

*PERSONAL SPACE WEATHER SYSTEM*

*Central Control System*

Functional Specifications

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VERSION HISTORY

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1. introduction

This Functional Specification describes the capabilities of the Central Control System which is to be a part of the Personal Space Weather System (PSWS). In the PSWS, the Tangerine Software Defined Radio (SDR) collects spectrum data (in general I&Q) and uploads it to a target system for storage and/or analysis. The target system in the typical PSWS will be the Central Control System (“Use Case 1”); but optionally could be a server if sufficient bandwidth is available (“Use Case 2”).

1. System overview

An overview of the system is shown in Figure 1. This specification is concerned with the Central Control System.

Radio

(includes ADC, FPGA + DE)

Local Host (SBC)

Central Control System

Database Control

Internet

Personal Space Weather Station

(hundreds or thousands of these)

One central system

Tangerine

Figure . Conceptual overview.

1. functional requirements
   1. General Requirements / Overview

Requirements and capabilities of the overall PSWS system are described in a separate document. This Functional Specification covers only the Central Control System which shall have the following capabilities:

* + 1. Functions for Data Collection Users:
* Allows users to create an account for themselves
* Issues a unique token to each user, which the user enters into the Tangerine to establish its identity
* Provides capability for users to perform functions as follows:
* Maintain their profile data
* Mark their system as being active
* Put their system into mode (inactive, test, production)
* Observe if their PSWS is handshaking with Central Host (based on heartbeat)
* Review records on data that has been uploaded from their system (amount of data, number of sessions, etc.)
* See their activity ranking as compared to other users
* Create/review selected data analyses on their data, and data of others
  + 1. Functions for science users
* Ability to trigger a system-wide (from multiple users) upload of selected data (expected to be in the ring buffers of users)
* Review statistics for data collection
* Create/review selected data analyses on selected/all user data

For information on screen layouts, database schemas, system configurations, etc., please consult the relevant Detailed Design Specification.

1. Operating Environment

The Central Control System will run in a Linux operating system, provide a web-based user interface, and interact with a back-end database (described separately) for data storage.

* 1. Assumptions and Dependencies

Tentative: the specific flavor of Linux will be Centos Linux release 7.3.1611 or higher

HERE ADD: Tentative: web server package selection; use of MariaDB as database

Capacity: the Central Control System shall be sized to accommodate at least 500 concurrent users.

Internet connectivity: the Central Control system will operate in a DMZ behind a firewall, and connect to the Central Database (which is in a secure zone) through a second firewall.

Packages anticipated to be needed include:

* Docker
* Web server
* Job queueing
* Load leveling
* Security
* Mail server connection (for verifying new accounts)
* Django
* Celery
* Captcha (for rejecting sign-up attempts from bots)

Tentative: Central Control server to be provisioned as a virtual machine with 2 cores, 8 GB RAM

. . . .

* 1. User Interface Requirements
     1. Guiding Principles

The system will expose a minimum of technical matter to the user. Users interested in the internal functions are expected to look at system content as archived in GitLab.

The system will collect and save a minimum of Personal Identifying Information (PII): only that necessary to determine a user’s location (to a 4-character Maidenhead grid square) and altitude above sea level. Note that users are free to include in their user-ID their amateur radio callsign (if they have one) which can be used to determine a large amount of PII that is already in the public domain.

1. Process of Use
   1. Use Case 1: Data Collection
2. This process is for the typical home or school user who will use a single Tangerine connected to the Central Control System.
3. Creating an Account – A new user uses a web browser to connect to the Control System (https, port # TBD). The user enters a desired UserID and password (entered twice for verification). The system sends a verification email to the user’s email address.
4. The user replies to the email, thus verifying their identity.
5. The user now logs in with their new UID and password.
6. The system shows them the profile fields needed to establish their location and other data needed for categorizing their data. Also, the system generates and displays a Token the user later will plug into their Tangerine so to link their Tangerine with their account.
7. The user configures their Tangerine (documented separately; see Tangerine Detailed Design).
8. When the Tangerine is ready for testing (antenna(s) connected, magnetometer connected, system on network), the user sets the Tangerine to ACTIVE/Testing status. The Tangerine begins sending a periodic heartbeat to Central Control. The heartbeat will change the user’s system status (as displayed in the user’s profile in Central Control web site) to Active/Testing. If the heartbeat received at Central Control ceases for more than 2 minutes, the status switches back to Inactive. Once active, a Tangerine starts collecting data and storing it in its ring buffer. The user’s status as Active/Testing or Active/Production will be reflected in metadata as sent during uploads. This allows users to experiment with various configurations, antennas, etc., and verify that uploading is happening at an early stage in their system setup.
9. Lists of data blocks that have been uploaded from a user’s PSWS to Central will be available in the web site. Some analysis capabilities will be provided (e.g., waterfall, noise measurements, etc., additional capabilities TBD).
10. Science Users (specially authorized by system master(s)) will have the ability to trigger PSWS stations in Active/Production status to send selected blocks of data up to Central Control (in reality, these will go to the Central Database). These users will have access to some data analysis tools and will also be able to download selected data for aggregation on their own system.
    1. Use Case 2: Firehose
11. This process covers the case where an institutional user is going to use one or more Tangerine SDRs to collect data to a large processing system in the local network. This description is only a brief overview, as the Central Control System is not part of the process. [Note: there may be some special cases where a user wants to use the Firehose capability, but also make the Tangerine available for Data Collection; process for that is TBD]
12. The user uses a function in Tangerine to specify the IP address(es) of the local large processing system(s). The Tangerine executes a handshake with the large system; data collection may start immediately or be triggered remotely. In this case, the data collected goes only to the local large system (not to the Central Database).

Technical Notes

Help

Localization

1. Appendix A: References

The following table summarizes the documents referenced in this document.

|  |  |  |
| --- | --- | --- |
| **Document Name** | **Description** | **Location** |
| *Tangerine SDR Requirements V0.3.pdf* | *System requirements* | *https://tangerinesdr.com/TangerineSDR\_documents/* |
| *Local Host Functional Specification* | *Functional Specification* | *TBD* |
|  |  |  |