Electromagnetism and transmission medium

I. Background Human society is entering an era of ubiquitous computing, when networks are seamlessly interconnected and information is always accessible at our fingertips.

The practical implementation of ubiquitous services requires three levels of connectivity: Wide Area Networks (WAN), typically via the Internet, to remotely connect all types of severs and terminals; Local Area Networks (LAN), typically via Ethernet or WiFi connectivity among all the information and communication appliances in offices and homes; and Human Area Networks (HAN) for connectivity to personal information, media and communication appliances within the much smaller sphere of ordinary daily activities– the last one meter. NTT's RedTacton is a break-through technology that, for the first time, enables reliable high-speed HAN. In the past, Bluetooth, infrared communications (IrDA), radio frequency ID systems (RFID), and other technologies have been proposed to solve the " last meter" connectivity problem. However, they each have various fundamental technical limitations that constrain their usage, such as the precipitous fall-off in transmission speed in multi-user environments producing network congestion. II. Technical RedTacton takes a different technical approach.

Instead of relying on electromagnetic waves or light waves to carry data, RedTacton uses weak electric fields on the surface of the body (*4) as a transmission medium. A RedTacton transmitter couples with extremely weak electric fields on the surface of the body. The weak electric fields pass through the body to a RedTacton receiver, where the weak electric fields affects the optical properties of an electro-optic crystal. The extent to which the optical properties are changed is detected by laser light which is then

converted to an electrical signal by a detector circuit. The three major functional features of RedTacton are highlighted below.

(1) A communications path can be created with a simple touch, automatically initiating the flow of data between a body-centric electronic device and a computer that is embedded in the environment. For example, two people equipped with RedTacton devices could exchange data just by shaking hands. A wide range of natural human actions — grasping, sitting down, walking, or standing in a particular place — can be used to trigger RedTacton to start a networked process. 2) Using a RedTacton electro-optic sensor, two-way communication is supported between any two points on the body at a throughput of up to 10 Mbps. Communication is not just confined to the surface of the body, but can travel through the user’s clothing to a RedTacton device in a pocket or through shoes to communicate with a RedTacton device embedded in the floor.

Unlike wireless technologies, the transmission speed does not deteriorate even in the presence of large crowds of people all communicating at the same time in meeting rooms, auditoriums or stores. Because the body surface is the transmission path, increasing the number of connected users directly increases the available number of individual communication channels . (3) RedTacton can utilize a wide range of materials as a transmission medium, as long as the material is conductive and dielectric, which includes water and other liquids, various metals, certain plastics, glass, etc. Using ordinary structures such as tables and walls that are familiar and readily available, one could easily construct a seamless communication environment at very low cost using RedTacton .

Note that constraints are imposed by the length and environment of the propagating conductor, and by the thickness of the dielectric.) III. Details RedTacton can achieve duplex communication over the human body at a maximum speed of 10 Mbps. 1. The RedTacton transmitter induces a weak electric field on the surface of the body.

2. The electric field sensor (transistor or photonic electric field sensor) detects electric field that reaches the RedTacton receiver. 3. Signals are processed in the receiver circuit and the data is downloaded. IV. Mechanism of Communication with REDTACTONThe transmitter sends data based on fluctuations in the weak electric field induced in the body.

The electric field is received using super-sensitive electric field sensing technology. – The naturally occurring electric field induced on the surface of the human body dissipates into the earth. Therefore, this electric field is exceptionally faint and unstable. – The super-sensitive electric field sensing technology measures the weak electric fields induced by the super-efficient alternating electric field induction technology developed by NTT. REDTACTON Tranceivers Transmitter – induced electric field to the bodyData sensing circuit – produces output control signals to control the two way communication VI. Human Safety Transmitter is covered with insulating film Only a small displacment current generated in the body .

Conforms Radio frequency Exposture Protection Test Electric field intensity ; 82. 4 v/m Displacment current ; 45mA at a frequency of 10Mhz VII. Comparison with other network technologies The chart below shows the positioning of RedTacton with respect to existing communication

technologies. The focus on ubiquitous service has brought about the shortening of distances in communication. RedTacton is positioned as the last 1m solution to ultimate close-range communication.

Wireless communication creates connections when signals arrive, allowing for easy connections because connectors are unnecessary. However, seen from another aspect, the arriving signals can be intercepted, so security becomes an issue. Wired communication transmits data between two connection points, so interception is difficult and security can be considered to be high. However, connectors and cables are a nuisance. Taking the above points in account, RedTacton is situated directly between wireless and wired communication.

In other words, RedTacton allows for easy connection without connectors, while at the same time allowing transmission of data only between two contact points. It thus has the feature of being difficult to intercept. VIII. Comparison with other human communication methods “ Intra-body communication” using the human body as a transmission medium have been reported, but the electric field/photonics method employed by RedTacton is superior to conventional methods in terms of communication distance, speed, and interactivity.

RedTacton does not require the electrode be in direct contact with the skin. High-speed communication is possible between two arbitrary points on the body. With the electric amperage method, a clear signal line and ground line are required. With the electric voltage method, capacity coupling can substitute.

Therefore, the electrode does not have to be in direct contact with the skin. IX. Applications – One-to-One services With the ability to send attribute data from personal information devices worn on the body to computers embedded in the environment, one-to-one services could be implemented that are tailored to the individual needs of the user. Intuitive operation of personal information devices Communication is triggered by totally natural human actions and behavior, so there is no need to insert smart cards, connect cables, tune frequencies, or any of the other inconveniences usually associated with today’s electronic devices.

– Device personalization Setup, registration, and configuration information for an individual user can all be uploaded to a device the instant the device is touched, eliminating the need for the device to be registered or configured in advance. – New behavior patternsTables, walls, floors and chairs can all act as conductors and dielectrics, turning furniture and other architectural elements into a new class of transmission medium. For example, a user could have instant access to the Internet merely by placing a laptop onto a conductive tabletop. – Security applications RedTacton could be installed on doors, cabinets and other locations calling for secure access, such that each secure access could be initiated and authenticated with a simple touch.

At the same time, all the transaction details and relevant user attributes (personal identity, security clearance, etc. could be logged by the security system. X. Conclusion Two major challenges 1.

To decrease the size of the transiever 2. To decrease the power consumption So we can dream that in the near future we can transfer information with a kiss or a slap . VIII. References 1] T. G.

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