ICE CHAIN

The Better Approach to Temperature Sensitive Cargoes

Business plan

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Abstract

Ice Chain is the dApp project aimed to simplify cooperation between operators of the sensitive cargoes. The project offers the all-purpose financial instrument to replace cargo insurance or bank letter of credit and provide the close tie between transportation service quality and effecting payments. This should be provided by the interaction between measuring device and Qtum-based smart contract.

1 Summary

Ice Chain project was started due to the QTUM Hackathon 2018.

Many companies get problems while dealing with their partners (especially abroad) about sensitive cargoes. Available financial instruments may not cover all the risks and all the reasons why the cargoes get damaged. As a result, the costs in these sectors are much higher, and the trust between market actors is much lower.

Ice Chain provides innovative measuring equipment and tries to integrate it with the capabilities of Blockchain technology in order to simplify conflict resolutions. Furthermore, the smart contract should operate with a deposit previously transferred to an account of the smart contract by one party to the treaty. The deposit may be equal to full cargo value (for instance, if the Buyer is the depositor) or just some share of it (for instance, if this is a kind of insurance guarantee and the depositor is a transport company). Two parties set basic terms of delivery when making a smart contract, including the date of delivery, and some special terms that may be watched by measuring device. And furthermore, Ice Chain deals with financial risks and payments as well.

For the QTUM Hackathon, the temperature range to be watched was chosen. This choice seems to be right because of the potential market fit for it.

2 Problem Overview

2.1 Two things to know about logistics

At first, in logistics, one deals with chains. The way from a manufacturer to a customer is the flow where goods run through many stages, such as forwarding, transportation, consolidation, customs, warehousing, distribution etc. On each stage, there can be even more than one enterprise, which could be represented as chain links. This term seems to be very correct, because like in an iron chain, one link damage makes the chain split, and many enterprises of the supply chain subsequently get their losses. This is where logistic risks come from.

Second, all the logistic processes might be compared with a coin. Everything that happens in a logistic chain inevitably has two sides: the technical side, and the commercial side.

The technical side is all about the real (material) movement or modifying of some objects. Some people with the special expertise use some special equipment and technologies to move some objects to the previous stage of logistic chain to the next one in proper time, place and condition. In other words, these are processing operations of production, warehousing, and transportation.

The commercial side is all about responsibilities and money. All the operators in the logistic chain actually work to make profits, so there is no any action made for free. Every movement in the logistic chain has its roots and traces on papers, documents, contracts and money transfers.

These two sides are closely interconnected. The transport operator is interested in moving cargo to the next link of the chain, as the owner of the cargo is interested in delivering it to the destination. So, the operator needs to manage things right on the technical side to get a result in the commercial one. This may include appropriate measures to make all the equipment work, to make personnel be careful while performing duties and many other things.

2.2 Technical and commercial risks in logistics

As an example, we showed how problems on the technical side may lead to results which cause problems on the commercial side for any subject of the logistic chain. Finally, seems to be evident.

Technical side risks	The results
● Personnel's mistake ● Manager's mistake ● Equipment brokerage	● Delay in delivery ● Delivery cancellation ● Cargo damage

The technical risks usually occur on the side of a transport operator, but however, their results may lead to both operator's and cargo owner's commercial problems. Let us take on consideration one made up a situation when a transportation company delivered a damaged cargo but no one knows who's responsible for that. The cargo might be damaged much earlier before, but the transport operator didn't have any special equipment to check it while acceptance (imagine that the cargo is a vaccine which requires a laboratory analysis to get tested). In this case, both transport operator and cargo owner meet some problems (see the schemes below).

Transport operator's commercial losses
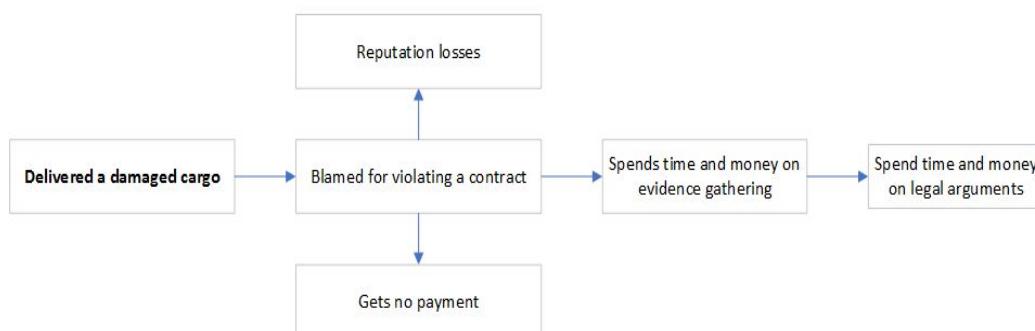
Cargo owner's commercial losses
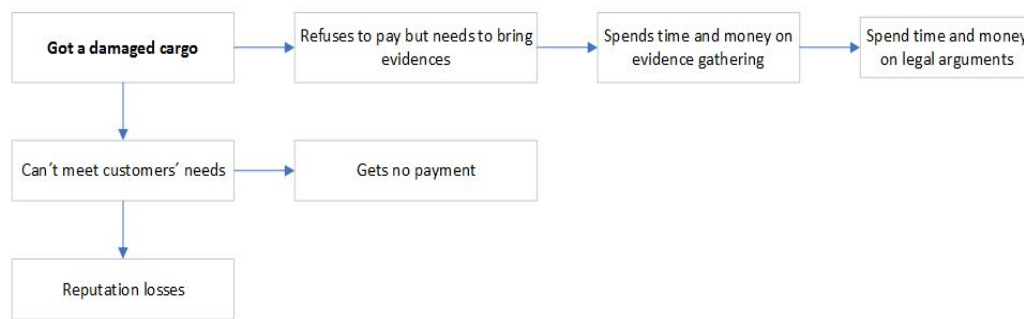
Ice Chain develops a service that might simplify many processes in the logistic chain and hedge commercial risks of all its subjects.

2.3 Problem Ice Chain solves

As it's shown in the previous paragraph, both transport operator and cargo owner meet many serious problems if they deal with a damaged cargo and can't easily define who's responsible for that. Therefore, they obviously need an instrument to make it clear.

Imagine we investigated somehow that our goods have perished due to the transport operator's fault. For instance, the driver accidentally switched off the cooling device in the car for a time, and we definitely know this. What happens next? What if the company refuses to pay the damages?

Needless to say, we go to law. Spend weeks and months on proving and arguing in the court while our business suffers from working capital deficiency. Finally, we'll win and get our money back (let alone justice system in many countries needs work), but wouldn't it be better if we got them at once? That is how another the problem sounds: the company's' working capital sticks and gets trapped on accounts of their partners.

Some experienced companies feel the risks we have just observed. But these are rather risks of the buyers. So, what about the sellers? They have many fears too. The root of them is mistrust. When the buyer is placed far away (maybe abroad), or we've never made deals with him before, how can we be confident of the payment? If the buyer delays the payment, this leads to the seller's working capital deficiency; if he scams, this leads to losses. So, the sellers prefer to work only with well-known big companies with a good reputation and well-proven financial capability. Therefore, finally mistrust on the market leads to additional market obstacles for SME-companies.

To sum up, Ice Chain makes an accent on three significant problems of the supply chains:

- Hard to find out who is responsible for the cargo damage

- The company's' working capital gets trapped on accounts of their partners for the time of legal proceedings
- Mistrust on the markets which, on top of everything else, makes barriers for SME-companies.

3 Solution: The Better Approach to Temperature Sensitive Cargoes

Frankly speaking, the foregoing problems are not revelation for those who operate in logistics or deal with sensitive cargoes. Apparently, some ways to solve or avoid them have been already implemented in practice. But nevertheless, Ice Chain offers the better way to deal with that, and this article is written to painstakingly make it clear.

First of all, remember that Ice Chain systems includes:

- Mobile application
- QTUM-based smart contract
- Temperature Data Logger with Bluetooth module

Working together as a complex, these elements allow solving the foregoing problems more productively than by traditional approach. To appreciate all the advantages of the product, it is necessary to know how they deal with such problems for the moment.

For instance, let us look at heat-sensitive vaccines as a case of a special cargo. In many parts of the world, vaccines go unused because they lose their potency over the course of long transportation periods along the chains of suppliers. To discipline transport operators and avoid overheating, they use some special devices called temperature data loggers (TDLs).

Temperature loggers by LogTag and Fridge-Tag

TDLs autonomously measure and record temperature in refrigerators, freezers, and shipping containers, and finally provide temperature logs, which help to get exact date and time when divergences had been made. Therefore, they help to trace the

weakest elements of cold chains and determine who is at fault for damage to cargo. However, the current practice has some imperfections. The biggest problem here is that TDL presents its measurements on its display or, more often, requires a wired connection to transfer data. So, it is necessary to unpack cargo to get out a TDL and take the readings. Consequently, acceptance of a batch may take much time (as we need to hardwire each device manually) and, more importantly, jeopardizes the sensitive cargo (as the container closure integrity is broken out).

Ice Chain TDL device has a Bluetooth module, which helps to overcome these issues. This simple innovation provides significant advantages:

Direct control after the temperature of the parcel with no need for unloading and unpacking. Truck driver or warehouse worker may connect to TDL via mobile phone to take the readings.

Faster cargo acceptance procedure. Just with a press of a button, the mobile app connects to all TDLs of the batch one by one and automatically takes the necessary readings. The batch may be accepted quick and released to the next stage of the supply chain without unpacking.

| Typical USB-based TDL	ICE CHAIN TDL with Bluetooth
One can not check indications until the cargo is unpacked	No need in unpacking. Allows real-time temperature control
Longtime cargo acceptance procedure. All the readings should be taken manually	Faster cargo acceptance procedure. Mobile app takes all the readings automatically

To prevent financial losses, the parties usually appeal to such instruments as bank letter of credit (if there is no trust among them) and cargo insurance (if they beware of damages while transportation).

Letter of credit (LC) is extremely common within international trade and goods delivery, where the reliability of contracting parties cannot be readily and easily determined. Its economic effect is to introduce a bank as underwriting the credit risk of the buyer paying the seller for goods.

It is particularly useful where the buyer and seller may not know each other personally and are separated by distance, differing laws in each country, and different trading customs. LC works by ensuring that the seller is paid for presenting the documents, which are specified in the contract for sale between the buyer and the seller. The bank will pay the seller the value of the goods when the seller provides negotiable instruments, documents which themselves represent the goods. The seller is confident due to bank guarantee of payment. This guarantee is provided by the buyer's advance payment made to special account or by the loan to the buyer. At the same time, the buyer feels confident as he knows that he get his money back if he doesn't get goods.

Ice Chain offers a solution, which is based on traditional LC scheme but also rectifies its common deficiencies.

Ice Chain solution
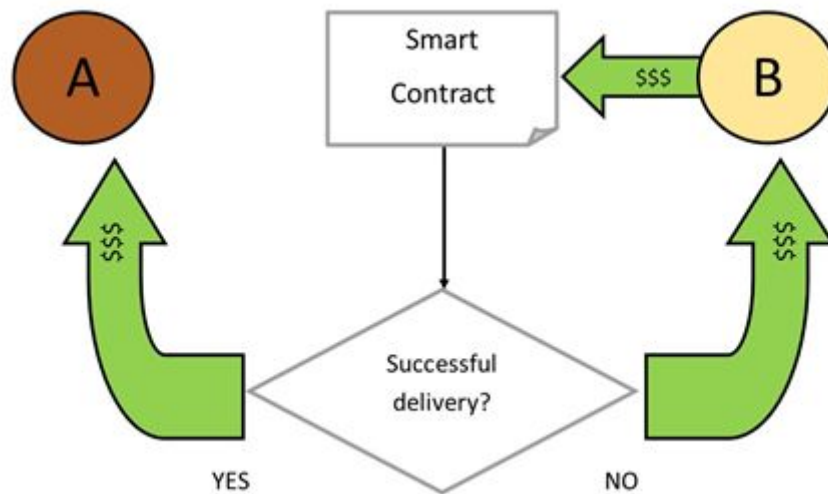
First, the buyer and the seller create a smart contract. They set all the basic terms such as the exact date of delivery and temperature range. Then, the buyer (B) places the value of goods on the account of smart contract. The seller forwards goods by carrier. While transportation, the temperature data loggers (TDLs) measure temperature in the batch and record measures to the log. When the goods come to the buyer's warehouse, a warehouse worker uses special mobile application to automatically get the logs and send them to Blockchain. Smart contract checks the temperature logs and searches for deviations. If there is no deviations found, smart contract transfers the payment to the account of the seller. Otherwise, the payment goes back to the buyer.

Necessary to say that this scheme is particularly actual for many types of temperature-sensitive cargoes such as vaccines. For this types of goods, even single deviation from the required temperature range leads to total perishing and devaluation.

Compared to LC, Ice Chain system provides ability to avoid the following disadvantages.

Longtime paperwork.

It takes to work for 5-10 days with the bank to apply for a LC and nearly the same time for the seller to get his payment. With Ice Chain it takes few minutes to create a smart contract, and the payment will be transferred immediately after the cargo got the buyer's warehouse.

High expenditures.

For international LC, the additional costs may estimate up to 3% of the goods' value. In Ice Chain, the smart contract fee is no more than 0,3%. Including the cost of TDLs, the total costs on risk management via Ice Chain may estimate no more than 0,6%. Given

that TDLs may be reused or sold back to Ice Chain for 50% of their price, these costs should be much lower.

When the parties beware of damaging, they appeal to insurance companies to reduce their risks. The problem is that most of companies avoid insuring temperature risks as too special. Moreover, Institute of London Underwriters (the most influential organization in the field, which elaborates the standards for insurance business) offers the so-called Institute Cargo Clauses. According to these rules, temperature risks shouldn't be insured, as they lie close to force majeure circumstances. Therefore, there are serious obstacles for those companies who operate with temperature-sensitive cargoes and want to insure their risks.

To solve this problem, Ice Chain offers another use of its smart contract
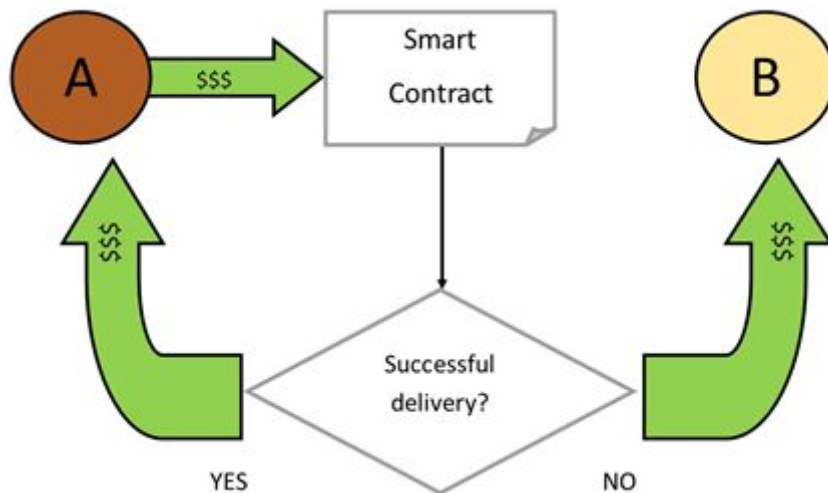
The transport operator (A) places the insurance deposit to the account. Then, the process goes as described before. Finally, in case of success, the deposit goes back to A. Otherwise, it goes to B (Buyer, or Cargo owner) as a compensation.

To make conclusion, Ice Chain helps to solve the actual problems of the market by its key features:

- Smart contract replaces the bank letter of credit and cargo insurance
- TDLs provide temperature measurement while in the cargoes boxes
- Ice Chain builds strong interrelation between the fact of successful delivery and payments.

4 Sample Use Case

The Ice Chain system consists of 5 separate modules, each for one stage of delivery process. The sample is shown in the table*.

	Call for contract =>	Approval =>	Loading =>	Transport =>	Unloading
User	Salesman (A)	Purchasing agent (B)	Warehouse worker (A)	Truck driver	Warehouse worker (B)
What does user do	Creates a new smart contract; sets all the terms	Confirms all the terms or makes some corrections	Puts TDLs into the cargo boxes; hooks TDLs to the smart contract by inputting their IDs	Connects to the TDLs via Bluetooth and checks	Comes to the cargo and launches the scanning mode in the mobile app
Application	Web	Web	Web / Mobile	Mobile	Mobile
Variables	● Contract ID ● Buyer ID ● Type of cargo ● Temperature range ● Cargo value ● Depositor party ● Deposit rate (% of cargo value) ● Deadline	● Contract ID ● Type of cargo ● Temperature range ● Cargo value ● Depositor party ● Deposit rate (% of cargo value) ● Deadline	TDLs' IDs	Temperature value (by minutes)	Temperature value (by minutes)
What happens	B gets notification and the task to confirm the terms	If any corrections have been made, the contract goes back to the A. If approved then A gets a notification and the task to input IDs of TDLs assigned to the current smart contract.	Smart contract has been created in blockchain. Deposit has been tied up Cargoholder has been set to A	TDLs send temperature log to the driver's smartphone via Bluetooth. Mobile app makes a graph and signalizes on deviations	The smartphone detects each TDL in the batch and gets the temperature logs.The mobile app consolidates the temperature data to the report and sends it to the server. Smart contract searches for breaches and finally makes a decision on deposit transfer. Cargoholder has been changed from A to B.

*For the Hackathon, we have to build up the mobile demo app with simplified architecture. 'Loading' and 'Transportation' modules do not exist as the judges do not have access to TDLs (Temperature Data Loggers). All other functions are realized in the mobile demo app.

5 Business Model Canvas

Problem	Solution	Unique Value Proposition	Unfair Advantages	Customer Segments
● Hard to find out who is responsible for the cargo damage ● The company's' working capital gets trapped on accounts of their partners for the time of legal proceedings ● Mistrust on the markets which, on top of everything else, makes barriers for SME-companies ● Traditional cargo insurance doesn't cover temperature risks	● Smart contract replaces the bank letter of credit and cargo insurance ● TDLs provide temperature measurement while in the cargoes boxes ● Ice Chain builds strong interrelation between the fact of successful delivery and payments	Ice Chain is a solution to automate and optimize any deal in the field of sensitive cargo transportation. It will give you a financial and reputation-saving guarantee.	**Insider knowledge:** The team members have deep knowledge in their areas (market problems, electronics, blockchain technology). We found and point out on the issues that nobody noticed but it can be easily solved. **Timing:** We are in the market trending of automatization and optimization. Furthermore, we apply blockchain to the real economy. **Technology:** Ice Chain is the first financial service for coldchain operators	● Manufacturers of sensitive cargoes (SC) ● Wholesale SC sellers ● Healthcare organizations operating the pharma ● Franchisee

Key Metrics	Channels
● TDL sales to customers ● TDL sales to franchisees ● Preowned TDL sales ● Franchisee's contribution (to total sales & fees) ● Income from franchisees' smart contracts ● Income from head company's smart contracts ● Number of franchisee's deals using smart contract ● Customer lifetime value	● Direct contacts with customers ● Profile conferences ● Targeted advertising

Cost Structure	Revenue Streams
Capital expenses: ● development a mobile and web apps ● development of the TDL ● promotion of the project to reach full capacity **Operational expenses:** ● platform support ● data storage ● purchase of components ● payment for assembly production services ● administrative and operational expenses ● TDLs buyback	● TDL sales ● Fee for the execution of a smart contract (% of the deposit) ● Share in franchisees' fees

6 Technologies Applied

6.1 Smart contract

Vendor (seller) creates the smart contract, which consists of following data needed to provide:

- Contract ID - the name of the smart contract
- Buyer ID - Vendor chooses a Buyer among Ice Chain contractors
- Cargo type - a short description of sensitive cargo
- Temperature range - Vendor sets temperature conditions
- Cargo value - cargo's fiat value
- Depositor party - Vendor chooses from who´s account deposit is made: Vendor or Buyer
- Rate of deposit - Vendor chooses deposit amount: it should be % of the cargo cost (from 0% to 100%)
- Deadline - deadline of the cargo delivery (date and time)

When setting the rate of deposit, some calculations are made. The deposit rate is X of cargo value, which equals Y or Z, where X is the rate of deposit chosen by the Vendor (%),

$$Y = Cargo\_value * X \text{ (US Dollars)},$$

$$Z = Y / Qtum \text{ Testnet Coins' rate (Qtum).}$$

Qtum Testnet Coins' rate equals current official USD/Qtum rate or some imitative rate made up by a developer.

For example: 'Deposit rate is 20% of cargo value, which equals USD 20000 or QTUM 371,65'

After providing all the information Vendor offers the contract. Buyer became notified about that. Buyer can approve this contract conditions or edit it. After approving, the deposit funds become frozen in the required amount, and a smart contract is created. Buyer has the rights to unload the data.

The process of TDL connection begins and all the temperature data is uploaded to the app. A temperature report with a time-temperature chart is created.
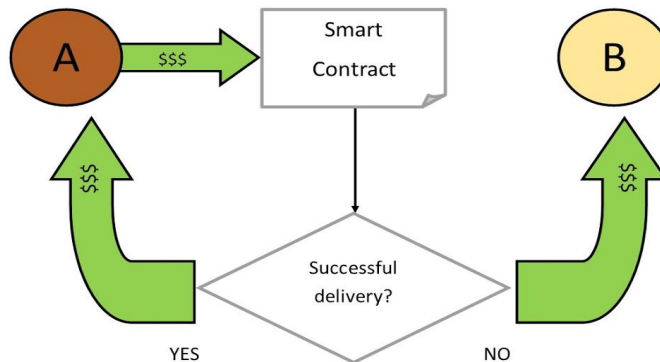
If there is no any deviation, then message the smart-contract completes the payment. If there is a deviation of temperature conditions, it means that a contractor violated the terms of the Smart-contract.

In both case the deposit goes to the vendor or the buyer in accordance with the following scheme.
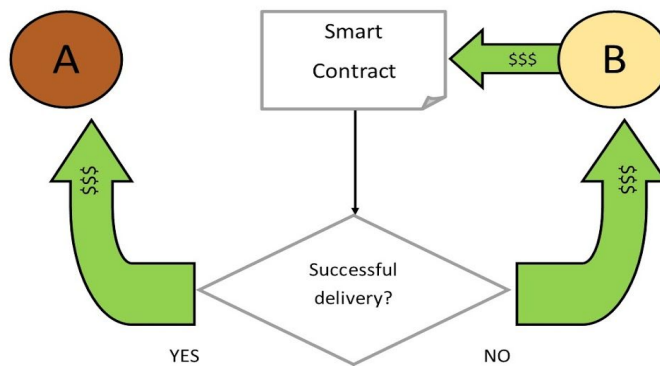
Smart contract logic

A = Vendor, B = Buyer, $ = Deposit

1. A is Depositor

2. B is Depositor

Important note: If the cargo wasn't unloaded before the deadline, the delivery is considered as unsuccessful.

6.1.1 Smart contract technology

Ice Chain makes use of the mobile platform to allow users to create and validate smart contracts on the blockchain. We required a blockchain technology that allows for smart contract capabilities. Another qualification is that since the mobile platform does not have a lot of memory, it is important that we have a platform that does not require downloading the entire blockchain for running a whole node to operate a smart contract.

QTUM particularly stood out to us because it addresses these two of our needs. The first being that it can run smart contracts. The way it does this is through an Ethereum Virtual Machine (EVM) running on the blockchain. Because of this, QTUM can take advantage of running any existing Ethereum smart contract on QTUM and vice versa.

The second is that QTUM can utilize the Simple Payment Verification (SPV) protocol to allow for verification of transactions and execution of smart contracts without the need to run an entire node. This is done because QTUM is using the existing technology of Bitcoin known as the Unspent Transaction Output (UTXO) model. This will allow us to run a light client on the mobile platform for users to create and validate smart contracts.

Check the Ice Chain GitHub workspace.

6.2 Temperature Data Logger (TDL) device

Ice Chain deals with the sensitive cargo which requires the exact temperature conditions of transportation. There may be different types of sensitive cargoes. For example, perishable goods such as vaccines and other types of sensitive medicine or it may be expensive brands of alcoholic drinks.

To deal with the field of cold chain Ice Chain implements Temperature Data Logger Device (TDL) which can measure temperature while transportation and send the temperature log to the mobile app via Bluetooth. Once received, the data goes to Blockchain, where Ice Chain smart contract checks the meeting of transport temperature conditions.

3D model of the TDL box
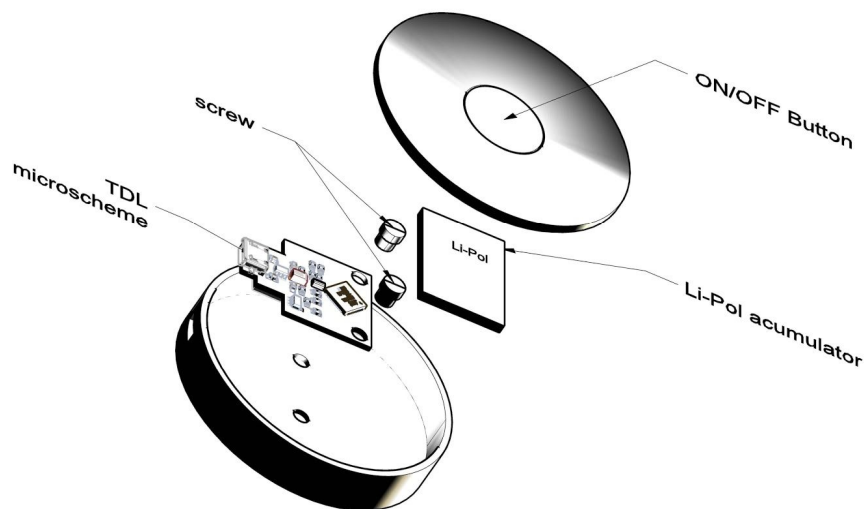
The TDL consists of:

- Prefabricated plastic (or caprolon A-type) round case (⌀60x13 mm) with the holes for the device enable button and micro USB connector for charging the battery (isolated from the crystal logic)
- Two-layer electrical board on fiberglass with microchip Atmega328
- Module JDY-08 Bluetooth Low Energy
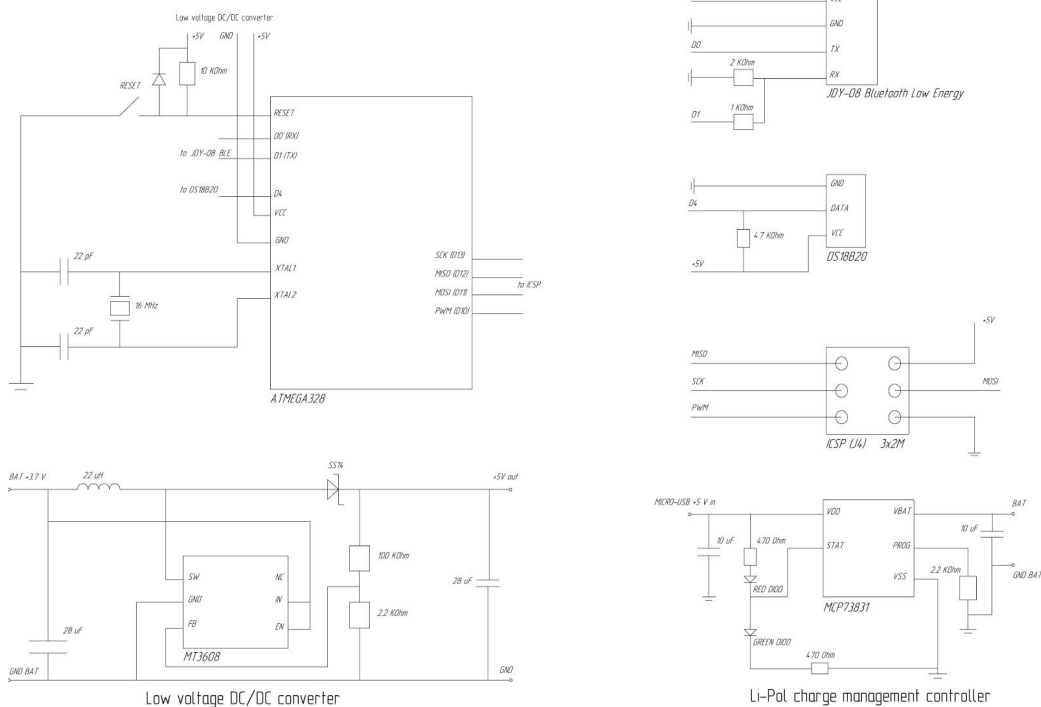- Solid-state temperature sensor (temperature range from -80 ℃ to 80 ℃)
- Battery (>1000 mAh)

The TDL microscheme circuit

Ice Chain works with following TDL usage workflow. First, a user holds the enable button for 3 seconds to turn on TDL. After that, the temperature sensor will begin collecting the temperature data. At any time user can request the data received by TDL, using Ice Chain app, and register the meeting of temperature conditions by Ice Chain Smart Contract. In the end, a user needs to hold the enable button for 3 seconds to turn off TDL.

The software for TDL will be performed as follows. When TDL is turned on, an empty data array is created. When temperature is measured, the value goes into the array. When TDL transmits the array of data, TDL puts a digital signature on the array and passes it via the Bluetooth module to the Ice Chain mobile app. Note that TDL reads temperature data per unit of time settled by user (one time in a minute by default, as required by GMP standards). After obtaining new temperature data, the data array becomes decoded and the new data goes into the array. It becomes encoded again. This procedure is needed to protect the data at each iteration.

For more information about Ice Chain Temperature Data logger device visit the Ice Chain GitHub [workspace](#).

6.2.1 Costs of TDL production

Total costs of Temperature Data Logger device are counted below. The whole Ice Chain financial model see in the chapter 9.

Components prices, USD per 1000 pcs	USA	Russia	EU
Atmega328	2 600	1 630	2 790
Resonator AT49S	54	157	43
MT3608 DC-DC conv	756	250	530
MCP73831	100	97	109
ICSP	150	100	100
DS18B20	1 300	570	1 057
JDY-08	1 820	1 730	3 316
micro-usb connector	755	76	437
li-pol 900 mAh	6 160	2 500	8 900
resistor 4.7 KOhm	20	13	20
resistor 1 KOhm	20	13	20
resistor 2 KOhm	20	13	20
resistor 470 Ohm (x2)	40	26	40
resistor 2.2 Kohm (x2)	50	26	50
resistor 100 Kohm	20	13	20
resistor 10 Kohm	20	13	20
condensators 22 pF (x2), 10 uF (x2), 28 uF (x2)	120	104	120
inductor 22 uH	66	65	66
microswitch	26	15	26
Subtotal	**14 097**	**7 411**	**17 684**
Total material costs per one TDL	**14.10**	**7.42**	**17.69**

	USA	Russia	EU
Manufacturing services, USD per 1000 pcs	1 955	924	2 199

	USA	Russia	EU
TOTAL DIRECT COSTS, USD per 1 TDL	**16.06**	**8.34**	**19.89**

7 Token Ecosystem

In this paragraph demands to the Ice Chain token will be clarified. Note that these requirements are in the developing stage. A future Ice Chain token can have other characteristics.

Ice Chain token will be issued due to the QTUM Hackathon and based on the QTUM blockchain. Ice Chain token will not be an instrument of the market speculations. It's not a trader investment because it's a full utility instrument, which takes the main role in the Ice Chain smart contract execution.

Ice Chain provides a bank letter of credit service based on blockchain technology for the sensitive cargoes transportation. It means that all financial operations and transport conditions data will be automated and protected by blockchain (nobody can fraud any operations unnoticeably). Thus, the criteria for the Ice Chain token are following at the moment.

Zero volatility level.

The token must have a zero level of volatility because of the saving cargo fiat price. All financial operations between Ice Chain contractors will be executed by using the smart contract. Thus, it requires the stability of the token price, so we can provide a good business practice to the customers without price speculations.

High liquidity level.

To ensure that all financial operations will be executed without obstacles the Ice Chain token must have a high level of liquidity. Thus, the token can be easily bought and sold using the currency of the country when Ice Chain is currently working (Russia, USA and / or Europe).

It's only the initial version of the Ice Chain token. It can be changed according to our business model future demands after project idea testing and customer development. A future Ice Chain funds raising can be done both by VC and / or ICO.

8 Market & Strategy

Ice Chain system is universal for any type of temperature sensitive cargo. However, the premium part of this market is pharmaceutical cargo type transportation. Some of our future customers can be:

- Manufacturers of temperature sensitive immunobiological products (vaccines)
- Wholesales
- Health care facilities that work with such products

Pharmaceutical market has the following reasons to be the main direction of Ice Chain development strategy.

Actual demand

Because of the high cost of vaccines and their risk to patients in case of damage, the business of pharmaceutical companies is more characterized by economic and reputational risks arising during transportation.

High market concentration

According to our research, production and wholesale supplies of vaccines in the European part of Russia deals with no more than 30 companies, each of which carries a significant amount of traffic. At the initial stage of business development, working with a small number of counterparties facilitates the organization of business processes.

The high cost of the cargo

The high cost of the cargo makes it expedient for the client to pay additional expenses for buying TDLs and creating of smart contracts.

As keys of the marketing strategy development, we consider:

- The price of thermal registrars and the amount of commission for the execution of a smart contract
- Directions of market expansion
- Promotion channels

8.1 TDL's price and fees of smart contract execution

The cost of products and services will be calculated according the following conditions:

- The TDL price of must be similar to the price of devices of a similar type
- The margin for TDLs must be minimal; the main profit comes from the fees
- The customer's expenses for using the Ice Chain system should not exceed 1% of the cost of the transported cargo

For the Russian market, when setting the price of the TDL, we were guided by the widespread model RC-12 at a cost of 18.00 USD. However, this model has somewhat less functionality (it does not have a communication module, a narrower measuring range).

8.2 Directions of the market expansion

At the beginning of our expansion, we assume development on the Russian market. Within 12 months after the product release, we plan to occupy a 10% market share.

Achievement of this indicator is possible due to coverage of an insignificant part of the volumes of 2-3 largest vaccine manufacturers. In the next years, the product is planned to be adapted and exported to foreign markets.

8.3 Promotion channels and franchising

As the main channel of promotion, we consider franchising. According to the plan, franchising can take 70% of deals on the Russian market and 100% on the foreign market.

The Russian pharmaceutical market is characterized by a high share of state players, and therefore sales channels are of particular importance for suppliers of products and services. Because of that, it is more expedient to give the sale of the Ice Chain products to existing organizations already possessing such channels and interacting with the largest producers.

Ice Chain franchising

Ice Chain responsibility	Franchisee responsibility
- System adaptation for the region features - Providing administrators rules in the system with the ability to get smart contracts fees from franchisees' customers - TDL supply (with discount)	- Payback for system adaptation - Promotion of the product in an established region or market segment - Pricing policy
Ice Chain earnings	Franchisee earnings
50% of franchisee smart contracts execution fees	50% of customers smart contracts execution fees - TDLs distribution

We've conducted a vaccines market analysis in USA, Europe and Russia. We're considering these region as potential markets where Ice Chain system can be implemented.

Vaccines market analysis

Region	Vaccines consumption volume, mln USD	Vaccines consumption volume, mln doses	Biggest local manufacturers	Average price of TDL, USD
USA	34,300	1,406	Pfizer, Johnson & Johnson, AbbVie	63,00
Europe	7,800	3,200	Roche, Sanofi,	40,00

			Merck & Co.	
Russia	366	242	Microgen, Nanolek, Petrovax	18,00

9 Financial Model

To show you some figures, we made a financial model. This model helps to answer the following questions on Ice Chain project:

- Where revenue comes from
- What are operational expenses
- How they depend on market situation
- How gross profit is calculated
- How much money are needed for working capital
- How long the payback period could be

Note that this model poses schematic representation of key business processes of Ice Chain as if the company was established in one of 3 regions (Europe, USA, Russia). We aim to show you the basic concept. To make this model simple and comprehensible, we set aside the following questions:

- Structure and value of initial capital expenses. They may include the costs of developing, testing and bringing the product to the market. To take this factor into account and calculate the payback period, you may type an assumed value of capital expenses in the Dashboard.
- Taxation details. We try to build a one-size-fits-all model which could be adopted for any country, so we put aside taxation details. You may set the total taxation level as % of gross profit in the Dashboard.
- Some other operational or non-operational costs which lie outside of our business model and depend on the exact business situation. Nevertheless, you may set the value of additional monthly operational costs in the Dashboard.

You can find Ice Chain Financial Model in PDF version and Excel version that you can download and manage it.

9.1 Instructions to the Financial Model

- **The Dashboard** is to set basic assumptions and drivers and display some key results.
- **Market Inputs** are to type in the market conditions and to edit Market Share Scenarios and Franchisee's Contribution Scenarios.
- **Direct Costs** are to calculate the cost of production of temperature logger device.
- **MODEL** displays the calculations of total revenue, total operational expenditures and gross profit.

Green cells are editable. Change the values in green cells to see how it affects the other measures.

9.2 Key drivers

- **Country**. By choosing country, you choose the relevant market volume, production costs and average TDL market price which are taken from Market Inputs.
- **Annual market growth**. The market volume grows every quarter by 1/4 of annual growth.
- **Cold chain multiplier.** Equals an average number of subjects in cold chain, or, in other words, how many smart contracts are created per one vaccine batch on its way to consumer. This driver helps to calculate the total value of delivery contracts to be serviced by Ice Chain.
- **Market share scenario**. Choose how fast Ice Chain should conquer its market share. The scenarios may be edited in Market Inputs.
- **Taxation level.** Decreases the total gross profit.
- **TDL price.** The price on our TDL compared to average market price.
- **Smart contract fee.** Average fee size, % of smart contract value.
- **Buyback price.** The % of TDL price payed to customer to get the used TDL back
- **Frachisee's contribution scenario.** Choose how big is the role of franchisees' in business
- **% of TDL repeated usage.** How many TDLs will be used repeatedly after arriving at the destination point.
- **% of TDLs buyback**. How many TDLs will be bought out after arriving at the destination point

9.3 Key Figures

Here we show key figures for Russian market as an example:

- Market share scenario: realistic (66% after 4 years)
- Franchisee's contribution scenario: medium (70% after 4 years)
- Total investments: USD 622,106

Total investments payback period: 2nd year 2nd quarter

	Y1	Y2	Y3	Y4
Revenue, USD	1,024,658.78	6,444,027.84	13,154,671.17	21,895,880.98
Operational Costs, USD	-762,199.09	-3,560,975.13	-7,071,903.71	-11,680,502.47
Gross Profit (after taxes), USD	183,721.78	2,018,136.90	4,257,937.22	7,150,764.96

Profit Margin	17.9%	31.3%	32.4%	32.7%

10 Roadmap

In the future, as our technology develops and experience increases, we plan to complete the app with the Android and Web versions, improve the Temperature Data Logger Device, make the final product.

The app will be improved in the following directions:

- The Android and Web app versions will be developed, where Ice Chain web dashboard enables extended user-friendly interface for creating smart contracts, tracking of shipments, data visualization and analytics
- The Analytic system that provides the statistics will be added
- The Loading and Transportation modules with the connection to the TDL will be added as well.

Temperature Data Logger device will be improved as follows:

- The TDL using PCB (Printed Circuit Board) based on Altmega328 will be made
- Li-Pol (Lithium-Polymer) battery will be added
- Flash memory drive and digital signature using hash function Sha256 will be added as well.

We're continuing develop the whole Ice Chain product using the Lean Startup methodology:

- Testing the MVP in real market conditions will be provided
- Deep customer development on Russian, US or European market will be conducted and edits in the Ice Chain business model in accordance to the custdev results will be made
- The final product will be finished.

The whole Ice Chain project will follow the next steps:

- Collaborate with professionals of the cold chain field
- Make a constant partnership with major market operators
- Conduct a partnership with QTUM
- Invite funds for future development.

At the end of the QTUM Hackathon, we will have a prototype Ice Chain system that can be easily developed into the fully working MVP version. After the contest, we plan to increase our team and invite experts of cold chain field, strong software developers, and engineers.

11 Blockchain in Logistics: Review and Comparison

One could say there are too many blockchain projects and ICOs related to logistics. For instance, icobench.com offers more than 40 ICOs. We´ve conducted a survey of actual ICO market to clarify the features of Ice Chain business model. First of all, we did not meet any project with the similar business model. Here, we have chosen the best known, funded and highly-rated projects to analyze and show some typical differences.

All information about the reviewed companies was taken from their official sources, white papers and websites.

Modum and Smart Containers attract the biggest attention because of using devices for tracking cargo transportation conditions. Also, FarmaTrust and Synthium Health were under analysis.

Modum combines IoT sensors with blockchain technology, providing data integrity for transactions involving physical products. The company concentrates on pharma cargoes supply. Modum offers a passive monitoring solution, ensuring GDP compliance and auditability by using blockchain and IoT technology.

The main difference between Ice Chain and Modum is that Ice Chain deals with financial risks and payments. Our project provides an alternative to bank letter of credit and insurance to guarantee trust between contractors and faster deals execution. Ice Chain also can transact payments automatically in accordance to smart contract terms. The Ice Chain smart contract based on QTUM was developed for that.

Smart Containers develops, builds and rents out airfreight containers for medicine and food transports. It combines blockchain and IoT sensors in a logistics ecosystem on the blockchain.

The comparison between Ice Chain and Smart Containers shows that solution we provide can be cheaper and more usable for most companies that produce or transport sensitive cargoes. Evidently, small temperature logger costs much less than a Smart Box which includes both refrigeration and temperature control systems. Moreover, as it was said before, Ice Chain deals with financial risks and payments.

FarmaTrust and Synthium Health are not designed for tracking the quality of sensitive cargo transportation. Their solution for this market is most different from Ice Chain's one. FarmaTrust uses blockchain to seamlessly and accurately trace individual packets of pharmaceuticals throughout the supply chain with the aim of eliminating counterfeit drugs. Synthium Health is a supply chain management platform engineered for the healthcare industry that enables providers and suppliers to exchange information and conduct eBusiness, cost-effectively.

As analysis showed they don't deal with financial risks and don't have any IoT device for tracking the quality of cargo transportation. The companies can provide a blockchain system to guarantee a supply of not damaged drugs. In turns, Ice Chain insures risks associated with temperature damages.

To summarize, Ice Chain has a set of special features:

- simple business model focused on particular problems of the market
- simple technology, easy and cheap to implement in actual business processes with no need in significant organizational adjustments or staff training
- dealing with financial risks and payments

The existence of companies dealing with blockchain in logistics confirmed that the business model when blockchain is implemented in the field of cargo delivery is alive. Thus, there's a lot of space for competition and improving the market.

After this review and comparison, we can say that Ice Chain has a unique approach to deal in the logistics field.

12 Team

The Ice Chain team has been created by a synergy of like-minded people. There are 3 members for now and all 3 have experience in business and financial development, inventing and engineering, iOS and solidity smart contracts developing.

Dan Kalinichenko, a fan of a deep analysis research, is a leader of the project. He takes care of the financial and business dimension of Ice Chain. Dan is experienced in financial and business analytics with 3 years of work with corporate finance in the banking sector. He graduated Kazan University in Russia with a degree in financial management and got a master degree in international relations in St. Petersburg State University.

Romano Potechin takes care of the technical part of Ice Chain. He is responsible for Temperature Data Logger device development. Romano is an inventor with 3 years of work in C++ and microarrays development. He is full of good ideas and, finally, he decided to contribute to blockchain development and build a brand new service at the intersection of cutting-edge technology and science. Romano is a former researcher at the Fok Institute of Physics, St. Petersburg State University, with a physics degree.

Thomas Luong is an iOS experienced developer, who got interested in blockchain technology as all of us here. He is responsible for the Ice Chain mobile app and Smart Contracts development. He graduated Oregon State University with two degrees in Chemistry and Computer Science. Thomas has a voluminous knowledge in mobile app development, UI, and smart contracts technology. As a experienced developer, Thomas is fully in charge of the Ice Chain mobile app developing. And furthermore, he is a software engineer at UserLAnd Technology.