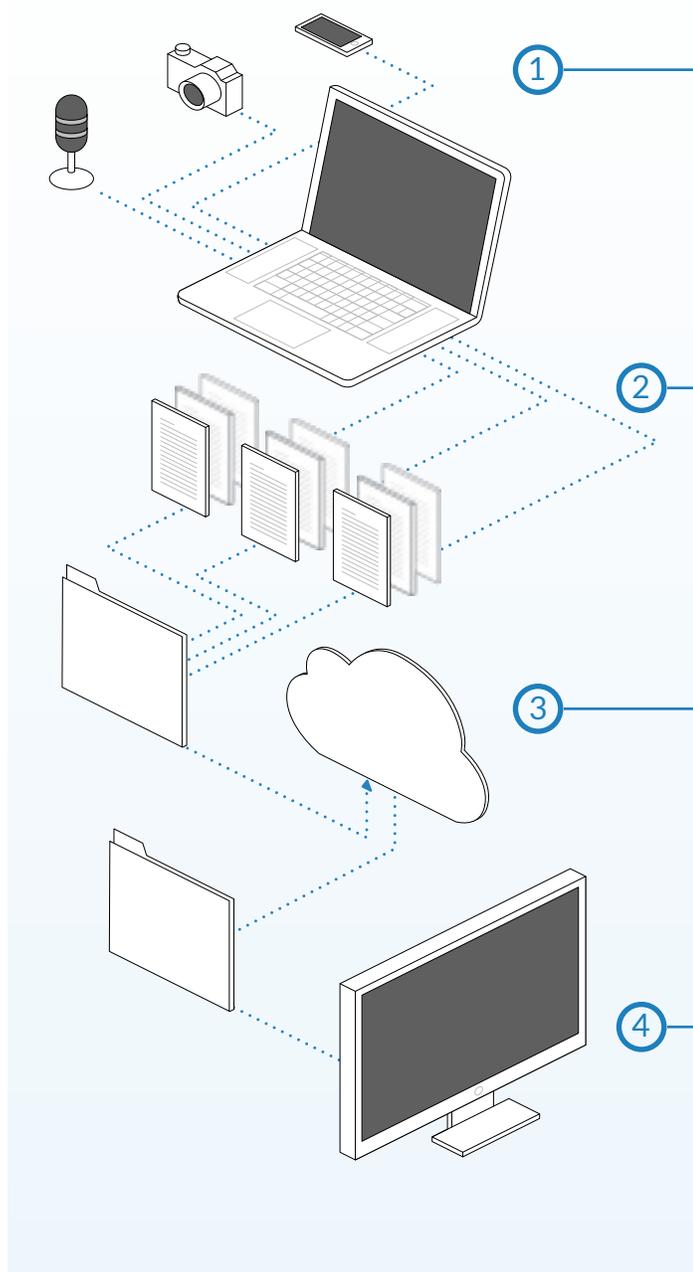




CloudTurbine is free open source stream sharing middleware that uses incremental files for communication (e.g. from sensors, cameras, Internet-of-Things appliances). CloudTurbine enables you to stream data, in real time, through popular file sharing systems like Google Drive, Dropbox, OneDrive and more.

CloudTurbine is data agnostic, it doesn't care about the type or format of the data. CloudTurbine allows seamless transitions between viewing live and archived data.

CloudTurbine supports secure end-to-end encryption to keep your data protected. CloudTurbine is simple, scalable, flexible, secure.



① Data Sources

There are many ways to get your data into CloudTurbine (CT) format. The CloudTurbine site provides a number of prebuilt source applications to get you started. Use the CT API to interface your own data sources and applications.

② Time-Coded Files

CloudTurbine reads and writes time-stamped channel files in nested folders according to simple rules and conventions:

SourceFolder / TimeFolder / ChannelFile

③ Stream via Cloud File Sharing

CloudTurbine leverages the proliferation and scalability of third-party file sharing services to distribute data across networks. Under your direction, data is mirrored to independent participating sites as real-time streams of incremental files. You never lose control of your data.

④ View Live or Replay Data

View live and historical data in your browser with WebScan, our flagship data viewer application, or select from a growing collection of custom and third party data viewers. Build your own data processing and monitoring applications using the CT "App-Kit" system.

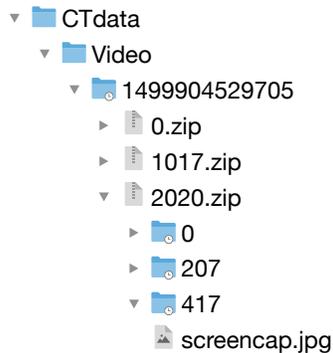


File Structure

CloudTurbine file system structure keeps your data in its native format (e.g. .wav .jpg .txt) allowing you to view content using standard file system utilities at any time.

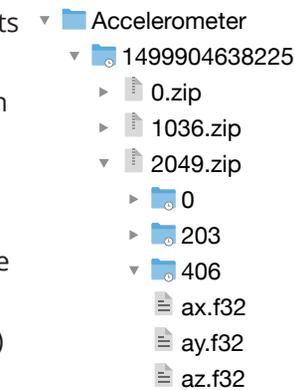
Source Folders

Each CloudTurbine “Source” has a top-level folder name that identifies the data, such as organization, project, instrument, or a test-system with nested test-run sub-folders.



Time Folders

Central to CloudTurbine are its time folders that contain the underlying data files. These in turn may be nested as multi-part time-stamps (time/sub-time), and may optionally be zipped at intervals to facilitate storage and to control the granularity (number and size) of files to be handled.



Channel Files

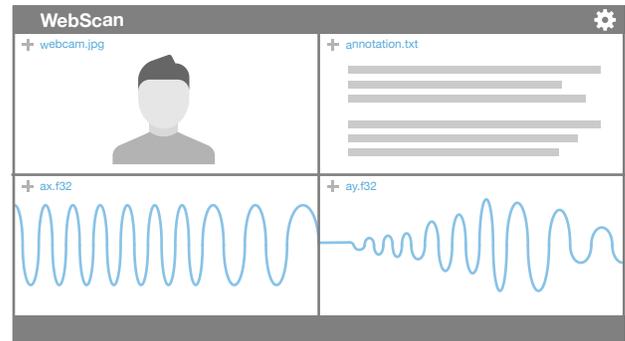
At the lowest level in the Source / Time / Channel hierarchy are files containing the streaming data. Each file at this level names a data “channel”, for example temperature, aircraft_altitude, or camera_image. Each channel file consists of one or multiple data samples. CT channel files can be any type of data file with any valid file name.

CloudTurbine Applications

Many CloudTurbine applications have been created to help you get your data in and out of the CloudTurbine system. Our two flagship applications are CTstream and WebScan.

WebScan

WebScan is a browser-based CloudTurbine data viewer. It connects to the CTweb HTTP/HTTPS server to stream selected data sources. View real-time or playback data from one or more numeric, image or text channels.



CTstream

CTstream provides a graphical user interface for streaming screen-captures, microphones, webcams, and text data. It has an extensible programming framework for adding new types of data streams. CTstream produced many of the demos at our website.

End-to-End Encryption

CloudTurbine provides end-to-end encryption for a high level of security and privacy. With a password or encryption key, channel data written to files (or within zip files) are encrypted using AES encryption. A unique initialization vector (“nonce”) is encoded with every encrypted file.





Use Cases and Examples

CloudTurbine has been applied to stream the following kinds of data: audio, JPEG images (screen capture and webcam), accelerometer, temperature, force, and text documents. Because of CloudTurbine's simplicity, it can integrate into your project on many different devices. We have had success utilizing CloudTurbine for various applications on Windows, Mac, Linux, Android, Raspberry Pi, Arduino, Matlab & more.

Example CloudTurbine projects include:

Open MCT

Open Mission Control Technologies (<https://nasa.github.io/openmct/>) is a free and open source framework being developed by NASA Ames Research Center and the Jet Propulsion Laboratory for mission planning and operations and browser-based viewing of streaming data. We have demonstrated using Open MCT as an interface for all channels available via a CloudTurbine CTweb server, including the display of numerical, text and image data. This provides an alternate viewing platform for visualization of CT data.

HDF5 to CT

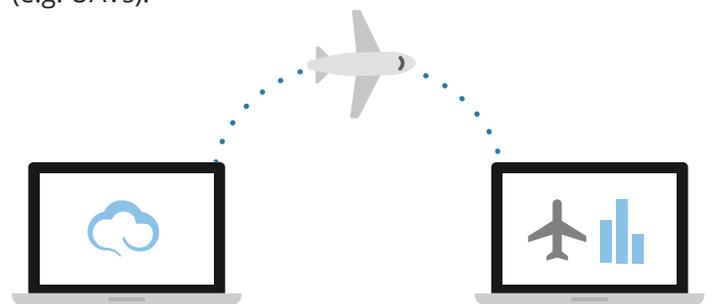
Hierarchical Data Format v5 (<https://www.hdfgroup.org/>) supports the storage of large datasets in a hierarchical "container", similar to a filesystem. Developed and maintained by The HDF Group, this open source and cross-platform solution is widely used by many government and commercial organizations. We have demonstrated the efficient extraction and storage of HDF5 data into CloudTurbine format. CT can bridge the gap between live data streams and HDF5 archives.

Cable test data

CloudTurbine has facilitated the monitoring of test data in a Navy sponsored project at Erigo Technologies to develop a light weight arresting gear cable on aircraft carriers. "Cyclic bend-over-sheave" (CBOS) tests determine steel versus titanium cable fatigue strength (cycles to failure) by running a loop of cable over "sheaves" (pulleys), translated back and forth under load. Cycle count, load, temperature and image data are saved to CloudTurbine and shared using Dropbox for remote monitoring.

Unity Game Engine

The CloudTurbine team has prototyped an interface for integrating real world NASA flight test data with the Unity game engine. The goal is a persistent virtual world in which humans interact with both live and simulated components to explore human-machine interaction and to enhance the trustworthiness of autonomous vehicles (e.g. UAVs).





Web Portal

As an open source project, CloudTurbine development is a collaborative effort. The CloudTurbine web portal has many resources to get you started:

News

Keep up to date with ongoing CloudTurbine development by visiting our news page. The news section explains updates to the CloudTurbine code base, new apps that are in development, updates to the website, and more.

Demos

The demos section of the website provides a glance at CloudTurbine in action. Here you can get a feel for how CloudTurbine may be useful for your project.

Docs

The CloudTurbine web portal provides a growing list of documentation to assist you when setting up your data streaming system. There is documentation for the general user, CloudTurbine administration, CloudTurbine development, and FAQs.

Apps

CloudTurbine's applications are divided into three categories. *Source* apps are responsible for translating your data into the CloudTurbine data format. *Utility* apps access, manipulate, convert CloudTurbine data. *Viewer* apps export or display CloudTurbine data.

App-Kits

App-kits are well-defined projects aimed at advancing CloudTurbine technology by engaging the open source community. Each App-Kit has a project page which describes the project and includes goals and links to sample code and support resources. Registered CT members can join app-kit teams and participate in development and testing.



Forums

The forums are the best way to get in contact with the CloudTurbine team and its community.

Future Development

CloudTurbine is an ongoing project in development. Our goals include developing CTstream into an extensible package, providing additional use cases and demos, including integration with "Internet-of-Things" products, and to further engage with outside communities and businesses including Synchting and Unity Game Engine.

It's free!

CloudTurbine is free open source software hosted on GitHub. To download CloudTurbine, you can visit the GitHub repo directly at <https://github.com/cycronix/cloudturbine> or navigate to the downloads section on the web portal. If you enjoy CloudTurbine, we encourage users to participate on the forums, or to get involved with the current CloudTurbine App-Kits.