Sony has developed TransferJet, a close-proximity wireless transfer technology, that can transfer large files such as photographs and videos from mobile devices such as smartphones and digital cameras to PCs or TVs simply by holding the devices close together. Sony announced this technology at CES International, held in the US in January this year, and it attracted interest from a variety of media, both domestic Japanese and international. This article presents Sony's unique TransferJet close-proximity wireless transfer technology and a discussion between two of the developers.

TransferJet is a wireless technology that allows a pair of devices that want to communicate to do so simply by bringing them close together. While the communication distance is only up to a short 3 cm, it achieves ultra-high-speed transfers with an effective data transfer rate of 375 Mbits/s. TransferJet needs none of the complex connection settings or access points required by current wireless systems. Thus we expect TransferJet to be able to be widely used as a universal interface between a wide variety of equipment types. For example, a digital camera image could be displayed on a TV screen just by holding the camera close to the TV, or audio files could be transferred just by holding a cellular phone close to a portable audio terminal.

**TransferJet Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Center frequency</td>
<td>4.48 GHz band</td>
</tr>
<tr>
<td>Transmission power</td>
<td>-70 dBm/MHz or lower (average power)</td>
</tr>
<tr>
<td></td>
<td>This conforms to Japan's domestic weak-field transmitter regulations.</td>
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<tr>
<td></td>
<td>TransferJet will conform to radio regulations in other countries as well.</td>
</tr>
<tr>
<td>Transfer rate</td>
<td>560 Mbits/s (maximum) - Effective rate: 375 Mbits/s</td>
</tr>
<tr>
<td>Communication distance</td>
<td>We are assuming use at distances up to 3 cm.</td>
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Main TransferJet Features

(1) Simple operation: just bring the devices close together
TransferJet solves the main problems with current wireless technologies: the complex settings that are required and the unstable data transfers. Simply by placing the devices that need to communicate near to each other, even someone who has never used a PC can connect equipment easily and without problem. Also, since there is no host/target relationship, a cellular phone can communicate with a PC, or a pair of cellular phones can communicate. Furthermore, communicating devices can be registered in advance. For example, by only registering your home equipment, you can prevent data leaking to third parties.

(2) Stable, high-speed transfers
The TransferJet physical transfer rate is up to 560 Mbits/s using the 4.48 GHz band. The effective rate, which takes error correction and protocol overhead into account, reaches 375 Mbits/s. This rate can reduce transfer times even for large files such as audio files or video files. Also, TransferJet includes a function for selecting an optimal transfer rate for the actual communication conditions and can, when communication conditions are poor, maintain communication by automatically lowering the transfer rate. The transmitted power is a level that conforms to the Japanese regulations on weak-field transmission and TransferJet has no effect on other wireless systems. This means that multiple users can use TransferJet at the same time and equipment that includes TransferJet can be used for data communication regardless of whether the equipment is indoors or outdoors, regardless of what country it is in, and regardless of what company manufactured the equipment.

(3) New type of coupler developed
The transmission principle that TransferJet uses is not the radiated electromagnetic field used by existing wireless transmission systems, but rather is the electric inductive field. Therefore, Sony had to develop a new type of coupler in place of the existing wireless antennas. The frequency band used by this coupler is the 4.48 GHz band. It transmits data with an output that meets the Japanese regulations for weak field wireless output levels. This new type of coupler has the feature that it acquires high gain at close distances but signal strength is attenuated rapidly when separated. This means that this coupler will not receive interference from other wireless equipment as long as that equipment is not brought within a few cm of the coupler. Furthermore, since the field is not polarized, communication is possible without loss of gain simply by bringing the devices close together without being aware of the angle between them.

Envisioned Product Deployment

—If TransferJet were included in a FeliCa port...

Authentication and billing would be possible by just bringing a portable terminal to a FeliCa port (a reader/writer that supports FeliCa). For example, when downloading music, the music content being purchased could be downloaded at high speed at the same time as authentication and billing.
— If all equipment included TransferJet ...

Any pair of equipment units would be able to transfer music, movies, or image data at high speed just by bringing them close together. Problems such as transfers taking too much time and the inconvenience of connecting and disconnecting cables would be eliminated. For example, it would be possible to download images captured with a digital camera to a recorder and then they could be uploaded to portable equipment. File transfers between digital cameras and data transfer between cellular phones would be simple.

In addition, we also envision a wide range of TransferJet product deployments as an interface between various equipment types.

Sony will encourage the industry to adopt this technology in the near future as a means for transferring large amounts of data, and, through the realization of products and services that apply TransferJet, will respond to the needs of the mobile equipment centered content-consuming society.

We are aiming for the wide popularization of home networks that connect the electronic equipment in the home, and expect that this will be made practical in the fiscal year starting in 2009.

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The complete opposite of the typical radio engineer's approach

Odaka: Although Sony promoted the development of UWB (ultra-wideband) from the end of the 1990s, I thought that there were many difficult problems, such as regulations differing between countries. For example, if interference reducing technologies are not included, then in some countries the power must be reduced, or in Japan, the device cannot be used outdoors. Given that, we decided to discover how far we could transmit if we lowered the power output enough so that it would clear the usage limits in any country. What happened was that we took UWB technology as the base, and made a major shift in our thinking. As a result of this study, we arrived at the idea of this new type of coupler, and realized that we could transfer data at high speed if we limited the distance to under 3 cm.

Maekawa: Radio engineers have the habit of wanting to transmit further and of wanting to connect many devices efficiently. Thus, to speak honestly, at the start I thought the communication distance of 3 cm was a limitation. However, when I resigned myself to the distance and began to consider what would happen when distances were limited to 3 cm, I found that there were actually many advantages. This “limitation” will become, inversely, a major sales point for this technology.

Odaka: Radio waves are, by their nature, something that reach out to everyone equally. This means that conventional wireless systems cannot, due to their nature, escape from the following three problems: (1) the other party in the communication must be identified, (2) data must be encrypted, (3) interference must be suppressed. Thus complex connection...
If you change your thinking, you can turn limitations into strengths

If you change your thinking, you can turn limitations into strengths.

settings cannot be avoided in wireless systems. Inversely, however, if the radio waves can only reach out to the very near vicinity of the device, the system is freed from that requirement and this becomes an enormous advantage from the standpoint of ease of use.

Maekawa: The strongest selling point will be its simplicity.

Odaka: Although the latest wireless systems have become easier to use, they are still too difficult for older users.

Maekawa: Even for younger users, although they would be able to use the keyboard for the connection settings on a PC, they would still have trouble with a digital camera.

Odaka: We want to create a wireless system that anyone can use pleasurably anywhere. I think that it has become possible to achieve this desire, which has become the primary starting point for wireless technology development, by changing our original concept of wireless communication. There was an interesting episode related to this development. The incorrect information that “Sony has developed a wireless technology that can only reach 3 meters.” was released on the Internet. This started a heated discussion as to whether or not 3 meters was adequate. But when we made the correction to 3 cm, all discussion simply stopped. With a distance of 3 cm, this concept is really all that is possible.

Transmission and reception with natural motions

Odaka: This new coupler has the characteristics that the gain increases rapidly as the devices move close together, and, inversely, the signal is attenuated radically as they are moved apart. This means that the switchover from where the connection is on to where it is off is extremely well-defined. It is not the case the connection will be established somewhere or other. The explicit user action of bringing the devices together connects directly with the device activity of sending or receiving data. This makes it possible to create an intuitive and easy to understand interface.

Maekawa: The fact that the gain falls rapidly when the devices are separated can, of course, be seen as a disadvantage. However, if we switch from the idea of connecting to large numbers of devices to a one-to-one connection concept, the advantage of interference being less like to occur becomes significant. For example, if one is comes across a series of posters, and only one is of interest, the usage modality in which one acquires information by holding one’s cellular phone up just the one of interest and downloads the music or promotion video one likes is now possible because of this new type of coupler.

Odaka: Since the concept is so clear, our presentation at CES International was well received. Since people from Japan are used to and familiar with the “Touch & Go” usage of the FeliCa* card in the public transportation system, they quickly understood that extremely high-speed data transfers would be possible with the same usage pattern. In contrast, since there are USB systems that support fairly long separation distances, the reaction of many people from other countries was one of “Huh? Only 3 cm?”. However, once the concept is explained, most people understood clearly and then reacted with “It’s cool!”

Maekawa: I think that the transfer technology itself is almost perfected. While I can’t mention a specific power consumption figure, I fully expect that the power consumption per bit transferred will be significantly lower than current wireless LANs or Bluetooth. Although the transfer rate could, technologically, be made quite a bit faster, there are considerations from the standpoint of the devices themselves. In some sense, there is a pitcher throwing a fastball called TransferJet, and a catcher who must catch that ball (that is, the various equipment and applications that support TransferJet), and the current state is that we must consider the combination of those players. We must create many ideal pitcher/catcher combinations.

Odaka: The most important thing is determining which application runs when a wireless connection is made. I hope to create systems that will please users through detailed discussions with the people who develop end applications. I hope that TransferJet will be able to communicate openly, not just with Sony products but with many devices from other manufacturers as well, and we are now working on preparations to make this technology open to the public.

*: FeliCa is a registered trademark of Sony Corporation.
+*: FeliCa is a contactless IC card technology developed by Sony Corporation. It is used widely for tickets (electronic tickets) in public transportation, for electronic payments, and personal authentication.