MESG

MESG's Application of the Decentralized Network of Services

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Introduction

This document outlines the implementation of the decentralized network of services (called MESG Network), previously introduced in the document entitled "Decentralized Network of Services: Migrating traditional technologies towards decentralization".

The use and functionality of the decentralized network is made possible via Core, a software which connects all actors in the network and manages the deployment and interaction of services.

Applications

Applications are the main feature of MESG. The goal of applications is to help users and companies to create better solutions and to allow businesses to use blockchain technology without needing to manage the actual complexity.

In order to keep Applications lightweight with shareable components, Applications on MESG are built to connect events from a technology to tasks on any other technologies.

Applications take the form of a list of tasks which are to be executed once a specific event occurs. All tasks within an Application built with MESG are based on events. Each time a task is completed, it can trigger one or more additional tasks which depend on the result of the previous tasks. This way, the system can remain flexible and simple as an event system where every event that contains data will eventually trigger an action. With this in mind, users can create any Application they need with any technology they want. If the technology can send and receive data, it can be integrated and used by MESG.

Applications are triggered when a selected event is triggered. Every time this selected event is triggered, the Workflow within the Application is executed. So, the same Workflow might have multiple executions with potentially different results.

Applications can be private or public. When set to private, only the creator will be able to use it. When they're made public, any user can use it. Because applications have one point of entry with specific data and potentially multiple types of results, it might be used exactly like a Service task. This way, users can use/create reusable Applications. Public Applications are accessible via a Marketplace with the objective of offering as many reusable Applications and Services, allowing basic users to create powerful solutions without the complexities, so they can focus on building their application / business.

Common users can create small Applications that are similar to what can be done with services such as IFTTT or Zapier. Small companies can use more complex Workflow systems to automate some of their tasks. Developers (possibly from companies) can create advanced Workflows to create full Applications the same way they already do using systems like Serverless or Backend-as-a-Service systems like Graph.cool or even Firebase.

Application Examples

Below is a non-exhaustive list of different applications that can be implemented to solve common issues that users, companies and/or developers face:

User wallet creation
When a new user registers on your Application
then an Ethereum address is created for them
then this address is added to their contract information
then some free ERC20 is given to this address
then an email is sent to notify the user of the completed actions.

IoT with an electric car example
When your electric car finishes charging
then the entity who delivered the electricity is paid
then the driver is notified that the charge has completed
then the car is put into standby mode.

Image processing (decentralized processing)
When an image is uploaded
then it is resized
then it is compressed
then it is uploaded it to different CDN

Blockchain value transfer
When you receive some Bitcoin
then the equivalent amount is transferred to Ethereum
then a notification of the result of the transfer is sent

Ecommerce cart system the accepts payments
When a user adds a new product to their cart
then a new Ethereum address is created for them
then wait for the completed payment in Ethereum to this address
then when the payment has successfully completed, mark the cart as processing
then send an email to the user
then send out the product for delivery
then when the delivery system receives the product, notify the user of the delivery status
then when the delivery has been made, mark the cart as paid.

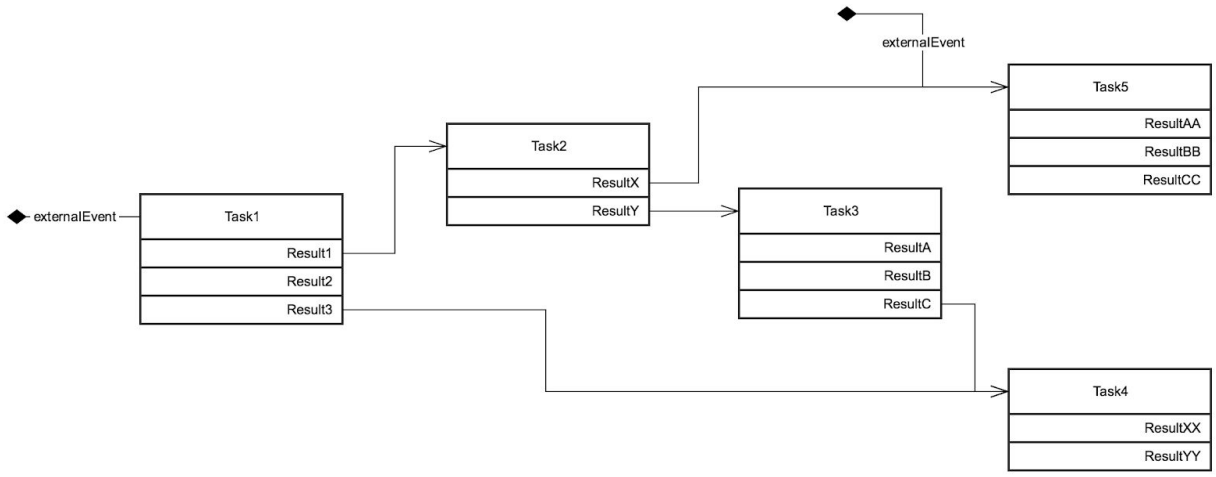
These are merely examples. It's important to understand that **any** system or technology that has events and actions is compatible with MESG and can be used in applications and workflows.

Task

A task is an action that accepts data as an input and returns a status with data as an output.
A task defines multiple statuses, but only one can be returned during the execution.

Rules

- the first task must be only connected to a single external event
- every subsequent task must be connected to a specific status of other task(s)
- every subsequent task can be connected to one external event



Workflow example

In this example, we have a list of tasks which are connected to each other according to the dependencies on the statuses of other tasks. The initial task will only have one external event, but the other tasks have both a dependency on a task, as well as a dependency on up to one external event.

The application first starts with the *Task1,* then *Task1* returns the status *Result1* and *Task2* is executed. If the *Task2* returns the status *ResultX, Task5* is waiting for another external event. This is considered as one branch of the Workflow, but the Workflow can have multiple branches (there are three in the above example). Every branch will have a status to show if the processing on the branch has completed or not. If it has not yet completed, the workflow has some remaining final tasks to execute.

Services

MESG is based on events and actions on many technologies. In order for MESG to listen to events from Technologies and execute tasks on technologies, a Service must first be created. This Service will act as a bridge between MESG Core and the technology.

Services have three main functionalities:

- Emit events from the technology it is connected to
- Execute a task related to the technology
- Verify the execution of a task

Services can implement all or any subset of those functionalities.

The more Services exist and the more nodes run them, the better and safer the MESG Network is. In order to reach this goal, different solutions will be created.

Once the Network is deployed, a Service Marketplace will be available within the software, Core. It will allow Users to easily find and select Services they need for their Workflows and Applications. The Marketplace displays the Service's price, rating, users comments, number of Applications using it, number of nodes running it and the reputation of the developer.

An incentive system for the developer and actors in the network will be implemented. Each time a Service is executed, the developer and actors who participate in the network will have an opportunity to receive revenue for the work they've completed.

An important aspect to the system of Services is to have as many Services as possible running at all times. This is essential to maintain the reliability of the Network and for the security of Services. The more nodes that run a Service, the more reliable and secure it becomes. In order to encourage this, all users running a Service will receive revenue for every event or task they process. The goal is to make it very simple for a user to register as a participating node in the Network. This will be accomplished by creating clear UIs and documentation to guide users and provide statistics to help them choose the best services for them. In the near future, the system will be able to automatically optimize the revenue of users and improve the performance and security of the Network.

Receiving tasks from Core

The Service needs to be able to receive tasks sent by Core. Each time a tasi is received, it will make sure that the sender is Core, then it will check to ensure that it can handle the task, and if so, it will execute it. Once executed, it will emit an event to Core with the result of the task.

Send events to Core

Services can send data to Core. This data is divided into two categories:

- The result of a task: When Core asks to start a task and expects a result from this task
- Events from the listener: When the Service emits a new event from its listener function. (e.g. a running web server receiving a request from a blockchain technology that received a new transaction)

Configuration File

In order for Core to know all tasks, events and configurations that the Service implements, the entire configuration of the Service is defined within a configuration file.

It's necessary to add metadata like the name, description and constraints on the environment the Service needs to run in. This is useful in helping to choose the right service for your needs.

Core

To allow people to use the MESG Network, a way must be provided for them to access the different features of MESG. For example, when users want to create an application, visualize the logs of execution, manage services, or create an account / wallet.

To allow these interactions, we have created an application called Core, which is a program that manages all complexities for all users. Core features different levels of complexity for the different kinds of users.

Accessible to all

In time, most users will not be developers, so they'll need a proper user interface to manage everything, from the workflow deployment to their participation in the network with a very low barrier to entry. The idea is to have an easy-to-use graphical user interface where users can deploy an application or start earning tokens by activating services with just a few clicks.

It's important for Core to be easy to set up. A standard user should need to do very little in order to have Core be fully functional for them. Also, users that want to install this application on another system, such as a remote server, will be able to do so easily, assisted by documentation that explains how to make your node run on most popular hosting companies.

Developer friendly

The second type of user will be developers or companies that want to have access to both the basic features and the more advanced ones. We will provide these users with a Software Development Kit (SDK) that can be used to access all functionalities. The SDK will be free and accessible to everyone without prerequisites. The SDK will contain two different interfaces: a Command Line Interface (CLI) and an Application Programmable Interface (API). The CLI will be used to access all functionalities of Core by developers who want to use Core manually. The API will also provide access to all functionalities so that developers will be able to use it from other software, automate actions on MESG or even create their own products on top of MESG.

All of the different parts of Core are completely open source, meaning that anyone can participate in improving them. Also, anyone can reuse any part of Core to integrate it in their own technology and/or business.

Smart proxy

The MESG Network is composed entirely of MESG Cores. All communication is done directly between the various copies of Core, with no direct communication between individual Services and Applications on the Network. Core connects and manages all Services and Applications in order to relieve Applications of unnecessary complexity.

If an Application requires an execution of Services which are not already being run by Core, Core will communicate with other deployed Cores on the Network which are running the desired Service. Core can ask other deployed Cores to forward an event from a Service which it is not running locally.

All Cores have equal rank in the Network and autonomously make their own decisions. All communication between Cores are first cryptographically verified prior to being processed.

Network

The Network is the communication mechanism which allows Nodes running Core to freely exchange data. The Network is decentralized without any single points of failure. It is responsible for syncing each Node's data with all of the other Nodes. The Network coordinates all Service events and actions from all Workflows and Applications with the Nodes. The security and trustability of the Network should increase each time a new Node is added.

Consensus

Creating a system of trust in the decentralized network will be achieved via a consensus mechanism.

Proof of work is inherently inefficient because resolution is based on high computational usage, and difficulty of resolution increases over time. Moreover, MESG Nodes are already responsible for executing Services and Applications, so we need a lightweight consensus system which is still secure.

MESG will implement a Byzantine Fault Tolerance (BFT) consensus mechanism coupled with a Proof of Stake system. Each staked token will afford one vote in the consensus mechanism. It will be expensive to have a majority of the voting power, resulting in higher security.

Side Chain

Scalability is a big issue for any decentralized network. A large number of Nodes executing or verifying the same task provides security to the network, however it comes at the cost of being rather inefficient and drastically limits the throughput.

Two methods can be implemented within the Network.

Clusterization

Multiple sub-networks can be ran so that each can be responsible for doing one specific job. In the case of MESG, these individual sub-networks consist of nodes running the same service.

One root-network will provide security and the most basic functions. The sole purpose could be to keep track of the MESG Token, such as balances and stakes.

Similar systems to this can be seen in products such as Cosmos (hub and zones) or Ardor.

Parallel execution

Workflow executions can be run in parallel, as opposed to sequential execution, which is what Ethereum currently does.

Asynchronous executions

Executions which take a very long time to execute should not interfere with executions which are able to execute within a very short timeframe so every execution needs to be treated as asynchronous. In order to do that a state machine will be implemented for every execution and this changement of states will be the transactions that the network needs to handle. (eg: execution created, execution started, execution failed, execution succeed...)

Glossary

Technology

A Technology is anything connected to the Internet that sends or receives data. (e.g. Blockchains, IOT, HTTP API, etc.).

Network

The MESG Network is a decentralized network made up of all nodes running MESG Core.

Core

Software that manages all actors in the MESG network, in addition to connections and communications between all applications and services, regardless of the technology or programming language.

Application

A list of Workflows supported by business logic.

Workflow

A list of Services' Tasks executed in a specific order. Workflows are triggered by a predetermined Service's Event.

Service

A list of Tasks and Events from one Technology. Tasks are triggered by Core to initiate interaction with the technology, and Events happening on a Technology are submitted to Core. Services are essentially bridges between Core and Technologies.

Task

A specific action to interact with the Technology. Tasks have inputs and outputs like functions in computer programming. Tasks belong to a single Service.

Event

A message sent by a Technology at a specific time, e.g. a blockchain transaction, a light bulb is turned on, or an user signs up to a website. Events belong to a single Service.