



ChronoLedger

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Blockchain Project Team 3
IBM i.am.vitalize Programme
Cyber Security 1002
30 June 2021

Agenda

- Background
- Business Problems
- Blockchain Use Case
 - Why Blockchain fits into the solution
 - Current Business Network
 - Assets
- Discover and Envision using EDT
 - Personas and Empathy Maps
 - As-Is Scenario and Pain Points
 - Ideas and Prioritization
 - Storyboarding and Hills
 - MVP and Agile development roadmap
- System Design
 - Blockchain Modeling
 - Blockchain Solution Architecture
 - Transaction Flow
 - MVP System Architecture
 - System Development and Deployment
- System Demo



Background

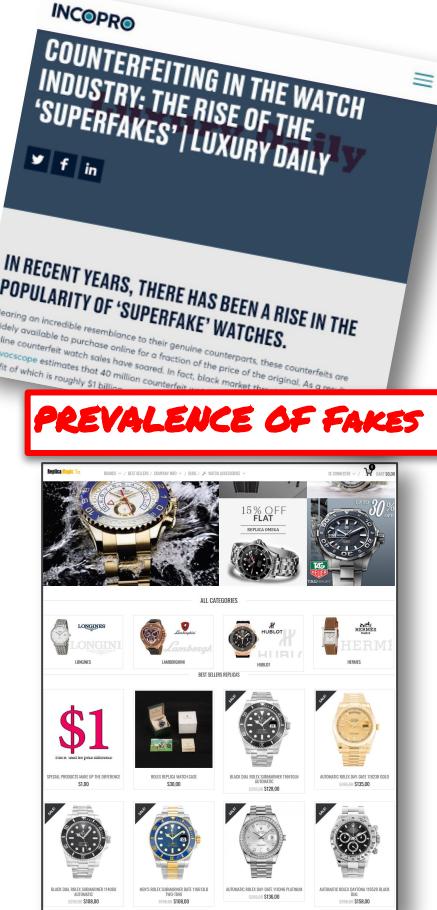
INCOPRO

COUNTERFEITING IN THE WATCH INDUSTRY: THE RISE OF THE 'SUPERFAKES' / LUXURY DAILY

IN RECENT YEARS, THERE HAS BEEN A RISE IN THE POPULARITY OF 'SUPERFAKE' WATCHES.

Bearing an incredible resemblance to their genuine counterparts, these counterfeits are widely available to purchase online for a fraction of the price of the original. As a result, online counterfeit watch sales have soared. In fact, black market online counterfeiting estimates that 40 million counterfeits are sold each year, profit of which is roughly \$1 billion.

PREVALENCE OF FAKES



The valuer at the pawnshop, Mr Chan Kam Wan, appraised the watch, erroneously assessed it to be a genuine watch, and quoted Lee a S\$10,000 offer, which he accepted.”

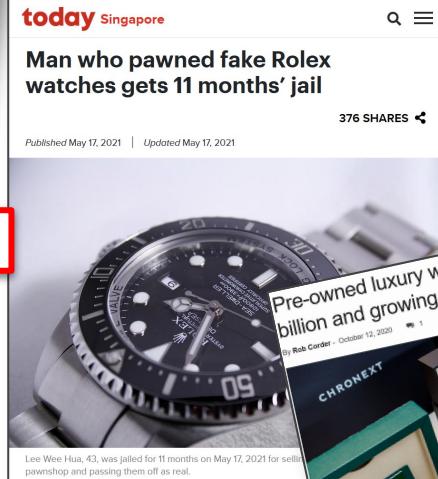
today Singapore

Man who pawned fake Rolex watches gets 11 months' jail

Published May 17, 2021 | Updated May 17, 2021

376 SHARES

Lee Wee Hua, 43, was jailed for 11 months on May 17, 2021 for selling fake Rolex watches to a pawnshop and passing them off as real.

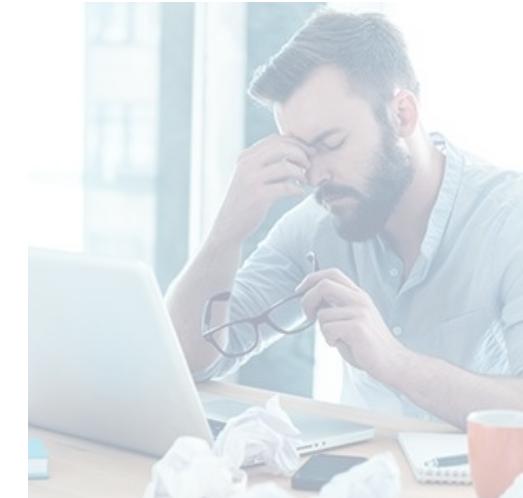



MARKET SIZE + GROWTH



Business Problems 1

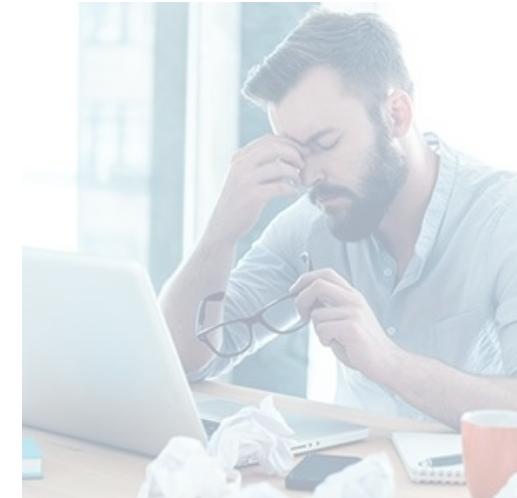
- **400 million fake watches** with an estimated value of US\$1B hit the global market each year making the watch industry as one of the most **susceptible to counterfeit**.
- Emergence of “**Super Fakes**” have made counterfeits trickier to detect, allowing consumers to be more vulnerable to deception, particularly across digital channels.



- Authentication of watches still rely on the **traditional warranty cards and paper certificates** issued by manufacturers, making it a dubious proposition when “Super Fakes” are introduced into the market. Original paper certificates are even available on eBay!
- A good watch lasts for generations. Ownership papers do not last that long or may simply be misplaced. Over time, it also becomes next to **impossible to get documents restored**.

Business Problems 2

- It may be hard to prove ownership when reporting a lost/stolen watch - **you would not remember a serial number!** And you might unknowingly buy a stolen item especially on the secondhand market.



- There is now a need to provide a watch's **digital "identity"** that remains secure and constant even as the watch itself changes hands multiple times.
- A fixed and immutable record should be available for any watch, **safeguarding transactions and devaluing counterfeits.**

Market Trends



TIM BARBER GEAR 18.10.2020 06:00 AM

Blockchain could soon make it impossible to sell a stolen Rolex

The authentication process for watches is archaic, still done using warranty cards and paper certificates. Blockchain will transform the nature of watch ownership

[f](#) [t](#) [e](#)

MONDAY, 26 APRIL 2021

By Christophe Roulet

5 MIN READ

[f](#) [t](#) [e](#)

Watch brands turn to blockchain



As discussed at one of the Watches and Wonders Geneva panels, blockchain technology is making inroads in the watch industry as a means of authentication that also opens up new possibilities for customer relations.

Blockchain: The Next Big Thing For The Luxury Watch Industry?

 **Simon Schneider**
14 April 2021 | 6 min read

[f](#) [t](#) [p](#) [e](#) [+](#)



INVESTMENT

Art and watch collectors: Here's how blockchain can stamp out fakes

RICHARD WHITEHEAD



According to an OECD report on counterfeiting, the world trade in fake goods is worth upwards of \$5624 billion a year. (Art: Jesper Loh)

Blockchain Fit

PROVENANCE

- The history of a luxury watch is retained in the blockchain, and this can be accessed anytime and anywhere.
- Buyers can easily verify whether a watch is new or second hand, based on the recorded date of the first sale.
- Secondhand dealers are able to check if the watch is a STOLEN or LOST piece.
- Instant verification for insurance purposes, resale or pledge, including service history and the date of the first sale, respecting privacy of the owner.

IMMUTABILITY

- Historical transactions in the blockchain remain permanent and unalterable.
- Any wrong transaction can only be reversed with a new transaction
- Furthermore, each block of information like transaction details uses a cryptographic principle or a hash value to keep the data unaltered, safeguarding transactions and devaluing counterfeits.

CONSENSUS

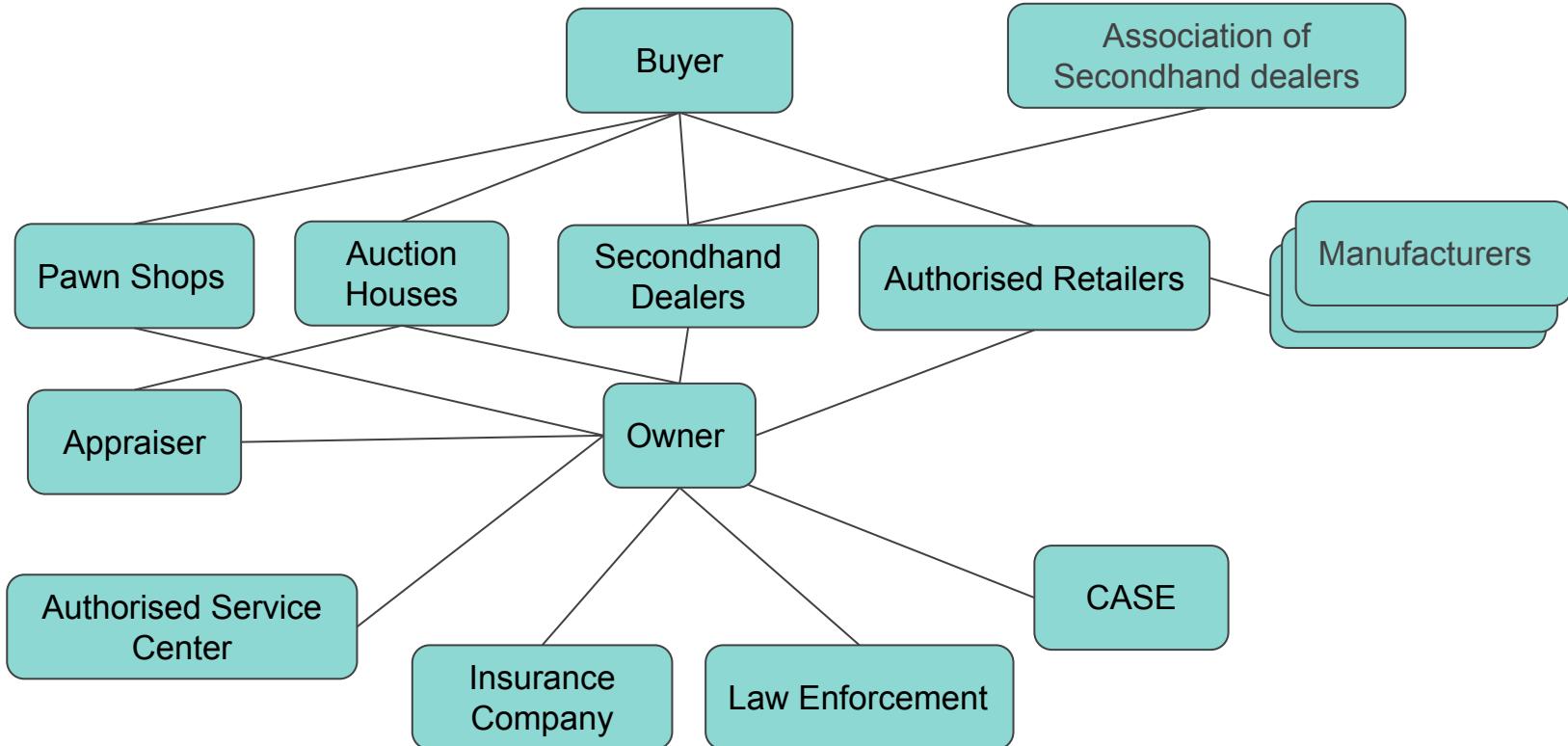
- Any recorded transaction like creating a new watch record or updating ownership, will require consensus among the participants in the blockchain business network. This enhances the important trust factor.

FINALITY

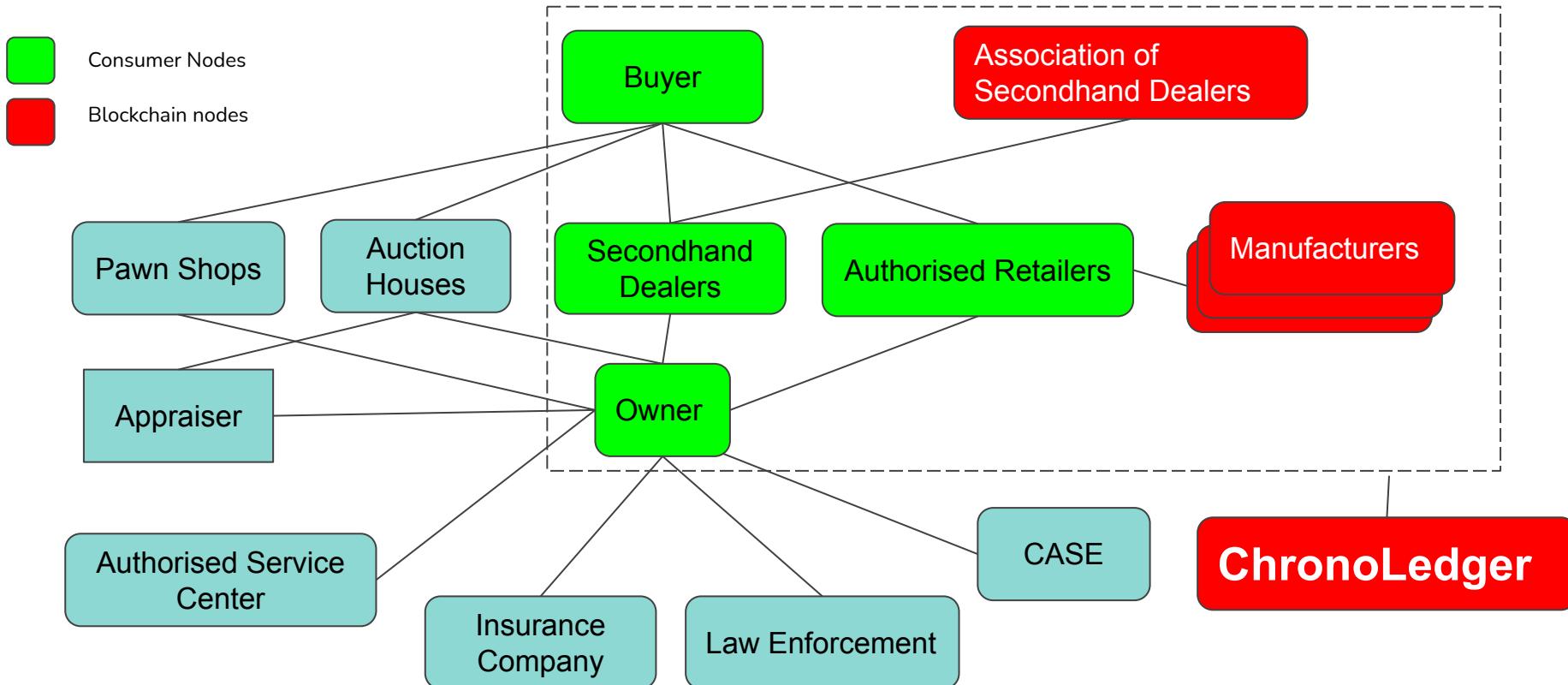
- When the users transact on ChronoLedger, they can be confident that once their transactions go through, these transactions cannot be arbitrarily changed or reversed.
- It is final, irreversible and with the inherent nature of blockchain, immutable.

- Taken together, these four characteristics give member organizations a high degree of trust in the data and the business network.
- With blockchain, as members of a members-only network, they will be assured of receiving accurate and timely data, and that confidential blockchain records will be shared only with network members to whom access has been specifically granted.

Current Business Network

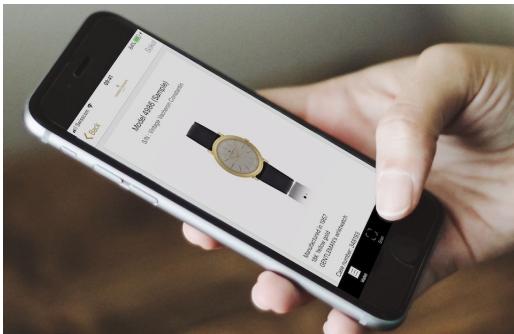


Proposed Blockchain Network



Asset & Trust - Watch's Digital Identity

- This process begins with clients putting their secondhand watches through a detailed checking and authentication process.
- The checks themselves are carried out by authorised service centres and can be validated by independent experts.
- A physical steel card is then provided, bearing a QR code linked to a digital certificate secured in the blockchain.
- It becomes a passport for a luxury watch, which can be viewed via a phone app.



- If you lose your card, you can claim your digital passport by a manual identification step with the dealer/retailer.

Assets

Digital Certificates to be issued for secondhand watches.



Secondhand Watch



Warranty Card or Paper

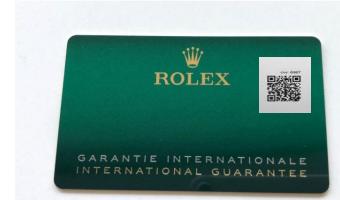


Digital Certificate

We will work with manufacturers to have warranty cards with Digital Certificates to be issued for new watches.



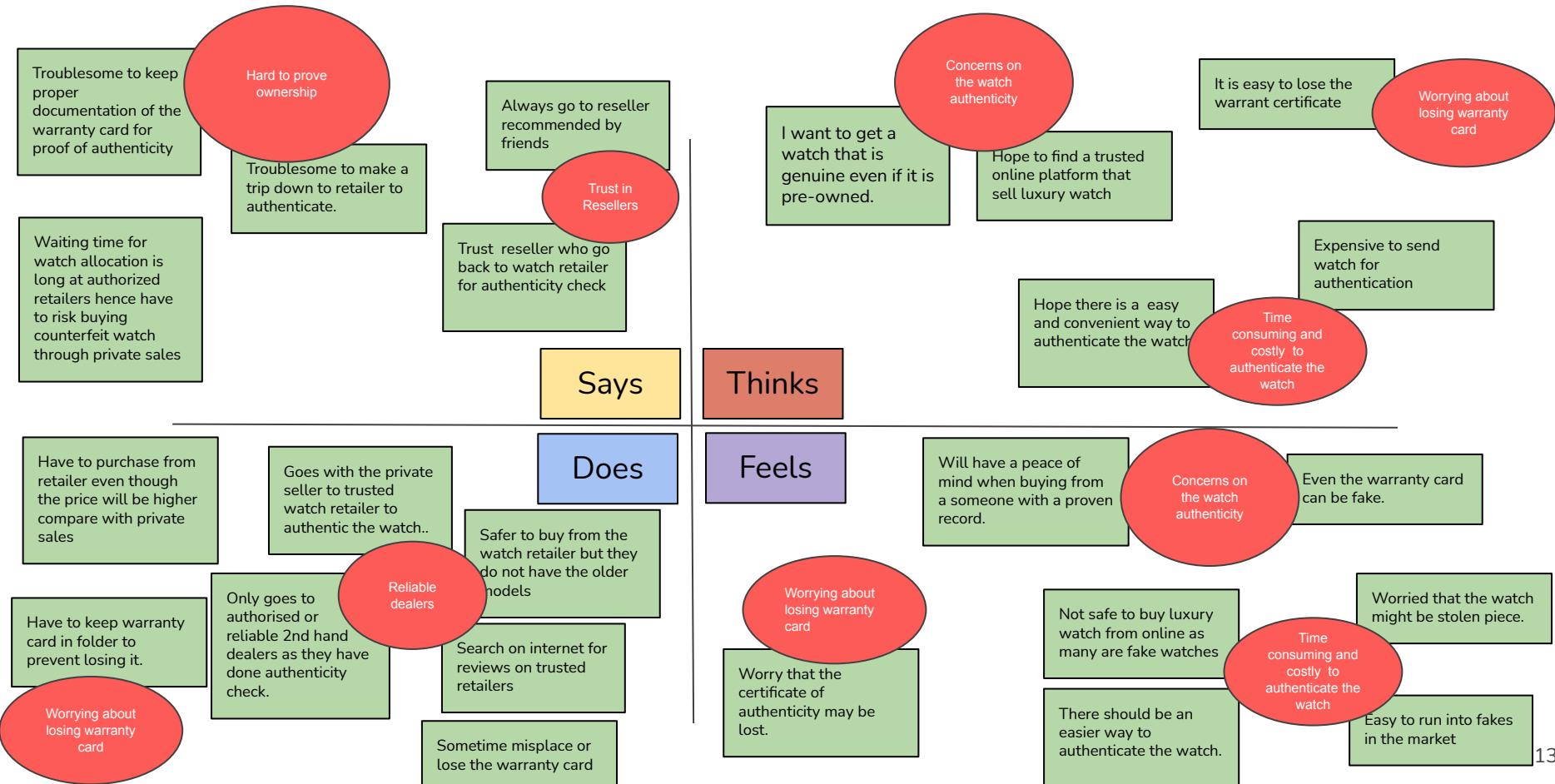
New Watch



Warranty card with Digital Certificate

Discover and Envision using Enterprise Design Thinking

Empathy Map - Buyer/Owner





| | |
|--------------------|----------------|
| Name | Richard |
| <hr/> | |
| Age | 56 years old |
| Location | Singapore |
| Education | University |
| Job | Senior Manager |
| Family | 4 |
| Work experience | 30 years |
| Technical literacy | Intermediate |

Motivations

- Avoid buying fake or stolen watches
- Hassle free shopping
- Peace of mind

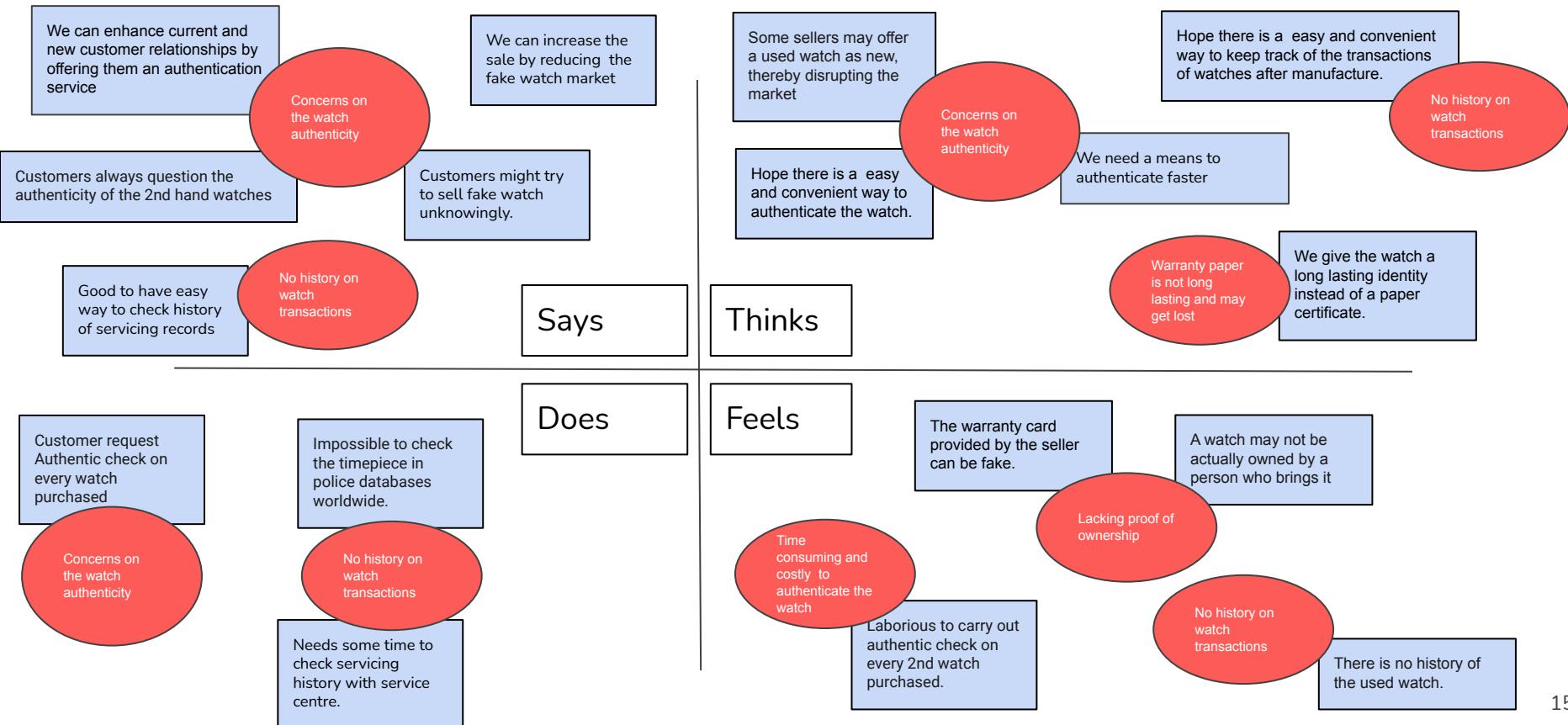
Goals

- Authentic watch at my fingertip
- Do not need to carry paper documents to prove authenticity
- Always have access to the latest status of my collection.

Needs

- Readily available record to verify the authenticity of the watch
- Secured digital certificate

Empathy Map - 2nd hand dealers / Retailer / Manufacturer



**Name**

John

Bio

Age

50

Location

Singapore

Education

University

Job

Second hand Luxury
Watch dealer

Family

Single

Work experience 30 years

Technical literacy Intermediate

Motivations

- Increase sale by increasing customer confidence on the authenticity of a watch
- Track the sale of watch in second market
- Improve Customer Relationship
- Avoid trading of fake watches

Goals

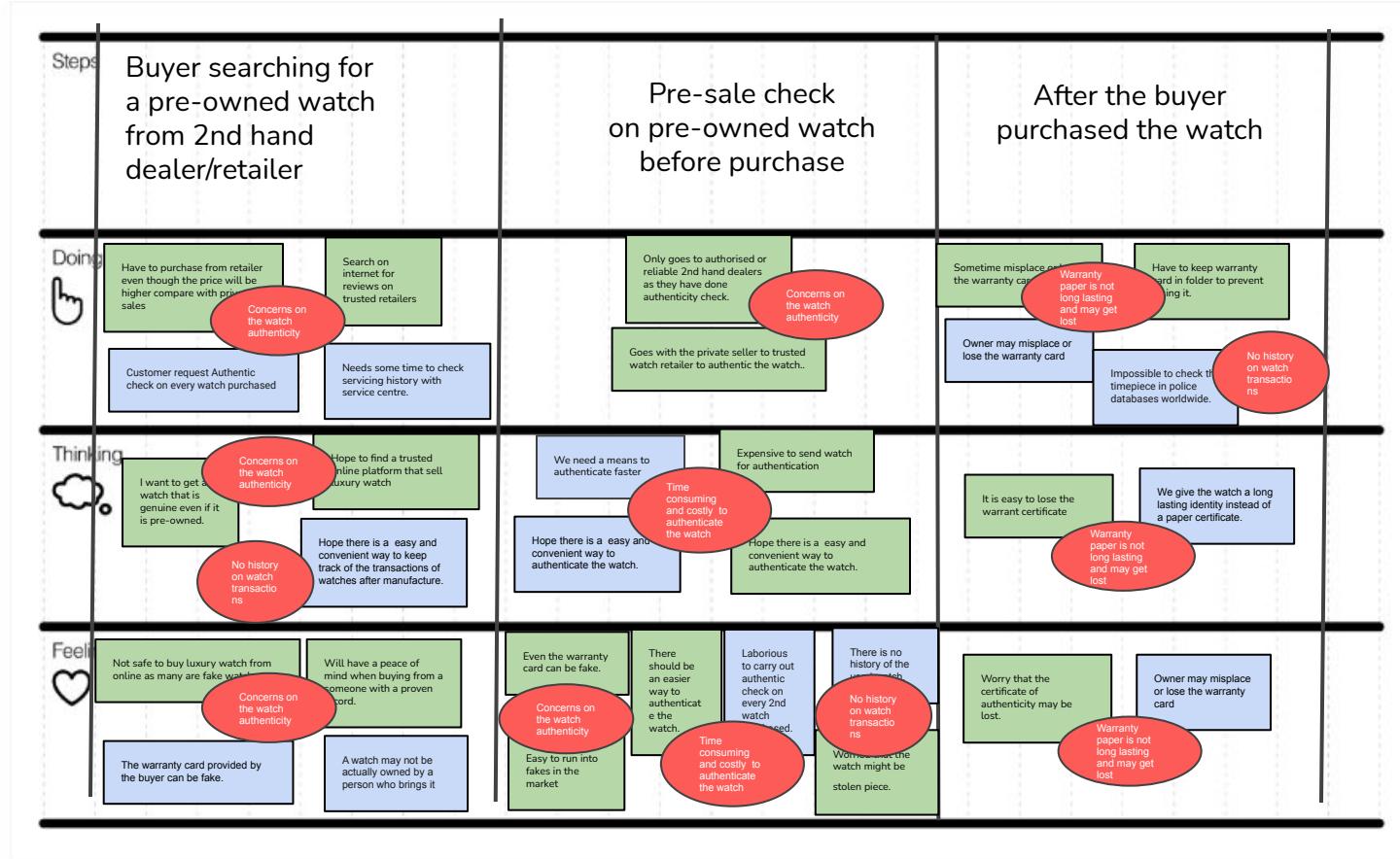
- Maintain the history of watch transactions to verify the authenticity of the watch
- Instant verification of the watch and the owner.

Needs

- Readily available record to verify the authenticity of the watch
- Solution to avoid dispute regarding the authenticity of the watch.

As-is scenario

Buyer / Owner
 2nd hand dealers / Retailer / Manufacturer



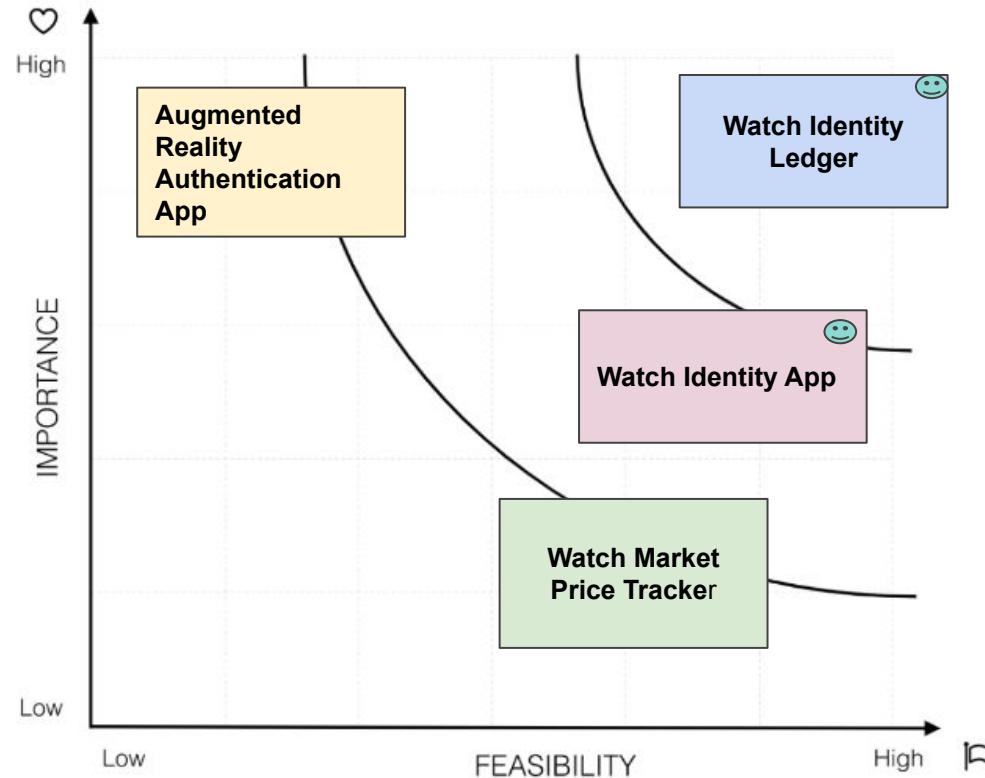
Pain Points

Key Findings

- 1) The counterfeit market continues to grow and it affects the sale of watch.
- 2) Consumers are more vulnerable to deception as the emergence of “Super Fakes” have made them trickier to detect.
- 3) Hard to prove ownership and report a lost watch if you lose the warranty papers.
- 4) Warranty papers
 - Do not last that long and impossible to get documents restored.
 - Easily misplace them
- 5) Time consuming and costly to authenticate the watch



Big Ideas & Prioritization



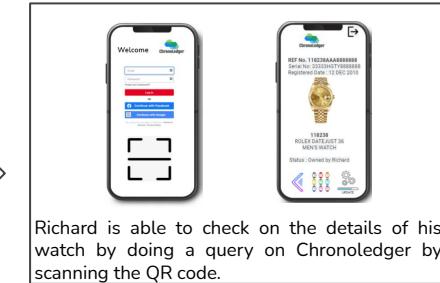
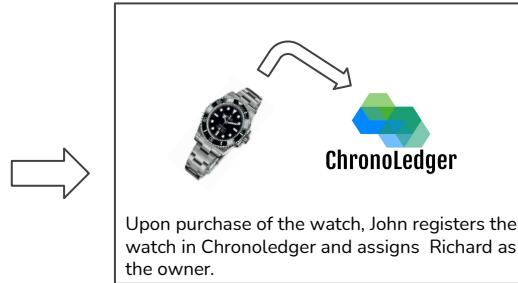
| Who | What | Wow |
|--|---|--|
| Specific user | Specific enablement  | Specific market value/differentiation  |
| A Luxury Watch Collector (who can buy new or used) | Can check authenticity, registration, history of a watch through a trusted network | So that the luxury watch collector has 100% assurance that his purchase is authentic. |
| A Luxury Watch Manufacturer/Retailer/2nd Hand Dealer | Can maintain a history of luxury watch transactions in a trusted network | So that they have a readily available record for purposes of authentication check, servicing, and avoidance of disputes |

How Might We



How might we allow owners and dealers
to authenticate luxury watches
with 100% confidence and conveniently?

Story Boarding





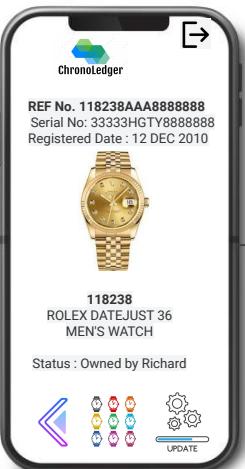
Minimum Viable Product Prototype

Login



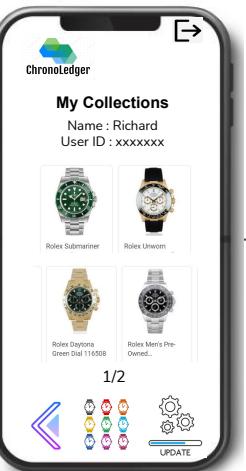
Scan QR code on the Digital Certificate Card

Watch Information



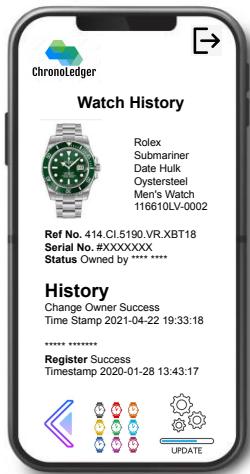
Able to access "My collections" only if the owner log in

My Collections



Click on the image of any watch to access watch history

Report Stolen Watch

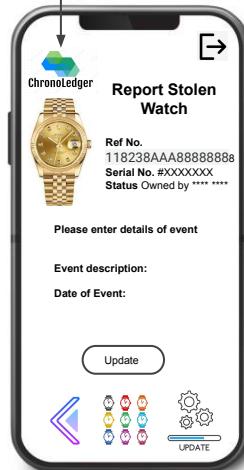


Back

My Collections

Update Status

Transfer Ownership



Please enter details of event

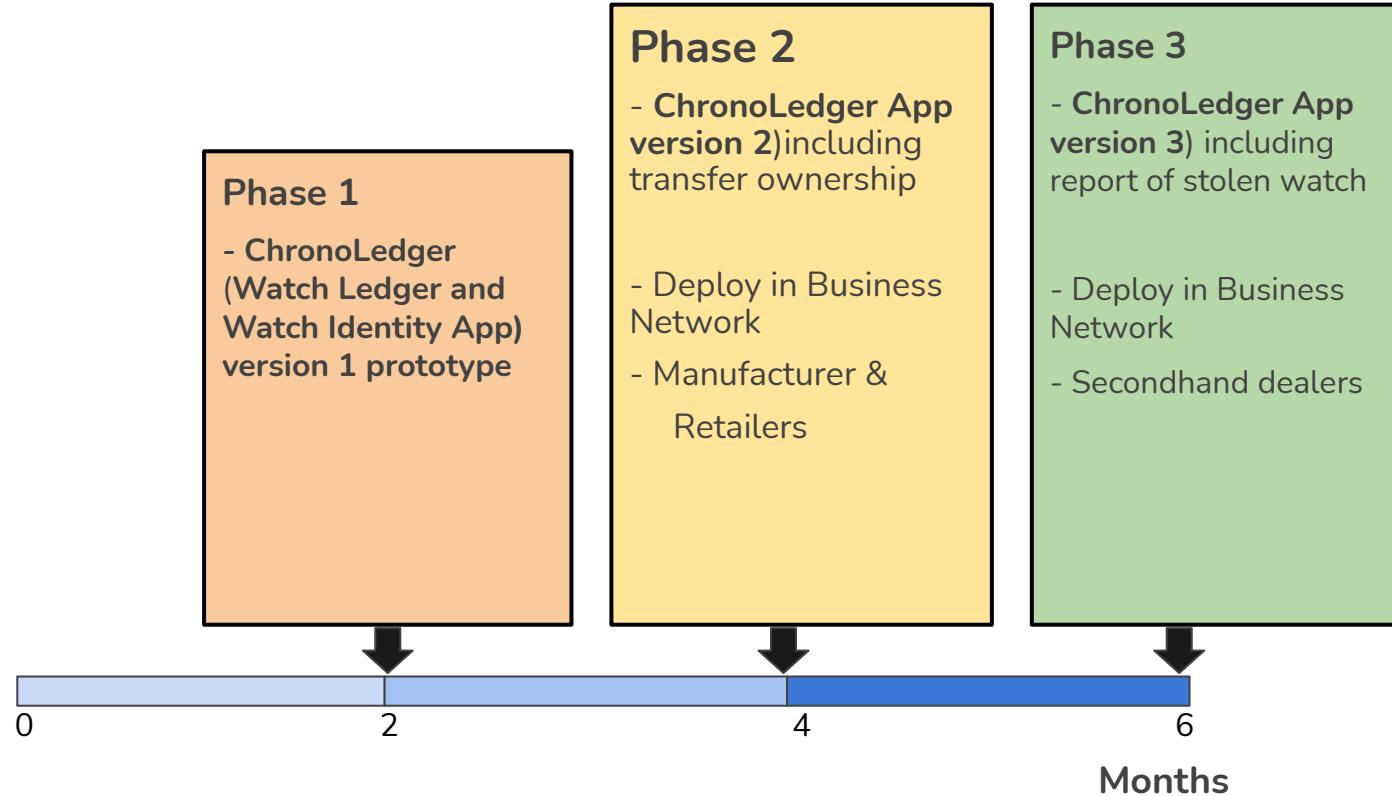
Event description:

Date of Event:

Update



MVP roadmap and Agile Development Approach



Future Chronoledger Roadmap

Future 1

- Integrating with the online Luxury Watch Market Platform

Deploy in Business Network

- Pawn Shop
- Auction House
- Service Centre

Future 2

- Integrating with Manufacturer Market Analysis System

Deploy in Business Network

- Insurance Company
- Law enforcement

System Design

Modeling of Blockchain Solution

Attributes

- | | |
|----------------------|-------------------|
| 1) Brand | 6) Certified by |
| 2) Model | 7) Certified Date |
| 3) Serial no | 8) Owner |
| 4) Purchase Date | 9) Ownership Date |
| 5) Authorised Dealer | 10) Status |
| | 11) Status Date |

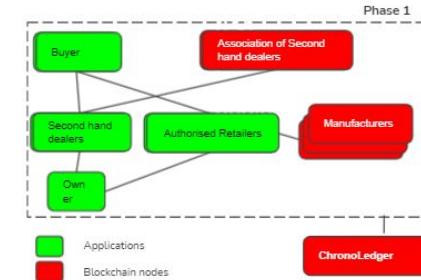


Participants

- 1) Buyer/Owner
- 2) Association of second hand dealers and its dealers
- 3) Manufacturer and its retailers

Transactions

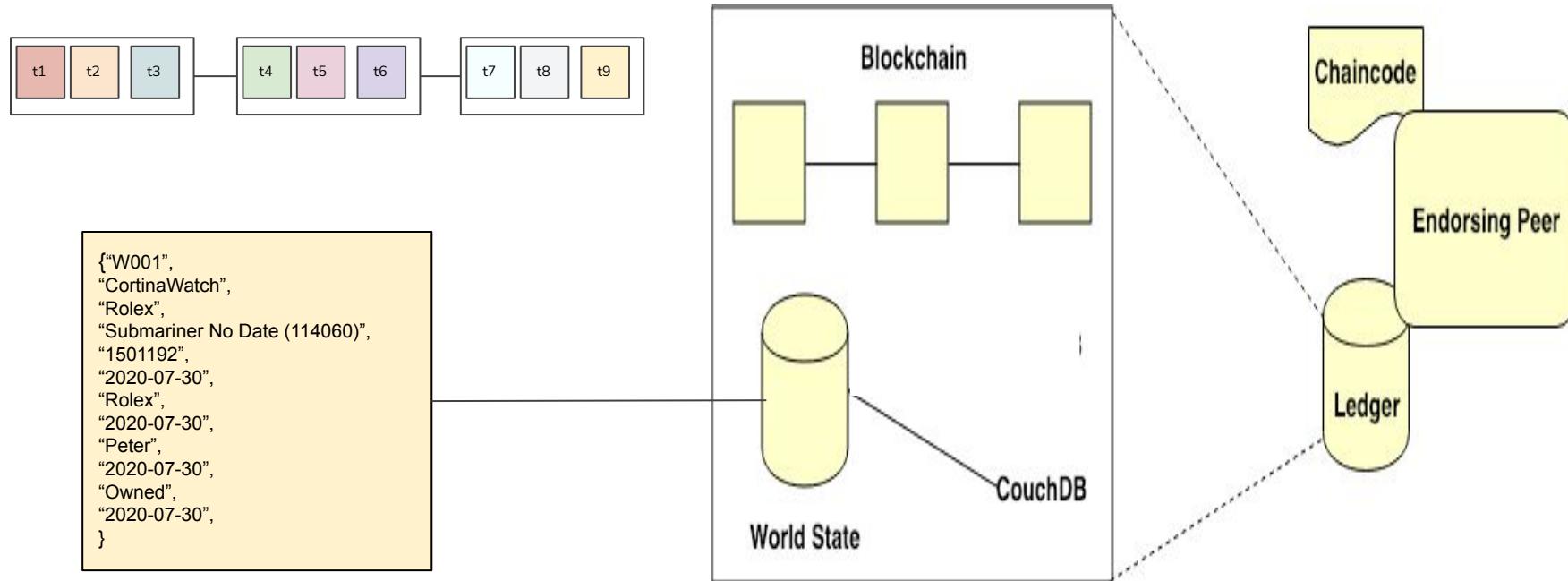
- 1) RegisterMyWatch
- 2) UpdateMyWatchOwner
- 3) UpdateMyWatchStatus
- 4) MyWatchExists
- 5) ReadMyWatch
- 6) ReadAllMyWatch
- 7) ReadMyWatchHistory



Modeling of Blockchain Solution - Assets

| PHYSICAL ASSETS | ATTRIBUTES | MODEL DEFINITION | INSTANCES | WORLD STATE |
|--|---|--|--|---|
|  <p>The Rolex warranty cards, starting in 2020 have included the following:</p> <ul style="list-style-type: none"> • Name of the authorized retailer (pre-printed by Rolex) • Date of sale • Reference number (model number) • Serial number | <p>Authorized Dealer: Cortina Watch Brand: Rolex Model: Rolex Submariner No Date (114060) Serial Number: 1501192 Purchase Date: 2020-07-30 Certified by: Rolex Certified date: 2020-07-30 Owner: Peter Ownership date: 2020-07-30 Status: Owned Status Date: 2020-07-30</p> | <pre>“MyWatch” : { “ID” : “string”, “AuthDealer” : “string”, “Brand” : “string”, “Model” : “string”, “SNo” : “string”, “PurDate”: “date”, “CertifiedBy” : “string”, “CertifiedDate” : “string”, “Owner”: “string”, “OwnershipDate”: “date” “Status”: “string”, “StatusDate” : “date” }</pre> | <pre>{"“W001”, “CortinaWatch”, “Rolex”, “Submariner No Date (114060)”, “1501192”, “2020-07-30”, “Rolex”, “2020-07-30”, “Peter”, “2020-07-30” “Owned”, “2020-07-30”, }</pre> | <pre>{"“W001”, “CortinaWatch”, “Rolex”, “Submariner No Date (114060)”, “1501192”, “2020-07-30”, “Rolex”, “2020-07-30”, “Peter”, “2020-07-30”, “Owned”, “2020-07-30”, }</pre> |

Modeling of Blockchain Solution



Modeling of Blockchain Solution - Contracts (Read Only Transactions)

MyWatchExists

INPUT: WatchID

OUTPUT: Boolean (TRUE OR FALSE)

DESIGN: Check the existence of the WatchID by reading the world state using the ***getstate method*** in Hyperledger Fabric SDK

ReadMyWatch

INPUT: WatchID

OUTPUT: Watch details

DESIGN: If WatchID exists, read the details of the WatchID in the world state using the ***getstate method*** in Hyperledger Fabric SDK

ReadAllMyWatch

INPUT: Owner

OUTPUT: List of watch owned by Owner

DESIGN: Read the details of all the watches of Owner in the world state using the ***getStateByRange method*** in Hyperledger Fabric SDK

ReadMyWatchHistory

INPUT: WatchID

OUTPUT: Watch History details of WatchID

DESIGN: If WatchID exists, read the history of the WatchID in the Ledger using the ***getHistoryForKey method*** in Hyperledger Fabric SDK

Modeling of Blockchain Solution - Contracts (Read and write Transactions)

RegisterMyWatch

INPUT: WATCHID,
AuthDealer, Brand, Model,
SNo, PurDate, CertifiedBy,
CertifiedDate,
Owner, OwnershipDate,
Status, StatusDate

OUTPUT: None

DESIGN: Once registered, a new watch entry will be created and the Ledger will be updated accordingly using the ***putstate method*** in Hyperledger Fabric SDK to update Ledger.

UpdateMyWatchStatus

INPUT: WATCHID, NewStatus,
NewStatusDate

OUTPUT: None

DESIGN: If WatchID exists, the Ledger will be updated with the NewStatus and NewStatusDate using the ***putstate method*** in Hyperledger Fabric SDK to update the Ledger.

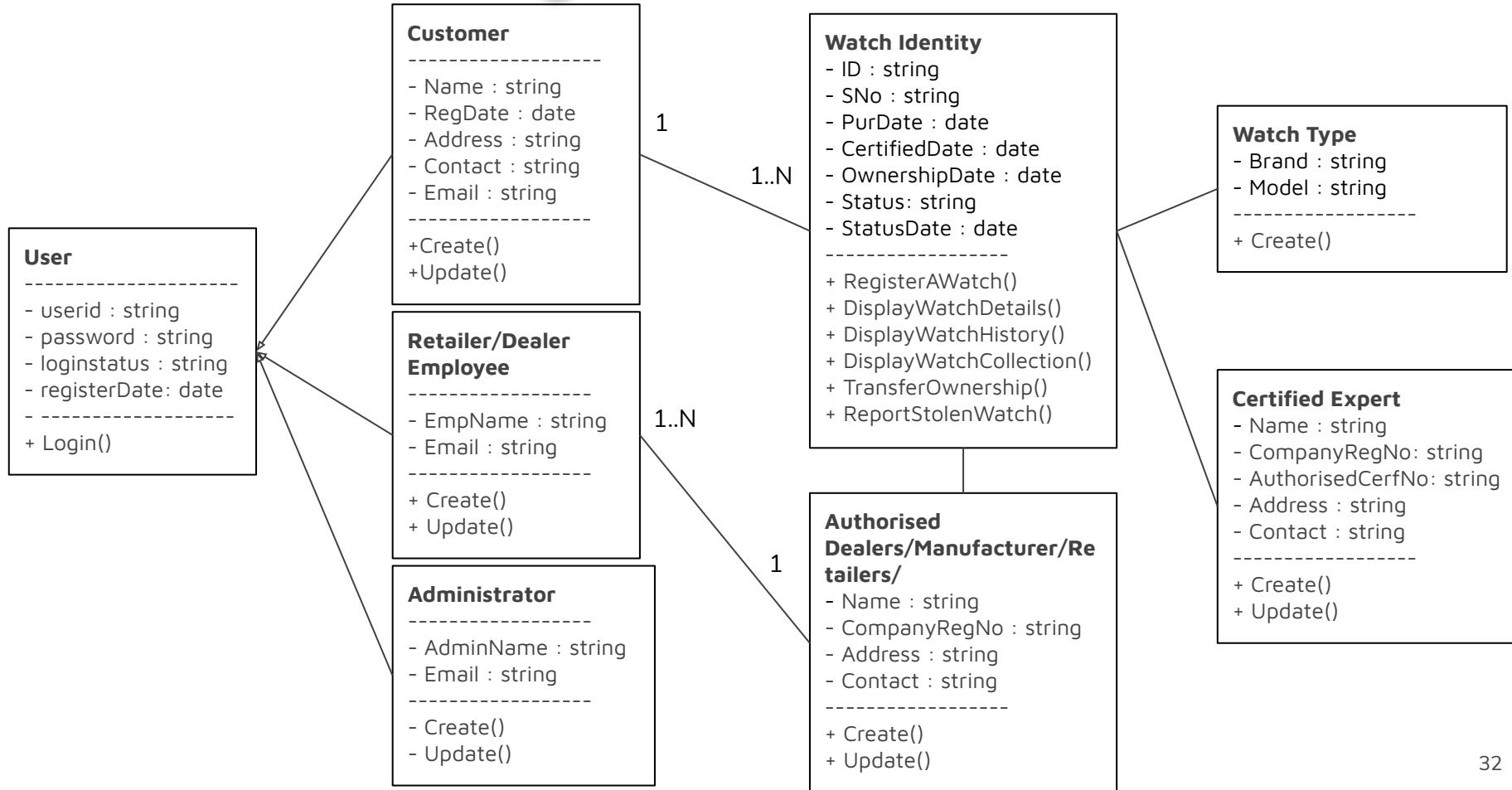
UpdateMyWatchOwner

INPUT: ID, NewOwner
NewDate

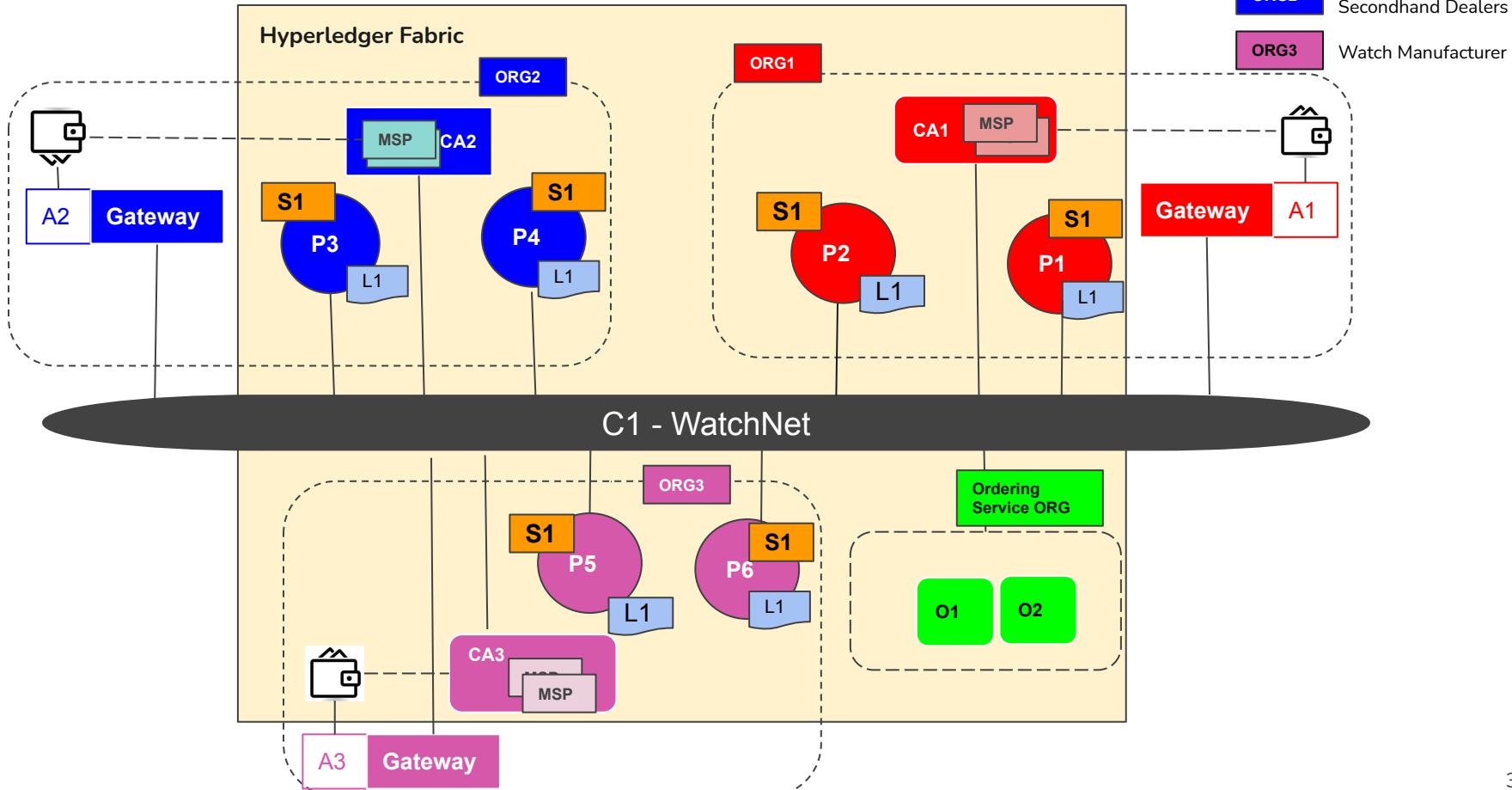
OUTPUT: None

DESIGN: If WatchID exists, the Ledger will be updated with the NewOwner and New OwnershipDate using the ***putstate method*** in Hyperledger Fabric SDK to update the Ledger.

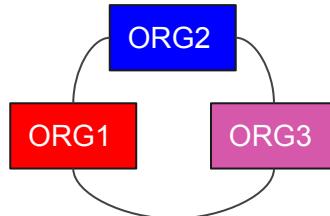
UML Class Diagram for MVP



Blockchain Solution Architecture

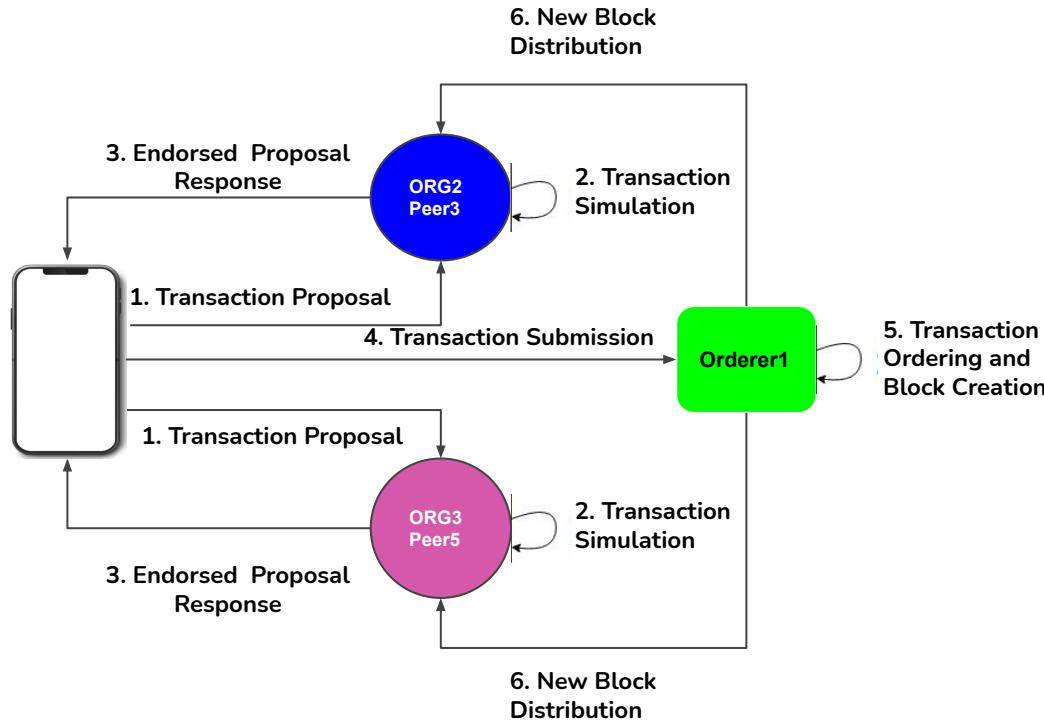


Endorsed transactions in the blockchain Flow

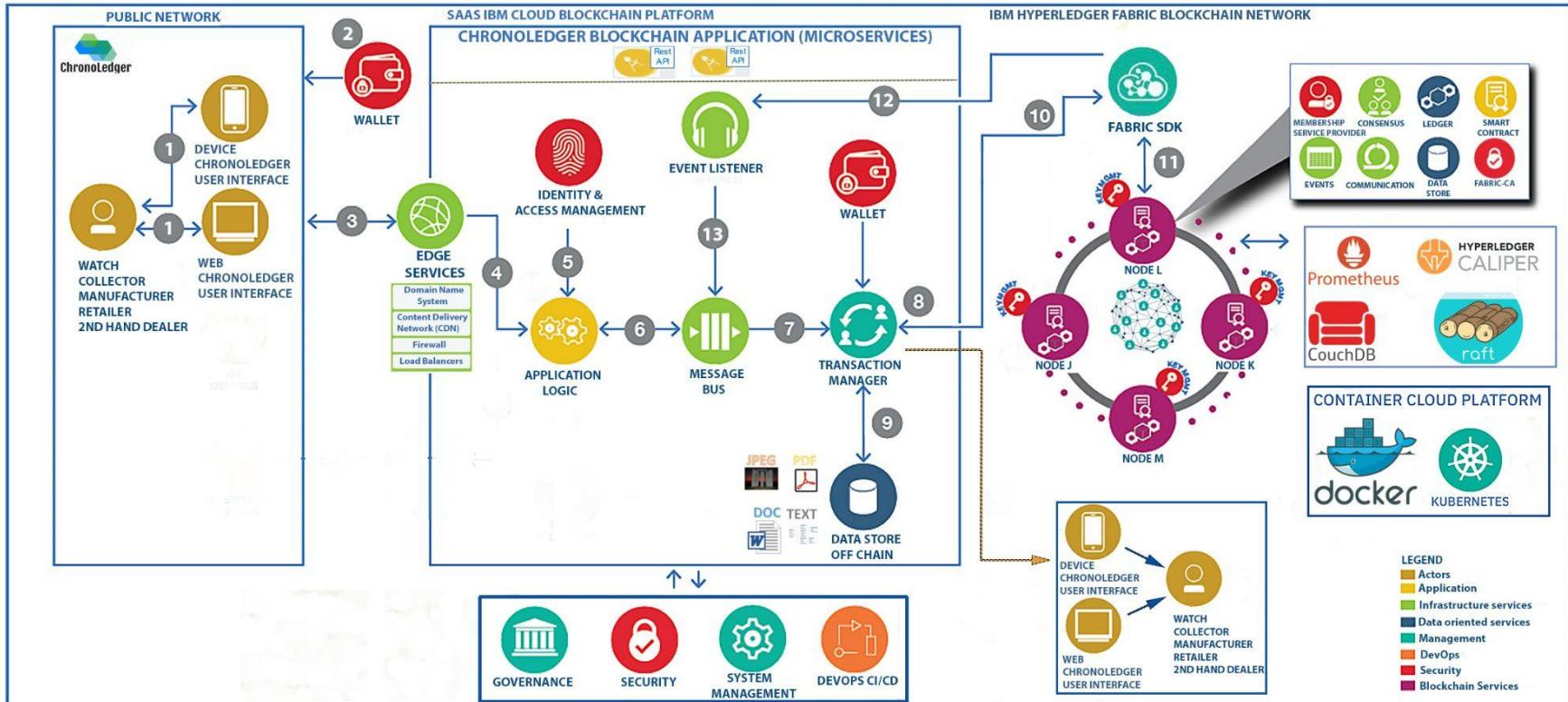


| | Transaction | Initiator | Receiver | Asset | Invoked TX | Invoked by | Endorsed |
|---|---------------------|-----------|----------|-------|--------------------------------|------------|------------|
| 1 | RegisterMyWatch | ORG2 | | W001 | RegisterMyWatch(W001, ORG2) | ORG2 | ORG1, ORG3 |
| 2 | UpdateMywatchOwner | ORG2 | ORG3 | W001 | UpdateMyWatchOwner(W001, ORG3) | ORG2 | ORG1, ORG3 |
| 3 | UpdateMyWatchStatus | ORG1 | | W002 | UpdateMyWatchStatus(W002) | ORG1 | ORG2, ORG3 |

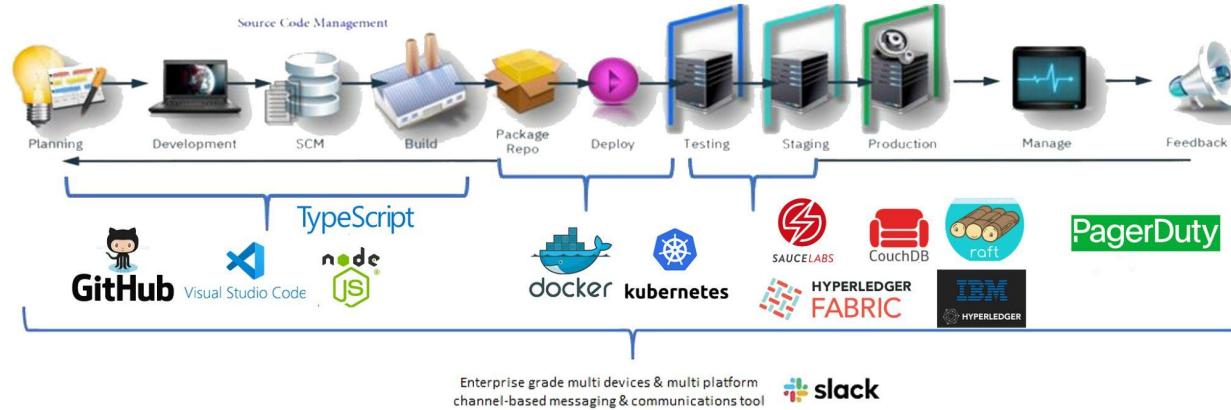
Transaction Invocation Workflow



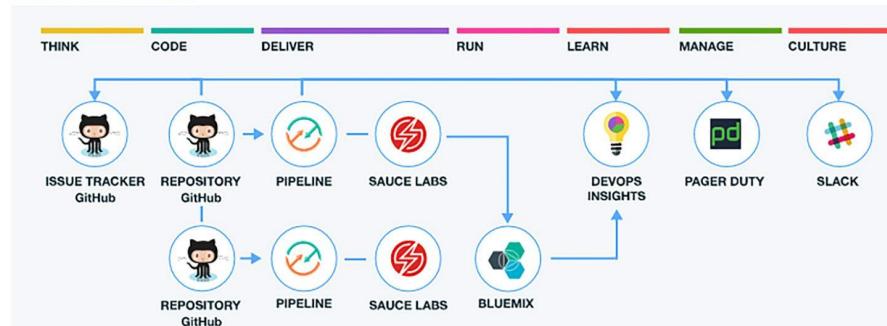
MVP System Architecture



Continuous Integration and Deployment

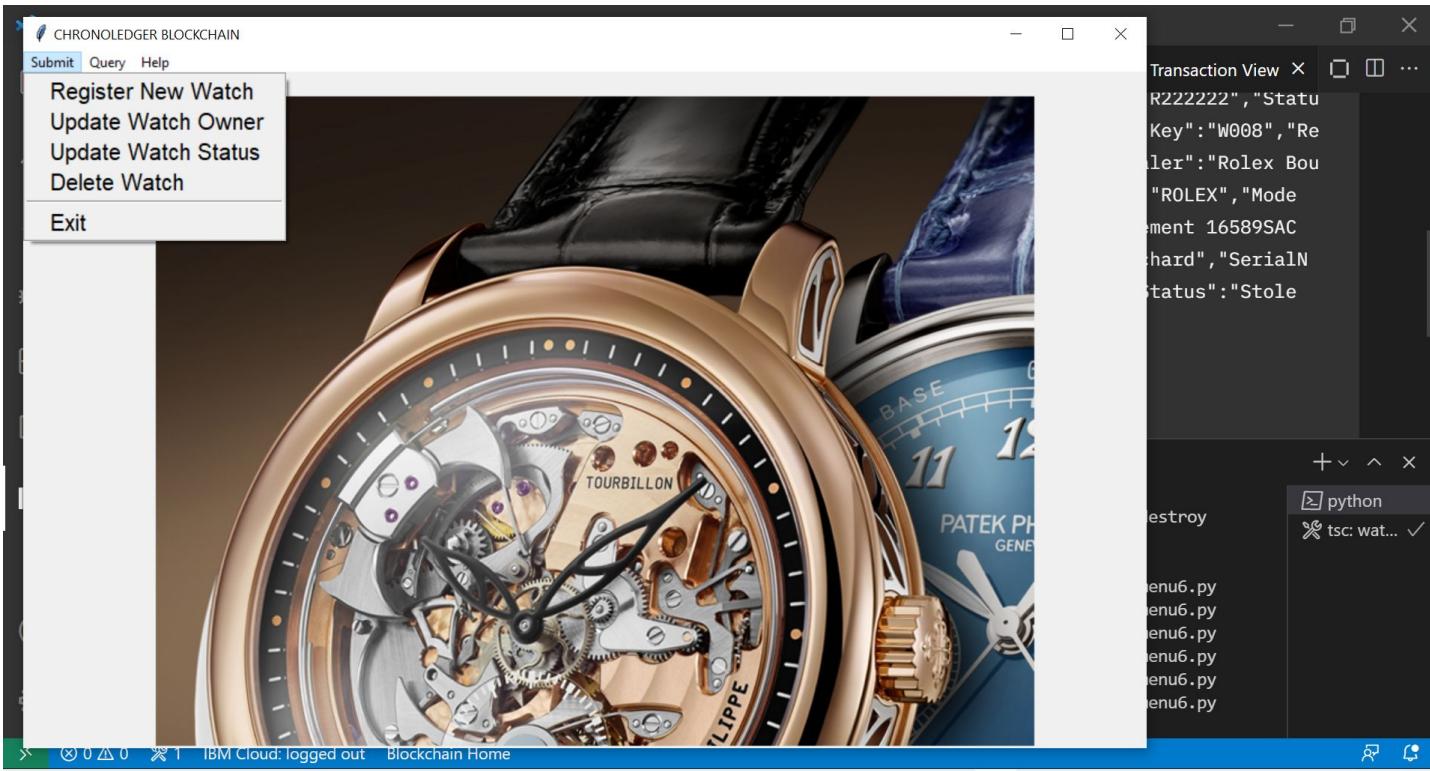


IBM TOOLCHAIN

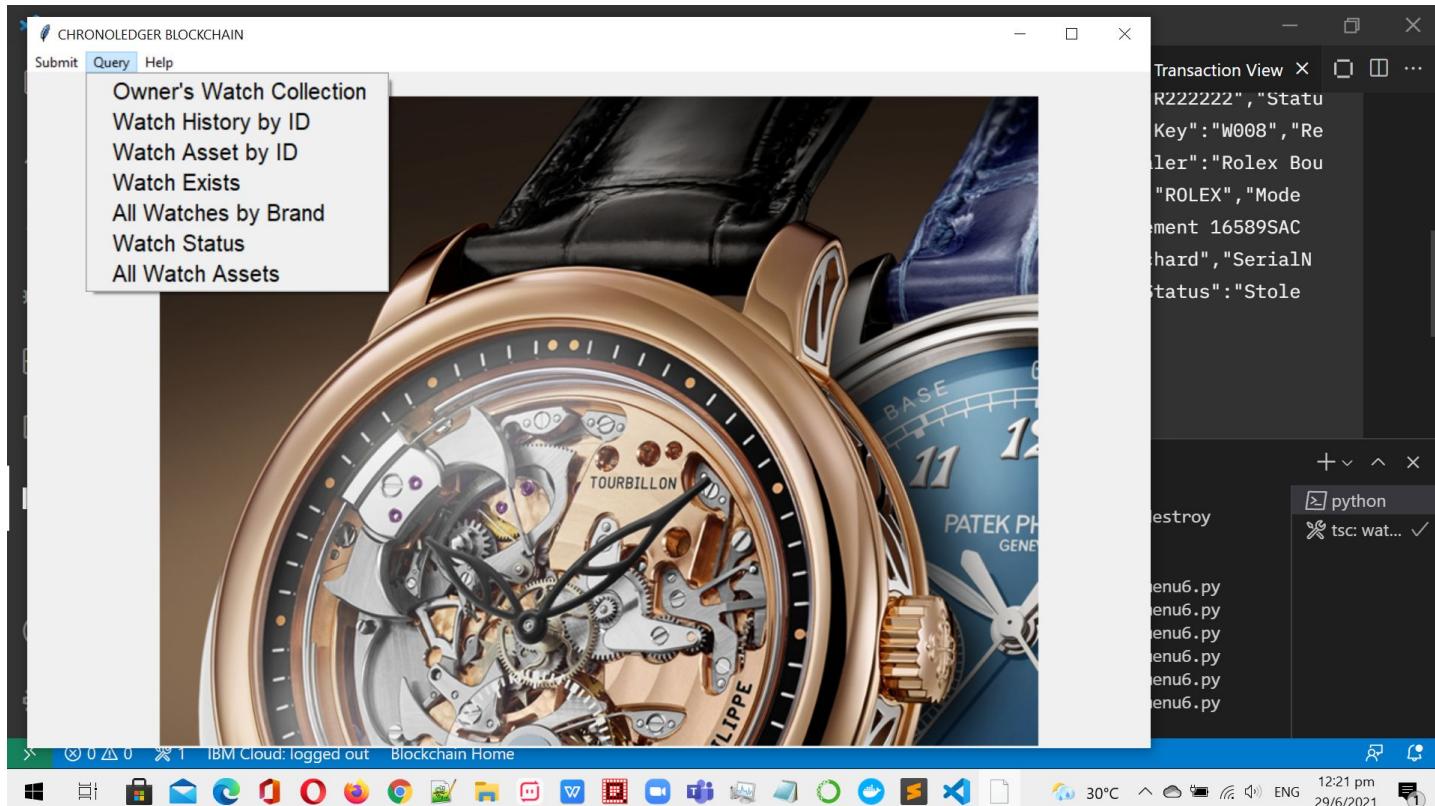


Working Prototype Within The Local Machine

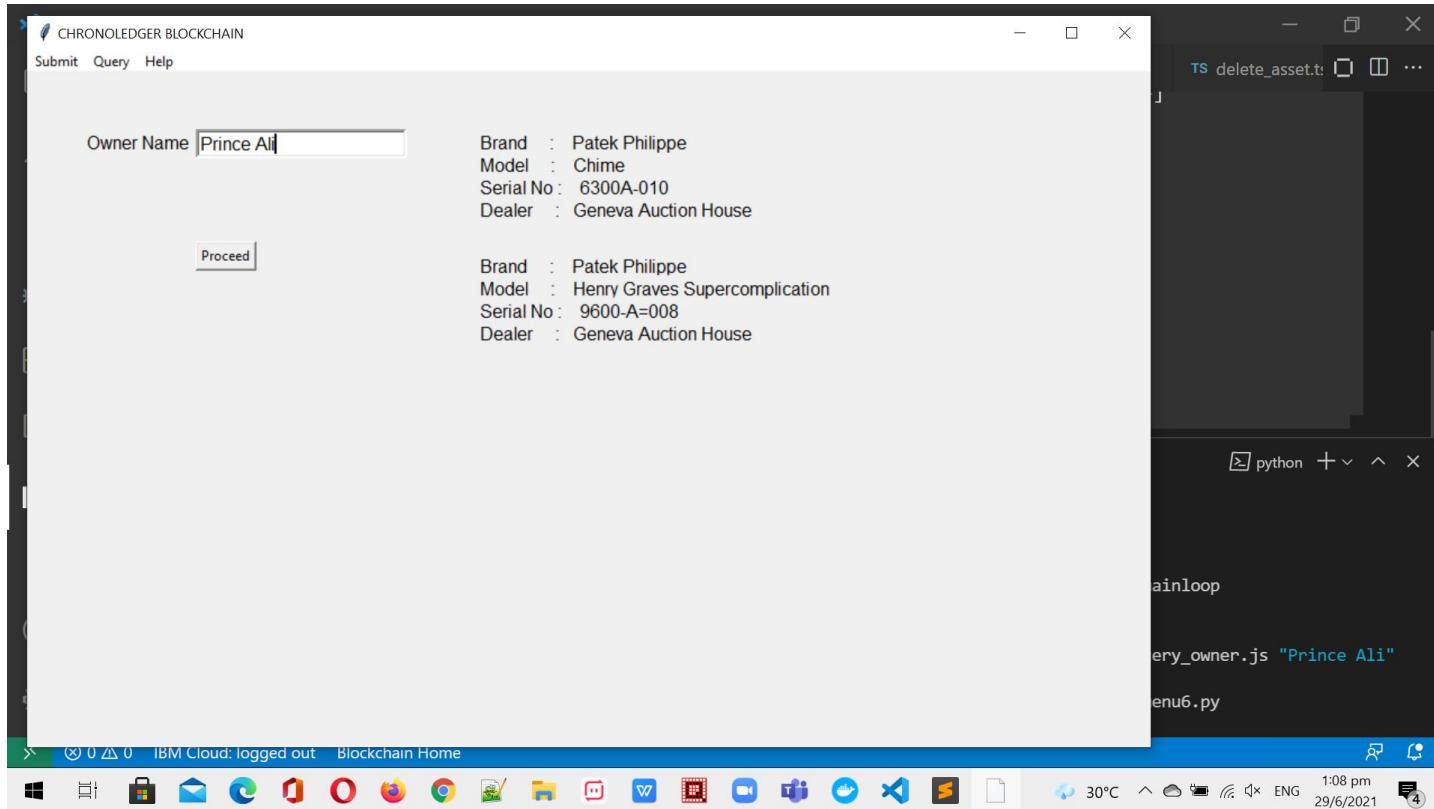
CHRONOLEDGER Web Application



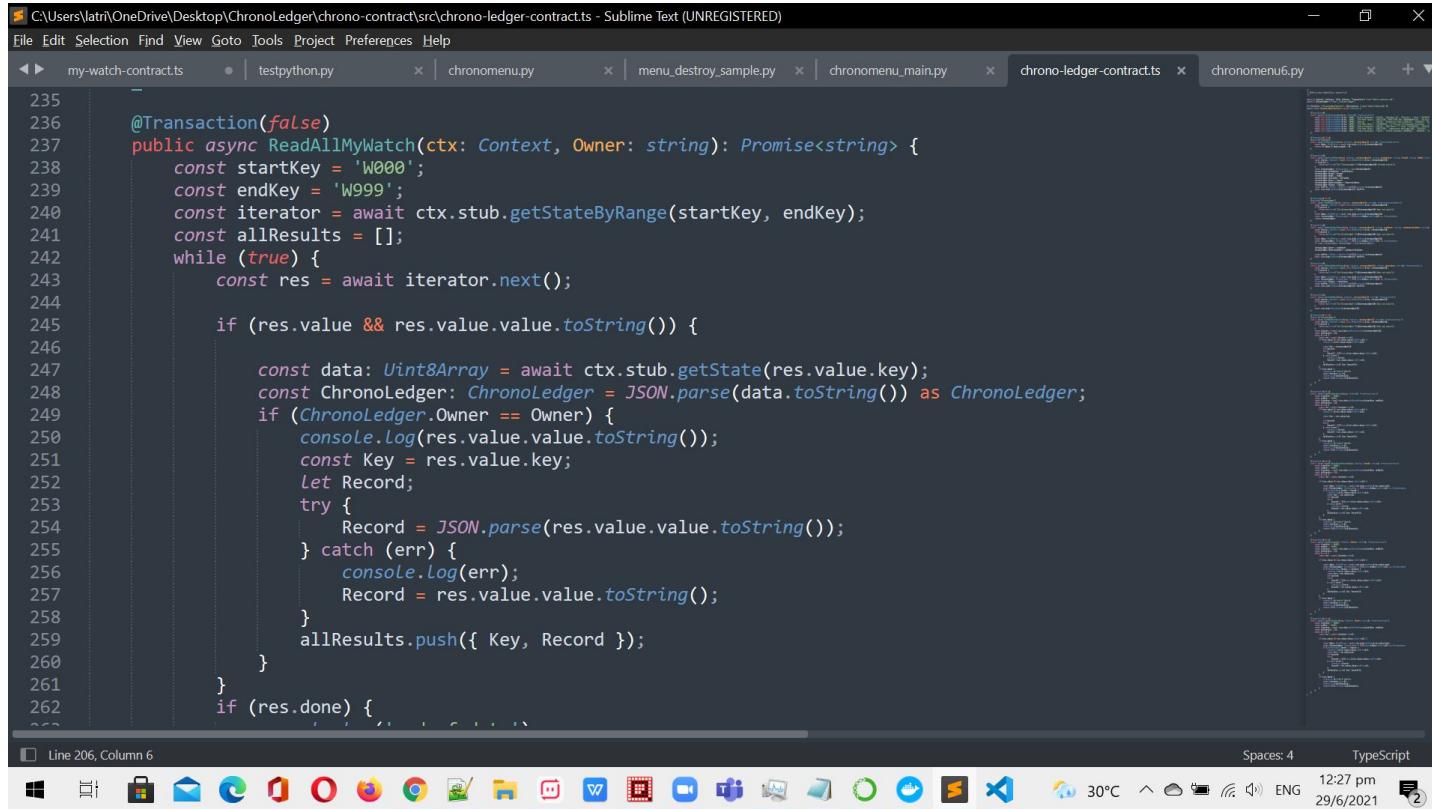
Working Prototype Within The Local Machine



Working Prototype Within The Local Machine



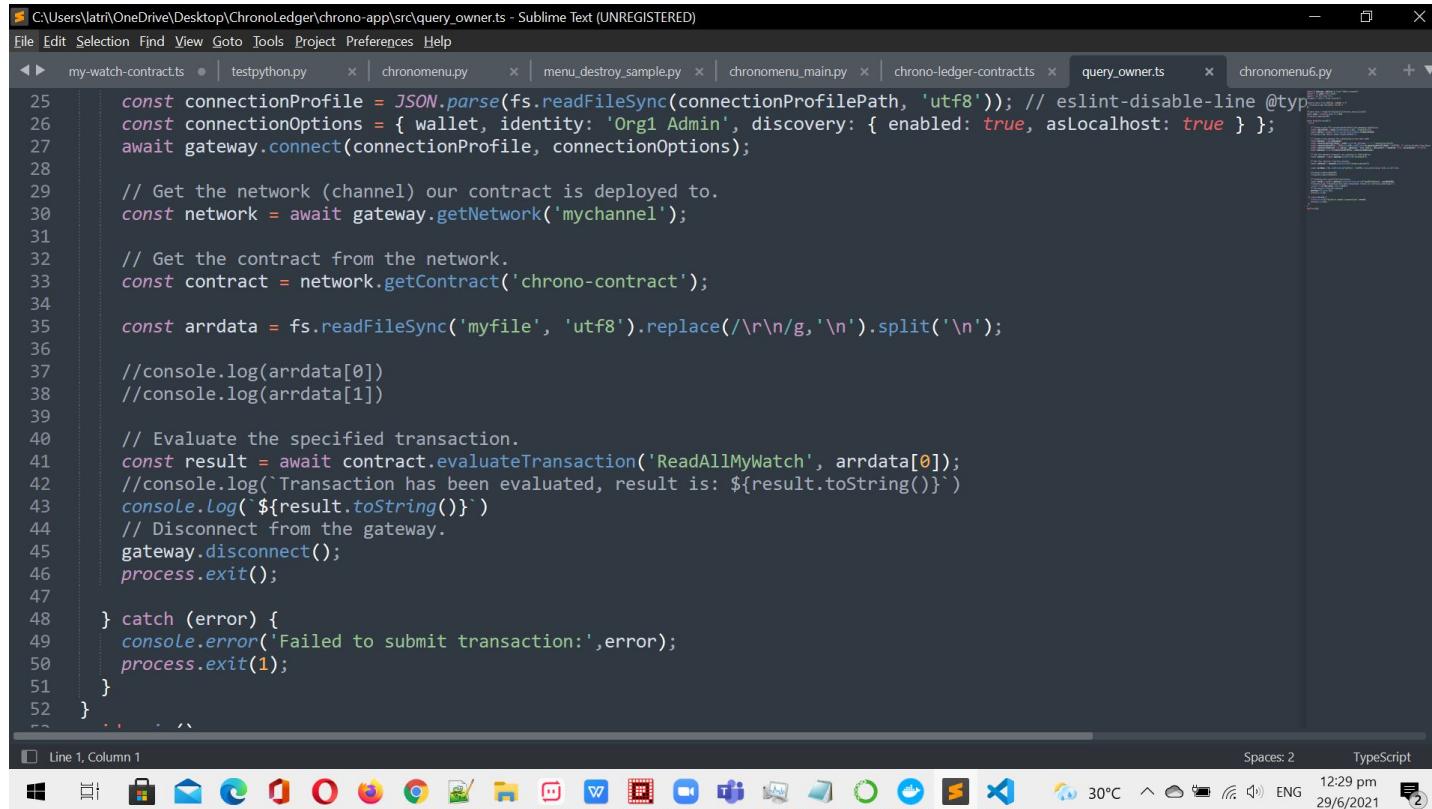
Working Prototype Within The Local Machine



The screenshot shows a Sublime Text window with multiple tabs open. The active tab contains TypeScript code for a ChronoLedger contract named `my-watch-contract.ts`. The code defines a transaction function `ReadAllMyWatch` that iterates over a range of keys from 'W000' to 'W999', parses the results as ChronoLedger objects, and logs them to the console. The Sublime Text interface includes a status bar at the bottom showing file information like "Line 206, Column 6", "Spaces: 4", and "TypeScript". The taskbar at the bottom of the screen displays icons for various Windows applications.

```
235
236     @Transaction(false)
237     public async ReadAllMyWatch(ctx: Context, Owner: string): Promise<string> {
238         const startKey = 'W000';
239         const endKey = 'W999';
240         const iterator = await ctx.stub.getStateByRange(startKey, endKey);
241         const allResults = [];
242         while (true) {
243             const res = await iterator.next();
244
245             if (res.value && res.value.value.toString()) {
246
247                 const data: Uint8Array = await ctx.stub.getState(res.value.key);
248                 const ChronoLedger: ChronoLedger = JSON.parse(data.toString()) as ChronoLedger;
249                 if (ChronoLedger.Owner == Owner) {
250                     console.log(res.value.value.toString());
251                     const Key = res.value.key;
252                     let Record;
253                     try {
254                         Record = JSON.parse(res.value.value.toString());
255                     } catch (err) {
256                         console.log(err);
257                         Record = res.value.value.toString();
258                     }
259                     allResults.push({ Key, Record });
260                 }
261             }
262             if (res.done) {
```

Working Prototype Within The Local Machine



```
C:\Users\latr\OneDrive\Desktop\ChronoLedger\chrono-app\src\query_owner.ts - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
my-watch-contract.ts ● testpython.py × chronomenu.py × menu_destroy_sample.py × chronomenu_main.py × chrono-ledger-contract.ts × query_owner.ts × chronomenu6.py × + ▾
25 const connectionProfile = JSON.parse(fs.readFileSync(connectionProfilePath, 'utf8')); // eslint-disable-line @typescript-eslint/no-var-requires
26 const connectionOptions = { wallet, identity: 'Org1 Admin', discovery: { enabled: true, aslocalhost: true } };
27 await gateway.connect(connectionProfile, connectionOptions);
28
29 // Get the network (channel) our contract is deployed to.
30 const network = await gateway.getNetwork('mychannel');
31
32 // Get the contract from the network.
33 const contract = network.getContract('chrono-contract');
34
35 const arrdata = fs.readFileSync('myfile', 'utf8').replace(/\r\n/g, '\n').split('\n');
36
37 //console.log(arrdata[0])
38 //console.log(arrdata[1])
39
40 // Evaluate the specified transaction.
41 const result = await contract.evaluateTransaction('ReadAllMyWatch', arrdata[0]);
42 //console.log(`Transaction has been evaluated, result is: ${result.toString()}`)
43 console.log(`${result.toString()}`)
44 // Disconnect from the gateway.
45 gateway.disconnect();
46 process.exit();
47
48 } catch (error) {
49 console.error('Failed to submit transaction:', error);
50 process.exit(1);
51 }
52 }
```

Line 1, Column 1 Spaces: 2 TypeScript



30°C 12:29 pm ENG 29/6/2021 2

THE END