# Design considerations

When designing a database there are many considerations which must be considered.

1. Who is going to use it?
2. How is it going to be used?
3. What guarantees can we have about the input?
4. What performance requirements are there?
5. …

# Choosing a database type

Most traditional databases are normalized. This means that data preferably only exist once and are linked via keys. This is referred to as normalized data. The advantage of this format is that it has a low footprint as duplicate data only exist in form of keys. To retrieve the data the different tables must be joined. Unfortunately the joining operations are costly, and if the throughput is very large, normalized data is actually not preferable.

Another important consideration is consistency. Traditional databases use ACID (Atomicity, Consistency, Isolation, Durability), which ensures that when data is written to the database subsequent requests is guaranteed to retrieve the new update. It also ensures that simultaneous updates are protected from each other and that transactions are supported. Unfortunately this form of access is also expensive, and sometimes not needed. An alternative is BASE (Basically Available, Soft state, Eventual consistency). Sometimes it is OK that we simply know that an update will eventually be completed, and that inconsistencies are OK for a limited time. This form of database is also used for very large project, and often combined with a distributed database. It often relies on NoSQL (Not Only SQL) as opposed to SQL.

As we are designing a database for a larger cloth wholesaler which includes payments, it is beneficial to have ACID ensured, however it would be quite possible to implement it on BASE. Also, since the database is to be used by a limited number of simultaneous users (< 10000000) an ACID DB should be sufficient, and normalized data will also be acceptable, and the databases indexing and performance optimization (keeping some tables joined in RAM to improve performance) should be sufficient.

# Who is going to use it

If the database is only used by fully trusted personnel then there is no need to place limitations on the access, however if the database is to be accessed by people we do not trust, then it is important to ensure that the users are not able to access more than he or she is allowed to.

Access to the database is not directly part of the SQL standard, but most database implementation works with Users, permissions and possibly Roles. The normal implementation allows for limiting a user’s permissions to one or more specific tables or views as well as whether the user is allowed to insert, update or select. Unfortunately this is insufficient when data from multiple individuals exist in the same table and it is therefore necessary to add another layer of protection. This could be on the form of a REST service with its own layer of authentication and exposing a limited interface to the user.

An alternative is the database principle of Row Level Security (RLS), which basically allows a database to limit access to a given row of a database based on the content of an attribute.

RLS is a very interesting, but though there is an implementation in a patch to postgresql, it has been decided to move the limitation on the row level to a layer above the database. The design of the database will however be in such a way that it make it simple to create a layer on top for row level authentication.

In the tables were RLS is required a GUID attribute is added to each row. This GUID is linked to a user, and the higher level authentication ensures that all quires includes a “WHERE GUID=”...”. If e.g. a 128bit GUID is used then it is infeasible that anyone can guess the correct GUID, and the limitation on the upper level authentication is simply to ensure that the where-clause is included, as that is not possible to enforce using standard SQL users, roles and privileges.

There is a special work-around which involves having all requests to the database go through functions, as functions may enforce a WHERE-clause, but this use of transactional SQL one every query has a high performance penalty and is not very “pretty” from a design perspective.

As a minor note, if the users are allowed to insert arbitrary data it is important to encode the text to prevent them from inserting SQL-statements inside the text.

# How is it going to be used

As mentioned before if the database is used through a predefined interface,e it is simple to limit the access based on authentication. We are going to attempt to create the database so it may be access through the normal postgresql access and authentication, so the database may simply be exposed “online”, yet with the simple pre-processing of validating that the WHERE-clause with the GUID is include for the shared tables.

The actual implementation of the layer above the database which enforces this WHERE-clause will not be a part of the project, and it will simply be assumes that it is included where appropriate.

# Relational design

The clothing wholesaler has four different kinds of people of interest; the retailers, the web-shops, the web-shops’ customers and the manufacturers.

These four groups are bound together by the product.

The retailers are actually just customers in the wholesaler’s web-shop, and it is therefore possible to work with only three groups; manufactorers, web-shops and customers. One of the web-shops is then the wholesaler selling to retailers.

A manufacturer may product one or more products at given prices.

## A purchase

Purchasing a product from a manufacturer is done by issuing an order for one or more products, receiving an order confirmation, receiving an invoice, receiving the delivery and paying the invoice. Special discounts may apply when issuing the order.

## Web-shop setup

Setting up a web-shop is a matter of deciding what products to carry, at what price the products may be purchased from the wholesaler and at what price it is offered to the customer.

The web-shop may negotiate a specific price for each product, a fixed discount on all or some of the products, a variable discount dependent on sales, or a combination of these.

The web-shop may offer the same types of discounts to their customers.

## A sale

Selling a product to a customer is done by the receiving an order for one or more products from the customer, sending an order confirmation, preparing the delivery (managing shipment and inventory), sending an invoice (possibly payment via credit card), sending the delivery and tracking payment. If payment is not performed, then the customer may be blacklisted.

## Complaints and returning products

If a customer complains about a product (or changes his mind) then an RMA is created and a return slip is sent to the customer and a case is created.

If it is a simple matter of returning a product then it is confirmed that the product is in OK shape and the money is returned and the case is closed.

If the customer has complained about a defect then a new product is shipped to the customer immediately. When the product is returned, it is determined if it is a flaw in the product. If so a case is created with the manufacturer. If the customer does not return a product as promised or if the customer has damaged the product, then the customer may be blacklisted.

## Products

A product can have many attributes, like a name, recommended sales price, colour, ... Unfortunately it is difficult to determine in advance all the possible attributes. Therefore the product will have a collection of predefined attributes and then a many to many reference to an attribute collection.

This may be done by having two relations, one with the attribute type (aid, name, type) and one with the relationships and value (pid, aid, value). Example (7, “Colour”, “string”) and (46,7,”Green”). Colour is special though and will receive its own relationship.

## Relations

* Products – define the products in the wholesaler’s assortment.
* ProductAttributes – list of possible attributes a product may have
* ProductAttributeValues – Attributes for products
* Manufacturers – The manufacturer producing for the wholesalers.
* Customers - The customers of a given web-shop.
* WebShops – the different Web-shops including the retailer one.
* WebShopProducts – The products offered by a given web-shop.
* ManufactorerOrders - The purchase orders to the manufacturer
* ManufactorerOrderConfirmation - The order confirmations from the manufactorer
* ManufactorerInvoices – the invoices received from the manufactorer
* ManufactorerReceptions – The products received from the manufactorer
* CustomerOrders – Orders received from the customers
* CustomerOrderConfirmations – Order confirmations sent to the customer
* CustomerInvoices – Invoice sent to the customers
* CustomerDeliveries – Deliveries to the customers
* CustomerComplaints – Complaints received from the customers and its status.
* CustomerReturns – Products returned by the customer.

Single location for the products – consider multiple warehouses.

As the price of the individual products is not so high we do not need to trace the origin of a given product.