Automating Batch & Saving Money

Established 1987
Independent software developer
Flagship product – ThruPut Manager
z/OS JES2 batch focus
Batch automation vision
300+ clients worldwide

2009 Issues

- Effects of financial meltdown
  - Budget cuts
  - Staff cuts

- Do more with less

- Service demands
  - Datacenter as service provider
  - Integral to organization

Service Perspective Lacking for Batch

- Difficult to manage service
  - Batch metrics work only for individual jobs
  - No metrics for workloads
  - No place for “business importance”
  - Too much power for the submitter
  - No management for non-CPU resources

- Lack of ability to provide predictable service has led to counter-productive situations
  - Department-owned job classes
  - Department-owned LPARs
  - Users deciding which media to use
  - Political responses
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Where Does Batch Fit?

- Back office support for your online systems
  - Deals with large amounts of data
  - Provides aggregation, reconciliation, trend analysis and reporting at corporate level
- Significant dollars
  - 20%+ z/OS workload and budget
- Neglected process
- Major opportunity for savings in the datacenter
  - Glaring inefficiencies in z/OS and JES2

z/OS and JES2 Inefficiencies

Unnecessary Delays

- Queue time in JES2 and WLM is dead time
  - Nothing is done to get the job ready to run
- Once in the queue, everything is FIFO
  - A job’s position relative to other jobs does not change

Adding initiators is not the answer!

  - Adds contention
  - Creates more delays
  - Reduces throughput

Queue Delays

- Dataset enqueue contention occurs at job initiation and can result in long delays
- May be caused by other batch jobs or TSO users
- Operations may cancel jobs to allow a critical application to run
  - Potential for damage

Initiation Delays
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**z/OS and JES2 Inefficiencies**

**Execution Delays**

- Allocation occurs for each DD statement, one at a time, at the beginning of each step.
- If a required device is unavailable it results in Allocation Recovery.
- Part of allocation is recognizing when a dataset has been archived, issuing the DFHSM Recall and waiting until it’s completed.
- Recalls occur serially:
  - If 3 datasets need recall there are 3 delays.

**z/OS and JES2 Inefficiencies**

**Execution Delays**

- When allocation finds a reference to a virtual volume it issues a mount request:
  - If the virtual volume is not in cache it must be staged (recalled).
- When a cartridge is required in an Automated Library (ACS or ATL), a mount is issued and there is a delay if the cartridge is not in the library.

**Batch Job Lifecycle**

**ThruPut Manager Standard Edition**

- **Pre-submission**
- **Submission**
- **Initiation**
- **Execution**
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Batch Job Lifecycle

Batch Service Lifecycle

Policy-driven batch

- Policy includes service goals for each type of workload as well as datacenter constraints
- Goals are multi-faceted
  - Service Targets
  - Escalation thresholds
  - Importance relative to other batch
- Importance and escalation thresholds allow ThruPut Manager to “triage” work

- Use SLAs if present, otherwise use job class figures

- System constraints
  - Restrict load by LPAR
  - Route to preferred LPAR, based on
    - Type of work
    - Software license
    - DBMS etc.
    - Combinations
- Tape drive constraints
  - Dedicate set of drives to production
  - Cap drives available to other batch work
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Automating Batch

- Automation engine driven by
  - Goals
  - Constraints
- Adjusts to
  - Current workload
  - Current datacenter conditions
- Batch specific optimizations
  - Avoids delays, contentions
  - Parallel resource fetching

Analysis

- ThruPut Manager analyses each job on submission
  - Determines needs of job – datasets, devices, programs, ...
- Analysis provide 250+ job profile descriptors
- Installation staff write rules using descriptors to:
  - Change some JCL parameters
  - Categorize for limiting and other constraints
  - Add routing information
  - ...
  - Establish service goals
  - Establish batch importance

Analysis

- Removes dependence on user JCL
- Removes dependence on user compliance to standards
- Allows datacenter to change standards without user involvement
- Provides flexibility to manage the environment while retaining all the needed control

Queue Management

- Use a single queue for batch
  - “bank line” v “grocery line”
- JES2 queue ordered by JES priority
- ThruPut Manager manipulates the JES priority to manage the queue position of jobs
- Each job moves through the queue at a rate appropriate to its goals and importance
- Jobs that fail to initiate within their target are queued by batch importance
  - When things are tight, more important work is given preference
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Example:
- Job A has a target of 10 minutes
- Job B has a target of 2 minutes

Recall Management
- Issue DFHSM recalls while in the queue
  - Hold the job until first 2 steps ready
  - Uses HSM API to prioritize based on batch importance
  - Maximum 40 recalls per job
  - Can avoid unnecessary recalls (IEFBR14)
- Issue virtual volume staging requests
  - Tasks carried out in parallel
  - Improves overall service and turnaround
  - Shortens time in execution
  - Removes a major z/OS inefficiency
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Preparing Jobs to Run
If an airport ran like JES2 ...
- Aircraft would wait on the runway while...
  - passengers were loaded,
  - baggage was loaded,
  - fuel was loaded, and
  - refreshments were loaded,
- ... one at a time

Preparing Jobs to Run
Airports don’t run like JES2 ...
- The aircraft park at gates while ...
  - passengers are loaded
  - baggage is loaded
  - fuel is loaded
  - refreshments are loaded
- ... all at the same time
- The runways are kept free until the aircraft are ready to take off
- ThruPut Manager implements this approach in z/OS

Selection Management
- Jobs at the top of the queue are checked first
- A job must be ready to run
  - Drives are checked against each job’s needs to ensure job can start
  - Dataset enqueues are checked to ensure job can start
- Workload is distributed across LPARs

Initiator Management
- Dynamic JES2 initiators managed by ThruPut Manager
- Starts and stops initiators, based on
  - WLM queries
  - PR/SM queries
  - Calculation of availability
  - Service class performance
  - Performance of each job against its goals
- Distributes initiators (and work) where capacity exists
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**Execution Management**

- WLM manages CPU, memory and I/O access based on the Service Class
- ThruPut Manager provides the Service Class to WLM from set reserved for its use
- Verifies that the Service Class is receiving service before starting another job in that Service Class
- Prioritizes access to allocation for tape drives (at step level), based on service goals
  - When a conflict occurs, the more important job is favored
  - Device allocation recovery is avoided through prediction and temporary suspension of lower priority work

**Execution Management**

- Capture service levels for later reporting
- Data includes:
  - Targets
  - Actual performance against targets
  - Delays experienced
  - For each job and all workloads
- Data captured in SMF

**Provide Feedback for Stakeholders**

<table>
<thead>
<tr>
<th>Operations</th>
<th>Users</th>
<th>Performance Analysts</th>
<th>Management</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Monitoring</td>
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<tr>
<td>Workload Reports</td>
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<td>✓</td>
</tr>
<tr>
<td>Job Reports</td>
<td>✓</td>
<td></td>
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</tr>
</tbody>
</table>

**Provide Feedback for Stakeholders**

A Single Batch Metric

- Automation Edition uses a single metric to express the service level for all batch jobs

<table>
<thead>
<tr>
<th>Target</th>
<th>Acceptable</th>
<th>Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better than Target</td>
<td>Beyond Acceptable</td>
<td>Approaching Critical</td>
</tr>
<tr>
<td>Better than Target</td>
<td>Beyond Acceptable</td>
<td>Approaching Critical</td>
</tr>
<tr>
<td>Better than Target</td>
<td>Beyond Acceptable</td>
<td>Approaching Critical</td>
</tr>
</tbody>
</table>

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Provide Feedback for Stakeholders
“How are we doing?”

--- TM/SLM Display Services ---

**Batch Services Status**

Command: 

- Policy: DAYTIME Description: DAYTIME AUTOMATION
- Activated at: 2008/04/02 14:16:13 By: P390K

--- As Of --- --- Batch Service --- ---- Trend ---

<table>
<thead>
<tr>
<th>Now</th>
<th>Before Target</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>15:40</td>
<td>Before Target</td>
<td>Stable</td>
</tr>
<tr>
<td>30 Mins Ago</td>
<td>At Target</td>
<td>Improving</td>
</tr>
<tr>
<td>2 Hours Ago</td>
<td>At Target</td>
<td>Improving</td>
</tr>
<tr>
<td>3 Hours Ago</td>
<td>Before Target</td>
<td>Deteriorating</td>
</tr>
</tbody>
</table>

Consolidated view of all workloads within the policy

Not an average – point at which jobs are being selected

Trend column shows “at a glance” if things are improving or not

**Service Group Statistics**

Command: 

- Policy: DAYTIME Description: DAYTIME AUTOMATION

As of: 14:44:52 In the Last: 30 MINS

**Status by Workload Type**

<table>
<thead>
<tr>
<th>Service Group</th>
<th>Completed</th>
<th>On Target</th>
<th>Beyond Acceptable</th>
<th>Critical</th>
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</thead>
<tbody>
<tr>
<td>FINANCE PAYROLL</td>
<td>98%</td>
<td>100%</td>
<td>0%</td>
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<tr>
<td>DEVT</td>
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<td>0%</td>
<td>0%</td>
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</tr>
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<td>PAYROLL</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>FINANCE</td>
<td>100%</td>
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<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

FINANCE PAYROLL workload is meeting its service goals

Provide Feedback for Stakeholders
User SDSF Information

**Job Summary Report**

**IEF374I STEP/STOP 2008 119 0.9652 CPU 0MIN 00.02SEC SRB 0MIN 00.00SEC VIRT K SYS 248K EXT 0K SYS**

**SDSF INPUT QUEUE DISPLAY ALL CLASSES**

*Read on Node N1, System SYS1* Executed on Node N1, System SYS1

**Command Input ====>** **Scroll ====> CSR NP JOBNAME JobID Owner Prty C Status Pos PrtDest**

**Service Group Information:**

**Description: Corporate Finance**

FIP390SF JOB08470 FIP390F 3 G SLM ets 02 mins 11 LOCAL

**Queue Time Information**

* Target... 00:02:00 Service Delivered: Before Acceptable
* Queue Time Delays
* Execution Time Information
  * Actual... 00:00:41 Delay... 00:00:11 Effective... 00:00:32
  * Target... 00:02:00 Service Delivered: Before Acceptable

**Execution Time Delays**

* DBS... 00:00:00 DCS... 00:00:00 HSM Recall... 00:00:01 Allocation... 00:00:00

**Allocation Time Delays**

* ThruPut Manager adds service and delay information to the job log.

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Provide Feedback for Stakeholders
Job Summary Report

Queue time delays are delineated

Provide Feedback for Stakeholders
Workload Reports

Benefits of Automating

- Reduced risk
  - Puts focus on work that really matters
  - Reduces human errors
  - Gives more management control
- Helps staff issues
  - Captures knowledge and business priorities
  - Frees up skilled staff from mundane tasks
- Delivers better service
  - Optimizes batch window
  - Embeds best practices
- Reduces costs
### Reduces Costs

**Software Licensing**

- Avoid common practice of licensing software everywhere
- Install for JESplex but license only on LPARs needed
- Ensure all workload - batch, TSO - runs on licensed LPARs only
- Meet license compliancy requirements

**ThruPut Manager automatically determines which jobs need which products**
- Automatically routes jobs to LPARs with required software licenses
- Dynamically adjusts when software is moved for outages
- Manages batch and TSO access to licensed software
- No specification required by the user

- Many products, big savings

### Reduces Costs

**Delay CPU upgrades**

- Optimize batch workload
  - Get jobs through faster
  - Remove delays
  - Distribute workload to use available capacity
- Give preference to more important work
  - Triage workload to do essential work and let other jobs wait for capacity to be available
  - Service goals and importance drive the process
- Drive the machine at 100% with useful work

**Managing subcapacity pricing thresholds**

- For (mostly) IBM system software
- z/OS, CICS, DB2, …
- Negotiate pricing model
  - Workload Licensing Charges (WLC), or
  - Monthly Licensing Charges (MLC)
- Charges based on highest 4-hour rolling average over the month
- Control by setting sub-capacity thresholds or “caps”
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**Reduces Costs**
Managing subcapacity pricing thresholds

- Whenever pricing cap is reached
  - Distributes batch workload to processors with available capacity
  - Defers lower importance batch workload until capacity available
- Triage batch workload to make sure most important and urgent batch workload is given priority
  - Reduce the 4-hour rolling average without excess pain

**Reduces Costs**
Delay resource upgrades

- Increases effective utilization
  - Shortening runtimes shortens drive residency
  - Manages contention for drives
  - Increases “useful” residency
- Triage usage
  - When demand exceeds supply, the more important work goes first

**Reduces Costs**
Organizational Savings

- Staff pressures alleviated
  - Fewer human errors
  - Increased productivity
  - Staff available for strategic projects
- Better user relations
  - Better throughput of their jobs overall
  - Better reporting on delays and job statistics
  - Can focus on the business, not the datacenter
- Fewer management issues
  - Reduced operational complexity
  - Datacenter more nimble and integrated with business
  - Service delivered more aligned with business expectations and needs

**Current Status**

- Automation Edition is in use at a number of installations
- One company has been managing their entire batch workload using Automation Edition since last July
- Next step – Production Services for CA 7 – ready for early user program beginning in May
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### ThruPut Manager Delivers
- Captures knowledge
- Automates batch based on service goals and importance
- Eliminates inefficiencies in z/OS batch
- Optimizes resources and reduces costs
- Makes better use of staff

**By-products are:**
- Better workload distribution
- Better end-user service
- More accountability

### Automating Batch & Saving Money
- ThruPut Manager provides benefits for every user as well as the datacenter
- Implements a holistic approach to automate the complete job lifecycle
- Manages to your service goals within your constraints
- Provides feedback for all stakeholders
- Saves money

### “A Quantum Leap”

“Automation Edition represents a quantum leap in batch management, meeting the outstanding requirements z/OS shops have had for decades. … With Automation Edition the entire problem is solved, once and for all, and batch processing takes care of itself. And MVS Solutions makes it easy to transition to their fast path deployment methodology. We were up and running quickly with no collateral problems.”

Kelly Vogt
Manager of Performance and Capacity Management
Humana