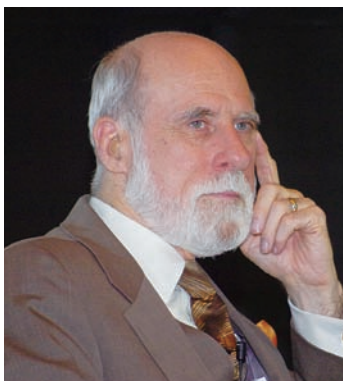2008(24th)

JAPAN PRIZE

Commemorative Lectures

13:00-16:00, Tuesday, April 22, 2008
Hotel New Otani

Dr. Vinton G. Cerf (U.S.A.)

Vice President and Chief Internet Evangelist, Google Inc.
Born in 1943

Achievement： Creation of network architecture
and communication protocol for the Internet

On the Road to the Internet

As a child growing up in the 1940s and 1950s, I was always surrounded by books and by a family that believed strongly in education. I was encouraged to work hard at school and to do my best for my teachers. While my mother and father were college graduates, they did not have advanced degrees, but they recognized the importance of education in their own lives and reinforced this belief in their children. I was the oldest of three brothers and until the age of five, I was an only child. I spent a lot of time with my mother during that time and she imbued me with a sense of humor and an appreciation for music. A favorite pastime was to listen to classical works played on the radio and to try to guess the name of the piece and the composer before the announcer reminded the audience of the origin of the piece just played. We also spent time at museums and, like many children, I was fascinated by dinosaurs, Egyptian mummies and other things from the ancient past. I was an inveterate reader and accumulated a respectable library of books as a child. I recall reading books like One, Two, Three, Infinity by George Gamow, and Microbe Hunters by Paul deKruit. A favorite book around age 12 was The Boy Scientist by John Lewellen. It was a practical book that described experiments and explained various scientific concepts that I found fully absorbing. By that time, I had acquired a chemistry set (this would have been around 1955 when American chemistry sets had quite an extensive array of chemical materials). I would spend hours trying out various mixtures to see what would precipitate out. Of course, like many boys my age, I was fascinated by pyrotechnics and delighted in making plaster of Paris volcanoes that could be set off using hypergolic materials, sulphur, powdered aluminum and powdered magnesium. Small rockets made by filling empty rifle bullet shells with match heads were another dangerous but equally fascinating pastime.

As I look back on those days, I am amazed that I and my inquisitive young friends did not damage property or themselves with some of these experiments.

Fascination with chemistry was matched by a deep interest in mechanical constructions using an Erector set. To this was added an abiding interest in mathematics. I recall complaining to a 5th grade teacher at age 11 that the arithmetic I was being taught was boring. I received a 7th grade algebra book in return and had a marvelous summer solving every problem in the book. I particularly liked the word problems because they seemed like little mystery stories. You had to figure out just what X was at the end.

My interest in mathematics led quickly to an interest in computers. By good fortune, my father had a good friend who was writing software for a project of the US Government called SAGE for Semi-Automated Ground Environment. This tube-based computer system accepted input signals from radars located in northern Canada placed at what was called the Distant Early Warning (DEW) line. The idea was to detect automatically any attempts by the Russians to fly bombers over the North Pole to attack the US or Canada. The computer that was used to do this work was so large that it filled several rooms. One actually walked inside the computer to use it. My first encounter with this system took place in 1958 at a placed called the System Development Center in Santa Monica, California. Two years later, my best friend in high school, Steve Crocker, got permission to use a computer called

a Bendix G-15 located at the University of California, Los Angeles. We were permitted to use the machine when it was not in use by others so we often spent nights or weekends preparing programs for the computer to run. Usually we were interested in plotting solutions to transcendental equations that could not be solved easily in closed form but could be plotted on paper using the values produced by the computer program.

During this high school period in my education, I took every academic advanced placement or enrichment course I could and participated in the math club contests and things like the Knowledge Bowl in which high schools competed with each other. It was a thrill to be part of the team that won these events for the honor of the school. I also served in high school as the editor of the creative writing magazine called the Winged Pen. From this experience I took away an interest in creative writing and poetry that has stayed with me to the present. I think it would be hard to over emphasize the effect of my early school years on my interest in science, mathematics, literature and history. The gift of books and reading has borne dividends for decades and continues to be a source of great pleasure for me.

I often envy young people today who are exposed to computers and the Internet a such early ages. Even six year olds seem to find things to do with computers these days. I was seventeen before I got to program a computer and of course, had to participate in inventing the Internet before I could use it!

My father also believed that learning a second language was an important experience so he engaged a tutor from Germany when I was still in Junior High (about 8th grade, at age 13). He would come every Wednesday evening and we would spend two hours reading and conversing in German after which I would have to recite something in that language for my parents and then we would have dessert.

It was my good fortune that my father worked at a company then called North American Aviation. It had a scholarship program and I was lucky to win a full 4 year scholarship that allowed me to take advantage of my acceptance at Stanford University. North American had a number of subsidiaries and I was able to work at many of them during summers as a high school and college student. One subsidiary, Atomics International, designed nuclear power systems, and I worked there during one summer as a high school student. Another subsidiary, Rocketdyne, was deeply involved in the American space program, notably the Apollo effort. I had a small role to play as a recently-graduated high school student during the summer of 1961 analyzing the test data from the huge F1 Apollo Saturn V rocket system. These massive liquid fuel engines produced 1.5 million pounds of thrust each. They were test-fired in the Santa Susanna mountains north of Los Angeles and I worked on the analysis of the data to try to determine whether these engines would survive the short but critical boost phase of an Apollo launch.

By the time I began my undergraduate work at Stanford University in 1961, I had a strong interest in mathematics and computing, and took a curriculum heavy with these subjects. Stanford is a liberal arts school and its curriculum required what was then called the History of Western Civilization. I had to read many, many books from Greek and Roman times up through the European Renaissance and the so-called Age of Reason. To this day, I am grateful that Stanford required me to read these books as it seems unlikely that I might have chosen to read these later in life. Stanford also had a foreign campus program and I chose to go to Germany in my sophomore year. Exposure to a different culture and language than my native American expanded my world view noticeably. We had classes in German and took many field trips to cities around Europe. We learned about history, geography, architecture, literature and even linguistics during this six month period. I was fascinated with the evolution of Old High German and Old English into their modern equivalents today.

During the summers, I would work at various of the subsidiaries of North American Aviation, including its Space and Information Systems Division where I wrote programs in support of the Apollo program and again at Rocketdyne.

After my undergraduate education in mathematics, I decided I wanted to get some practical experience with computing so I applied to work at IBM in Los Angeles and was accepted into their systems engineering program. I wound up working in the Los Angeles Data Center running their Quiktran time sharing system in 1965.

This was very early in the history of time-sharing systems that had been invented only a few years before at the Massachusetts Institute of Technology by a professor, John McCarthy and his colleagues. McCarthy later went to Stanford where I encountered him as an undergraduate there.

After two years with IBM where I learned a great deal about practical computer systems, especially operating systems, I felt a strong need to return to school for advanced training in computing. My good friend, Steve Crocker, once again helped me by introducing me to his advisor, Prof. Gerald Estrin, who was an enthusiastic mentor and encouraged my return to academic life.

The invention and subsequent evolution of the Internet rests on a foundation that reaches into the early 1960s and by some measures even further back, arguably as far as the mid-1900s with the invention of the Telegraph. Indeed, a popular historical book by Tom Standage entitled The Victorian Internet is, in fact, all about the telegraph and its rapid adoption and global reach. Following that is, of course, the invention of the telephone and then radio. Every one of these inventions and the technologies associated with them has had some influence on the emergence of the Internet.

It is a truism that inventions can only happen when conditions are right for their successful implementation. These conditions may be technical, economic, social or political or a mixture of the three. In some respects we can attribute the conditions leading to the Internet to all four of these categories.