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Design and Analysis of a D2D based System for Contents Transfer

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Abstract

Content transfer amount, which is based on mobile communication networks in the development of applications for many applications and the dissemination of rapid smart devices, has increased. However, as mobile data traffic increases rapidly, limits appear in the content delivery of mobile communication network base. Device-to-Device (D2D) technology solves the limitations of content delivery network-based mobile phones to communicate between devices. However, this feature of D2D communication technology causes a problem of device overhead; in this paper, we propose a system that can reduce such overhead of D2D communication devices. By performing only one role specified for each device, overhead can be reduced, and a high performance of content delivery is allowed. By performing experiments for content distribution in consideration of multi-national communications, device mobility, and travel through application implementation, we can measure and analyze content speed and transfer rate. This reduces device overhead in D2D communication technology; it is expected that the provision of many more services is possible in the future.

Keywords: D2D, Contents Transfer, Data Traffic, .

Introduction

With rapid advancements in Information Technology, the concept of social networking communication has now been extended to physical things. This implies that as the concept of communication between physical things becomes widespread, a tendency to connect an increasing number of devices in a user's environment will emerge. Accordingly, a rapid spread of smart devices to enable communication between devices is imminent[1,2]. Mobile data migration services increases rapidly in the service of the data center around a wireless multi-media content mobile communication service of voice-centric I show a tendency. In recent years, it has been predicted that the spread of tablet PCs will increase; therefore, the increasing trend of wireless traffic will only surge. The increase in the penetration of these smart devices has occurred because of a number of factors. First, because of WiFi chips and the falling prices of WiFi equipment, such technology has been integrated into mobile platforms and high-performance computing; furthermore, mobile devices equipped with WiFi have increased rapidly[1]. Figure 1 shows the overview of mobile data traffic. Smartphones and tablet PCs are expected to grow rapidly at an annual average rate of 23.3% and 62.3%, respectively, based on the volume for 2015. Increase in the volume of data transmitted and received in smartphone devices corresponds to 24 times (2G) that of mobile phones; furthermore, a general increase in the usage of mobile communication equipment is expected to induce a rapid increase in the phenomenon of mobile data traffic[3,4].

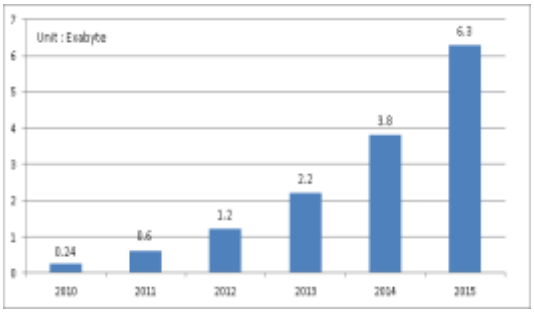

Fig.1. Mobile data traffic

This way, application services that use the same spread of smart devices in the future will be further activated. Demand frequency will also continue to increase, and data traffic should increase also. However, it is expected that because the supply associated with smart devices is slow, eventually, the scarcity of frequencies will result in problems. In

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order to accommodate exponentially increasing mobile communication network data traffic, telecom operators have been studying new technology. Interference control technology for efficient capacity increase (ICIC), cooperation transmission and reception (CoMP) technology, MIMO technology of the antenna base multiple, direct end-to-end for traffic load balancing of the base station at the edge of cell communication, and device-to-device (D2D) communication technology have been developed. In particular, to reduce the load on base stations, more rapid communication is possible because direct communication techniques between terminals has been noted more[3]. However, with the D2D method for transferring multimedia and voice information in smart devices, such as for outbound connections, mobility, and cooperation, instrument no overhead will within the instrument only increase. According to a survey, it is expected that the current traffic of mobile communication network will increase three times every year; whereas video content delivery traffic, which accounts for 50% of the overall traffic, will double and increase to 66% by 2017[4,5,6]. Thus, the problem of content distribution cost is a fundamental limitation of mobile communication, and it has increased end-to-end delay, thus associating with increased traffic of mobile communication networks because of bottleneck; furthermore, reaction time, in addition to delay, has become a factor inhibiting service quality. Currently, the discovery of devices located at a short distance and D2D performance evaluation is being performed in a number of studies, such as the development of new techniques in D2D to take advantage of many services applications. Therefore, in this paper, we provide a content delivery service that can reduce the overhead of using the techniques of D2D applications by describing inter-terminal direct communication with D2Ds.

Trends and research

1. Mobile Bluetooth

Small size, low cost, low power consumption (100 mW), mobile Bluetooth, short distance wireless connection (10 – 100 m) are all standard specifications for the wireless interface of mobile devices such as mobile phones, notebook computers, personal digital assistants (PDAs), consumer electronics, and PC peripherals. Such an interface is suitable for cases different from remote common techniques, it should be able to communicate even if there is an obstacle between devices, and it should be used in connections that are always on. In a wireless environment, using the 2.45 GHz industrial, scientific, and medical (ISM) frequency band is unauthorized; this band supports voice channels and three data transfer rates of up to 721 kbps. In addition, the amount of transfer, 3 – 30 mAmps range, is determined by the many devices that use 30 mAmps for "standby mode" power consumption; Bluetooth is intended for a wide range of products. Bluetooth was developed to support the personal space surrounding a user in a room with the devices found in an office/meeting room/home in terms of reach. Because the power consumption of Bluetooth is low, and it uses a separate frequency band, Bluetooth can be transferred by dividing the frequency of the plurality of data to be transferred. However, in order to provide a maximum of 24 Mbps transfer rate, which is relatively slow compared to the 300 Mbps of WiFi peer-to-peer (P2P), the effective speed of sound should be 64 kbps, and a maximum low-speed transfer rates of 723 kbps of data transfer should be supported. It is inappropriate to transfer multimedia content. The maximum transmission range is approximately 100 m; however, the authors have a valid transmission limited range of approximately 10 m in general. Recently, Bluetooth modules, such as network access points, has spread rapidly as a tendency device installed by default into hands-free devices and tablet PC smart phones, as well as into notebooks, such as those used for data synchronization and file transfer. However, because of the scrupulous disadvantage of narrow transmission ranges and limited transmission rates, Bluetooth is not widely used by general users, although it is suitable for transferring massive amounts of multimedia content [7,8,9,10,11,12].

2. WiFi P2P

WiFi P2P is a technique available where wireless local area networks (LANs) are supported. This technique is extended based on IEEE 802.11n, and it is currently separated in the IEEE 802.15 Peer Aware Communication (PAC). The WiFi network, and then connected via the AP, and by connecting with the Internet network, WiFi existing terminals was common practice to use the WiFi equipped device. WiFi P2P involves support for direct communication between devices, while maintaining most of the functionality of the existing WiFi standard. This is advantageous in that communication between devices is possible on the go even if there is no wireless AP. Further, WiFi P2P can be extended to terminals equipped with WiFi capability that support 802.11n through a firmware upgrade. Further, since backward compatibility is supported, the operation can also support WiFi P2P even if one of both terminals, in this case, the security algorithm between two terminals uses WPA2. Since WiFi P2P's adoption as an official standard in 2009, WiFi

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Alliance has launched a certification program in 2010 for WiFi equipped devices [6]. WiFi P2P has often been compared with ZigBee and NFC, and Bluetooth in particular. However, even Bluetooth 3.0, the latest version of Bluetooth technology, fails to match up to WiFi P2P in terms of distance coverage and speed. WiFi P2P is supported in LG Optimus Black and Samsung Galaxy S2; a WiFi P2P technology of Motorola Xoom has been launched recently; Apple has also launched Bonjour, a service implementing WiFi P2P technology. On the other hand, chip sets developed by some manufacturers, have included D2D solutions for a long time. Representative examples include Intel's chipset technology, which incorporates D2D Wireless Display technology and Push2TV of NetGear. The 2011 Mobile World Congress (MWC), and the public (communication between terminals of 1Km in can) the FlashLinQ is a short-range wireless communication technology of P2P-based, Qualcomm was or perform practical experiments in collaboration with SKT in Korea . In the case of WiFi P2P, and while you use radio Ren'yon unlicensed frequency band, FlashLinQ uses the frequency of license assigned to the mobile operator[13,14,15,16].

3. LTE D2D

D2D's recent versions support direct data exchange between communication terminals such as smart phones. This has led to a new era in direct communication between devices. Further, D2D is a candidate technology for standard Hutchison of LTE in the long-term, which involves circumventing the base station In the next generation, D2D LTE communication standard, electronic newspapers, 5.30 in 2013. Without the use of separate network equipment, for short-range communication that allows direct communication between terminals within a certain radius, in the case of LTE-Advanced, LTE frequency band of dedicated LTE D2D is being (licensed band) use; however, because it is direct communication between terminals, there is no relay of small base stations such as pico / femto cell and communication with the eNB, to support interconnection between terminals. D2D link for direct communication between terminals adjacent to each other are set, which means that data is received via the link D2D without going through the base station transmission and reception data. By placing smartphones close to each other data can be transmitted and received directly through D2D In comparison, Bluetooth takes longer for data transfer, whereas in LTE D2D, the LTE terminal always receives the signal Since connected yl,'s recognize each other automatically, the obvious advantage is that speeds up to 75Mbps, the highest rate of LTE in theory, can be achieved. In eNB, manage and transfer state with the state of the terminal, the resources of D2D links to other leading role of providing communication services between the terminal and the base station in the D2D communication. Based on the state information it is possible to analyze the state of the D2D communication by traversing continuously to the control signal terminal, and by analyzing eNB controls the D2D communication state. The benefits of D2D include security in authentication, which causes users to use an LTE, reuse spatial frequency resource terminals adjacent (proximity)-based, rather than the transmission and reception to and from the base station, and direct communication between terminals. There is an increase in capacity of the network through the reduction of power consumption of the terminal, the load distribution of the base station through an increase in data rate, and an increase in cell area[17,18].

Experimental environment

In this paper, we extend the research and performance evaluation of D2D transfer overhead through a content delivery system and developed applications.D2D scheme implies communication between devices. If one were to evaluate an existing content delivery system of mobile communication network base, Base Station (BS), and the user's device connect following recognition of the network, mobile devices, content to the server he or she would like the request, the server responds to this. The D2D system will additionally transfer content on all the units receiving equipment to transmit the content. That is, it may become a principal when each device requests a service, or offer, and serves to mediate all these situations. In the end, content transmission system of these results in several problems. In an attempt to alleviate these problems, in this paper, we designed a content delivery service that is described in the following.

- For certain operations, each node executes only its designated purpose
- Content delivery through cooperation node (device)
- Update the information in the device in the movement vicinity
- Each device collects connection information about all nodes (device)

Each node (hereinafter, device), is assigned a role that suits the current state (request, provide control). This can reduce the overhead of the device owing to reduced redundancy. In addition, the information needs to be regularly updated to enable connection to the device itself. Moreover, the mobility of the mobile device has information about

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the connection between the subject of the movement of the feature or more. This effect can be expected to reduce the time in detecting a device in terms of cooperation between devices. Fig 2. shows the role of each participating node in the content delivery system.

Fig.2. Role of each node

Fig 2. As, there is only one role for transmission and reception status of content, the device reduces resource overhead. Further, each device is connected such that cooperation with each other is facilitated and the transfer of multimedia data is possible. To shorten the transfer time by supporting the content delivered through the device so as to update the information of the target device, each device serves as a control. Fig 3. shows a method of transfer of content from a device.

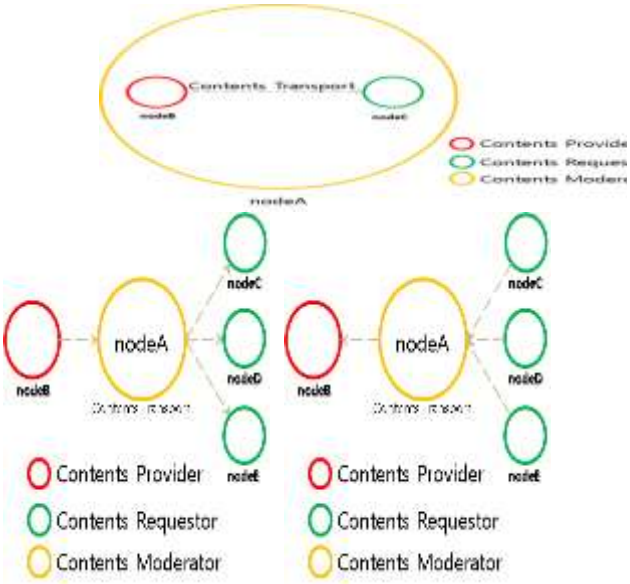

Fig.3. Content transmission

Further, since the state of the service is known, status information updates of the device state and information acquisition about the mobility of the device occur rapidly. By then reduce the frequency of updating the information of the device there is little change in the state and to increase the period of the device not, thereby minimizing the waste of resources. As shown, are transferred to the adjacent device detection signal detected new device, it possible to update the information.

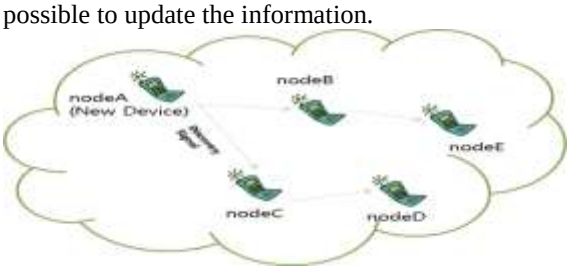

Fig.4. New device detected

In order to perform a given role, each device must have the information of the other devices. In this system, device information, is essential for efficient content distribution. Information on discovery of a new device, the requesting device, transmission device, the control device is stored in the candidate device. information is stored by use of SQLite DB in smart devices. Index is used to access DB for the value of the primary key of each table. It also indicates the the current role of the equipment. Type has a value of the following three control, the request. Mac Address is the intrinsic value of the apparatus MAC address. Status indicates the current state of the device, i.e., if the content is in transmission, wait-send the request, which has a value of the information updated. The Target ID denotes the ID of the target device's Status. Location Information indicates the location of the device. Mobility shows the movement of the current device.

Fig 5. shows the method to transfer content to multiple devices. The transmitting device selects an intermediary device within the radius of transmission and stores the position information of the device selected for connection in the database and communication environment. The intermediary device selects the receiving device for de-transmission within a certain radius, and stores the connection information in the database of the receiving device. Connection after completion is verified by the transmitting device to determine if the intermediary is ready to receive data; accordingly, a reception preparation acknowledgment message is transmitted. The intermediary device that receives the message, prepares to send a confirmation message to the receiving device. An intermediary message is sent indicating that the intermediary device is ready to receive the data. The receiving device that receives the message, sends to the intermediary device the data ready message. Intermediary data is sent to the intermediary device and multiple receiving devices by the receiving device. An intermediary reception

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completion message of data reception is sent by the intermediary device to the receiving device that is transmitting the data, and the message of the reception completion of the data to the transmitting device. When the data transfer is completed, then the receiving device closes the connection with the intermediary and the intermediary device closes the connection to the respective receiving device. The transfer is then complete.

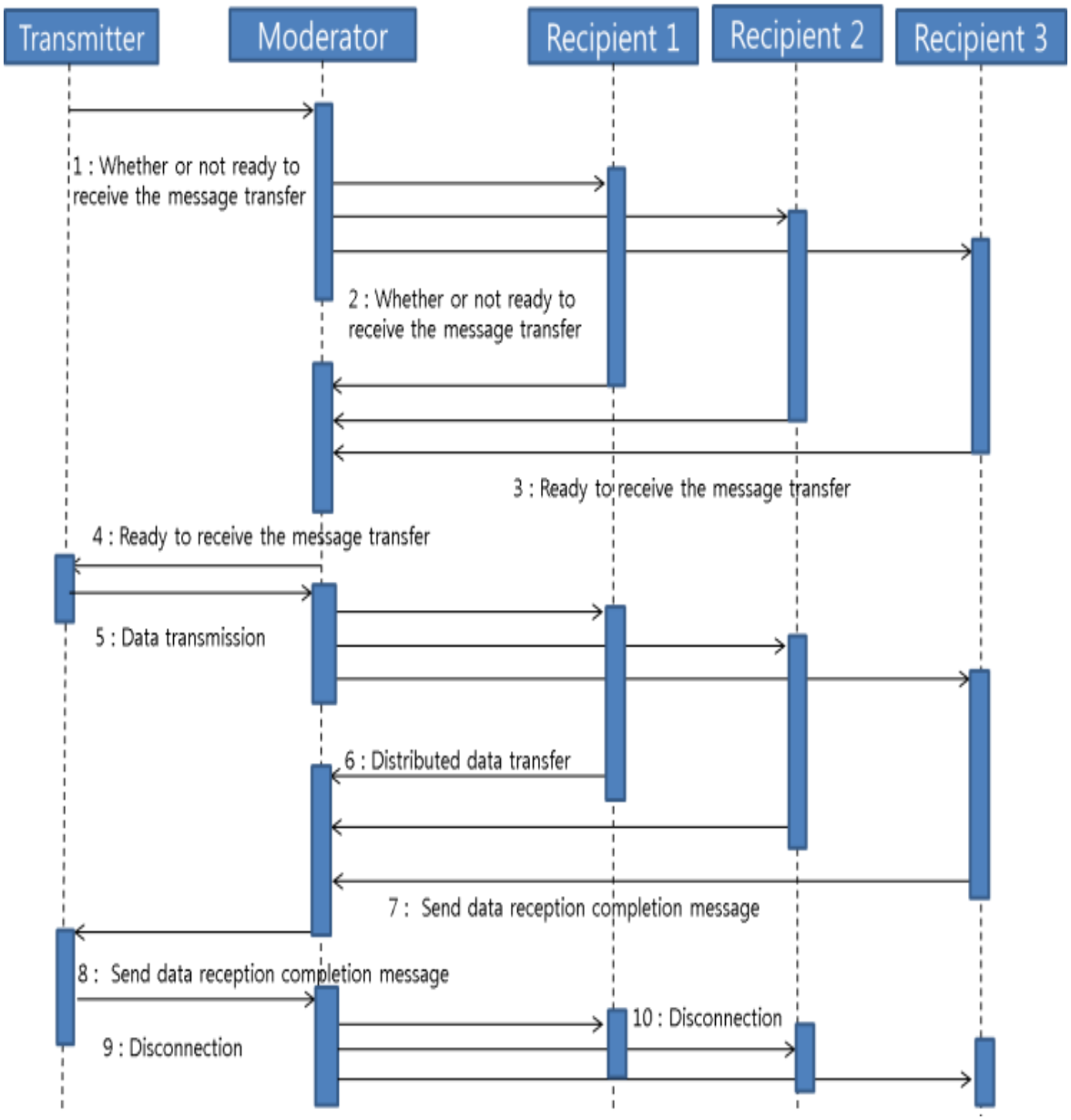

Fig.5. Sequence diagram of content transmission (multiple devices)

Fig 6. shows a sequence of cooperative forwarding. The transmitting device selects an intermediary device within the radius of transmission. It stores the position information of the device selected for connection in the database and communication environment. The intermediary device selects the receiving device for de-transmission within a certain radius, and it stores the database information of the receiving device and the connection. To determine if the intermediary is ready to receive data a message is sent to the intermediary device to confirm if it is ready to receive data; the transmitting device transmits to the receiving device

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a confirmation message. Receiving device transmits to the intermediary device the message of data ready to receive when the receiver is ready. Simultaneously as it receives the message of ready to receive, an intermediary that received the ready to receive messages sends a distributed range of data to and from each transmitting device. Transmissions of data to the intermediary device are performed within the range of the intermediary device, to consolidate data, and each transmission device transmits to the receiving device. Receiving device which is receiving the data, and transmits to the transmitting device via an intermediary device message receiving completion. Each transmitting device, and that it terminates the connection to the intermediary device, and terminates the connection of the receiving device and the intermediary device, the transfer is complete.

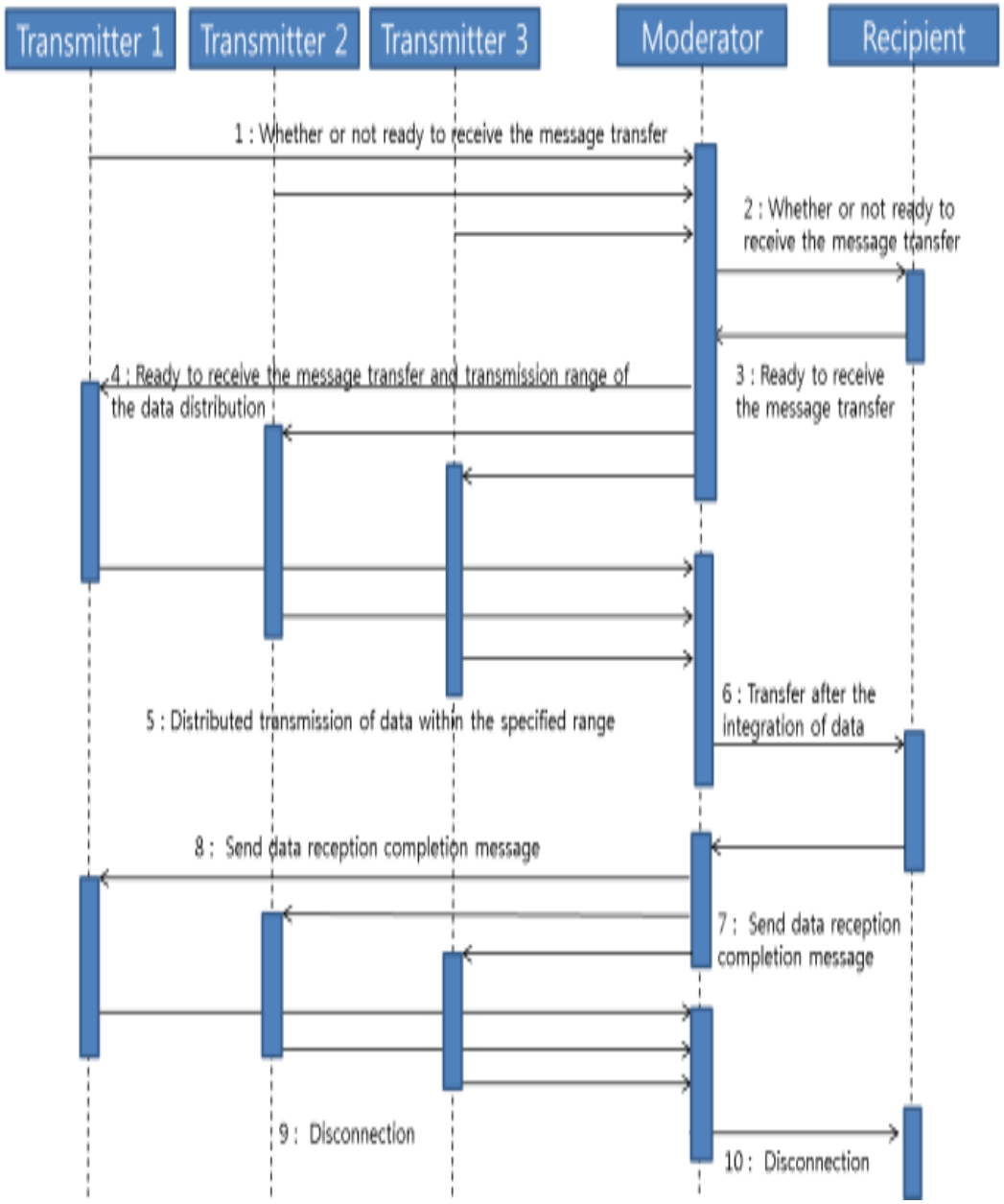

Fig.6. Sequence diagram of content transmission (cooperative)

Experiments were conducted using a mobile device and an application was developed for the same. Unity, WebOS, and Augment Reality systems were used. The applications enables the opening and closing of the door of a vehicle using a mobile device. Execution screen of the system is as follows Fig. 7.

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Fig.7. Applications running

Using the WebOS, the application is designed for operation on all devices to allow for the modeled door by using Unity3D. The application employs password authentication To prevent an authorized person from opening or closing the vehicle's door. The vehicle, smart devices other can control the connection of the door and the smart device is installed. Thus, by a communication connection to the door by using a smart device, enter the password that he or she specified, the user is able to control the contact Gyepye. The experiment focused on transmission of not only text information but also multimedia. Fig 8. shows a block diagram of the system.

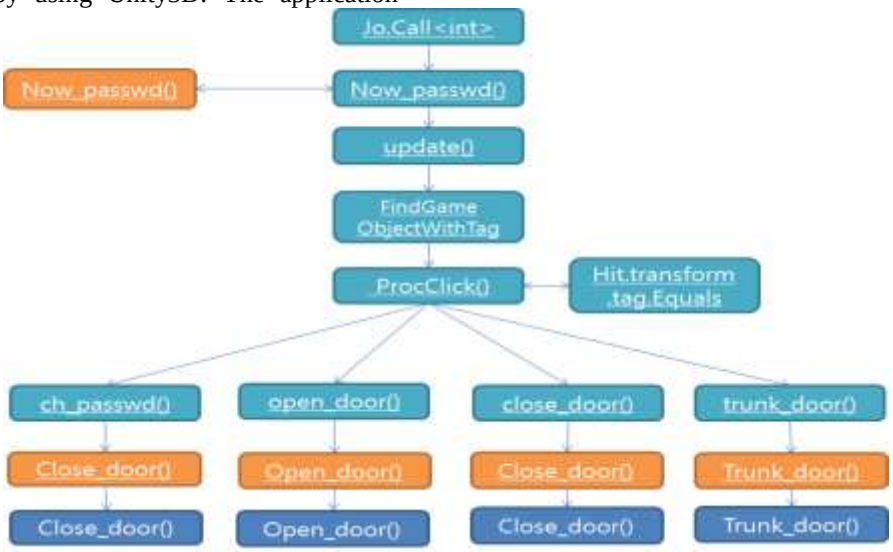
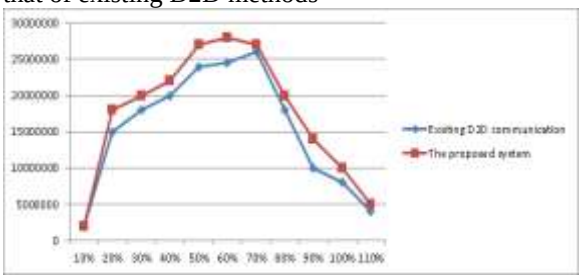


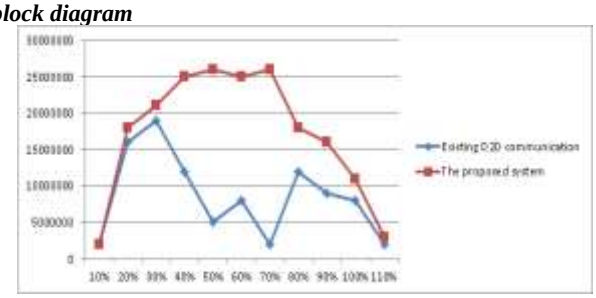
Fig.8. Application block diagram

Analysis of performance

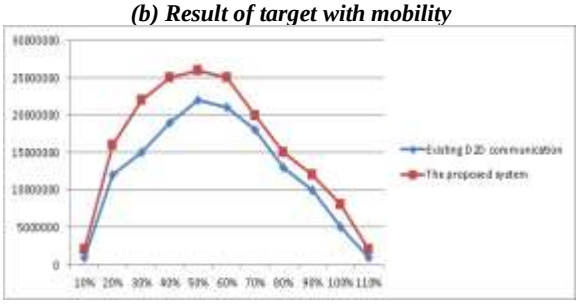
The experiments were performed using the content distribution system and application described in Chapter 3. Data transmission performance for fixed target and mobile target was evaluated. Further, the proposed system's performance was compared to that of existing D2D methods



(a) Result of target without mobility



(b) Result of target with mobility



(C) Result of multiple targets

Fig.9. Measurement results

The y-axis represents the content rate (%), and the x-axis of the graph shows the transfer rate of the content (bit / second). Fig 9-(a). is the

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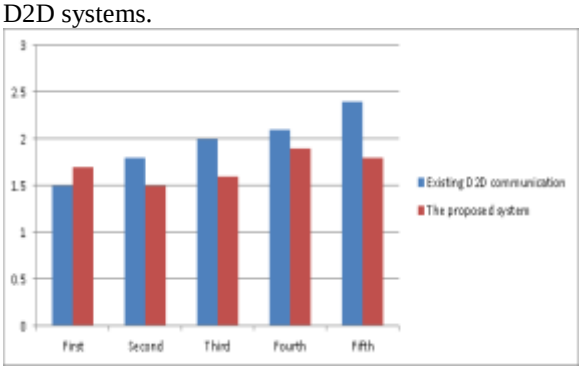
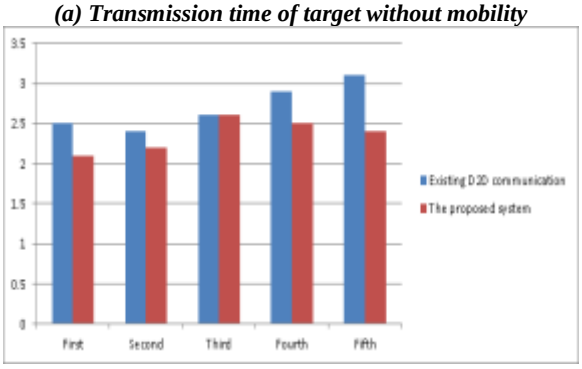
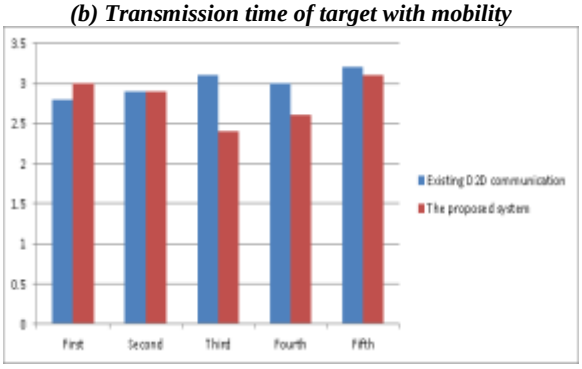
measurement result of a fixed target. The proposed method rather than existing methods showed higher performance. Fig 9-(b). is the measurement result of a mobile target. For a moving target, in the conventional method, the intervals of considerably low performance is high. On the other hand, in the proposed system, performance similar to that of a fixed target was measured. Fig 9-(c). is the measurement result of the case of transferring the content to multiple targets. The performance of the proposed system is higher than that of the existing D2D systems.



(a) Transmission time of target without mobility



(b) Transmission time of target with mobility



(c) Transmission time for multiple targets

Fig.10. Transmission time (three cases)

In each situation, Fig 10. is a graph showing the time taken till the content is forwarded. Number that sent the content, the y-axis, x-axis of the graph shows the time taken before the content is transferred. Figure 10 shows the content transfer time for a fixed target (a), mobile target and (c), multiple targets. The proposed system exhibited 27% better performance on an average compared to existing systems. Fig 11. shows the average content transfer rate of the proposed system and existing D2D systems.

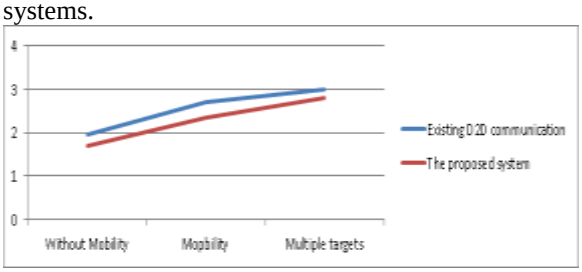


Fig.11. Transmission time average

Conclusion

Limitations have emerged in the delivery of content based on mobile communications as mobile data traffic increases in recent times. D2D communication technology has attracted considerable attention as a potential solution. In this paper, we have proposed a system for efficient content distribution based on D2D. Using D2D, the system shows increased transfer rate and speed and reduced device overhead. By increasing the content transfer efficiency for mobile devices and multi-national communications, it is possible to mitigate problems such as disruption of connections during transfer. However, further research is required on the number of mobile devices, the nature of the mobile environment, movement characteristics, such as range, pertaining to D2D communication. Accordingly, future research is aimed at the development of a system that can provide a variety of services in line with the aforementioned considerations

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