Alternative Data Service

arrowhead Timestamp Data

Data Specification

Ver. 1.1

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Revision history

#	Version	Date	Chapter	Description of changes	Remarks
1	1.0	2025/07/22	-	Initial version.	-
2	1.1	2026/07/10	2.SERVICE DETAILS	Added notes for the records of cancel orders resulted in registration errors	

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1 About This Specification

1.1 Introduction

This is a specification document for “arrowhead Timestamp Data”, one of the datasets of the Alternative Data Service (“the Service”). It mainly describes information necessary for users of the Service to handle the dataset.

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2 Service Details

2.1 Data Overview

(1) Order Reception Timestamp

This is a CSV file that records the times at which each message that is transmitted between each virtual server and arrowhead, such as order message, has passed through each timestamp point or has been processed by the trading server. This file does not include information to classify message types. The messages covered by this file are as follows:

Messages Covered	Messages Not Covered
● New orders (excluding those with acceptance errors[1]) ● Modification orders (excluding those with acceptance errors[1]) ● Cancel orders (excluding those with acceptance errors[1]) ● Mass cancellation orders (excluding those with acceptance errors[1])	● New order acceptance error notifications ● Modification order acceptance error notifications ● Cancel order acceptance error notifications ● Mass cancellation order acceptance error notifications ● Acceptance-related notices output completion messages ● Administrative messages[2]

Messages from other trading participants are also included. However, it does not contain information that can identify the investors or trading

[1] The Order Acceptance Messages for orders that result in registration errors are recorded. However, OrderID of the records of cancel orders resulted in registration errors will be left blank.

[2] Retransmission Request Messages, Retransmission Response Messages, and retransmitted notification messages such as New Order Acceptance Messages are not included. Additionally, messages sent in response to Resend Requests are also excluded. However, notification messages sent when a virtual server starts up may be recorded as duplicates. For the relevant records, some timestamp fields will be left blank.

participants who sent the individual messages. Please note that the recorded timestamp information is based on the times recorded by the OS (middleware) or business applications.

(2) Registration Result and Execution Timestamp

This is a CSV file that records the times at which each message that is sent and received between each virtual server and arrowhead, such as execution completion notice message, has passed through each timestamp point or has been processed by the trading server. This file does not include information to classify message types. The messages covered by this data are as follows:

Messages Covered	Messages Not Covered
● Execution completion notifications ● Modification result notifications ● Cancel result notifications ● Invalidation result notifications[3]	● New order registration error notifications ● Modification order registration error notifications ● Cancel order registration error notifications ● Mass cancellation order registration error notifications ● Mass cancellation completion notifications ● Execution-related notices output completion messages ● Administrative messages

Messages from other trading participants are also included. However, information that can identify the investors or trading participants who sent the individual messages is not contained. Please note that the recorded timestamp information is based on the times recorded by the OS (middleware) or business applications.

(3) jitter Information

Since the timestamps are obtained from multiple different servers, the time differences between each server may affect the recorded

[3] Including Invalidations due to IOC expiration, STP expiration, and Cancel on Disconnect, etc.

timestamps. To enable analysis that corrects these time differences between servers[4], the following information related to the time differences is provided. Each time difference is the difference in nanoseconds obtained every second.

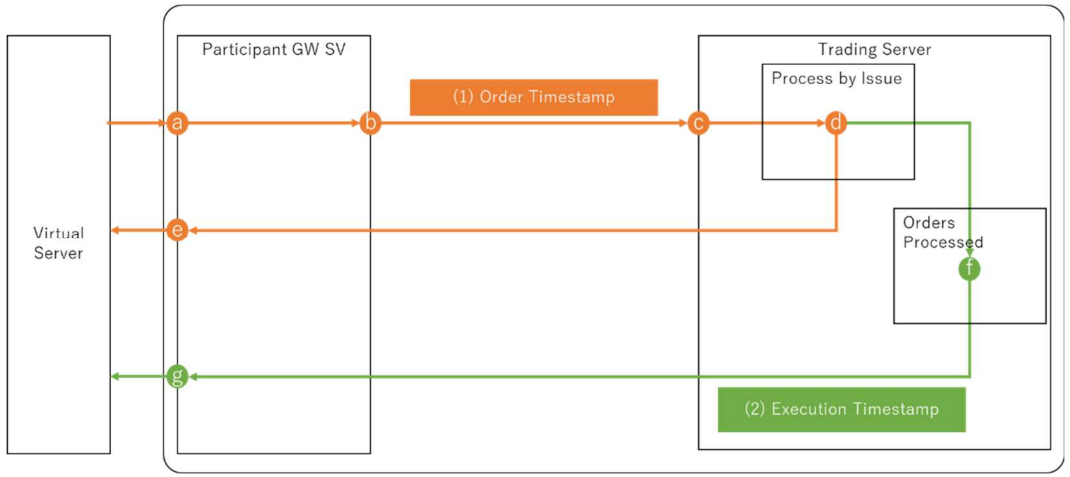
① Time difference between the grandmaster clock (GM) of arrownet and the boundary clock (BC) of arrowhead[5]

② Time difference between the boundary clock (BC) of arrowhead and the NIC of each server[5]

③ Time difference between the NIC of each server and the OS of that server[5]

2.2 Timestamp Points

The timestamp points and storage files for each type of message are as follows.



[4] Time differences can be corrected using the following formula.
The grandmaster clock (GM) of arrownet = The time on each server's operating system provided by this service+③+②-①

[5] For details of each time difference, please refer to the appendix.

Points	Servers	Contents	Remarks
a	Participant GW Server	Timestamp of messages received from virtual server	
b	Participant GW Server	Timestamp of messages sent from Participant GW Server to Trading Server	
c	Trading Server	Timestamp of messages received from Participant GW Server	
d	Trading Server	Timestamp when orders are committed to process by issue of Trading Server	Up to microseconds, it matches the timestamp information of notice common fields in the order acceptance notice messages for the relevant messages. This commit finalizes the process priority of the orders.
e	Participant GW Server	Timestamp of messages sent from Participant GW Server to virtual server	Up to microseconds, it matches the transmission time in the message header of the acceptance notice messages for the relevant messages.
f	Trading Server	Timestamp of orders processed in Trading Server	Up to microseconds, it matches the timestamp information of notice common fields in the execution notice messages for the relevant messages.
g	Participant GW Server	Timestamp of messages sent from Participant GW Server to virtual server	Up to microseconds, it matches the transmission time in the message header of the execution notice messages for the relevant messages.

3 File Specifications

3.1 File Name and Format

The provided file name and format are as follows.

Data	File Name	File Name after compression[6]
Order Reception Timestamp	[Business Date]_h00_1_TIMESTAMP_Order.csv	[Business Date]_h00_1_TIMESTAMP_Order.tar.gz
Registration Result and Execution Timestamp	[Business Date]_h00_1_TIMESTAMP_Execution.csv	[Business Date]_h00_1_TIMESTAMP_Execution.tar.gz
jitter Information (BC-GM)	[Business Date]_h00_[L2SW ID]_NET.log	[Business Date]_h00_NET.tar.gz
jitter Information (PTP Log)	[Business Date]_h00_[Target Server ID]_ptp.log	[Business Date]_h00_ptp.tar.gz

The parameters included in the file name are as follows.

Parameter	Details
Transaction Date	The trading date written in the yyyymmdd format.
L2SW ID	The L2SW ID included in each file.
Target Server ID	The server ID included in each file. TRSV, PARGW.

The file format is as follows. It is the same in all files.

Encoding	Line Ending	Field Delimiter	Header	Number of Digits
UTF-8	LF	, (comma)	None	Variable

[6] The file name used when each dataset is provided in the data provision environment

3.2 Data Specifications

3.2.1. Order Reception Timestamp

The data specifications for this file are as follows.

#	Column	Type	Digits	Contents
1	OrderID	char	8	Order identification number. The same Order ID assigned to the order acceptance notification for the relevant message is applied. For messages where the Order ID is not assigned in the acceptance notification, the following rules apply: ➢ Cancel orders: The latest Order ID for the order being canceled is recorded. ➢ Mass cancellation orders: The Order ID is not recorded. (Note) Multiple records may be generated for specific Order ID.
2	IssueCd	char	12	Issue Code
3	Timestamp (seconds, point a)	char	18	Timestamp at the point. UNIX time (accumulated seconds).
4	Timestamp (nanoseconds, point a)	char	9	Timestamp at the point. Time below milliseconds is recorded in nanoseconds (nsec).
5	Timestamp (seconds, point b)	char	18	Same as in No. 3
6	Timestamp (nanoseconds, point b)	char	9	Same as in No. 4
7	Timestamp (seconds, point c)	char	18	Same as in No. 3

#	Column	Type	Digits	Contents
8	Timestamp (nanoseconds, point c)	char	9	Same as in No. 4
9	Timestamp (seconds, point d)	char	18	Same as in No. 3
10	Timestamp (nanoseconds, point d)	char	9	Same as in No. 4
11	Timestamp (seconds, point e)	char	18	Same as in No. 3
12	Timestamp (nanoseconds, point e)	char	9	Same as in No. 4
13	FASvID	char	8	Server ID of the Participant GW Server Indicates the server from which the timestamps at points a, b, and e have been obtained. PARGWXXX (where XXX is a number[7]).
14	BJSvID	char	7	Server ID of the Trading Server Indicates the server from which the timestamps at points c and d have been obtained. TRSVXXX (where XXX is a number[8]).

[7] This number matches the server number of the participant GW in the arrowhead Information (System Stats). The same applies below.

[8] This number matches the server number of the Trading Server in the arrowhead Information (System Stats). The same applies below.

3.2.2. Registration Result and Execution Timestamp

The data specifications for this file are as follows.

#	Column	Type	Digits	Contents
1	OrderID	char	8	Order identification number. The same Order ID assigned to the relevant message is applied. For relevant messages where the Order ID is not assigned, the following rules apply: ➢ Execution completion notifications: The latest Order ID for the executed order is recorded. ➢ Modification result notifications: The Order ID set in the corresponding modification order acceptance notification is recorded. ➢ Cancel result notifications: The latest Order ID for the order being canceled is recorded. (Note) Multiple records may be generated for a specific Order ID.
2	IssueCd	char	12	Issue Code
3	Timestamp (seconds, point f)	char	18	Timestamp at the point. UNIX time (accumulated seconds).
4	Timestamp (nanoseconds, point f)	char	9	Timestamp at the point. Time below milliseconds is recorded in nanoseconds (nsec).
5	Timestamp (seconds, point g)	char	18	Same as in No. 3
6	Timestamp (nanoseconds, point g)	char	9	Same as in No. 4
7	FASvID	char	8	Server ID of the Participant GW Server Indicates the server from which the timestamps at point g has been obtained. PARGWXXX (where XXX is a number).
8	BJSvID	char	7	Server ID of the Trading Server Indicates the server from which the timestamps at point f has been obtained.

#	Column	Type	Digits	Contents
				TRSVXXX (where XXX is a number).

3.2.3. jitter Information (BC-GM)

The data specifications for this file are as follows.

#	Column	Type	Digits	Contents
1	TmStUNIX	char	18	Records the time when the jitter information has been obtained in UNIX time.
2	TmStNsec	char	9	Records the time below milliseconds (in nanoseconds) when the jitter information has been obtained.
3	jitterVal	char	10	Records the time difference between the grandmaster clock (GM) of arrownet and the boundary clock (BC) of arrowhead in nanoseconds. The time difference can be negative value and is calculated using the formula: Boundary clock (BC) of arrowhead - grandmaster clock (GM) of arrownet.

3.2.4. jitter Information (PTP Log)

The data specifications for this file are as follows.

#	Column	Type	Digits	Contents
1	TmSt	char	18	Records the time when the jitter information has been obtained in UNIX time.
2	jitterPTP1Val	char	10	Records the time difference between the boundary clock (BC) of arrowhead and the NIC of each server in nanoseconds. The time difference can be negative value and is calculated using the formula: Boundary clock (BC) time of arrowhead - time at the NIC of each server.
3	jitterPTP2Val	char	10	Records the time difference between the NIC of each server and the OS of that server in

#	Column	Type	Digits	Contents
				nanoseconds. The time difference can be negative value and is calculated using the formula: Time at the NIC of each server - time at the OS of that server.

4 Notes on Recorded Data

- If you want to identify your own order information from this dataset, you need to keep the Order ID and issue code information related to your orders for each business day and link them using the Order ID and issue code as the merge keys in this dataset.
- Since this data refers to the order messages which arrowhead accepts or the notice messages which arrowhead sends, the below records might be included:
  - Missing data: In cases where the virtual server is disconnected after sending an order message and does not received the notice message until the online session ends, etc.
  - Duplicated data: In cases where notice message that has already been sent by arrowhead is retransmitted during the operation start sequence of the virtual server, etc.
- If communication with the virtual server is interrupted, etc., and communication does not continue, there may be significant discrepancies in the timestamps of the points before and after the virtual server disconnections. For example, if the connection with the participant's virtual server is lost before sending a message from the Participant GW Server to the participant's virtual server and the message is sent after the reconnection, there may be a significant discrepancy between the timestamp of the message sent to the virtual server (e, g) and the previous timestamps (a-d, f).
- If the data is duplicated, the timestamp points b-d and f of the retransmitted message become blank.
- This dataset does not guarantee the completeness or orderliness of the data, and due to factors such as sudden increases in the number

of orders or various system settings, there may be cases where not all order information or jitter information is recorded. Additionally, due to data constraints, records may contain timestamps that are not consistent in terms of chronological order. Users of the data need to take or omit the data and records appropriately based on their own judgment, including selectively using records as necessary.

- Regarding jitter Information (BC-GM), under normal circumstances, L2SW01 is the active device and L2SW02 is the standby device. L2SW02 is only utilized in case of a failure of L2SW01. If a failure occurs and L2SW02 becomes the active device, users of this service will be informed afterwards via email or other means.

5 Others

- Week end test data is not provided.
- For details on the service specifications such as delivery methods and update frequency, please refer to the "Alternative Data Service Guide."
- For information about the time synchronization connection lines provided by arrownet, please refer to the "arrownet Guidelines for Co-Location Connection (Reference translation)."

6 Appendix

- The time differences provided as jitter information are as follows.