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July 30, 2018

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Recommended Citation

INC, HP, "TRANSFERRABLE QUOTA SYSTEM FOR PRINT DEVICES", Technical Disclosure Commons, (July 30, 2018)
https://www.tdcommons.org/dpubs_series/1378



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Transferrable Quota System for Print Devices

Abstract

In the world of printing, a print quota is an administrator imposed restriction which limits the number of prints that can be printed by a particular user. Such quota services are popularly used in Enterprise Business, Schools, College and Universities. In the quota service, administrator given credit which may be in terms of currency is based on the calculation of number of pages printed. Once the quota is over, the user can't print anymore and they need to buy the credit from the Administrator.

A transferable quota system would be an advantage for the users, especially in the case of printing an important job when the user is short of the quota credit and unable to buy/recharge quota credit immediately. This paper discusses an idea of having a transferable quota system among users for print devices.

Problem statement

Existing quota system in print devices is based on the number of pages to be printed. Credits from quota for a user will be deducted depending on number of pages printed, though the sizes of paper used, duplex or simplex mode etc. are considered to define the cost of a print job.

Quota system is widely used in schools, colleges and universities in the form wherein they define the number of credit based on the number of pages per students per year or per semester. Few educational institutes provides the credit in the form of currency wherein cost of each job is calculated and charged with currency accordingly. In the enterprise world as well quota is given for a specific period of time, per employee. Once the quota is over for a student/user, they need to go through a process wherein they need to request to the administrator for additional quota and once approved they would be able to resume the printing again. While this process is systematic, it is time consuming. When user is in need of printing an important document and is running short of quota, a transferable quota system would be real handy.

Solution

An example of quota system is explained below. Quota based printing is already existing on HP printers.

The screenshot shows a web interface titled "Device User Accounts". Under the heading "New Device User Account", there are several input fields:

- Display Name:** user1
- Email Address:** user1@quota.com
- Contact Number:** +919999911111
- Network Name:** User1
- Access Code:** 11111
- Permission Set:** Device User (selected from a dropdown menu)

Figure 1: Local user details added to print device database.

Figure 1 depicts a Local user 'user1' added to the printer local database. This database is used to store information about all the local users and is stored in the printer hard disk and is maintained by the print device.

The screenshot shows the configuration page for user "user1". It includes a table of user details and a section for defining quotas for different job types:

Display Name	Email Address	Permission Set
user1	user1@quota.com	Device User

Action: Stop

Black/Empty Print: 250 (0 to 999999) credits

Color Print: 150 (0 to 999999) credits

Black/Empty Copy: 500 (0 to 999999) credits

Color Copy: 150 (0 to 999999) credits

Digital Send: 1000 (0 to 999999) credits

Figure 2: Quota of local user "user1" defined

Figure 2 depicts a local quota configured for user user1, where he has different credits for different type of jobs such as black/monochrome print, color print, black/monochrome copy and color copy.

Name	Black/Empty Print	Color Print	Black/Empty Copy	Color Copy	Digital Send	Action
<input type="checkbox"/> Guest	0 of 0	0 of 0	0 of 0	0 of 0	0 of 0	Stop
<input type="checkbox"/> Others	0 of 0	0 of 0	0 of 0	0 of 0	0 of 0	Stop
<input type="checkbox"/> Administrator	1000 of 1000	500 of 500	1000 of 1000	500 of 500	10000 of 10000	Stop
<input type="checkbox"/> user1	250 of 250	150 of 150	500 of 500	150 of 150	1000 of 1000	Stop
<input type="checkbox"/> user2	250 of 250	150 of 150	500 of 500	150 of 150	1000 of 1000	Stop

Figure 3: Local Quota defined in the print device

Figure 3 depicts the quota system for the print device where in each user quota is defined for different type of print jobs. Once the quota is used this list will be updated automatically by the print device. Once the quota for a user is over, its Action is defined as “Stop” as highlighted which means once the quota is over the job will be stopped.

Usage Charges

Use this area to specify the credit cost for each color printed slide, black printed slide, empty printed slide, and scanned slide. All copy job charges will be deducted from either Black/Empty Copy credits or Color Copy credits (not from Scan credits) based on the Color/Black setting and image color. If the printed slide is color, the scan and print charges will be deducted from Color Copy credits. If the printed slide is black or empty, the scan and print costs will be deducted from Black/Empty Copy credits. If the original document is color but the copy will print in black because the Color/Black option is set to Black/Gray, the costs for scans and prints will be deducted from Black/Empty Copy credits.

Charge Type	Cost in Credits (0 to 999999)
Color print side	3
Black print side	2
Empty print side	1
Scanned side	1

Figure 4: Charges defined for quota system shown in Figure: 3 in printer

Figure 4 depicts the charges defined for different type of print jobs. Depending on the type of job used by a user, its credit will be deducted from its quota accordingly.

Display Name	Email Address	Permission Set
user1	user1@quota.com	Device User

Action

Stop (selected)
 Stop
 Finish
 Borrow

Black/Empty Print 250 (0 to 999999) credits

Color Print 150 (0 to 999999) credits

Black/Empty Copy 500 (0 to 999999) credits

Color Copy 150 (0 to 999999) credits

Digital Send 1000 (0 to 999999) credits

Figure 5: Modified Quota of local User “user1” defined

Name	Black/Empty Print	Color Print	Black/Empty Copy	Color Copy	Digital Send	Action
<input type="checkbox"/> Guest	0 of 0	0 of 0	0 of 0	0 of 0	0 of 0	Stop
<input type="checkbox"/> Others	0 of 0	0 of 0	0 of 0	0 of 0	0 of 0	Stop
<input type="checkbox"/> Administrator	1000 of 1000	500 of 500	1000 of 1000	500 of 500	10000 of 10000	Stop
<input type="checkbox"/> user1	250 of 250	150 of 150	500 of 500	150 of 150	1000 of 1000	Borrow
<input type="checkbox"/> user2	250 of 250	150 of 150	500 of 500	150 of 150	1000 of 1000	Borrow

Figure 6: Modified Local Quota defined in the Print Device

A new option is introduced to indicate if user is allowed to borrow the quota from other users. To have a transferable quota system, once the user quota is over, it can borrow quota from a different user depending on the action defined by the administrator as highlighted in the *Figure: 05 and 06*.

We can have local as well as remote print job in the print device. When print is initiated from printer control panel or any embedded web interface of the printer, it is referred as local print where as when print is initiated from a remote device or client, it is accounted as remote print. Remote print request to the printer can come via port 9100/http/ https. To differentiate and to have a cleaner solution, two quota system can be defined, one for local print job and one for remote print job.

Transferable quota system for Local Print Job:

As and when a user initiates a local print job at the control panel by using printer provided local authentication mechanism, print device will extract the number of pages and will search the username in the local printer database and get its available quota.

If the user's available quota is greater than what is required for the job to be completed, print job will be completed and depending on the charges defined for the type of the job, quota will be deducted.

If the user's available quota is less than what is required for the current job to be completed, user will be prompted with an option if it wants to get quota from different user. If user (say user1) is fine to get the remaining quota required for current job to be completed, user1 will be asked to provide the username of the other user (say user2) from which it wants to borrow the quota. Once user 'user1' provides the username of the other user 'user2', print device will search the local database if 'user2' is a valid user and has quota available that user1 is needed to complete its job. Once it is verified that user2 has required quota needed by user1, user2's contact number and/or email address will be fetched and an OTP will be send to user2 email/contact number.

User1 has to get the OTP from user2. Once user1 receives the OTP shared by user2, it will provide it in the print device and upon successful validation of OTP, user1's job will be completed using its own full quota and user2's granted quota. Quota for both user1 and user2 is updated.

If user2 has not enough quota available requested by user1, it will prompt user1 to get the quota from a different user. If user2 is not a valid user or user2 doesn't grant user1, user1 will be prompted to borrow quota from other users. A restriction of maximum three attempts can be enforced.

If user initiates a print job without any authentication, it will be treated as a guest and guest's quota will be used if it is available.

Transferable quota system for remote Print Job:

For remote quota, user's quota credit will be defined in the remote LDAP Active Directory. The quota system shown in figure2 and 3 can be replicated in LDAP Active directory.

As and when a user initiates a local print job at the control panel by using network authentication mechanism (LDAP/windows/smartcard) or when a remote print job is received by the print device via 9100/http/https/ftp, the username (say user1) associated with the job or the signed in network user and number of pages from print job will be extracted. Print device will connect to the LDAP Active Directory and verify if it's a valid user. On successful verification, user's available quota will be fetched from LDAP and compared against the number of pages of the current job.

If the user's available quota is greater than what is required for the job to be completed, print job will be completed and depending on the charges defined for the type of the job, quota will be deducted.

If the user's available quota is less than what is required for the current job to be completed, printer will hold the job temporarily. A notification indicating that the job cannot be completed as it requires more quota and needs manual intervention to complete the job, will be send to user email and/or contact number. Upon receiving notification user has to come to printer control panel and on retrieving its job which is held temporarily by the printer, user will be prompted with an option if it wants to borrow quota from different user to complete the job. If user (say user1) is fine to get the remaining quota required for current job to be completed, user1 will be asked to provide the username of the other user (say user2) from which it wants to borrow the quota. Once user 'user1' provides the username of the other user 'user2', print device will search the LDAP database if 'user2' is a valid user and has quota available that user1 is needed to complete its job. Once it is verified that user2 has required quota needed by user1, user2's contact number and/or email address will be fetched from Active directory and an OTP will be send to it.

User1 has to get the OTP from user2. Once user1 receives the OTP shared by user2, it will provide it in the print device and upon successful validation of OTP, user1's job will be completed using its own full quota and user2's granted quota. Quota for both user1 and user2 is updated.

If user2 has not enough quota available requested by user1, it will prompt user1 to get the quota from a different user. If user2 is not a valid user or user2 doesn't grant user1, user1 will be prompted to borrow quota from other users. A restriction of maximum three attempts can be enforced.

If username associated with the job is not valid or not part of LDAP Active Directory, it will be treated as a guest and guest quota will be used if it's available.

Below flow charts explain the solution for both local and remote print for guest and authenticated users.

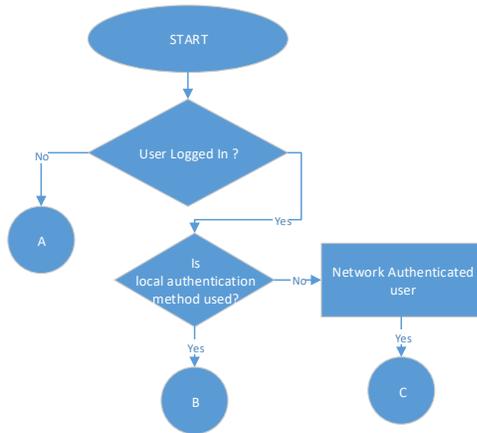


Figure 7: Determine the user's role (Guest or Local user or Network User)

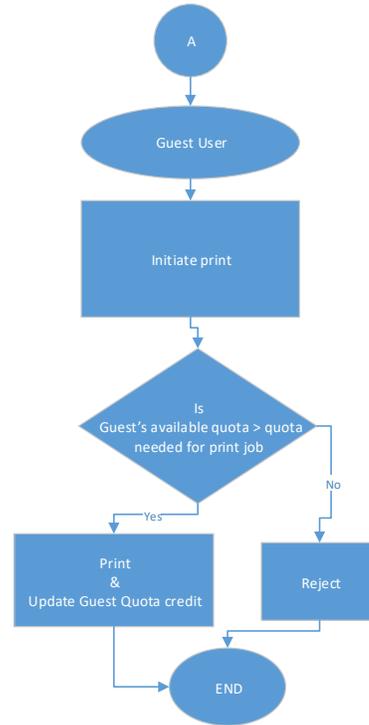


Figure 8: Print Job initiated by guest user (continued from Figure 7)

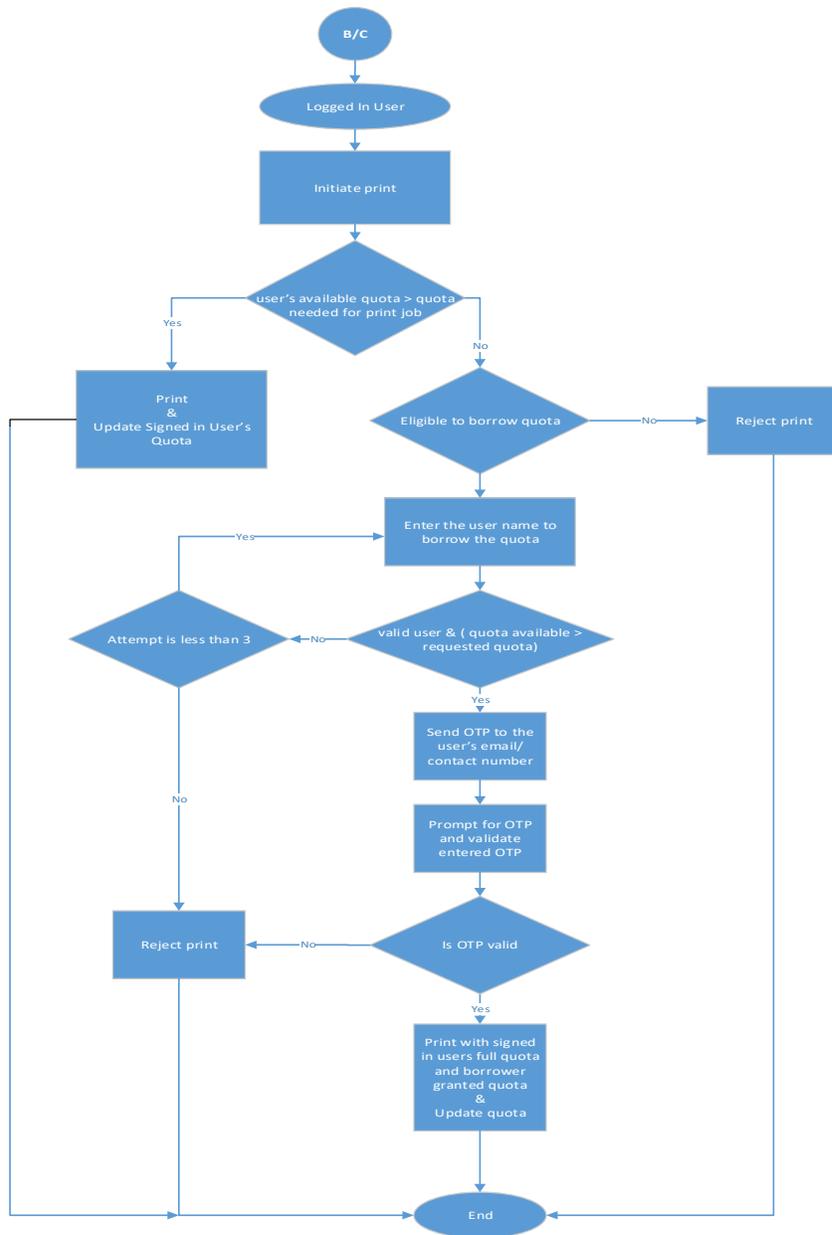


Figure 9: Local print job initiated by local or network user (continued from Figure 7)

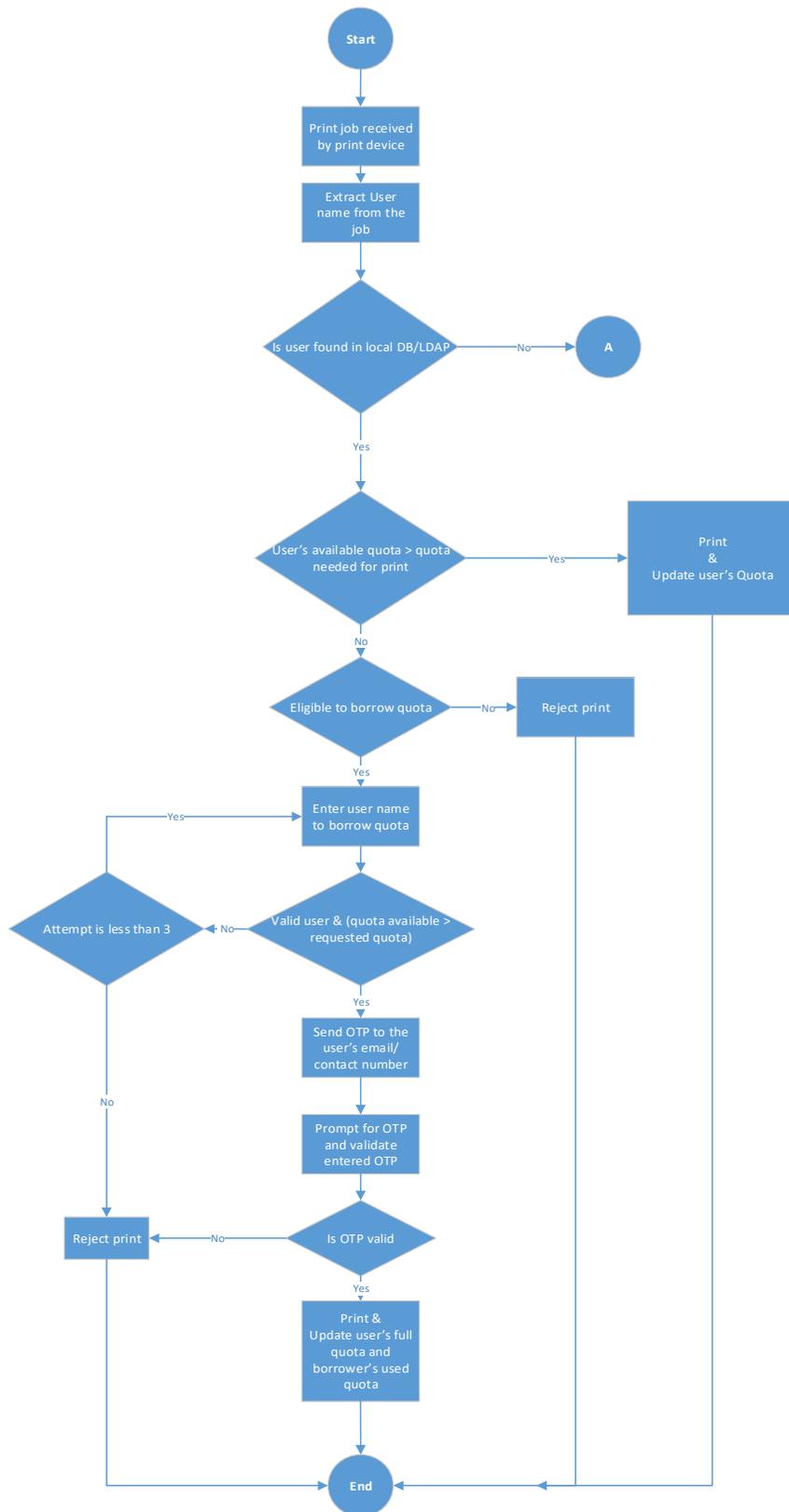


Figure 10: Print job initiated by remote user

Prior Solution: There are no prior solutions which offer quota sharing on HP printers. Looking at the other printer vendor's documentation and third party solutions, even they offer an options for quota but not sharing of quota across users.

Advantages:

- ✓ Enhanced user experience by enabling continuous printing.
- ✓ Enables sharing of quota between friends and families.
- ✓ Ease of use.

Disclosed by Gopesh Bhardwaj, Sannagonappla Pampanna Mahendra, Sahu Rajakishore, Pradhan Puranjaya and Asghar Md, HP Inc.