Mitsuo Koikawa

2019. Brave Biz-con Venue Award
2018. MIT-VFJ BPCC18 First prize
2015. Establish the tonoi co.,ltd.
2014. CEDEC award of excellence for IPv6 support

Microsoft: Xbox P2P core patent, President award
for cryptography of Japanese terrestrial digital
broadcast
Silicon Graphics: Pre-sales engineer of Netscape
server

Master of Technology (MOT) at Tokyo University
of Science
Entrepreneurship program at Grenoble Ecole de
Management (@GrenobleEM)
Honor from Nomura Research Institute for
Proposal of the future world (3x3 map)

Competitive Comparison

	Hybrid Computing	Amazon IoT	Embedded Development
Cloud resource	Web UI, Storage, AI	Web UI, Storage, AI, GPU	Web UI, Storage, AI
Running cost	◎	×	◎
Cloud App	OSS	Amazon Lambda	OSS
Edge App	n/a	Docker, FreeRTOS	Ubuntu, Windows, etc
Development cost	◎	○	×
Distribute unit	Binary Image	Docker, Binary Image	Docker, Binary Image
Distribute method	HC method	Greenglass	manual
Support cost	◎	○	×
Edge OS	Ubuntu	Ubuntu, FreeRTOS	Ubuntu, Windows, etc
Initial cost	○	◎	×
Processing	Cloud + Edge	Cloud	Edge
Data Transfer	less	Huge	less

Amazon IoT has an advantage of the initial cost.
HC has advantages in Development, Running and Support costs

Value proposition of Hybrid Computing

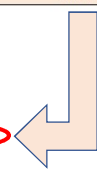| High Performance	Easy Management	Low Cost
• Speed up by reducing data transfer time. • Speed up to share processing between cloud and devices. • Speed up with real devices instead of virtualization.	• Easy to manage because development and operation are completed in the cloud. • Easy to manage the privacy because data would not be stored in the cloud. • Easy to put the HC technology in existing environment such as NAS.	• Reduce costs by sharing GPU load with devices such as NAS. • Reduce costs by suppressing power consumption of DATA transfer. • Reduce travel and remote maintenance fee by cloud centric management.

HC POC Test Result

Theoretical Values

Target： NVDIMM: Samsung 4T M2.SSD
Edge CPU: Intel Skylake 530
Cloud GPU: nVIdia Tesla K80

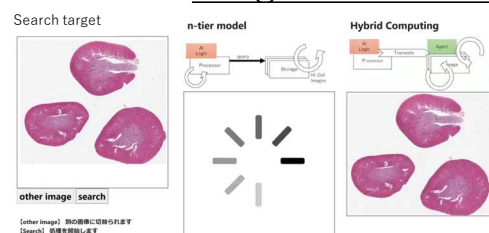| data (Mbyte)	PCIe Gen3x32 (32Gbps)	M2.SSD (3.5Gbps)	Serial SSD (0.5Gbps)	【HC】Serial SSD (0.5Gbps)
1 M	0.0003	0.0023	0.0160	0.0160
10 M	0.0026	0.0229	0.1600	0.0162
100 M	0.0255	0.2287	1.6001	0.0178
1 G	0.2553	2.2871	16.0014	0.0341
10 G	2.5531	22.8714	160.0143	0.1974
100 G	25.5314	228.7140	1,600.1426	1.8301
1 T	255.3137	2,287.1403	16,001.4260	18.1566

Legacy processing time / HC processing time

data (Mbyte)	PCIe Gen3x32 (32Gbps)	M2.SSD (3.5Gbps)	Serial SSD (0.5Gbps)
1M	x0.9386	x0.9927	x0.9990
10M	x5.8653	x9.2705	x9.8888
100M	x12.8799	x55.7870	x89.8247
1G	x13.8799	x111.9703	x468.6921
10G	x14.0545	x124.5098	x810.5850
100G	x14.0722	x125.9200	x874.3667
1T	x14.0740	x126.0627	x881.3013

Experiment by pathological image search of rat

Search target

other image search

【other image】別の画像に切替られます
【Search】処理を開始します

N-Tier
HC stub-1   HC stub-Z   HC stub-3

Movie： https://youtu.be/Ur21hdNWWgQ

Logic： From the pathological image of the rat in the storage, search for an image having the same hash value as a target image.
Result： On AWS environment, Legacy implementation costs 28sec, and HC implementation with same logic costs only 3sec.
The experimental result is **9 times faster.**
(Closer value with theoretical 9.888 times)

More DATA size makes more advantage of HC.