Managing the resources consumed by any computer system is a time-consuming, unrewarding and often an expensive proposition in terms of time. Unfortunately, as the system grows, disk management tasks must be performed more frequently. By using software that automates these critical tasks, organizations can realize tangible benefits in better utilization of computing and human resources.

Areas of Concern

1. Machine throughput and performance
2. The availability of machine production time
3. Time consumed facilitating backups, recovery or generally protecting disk resources
4. Expenses associated with having technicians monitor disk space
5. Accurately forecasting future disk size requirements
6. Documentation and control of thousands of objects
7. Identifying and removing objects that are no longer needed from both the ASYS and IFS file systems

IBM i on IBM Power Systems is an exceptional computing platform. With over 10,000,000 lines of code and 20,000 plus objects in the operating system, it provides a very sophisticated operating environment. With power, comes complexity. IBM i keeps many undocumented items of information that must be managed. An automated disk management solution can eliminate these tedious, time consuming, and sometimes technically difficult housekeeping tasks by tending to them automatically and continuously. DASD-Plus from S4i Systems provides this functionality which is designed to be easy-to-use and automatic in its operation.

DASD-Plus routines are all parameter-driven with time constraints so you have the flexibility to dictate just how much of the System i's time is spent on these housekeeping tasks. For instance, the disk compression functions will continually analyze and optimize the disk usage of your system. Once a technician defines the window of time for the defined jobs, DASD-Plus will run automatically and maximize disk space.

DASD-Plus encompasses two major functional areas of disk management, tactical and strategic, which can be managed centrally through the Job Management Center.

Job Management

DASD-Plus includes a built-in job monitoring and control system, called *Job Execution Manager* that allows you to setup and run a series of DASD-Plus tactical cleanup tasks and more strategic analysis and reporting tasks as a complete job stream without having to create CL programs. *Job Execution Manager* features include:

- Organize tasks (commands) into one or more job streams (without having to create CL programs), e.g. Daily, Monthly. etc.
- Include DASD-Plus Cleanup Routines or user-defined tasks as steps in a job
- Include any DASD-Plus surveys and corresponding reports as steps in a job
- Automate running the steps using your job-scheduling system
- Set up a job execution window by setting a maximum run-time length for the job and use historical information to plan job duration
- Automatically restart a job where it left off at a specific job step or top of the job stack from the last time the job was run

```
JX1002                      Change job

Type choices, press Enter to change.

   Job . . . . . . . . . :   Z53RCLFIL
   Description . . . . .   Reclaim file space
   "What-if" only. . . .   *YES      *YES, *NO
   Duration. . . . . . .    0:00     hh:mm
   Restart . . . . . . .   *JOB      *JOB, *STEP
   Run history . . . . .       7     1-99999
   Reclaim DASD report .   *YES      *YES, *NO, *SUM
   Report definition . .   *YES      *YES, *NO

   Last run:
      Date. . . . . . . :    2/13/13
      Time. . . . . . . :   19:36:21
      User. . . . . . . :   SSTATES
      Elapsed time. . . :    0:15:37
      Ended . . . . . . :   01
      Last step . . . . :

F3=Exit   F5=Refresh   F12=Cancel
```

- Create a history entry for each job and each step in each job so you're not required to search for job logs to see how the job ran
- Run clean up jobs in a "What if" scenario and report statistics in a summary report and details for each job step for visibility into the items that met the criteria and assurance that the job is configured to meet your needs

This feature allows you to segregate your routine *tactical* cleanup jobs by setting them up one time and letting them run; 'set it and forget it' from the more *strategic* functions of monitoring and managing your system through surveys, reporting and charting.

Tactical | Reclaim Disk Space

The Reclaim Disk Space group includes over 27 automated disk clean routines that may be run individually or under the control of the Job Execution Manager. These routines scour your DASD storage based on rules you define. Reclaim Disk Space manages the DASD used by the operating system and your applications.

You have the ability to place limits on the libraries and objects that Reclaim Disk Space utilities examine. These routines can be run in "_What-if_" mode. "_What-if_" is a facility where you can simulate running these cleanup routines without actually making any permanent changes. Reclaim Disk Space is divided into the following subgroups:

Reclaim Disk Space

These are routines that reduce your DASD usage by removing, reorganizing, and resizing various objects that are no longer needed. These functions include the following features:

```
EDPRCL                       Reclaim Disk Space
                                                    System:   S1004DCA
Select one of the following:

        1. Clear queues menu
        2. Clear logs menu
        3. Reclaim file space menu
        4. Reclaim object space menu
        5. Reclaim document space menu
        6. Special reclaim functions menu
        7. Manage IFS space




                                                           Bottom
Selection or command
===> _

F3=Exit   F4=Prompt   F6=Display messages   F9=Retrieve   F10=Command entry
F12=Cancel   F14=Work with jobs   F15=Work with output   F24=More keys
Copyright (c) 2002-2008 S4i Systems Inc. All rights reserved.
```

- Include various housekeeping tasks addressing different areas of the disk such as clearing queues, logs, file re-orgs and IFS
- Define when to run each, what objects to include, exclude and other parameters
- Include the function in a Job Execution Manager job, or it may be run as required
- Run all functions in "What-if" mode to ensure the desired results and to consider the appropriate allocation of time when scheduling

Compress and Expand

The second sub-group allows you to save additional space by compressing your source files and objects. These functions include the following features:

- Compression and automatic expansion of objects based on date last used
- Allow compression and expansion of source file members
- File member attributes are retained and restored when the file is expanded

- Compression can be to a new member in the same file, to a new file in the same library, or to a new library
- DASD-Plus maintains a database of all compressed members for quick retrieval
- DASD-Plus records a history of every compress or expand action that is carried out, for easy audit of what has been done
- If the DASD-Plus edit commands are installed, then compressed source can be transparently expanded for edit
- A flexible inquiry by object name or description allows quick retrieval of compressed members
- All compress and expand functions can be run in what-if mode

Strategic | Analyze Disk Space

The Analyze Disk Space group of functions, allow you to survey the disk on your system(s), run a variety of reports, and display the results in a graphical format with DASD-Plus Chart. Additionally, DASD-Plus can automatically monitor for spikes in disk usage; pinpointing the culprit so action can be taken immediately. Analyze Disk Space functions may be run interactively, batch mode, submitted individually to the job scheduler or as a Job Execution Manager step. The analyze Disk Space functions consist of the following:

Disk Space Survey

Surveys are used to build a database of information about your DASD utilization. The survey functions include the following:

- Ability to create multiple survey definitions to gather information over system ASPs/iASPs, libraries, objects, file systems, directories, files or entries to be surveyed
- Ability to configure an IFS survey to look at specific files or file types
- Availability for online inquiries by drilling down to the desired results and sorting those results online by name, size, count, ASP, owner, etc.
- Create information for analysis, trending and forecasting
- Compare survey results taken at two points in time, for variance Reporting (baseline and rolling). A baseline survey compares the most recent results to a specific date/time, whereas a rolling type survey compares the most recent results to the previous results as the dates roll forward new results are compared to the current results last time it was run
- Add surveys to the Job Execution Manager so they become part of a sequence of steps that include reporting in a single job.
- Reorganize your survey results database

Survey Reports

DASD-Plus includes a report definition facility where you can set parameters to produce DASD-Plus reports that meet your individual needs. A number of out of the box reporting options include analysis, variance, trend and exception reports. However, users can create custom reports to meet individual needs. Some features include:

- Standard Disk Analysis reports that provide a snapshot of your disk and are available to run with specific user parameters
- Variance reports that display specific baseline and rolling survey information
- Trend reports show results over time and forecast a year in the future
- Any report can be run over any set of corresponding survey results

- A pop-up box on the report selection that shows the last "rebuild" date and asks if you want to rebuild the survey prior to building the report results

Analysis Reports: Technicians can use analysis type surveys to obtain a snap shot to evaluate their system disk utilization at a specific date in time.

- Disk Space Analysis Sequenced by Library Name/Size
- Disk Space Analysis Sequenced by Object Type
- Disk Space Analysis Sequenced by Library Size/Object Type
- Disk Space Analysis Sequenced by Object Type/Library Name
- Disk Space Analysis Sequenced by Object Type/Object Attribute
- Disk Space Analysis Sequenced by Library Size/Object Type/Object Attribute
- Disk Space Analysis Sequenced by Object Type/Object Attribute/Library Name
- Disk Space Analysis Sequenced by Library Size/Object Type/Object Size
- Disk Space Analysis Sequenced by Library Size/Object Type/Object Attribute/Object Size
- Disk Space Analysis Sequenced by Library Size/Object Size
- Disk Space Analysis Sequenced by Object Type/Object Size
- Disk Space Analysis Sequenced by Object Type/Library Name/Object Size
- Disk Space Analysis Sequenced by Object Type/Object Attribute/Object Size
- Disk Space Analysis Sequenced by Object Type/Object Attribute/Library Name/Object Size
- Disk Space Analysis Sequenced by Object Size/Object Type/Object Attribute/Library Name
- Disk Space Analysis Sequenced by Object Owner/Object Size
- Disk Space Analysis Sequenced by Object Owner/Library Name/Object Type/Object Size
- Disk Space Analysis Sequenced by Object Owner/Object Type/Library Name/Object Size
- Library, Object and document analysis by date last used, date last changed, date last saved or date last restored
- Unused Objects (List objects not used in X number of days)
- Unused Object Summary (aged by date last used, date last changed, date last saved, or date last restored)
- Unused Object/Library Detail
- Disk Space Analysis Sequenced by Directory/Size/Entry Count/ASP/Owner
- Disk Space Analysis Sequenced by Entry Name/Size/Type/Owner/Text/Date Created/Changed/Saved/Accessed/Creator/ASP

Exception Reports: DASD-Plus includes the following pre-defined Exception Reports. These reports allow users to extend their visibility into the survey data to identify other factors that might impact system performance beyond what is defined through analysis, variance and trend reports.

- Date Analysis
- Files Nearing Capacity (List of files within X% of their capacity)
- Damaged Objects (List of damaged objects)
- Files with Deleted Records
- ASP Exception Reports such as overflowed and misplaced objects
- Duplicate Objects

<u>Variance Reports</u>: There are two types of reports: Object and Library. An object type report allows you to compare objects over two points in time and included in the same survey whereas a library report allows you to compare libraries in the same survey. You can use these reports to determine objects added, objects deleted, or any object changes that occurred between the two observations, or the differences that exist between two libraries.

Variance reports contain an extremely flexible selection method where you can easily set up comparison logic on any or all of the following attributes:

- Size
- Date changed
- ASP
- Damaged
- Text

- Date saved
- Owner
- Deleted records
- Record count
- Date restored

- Creator
- Members
- Date created
- Date Used
- Freed

In addition, you can set limits on numeric fields (size, record-count, deleted records, members) by absolute number or percent (e.g., show me all files that are larger than 5,000,000 bytes and have grown more than 10%).

<u>History-Based Trend Reports and Forecasting</u>: Trend reports provide the ability to forecast your future DASD needs based on historical trends. DASD-Plus uses linear regression formulas to predict future DASD growth and size. Trend reports include the following features:

- Confidence factor that indicate accuracy of the trend-line
- Reports that indicate fastest growing libraries and files
- Available by record count, object count and size
- Available as online query, report, or graphical display (DASD-Plus Chart)
- Ability to limit scope of analysis

DASD-Plus Chart

 Take survey results and display them in a graphical format using 2 or 3D pie, horizontal, vertical, or Gantt bar charts. Display variance results using difference or high/low charts while trending and forecasting can be best illustrated with a line chart. Switching dynamically between chart views, changing chart definitions and exporting these results allow you to share your data across the business and in a way that is meaningful.
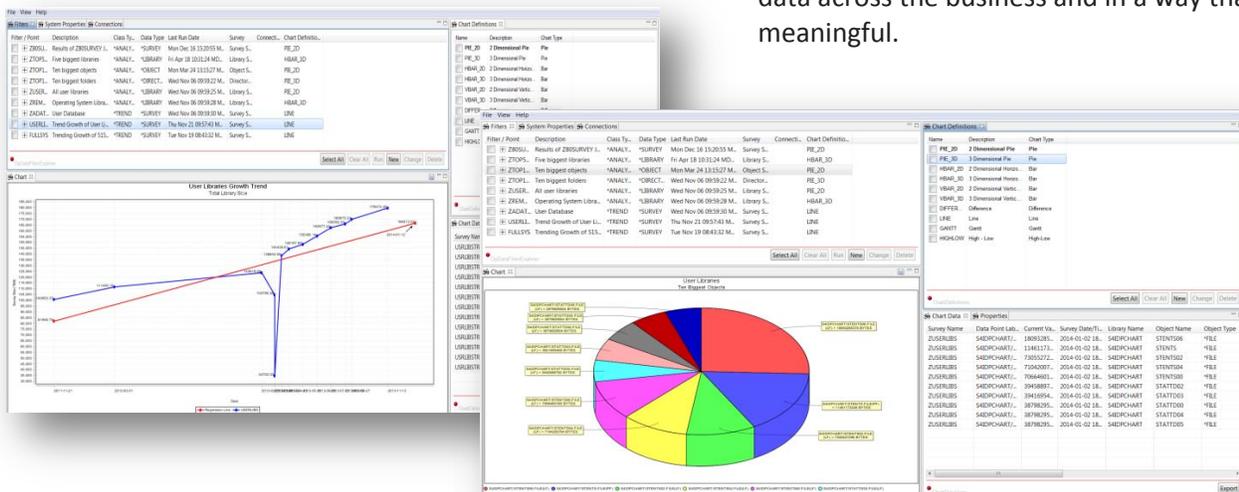
Alert Menu

DASD Alert provides a simple and strategic means of getting ahead of runaway disk usage. Simply set it one time and leave it alone. Alert runs in the background to continuously monitor available disk space and when the threshold is met, a trace will quickly alert you via messaging or email with specific accounts of what transpired so that you may quickly and efficiently stop these jobs and regain your system before catastrophe hits and your system goes down.

Remote Control

This facility allows you to manage DASD-Plus on remote Systems without having to log-on to the remote machine. You have the ability to perform the following tasks from a central processor:

- Define surveys for remote machines
- Define Analysis, Trend and Variance reports for remote machines
- Set up Job Execution Manager jobs for remote machines
- Submit or schedule jobs to run on remote machines
- Check the status of any DASD Remote task
- Address multiple locations for each task
- Build and maintain list of remote locations
- Uses DDM and IP for transmission
- Remote tasks can be combined into groups and transferred to remote systems as a single unit
- Multiple remote locations be grouped together and referred to with a single location name.
- All functions are centralized under two "work-with" screens

Conclusion

DASD-Plus automates all of the functional areas of IBM i DASD management and hence, delivers several

tangible benefits:

1. Housekeeping and disk saving will be performed continually and automatically, according to your specific needs and instructions; no operator action is necessary.
2. As well as saving space, your machine performance can improve dramatically when over utilized disks are optimized.
3. Automated housekeeping saves valuable technician time.
4. Technicians can accurately forecast future disk needs.
5. Valuable management enquiries, reports and charts illustrate disk-utilization efficiency.
6. DASD-Plus provides a full audit of all activities it performs.
7. Less unwanted data on the disk means shorter backup times.