



MetaXpress® PowerCore

High Throughput Image Analysis option for MetaXpress

Updated July 12, 2018
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Agenda

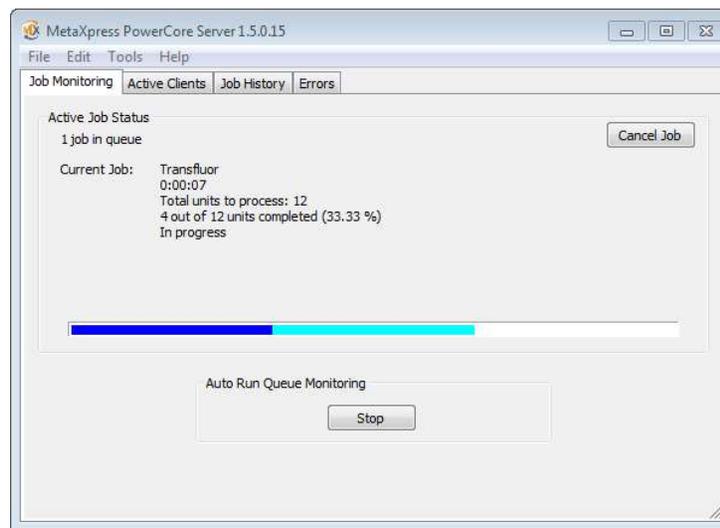
- High-throughput Image Analysis
- How does it work?
 - MetaXpress setup
 - PowerCore setup
 - PowerCore Workflow
- Running MetaXpress PowerCore software
- Sending a job to MetaXpress PowerCore
- PowerCore software licenses
- Computer configurations
- Installation of MetaXpress PowerCore software
- Common installation issues
- PowerCore Errors / Troubleshooting / FAQs



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High Throughput Image Analysis

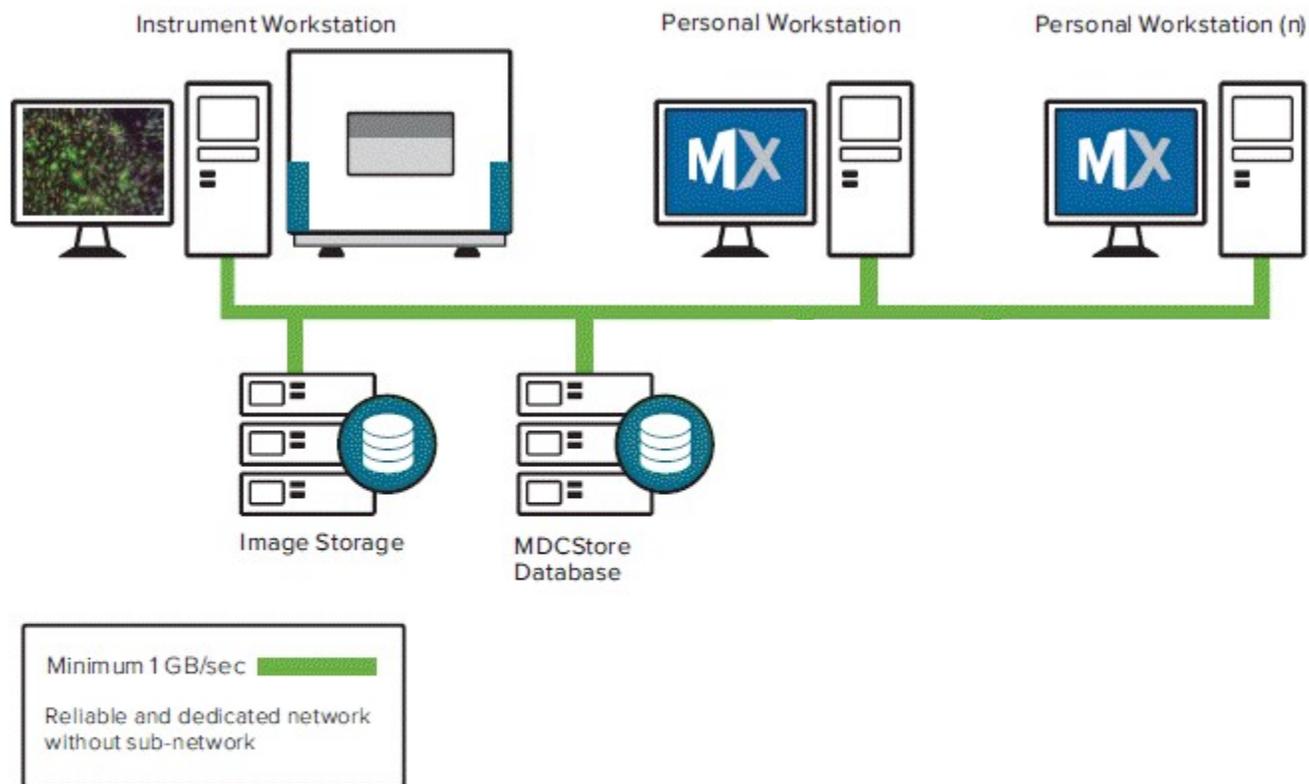
- Example: 384-well plate, 3 colors, 4 sites per well = 4608 images
 - Acquisition: ~45-60 minutes/plate (actual timing depends on assay)
- Multi Wavelength Cell Scoring analysis, standard algorithm
 - Analysis with MetaXpress software: **10 hours/plate**
 - Analysis with MetaXpress PowerCore Software, 16 cores : **39 min/plate**
 - **> 15-fold improvement in analysis throughput**



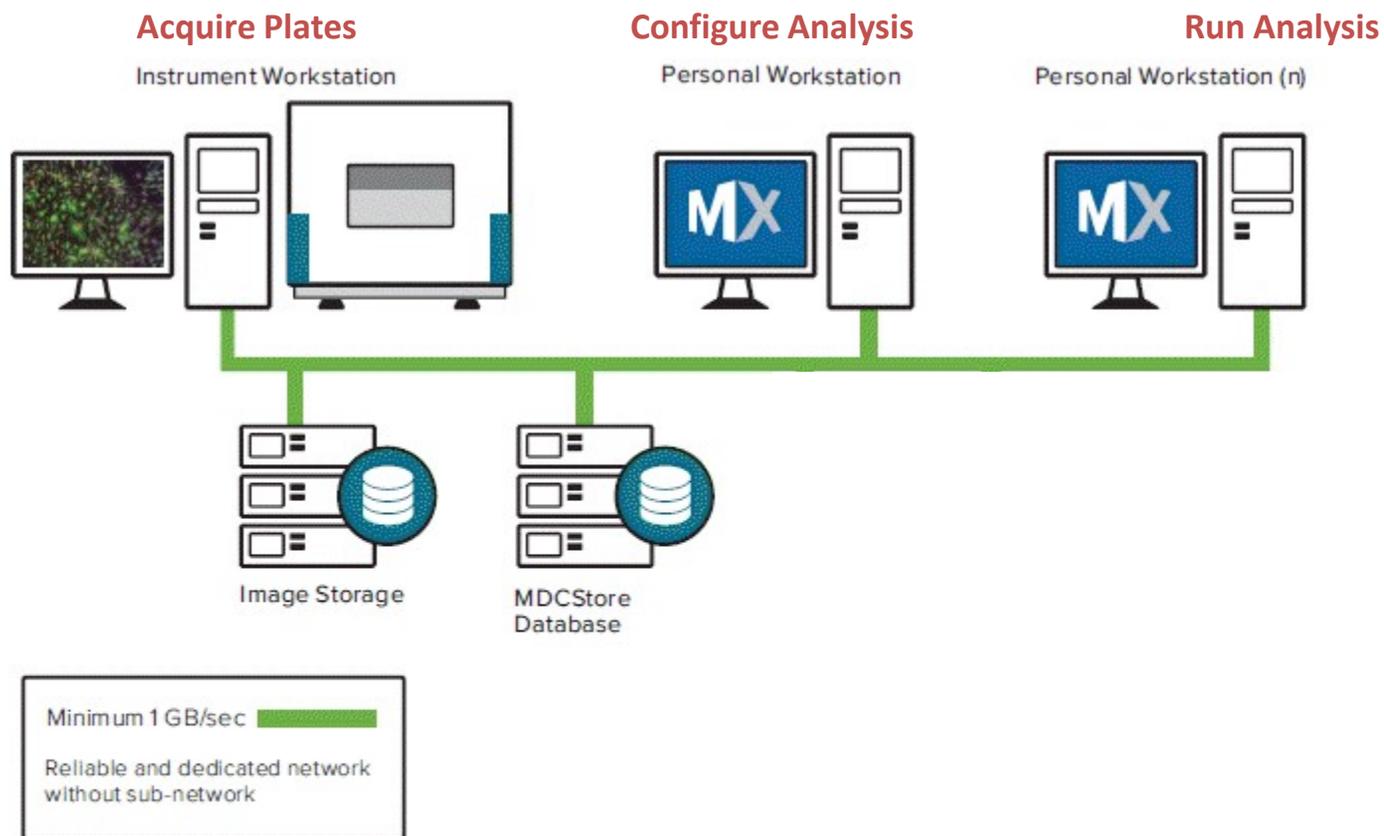
Note: Actual times depend on plate and acquisition settings, assays, software and hardware configurations. These times are provided as an example.



Auto run analysis: MetaXpress-only setup



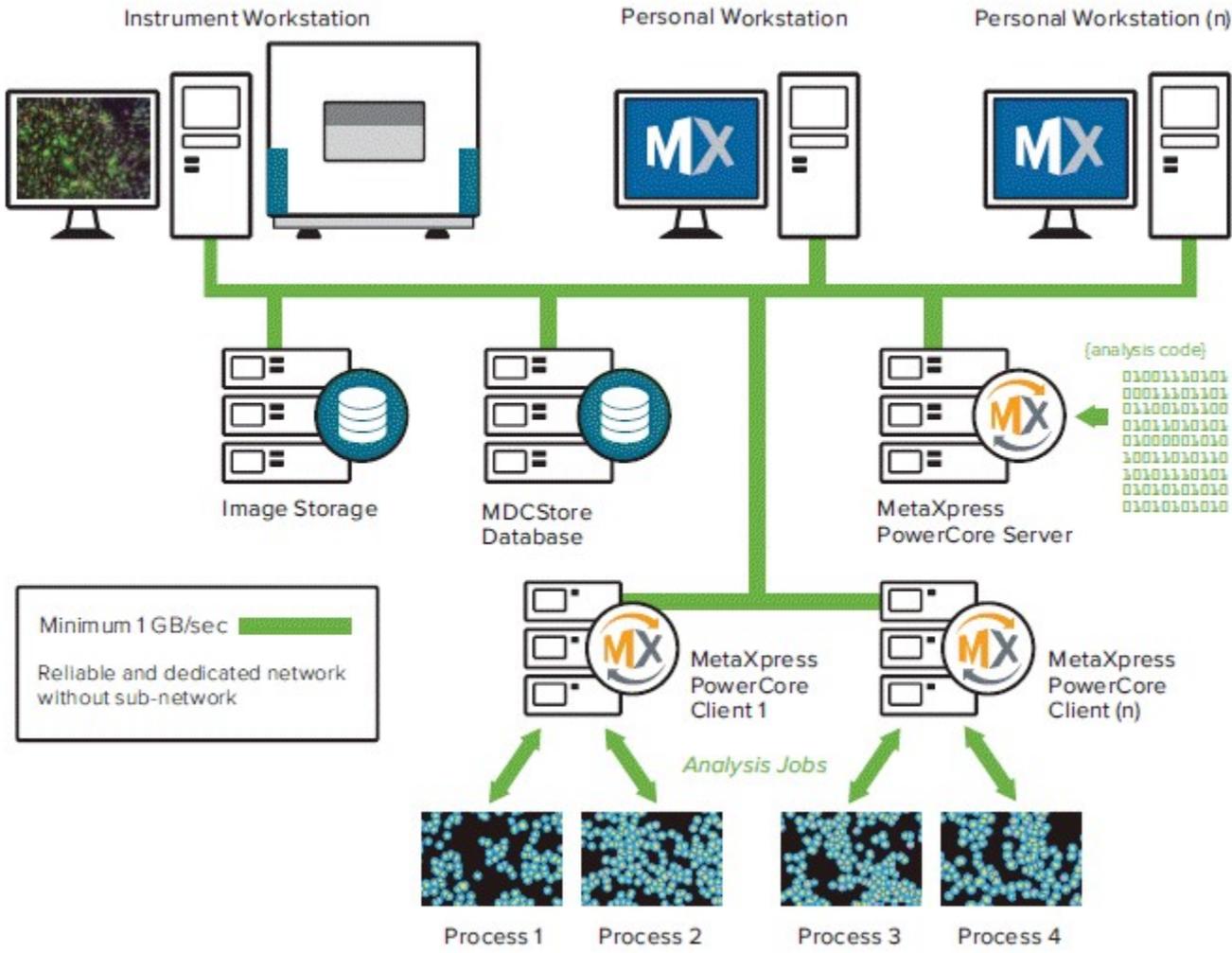
Auto run analysis: MetaXpress-only setup



**Slower analysis with
MetaXpress software**



Auto run analysis: PowerCore setup



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Work flow for the end user

MetaXpress analysis work flow:

- Schedule analysis in MetaXpress software
- Set MetaXpress work station to auto run mode
- Wait hours to retrieve data

Note: actual times vary with specific plates/assays and computer specifications

PowerCore analysis work flow:

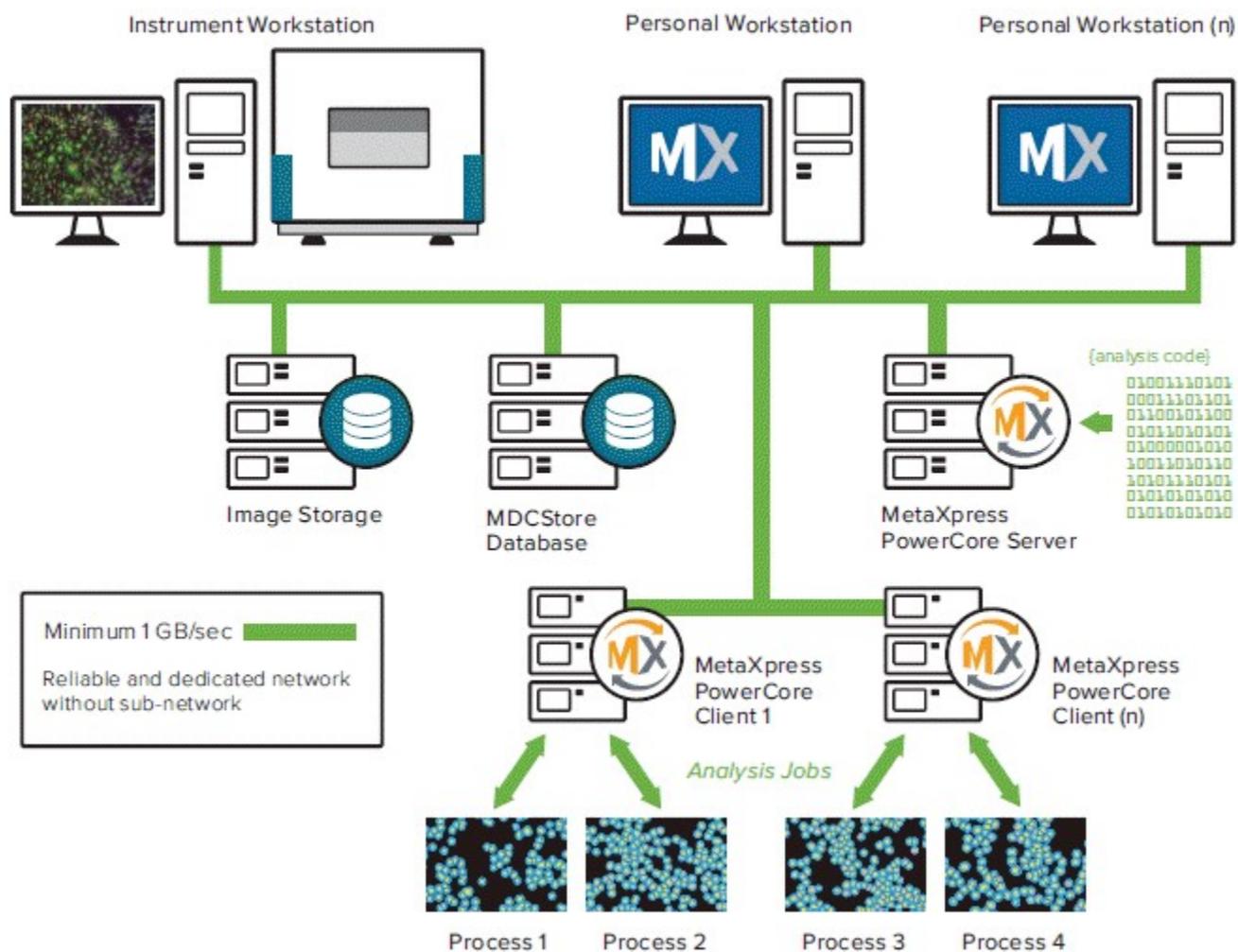
- Schedule analysis in MetaXpress software
- Wait minutes to retrieve data
- Continue using MetaXpress while analysis runs

Note: actual times vary with specific plates/assays and computer configurations



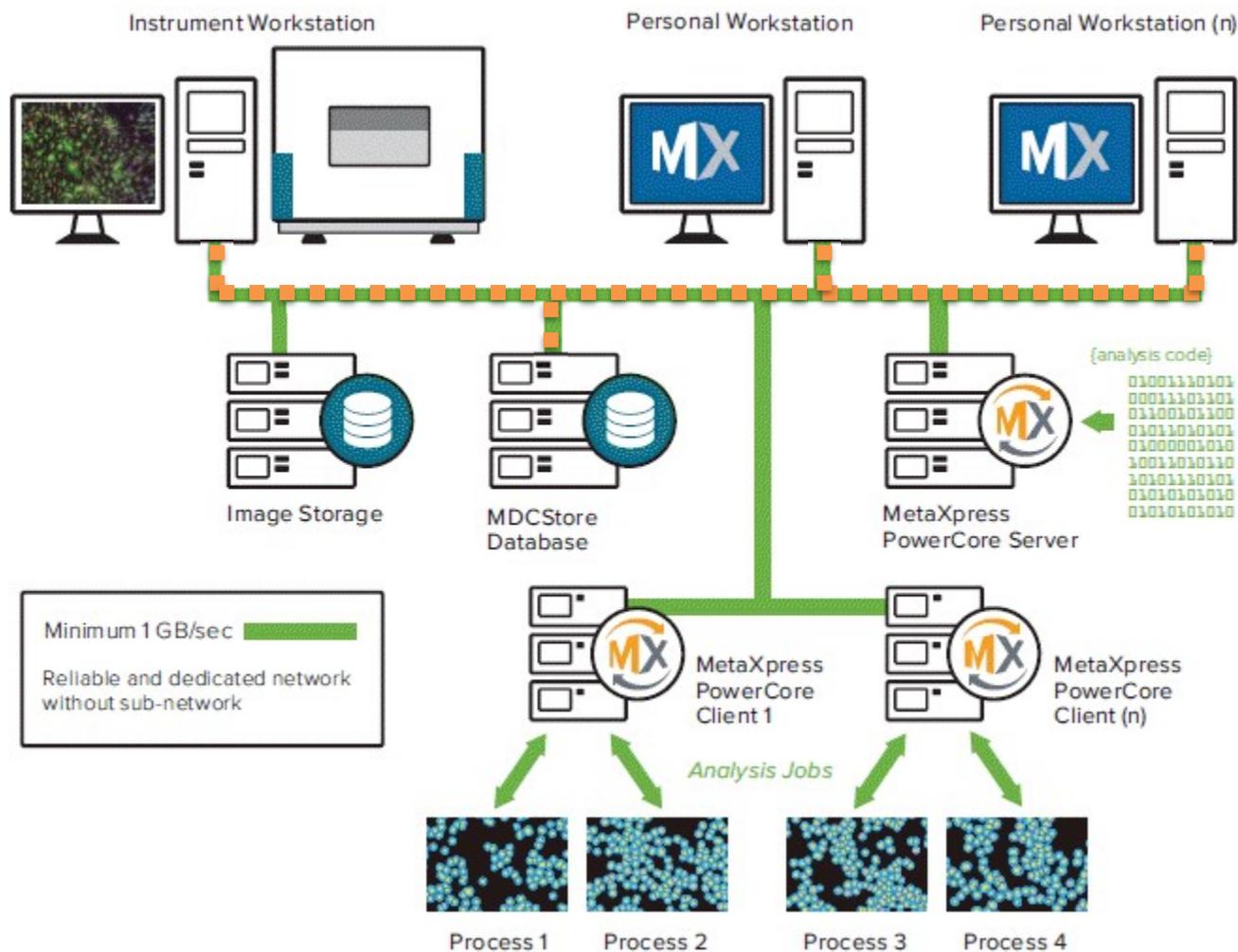
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PowerCore workflow:



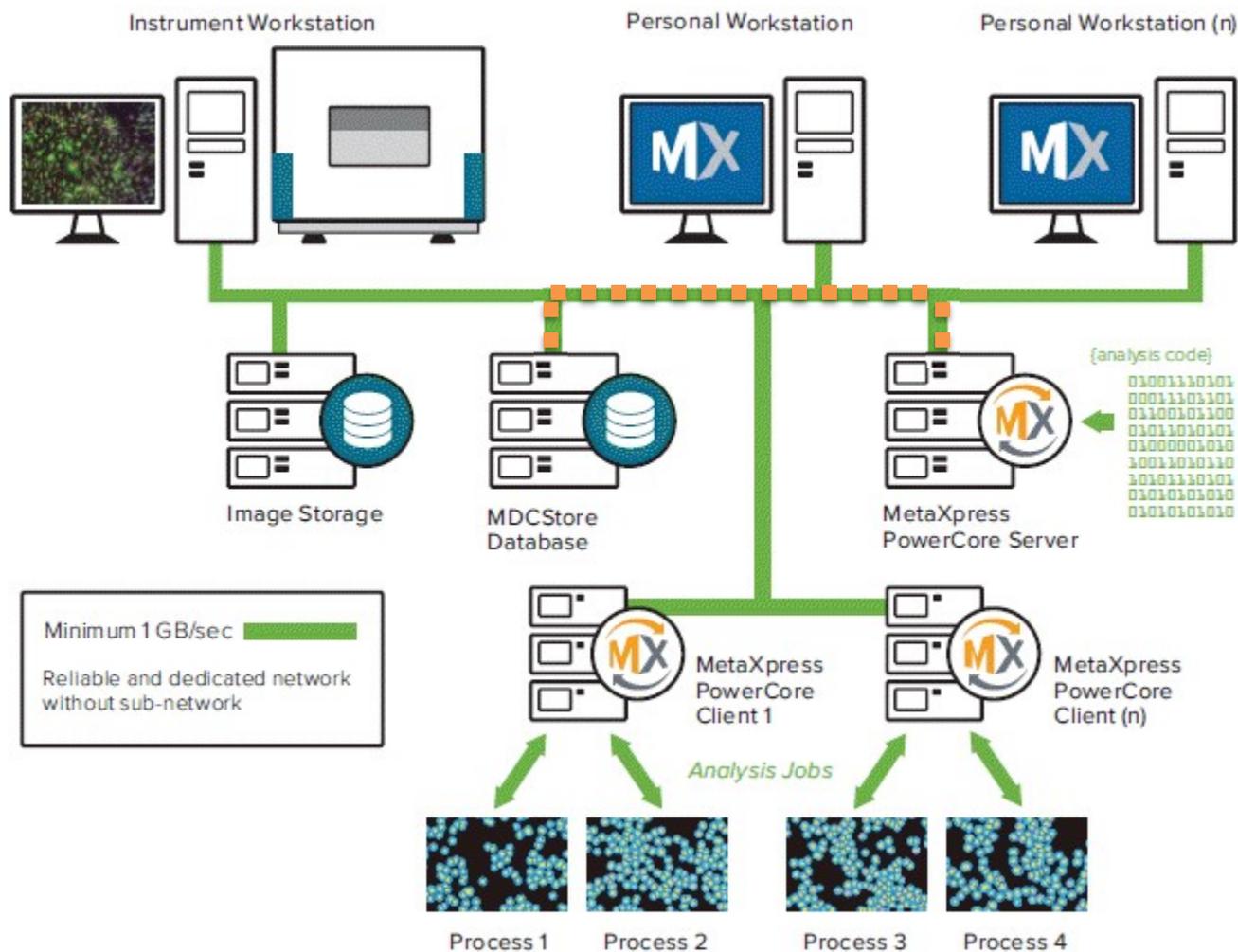
PowerCore workflow:

MetaXpress computers add analysis jobs to queue in database



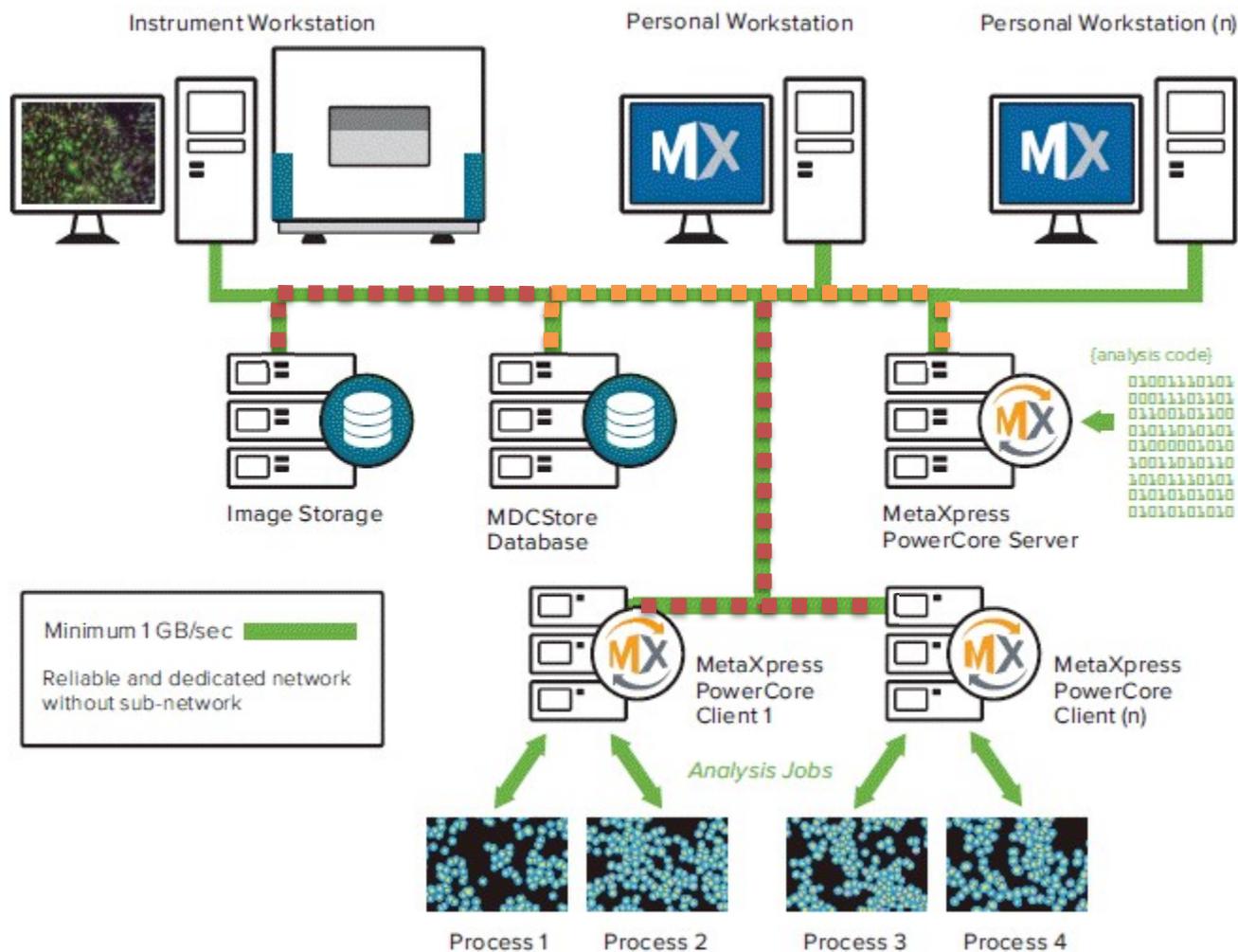
PowerCore workflow:

PowerCore Server monitors queue for new jobs



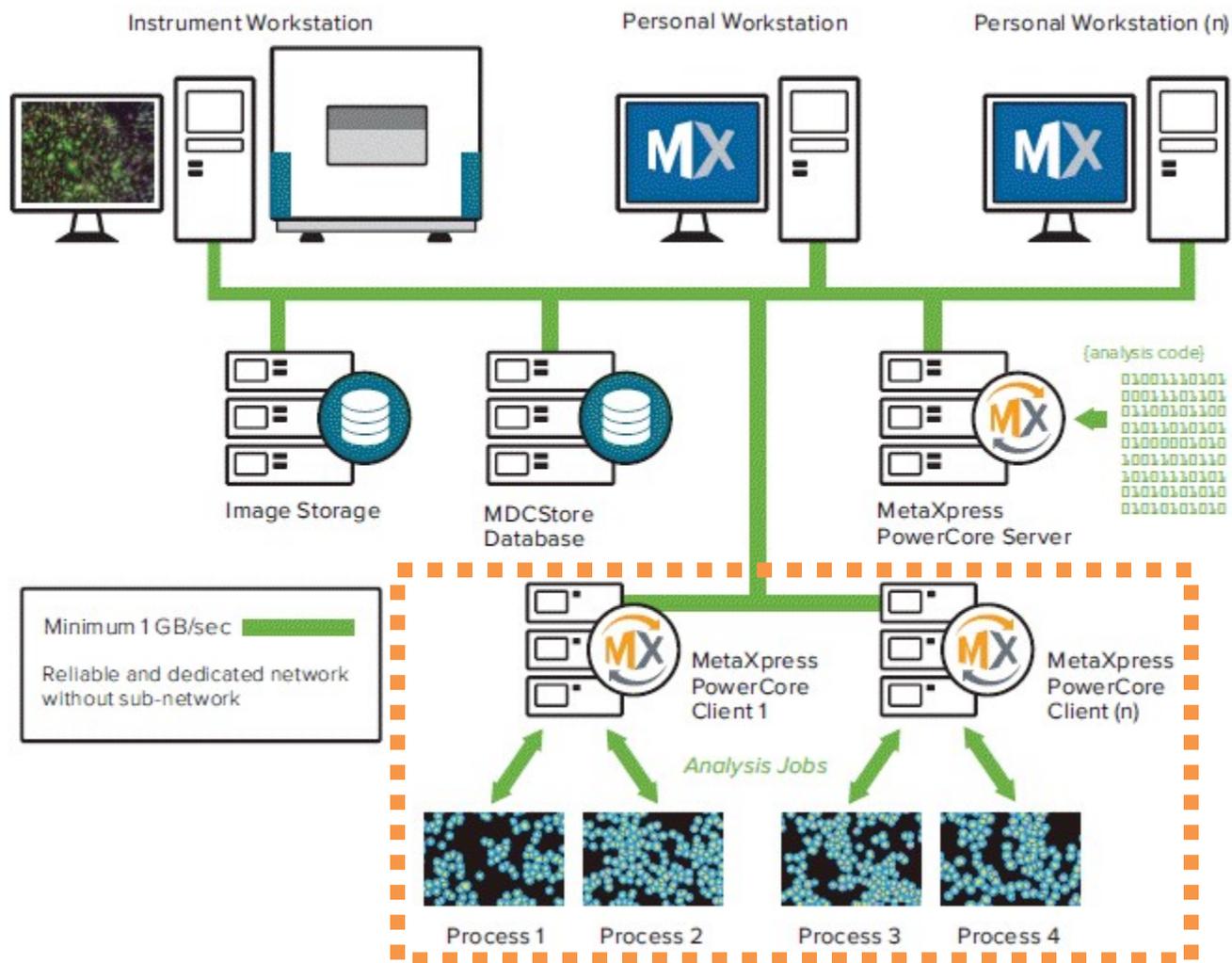
PowerCore workflow:

PowerCore Server distributes work units to PowerCore Clients



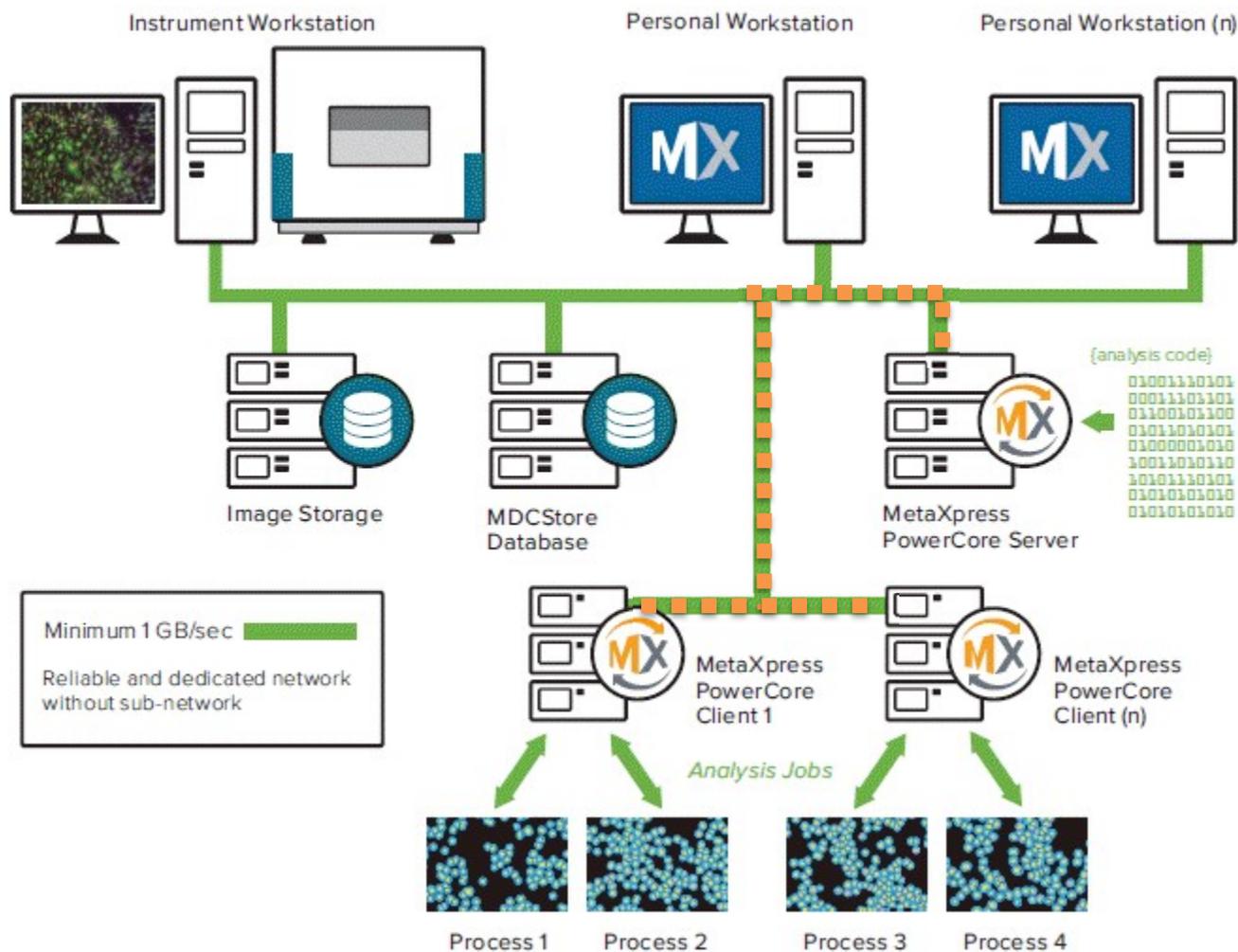
PowerCore workflow:

PowerCore Clients perform analysis



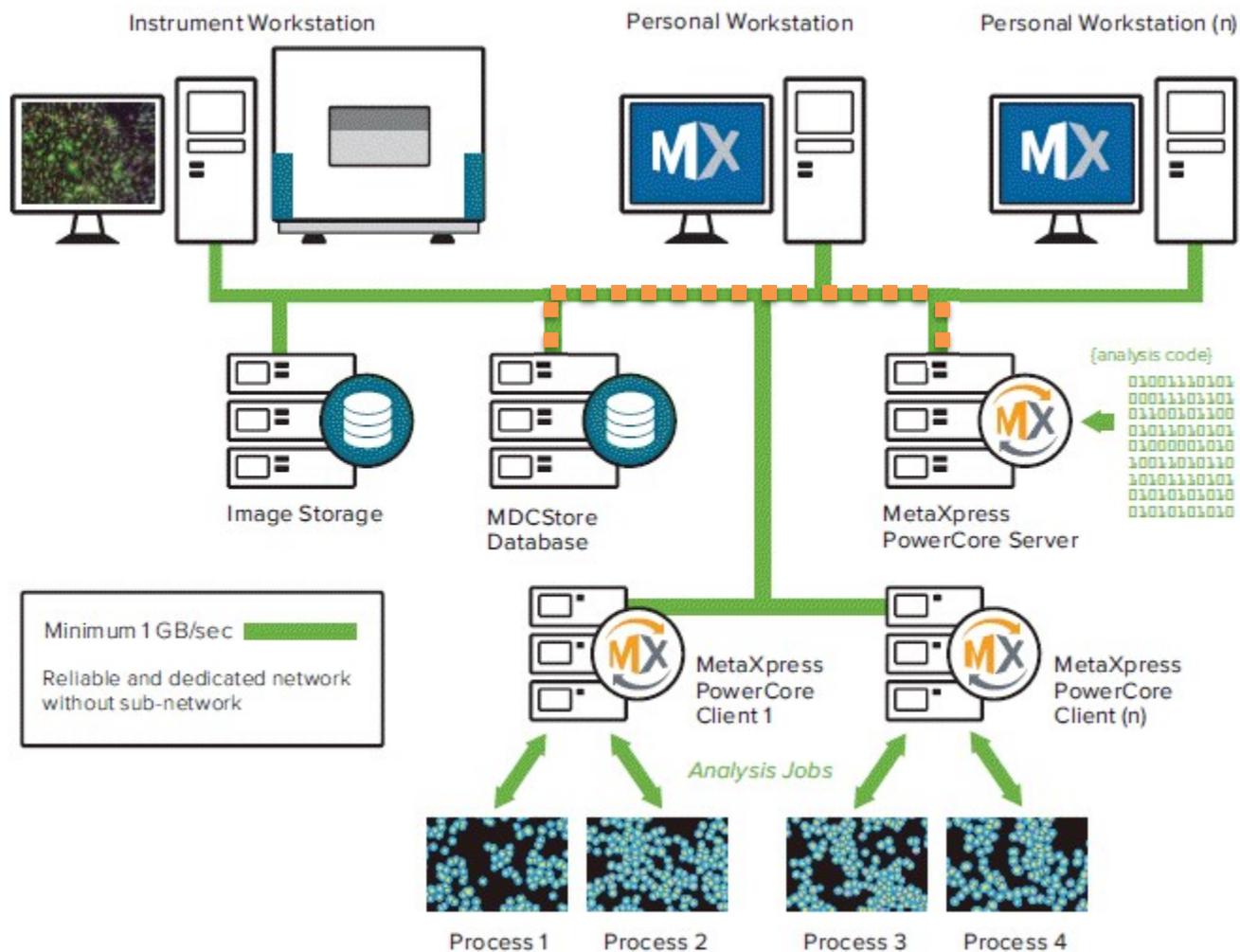
PowerCore workflow:

PowerCore Clients send results back to PowerCore Server



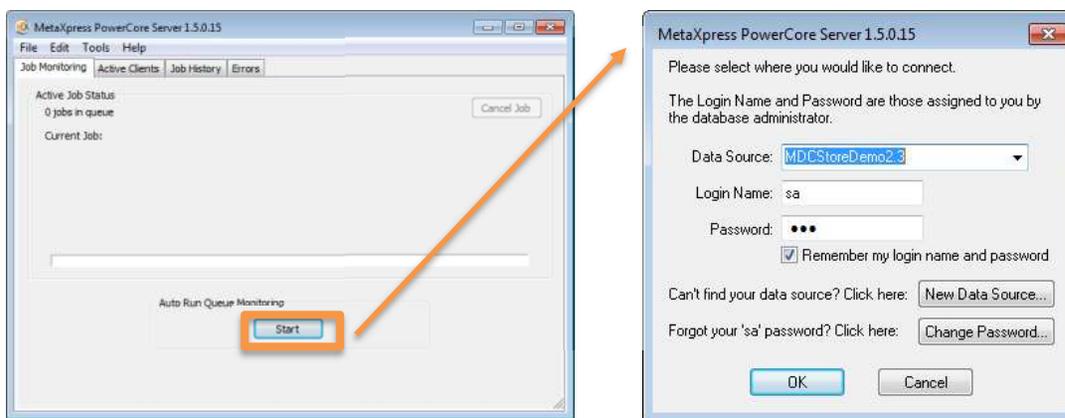
PowerCore workflow:

PowerCore Server writes results to MDCStore database



Run MetaXpress PowerCore

- 1) If it is not already running, start the MetaXpress PowerCore Server (**Start menu > Molecular Devices > PowerCore**).
- 2) Verify the Server Settings, then click **OK**.
- 3) Click **Start**.
- 4) Select the appropriate database.
- 5) If the Data Source dropdown does not show the database, create a Data Source:
 - Recommended: click **New Data Source** to configure the ODBC connection
 - Alternatively: Go to **Control Panel > Administrative Tools > ODBC Data Sources (64-bit)**
- 6) Log into the database using an account that has read-write access to all of the plates requiring analysis (it is recommended to use a database administrator account)



Start PowerCore Server from the Command line (optional)

- The MetaXpress PowerCore Server software can optionally be started from the command line using the following format:
 - C:\Program Files\Molecular Devices\MetaXpress PowerCore Server >
MetaXpressPowerCore.exe -s
(Note: program location may vary depending on your particular installation)

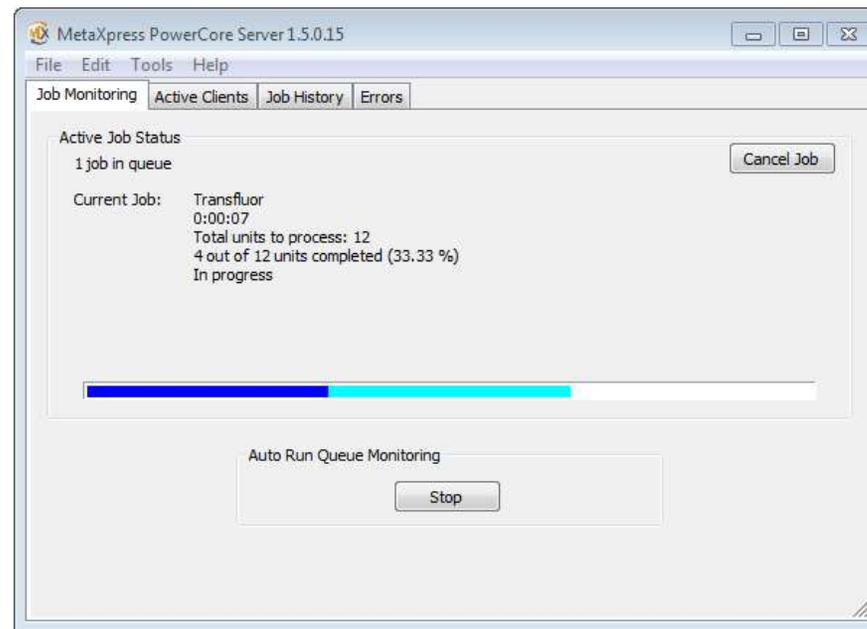
```
C:\Program Files\Molecular Devices\MetaXpress PowerCore Server>MetaXpressPowerCore.exe -s
```

- The following arguments are supported:
 - **-s** start
 - **-p** pause
 - **-x** exit
- If the **Remember my login name and password** option was previously selected and the user credentials were entered properly, the MetaXpress PowerCore server program will open and automatically login to the database.



Job Monitoring

- If there are any analysis jobs in the database job queue, the PowerCore software will start processing them.
- The jobs are processed in the order that they were added to the queue.



Active Clients

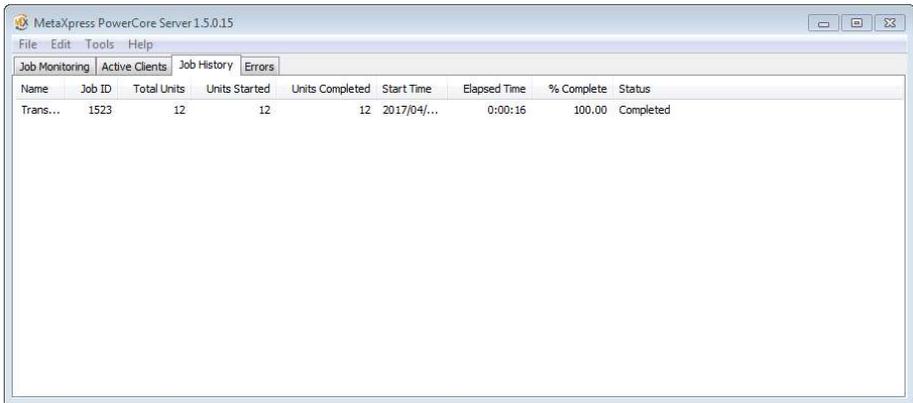
- The PowerCore software can only process jobs if it is connected to active PowerCore Clients.
- View PowerCore Clients in the Active Clients tab in the PowerCore Server software.

Host Name	CPU Speed (MHz)	RAM (MB)	Total CPUs	Free Processes	Active Processes	Units Started	Units Completed	Units Failed	Status
CPOD01-SVL	1995	3326	8	0	4	12	8	0	Busy
THUNDERDOME003	2394	3326	4	0	4	9	5	0	Busy
THUNDERDOME002	2394	3326	4	0	4	8	4	0	Busy
THUNDERDOME006	2394	3326	4	0	4	8	4	0	Busy
THUNDERDOME005	2394	3326	4	0	4	8	4	0	Busy
THUNDERDOME001	2394	3326	4	0	4	9	4	1	Busy
THUNDERDOME007	1995	2046	4	0	4	8	4	0	Busy
THUNDERDOME008	1995	2045	4	0	4	8	4	0	Busy



Job History and Logs

- The Job History tab maintains a list of analysis jobs that have been processed during the current PowerCore session.



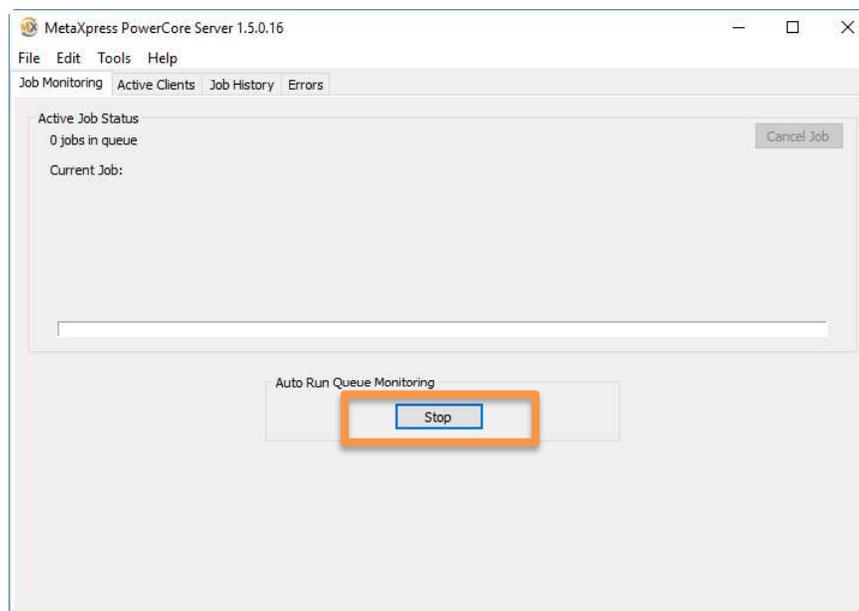
Name	Job ID	Total Units	Units Started	Units Completed	Start Time	Elapsed Time	% Complete	Status
Trans...	1523	12	12	12	2017/04/...	0:00:16	100.00	Completed

- The job history, including any associated error messages, is also stored in the MetaXpress PowerCore Log.
 - The default location of the log files is **C:\Program Files\Molecular Devices\MetaXpress PowerCore Server**
 - Go to **Edit > Preferences** to change the log file location. In some cases, Windows permissions may prevent the log files from being created within C:\Program Files.



Change Database Connection

- To change your database connection, click **Stop**, then click **OK**.



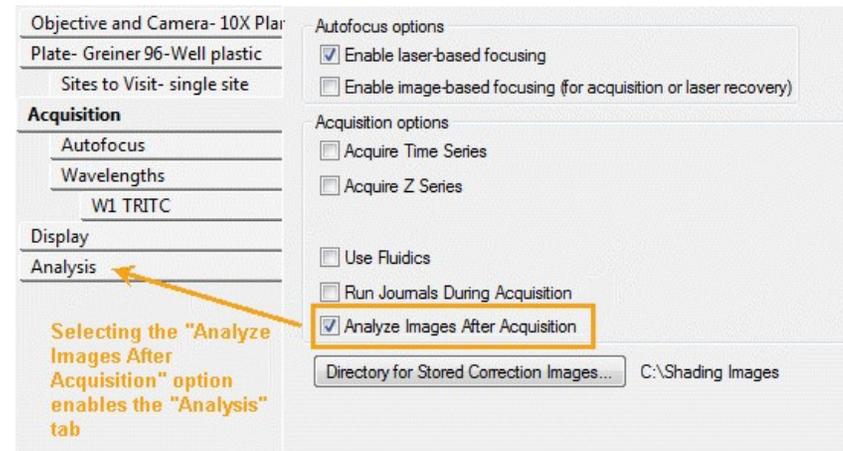
- Click **Start** and sign into the appropriate database.



Schedule an analysis job in MetaXpress

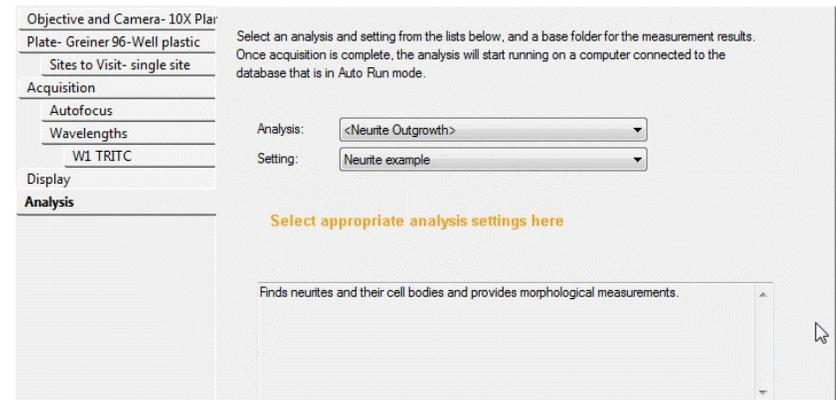
Option A: Schedule at time of Image Acquisition:

- 1) In the MetaXpress software, go to **Screening > Plate Acquisition Setup**.
- 2) Load or create plate acquisition protocol.
- 3) On Acquisition tab, enable “**Analyze Images After Acquisition**”.
- 4) On Analysis tab, select the analysis module and appropriate settings.
- 5) **Acquire Plate**.



Option B: Schedule after Image Acquisition is completed:

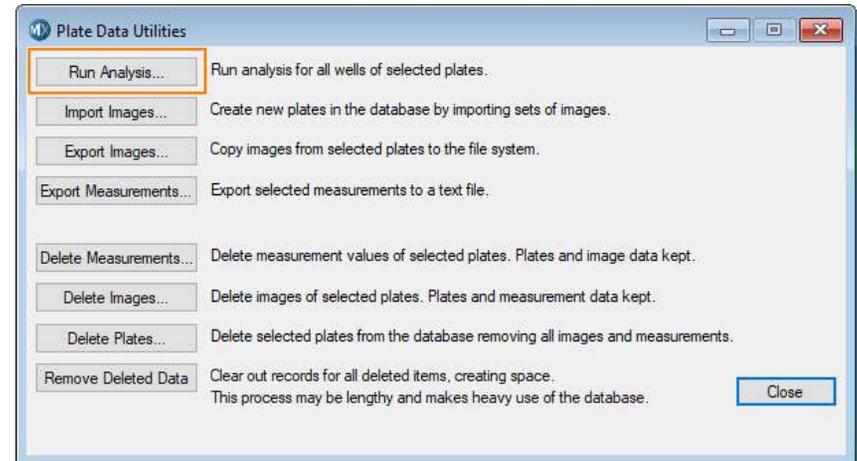
- 1) In the MetaXpress software, go to **Screening > Plate Data Utilities**.
- 2) Click **Run Analysis**.
- 3) Select the plate(s) to analyze.
- 4) Select the analysis module and the settings.
- 5) Set the “Run method” to “Add to auto run list”.
- 6) Click **OK**.



Schedule an analysis job in MetaXpress

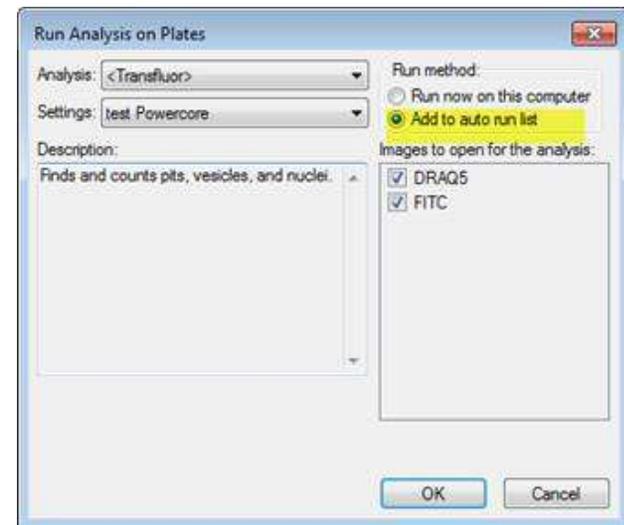
Option A: Schedule at time of Image Acquisition:

- 1) In the MetaXpress software, go to **Screening > Plate Acquisition Setup**.
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- 4) On Analysis tab, select the analysis module and the settings.
- 5) **Acquire Plate**.



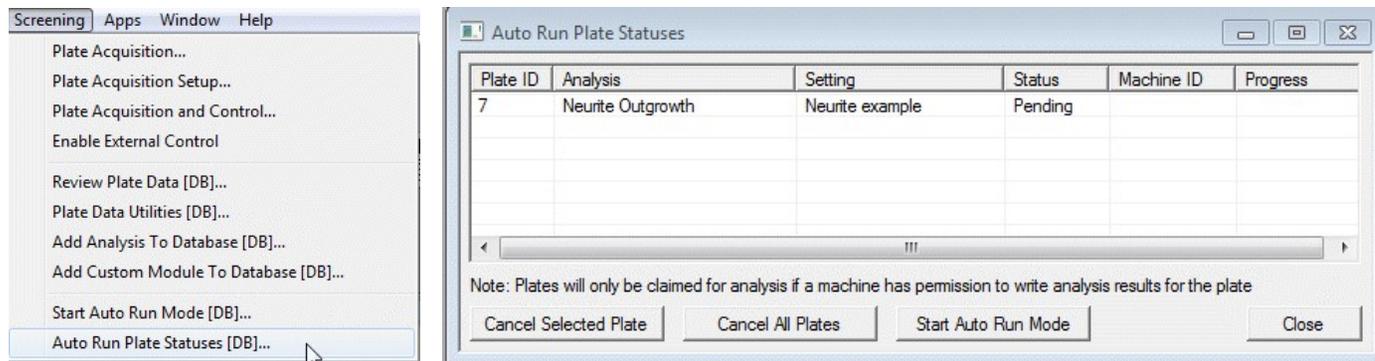
Option B: Schedule after Image Acquisition is completed:

- 1) In the MetaXpress software, go to **Screening > Plate Data Utilities**.
- 2) Click **Run Analysis**.
- 3) Select the plate(s) to analyze.
- 4) Select the analysis module and appropriate settings.
- 5) Set the “**Run method**” to “**Add to auto run list**”.
- 6) Click **OK**.



Monitor analysis jobs in MetaXpress

- Once the analysis job is scheduled, it is added to the job queue / auto run list in the database.
- To view the job queue in the MetaXpress software, go to **Screening > Auto Run Plate Statuses**.
- Do **NOT** click **Start Auto Run Mode** unless you have journal analyses scheduled. This will put MetaXpress into Auto Run mode and it will compete with the PowerCore software for analysis jobs.
- **NOTE:** Analysis jobs can be canceled as needed in the Auto Run Plate Statuses dialog. It is recommended to remove any old jobs showing errors.
- **NOTE:** It is not recommended to leave the Auto Run Plate Statuses window open in the background, as this queries the database frequently and can slow down database performance.



MetaXpress PowerCore limitations

- The PowerCore system processes only those jobs that contain MetaXpress application modules or custom modules.
- If a job contains any MetaXpress journals, it is ignored by the PowerCore system and must be processed by the MetaXpress software.



PowerCore Licensing

- Network License key
 - Install on any suitable Windows computer on the network.
 - License key controls the total number of parallel processes that can be run.
 - Multiple PowerCore Servers and Clients can be served with one key, but the total number of processes running is limited by the license.
- PowerCore licensing options: 4, 8, 16, or 32 parallel processes
 - PowerCore Clients can be located on multiple computers as needed.
 - If your system uses Hyper-Threading, count each logical core separately.



Computer configurations

- See Computer Requirements document (https://mdc.custhelp.com/app/answers/detail/a_id/20105) for minimum and recommended computer specifications
 - **NOTE:** 3D analysis jobs have higher RAM and core requirements than regular analysis jobs
- Optimal Configuration:
 - Dedicated server for MetaXpress PowerCore Server
 - Dedicated computer(s) for MetaXpress PowerCore Clients
 - Dedicated server for MDCStore database
 - Dedicated server for image storage
- Common alternative configurations:
 - Put image storage on MDCStore database server
 - Put image storage on network share
 - Run MetaXpress PowerCore Server and Clients on the same server



MetaXpress PowerCore Installation - Summary

- 1) Prerequisites:
 - Read Install documentation (https://mdc.custhelp.com/app/answers/detail/a_id/18754)
 - Read Release notes (https://mdc.custhelp.com/app/answers/detail/a_id/18818)
 - Read Required IT documentation (http://mdc.custhelp.com/app/answers/detail/a_id/20105)
- 2) (*Oracle database only*): Install the Oracle Clients on all PowerCore computers.
- 3) Verify that the MDCStore database is at version 2.3.
- 4) Verify that the PowerCore installer version is compatible with the MetaXpress version (see Compatibility Chart at https://mdc.custhelp.com/app/answers/detail/a_id/18817).
- 5) On the **PowerCore Server computer**:
 - 1) Run the PowerCore installer and click **Setup**.
 - 2) Remove all Sentinel USB license keys.
 - 3) Click **Install License Key Server** and follow the prompts.
 - 4) Select **Install PowerCore Server** and follow the prompts.
 - 5) Configure the ODBC connection via PowerCore Server, or via the Control Panel > Administrative tools.
- 6) On the **PowerCore Client computer(s)** (may be the same or different computer):
 - 1) Configure the ODBC connection via the Control Panel > Administrative tools.
 - 2) Run the PowerCore installer and click **Setup**.
 - 3) Select **Install PowerCore Client** and follow the prompts.
 - 4) Optionally configure the PowerCore screensaver.



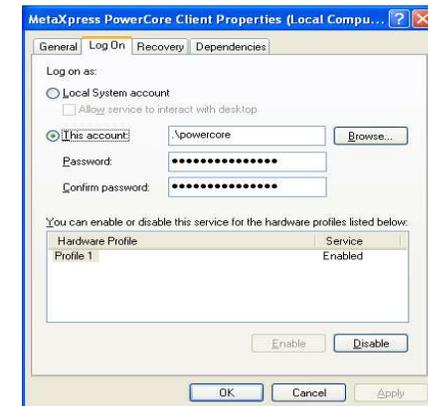
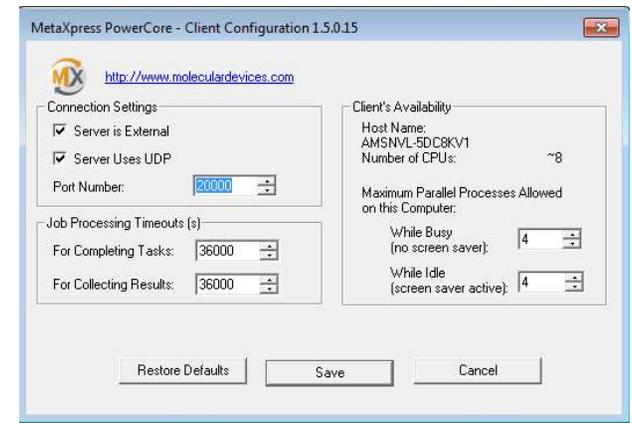
MetaXpress PowerCore Installation I: License key

- Click **Install License Key Server**.
- Follow the instructions in the wizard to complete the installation.
- Standard Windows firewall:
 - During installation, you might see a message that Windows Firewall settings on the license key server are being changed. This is because the license key driver opens a port on the computer for licensing access.
- If other firewall software installed:
 - add TCP/IP port 6002 and spnsrvt.exe to the exception list



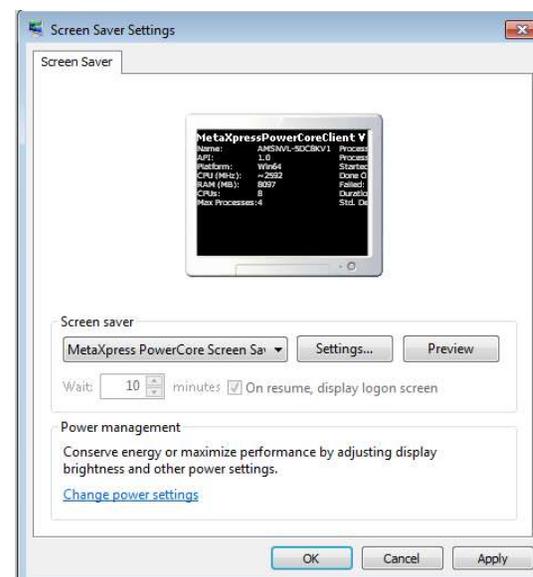
MetaXpress PowerCore Installation II: Client

- (Oracle Database Only): Install Oracle Client software.
- Configure ODBC connection.
 - The Data Source name must match the name on the PowerCore Server computer.
- Start the PowerCore client software (**Start → Programs → Molecular Devices → PowerCore Client**).
 - Modify the settings as appropriate.
 - Click **Save**.
- If using a UNC image storage location, set the LogOn properties of the MetaXpress PowerCore Client service to use a suitable user account with access to the image location.
 - If the user password changes, the service logon properties must be updated.



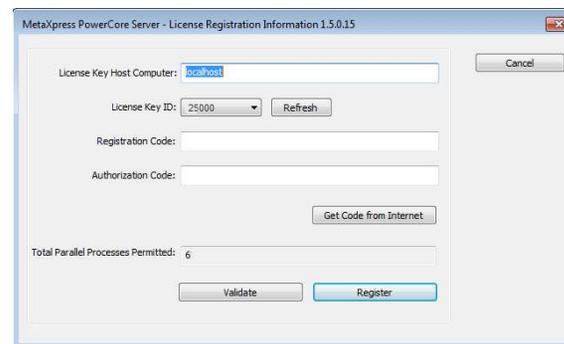
MetaXpress PowerCore Installation III: Client

- Select a port number:
 - Default is 20000
 - Consult customer's IT administrator
 - <http://www.iana.org/assignments/port-numbers>
- Job Processing Timeouts:
 - Consult customer's IT administrator
 - Depends on network latency and analysis complexity
- Set Screensaver:
 - Configure the Windows Screen Saver Settings to use MetaXpress PowerCore Screensaver
 - The server checks the client's screen saver state to determine how to use the client's CPU
 - If the client's screen saver is not set to use MetaXpress PowerCore Screensaver, the PowerCore server considers the client to be busy, even if the client is idle, or if another screen saver is active.



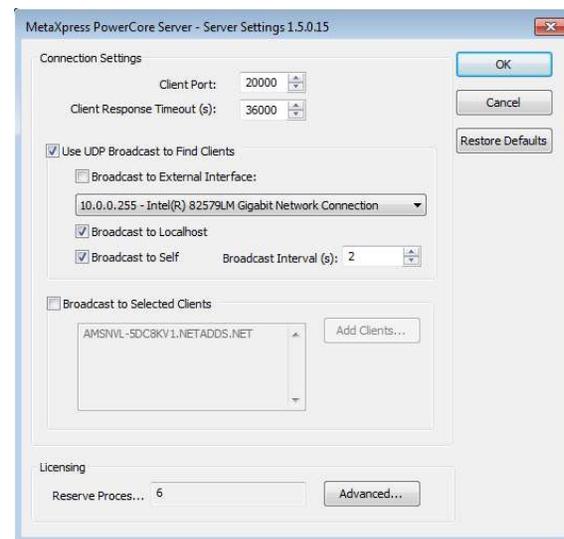
MetaXpress PowerCore Installation IV: Server

- Start the PowerCore Server software
 - Go to **Start** → **Programs** → **Molecular Devices** → **PowerCore Server**
 - Insert the USB license key
 - Go to **Tools > Licensing**
 - Modify the location of the key if needed
 - Select the correct License Key ID from the drop down
 - Click **Get Code From Internet**, or enter registration/ authorization codes manually (<http://www.meta.moleculardevices.com/authorize/>)
 - Click **Validate**
 - Click **Register**, then click **OK**.
 - Restart the PowerCore Server software.



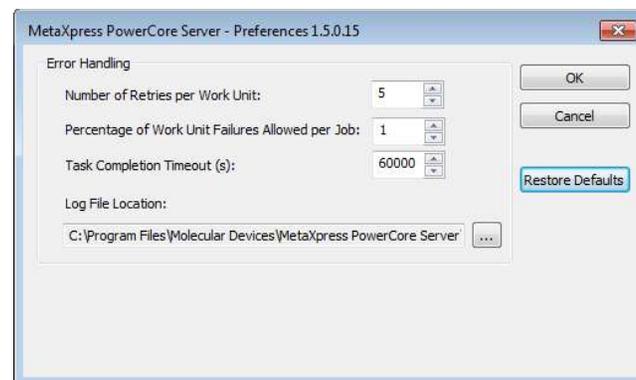
MetaXpress PowerCore Installation V: Server

- Go to Server Settings (**Edit → Server Settings**)
- Verify that the port number matches the PowerCore Client port setting.
- If appropriate, add specific PowerCore Client computers to the selected client list
- Click **Advanced** and verify that the number of Reserved Processes matches the license key.



MetaXpress PowerCore Installation VI: Server

- Go to Preferences (**Edit**→**Preferences**)
- Configure:
 - The number of retries (typically 3-5)
 - The % of work failures allowed (typically 1%)
 - Task Completion Timeout (this depends on your network and analysis complexity)
 - The location of the log files
 - Recommend changing from the default location, since Windows permissions may prevent saving to C:\Program Files.



Firewalls and Antivirus Software

- Avoid firewalls between PowerCore servers and clients.
- Install clients and servers on the same subnet if possible.
- Firewall settings on PowerCore Client computers: add MetaXpressPowerCoreClient.exe and AMExecutioner.exe to the exception list.
- Firewall settings for the network key driver: add spnsrvt.exe to the exception list as needed
- Verify that firewalls are configured to permit both UDP (User Datagram Protocol) and TCP (Transmission Control Protocol) transmissions on the specified PowerCore port and on 6002 for the network license key.
- Verify that antivirus software permits UDP and TCP transmissions on the specified port.
- Verify that antivirus software allows running of analysis modules by the MetaXpress PowerCore client.



PowerCore Error Handling Overview

- The PowerCore software has 4 operational states:
 - Idle
 - Monitoring for jobs [After clicking **Start**]
 - Executing a job
 - Stopping: stop monitoring for new jobs and finishing up current job. [After clicking **Stop**]
- The PowerCore software has three error report mechanisms
 - Prompt User: the system cannot proceed without user intervention.
 - Errors tab: an error or warning occurred while processing the job or work unit but application can proceed.
 - Log file: All warnings, notifications and error messages are written to the PowerCore log file.



MetaXpress PowerCore: Error messages at Start

Error: Cannot start Autorun Queue Monitoring because ...	Possible solutions
the license key is not valid. Verify the license settings, then try again.	<ol style="list-style-type: none">1. Close the Server program and reopen it.2. Make sure the proper license key number is selected under Edit > Server Settings > Advanced3. Try to reduce the processes reserved for this server by 1 (once successful, reset the number).
there are no active clients. Verify the network connections and port settings or install clients.	<ol style="list-style-type: none">1. Make sure the clients are running → start clients2. Make sure the clients are registered on the Active Clients →<ol style="list-style-type: none">1. Restart clients2. Same client port on Server and client software3. Check network connections/ UDP/TCP



Troubleshooting MetaXpress PowerCore Server-Client Communication issues

- Verify firewalls allow communication between servers and clients using the specified port (UDP and TCP).
 - **NOTE:** UDP broadcast is used to establish communication, but once the PowerCore client has begun processing a work unit, the system uses TCP to send and receive analysis results across the network.
- If your network cannot accommodate UDP transmissions, configure the PowerCore server to broadcast to selected clients using TCP.
- If server and client computers are on different subnets, try specifying static IP addresses instead of computer names.
- Use of Windows Server OS is recommended.
- UNC image storage locations: All PowerCore computers must have access to the images.
 - Recommended: Configure the MetaXpress PowerCore Client service to use a specified service account



Troubleshooting: Connecting to a PowerCore Client

Error message:

- Can't connect to a specific PowerCore client
- Client in preselect list is not available

Possible causes:

- Client [metaxpresspowercoreclient.exe] is not running
- Server and client ports do not match
- Client computer turned off.
- Client is busy (connected to another PowerCore Server)
- Network is down (Network cable unplugged)
- Not ping-able from Server to client machine (from command line prompt, type: “ping <client-machine-name>”)
- Windows Firewall is blocking UDP/TCP transmissions



Troubleshooting: Client dropped from the Active Clients tab

- The PowerCore Server will check periodically if the client is available.
- A previously connected Client may be removed from the Active Clients list if Server can't get a response from the client:
 - Client setting has changed [port number].
 - User stopped metaxpresspowercoreclient.exe.
 - Client machine was shut down.
 - Network is down (cable unplugged, Local network down, etc.).
 - Network latency
 - Try increasing the “Client Response Timeout” setting.



Troubleshooting: License related issues

- Note: Since PowerCore uses a network dongle, the license key may be located on a non-PowerCore computer
- Possible issues:
 - License key and/or license key driver not installed.
 - Key is invalid (expired, or not programmed for PowerCore).
 - The key host computer is not accessible on the network.
 - Can't read key (damaged).
 - Network key communication blocked by firewall.



Troubleshooting: Database Connection

- “Failed to establish a Database connection” possible causes:
 - ODBC Data Source name is incorrect (Data Source on Clients must match Server)
 - Incorrect username or password.
 - Database server is down or database software not running.
 - Network connection to database server failed.
 - Database server errors: exceeds the max sessions allowed [Oracle]
- “Database Connection dropped” possible causes:
 - Database server is down or database software stopped running.
 - Network connection to database server failed.
 - Database server errors: exceeds the max sessions allowed [Oracle]



Incomplete analysis: Avoiding timeout errors

- Complex analyses (e.g. Neurite Outgrowth and Custom modules) can be slow, requiring longer timeouts.
- If simple analysis jobs succeed, but complex ones fail with timeout errors (“UNIT ERROR - DS - The task was not completed within the timeout period.”):
 - Time the analysis of one site in the MetaXpress software as an estimate.
 - Increase the following timeout settings as appropriate:
 - MDCStoreTools: **MX Settings > Auto run timeout**
 - PowerCore Server: **Edit > Server Settings > Client Response Timeout**
 - PowerCore Server: **Edit > Preferences > Task Completion Timeout**
 - PowerCore Client: **Job Processing Timeouts**
 - Repeat for every PowerCore Client computer. Check the Active Client list in the PowerCore Server interface.



Other common errors and warnings

- “Processing failed - Internal error. The work unit could not be processed because the image file could not be saved on the client computer.” or “The job was skipped because it does not contain any work units”
 - Verify that the module settings (wavelength selections) matches the plate.
 - Test run the module settings on the plate in MetaXpress.
- “Analysis type cannot be processed by the application or error starting the job”
 - Verify that the PowerCore version is compatible with the MetaXpress version.
 - Verify that the PowerCore computer has all the required software prerequisites (e.g. correct Microsoft .Net version)
- “Data source name not found and no default driver specified”
 - Check the ODBC connection and make sure it is the correct type (e.g. 64-bit and not 32-bit)
 - Verify that the Data Source name matches on the PowerCore Server and Client computers



Other common errors and warnings

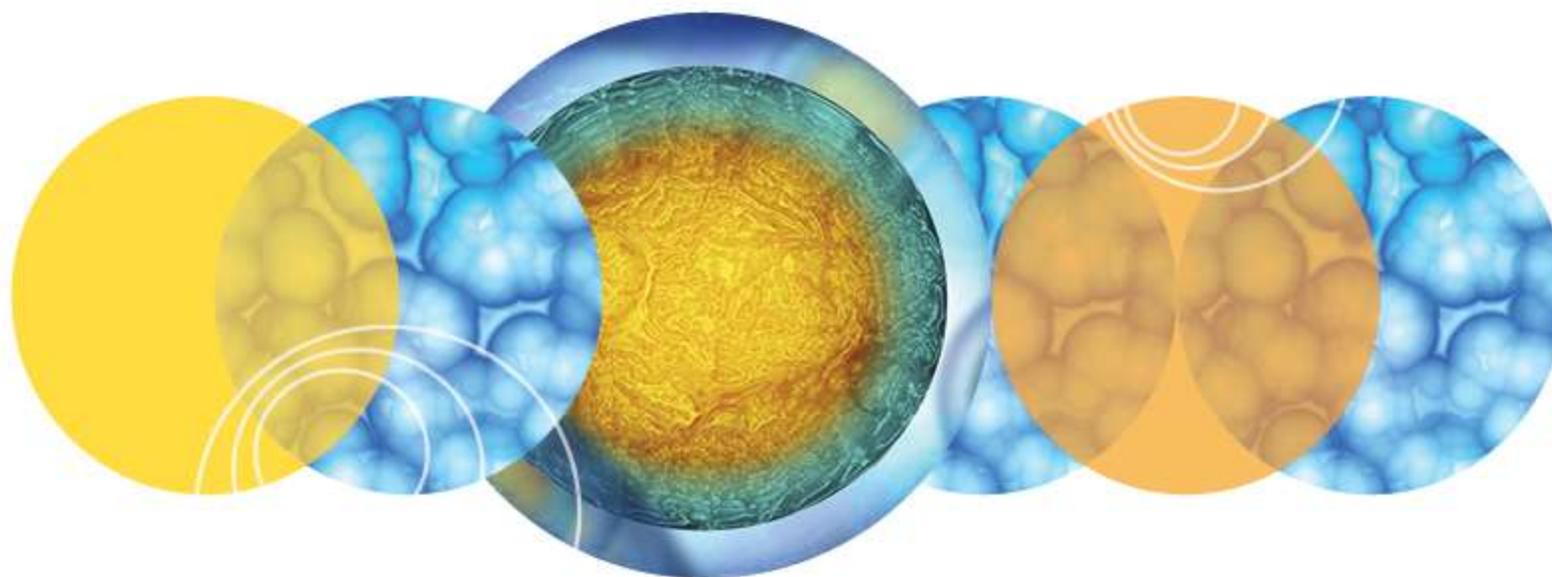
- “An unknown error occurred while accessing \\servername\folder\folder\imagename.tif.”
 - Check MetaXpress PowerCore Client service Log on settings – see slide 30
- “UNIT ERROR - ExitCode = 1. Unit Info - Plate ID: ### : well C02, site ##, Time Point 1, Z Index 1”
 1. Clear out the DLL cache on the PowerCore client computer
 - Stop the MetaXpress PowerCore Client service. (Windows service manager)
 - Delete the "AMExecutioner-0.0" folder from C:\ProgramData\Molecular Devices\MetaXpressPowerCoreClient\
 - Restart the MetaXpress PowerCore Client service.
 2. If clearing the DLL cache does not resolve the error, reinstall the PowerCore Client.
 - Uninstall PowerCore Client (Control Panel > Programs and Features).
 - Install PowerCore Client.
 - Reboot the computer.
 - Verify the PowerCore Client service log on settings.



Where to seek help and info

- Download latest version and view release notes:
https://mdc.custhelp.com/app/answers/detail/a_id/18818
- Download user guides, including:
 - MetaXpress PowerCore Installation and User Guide
 - OS (operating system) and Computer Requirements
 - IT Requirementshttps://mdc.custhelp.com/app/answers/detail/a_id/18754
- Customer's IT expert
- Customer's DBA (database administrator)
- Search the Knowledge Base or contact Molecular Devices support at: www.moldev.com/support
 - If troubleshooting PowerCore errors, please have the MetaXpress Powercore Log available (log file location is defined in Powercore Server → Edit → Preferences)





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