans Hotel