

Celiveo 8 Secure Print Management

White Paper

https://www.celiveo.com

NOVEMBER 2026

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Creating business solutions helping people to work, wherever

Revisions

Version	Date	Author	Comments
1.0	20181010	LD	1st Edition for version 8 R1
1.1	20181220	JF	Revision for version 8 R1SP2
1.2	20190109	LD	Revision for version 8 R2
1.3	20190206	JF	Revision for version 8 R3
1.4	20190206	ST	Revision for version 8 R4
1.5	20190702	ST	Revision for version 8 R5
1.6	20191120	ST	Revision for version 8 R6
1.7	20200211	JF	Revision for version 8 R7
1.8	20200428	JF	Revision for version 8 R8
1.9	20200615	ST	Minor corrections
2.0	20200714	JF	Update
2.1	20221001	JF	Update
2.1	20261110	LD	Update

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About Celiveo

Celiveo is creating business solutions helping people to work, wherever.
Celiveo has been granted international patents for its Documents Security Management solution in the US, Singapore and Australia, comprising more than 30 key claims that are the basis of its permanent innovation process. This technology is materialized in our Celiveo Enterprise solution.

Celiveo is organized in 5 sales and support structures:

- Celiveo EMEA for EMEA
- Celiveo Americas for USA and Latin America
- Celiveo Canada for Canada
- Celiveo Pte Ltd for Asia Pacific

You can contact them through the Celiveo web site at https://www.celiveo.com by clicking the links at the bottom of the page.

This international structure makes Celiveo one of the few Enterprise-Class print management software publishers capable of delivering service and support globally. Our solution is also localized in 17 languages to meet our customers' needs.

When most solutions are for small and medium business, our clients are mostly large enterprise companies with high security, mobility and cost reduction requirements who find in Celiveo a scalable, innovative and cost-effective solution. Celiveo 8 is our on-premises solution and Celiveo 365 our SaaS.

The aim of Celiveo R&D is to provide a solution to the growing request from our clients for a comprehensive solution that removes all print servers and all print application servers then optimizes the number of printers while not disrupting the end-user work when printers or MFPs are changed in the field.

Quality of service and products has always been a key objective for Celiveo, and this is necessary to be able to serve enterprise clients around the world. Celiveo is ISO9001:2015 certified since 2008 and ISO27001:2022 since 2024.

This document describes the Celiveo 8 on-premises Print Management solution, how it resolves printers and document management issues in small and large organizations. Not all features are shown, we recommend you check the list of capabilities included in the 4 Celiveo Editions: Print Direct, Business, Business+ and Enterprise.

1. High Level Architecture

The aim of the Celiveo 8 solution is to:

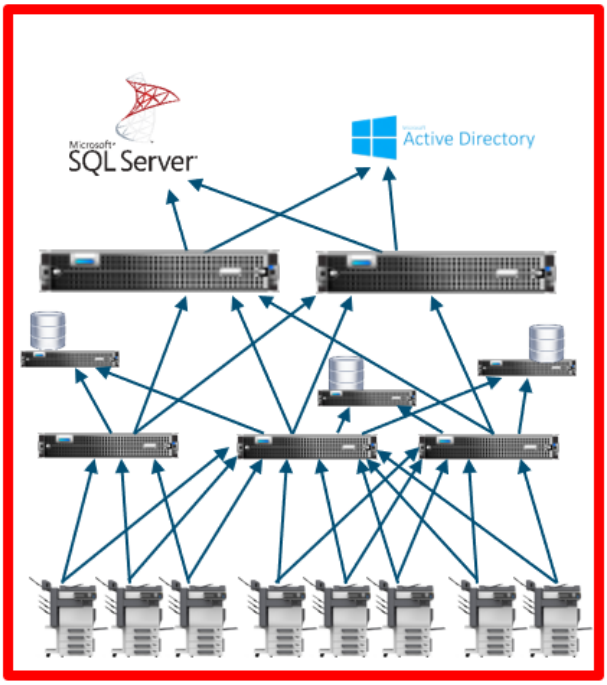
- Secure printers, MFPs access and documents printing throughout the company
- Provide Pull Print capability with full roaming, low bandwidth usage and High Availability
- Remove print servers and print management servers as they are very costly in TCO & CO^2
- Help to optimize the number of printers and copiers throughout the company
- Help end-users in their usage of printers and copiers, to locate the most appropriate printer
- Inform users and management about print and copy usage and cost, as well as savings
- Provide accurate tracking information as $, CO^2 and tree-equivalence units

1.1 A fully distributed architecture

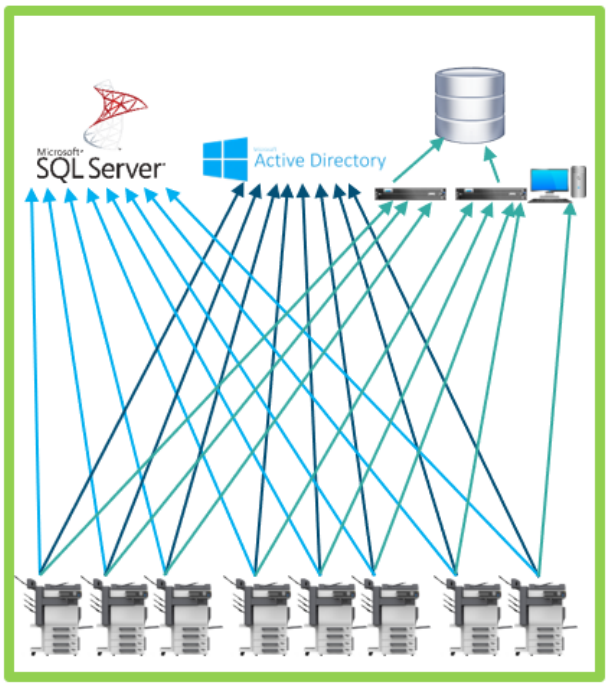
Unlike all other solutions, Celiveo intelligence is not on servers, it is at the printer level, using ZeroServer Edge Computing Technology.

Pull Print architecture, from the printers' view:

Printers without Celiveo



Printers with Celiveo



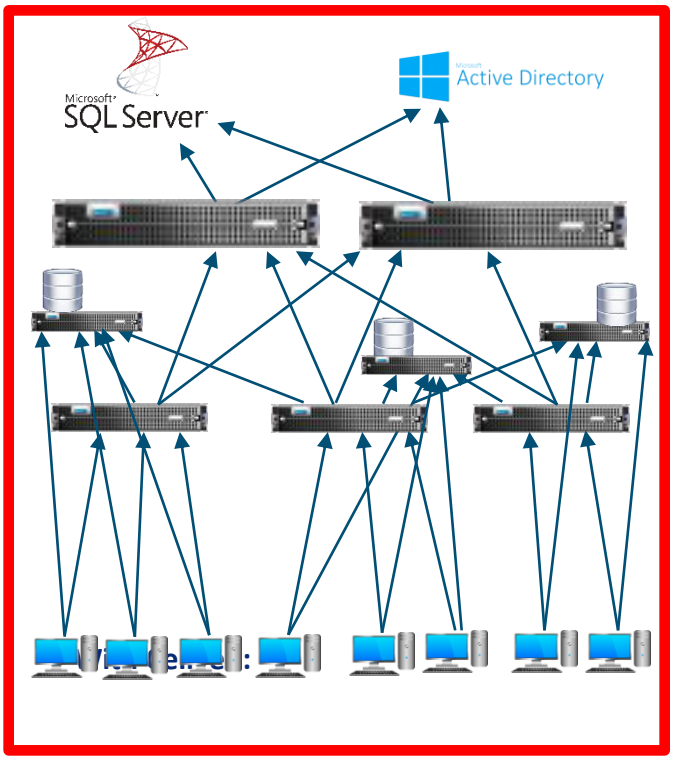
With Celiveo:

- Each printer connects directly to the IT backbone for AD and SQL Server
  - No dependency on any server
- Each printer has caches and failover mechanisms for High Availability

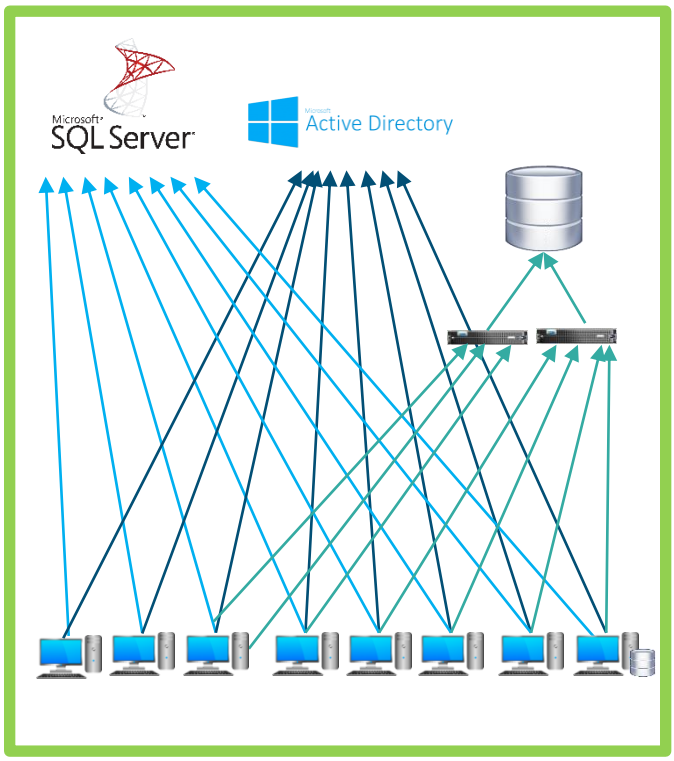
  - Very high-speed authentication
  - Access control, tracking and Pull Print are possible even if the WAN/LAN/SQL/AD are unreachable
  - Access control for copy/fax and tracking are available even if the network is down
- The solution is immune to servers Operating System and solution updates
  - Other solutions are affected by application server reboots or require multiple servers to be immune to updates/reboot
- No Master-Slave server system, no complex architecture prone to downtime
- Full scalability and Cloud compatible through local storage on PC HDD (low bandwidth) and NAS storage (high bandwidth) with possibility to mix the storage modes

Pull Print on PCs, server-based and/or ZeroServer

PCs without Celiveo 8



PCs with Celiveo 8



Pull Print queues can be installed on:

- Print Servers (Print-Server-based Pull Print) and VDI (Virtual Desktop Infrastructure)
- User client PC (ZeroServer, using a light client service on the Windows PC or macOS)

Print jobs can be stored:

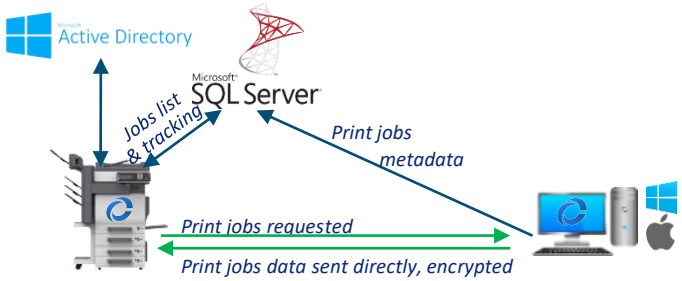
- On the local storage (Server or local PC)
- On a NAS (local or Cloud/Datacenter) for even better resilience

There is no forced architecture, it is even possible to mix both, have some users store print jobs on NAS/Print server, i.e. for laptops, and have some users store print jobs on the local PC, i.e. for desktops.

Printers query a SQL Server to know where print jobs are for a user, then connect directly to the print server or end-user PC that holds the print jobs to request them. The print job is then sent directly from the storage sources to the printer.

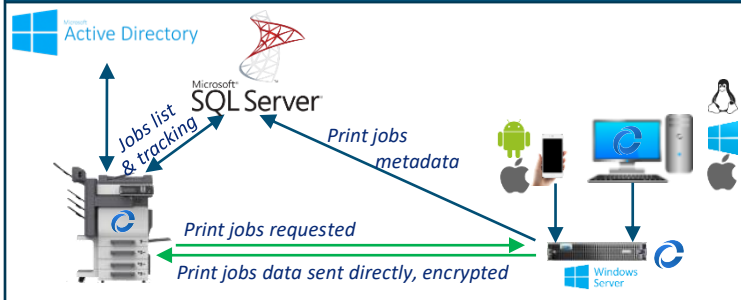
Celiveo provides a simple, scalable, flexible and resilient architecture:

Celiveo ZeroServer Pull Print



- No application server, technology embedded in printer or micro appliance
- All print jobs stay local
- SQL & AD can be local or in Cloud
- TLS 1.2-encrypted AD/SQL transactions
- Print jobs encryption for most editions
- SQL Express & AD LDS supported for small setup & projects without AD

Celiveo Print-Server Pull Print



- No application server, technology embedded in printer or micro appliance
- Print jobs stay local, from shared Print Queue
- SQL & AD can be local or in Cloud
- TLS 1.2-encrypted AD/SQL transactions
- Print jobs encryption for most editions
- SQL Express & AD LDS supported for small setup & projects without AD

- User print jobs tickets
- Tracking information
- Solution settings
- Information & errors log







- User authentication
- Enrollment into AD (optional)
- User groups and OU

- Get print jobs directly from shared print queue or indirectly from NAS, if applicable





- Get print jobs directly from end-user PC, if applicable

- High Availability Cache
  - Users unclassified information (encrypted):
    - UPN
    - DisplayName
    - FQDN
    - domain
    - @ address
    - OU, groups
  - Tracking information, when SQL Server is unreachable

Pre-requirement

- Compatible printers and MFPs with latest supported firmware
- Network access to Active directory, SQL Server instance. For small networks without AD or SQL Server, it is possible to use the free AD LDS and SQL Express as a replacement.
- Network access to Print Servers (if used) and to client PCs
- Ability to open a very few ports for communication on the intranet (no connection to the Extranet needed)

1.2 Printers and MFP support

The features available on a printer or MFP depend on the device brand, model and firmware. On most models all the features are available: User authentication, Pull Print, rules-based printing and tracking with full integration on the printer screen. On models where integration on the printer screen isn't possible, the user authentication with instant pull print and tracking are always available. Celiveo can also run inside some printers through firmware extension (embedded) or outside the printer on the Celiveo Smart Appliance, (CSA) a LAN micro-appliance itself connected to the printer network port.

Printer type	User authentication	Pull Print service	Rules based printing	Copy/Scan control	Print tracking	Copy/Scan tracking	Integration on printer screen	Embedded/ Appliance
FujiFilm	*Coming soon*	*soon*	*soon*	soon	soon	soon	soon	Embedded
HP LaserJet Enterprise	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Embedded
HP LaserJet Pro MFPs	Yes	Yes	Yes	Most	Yes	Most	Most	Appliance
HP LaserJet Pro	Yes	Yes	Yes	Most	Yes	Most	Most	Appliance
HP wide format	Yes	Yes	Yes	Most	Yes	Most	T1600/2600	Appliance
Other HP network	Yes	Yes	Yes	No	Yes	No	No	Appliance
Konica Minolta Bizhub	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Appliance
Lexmark printer	Yes	Yes	Yes	N/A	Yes	N/A	with screen	Appliance
Lexmark MFPs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Embedded
Ricoh SOP 2.X MFPs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Embedded
Other Ricoh MFPs	Yes	Yes	Yes	No	Yes	No	No	Appliance
Xerox printers (EIP)	Yes	Yes	Yes	Yes	Yes	Yes	with screen	Appliance
Xerox MFPs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Appliance
Other network printers	Yes	Yes	Yes	No	Yes	No	No	Appliance

Please refer to the www.celiveo.com web site for the exact list of supported printers/MFPs, the table above is a simplified table and exceptions may exist for some printers support.

2. Installation, deployment

2.1 Celiveo 8 Web Admin

Celiveo Web Admin is where the installation starts. It is the IIS-based web portal used to display and update the SQL database where the distributed architecture gets and set all its information. Deployment of the front end portal is very easy and fast, around 5 min not counting the SQL Server installation time (as most clients already have instances). Unlike other solutions, it does not need to be up and running for the solution to work.
Amongst other features, the installation of the Celiveo Web Admin includes:

- Installation wizard, from start to end with verification of pre-requirement
- Verification of credentials in real time in the wizard
- Installation of SQL Express if no existing instance can be used, creation/update of databases
- Automatic upgrade from previous Celiveo releases

Once Celiveo Web Admin is installed, the SQL database is ready and the remaining tasks are about deploying Printer agents to provide Pull Print and PC clients to provide Serverless Print-Direct, Serverless Pull Print or Server-based Pull Print. Celiveo Web Admin supports delegation, where part of the printers fleet administration can be delegated to sub-administrators who only see that part.

2.2 Celiveo Printer agents

The Celiveo Printer Agent is where the intelligence is located, at the printer level. It is a software loaded by the printers themselves from SQL Server or USB sticks, after a start code is loaded by the Celiveo Web Admin (this is called a bootstrap loader).

MASS DEPLOYMENT



ZeroConfig technology

Printers get the Celiveo solution from the Intranet and clone existing master printer, with just a USB stick to fully add & setup a printer



CLI and RESTful APIs

Integrate API to your scripts, to deploy Celiveo, update the license or sync printers with latest settings or cloning a master printer setup



Web Console

Intuitive and configurable Web UI with big-data filtering for fleet and events

POST DEPLOYMENT MANAGEMENT



Self-Healing

On some printer models Celiveo can automatically reinstall & self-configure i.e. if the HDD or formatter is replaced, or the printer replaced.



CLI and RESTful APIs

Integrate API to your scripts, to update the license, sync printers with latest Celiveo and/or new settings, get solution status, activate and get solution deep logs from printer



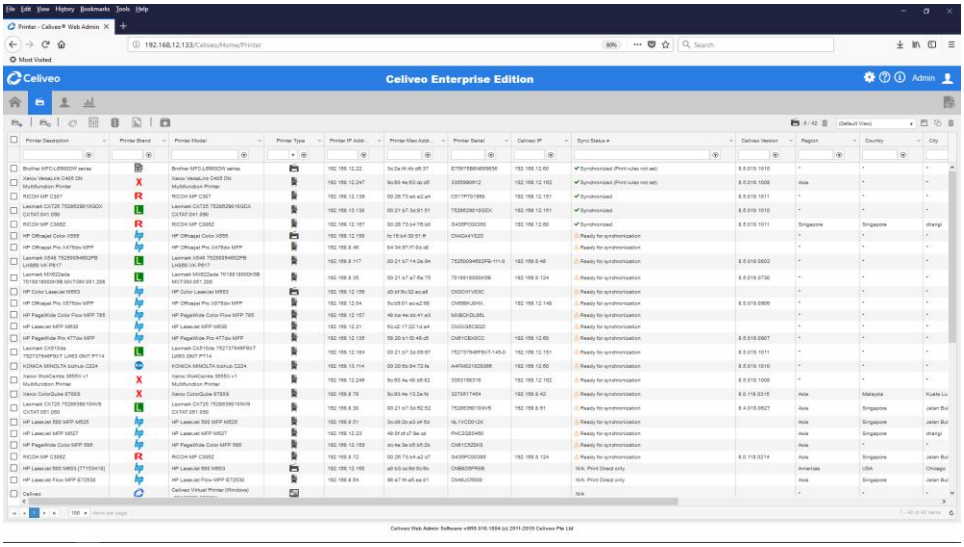
Web console

Intuitive control panel with live alerts communicated by printers and clients, big data UI with customizable
views and multiple tabs support for global monitoring

3. Celiveo 8 Modules

3.1 Celiveo 8 Web Admin Software

Celiveo Web Admin software is a user-friendly administration portal installed on an IIS server or PC. It is used to configure the solution and deploy it on printers. On the technical side, that web portal is just a front-end to SQL Server tables where the whole configuration is stored, and Celiveo nodes (printers, PCs, print servers…) connect directly to those SQL Server tables to get information and store status. All communication is TLS 1.2/1.3-encrypted as soon as the IIS Server encryption is activated. Access to the Celiveo Web Admin Software is controlled by static login/password or Active Directory/LDAP logins and/or groups.



The Celiveo Web Admin software allows you to load a list of printers IP address from a CSV file or discover them on the network, then apply to those devices some profiles that are either predefined or created on the spot then saved. Successful bandwidth tests have been performed with 35,000 printers defined on the portal.

The configuration of user authentication with cards for access control, cost definition and pull print is all done on the web portal. Settings are automatically saved into profiles that can be applied to new and existing printers for a very fast configuration process.

The deployment of the Celiveo solution on printers is accomplished by selecting printers and clicking on the “Sync” button.

Pre-requirement

- Operating System: Windows Server 2016, 2019 or 2022
- 8 GB RAM
- 4 Core
- Available disk space: 2 GB minimum

3.2 SQL Server instance for Celiveo 8

Celiveo 8 relies on SQL Server to share critical information used by the distributed architecture.

For a small setup, 100 printers and less, SQL Server Express is enough and can be installed automatically by the Celiveo 8 installer. It can also be an option to use SQL Server in a Private Cloud with a fixed IP in the Private Cloud and firewall rules to restrict that access to the SQL table to your (static) public IP address.

For a larger setup with less than 5000 printers and one region, one SQL server Standard or Enterprise is enough, and a standard clustered fault tolerance setup is strongly recommended.

For very large, multi-region setup, SQL Server enterprise edition is needed, and multiple instances of SQL Server are best with one server per region (to get the lowest latency) and for 3 to 5000 printers and MFPs, depending on the print load. Such servers can use CSV clustering for fast failover and merged replication so that information is available worldwide for roaming and job accounting reporting. A SQL instance in the Cloud can be used, with proper VPN access and SQL sizing to ensure good response time.

All communication to SQL Server, from printer, clients and Web Admin, is TLS 1.2-encrypted as soon as the SQL Server encryption mode is activated and TLS 1.2 set as the only authorized protocol.

Pre-requirement for each VM hosting SQL Server

- Microsoft SQL Server 2014, 2016 or 2019
- 2.0 GHz or faster CPU
- 4 Core, 12 GB RAM
- 500 GB storage or more, depending on tracking data (read below)

Celiveo does not require much storage space. Here is the average size for Celiveo data stored in SQL:

- Celiveo configuration: 100 MB
- Celiveo drivers library: 30 MB to 300 MB, depending on the driver version and quantity in library
- Celiveo users enrollment: 2 KB per user, for 10,000 users that's 20 MB
- Celiveo print job tickets: 2 KB per ticket, for 10,000 users with 10 pending jobs that's 200 MB
- Celiveo print tracking data: 2 KB per ticket, for 10,000 users printing 5 documents per day that's 32 GB per year, 160 GB over 5 years with data retention i.e. for audit purpose. Note that the tracking record can be much bigger in case users are part of many AD groups, as AD groups information can be as large as 64 KB per user.
- Total: 200 GB for 5 years tracking data.

3.3 Celiveo 8 Printer Agent

The Celiveo 8 solution runs in a secure, encrypted environment inside the printer or in the Celiveo Smart Appliance behind the printer to provide the User Authentication, Pull Print and Tracking functionality. It does not rely on a remote application server; all the intelligence is local. The miniature Celiveo Smart Appliance (CSA) connected to the printer LAN port as well as corporate network, is only needed when the printer does not provide the needed functionality to host the Celiveo 8 Printer Agent.

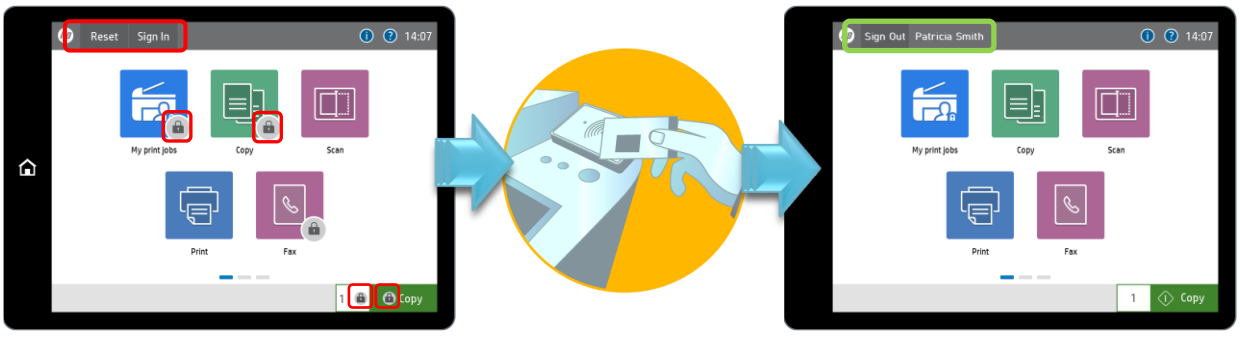
The Celiveo 8 Printer Agent is deployed to printers and CSA appliances using the intuitive, scalable and fast Celiveo 8 Web Admin portal. It is possible to easily configure from one to tens of thousands of printers with one or multiple profiles for access rules, print rules, cost profiles etc.

The Celiveo 8 Printer Agent is totally autonomous, read/write directly in SQL Server and/or Active Directory servers, communicates with the Cloud, requests documents from print jobs depository which can be on Windows PC, shared Windows server print queues or macOS clients.

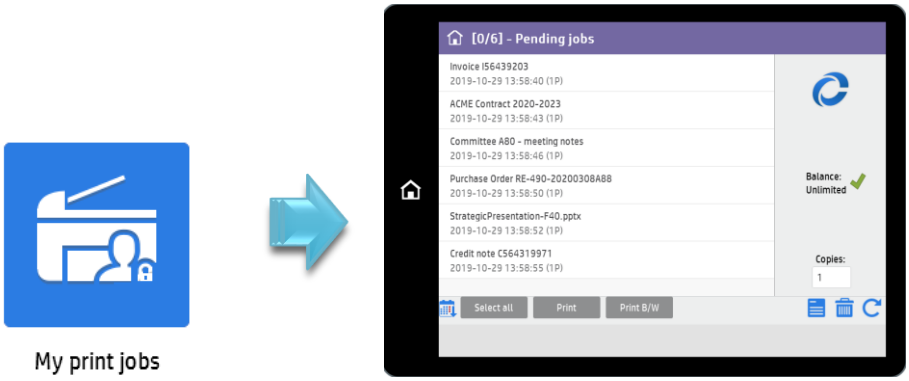
Printer agents are written in C++ or Java language, depending on their host printer or the CSA. Embedded Printer agents are tested and certified by Printer vendors before being signed and are secure against modification by third parties. The Celiveo 8 agent running inside the CSA is heavily tested, developed in C++ and is signed and secure before being released to clients.

The printer agent adds a “My Print Jobs” button on the printer screen, giving access to the pending print jobs list. That UI is similar across all printer brands, so that there is one single user experience.

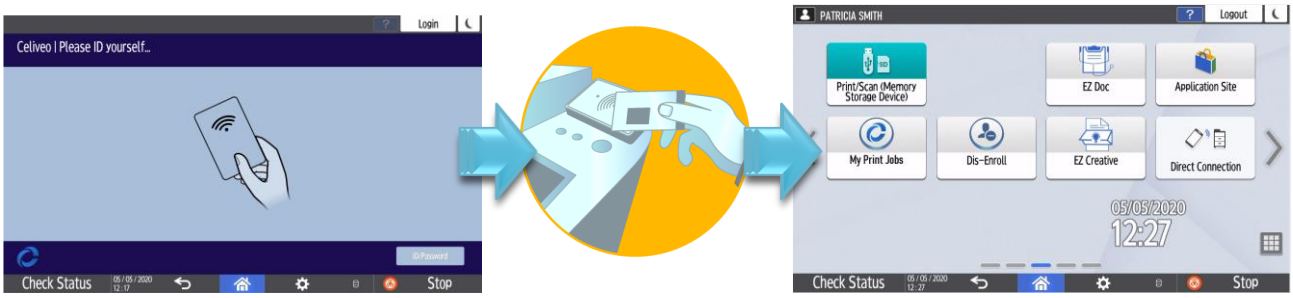
Example of Celiveo User Authentication on an HP MFP:



Example of Celiveo Pull Print jobs list on an HP MFP screen:



Example of Celiveo User Authentication on a Ricoh MFP:

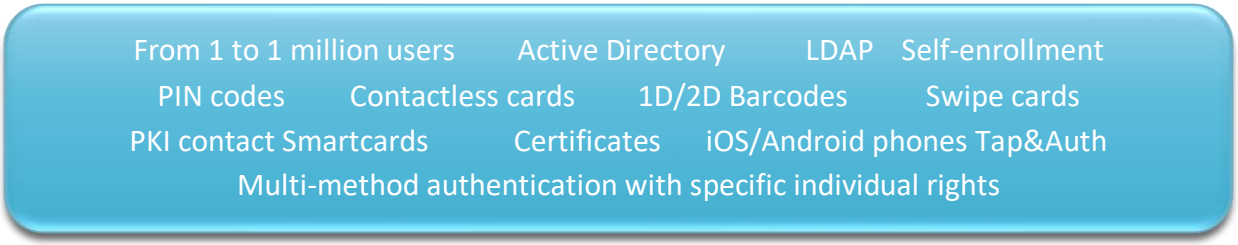


Example of Celiveo Pull Print jobs list on a Ricoh MFP screen:



3.4 User Authentication on printers and MFPs

Celiveo 8 provides the most advanced user authentication capabilities on the market



Up to 4 authentication methods on the same MFP at a given time:

Many authentication methods can coexist, they range from PIN codes to PKI cards with Certificates.

It is then possible to use on the same device, at any time, up to 5 authentication methods:

- An Android or iOS smartphone with BLE/NFC application
- A contactless card (the corporate door card), or swipe card, or 1D/2D barcode ID
  - With or without dual factor validation, with user-defined card password
  - Support for 70 card types, from the most standard to the most secure
  - Self-enrollment of card on the MFPs, upon AD/LDAP authentication
- A PKI smartcard with X509 certificate
  - With smartcard PIN login support
  - For highest security
- A LDAP/AD login/password
  - Multi-domain
  - Ideal when users have forgotten their card
- An ID Code which can be a numeric PIN code (i.e. “123456”) or an AlphaPIN ID (i.e. “CV8E”)
  - Obtained from a self-enrollment portal with SSO support
  - Ideal for guests

Advanced user rights:

What a user can access/do upon login on an MFP is defined by simple to design but powerful Access Control rules, based on:

- The user AD OU or Group
- The method used to authenticate (i.e. grant access to some MFP functions when a contactless card is used, and to more functions when login/password is used)

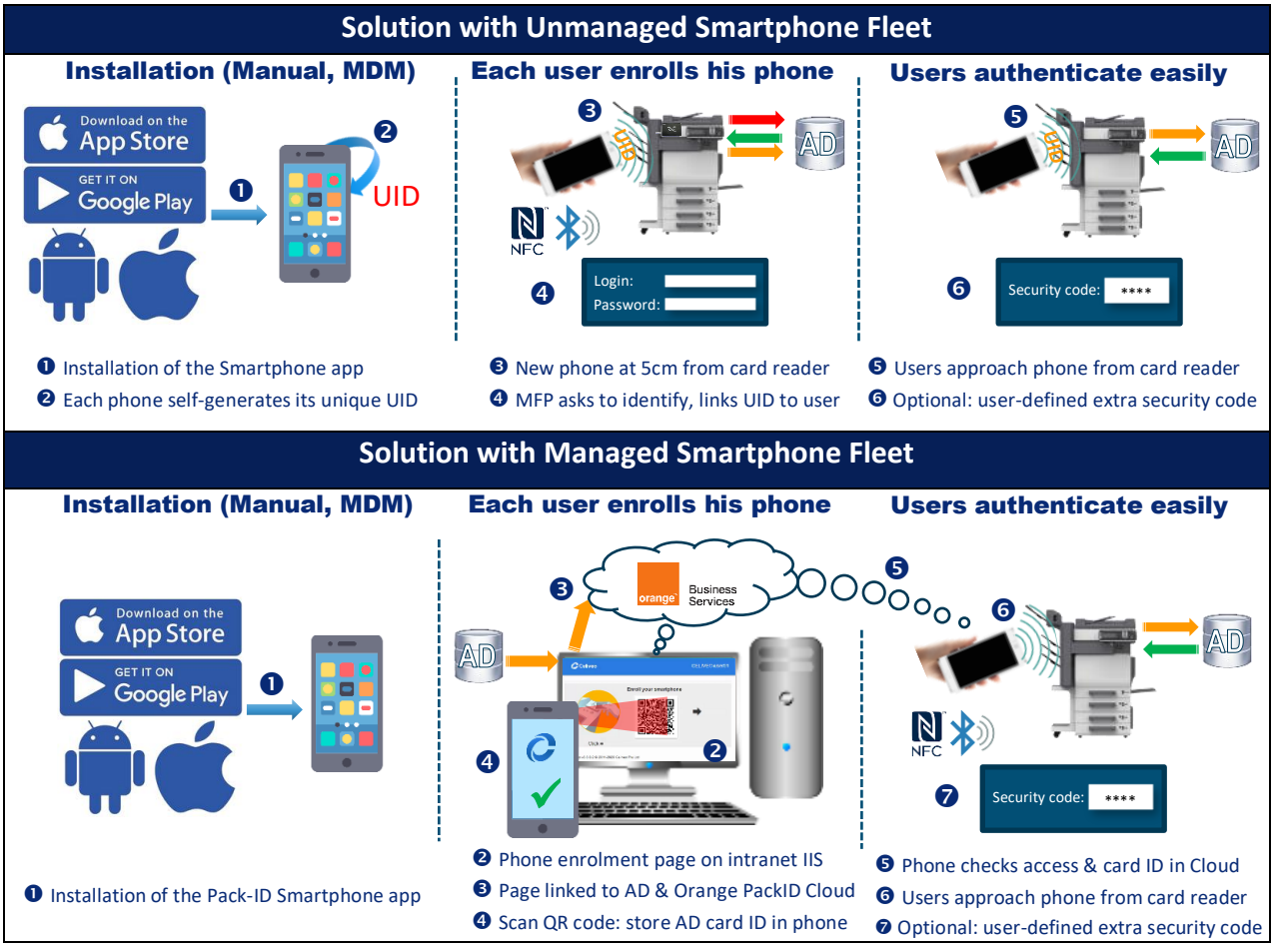
Authentication using iOS and Android smartphones (option)

A person may forget his/her employee badge at home, realize it halfway to the office and just request a spare access card when arriving. Would that same person forget his/her phone home, he/she would do a U-turn to get the smartphone. Celiveo allows to use the personal or corporate smartphone as a card to authenticate on printers and MFPs, exactly like with a card.

This authentication using smartphone is very flexible, possible in parallel with card authentication, PIN authentication, AlphaPIN authentication and login/password.

Celiveo supports two optional smartphone authentication systems:

- Managed smartphone authentication, using Orange Business Service Pack-ID technology
  Upfront setup & cost per phone ID, then yearly maintenance fee. A perfect solution, for corporate phone fleets.
- Unmanaged smartphone authentication, with an app on phone
  No upfront or yearly maintenance fee? Ideal for BYOD as there is no link to a backbone.



Minimum Android version: 8 - Minimum Apple iOS version: 12

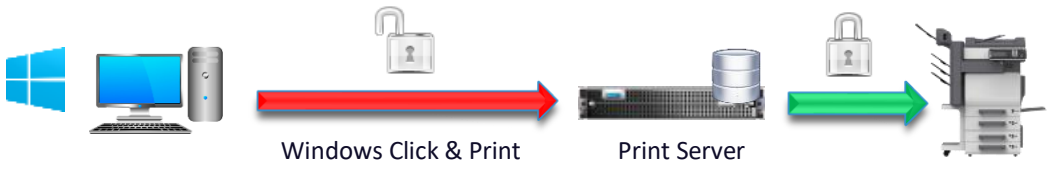
3.5 Celiveo Shared Virtual Printer (CSVP) for pull print through print-servers

The Celiveo Shared Virtual Printer (CSVP) is a software module featuring services and a port monitor. It is meant to be installed on a Windows Print Server, to provide classic Server-based Pull Print service. It is configured on the Celiveo Web Admin portal as a virtual printer, and the self-sufficient and compact package is downloaded with just a click. It can be deployed silently by any remote installation software, or manually.

The CSVP services use just 60 MB in RAM and interact with the Windows Print Server port monitors.

Print jobs reach the CSVP through a Windows shared printer queue and benefit from 25 parallel processing print jobs usage, encryption, rules-based enforcement, job content analysis (pages, B&W/color, paper format etc.) for rules based and storage on local HDD or NAS (preferred).

3.5.1 Shared Network print queue printing process (Windows Client)



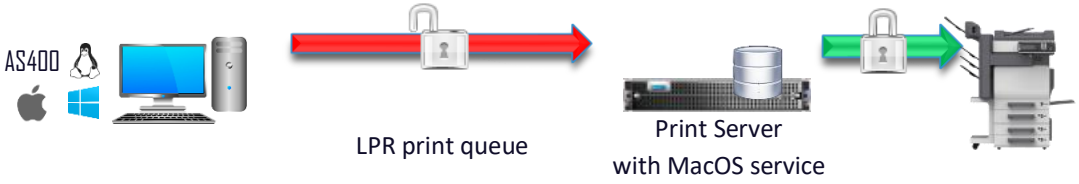
There is no client installed on the client PC, the flow is unencrypted between the PC and the client as it uses the standard Windows Shared Print queue process.

Print jobs are encrypted when they reach the Print Server and stored on local HDD or on Network-Attached Storage (NAS). NAS provides High Availability by detaching storage from the CSVP.

A 2 KB print job ticket is created in the SQL Server, containing the print jobs metadata and the location where the print job is stored. That ticket will be read by a printer later before it sends the print job release request to that CSVP.

3.5.2 Shared Network print queue printing process

(used by Windows clients, MacOS without the Celiveo Virtual Printer client, AS400 or Linux Client, Celiveo.me for Mobile Printing).



There is no client installed on the client macOS, the flow is unencrypted between the macOS and the client as it uses the standard LPR protocol. LPR is still in Windows Server 2019 and a replacement will be provided for newt Windows Server editions.

Print jobs are encrypted when they reach the Print Server and stored on local HDD or NAS.

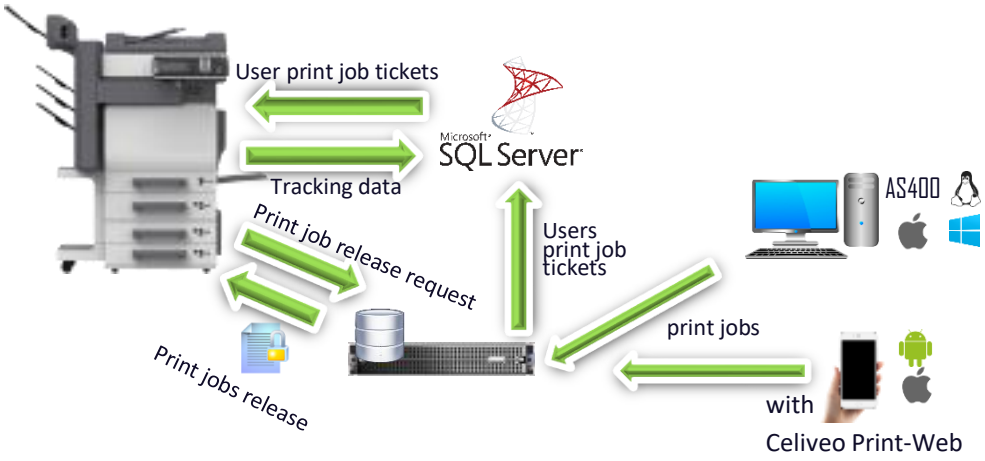
A 2 KB print job ticket is created in the SQL Server, containing print jobs metadata and the location where the print job is stored. That ticket will be read by a printer later before it sends the print job release request to that CSVP.

Pre-requirement

- Operating System: Windows Server 2016, 2019 or 2022
- DotNet 3.5, 4, 5, 6
- 200 MB HDD for the CSVP App plus enough storage for pending print jobs

3.5.3 Print jobs release process, from CSVP

1. Upon authentication and print jobs list request, the Celiveo software in the printer directly contacts SQL Server to read the user print jobs tickets stored in the SQL Server.
2. Local printer print rules are applied to the list to prevent releasing some documents (too many pages, wrong paper format, cost too high etc.)
3. The user selects the print jobs he wants to release, or all jobs.
4. The user press Print or “Print B&W” to force all documents to B&W.
5. The printer contacts the CSVP where selected print jobs are stored and requests them.
6. The Celiveo Shared Virtual Printer sends the print jobs to the printer, encrypted.
7. The Celiveo software inside the printer decrypts print jobs in RAM, inline with printing.
8. The Celiveo software in the printer creates a ticket in SQL Server with the actual print tracking information.

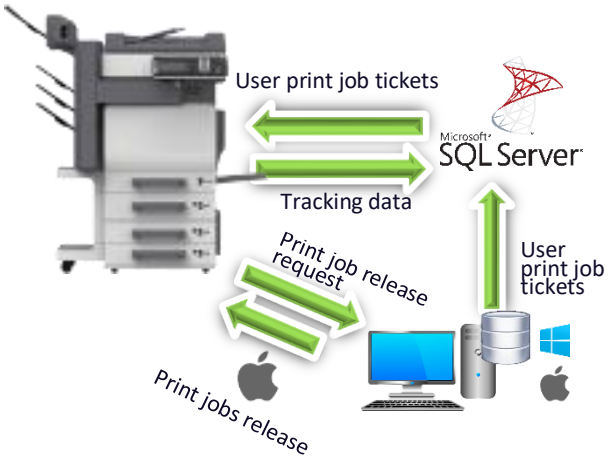


3.6 Celiveo Virtual Printer (CVP) for serverless pull print

The Celiveo Virtual Printer (CVP) is an 100 MB autonomous client package including UI, services and a port monitor creating a virtual printer on PCs. It is meant to be installed on a Windows or MacOS Client PC, to provide ZeroServer Pull Print service. Print jobs are retained on the PC of the user who prints them, therefore reducing network traffic, increasing security and removing the need for a print server. It is configured on the Celiveo Web Admin portal as a virtual printer, and the self-sufficient and compact package is downloaded with just a click and can be deployed silently by any remote installation software, or manually.

The CVP services use just 90 MB in RAM and interact with a port monitor under Windows and CUPS listener on MacOS, using the standard Class 3 and Class 4 drivers (Windows) and MacOS drivers (Mac).

Print jobs arrive from the Celiveo Virtual Printer, a local printer queue that analyzes the print jobs (pages, B&W/color, paper format etc.), encrypts them if applicable, enforce print policy rules, and storage on local HDD or NAS (preferred).



The CVP client software is installed on the client PC, print jobs are encrypted when they are stored on local HDD or Network Attached Storage. NAS provides High Availability by detaching storage from the CSVP, and laptop users can also release print jobs when their PC is switched off.

A 2 KB print job ticket is created in the SQL Server, containing print jobs metadata and the location where the print job is stored. That ticket will be read by a printer later before it sends the print job release request to that CVP.

3.6.1 Local Serverless Pull Print process (Windows Client), encryption is peer to peer.



Pre-requirement

- Operating System: Windows 7, Windows 8, Windows 10/11 client PCs
- DotNet 3.5, 4.9, 5 (for pull print delegation)
- 200 MB HDD with enough space for print jobs storage space

On MacOS PC:

The CVP client software is installed on the client macOS, print jobs captured in CUPS are stored on the local HDD.

A 2 KB print job ticket is created in the SQL Server, containing print jobs metadata and the location where the print job is stored. That ticket will be read by a printer later before it sends the print job release request to that CVP.

Pre-requirement

- Operating System: MacOS 10.12 Sierra and higher
- Login on corporate Domain (to get the identity of the user)

3.6.2 Print jobs release process, from ZeroServer CVP:

1. Upon authentication and print jobs list request, the Celiveo software in the printer directly contacts SQL Server to read the user print jobs tickets stored in SQL Server.
2. Local printer print rules are applied to the list to bar from releasing some documents (too many pages, wrong paper format, cost too high etc.).
3. The user selects the print jobs he wants to release, or all jobs.
4. The user press “Print” or “Print B & W” on the printer UI to release the documents.
5. The printer contacts the PC where selected print jobs are stored and requests their release.
6. The Celiveo Virtual Printer sends the print jobs to the printer, encrypted (if activated).
7. The Celiveo software in the printer decrypts the print jobs on the fly, in RAM, while printing.
8. The Celiveo software in the printer creates a ticket in the SQL Server with the actual print tracking information.

Release print jobs even if the PC or Mac is switched off:

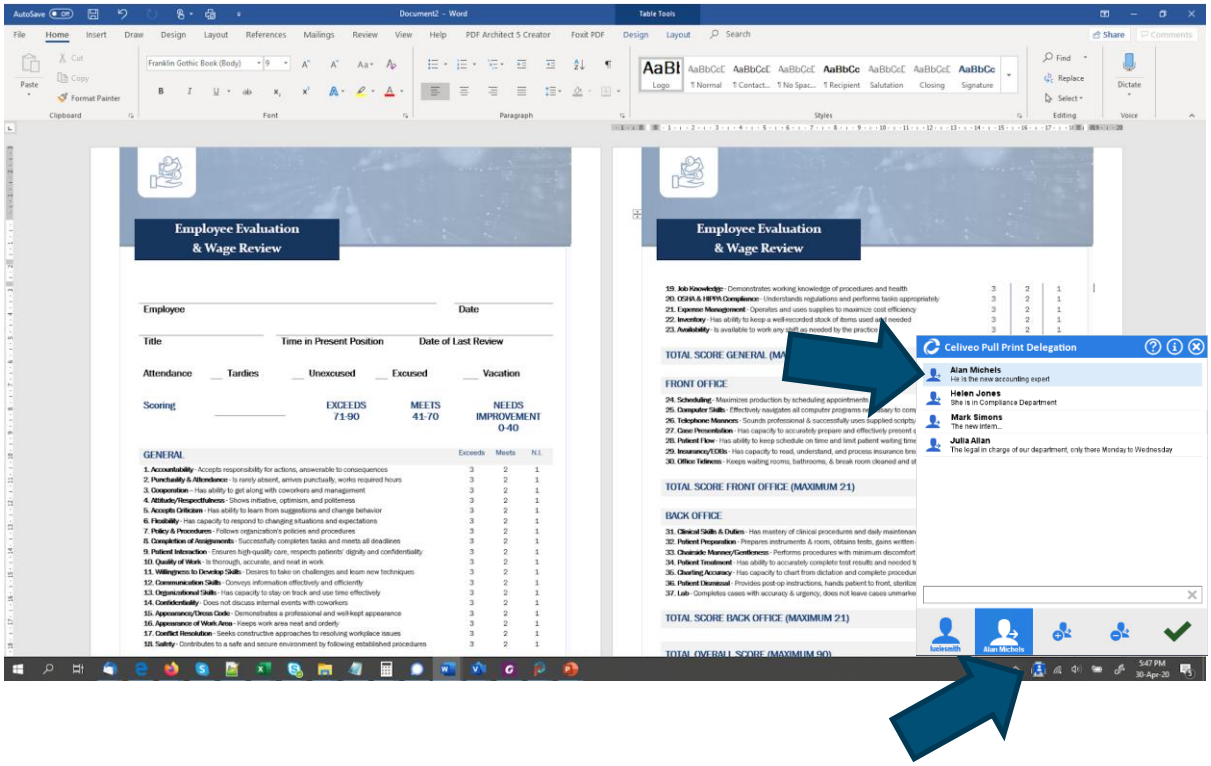
If a user wants to close his laptop but still have access to his pending print jobs for release, he can trigger the quick transfer of pending jobs to a NAS (Windows, Mac), and that task can be configured to happen automatically during Windows PC shutdown. Such features just require the appropriate configuration with a few mouse clicks and the NAS details in the Celiveo Virtual Print Queue screen.

3.7 Celiveo Pull Print Delegation for CVP

In Serverless Pull Print mode, it is possible to delegate the release of the pull print job to a colleague. This is called “Pull Print Delegation”, available with Celiveo Business+ and Enterprise Editions, inside the Celiveo Virtual Printer for Windows.



Once activated in the CVP settings, “Pull Print Delegation” maintains an icon on the Taskbar. Its appearance changes with the delegation status, that will be detailed later. When the user right-clicks the icon, a popup allows them to change the delegation state with a mouse click.



You will be able to add a user to the preferred contacts list by searching in the corporate LDAP/Active Directory.

The switch between delegation and non-delegation is done in two clicks and is reflected by the taskbar icon. Subsequent print jobs are stored in the system for the user selected in the delegation process. That user will see that document in his jobs list when he reaches an MFP to collect his print jobs.

3.8 Storage on NAS and Transfer to NAS for CVP

ZeroServer printing has many benefits, as there is no need for storage or print server, there is direct communication between a printer and user PC to retrieve and release the user print jobs.

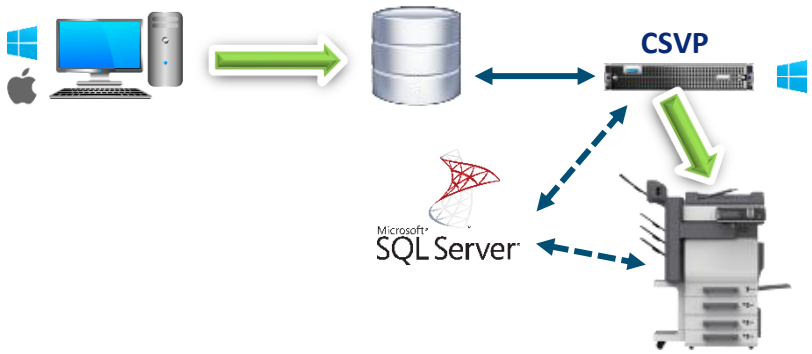
The drawback is that no printing can happen if the PC is off or disconnected from the network.

For such a case the following features can be used to provide extra coverage:

Storage on NAS for all pending print jobs

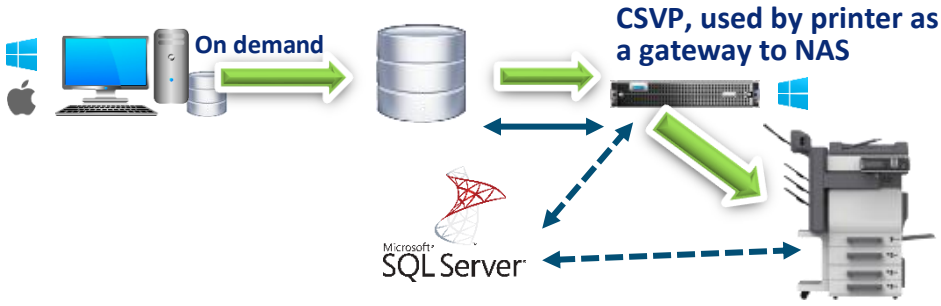
Storage on NAS allows the CVP and/or CSVP to use a NAS drive to store print jobs instead of the local PC/server HDD. The CVP is also configured to force another CSVP hostname/IP address to be used for the job release (default value is the hostname/IP of the CSVP/CVP). The client PC can then be switched off and print jobs are still releasable. Using a shared drive is safer than relying on a shared print queue where clear print jobs capture and storage is a standard feature.

Drawback compared to the on-demand transfer to NAS (below) is that a NAS access failure prevents all printing and print jobs release.



Local storage, with on-demand transfer to NAS

When a user is about to switch off his laptop, he can request a transfer to a shared print jobs storage, on NAS to be able to still release his pending print jobs. A print jobs transfer button on the user taskbar transfers all pending print jobs to NAS, with a progress bar. A CSVP (80 MB in RAM, light process) is informed about the print jobs transfer to the NAS directory and stores the print jobs for the user, while updating the job tickets in SQL to adapt the storage resource name. The MFP then gets the print job tickets from SQL and contacts the CSVP to get the print jobs, instead of trying to contact the user PC.



4. Printing from mobile devices

More and more users need to print from tablets and smartphones, whether that's a corporate device or a BYOD (Bring Your Own Device) policy.
The Celiveo.me subscription allows to safely, easily and quickly Print from any mobile devices equipped with an email client (smartphone, tablet, PC) for pull print release onto the corporate printers equipped with Celiveo.

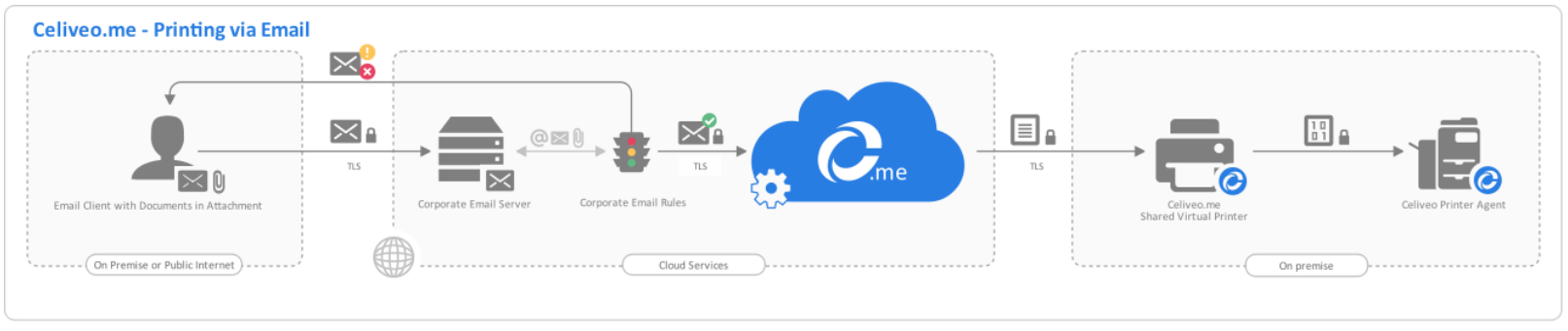
Celive.me supports any device capable of sending emails such as iOS/Android phones & tablets, laptop PCs.

Documents to print are emailed to a mobile print corporate email address that applies policy rules in term if sender verification, authorized attachments, access to color print queues etc.

Documents are converted into print jobs by Celiveo.me in the Cloud and become available for release in the print jobs list upon user authentication.

You benefit from the outmost security thanks to Celiveo.me exclusive Zero-Trust-Access architecture based in ECC-P256 Certificate chains securing all communication of documents from the Cloud to your network. All documents benefit from double encryption, TLS 1.2 for transport and dynamic-key AES256 for the document file, there is no inbound connection to your network, no VPN, to gateway, it is safe.

- Documents are sent with TLS-encryption from client smartphone/PC/tablet to your corporate email server
- Multiple mobile-print email address can be defined, each with their AD-based access rules and default print attribute (force B&W, force duplex)
- No inbound connection to your network, for the highest safety
- Outbound polling of print jobs from your network to the Celiveo.me secure hosting, with triple security:
    - TLS 1.2 mutual authentication using unique ECC-P256 Certificates on both sides, instead of login/pwd or keys that can leak
    - TLS 1.2 encryption of data transport using those unique certificates
    - Print jobs are encrypted in motion and transport, with dynamic keys unique to your tenant



5. Native printing from SAP

Celiveo Pull Printing can secure the release of jobs sent by the SAP Output Management to a Celiveo 8 CSVP (Celiveo Shared Virtual Printer).

Requirement: the user sAMAccountName or email address need to be known by SAP and available as a variable in the SAP device type editor.

The Device Type needs to be modified and once it is saved, activated it in the production environment and used to produce documents all documents are captured, encrypted and ready to be released with PIN or badge.

Note: ABAP List printing is not supported as its header cannot be modified.

6. Large Format Printers (LFP)

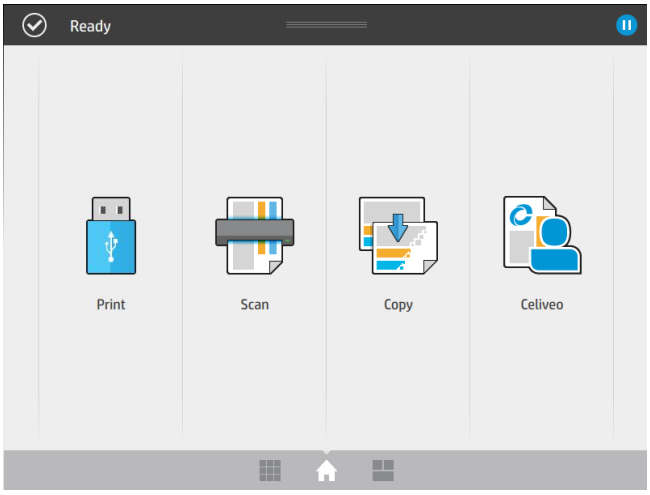
Large Format Printers are getting faster and faster, it is now possible to print an A0 in less than 20 seconds. At the same time the cost or LFP outputs can still be high due to special cost and mis-usage of LFPs can bear a significant cost. Celiveo provides the most advanced solution to provide professional print management for all LFP and addressing all the requirement expected from security and cost-minded users.

Celiveo Enterprise adds its intelligence to Large Format Printers:

- Advanced user authentication (card, PIN, login/pwd, PKI Smartcard) to control LFP usage with full Active Directory integration and High Availability capability
- Pull-Print easily by using one same print virtual queue for office and LFP printing, release your print jobs upon authentication
- Print jobs list and selection for release/deletion/multicopy on the LFP touch screen*
- Print-Direct to print directly to LFP without badge release from the unified Celiveo Virtual Printer
- Automatic selection of Windows print driver when direct-printing on LFP
- Release of print jobs produced for LFP, not by mistake your emails or letters
- Advanced rules-based printing to control LFP usage and filter print jobs
- Track and bill-back LFP activity and usage with granular media and inks cost for each printing
- Advanced LFP print reports with granular ink usage* per user, printer, OU, group, department

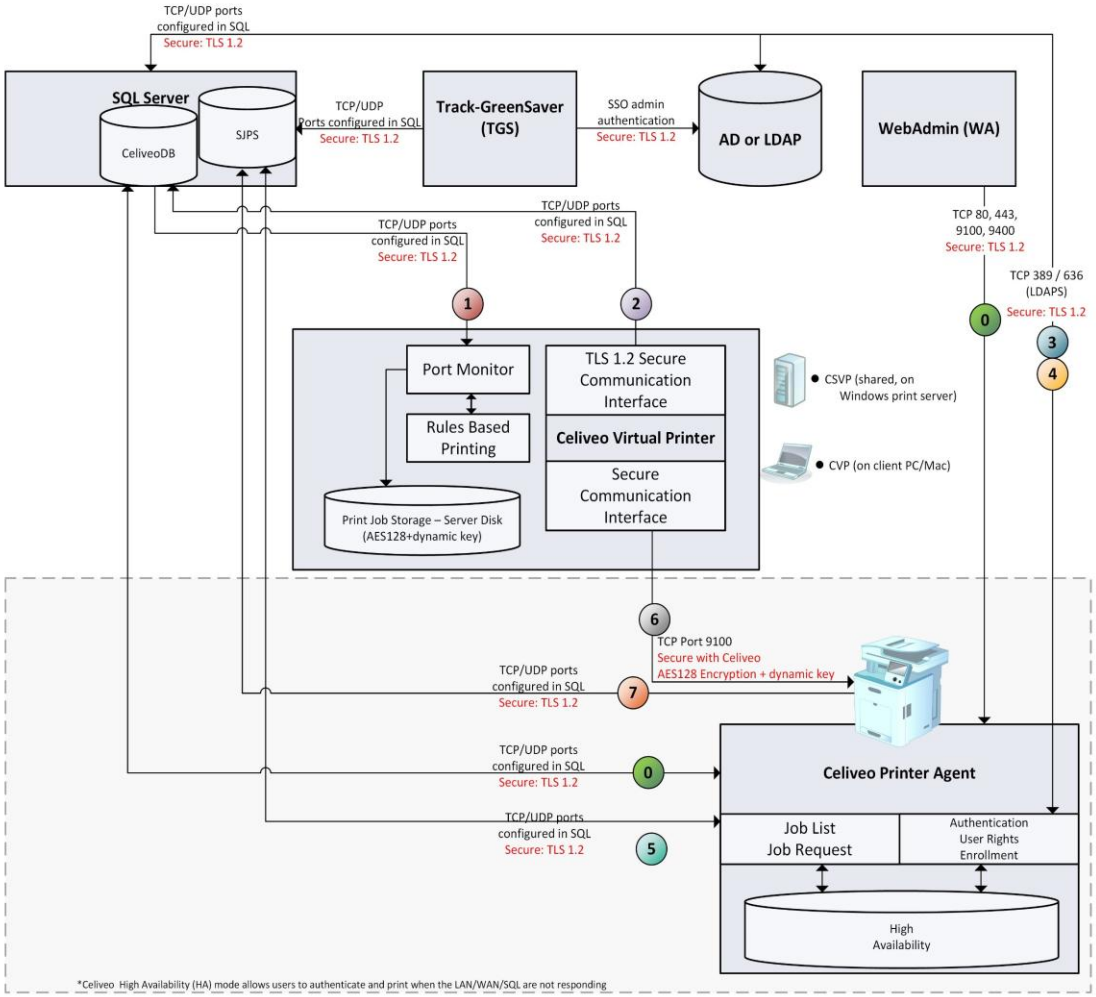
*: On advanced LFP models such as a recent HP DesignJet and HP PageWide XL, the pending print jobs list appears on the printer touch screen where they can be selected for release or deletion. Usage tracking with total granularity with paper type, surface, ink volume per cartridge and total cost (multicurrency) is available on most HP DesignJet and PageWide XL LFP, even without touch screen.





7. Ports, protocols and flows

Celiveo 8 Bandwidth Overview
Pull Print, card enrollment and authentication



Modules

WA – Celiveo Web Admin portal – Solution configuration and Management (Multi-users Web Interface, with delegation & rights)
CVP/CSVP – Celiveo (Shared) Virtual Printer (Job Storage and Rules Based Printing)
TGS – Track-GreenSaver Usage & Cost Report Center (Web Interface)
CPA – Celiveo Printer Agent– Celiveo intelligence running inside the printer or in secure micro appliance with direct connection to backbone resources.

Notes

SecureJet modules **CVP, WA, TGS** can all be installed on the same PC, VM or Server or on different Windows machines in order to provide a flexible architecture. Server-Based and Serverless architectures can be mixed on the same environment.

Average Bandwith Usage

0 WA sends signed bootstrap code to Printer - (32 to 50 KB)
Sync is a one time operation that remotely installs and configures Celiveo Printer Agent. Printer (Bootstrap) gets installation files from Celiveo SQL table - (22 MB)

1 The service contacts SQL DB (CeliveoDB) to collect the Update on print rules, driver and driver settings as needed – (variable size depends on driver and setting size)

2 Celiveo Virtual Printer sends the Job ticket to the Celiveo SQL table – (2 to 3 KB)

3 The user performs self enrollment on the printing device. The service contacts the AD or SQL DB (SJPS) to send the user card ID data and other metadata as needed. – (5 to 10 KB)

4 Upon authentication the service contacts the AD or SQL DB to authenticate the user. If the those are unreachable the service switches to the High-Availability mode to authenticate and give User Rights to the user – (5 to 10 KB)

5 The service contacts the SQL DB (SJPS) and if it is unreachable the service switches to the High Availability mode to use the last known Hostname/IP Address and tries to contact the server again – (2 to 3 KB). This HA mode is available with Celiveo Enterprise Edition.

6 When the user presses Print on the printing device the Celiveo Virtual Printer sends the print job to the printing device -
(20 MB – Average 3 Pages PDF rendered with a PCL 6 Driver)

7 The Celiveo Printer Agent contacts the Celiveo SQL Database to Inject the tracking data ticket. If SQL Server is not responding the tracking data is stored locally and only pushed once communication to SQL is restored. - 2 to 3 KB, or more if the user is part of many AD groups(up to 65KB per ticket)

8. Scalability

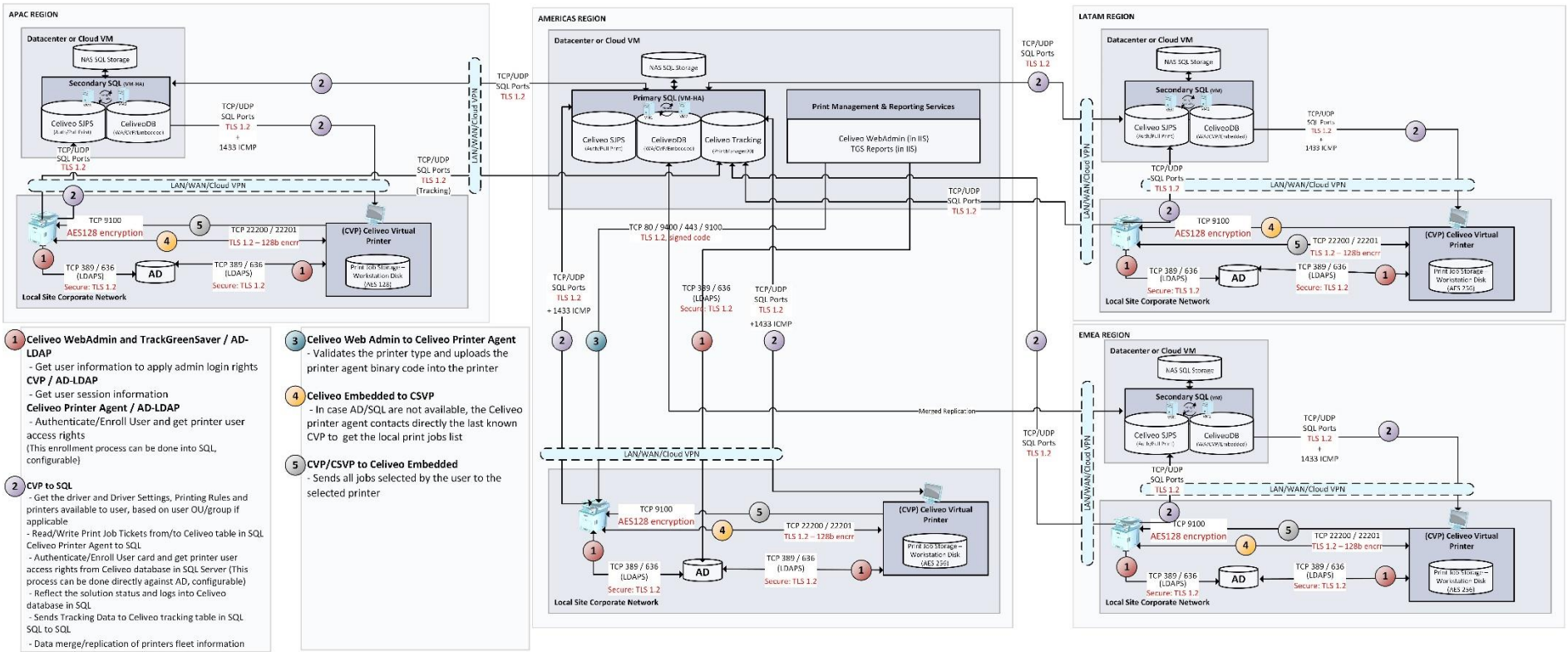
Celiveo does not rely on servers to control printers or authentication and leverages from internal caches. It does no require master or slave servers, the architecture is the same for 1 or 10,000 printers therefore, its scalability is much higher than in any other print management solution.

SQL Server is queried by printers and PCs when print jobs are generated and released.

- SQL Server access is the only limiting factor
- If SQL Server is unreachable, High Availability cache mechanisms allow Celiveo Enterprise Edition to continue working:
    - User authentication
    - Access control rules
    - Pull Print
    - Usage Tracking
- There is a limit of 32767 simultaneous connections on one instance of SQL Server:
    - The Celiveo software inside the Printer can contact the SQL Server only when it doesn't have the information in its internal Cache (HA available in Celiveo Enterprise Edition)
    - Connections from printers and PC last no more than a fraction of a second
- For very large global deployments, it is recommended to use Celiveo exclusive "Regional SQL Instances" features, where printers and users can automatically connect to their regional SQL Server to store print jobs tickets and enrollment information.
    - The Celiveo CVP client module takes care of moving print job tickets between SQL Server job tickets tables when a user is roaming from one region to another
    - Tracking information is centralized in the primary SQL Server
    - Printer lists are propagated to all regional servers so that users can use Direct IP Printing to authorized printers anywhere in the world

The following diagrams shows how a global, multi-region, print management project can be equipped with Celiveo Enterprise, first as a full ZeroServer Pull Print, then as a Print-Server-based architecture for tens of thousands of printers and hundreds of thousands of users. Note the two architectures can be combined, some sites being ZeroServer and some sites using print servers.

Celiveo 8 Enterprise Edition - Full Serverless Global Pull Printing Architecture Example



1 Celiveo WebAdmin and TrackGreenSaver / AD-LDAP
- Get user information to apply admin login rights

CVP / AD-LDAP
- Get user session information

Celiveo Printer Agent / AD-LDAP
- Authenticate/Enroll User and get printer user access rights

(This enrollment process can be done into SQL, configurable)

2 CVP to SQL
- Get the driver and Driver Settings, Printing Rules and printers available to user, based on user OU/group if applicable
- Read/Write Print Job Tickets from/to Celiveo table in SQL Celiveo Printer Agent to SQL
- Authenticate/Enroll User card and get printer user access rights from Celiveo database in SQL Server (This process can be done directly against AD, configurable)
- Reflect the solution status and logs into Celiveo database in SQL
- Sends Tracking Data to Celiveo tracking table in SQL SQL to SQL
- Data merge/replication of printers fleet information

3 Celiveo Web Admin to Celiveo Printer Agent
- Validates the printer type and uploads the printer agent binary code into the printer

4 Celiveo Embedded to CSVP
- In case AD/SQL are not available, the Celiveo printer agent contacts directly the last known CVP to get the local print jobs list

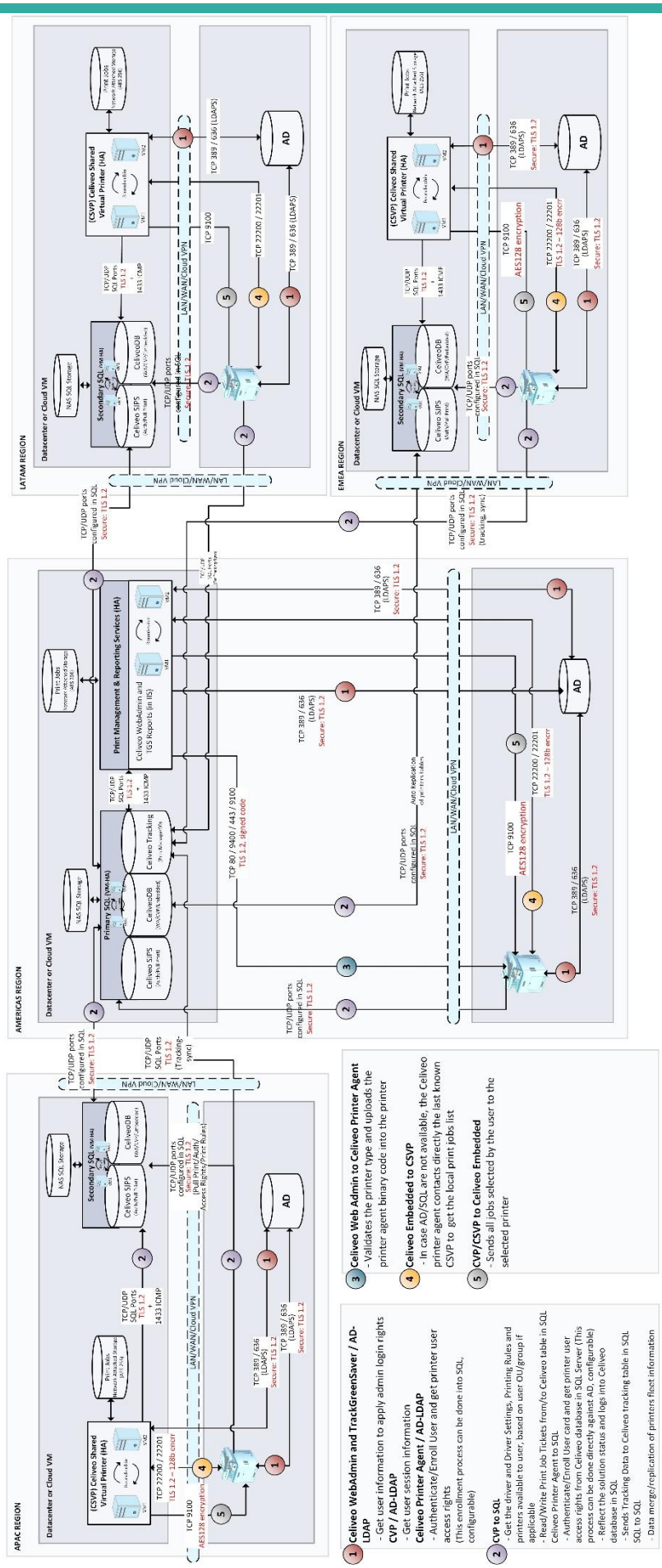
5 CVP/CSVP to Celiveo Embedded
- Sends all jobs selected by the user to the selected printer

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V2.1

Your Notes:

Celiveo 8 Enterprise Edition - Print-Server-based Global Pull Printing Architecture Example



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Your Notes:

9. Securing the metadata

Celiveo provides a comprehensive High Security technology that applies to:

- Print jobs content
- Information stored in SQL Server
- Usage tracking
- Rules based printing

One such High Security feature is available with Celiveo (all editions) with the Stealth option or one of the following optional connectors: FSI, Public Sector, Oil & Gas, Premium.

9.1 Stealth Mode

With Stealth mode, ticket information in the database and filenames and metadata files on the HDD are encrypted or hashed if they don't need to be decrypted.

Below is an example of a job ticket in the database when Stealth Mode is ON. No user or job information contains clear information, IT won't be able to use it besides pure troubleshooting.

```
[SJPS].[dbo].[T_PrintJob]
```

Results | Messages

	id_PrintJob	id_Server	id_User	lab_Date	lab_Name
1	905	1	14	20140513145453	b0e774855d0b1639604dc3845b711c9449185e9e4832697f...

lab_HeaderFile	lab_JobFile
D:\myprint-spool\jobs\USER\5eca329f4d6cc966da634...	D:\myprint-spool\jobs\USER\5eca329f4d6cc966da634...

Below is an example of a user record in the database when Stealth Mode is ON. No user information contains clear information.

```
[SJPS].[dbo].[T_User]
```

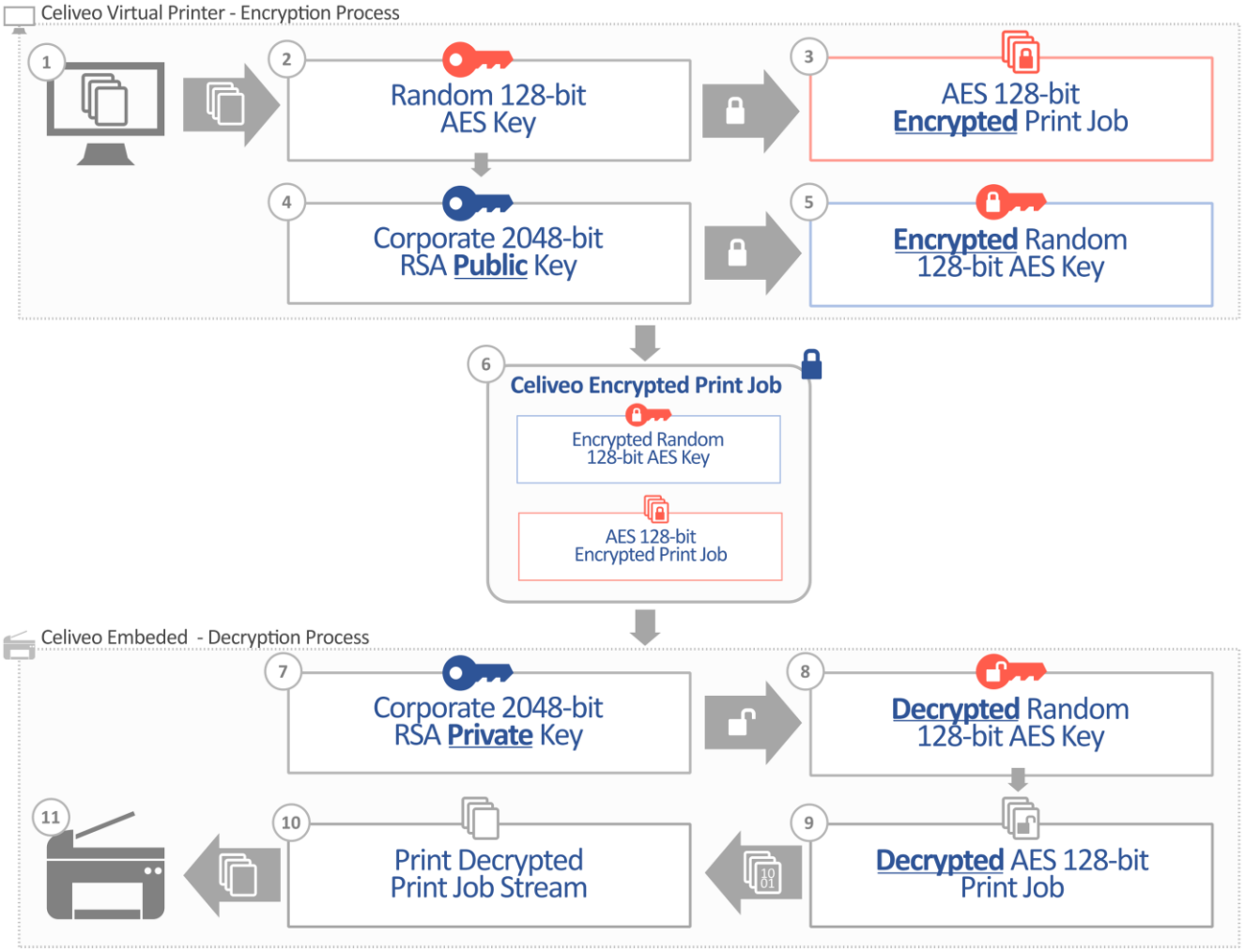
Results | Messages

	id_User	lab_Type	lab_Name
1	14	USER	5eca329f4d6cc966da634dd6cc69942e52b8648dd07919f6bdc4ae718e12f108

9.2 Print Jobs Encryption

It is very easy for rogue IT administrators to hack and capture every single print job of other employees if they are managing print servers. All it takes is clicking a checkbox to archive print jobs and use a (free) spool file viewer downloadable on the Internet. It is even possible to sort all the files to target one specific individual print job. And it is possible to capture, print and display all print jobs going to a printer using tools such as Wireshark (just google “hack printer wireshark”).

Celiveo protects the print jobs content using advanced print jobs encryption. Print job data can be encrypted from the client PC to the printer level, like tunneling. Even if the data goes through servers, routers or the Internet, it is safe. A new AES key is calculated for every print job and the print job is decrypted on the fly in memory either inside the printer engine when Celiveo is embedded in the printer, or inside the Celiveo Smart Appliance behind the printer for other cases.



10. High Availability (HA)

Celiveo provides a comprehensive High Availability technology that applies to:

- **User Authentication**
- **Pull Print**
- **Usage Tracking**
- **Rules-based Printing**

The High Availability feature is available with Celiveo Enterprise accessible by one of the following optional connectors: FSI, Public Sector, Oil & Gas and Premium.

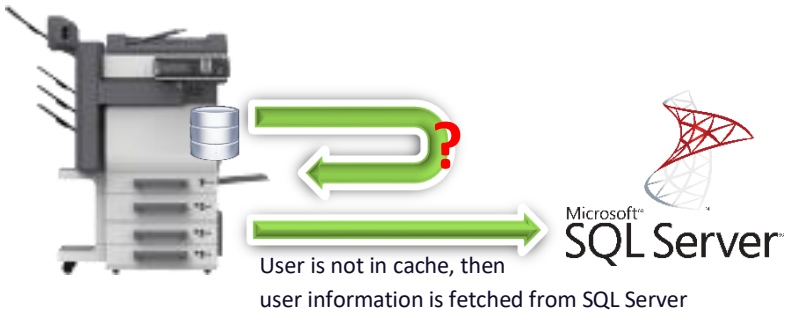
10.1 User Authentication HA

Upon authentication, the user non-confidential information is stored inside an encrypted database, at the printer or Celiveo Smart Appliance level. Records include users unclassified information:

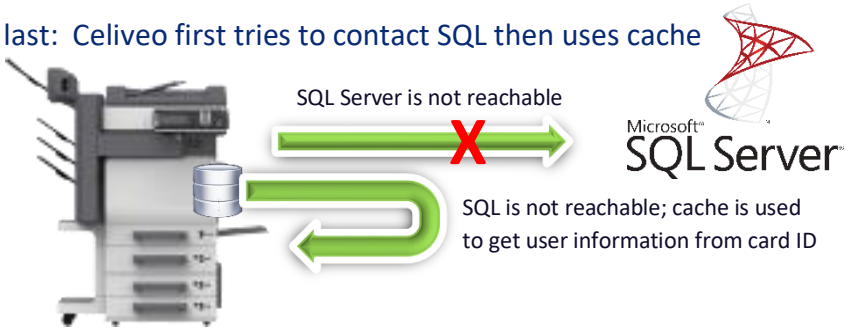
- **User UPN**
- **DisplayName**
- **domain**
- **@ address**
- **OU, group**
- **Last known print job depository for that user (hostname & IP)**

When a user uses that device, his information is stored by the Celiveo embedded solution in an encrypted SQL database inside the printer HDD or Celiveo Smart Appliance (both are encrypted). That database is used as a cache that can be used in “cache first” and “cache last” modes.

Cache First: Celiveo first checks the cache and only contacts the SQL Server if user is not in cache



Cache last: Celiveo first tries to contact SQL then uses cache

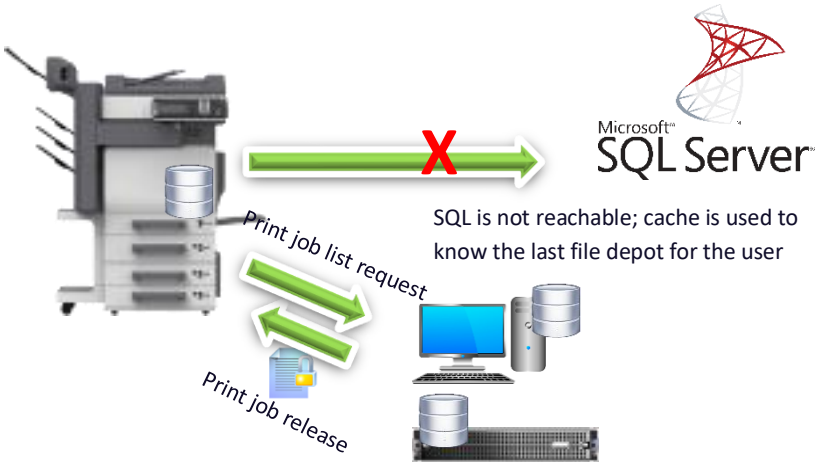


10.2 Pull Print HA

When the user is authenticated by Celiveo, he can request his pull print jobs release.

Celiveo, at the printer level, directly contacts the SQL Server database containing print job tickets, to get the jobs list.

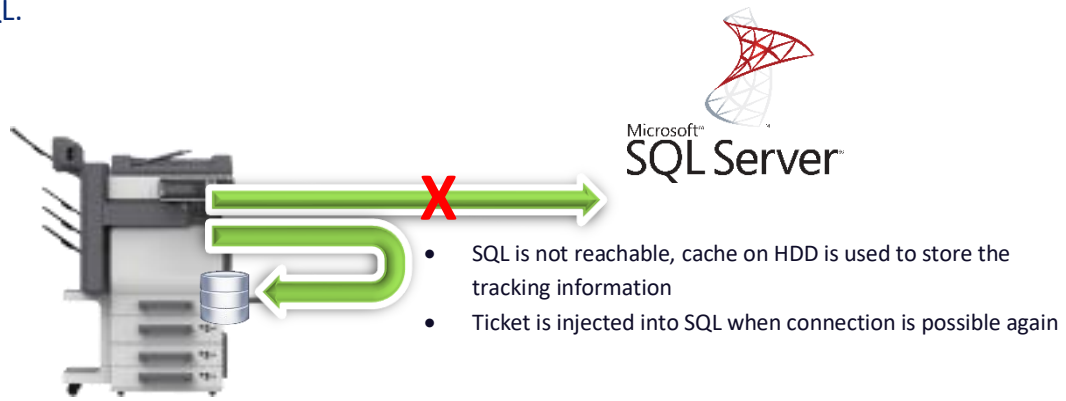
If SQL Server is not available, the printer uses its cache to determine the last print jobs depot that was valid for the user. Celiveo then uses that information to get the list of print jobs stored on that depot, without requiring information from SQL Server.



10.3 Tracking HA

Whenever a printer performs printing, scanning, copying, the embedded Celiveo solution stores a tracking ticket on SQL Server.

If SQL Server is not reachable then the ticket is stored temporarily on the MFP HDD or on the Celiveo Smart Appliance disk, both are encrypted. When the connection to SQL Server is restored the ticket is stored in SQL.



11. Reporting

The Celiveo Report Center provides interactive and scheduled reporting capabilities, based on the SQL database containing the tracking tickets.

11.1 Ultra-Precise Tracking on printers equipped with Celiveo

Every time the printer finishes copying, emailing, faxing, or scanning a document, Celiveo collects information about the job and stores it directly and safely into the SQL database, without needing any server or PC in the middle. This secure and direct technology offers unmatched performance, confidentiality and accuracy.

Collected metadata:

- Username
- User domain
- User groups
- User organization unit
- Workstation name
- Server name
- Printer name
- Printer tags for group allocation
- Time/Date of printing
- Document title
- Document type (pull print, direct print, photocopy, scan, fax…)
- Page count
- Copy count
- Page size
- Print job size
- Black & White output
- Color output
- Duplex
- Toner saving mode
- Ink usage per cartridge most (HP DesignJet LFP)
- Print job cost and currency

11.2 Detailed Cost Information

The administrator defines cost profiles used for usage tracking, considering parameters such as color, duplex, paper format and printers technologies. Multiple profiles can be defined so that each printer or printer model reflects its exact usage cost.

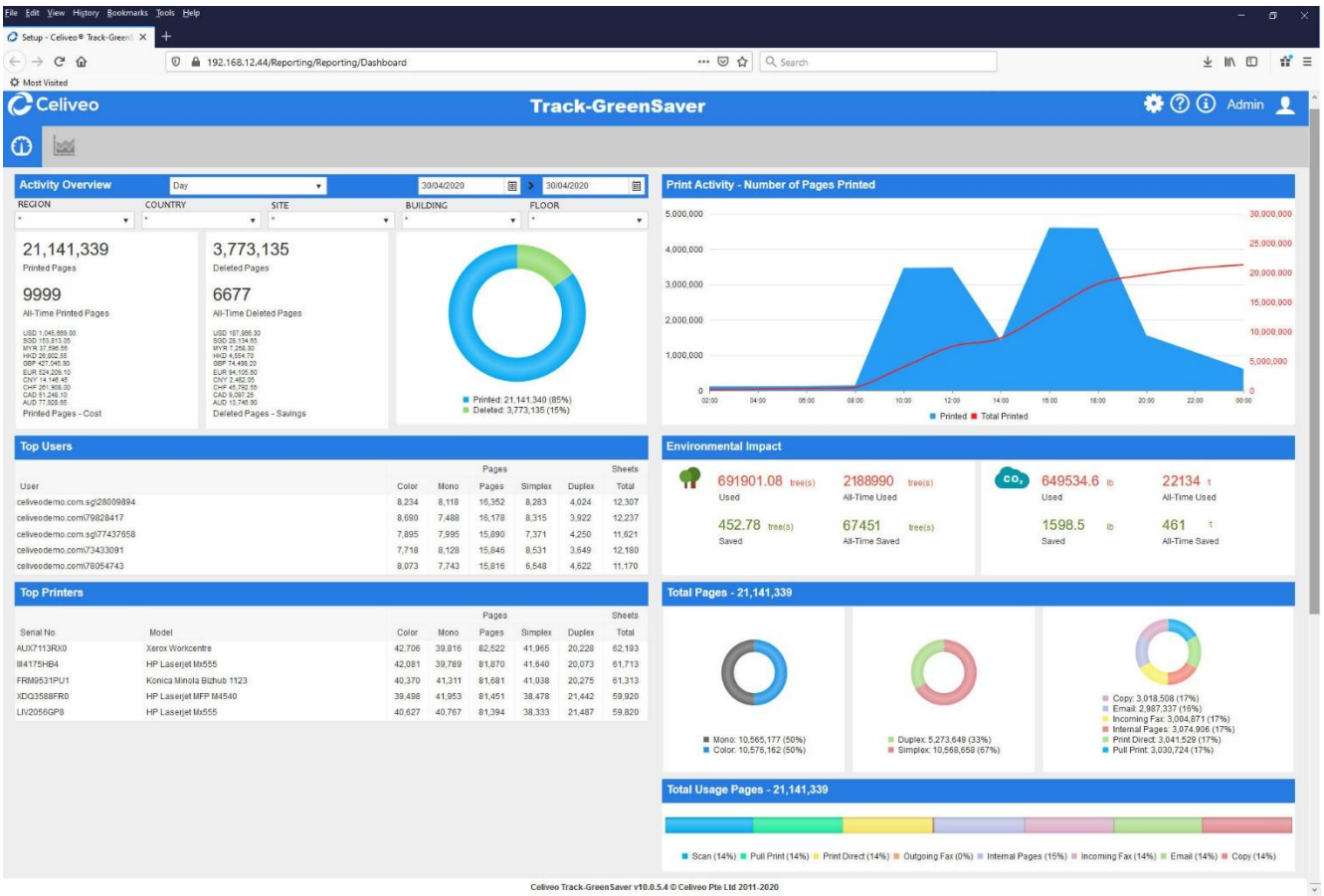
11.3 Advanced Reporting

The collected data is accessed and analyzed using a server-based web application name Celiveo Track-Green-Saver (TGS). It features flexible report templates that can be customized through filtering to illustrate the precise amount that your organization is spending on printing and where and when this money is being spent.

- Monitor all printers and MFP usage with detailed pre-made web-based reports, statements, and graphs that allow to see who is using the devices, document details and the cost of that usage.
- Bill back department budgets or just examine overall print traffic and budgets.
- Export to one of many formats (CSV, Excel, Word…)

11.4 Celiveo report center dashboard

The Celiveo report web portal is accessible through the Celiveo Web Admin portal and through a direct URL. It provides a comprehensive view on printing, copy, fax, scan from MFPs in the company.



12. Celiveo editions

Because not all projects have the same need and the same budget, Celiveo is available in four progressive editions, with the possibility to upgrade from a lower to a higher version with no extra installation. A simple license key update exposes new options and unlocks new advanced features.

- **Celiveo Print-Direct**
  - Print driver and settings distribution and management
  - Smart Direct-IP printing
  - Print policy enforcement rules
  - Print audit
  - Print fleet geotagging and maps for end-users
  - Printer status on maps

- **Celiveo Business Edition**
  - Everything in Print-Direct Edition plus…
  - Server-based Pull Print with ID code and card authentication on printers and MFPs
  - Pull Print for printers supporting an embedded Celiveo Printer Agent

- **Celiveo Business+ Edition**
  - Everything in Print-Direct and Business Editions plus…
  - ZeroServer Pull Print
  - Print jobs encryption for Pull Print
  - Active Directory / LDAP groups support in print and Access Control rules

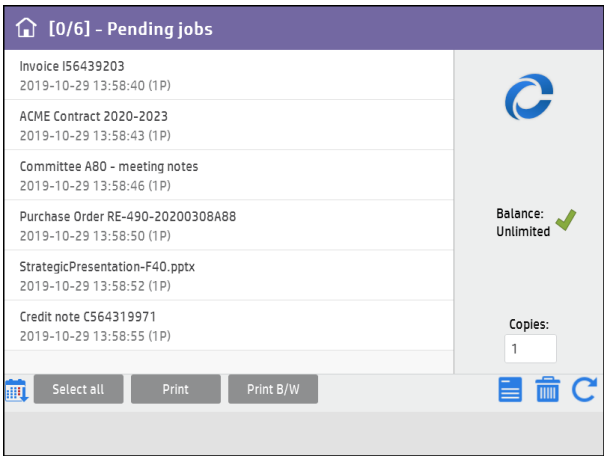
- **Celiveo Enterprise Edition**
  - Everything in Print-Direct, Business Editions and Business + Editions plus…
  - High Availability to allow MFP usage even when SQL or AD are non-responding
  - Multi-level authentication with granular rights depending on auth methods
  - Multi-drivers support in CVP for Print-Direct and Pull Print
  - Proactive rules to determine who can use printers and drivers' settings, using AD/LDAP OU and group metadata
  - Dual factor authentication for cards, to require a user-defined password with cards
  - Optional Large Format Printers support with front panel screen integration on specific models
  - Optional SAP BC-XOM native printing connector for integrated secure pull print

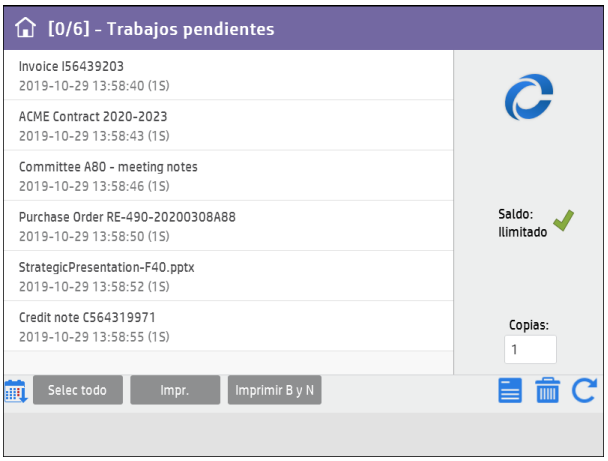
13. Supported languages

Because Celiveo clients are located all over the world, Celiveo Web Admin, Print Agent and CVP/CSV clients for Windows and MacOS are in the following languages:

Brazilian
Czech
Dutch
English
Finish
French
German
Hungarian
Indonesian Bahasa
Italian
Japanese
Korean
Malay
Polish
Portuguese
Russian
Slovakian
Swedish
Turkish
Chinese (simplified)
Chinese (traditional)

Example of Celiveo Printer Agent screen in English and in Spanish, on a MFP touch screen:





14. Features per Celiveo Edition

	Celiveo Print-Direct Edition	Celiveo Business Edition	Celiveo Business+ Edition	Celiveo Enterprise Edition
■ standard □ optional				
CORE FUNCTIONS				
Smart Direct IP printing	■	■	■	■
Print tracking & reporting	■	■	■	■
User authentication on MFP & printers		■	■	■
MFP walkup tracking & reporting		■	■	■
Smart & secure roaming Pull Print		■	■	■
Mobile printing	□	□	□	□
ADMINISTRATION				
Web admin software	■	■	■	■
Multi-SQL instances support	■	■	■	■
Printers discovery and auto-import	■	■	■	■
Print Servers discovery and migration	■	■	■	■
Print Drivers and setting import	■	■	■	■
Multi-driver support				■
Multi-driver settings support				■
Delegation of administration	■	■	■	■
Conditional access to printers by OU	■	■	■	■
Conditional access to printers by group	■	■	■	■
Conditional access to printers by IP	■	■	■	■
USER AUTHENTICATION				
Multi-domain support	■	■	■	■
Authentication on printer: PIN ID Code		■	■	■
Authentication on printer: AlphaPIN ID Code		■	■	■
Authentication on printer: Card		■	■	■
Card self-enrollment on MFP		■*	■*	■*
Authentication on printer: Barcode		■	■	■
Login Password authentication (MFP)		■*	■*	■*
iOS and Android Smartphones		□	□	□
Authentication on printer: PKI Smartcard		■	■	■
Authentication rules		■	■	■
Multilevel authentication (i.e. card & login/pwd, or PIN & proximity & Login/Pwd)				■

Dual factor (card + password)				■
Direct badge validation against Active Directory & LDAP			■	■
Indirect validation against Active Directory & LDAP		■	■	■
Authentication against offline users list in the printer/MFP		■	■	■
Failover Authentication to other AD/LDAP/cache				■
Automatic sync of offline users list with AD/LDAP		■	■	■
High Availability				■
Direct Card/PIN enrollment into Active Directory/LDAP			■	■
Direct Card/PIN enrollment in SQL Server/SQL Server Express		■	■	■
Standard Access Control rules		■	■	■
Advanced Access Control rules (with Active Directory OU and groups)			■	■
SMART PRINTING				
Direct IP printing, printer selection on floor map	■	■	■	■
Direct IP printing, live printer status	■	■	■	■
Pull Print jobs list on MFP screen		■*	■*	■*
Server-based Follow-me Pull Print		■	■	■
Serverless Follow-me Pull Print			■	■
Serverless Pull Print High Availability				■
Dynamic Printer Discovery with rules	■	■	■	■
Drivers deployment and installation	■	■	■	■
Print jobs data encryption (AES dynamic keys)		■	■	■
Print rules on PC	■	■	■	■
Print rules on printer/MFP		■	■	■
Print rule to stop print job	■	■	■	■
Print rule to force Black & White	■*	■*	■*	■*
Print rule to force toner saving	■*	■*	■*	■*
Print rule to force duplex	■*	■*	■*	■*
Soft quota for print & copy		■	■	■
hard quota for pull print		■	■	■
Serverless Pull Print for Windows			■	■
Serverless Pull Print for MacOS			■	■
Pull Print delegation (Windows CVP)			■	■
Pull Print delegation (MacOS CVP)			■	■
Stealth mode for print jobs metadata		□	□	□
Print job name anonymizer		□	□	□
Windows servers support			■	■

MacOS clients support (server-based)	■	■	■	■
Linux clients support (server-based)	■	■	■	■
AS/400 clients support (server-based)	■	■	■	■
Print from iOS, Android smartphones	□	□	□	□
Large Format Printers support			□	□
Native SAP integration (BC-XOM)				□
TRACKING & REPORTING				
Tracking data from printer engine	■*	■*	■*	■*
Tracking data from print job analyzer	■	■	■	■
Web reporting portal	■	■	■	■
Table reports	■	■	■	■
Graphical reports	■	■	■	■
Green IT reports	■	■	■	■
Detailed cost definition	■	■	■	■
Detailed jobs and user metadata	■	■	■	■
Jobs report per user	■	■	■	■
Jobs report per printer	■	■	■	■
Reports per OU/group	■	■	■	■
Advanced filtering in reports	■	■	■	■
Multiformat output (PDF, CSV, XLS…)	■	■	■	■
OPTIONS				
Stealth mode, protecting metadata		□	□	□
Large Format Printers support				□
Celiveo Print Web (mobile printing)				□
Oil & Gas connector				□
Finance, Services and Insurance				□
Public Sector connector				□
SAP Native Printing connector				□
LICENSING MODEL				
License per printer	■	■	■	■
No cost per client or server	■	■	■	■
Support & Update contract	18%/year	18%/year	18%/year	18%/year

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*: verify the list of supported printers and MFP on www.celiveo.com

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Your notes

Your notes



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Creating business solutions helping people to work, wherever