MOSCOW EXCHANGE

ASTS Bridge (v. 4.4)

Interface for connecting
external systems to the Moscow Exchange
ASTS trading & clearing system

User Guide

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INTRODUCTION

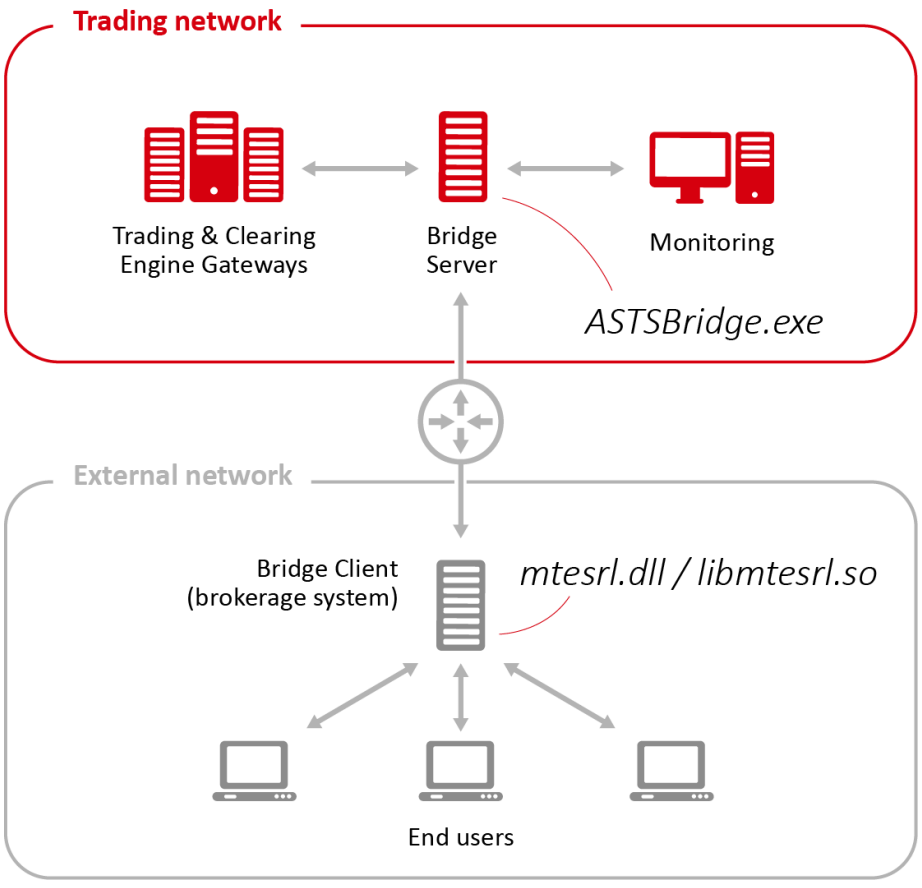
This guide describes the ASTS Bridge software package that is used to connect external systems (such as brokerage systems, market data distribution systems, HFTs, risk management, back offices) to the Moscow Exchange ASTS trading & clearing system in real time over the native API.

ASTS Bridge provides bidirectional connection to the trading & clearing system and includes an application programming interface (API), which provides functions for obtaining data from trading and clearing systems (orders, trades, instruments, etc.) as well as for executing transactions (enter and cancel orders, etc.). The API itself is described in a separate document: "Application Programming Interface for connecting external systems to the Moscow Exchange ASTS Trading & Clearing System".

A sample client application TEClient is included into the ASTS Bridge package. It uses a dynamic library (Windows DLL) mtesrl.dll that provides application programming interface (ASTS Connectivity API) to connect to ASTS trading and clearing systems. TEClient should not be used in production environments.

SYSTEM ARCHITECTURE

The system architecture is shown on the following diagram:



PIC. 1 ASTS BRIDGE SYSTEM ARCHITECTURE

MAIN FUNCTIONS OF ASTS BRIDGE

ASTS Bridge supports following main operations:

- connect to the ASTS trading & clearing system (TS);
- receive requests for trading or clearing data from an external system, and pass them to the TS;
- receive replies (data updates) from TS and pass this information to the external system;
- receive requests for transactions (enter or cancel orders, etc.) from the external system and transmit them to the TS;
- receive reply to the transaction from TS and pass it to the external system;
- receive error messages (resulting from processing requests for data or transactions) from TS and pass them to the external system;
- pass the description of "bridge interface" to the external system;
- state recovery after connection loss or any failures in the trading system, external system or bridge;
- disconnect from TS.

ASTS Bridge provides logging for the following events:

- connection to trading/clearing system;
- transaction requests from an external system;
- requests for data (updates) from an external system;
- disconnection from the TS.

ASTS Bridge provides connection to the Moscow Exchange equity & bonds market, FX and precious metal market, money market.

IMPLEMENTATION DETAILS

The application is implemented as two software components that can be executed on two separate machines. The server component (ASTS Bridge), implemented as separate application for 32 or 64 bit versions of Microsoft Windows 10 or Microsoft Windows Server 2016/2019, connects to ASTS trading & clearing System via the internal Mustang protocol (a new transport protocol backwards compatible with the old TSMR protocol). The client component ASTS Connectivity API (mtesrl.dll for 32 or 64 bit Windows; libmtesrl.so for 64 bit Linux) provides an application programming interface (API) to external system. API is described in a separate document: "Application Programming Interface for connecting external systems to the Moscow Exchange ASTS Trading & Clearing System". Data is transferred between components over the TCP/IP protocol.

In order to provide connection flexibility all the interaction between external systems and trading/clearing systems is carried out through particular versions of bridge interfaces with appropriate access permissions granted to connecting users. Description of the allowed bridge interfaces can be requested by external system dynamically. This description has a specific structure and includes:

- description of tables (table names, types and additional information) available to the client;
- description of table fields (field names, types, formats and additional information) available to the client;
- description of transactions (transaction names, types, formats and additional information) available to the client;
- description of transaction fields (field names, types, formats and additional information) available to the client;
- description of specific constants (so called enumerations) used to encode field values in tables and transactions.

Bridge interface descriptions are stored and maintained centrally, and the required description is transferred from a trading system to the bridge on request at the beginning of working session.

Usually, most of external systems establish two or more connections. Any connection may be used either for market data transmission or for transaction execution or for both. It is up to external system developers to decide how to utilize each connection.

Several connection profiles for parallel connection to different trading/clearing systems can be set up on a single instance of ASTS Bridge. It is also possible to run multiple instances of ASTS Bridge on a single machine with different configuration files and working directories.

HARDWARE AND SOFTWARE REQUIREMENTS

For proper operation of ASTS Bridge server and external systems that use the mtesrl library, the following minimal software and hardware requirements are established:

Operating system of one of the following versions for ASTS Bridge server and Windows clients:

- Microsoft Windows 10;
- Microsoft Windows Server 2016;
- Microsoft Windows Server 2019.

Operation system of one of the following versions for Linux clients:

- RedHat/CentOS 7 and newer;
- Using of other distributions is possible.

Hardware – minimum:

- CPU – Intel Core or compatible 1,4GHz or higher;
- RAM –4GB or more;
- HDD with 10 GB free space for logging;
- Ethernet network card.

Hardware – recommended:

- CPU – Intel Core or compatible 3GHz or higher x 4 core;
- RAM –16GB or more;
- HDD with 10 GB free space for logging;
- Ethernet network card.

Bit rate:

- From 100 Mbit/s. Recommended is 1 Gbit/s.

These requirements do not consider specific characteristics of an external system and may be adjusted upwards depending on the resources required for external system proper operation.

INSTALLATION, UNINSTALLATION, UPDATES

The product is supplied as a ZIP archive.

To install ASTS Bridge just unzip the archive to any directory on your hard drive.

SECURITY NOTE:

> Place the executable files of the bridge into a write-protected folder, for example into "**C:\Program Files**ASTSBridge\" folder.

Right-click on archive icon and select "Extract all" in a context menu, then follow the instructions.

The distribution package has the following directory structure:

server	ASTS Bridge server component;
mtesrl	client library (API) for external systems;
demo	API examples on C++, Delphi, Java, C# and sample TEClient application;
doc	product documentation;
embedded	client library for direct connection to ASTS trading/clearing system. Can be used only from the Moscow Exchange colocation zone (so-called embedded bridge).

To run ASTS Bridge server double-click its icon from the server directory:

ASTSBridge.exe
ASTSBridge
Moscow Exchange

After configuring ASTS Bridge server (see *ASTSBridge -> Settings*) you can run sample client application. To do so, double-click TEClient or TEClient64 (64 bit version) icon in the demo directory:

TEClient.exe
ASTSConnectivity API Demo Client
Moscow Exchange

TEClient64.exe
ASTSConnectivity API Demo Client
Moscow Exchange

For information on connecting your own external system to ASTS trading & clearing system, refer to the developer manual - "Application Programming Interface for connecting external systems to the Moscow Exchange ASTS Trading & Clearing System".

NOTE:

When updating the product be sure to backup configuration files of previous version.

Do not unzip the distribution archive to the working folder of previous version. This can cause loss of important data and break ASTSBridge and external systems operability.

Default format for configuration files is XML. Support for INI format is provided for compatibility with old versions. It is recommended to convert old INI files to XML format with the BridgeConfig utility included into the package.

To uninstall the product delete its folder. If ASTS Bridge was set up as a Windows Service, it's necessary to uninstall the service first. If products working folder differs from its installation folder, it's necessary to delete working folder first.

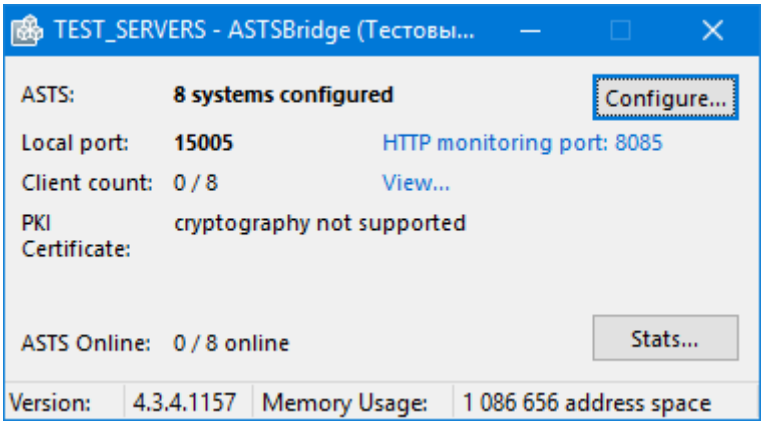
WORKING WITH ASTS BRIDGE

Clients connect to ASTS Bridge server over the TCP/IP protocol. The key software functions are:

- possibility to indicate bridge interface (set of tables, fields and transactions) and list of trading boards for each client connection;
- possibility to specify several Bridge addresses at connection time, so connection will dynamically switch between them in case of network problems;
- support for Validata electronic digital signature and streaming encryption from;
- possibility to run ASTSBridge as Windows Service.

ASTS Bridge server accepts incoming client connections and establishes connection to the ASTS trading & clearing system for each client individually.

ASTS Bridge server user interface



PIC. 2 ASTS BRIDGE SERVER MAIN WINDOW

Main ASTS Bridge server user interface elements:

Element	Description
Title	The window title displays server ID and full name, clients will connect to (see ***Settings***).
Connection info	«**Connection info**» panel displays the parameters of the active connection: **ASTS**: name of the ASTS server and the name or number of the trading system service; **Local port**: name or number of a local port, clients should connect to;

HTTP monitoring port: port number for web monitoring. Click this link to open the monitoring interface;

Client count: number of currently connected clients / maximum allowed number of connections;

View: click this link to open clients' connection details in a web-browser;

PKI Certificate: title of the digital signature certificate when cryptography is enabled;

ASTS Online: active connection to trading system is established.

«Configure» button

Click the «**Configure**» button to run ASTSBridge Configuration Utility (BridgeConfig) - tool for editing configuration file.
Changes made with BridgeConfig take effect immediately and do not require bridge restart.

«Stats» button

Click the «**Stats**» button to show some additional statistical data:

- **Running time**: running time of current server instance;
- **Max clients**: maximum number of simultaneous client connections today and since the server startup (total);
- **Today**: number of requests (reqs), read bytes and sent bytes for today;
- **Total**: number of requests (reqs), read bytes and sent bytes since the server startup.
- Click «**Hide»** button to hide additional statistical data.

Status bar

Status bar shows the ASTS Bridge version and memory usage.

Settings

Current version uses configuration files in XML format. XML configuration files support several connection profiles to establish connection to different trading/clearing systems. INI format is supported for compatibility with old versions. It is recommended to convert old INI files to XML format with a BridgeConfig utility, included into distribution package.

By default, ASTS Bridge server loads its parameters from configuration file whose name matches the name of the main executable. XML files have priority over INI files, so ASTSBridge.exe will first try to load ASTSBridge.xml, and if such file does not exist - ASTSBridge.ini will be used. For ASTSBridgeEQ.exe it will be ASTSBridgeEQ.xml (or ASTSBridgeEQ.ini) and so on.

Configuration file name (and full path) can be specified at ASTSBridge server startup from the command line:

```
ASTSBridge.exe /config ConfigFileName.xml
```

Configuration file that ASTSBridge server currently uses is displayed at the top of the BridgeConfig utility main window (see pic.3).

BridgeConfig configuration utility

ASTSBridge distribution package contains BridgeConfig.exe - a GUI configuration utility. Old INI files can be converted to XML with BridgeConfig.

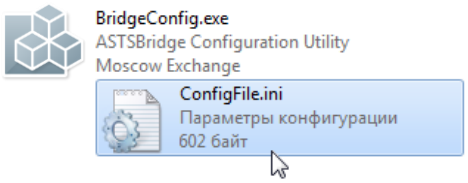
When starting BridgeConfig directly (i.e. not by clicking the Configure button in ASTSBridge) then the configuration file name should be specified explicitly:

from the command line:

```
BridgeConfig.exe  ConfigFileName.ini
```

Windows graphical environment:

drag the desired configuration file to the BridgeConfig.exe icon



from ASTSBridge.exe main widow:

start the Bridge server with a desired configuration file (described above), and click "Configure…" button at the top right of the main window.

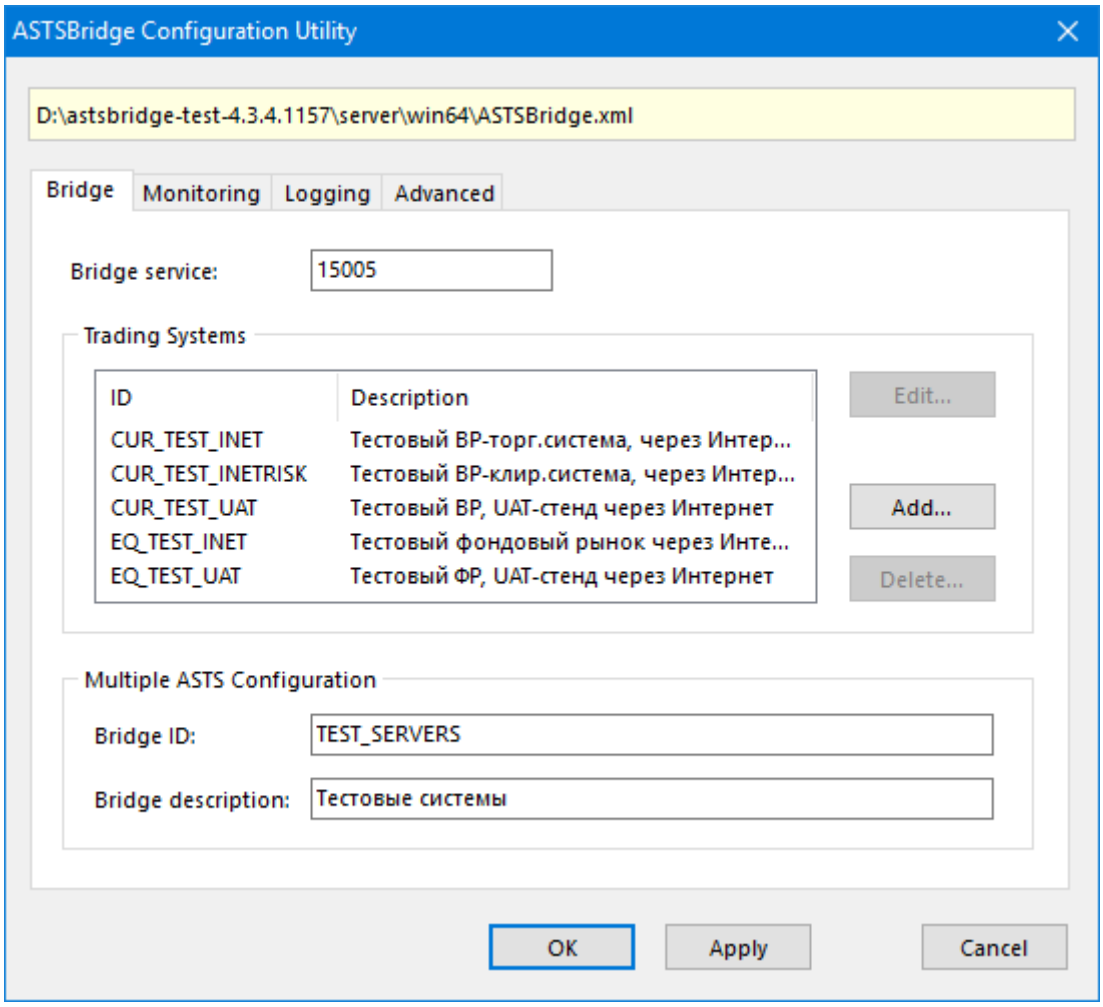
To convert old configuration file to XML format, start BridgeConfig with each needed configuration file, and press "**Convert to XML**" button at the top right of the window. Save changes, by pressing "**OK**" or "**Apply**". A new configuration file will be named filename.xml, and initial INI-file will be renamed to filename.ini.bak.

After conversion to XML, some additional features will become available such as setting up access to multiple trading systems, control of allowed client IP-addresses and others.

ASTS Bridge monitors changes of its configuration file during operation, so settings made with the configuration utility will automatically take effect after pressing «*OK*» or «*Apply*» buttons, restart of Bridge server is not required. Important: when running ASTS Bridge as a service, the service must be restarted to apply configuration changes.

Configuration file also can be edited manually with a text editor. (see XML configuration file structure)

BridgeConfig main window



PIC. 3 BRIDGECONFIG MAIN WINDOW

Interface elements of BridgeConfig main window are divided into four tabs: "Bridge", "Monitoring", "Logging" and "Advanced". At startup, Bridge tab is active.

Main BridgeConfig interface elements:

Element	Description
Configuration file	Full path to ASTS Bridge configuration file.
	Bridge
Bridge service:	Name or number of the TCP service of the server. For example, "15005".
Trading Systems	List of configured connection profiles, containing server identifiers and their text descriptions.
«Edit...» button	Edit connection profile parameters.

«Add…» button	Add a new connection profile.
«Delete…» button	Delete selected connection profile.
Multiple Trading System Configuration	Unique Bridge identifier and description. This group becomes available after configuring multiple connection profiles to different trading systems.

Monitoring

Allow HTTP-monitoring on port:	Name or number of the service, on which http-agent for server monitoring is running. Monitoring is available using a web-browser at: *http://{server_address}:{service}*.
Host name:	If this parameter is set, the http-agent checks the Host header in the HTTP-request to match the specified value (protects against Anti-DNS Pinning attack).
Gather per-user statistics every:	Interval to collect statistics on client connections. For each client the following data is collected: bytes received and sent, number of requests, average time of request processing by the Trading System, packet delays.
Notify about problems by e-mail. Server:	Mail server IP or name (SMTP) to send diagnostic e-mail notifications to administrators.
E-mail account to send from:	E-mail address for the FROM field of diagnostic notifications.
Bridge administrator e-mail addresses:	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the server startup & shutdown and other system messages. Empty value means not to send any such messages.
Notify if free disk space less than:	The lowest free drive space (in MB) when notification on the low disk space is sent to the system administrator. Check is performed once at the bridge start and each time when date changes.
Or key expires in … days	Number of days before Validata key expiration, when system administrator will be informed about it. This parameter is valid only when cryptography is enabled. Check is performed once at the bridge start and each time when date changes.
E-mails to notify of logon problems:	List of e-mail addresses (comma separated) of recipients who would like to get notifications on client connection problems. Empty value means not to send any such messages.
E-mails to notify of bridge slowdowns:	List of e-mail addresses (comma separated) of recipients who would like to get notifications on Bridge server performance, new client connections establishing, as well as at slow connection to the ASTS trading system or its absence. Empty value means not to send any such messages.
Notify in case of … slowdowns within … min.	Condition for sending a slow connection notification – number of times the value of MaxProcessingTime was exceeded during the specified time interval (minutes).
E-mails to notify of network failures:	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the client's network problems. Empty value means not to send any such messages.
Notify in case of … slowdowns within …	Condition for sending a network problem notification – number of failures during the specified time interval (minutes).

min.	

Logging

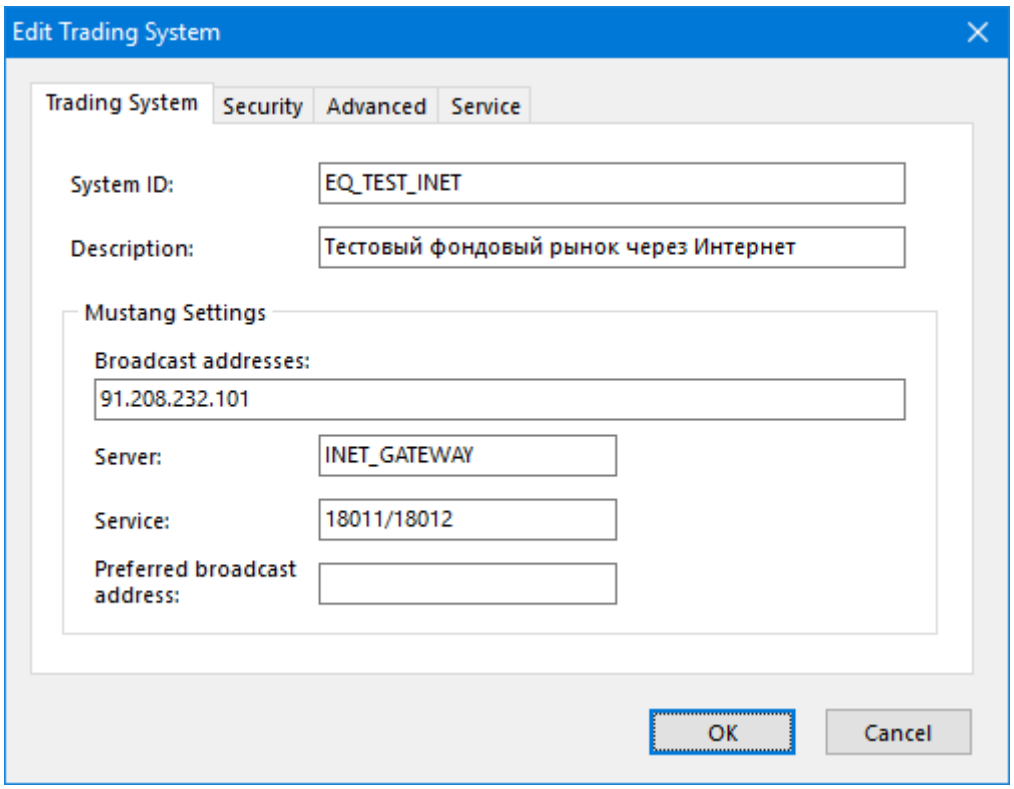
Working folder:	Full path to ASTS Bridge working directory, which will be used for storing log-files and TS interface caching. If value is not specified, or is an empty string, installation directory will be used.
Automatically delete log-files older than … days	Number of days to keep log files on the server hard drive. If not checked, the log will never be removed.
Save user logs to file	Log user activity statistics. In case of high client applications activity, statistic data may require a large amount of memory and it is recommended to disable this function.

Advanced

Automatically stop bridge after:	Time of automatic server shutdown. On specified time, ASTS Bridge server will automatically stop and all connected clients will receive an appropriate message.
Disconnect clients idle more than: … sec	Maximum idle time (in seconds), after which the client will be forcibly disconnected. Clients, who do not query the server for a long time, are considered to be "hanged up". It's recommended not to set this parameter to less than 60 seconds.
Send LOGOFF for idle clients	ASTSBridge will send LOGOFF transaction for clients with expired idle timer. The checkbox is set to "Yes" by default.
Default language for messages:	Language for error messages. Possible values are: "English", "Russian" and "Ukrainian".
Compression level:	Compression of transmitted data: No compression, Zlib, BZip2. Recommended value – Zlib. Support for BZip2 compression may be removed in future versions.

Add or edit connection profile

Press "Add" or "Edit" buttons in BridgeConfig main window.



PIC. 4 CREATE NEW CONNECTION PROFILE

"Add Trading System" window is divided into four tabs: "Trading System", "Security", "Advanced" and "Service".

Main interface elements of "Add/Edit Trading System" window:

Element	Description
	Trading System
System ID	Server ID (connection profile ID), for example EQ_TEST. This ID is defined by user at connection time in order to verify the connection to the needed server.
Description	Arbitrary server description. For example: "TEST Equities & Bonds market".
Broadcast addresses	List of trading/clearing server broadcast addresses. If not specified, the value from TSMR.INI will be used.
Server	Trading/clearing system server identifier.
Service	Trading/clearing system TCP and UDP services. Either an alias registered in the system services file can be specified here or direct port numbers, such as 18011/18012.
Preferred broadcast address	Preferred broadcast address.
	Security
Authorize connections	"Validata" profile name, which is used by the server for digital signature

with Validata profile	validation and traffic encryption (in case of specified “Validata” version supports the function), e.g. "Default profile". If digital signature is not required, this parameter should not be specified.
Configure Validata	Display a window to choose using of local cryptography or configure group of crypto servers for traffic encryption and digital signing of transactions.
Reject clients without digital signature	Do not accept clients without digital signature.
Secure connections with OpenSSL	Enable support of channel encryption with TLS protocol. If encryption is not required, this parameter should be disabled.
Reject unsecured connections	Do not accept clients not using channel encryption.
Restrict user access to the Bridge	If this option is enabled – only specified users are allowed to connect, if disabled – all users are allowed to connect. — Only specified users allowed to connect — in this case, a full list of firms and their users with IP addresses who are allowed to connect should be defined (“Define User List and IPs” button or <CryptoNames> container in XML configuration file). — Only Technical Center Members allowed — in this case, only members of specific Technical center are allowed to connect (list of users are configured by administrators of TS). To use this option, ID and password of firm-Technical center should be defined.
Allowed IP-addresses	Range of allowed IP addresses can be defined for any client. Clients, for whom the range of IP addresses is not specified, are allowed to connect from any IP.
Banned Users	Edit banned user list.
	Advanced
Mustang connect timeout	Timeout for UDP reply from the trading/clearing system during the connection sequence, in seconds. If set to 0 (zero) then the default value will be used (30 seconds).
Mustang timeout	Timeout of the Mustang connection in seconds. If set to 0 then the default value will be used (30 seconds).
Mustang buffer size	Mustang buffer size in bytes. If set to 0 (zero) then default value will be used (60000).
Allow users to override Mustang buffer size	Allow users to choose Mustang buffer size, by specifying values from 10000 to 60000 in PACKETSIZE parameter when calling MTEConnect.
Compress Mustang traffic to/from Trading System	If this option is enabled Mustang traffic between trading system and Bridge will be compressed. No compression is used if disabled.
Connect from specified network interfaces in	List of IP addresses of network interfaces that are allowed to connect to

the following order	trading systems. The order of IP addresses in the list defines the priority.
Do not use network interfaces other than listed above	If this option is enabled, search for trading/clearing system gateways will be performed only from network interfaces specified in the previous option. If disabled – all network interfaces will be involved.
Turn on internal Mustang logging	Level of TSMR.DLL internal logging. If this option is disabled no logging will be used. If enabled, then Logging level parameter defines logging depth.
Transport library	Transport library name (*TSMR* or *Mustang*). If *Default* is specified, client can choose the library when connecting (TSMR by default).
Direct connect	Do not use servers UDP discovering, connect directly to Broadcast addresses via TCP. Enable this option in extreme cases only, if you can't configure UDP-broadcasting on the network.
	Service
Log requests executed longer than …	Maximum time for trading system to process the requests, in ms. On timeout the warning will be given.
Check trading system availability at:	Time after which the trading system is supposed to be accessible. If the system is not accessible, then the notification will be sent to the administrator. 0:00:00 – do not send any notifications.
Turn on Mustang logging for the following users	A comma-separated list of user identifiers.

Note: Connection parameters values for different markets are given in Appendix 2.

XML configuration file structure

<Element> Tag / Attribute	Description
<Bridge>	**Root element.**
<Settings>	**ASTS Bridge general settings.**
<Service>	Name or number of the TCP service of the server. For example "15005".
<DisconnectIfIdleFor>	Maximum idle time (in seconds), after which the client will be forcibly disconnected. Clients, who do not query the server for a long time, are considered to be "hanged up". It's recommended not to set this parameter to less than 60 seconds.
<AutoStopTime>	Time of automatic server shutdown. On specified time, ASTS Bridge will automatically stop and all connected clients will receive an appropriate message. If not specified, the server will work non-stop.
<Language>	Language for error messages. Possible values are: "English", "Russian".
<MinSupportedClientVer>	The minimum version of MTESRL.DLL, which is permitted to connect to the server. Default value is "6.71".
<Compression>	Compression of transmitted data: "0" — No compression; "1" — Zlib — default and recommended value; "2" — BZip2.
<LogoffAfterTimeout>	Values: "0" or "1". Forbids or allows sending a LOGOFF transaction for idle clients. If not specified, ASTS Bridge will send the transaction by default.
</Settings>	
<Logging>	**ASTS Bridge logging settings.**
<WorkingFolder>	Full path to ASTS Bridge working directory, which will be used for log files and TS interface caching. If value is not specified installation directory will be used.
<KeepLogFiles>	Number of days to keep log files on the server hard drive. If set to 0, the log will never be removed.
<SaveUserLogsToFile>	Values: "0" or "1". Forbids or allows collecting and storing statistics of user activity. In case of high client applications activity, statistic data may require a large amount of memory and it is recommended to disable this function.
</Logging>	
<Monitoring>	**ASTS Bridge monitoring settings.**
<Service>	The name or number of the service, on which http-agent for server monitoring is running. Monitoring is available using a web-browser at: *http://{server_address}:{service}*.
<HostName>	If this parameter is set, the http-agent checks the Host header in the HTTP-

	request to match the specified value (protects against Anti-DNS Pinning attack).
<StatsInterval>	Interval to collect statistics on client connections. For each client the following data is collected: bytes received and sent, number of requests, average time of request processing by the Trading System, packet delays.
<KeyExpireDays>	Number of days before Validata key expiration when system administrator will be informed about this. This parameter is valid only when cryptography is enabled.
<LowDiskSpace>	The lowest free drive space (in MB) when the notification on the low disk space is sent to the system administrator.
<MailServer>	Mail server IP or name (SMTP) to send diagnostic e-mail notifications to the administrators.
<MailSender>	E-mail address for the FROM field of diagnostic notifications.
<AdminEmails>	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the server startup & shutdown and other system messages. Empty value means not to send any such messages.
<ConnectErrorEmails>	List of e-mail addresses (comma separated) of recipients who would like to get notifications on client connection problems. Empty value means not to send any such messages.
<NetworkErrorEmails>	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the client's network problems. Empty value means not to send any such messages.
<NetworkErrorEvent>	Condition for sending a network problem notification – number of failures during the specified time interval (minutes); for example: <NetworkErrorEvent>3,2</NetworkErrorEvent>.
<SlowTsmrEmails>	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the slow connection to the ASTS trading system or its absence. Empty value means not to send any such messages.
<SlowTsmrEvent>	Condition for sending a slow connection notification – number of times the value of MaxProcessingTime was exceeded during the specified time interval (minutes); for example: <SlowTsmrEvent>5,5</SlowTsmrEvent>.

</Monitoring>

<Engines>	**Trading/clearing systems connection settings.**
<Engine …Id="…"> …	Bridge connection profile ID for example EQ_TEST. This ID is defined by user at connection time in order to verify the connection to the needed server.
…Name="…">	For example: "Equities & Bonds Market".
<TSMR>	**Connection parameters.**
<Broadcast>	List of trading/clearing server broadcast addresses. If not specified, the value from TSMR.INI will be used.
<Server>	Trading/clearing system server name.
<Service>	Trading/clearing system TCP and UDP services name or port numbers.

<PrefBroadcast>	Preferred broadcast address.
<MaxProcessingTime>	Maximum time for trading system to process the requests, in ms. On timeout the warning will be given.
<ConnectTimeOut>	Timeout for UDP-reply from the Trading System during the connection sequence (seconds). If set to 0 (zero) then the default value will be used (30 seconds).
<Timeout>	Timeout of the Mustang connection (seconds) in range [1... 300] If set to 0 then the default value will be used (30 seconds).
<BufSize>	Mustang buffer size in bytes. If set to 0 (zero) then default value will be used (60000).
<IgnoreUserBufSize>	"0" — allow users to choose Mustang buffer size, by specifying values from 10000 to 60000 in PACKETSIZE parameter, when calling MTEConnect; "1" — user buffer size settings are ignored. Mustang buffer size, defined in BufSize parameter, is used. This is the default value.
<TEUpTime>	Time after which the trading system is supposed to be accessible. If the system is not accessible then the notification will be sent to the administrator. 0:00:00 – do not send any notifications.
<LogUsers>	Enable logging for the following users. Comma-separated list of user identifiers.
<Compression>	Enable or disable internal Mustang compression: "0" — compression disabled; "1" — compression enabled.
<IpSrcOrder>	Comma-separated list of IP addresses of network interfaces that are allowed to connect to trading systems. The order of IP addresses in the list defines the priority.
<RestrictList>	If this option is enabled, search for trading system gateways will be performed only from network interfaces specified in the previous option. If disabled – all network interfaces will be involved.: "0" — all network interfaces will try to connect to the trading system; "1" — search for trading system gateways will be performed only from network interfaces specified in `IpSrcOrder` parameter.
<LogLevel>	Level of Mustang internal logging: "0" — logging disabled; "1.."30" — logging enabled with specified level of depth.
<Transport>	Transport library name: "TSMR" — use tsmr.dll for all connections; "Mustang" — use mustang.dll for all connections. Value not specified — client can choose the library when connecting, TSMR by default.
<DirectConnect>	Enable or disable Trading System server UDP discovering: "0" — use UDP discovering (recommended); "1" — do not UDP discovering.

</TSMR>

<IPAddresses>	**Allowed IP addresses.**
<Firms>	Firms
<Firm… …Id="…">	Firm identifier in the trading system.
<IP… …From="…" To="…"/>	Range of allowed IP addresses for the firm.
</Firm>	
</Firms>	
<Users>	Users
<User… …Id="…">	User identifier in the trading system.
<IP… …From="…" To="…"/>	Range of allowed IP addresses for the user.
</User>	
</Users>	
</IPAddresses>	
<Security>	**Security settings.**
<ProfileName>	"Validata" profile name, which is used by the server for traffic encryption (in case of "Validata" version supports the function) and digital signature validation, e.g. "Default profile". If digital signature is not required, this parameter should not be specified.
<CryptoServers>	Group of "Validata" crypto servers' settings.
<CryptoServer>	Settings of "Validata" crypto server that is used for traffic encryption and digital signature validation.
<Address>	Crypto server IP-address.
<Alias>	Alias of crypto server session.
<Password>	Password of crypto server session.
</CryptoServer>	
</CryptoServers>	
<SignRequired>	"0" — digital signature is not required; "1" — digital signature is required.
<OnlyKnownUsers>	0 — all clients are allowed; 1 — a limited list of clients is allowed (can be configured with BridgeConfig - "Define User List and IPs" button or <CryptoNames> container in XML configuration file).
<OpenSSLSupport>	TLS 1.2 channel encryption support: "0" — channel encryption is not supported; "1" — channel encryption is supported.
<OpenSSLKeyFile>	A path to a private key in PEM format
<OpenSSLCertFile>	A path to a certificate in PEM format.

<EncryptRequired>	"0" — channel encryption is not required; "1" — channel encryption is required.
</Security>	
<CryptoNames>	**Allowed users. Is valid when OnlyKnownUsers = 1.**
<Firm… …Id="…" Name="…">	Firm identifier in the trading system.
<User… ..Id="…" CryptoName="…"/>	User identifier in the trading system and the name of certificate holder in X.509 format: «CN=User,O=Company name,DC=pki,DC=micex,DC=ru».
</Firm>	
</CryptoNames>	
<BannedUsers>	**Banned user list.**
<User… …Id="…" Reason="…"/>	Banned user identifier in the trading system. “Reason” attribute is mandatory and can’t be empty, otherwise the ban will have no effect.
</BannedUsers>	
</Engine>	
</Engines>	
</Bridge>	

Note: INI configuration file structure is given in Appendix 1

Running ASTS Bridge as Windows service

To run ASTS Bridge as Windows Service it must be registered in the system with the following command:

```
ASTSBridge.exe /install [/name "{service_name}"] [/account "{account_name}"] [/password "{account_password}"] [/config "{config_file}"] [/silent]
```

where:

service_name	If not specified, "ASTSBridge" will be used by default. The service name must begin with a letter or an underscore character, followed by alphabetic characters, digits or underscore characters. In case of specifying an invalid value, the message "Invalid service name specified" will be given".
account_name	The name of the system account under which the service should run in the form "DomainName\UserName". If the account belongs to the built-in domain, you can specify ".\UserName". To use the LocalService account specify "NT AUTHORITY\LocalService" (default). You can specify the following values:

Value	Account
.\UserName	Local computer account
Domain\UserName	Domain account
NT AUTHORITY\LocalService	Predefined local account that has minimum privileges (used by default)
NT AUTHORITY\NetworkService	Predefined local account that has minimum privileges and acts as the computer on the network
NT AUTHORITY\System	Predefined local account that has administrative privileges (not recommended)

Note: you can change account after the service installation in the "Services" applet of the Windows Control Panel.

password — The password for the account name specified by the /account parameter. For "NT AUTHORITY*" accounts no password is required.

config_file — Full path to configuration file. If not specified, ASTSBridge.xml (or ASTSBridge.ini) from the installation directory will be used by default.

silent — Do not display success message after service (un)registration Error messages are always displayed.

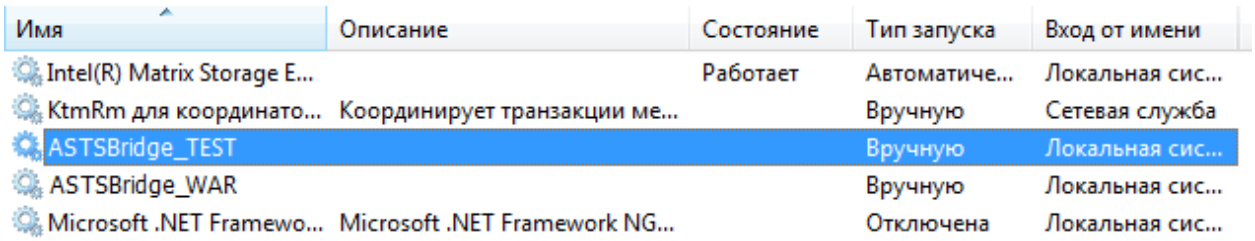
Registration as a Service must be performed by a user with administrative privileges.

SECURITY NOTES:

Run the bridge service under an account with the minimum possible privileges. You should not use the "system account" with administrative privileges.

Place the executable files of the bridge into a write-protected folder, for example into "**C:\Program Files**ASTSBridge\".

In case of successful ASTS Bridge registration as a service, an appropriate message will be given. Installed service will appear in "Services" MMC:



Pic. 5 ASTSBridge as Windows service

Multiple services can be registered in the system by assigning them different names and specifying different configuration files. It's important to specify different numbers of listen-ports and working directories in configuration files.

When ASTS Bridge operates as a service, *AutoStopTime* parameter in configuration file is ignored, so Bridge can't be stopped on a schedule. Bridge in the service mode can be monitored with its usual method: using a web-browser. To configure ASTS Bridge in a service mode BridgeConfig utility can be used, along with specifying configuration file name in a command line. For changes to take effect the service should be restarted.

```
BridgeConfig.exe {config_file}
```

When Bridge is started by an operating system, following parameters are used:

```
ASTSBridge.exe /service [/name "{service_name}"] [/config "{config_file}"]
```

To uninstall the service, execute:

```
ASTSBridge.exe /uninstall [/name {service_name}]
```

Monitoring

ASTS Bridge server supports monitoring from a web browser. The default monitoring port is 8085. Server status, logs, connected clients can be viewed at: **http://{server_address}:8085**. Direct link is available in ASTS Bridge main window.

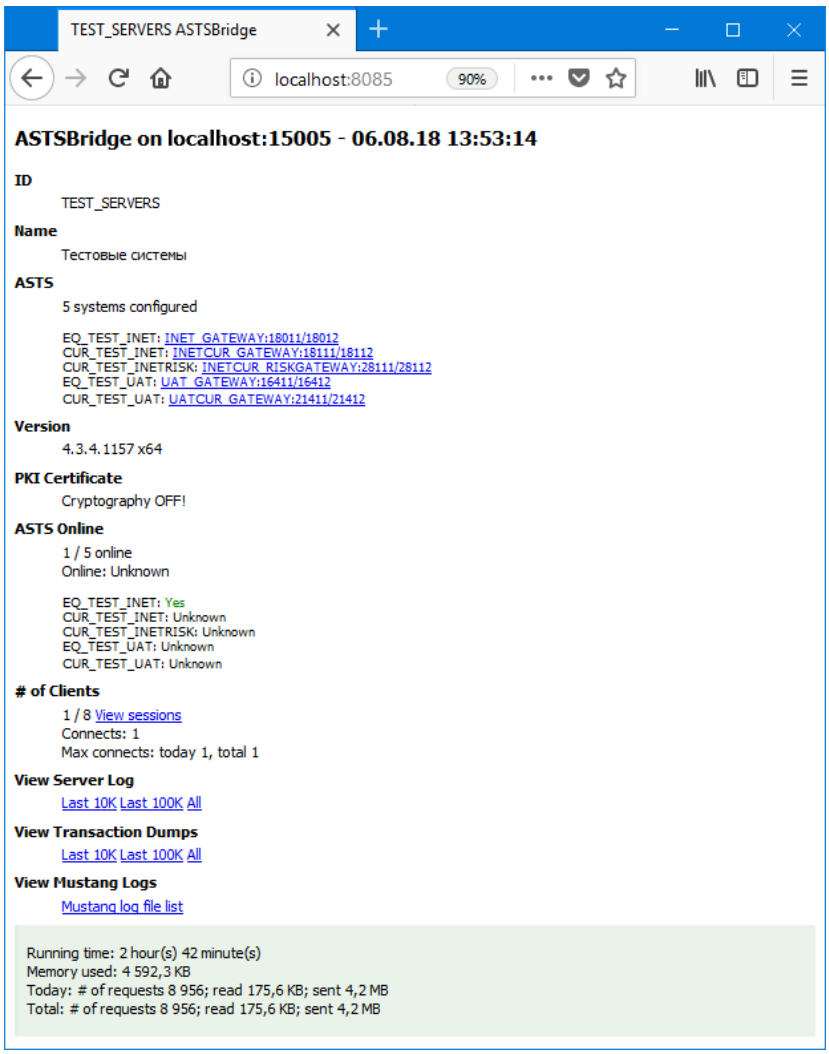
Server operation protocols and client transaction logs are stored in a **Logs** subdirectory of the server working directory.

SECURITY NOTE:

> Set a non-empty value for the **HostName** parameter to eliminate the possibility of an Anti DNS Pinning attack.

Monitoring Web interface

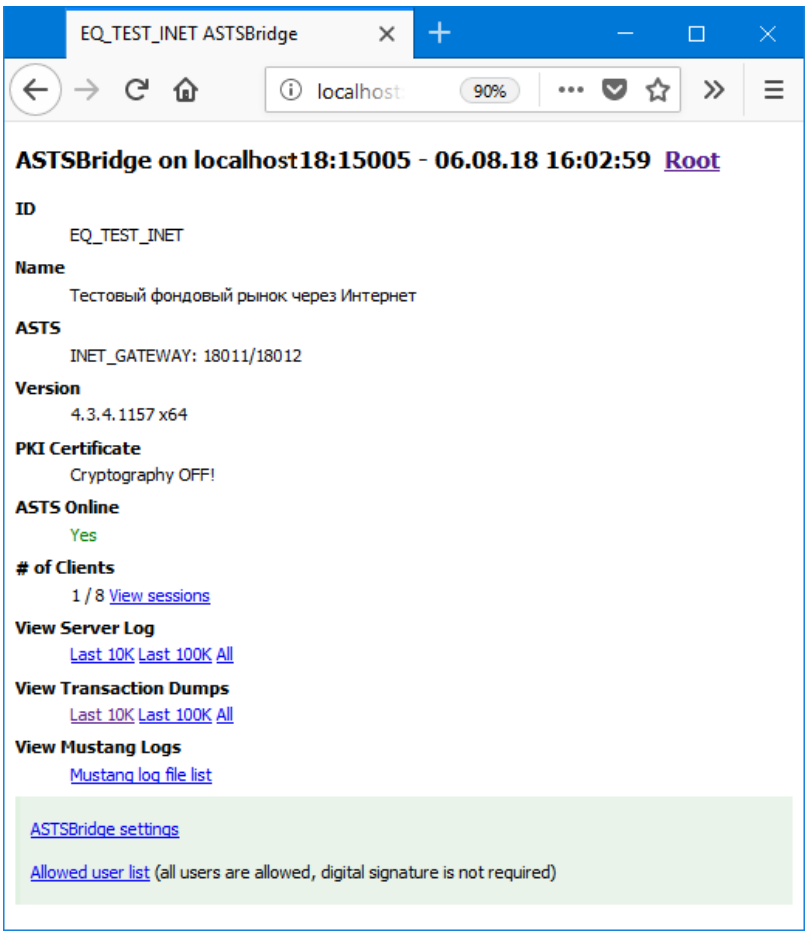
The main monitoring page displays brief connection information (see **ASTSBridge user interface**) and provides links to pages with more details on current settings, transactions, server log and connected clients.



PIC. 6 ASTS BRIDGE MONITORING MAIN PAGE

Connection profiles

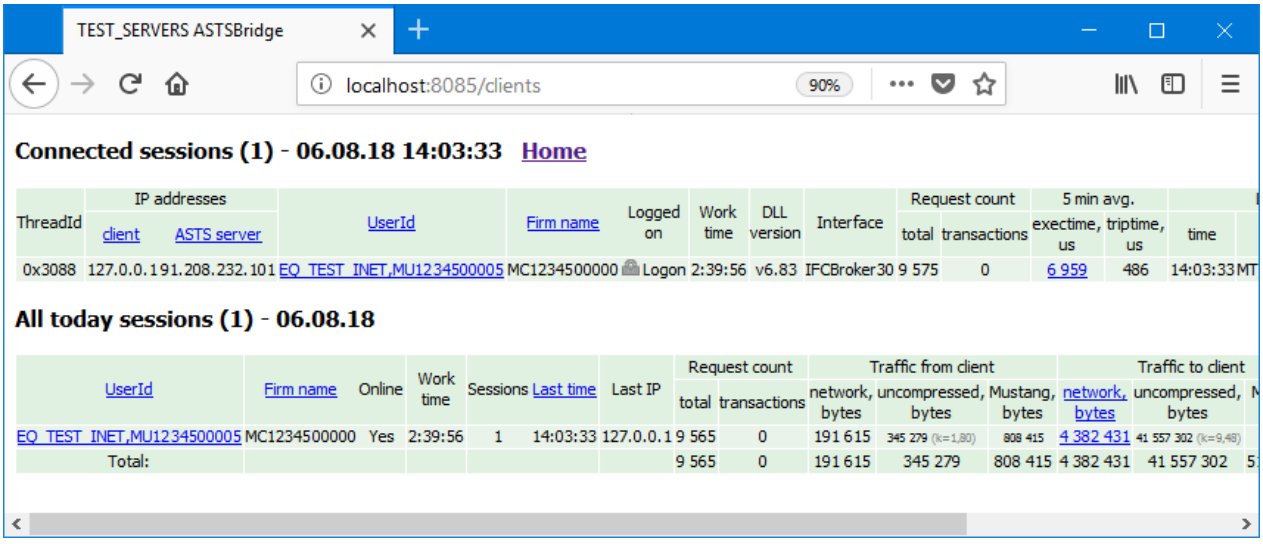
If several connection profiles are set up, click a corresponding profile ID in the ASTS list to go to the profile specific page.



PIC. 7 CONNECTION PROFILE PAGE

Connected clients

Click "**View sessions**" link on the main monitoring page to open page with details on client connections.



PIC. 8 CONNECTED CLIENTS MONITORING PAGE

Click "**Home**" button to return to the main monitoring page.

Connected client list

This table lists currently connected clients. The number in brackets is the total number of active connections, followed by the date and time when the table has been refreshed.

Column	Description
ThreadId	Unique connection ID.
IP addresses	IP address of the client and of the ASTS trading/clearing server.
UserId	Client User ID in the ASTS trading/clearing system. Click this ID to show user transaction log (see **below**).
Firm name	Client firm name.
Logged on	The client has connected to the trading/clearing system:  — the client uses encryption;  — the client has established a non-secured connection.
Work time	Client work time in the trading/clearing system in the current session (i.e. since the last login).
DLL version	Version of the client access protocol.
Interface	ID of the interface to the trading/clearing system.
Request count	Number of requests: total number of requests and number of transactions.
N min avg.	Average time for processing requests for the last N minutes. N is a value of StatsInterval parameter from the ASTS Bridge configuration; exectime – time to execute in ms; triptime – packet trip time in ms. Click the exectime value to view client transaction log (see **Client transaction log**).
Last request	Information about the last request: time of the request, its body and execution time in ms.
Feedback Info	Additional information, defined by the client in Feedback field.

Click an underlined column title to sort the table by the corresponding parameter.

All today clients

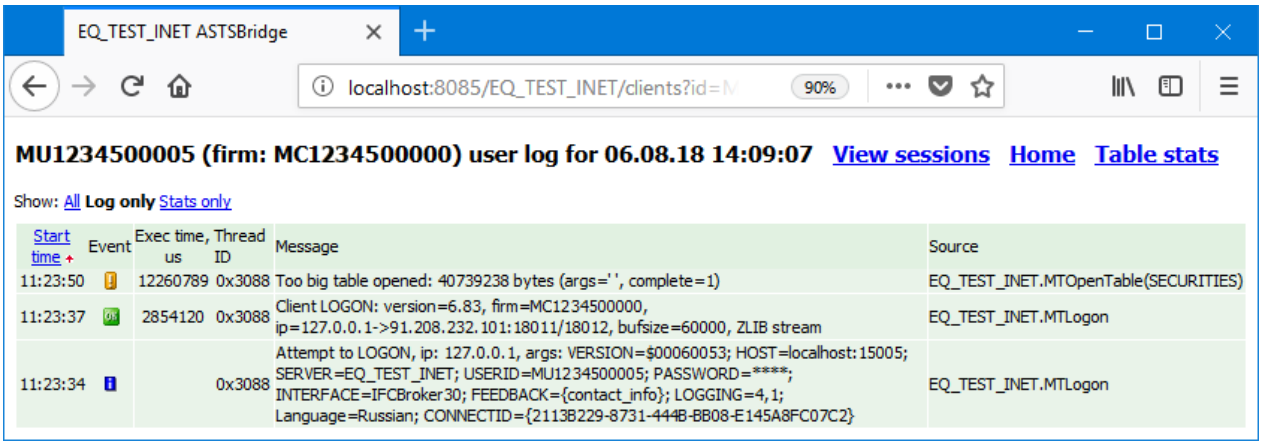
This table lists all the today's client connections. The number in brackets is the total number of connections for the current day, followed by the date and time when the table has been refreshed.

Column	Description

Column	Description
UserID	Client User ID in the trading/clearing system. Click this ID to view client transaction log (see **Client's transaction log**)
Firm name	Client firm name.
Online	Shows whether the client is currently connected to the trading/clearing system or not. indicates that client has been disconnected because of some error.
Work time	Total client work time in the trading/clearing system.
Sessions	Number of connection sessions during this day.
Last time	Last time the client was seen in the trading/clearing system.
Last IP	IP address, from which the client connected to the system last time.
Request count	Number of requests: total number of requests and number of transactions.
Traffic from client	Statistics for traffic from the client to the server, in bytes: — real amount of transferred data (network); — amount of uncompressed data (uncompressed), compression ratio is indicated in brackets; — amount of data, transferred to TS via Mustang protocol.
Traffic to client	Statistics for traffic from the server to the client, in bytes: — real amount of transferred data (network); — amount of uncompressed data, compression ratio is indicated in brackets; — amount of data, transferred from TS via Mustang protocol.

Client transaction log

Click the UserID in the clients table to show the client transactions and requests log.



PIC. 9 USER LOG

The page title shows: User ID in the trading/clearing system, ID of the user firm (in brackets), date and time when the table has been refreshed, followed by the links to the clients table (**View sessions**), main monitoring page (**Home**) statistics per loaded table (**Table stats**).

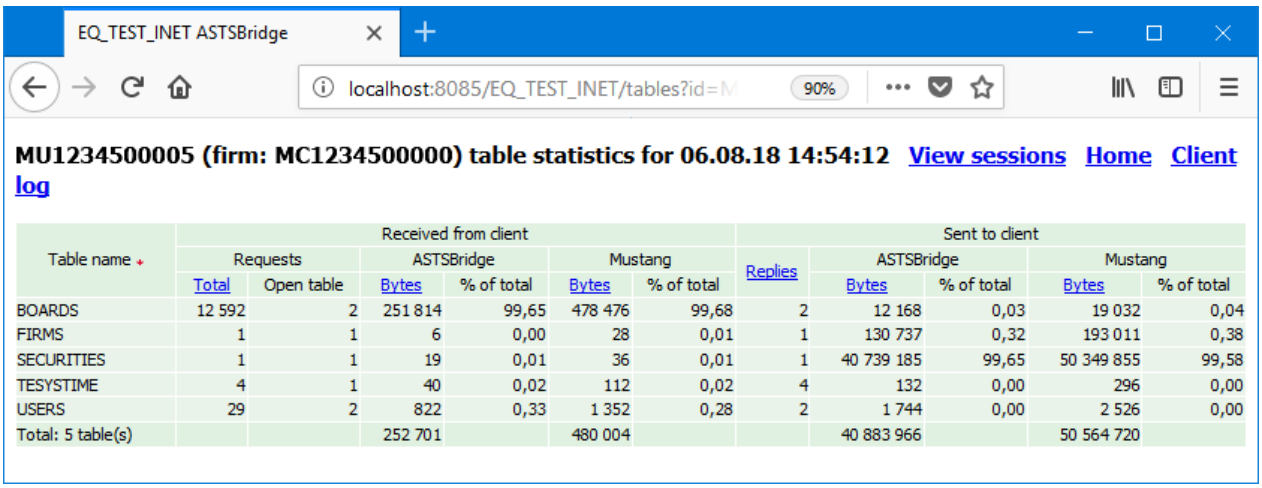
Click the **All**, **Log only** or **Stats only** to switch between different levels of details in the following table.

Column	Description
Start time	Time of transaction or event start.
End time	Time of event end.
Event	Event type: connection statistics; warning; successful transaction execution; important event; error.
Requests	Total number of requests.
Exec time, us.	Time of request execution in microseconds.
Avg. trip time, us	Average packet trip time in microseconds.
Read, bytes	Size of data received by the client in bytes.
Sent, bytes	Size of data sent by the client in bytes.
Thread ID	Unique ID of this client connection.
Message	Description of a transaction and the list of arguments that were passed to the server.
Source	Name of the function which invoked the transaction.

Click the Start time column header to sort the table either in ascending or descending order.

Statistics

To view statistics on tables, opened by the client, click the **traffic to the client** value in the client table or the **table stats** link in the client transaction log:



MU1234500005 (firm: MC1234500000) table statistics for 06.08.18 14:54:12 View sessions Home Client log

Table name	Received from client						Sent to client				
	Requests		ASTSBridge		Mustang		Replies	ASTSBridge		Mustang	
	Total	Open table	Bytes	% of total	Bytes	% of total		Bytes	% of total	Bytes	% of total
BOARDS	12 592	2	251 814	99,65	478 476	99,68	2	12 168	0,03	19 032	0,04
FIRMS	1	1	6	0,00	28	0,01	1	130 737	0,32	193 011	0,38
SECURITIES	1	1	19	0,01	36	0,01	1	40 739 185	99,65	50 349 855	99,58
TESYSTIME	4	1	40	0,02	112	0,02	4	132	0,00	296	0,00
USERS	29	2	822	0,33	1 352	0,28	2	1 744	0,00	2 526	0,00
Total: 5 table(s)			252 701		480 004			40 883 966		50 564 720	

Pic. 10 Clients operation statistics

The page title shows: User ID, firm ID (in brackets), date and time when the table was refreshed; followed by the links to the clients table (**View sessions**), main monitoring page (**Home**) and client transaction log (**Client log**). The bottom row displays summary of data transmitted over the network.

Column	Description
Table name	**Name of the table in trading/clearing system.**
Received from client	**Data received from the client:**
Requests	Total number of requests; number of requests to open the table;
ASTSBridge	Size of data transferred from the client to ASTS Bridge server in bytes and in % of the total;
Mustang	Size of data transferred via Mustang protocol to the trading system in bytes and in % of the total.
Sent to client	**Data received by the client:**
Replies	A number of replies to client's requests;
ASTSBridge	Size of data transferred from the ASTS Bridge server to the client in bytes and in % of the total;
Mustang	Size of data, transferred via Mustang protocol from the trading system in bytes and in % of the total.

Click an underlined column title to sort the table.

Server log

To view the server log, click one of the links under the **View Server Log** title on the main monitoring page: **Last 10K** – to view the last 10 Kbytes of the log; **Last 100K** – to view the last 100 Kbytes of the log; **All** – to open the whole log.

The server log is opened as plain text which shows the event time, connection ID, ID of the event source, event type, description, name of function which caused the event:

```
[10:42:41 thrd:0x0988 id:<server>     evn] New connection accepted
(ip=127.0.0.1, threadid=0x0CA0) {serv.AuthorizeClient}
```

If Mustang logging is enabled in connection profile settings then use the **Mustang log file list** link to view the available log files.

Transaction dump

To view the binary transaction dump click one of the links under the **View Transaction Dumps** title on the main monitoring page: **Last 10K** – to view the last 10 Kbytes of the transaction log; **Last 100K** – to view the last 100 Kbytes of the transaction log; **All** – to view the whole transaction log. The log opens as plain text.

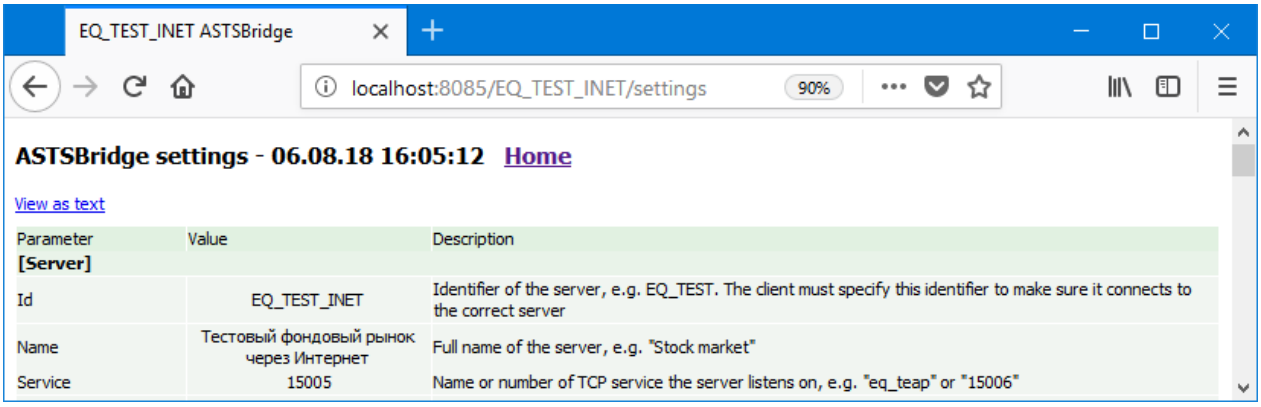
```
 ----- BEGIN TRANSACTION -----
User ID:        EQ_TEST_INET,MU1234500005
Exec time:      06.08.18 11:23:37.415152
Recv time:      06.08.18 11:23:34.483130
Client time:    06.08.18 11:23:34.483000
Command:        MT_LOGON
Transaction:    "LOGON"
Arguments:
        "VERSION=$00060053..HOST=localhost:15005..SERVER=EQ_TEST_INET
..USERID=MU1234500005..PASSWORD=****..INTERFACE=IFCBroker30..FEEDBACK
={contact_info}..LOGGING=4,1..Language=English..CONNECTID={2113B229-
8731-444B-BB08-E145A8FC07C2}"
ASTS OK  (2854120 us): "(206) Logon OK (firm:
MC1234500000).UT=3;FI=MC1234500000;FT=1;LN=R;ST=112337413169;"
 ----- END TRANSACTION -----
```

Field	Description
User ID	ID of the user, who performs the transaction.
Exec time	Time when the transaction or request has been executed. Stamped by the ASTS Bridge at the moment of receiving a reply from trading system.
Recv time	Time when the request to perform a transaction has been received from client.
Client time	Time when client has sent a request to ASTS Bridge, according to his local machine time.
Command	Function which submitted the transaction or request.
Transaction	Name of the transaction or request.
Arguments	Arguments that were sent to the trading system.

Field	Description
HEX Dump	Hexadecimal dump of the transmitted packet.

Current ASTS Bridge settings

Click the ASTSBridge settings link, to view the current server configuration (see **Settings)**.



PIC. 11 ASTS BRIDGE CONFIGURATION PARAMETERS

The page title shows the date and time when the page has been refreshed, followed by the link to return to the main monitoring page (**Home**). Click the **View as text** link to open the configuration file in plain text.

Allowed users

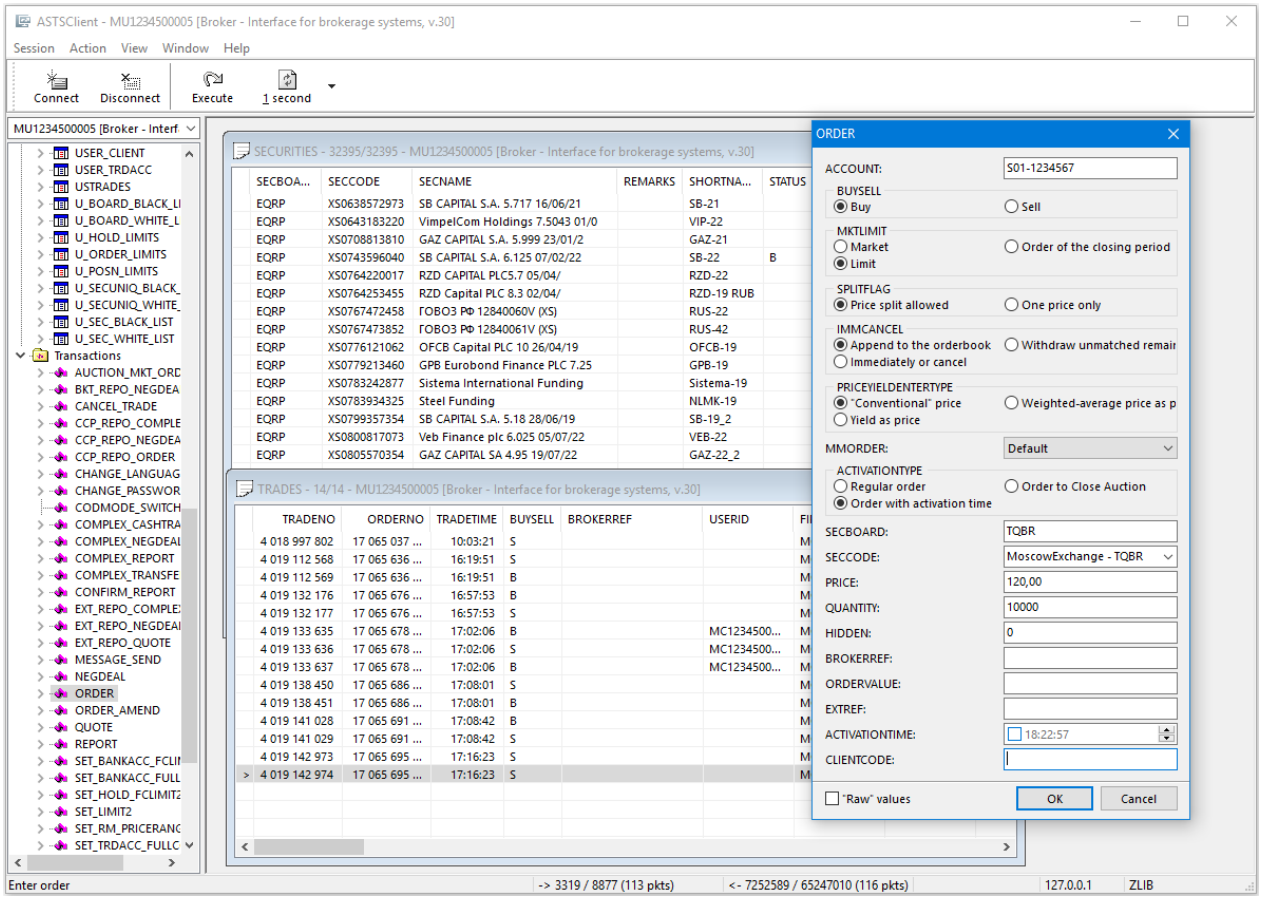
Click **Allowed user list** link in the main window, to load a form with a list of clients, which are allowed to connect to the trading system

The list is grouped by firms and contains user IDs and titles of their digital certificates. Click user ID to load **User Transaction Log.** The page title shows the date and time when page was refreshed followed by the link to return to the main monitoring page (**Home**). Allowed users list can be configured using **BridgeConfig.exe** configuration utility.

SAMPLE CLIENT APPLICATION: TE CLIENT

ASTS Bridge distribution package includes TE Client – demo client application, useful as an example of Bridge features and for testing purposes

TE Client user interface



PIC. 12 TE CLIENT USER INTERFACE

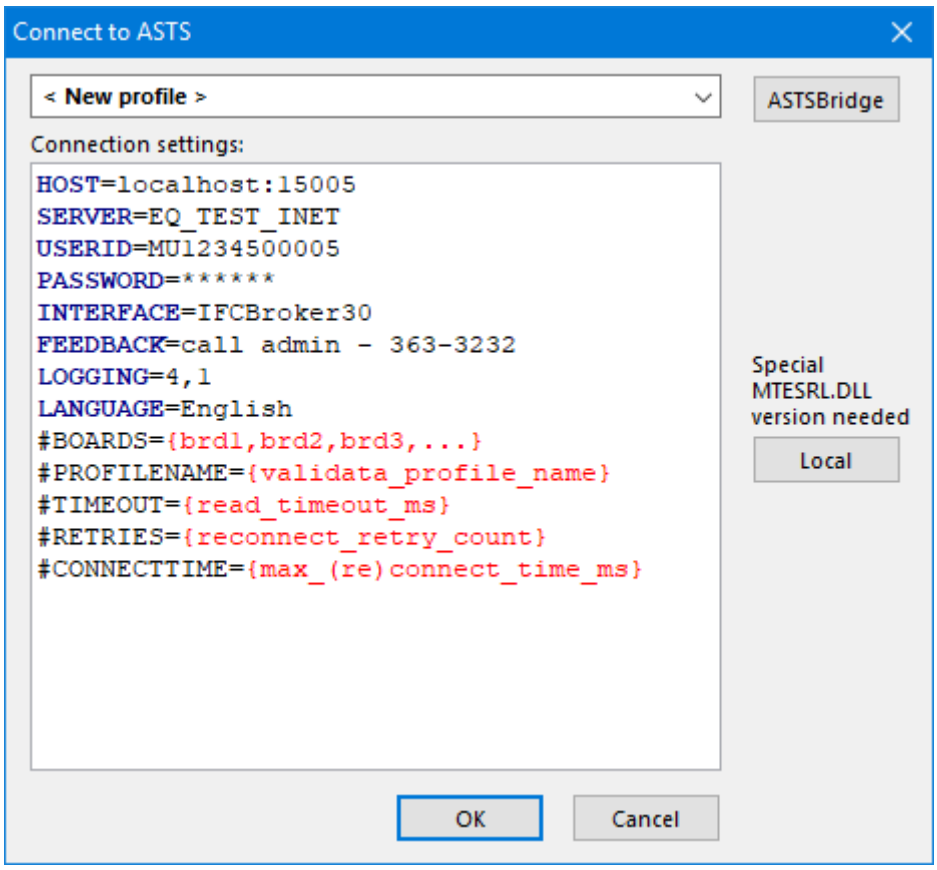
Main interface elements:

Element	Description
Title	Application title contains current Bridge server name and service number or user identifier in the trading system (depends on connection scheme) and name and type of currently used interface.
Main menu	Main menu contains basic application commands.
Toolbar	Toolbar contains a shortcut buttons to call major functions of main menu.
Connections list	Several parallel connections can be established using different user IDs. The drop-down list allows switching between connections.

Element	Description
Information objects tree	Information objects tree contains enumerated types, tables and transactions available to the user. Double-click a table to open it. Double-click a transaction name to open a dialog window.
Status bar	Status bar displays the service information: table opening time, amount of transferred data, bridge server IP address, data compression indicator, field values of tables and transactions selected in information objects tree.

Connecting to bridge server

Use **Connect** command in **Session** menu or button on a toolbar to connect to one of the interfaces of the bridge server



Pic. 13 Connection to ASTS Bridge

Choose one of previously used configurations from a drop-down list at the top of the window, if they exist.

If connecting first time, or in order to create a new configuration, click "ASTSBridge" button on the right side of the window to load a template of connection parameters. It's necessary to fill all parameters in the template according to values, specified when configuring ASTS Bridge server.

Parameters are described in "MTESrl API Guide – ENG.pdf".

APPENDIX 1 – INI CONFIGURATION FILE STRUCTURE

Parameter	Description
	[Server]
Id	Server ID, for example EQ_TEST. This ID is defined by user at connection time in order to verify the connection to the needed server.
Name	Full server name. For example "TEST Equities & Bonds market".
Service	Name or number of the TCP service of the server. For example "15005".
DisconnectIfIdleFor	Maximum idle time (in seconds), after which the client will be forcibly disconnected. Clients, who do not query the server for a long time, are considered to be "hanged up". It's recommended not to set this parameter to less than 60 seconds.
ProfileName	"Validata" profile name, which is used by the server for traffic encryption and digital signature validation, e.g. "Default profile". If encryption and digital signature is not required, this parameter should not be specified.
MinSupportedClientVer	The minimum version of MTESRL.DLL, which is permitted to connect to the server. If not specified, version 6.71 is used by default.
AutoStopTime	Time of automatic server shutdown. On specified time, ASTSBridge will automatically stop and all connected clients will receive an appropriate message. If not specified, the server will work non-stop.
	[TSMR]
Broadcast	List of Trading Server broadcast addresses. If not specified, the value from TSMR.INI will be used.
PrefBroadcast	Preferred broadcast.
BufSize	Mustang buffer size in bytes. If set to 0 (zero) then default value will be used. For better performance it is recommended to set this parameter to 60000.
Server	Trading System server name.
Service	Trading System TCP and UDP services name.
ConnectTimeout	Timeout for UDP-reply from the Trading System during the connection, in seconds. If set to 0 (zero) then the default value will be used (3 seconds).

Timeout	Timeout of the Mustang connection in seconds in range [1…300]. If set to 0 then the default value will be used (30 seconds).
SignRequired	0 — transactions digital signature is not required, 1 — transactions digital signature is required.
OnlyKnownUsers	0 — all clients are allowed, 1 — a limited list of clients is allowed (can be configured with BridgeConfig.exe).
MaxProcessingTime	Maximum time for Trading System to process the requests in ms. On timeout, the warning will be given.
TEUpTime	Time, after which the Trading System is supposed to be accessible. If the system is not accessible, then the notification will be sent to the administrator. 0:00:00 – do not send any notifications.
IgnoreUserBufSize	0 – allow users to choose Mustang buffer size, by specifying values from 10000 to 60000 in PACKETSIZE parameter, when calling MTEConnect, 1 – users' buffer size settings are ignored. Mustang buffer size, defined in BufSize parameter, is used. This is a default value.
Compression	Enable or disable internal Mustang compression: 0 – compression disabled, 1 – compression enabled.
IpSrcOrder	Comma-separated list of IP addresses of network interfaces that are allowed to connect to Trading Systems. The order of IP addresses in the list defines the priority.
RestrictList	If this option is enabled, searching for Trading System Gateways will be performed only from network interfaces specified in the previous option. If disabled – all network interfaces will be involved.: 0 – all network interfaces will try to connect to the Trading System; 1 – searching for Trading System Gateways will be performed only from network interfaces specified in IpSrcOrder parameter.
LogLevel	Level of Mustang internal logging: 0 – logging disabled, 1..30 – logging enabled with specified level of detalization.
	[Monitoring]
Service	Interval to collect statistics on the client connections. For each client the following data is collected: bytes received and sent, number of requests, average time of request processing by the Trading System, packet delays.
HostName	If this parameter is set, the http-agent checks the Host header in the HTTP-request to match the specified value (protects against Anti-DNS Pinning attack).
StatsInterval	Interval to collect statistics on the client connections. For each client the following data is collected: bytes received and sent, number of requests, average time of request processing by the Trading System, packet delays.

MailServer	Mail server IP or name (SMTP) to send diagnostic e-mail notifications to the administrators.
MailSender	E-mail address to put in the FROM field of diagnostic notifications.
AdminEmails	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the server startup & shutdown and other system messages. Empty value means not to send any such messages.
ConnectErrorEmails	List of e-mail addresses (comma separated) of recipients who would like to get notifications on client connection problems. Empty value means not to send any such messages.
SlowTsmrEmails	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the slow connection to the Trading System or its absence. Empty value means not to send any such messages.
SlowTsmrEvent	Condition for sending a slow connection notification – number of times the value of MaxProcessingTime was exceeded during the specified time interval (minutes); for example: SlowTsmrEvent=5,5.
NetworkErrorEmails	List of e-mail addresses (comma separated) of recipients who would like to get notifications on the client's network problems. Empty value means not to send any such messages.
NetworkErrorEvent	Condition for sending a network problem notification – number of failures during the specified time interval (minutes); for example: NetworkErrorEvent=3,2.
LowDiskSpace	The lowest free drive space (in MB) when the notification on the low disk space is sent to the system administrator.
KeyExpireDays	A number of days before Validata key expiration, when system administrator will be informed about it. This parameter is valid only when cryptography is enabled.
	[Logging]
KeepLogFiles	Number of days to keep log files on the server hard drive. If set to 0, the log will never be removed.
SaveUserLogsToFile	Values: "0" or "1". Forbids or allows collecting and storing statistics of users working in files. In case of high client applications activity, statistic data may require a large amount of memory and it is recommended to disable this function.
WorkingFolder	Full path to ASTSBridge working directory, which will be used for storing log-files and TS interface caching. If value is not specified, or is an empty string, installation directory will be used.

APPENDIX 2 – CONNECTION PARAMETERS

Adding entries to the services system file

In case of specifying service names in connection settings instead of port numbers, corresponding aliases should be added to the /Windows/system32/drivers/etc/services file. This step should be performed by a user with administrative privileges.

WARNING:

An empty line must be added to the end of the `services` file (after all parameters). Do not forget to add a line break.

Market	Values
Equity & Bonds	`gateway 8011/tcp` `gateway 8012/udp`
Deposits & credits	`gko_gateway 9011/tcp` `gko_gateway 9012/udp`
FX – trading system	`cur_gateway 8111/tcp` `cur_gateway 8112/udp`
FX – clearing system	`cur_riskgateway 8171/tcp` `cur_riskgateway 8172/udp`

Connecting ASTS Bridge to ASTS trading/clearing system

WARNING:

BROADCAST addresses must be **separated by comma, without spaces.**

Market	[TSMR] Server	[TSMR] Broadcast	[TSMR] Service
Equity & Bonds	`GATEWAY`	`10.63.1.255,10.63.3.255,` `10.61.1.255,10.61.3.255`	`gateway`
Deposits & credits	`GKO_GATEWAY`	`10.63.1.255,10.63.3.255,` `10.61.1.255,10.61.3.255`	`gko_gateway`
FX – trading system	`CUR_GATEWAY`	`10.63.1.255,10.63.3.255,` `10.61.1.255,10.61.3.255`	`cur_gateway`
FX – clearing system	`CUR_RISKGATEWAY`	`10.63.1.255,10.63.3.255,` `10.61.1.255,10.61.3.255`	`cur_riskgateway`

To obtain information on connecting to test environment, please contact our technical support team help@moex.com.