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**For Immediate Release**

**NEC C&C Foundation Awards 2009: C&C Prize to  
Dr. Fumitada Itakura, Prof. Ronald L. Rivest,  
Prof. Adi Shamir and Prof. Leonard M. Adleman**



Dr. Fumitada Itakura



Prof. Ronald L. Rivest



Prof. Adi Shamir



Prof. Leonard M. Adleman

**(Tokyo – 28<sup>th</sup> October, 2009)** NEC C&C Foundation announced that the 2009 C&C Prize will be awarded to two groups. Dr. Fumitada Itakura as a Group A and Prof. Ronald L. Rivest, Prof. Adi Shamir and Prof. Leonard M. Adleman as a Group B. Each recipient will be recognized with a certificate of merit, a plaque, and a cash award of ten million yen for each group.

The C&C Prize was established in 1985 and is awarded to distinguished persons in recognition of outstanding contributions to R&D activities and pioneering work related to the integration of computers and communications technologies and the social impact of developments in these fields. Two recipient groups of this year are outlined below.

The prize ceremony will be held on Wednesday, November 25 from 15:30 at ANA Intercontinental Hotel Tokyo and will be followed by acceptance speeches.



Best Ubiquitous Networking  
(Mobile Enterprise Solution) Award  
最佳無間斷網絡(流動企業方案)獎



Best Business (Product) Silver Award  
最佳商業系統(產品)銀獎



Best Business (Application) Certificate of Merit  
最佳商業系統(應用)優異證書

## **Group A**

Dr. Fumitada Itakura

Professor, Meijo University / Professor Emeritus, Nagoya University

### **<Citation>**

For pioneering research and the development of highly efficient voice-coding technology with analysis-synthesis methods for speech

### **<Achievement>**

Dr. Fumitada Itakura started his pioneering research on efficient voice coding during his doctor's course at Nagoya University. Boosting the level of research at the Electrical Communication Laboratory of NTT Public Corporation and AT&T Bell Laboratories, he developed a number of fundamental new methods one after another. These methods were based on frequency spectrum-parameter extraction from speech signals using statistical approaches. In other words, his approaches involved approximating vocal-tract characteristics using an all-pole digital-filter model, transmitting its filtering coefficients, and reproducing the original voice with a speech synthesizer. These methods enabled the speech signal data rate to be reduced to 1/10 to 1/20 of that for the pulse-code modulation (PCM) method, which transmits speech data using the direct digitization of speech waveforms.

The first analysis-synthesis approach developed by Dr. Itakura in 1966 was based on maximum likelihood spectrum estimation. It analyzed voices to obtain filtering coefficients effectively and suitably for synthesis using the estimation method. Dr. Itakura was the first to propose an algorithm for the approach, established the approach mathematically, and demonstrated clear and natural voice reproduction using the synthesis. In addition, he improved its filter stability by introducing partial correlation coefficients using forward and backward prediction errors and developed the partial auto correlation (PARCOR) method in 1969.

The PARCOR method was put to practical use as an audio response system in 1971 and was used for various telephone data services. His research totally modernized the conventional speech analysis-synthesis methods and paved the way for new speech research areas.

In 1975, fostering the advancement of an algorithm for PARCOR, he developed the line spectrum pair (LSP) method by introducing the line spectrum representation of linear predictor coefficients of speech signals. The LSP method further improved the quantization properties in speech synthesis and reduced the effects of coding errors, which made it suitable for use in digitalization. It is also very well suited for use in coding LSIs, which proved to be beneficial for making mobile terminals smaller and reducing power consumption.

A voice coding system based on the LSP method was adopted as an international standard and became ITU-T specifications such as G.723 and G.729, both in 1995. Specification G.729 has been widely used as low-bit-rate compression coding for VoIP worldwide. For instance, previously, Japan created a second-generation mobile phone system called Personal Digital Cellular (PDC), Europe made a second-generation one dubbed Global System for Mobile Communications (GSM), and third-generation mobile phone systems such as W-CDMA were made. In each case, these systems were developed based on fundamental technologies such as PARCOR and LSP pioneered by Dr. Itakura, reproducing clear vocal sounds with only 1/10 to 1/20 of the data rate compared with that of PCM technology.

Consequently, the NEC C&C Foundation highly praises Dr. Itakura for his pioneering research and development of fundamental technologies indispensable to current mobile phone systems and VoIP. His achievements laid the foundation for achieving international standards for low-bit-rate compression coding and the widespread use of mobile phone systems.



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## **Group B**

Professor Ronald L. Rivest

Andrew and Erna Viterbi Professor of Electrical Engineering and Computer Science  
Massachusetts Institute of Technology

Professor Adi Shamir

The Paul and Marlene Borman Professorial Chair of Applied Mathematics  
The Weizmann Institute of Science

Professor Leonard M. Adleman

Henry Salvatori Chair in Computer Science and Distinguished Professor of Computer Science and  
Biological Sciences  
University of Southern California

### **<Citation>**

For the invention of the RSA algorithm for public-key cryptography

### **<Achievement>**

Drs. Ronald L. Rivest, Adi Shamir, and Leonard M. Adleman invented a pragmatic algorithm for public-key cryptography in 1977 as researchers at the Massachusetts Institute of Technology. Using the initials of these three inventors, it was named the RSA algorithm. It takes advantage of computing difficulty in factoring large numbers.

The idea behind public-key cryptography is quite different from that of conventional symmetric-key cryptography, where the same key has to be used for encryption by the sender and decryption by the receiver. In public-key cryptography, the owner creates a pair of keys. One is used as a public key for encryption. The other is used as a private key for decryption. The encrypted data can only be decrypted by using the owner's private key.

In a practical RSA system, the public key and private key are created using two prime numbers having hundreds of digits. However, because only the product of the two prime numbers is disclosed, the prime numbers are virtually unidentifiable due to the difficulty of computing factorization into prime factors. This means that without knowledge of the owner's private key, it is almost impossible to decrypt within a viable timeframe even if the best currently known algorithms and the fastest computer systems are used.

Until the invention of public key cryptography, a symmetric (secret) key had to be exchanged in advance between the sender and receiver via a secure communication path. However, with the emergence of the RSA algorithm, a secure form of network communications was created in a practical manner because secret key exchange is no longer required.

Another feature of public-key cryptography is that it is used for the generation and authentication of electronic signatures. It proves that a signed message originated from the owner. For the authentication, the owner sends the message and message-dependent data encrypted with a private key as a signed message. The receiver then decrypts the data with a public key. If the data is decrypted correctly, it proves that the owner sent the data. The Public Key Infrastructure (PKI) on the Internet based on the authentication technology developed with public-key cryptography has enjoyed widespread use in inter-business e-commerce, electronic application procedures in e-government, electronic document signing, user certifications, and so on.

Thus, the invention of the RSA algorithm for public-key cryptography by Drs. Rivest, Shamir, and Adleman and their contributions to the progress of the IT security industry have received very strong international recognition.



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## About the NEC C&C Foundation

The NEC C&C Foundation is a non-profit organization established in March 1985 to foster further growth in the electronics industry by encouraging and supporting research and development activities and pioneering work related to the integration of computers and communications technologies, that is, C&C, and ultimately to contribute to the world economy and the enrichment of human life. The Foundation is funded by NEC Corporation. The Foundation currently has three main activities. It presents the annual C&C Prizes to recognize outstanding contributions to R&D activities and pioneering work in the area of C&C. Candidates are recommended from all over the world. Each prize winner receives a certificate, a plaque, and a cash award (ten million yen per group). As of 2009, 82 prominent persons had received the prize. In 2009, the Nobel Prize in Physics was awarded to three previous recipients of the C&C Prize (Charles K. Kao: 1987, Willard S. Boyle and George E. Smith: 1999). In addition, an Outstanding Paper Award for Young C&C Researchers is awarded annually to one outstanding paper presented at an international conference overseas with the support of a grant from the Foundation. The recipient is given a cash award of 200,000 yen. The Foundation also gives the following four grants: (1) grant to enable researchers in Japan to attend international conferences overseas to make presentations in the field of C&C, (2) grant to non-Japanese researchers in Japan, (3) grant to young researchers who have recently moved to a university in Japan, having received a doctorate from a different university, and (4) grant to students proceeding to doctoral courses. The Foundation also studies the influences on the world economy and human life resulting from C&C developments.

For additional information, please visit the NEC C&C Foundation website at: <http://www.candc.or.jp/en/index.html>

## About NEC Hong Kong Limited

NEC Hong Kong Limited has a long and eventful history in Hong Kong since its establishment in 1984 and has been expanding its activities rapidly to meet the growing customer demand in Hong Kong, Macau and Mainland China. Dedicated to information and communication technologies, NEC provides advanced display & visual products, server & storage and telecommunication devices. NEC also plays a leading role in business solutions for security & border control, unified communication and IT platform, as well as services of IT consulting, networking and outsourcing. With a full range of technical experts and resources, we achieve professional customization in response to the dynamic needs of customers in various industries. With our extensive products and services, we continuously develop beneficial values for customers globally and become the one-stop answer for innovative technological excellence.

For more information, please visit [www.nec.com.hk](http://www.nec.com.hk).



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