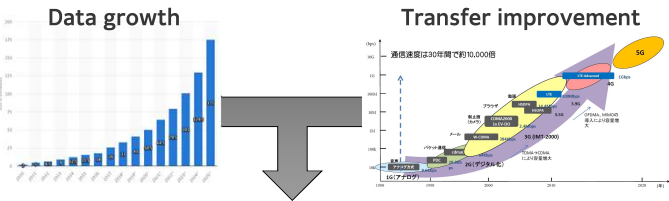


## Issue

Data growth speed is faster than transfer improvement speed  
 $\therefore$  The data is too large to process.



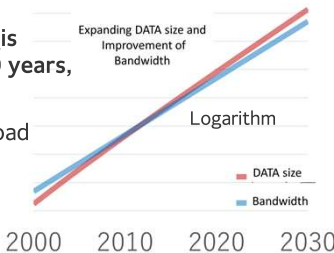
Approximate expression:

$$\text{Data growth : } \lim_{x \rightarrow \infty} n \times \log n > \text{Transfer improvement : } 2^{x/1.5} \times 3$$

$$\text{Fibonacci number : } n = \frac{\phi^n - (-\phi)^{-n}}{\sqrt{5}}, \text{ Golden ratio : } \phi = \frac{1+\sqrt{5}}{2}$$

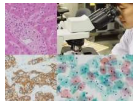
If the transfer speed improvement is calculated from data of the past 30 years, it will be 1/10 in 10 years relatively.

Even in reality, it takes time to upload RAW data from digital cameras.



## Current status

### Medical images



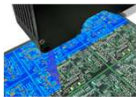
Medical images with large amounts of data (Terabytes or more), such as DICOM format files on MRI, **cannot be transferred to the cloud**. These are also **high level of privacy information**, and if the cloud were cracked it would be a massive data breach.

### Smart cameras



Object recognition in security cameras requires an advanced processor for image processing and is provided as a service in the cloud. Since it is **difficult to transfer** all security camera images **to the cloud**, it is important to reduce the number of security cameras in smart stores.

### Factory line inspections



In the line inspections of the factory, the image of several Mbps is always acquired, and the failure judgment is carried out by the inference by AI. Images acquired during the examination **were discarded** because they were **too large**. In order to change the inspection object on the line, it is necessary to learn a new AI, and image data of the new inspection object is collected as teacher data in the development room.

### Server racks



Servers consume less power due to higher semiconductor density, but the network that connects the storage (JBOD) at the bottom of the rack to the CPU/GPU at the top is always low on bandwidth, so transfer speed is more important than power. Therefore, **37% of the power consumption of the server rack** is consumed **by the network communication** of 40 cm in the rack.

## HC Technology

The current memory, such as the GPU that runs AI applications, is around 16GB, so it is not suitable for reading large amounts of data beyond terabyte, and it corresponds by batch processing.

HC transfers and executes distributed logic (the left figure "AI processing") that actually accesses data to storage where large amounts of data are stored. Transfer efficiency is improved by transferring only the results processed within the storage (learning results).

### Shadow image

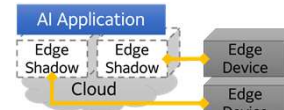
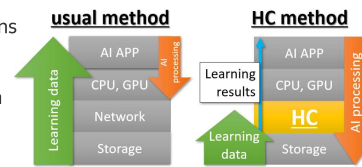
The technology that makes all edge devices look as if they are in the cloud.

For existing AI applications, distributed processing is possible only by rewriting the code according to this patent technology.

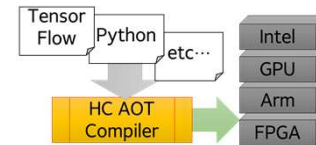
### Heterogeneous

A technology that compiles the same source code into the native execution form of each processor and distributes it through images.

Storage controllers and edge devices use various processors, making this technology an important part.



Japanese Patent : 2018-089022



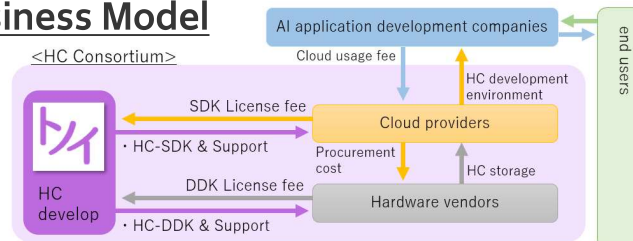
Japanese Patent : 2018-159325

Related patent applications in preparation

# Hybrid Computing (HC)

~ next-gen data access technology ~

## Business Model



### 1. HC-SDK



An expansion kit to make an existing AI application as a HC compatible. It consists of a pre-compiler and libraries that extend the existing compiler, and tools to execute it. Provided for software development vendors and cloud providers.

### 2. HC-DDK



Object storage expansion kit to make existing storage devices as a HC compatible. Provided for hardware vendors and homebuilders.

### 3. Crypt key



tonoi in-house encryption keys to bind the cloud and the edge. It protects data access and computing resources in the quantum computer era. Provided for any HC users.

## Main members



**Mitsuo Koikawa**  
 Founder, Primarily Inventor  
 2015 Establish tonoi co.,ltd.  
 2014 CEDEC award for IPv6  
 MOT at TUS  
 Biz School' of Grenoble  
 2008 MS president award  
 2002 MS Xbox core patent  
 Nihon Silicon Graphics SE



**Takeyuki Ogura**  
 Co-Founder, Inventor  
 Virtua Fighter 2 dev  
 Xbox Math Library dev  
 CEDCE Committee



**Shinich Manaka**  
 Advisor  
 MS former officer  
 VMS, Win98, Xbox  
 LIVE prod lead



**Kouichi Hashida**  
 Advisor  
 Professor of  
 Tokyo University

## HC Advantages

HC is designed for the Product Life Cycle.  
 There are advantages in each product face.

### Advantages over the existing environment

High-resolution analysis independent of transfer rate	Faster response times regardless of data capacity
Object Storage	Provides equal or greater functionality than existing embedded development.

### Immediate effects

Communication load reduction
Power consumption reduction

### Post-implementation benefits

Dev Ops
<ul style="list-style-type: none"> <li>Achieve centralized management at multiple sites</li> <li>Reduce Sler travel cost</li> <li>Reduce code development effort</li> </ul>

reduce risks for leakage of personal information

Provides operational capabilities for non-stop services.

### Hardware update / replacement

Cost reduction of system update	Heterogeneous
---------------------------------	---------------

General-purpose services based on general-purpose parts provide continuity so that users can continue to switch to the latest commodity hardware without being noticed.

## HC's Introduction effects

### Medical images

Using HC's distributed processing technology, pathological images can be analyzed from the cloud while remaining in the hospital. Because **it doesn't transfer data**, it can get a second opinion from, say, a European doctor. Even for privacy information, **analysis results anonymized by logic dispersion** can be used for research.

### Smart cameras

The HC imaging technology allows the security cameras in the smart store to process images **as if they were in the cloud**. Because distributed processing is performed regardless of the communication band, it is possible to install a security camera **without worrying about the number limit**.

### Factory line inspections

With HC's distributed processing technology, the image data discarded in the factory line inspection is distributed as if it were in the development room, and the inspection objects in the line are **changed at zero downtime**.

### Server racks

HC's heterogeneous technology allows existing large data analysis apps written in various languages to be offloaded (distributed operation) to storage with simple HC support, **reducing network power consumption** by 40 cm.

tonoi co.,ltd.

Mitsuo Koikawa as Founder

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