datahash

Dairy alpha - trial report

Supported by the South Australian Dairyfarmers Association

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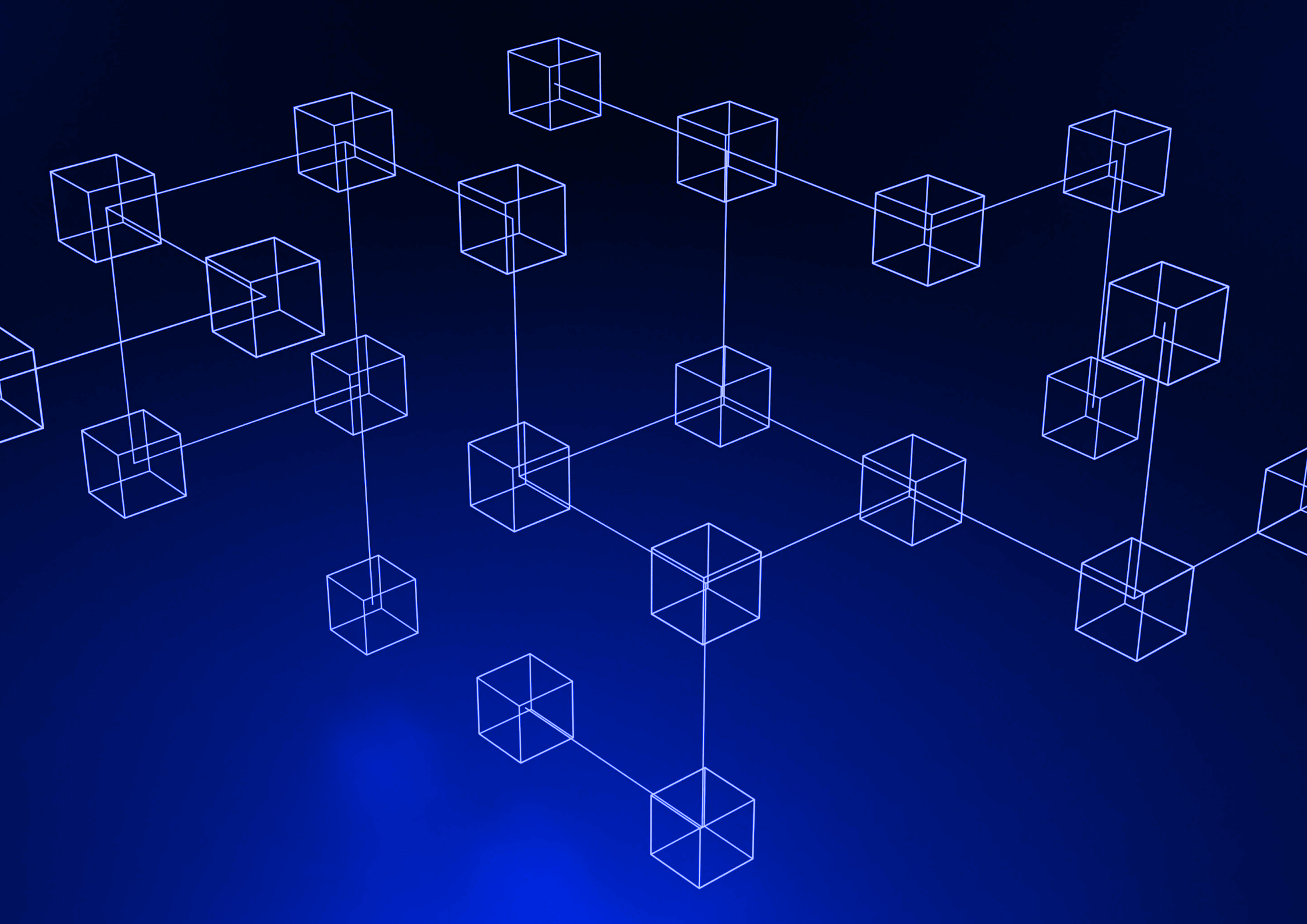


Datahash

Datahash is an Australian data company. Over the past two years Datahash has built an immutable Event Ledger (an advanced database) and an application programming interface (API). The Event Ledger records certain agricultural supply chain information, while the API allows this data to be seamlessly exchanged with other users' systems.

Datahash's Event Ledger operates on Hedera, an enterprise-grade distributed ledger technology (DLT), that is governed by up to 39 of the world's largest companies, academic institutions and non-profits, including Google, IBM, Boeing, LG, Deutsche Telekom, Nomura, Standard Bank, UCL and eftpos. Datahash is currently one of only two agricultural companies operating on Hedera. The use of Hedera means Datahash has inherited superior properties of trust, scalability, security, stability and fair ordering. Datahash supports the tokenisation of all supply chain assets such as goods, money and contracts.

Hedera is the third generation of what is commonly called 'blockchain'. Generation one (Bitcoin) and two (Ethereum) are traditional blockchains. Hedera is also a public ledger, but overcomes the challenges of time, cost and energy consumption (see Table 1) through its unique application of gossip and virtual voting protocols. Hashgraph is an alternate DLT protocol to blockchains and the only authorised ledger is Hedera Hashgraph. Hedera's native cryptocurrency is HBAR (ℏ).

The Hedera patent of the Hashgraph algorithm prevents forking and therefore protects all HBAR value. Forking is when competing development teams take open-source code and create their own blockchain versions, which duplicates tokens on the network, and potentially undermines all the value stored on the network.

Datahash's API is 'smart' because it allows simultaneous access, validation and record updating on a network that's spread across multiple entities and locations. This is important as it allows for the transparent transfer of ownership, transaction recording and asset tracking and in an environment where trust is confirmed via a third party using digital payment methods.

Supported by the South Australian Dairyfarmers Association

Hedera

Hedera is the third generation of what's commonly called 'blockchain'. Generation one (Bitcoin) and two (Ethereum) are traditional blockchains. Hedera is also a public ledger, but overcomes the challenges of time, cost and energy consumption (see Table 1) through 'hashing' data strings.

	1st Generation	2nd Generation	3rd Generation
Transactions per second	3+ TPS	3+ TPS	3+ TPS
Average fee	22.57 USD	19.55 USD	0.0001 USD
Transaction confirmation	10-60 MINUTES	10-20 SECONDS	3-5 SECONDS
Energy use per transaction	885 KWH	102 KWH	0.00017 KWH

1. Executive summary

Through 2021, with the support of the South Australian Dairyfarmers Association, Datahash designed, developed and delivered a Proof-of-Concept (PoC) to record and display critical dairy supply chain events. It was known as 'dairy alpha', and the physical trial ran over three weeks in December 2021.

The PoC was designed to demonstrate the immutable recording of the end-to-end journey of milk – from cow to package – and the storage of this data on Datahash's Event Ledger which could be validated independently by an external third party.

The trial recorded the journey of some 231,769 litres of South Australian milk, from two dairies – the Fleurieu Milk Company and Golden North – and five dairy farms. Datahash is highly appreciative of the support of these dairies and farmers. DLT is an emerging technology which is not well understood and the trial participants were supportive, engaged and understanding.

The trial captured 116 'events' which were recorded including 87 events from Fleurieu Milk and 29 events at Golden North.

While the application enabled some 130 products to be measured, this report focuses on the journey of four specific products: raw milk (farm pick up to processor) and flavoured milk from Fleurieu Milk, and Halal Vanilla Base Mix and Iced Coffee from Golden North.

Datahash built a basic user interface (UI) specifically for the dairy alpha trial so the milk truck drivers and dairy staff could record the key supply chain 'events' on smart phones and tablets.

Datahash considers the trial a success. It enabled us to both prove the concept that critical dairy supply chain data could be captured, encrypted and immutably recorded to our Event Ledger where it could then be validated independently (in this case, using the Hedera explorers DragonGlass and Kabuto). The trial did not seek to exchange this information with others' systems (such as a dairy's own production software or a supermarket's ordering system) but these purposes should form part of any beta trial.

As expected in a PoC, there were challenges, bugs, errors and unexpected outcomes, but the totality of these outcomes strengthened our understanding of how to prepare for a beta trial which could involve significantly more dairy products, events and broader supply chain transaction recording.

The immutable record keeping of the dairy supply chain is substantially more complex than wine movements conducted in Datahash's alpha and beta trials with Wine Australia. There are three broad reasons for this complexity:

1. Executive summary (cont.)

1. *Speed* – the milk journey is much faster than the wine journey, so the number of events relative to time periods is greater (for alpha manual recording);

2. *Product content* – the number of ingredients used in some dairy products (e.g. ice cream and flavoured milk) involves significantly more actions (including differing measurement systems, such as liquids and dry good volumes) and movements (aggregation and disaggregation) of volumes to achieve end products; and

3. *Perishability* – critical measurements (such as temperature) and timescales are more important in ensuring food safety.

While both Fleurieu Milk and Golden North already manage these three complexities within existing processes and systems, adaption into an asynchronous alpha trial environment produced some data fracturing and contamination. While this challenge had its frustrations, the adoption of solutions to adapt to these complexities ultimately yielded learnings which we believe outweighed the in-trial frustrations. It provided some key insights to assist Datahash understand how to best track these movements in a cloud environment, particularly ahead of a planned beta trial.

The key adoption in-trial was the decision to introduce active forms that allowed the application to record events, instead of tracking hard coded 'movements' (a simpler – and more stable – process used in wine alpha).

The dairy alpha trial results will enable SADA and other stakeholders to use the Datahash event ledger to verify:

- a data event;
- that a data event has not been tampered with or altered; and
- the exact history (provenance) of a data event;
- The exact sequence of an event in relation to all other events that have been recorded and ordered.

Both Golden North and Fleurieu Milk reported that the application was generally intuitive and easy to use.

David Travers
Founder
11 January 2022

2. Background

The dairy industry is Australia's fourth largest rural production industry, with a farmgate value of $4.8 billion in 2019-20. The industry employs 43,500 people in Australia and the total value of dairy exports in 2019-20 was $3.4 billion. Dairy is a key employer in regional and rural Australia.

The '$1 per litre milk' period resulted in significant downward pressure of farmgate margins. The Australian Competition and Consumer Commission (ACCC) found long, complex and opaque supply chains, uncertain payment terms, low bargaining power for farmers (ACCC, 2018) and a distinct lack of technology standards had encompassed the whole industry. It found the power imbalance combined with uncertain world market prices, discount supermarket milk and processor margins to significantly impact farmgate pricing. Transparency, efficiency and trust are long term values that bring sustainable benefits to dairy farmers.

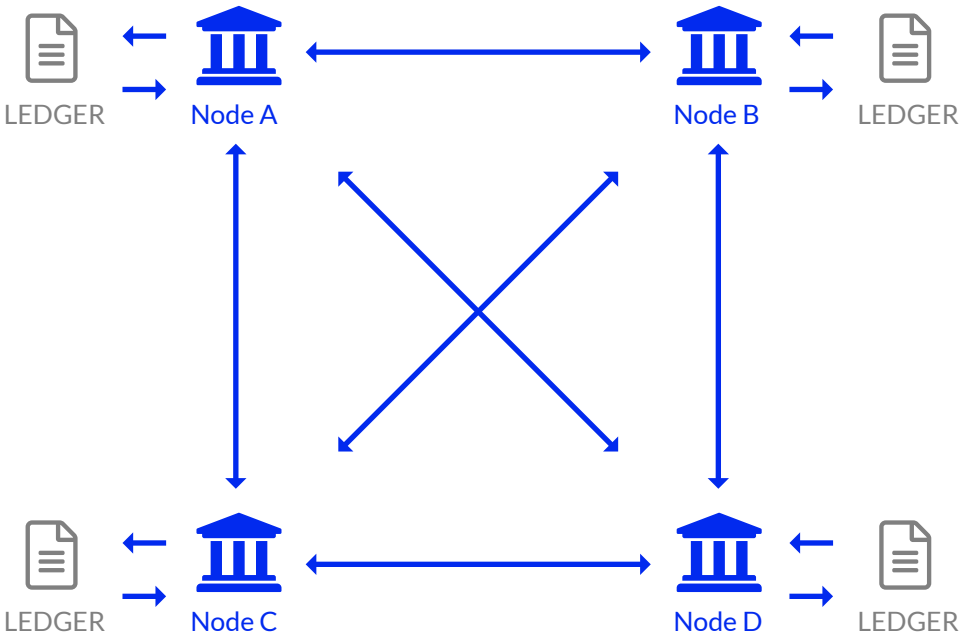
COVID-19 and trade tensions (particularly with China) have highlighted Australia's vulnerability to 'just-in-time' supply chains – including dairy and other agricultural supply chains. The Australian and South Australian governments – and industry – accept more sustainable and resilient technological solutions must be found. Technological progress is being made and blockchain, or DLT, may form part of these future solutions.

While supply chain resilience and system inoperability will be key drivers in the future commercialisation of these technologies, fraud in the dairy industry, especially in processed dairy products, including cheese (Montgomery et al., 2020) is also a potential beneficiary. McLeod estimates an annual cost of $360 million to the dairy industry due to fraud (2017). The most commonly cited example on the damaging impact of fraud in the dairy industry is the adulteration of infant formula with melamine in China in 2008. This resulted in not only the recall of many dairy-based products, but also the hospitalisation of more than 12,000 infants (FOA, 2008). This incident, and the prevalence of fraud in the industry, highlights the need for not only comprehensive supply chain record keeping, but also the ability to access it in near real time. McLeod highlights this, recommending that blockchain or a similar distributed ledger technology, could be applied to combat food fraud (2017).

2. Background (cont.)

In the US, chains such as Walmart have explored the use of blockchain technologies to enable faster recalls and found that the time to pinpoint a source and issue a recall declined from six days without the use of blockchain to 2.2 seconds with the use of blockchain (Kamath, 2018), highlighting the usefulness of blockchain/DLT in consumer safety and trust.

Digital Ledger Technology (DLT)



A DLT allows for data to be synchronised across a distributed network of computers with the network as a whole reaching consensus about the state of that data. In agriculture, this can allow for a secure, comprehensive digital system that records every stage of the supply chain in a trusted and immutable (tamper-proof) way.

DLTs face three particular challenges in the agricultural sector. Firstly, the base technology (blockchain) is not well understood, and it also suffers deep suspicion in some quarters due to its association with crypto currencies (particularly Bitcoin). Secondly, there are few (if any) real life case studies which farmers and agricultural producers can consider which demonstrate the technology's potential. Thirdly, many of the necessary open-source data standards which are required to ensure interoperability are yet to be developed – much less agreed.

While dairy alpha did not attempt to directly address these three challenges, it is hoped this initial report adds to the body of evidence in addressing the first two questions. In regards to the third, on 8 September 2021, the Australian Dairy Farmers and GS1 released the Australian Dairy Traceability implementation guideline 1.0. Such traceability standards are an important foundation in taking steps towards faster, more secure and robust supply chains.

2. Background (cont.)

Datahash is a member of GS1 and this alpha trial was based on the new standard. The trial also builds on Datahash's experience in testing its Event Ledger and API in two wine trials in 2020 and 2021. Datahash believes open-source standards must be the foundation on which all companies develop their technologies.

Datahash combines its Event Ledger and API with three other technologies – mobile, geolocation and timestamping – to ensure that the supply chain records are secure, immutable and trusted.

However, the potential of DLTs are greater than providing a tamper-proof shared database recording system. Datahash believes a dairy beta trial should focus on capturing data through increased levels of dairy supply chain automation and device integration – for example, on farm vat temperature monitoring, capturing SCADA data from existing management systems.

Datahash's system could also be used to enable smart contract settlements between supply chain participants.

Datahash believes that the future of agriculture infrastructure will be universal multi-commodity digital assets that allow farmers to complete B2B transactions, process large datasets (such as during indexing of packaging), provide faster payment and eliminate the middlemen during the processing of payments.

All systems will need to operate within open sources standards, such as the National Freight Data Hub, and be adopted by all supply chain participants. Such process will strengthen interoperability with others' systems and allow Australian farmers to benefit from simplification in trade systems and automation of trade documentation. However, Datahash cautions that these adoptions will take time and currently the technology and benefits are poorly understood by bureaucrats who continue to slow progress while they develop knowledge and process to control the technologies.

3. Trial design and methodology

REQUIREMENTS

The objective of dairy alpha was to prove the concept (PoC) that critical milk supply chain events could be traced – with data recorded for immutability and provenance (on a distributed ledger) – and shared with third parties via an API. The overarching requirements were to:

1. Broadly map ADF-GS1's Australian Dairy Traceability implementation guideline 1.0 to the production supply chains of Fleurieu Milk and Golden North;
2. Design a trial that captures enough key stages of these two supply chains (from the farm vat to package, including transport and processing) to prove the concept (i.e a PoC);
3. Construct an application – including both the basic smart phone and tablet user interface (UI) to allow data to be manually logged and recorded to Datahash's distributed Event Ledger;
4. Demonstrate the recording of the supply chains from requirement 2 in a database (the Event Ledger);
5. Demonstrate that the recorded data is consistent and query able.

3. Trial design and methodology

DESIGN

At the heart of our design is the decision that destinations are the event recorded, rather than the inventory units being the source, volume and destination of the material movements.

Our design comes from significant software experience in the global minerals supply chain which is substantially further advanced than agriculture in moving primary production to complex secondary and tertiary stages.

In practice this means moving milk from Vat A to Silo B, was recorded (and thus tracked) as a first event and the moving of milk to Silo B becomes a second event. Thus, the destination is the event (which puts the milk in Silo B). The advantage this gave us is that we have an expressive model to represent more complex logistics, processing, blending and manufacturing. In any beta, by focussing on the event we can immutably record a specific timestamped piece of data and by having this encrypted and stored on our Event Ledger it will allow accurate data synchronisation (via the API) between Datahash and other external systems (such as an ordering system operated by a supermarket). It could also allow a permissioned third party (such as a regulator) to view the records.

The alpha trial was designed to capture key data points at the farm, the truck driver's journey, the factory sampling, the separation/mixing, the manufacturing and the distribution stages of the supply chain.

3. Trial design and methodology

Datahash's API and UI design were driven by two key insights:

Firstly, logistics and manufacturing processes can be described with a degree of commonality between businesses and localities. Key concepts, such as start and end dates of processes, key lab tests, units of measure, material properties, raw material definitions, etc. are common across the industry. Importantly, the ADF-GS1 traceability standards has begun to formally document these processes into a set of standards.

Secondly, logistics and manufacturing processes exhibit large variability between businesses and localities. Final product naming, recipes, process steps and business processes vary between business and sub domains of the dairy industry.

In short, recording the production of bottled unhomogenized milk requires different data points than recording the production of chocolate ice cream. In both examples, pasteurization, refrigeration and packaging are required. However, manufacturing chocolate ice cream requires a range of ingredients. Some of these ingredients are tracked by weight, whereas other are tracked by volume.

This variability led Datahash to also develop an expressive modelling language. The API allows the administrative user to define an organisation with assets and operations. Some examples of such operations are: milk extraction, transport, delivery to plant and honey ice cream production.

The API allows the administrative user to define the ingredients and additives required for the operation and any number of parameters that are required. Furthermore, the API allows the definition of alternative 'methods', or variants, for a single operation.

Making the organisational model configurable, as a design principle, allows Datahash to deliver on requirements 1 and 2. Datahash can easily configure the system to comply with ADF's Australian Dairy Traceability implementation guideline 1.0 and at the same time map to the business processes of both Fleurieu Milk and Golden North.

3. Trial design and methodology

Once an organisation with users, assets and operations exists on the API, the application can be deployed in production. The operations user can, at that point, access list of UI forms that enables them to record operation execution. For instance, a farmer can record the milking of that morning, the quantity, temperature and destination vat. A plant supervisor can record an intake of cream and milk to the plant for the production of ice cream custard. The form presented to the supervisor will include the order number, start and end date of pasteurization, temperature, and other relevant information as applicable.

Schema driven UI, as a design principle, delivers the first half of requirement 3, providing both the basic smart phone and tablet user interface (UI) to allow data to be manually logged.

3. Trial design and methodology

User journeys - Personas

Persona - Farmer

"Best milk comes from grass-fed cows"

David Travers
Age: 38
Job: Dairy farmer
Location: Myponga, South Australia

Wants to produce and deliver milk to processing plant while tracking every step of his product along the supply chain.

Bio:

By day, David is a farmer. Working on his family's farm producing raw milk for local dairy industry.

In his spare time, David enjoys woodworking, winemaking and spending time with his family on the farm

Goals:

- Producing good quality milk.
- Have better overview of the available pick-up and delivery times.
- Being able to track where, when and how his product is being used
- Have better overview of incoming payments

Frustrations:

- Hard to track his product with 'paper-based' evidence
- not having a good overview when is the next available pickup
- not sure what technology to use for tracking

Preffered brands and technologies:

Google
Facebook
Ford
Toyota
Android

Reasons to use our product:

- Ability to track his product from the cow to the retailer
- Forecast demand??
- Financial overview??

Reasons to pay for our product

Not sure here, is the product going to be offered free to the farmers?

Persona - Driver

"Something to go here"

James Shanahan
Age: 46
Job: Truck driver
Location: Myponga, South Australia

Wants to deliver milk on time. DOesn't want to worry about keeping all data and logs.

Bio:

By day, James is a truck driver. Working for Fleurieu Milk Plant, organising milk pickups from local farms.

In his spare time, James enjoys futball, gardening, motorsport and working around his family's house.

Goals:

- Producing good quality milk.
- Have better overview of the available pick-up and delivery times.
- Being able to track where, when and how his product is being used
- Have better overview of incoming payments

Frustrations:

- Difficult to keep track on all variables of milk he is collecting (temperature, visual observiations..)
- needs enter all data into notebooks and make sure to keep the data safe
- not sure what technology to use for tracking

Preffered brands and technologies:

Apple
Nissan
Tesla
Bunnings

Reasons to use our product:

- Ability to track the pick up schedules
- Easily enter and access data
- no need to keep archives (data in cloud)

Reasons to pay for our product

Not sure here, is the product going to be offered free to the farmers?

Persona - Plant worker

"Something to go here"

Peter Simonds
Age: 51
Job: Dairy producer
Location: Myponga, South Australia

Wants to record quantity and quality of milk delivered. Samples will be taken and tested.

Bio:

By day, Peter is working at Fleurieu Milk plant as milk proccessor??.

In his spare time, Peter enjoys art, cheese making and cooking.

Goals:

- Have a good overview of produce quality
- Being able to create reports and share findings
- Keep track and and have one source of truth

Frustrations:

- Hard to track the milk characteristics
- Data entry is manual process
- Data is not available immediately to other stakeholders

Preffered brands and technologies:

Penfolds
Haigh's
Mercedes-Benz
Twitter
Uber

Reasons to use our product:

- Ability to add test results into one shared database
- easy access and product review and reports

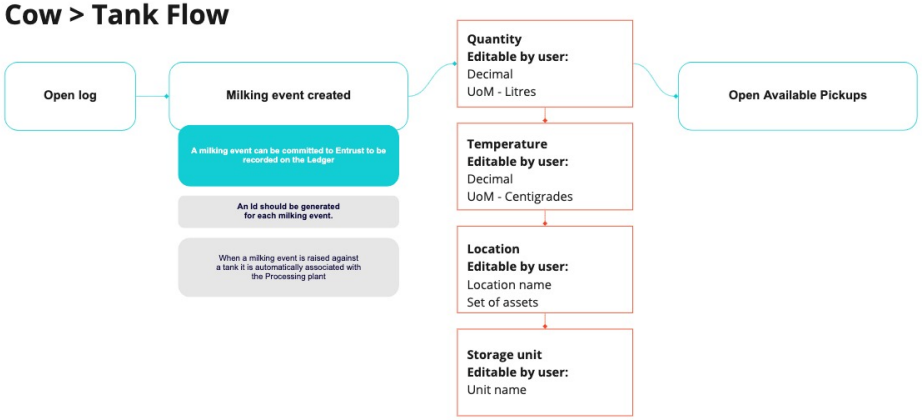
Reasons to pay for our product

Not sure here, is the product going to be offered free to the farmers?

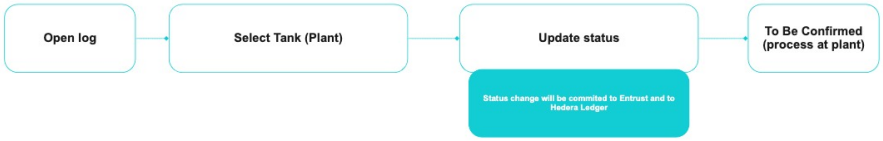
3. Trial design and methodology

User journeys - Wireframes

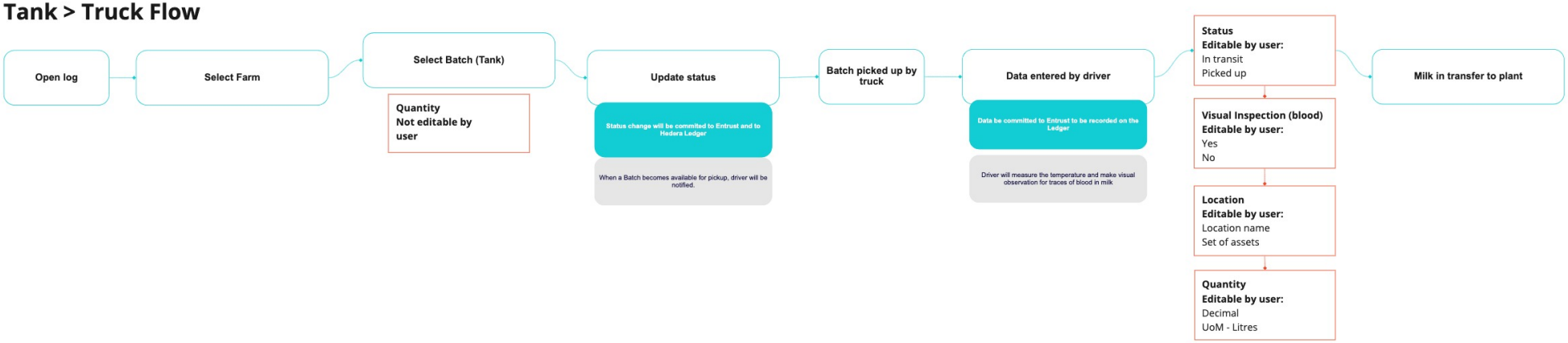
Cow > Tank Flow



Truck > Plant Flow



Tank > Truck Flow

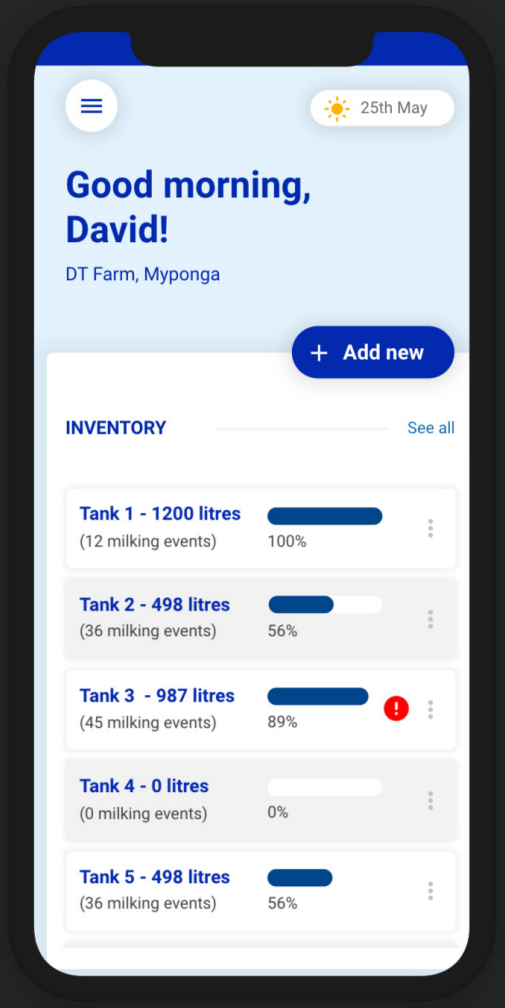


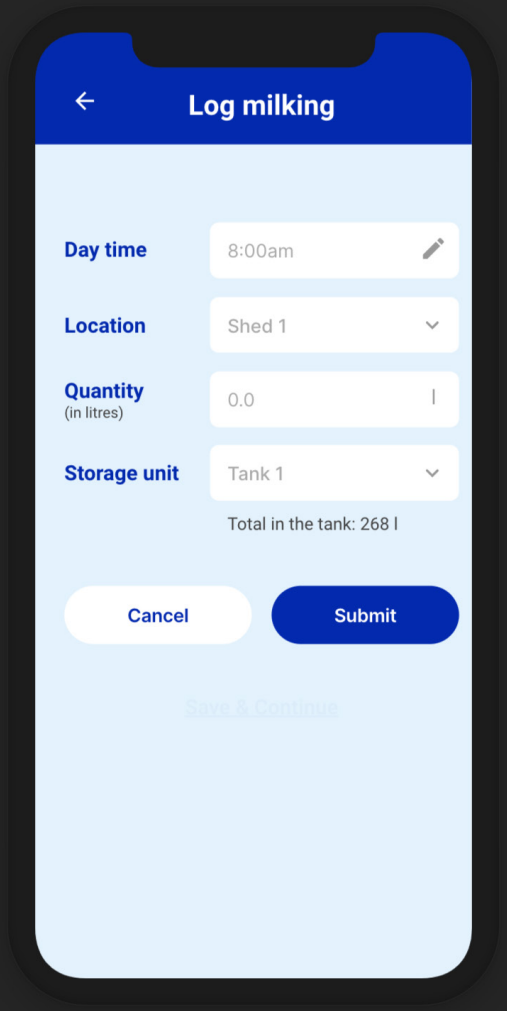
3. Trial design and methodology

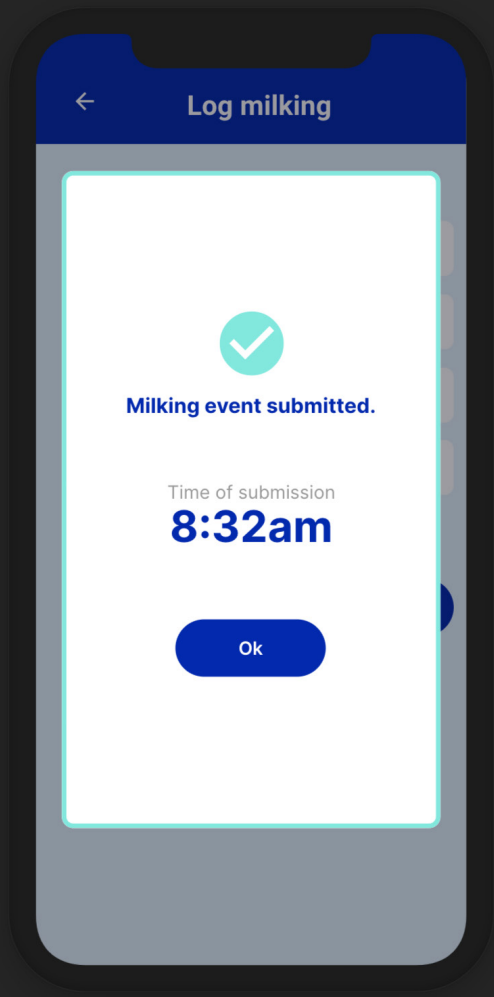
User research - Prototypes

3. Trial design and methodology

User research - Prototypes

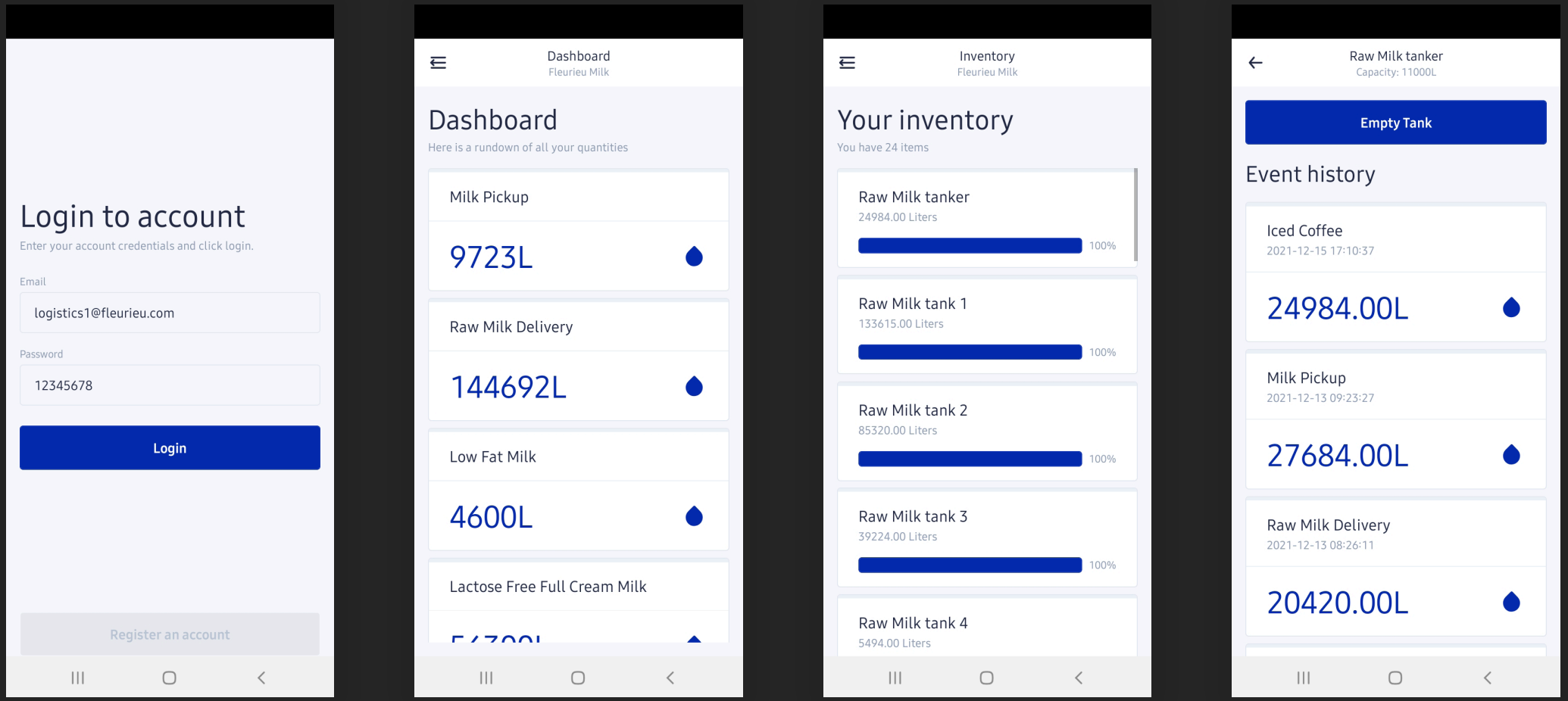






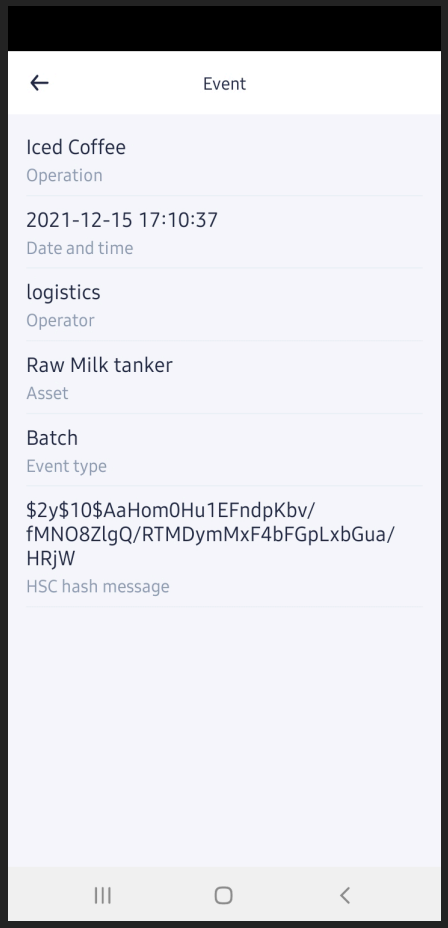
3. Trial design and methodology

Figure 1: High level architecture



3. Trial design and methodology

Figure 1: High level architecture

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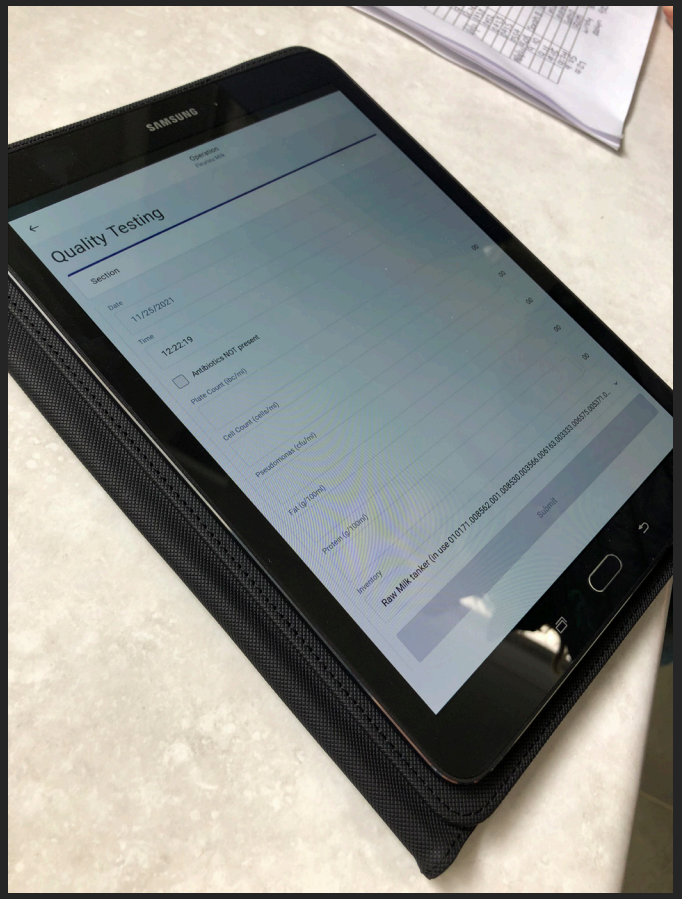
3. Trial design and methodology

Android app - alpha release



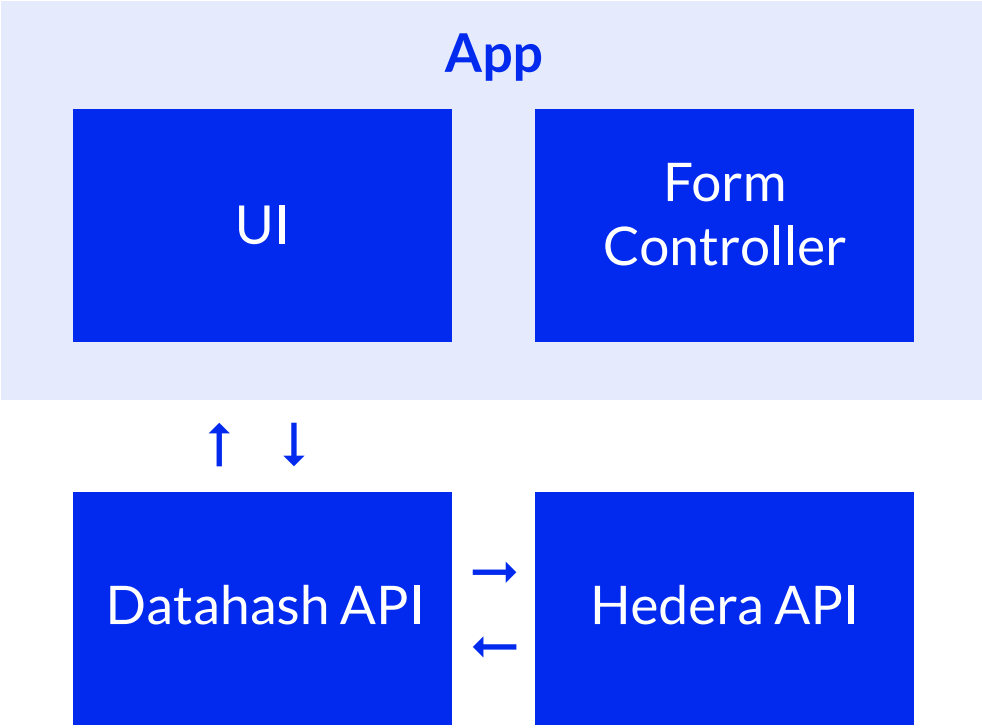
3. Trial design and methodology

ARCHITECTURE

Datahash delivers a React application that can be installed in both Android and iOS devices (smart phones and tablets). The UI is a single page application with login, dashboard, inventory view and a list of operation forms.

When the user logs an operation through a form, the Form Controller constructs the calls to the Datahash API. That is, it decides which events need to be created or updated and what metadata needs to be created. In short, the Form Controller translates the contents of the form into events that can be added to the ledger.

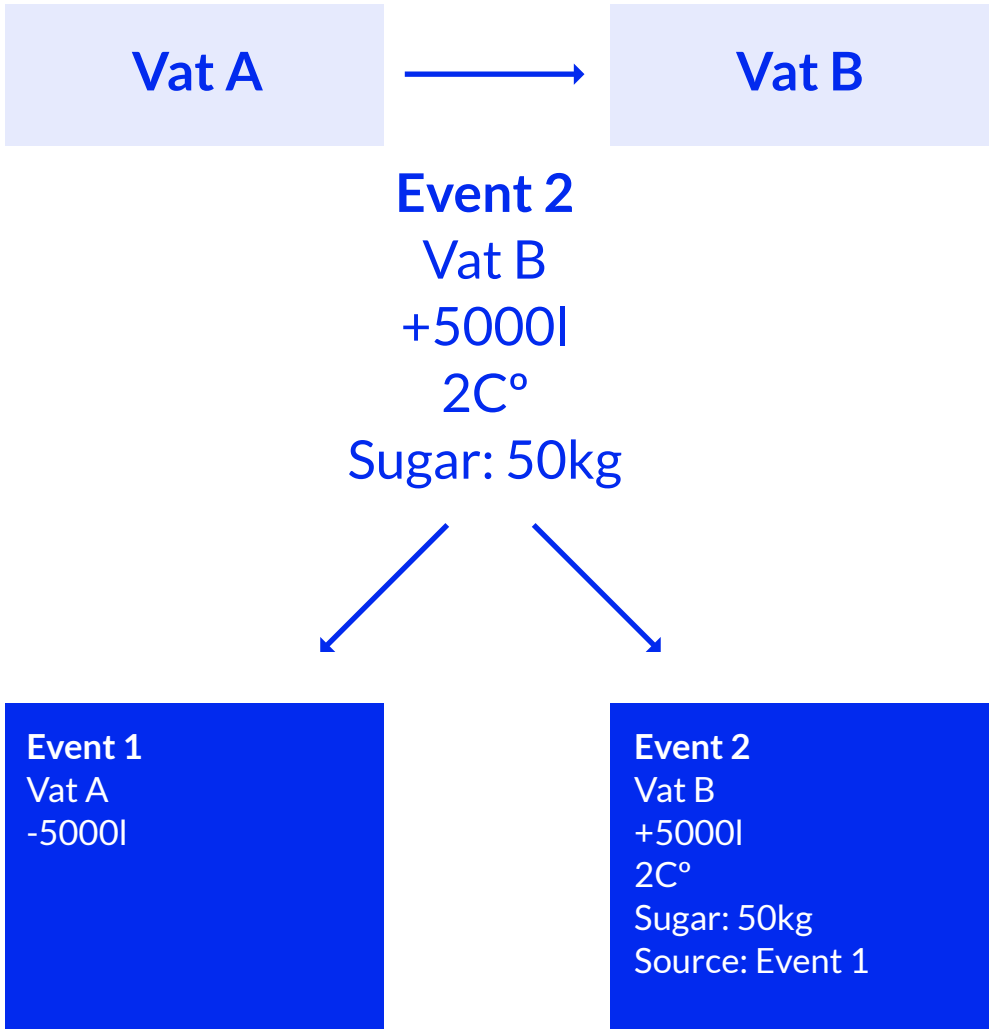
These events are, in turn, passed onto the Datahash API which pushes them to the Datahash Event Ledger (Hedera) and manages the return message, a confirmation for the user, which is finally presented in the UI.



3. Trial design and methodology

These events are, in turn, passed onto the Datahash API which pushes them to the Datahash Event Ledger (Hedera) and manages the return message, a confirmation for the user, which is finally presented in the UI.

Figure 3: Translation of a single material movement into multiple events



3. Trial design and methodology

USE CASES

From a user perspective, the PoC considered the following use cases:

1. accessing the app from a mobile device;
2. milk extraction events logged at the farm, recording the time, the quantity of milk, the tank used and the location of the milking event;
3. milk pick up, the driver records volume collected, whether blood was present, whether a sample was taken, temperature at pick up;
4. milk delivery to the dairy, the operator records that the delivery had taken place, the actual litres of milk delivered and the silo the milk is placed into;
5. lab testing, recording the somatic cell count, protein, and fat content;
6. processing steps, recording methods (pasteurization, separation), key operational parameters (temperature, time start, time end), ingredients and additives;
7. bottling, recording sku, quantity;
8. view movements summary in dashboard; and
9. view inventory status on inventory page.

3. Trial design and methodology

METHODOLOGY

The trial had six distinct phases:

1. Data capture – During this period the Datahash team engaged with the target dairies to understand and capture their production and business processes, and identified the assets, products, operations, ingredients and operational parameters to be captured;
2. Configuration – The Datahash team used the output from the data capture phase to create files that 'configure' the application for each dairy;
3. Training and verification – The Datahash team presented the configured application to the users of each dairy. The utilisation of the application was explained to the users. User devices were configured with the App. Any discrepancies between the configuration and the actual business process were identified;
4. Deployment and execution – An amended configuration was deployed. The trial on the field started. Bugs and design issues were identified and logged. Data was recorded via the application;
5. Assessment – The resulting data was analysed. Users were engaged and queried about the usability of the application. Final list of items for the next iteration was collated; and
6. Reporting – The first draft (this document) of the trial is delivered. A final draft will be delivered following consultation with SADA.

3. Trial design and methodology

The deployment and execution phase of the trial started on 24 November 2021. It ran for two weeks at Fleurieu Milk. The configuration of the application had to be reset once during the trial to amend initial bugs.

The trial was executed at Golden North on 21 December 2021. It ran for one day but the operations for a full week were recorded.

The data was retrieved and analysed between 1-12 January 2022. More than 180 events were created.

4. Results and findings

The alpha trial achieved its objective of proving the concept that critical supply chain data could be immutably recorded to a distributed ledger and viewed by a third-party consensus service. It also produced a UI that can be used to audit or verify claims of the product.

It was highlighted in this alpha trial that dairy supply chains are highly complex, for this reason any system that has to track the supply chain must make allowances for this complexity. This means that material movements are not linear, blending and splitting of material is common there is high variability of recipes and processes. Accordingly, the system must be flexible and should eventually be configurable by the administration users from the dairies. This was one of the main issues that occurred during alpha testing. For the alpha trial the configuration of operations and forms was performed by Datahash in conjunction with Golden North and Fleurieu Milk. As a consequence, some aspects of the operations could not be captured accurately. For instance, source inventory was limited to a single unit in the UI, which precluded blending. Although our event model and API allowed blending, the limitation of the UI forced the users to break down a single operation into multiple operations to represent blending. This is a natural outcome of a PoC and provides valuable research and learnings for future development.

Ultimately, it is the nature of software development to improve the software over multiple iterations. For the Datahash Dairy application, the feedback from both Golden North and Fleurieu Milk was generally positive. This bodes well for using the application in as a regular part of logging the supply chain within the dairy industry.

4. Results and findings (cont.)

The Datahash Event Ledger has recorded immutable data, meaning the data are available indefinitely and cannot be tampered with. Data events are encrypted as a message on the Hedera Consensus Service Network (Hedera Hashgraph proofs). These two functions allow us to ensure data provenance so the complete history of a data event could be retrieved (if necessary) with Hedera Hashgraph proofs testifying to that history. The importance of this function is to allow accurate data synchronisation between systems as well as independent verification of events where necessary for compliance-based activities.

4. Results and findings (cont.)

FLEURIEU MILK

At Fleurieu Milk, there were 186 milk pickup events and 154,369 litres of milk collected, 70 raw milk delivery events and 215,372 litres of milk delivered and 252,642 litres produced in 15 events. Importantly, events were able to be traced throughout the process.

However, due to user error and/or issues with data entry, some events had to be lined up manually – something which needs to be rectified moving forward. Despite this, events were able to be linked together and products traced. This report's analysis focusses on the production of strawberry and chocolate milk on 30 November.

At 1617 hours, three milk event pickups occurred, totalling in 8551L. This was placed into Raw Milk Tank 2, resulting in 36,496L of milk in this tank. Some 840L of Strawberry Milk was produced and placed into finished milk vat 3, leaving 35,656L of milk in Tank 2. Some 2000L of chocolate milk was produced and placed into finished milk vat 5, leaving 33,656L of milk in raw milk tank 2. This

Strawberry and Chocolate Milk

	Assets			
Event	Raw Milk Tanker	Raw Milk Tanker 2	Finished Milk Vat 3	Finished Milk Vat 5
Milk pickup	3499	27952	0	0
Milk pickup	6046	27952	0	0
Milk pickup	8551	27952	0	0
Raw Milk Delivery	7	36496	0	0
Strawberry Milk	7	35656	840	0
Chocolate Milk	7	33656	840	2000

4. Results and findings (cont.)

FLEURIEU MILK

This report also considers the pickup of milk from farms and then the production of full cream unhomogenised milk is also traced through the supply chain.

Pickup and Unhomogenised Milk

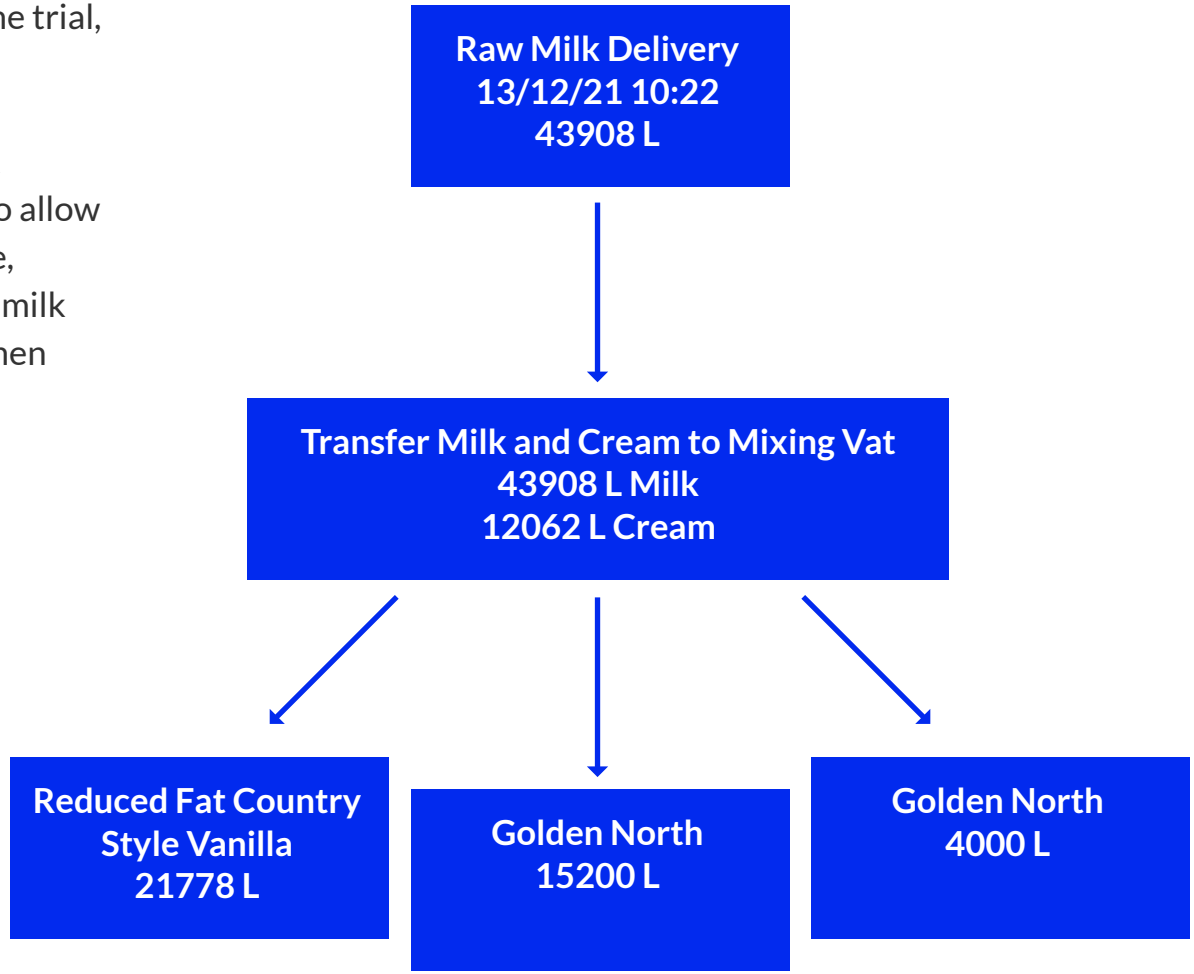
	Assets		
Event	**Raw Milk Tanker (L)**	**Raw Milk Tank 2 (L)**	**Finished Milk Vat 6 (L)**
Milk pickup	0	38522	0
Milk pickup (MIsty Brae)	2893	38522	0
Milk pickup	9992	38522	0
Raw Milk Delivery	7	48507	0
Full Cream Unhomogenised Milk	7	41507	7000

4. Results and findings (cont.)

GOLDEN NORTH

At Golden North, 16 products were tracked throughout the trial, and 117,355 litres were processed.

There were 123,402L of milk delivered and eight raw milk delivery events. Golden North used a virtual 'mixing vat' to allow the mixing of products from multiple sources. For example, 43,908L of milk was received on 13 December 2021. This milk was transferred to the mixing vat as milk and cream and then used in three respective recipes.



4. Results and findings (cont.)

FEEDBACK

Both Golden North and Fleurieu Milk reported that the application was easy to use and intuitive. They also both reported several bugs with the system, or areas for improvement. These comments included:

- Issues with the items in each form (i.e. missing ingredients, incorrect ingredients);
- The use of a 'mixing tank' doesn't make sense. Instead, multiple sources should be able to be selected at once in a recipe;
- There is a discrepancy between the inventory and the dashboard and issues with the count within assets;
- A daily summary would be useful;
- An undo button would account for human error more easily;
- The ability to create recipes within the app would fix a number of problems;
- There is no way to account for loss of product within the app, so it is often out of sync in relation to product dispatched and ingredients received; and
- The changes in login were hard to keep up with.

4. Results and findings (cont.)

NEXT STEP

Datahash has completed an API infrastructure upgrade which will provide beta with a target service level of 99% uptime utilising secure serverless cloud technologies. This will be trialled with wine beta in February and March 2022.

We are also considering the suitability of the current Datahash Event Ledger as a database for a broader dairy and wine beta uses (particularly as we work towards a more substantial trial which is likely to involve one or more supermarkets so 'accurate data synchronisation between systems'.

The shift towards B2B automation will allow farmers, dairies and supermarkets to reduce administrative paperwork and create more efficient supply chains. It will reduce receipting discrepancies and claims by eliminating human error. However, it will increasingly rely on accurate data synchronisation between systems, such as is being tested by Datahash in this trial. For the B2B receiving process to be successful it will rely further on open-source data standards being agreed and the supplier entering key item data via the GS1 National Products Catalogue or a supermarket's own product catalogue. Existing automation systems, including robotic milking, on-farm vat sensors and Bluetooth connections, are already available and could be integrated within a beta trial, potentially enabling the trialling of smart contract settlements on the ledger.

During dairy alpha, Datahash took the learnings from wine alpha and beta and re-engineered the API completely. The approach was to create a more comprehensive API which would cater for the dairy supply chain but also any other supply chain. In addition, an API that potentially could be easily integrated with existing third-party systems and applications (e.g. Fleurieu Milk's SCADA system). We have employed a microservice architecture, in which we have two main services, the ledger and the Hedra integration. Previously, our Hedera integration service would perform stateless transactions, but we then introduced MongoDB to process stateful transactions to minimise failures.

Datahash's Event Ledger is also designed to be scalable for future development. As we introduce more supply chains and create new learnings, we could more easily modify or create new data modelling without impacting on existing supply chain data. The Event Ledger's data modelling is very flexible. Datahash also improved the authentication and security of the API introducing additional guards at each endpoint. Plus introduced data encryption at rest. Overall, these improvements have meant the API is more efficient and lean in performance, flexible and scalable for the future, and more secure and better at preserving data integrity.

Appendix 1

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Appendix 2

Trial stakeholders

Datahash acknowledges the invaluable support of the South Australian dairy industry in making this trial possible. It particularly included three key stakeholders:

South Australian Dairyfarmers Association (SADA) and the South Australian Dairy Industry Fund (SADIF)

Dairy Farmers Association (SADA) and the South Australian Dairy Industry Fund in making this proof-of-concept (PoC, or alpha trial) possible. Datahash looks forward to continuing the relationship and building towards a potential beta trial. The SADIF was formed in 2014 to "finance projects that directly benefit the South Australian dairy industry". The fund is chaired by Will Rayner and includes dairy farmer Nick Brokenshire, who's dairy is a key source of milk to the Fleurieu Milk Company.

SADA is the peak body for dairy farmers in South Australia, focussing on advocating for dairy farmers and advancing technology in the industry. SADA commissioned this trial as a PoC to demonstrate the potential for a simple decentralised solution to fraud, supply chain traceability and immutable record keeping, as well as more efficient auditing.

Datahash is highly appreciative of SADA's support for this trial, particularly the Andrew Curtis, CEO; John Elferink, policy officer; Ashleigh Pulford, project officer; and Tom Cosentino, the SADIF executive officer.

Appendix 2

Trial stakeholders

Fleurieu Milk Company

Based near Myponga, an hour south of Adelaide, the Fleurieu Milk Company is owned by three dairy families. The company produces a variety of milk, flavoured milk and yoghurt products, with raw milk and cream sourced from eight local farms. The milk from three farms were involved in this trial. These included:

- Robert, Mandy and Nick Brokenshire (Roslyn Amdena)
- Rob and Bec Walmsley (Windy Vale)
- Gino and Mandy Pacitti with their sons Ashley and Andrew (Misty Brae)

Datahash acknowledges particularly the support of the Fleurieu Milk Company team – Nick Hutchinson, general manager; Doug Pollnitz, data analytics/quality control officer; and Sarah Raper, quality control officer.

Golden North Ice Cream

Founded in 1923 and based in Laura, Golden North is an award-winning ice cream company which sources milk and cream from South Australian dairy farmers. The production processes used to make ice cream made them an important participant for this trial.

Datahash acknowledges the support of Peter Adamo, managing director; Rick Willis, operations manager, and production team members Jessica Marwick and Tyson Stark.

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