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PCL3GUI FORMATS COMPARATOR TO VERIFY PRINT DATA

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PCL3GUI FORMATS COMPARATOR TO VERIFY PRINT DATA

Abstract

Cloud platform enables anyone with an Internet-enabled device to print documents, photos by rendering any document entering the system into a printable format and then sends to the corresponding printer for printing. Document gets converted into a printable format in the rendering engine component, the most common format being PCL3GUI (Printer Command Language) [2]. Cloud platform supports several features. It is the rendering engine component of the cloud where the document gets converted into a printable format, the most common format being PCL3GUI (Printer Command Language). Cloud print platform supports several features. Rendering features are hard to validate as it consumes more time to ensure that all print features and value-added content are working correctly as per designed. Manual verification is required to make a judgment whether the printed output is correct by visually comparing the output on paper to the document within the printing application or comparing to a printed master file. This disclosure discusses an automated solution that eliminates manual validation and human errors without having to print the file by extracting raster data of a print file to verify the print data by comparing PCL3GUI formats.

Keywords—PCL3GUI (Printer Command Language 3 Graphical User Interface), Printer Command Language (PCL), Rendering, Raster data, page description language (PDL)

BACKGROUND

PCL (Printer Control language) is a page description language (PDL) developed as a printer protocol. PCL (Printer Control Language) provides an efficient and effective way to control printer features across many different printing devices. PCL commands are compact escape sequence codes that are embedded in the print job before being sent to the printer. Issuance of the sequence was relatively easy from any high-level language or from assembler. PCL formatters and fonts were designed to quickly translate application output into high-quality, device-specific, raster print images. The PCL printer language is common to virtually all printers, but not universal. PCL feature was implemented in very cost-effective formatters. Printers with PCL have ability to ignore most unsupported commands without causing the printer or issuing device to crash.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings are provided to illustrate the disclosure as explained in the detailed description

Fig 1 is a block diagram of automated validation process for PCL printers

Fig 2 shows an example of structure of PCL3GUI file

Fig 3 is a block diagram to illustrate the system architecture

Fig 4 illustrates the internal details of the PCL3GUI comparison

Fig 5 provides implemented solution details in Generation 1 Cloud platform

Fig 6 provides implemented solution details in Generation 2 Cloud platform

PROBLEM STATEMENT

There is no method to compare the PCL3GUI output as PCL print jobs has metadata along with raster data, the metadata of PCL3GUI files gets changed with each test run. This results in failure of normal binary comparison between two PCL3GUI print files. Metadata content of the PCL3GUI file has data related to time stamp, printer details picked up for the job, job start time, page start time, job creator and other details.

This disclosure deals with a new automated solution of raster data extraction of the Print file and compare with raster data of the Master file/Baseline file. This solution will compare only the extracted raster data of the Printed PCL file from the print outputs of the Printer Simulator with the Baseline or the Master file.

SOLUTION

An automated PCL3GUI Comparator tool is designed to compare the PCL3GUI formats for the jobs. The intention is to avoid the physical print of the jobs on the PCL printers. This Solution improves accuracy with comparison precision and is eco-friendly that will eliminate the wastage of ink, paper, and time. It also eliminates the need for human interpreter for assessing the print quality and offers faster feedback on rendering code changes and capture formatting scenarios or find rendered issues early.

This solution will compare only the extracted raster data of the Printed PCL file from the print outs of the Printer Simulator with the Baseline or the Master file. The Baseline\Master output is first created on a successful build. And then during new build development, the output of the new developed build is compared to the Baseline\Master file. The comparison can be either pass or fail.

Consider the Baseline PCL3GUI file say BASELINE_FILE.pcl3gui as shown in Fig 1 below, which has been created from successful build and Printed PCL3GUI file say PRINTED_FILE.pcl3gui which has been created from the new developed build. The differences between the two files is compared and test result is logged.

The Solution is integrated with Continuous Test Framework (CTF) for Generation 1 of Cloud platform that submits jobs to the Cloud Print Platform automatically using Printer Simulator. The Solution is also integrated with Generation Test Framework that submits jobs to Generation 2 of Cloud print platform. The structure of the PCL3GUI file is given as in Fig 2. Data between Start Raster and End Raster is the actual data extracted for comparison.

DESIGN AND IMPLEMENTATION

This section explains design and implementation of the solution where important modules of the system architecture as shown in Fig 3 below, are explained in detail. The Baseline/Master File is formed from the prn or pcl file that is generated using standard build. The Printed file is prn file that is generated using untested build. This automation tool can be modularized into following modules:

PCL DISASSEMBLER: PCL3GUI file to be created from print job submission. In the formed PCL3GUI file, the PCL commands are in binary format and difficult to read pcl commands directly. Hence the PCL disassembler such as JetAsm tool is used to convert a PCL binary file that was generated by the Print driver into a human readable source file. In the disassembled file, the unique strings used for “Start Raster” and “End Raster” are found.

EXTRACT RASTER DATA: The Extract Raster Data module will consider the strings used for “Start Raster” and “End Raster” in the formed disassembled (.asm) file of a PCL Disassembler and extracts the raster data only, excluding the unnecessary Metadata. The “Start Raster” data is sent using command (Esc*r1A) and “End Raster” is sent using command (Esc*rC). Start and End Raster are available for each Page of the PCL file. Raster data extraction is done for each page till the end of the file.

PCL3GUI COMPARATOR: Once the Master/Baseline.pcl3gui and Printed.pcl3gui files are generated, the PCL3GUI Compare Module is invoked. This Module compares the Baseline and Printed files pixel by pixel of only the raster data. When both files are same, then test result will be returned as PASS and when both the files are different then the test result will be returned as FAIL. Internals of PCL3GUI Comparator is shown in Fig 4.

USE CASES:

Use Case 1: Solution can be used in Secure Printing in Banks, airlines, institutions, telecom and other industries to check if a particular document is already printed on a particular printer by comparing the print data before printing with the already printed jobs in backend storage, thereby providing security, protection against fraud and other counterfeits of misusing the infrastructure and avoiding reprints of secure documents.

Use Case 2: In a **collaborative Enterprise environment** related solution like SharePoint Services, where team members work on a single document, this can be used to verify before printing if any latest change is done by some other member of the team or not. Based on the result, user can decide whether he want to print the latest version changes or not.

Use Case 3: This solution can be used to **compare PCL3GUI print formats** for verification of Print jobs sent to PCL3 printers without printing on paper. This solution avoids printing on real printers for print job verification. Usage of ink and paper for PCL3 print

jobs is reduced. Test Execution time for PCL3 printers is also reduced.

Use Case 4: This solution can be used in **Print Spooler optimization**, so that spooler can check if a document is already printed recently (specific timeframe) and user can decide whether he wants to print the document or not.

Use Case 5: Solution can be **leveraged** and integrated with any job submission tools

IMPLEMENTATION OF SOLUTION

The PCL3GUI Comparator working solution has been integrated with Common Test Framework which is used as standard qualification process in Cloud Platform for Generation1. Screenshot of the implemented solution of Generation 1 is shown in Fig 5 where BaselineFile.pcl3gui and PrintedFile.pcl3gui are compared. The Solution is also implemented in Generation2 of Cloud platform as shown in Fig 6.

PRIOR SOLUTIONS

There are no solutions available to compare PCL3 files. There are PCL viewers in the market such as Redtitan EscapeE which is used just for viewing PCL3GUI files, it would not do comparison of two PCL3GUI files. PCL viewer does not show Margins, Formats, Page Scaling and Page size differences. These differences cannot not be verified unless printed.

Link for PCL Viewer http://www.pclviewer.com/help/index.html?home_page.htm

ADVANTAGES

1. **Revenue** - Software can be integrated to various other solutions and software where PCL3 print formats are used for Printers.
2. **Eco-friendly**- With the proposed solution that compares the PCL3GUI formats before printing, Ink and Paper usage can be reduced.
3. **Leverage** – PCL3GUI Compare **Solution can be leveraged** and integrated with any job submission tools.
4. **Improves Test Coverage** – Improves the test coverage. Tests can be run simultaneously across multiple PCL devices and stacks.
5. **Removal of Hardware dependency** – No need to have real Printers to verify the PCL3 outputs. Printer Simulator can be used to compare the PCL3GUI outputs

6. **Removal of Person dependency** – No need to depend on the trained observer to verify, as this innovative solution will compare the PCL3GUI outputs.
7. **Optimizes the Cost** - Optimizes the cost incurred for Manual test execution efforts.

References

[1] History of Printer Command Language (PCL) -
<http://www.csgnetwork.com/hppclhist.html>

[2] Page Description Language :
http://www.undocprint.org/formats/page_description_languages/pcl

[3] Printer Job Language Reference Manual
https://developers.hp.com/system/files/PJL_Technical_Reference_Manual.pdf

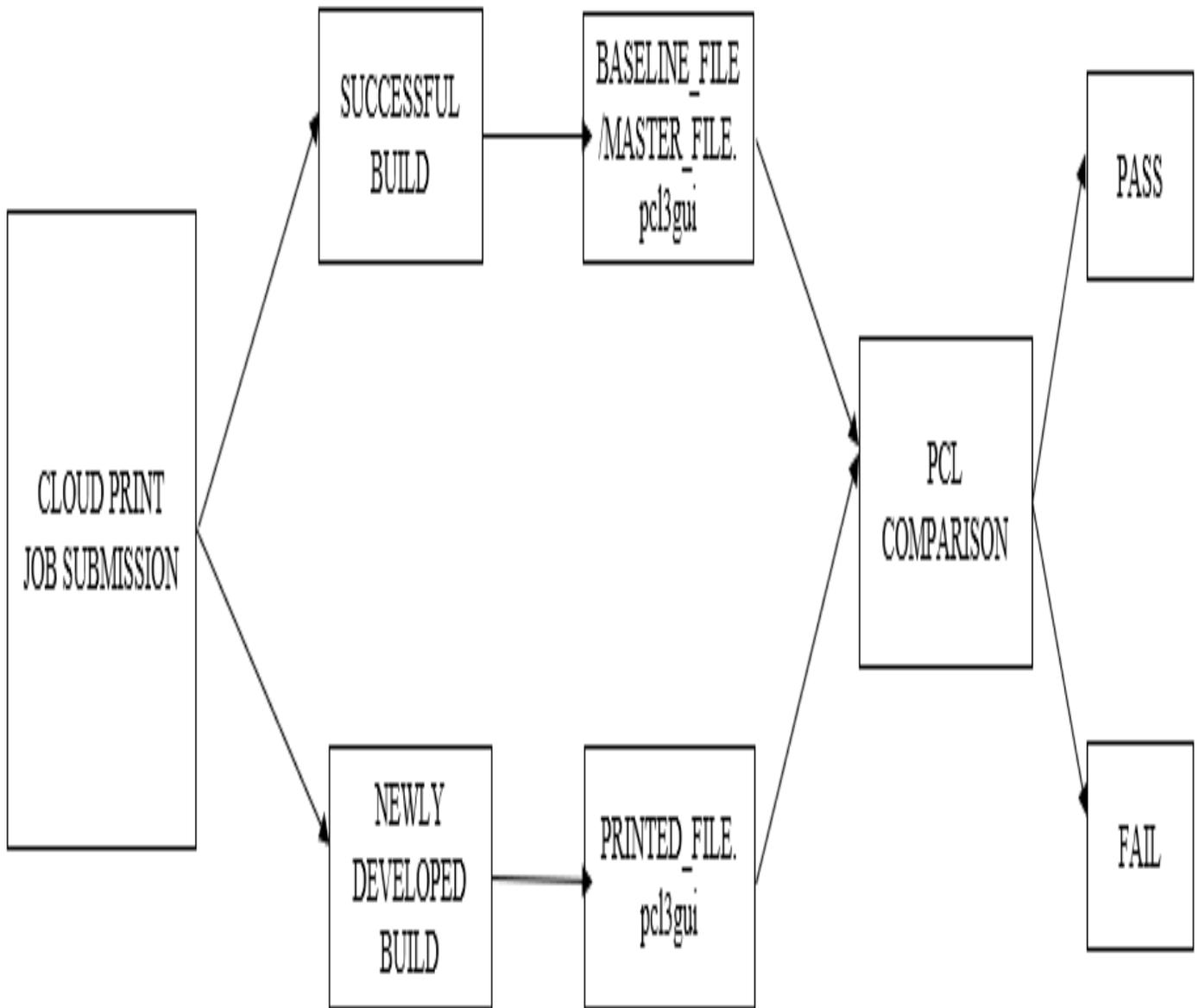


Fig 1

```

@PJL COMMENT-"Job Start Time: Tue Apr 15 04:58:32:658 2014"
@PJL JOBNAME-"file"
@PJL SET JOBNAME-"file"
@PJL COMMENT-"PS2; Windows Vista 6.1.7601 Service Pack 1; UNIDRV.DLL; 6.1.7600.16385 (win7_rtm.090713-1255); hpvpldrv10.dll; 10.93.00.1216;"
@PJL COMMENT-"Username: SYSTEM; App Filename: file; 4-15-2014"
@PJL SET JOBATTR-"JobAcct1-SYSTEM"
@PJL SET JOBATTR-"JobAcct2-C0007141"
@PJL SET JOBATTR-"JobAcct3-Ext=anet.hp.com"
@PJL SET JOBATTR-"JobAcct4-20140415045832"
@PJL SET JOBATTR-"JobAcct5-006790c6-7528-41e6-9aac-c906aaafc9bf"
@PJL SET TIMESTAMP-20140415045832
@PJL SET JOBATTR-"JobAcct6-Spooler Subsystem App"
@PJL SET JOBATTR-"JobAcct7-"file"
@PJL SET JOBATTR-"JobAcct8-"SYSTEM"
@PJL SET JOBATTR-"JobAcct9- (null)"
@PJL ENTER LANGUAGE-PCL3GUI
@PJL SET USERNAME-"SYSTEM"
@PJL ENTER LANGUAGE-PCL3GUI
[Start Raster]
[Row 0]
[Row n]
[End Raster]
Page 1
-----
-----
[Start Raster]
[Row 0]
[Row n]
[End Raster]
Page N
Esc-12345X [Universal End-Of- Language]

```

Fig 1

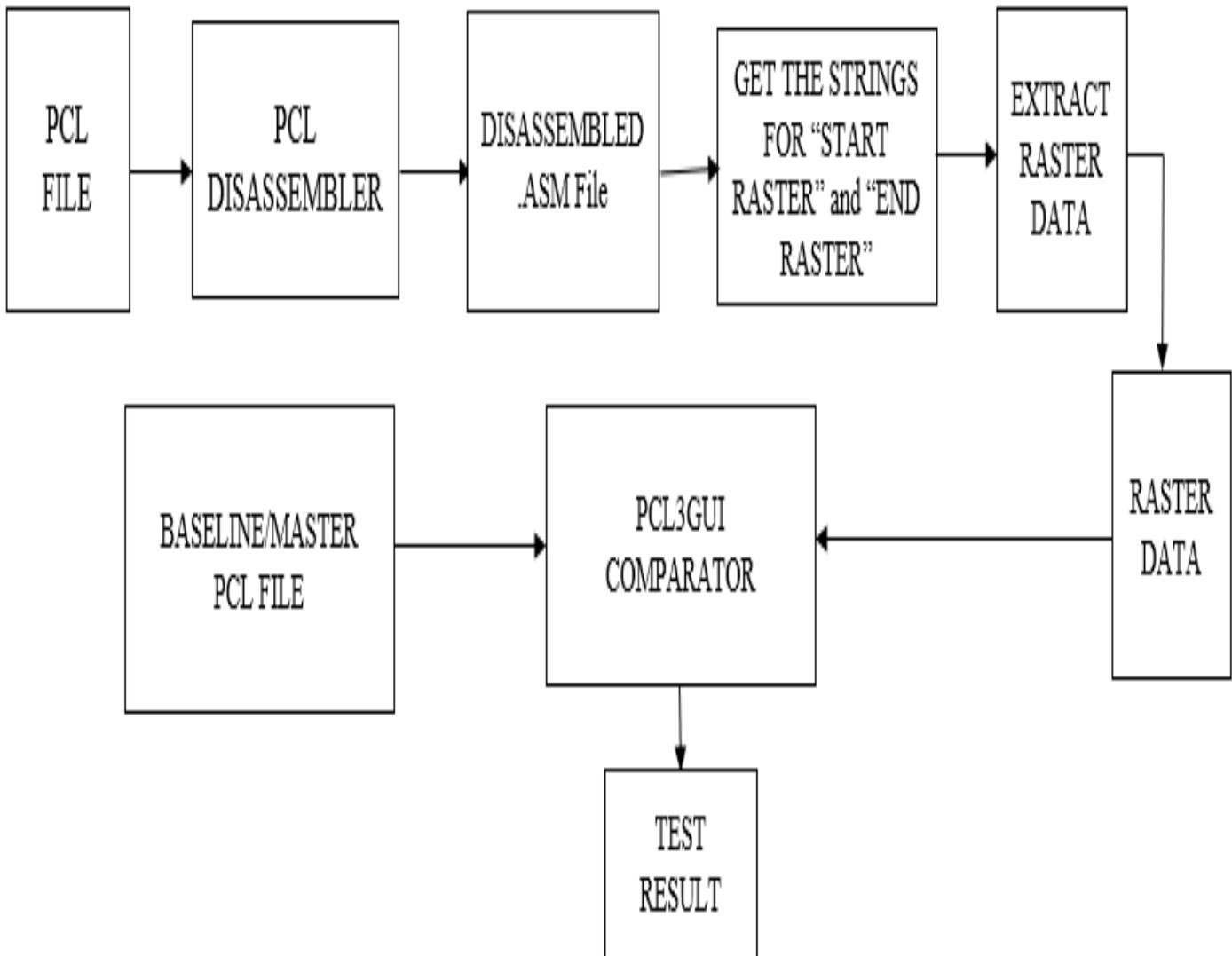


Fig 3

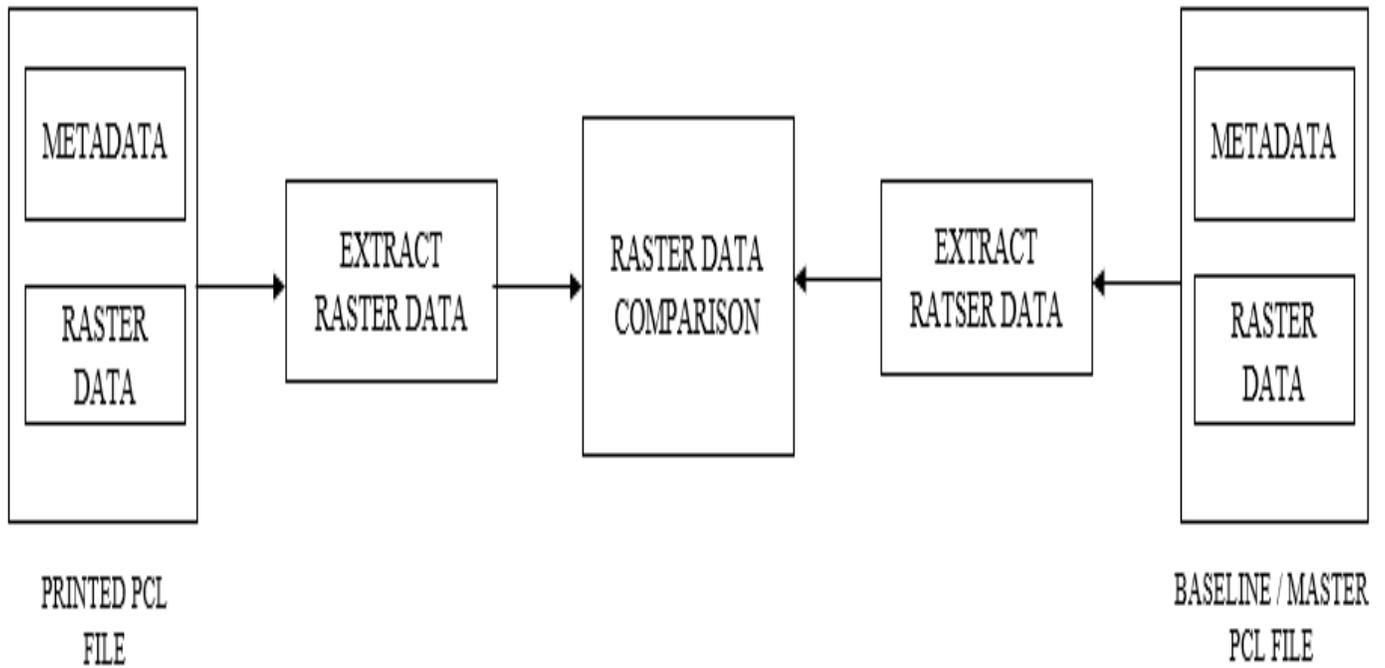


Fig 4

Menu

Welcome Pushpa

[Home Page](#)

[Dashboard](#)

[Test Case Management](#)

[Test Set Management](#)

[Stack Management](#)

[BaseLine Management](#)

[Result & Reports](#)

[Archival](#)

Step number=2, detail=Upload document for print
 PUT: <https://onramp-ext-test4.itcs.hp.com/onramp/jobs/printjobs/01Sc61e6125-4c11-4651-acc9-58dd0ad82731/documents/01Sc3453b38-ed>;

Result of assertions:
 The assertion "Status" of type "Equals" "PASSED" because expected value is "200" and actual value is "200".

Assertions for this step passed. :)
 Output file is to be compared with the baseline document.
 Waited for 180 seconds to download the printed file.
 Result of comparison with Baseline Document: Passed
 Baseline Document Url: http://expedite.ind.hp.com/eXpedite/download.do?baselineDetail=6105:2.1v_OJ_test2:BaselineFile.pd3gui
 Comparison result is Passed
 Compared Output Document Url: <http://expedite.ind.hp.com/eXpedite/download.do?artifactDetail=6105:120854:PrintedFile1.pd3gui>
 Output Document Url: <http://expedite.ind.hp.com/eXpedite/download.do?artifactDetail=6105:120854:InstructionPage.pd3gui>
 Comparison Log File Url: <http://expedite.ind.hp.com/eXpedite/download.do?artifactDetail=6105:120854:comparator.log>

 Stop printer initiated successfully.

 Detail of step executions: <http://expedite.ind.hp.com/eXpedite/download.do?artifactDetail=6105:120854:executiondetails.txt>

Fig 5

PCL3GUI COMPARATOR

```

Pages match
Line found for start raster of Baselinefile!! 20984

Line found for start raster for Printfile!! 20984

Line found for end raster in Baselinefile!! 24175

Line found for end raster in Printfile!! 24175

Pages match
Line found for start raster of Baselinefile!! 24177

Line found for start raster for Printfile!! 24177

Line found for end raster in Baselinefile!! 29879

Line found for end raster in Printfile!! 29879
    
```

```

Pages match
Files match!
    
```

```

[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
    
```

```

[INFO]
[INFO] total time: 44.947 s
[INFO] finished at: 2018-04-23T11:52:04+00:00
[INFO] final Memory: 278/60M
[INFO] -----
Started calculate disk usage of build
Finished calculation of disk usage of build in 0 seconds
Started calculate disk usage of workspace
Finished calculation of disk usage of workspace in 0 seconds
Finished: SUCCESS
    
```

Fig 6

Disclosed by Pushpalatha K. R., HP Inc.