



# BLUEWAVE



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# Chapter 1

OVERVIEW

Yacht Tourism

## **Executive Summary**

The yacht rental and charter industry epitomize luxury, adventure, and exclusivity, catering to the desires of affluent travelers seeking unparalleled experiences on the open seas. With a myriad of yacht types, destinations, and services, this industry has flourished, offering tailored experiences for individuals, families, corporate groups, and celebrities alike. However, despite its allure, the industry faces challenges related to security, transparency, and operational efficiency.

In response to these challenges, a revolutionary solution has emerged: a blockchain-based platform designed to transform the yacht rental experience. Leveraging the inherent benefits of blockchain technology, this platform promises to address concerns regarding security, authenticity, and transparency in yacht rentals. By integrating blockchain into the rental process, the platform aims to revolutionize the industry, offering enhanced trust, streamlined operations, and unparalleled security for all stakeholders involved.

### *Current Landscape of the Yacht Rental Industry*

The yacht rental industry encompasses a diverse range of services, catering to various preferences and desires of travelers worldwide. According to data from Fortune Business Insights, the global yacht charter market was valued at approximately \$7.59 billion in 2023, with steady growth projected in the coming years. This growth is fueled by an increasing demand for luxury travel experiences, particularly among high-net-worth individuals and corporate clientele.

Yachts are available in various sizes and types, ranging from small sailing boats to opulent mega yachts equipped with state-of-the-art amenities. According to a report by Boat International, the majority of yacht charters fall into four main categories: motor yachts, sailing yachts, catamarans, and superyachts. Each type offers a unique experience, catering to different preferences and interests of travelers.

Yacht rental companies provide a range of services to accommodate diverse needs and preferences. These services include bareboat charters, where renters are responsible for navigation and operation, as well as crewed charters, which provide professional crew

members to handle all aspects of the voyage. Additionally, companies offer day charters for short-term rentals and weekly charters for longer-term exploration of multiple destinations.



## Problem Statement

Despite the industry's growth and popularity, it faces several challenges that can hinder the rental experience for both yacht owners and travelers. One of the primary challenges is related to security and authenticity. Without a transparent and secure system in place, there is a risk of fraudulent activities, data breaches, and disputes between parties.

Moreover, operational inefficiencies and administrative burdens can impede the smooth functioning of yacht rental companies. Manual processes, paperwork, and communication barriers can lead to delays, errors, and frustration for both yacht owners and travelers.

Additionally, fluctuations in demand, seasonal variations, and economic uncertainties can impact the profitability and sustainability of yacht rental businesses.

## **The Blockchain Solution: Revolutionizing Yacht Rentals**

In response to these challenges, a groundbreaking solution has emerged: a blockchain-based platform designed to revolutionize the yacht rental experience. By harnessing the power of blockchain technology, this platform offers a secure, transparent, and efficient ecosystem for yacht rentals, addressing key concerns and enhancing the overall rental experience for all stakeholders involved.

Blockchain technology provides several inherent benefits that are particularly well-suited to the yacht rental industry. Firstly, blockchain offers immutable transaction records, ensuring that rental agreements and transactions are securely recorded and tamper-proof. This transparency and security instill confidence in the rental process, reducing the risk of disputes and fraudulent activities.

Additionally, smart contracts are employed to automate rental agreements, streamlining the rental process and reducing the need for manual intervention. These self-executing contracts automatically enforce the terms and conditions of the rental agreement, facilitating seamless transactions between yacht owners and travelers. This automation improves efficiency, reduces administrative overhead, and enhances the overall rental experience.

Furthermore, blockchain technology enhances trust between parties by providing a decentralized and transparent platform for conducting transactions. The decentralized nature of blockchain eliminates the need for intermediaries, such as brokers or agents, reducing costs and increasing transparency. This fosters greater trust and collaboration between yacht owners and travelers, leading to mutually beneficial relationships and enhanced customer satisfaction. Therefore, BlueWave aimed to utilize the permissioned blockchain, Hyperledger Fabric, to improve the yacht rental industry.



# Chapter 2

TECHNOLOGY

Hyperledger Fabric

## **Blockchain Network: Hyperledger Fabric**

Hyperledger Fabric is a well known permissioned blockchain framework that is suited to build blockchain-based solutions that prioritize privacy, scalability, and modular architecture. Use Cases in the supply chain industry also prove that Hyperledger Fabric network is suitable in the use of ensuring transparency and accountability by providing traceability and immutability features. (IBM, 2019)

After reviewing the architecture of Hyperledger Fabric, the setup and performance capabilities align closely with the specific requirements of our project. Our aim is to streamline the yacht booking process while maintaining control over the booking progress and services, ensuring transparency and traceability throughout.

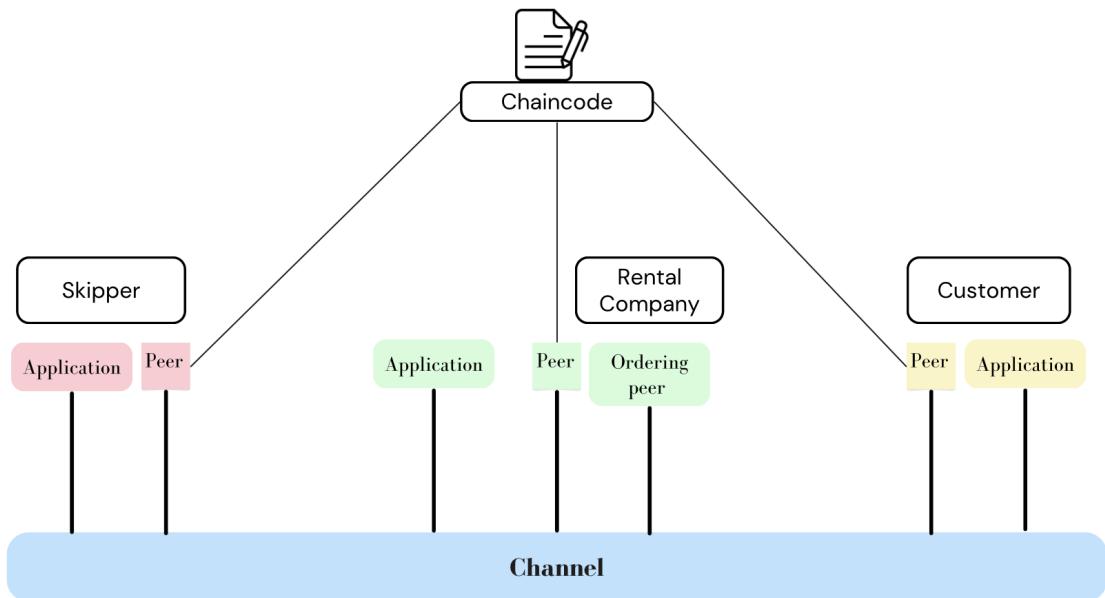
According to Hyperledger Foundation in 2023, Hyperledger Fabric's modular architecture offers scalability with up to over 2,500 TPS, enabling us to adjust deployments according to transaction volume without sacrificing performance. This flexibility allows for efficient resource utilization, reducing costs during periods of low network activity. Additionally, research has shown that there are solutions to further scale up to 20,000 TPS to handle potential increase in the number of transactions in the future. (Gorenflo, Lee, Golab, & Keshav, 2020)

Utilizing private channels within Hyperledger Fabric further enhances confidentiality by restricting access to transaction ledgers and communication solely to authorized participants. Through implemented data encryption, we can ensure that sensitive information remains protected. In our use case, the endorsement of transactions by peers validates booking requests, payments, and goods tracking, with committing peer nodes finalizing transactions.

The framework's support for smart contracts (chaincode) automates business logic and contractual agreements, boosting overall efficiency. Orderer peer nodes maintain transaction order and network consistency, facilitating secure transaction execution. Certificate Authority (CA) peer nodes issue digital certificates to network participants, aiding in secure communication and user authentication.

Client peer nodes represent various stakeholders involved in yacht rentals, ensuring seamless interaction within the network. Employing the Practical Byzantine Fault Tolerance (PBFT) consensus mechanism enhances performance, energy efficiency, and security, even in the presence of malicious actors or faulty nodes.

## Channel



In this setup, there is a single communication channel for the three peer nodes. The channel ensures that only the skipper, rental company, and customer nodes involved in a specific rental transaction can communicate and interact with each other. Each node's web application interacts with the chaincode deployed on the channel to perform various actions related to yacht rental, such as listing all yachts, requesting rentals, and recording yacht information. When a node initiates a transaction through its web application, it invokes specific functions defined in the chaincode relevant to the action it wants to perform.

## **Organizations: Peer Node**

### *Yacht Rental Company*

Yacht Rental Company peer serves as a critical component for managing yacht rental transactions and interactions within the network. As the primary interface for the rental company, this peer provides access to essential functionalities, including the ability to add new yachts to the platform, query existing yacht records, and sign agreements on behalf of the company.

### *Skipper*

The Skipper peer serves as a specialized interface for qualified skippers to interact with the network and perform essential actions related to yacht rentals. Through the Skipper page, authorized skippers can access functionalities tailored to their role, primarily focusing on signing yacht agreements to attest to their readiness and qualification as a skipper for specific yacht rentals. The signature appended by the skipper serves as a unique Decentralized Identifier (DID), providing cryptographic proof of their identity and qualifications. By leveraging DID technology, the skipper's signature ensures trust and authenticity in the rental process, validating their competency and adherence to regulatory standards. Through the peer node, skippers can seamlessly engage with yacht rental companies, confirm their involvement in rental agreements, and contribute to the secure and transparent execution of rental transactions.

### *Customer: Renter*

The Customer peer provides renters with a dedicated interface to access essential functionalities and services tailored to their needs. Through the Customer page, renters can seamlessly browse and view available yachts, accessing detailed information such as location and status of the yacht. This interface empowers customers to make informed decisions based on their preferences and requirements, ensuring a personalized and satisfying rental experience. Additionally, the Customer peer enables renters to book the yachts directly within the platform. By selecting their desired yacht and specifying the rental duration, renters can securely book their chosen vessel with confidence, knowing that the transaction is recorded immutably on the blockchain network. This streamlined process eliminates the need for intermediaries and enhances transparency, efficiency, and trust in the rental process.

## Chaincode

The chaincode serves as the backbone of the yacht rental application, facilitating seamless interactions and transactions between participants in the Hyperledger Fabric network. The seven main functions implemented in the chaincode enable the essential operations required to manage yacht rentals effectively. In the subsequent sections, each function will be elaborated upon in detail, accompanied by the complete code snippets, all of which are available on our [GitHub](#) repository or Appendix 1.

### queryYacht

This function takes one argument which allows users to query detailed information about a specific yacht by providing its unique identifier (ship ID).

Users can use this function to access key details such as location, owner, booking status, timestamps, and previous bookings. This function ensures transparency and accessibility of yacht information for all participants in the network.

### initLedger

The initLedger function initializes the ledger with default data, pre-populating it with a set of predefined yacht records. These records include essential details such as ship ID, location, owner, and booking status. By populating the ledger with initial data, this function ensures that the platform is ready for use upon deployment, expediting the onboarding process for users.

In the real world situation, this function allows companies to switch their data from their original database to the Hyperledger Fabric network.

## addYact

This function enables yacht rental companies to add new yacht records to the ledger. This function accepts five arguments - key, ShipId, location, logbook, owner, company signature, which are then stored as immutable entries on the blockchain.

This function facilitates the expansion of the yacht rental platform's fleet, ensuring that new vessels can be seamlessly integrated into the network.

## queryAllYacht

The queryAllYacht function retrieves and returns a comprehensive list of all yacht records stored in the ledger. It is an important function that allows users to access a complete overview of available yachts, including their respective details and booking statuses. This function enhances transparency and visibility, allowing users to make informed decisions when selecting a yacht for rental.

## book

This function enables customers to book a specific yacht for a specified duration. Users provide the key of the yacht along with the desired booking dates, initiating the booking process. The function validates the availability of the yacht and updates its booking status and timestamps accordingly. This function streamlines the rental process, providing customers with a convenient and secure way to reserve yachts for their desired dates. This function will also append the booking to the overall records which can check availability.

## signskipper

The signskipper function allows qualified skippers to digitally sign yacht agreements, confirming their readiness and competence to operate specific vessels. Skippers provide

their digital signatures, which are stored on the blockchain as Decentralized Identifiers (DIDs), providing cryptographic proof of their identity and qualifications. This function enhances trust and authenticity in the rental process, ensuring that only qualified skippers are entrusted with operating yachts.

### signcompany

Similar to the signskipper function, the signcompany function enables authorized representatives of yacht rental companies to digitally sign rental agreements. Company representatives append their digital signatures to confirm and authorize yacht bookings, validating the contractual agreements between the company and customers. This function enhances the integrity and legality of rental transactions, ensuring compliance with regulatory standards and internal policies.

### removebooking

The function takes one argument to reject the latest booking if the rental company found any faults in the latest booking. The removebooking function ensured the validity of the booking by preventing double booking.

## **Client Application**

### **Front-End and Back-End**

Client applications interact with the Hyperledger Fabric network to perform various actions, such as querying yacht information, booking yachts, and signing agreements. The applications included three major user interfaces for the three major users to access the rental platform, submit requests, and view transaction history. Client applications communicate with the network using APIs provided by the Hyperledger Fabric SDK. Some of the user interfaces will explain detailedly in the following pages.

## Add Yacht Page

The screenshot shows the 'Add Yacht' form on the BlueWave Tourism website. The form consists of several input fields and sections for entering yacht details:

- Yacht ID:** A text input field labeled "Enter yacht ID".
- Yacht Name:** A text input field labeled "Enter yacht name".
- Description:** A text input field labeled "Describe the yacht".
- Location:** A text input field labeled "Provide the yacht location".
- Owner:** A text input field labeled "Specify yacht owner".
- Skipper:** A text input field labeled "Provide skipper information".
- Capacity:** A text input field labeled "Enter maximum capacity".
- Length (LOA):** A text input field labeled "Enter yacht length (feet/meters)".
- Width (Beam):** A text input field labeled "Enter yacht width (feet/meters)".
- Model:** A text input field labeled "Enter yacht model".
- Number of Bedrooms:** A text input field labeled "Enter number of bedrooms".
- Amenities:** A text input field labeled "List yacht amenities".
- Crew Details:** A text input field labeled "Describe the crew members".
- Safety Features:** A text input field labeled "Highlight safety equipment".
- Add Photos:** A file upload section with a "Choose file" button and a placeholder "No file chosen".
- Add Yacht:** A blue "Add Yacht" button.

At the bottom of the page, there is a dark footer bar with the text "© 2024 BlueWave Tourism" and social media icons for Facebook, Twitter, and Instagram.

The "add yacht" page will exclusively be accessible to rental companies, enabling them to input yacht data into the blockchain network. A total of 15 inputs will be stored in the blockchain network and can be queried for information retrieval.

The image below shows call to Hyperledger Fabric network, and it shows submitted data and confirms that transaction was submitted

```
[{"id": "4", "name": "test", "value": "test"}, {"id": "logs", "name": "test", "value": "test"}, {"id": "yachtPicture.jpg", "name": "Ocean yacht", "value": "test"}, {"id": "test", "name": "test", "value": "test"}]  
Transaction has been submitted
```

## List of Available Yacht



BlueWave Tourism   [Add Yacht](#)   [Yacht List](#)

### Available Yachts



#### Blue Moon

**Model:** Ocean Voyager

**Description:** Luxury yacht with spacious cabins and stunning ocean views. Perfect for a relaxing getaway.

**Amenities:** Jacuzzi, BBQ grill

**Crew:** Captain, Chef, Steward

**Location:** 67.0006, -70.4576

[Book Now](#)

This is list of yachts, and the image below shows data received from HyperLedger network

```
kirillspitsyn@LAPTOP-VPGTN0GN: ~/fabric-samples/yacht-application
{
  Key: '3',
  Record: {
    shipid: '92F 8193',
    location: '46.147656, -1.163943',
    logbook: 'Hash',
    owner: 'Anna',
    signatureC: '',
    signatureS: 'DID_S',
    booking: false,
    timestampfrom: '',
    timestampto: '',
    allbooking: [],
    ipfs: 'https://bafybeihggydwg2np5j2froc62h3ybf2wxhng4jqquwnpbvoaimnnntujckq.ipfs.cf-ipfs.com/',
    name: 'Flying the Seas',
    model: 'Sea Voyager',
    capacity: '7 guests',
    description: 'Luxury yacht to travel around the world.',
    length: '40 ft',
    width: '15 ft',
    amenities: 'BBQ grill',
    crew: 'Captain, Chef',
    safetyFeatures: 'fire extinguishers'
  },
  {
    Key: '4',
    Record: {
      shipid: 'test',
      location: 'logs',
      logbook: 'test',
      owner: 'yachtPicture.jpg',
      signatureC: '',
      signatureS: '',
      booking: false,
      timestampfrom: '',
      timestampto: '',
      allbooking: [],
      ipfs: 'https://fuchsia-absent-goose-826.myipinata.cloud/ipfs/QmUjoJZswNVWysApba8mUgCix2PsaaITKhdGbVcfNxSJvZ',
      name: 'test',
      model: 'test',
      capacity: 'test',
      description: 'test',
      length: 'test',
      width: 'test',
      amenities: 'test',
      crew: 'test',
      safetyFeatures: 'test'
    }
  },
  {
    Key: '5',
  }
}
```



## Green Wave

**Model:** Sea Yacht

**Description:** Luxury yacht with spacious cabins.

**Amenities:** Jacuzzi

**Crew:** Captain

**Location:** 40.6064, -73.6745

[Book Now](#)

The listing page will display all yachts currently available for booking. It incorporates the "get\_all\_yachts" function, enabling users to retrieve all yacht data stored in the blockchain.

Booking Page



BlueWave Tourism



## Blue Moon

**Model:** Ocean Voyager

**Capacity:** 10 guests

**Description:** Luxury yacht with spacious cabins and stunning ocean views. Perfect for a relaxing getaway.

**Length:** 50 ft

**Width:** 20 ft

**Amenities:** Jacuzzi, BBQ grill

**Crew:** Captain, Chef, Steward

**Safety Features:** Life jackets, fire extinguishers

**Location:** 67.0006, -70.4576

**Owner:** John

Book From:

dd/mm/yyyy



Book Through:

dd/mm/yyyy



**Book Now**

© 2024 BlueWave Tourism



On the booking page, customers can access comprehensive details about a yacht. Additionally, customers can input the start and end dates for their booking, which will be recorded in the Hyperledger Fabric Network. Following the submission of a booking, the yacht's availability will be temporarily disabled until confirmation is received from the rental company, ensuring no double bookings occur.

The image below shows confirmation of booking on HyperLedger network:

```
[ '1', '2024-04-25', '2024-05-11' ]  
Transaction has been submitted
```

[Skipper Verification Page](#)

### Available Yachts

Blue Moon

Model: Ocean Voyager, Capacity: 10 guests, Luxury yacht with spacious cabins.

Your Decentralized Identity (DID) Number:

Enter your DID

This page is still in development and will allow to provide a DID's identifier to verify identity for skipper.

## **Risk Analysis**

Hyperledger Fabric stores sensitive data about all transactions and channel participants on the blockchain ledger which makes it a target for data breach security attacks. Encryption techniques and secure data transmission protocols should be used to protect data both at rest and in transit. Additionally, regular security audits and monitoring are required to help detect and mitigate potential breaches.

With the growth in number of users, the number of transactions are expected to increase, Hyperledger Fabric may face scalability challenges. To mitigate this risk, we can partition data, optimize network configurations, and utilize off-chain solutions for storing non-critical data. Also, Hyperledger Fabric's permissioned architecture may raise concerns about decentralization compared to other public blockchains. But in our luxury yacht tourism use case, controlled access and privacy are very important and centralization is a benefit for our solution because rich people who rent yachts won't use public networks where all their transactions and information are public.



# Chapter 3

BUSINESS

Market Research

# Our Value



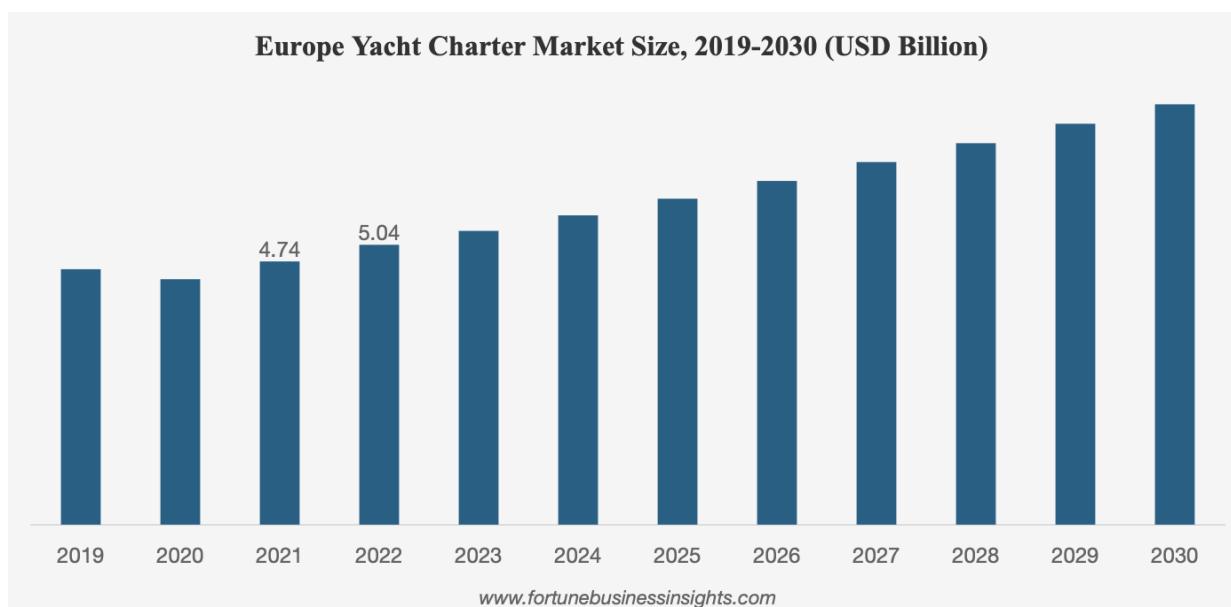
“Our company aims to revolutionize the yacht rental industry by leveraging blockchain technology to enhance transparency, security, and efficiency in the rental process.

By providing a secure and immutable ledger, we ensure that yacht rental transactions are conducted with utmost trust and integrity, benefiting both yacht rental companies and customers alike.

Our platform streamlines operations, reduces administrative overhead, and minimizes disputes, ultimately delivering a seamless and hassle-free rental experience. Through personalized services, transparent pricing, and reliable customer support, we strive to exceed the expectations of our users and establish ourselves as the premier destination for yacht rentals.”

## Market Analysis

The yacht rental industry is experiencing significant growth and transformation, driven by various factors such as increasing demand for recreational boating activities, rising disposable income, and a growing preference for luxury travel experiences. The following content provides a comprehensive analysis of the current state of the yacht rental industry, drawing insights from recent articles and studies. According to a report by Mordor Intelligence in 2023, the global yacht charter market is expected to register a Compound Annual Growth Rate (CAGR) of 5.79% during the forecast period. In 2021, the market was valued at USD 18.9 billion, and it is projected to reach USD 26.5 billion by 2027. Despite the negative impact of the COVID-19 pandemic in 2020, the market has shown resilience, with key players adapting strategies to counter challenges such as supply chain disruptions and a shortage of skilled workers.

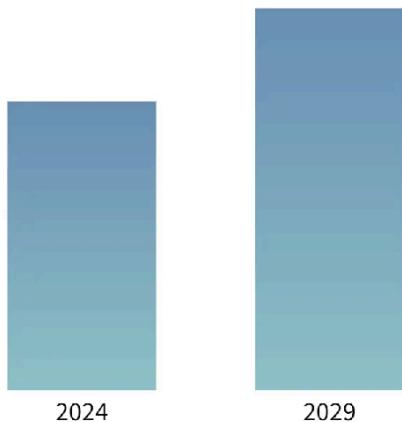


Several trends are driving the growth of the yacht rental industry. One significant trend is the augmentation in fleet size by key players (Mordor Intelligence, 2023). Yacht charter companies are investing in upgrading their fleets by adding new yachts to remain competitive. Additionally, the demand for luxury small ship cruises and private yacht charters is witnessing remarkable growth. (Travel Weekly, 2022) High-end travelers are increasingly seeking exclusive experiences, personalized service, and access to less-visited destinations, driving the popularity of yacht charters.

### Yacht Charter Market

Market Size

CAGR 5.79%



Source : Mordor Intelligence



Study Period 2019 - 2029

Base Year For Estimation 2023

CAGR (2024 - 2029) 5.79 %

Fastest Growing Market Asia-Pacific

Largest Market Europe

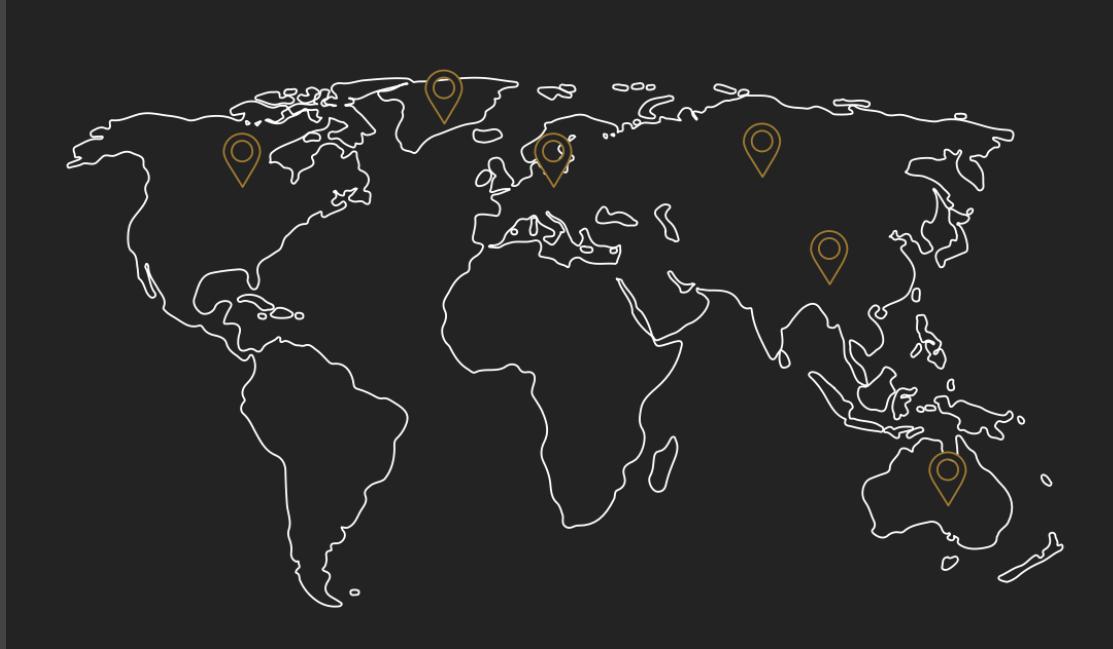
Market Concentration Medium

### Major Players



\*Disclaimer: Major Players sorted in no particular order

## Regional Analysis



*figure1: World map showing the potential market of the yacht industry.*

According to the report from Mordor Intelligence in 2024, the yacht rental market exhibits regional variations in growth and demand. Europe and North America are anticipated to lead the market. Northern Europe, in particular, has a rich culture of yacht charters, with countries like Germany, Sweden, and England offering a variety of options for motor yachts and luxury vessels. In Asia Pacific, countries like Australia and Indonesia are the major contributors to the region's growth potential. Research on the consumption potential of yachting tourism in China highlights opportunities for market expansion. (Yao, Li, Zhou, & Parmak, 2023) With the rapid development of the Chinese economy and increasing middle-class population, China has become a key market for yacht rentals. Efforts to improve yachting infrastructure and promote yachting tourism are creating opportunities for industry players to tap into this lucrative market. Thus, these regions are the potential market for launching our application.

## MODEL CANVAS

### DECENTRALIZED BUSINESS MODEL CANVAS

03. Proposed Solution.	05. Validator Incentive	02. Value Proposition	07. Network Governance	01. User/customer segments				
-Web application to book yacht and luxury goods from different yacht owners and rental companies.	Giving network validators part of transaction fees as a reward for validating transactions.	- Security and transparency in Yacht Rental Transactions and booking process	Depends on organization's agreement, which included policies and rules. Governance protocol will be established by all members of our Hyperledger Fabric network channel. On initial creation of network channel, Protocol will define how many signatures will be required for transaction to proceed, and the ledger with all transactions and data will be available for all members of the channel.	Yacht Owner Yacht Renters Yacht Rental Companies				
- Using permissioned blockchain (Hyperledger Fabric) to improve transparency and security (traceability)	- Enhancing user experience by utilising smart chaincode to automate the whole booking process and add extra verification to the booking process.	- Safety in trips without worrying about scams		- W-D-A - UD Yachts - Book Luxury Boat				
- Luxury Goods origin will be tracked using Hyperledger Fabric blockchain.	04. Reaching Trust	- Seamless and user-friendly booking using our web application	08. Interaction Channels					
for authentication and authorization of owners, renters, and rental companies on Hyperledger network channel	Using CA (Certificate Authority) and MSP (Membership Service Provider)	- Trustworthy identity verification mechanisms using HyperLedger Fabric	- Hyperledger Fabric Network channel will be used for communication, booking, verification, and sending transactions between our web application and users, rental companies, yacht owners, and luxury goods providers					
	06. Cost Structure	06. Cost Structure	09. Revenue Streams					
- Hyperledger Fabric network channel configuration and setup	- Web application development	Operational Costs:	- Subscription (access to more yacht and extra luxury goods)					
- Infrastructure cost of hosting the application	- Integration of blockchain and web-app	- Maintenance of software and infrastructure	- Transaction fees					
		- Monitoring costs to avoid security breaches	- Sponsorships and advertisement with yacht rental companies					
		Marketing and promotional costs to get more clients						

Through the business, Desirability, Feasibility, and Viability have been covered. It is also important to recognize any legal and compliant issues in this project. One major aspect that needs to be addressed is privacy and data protection. To address the issue, we will implement measures to protect user privacy and comply with data protection regulations such as the General Data Protection Regulation (GDPR), which is to safeguard the fundamental right to privacy and personal data protection of individuals within one of our major potential market, European Union (EU) and the European Economic Area (EEA). Also it is important to ensure appropriate data privacy measures, such as encryption, pseudonymization, and access controls, to safeguard sensitive information stored on the blockchain has been implemented.

## PERSONA

Client:	Luxury Yacht Renter
Project:	Blockchain Yacht Rental Service
Date:	03.17.2024
<b>DEMOGRAPHICS</b>	
Name	John
Age	40
Gender	Male
Status	Married
Education	Master's Degree In Business Administration
Employment	Owner of a medium-sized retail business
Income	\$250k
Location	the USA
BIO (shorthand)	John is a successful businessman who has a busy lifestyle and he likes to spend his vacations and day-offs yachting but he doesn't have his own yacht.

Needs/Frustrations	<p>He wants to see the authenticity and quality of luxury goods provided during his yacht trips.</p> <p>He wants a service where he can choose and book yachts with goods for his trips, and he wants to make sure that the goods he chooses are authentic and traceable. Also, he wants to make sure that the whole yacht booking and payment process is secure and transparent, and that he won't get scammed and lose his money.</p>
Motivations	<p>John will get the most out of his yachting experience with our service. He will be able to ensure that he can choose different luxury goods for his trip and that the luxury goods provided during his yacht trips are genuine and of high quality. Also, he will receive a secure and transparent service for the whole booking and payment process in our application. Besides, with our service, John won't need to worry about scams, and he will be able to fully relax during his yacht trips. Our UI will also make the booking process much more convenient.</p>
Brands	<p>John chooses luxury brands. He wears a pair of Rolex, drives a Porsche 911, has an Apple phone, and stays at expensive hotels such as Hilton and Marriot. John also dines in Michelin restaurants. He wears clothes from Versace and Gucci. Besides, John has a condo in Miami.</p>

## **Cost-Benefit Analysis**

For detailed information of the costs for each section, please refer to Table 1 and Table 2. All the data is based on estimated value that takes reference to similar projects and actual tools, such as AWS management for Hyperledger Fabric (\$1.93/month for holding production network) and BEM marketing estimate pricing.

### **Direct Costs**

Costs associated with the development of our platform will include expenses related to the design, development, and deployment of our web platform for yacht rentals. Those costs might include hiring developers to help finish the website.

#### **Section 1: \$60000**

Costs associated with hosting our platform and HyperLedger fabric network. This will include costs associated with hosting our platform on the internet and keeping our HyperLedger fabric network running.

#### **Section 2: \$19000**

Costs associated with training programs to educate stakeholders which includes yacht owners, rental providers, and users, on how to use the new blockchain platform effectively. This will include in-person training, documentation, and phone, mail, and chat support.

#### **Section 3: \$15000**

Marketing costs. This will include expenses related to marketing and promoting our platform to attract new users and yacht owners. This will require advertising campaigns and promotional events.

#### **Section 4: \$40000**

## Indirect Costs:

Maintenance and support costs. This will include costs for maintaining and supporting the blockchain platform, and it includes making software updates, hosting our application, HyperLedger Fabric network, and providing phone, mail, and chat support. This will help to make sure that the platform stays stable over time.

**Section 1:** \$151000/year

Marketing costs. This will include expenses related to marketing and promoting our platform to attract new users and yacht owners. This will require advertising campaigns and promotional events.

**Section 2:** \$8000/year

<b>Direct Costs</b>	<b>Cost \$ CAD</b>
<b>Section 1</b>	
Hiring developers for 6 months	60000
<b>Section 2</b>	
Hosting application in a cloud (Initial)	10000
Hosting HyperLedger Fabric network (Initial)	9000
<b>Section 3</b>	
In-person training sessions (Initial)	5000
Documentation	2500
Phone, mail, and chat support (Initial)	7500
<b>Section 4</b>	
Advertising campaigns (Initial)	30000
Promotional events (Initial)	10000
	-----
	134000

<b>Indirect Costs</b>	<b>Cost \$ CAD</b>
<b>Section 1</b>	
Add software updates	120000/year
Hosting application	10000/year
Hosting HyperLedger Fabric network:	16000/year
Providing phone, mail, and chat support	5000/year
<b>Section 2</b>	
Advertising campaigns	5000/year
Promotional events	3000/year
	159000/year

## **Projected Benefits**

Our platform aligns with the essence of "luxury" in yacht tourism by implementing a secure rental process. Leveraging HyperLedger Fabric blockchain technology ensures an unalterable record of transactions. Additionally, our user-friendly platform provides a seamless experience, maintaining high standards and top-notch quality for users to enhance their vacation enjoyment. Market research has highlighted significant growth potential for our application on a global scale. As a result, we expect our services will continue to attract an increasing number of potential users in the years to come.

## **ROI**

Through our platform, revenue will be generated from each transaction. A transaction fee of 2% will be applied, and in the initial year, we anticipate approximately 6,000 rental transactions, yielding an average transaction fee of \$24. Additionally, revenue will be derived from subscriber fees. Our subscription service, priced at \$50 per month (\$600 annually), grants access to exclusive yachts. It is projected that we will have 100 subscribers within the first year.

---

Return on Investment (ROI) =  $(\text{Net Profit} / \text{Total Investment}) * 100$

Net profit = total revenue - total costs

Total Investment = direct costs + Indirect costs

Total revenue from transaction fees =  $\$24 * 6000 = \$144000$

Total revenue from subscriptions =  $\$600 * 100 = \$60000$

Total Revenue =  $\$144000 + \$90000 = \$204,000$

Total Investment =  $\$134000 + (\$159000)/2 = \$213,500$

Net Profit =  $\$204000 - \$213500 = (-\$9500)$

ROI =  $(-\$9500 / \$213,500) * 100$

**ROI = -4.45%**

---

*Note: All calculations are based on estimated values.*

This ROI metric shows that the project is potentially highly profitable for investors because investors will get **-4.45%** of their investment back after 1 year based on the Return on Investment (ROI) calculations above. (Vipond, 2023) It is noted that the initial cost is comparatively higher in the first year. Also, with expected growth in the number of users in the future, it is expected to have a positive ROI in the third year.

## Road Map

While we have made significant progress with our yacht rental platform, there are several key areas on our roadmap that we are yet to address. One of these areas is the implementation of Decentralized Identifiers (DID), which will enhance the security and privacy of our users' data. By incorporating DID technology, we aim to provide a more robust authentication system for our platform. Also, part of the user interfaces are still under development and we believe it will be complete soon.

Furthermore, we recognize the potential for implementing more features that could refine our current application such as integrating Internet of Things (IoT) devices to track the location of yachts in real-time. This can further improve our performance and service quality of the application.

### Future potential

In terms of future plans, we are exploring opportunities to collaborate with yacht rental companies such as Ocean Blue and Dream Yacht Hellas to expand our market reach. By forming partnerships, we can leverage existing networks and resources to attract a broader customer base and enhance the availability of yachts with our solution.

Moreover, we see potential in diversifying our use cases beyond yacht rental. One of the potential fields is the rental of camping cars, which aligns with the broader tourism industry. By expanding our offerings to include camping car rentals, we can expand our market to a wider audience of travelers seeking high quality experiences.

Overall, our roadmap outlines our planning for continuous innovation and growth. We remain passionate to provide services to our customers and stakeholders while exploring new opportunities for expansion and collaboration in the dynamic landscape of the tourism industry.

## **Acknowledgments**

We would like to express our sincere gratitude to all those who have contributed to the development and success of our yacht rental platform. Special thanks to Professor George Petrovic and Professor Lawrence Ley for all the feedback and guidance in this project. We also extend our appreciation to all the professors who teach the Blockchain Development program for their unwavering support.

Last but not least, we are grateful to our families, friends, and peers for their encouragement and guidance throughout this journey. Your encouragement has been a source of motivation, and we look forward to continuing to serve our customers and stakeholders with excellence.

Thank you.

*BlueWave*

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## Appendix

### Appendix 1: Chaincode Function

All the invoke functions

```
/*Invoke*/
func (s *SmartContract) Invoke(APIstub shim.ChaincodeStubInterface) peer.Response {
    function, args := APIstub.GetFunctionAndParameters()

    if function == "queryYacht" {
        return s.queryYacht(APIstub, args)
    } else if function == "initLedger" {
        return s.initLedger(APIstub)
    } else if function == "addYacht" {
        return s.addYacht(APIstub, args)
    } else if function == "queryAllYacht" {
        return s.queryAllYacht(APIstub)
    } else if function == "book" {
        return s.book(APIstub, args)
    } else if function == "signcompany"{
        return s.signcompany(APIstub, args)
    } else if function == "signskipper"{
        return s.signskipper(APIstub, args)
    } else if function == "removebooking"{
        return s.removebooking(APIstub, args)
    }
    return shim.Error("Invalid Smart Contract function name.")
}
```

## Initial the Ledger

```
func (s *SmartContract) initLedger(APIstub shim.ChaincodeStubInterface) peer.Response {
    yacht := []Yacht{
        Yacht{ShipId: "80F 3476", Location:"67.0006, -70.4576", LogBook: "Hash", Owner: "John", SignatureCompany: ""},
        Yacht{ShipId: "35M 3314", Location:"40.6064, -73.6745", LogBook: "Hash", Owner: "Peter", SignatureCompany: ""},
        Yacht{ShipId: "92F 8193", Location:"46.147656, -1.163943", LogBook: "Hash", Owner: "Anna", SignatureCompany: ""},
        Yacht{ShipId: "45C 8822", Location: "33.6895, -118.0436", LogBook: "Hash", Owner: "Michael", SignatureCompany: ""},
        Yacht{ShipId: "78K 6543", Location: "25.0343, -77.3963", LogBook: "Hash", Owner: "Emily", SignatureCompany: ""},
        Yacht{ShipId: "22T 9988", Location: "41.9028, 12.4964", LogBook: "Hash", Owner: "Sophia", SignatureCompany: ""},
        Yacht{ShipId: "66R 7766", Location: "33.9416, -118.4085", LogBook: "Hash", Owner: "David", SignatureCompany: ""},
        Yacht{ShipId: "19P 3321", Location: "25.0343, -77.3963", LogBook: "Hash", Owner: "Robert", SignatureCompany: ""},
        Yacht{ShipId: "88W 1234", Location: "51.5074, -0.1278", LogBook: "Hash", Owner: "Olivia", SignatureCompany: ""}
    }

    i := 0
    for i < len(yacht) {
        yachtAsBytes, _ := json.Marshal(yacht[i])
        APIstub.PutState(strconv.Itoa(i+1), yachtAsBytes)
        i = i + 1
    }
    return shim.Success(nil)
}
```

## Querying all Yacht

```
func (s *SmartContract) queryAllYacht(APIstub shim.ChaincodeStubInterface) peer.Response {
    startKey := "0"
    endKey := "999"

    resultsIterator, err := APIstub.GetStateByRange(startKey, endKey)
    if err != nil {
        return shim.Error(err.Error())
    }
    defer resultsIterator.Close()

    // buffer is a JSON array containing QueryResults
    var buffer bytes.Buffer
    buffer.WriteString("[")  
  
    bArrayMemberAlreadyWritten := false

    for resultsIterator.HasNext() {
        queryResponse, err := resultsIterator.Next()
        if err != nil {
            return shim.Error(err.Error())
        }

        if bArrayMemberAlreadyWritten == true {
            buffer.WriteString(",")
        }

        buffer.WriteString("{\"Key\":")
        buffer.WriteString("\"")
        buffer.WriteString(queryResponse.Key)
        buffer.WriteString("\"")  
  
    }

    }

    buffer.WriteString("]")
    return shim.Success(buffer.Bytes())
}
```

```

        buffer.WriteString("", \"Record\":")
        buffer.WriteString(string(queryResponse.Value))
        buffer.WriteString("}")
        bArrayMemberAlreadyWritten = true
    }
    buffer.WriteString("]")
    fmt.Printf(" - queryAllYacht: \n%s\n", buffer.String())
    return shim.Success(buffer.Bytes())
}

```

Signature by company.

```

// sign company
func (s *SmartContract) signcompany(APIstub shim.ChaincodeStubInterface, args []string) peer.Response{
    if len(args) != 2 {
        return shim.Error("Invalid number of arguments - expecting 2")
    }

    yachtAsBytes, _ := APIstub.GetState(args[0])
    if yachtAsBytes == nil {
        return shim.Error("Can not find yacht record")
    }
    yacht := Yacht{}
    json.Unmarshal(yachtAsBytes, &yacht)
    yacht.SignatureCompany = args[1]
    yacht.Booking = false
    yachtAsBytes, _ = json.Marshal(yacht)
    err := APIstub.PutState(args[0], yachtAsBytes)
    if err != nil {
        return shim.Error("Sign failed.")
    }
    return shim.Success(nil)
}

```

## Signature by Skipper

```
func (s *SmartContract) signskipper(APIstub shim.ChaincodeStubInterface, args []string) peer.Response{
    if len(args) != 2 {
        return shim.Error("Invalid number of arguments - expecting 2")
    }

    yachtAsBytes, _ := APIstub.GetState(args[0])
    if yachtAsBytes == nil {
        return shim.Error("Can not find yacht record")
    }
    yacht := Yacht{}
    json.Unmarshal(yachtAsBytes, &yacht)
    yacht.SignatureSkipper = args[1]
    yachtAsBytes, _ = json.Marshal(yacht)
    err := APIstub.PutState(args[0], yachtAsBytes)
    if err != nil {
        return shim.Error("Sign failed.")
    }
    return shim.Success(nil)
}
```