Fermat Chapter Network

Version 0.1 - December 2016

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Introduction

Mining IoP tokens will be done in the most decentralized and resilient way possible. In the very long term securing the network by mining will be done by different networks that we will build over time. The mining will evolve until its final state where a block is going to be mined by one network, the next block by a second network and so on, including end users as one of the possible networks. Current network ideas includes these ones:

1. Fermat Chapter Network → We are building this one today.
2. Fermat Research Network
3. Fermat Business Network
4. Fermat End Users Network

The first phase in this mining roadmap is the Fermat Chapter Network, and that is what we are going to describe and analyze in this document.

Part I - Fermat Chapter Network

A Fermat Chapter is a team of people that advocates the Fermat project in a certain region. This team usually is formed by people with different profiles and backgrounds. Some of them are idealistic, some have good writing skills, some are geeks, etc. The good thing is that they all complement each other and have a common goal of making Fermat succeed.

The Fermat Chapter Network supports the project and helps spread the word. The core idea is that these teams take some pre-defined tasks of the project that need to be done, and execute them over time, indefinitely. In exchange for doing so, the project awards them with newly issued tokens.

Chapter Network Structure

The Fermat Chapter Network on one side interfaces the world population, and on the other side, interfaces Fermat computer systems (IoP for instance). This network must have a topology, a structure.

The equivalent network in bitcoin is the network of node operators running bitcoin nodes and miners. In bitcoin Nakamoto intended to align the incentives / rewards produced by the bitcoin network, with the network of people operating the software. Once the mining was extracted from the original bitcoin node and run in mining farms or mining pools this balance was broken and put bitcoin on a path of centralization.

Decentralization at a human level means people in every country of the world, in every state / province and in every city, town and village. The most decentralized and resilient human network we can imagine, is the one where there is at least one person at each placeholder of that structure.

To avoid what happened to bitcoin we should have a certain structure for the Fermat Chapter Network that is fixed and cannot lead to centralization. Once the Chapter Network is there, we can open the mining to anyone else to participate, including end users. It is important to know that we need more than the Chapter Network to be censorship resistant, since the Chapter Network is run by known individuals.

Naming

Since the target is to have a geo-localized Chapter Network structured upon existing political divisions, the easiest way to call the members of this network is with the same terms that they are called today: Country Chapters, State Chapters, City Chapters, Town Chapters and Village Chapters.

Mining Licenses

Mining Licenses is the technique used to distribute newly issued tokens. The concept is very simple:

One Mining License allows the mining of IoP tokens using a regular computer and using only one of its processors. The mining license is used at the mining software. Each license holder cannot mine more than 2 or 3 times the average for a certain period of time, called *Mining Period* (it is 2 or 3 depending on the user base of the chapter as explained below). This prevents centralization of mining with powerful computers and prevents disallowing regular people to mine with their regular PCs.

Chapters are entitled to be awarded a fixed number of mining licenses which are intended to be distributed among the chapter members according to their own internal rules. In this way we can guarantee that if for example, there

are 200 countries in the world, and a maximum possible number of 10 licenses per country, then there will be 2,000 mining licenses distributed evenly all over the globe. In such a situation our objectives of decentralization are met.

Mining licenses are meant to be distributed between chapter members as they wish. This is done by the Chapter Leader. A license can be installed in more than one miner software and it will make it mine until the miner cap is reached in either computer. This means that the system doesn't allow cheating in this sense and that licenses can be shared between chapter members without causing any disruption. If a miner reaches the predefined cap it just stops and waits for the next mining period, sitting idle without consuming any resources of the computer where it is running. Every node, before accepting new mined blocks, check that the Chapter submitting this block has not exceeded its cap. If one Chapter exceeded its cap and still submit mined blocks to the others then other nodes will ban it from the network for breaking the rules.

For example: Let's say the IoP Token Network is set for one block to be mined every 10 minutes, and that each *Mining Period* can have 1,000 blocks. Let's also say that Chapter Spain has mined 10 blocks, Chapter Germany 8 blocks and Chapter Italy 12 blocks since the opening of the current *Mining Period*. The average of blocks mined in this *Mining Period* is 10 = (8 + 10 + 12) / 3 . This means that each chapter cannot mine more than 20 or 30 blocks, depending on their membership base.

TIP: Mining Licenses are bound to the the public key of the wallet software used to mine.

Tasks a Fermat Chapter can do

Every chapter in the Fermat Chapter Network is entitled to receive a Mining License (ML) for each one of these tasks (the list might grow as we discover other useful things each a chapter can do):

- **Twitter:** Running a regional Fermat Chapter Twitter account according to the provided guidelines (or the equivalent to Twitter in countries where there is no Twitter). After the first 100 followers the chapter gets a ML.

- **Facebook:** Running a regional Fermat Chapter Facebook page, personal account or group according to the provided guidelines (or the equivalent to Facebook in countries where there is no Facebook). After the first 100 likes or friends or group members the chapter gets a ML.

- **LinkedIn:** Running a regional Fermat Chapter LinkedIn profile according to the provided guidelines (or the equivalent to Linkedin in countries where there is no Linkedin). After the first 100 connections the chapter gets a ML.

- **Web Site:** Running a regional Fermat Chapter web site according to the provided guidelines.

- **Original Blog**: Writing a Fermat Chapter blog in the local language with original content.

- **Translated Blog**: Writing a Fermat Chapter blog in the local language with translations of other blogs citing the author and linking the original.

- **Newsletter**: Writing a Fermat Chapter Monthly newsletter.

- **Youtube Channel**: Running a Fermat Chapter Youtube channel or similar service in countries where youtube is not the largest of it's kind.

- **Meet-ups:** Hosting regional Fermat meetups according to the provided guidelines entitles a chapter up to 3 MLs.

- **Running a Testnet Node**: One ML.

- **Forum Signature Marketing**: Influencers at the bitcoin / blockchain industry like “Forum Super-Hero” on bitcointalk and reddit could wear his Chapter Signature / Logo / Links and by doing so promote the Fermat Project continuously. One ML goes for this.

Tip: Below you will find a detailed table with how many licenses are awarded for how many users / followers / likes, etc.

Roadmap

The Fermat Chapter Network is going to end up being huge. To build it, we need to go step by step building the network. So far we identified these five phases on our roadmap:

- **First Phase - Country Chapters:** The first step is to be in every country of the world. Because of their relevance, we include in this phase States of the United States. This is where we are now, with 60+ Country Chapters and some US States. To lead or be a member of a Country Chapter you must either have been born at that country, or be a resident of it.

- **Second Phase - State Chapters:** Phase 2 starts when Phase 1 is at 50% of their final goal and Chapter App is released. Only states legally recognized as states at the country they belong to are allowed as State Chapters. To lead or be a member of a State Chapter you must either have been born at that state, or be a resident of it.

- **Third Phase - City Chapters:** Phase 3 starts when Phase 2 is at 50% of their final goal globally. Only cities legally recognized as a city at the country or state they belong to are allowed as City Chapters. To lead or be a member of a City Chapter you must either have been born at that city, or be a resident of it.

- **Fourth Phase - Town Chapters:** Phase 4 starts when Phase 3 is at 50% of their final goal globally. Only town legally recognized as a town at the country or state they belong to are allowed as Town Chapters. To lead or be a member of a Town Chapter you must either have been born at that town, or be a resident of it.

- **Fifth Phase - Village Chapters:** Phase 5 starts when Phase 4 is at 50% of their final goal globally. Only villages legally recognized as a village at the country or state they belong to are allowed as Village Chapters. To lead or be a member of a Village Chapter you must either have been born at that village, or be a resident of it.

Bootstrapping the Fermat Chapter Network

Today we have Fermat Chapters in around 60 different countries. An incentive must be in place in order to complete the first phase and other phases in the shortest possible period of time.

Bootstrap Incentives

The incentives for any existing chapter member referring one new chapter is one Mining Licence (ML). Each chapter member that finds the right people to start a new chapter can get one ML. Finding the right people means

finding one or more persons the rest of the community members approve by endorsing them. More details about endorsements follows below at this same document. These persons should share the Fermat Vision and have an entrepreneurial mindset.

Chapter members acquiring MLs for referring new chapters can mine with those licenses indefinitely, as long a the referred chapter is *Inside the Network (*definition of what means to be *Inside the Network* in the next section). It is important to note that this type of ML is granted to an individual not a chapter.

Pre-Automation Stage

We are currently at the pre-automation stage. That means that the management of the chapters is done manually with the help of a shared spreadsheet. The awarding of new licenses today is done in a centralized way by a few administrators. All this needs to be automated allowing the network to self-govern and self-audit.

Mining Licences Spreadsheet

https://docs.google.com/spreadsheets/d/1BI2l4jPPmh0I2V2ePWLTgLJUpWPymdpQ1-E-qUEfpyQ/edit?usp=sharing

New chapters need to fill in the information in a new row by commenting in each cell as appropriate. Later those comments will be accepted as data on the spreadsheet, and after validation MLs will be granted and recorded in the blockchain.

This spreadsheet is our first organizational effort to maintain the Fermat Chapter Network. The current situation is that a couple of administrators authorize the mining. This should be replaced by an automated system that does not depend on anyone in particular. Until we reach that point, we have to keep the manual system as clear and transparent as possible. At the public spreadsheet anyone can see the current status of the Fermat Chapter Network.

Revocation of the ML

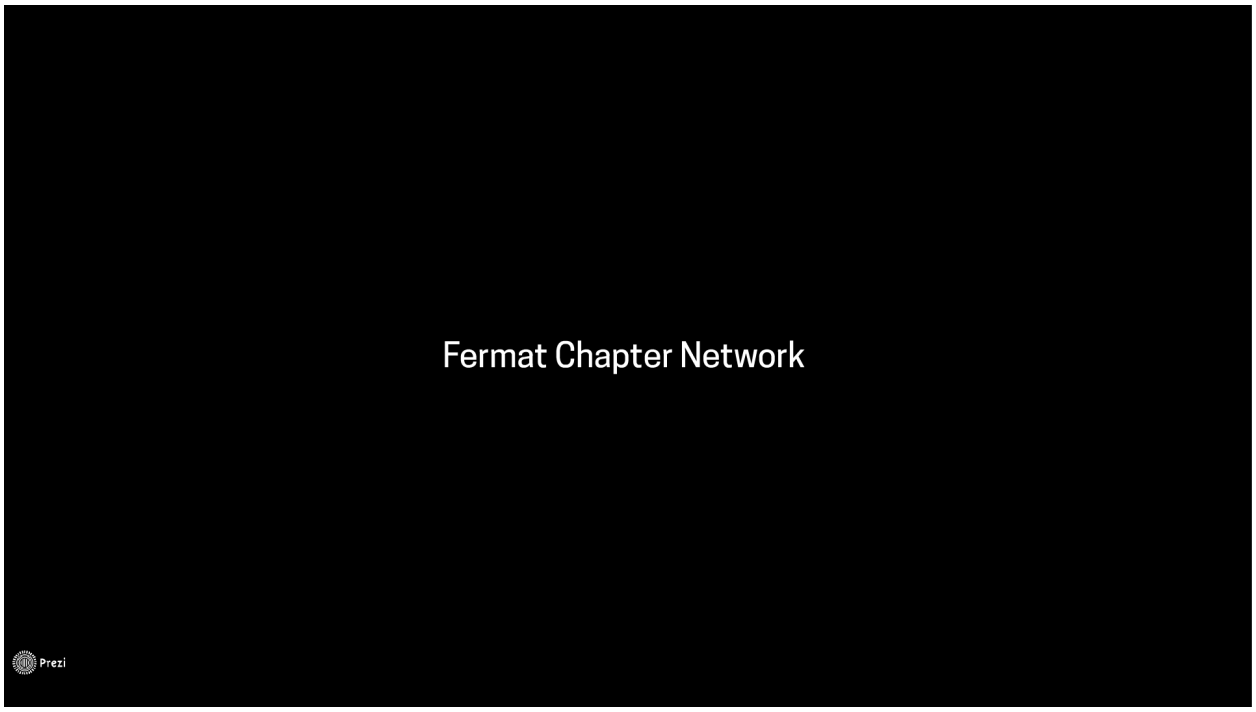
Currently we are self controlling and self enforcing our rules as a community. The first mechanism is to allow anyone in the network to comment on the “Chapter Status” field of the spreadsheet. The administrators might revoke MLs of chapters not following the rules after several warnings.

Automation Stage

We need to automate these proceedings in order to avoid corruption, mistakes, and suspicions. The blockchain token system must understand that on top of it, there runs the Fermat Chapter Network and it should provide the functionality to allow it to run without any single point of failure. The next section enters into the details of the system that is going to be created to bootstrap and run the Fermat Chapter Network in a **decentralized way.**

NOTE: All the licenses granted manually by the administrators are ignored once the automated system replace the current spreadsheet, and all existing chapters must be founded from scratch on the new system.

Part II - Fermat Chapter Network System



Here we analyze the system we need to develop in order to allow the Chapter Network to exist and scale to the level we envision. The analysis starts with defining the possible actors, and continues with the required software components.

Actors

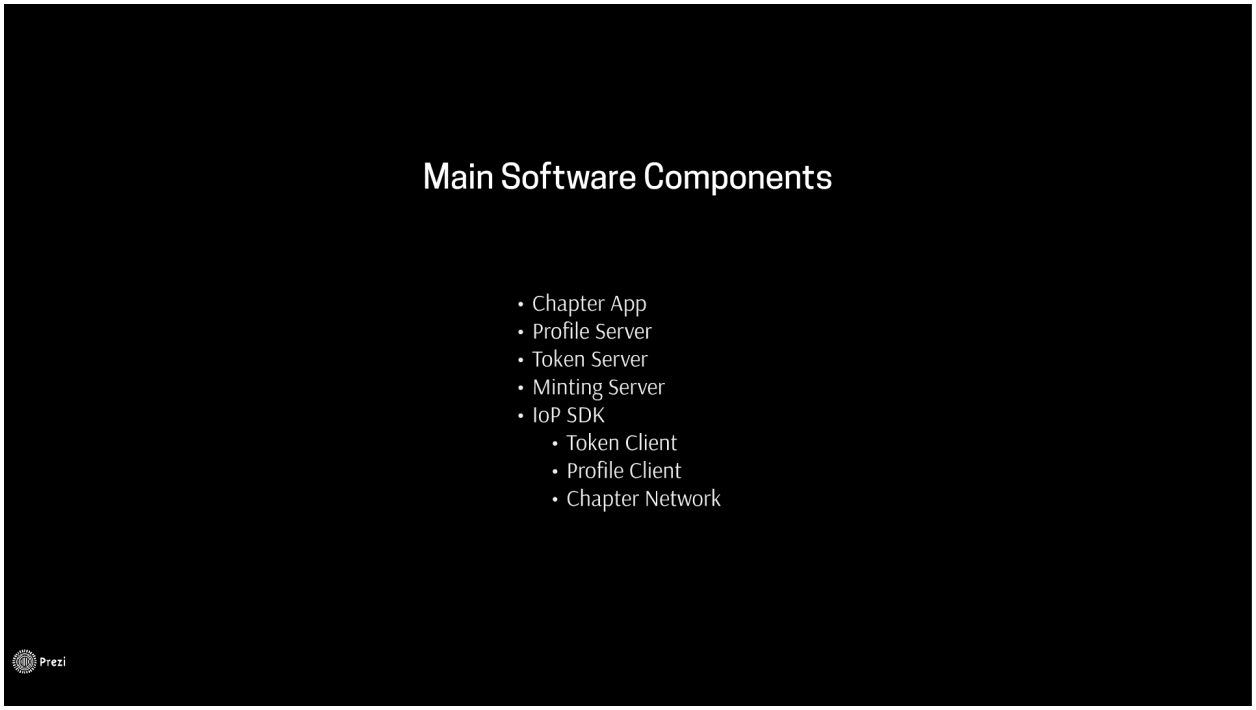
We identify for this system these possible actors:

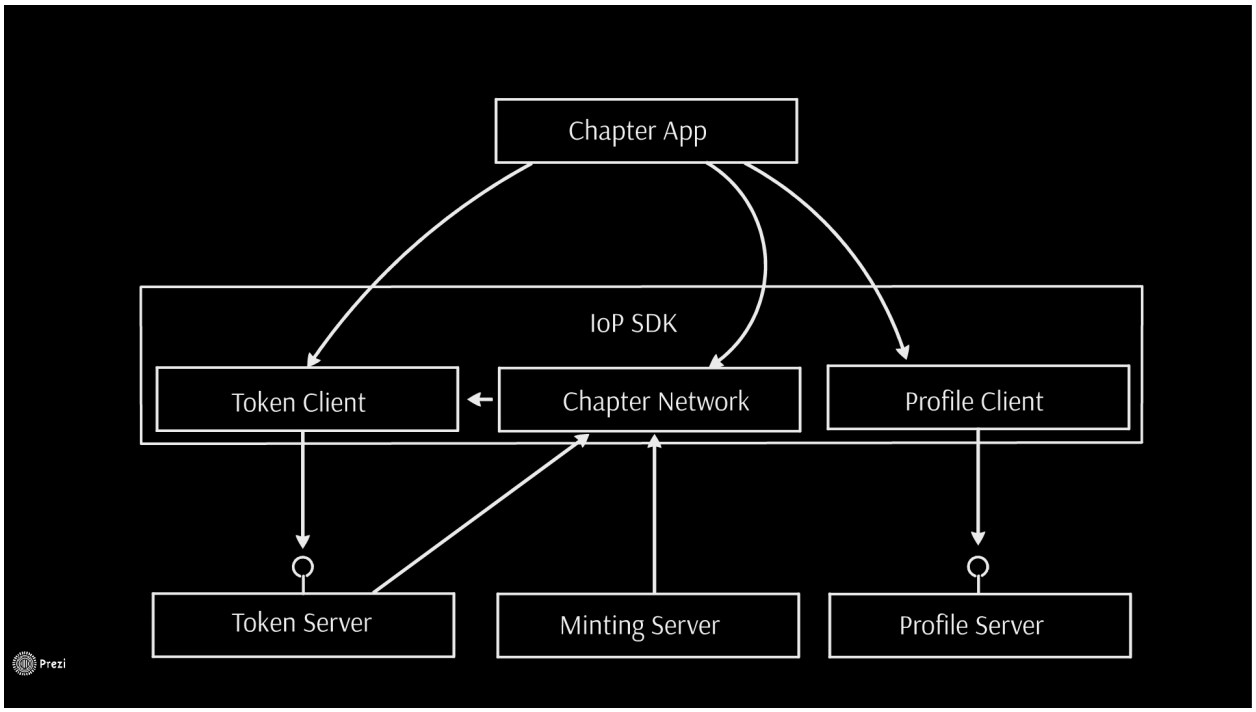
- **A Chapter:** A Chapter is a team of people bound to a specific territory. There are 5 different types of chapters:
    - **Country Chapter:** It is a chapter representing one real life country.
    - **State Chapter:** It is a chapter representing one state within one country.
    - **City Chapter:** It Is a chapter representing a city within a state of a country.
    - **Town Chapter:** It Is a chapter representing a town within a state of a country.
    - **Village Chapter:** It Is a chapter representing a village within a state of a country.
- **A Chapter Member:** Members of a chapter are approved persons. They execute the tasks (Twitter, Facebook, etc) related to a chapter. One of the members is the chapter leader. Each task can be performed by one or many chapter members at the same time.

    - **For Example:** the chapter Twitter account might be run by only one chapter member, or shared between several members.
    - **Other Example:** There might be a chapter where one member run both the Twitter and Facebook account.

- **A Chapter leader:** Are the ones that endorse other chapters in order to validate the work they are doing. They also manage the mining licenses under which chapter members are mining.

Software Components





For this system we need:

- **IoP SDK:** It is a software library. Inside it we can find several modules. For this system we will need 3 of them:
    - **Token Client:** For the Chapter App we need the Token Client for holding IoP tokens needed for the different blockchain operations and deposits. The Token Client internally has an SPV wallet.
    - **Chapter Network:** To be able to access Chapter Network functionality. This module encapsulates the Chapter Network protocol described below, required to encode information into IoP token transactions. This module interfaces the Token Client. It uses it for sending the Chapter Network transactions to the Token Server. Also for storing this type of transactions locally and dealing with synchronization problems like blockchain forks. This module is capable of recreating the Chapter Network structure in-memory based on IoP transactions. By doing so, it knows everything about the Chapter Network runtime status including which mining licenses are active.
    - **Profile Client:** It can communicate to Profile Servers. It is used by the Chapter App. Each chapter is expected to have a profile at Profile Servers in order to be found on the IoP and be able to receive membership requests or later to chat between each other. Chapter Members also sends requests to each other.
- **Chapter App:** It is an IoP Chapter mobile App for chapter members that allows the chapter's members to manage all of the Chapter related issues. It is a regular Mobile App that uses the IoP SDK to consume IoP services.
- **Minting Server:** The Minting Server is responsible for the minting of IoP tokens. It computes all the rules needed to decide how many tokens to issue and to whom. The Minting Server doesn't need to know how to

estimate which mining licenses are active. It just uses the IoP SDK and specifically the Chapter Network module inside it for that task.

- **Token Server:** The token server's task is to process IoP transactions and store them at the blockchain. Bloom filtering functionality might need to be upgraded in order to allow special transactions to pass the through the filter.

- **Profile Server:** It hosts profiles online. No changes needed to be done at the Profile Server.

Mining Licenses

The whole purpose of this system is to determine who deserves the mining reward. In our scheme, the mining reward can be received by any Chapter Member with an **Active Mining License**. And to have active mining licenses people need to do some valuable task for the project. Finally the rest of the community must recognize that they are doing a good job.

Licenses are granted for each activity a chapter does. This means that an endorsement is needed for each of the possible tasks a chapter can do in order to have the Mining License associated to that task considered active. This table summarizes the current tasks chapters can do, the number of licenses to be granted, and the conditions:

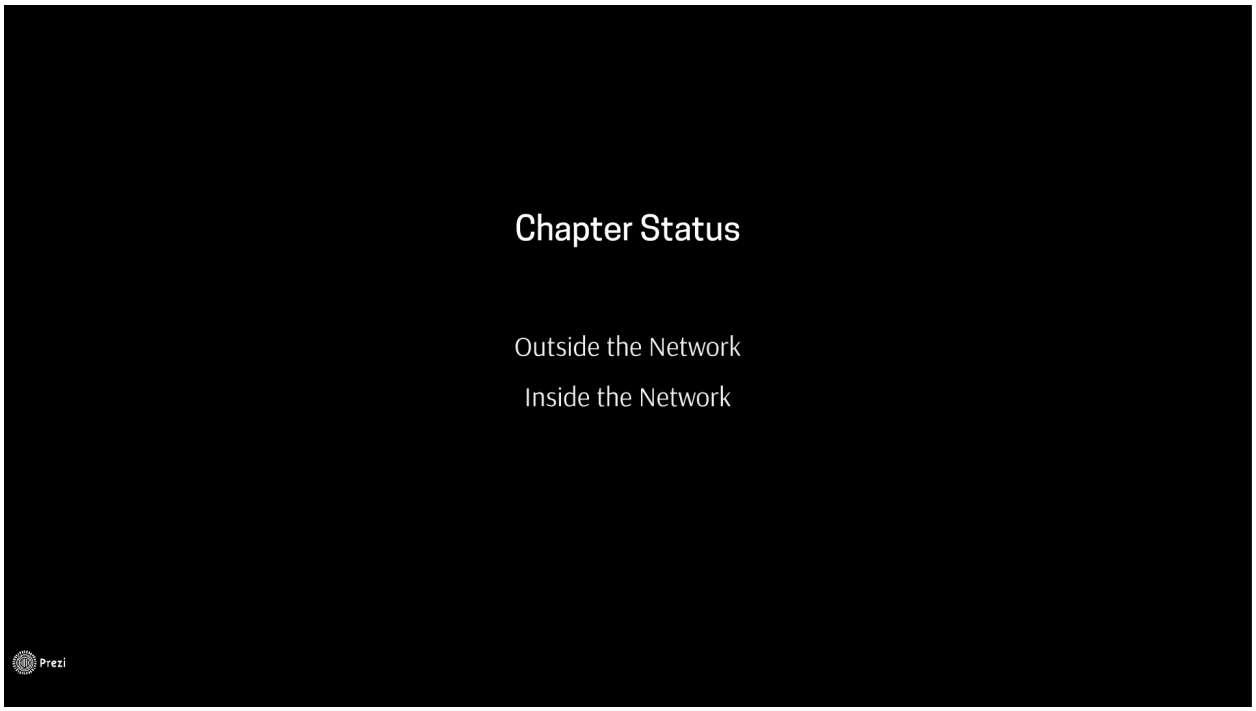
TASK	1st License	2nd License	3rd License
Chapter Twitter	100 followers	1,000 followers	10,000+ followers
Chapter Facebook	100 likes / friends	1,000 likes / friends	10,000+ likes / friends
Chapter LinkedIn	100 connections	1,000 connections	10,000+ connections
Chapter Website	100 Visitors Last 30 Days	1,000 Visitors	10,000+ Visitors
Chapter Original Blog	4 posts per month	8 posts per month	12 posts per month
Chapter Translated Blog	4 posts per month	8 posts per month	12 posts per month
Chapter Newsletter	100 subscribers	1,000 subscribers	10,000+ subscribers
Chapter Youtube Channel	100 subscribers	1,000 subscribers	10,000+ subscribers
Chapter Meetup	10 Assistants Last 30 Days	20 Assistants Last 30 Days	30 Assistants Last 30 Days
Chapter Public Relations	1 Article Published Last 30 Days	2 Article Published Last 30 Days	3 Article Published Last 30 Days
Chapter Forum Marketing	Senior Member Last 30 Days	Hero Member Last 30 Days	Legendary Member Last 30 Days
Fermat Taxi App	10 Taxi Drivers at the area	100 Taxi Drivers at the	1,000 Taxi Drivers at the

Marketing	covered by the Chapter	area covered by the Chapter	area covered by the Chapter

Mining Licenses are activated once the chapter receives enough endorsements from other chapters that they are doing a good job.

Overtime, the Chapter app is going to automate the verifications needed to be done, by accessing web information that keep track of those statistics. In the meantime, chapter leaders are responsible for researching the requestors and deciding if they accept or not their endorsement requests.

Chapter Status



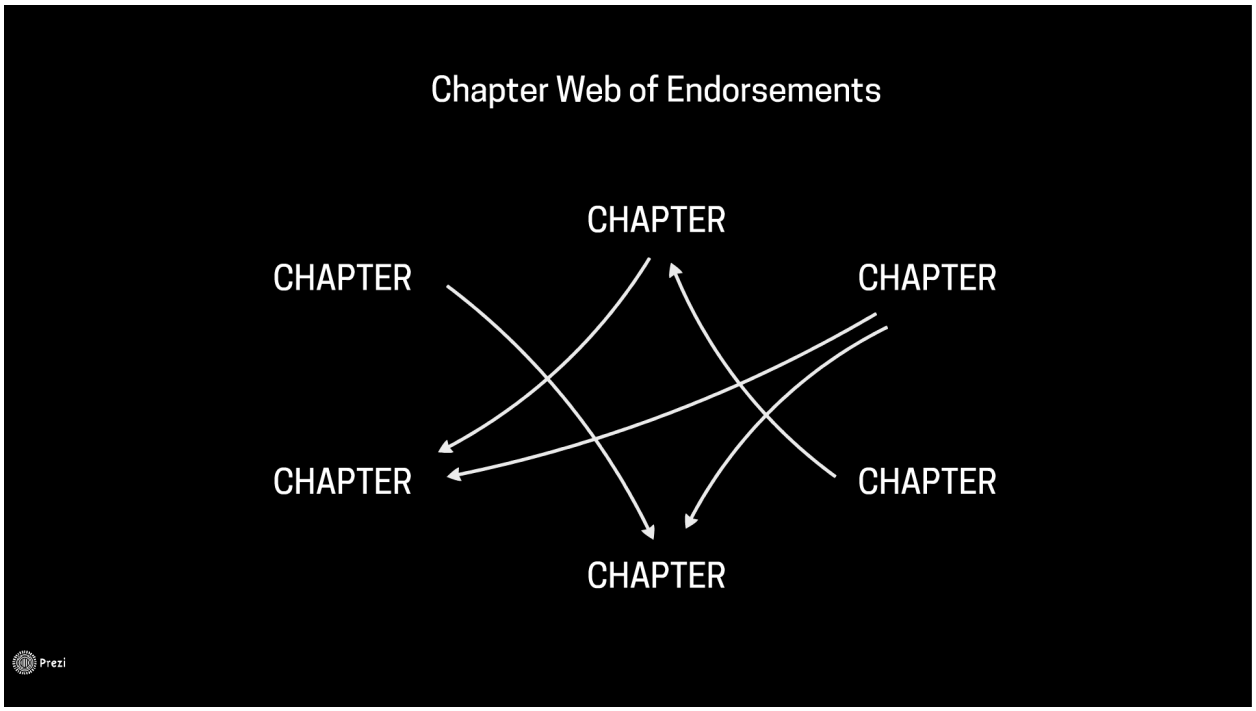
There are two possible status chapters can be in:

- **Outside the Network:** A chapter is considered to be *Outside the Network* when it does not have the required amount of endorsements needed to be considered *Inside the Network* **or** the amount of members is below half of the average of the membership of the chapters of the same type and in the same context **or** above the double of the average of the membership of the chapters of the same type and in the same context. Mining Licenses of a chapter *Outside the Network* are considered *Inactive* and therefore can not be used to mine.
    - **Example 1:** If Chapter France has 4 members and the average of members of all countries chapters *Inside the Network* is 10, then Chapter France is *Outside the Network*. Within 5 to 20 members it would be *Inside the Network,* with 21, it would be *Outside the Network* again.

    - **Example 2:** If Chapter Madrid has 9 members and the average of the members of Spain's States is 20, the Chapter Madrid is *Outside the Network.* With 10 members it would have been enough to be *Inside the Network.* The context here is Spain as a country.

- **Inside the Network:** A chapter is considered to be *Inside the Network* when it is being endorsed by 75% of all *Inside the Network* chapters of the same type in their context on any of the task that the chapter claim it is doing well. For State Chapters they need the 75% of endorsement of other State Chapters of the same country (the country is the context) plus the Country Chapter. For City Chapters the same but with other cities of the same state (the state is the context) plus the state the City Chapter belongs to. Towns and Villages are similar to cities, they must be endorsed in the context of a state. To be clear: Chapter A is considered endorsed by Chapter B once Chapter B endorses any of the task Chapter A is doing. Mining Licenses of a chapter *Inside the Network* are considered *Active* and therefore can be used to mine.
    - **Exception:** The first Country Chapter founded is considered to be Inside the Network.

Chapter Web of Endorsements



Chapters can broadcast an endorsement requests for each type of task (Twitter, Facebook, etc) . Only chapter leaders that can act upon these request can see them (in the same context). They can accept these requests, reject them or leave it there to decide later. But they have 3 days to decide, otherwise leaders lose their own endorsements made by chapter members (see below how a leader is elected).

Leaders have the task to decide whether to endorse the new requesting chapter or not. After the 3 days period is over and all chapter's leaders have either endorsed or not the task of the requesting chapter, then it starts a period of time

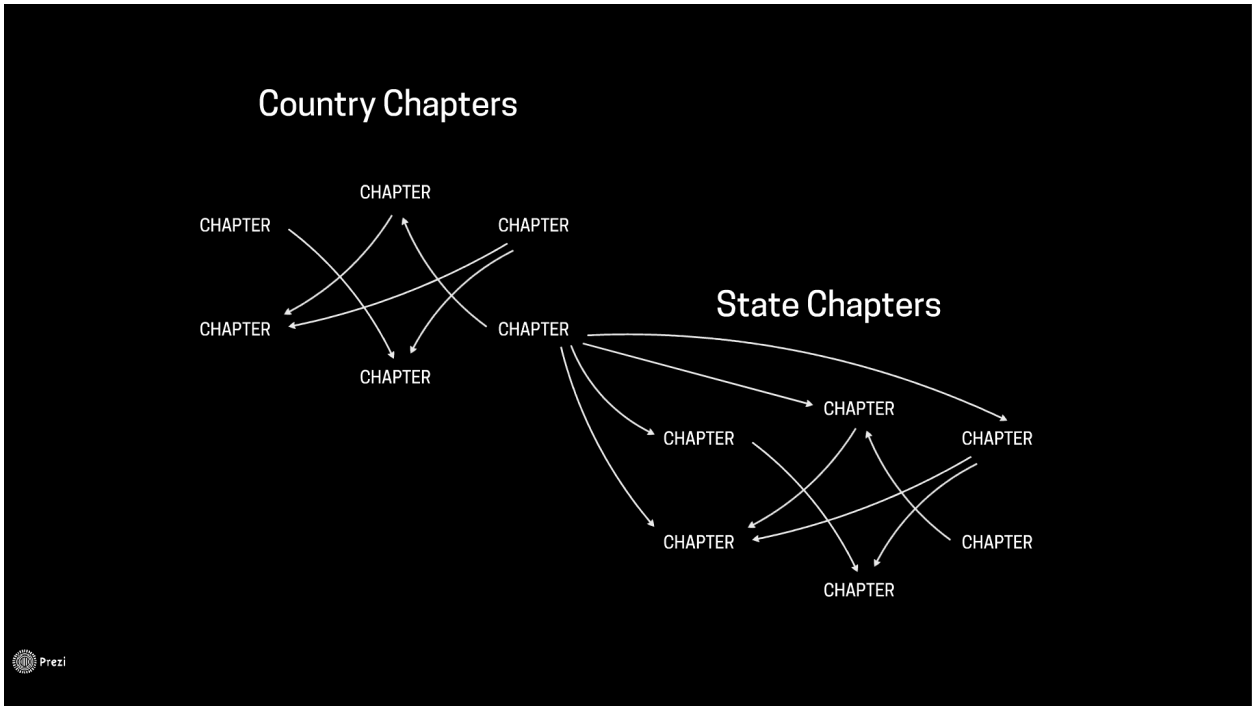
called the *Suspension Time*. If the action executed by the leader (endorse or not) falls within the largest group decision, then nothing happens, but if it falls within the minority group then the chapter enter into *Suspension Time*.

For example: if 56% of the Chapters that need to decide endorse the job of the requesting Chapter and Chapter Spain does not endorse it, then Chapter Spain is punished entering into *Suspension Time*.

While suspended a chapter licenses are considered inactive. The suspension period is a progression measured in weeks: the first suspension is of 1 week, the second of 2 weeks, and so on. This progression is not altered even when the leader of the chapter is replaced. Only one action is accepted, either endorse the task or not endorse it. Submitting more than one answer is considered a missbehaviour and gets the Chapter into *Suspension Time*.

The endorsements can be removed at any time by a procedure that involves opening the same subject for consideration, not individually. This is the mechanism that allows the community to manage themselves. Chapters falling *Outside the Network* will have their mining licenses deactivated until they get *Inside the Network* again.

Overtime, a web of endorsements determines which Chapters are allowed to mine and which ones are not. The rules to endorse or not endorse a chapter are not written in code. These rules are determined by the community and are expected to evolve over time. We expect chapters to audit each other and use the endorsement mechanism to dynamically adjust what is considered a good chapter performance.



Chapters are arranged in a three level structure: countries, states and: cities, towns and villages. At the state level, the rules are very similar than at the country level. Except that the endorsement needs to come from other states of the same country and from the country chapter they belong to. The first State Chapter needs to be endorsed by its corresponding Country Chapter to be considered *Inside the Network*. Later on, other State Chapters need the endorsement of 75% of *Inside the Network* State Chapters plus the endorsement of the Country Chapter.

If a Country Chapter falls *Outside the Network* that means that all the states in that country fall with it and in cascade, same for all cities within the respective states. It must be in this way if not otherwise it would open the door

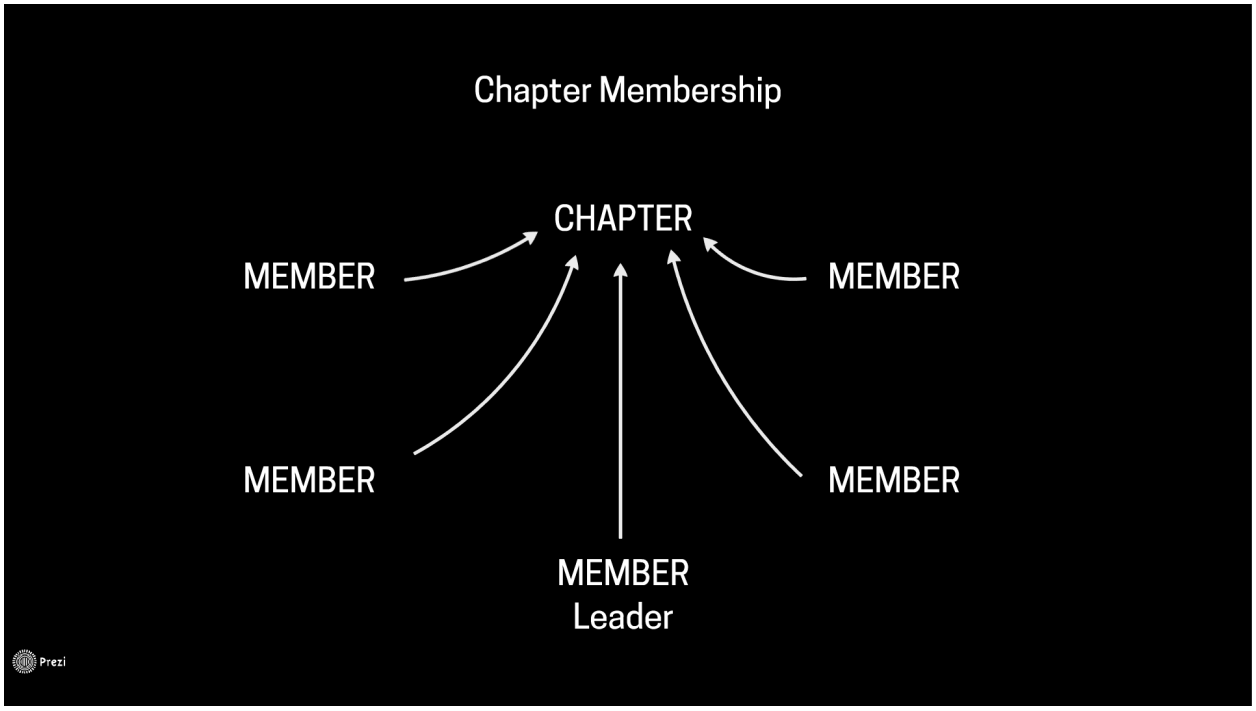
to sybil attacks (this is how it is called to attacks on a computer system where many fake identities are created to make the system believe that are many different real users) where an adversary creates and operates state chapters without any connection to any country chapter at all. For the same reason, a country chapter must endorse all of the states.

The first reaction to this structure might be to think that there is a lot of power related to operating a Country Chapter. To mitigate this, if the leadership of a Country Chapter gets corrupted there are two possible workarounds:

- **Competing Chapter:** Anyone can create an alternative Country Chapter *Outside the Network*, and campaign for all Country Chapters to switch their endorsement to the newly created Country Chapter. Two Chapters in the same country are identified by its founder. The founder is the one who created the chapter. By endorsing a competing chapter the corrupt chapter might lose its endorsements and it might fall *Outside the Network* giving the chance to the new Chapter to take its position if it gets enough endorsements.
- **Leader Replacement:** Another mechanism is that members of that corrupt leader's chapter can vote for a new leader and replace him.

For Example: Let's say that Chapter Spain endorses the task Twitter done at Chapter Italy founded by Carlo.. After a while Chapter Spain endorses the Task Twitter done by Chapter Italy founded by Camilo. After doing this, the first endorsement is lost. Note that a Country Chapter can only endorse one Country Chapter at the time for a given Task. These rules explained above are also valid for other Chapter Types like State Chapter, Cities, Etc.

Chapter Membership



The founder of a chapter becomes its leader. Leaders then accept the first Membership Request. By joining a chapter, members accept their current leader, but that doesn't mean the leader can not be changed.

Each chapter member is expected to be granted only one mining license. This means that in order for the chapter to mine as many IoP tokens as it is possible, it must attract new members until all the possible mining licenses are exhausted.

The system must be designed in this way to prevent that a few people do all the tasks and the chapter end up highjacked. With time, the Fermat project might allow new license types, allowing the chapter membership to grow even bigger.

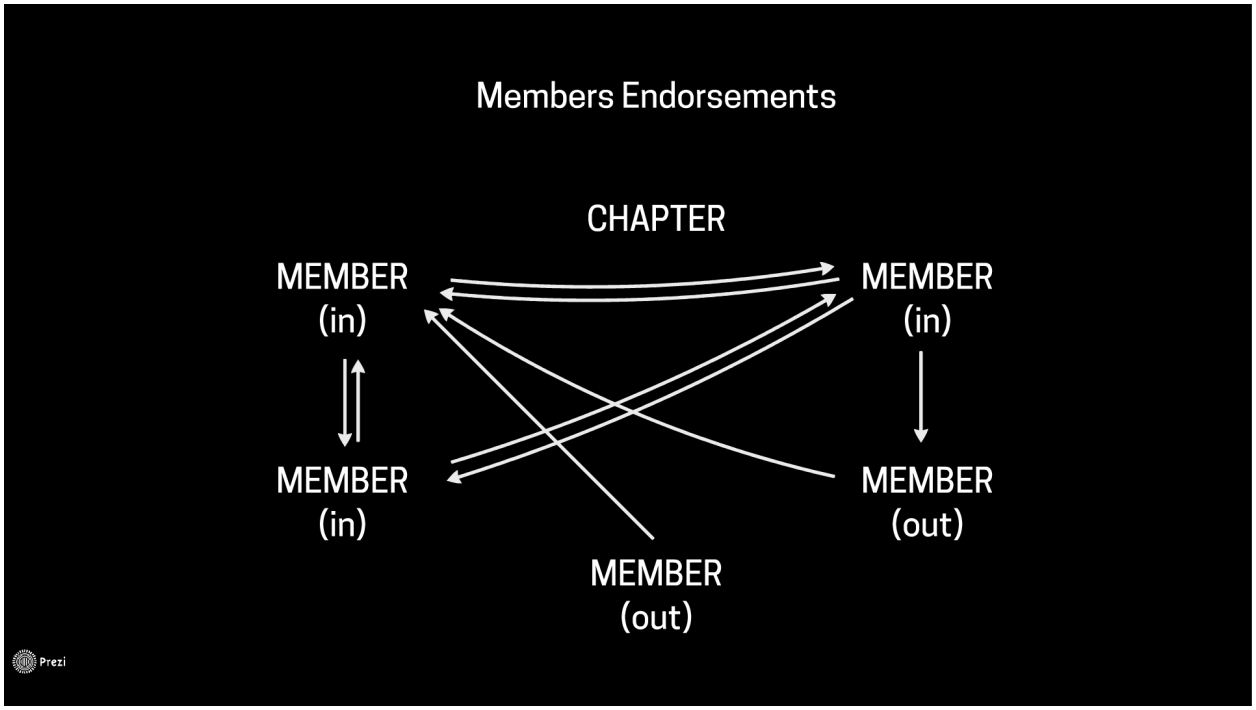
Each member is expected to run an IoP Full Node Package, which means a set of IoP Nodes and Servers. This includes on a first phase an IoP Test-net Wallet and Miner, a Main-net Wallet and Miner, a Profile Server, a LOC node, and a CAN NET node. Later all other servers and nodes will be added to this package.

Leadership Voting and Responsibilities

Each individual member has the chance to vote for a leader at an online and continuous democracy. Whoever is holding the majority of the votes is considered the chapter leader. Leaders must respond to endorsements request submitted by other chapters within a period of time of 3 days. Failing to do so deletes all the leadership votes of other members towards the current leader, and forces him to get these votes again. In the meantime the second member most voted gets to be the leader.

Leader Mining License: Chapter members are incentivized to become chapter leaders by a special mining license for chapter leaders.

Members Endorsements



Besides the voting for leaders, members of a chapter endorse themselves in order to gain different status as members.

To avoid dictatorships, no member, including a leader can expel other members of the chapter. To cancel its membership the majority of the members have to agree to do so. The mechanism to do this is also based in endorsements. If a member loses the endorsements of more than 50% of other members it is automatically considered out of the chapter. At the same time, new members need to be endorsed by more than 50% of current members to be considered Active Members.

Member status can be summarized in this way:

- **Member Applicant:** It gains this status when it applies to become member of a chapter.
- **New Member:** It gains this status when its application is approved by more than 50% of the current Active Members of the same Chapter.
- **Active Member:** It gains this status when it gets more than 50% endorsements of the current Active Members of the Chapter. It can become Active Member again after being passive. Only licenses granted to Active Members are considered active and can be used to mine. If a member loses its active status then his mining license becomes automatically *inactive*.
- **Passive Member:** It falls into this status when it loses the required amount of endorsements to be an Active Member or when it doesn't respond to membership requests for more than 7 days. Once it responds and if he has the required endorsements it is considered an Active Member again.
- **Ex-Member:** It falls into this status when the endorsement from Active Members goes below 25% or they explicitly abandon the chapter. To become member of a new Chapter, members are required to be at this status. To get out of this status they must apply again to become part of the Chapter or some other Chapter. Ex-Members can not be re-endorsed.

If a chapter falls *Outside the Network*, that doesn't mean that their membership structure is altered. The consequence of being out is that no mining license from those chapters are considered active. While *Outside the Network*, a chapter is risking itself that someone else creates another instance of the same chapter and get it *Inside the Network*. That would prevent the original chapter to enter the network unless the new instance falls out. If it does so, it is possible to take over with it's current member structure.

Mining Cap based on Active Members

The amount of active members a chapter have determines the mining cap for the licenses of the chapter. The way to calculate the mining cap for a chapter is based on the average of active members of chapters of the same type at the same context.

Chapter's Active Members	**Mining Cap**
< Average / 2	1

<= Average / 2 < Average	2
<= Average < Average * 2	3
<= Average * 2	4

For example: Chapter Madrid has 10 active members, and the average in State Chapters *Inside the Network* in Spain is 9. Then Chapter Madrid's mining cap is 3. If the average moves to 11 then Chapter Madrid's mining cap would be 2.

This mechanism is designed to incentivize the growth of the chapter membership base.

Main Workflow

The main workflow starts when someone downloads and runs the Chapter App. With this app, end users can see the current chapter list, their status and members. From there two things might happen:

1. The chapter they need to join does not exist yet or if it exists it is in the *Outside the Network* status, meaning it doesn't have yet the required approvals to be *Inside the Network*. In this situation they can create a new chapter themselves and become their leader, but for this they will need the Chapter App.
2. They can request to join the Chapter. Once the request is sent, they have to wait to be approved by the Chapter members.
3. Chapter members see the request and react to it either by approving or declining the membership request.
4. Immediately after approving, Chapter Members also endorse the new member, in order activate him.
5. The new member then endorses back the other members he wish, and if he wants he can vote for the chapter leader.
6. The new member takes some task assigned by the leader.
7. The chapter leader requests a Mining License for the new task being done.
8. Once the task is being done and in an advanced state, the chapter leader requests endorsements from other chapters that his chapter is doing that task well.
9. Other chapters endorse that chapter and by doing so, the new mining license is activated.
10. The new member mining software detects that and start mining on behalf of the new member.

Chapter Network Module

The Chapter Network Module inside of the IoP SDK can rebuild all the Chapter Network Structure by scanning the blockchain from the beginning searching for transactions related to the Fermat Chapter Network. After the scan is complete it ends up having an up-to-date structure of the Chapter Network. From there, it can update this in-memory structure with each new mined block. Under certain circumstances, for example when a new chain is selected, the in memory structure of the Chapter Network needs to be recalculated. The access to the blockchain is through the

Token Client, also part of the IoP SDK. In fact, the Token Client is the one retrieving all the needed transactions and dealing with fork synchronization problems.

This module provides an interface to Apps and Servers consuming its services. This interface allows its clients to submit Chapter transactions and to read the status of the network as well. The module later encodes these transactions in IoP transactions and pushes them forward to the Token Server via the Token Client.

Transaction Protocol

Although chapters are endorsing each other, chapters are lead by a person that ultimately is the one producing these endorsements. We need to record transactions at the blockchain in a way that allows us to reconstruct the whole endorsement history and the current state of the Chapter Network. Any App and Server must be able to arrive to the same state in order to decide in the same way like the other servers in the network, who is authorized to mine a block and who is not. This is certainly possible since all of them, as well as client Apps use the Chapter Network module inside the IoP SDK library to compute the status of the network. This module encodes Chapter Network Transactions into IoP Token transactions in the following way:

1. **Found New Chapter:** This transaction is sent when a new chapter of any type is created.

2. **New Chapter Member Profile:** It is used every time a potential member downloads the app and creates a Chapter Member Profile.

3. **Membership Request:** It is recorded when a member profile requests to join a chapter. For a Chapter with no members, it will be considered after this request that the membership is accepted and the requester as the first member of that chapter and also its current leader.

4. **Membership Request Accepted:** The new member enters the chapter. The membership request transaction is read by all the members of a chapter and each one decides whether to accept the request or not. That means that multiple transactions of this type can be recorded for a single Membership Request.

5. **Membership Request Declined:** Membership application rejected. The same happens here, where all chapter members are entitled to submit this transaction in response to a membership request. A code is added to the information of this transaction to identify the reason of the rejection.

6. **Add Member Endorsement:** Membership at a chapter if quite fluid. The request to join might have been accepted, but besides that *Passive Members* and *New Members* need to be endorsed all the time by more than 50% of current *Active Members*. When they fall below that threshold, they are not considered an *Active Member* anymore and to regain their status they have to convince the others to re-endorse them.

7. **Remove Member Endorsement:** Active Members can remove their endorsement of other members at any time. When endorsements fall below 25%, the already *Passive Member* is not considered a chapter member anymore but an *Ex-Member*. To rejoin he would need to start the process all over again.

8. **Add Leader Vote:** Active Members can decide anytime who to vote as a leader. Each time they change their mind and would like to vote for another leader, they can execute this transaction and the new vote will be casted overriding their previous votes if any.

9. **Request Chapter Task Endorsement:** This transaction broadcasts a request for other chapters to review a chapter performance at a certain task and hopefully get an endorsement. Only chapters entitled to endorse can see the request. The solicitor does not need to be the one to be endorsed. Anyone can submit this

request. The solicitor does not even need to be *Inside the Network*, it can be a competing chapter to the current one *Inside the Network.* By endorsing a competing one, the endorsement to the current one is removed.

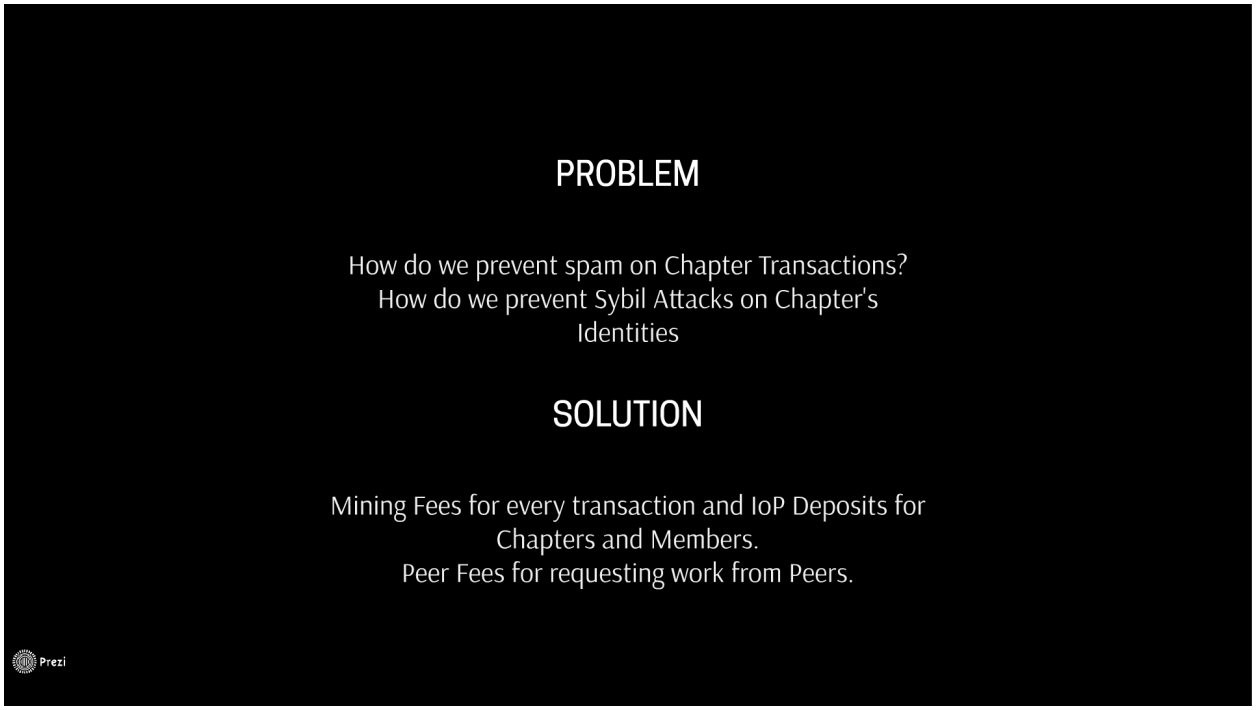
10. **Chapter Endorsement:** Chapter Leaders can endorse other chapters for the tasks they are doing, if he believes they are doing fine. To do so it uses this transaction, which encodes which tasks are endorsed and which are not. Every transaction submitted overrides previous endorsements from the same Chapter to the same Chapter. If the submitter is not considered the current Chapter Leader, this transaction is ignored. It is also ignored if it doesn't follow the previously explained rules like for example: a City Chapter can be only endorsed by cities on the same state of the State Chapter that it belongs to. The same transaction is used to respond to a Request Chapter Task Endorsement. Whether you want to endorse or not a task, by submitting this transaction chapter leaders are either accepting or rejecting the requested endorsement for an specific task.

11. **Issue Mining License for Task:** This transaction creates a mining licence for a certain activity a chapter is doing well. It is executed by the current leader and accepted by the Chapter Network only if all the conditions are in place to be a valid license. The status of the license is dynamic, meaning that a leader can request a license for some task while the task is still not endorsed by the required chapters. In this case the Chapter Network issues the license but in *Inactive* status. Once the endorsements are there, then the license will be considered *Active* and blocks from the public key provided are going to be accepted. At the same time this transaction can be use to replace an existing license for another. This is useful when the leader needs to authorize a different member to mine with that license. In this situation a new transaction is submitted with the new public key and the Chapter Network will internally override the previous information. The outputs of this transactions determines the distribution of the tokens mined by this license. In this way one license can mine for a team of people.

12. **Issue Mining License for Referrer:** This transaction is executed by a Chapter Member referring another member to create a found a New Chapter. The License is not issued until the referred member creates the new Chapter Profile and this Chapter gets *Inside the Network*.

13. **Confirm Referral:** This transaction is executed by a referred Chapter Founder and confirms that he was referred by someone else. Without this confirmation the Referral License is never activated. This is only valid before the chapter adds new members. Only one of these transactions are valid per Chapter, meaning that it can not be referred by more that one.

Fees & Deposits



Each of these transactions have either Mining fees, Deposits, Peer Fees that prevents spam and sybil attacks. What does each of these means?

- **Mining Fees:** Are fees paid to the IoP network and collected by miners. It can be seen as the cost of that transaction type.
- **Deposits:** Are amounts deposited at an account of the same entity submitting the transaction? Deposits should not be withdrawn or the transaction is later invalidated, or cancelled.
- **Peers Fees:** Are IoPs sent to someone else from which we expect some work to be done. For example Referrers send IoPs to referred in order for them to confirm they have be referred.

The following table summarizes these requirements for each transaction type:

Transaction Type	Mining Fee	Deposit	Peers Fee
Found New Chapter	10	100	
New Chapter Member Profile	1	10	
Membership Request	1		
Membership Request Accepted	1		
Membership Request	2		

Declined			
Add Member Endorsement	1		
Remove Member Endorsement	1		
Add Leader Vote	1		
Request Chapter Task Endorsement	10		
Chapter Endorsement	1		
Issue Mining License for Task	1		
Issue Mining License for Referrer			2
Confirm Referral			1

Profile Server

The Chapter App uses the Profile Server to keep an online profile. In this way users of the App can find each other. Chapter Members can freely find and connect to other Chapter Members of any Chapter. They can establish a "Member Contact" relationship which will allow them to both exchange requests and chat. Two *Application Services* are involved in Member to Member communications:

- **Fermat Chapter Member Application Service:** Enables the exchange of Member to Member requests.
    - **Membership Request:** Members can request becoming a Member of a Chapter. They don't request this to the Chapter, but to their members. This message complements the formal request recorded at the blockchain. In this case the requestor can send information about himself including why he is applying to become a member and which available position he intents to cover.
- **Chat Application Service:** Enables the exchange of chat messages.

Minting Server

The Minting Server uses the IoP SDK module Chapter Network to evaluate which are valid mining licenses and which are not. By having an in-memory up-to-date structure, then it can evaluate if any candidate to receive the minting reward is valid or not according to the mining licenses active within that same structure.

Migration Procedure

In order to migrate from the current system where two administrators grant mining licenses to the new one, where chapters self organize into a network, we need to follow these steps:

1. Stop issuing current mining licences.
2. Release the Token Server API for Chapters & Members.
3. Release the Chapters and Chapter Members apps.
4. Create the first Chapter.
5. Create the other Chapters and allow them to endorse each other.
6. Allow Chapter Members to be created and endorse each other.
7. Revoke all current mining licenses except the ones of the seed servers.
8. Let the seed servers mine alone for a while.
9. Replace the Minting Server with its new version at the seed servers.
10. Test if the mining is done well with the recently created chapters.
11. Upgrade the Minting Server at all the nodes of the network.

Chapter App

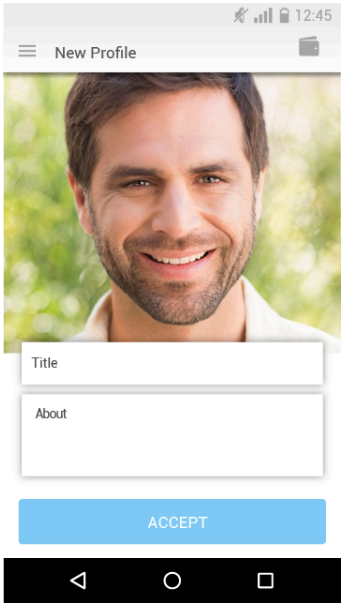
The chapter App is a mobile App with the following screens:

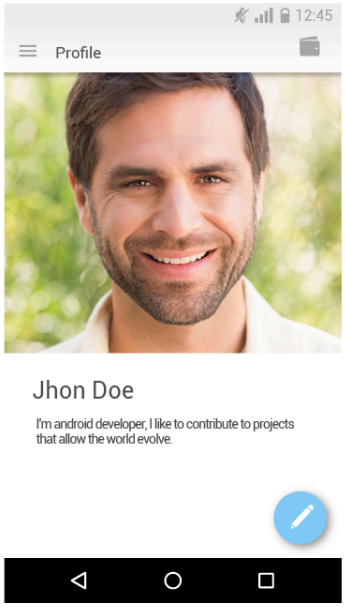
Profile Screen

The profile screen allow end users to create and modify their profile. Chapter Member profiles includes this:

- **Profile Picture:** 250 x 250 pixels.
- **Profile Alias:** 50 characters.
- **About me:** 150 characters

Proposal 1

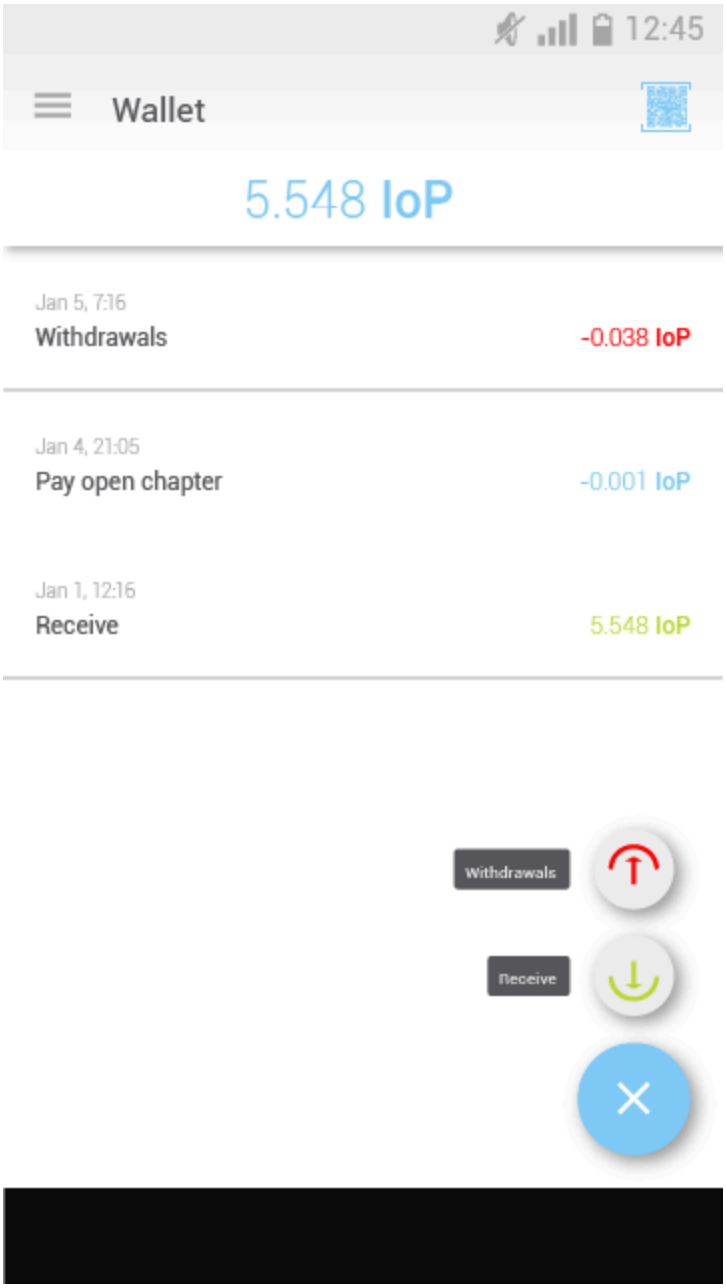




Wallet

The operation of the wallet in the background should give the user the possibility of entering the necessary IoP that allows a full interaction with the application.

With this internal wallet the user can deposit and extract their IoP by entering a wallet number or using a QR code reader. You can also see a detailed movements with an automatic description, quantity and date history.



User status

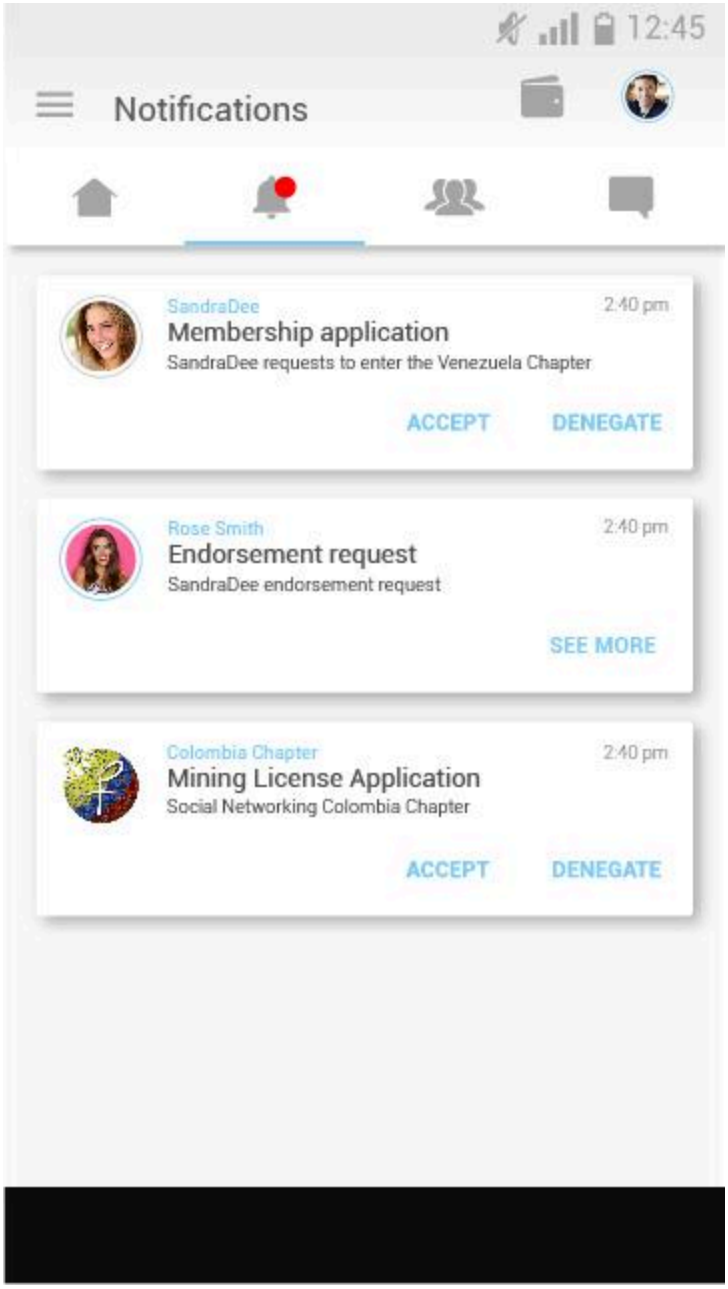
The status of the user within the chapter will be reflected in the color of the line that surrounds your profile photo.

Home

The Chapter home, shows activities from all chapters

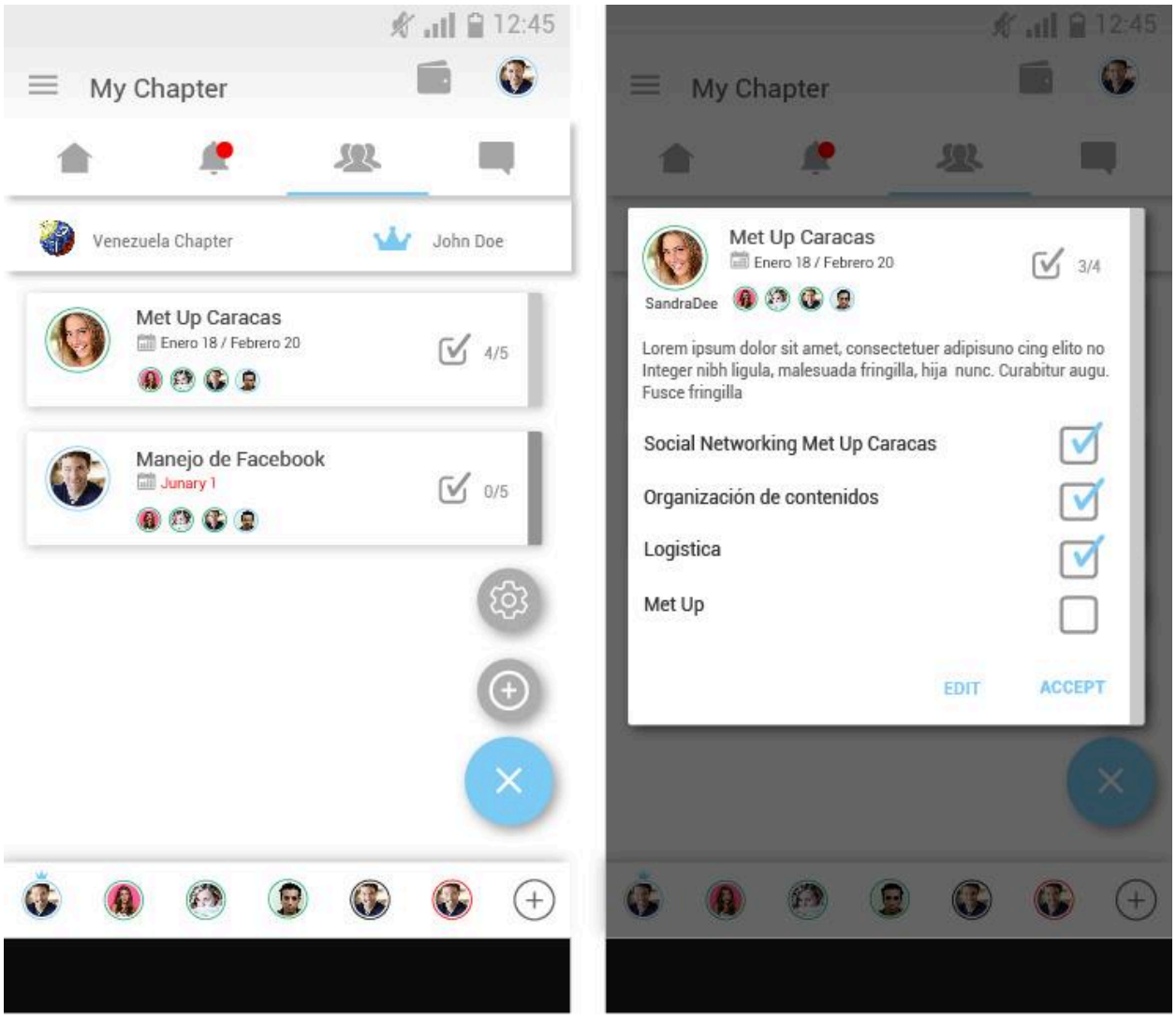
Notifications

In this screen the user will receive notifications of requests of the different chapters and users, as well as the activities of his own chapter. These notifications will depend on the person's rank within the chapter, to accept membership and to approve endorsements.



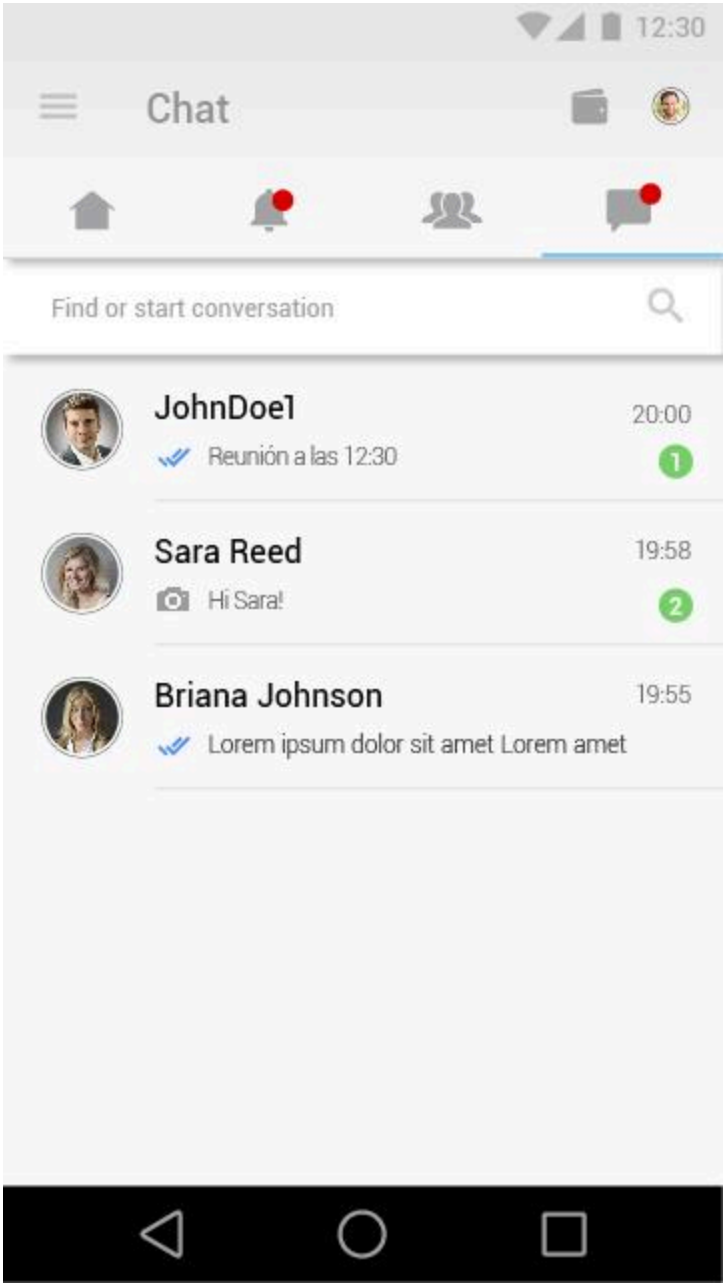
My Chapter

This screen shows the Chapter to which the user belongs and its status within it, as well as the people who make up the team. You can also see and create the activities that the team is developing. These activities may contain checklists, images, or files. The date of the activity can be a definitive or a continuous date and must have a person in charge.



Chat

Chat is a sub application within the Chapter app where users can communicate with their team and the rest of the world



New Chapter Screen

This screen allows any member on any status to create a new chapter. There is a predefined data structure that contains all countries, states and cities the App supports. They are linked between each other. It also contains the geo location information necessary to draw each region in a map.

This screen shows the world map and at 3 different zoom level end users are able to see 3 different layers:

- **Country Layer:** Draws each country Fermat logo at each country on the map. To create a new chapter of a certain country, end users net to tap and hold a country logo. Countries in the map but without the logo are not supported countries.

- **State Layer:** Draws each state Fermat logo at each state on the map. To create a new chapter of a certain state, end users net to tap and hold a state logo. States in the map but without the logo are not supported states.

- **City Layer:** Draws each city Fermat logo at each city on the map. To create a new chapter of a certain city, end users net to tap and hold a city logo. Cities in the map but without the logo are not supported cities.

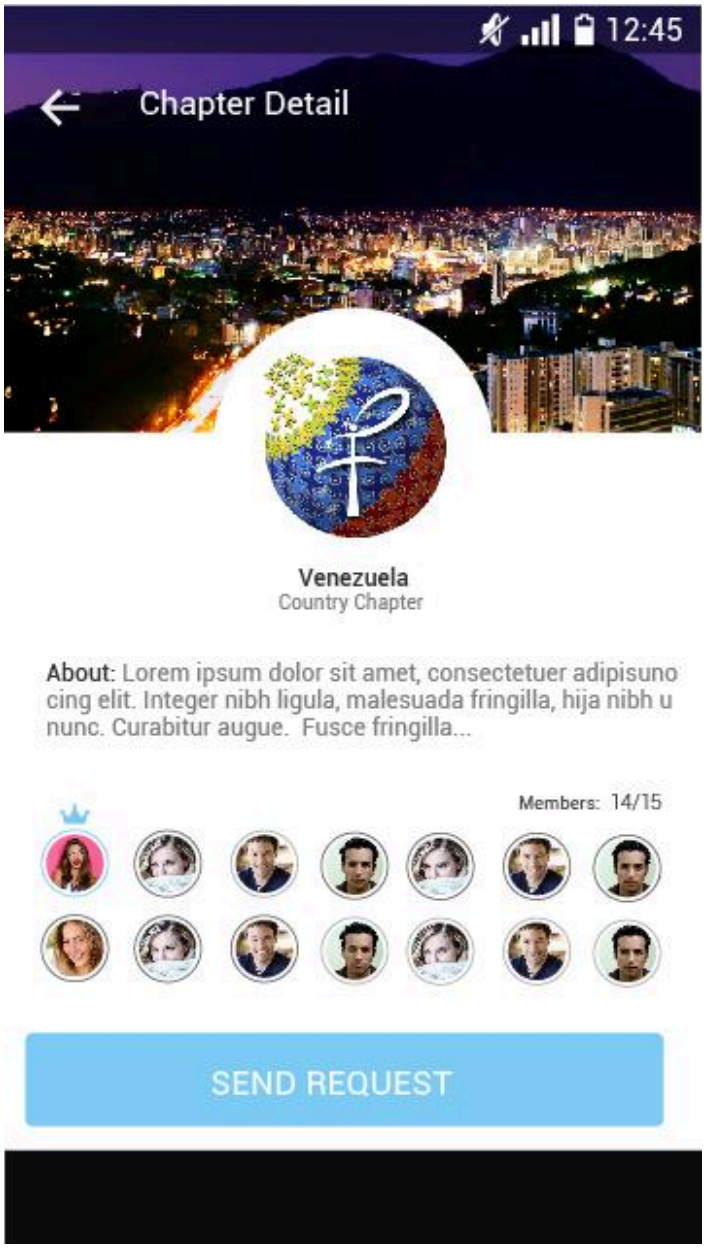
This screen has a filter switch which allows end users to show places for non existing chapter, existing chapters or both. There is a 4th filter which shows the existing instances of existing chapters. This means that for example if a country has 2 chapters created it will show both. The name of the founder is added to each chapter to be able to differentiate them.

Touching on Chapter Logo signals the intention to create the touched Chapter. The Member Profile should already be there.

Chapter Detail Screen

This screen must show Chapter information like:

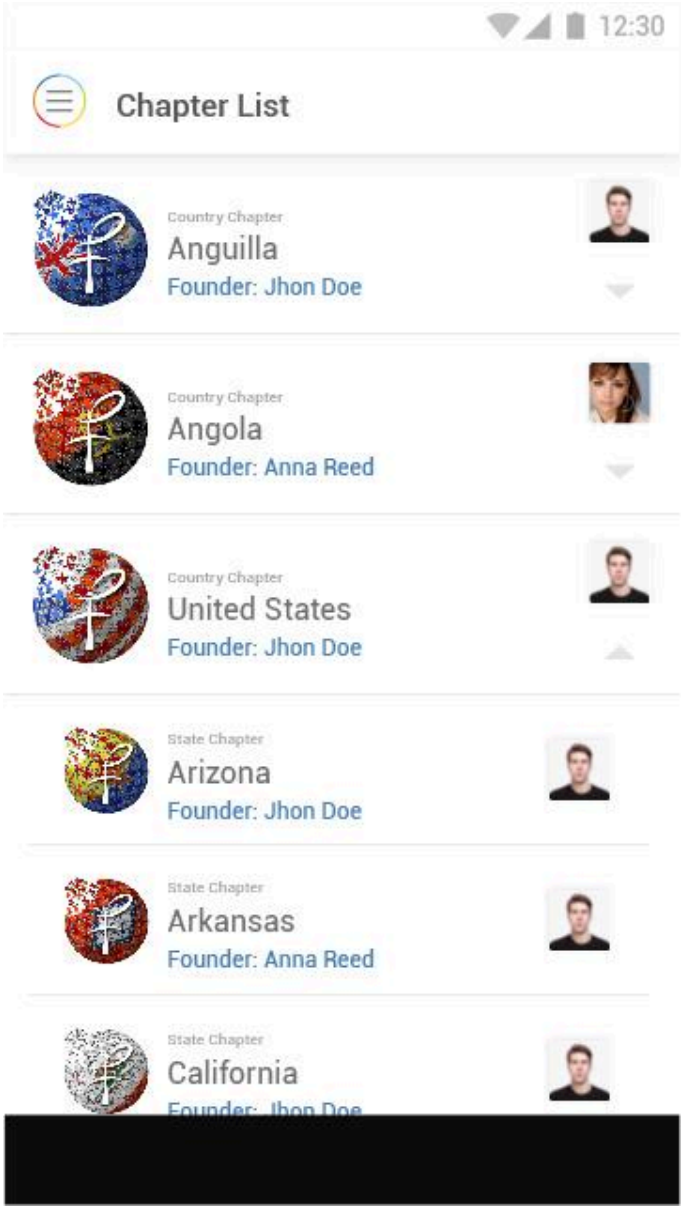
- **Chapter Banner:** Chapter Banner picture at 360 x 220 pixels
- **Chapter Logo:** Chapter Logo picture at 100 x 100 pixels.
- **Region Name:** This is the formal name of the country, state or city. Country, state and city names are in English or as they would appear in an English language map.
- **Chapter Type:** Either Country, State or City.
- **About:** 150 characters
- **Chapter Members:** The totality of the chapter members identified with the status



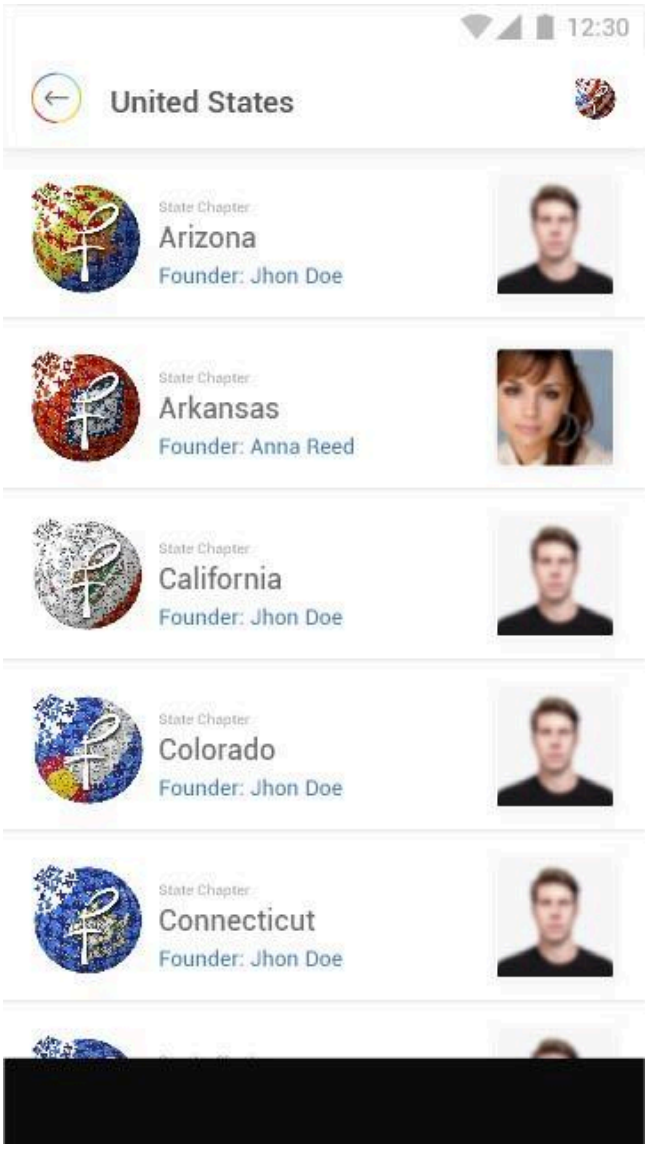
Chapter List Screen

List of all chapters already founded divided in three different fragments. The first one is the Country Chapter list, to access the others it is needed first to select a Country and then a State within that country:

- **Country Chapters:** List of all registered country chapters. The first part of the list includes the chapters *Inside the Network* and the last part of the list the chapters *Outside the Network.* By default the chapter this member belongs to is selected. If he doesn't belong to any chapter yet, then the first in the list is selected. The list is ordered alphabetically.



- **States Chapters:** List of all registered state chapters of the selected country in the previous tab. All *Inside the Network* chapters goes at the beginning of the list, while the *Outside the Network* chapters goes at the end. By default the chapter this member belongs to is selected. If he doesn't belong to any chapter of the list, then the first in the list is selected. The list is ordered alphabetically.

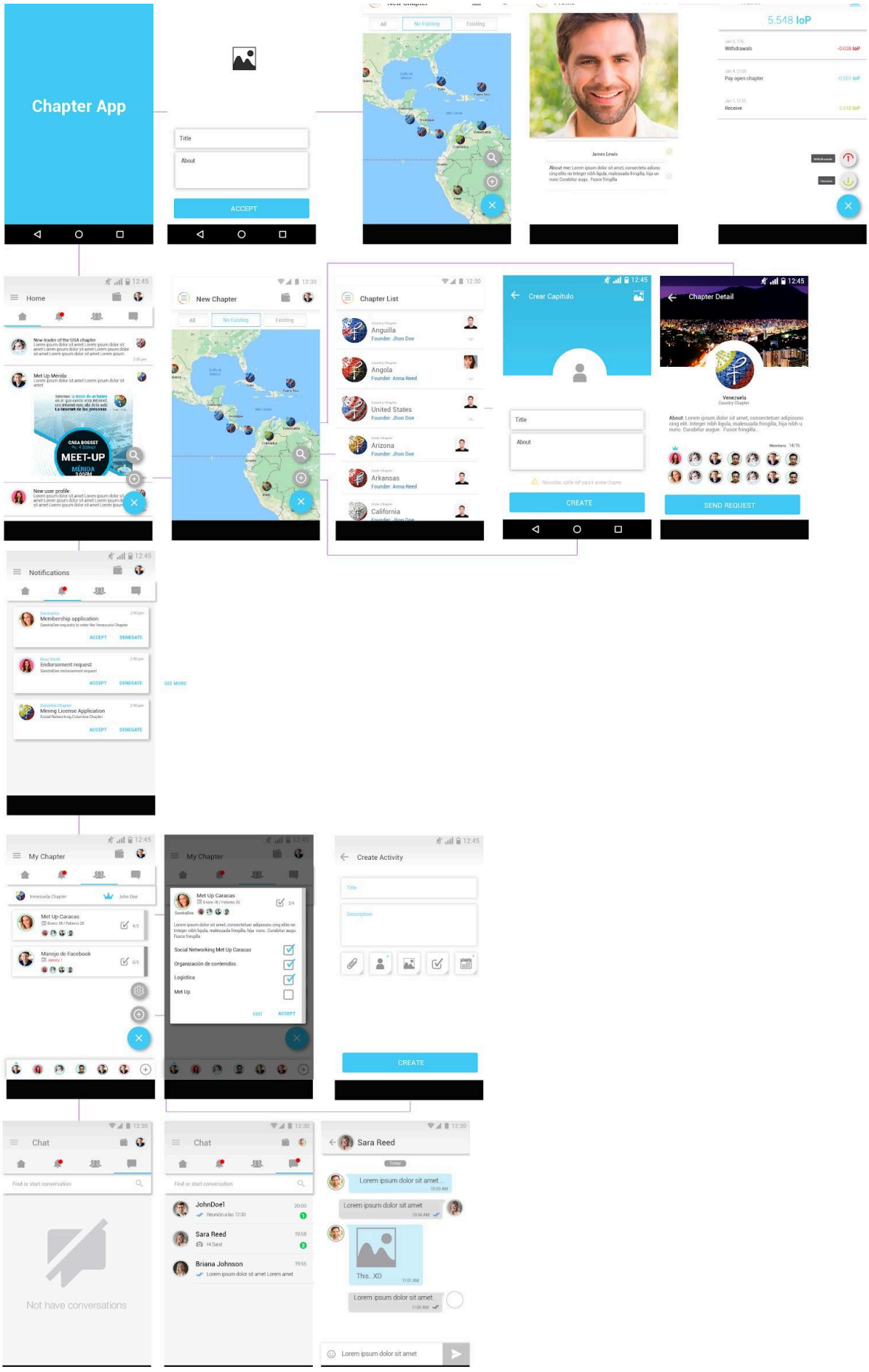


- **City Chapters:** List of all registered city chapters of the selected state in the previous tab. All *Inside the Network* chapters goes at the beginning of the list, while the *Outside the Network* chapters goes at the end. By default the chapter where this member belongs to is selected. If he doesn't belong to any chapter of the list, then the first in the list is selected. The list is ordered alphabetically.

If end users browsing the chapter list are not members of any chapter (including ex-members) taping submits a request to join the chapter. The standard CANCEL button appear when tapped.

Scheme of the general flow

In this scheme can be observed the behavior of the app in a hierarchical way, however there are internal flows that are not yet defined


Chapter App
Title
About
ACCEPT
5.548 IoP
Withdrawals
Pay open chapter
Receive
James Lewis
Home
New Chapter
Chapter List
Anguilla
Founder: Jhon Doe
Angola
Founder: Anna Reed
United States
Founder: Jhon Doe
Arizona
Founder: Jhon Doe
Arkansas
Founder: Anna Reed
California
Crear Capítulo
Title
About
CREATE
Chapter Detail
Venezuela
SEND REQUEST
Notifications
Membership application
Endorsement request
Mining License Application
ACCEPT
DENEGATE
SEE MORE
My Chapter
Met Up Caracas
Manejo de Facebook
Social Networking Met Up Caracas
Organización de contenidos
Logística
Met Up
EDIT
ACCEPT
Create Activity
Title
Description
CREATE
Chat
Find or start conversation
Not have conversations
JohnDoe1
Sara Reed
Briana Johnson
Sara Reed
Lorem ipsum dolor sit amet
This...XD
Lorem ipsum dolor sit amet