DeFi Data Engine Internal Manual

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06/23/2022

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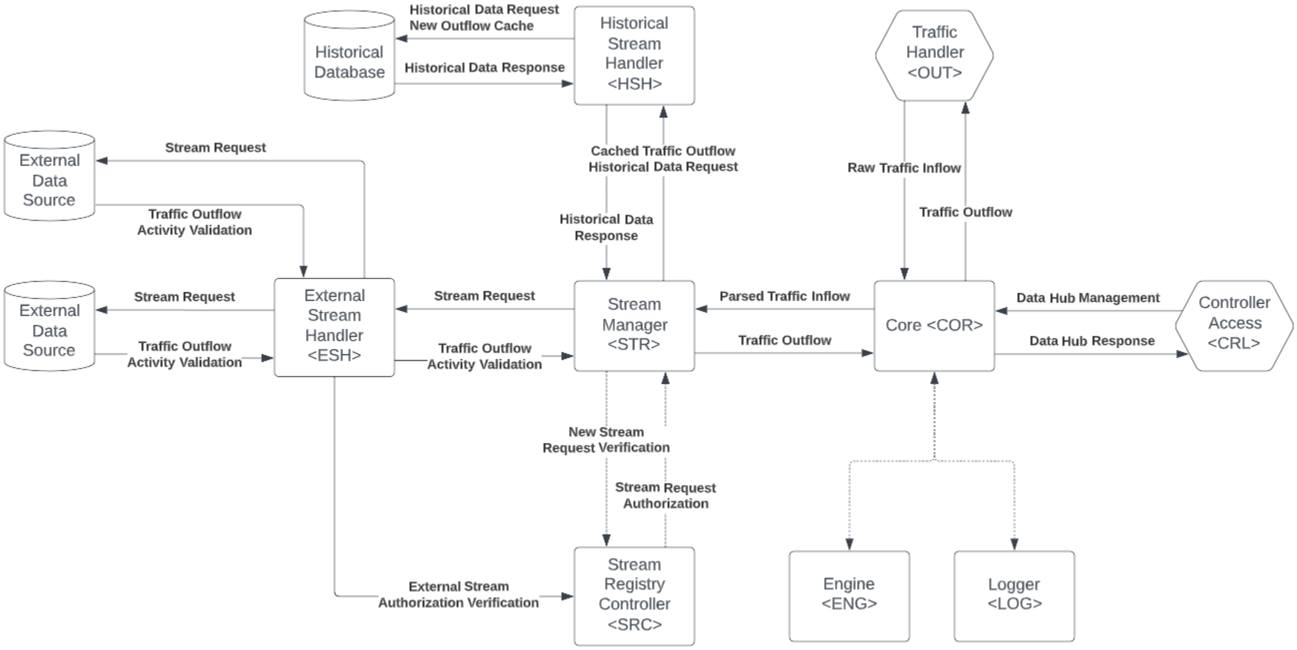
1 Abstract

The DeFi Data Engine is an engine which serves as a gateway between data brokers and user interfaced applications. The engine is built to service data requests, historical data caching, and data distribution protocols all within a low latency, high frequency environment. This engine specifically caters to financial data, pertaining to asset prices, liquidity data, and exchange volume. Below is a high level model of the engine which will be expanded upon in Section 3 of this manual.



2 Stack

This section describes the stack going to be used for this engine. Please make sure all pre-requisites are completed before attempting to use this engine in any capacity.

2.1 Java

Java SE 17 will be used for the development of the DeFi Data Engine. External libraries will be included in the build of the application and will be documented upon completion. All files will contain Java Docs as well for further development.

Prerequisites

Java JDK 17 Downloaded and Installed:
- https://www.oracle.com/java/technologies/downloads/#jdk17windows

2.2 Cap'n Proto

Cap'n Proto is a data exchange format based on the RPC Protocol. It will be used for communication between the R Shiny application, DeFi Data Engine, and the Controller. The application was designed in C++ and therefore requires a development environment built to handle C++. Note this is ONLY required for development purposes and NOT required for use.

3 Data Core

This section describes the data core of the engine, including an overview, component analysis, internal language, and internal connections.

3.1 Overview

The data core is a multi-threaded engine built for the handling of historical and live data streams. It will be able to accept requests through it's outside port and parse the specific requests to push data to the proper locations.

Historical data will be stored within a database contained within the engine, and will be cached automatically via the live operating stream. Outside components can then request specific data from a historical time frame and the engine will automatically open a connection to the data base to feed in that stream.

Live data also can be requested through the engine, through a similar requesting process. Once requested, the data core will request authentication from the outside source to open the data stream. After authenticated successfully, a channel will be opened where all requested data will flow through.

All internal and external processes relating to the data core are documented below.

3.2 Packets

All external communication will use Cap'n Proto for the requesting and receiving of internal processes. To maintain consistency throughout calls only one object type will be accepted for these requests, called Packets. Packets will contain the format listed below, with the contents required of each section listed based on the needs of the engine.

Packet Formatting		
Name	Type	Description
Time	Long	NS Epoch time-stamp of packet when sent.
Destination	String	Packet destination.
Sender	String	Sender of the packet.
Tag	String	Request type of packet.
Sub-Tag	String	Additional Tag information. (optional)
Data	String	Data contained in packet.

3.3 Controller Connection

The controller is an external application that is used to monitor the engine's internal processes. It is connected via Cap'n Proto and allows for multiple requests and checks detailed below. Note these requests can also be made by other external applications however it is recommended against as it could hinder the speed of the engine.

Listed below are details relating to the identification of the Controller.

Controller Process Variables		
Name	Value	Description
UUID	controller_process	Unique identifying name of the process.
Tag	CRL	Unique tag of the Controller process.

3.3.1 Management

The controller (and other external processes) will have the ability to request the following processes listed below. Processes refer to components within the engine which may require external monitoring for stability purposes. Description gives a short summary of the process being requested. Formatting of these requests will be listed in a later section.

Management Requests	
Process	Description
Engine Start	Start engine processes.
Engine Kill	Force kill all engine processes.
Engine Active	Determines if the engine is currently active.
Engine Active Streams	List of all active streams being executed in the engine.
Log Request	Returns logs for given period if exists.
Log Stream	Opens stream of logs for processing.
Stream Exists	Determines if the stream has been requested by an external source at any time and has been stored within the active stream manager.
Stream Authorized	Checks if stream has been successfully authorized to start live data stream.
Stream Active	Determines if a stream is currently active. Does not have to be flowing data to return true.
Stream Last Call	Checks for the last time the stream saw a live data point flow through.
Historical Exists	Determines if historical data for specific type exists.
Historical Request	Returns historical data stored if exists.

3.3.2 Request Formatting

This section details all request formatting for calling the managerial processes listed in the prior section.

Request Formatting			
Process	Tag	Sub-Tag	Data
Engine Start	ENG	STRT	N/A
Engine Kill	ENG	KILL	N/A
Engine Active	ENG	ACTV	N/A
Engine Active Streams	ENG	ACTS	N/A
Log Request	LOG	RQST	start_epoch: <Long> end_epoch: <Long>
Log Stream	LOG	STRM	TBD
Stream Exists	STR	EXST	stream_tag: <String>
Stream Authorized	STR	AUTH	stream_tag: <String>
Stream Active	STR	ACTV	stream_tag: <String>
Stream Last Call	STR	LCAL	stream_tag: <String>
Historical Exists	HSH	EXST	start_epoch: <Long> end_epoch: <Long> time_freq: <Long> data_category: <String>
Historical Request	HSH	RQST	start_epoch: <Long> end_epoch: <Long> time_freq: <Long> data_category: <String>

3.3.3 Response Formatting

This section details all response formatting for the managerial requests listed in the prior section.

Response Formatting			
Process	Tag	Sub-Tag	Data
Engine Start	ENG	STRT	response_code: <Long>
Engine Kill	ENG	KILL	response_code: <Long>
Engine Active	ENG	ACTV	is_active: <Boolean>
Engine Active Streams	ENG	ACTS	active_streams: <String[]>
Log Request	LOG	RQST	logs: <String[]>
Log Stream	LOG	STRM	TBD
Stream Exists	STR	EXST	does_exist: <Boolean>
Stream Authorized	STR	AUTH	is_authorized: <Boolean>
Stream Active	STR	ACTV	is_active: <Boolean>
Stream Last Call	STR	LCAL	last_call: <Long>
Historical Exists	HSH	EXST	does_exist: <Boolean>
Historical Request	HSH	RQST	returned_data <String[]>

3.4 Processes

This section details all processes contained within the engine including: overview, functionality, and framework design.

3.4.1 Router Superclass

The Router is a super class that every process inherits. It is used to route data in a standardized manner throughout the engine. Each process that inherits the Router super class will be required to supply several types of information including: a UUID, a three-character tag, tags contained within the process, and routing tag information.

Listed below is information regarding the required information supplied above.

Router Parameters		
Name	Type	Description
UUID	String	Unique identifier of the inheriting process.
Tag	String	Unique tag of the inheriting process.
Contained Tags	String[]	All tags that will be processed within the inherited process.
Routed Tags	String[]	All tags that will be routed to other processes.

The Router also has several built in functions to handle the sending and receiving of Packet's between the processes. Listed below are all methods defined by the Router that will by used to send and receive packets. Please note that all methods passed in the Map objects must take a Packet as a parameter and return a Boolean.

Router Methods		
Method	Return	Description
Router(String, String, String[], String[])	void	Base constructor for Router class. Defines all values stored within the Router class. Does not automatically connect any Router objects to self.
Router(String, String, String[], String[], Router[])	void	Constructor for Router class. Defines all values stored within the Router class. Automatically connects all Router objects passed as a parameter such that individual function calls are not required.
getUUID()	String	Returns UUID provided in the constructor.
getTag()	String	Returns Tag provided in the constructor.
getContainedTags()	String[]	Returns Contained Tags provided in the constructor.
getRoutedTags()	String[]	Returns Routed Tags provided in the constructor.
getRouter(String)	Router	Returns connected Router object based on Tag sent as a parameter.
createPacket(String, String, String, String)	Packet	Helper function used to create a Packet object based off of the given parameters. Parameters are as follows: (Destination, Tag, SubTag, Data).
connect(Router)	void	Connects Router object to Router passed as a parameter. Stores all connections and uses them for routing functions.
send(Packet)	Boolean	Sends Packet to connected Router object stored. Returns whether Packet was successfully sent. Throws error if destination does not exist in Router.
receive(Packet)	Boolean	Sends Packet to handler method based on method defined in constructor. Returns whether Packet was successfully processed.
abstract process(Packet)	Boolean	Router subclass function for handling incoming Packet objects.

3.4.2 Core

The Core of the data engine will be the main router for traffic. This includes all incoming Packets from both the Controller as well as outside applications. All data will be subsequently logged and pushed to the proper locations from within the engine.

There are 3 main connections in and out of the core: the Traffic Handler, the Controller Access Point, and the Stream Manager.

Connection from the Traffic Handler will contain all incoming and outgoing processes, with all requests and responses documented in the Internal Language section. The Core also utilizes a Router super-class, which is the standard communication process for the engine and will be discussed in the Internal Language section.

Listed below are details relating to the identification of the Core.

Core Process Variables		
Name	Value	Description
UUID	core_process	Unique identifying name of process.
Tag	COR	Unique tag of the Core process.
Contained Tags	ENG	All main engine controls.
	LOG	Logging functionality of the engine.
Routed Tags	STR	Routed to Stream Manager.
	SRC	Routed to Stream Manager.
	ESH	Routed to Stream Manager.
	HSH	Routed to Stream Manager.
	OUT	Routed to Traffic Handler.
	CRL	Routed to Controller.

The Core will have several classes and files that are used to manage traffic and functions contained within it. Listed below are the different classes and their functions.

Core Process Class Objects			
Class	Method	Return	Description
Core	Core()	void	Initializes the Core and defines all default values. Also initializes Router super class. Defines and initializes Logger, Engine, StreamManager, TrafficHandler, and ControllerHandler.
	process(Packet)	boolean	Processes all incoming COR packets.
ENUM LogSeverity	INFO		Used for generic messages.
	WARNING		Used for process warnings that may have impact on engine stability.
	ERROR		Used for process errors that have critical impact on engine stability. Engine terminates immediately following an ERROR.
Logger	Logger(OutputStream)	void	Initializes Logger object with given output stream. Also initializes Router super class.
	process(Packet)	boolean	Processes all LOG packets.
	log(Object)	void	Pushes Object to OutputStream. Uses default LogSeverity of INFO.
	log(LogSeverity, Object)	void	Pushes Object to OutputStream. Uses LogSeverity provided as a parameter.
Engine	Engine()	void	Initializes the Engine object. Also initializes Router super class.
	process(Packet)	boolean	Processes all ENG packets.
	start()	void	Starts internal clock and process stability manager.
	stop()	void	Stops internal clock and stability manager.

3.4.3 Stream Manager

The Stream Manager is the main processor for all stream requests, stream authorization, and stream handlers. This includes all stream request packets (external and historical), stream authorization packets, data return packets, and data caching packets.

There are 4 main connections in and out of the Stream Manager: the Core, the External Stream Handler, and the Historical Stream Handler. All request types and data formatting between these connections will be covered in the Internal Language section.

Listed below are details relating to the identification of the Stream Manager.

Core Process Variables		
Name	Value	Description
UUID	stream_manager	Unique identifying name of process.
Tag	STR	Unique tag of the process.
Contained Tags	SRC	Stream Registry Controller process.
Routed Tags	ESH	Routed to External Stream Handler.
	HSH	Routed to Historical Stream Handler.
	OUT	Routed to Core.
	CRL	Routed to Core.
	ENG	Routed to Core.
	LOG	Routed to Core.

The Stream Manager has several classes which control all processes and sub processes within this section of the engine. Listed below are the different classes and their functions.

Stream Manager Process Class Objects			
Class	Method	Return	Description
StreamManager	StreamManager()	void	Initializes the StreamManager object and defines all of the necessary channels. Also initializes the Router super class. Defines and initializes ExternalStreamHandler, HistoricalStreamHandler, and StreamRegistryController.
	process(Packet)	boolean	Processes all STR packets.
StreamRegistry-Controller	StreamRegistryController()	void	Initializes the StreamRegistryController object and the Router super class.
	process(Packet)	boolean	Processes all SRC packets.
	exists(String)	boolean	Returns whether a Stream with given tag exists in the registry.
	authorized(String)	boolean	Returns whether a Stream contains the proper authorization credentials to start.
	active(String)	boolean	Returns whether a Stream with the given tag is active.
	execute(Packet)	boolean	Executes a Stream based off of the passed information. Validates all required information prior to execution.
	register(Packet)	void	Registers a stream into the registry to track activity.
	update(Packet)	void	Updates the status of a stream based on transferred packet.

3.4.4 External Stream Handler

The External Stream Handler is the main hub for all integrated data sources. Here, requests are processed and sent to the requested sources and then data streams are opened and sent to the outside sources. Requests must first be processed and authorized in the Stream Registry Controller before being sent.

Listed below are details relating to the identification of the Stream Manager.

External Stream Handler Process Variables		
Name	Value	Description
UUID	external_stream_manager	Unique identifying name of process.
Tag	ESH	Unique tag of the process.
Contained Tags		
Routed Tags	SRC OUT	Routed to Stream Registry Controller. Routed to Traffic Handler.

The External Stream Manager has several classes which control all processes and sub processes within this section of the engine. There is also an abstract class which all outside sources are required to implement and handle should they want to be recognized by the engine.

Stream Manager Process Class Objects			
Class	Method	Return	Description
ExternalStreamHandler	ExternalStreamHandler()	void	Initializes the ExternalStreamHandler object and defines all necessary channels. Also initializes the Router super class. Uses Reflections library to recognize all outside data sources compatible with the engine as to not require manual integration.
	process(Packet)	boolean	Processes all ESH packets and sends requests to appropriate outside sources.
ABSTRACT ExternalConnection	ExternalConnection()	void	Initializes the outside connection class, defining all necessary variables.
	final const SOURCE	String	Required unique source id of the outside source. Used by engine to identify external connection.
	getSource()	String	Returns unique source id.
	process(Packet)	boolean	Function used to process data packets sent by ESH.
	abstract authorize(Packet)	boolean	Used to authorize connection.
	abstract isAuthorized()	boolean	Used to confirm authorization.
	abstract valid(Packet)	boolean	Used to confirm that request is valid to send.
	abstract request(Packet)	boolean	Sends request for data to connection.

3.4.5 Historical Stream Handler

The Historical Stream Handler is the main hub for all historically cached data. Outside sources can make requests for cached data to then use for various processes. Externally sourced data is also cached here real time to reduce latency when requesting historical data. All requests are first validated through the Stream Registry Controller before being submitted.

Listed below are details relating to the identification of the Historical Stream Manager.

Historical Stream Handler Process Variables		
Name	Value	Description
UUID	historical_stream_manager	Unique identifying name of process.
Tag	HSH	Unique tag of the process.
Contained Tags		
Routed Tags	SRC OUT	Routed to Stream Registry Controller. Routed to Traffic Handler.

Functions within the Historical Stream Handler are TBH due to the current design being undecided.

3.5 Internal Language

The Internal Language section will discuss how managerial processes are executed, how to request streams from within the application, and how to manage data outflow.

3.5.1 Management Processes

Please reference section 3.3.1 for all Management Process requests. This section will most likely be expanded in later versions.

3.5.2 External Stream Requests

External Stream Requests are requests made the External Stream Handler to subscribe to a live data feed. Each of these requests is first processed through the Stream Registry Control before being sent to the External Stream Handler.

The general flow of the an External Stream Request is listed as follows.

External Stream Request Path					
Step	Sender	Responder	Tag	Sub-Tag	Description
1.	OUT	COR	SRC	EXEC	Transit from OUT to COR.
2.	COR	STR	SRC	EXEC	Transit from COR to STR.
3.	STR	SRC	SRC	EXEC	Transit from STR to SRC.
4.	SRC	-	SRC	EXEC	Process request and send authorization to ESH.
5.	SRC	STR	ESH	AUTH	Transit from SRC to STR.
6.	STR	ESH	ESH	AUTH	Transit from STR to ESH.
7.	ESH	-	ESH	AUTH	Authorize stream and reply with response code to SRC.
8.	SRC	-	-	-	Process response code from ESH.
9a.	SRC	OUT	-	-	If invalid response from ESH, return response code to OUT.
9b.	SRC	STR	ESH	EXEC	If valid response from ESH, send execution packet to ESH. Transit from STR to SRC.
10.	STR	ESH	ESH	EXEC	Transit from STR to ESH.
11.	ESH	-	ESH	EXEC	Process execution packet and open stream on provided channel.
12.	ESH	STR	OUT	EDAT	Data packet from ESH to OUT. Transit from ESH to STR.
13.	STR	COR	OUT	EDAT	Transit from STR to COR.
14.	COR	OUT	OUT	EDAT	Transit from COR to OUT.
15.	OUT	-	OUT	EDAT	Submit data packet to outside source.

3.5.3 Historical Stream Requests

External Stream Request Path					
Step	Sender	Responder	Tag	Sub-Tag	Description
1.	OUT	COR	SRC	HRQS	Transit from OUT to COR.
2.	COR	STR	SRC	HRQS	Transit from COR to STR.
3.	STR	SRC	SRC	HRQS	Transit from STR to SRC.
4.	SRC	-	SRC	HRQS	Process request and send validation request to HSH.
5.	SRC	STR	HSH	EXDT	Send request to see if data exists in database. Transit from SRC to STR.
6.	STR	HSH	HSH	EXDT	Transit from STR to HSH.
7.	HSH	-	HSH	EXDT	Validate data exists and send response code to SRC.
8.	SRC	-	-	-	Process response code from HSH.
9a.	SRC	OUT	-	-	If invalid response from HSH, return response code to OUT.
9b.	SRC	STR	HSH	HRQS	If valid response from HSH, send data request to HSH. Transit from SRC to STR.
10.	STR	HSH	HSH	HRQS	Transit from STR to HSH.
11.	HSH	-	HSH	HRQS	Process request packet and send data to OUT on provided channel.
12.	HSH	STR	OUT	HDAT	Data packet from HSH to OUT. Transit from HSH to STR.
13.	STR	COR	OUT	HDAT	Transit from STR to COR.
14.	COR	OUT	OUT	HDAT	Transit from COR to OUT.
15.	OUT	-	OUT	HDAT	Submit data packet to outside source.