z/OS Hybrid Batch Processing on the zEnterprise

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Agenda

• Define Hybrid Batch Computing
• Hello World Example
• Applications
• Load balancing Hybrid Batch workloads
• Summary / Questions
zEnterprise Hybrid Computing

• A **System of Systems**
  • Combined technology platforms: zSeries, POWER, x86
  • Capable of hosting many workloads integrated together
  • Managed as a single entity

“IBM’s new hybrid z/blade environment is really a new governance arrangement between the z world and the distributed systems world.”

-- Jeff Frey, IBM Fellow
What Are the Implications for z/OS?

“The sweet spot for z/OS is highly integrated applications for which transactional integrity, recoverability and data proximity are critical.”

-- Jeff Frey, Jose Castano
zEnterprise Hybrid Computing Models

Well Known:

- zBX/zLinux as user-facing edge, web and application servers
  - z/OS provides back-end databases and transaction processing
- zBX as special purpose appliances or optimizers
  - DB2 Analytics Accelerator
  - DataPower

Another Model: z/OS Hybrid Batch
- zBX/zLinux integrated with z/OS batch
z/OS Hybrid Batch Processing

1. The ability to execute a program or script on a virtual server from a z/OS batch job step
2. The target program may already exist and should require little or no modification
3. The target program’s input and output are redirected from/to z/OS spool files or datasets
4. The target program may easily access other z/OS resources: DDs, data sets, POSIX files and programs
5. The target program’s exit code is adopted as the z/OS job step condition code

Requires new enablement software…
Co:Z Co-Processing Toolkit

- Implements z/OS Hybrid Batch model
- Co:Z Launcher starts a program on a target server and automatically redirects the standard streams back to jobstep DDs
- The target program can use Co:Z DatasetPipes commands to reach back into the active jobstep and access z/OS resources:
  - fromdsn/todsn – read/write a z/OS DD or data set
  - fromfile/tofile – read/write a z/OS Unix file
  - cozclient – run z/OS Unix command
- Free (commercial support licenses are available)
Co:Z Hybrid Batch Processing

zEnterprise

zBX
- x86
- Linux/Win
  - Target System Toolkit

z196/EC12
- GCP/zIIP/zAAP(s)

z/OS

IFL
- Linux
  - Target System Toolkit

PPC64
- AIX/Linux
  - Target System Toolkit

IEDN
- encryption optional

HiperSocket
- encryption optional

Co:Z Launcher

Complete your sessions evaluation online at SHARE.org/SanFranciscoEval

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Hybrid Batch – Hello World

• Simple example illustrating the principles of Hybrid Batch Processing
• Launch a process on a remote Linux server
  • Write a message to stdout
  • In a pipeline:
    • Read the contents of a dataset from a jobstep DD
    • Compress the contents using the Linux gzip command
    • Write the compressed data to the z/OS Unix file system
  • Exit with a return code that sets the jobstep CC
z/OS

```
//HYBRIDZ JOB ()
//RUN EXEC PROC=COZPROC,
// ARGS='u@linux'
//COZLOG DD SYSOUT=* 
//STDOUT DD SYSOUT=* 
//INPUT DD DSN=MY.DATA
//STDIN DD *
```

```
echo "Hello $(uname)!"
fromdsn -b DD:INPUT |
gzip -c |
tofile -b /tmp/out.gz
exit 4
```
Hello World: Hybrid Batch

1. A script is executed on a virtual server from a z/OS batch job step
2. The script uses a program that already exists -- gzip
3. Script output is redirected to z/OS spool
4. z/OS resources are easily accessed using fromdsn, tofile, etc…
5. The script exit code is adopted as the z/OS job step CC
Hello World – DD:STDOUT

Hello Linux!
Hello World – DD:COZLOG

CoZLauncher[N]: version: 2.2.0 2012-09-01
cozagent[N]: version: 1.1.0 2012-03-16
fromdsn(DD:STDIN)[N]: 5 records/400 bytes read...
fromdsn(DD:INPUT)[N]: 78 records/6240 bytes read...
tofile(/tmp/out.gz)[N]: ... 1419 bytes written
todsn(DD:STDOUT)[N]: ... 13 bytes written
todsn(DD:STDERR)[N]: ... 0 bytes written
CoZLauncher[E]: u@linux target ... ended with RC=4
Hello World – DD:JESMSGLG

JOB01515    ---- FRIDAY,  7 SEPT 2012 ----
JOB01515    IRR010I  USERID GOETZE   IS ASSIG...
JOB01515    ICH70001I GOETZE   LAST ACCESS AT...
JOB01515    $HASP373 HYBRIDZ STARTED – INIT...
JOB01515    –
JOB01515    –STEPNAME PROCSTEP    RC    EXCP...
JOB01515    –RUN    COZLNCH    04    1345...
JOB01515    –HYBRIDZ ENDED.  NAME–
JOB01515    $HASP395 HYBRIDZ ENDED
Co:Z Data Security

- Remote processes are securely launched using proven OpenSSH technology
- Access to z/OS resources controlled by launching userid’s SAF profile
- By default, data transfer is tunneled (encrypted) over the ssh connection
  - Optionally, data can be transferred over raw sockets (option: ssh-tunnel=false)
    - This offers very high performance without encryption costs
    - Ideal for a secure network, such as zEnterprise HiperSockets or IEDN
Hybrid Batch Examples

• Virtual Server Batch Administration
  • Data integration between platforms
  • e.g. maintain Oracle databases from z/OS batch

• “Fit For Purpose”
  • Moving z/OS SAS Programs to the Linux blade
  • Moving resource intensive (PDF generation) application to the Linux/Windows blade
Virtual Server Batch Administration

• Extend z/OS batch schedules to maintain virtual servers
  • AKA “Herding Penguins”
• More than an Enterprise Scheduler
  • Enables cooperative data exchange
• Retains full operational control from z/OS even as hybrid computing model expands
Data Administration Example

```bash
//APPINT  JOB (),'COZ',MSGCLASS=H,NOTIFY=&SYSUID
//CUSTDATA EXEC PGM=CUSTCOB
//OUTDD    DD   DSN=&DATA,DISP=(NEW, PASS),
//         UNIT=SYSDA, SPACE=(CYL, (20, 20))
//COZLOAD  EXEC PROC=COZPROC, ARGS='u@linux'
//PARMS    DD   DSN=HLQ.ORACLE.PARMS, DISP=SHR
//CUSTDATA DD   DSN=&DATA, DISP=(OLD, DELETE)
//CUSTCTL  DD   DSN=HLQ.CUST.CTL, DISP=SHR
//CUSTLOG  DD   SYSOUT=*  
//STDIN    DD   *
sqllibr control=<(fromdsn DD://CUSTCTL), \ 
data=<(fromdsn DD://CUSTDATA), \ 
parfile=<(fromdsn DD://PARMS), \ 
log=>(toddsn DD://CUSTLOG)
```
//APPINT JOB () ,'COZ', MSGCLASS=H, NOTIFY=&SYSUID
//CUSTDATA EXEC PGM=CUSTCOB
//OUTDD DD DSN=&DATA, DISP=(NEW, PASS),
//       UNIT=SYSDA, SPACE=(CYL, (20, 20))
//COZLOAD EXEC PROC=COZPROC, ARGS='u@linux'
//PARMS DD DSN=HLQ.ORACLE.PARMS, DISP=SHR
//CUSTDATA DD DSN=&DATA, DISP=(OLD, DELETE)
//CUSTCTL DD DSN=HLQ.CUST.CTL, DISP=SHR
//CUSTLOG DD SYSOUT=* 
//STDIN DD *

sqlldr control=<(fromdsn DD://CUSTCTL), | data=<(fromdsn DD://CUSTDATA), | parfile=<(fromdsn DD://PARMS), | log=>(todsn DD://CUSTLOG)

z/OS

Linux on z / zBX
Data Administration Summary

- Scheduled via nightly batch stream
- `sqlldr` exit code seamlessly becomes jobstep CC
- Concurrent transfer and loading: *No data at rest!*
  - *Enabled via process substitution*
- High performance
- Operations can observe real-time job output in the JES spool
- Credentials are restricted by SAF data set controls
Moving SAS Programs to Linux

- SAS programs have a rich legacy on z/OS
  - Data analysis
  - SMF report generation
- Interest in moving processing off platform
  - Licensing cost consideration
  - Overall workload reduction
- Several popular tools already exist
- Hybrid Batch processing offers new options
  - Program source and data can stay on z/OS
  - Job Step integration of output and return codes
SAS Language Population Analysis Example

- Performs analysis of Birth/Death population data
- Program source and data reside on z/OS
- Hybrid Batch used to move **execution** to a blade
- For more information see: http://dovetail.com/products/castudysas.html
Multipage PDF Generation

- z/OS hybrid batch computing can be used to locate resource hungry jobs to the best architecture
- Java driven PDF generation can be time consuming on the zSeries architecture
- Co:Z can be used to:
  - Target Java execution to a zBX or zLinux engine
  - Enable z/OS operations to retain control of scheduling
  - Keep all data-at-rest on z/OS
- For more information see: 
PDF Success Story

• Generate PDFs from XML dataset in z/OS batch
  • Java application using open source iText framework
  • 59 docs/minute on existing 2094-405 workload
• Added (1) zIIP (zAAP mode)
  • 80 docs/minute
• Hybrid batch with Co:Z Toolkit
  • Targeted Linux on IFLs
  • Exploited ssh-tunnel=false and HiperSockets
  • Simple JCL change; no program changes required
  • >900 docs/minute
• Surprising new z/OS operator training required:
  • Don’t cancel job if it doesn’t use CPU time!
Load Balancing

- As hybrid batch computing is adopted on a large scale, pools of target virtual servers become necessary
  - Some hybrid batch jobs are short, others require more time
  - Different servers have different capabilities
- Ideally, new hybrid batch work should be dispatched to the most suitable virtual server
- Need real-time performance load feedback
- zManager to the rescue!
Co:Z Load Balancer Features

• Implements Server/Application State Protocol (SASP)
  • Interfaces with IBM zEnterprise Unified Resource Manager (zManager)
• Distributes hybrid batch work to zBX virtual servers
• Integrates with console when deployed on z/OS
  • WTO logging
  • Console commands for restart and shutdown
• Web service for status, advice, restart shutdown
• For more information see: http://dovetail.com/products/loadbalancer.html
Summary

• zEnterprise / zBX
  • Provides hybrid computing environment

• Co:Z Launcher and Target System Toolkit
  • Provides framework for hybrid *batch* processing

• Co:Z Load Balancer and zManager
  • Provides load balancing capabilities for hybrid batch processing workloads
For More Information

• Visit our website:  http://dovetail.com
  • Hybrid Batch Information:  
    http://dovetail.com/solutions.html
  • View Pre-recorded webinars:  
    http://dovetail.com/webinars.html
• Email us at: info@dovetail.com
• View a Hybrid Batch video on YouTube:

http://www.youtube.com/embed/WlZbN_vs7us
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