GSE UK Conference 2018

Better, stronger, faster; The Mainframe….. the Machine!

Leverage Checkpoint Pacing to Reduce Batch Windows

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November 2018
Session HJ

Abstract

Checkpoints are good things for batch IMS applications to take; however, you can have too much of a good thing. Applications that take too many checkpoints are not easy to identify. They end with condition code 0 and produce the expected results. One checkpoint a second is a good rule of thumb, but we have seen programs taking 30, 50 even over 100 checkpoints a second, wasting CPU and elongating elapsed times. How can you identify offending programs and how can you eliminate unneeded checkpoints without changing the programs? This session will discuss a way to find the programs taking too many checkpoints and suggest some things you can do to address the problem.

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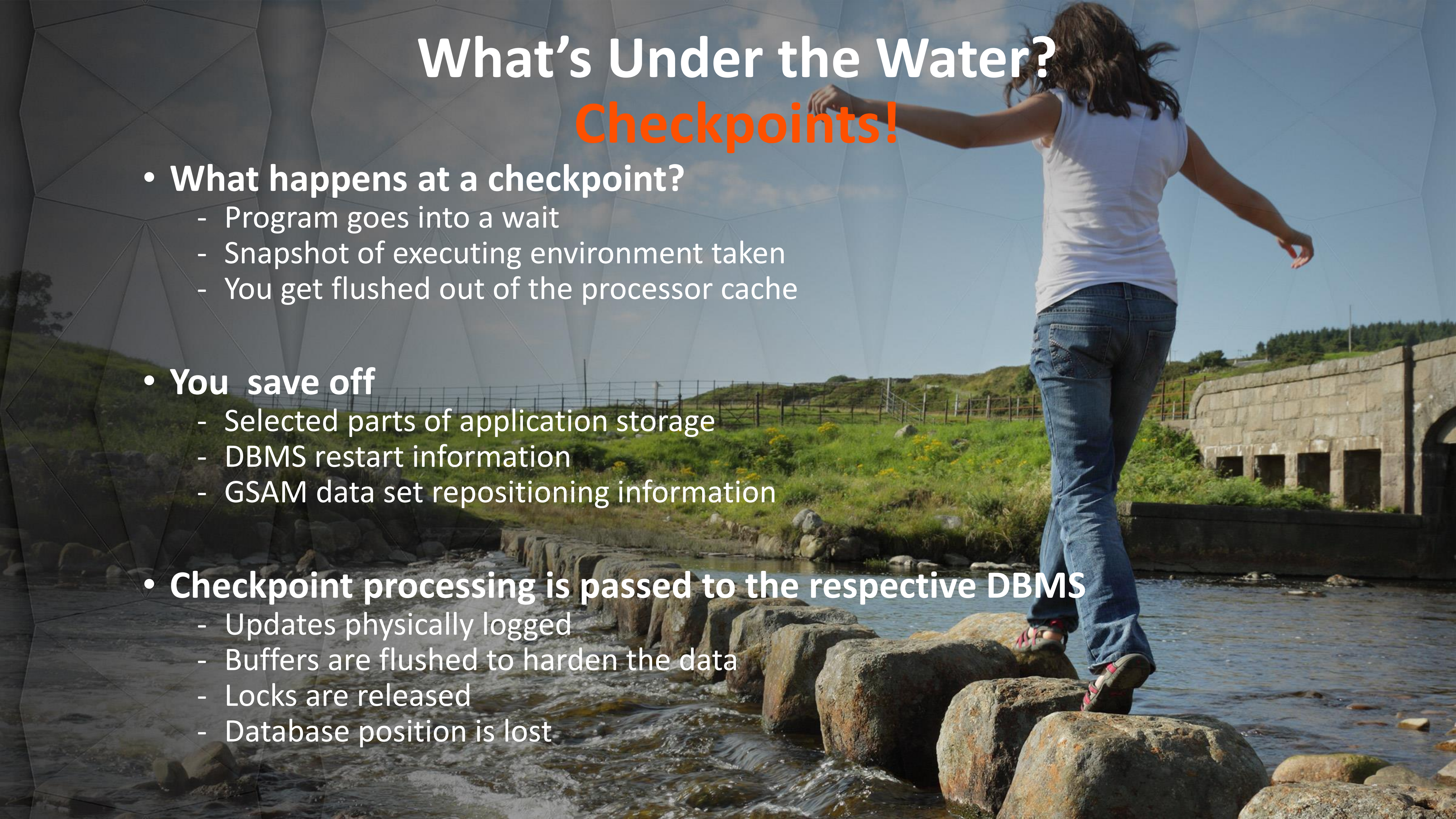
Everything Looks Fine…

- Your batch cycle ends on time. When the batch grows, you upgrade your capacity. Problem solved!

- Now you have the new normal. But, what’s under the still water?



What’s Under the Water?

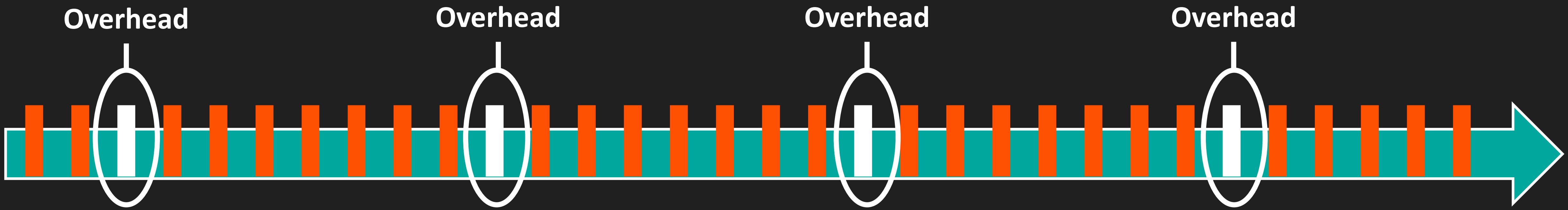
Checkpoints!

- **What happens at a checkpoint?**
  - Program goes into a wait
  - Snapshot of executing environment taken
  - You get flushed out of the processor cache

- **You save off**
  - Selected parts of application storage
  - DBMS restart information
  - GSAM data set repositioning information

- **Checkpoint processing is passed to the respective DBMS**
  - Updates physically logged
  - Buffers are flushed to harden the data
  - Locks are released
  - Database position is lost

Checkpoints



Each checkpoint

Concludes a unit of work and commits changes

- IMS – Checkpoint
- DB2 – Commit
- VSAM – Sync

Typically coded into most application programs

Checkpoints are costly

Checkpoint processing is 100% overhead and creates lots of I/O

It’s not uncommon to see hundreds of checkpoints per second in legacy applications

Excessive checkpoints drive higher CPU costs and longer elapsed batch run times

Rules of thumb for Checkpoints/Commits

1 per second for IMS

5 per second for Db2

Less than 4 per minute (IMS or 1 per second (Db2) can cause lockouts/deadlocks

No checkpoints is probably not good

Checkpoint/Commit Frequency Analyzer (CFA)

- Lightweight stand-alone utility that evaluates IMS and DB2 logs
  - Easy to install and execute
- Reports show number of checkpoints/commits taken as well as the frequency
- Suggests candidates with too high/low checkpoint frequency
- Provides savings estimation calculator
- No charge for CFA

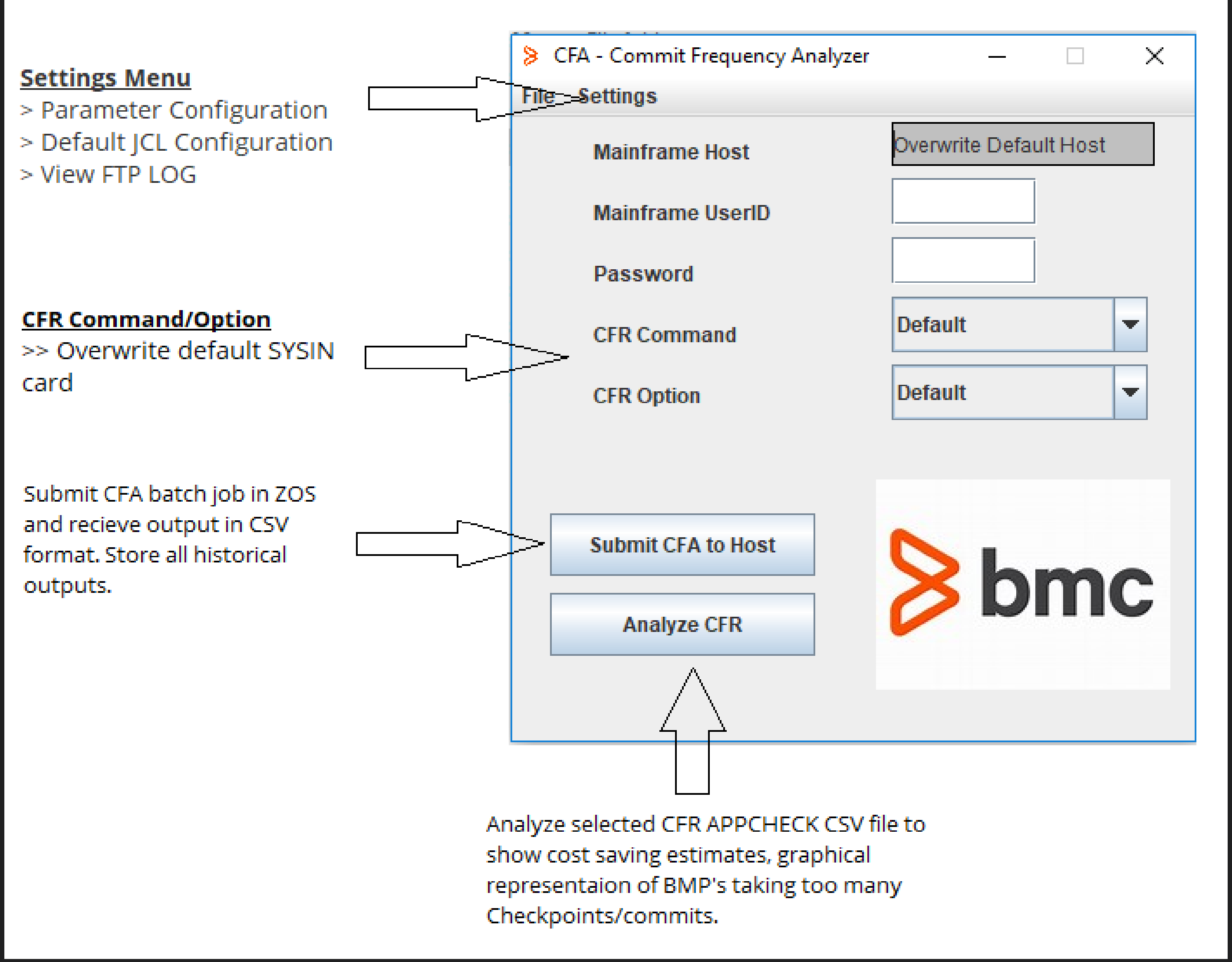
Preparing for a CFA Test

- We determine goals for the test and a date for an onsite visit with you
- You get
  - Two tersed files that simply need to be untersed
    - Loadlib with CFA programs and a password module valid for 7 days
    - Sample JCL for report generation
  - A User Guide that describes all options
- We execute the utility together with you during the onsite visit and discuss results

Using CFA

- **Selection of logs**
  - Explicitly (DSNs of IMS or DB2 logs)
  - Implicitly: Specification of RECON or BSDS and timeframe of the analysis
- **Thresholds for exceptions**
  - Default settings
  - Adjustment possible via control statements
- **Reporting can be limited using fiters to select or exclude jobs by**
  - Jobnames, IMS PSB names, DB2 Plan names

CFA GUI Interface



Settings Menu
> Parameter Configuration
> Default JCL Configuration
> View FTP LOG

CFR Command/Option
>> Overwrite default SYSIN card

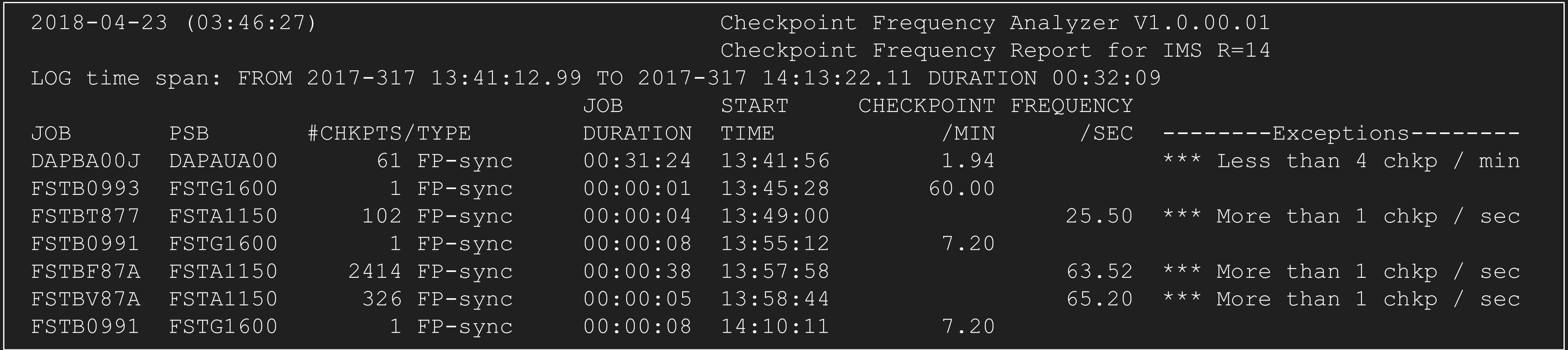
Submit CFA batch job in ZOS and recieve output in CSV format. Store all historical outputs.

Mainframe Host: Overwrite Default Host
Mainframe UserID:
Password:
CFR Command: Default
CFR Option: Default

Analyze selected CFR APPCHECK CSV file to show cost saving estimates, graphical representaion of BMP's taking too many Checkpoints/commits.

- **Software/Hardware Compatibility**
  - Windows OS
  - Java version 1.8.0_161
- **Architecture**
  - Additional infrastructure not required on z/OS.
  - Windows client sends JCL to z/OS JES using FTP and gets output in CSV format.
  - Userid/Password validation through z/OS RACF.
- **Installation**
  - Install folder CFA.ZIP is 2MB in size and can be distributed by email. Extract CFA folder and user is ready to execute GUI interface.

Example of IMS Report

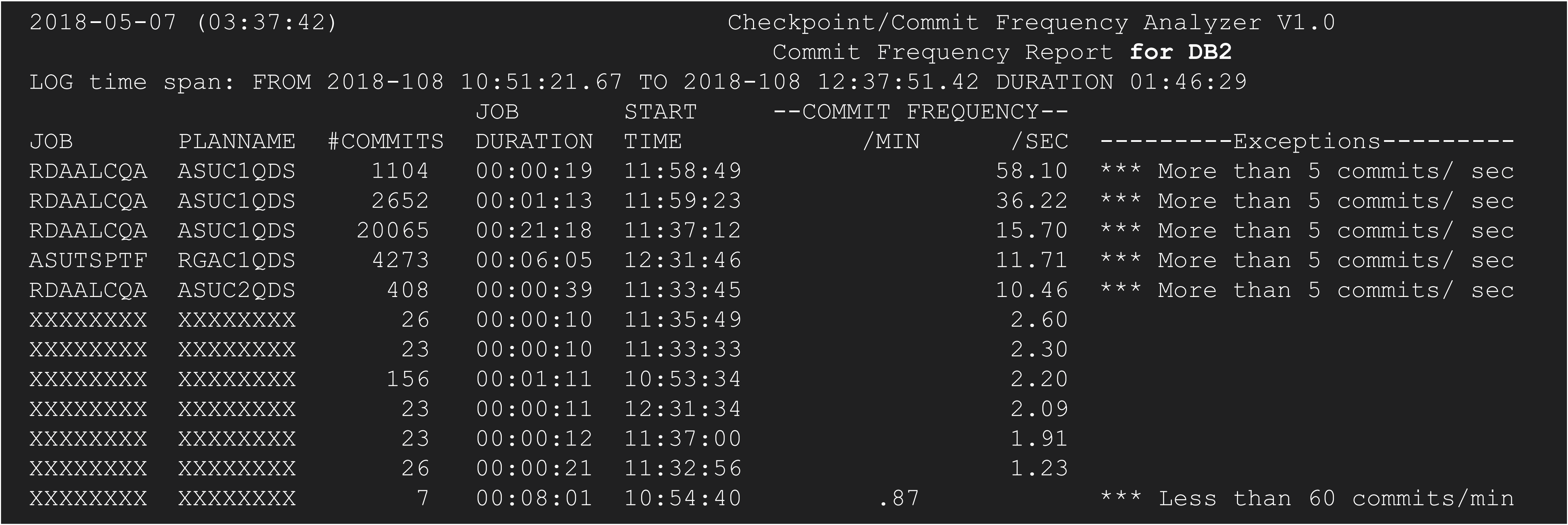


```
2018-04-23 (03:46:27)                                    Checkpoint Frequency Analyzer V1.0.00.01
                                                         Checkpoint Frequency Report for IMS R=14
LOG time span: FROM 2017-317 13:41:12.99 TO 2017-317 14:13:22.11 DURATION 00:32:09
                                              JOB       START     CHECKPOINT FREQUENCY
JOB       PSB       #CHKPTS/TYPE              DURATION  TIME            /MIN       /SEC  --------Exceptions--------
DAPBA00J  DAPAUA00        61 FP-sync          00:31:24  13:41:56        1.94             *** Less than 4 chkp / min
FSTB0993  FSTG1600         1 FP-sync          00:00:01  13:45:28       60.00
FSTBT877  FSTA1150       102 FP-sync          00:00:04  13:49:00                  25.50  *** More than 1 chkp / sec
FSTB0991  FSTG1600         1 FP-sync          00:00:08  13:55:12        7.20
FSTBF87A  FSTA1150      2414 FP-sync          00:00:38  13:57:58                  63.52  *** More than 1 chkp / sec
FSTBV87A  FSTA1150       326 FP-sync          00:00:05  13:58:44                  65.20  *** More than 1 chkp / sec
FSTB0991  FSTG1600         1 FP-sync          00:00:08  14:10:11        7.20
```

Default thresholds

- No checkpoint
- Less than 4 checkpoints per minute
- More than 1 checkpoint per second

Example of DB2 Report

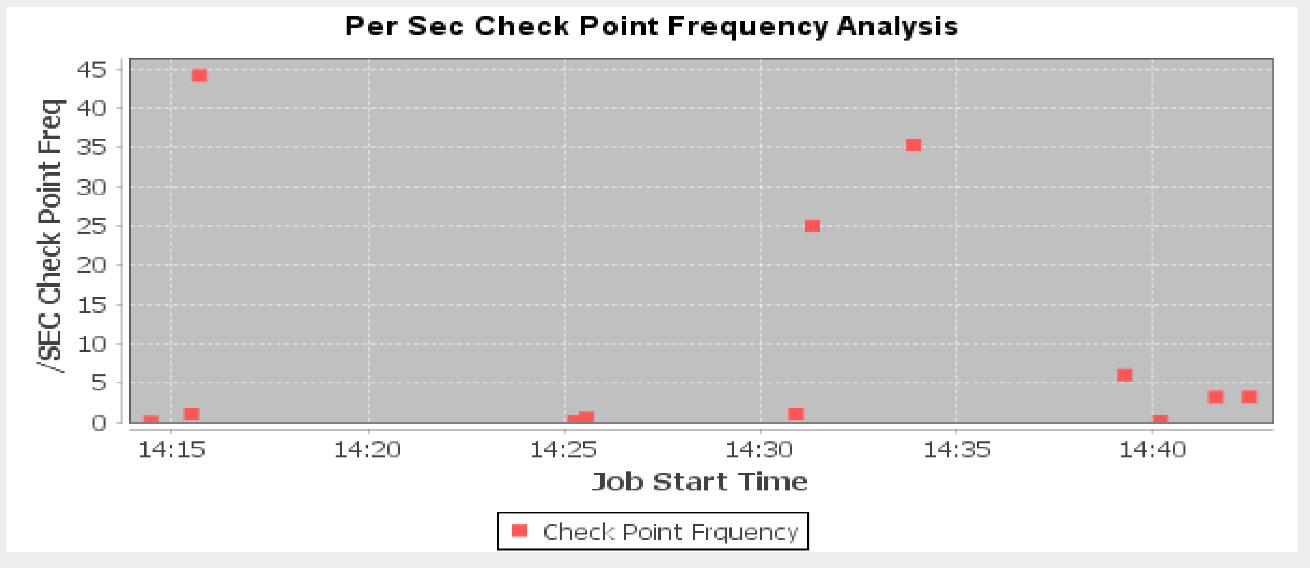


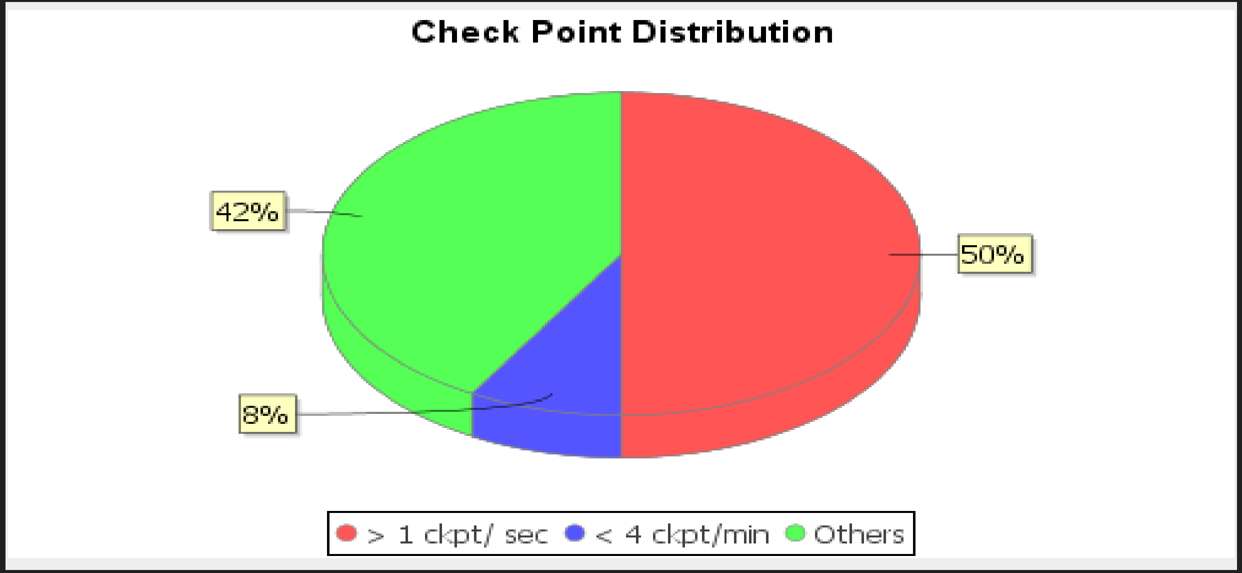
```
2018-05-07 (03:37:42)                          Checkpoint/Commit Frequency Analyzer V1.0
                                                  Commit Frequency Report for DB2
LOG time span: FROM 2018-108 10:51:21.67 TO 2018-108 12:37:51.42 DURATION 01:46:29
                              JOB       START     --COMMIT FREQUENCY--
JOB       PLANNAME  #COMMITS  DURATION  TIME            /MIN      /SEC  ---------Exceptions---------
RDAALCQA  ASUC1QDS      1104  00:00:19  11:58:49                 58.10  *** More than 5 commits/ sec
RDAALCQA  ASUC1QDS      2652  00:01:13  11:59:23                 36.22  *** More than 5 commits/ sec
RDAALCQA  ASUC1QDS     20065  00:21:18  11:37:12                 15.70  *** More than 5 commits/ sec
ASUTSPTF  RGAC1QDS      4273  00:06:05  12:31:46                 11.71  *** More than 5 commits/ sec
RDAALCQA  ASUC2QDS       408  00:00:39  11:33:45                 10.46  *** More than 5 commits/ sec
XXXXXXXX  XXXXXXXX        26  00:00:10  11:35:49                  2.60
XXXXXXXX  XXXXXXXX        23  00:00:10  11:33:33                  2.30
XXXXXXXX  XXXXXXXX       156  00:01:11  10:53:34                  2.20
XXXXXXXX  XXXXXXXX        23  00:00:11  12:31:34                  2.09
XXXXXXXX  XXXXXXXX        23  00:00:12  11:37:00                  1.91
XXXXXXXX  XXXXXXXX        26  00:00:21  11:32:56                  1.23
XXXXXXXX  XXXXXXXX         7  00:08:01  10:54:40         .87            *** Less than 60 commits/min
```

Default thresholds

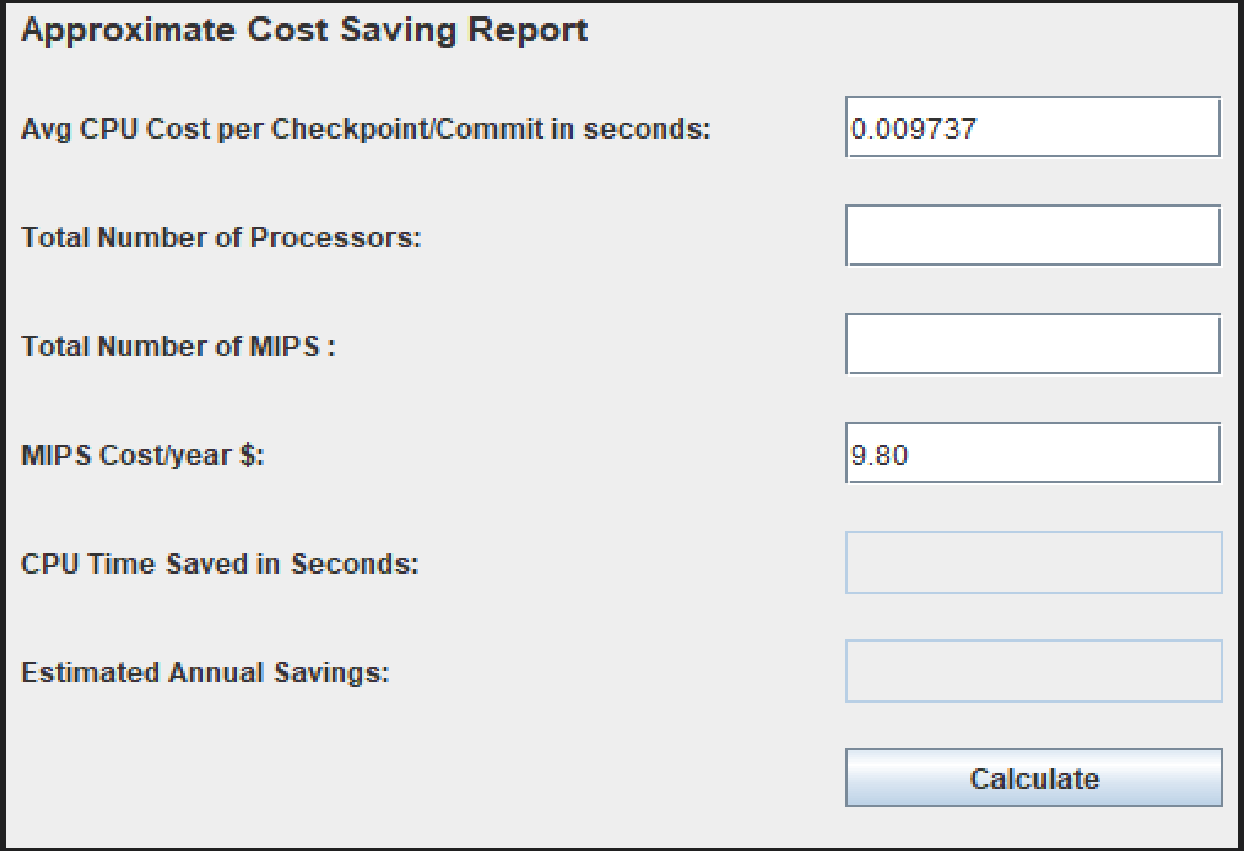
- Less than 1 commit per second
- More than 5 commits per second

CFA Analysis Reports





CFA Cost Saving Estimator



Approximate Cost Saving Report

Avg CPU Cost per Checkpoint/Commit in seconds: 0.009737

Total Number of Processors:

Total Number of MIPS :

MIPS Cost/year $: 9.80

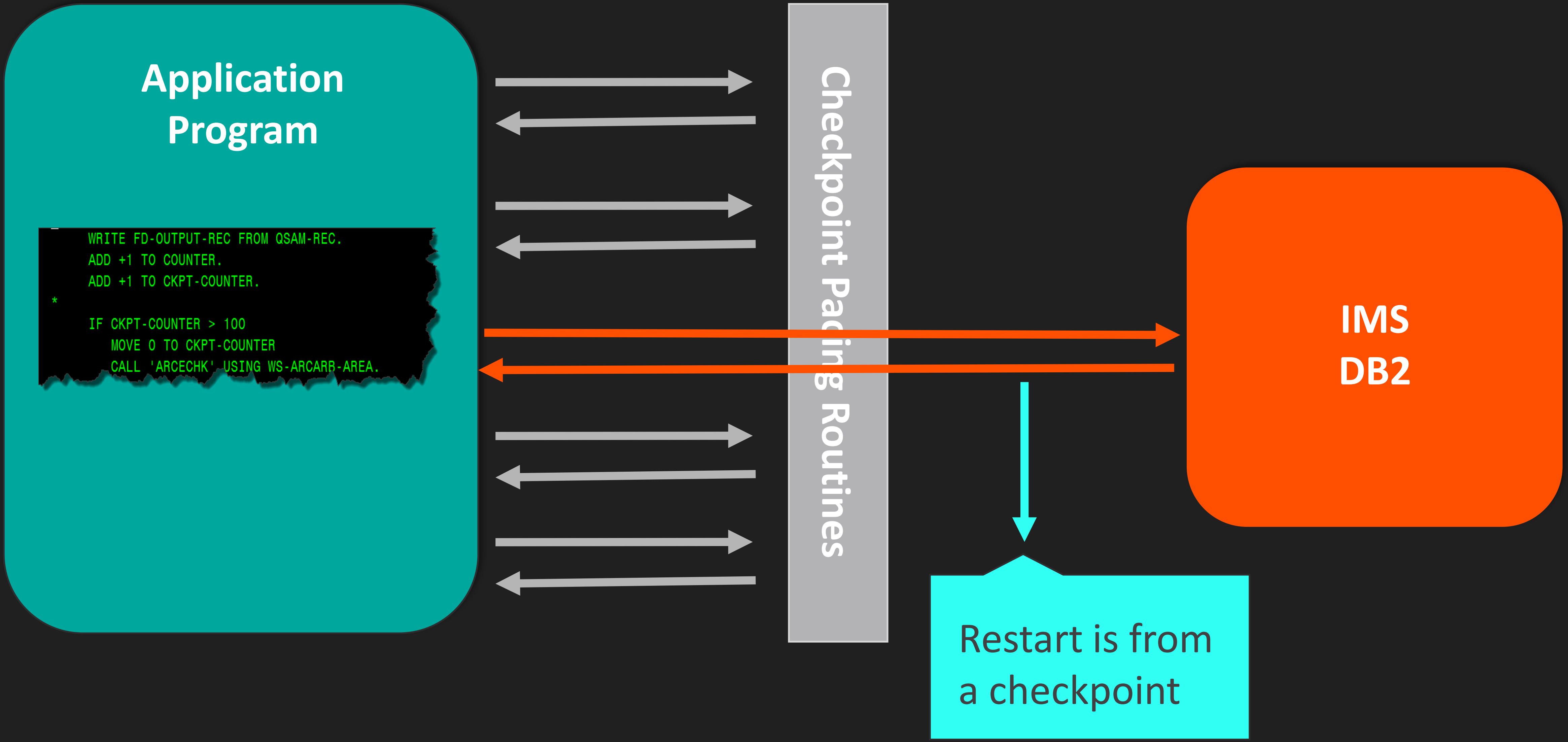
CPU Time Saved in Seconds:

Estimated Annual Savings:

What to do about excessive checkpoints

- Ignore them and live with the cost
  - It isn't broke so don’t fix it
- Change application programs
  - Requires interaction with other areas – applications development, QA, production control, etc.
  - Need to do full testing scenarios
  - Go through change control process
  - Probably only good until next CPU upgrade, then do it again
- Implement checkpoint pacing

Checkpoint Pacing



Application Program

```
      WRITE FD-OUTPUT-REC FROM QSAM-REC.
      ADD +1 TO COUNTER.
      ADD +1 TO CKPT-COUNTER.
 *
      IF CKPT-COUNTER > 100
         MOVE 0 TO CKPT-COUNTER
         CALL 'ARCECHK' USING WS-ARCARB-AREA.
```

Checkpoint Pacing Routines

IMS
DB2

Restart is from a checkpoint

Application Restart Control (AR/CTL) Checkpoint Pacing

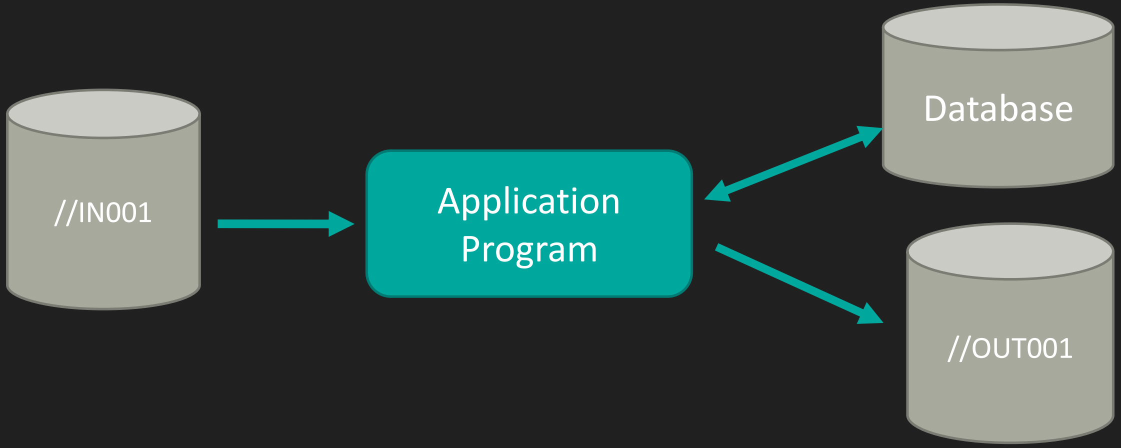
- **Filters/throttles checkpoint activity based on your processing requirements**
  - Prime shift - heavy online access
    - Short checkpoint interval to release locks and help online users
  - Second/third shift - heavy batch access
    - Longer checkpoint interval to facilitate batch

- **Centrally managed**
  - No need to regulate the checkpoint interval in thousands of individual programs

AR/CTL Automatic Checkpoint Insertion

- **Application program does not have enough checkpoints**
- **Locks are held too long causing deadlock situations and abends**
  - AR/CTL automatic checkpoint insertion
  - Implement checkpoint processing through JCL keywords

```
//ARCSYSIN DD *
 AUTOCHECKPT=YES
 AUTORESTART=YES
 AUTOCPRSDDN=IN001
 AUTOCHKPCNT=500
/*
```



Outside of the application code!

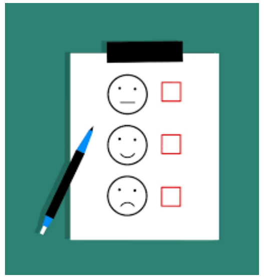
Checkpoint Pacing Savings

- Reduces CPU usage
- Reduces elapsed time to complete batch jobs
- Frees up resources for other processing
- Saves developer effort
- Increases application availability

THANK YOU

We want your feedback!

- Please submit your feedback online at ….
  - ➢http://conferences.gse.org.uk/2018/feedback/HJ
- Paper feedback forms are also available from the Chair person
- This session is HJ



Tuesday 6th November

Start Time	End Time	Stream	Room	Title	Speaker
11:45	12:45	IMS	Wellington B	The No Cost Way to Manage the IMS Catalog	David Schipper
15:00	16:00	IMS	Wellington B	Current Trends in IMS Analytics	David Schipper
16:30	17:30	zCMPA	Woodcote	zIIP stealing GCP MSUs time for Capacity Management	Donald Zeunert

Wednesday 7th November

Start Time	End Time	Stream	Room	Title	Speaker
09:30	10:30	Db2	Nurburgring	Know your onions when it comes to Db2 indexes	Randy Bright
09:30	10:30	IMS	Wellington B	IMS Checkpoint Pacing	David Schipper
10:45	11:45	zCMPA	Nurburgring	How many GCP MSU is my CF stealing?	Donald Zeunert