# Summary Minutes of the 3rd Meeting of the Study Group on Network Architecture

1. Time & Date: 10:00 – 12:00, Thursday, March 15, 2007

2. Place: Special Meeting Room #1, 8th floor, Ministry of Internal Affairs and Communications

3. Attendees

(Members) (in Japanese alphabetical order, with honorifics omitted)

Tomonori Aoyama, Youichi Isokawa, Naoyuki Iwashita, Gota Iwanami, Hiroshi Esaki, Yoshiro Okamoto, Hideo Okinaka, Toshifuku Yoshioka (on behalf of Mitsuo Kawato), Mikio Goto, Hideshige Komatsu, Shinji Shimojo, Yasubumi Chimura (on behalf of Harushige Sugimoto), Yoshiyuki Takeda, Yujiro Iizuka (on behalf of Tetsuo Takemura), Satoshi Nojima (on behalf of Toshitaka Tsuda), Yasuhiro Katsube (on behalf of Miwako Doi), Hideyuki Tokuda (Chairperson), Akihiro Nakao, Shu Maruno (on behalf of Takashi Hanazawa), Michitaka Hirose, Yayoi Hirose, Yoshihiro Fujita, Masaki Fujihata, Hiroshi Fujiwara, Motoo Matsuda, Takamichi Miyoshi, Ryuichi Yamamoto, Tetsuya Yuge

(Total: 28)

(Ministry of Internal Affairs and Communications)

Kiyoshi Mori (Director-General of the Telecommunications Bureau), Katsuya Watanabe (Director of the Telecommunications Systems Division), Yasuo Tawara (Director of the Research and Development Office, Technology Policy Division), Naohiko Hagiwara (Assistant Director of the Telecommunications Systems Division), Manabu Nakazato (Assistant Director of the Research and Development Office, Technology Policy Division)

4. Agenda

(1) Presentations

(2) Other

5. Summary of Discussions

[Presentations]

○ Member M. Hirose presented “Media Environment for the Future” (Handout 3-2).

○ Member Fujihata presented “Network Architecture Study Group” (Handout 3-3).

○ Member Matsuda presented “What Is Expected of a New-Generation Network as Social Infrastructure" (Handout 3-4).

○ Member Isogawa presented “Toward Construction of a New-Generation Network” (Handout 3-5).

6. Free Discussion

7. Next Meeting

The next meeting is scheduled for early April. The Secretariat will announce the details at a later date.

[Main comments and remarks made during free discussion]

- ○ Concerning M. Hirose's presentation on various new media technologies, I would like to know more about their technical structures and the projected roadmap for their progress.
- ○ It is extremely difficult and even dangerous to draw a roadmap for this field. A macroscopic roadmap tends to be incapable of representing the agility of individual technologies, and hence it is hard to expect your first roadmap to capture everything that will happen later. It would be better to allow for flexible development.
- ○ The picture of composite reality on page 8 of M. Hirose's presentation famously visualizes how the real and the virtual worlds are going to converge. Now, how is this convergence going to take shape, primarily from the real side, primarily from the virtual side, or equally from both sides?
- ○ "Real" and "virtual" are not mutually-conflicting or exclusive concepts. Things are occurring simultaneously in both directions, from real to virtual and vice versa. We need to consider both scenarios.
- ○ An interesting network attack is emerging which slowly sends thin but long traffic. Although this is a small and slow attack, it has a very large impact on the network. So far, no countermeasures have been devised. If we were to have a large number of sensors, we would end up having a huge amount of data sprawling thin but long connections.
- ○ I feel that the current networks have a huge overhead, and would like to see it reduced. Being large can mean a variety of things. It is important to examine whether the overhead is inherently large or it is large because of many tiny things piling up in one place. If we were to build the new-generation network as a general and versatile one, we would end up producing a system with excessively high quality. In this regard, it is crucial, in the design stage, to identify what is really required and where full strength is not necessarily required through discussions with the users. In other words, it is important to think of the density or sparsity of information.
- ○ We once tested a sensor network in the field. Transmission of just 10 bytes a minute caused the network doing state management to break down. If we were to build many virtualized networks, the system would end up having various states and would behave unpredictably. This is the area where we lack experience and thus need to think fundamentally. How to design state management and memory management no longer belongs in the field of information/communication. It belongs in the area of operating systems.
- ○ Speaking from the viewpoint of a bank, the mere notion of security being maintained in the network does not help very much if its mechanism is not visible. Our problem is that we cannot use the network unless we understand how security is guaranteed.

○ The point is how to use resources on the real side. Dedicated lines are okay because they are physically separated. Assuming that, if routers and switches are partitioned by application, each partition is not affected by any application other than the one using it, and then physical partitioning may become a requirement. We will be able to build a network that is easy for users to understand by first conducting a simulation in the upper layers, then expressing what can be done and what cannot be done in a logical network, and finally mapping them onto a physical network.

○ It is said that the story of "community" originated in culture. I would say that locality, which is the basis of culture, is also important. The network expands locality instantaneously. When the network gains autonomous intelligence, a question arises on how to deal with locality in terms of timing issues, etc.

○ That is a question for which it is difficult to give a clear-cut answer. Before, as well as after, the digital network takes hold, there can be communication that does not depend on locality. How the network is constructed inside is irrelevant to the user. Sometimes the design of the interface determines the impression of what is happening inside.

○ However, if the network is invisible, application providers as well as users would be in trouble. This is because a network in which everything is fixed beforehand would not allow for new designs, thereby limiting the user's freedom.

○ Virtualization is a technique that is frequently used in operating systems. For example, several operating systems can run on a single platform. If we are to apply virtualization down to lower layers such as the router that operates in the real domain, we would be able to realize an environment that, while running under IP, allows us to operate the new-generation network architecture on a trial basis. That would be very useful in building a testbed.

○ Turning what we discussed today into reality would require huge amounts of resources. Unless we think of ways to optimize them, we would not be able to find good balance in cost in the true sense. In addition to simulations in the virtual domain, we should further consider and verify how far we can go when mapping the results onto the real domain. It should be pointed out that resource management has not reached that point.

○ Today we discussed various requirements for applications. In conducting practical verification under the new protocol based on the new architecture, it is imperative to have an environment that allows the IP network and the new protocol running on it to coexist. At the same time, it is important to prove that the network will not break down. While network virtualization requires the virtualization of operating systems, how to define the requirements is yet to be discussed. Thus, we would first need to build such an environment.

○ In designing virtualization, engineers should not lose sight of the outside. In realizing the convergence of the real and the virtual worlds, we should realize the human system or its agent.

○ Everybody talks about virtualization and wants to build a user-friendly network. That is fine. If, however, we are to let everybody do whatever they want, there would be a whole mess of

IDs and we would be in trouble. We should pursue management in the ID space as a matter of a huge grand design.