SPx Server

Radar Plot Extraction, Target Tracking and Network Distribution

CAMBRIDGE PIXEL

What is SPx Server?

A Software Solution

SPx Server is a ready-to-run COTS radar plot extraction, tracking and distribution server application, from Cambridge Pixel's SPx radar processing family of software.

The server is an executable program that acquires radar data, processes it, extracts target information and optionally outputs compressed radar data and track reports to one or more client applications via a network. In addition, it may also record the radar data to a local hard drive.

Radar data is received from one of a number of configurable sources, including internal test generators, network receipt and digitisation with a hardware acquisition car

The software can identify target-like shapes called plots, according to highly configurable rules. These plots may be output directly after detection, or may be further processed by SPx Server to estimate speed and course.

Target Tracking

A radar tracker interprets radar observations to distinguish real targets from noise, and to construct models to describe the motion of the targets.

As radar measurements are imperfect, there will be noise from the detection process, in addition to clutter returns from the environment.

SPx Server uses advanced algorithms and a highly reliable multiple-hypothesis process to give the best interpretation of noisy measurements from the target of interest.

Video and Track Distribution

SPx Server can provide network distribution of radar video and track reports to remote clients, supporting output as UDP packets in a number of different formats including SPx, ASTERIX (CAT-240 for video and CAT-048 / CAT-010 for tracks) and NMEA 0183 "TTM".

Up to three separate video distribution channels are supported, each may contain the raw, processed, clutter or auxiliary radar video. The auxiliary video is derived from the primary input source, via a look-up table, and could be a selected portion of the input sample (such as the second input channel from an HPx radar input card).

SPx Server outputs plot and track data onto a standard Ethernet network to remote clients for data fusion or display. The time-stamped reports are delivered with low latency, and may include both the filtered and measured components of the track's state vector.

SPx Server's target track designation supports the distribution of a separate stream of selected tracks for tasks such as following specific targets with an optical tracker or supporting the output of tracks in multiple formats.

Other SPx software or third-party applications may receive the video data for additional processing or scan conversion and display. Track reports may be received and conveniently decoded into data structures for processing or display.

SPx Fusion Server can be used to correlate track reports from multiple instances of SPx Server and/or secondary sources, such as AIS and ADS-B.

Trusted by Lockheed Martin, BAE Systems & the US Navy

Product Summary

Server Software

Ready-to-run software developed to process radar video, extract plots, track targets and distribute the radar video and/or tracks to remote clients, such as operator display software.

Integrated Radar Processing

Configurable pre-processing of radar video including filtering, CFAR thresholding, area-based video masking, and clutter map generation.

Advanced Radar Tracking

Using multi-hypothesis association and configurable target extraction parameters to provide highly accurate and reliable track data.

Video and Track Distribution

Supports network distribution of radar video and track reports to remote clients in SPx, ASTERIX or NMEA-0183 formats.

User Interface

Includes local display and remote web GUI.

Key Features

Supports primary and secondary Surveillance Radar Extraction

In-built AIS Association

Doppler Video Support

Built-in Coastline Database

Area Based Tracking

Radar, NMEA & AIS Record/ Replay

Comprehensive User-interface for Configuration

Network Remote Control

Redundant Operation

Available for Windows and Linux

Area-Based Processing

SPx Server supports the processing of radar video in user-defined areas. These areas may be sectors or complex polygons and may be relative to the platform or fixed, in world coordinates.

The built-in world vector shoreline database may also be used to provide a processing boundary, for example, suppressing tracking over land. The maintenance display provides a convenient graphical tool for defining areas.

Areas may also be used within the tracking process, so that different parameter values may be set in each defined area. This is an extremely powerful capability, allowing a single tracking process to be optimised for each area.

For example, in areas of high noise (woodlands, sandbanks, windfarms etc.), it may be desirable to suppress the automatic initiation of tracks whilst still permitting established tracks to be maintained.

Model Based Tracking

The MBT extensions to SPx Server (Windows version only) provide a method for different sets of tracking parameters to be used to process the same input data.

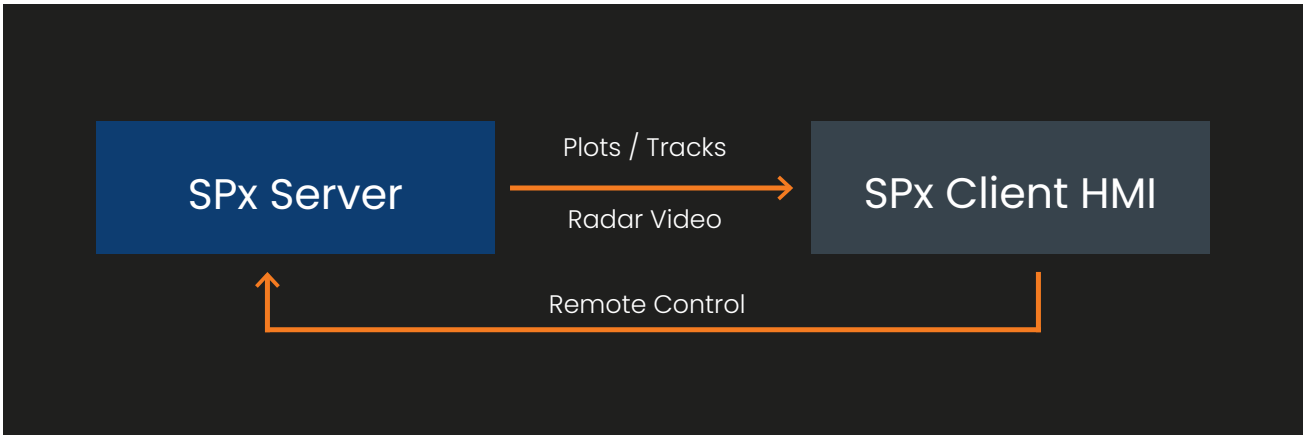
Models may be created that are tuned to look for specific types of target.

Multiple models may be run in parallel.

> “The software delivers considerable flexibility in the way radar information can be processed and distributed...”
>
> **BAE Systems**

Remote Client Control

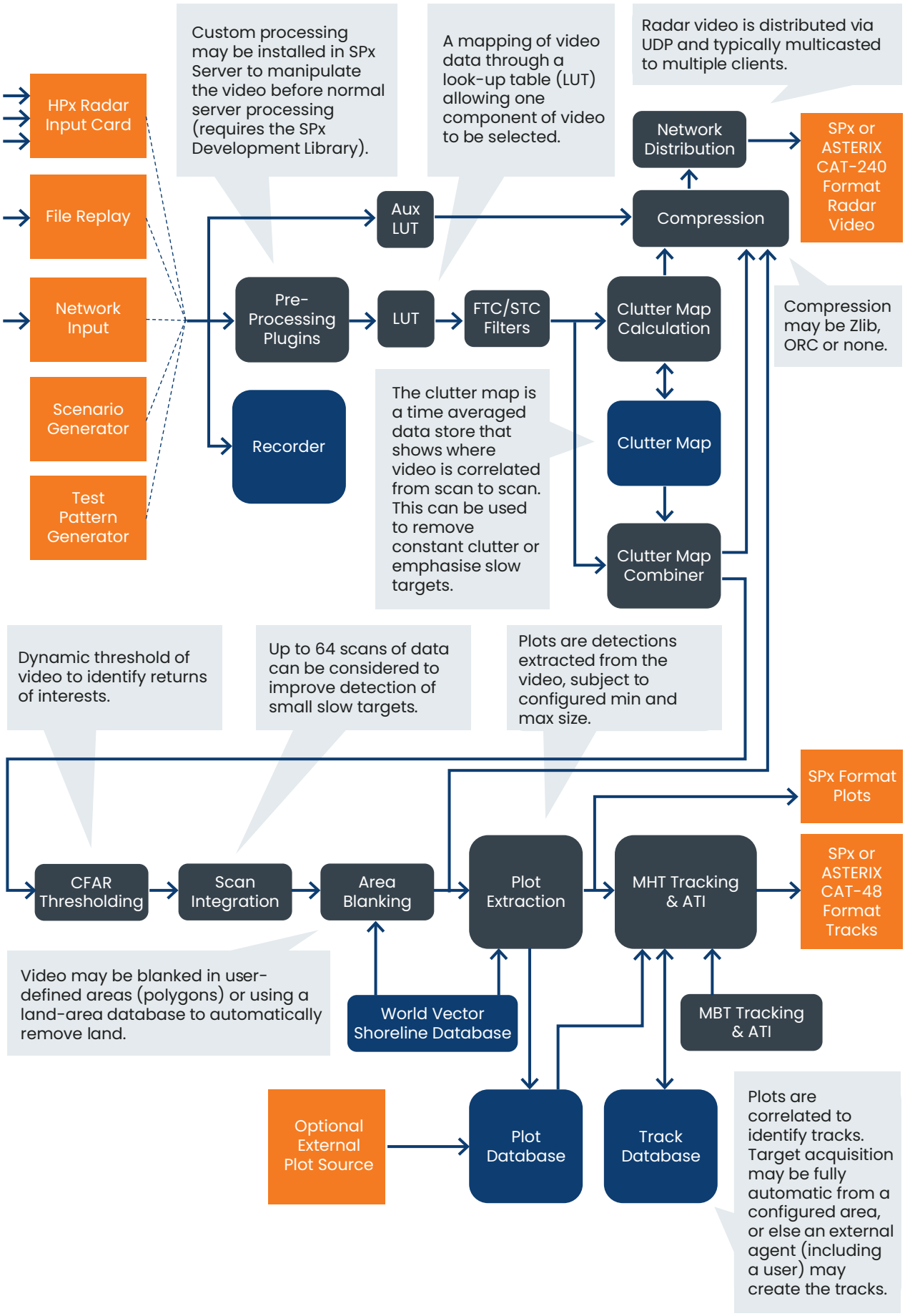
SPx Server presents a network interface for control and monitoring, facilitating remote control from third-party applications. Commands may be sent to the server to configure and modify parameters of high-level processing.



Commands include:

- Change current radar source
- Change parameters of source object
- Change network addresses for output
- Enable/disable processing objects
- Change parameters of processing objects
- Start/stop radar recording
- Start/stop network distribution
- Control HPx hardware input source
- Manually initiate, repair or delete a track
- Download new tracking area polygons and range-azimuth segments
- For radars that have embedded control support, change parameters such as scan rate, gain, sea clutter and FTC.

SPx Server Modules



Processing from Video to Tracks

1. Plot Extraction

The plot extraction process examines the processed video to search for returns that form a connected target-like shape. A set of configurable parameters defines the target size of interest, eliminating small noise returns or larger clutter or land masses early in the processing.

2. Track Initiation

The tracker maintains an active track database. The contents of the database are updated with new plot data derived from the extraction stage. New tracks are added to the database either from a manual request or else automatically.

Automatic track creation occurs when plots entered into the database are seen to be uncorrelated with any existing known target. A new preliminary track is created and is updated with future detections until confidence is established that the track is likely to be a target of interest.

3. Track Association

Established tracks are updated using new measurements provided by the extraction process.

The first stage of this is association by which a measurement is attached to the most likely track. In a simple situation, a true target will give rise to a single plot that can be directly associated with the expected target position. However, in the general case, there may be ambiguity as to which measurement relates to which track. A gating function is used to calculate an area around the expected position of a track, within which the next measurement must lie for it to be considered for association.

4. Track Filtering

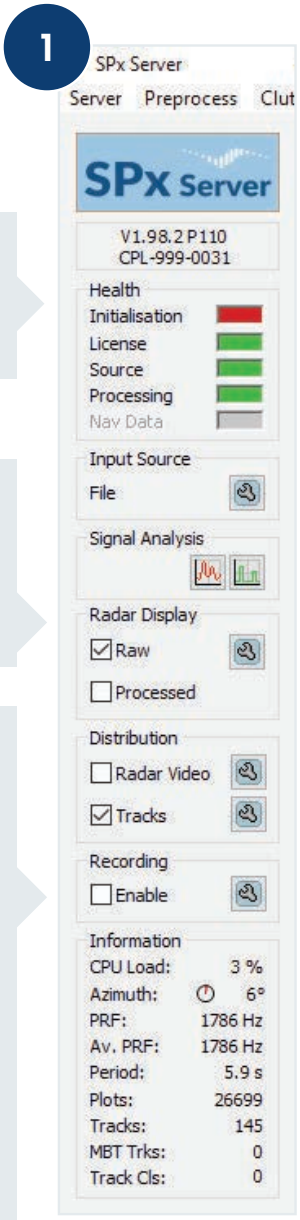
The tracker updates the current estimated position using the new measurement. If the measurement were known to be completely accurate, the update process would entirely believe the measurement and the new estimate would be exactly the measured value.

However, the measurement will contain errors, so the update process must use filtering to take a weighted combination of the expected position and the measured position. The filter works by computing a dynamic gain, based on estimated system noise and measurement noise models.

Local Engineering and Maintenance Display

SPx Server provides a choice of native or web-based user interfaces for set-up, monitoring and configuration.

The server software can be configured without these interfaces, but for most situations they provide an extremely valuable display capability to assist in the initial deployment and maintenance of the tracker.



Sub-menus for application and processing control.

Server health indicators provide an instant visual warning of any problems.

Input source selection.

Local radar display control (colour, fading and brightness). Display raw and processed video simultaneously.

The radar video and track distribution controls (enable/disable, set distribution IP address, message format, compression method).

Radar Video Recording.

The server features a built-in radar video recorder, which can capture, compress and store radar video to disk. This happens without affecting tracking or network distribution activities. If available, platform navigation data and AIS data is also captured, allowing full analysis of the recorded scenario at a later date.

Current status information, including an indication of the source PRF and current antenna bearing.

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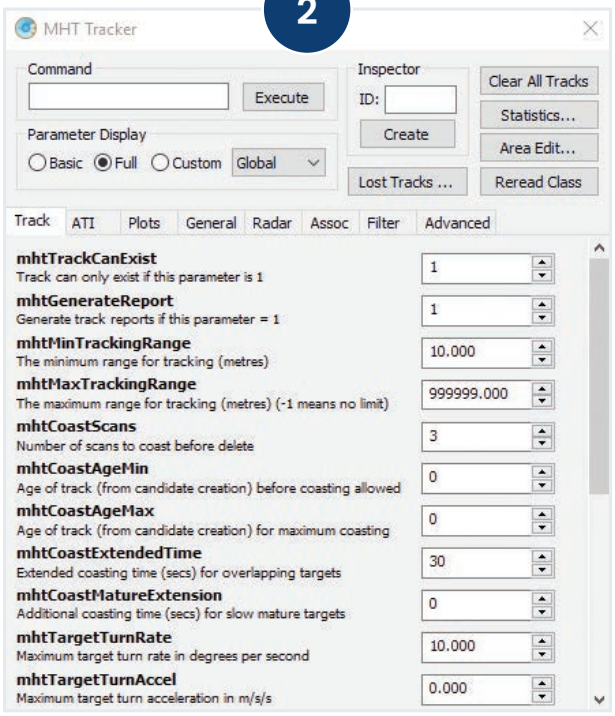

Graphical controls are provided to configure parameters for each of the processes in SPx Server, including tracking. A graphical area editor is also available, to assist with configuration of area-based processing.

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Graphical tools, such as an A-scan display, are available to assist with process configuration.

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Tracked targets are drawn with a symbol, label, velocity vector and history trail. Show targets with some velocity, not static ones.

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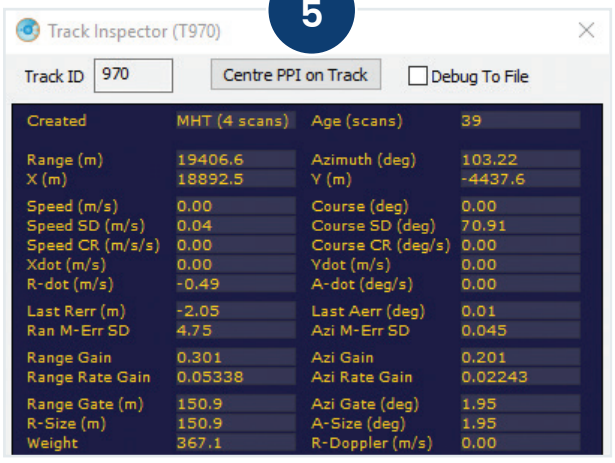

Track inspector provides detailed information about a selected radar track, including details of the tracking gate.

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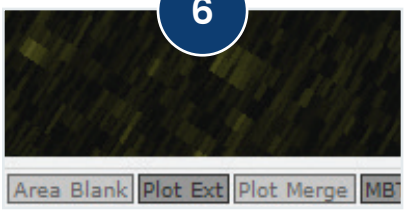

Indicators show which processes are currently enabled.

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Local display graphics controls (e.g. turn on/ off plot markers).

SPx Server Feature List

Primary and secondary (IFF) radar processor

Radar video from HPx cards or network

Radar processing:

- Filtering
- CFAR thresholding
- Area-based video filtering/masking
- Clutter map generation

Plot extraction and merging

In-built AIS association

AIS track display and recording

Doppler video support

Multi-hypothesis target tracking

Model-based tracking extension

Fully configurable tracking

Area-dependent tracking parameters

Full automatic track initiation

Redundant operation, with automatic failover

Built-in world coastline database

Static or moving platform

NMEA navigation input for mobile systems

Radar network distribution

Radar, NMEA and AIS record/replay

Comprehensive configuration GUI

Web Interface for control and monitoring

Sidelobe suppression

Intel x86 and ARM support

Windows or Linux versions

Network remote control

Receipt and tracking from plot data

Receipt and distribution of lidar data

Video, plot and track output to network

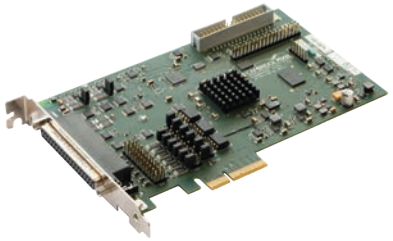
+ Regular updates with new features

System Requirements

Processor	X86 architecture Recommended: Intel Core i5 or higher. 8GB system memory or higher. ARM
Operating System	Windows 11 Linux (Fedora, Ubuntu, RHEL) For other operating systems consult factory
Graphics	Requires 1024 x 768 graphics display or higher for configuration. Recommended: PCIe or XMC graphics card. Use of GUI is not essential.
Network	1 Gbit Ethernet adaptor recommended.
Analogue Input Option	PCIe or XMC expansion slot required if using HPx radar interface cards.

Radar Input Sources

SPx Server works with Cambridge Pixel's HPx range of radar input cards and is also capable of receiving network radar video from SPx applications that distribute radar video or from radars that provide a network video output directly (ASTERIX CAT-240 and various proprietary formats).



HPx Radar Input Cards

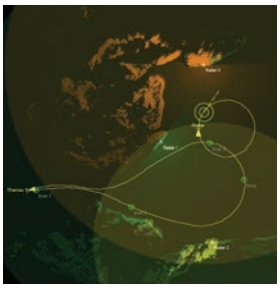
HPx cards are compatible with a wide range of commercial and military radars using video, trigger and ACP/ARP or parallel azimuth signals. HPx cards provide a flexible range of options to support dual analogue and up to eight digital video inputs. The cards are software-programmable to allow the analogue and digital video inputs to be mixed to a single intensity level for each sample.

HPx cards are available in PCIe or XMC form-factors and as a box-level radar-to-network solution.

Network Sources

SPx Server can accept network radar video input directly in a number of different formats, including SPx format and ASTERIX CAT-240. This makes it possible for software applications to send data into SPx Server for processing.

It is also possible for SPx Server to receive the network video data directly from certain radars, such as Kelvin Hughes' SharpEye, Simrad, Furuno, ICS and Raymarine.



Simulation and Test

SPx Server supports a built-in test generator to create radar video for testing. A more sophisticated option is to use SPx Radar Simulator which permits complex target and radar movements to be modelled. The ASTERIX CAT-240 output of SPx Radar Simulator may then be input directly into SPx Server.

SPx Server Ordering Information	**Part Number** (Linux)	**Part Number** (Windows)
SPx Server for target tracking and radar video distribution	110-702	110-703
SPx Server radar video distribution only (no target extraction)	110-640	110-641
Upgrade of SPx Server to include radar record and replay	110-715	110-715
IFF plot extraction	110-730	110-731

Supporting Developers & Integrators in Security, Maritime & Defence

Trusted by Lockheed Martin, BAE Systems & the US Navy for reliable radar and sensor processing solutions and system engineering support.

Leading innovators of safety, security and defence solutions use our radar, camera and sensor processing technology to enhance their capabilities, speed up project delivery and reduce risks.

Cambridge Pixel is driving innovation for a safer, more secure world.

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