User Guide: DataGate v2 – Introduction.

(System components, Terminology and Accounts).

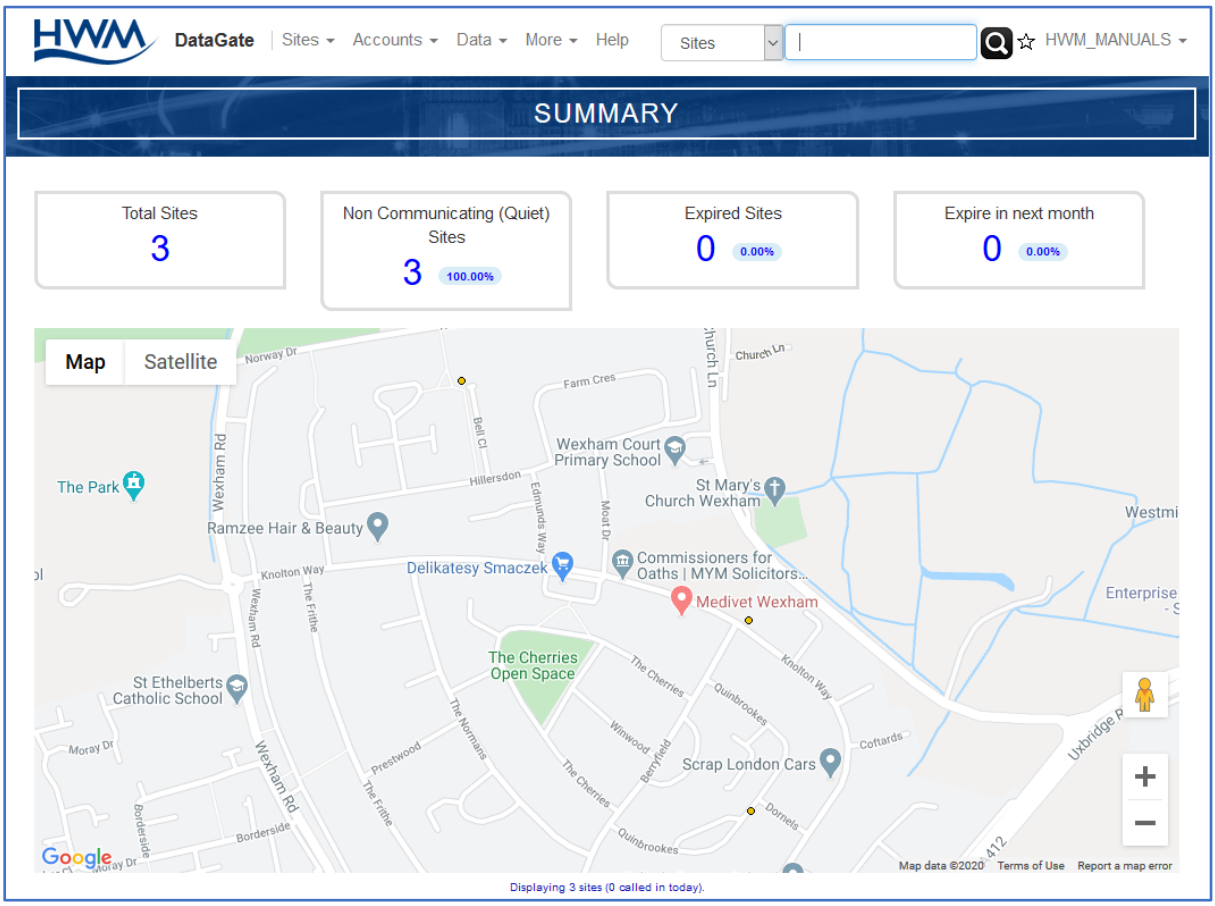


TABLE OF CONTENTS

1 SYSTEM DOCUMENTATION AND SUPPORT OF PRODUCT

1.1 DOCUMENTATION AND TECHNICAL SUPPORT

The manual introduces the reader to the HWM DataGate2 system. DataGate2 is the name of software provided by HWM. It operates on a server which acts as a repository for data provided by HWM equipment. It includes various web portals into the system, such as “DataGate”, “PermaNETWeb” and “PressView” (amongst others).

This manual includes concepts and simplified explanations of how the DataGate2 system works and introduces the terminology of the system.

Use of the system depends on the correct configuring of it, which is primarily an administration task. Configuration is not an isolated topic; a user’s experience and the way the system functions often depends on the way it has been configured. For this reason, administration settings may be referred to only briefly in this user manual. An introduction of how to setup the system for use with a basic configuration and initial settings is covered elsewhere. Refer to the following manual:

MAN-130-0016 DataGate2 – Introduction to Administration.

Discussion of any additional or alternative setting options is deferred to the manual covering the web portal for which the setting is most relevant.

Note: The system periodically has new features and changes released, thus you may observe slight changes in layout from those shown in this manual. Additionally, views can vary depending on what user-role you have been given and its permissions.

HWM provides support of DataGate2 system by a set of online help documents. DataGate2 is also supported by some introductory user documentation (a user guide for general users and also administrators; an administration guide for system administrators).

On-line help pages are also available from our support webpages:

https://www.hwmglobal.com/help-and-downloads/

Should you have any questions that are not covered by this manual or the system’s online help, please contact the HWM Technical Support team on +44 (0) 1633 489479, or email cservice@hwm-water.com

2 INTRODUCTION

2.1 OVERVIEW OF VARIOUS HWM SYSTEM COMPONENTS

This section gives an overview of the HWM system components. Some are device-based (e.g. measuring equipment), whilst some are server based (e.g. Websites for viewing data).

2.1.1 Measurement and Logging Devices

HWM produces a variety of devices which make measurements. In some cases, the devices can also have electrical outputs for the purpose of controlling other equipment. Most devices record data (along with its time-stamp); the manual will refer to these devices collectively as "loggers". Some logger devices are designed for a specialised purpose (e.g. Leak detection in clean water pipes), whilst others are more general-purpose in nature. A general-purpose logger can be adapted for use in a variety of applications; they support a variety of interfaces and sensors. Loggers can also look at recently gathered data to determine if certain conditions are met (or no longer met) and report the change as an event "alarm".

The logger is installed at an installation *site*. Sensors are attached to the required monitoring point and may be integrated into the construction of the logger or connected to it by a short cable. Some devices are installed in a cabinet alongside other equipment, whilst others are installed in somewhat restrictive areas (e.g. Leak detectors are often installed below ground, being attached to an asset on the pipe network, such as a valve or hydrant).

After making its measurement or evaluation, a logger device temporarily stores the results (hence the name "logger"). Periodically, the device transfers its results to a server (e.g. DataGate). This may be done by a variety of methods. Typically, the device can call-in over the cellular network, which gives it access to the internet. Some devices can send data in by SMS (as used by the mobile text service). Some devices use e-mail messages. Other types of devices have no direct access to a network but have their data collected manually (e.g. Data may be sent over a low-power radio link to an app running on a mobile phone. The phone then uses its network access to forward the data to the server; several HWM apps exist).

2.1.2 DataGate Server

"DataGate" is a cloud-based website, provided by HWM. A similar server can be found in the USA, branded "OmniColl". The server acts as a receiver of data from loggers, which is then stored for future access by users that have the appropriate permissions.

The server software supports several sub-systems including components for database storage and access, event detection, alarm generation, administration, and presentation to the user. The user interface is by means of several portals which can be accessed

using a standard internet browser to view data suitably organised and presented on webpages.

Each portal contain pages that are geared towards a particular application of logger devices (although DataGate can jump between the pages specific to the portal and more general DataGate pages).

Datagate has administration pages for configuring the system, including options that switch on features for a specific portal. It also includes settings for controlling internal tasks, such as for background services that provide system functions. The Datagate2 admin pages are somewhat "hybrid" in nature; some options do not need to (or indeed should not) be activated for the user or the group of sites containing logger devices.

The portals include:

- The SpillGuard portal provides webpages that are mainly used for displaying site status and measurement data from loggers that have sensors detecting excess water levels (typically wastewater). The portal is used to warn of sewer systems reaching their capacity or of potential spillage.
- The PermaNETWeb portal provides webpages that are mainly used for displaying site status and measurement data of leak-detection loggers (for clean water pipe networks).
- The PressView portal provides webpages that are mainly used for displaying site status and measurement data from Controllers, loggers and actuators that monitor and control water pressure (clean water pipe networks).
- The HWMOnline portal provides webpages that are mainly used for displaying in a graphical form the site status and measurement data from loggers that have transducers. The transducers can monitor a variety of physical parameters or a meter reading interface.
- The DataGate portal provides webpages that are mainly used for administration and setup.

2.1.3 A Site oriented system.

A user logs into the system views information and data using webpages. The system is mainly site oriented; the data belongs to the measurement site. It should be irrelevant which particular logger obtained the data; loggers are occasionally swapped on a site for maintenance purposes (and other reasons).

Certain views occasionally include information concerning the logger that is currently deployed, or loggers previously deployed, but the main focus of the system is the **site** and the **data for the site**.

During setup of the system, sites will be linked to accounts. Accounts are set up as a hierarchy, which (on some portals) the user can navigate. Accounts have many uses,

one of which is to act as a container in which to group sites. An account may therefore represent a specific area of the water supply pipe network.

Users of some portals (e.g. PermaNETWeb) may apply filters to page views to look for a particular area. Similarly, they can apply additional filters to select specific sites, or to select only sites with a particular state.

2.1.4 Multi-User system / multiple roles

The DataGate system allows multiple users to log into it simultaneously. All users are required to log into the system using their own allocated username and password.

Each user is assigned a certain role (e.g. administrator, installer; this is a setting within their user-account). A role gives the user a particular set of access rights (e.g. which pages they have access to, the availability of some menu options and availability of certain controls on pages). Access is further restricted by linking a user to their "top-level account", which reduces their scope of visibility of the entire system to only the area (represented as being below them within the account structure) over which they have responsibility.

HWM also provides certain apps to help installers with the tasks involved with deployment. The apps interact with DataGate and similarly require a user account (of a role "app") that give them permissions to use the system (effectively, each app also has to log-in).

2.1.5 Monitor of logger health

The primary purpose of the system is to receive measurement data of physical parameters at the site where devices (with appropriate transducers) are installed. This can include both the raw measurement data and also messages from the devices about any events. For example, the logger can check if a measurement is within or outside of certain limits and send a message (sometimes called an "alarm") to the server whenever the change occurs (called an "event"). A user can initiate an investigation, fix the issue, and clear (or acknowledge) the alarm.

The system also has secondary tasks which include monitoring itself for problems. This could be in the form of a logger device detecting an irregularity (e.g. a low battery, or a detached sensor wire) and sending a message to the system (often this is called an "alarm" message). Another form of monitoring for problems is for the server itself to detect issues. It can for example be set up to check for problems with data arrival, or data that it considers suspicious (e.g. unchanging). Loggers are sometimes unable to send data due to adverse weather conditions (e.g. the site is flooded). If a site has "gone quiet" (it has received no data for a certain period) or if the logger is sending in non-sense values the system can check for these conditions.

2.1.6 Remote programming of loggers

The system can remotely program loggers to perform certain tasks, where the logger supports this type of operation. Sometimes the re-programming of the logger is initiated by a user (e.g. to modify the settings of the unit). In addition, the system itself may initiate the request (e.g. the facility is used by the system to request a set of "leak-detection" loggers to make sound recordings to help investigate a potential leak). The system stores the re-programming commands and waits for the logger to call-in with data. Before the call ends, the system sends any stored commands to the logger.

Note: This feature obviously requires the logger to be able to call in with data in order to subsequently receive the follow-on commands from DataGate. Where a logger is unable to call-in, it is not possible to transfer commands to it.

2.1.7 Periodic run of tasks

The DataGate system can periodically run tasks automatically for various purposes.

Tasks are specific to the application of the various portals. For example, they could be:

- To assist in detecting water leaks.
- To update parts of the system (e.g. tables). These are often run at specific times or intervals.
  (Responsiveness to the user can be impaired when the system is heavily loaded with tasks and data arrival. Therefore, certain lengthy tasks are scheduled to occur over-night when system use is low. Load spreading of less time-critical tasks is also implemented, but any logger calling in with data later than normal can, for some portals, take several minutes for it to be fully processed for display purposes; this will usually be only a small fraction of the logger fleet).

2.1.8 Communication of important events direct to system users

DataGate provides a graphical interface to users via several web-page based portals into the system. It can also optionally forward any important events (sometimes called an "alarm") to a user's phone (via a SMS text message) or via e-mail. Each user has to *subscribe* to the individual sites for which they wish to receive information in this way. Alternatively, the user may subscribe to an entire collection of loggers that are linked to specific accounts. Depending on the portal, the user can set the subscription for themselves, or an administrator may be required in other situations.

3 DATAGATE2

3.1 TERMINOLOGY AND SUMMARY

DataGate and its various application portals give users access to webpages produced by a server that retrieves data from a database. Because the system is multi-user, the system manages data access. Users are only permitted to view data which is relevant to them; access to the data of other users is denied. The system organises access to data further by the use of a hierarchical structure of accounts.

The terminology used and an overview of the database scheme is summarised here…

HWM produces **logger devices** (many different models, plus transmitter devices) that produce several forms of measurement **data**, each of which can be considered as a data **channel**. The data represents a measurement made by a logger that has been deployed at an installation **site**. A site can be one of many that are in an area or suburb and may therefore be grouped together on the system within an **account**. With the clean-water pipe network the account is often referred to as a **DMA** (or a zone), particularly if it is a metered area within the network; for pressure management, an account may be referred to as a **PMZ** (Pressure Management Zone); other applications similarly group sites using accounts. DMAs (or accounts), in turn may be collected together in a group, also referred to as an **account**. Each of these separate entities are represented within the database used by the **DataGate** system. Some accounts can be used to link a **User** into the system.

Or, put in reverse order…

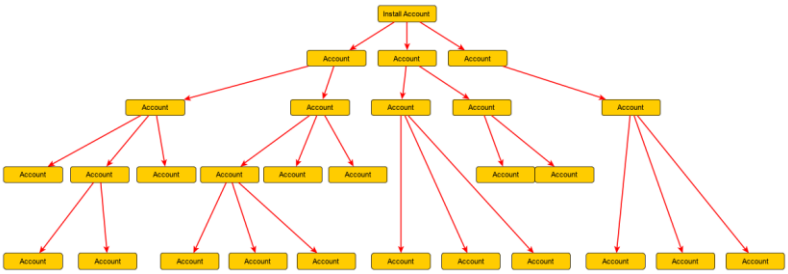
- **DataGate** contains a database.
- A **User** of Datagate can be linked with an account.
- An **account** in Datagate can be a group of multiple DMAs (or other accounts).
- Each **DMA** (or account) can contain multiple sites.
- Each **site** can have one logger device installed (maximum, at any given time).
- Each **logger device** can produce multiple **channels** of measurement data.
- The **data** of a channel may consist of multiple samples (called **datapoints**) that are obtained at different times. Data is often timestamped by the device that collects it.

Sites have additional terminology:

- A site which has a logger deployed (installed) is referred to as an **active site**. (The logger should be actively producing data for the site). Alternatively, it could be called an **occupied site**.
- A site which does not have a logger deployed is referred to as an **inactive site**. (Nothing produces data for the site). Alternatively, it can be called a **vacant site**.

The grouping of multiple sites into DMAs, and of multiple DMAs (or accounts) into other accounts allows the formation of a hierarchical structure, similar to a pyramid or the branching roots of a tree.

The accounts part of this hierarchy is referred to as an "**account tree**" within this manual.



The account tree is often structured to represent the organisational structure (e.g. regional areas) of the company owning the loggers and sites. It can also be used to split the tree into the various uses / functions of the loggers (e.g. Pressure Management, Leak detection, Spill detection).

Each account is either linked to another one (and only one) above it, referred to as its "**parent**", or if it has no parent, it is referred to as a "**top level**" account.

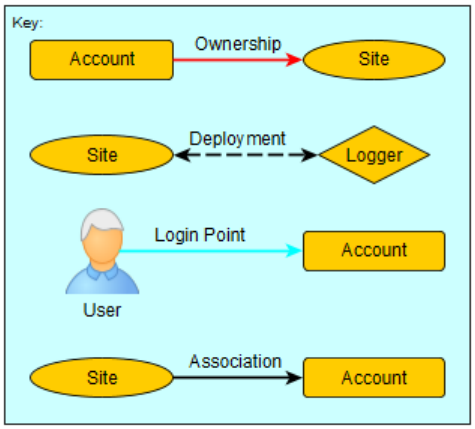
A user of certain portals can navigate through the account tree, by nominating an account to be the **current account** (or DMA). In doing so they exclude any visibility of what is above the current account or any branches linked to accounts above. They only have visibility of the current account or (if selected) its **sub-accounts**. The user cannot navigate up the account tree beyond the point at which they are linked to it. This manual refers to this account as the user's login-point; it is *their* top-level account.

On DataGate2 **administration pages**, an administrator has no need to navigate through the account tree for their administration tasks. They can search for whatever entity (user, account, site, device) they wish to edit. They still fall under the constraints of their link into the account tree (which cuts off access to out-of-scope data), permissions given to them by their role, and the ownership of the various entities.

On DataGate2 **portals**, users experience the system under the same constraints of their link into the account tree (which cuts off access to out-of-scope data), permissions given to them by their role and the ownership of the various entities. They can also be restricted by an additional link (called "association") … which provides considerable flexibility, but if used unwisely can lead to the system being somewhat quirky in nature; the association link can sometimes impede intuitiveness.

3.2 DATABASE LINKS

DataGate2 uses a database which defines various types of links between entities.



They are:

- Ownership
- Deployment
- Association

They are discussed in the sections that follow.

(Note: The direction of any arrows in the diagrams are shown this way as a drawing convention only).

3.2.1 Database links: Ownership

Each entity (site, DMA / Account, User) has a property which defines its "owner". The owner will always be an account.

Thus:

- Accounts are owned by other accounts (unless it is a top-level account).
- Sites can be owned by DMAs (preferred; a DMA is an account that should end the branch of the account tree), or by an account (not preferred). Some companies do not use the term "DMA" within their pipe network; a DMA can alternatively be regarded as an area or zone.
- Users are owned by an account.
  (This permits multiple users to be linked to the same point of the account tree, if required).
- Loggers are owned by an account.

The ownership link is used to build the hierarchy of the account tree. The owner of each account points to its parent account.

The ownership link binds a user to the highest point in a branch of the account tree to which they have access. The user is owned by an account. When a user logs into a portal of the system, the account owning the user is adopted as the "current account" for account navigation purposes. In other words, the owner account becomes the "**login point**" of the account tree for a user. It is also an upper "end-stop"; the user cannot navigate any higher up the account tree.

The ownership link is also used in conjunction with the account tree as a security measure. One of the requirements to give edit access (create or modify) to an entity is that it is *owned by* the same account as a user is owned by, or an account below it (connected via a lower branch or branches).

Caution: From the statement above, it follows that if a device, site, or sub-account has its owner account deleted, it will become detached from any account, and owned by no-one. i.e. Lost.
Only HWM can edit the entity to link it back to an account.

3.2.2 Database links: Deployment

In order for the system to link an installed logger to a site, a deployment link exists. A site can either have no linked logger, or a single linked logger.

Loggers can be removed from a site and later replaced with another for various reasons (some are mobile loggers that are deployed for short periods, whilst others may be swapped out for maintenance purposes). The system keeps a history of which loggers have been deployed to a site and the start and (if applicable) end time of the deployment.

3.2.3 Database links: Association

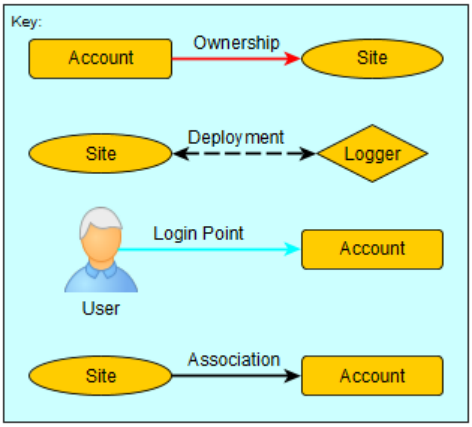
An association link can exist between a site and (zero, one or many) accounts.

The link has 3 purposes in DataGate2:

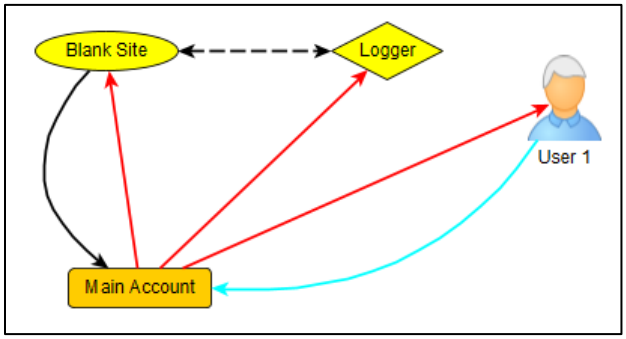
- It gives a site **visibility** within certain portals of the system.
  Whilst the user may be able to navigate through accounts within their scope of the account tree (based on ownership of accounts), this has no bearing on whether a site can actually be seen.
  i.e. Ownership has no effect on site visibility; only site to account association governs the visibility of the site from the account.
  Thus:
  - The site has to be linked (via association) to every account from which it is required to be seen. This starts at the bottom level of the tree (a DMA) and moves to each account above, in the direction of the top-level account. This is a manual process, is error prone, open to the possibilities of being left incomplete, and therefore being inconsistent. Where gaps exist, these can degrade the experience of the user as intuitive behaviour is lost.
  - Users that own sites can lose visibility of them if all of the association links are removed from the range of accounts they can navigate to.
    (Caution should therefore be exercised when deleting association links).
- It gives a way of grouping sites where it is useful to link them to more than one account.
  This can be implemented intuitively, (as above) to link the site through various levels of the account tree. Thus, visibility is given to more than one account level. Equally it could … alas … be implemented non-intuitively (e.g. leaving gaps or cross-linking sites to accounts on entirely different branches).
- The link could be used to restrict the “visibility range” of a site through the account tree.

3.3 Initial Setup of accounts and devices by HWM

This description assumes a starting point of a new HWM customer.



Customers may be small or large companies … there is no database restriction on the how many users, accounts, sites, or devices the company can have.



A DataGate account (shown opposite as "Main Account") is created for the customer (e.g. a utilities company) by HWM. It is required in order to be able to create users of the system for the customer.

HWM also creates the first system user (shown opposite as "User 1"). Typically, this will be an administrator account so that the customer will be able to use it for administration (in addition to regular use); other companies may enter into an agreement for HWM to do the administration on their behalf. The first user is owned by the customer's main account, and therefore the login point of the user is set at this account.

At this point there is no account tree for the customer. The account tree is subsequently to be created under the main account by an administrator.

A logger device that is sold to a customer has to be made visible to the customer's system administrator. Therefore, when a logger device leaves the HWM factory, it is also registered (by HWM) on the DataGate system and linked to a newly registered "blank site" (one new blank site is created per logger). Both the blank site and the logger are usually initially *owned by* the main account, unless an alternative customer account was negotiated with the HWM sales representative. The blank site is also *associated* with the main account in order to make the site visible. System administrators can then both see and modify these entities (site and logger) as they require.

(A "blank site" contains no GPS coordinates and has a site name related to the sales order-number; this is merely a HWM convention).

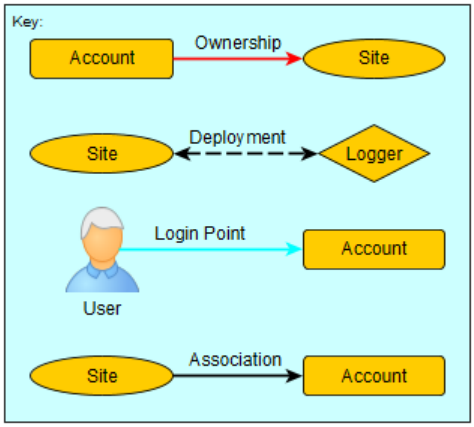
3.4 DataGate2 customer setup options: Account Tree / Database links

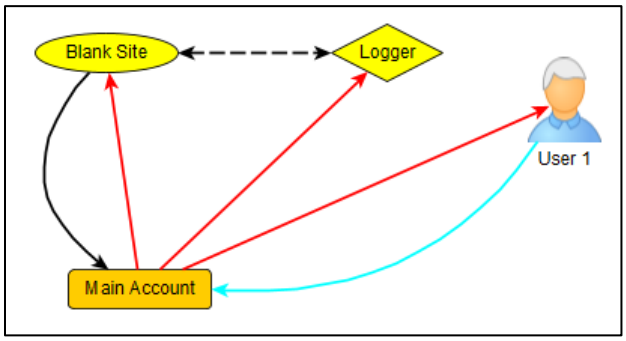
3.4.1 The account tree scheme

A large utility company will have many reasons to create a *hierarchical account structure* underneath their main account. Typically, a company has a main office and regional offices. The regional offices may be further divided into smaller areas of responsibility or geographical areas. A smaller company may not require such a deep structure. Logger functionality differences are also a good reason for making an account hierarchy.

A simple example is given here to show how the DataGate2 system operates.

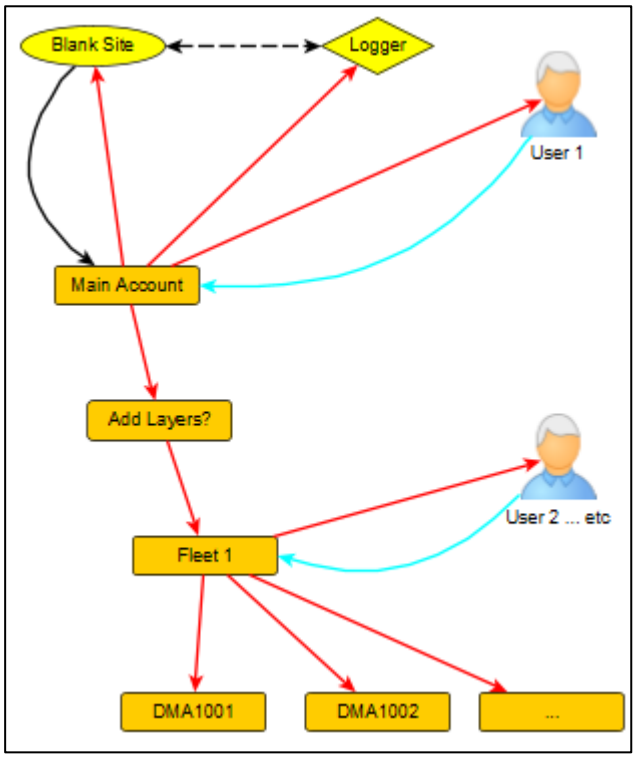
The initial setup of the system is shown below …





The initial user of the system will be "owned by" the "Main Account". An employee of the utility company will be given the account name and the password for the account.

Accounts can be linked together to form a hierarchy (the account tree).
For simplicity, only a single branch of such an account tree is shown opposite.
The accounts are linked together by *ownership*.



A user logs-in at the level of the account that owns them (their login point). The user has permission to access this account and any account that may exist in the hierarchy below this level (i.e. sub-accounts), but no access to any accounts above this level or any outside of this branch.

The system administrator can add new Users; if they are owned-by lower level accounts, it will limit their scope of access to the

account structure even further (they, cannot navigate to an account above *their own* login point).

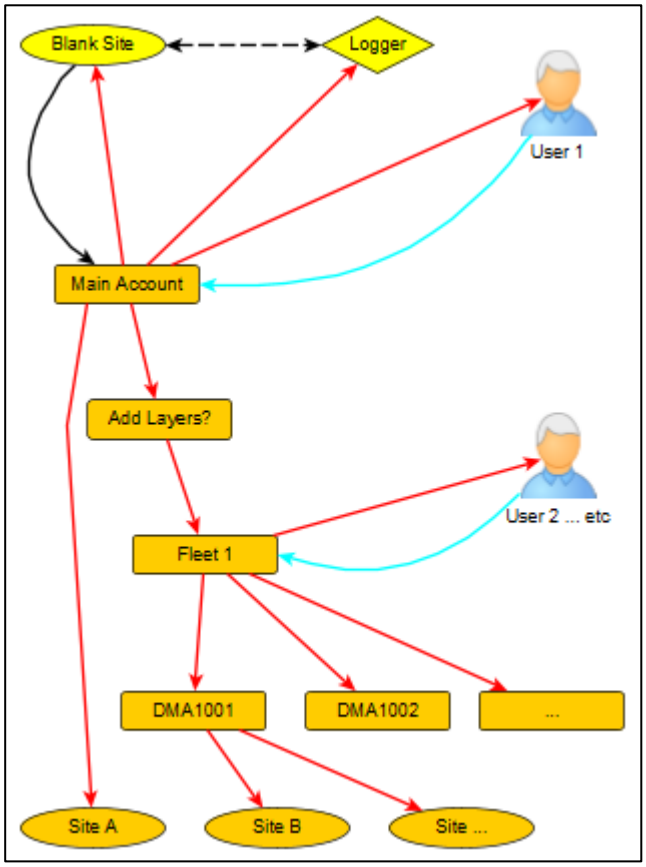
If the User is given a role of being a system "user", their login point restricts access to sites and hence site measurement data. If the User is given a role of being a system "administrator", their login point also affects the ability to edit things (there is no edit access to any entity owned by accounts above the login point). In both cases, the permissions to do certain tasks being also governed by user role.

DMAs are very similar to Accounts (indeed, within DataGate2 they are identical). They also are linked into the account tree hierarchy by the concept of ownership. Thus, in the diagram above, "DMA1001" has the "Fleet 1" account as its owner. They *should be* used to terminate the hierarchy (like a leaf on a tree); the user should not have additional accounts linked to them and thus they are the are lower "end-stops" of any account branch.

Accounts (and DMAs) can be created manually by users who are system administrators of DataGate. DMAs can also be created by users of certain *HWM apps* that support their creation (e.g. any app used for deployment purposes; the app does much of the administration for the app user).

Now consider the situation regarding Sites:

Sites also have an owner account. The DataGate2 system gives a utility company a considerable amount of flexibility as to which account owns a site.



A common scheme is for all sites to be owned by the main account (e.g. Site A is owned by main account). This excludes lower-level users from having permission to edit the site details.
e.g. User 2 *cannot* edit Site A details.

An alternative scheme is for lower levels (down to the DMAs) to own the sites (e.g. Site B is owned by DMA1001). This allows edit access to be given to users at a lower level (if their role has permissions).
e.g. User 1 and also User 2 can edit Site B details.

A similar manipulation of the ownership scheme can be used with logger devices … these can have their ownership moved to a lower level if required.

Note: Keeping ownership above a user (e.g. Installer) is a popular choice.
An installer can still be given "create / edit access" to the loggers and sites by using an app on a mobile phone that includes *deployment* functions.
The app is given a user-account at a high level (so it has ownership permissions to change the system structure) but its role does not allow viewing webpages.
(The app provides an alternative user interface designed specifically for installers; it takes them through the process of providing the information required for DataGate). An app handles structure changes by special messages (e.g. using APIs) between the phone and system.

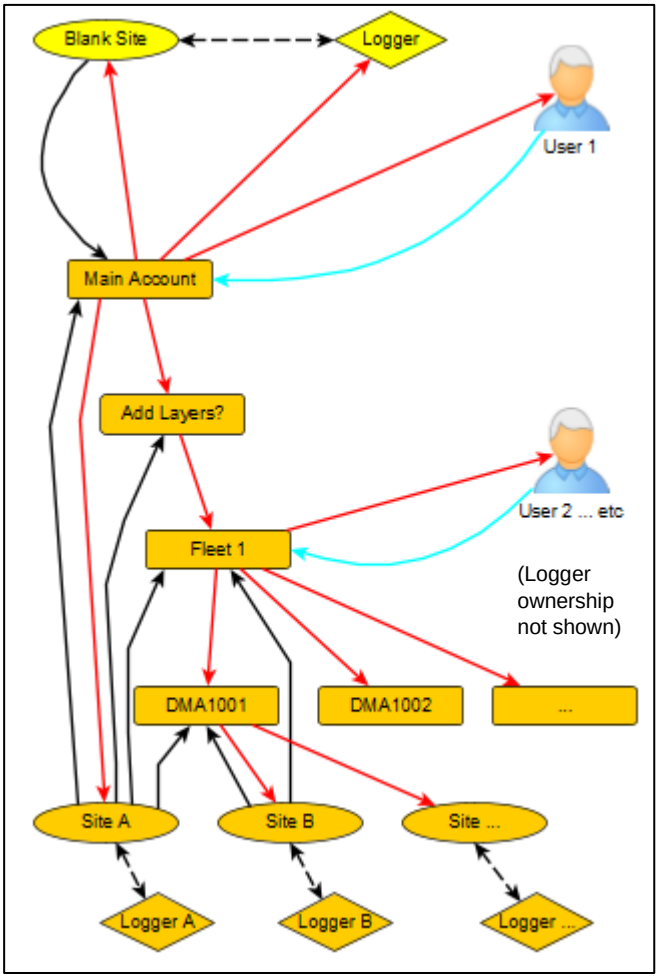
3.4.2 The Site association (to accounts) scheme

The final means of linking, shown in the example structure opposite, is that Sites can be "associated with" accounts (or DMAs).

It should be noted that for many of the DataGate2 system portals, ownership of a site by an account (or sub-account) does not give a user visibility of the site.
The association link will give visibility of a site from an account.

Site "A" and "Site B", opposite show some association links added.

A site can be linked by association to zero, one or many accounts, which can give flexible control over visibility (this can also potentially lead to inconsistencies; administrators should follow a common set of rules for making site associations).



Users of some portals can navigate to a specific account through the ownership tree. Site associations / account navigation could be used as a means to view a wider or narrower scope of the system.
Alternatively, associating a site to accounts at lower levels but not at higher levels could be used to give more details at lower levels that is "too much detail" at the higher levels

(i.e. to set a visibility range, by making sites invisible at the higher level accounts). The scheme in use should be defined by the utility company and implemented consistently.

Referring to the diagram above, User 2 can see Site A and Site B from either the "Fleet 1" or "DMA1001" accounts. There is no association link of these sites to the "DMA1002" account since it represents a different area on the pipe network and will have its own unique sites.

User 1, when looking from the Main account, can see only Site A. They cannot see Site B because there is no site association link to it. If they navigate to a lower account (e.g. Fleet 1) they can now in addition see Site B.

In summary: Site A has been made visible throughout the whole chain of branches of the account tree, whereas Site B has its visibility restricted to only be visible at the lower levels of the account tree. The Site A scheme supports the aim of inclusion in a wider view of the system, whereas the Site B scheme supports visibility of details only at a scale where they become meaningful (Site B setup parallels zooming into a map, where street names only become visible when the scale makes them readable).

(Note: HWM apps may require a specific account structure within DataGate2 in order to operate; If using an app, refer to the app user guide for its requirements).

The system of site to account associations can be very flexible, but has two competing goals, from the perspective of **visibility**.

- Including sites in a wider view of the system.
- Excluding sites from view in a wider view of the system.

Failure to design a scheme and apply its rules consistently will quickly lead to confusion of the user from what seems to be irregularities in system behaviour.

The aspect of site visibility introduces additional terminology for DataGate2:

- A site is said to be "**within**" an account if it visible to a user that has navigated to the account; this will be the case if *the site is associated to the account*.
- A site is said to be "**not within**" an account if it is not visible to a user that has navigated to the account; this will be the case *if the site is not associated to the account*.

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