PERSONAL SPACE WEATHER SYSTEM
Central Control System
Functional Specifications

Version Number: 0.1

Version Date: June 3, 2019

W2NAF General comments:
1. Need to accommodate multiple stations per account.
2. Need a glossary of acronyms as an appendix.
3. Access to any function that can degrade the performance of the whole network needs to be carefully controlled.
4. We may need multiple levels of science users to allow for comment 3.
5. Need ability for science users to export/download observations.
6. We need a PI and institutionally-approved data policy. (Goes beyond the scope of this document, but will influence choices in this document.)

VERSION HISTORY

Version Number	Implemented By	Revision Date	Approved By	Approval Date	Description of Change
0.1	W. Engelke	*6/3/2019*			

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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 ("Data Collection Use Case 1"); but optionally could be a server if sufficient bandwidth is available ("Data Collection Use Case 2").

2 SYSTEM OVERVIEW

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

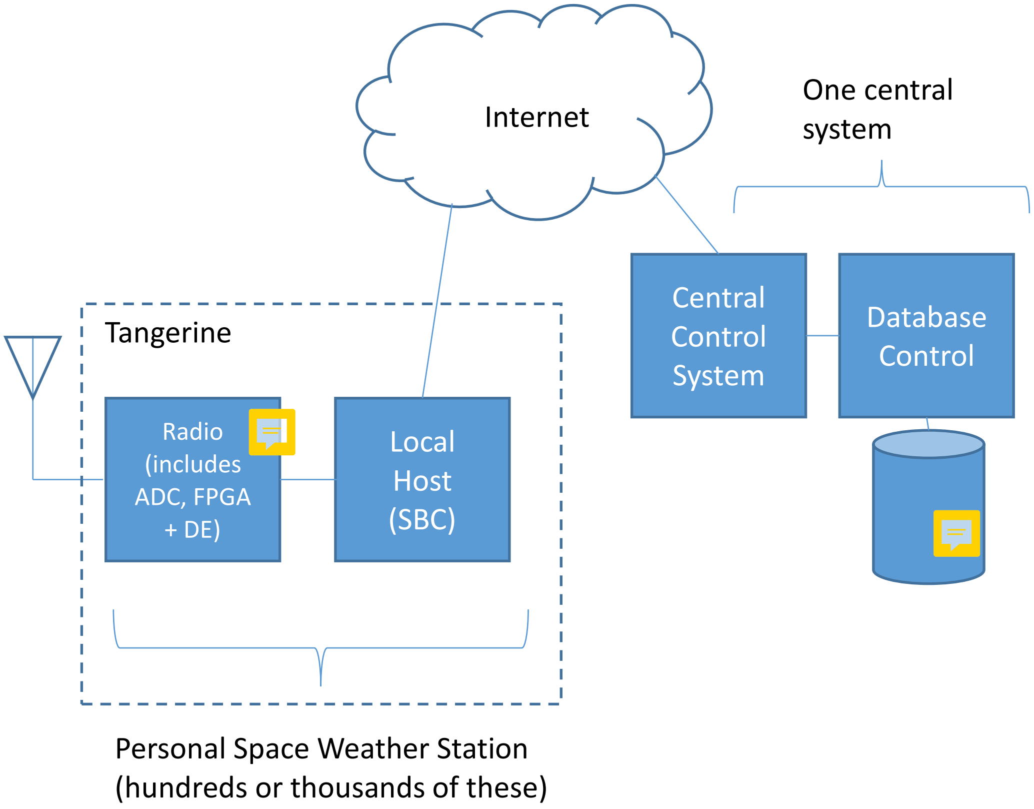
Internet
One central system
Tangerine
Radio (includes ADC, FPGA + DE)
Local Host (SBC)
Central Control System
Database Control
Personal Space Weather Station (hundreds or thousands of these)

Figure 1. Conceptual overview.

3 FUNCTIONAL REQUIREMENTS

3.1 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:

3.1.1 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

3.1.2 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)
- Ability to remotely trigger data collection for home users (users not in firehose data collection)
- Manage the total collection of data
- 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.

4 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.

4.1 Assumptions and Dependencies

Tentative:

- the specific flavor of Linux will be Centos Linux release 7.3.1611 or higher
- Django will be used as the framework for serving web UI
- Celery will be used for queuing tasks
- MariaDB (open source version of MySQL) will be used 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

(The above section may be more appropriate in the Detailed Design Specification)

4.2 User Interface Requirements

4.2.1 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.

5 PROCESS OF USE

The appearance, layout, and detailed content of pages mentioned below is included in the Detailed Design Specification. The Use Cases below describe the process of using the system (not to be confused with Data Collection Use Cases 1 and 2, which describe the two ways of storing collected data).

5.1 Use Case 1: Signup/Login

1. The first time a user browses to the site, the UI will display a base page showing the option to Sign Up or Login. (Later, once the user is signed up and authenticated, this option disappears).
2. A new user uses the Signup page to request an account. The user provides, at minimum, a requested UserID (UID) and valid email address.
3. If the user requests a UID that already exists, the user is prompted to provide an alternate UID.
4. The system sends a validation email to the provided email address. The email will include a link including a token the user clicks (upon receiving the email) to validate the email. The token is sent to the system and matched. If it matches, the user is prompted to provide a requested password (PW). The PW must be requested twice, both of which must match. The PW must be at least 8 characters in length. After the user successfully enters their desired PW, they are directed to the sign-in page. The new user now becomes an existing user.
5. Existing users login via the log-in page. An option to request a new PW (“forgotten PW”) will direct an email to the email on file for the given UID.
6. After successfully logging in, the user is shown their Dashboard.

5.2 Use Case 2: Dashboard

1. The purpose of the Dashboard is to give the user a standard starting point for all activities, including:
    a. An option to edit their profile
    b. View their station’s status (online, offline, etc.)
    c. View their own recent data (collected, uploaded, etc.)
    d. View data collected/analyzed by others
    e. Control operation of their station, such as activating, deactivating, connecting to local large server, etc.
2. The dashboard will show the Central Server’s view of the user’s station status, i.e., if the user station heartbeat is current to the Central Server, the user’s station shows as online. (DETAIL: heartbeat once per minute (?))
3. The dashboard will show the status of data collection and any pending uploads. The most recent 10 events will be shown by default (with status of each shown in a list); user will be able to page up and down.
4. If the user has multiple stations, the different stations will be listed, giving the user the ability to independently control them.

5.3 Use Case 3: Edit Profile

1. The user will be able to edit all parameters of their station (this does not include changing UID).

5.4 Use Case 4: Show Stations

2. A list of all user stations will be available so the user can compare their activities to others. This will be filterable by status, and sortable by various columns.

5.5 Use Case 5: Show Observations

1. A list of all observations will be available. This will default to the last 10 (or less) observations made by the user; filtering will be possible to show the observations of other selected user groups (by location), shown 10 to a page, sortable by various columns. TECHNICAL NOTE: for practical reasons, it may become necessary to restrict what is shown here, due to data volumes (TBD)
2. When the user selects a specific observation, any analysis completed will be viewable. (DETAILS OF ANALYSIS?)

OPEN POINTS

Will all users (or just science users) be able to combine observations from multiple stations (say, for mapping TIDs)?

Localization: do we need to provide multiple language support?

6 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*