

Volume

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SYNCCLOUD 0.5.2

Data Experts Consulting International



Overview

User Manual

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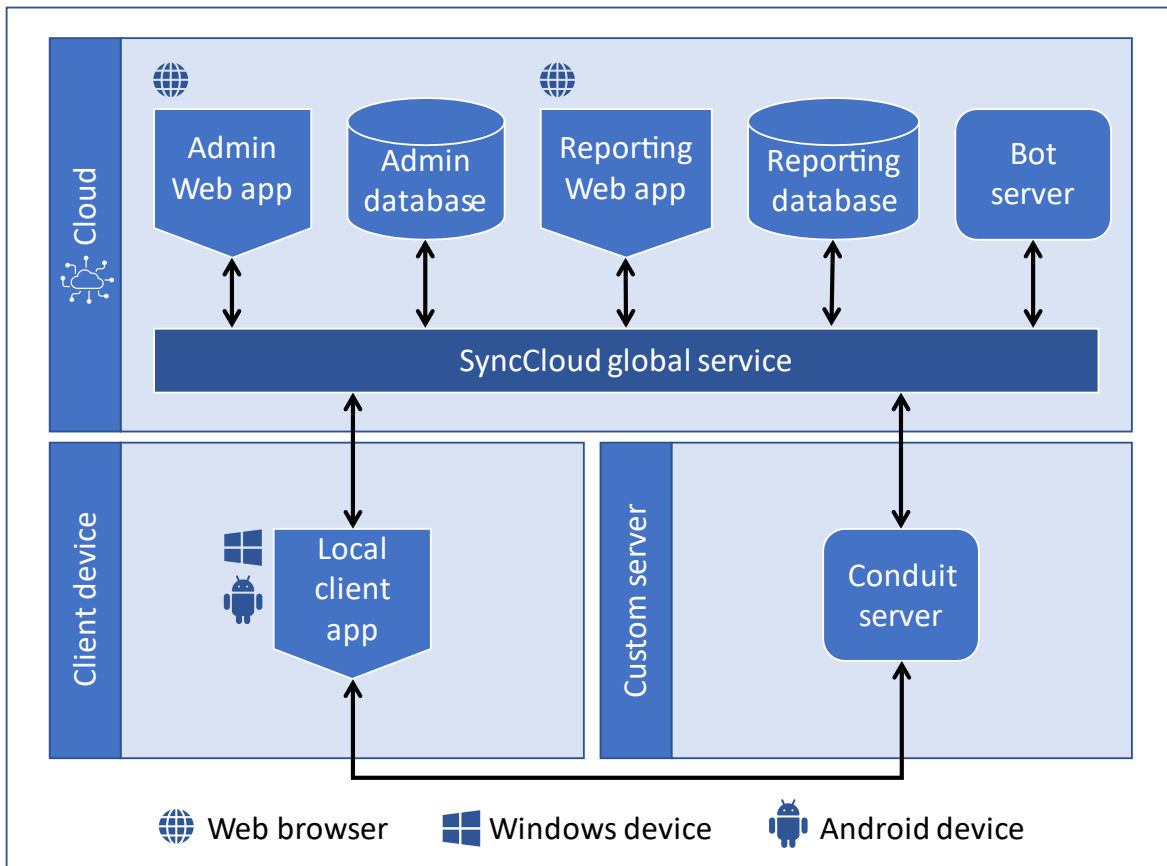
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SYNCCLOUD OVERVIEW

SyncCloud is a Web-based service platform designed to enable users to share, transfer, and synchronize digital information automatically and securely. The system provides centralized approach of setting up a virtual environment that automatically governs all transactions between client applications. Additionally, SyncCloud implements a Web-based real-time reporting service providing users with tools to monitor and analyze transferred data.

The SyncCloud platform is primarily designed to support computer-assisted personal interview (CAPI) data collection and monitoring operations in household surveys. **Figure 1** outlines the overall architecture of the SyncCloud system.

FIGURE 1. SYNCCLOUD COMPONENTS



The SyncCloud system architecture is separated into the following three main sections:

- Cloud-based apps and services
- Client apps
- Custom Web services

Cloud-based apps and services provide users and administrators centralized access to the system resources independently of the device used to access these resources. Client applications are small light weight apps designed to automatically synchronize data with custom **conduit server** endpoints. Conduit endpoints are third-party self-contained servers used to facilitate data transfer between users and global services.

SyncCloud global service (SC-GS) acts as the backbone of the entire network. It facilitates all metadata exchanges between various system components.

Administrator Web application is the main tool used to set up the virtual project environment. This application does not require any specialized hardware, software, or operating system to run. It can be accessed on any device through a Web browser. The Web app supports all modern Web browsers capable of rendering HTML-5 and CSS-3 Web sites.

Administrative database is a Structured Query Language (SQL) server database that houses most of the metadata related to execution and management of data transfer in virtual projects. It is also used for user and admin account management.

Reporting Web application is a specialized tool for aggregating and presenting data analysis. Input data sources for the analysis can be transferred from client devices to the report database. Then specially formatted report templates are used to aggregate, process, and present the data to the end user. Both admin and reporting Web application Web reside on server-side and is accessible through a Web browser.

Bot server is an active system resource that is used to start and run bot instances. A bot instance can then be linked to a project user account enabling the system to send and receive data to and from this user account. The bot, being constantly active, is capable of processing packages incoming to the linked user account. Bots are used as data transfer stations between conduit server and other global resources such as reporting database, for example.

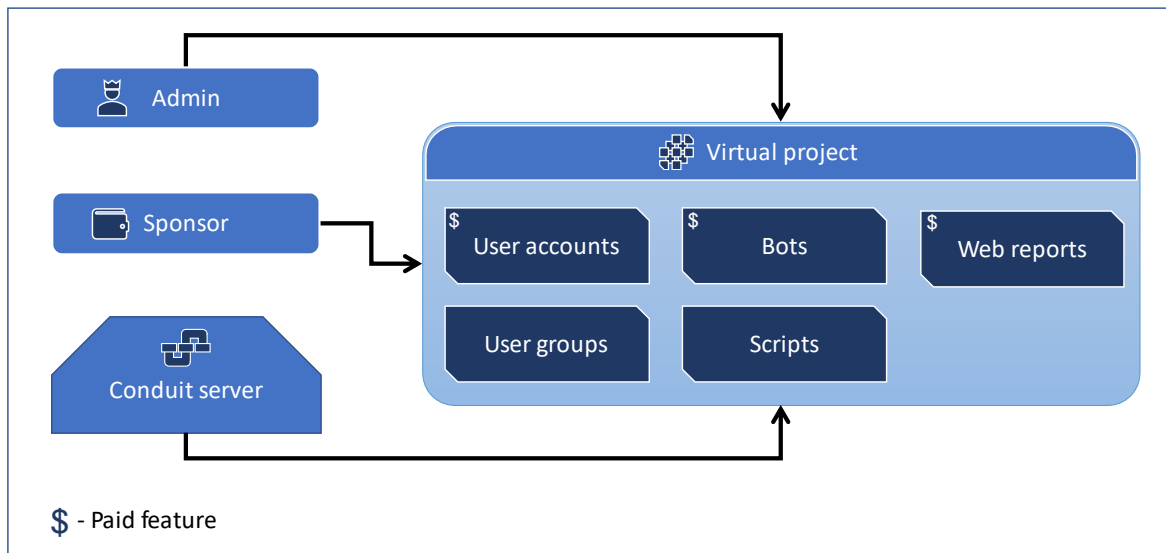
Client applications are local processes that are designed to run on user end devices. Unlike **cloud-based** applications, client applications are not platform-independent. Client applications run as Operating System (OS) native processes and can only be executed on devices running Windows or Android OS. Client applications are used to authenticate the project user to any virtual project, download, and execute system and project scripts and, most importantly, to exchange data with conduit servers.

Conduit server is a specialized server software that is used to facilitate data transfer between two client applications. Condit server can be installed on a custom Web server running Windows OS. It can then be configured to accommodate transactions for a single or multiple SyncCloud virtual projects.

SYNCCLOUD VIRTUAL PROJECTS

SyncCloud encapsulates data transfer inside virtual projects. They are special virtual spaces where different system features and resources can be allocated by project administrators. **Figure 2** outlines contents of virtual projects as well as interaction between virtual projects and other SyncCloud resources.

FIGURE 2. SYNCCLOUD VIRTUAL PROJECT STRUCTURE



Virtual projects are created and managed by project administrators using admin Web application. Administrators then add different features to their virtual projects. These features are as follows:

- Project user accounts store credentials through which users can access the system via client applications and transfer data between each other. Conduit servers facilitate data transfer. Data may only be transferred between users of the same virtual project. There is no cross-project data transfer.
- User groups are used to group project users under a group name. This group name can then be used to transfer data in bulk to all users in that group.
- Automated bots are specialized server processes that are used to impersonate project users and participate in data transfer without the need for the actual user and client application. Bots can both send and receive data, and have access to other cloud resources such as reporting database. Bots are always online and therefore capable of real-time data synchronization and processing.
- Project scripts are specialized algorithms that are executed by client applications upon successful authentication of a project user. Scripts are encoded using **NEST** programming language. Most automated actions by client applications are performed by executing project scripts.
- Web report templates are XML encoded files that can be attached to a project and used for generating Web reports using the reporting Web app.

To activate a virtual project, it requires a linked active sponsor. Projects can be self-sponsored, that is project is sponsored by the sponsor profile created under the same admin account as the project.

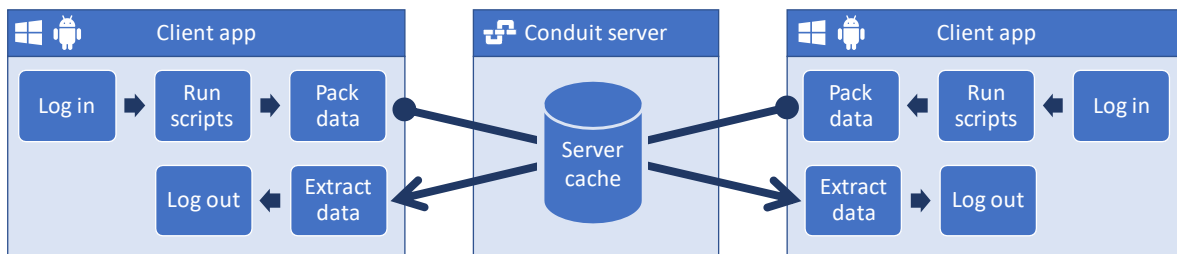
Alternatively, projects can be sponsored by an external sponsor profile. In this case an explicit approval may be required by the owner of the sponsor profile for the project to be activated.

Another project resource that is required in most circumstances is a linked active conduit server. While some features do not require a linked conduit server and projects can be activated without it, no data transfer and synchronization can take place until active conduit server is linked to the project. All of the data transfer between client applications as well as clients and cloud services is routed through a conduit server.

DATA TRANSFER PIPELINE

The main purpose of the SyncCloud system is to transfer data such as files or serialized objects between two Windows or Android devices. The data is transferred between project users using specialized client applications installed on their end devices via conduit server endpoint linked to the virtual project. **Figure 3** describes the data transfer pipeline.

FIGURE 3. SYNCCLLOUD DATA TRANSFER PIPELINE



Client application initializes synchronization with the conduit server by logging into the SyncCloud system. At this stage, the user provides their credentials in the form of username and password. Additionally, client application also needs to supply a globally unique project identifier.

Upon successful login the SyncCloud global service provides the client address of the conduit server to be used in the requested project as well as automated script data to be executed by the client. Client application then proceeds to execute the received scripts. If no scripts are assigned to the user, this step is skipped.

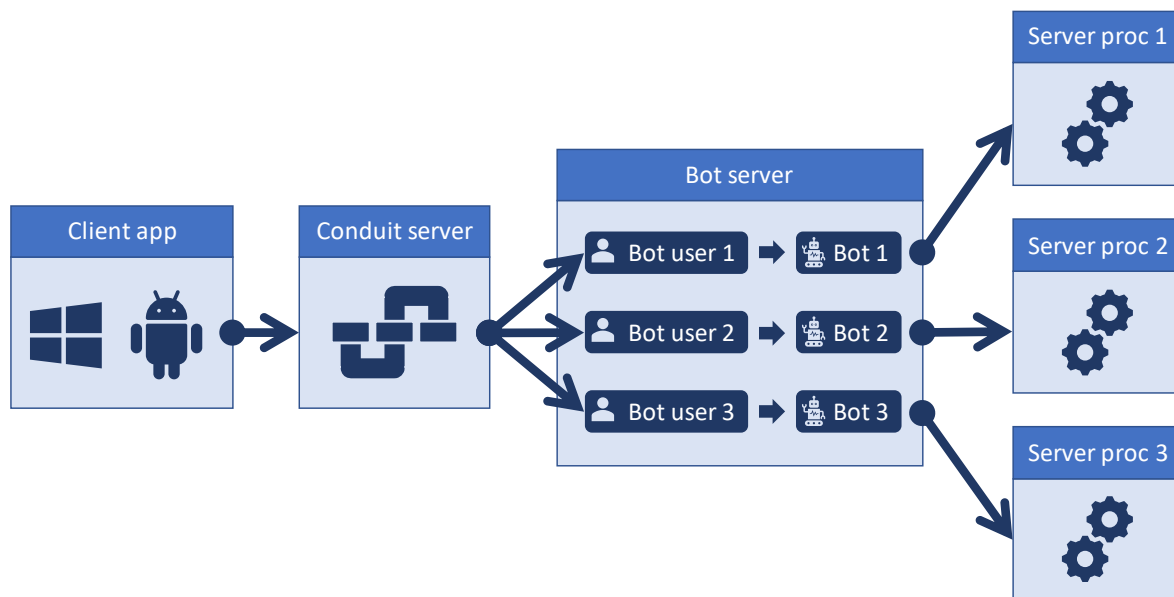
During script execution client application may create data packages to be delivered to another user in the project. The next stage in the pipeline is synchronization with the conduit server. If any data packages are scheduled to be delivered, they are at this time uploaded to the conduit server. Similarly, if there are any incoming packages to be received from the conduit server sent by another user in the project, they are downloaded from the conduit server and extracted. All of the data transferred between client applications and conduit server is encrypted.

BOT SERVICE

SyncCloud system provides a special automated service that allows project administrators to set up bots, active server instances. A bot is a server-side process that can synchronize with the conduit server using the same client/server protocols as regular client applications. The difference is that unlike client applications designed for human interface, bots are automated and do not require any human input. This ensures that whenever any data is transferred to a bot, it always receives it immediately.

Bots are visible to the SyncCloud network and conduit server networks as regular clients. Just as a project user, a bot needs credentials to access the SyncCloud system to synchronize with the conduit server. I.e., bots are automated project users that are online 24/7. **Figure 4** describes the client-server-bot interaction pipeline.

FIGURE 4. BOT PIPELINE



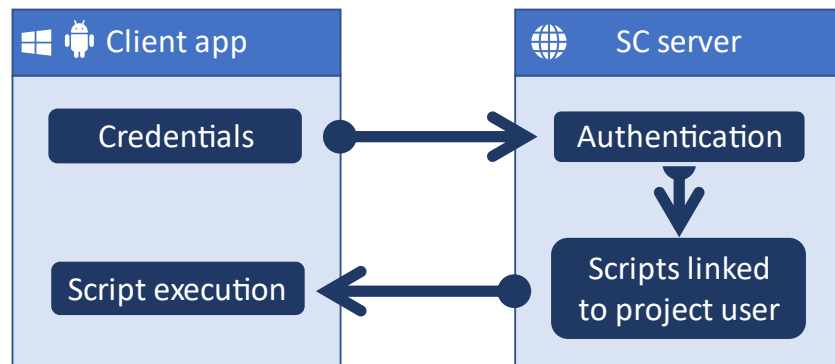
When project administrators create a bot instance in their project, this bot instance requires a project user account to be associated with it. The bot uses this user account credentials to log into the project and exchange data with conduit server. The conduit server does not differentiate between regular user accounts and user accounts linked to bots. Therefore, all data transfer protocols that apply to transfer data between projects users also apply to transfer data between users and bots.

Once the bot receives the data, it proceeds to execute the specialized server procedures depending on the type of bot and data received. For example, a report processing bot receives a specially formatted message with a data source records. Upon successful validation of the data received, the bot executes a server procedure that deposits received data source records to the reporting database.

SCRIPTING

SyncCloud is an automated system for data transfer and synchronization. The 'automated' part of this definition is facilitated by the scripting component. SyncCloud client script is a piece of XML formatted text which is executed by client applications. Scripts can be defined by project administrators using a Web administration console and linked to project users or groups. Upon successful authentication, all scripts linked to an authenticated project user are downloaded and executed by client application. **Figure 5** illustrates the process of script acquisition and execution.

FIGURE 5. SCRIPT EXECUTION PIPELINE



Script execution tied to certain events that occur during client cycle. Whenever an event is fired by the client application a corresponding script procedure is executed. Different client applications define their own event types. General package transfer client application, for example, fires four different events:

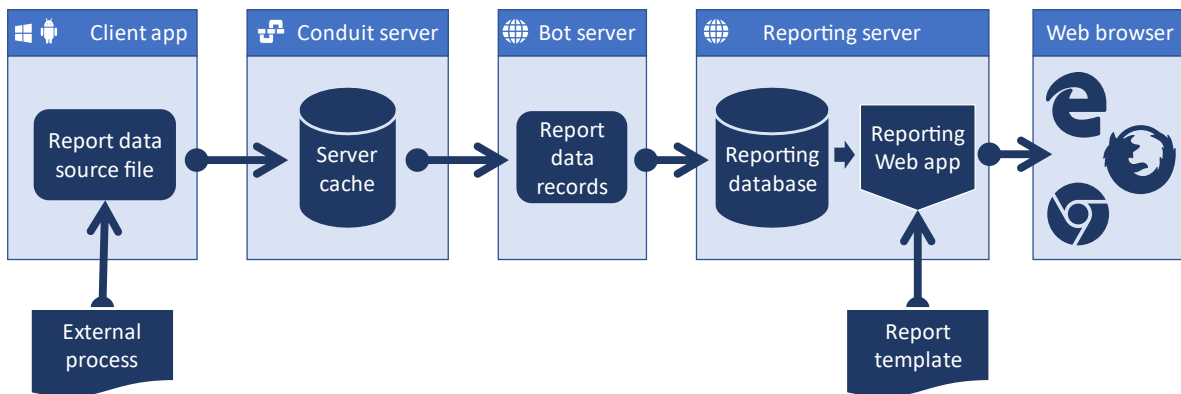
1. **AFTERLOGIN** –fires after successful user authentication with SyncCloud project
2. **PACKAGESENT** – fires after each package in send queue is uploaded to conduit server
3. **PACKAGERECEIVED** – fires after each package is downloaded from conduit server
4. **CLIENTCLOSE** – fires after all packages have been sent/received/processed and just before client application process is terminated

When event being fired, the client application extracts the body of the script (or scripts) associated with the given event. The body of the script consists of one or more commands. A command is represented by an XML formatted node with parameters or other nested commands. See SyncCloud scripting document for detailed documentation on different types of commands.

WEB REPORTING PIPELINE

SyncCloud implements a Web-based reporting feature which can be used to aggregate and display data synchronized by users within a virtual project. Project administrators can publish report templates in their virtual projects. Web reporting application can then format the report per published report templates and populate it with data shared by project users. **Figure 6** outlines the process of generating SyncCloud Web reports.

FIGURE 6. WEB REPORTING PIPELINE



Data for Web reports usually originate from a user device (Windows or Android). Typically, it is generated by some external process or application. These data then undergo formatting compatible with the reporting data base schema. This specially formatted data file is called reporting data source. This data source file is then synchronized with conduit server by client application. Conduit server routes this data source to a reporting bot that proceeds to convert the data source and to deposit it to the SQL reporting database. When the end user accesses Web reporting application through a web browser, Web reporting application builds a report document based on the template provided by the project administrator. This report is then populated with data extracted from the reporting database. Web reporting application supports all major modern Web browsers.

Report template is an XML formatted document which serves as a markup for the final report document. It consists of series of elements such as labels, tables, graphs, and raw HTML text. Once report template is published in the project using the administrator Web app, the system generates a unique URL which can be used to access the published report.