HULFT White Paper

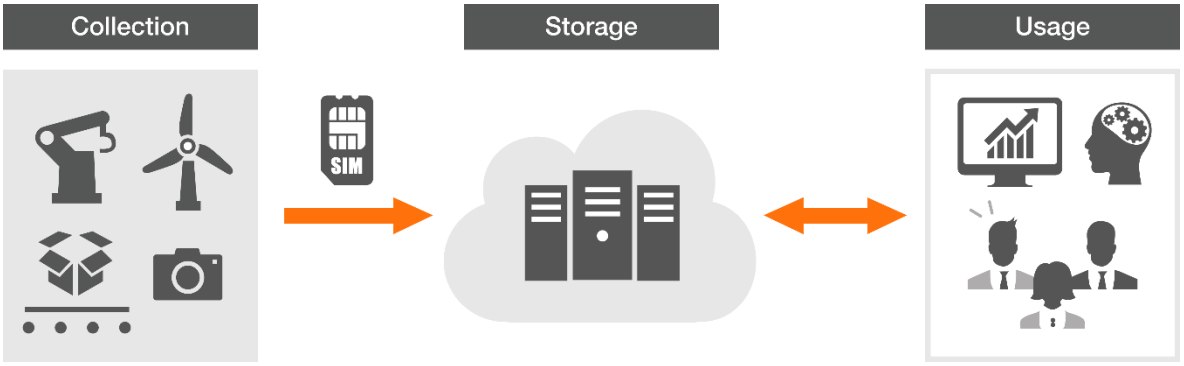
Compression Techniques for Resolving Issue of Ballooning Communication Costs in IoT Era

We are now in the IoT era, in which everything around us is connected to the Internet. In the manufacturing industry, which is the backbone of *Manufacturing Japan*, it is especially important to be able to collect and use information, not only from manufacturing devices installed in factories, but also from devices deployed in the world such as in shipping containers or at customer sites. Low-cost SIMs for IoT distributed by telecom providers can be used in this context, to build an infrastructure capable of collecting information without impacting currently-operating network environments. However, even if the SIM cost is relatively low, users are still concerned about the communication costs resulting from data usage. Users require larger data sizes as they collect more information, and as a result, communication costs become a critical issue. In this white paper, we compare actual communication costs for SIMs used with IoT applications and introduce compression techniques to reduce these costs. Because of the wide cost difference between using and not using compression, this is a key point that needs to be taken into consideration.

Which Data Transmission Method is More Suitable for the IoT Era – Real -Time or Batch?

Even before IoT technology became a widespread phenomenon, many organizations have collected information regularly from various fields to utilize it for business. For example, there are cases in the manufacturing industry where environmental information and other logs recorded by manufacturing equipment are collected for use in fault prediction and maintenance. It is natural to consider the use of IoT technology to collect information in such contexts. Moving toward this trend, increasing

attention has been focused on using low-cost SIMs from telecom providers to directly store information in a cloud environment on the Internet. Although factories and other sites typically already have their own installed network environment, many companies prefer to build a new environment that will not affect their existing stably-operating network, and more and more are selecting low-cost SIMs.



In this case, two methods are possible for data transmission. The first method is to send information to the cloud in real-time. An alternative method is to store information directly in the equipment or in a dedicated device such as an IoT gateway, for sending to the cloud later. Simple log information, for instance, has a small data size and can be sent in real-time. However, the data is sent using message-based communication, and when a communication error or other problem occurs, the required information may be unable to be collected properly. Unless it is strictly necessary to collect the information in real-time at the site, if the information being collected is for business and analysis purposes, it is worth considering the second method of storing the information as files

and then sending it in batches. There is a tendency to think that IoT means only real-time information collection, but if transmission is performed using files, high-quality communication systems can be implemented, equipped with the function to detect errors before and after transmission and to resend data when errors occur.

	Feature	Scenario
Streaming, real-time integration	System in which data is processed and integrated in real-time. Suitable for processes that require immediacy.	Factory line control, instant feedback to equipment, automatic operation, real-time analysis and monitoring, video and audio distribution
Batch file integration	Method of integrating data in file format during the transmission process. Suitable for processes that require efficiency by performing data processing on the edge side and for reliable integration of data.	Data analysis and visualization, predictive maintenance, processing of sensor data on the edge side, image and video analysis, firmware distribution

Fear of Ballooning Costs: IoT Communication Simulations Based on Packed Volume

Transmission in file format has many advantages from the standpoint of actual operation. This is because the SIM is not simply used to send collected data such as log information, but also has other uses. For example, there may be a case where a user wants to send a configuration file or other data downstream using the SIM to a device installed at the customer's site. In systems with surveillance cameras, image, video, and

other data are sent regularly to the main office over the SIM for use as information for analysis whenever defects or other problems occur. This method of transmitting information by files also provides many advantages in terms of communication quality and usage applications. However, unsurprisingly, if the communication capacity becomes large, the costs for using the SIM will also grow. Continuing to send large amounts of data without recognizing the costs could result in unexpectedly high costs for IoT. This could even result in a state of running up a huge communication bills due to IoT.

In response to this, let's calculate the costs for data transmission using SIMs. This simulation is based on the services of SORACOM, INC. which provides data communication SIMs as a mobile virtual network operator (MVNO). Broadly speaking, SORACOM has two types of available fee structures. The most viable options are SORACOM Air for Cellular: Air SIM for Japan and SORACOM Air for Cellular: Air SIM for Global Plan01 Low Data Volume. Simply put, the first plan features high fixed cost and low communication cost, while the second plan features low fixed cost and high communication cost.

		SORACOM	
Plan		SORACOM Air for Cellular Air SIM for Japan	SORACOM Air for Cellular Air SIM for Global Plan01 Low Data Volume
Initial cost		¥954 / ISIM + shipping	US$5 / ISIM + shipping ¥544
Speed class		s1.standard (512kbps)	-
Basic fee		¥10 / day	US$0.40 ¥44 / month
Data communication fee	Upload	¥0.24 / MB	US$0.50 / MB ¥55
	Download	¥0.8 / MB	US$0.50 / MB ¥55

Yen conversion for the global plan is calculated based on US$1=¥108.8.
*The SORACOM basic fee includes the SIM communication fee and the ISP usage fee.

In this case, we conduct our fee simulation based on a scenario of collecting operational log data for devices installed in a remote location.

We compare the resulting fees by measuring the data traffic volume when a file with 500KB per transfer is sent twice per day, and this is used for one year.

The calculation is performed for 100 devices, and a polling interval of once per day.

Verification conditions	
Data transfer count per day: 2	Data transfer capacity per day: 1MB
Data capacity per transfer: 500KB	
Compression rate of transfer file: Approx. 1%	
Polling* count per day: 1	

*Polling
The polling process finalizes changes to the settings and the transfer history. This process generates a small amount of data communication.
The data communication fee will vary in proportion to the number of transfer processes.

The simulation results in an annual cost of 370,356 yen for the first plan and 2,210,904 yen for the second plan. These figures show that a plan with a high fixed cost but limited variable cost (communication cost) is significantly more cost-effective. However, looking at a breakdown of this cost shows that 360,000 yen is required just for the fixed communication cost, indicating that the fixed cost portion alone accounts for most of the cost. If possible, we would like to examine a method that enables use with a reduced basic fee.

Calculation result ① SORACOM Air for Cellular Air SIM for Japan	Calculation result ② SORACOM Air for Cellular Air SIM for Global Plan01 Low Data Volume
Total cost per month ¥30,863 Approx. ¥30,000	Total cost per month ¥184,242 Approx. ¥185,000
Total annual cost ¥370,356 Approx. ¥370,000	Total annual cost ¥2,210,904 Approx. ¥2,210,000

Breakdown of calculation result ①

- Fixed cost (Basic fee)

  1 day ¥10 x 30 days x 100 devices = ¥30,000

- Variable cost (Data communication fee)

  [Total communication]

  ¥863

  [Details]

  Upload:

  1,113,275 bytes x 30 days x 100 devices = 3,339,825,000 bytes

  3,339,825,000 bytes ÷ 1,024 ÷ 1,024 x ¥0.24 ≈ ¥765

  Download:

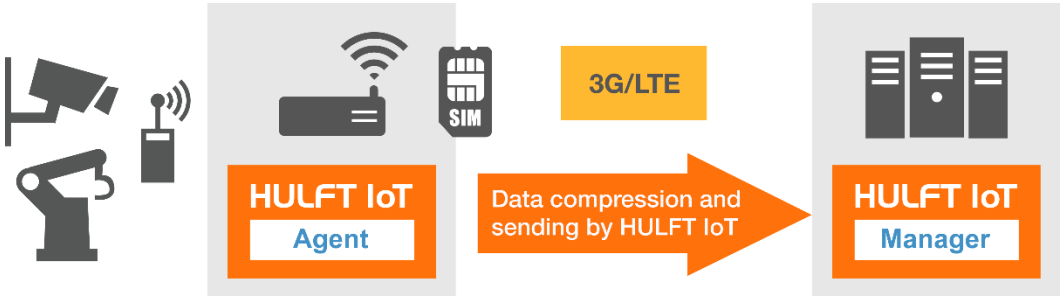
  42,533 bytes x 30 days x 100 devices = 127,599,000 bytes

  127,599,000 bytes ÷ 1,024 ÷ 1,024 x ¥0.8 ≈ ¥98

Use of Compression Techniques for Potential Dramatic Improvements

Although the second plan is ideal for reducing the basic fee, the high communication cost of this plan is a major stumbling block. One possible way to reduce this communication cost is through data compression techniques where the data itself is compressed for enabling significant reductions in the communication cost.

One method is HULFT IoT, which can be used not only for data compression, but also for implementing the various processes necessary for file transmission using only simple settings, and which provides a high quality of communication. This enables avoiding of communication problems that can occur in message transmission, such as resending processes, and techniques for transmission while compressing can be used to enable dramatic reductions in cost due to the extremely high compression rate.



When HULFT IoT is actually used to perform data compression based on the second plan, successful compression is possible to about 1/50 of the upload packet size in actual measurements. As a result, the cost of 2,210,904 yen is reduced to only 118,296 yen, enabling a cost compression to about 1/20. Compared to the first plan with a high basic fee, this enables the cost to be reduced to about 1/3 of the original cost. The HULFT IoT compression function can be used to reduce the data transmission volume for enabling both lower fixed and variable costs.

Data transfer volume per device

		No compression		With compression	
1 month	Upload	33,398,250 Byte	Approx. 31.85 MB	762,870 Byte	Approx. 0.73 MB
	Download	1,275,990 Byte	Approx. 1.22 MB	298,260 Byte	Approx. 0.28 MB

Calculation result ❶ SORACOM Air for Cellular Air SIM for Japan	Calculation result ❷ SORACOM Air for Cellular Air SIM for Global Plan01 Low Data Volume	Calculation result ❸ Calculation result ❷ plan + HULFT IoT with compression
Total cost per month ¥30,863 Approx. ¥30,000	Total cost per month ¥184,242 Approx. ¥185,000	Total cost per month ¥9,858 Approx. ¥10,000
Total annual cost ¥370,356 Approx. ¥370,000	Total annual cost ¥2,210,904 Approx. ¥2,210,000	Total annual cost ¥118,296 Approx. ¥120,000

We know now that compression enables lower communication costs, and naturally, ZIP and other methods are available to use beforehand to compress data for communication. However, when using such compression methods, the compression process will not only impose a heavy load on the system, but a script must also be written for returning the compressed data to plain text at the cloud side that receives the data. Compared to using HULFT IoT, separate coding for the various integration processes would be required, including the sending and receiving processes, the confirmation of file arrival, and the resending processes when errors occur. HULFT IoT has the advantage in this sense, since it can be used to implement IoT communication and data integration without the need for coding.
Another advantage of selecting HULFT IoT is that actual equipment verification of HULFT IoT with various IoT gateways has been completed, and so a wide lineup of operation-verified devices is already available.

Today, when IoT technology can be used to expand data usage even wider than before, people are looking to build an environment where data can be collected at the optimum cost without waste. Compression using HULFT IoT is primed to become a viable option for this purpose.

Note: Some of the contents described above are not applied outside Japan.

Contact Us

Saison Information Systems Co., Ltd.

Headquarters

Akasaka Intercity AIR 19 F, 1-8-1 Akasaka, Minato-ku, Tokyo 107-0052, Japan
TEL : +81-3-6370-2300
Business Hours: Monday - Friday, 9:15 - 17:45 (UTC +9)
(Closed on weekends, Japanese national holidays, and Dec.30 - Jan. 3)

● **UK Office**
EMEA Office 6th Floor, First Central 200, 2 Lakeside Drive,
London, NW10 7FQ, United Kingdom

● **USA**
HULFT, Inc.
1820 Gateway Drive, Suite 120 San Mateo, California 94404
TEL : +1-650-393-4930

● **Singapore**
HULFT Pte. Ltd. (ASEAN HQ)
7 Temasek Boulevard #32-51, Suntec Tower 1, Singapore 038987
TEL : +65-6678-6566 FAX : +65-6678-6501

● **China**
HULFT China Co., Ltd.
3B/D, No.1068 Tianshan West Rd., Shanghai, P.R. China
TEL : +86-21-62399201 FAX : +86-6239-9321

URL www.hulft.com/en e-mail info@hulft.com