

Assignment type a) own work: Lauma

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11.3.2020

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1 Introduction

The knowledge of a domain model allows for architectural design to take place and form into a description of a future system. One such possible target is the domain of kennel operations, where kennel operators perpetuate the life cycle of dogs. This project work explores the domain of kennel operations and the life cycle of a dog as expressed in the microservice architecture of the web service Lauma. The goal of the project was to create an architecture for a service that adheres to existing constraints set by organizations within the domain, while offering meaningful services to the key actors of the Finnish companion animal trade pertaining to registered purebred dogs. This report consists of a description of the domain, the top-level component assembly of the system architecture using the microservice architecture pattern, a summary of use cases with example sequence diagrams, an exemplary functionality scenario, as well as an architecture assessment using change scenarios.

2 Domain

The work related to the domain of kennel operations was done in two parts. As the domain has previously not been explicitly mapped for software development, a notable part of the project work was spent researching the domain and identifying the correct constraints for a usable domain model. After the domain was researched and the constraints identified, a domain model was built on top of the research work and. The included list of definitions is to allow for someone unfamiliar to the domain to gain reasonable familiarity with the topics and theme of the application.

2.1 Definitions

1. Dog

- A domesticated animal of the species *Canis lupus familiaris*
- Societal functions include companion animal, working dog, hobby/competition dog
- Are commonly produced and sold by hobbyists running kennels
- Bought by regular people to fulfill aforementioned societal functions

2. Dog breed

- A subset of the set dog
- Defines a set of distinct and expected phenotypical features for the descendants of two dogs of the same dog breed

3. Purebred dog (breed)

- A dog that is considered by its lineage to be registrable at a purebred dog organization
- Strictly defined external features
- In some cases required to pass certain health checks to be used as breeding stock
- May also be referred to as a pedigree dog

4. Breeding stock

- Selected animals bearing desirable traits worth perpetuating
- May or may not be used for producing future litters

5. Line

- Defines the purpose of the dog based on the lineage of the dog
- Working line dogs are bred for traits desirable for work such as hunting or herding
- Show line dogs are bred for traits desirable for dog shows, but should be bred balancing and promoting their general health as well as their appearance

6. Sire, dam

- Commonly used terms for the parents of a litter of puppies
- A male can produce vastly greater amounts of offspring during its lifetime compared to a female

7. Kennel

- An establishment that produces dogs
- Operational focus is often on producing registrable purebred dogs of a certain breed

8. Litter

- A group of dogs born from the same mother from the same pregnancy

Working dog	FCI	Kennelliitto
www.working-dog.com	www.fci.be	www.kennelliitto.fi
Platform standards for classifying dog breeds	FCI dog breed standards and validity	Finnish dog breed standards and validity
Platform connectivity and interconnectivity	FCI standards for kennel operations	Finnish standards for kennel operations
Platform model for kennel operations	FCI standards for health and well being of dogs	Finnish standards for health and well being of dogs
Platform scope of platform operations	FCI standards for partner organizations	Platform connectivity and interconnectivity

Table 1: Domain sources

2.2 Domain research

To build a realistic domain model (Figure 1) and the resulting textual information model (Table 2), dog breeding practices were mapped through five unrecorded interviews with kennel operators, and a number (<50) of small survey-type interviews with dog owners. To understand the contemporary policies surrounding the existing standardization of kennel operations and dog breeds, three operations (Working Dog, FCI, Kennelliitto) were used as source material (Table 1). Working Dog is a German interactive platform for information and multimedia sharing between dog breeders and dog owners. FCI (Fédération Cynologique Internationale) is a Belgian organization which provides for a list of dog breeds the organization considers to be valid purebred dog breeds, as well as their descriptions and classifications. The FCI also serves as a parent organization for country-based partner organizations operating locally. Kennelliitto is the Finnish partner organization of the FCI. Kennelliitto uses the standards set by the FCI regarding dog breeds considered registrable as purebred dogs. In addition to the FCI standardized breeds, Kennelliitto recognizes some additional dog breeds to be registrable as purebred dogs. Kennelliitto in accordance with local breed associations is responsible for defining the policies of kennel operations revolving around dog breeds considered registrable as purebred dogs, as well as the breed specific health requirements for a dog to be classified as breeding stock.

2.3 Domain model

Registered purebred dogs are produced by kennels, which are ran by kennel operators. An amount (1-3) of kennel operators can be responsible for one kennel at any given time, and one kennel can be associated with an amount (1-3) of dog breeds. A kennel producing purebred dogs may only call their dogs purebred if they can be registered as such by external policy.

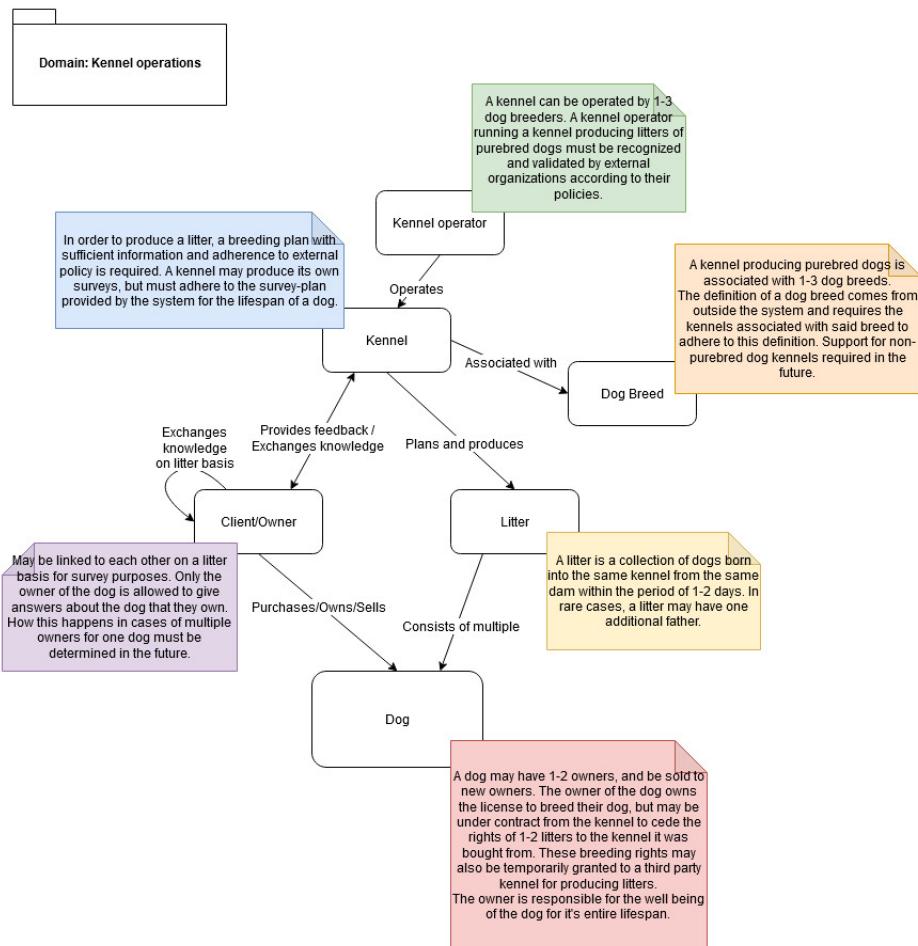


Figure 1: Domain model

Kennels producing purebred dogs make breeding plans for producing litters that uphold the description of the dog breed(s) the kennel is associated with. The breeding plan revolves around finding a pair of suitable mates with suitable characteristics in the expression of the phenotype, and in some cases, the genotype. Once a suitable dam and sire of the same breed have been found, a litter is produced.

The puppies live with their mother at the location of the kennel for 7-8 weeks. During this time they are health checked, socialized and registered into an external database. At 7-8 weeks, the puppies are sold and homed to clients of the kennel. It is common for the kennel to keep or place one of the puppies from each litter for potential future breeding stock use. The decision to either use or not use the potential breeding stock from the

depends on various things, such as the development, health and behavior of the puppies from the litter.

It is customary that kennel operators keep contact with their clients so that they may receive information about the dogs that their kennel has produced. This information is often useful for the kennel operator in the form of feedback and information about the qualitative properties of the puppies from their breeding lines. This information exchange is also useful for their clients, as the kennel operators often have experienced insight into the behaviour or health of the litters their kennel has produced.

The domain model was translated into a graphical information model (Figure 2).

Type	Definition
Dog	An entity that can be owned by an owner and produced by a kennel. Contains the relevant information of it's living counterpart.
Owner	A user who owns dogs and can create or participate in surveys.
Kennel operator	A user who manages a kennel. A KO can make litterplans, litters and make, send and receive surveys
Kennel	An entity that defines the constraints of which dog breeds a kennel operator can create litterplans and litters for.
Litterplan	An entity containing the information about a planned future litter of dogs.
Litter	An outcome of a litterplan and a collection of dogs that can be the subject of a survey.
Survey	A collection of questions sent by users and kennels to be answered by other users.
Dog breed	Type definition of the dog entity.
Health policy	Constraints defining what health standards require adherence for a breeding pair of a specific dog breed.

Table 2: Textual information model

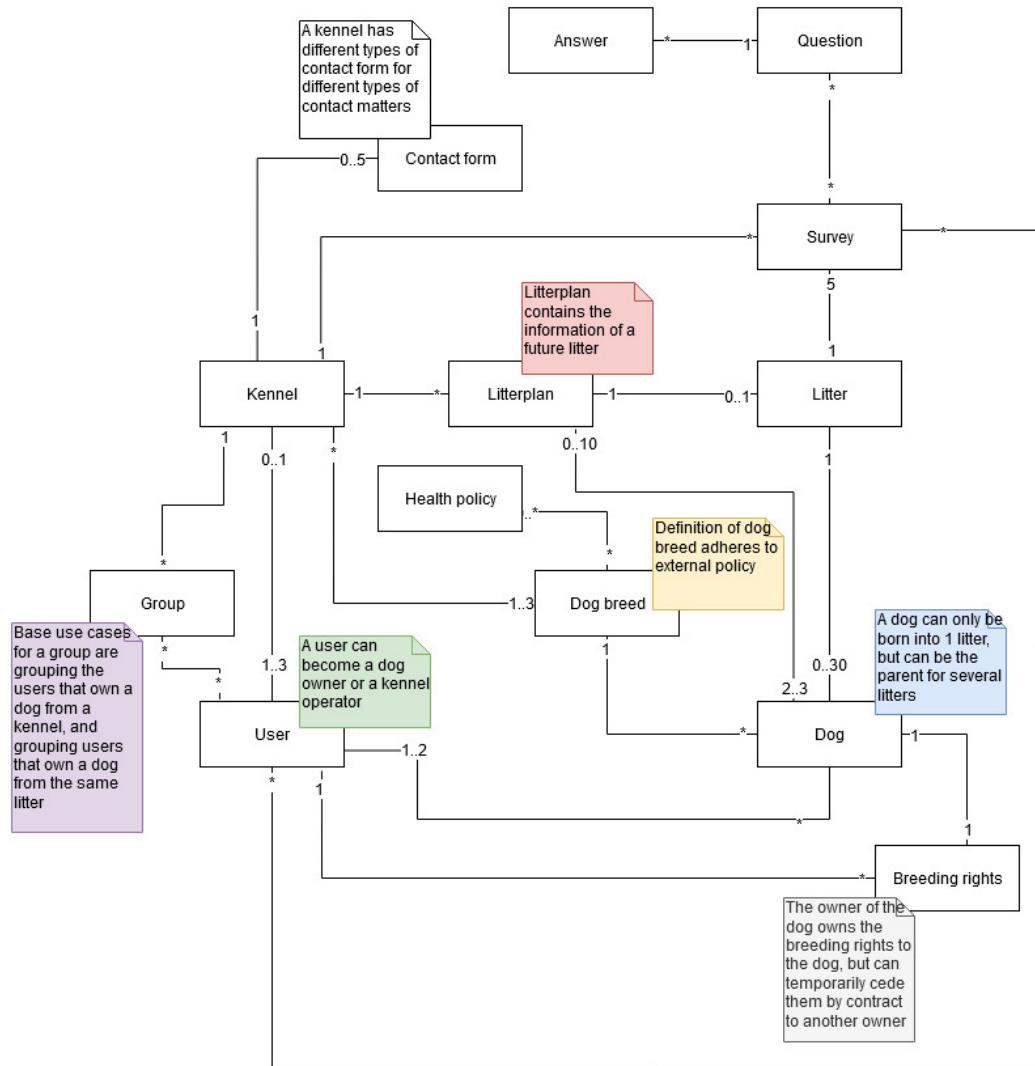


Figure 2: Graphical information model

2.4 Comprehensive functionality scenario: Planning a litter

Name: Making a litter of puppies

Initial State: User is a kennel operator in Lauma and has a plan for a litter of puppies

Actors: Kennel operator, client, dogs

1. A kennel operator plans a litter after having found a suitable breeding pair
2. The kennel operator creates a litter plan using Lauma with all the relevant information about the plan and saves it
3. Throughout the planning phase, the kennel operator keeps adding important notes to the litter plan
4. The puppies are born, and the kennel operator generates a litter entry based on the litter plan and subsequently fills in the information about the birth type and size of litter
5. The kennel operator uses Lauma to generate dogs based on the litter information and link the dogs to the litter
6. The kennel operator gives nicknames or identifiers for each puppy to tell their entries apart and saves them
7. As the puppies keep growing and developing throughout the weeks 2-8, the kennel operator keeps making both individual and litter specific notes about the progress
8. At around 7 weeks, the puppies have a veterinary check and get microchipped with a unique microchip ID
9. The puppies are registered and get unique registry numbers
10. The puppies are close to being rehomed, and the kennel operator saves each individual puppy's microchip ID and registry number into Lauma
11. The kennel operator synchronizes the individual litter entries with each respective dogs individual data
12. The kennel operator generates an activation token for each puppy
13. The new owner picks up their puppy and the activation code to claim ownership in Lauma once they arrive home
14. Once the 8-week period is over, the kennel operator archives the litter by combining the litter plan and litter information into one single entry

3 Design model

The subdomain figure (Figure 3) shows how the domain model is decomposed into subdomains. There is an interest to keep user, dog and kennel data separate from each other, so it makes sense that the microservice decomposition would follow suit. The entity figure (Figure 4) is still a rough draft, but displays the intent of the role of the core entities. The top-level microservices figure (Figure 5) represents the connectivity between the microservices of the system.

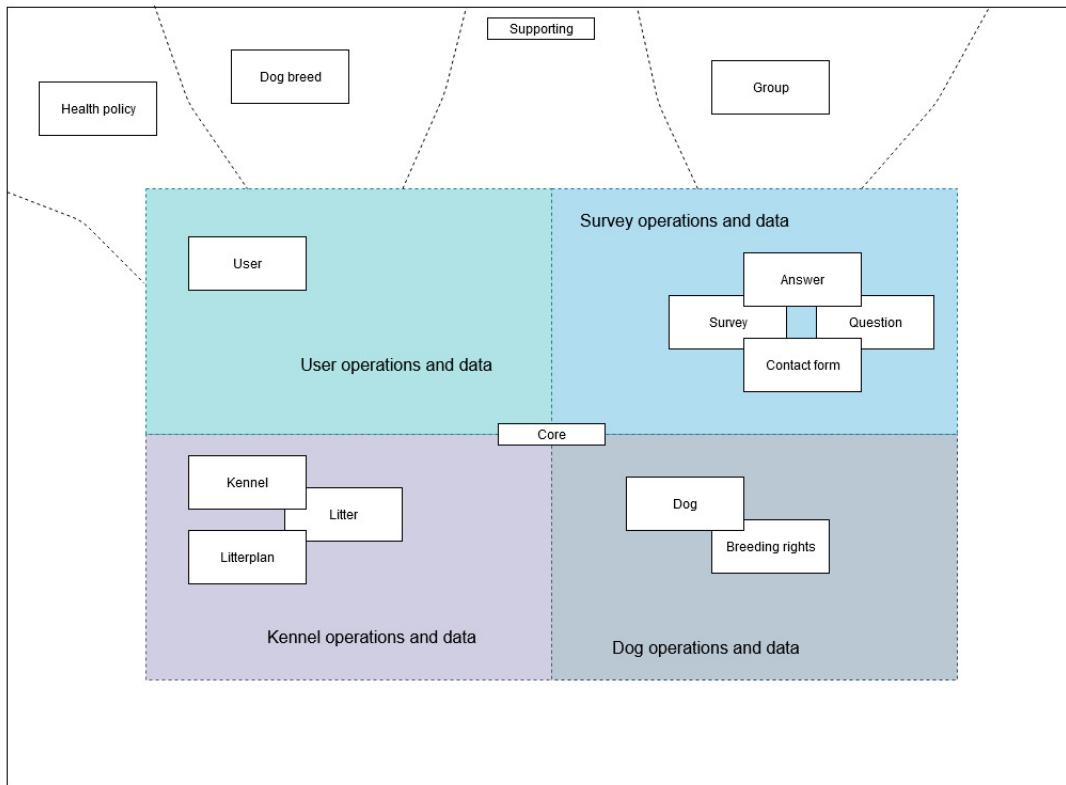


Figure 3: Subdomains

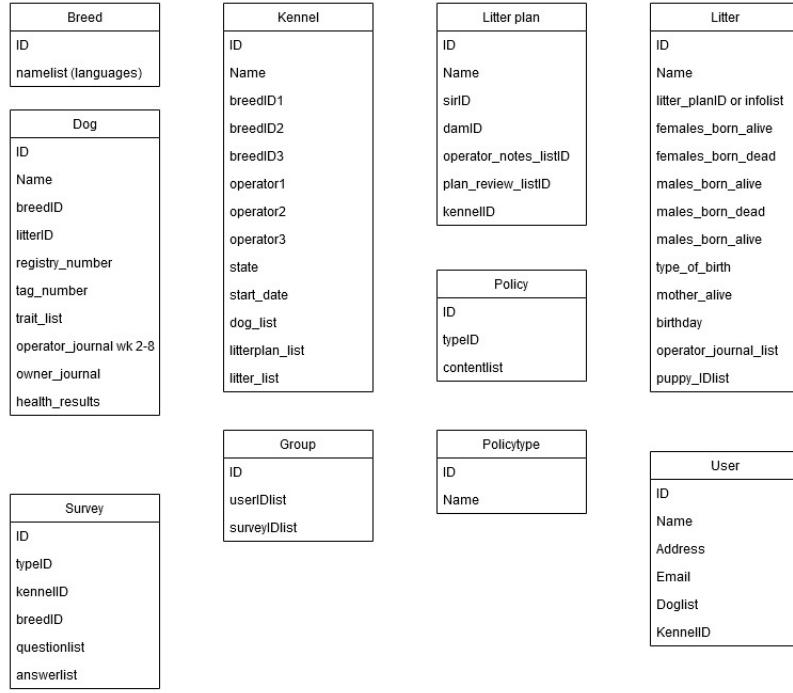


Figure 4: Entities

3.1 API Gateway

The incoming traffic to the application comes through the API gateway and connects the traffic to the correct microservices. In this model, authorization runs as it's own microservice, but could be included as functionality of the API gateway if implementing the API gateway using for example NGINX plus, which offers authorization and a certain level of user management. It is expected that tasks such as load balancing is done by the API gateway.

3.2 Dog manager

The dog manager is responsible for dog related functionality and management. For information gathered about the dog to be passed along to a new owner, the design choice of separating the dog context from user context has been made.

3.3 User manager

The user manager is responsible for user related functionality. This includes functionality of transferring in-system ownership and breeding rights of a dog to another user in the case

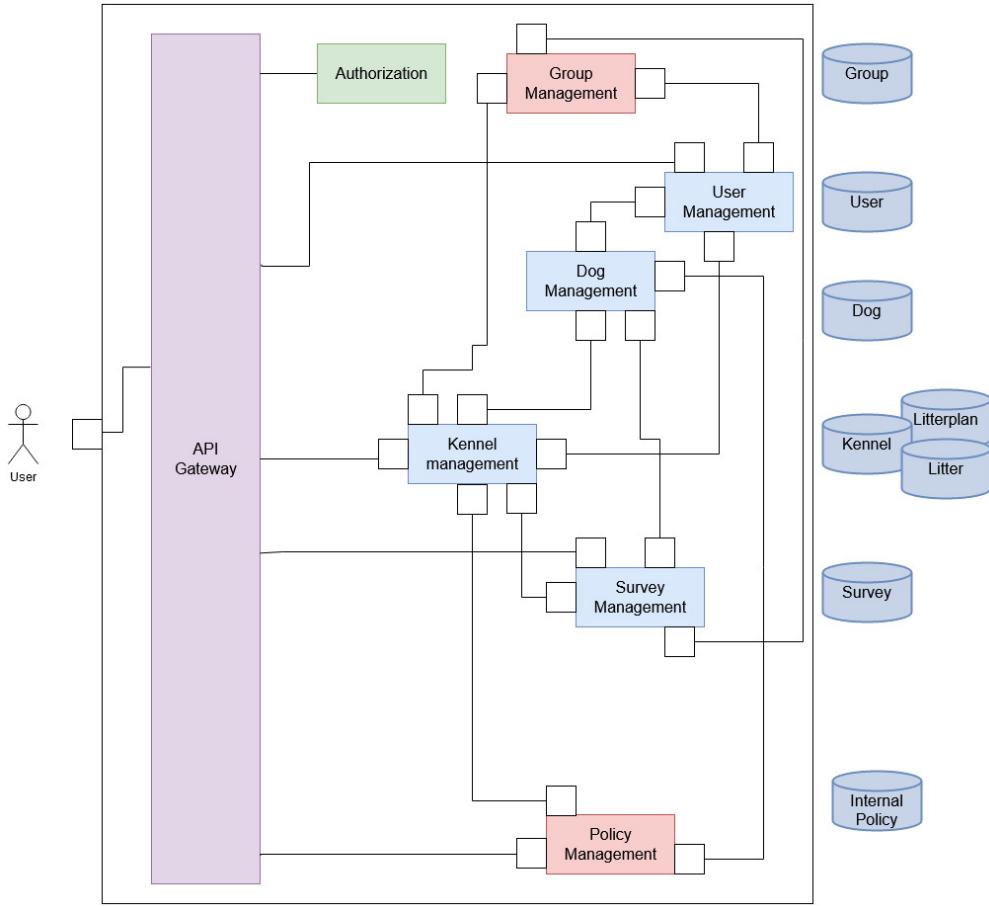


Figure 5: Top-level microservices

of the dog being resolved.

3.4 Kennel manager

The kennel manager is responsible for kennel related functionality and management. There could be a debate over decomposing the kennel manager further, and separating the litter management into a microservice of its own to achieve an even looser coupling.

3.5 Survey manager

The survey manager is responsible for survey functionality and management, and is accessible to kennel operators using the kennel manager as well as regular users using the user manager. The survey manager also includes a database for typical or popular question-

nnaire templates depending on the breed, type or purpose of the dog. The survey manager is responsible for creating aggregate data based on the received surveys. This could also be separated into a microservice of its own further down the line of development.

3.6 Policy manager

The policy manager is responsible for functionality and data related to internal and external policies. The focus on external policies revolves around the quality attributes of registered kennel operators and the health attributes of breeding stock. The policy manager is for example needed when a kennel operator makes a litter plan with the intent to execute the plan. In certain dog breeds the offspring resulted from pairings below certain health standards cannot be registered as purebred dogs, and the ability of informing a kennel operator of the possibility of making a sub-standard pairing before the litter plan is executed is an important feature.

3.7 Group manager

The group manager is responsible for group functionality for managing user groups and addressing the right surveys to the right groups participating in them. For example, the owners of a litter of puppies are all automatically added to the same group for consistency in survey deliveries.

4 Use cases

The use cases of Lauma are presented in table 3. They are still subject to change, as it is impossible to determine the entire set of use cases from the current project perspective. Two use cases were chosen for closer examination using message sequence charts (Figure 6, Figure 7).

Core user	
Log in Suspend account Edit user info Browse kennels Read Terms of Service Decline Terms of Service Activate Dog	Log out Delete account Save user info Create Kennel Accept Terms of Service Join kennel
Owner	Kennel operator
Join group Generate dog token View dog Create survey Answer survey Give feedback to kennel Update dog information View aggregate information based on surveys Publish dog information	Add kennel operator to kennel Assign dog breed to kennel Update kennel information Save kennel information Create litterplan Save litterplan Update litterplan View aggregate information based on surveys Create litter Create survey Send survey Generate dogs based on litter info

Table 3: Use cases

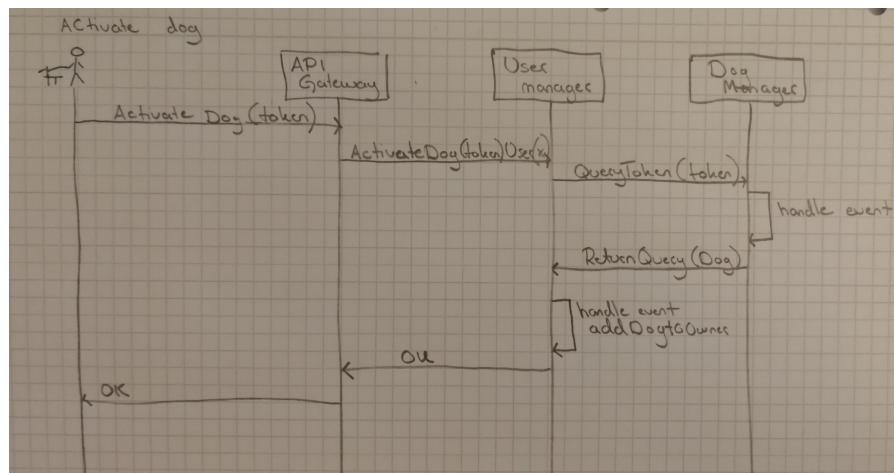


Figure 6: Use case: User activates dog

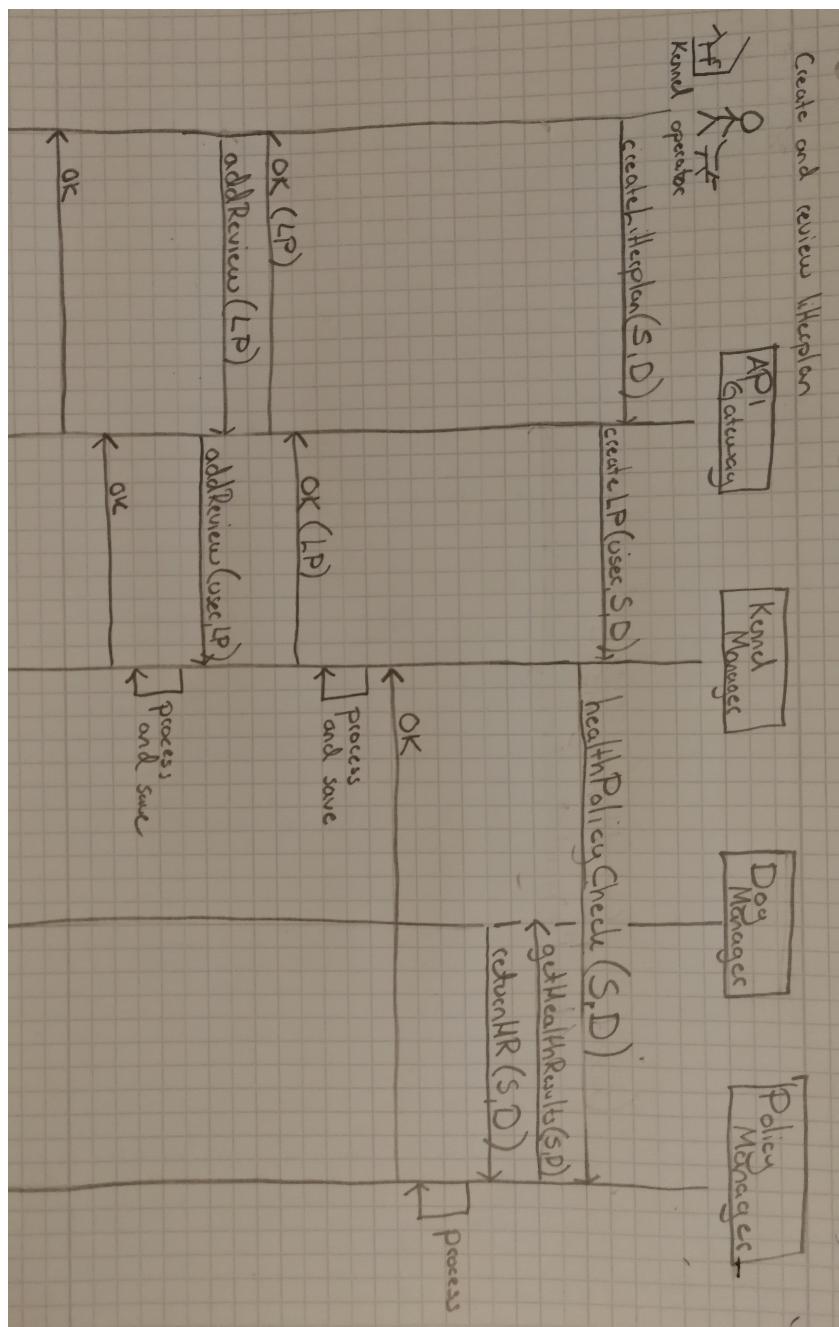


Figure 7: Use case: Kennel operator creates and reviews litter plan

5 Architecture assessment

The architecture assessment was done with two change scenarios. The scenarios considered are realistic possibilities how the Lauma system could develop it's operations in the future. In the first scenario (Table 4), we add a messaging service to Lauma using an external messaging service provider. In the second scenario (Table 5), the operations of Lauma are extended to support casual kennel operations for dogs that do not qualify as purebred pedigree dogs. The modeled domain contains many very specific and seemingly arbitrary edge cases that will always need to be taken into consideration when doing further development on the system.

Scenario
The Lauma original service has provided usefulness through it's surveys and has been taken up by a larger user base with a growing interest in exchanging information about their dogs
Quality Attributes
Usability
Environment
The Lauma original service has provided usefulness through it's surveys and has been taken up by a larger user base with a growing interest in exchanging information about their dogs
Stimulus
Users are interested in discussing the survey results within their respective groups
Response
Users that are members of a group are able through API connect to an external messaging service to exchange instant messages with each other.
Argumentation
As one of the purposes of the system is facilitating information transferring between stakeholder groups, extending the system with further possibilities for communication is logical. There is not necessarily interest in the development scope of the Lauma service to implement and maintain a messaging service within it's architecture, but to instead use an external service with an API entrypoint to the group manager. The group manager would need to be updated to conform with the new expectations of being a middleman between the activities in Lauma and the activities of the external messaging service.

Table 4: Change Scenario: Implement messaging service

Scenario
There is interest in diversifying the user base of kennel operators in the Lauma service. The original service only supported purebred pedigree dogs in order for the base construction of the system, but can also be extended to supporting kennel operators interested in participatory clients for their mixed breed litters.
Quality Attributes
Usability
Environment
There is a need for the Lauma original service to transform into supporting a wider spectrum of kennel operations available for its users operating kennels.
Stimulus
There is an existing usergroup with potential use cases that Lauma could accommodate with minor changes so that the platform can at the same time allow for both pedigree dog kennel operations and non-pedigree dog kennel operations to have their own, distinct rulesets in the system, and express their activities of interest in managing information traversal between them and their clients.
Response
Users that want to be kennel operators for non-pedigree dogs can start and manage their kennel using Lauma, not having to adhere to the policies of kennel operations for pedigree dogs, and instead being able to adhere to policies of more generic terms such as broader dog type definitions with their own agenda for example health testing before being classified as possible breeding stock.
Argumentation
One goal of Lauma is to offer usable services for kennel operators and their clients. If the service proves itself useful for pedigree kennel operators, who have various interests in tracking desirable traits in their breeding lines, one can reason that the service could be made available for the kennel operators that do not fall in the category of producing purebred pedigree dogs. The litter planning, information management as well as the dog information management and feedback functions can be argued to be useful for all kinds of kennel operators. The way to implement this would be by making changes in both the kennel manager and the policy manager. Due to external policy, producing pedigree litters at the same time as non-pedigree litters is not possible, so this would not be supported by the Lauma system either. It would be reasonable to expect that litters produced using Lauma would be required to adhere to some kind of secondary health and breeding policies (in matters such as retinal atrophy or hip dysplasia, for example) to ensure the best health for the future litters. A rating system based on the health score of the known information of the parents could also be considered, in order to create an understanding on how much effort has been put into each and every litter that started as a litterplan in the system.

Table 5: Change Scenario: Kennel policy extension

6 Bonus content: Portal prototyping

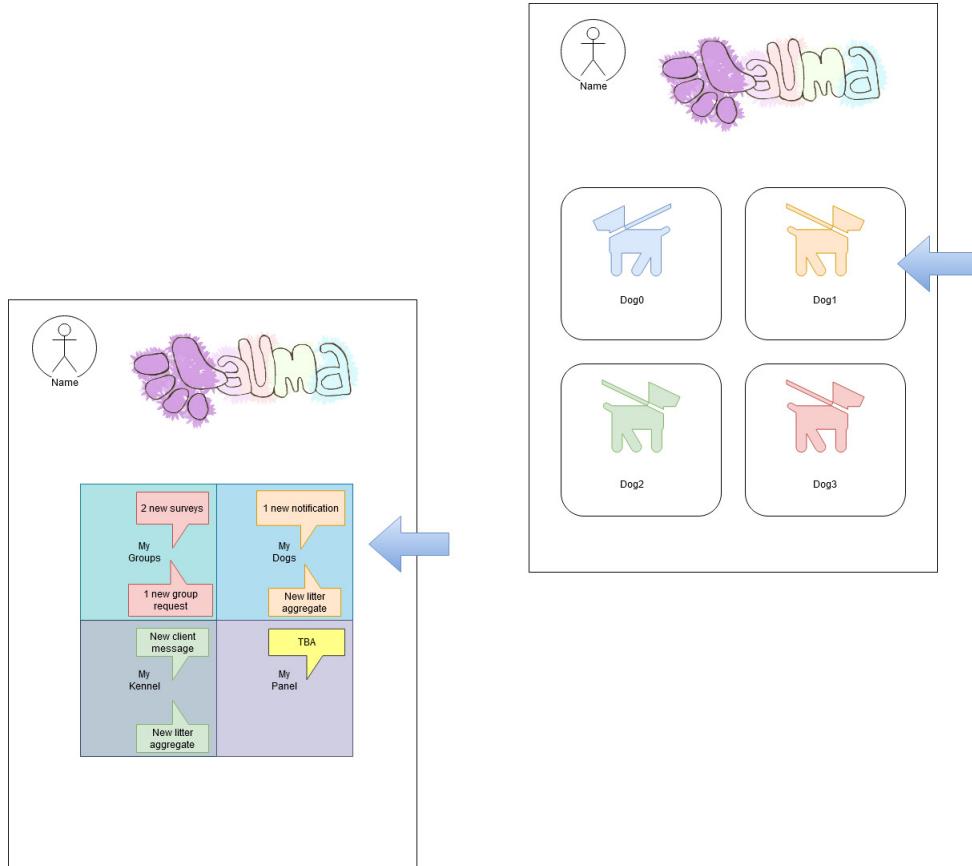


Figure 8: User portal prototype 1/2

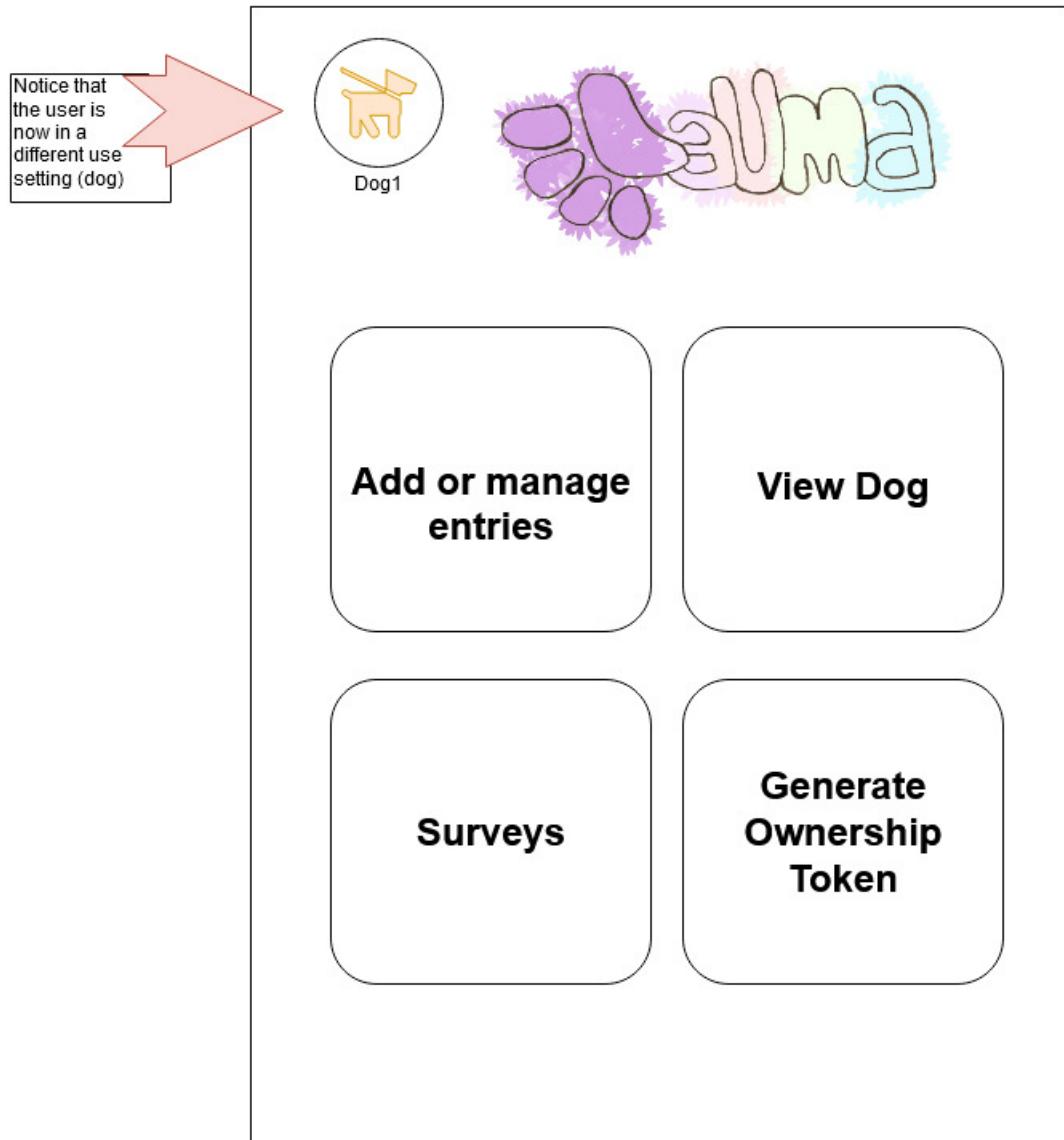


Figure 9: User portal prototype 2/2