Implementation and Use of the Idaho Department of Water Resources Telemetry Networks

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Background

Head waters spring complex – Ft Hall

Clear Creek – Ft Hall

Started in 2007 with the down turn in the economy. At that time we had most of our monitoring work contracted out and those contracts were brought in house to reduce costs. At the same time the Legislature passing of the Strawman Proposal and later through the creation of the Comprehensive Aquifer Management Plan (CAMP) funds were given to the department for monitoring work.

In 2008, chose Intermountain Environmental as vendor for Campbell Scientific equipment.

Had initial training of IDWR personnel in July of 2008 and installed first station in the Hagerman area at that time with telemetry added later.

Focus Area

Eastern Snake River Plain

Largest agriculture area in the state producing approximately 33% of all goods and services.

Declines in the aquifer are causing numerous water conflicts between groundwater users and surface water users.
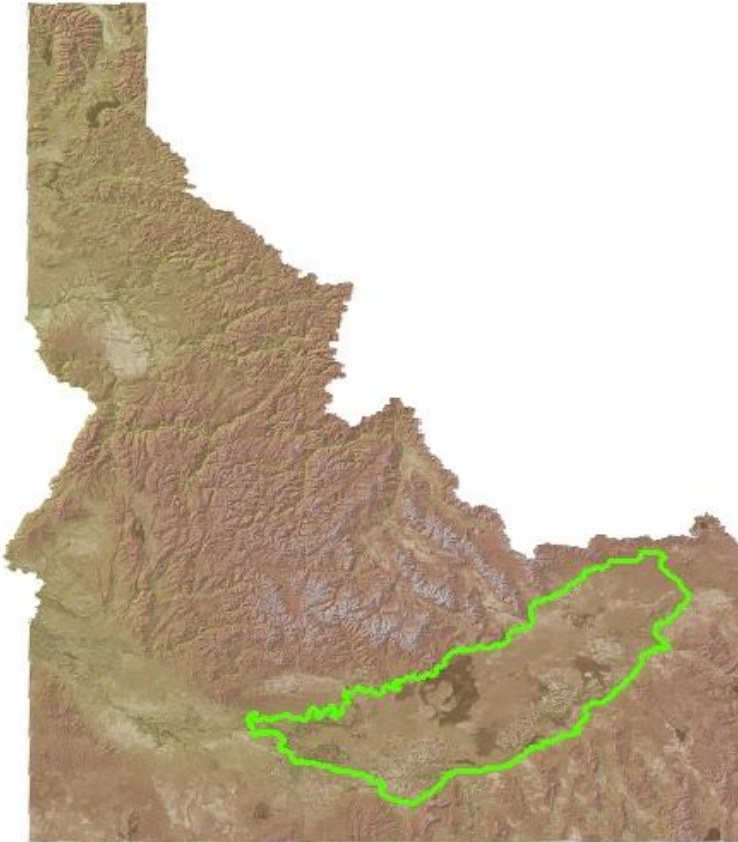
Installations

Clear Creek site Ft Hall Bottoms

Site Rehab at Blind Canyon in Hagerman Valley

Majority of installations are radio with cell modems used at more remote sites or in areas where radio communication is encumbered.


Tucker site Hagerman Valley

Installation –Tools

Radio Setup
Use mobile radio setup for radio sites.

Radio Mobile Program (free software)

Cell Modem Setup
Squid Pro used for cell signal strength and carrier.

*Radio Mobile screen captures*

Data Collection

Sensor output is read every 15 seconds or at the appropriate time frame for equipment being used and averaged over 15 minutes, then downloaded to base every hour using Campbell Scientific (CS) LoggerNet.

Cooperative sites are similar except that they send data to their base location and then to our office via SmartFTP. We encourage cooperator to use CS equipment but not mandatory.

Try to stay close to USGS standard for data collection.
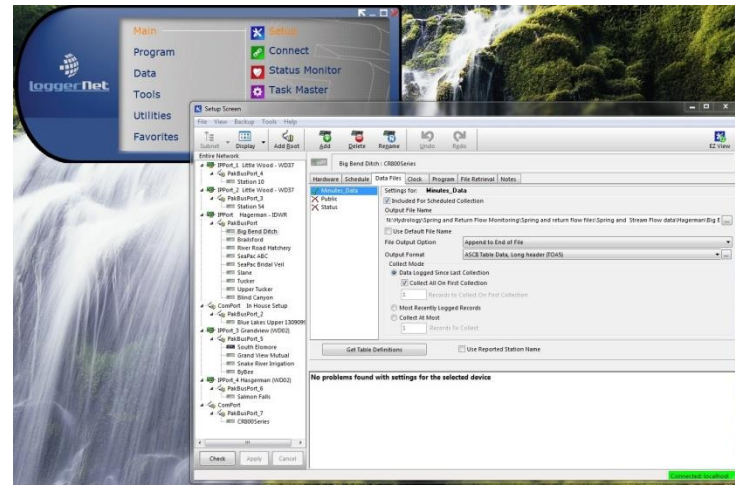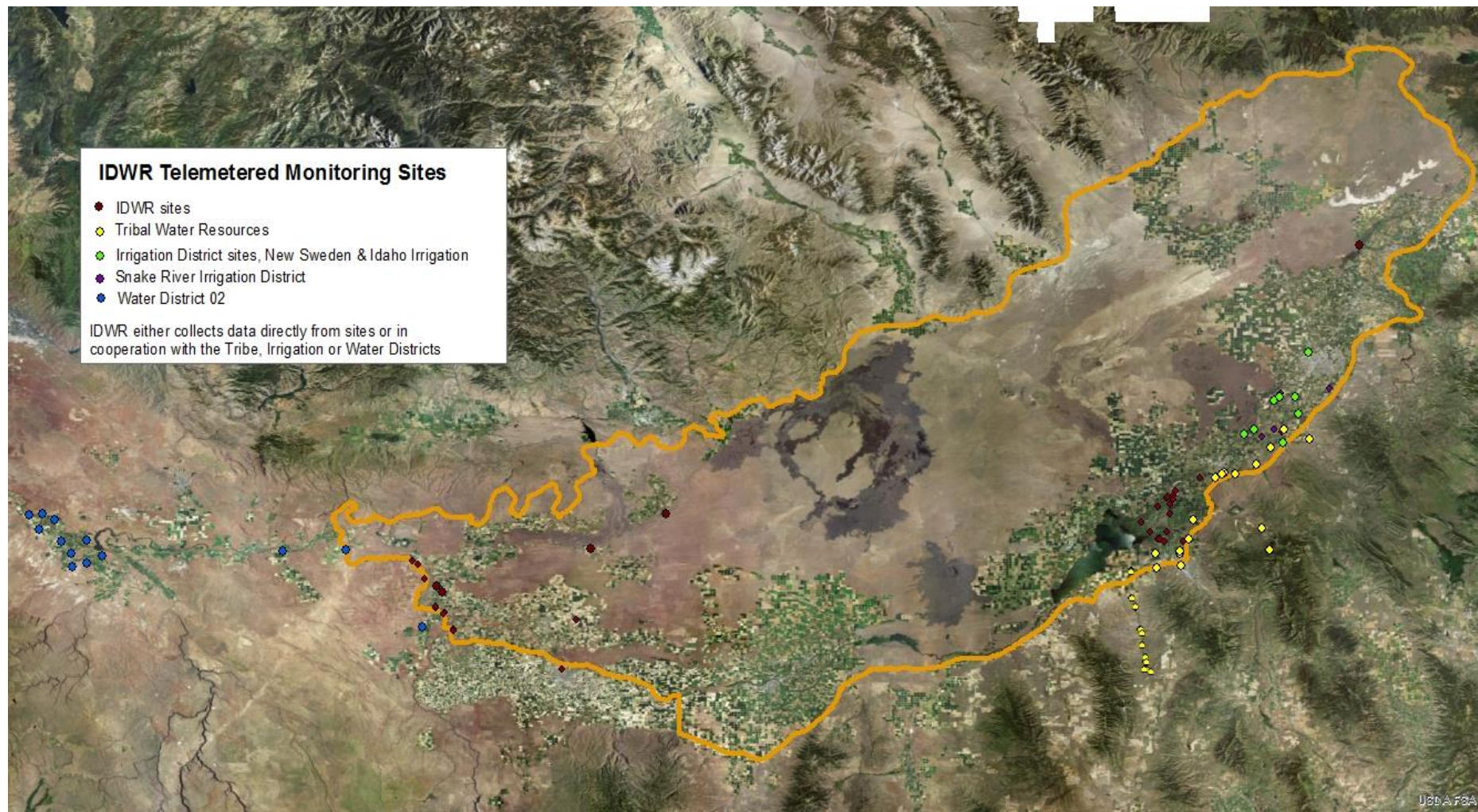

LoggerNet screen capture
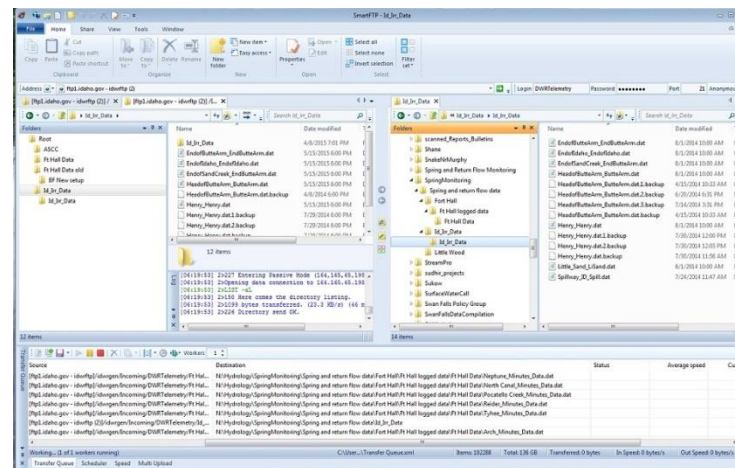
SmartFTP Screen capture

Telemetered Monitoring Sites Across the Eastern Snake River Plain

Currently 53 sites with 42 scheduled for installation in the next 2 years.

Water District 02   15 sites with 40 additional scheduled within the next 2 years

Hagerman Valley   9 site with 2 scheduled for installation this summer

Little Wood River   2 sites

Cooperatives   12 sites

Ft Hall   15 cooperative site, 80 sites operated by the Sho-Ban Tribe which have been installed and are maintained with the assistance of IDWR staff, 10 additional sites to be installed this year for the Tribe with 2 additional cooperative sites to be installed in 2016 - 2017

IDWR Telemetered Network

IDWR Telemetered Monitoring Sites

- IDWR sites
- Tribal Water Resources
- Irrigation District sites, New Sweden & Idaho Irrigation
- Snake River Irrigation District
- Water District 02

IDWR either collects data directly from sites or in cooperation with the Tribe, Irrigation or Water Districts

Rough terrain – Snake River Canyon

Problems encountered

Hardware from vendor
- Hardware package had wrong cable

Transducers
- Signal drift, non-repeatability

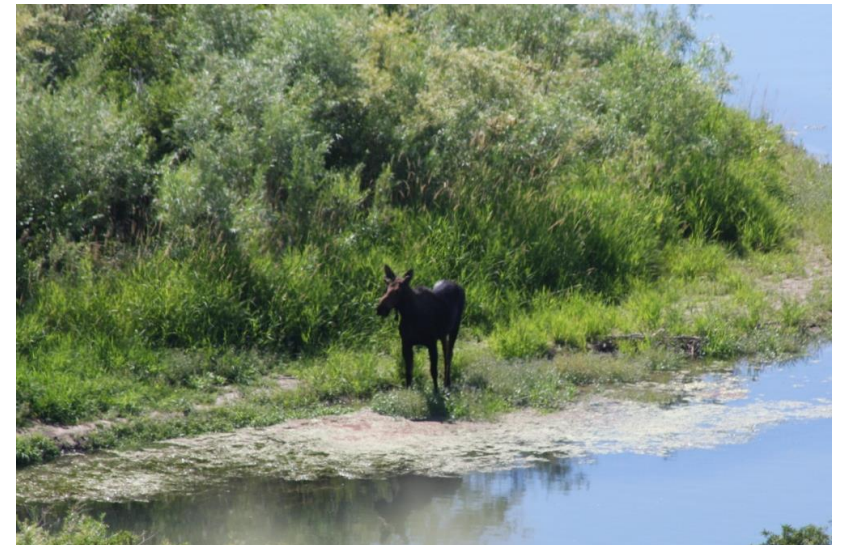Signal interference – spread spectrum radios
- Signal blocking all 900 MHz signals

Low frequency VHF radios
- Selecting the right frequency

Moose – Portneuf River, Ft Hall

Problems encountered

Locating equipment / antenna positions
- Snake River Canyon
- Trees
- Buildings/Air conditioners

Animals
- Chewing wires, knocking over stations

Site Acquisition
- BLM permissions for relay tower

Multiple Base Stations
- Adding a multiple base stations to receive data

Changing stream conditions
- Stream channel shift
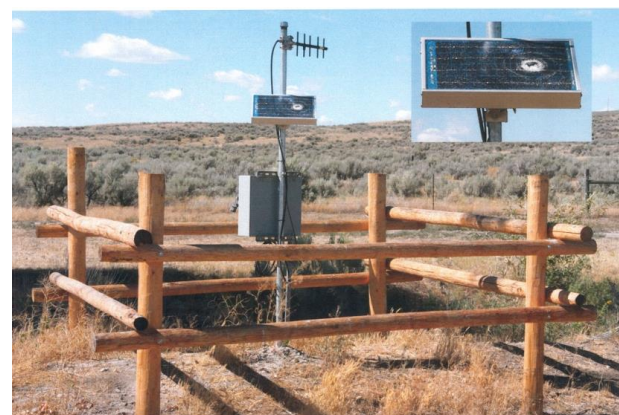

Stream Channel change – Ft Hall

Blue Lakes weir site –Snake River canyon near Twin falls

Problems Encountered

Solar Panel Sizing

Vandalism

Problems encountered

Installation, aquatic growth, abnormal water deliveries, human error

Station Costs and O&M

COSTS
Stations run between $2800 - $3500
- Includes data logger, radio, battery, antenna, pressure transducer and associated equipment
- Additional costs come when other type of monitoring equipment are used, these are generally magnetic meters, ultra sonic meters, etc. ($3000 - $10,000)
- Additional costs also show up if structures are required for measurement ($4000 - $50,000)

O&M
Typically minor costs associated with radio stations

Cell modems have monthly fees for service but the cost of the cell modem is about ½ of what a radio costs

Starting to see replacement costs for batteries and transducers which run around $85 and $780 respectively

Largest expense is monthly or bi-monthly visit to sites

North canal – Ft Hall

Woonsook site – Arbon valley

Funding

Legislature provided funding for monitoring work initially through the Strawman Proposal and then again through CAMP, this funding ended in 2014.

Funding for equipment will now come from the Aquifer Management Fund.

Water Districts are beginning to have the grower pay for monitoring equipment. This is being done with the help of the Idaho Water Resource Board who sponsors a Water Smart Grant to help reduce overall cost of equipment and installation. Grant typically covers between 35% - 45% of equipment and installation.

Accomplishments

Cooperation between IDWR and Irrigation Districts

Relationship with the Sho-Ban Tribes

Helps State in meeting Nez Perce Agreement requirement

Better data for modeling efforts

Where are we headed …

Hiring a technician to work full time on telemetry and monitoring equipment

Broaden our telemetered network by working with other entities

Add other areas of the state and possibly some remote groundwater wells

Use for managed recharge sites to monitor input and equipment control

Streamline data processing using Aquarius Server…

Target: Stage.Cedar Draw 15 min gage ht.txt Datalogged

Offset correction

Target: Stage.Blind C Logged time series.txt Stage

Drift correction

Background on our Data Processing

Prior to 2007, all processing done with MS Excel

In 2007, began using Aquarius Workstation
  + more powerful tool for correction of time series data
  + greatly improved rating curve development
  - manual importing to append data
  - file management is crucial

In 2014, began using Aquarius Server
  + all of the benefits of Workstation
  + imports and exports automated
  + no more file management
  + hydrographs automatically updated
  + minor data corrections automated
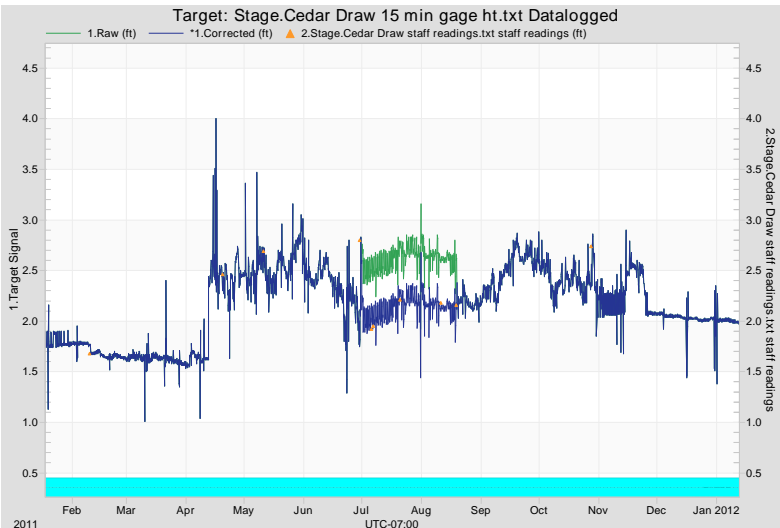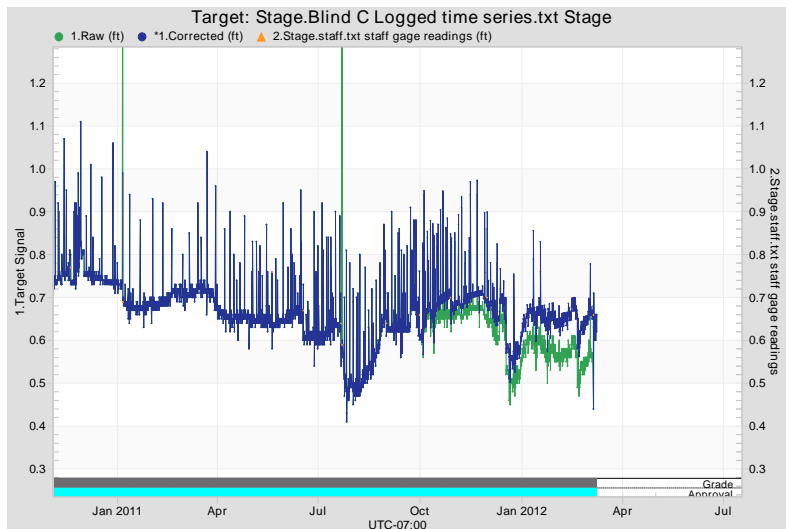
Additional Benefits of using Aquarius Server

+ Conduit for telemetry data

+ Real-time data for sites

+ Easier exchange of data with our partners:
USGS, Idaho Power Company, irrigation districts, tribes, federal and private hatcheries, etc.

+ Time Savings as data are automatically "ingested", appended, processed, and exported

    + Saves an estimated 3 to 5.5 hours/site/year

    + For 80 sites, that's **30 to 55 days/year** of time savings annually!
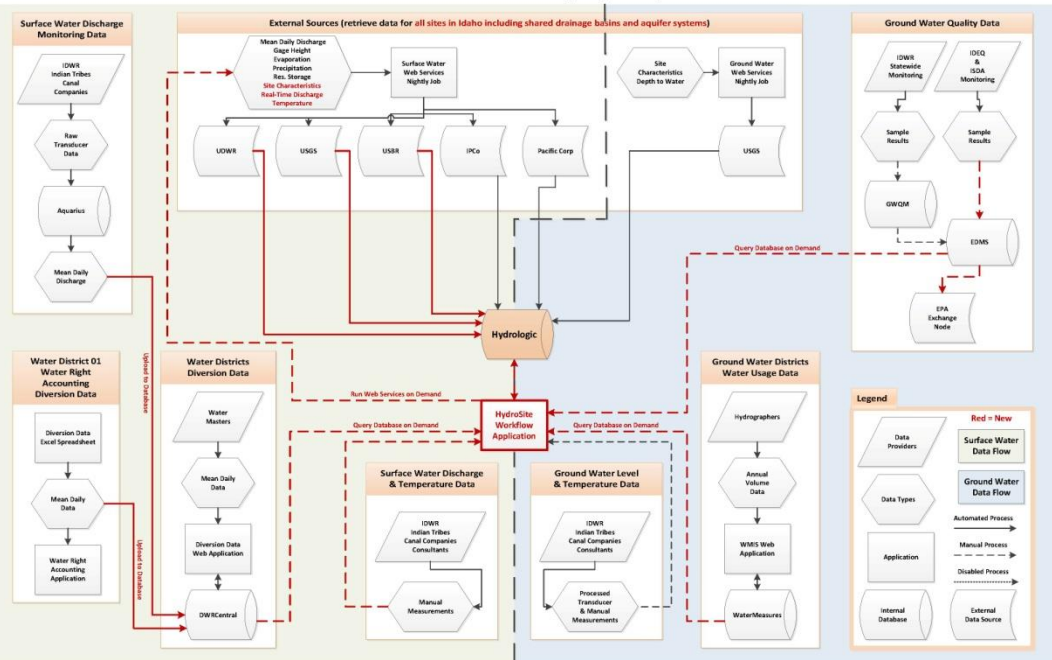
Email notifications set-up

Benefits Continued

Alerts staff of site problems for quicker resolution through the use of email notifications

Keeps managers and clients informed via automated email reports

Business processes, the big puzzle

Problems Encountered

Department-wide communication necessary to get all pieces of the puzzle working together → slow, but steady progress

Very time consuming to convert all sites previously processed in Excel and Workstation to Server

Limitations for loading data into Aquarius via Hot Folders – 24 hours of compiled 15 minute data loaded nightly and staggered;
(API also an option)

Solutions – Data Flow

Unprocessed real time data automatically goes straight to web for some partners (irrigation districts and Idaho Power Company)

And simultaneously:
Step 1
Within IDWR, nightly drops of 15 minute data to Aquarius for each site

Step 2
Aquarius Server automatically appends -
15 minute water level ⇨ 15 minute flow ⇨ daily flow

Step 3
Automatically updates hydrographs of water level and flow and does some basic QA (filling gaps)

Solutions – Data Flow (cont.)

Step 4
User conducts a more personal QA review requiring judgment and manually approves data

Step 5
Approved data gets kicked over nightly to our database for internal access and automated reports are generated for our partners

As we spring forward…

Explore posting processed data to web for general public

Consider adding pre-existing sites to telemetry network

Supply high quality data to internal and external customers